

# COVID-19 Discussion Paper

Impacts and Implications for Global Metros

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Community of Metros (COMET)

**Authors:**

Alice Saunders  
Alexander Barron  
Richard Anderson  
Roger Allport  
Deborah Mundy



# Headlines

## Impacts of COVID-19 on Metros

- COVID-19 has had a **dramatic impact on metro passenger demand globally** with significant regional variation – average demand fell to 9% of pre-COVID levels in Europe, 10% in America and 21% in Asia/Pacific at its lowest point, and currently averages just 49% globally.
- Nearly all metros responded by adjusting service levels to an average minimum of 62% of pre-COVID levels during the first peak of the pandemic in early-mid 2020, but metros globally restored service quickly and **maintained higher service provision relative to reduced demand** to ensure transport for essential trips and provide excess capacity for social distancing.
- Metros faced an unprecedented challenge to respond very quickly to **ensure safety for passengers and staff** – by enhancing cleaning as well as establishing, communicating, and enforcing new protocols at short notice whilst managing higher levels of staff absence.
- Metros face **significant funding gaps due to the loss of commercial revenues** – on average, fare revenues were down 50% and non-fare revenues were down 37% in 2020 – whilst operating costs have been relatively unaffected, with added costs for enhanced cleaning and new protocols generally offsetting any savings accrued (such as from reduced service levels).

## Future Implications of COVID-19 for Metros

- **Recovery will extend well beyond 2021**, with considerable uncertainty remaining about the path to a 'new normal'. Metros are predicting a wide range of recovery scenarios – current forecasts for mid-2022 range from 31% to 100% of 2019 demand, and some metros are not expecting to reach pre COVID-19 ridership levels in the foreseeable future.
- Metros remain essential for cities, providing **critical urban mobility** – the only way to move large volumes of people in dense urban corridors – and serving as **catalysts for equitable and sustainable economic recovery** and long-term success.
- Metros are long-term, infrastructure-heavy systems with high fixed-costs – on average, 82% are fixed in the short term and 58% are fixed in the medium term – so **costs cannot be reduced in line with falling revenues, leading to significant funding gaps**. Reducing service levels will result in only small savings but have major impacts on demand and revenue.
- **Substantial increases in government support are required** in the short and medium term to ensure that metros deliver essential service and support economic recovery. Funding decisions should be made with long-term vision, including sustaining (or increasing) re-investment.

# Introduction

The Transport Strategy Centre (TSC) at Imperial College London has closely monitored the impacts of COVID-19 on metro operators through the Community of Metros (COMET). COMET is a global consortium of 42 metro systems in 39 cities that is led by the TSC. This paper sets out the impacts that the COVID-19 pandemic has had on COMET metros so far, and the TSC's view of the implications for metro operators and their authorities in the uncertain recovery period ahead.

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# 1. Impacts of COVID-19

The primary and immediate impacts of the COVID-19 pandemic on metros have been related to passenger demand, service levels, safety protocols, staff availability, and funding, which are detailed below.

## 1.1 Passenger Demand

The outbreak of COVID-19 and related government restrictions led to **metro demand falling dramatically** across the entire world. During the first wave of the pandemic in 2020 all but two COMET metros experienced some period where demand fell below 50% of normal (Figure 1), and half experienced less than 10% of normal. During the first wave 60% of COMET metros were actively discouraging all but essential travel; in India, all metros were shut down entirely from March to September. While these actions were taken in the interest of health and safety, they may have encouraged changes in travel habits, including towards unsustainable modes such as private vehicles.

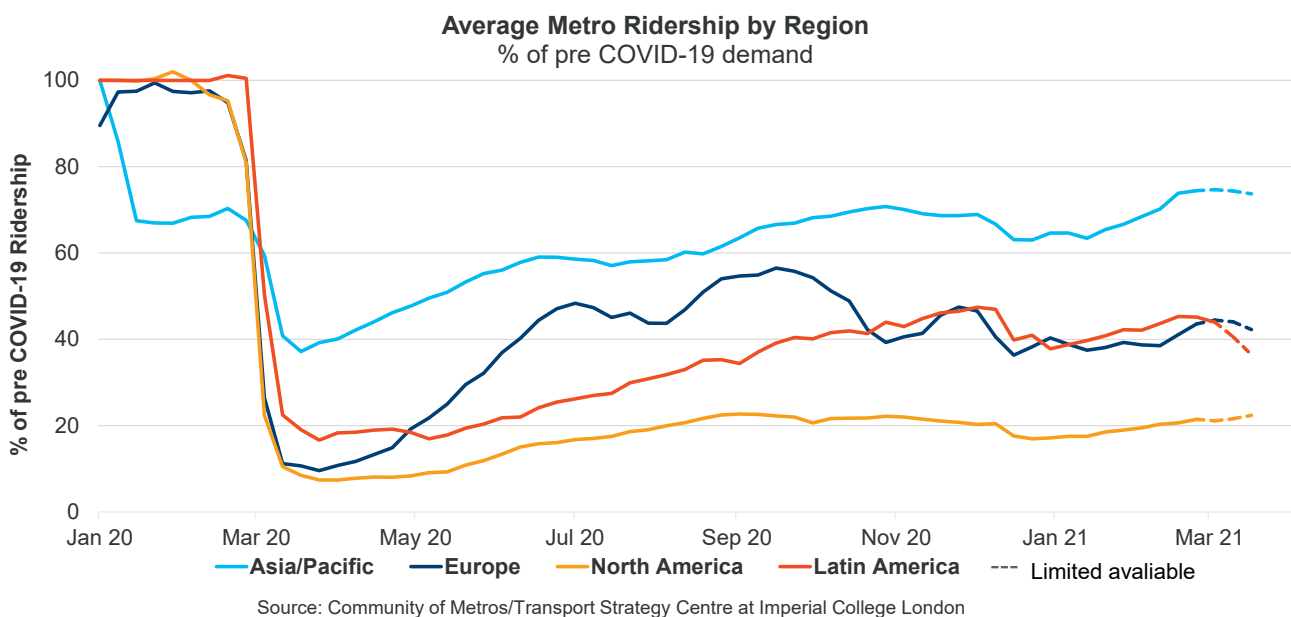


Figure 1: Average Metro Ridership by Region, Jan 20- Apr 21

Metro demand has not only fallen dramatically but also changed in terms of the **times of day, ticket types, locations, and customer demographics**. Across the board, there has been evidence of major falls in radial travel into the inner city and central business districts, while local neighbourhood travel has been more resilient. Linked to this, metro ridership has typically remained lower than local bus demand in COMET cities (for example, as of early April 2021 in New York bus ridership is approximately half of pre COVID-19 levels but subway ridership is only about one-third).

Most metros have seen quicker recovery of off-peak travel, but also relatively high levels of demand during early mornings, reflecting travel by shift, construction, and front-line workers at these times. As demand started to recover, two-thirds of metros have observed faster recovery in work travel than leisure travel (including in Asia, where overall recovery has been strongest). Some metros are now **seeking to attract passengers back**, in coordination with government regulations, by offering near-normal service levels (to ensure adequate space for social distancing), enforcing new policies (e.g. requiring face coverings), actively promoting the benefits of public transport, and/or working with the leisure industry to stimulate ridership.

Recovery has progressed unevenly and in step with the evolution of the pandemic, as shown in Figure 1. Instructions to avoid the use of public transport, to prevent the spread of the virus and ensure space for key workers, may have created false perceptions about the severity of risk on public transport. The average ridership as of March 2021 was just 49% of normal, with 8 metros across the UK, Canada and the USA still below 25% of normal. Beyond just the severity of the pandemic, these differences are also influenced by the degree of adoption of home working – itself influenced by the focus of local economies, the policies and attitudes of employers, and the domestic capacity for working from home.

However, some Asian metros have already seen demand recover to near 90% of pre COVID-19 levels. The resilience in demand in Asia, alongside the pace of recovery in Europe during the summer of 2020, show high latent demand for mass transit, suggesting that demand may rebound strongly after the pandemic. Operators can also play an active role in regaining demand: some metros have plans to attract new market segments with new pricing and targeted marketing. In this way, the transport sector can shape future travel patterns in a more sustainable manner (e.g. less peaked), rather than simply trying to regain pre-pandemic demand.

## 1.2 Service Levels

All but four COMET metros reduced service levels to some extent during 2020 in response to the first wave of the COVID-19 pandemic. Figure 2 summarises the service levels throughout the pandemic by region. The average minimum service level operated by COMET metros was 62% of the pre-COVID level, with three in five of metros returning to normal service levels by September 2020. The average metro cut service for 18 weeks in total and spent 10 weeks below 75% of normal. Typical service changes included reductions to off-peak and peak frequencies (87% and 73% of COMET metros respectively), reduced service hours (42%) and, in fewer cases, station closures (15%).

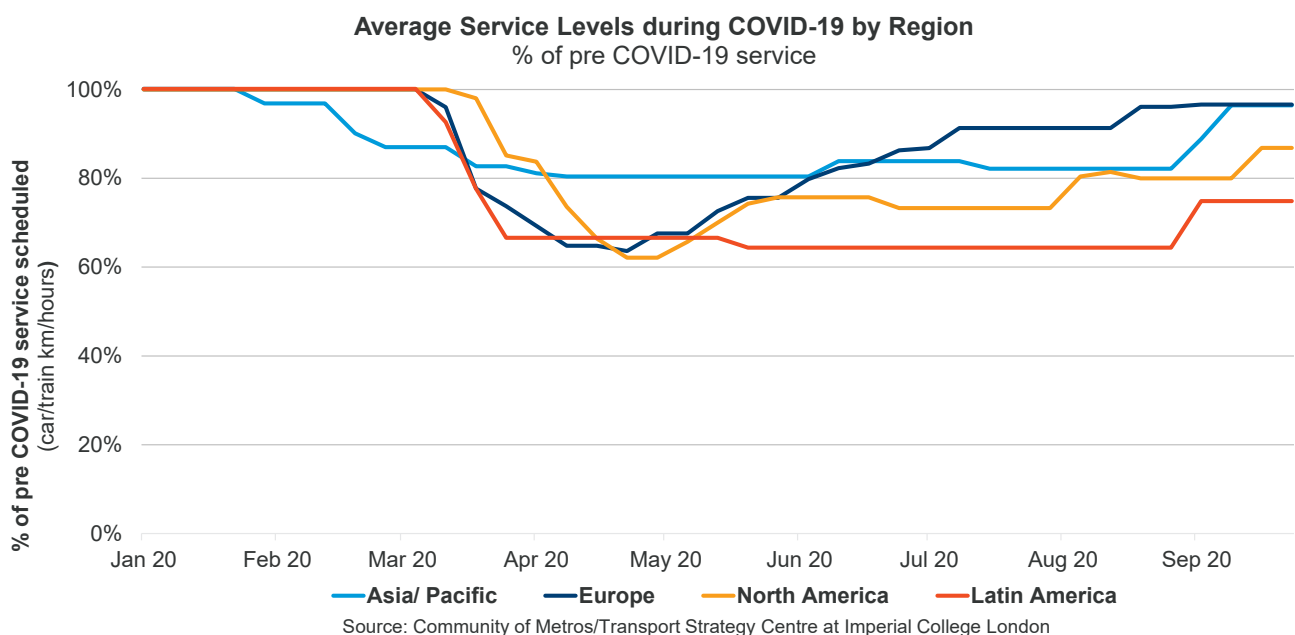


Figure 2: Average Service Levels by Region, Jan-Sep 2020

Across all cities, metros **maintained higher service provision than reduced** demand might warrant to ensure transport for essential workers and provide excess capacity for social distancing. **On average, metros estimate that they could accommodate just 39% of normal demand with full service if local social distancing requirements remain in force.** Typically, those metros experiencing the biggest losses in ridership initially responded by implementing the most severe service cuts, but there was significant variation in responses to similar demand patterns. For example, half of metros saw ridership fall to less than 10% of pre COVID-19 levels, but the service levels offered at this low level of ridership varied from 35% to 80% of normal levels.

Falling ridership was the main driver of service reductions (a key factor for 87% of metros), but decisions were also influenced by staff availability, government directives, social distancing requirements, cleaning and maintenance requirements, and, later, budget constraints. Service decisions that previously took months to agree had to be made in a matter of days. This newfound agility means that metros are now better prepared to respond quickly to changing circumstances (e.g. with various pre-existing and flexible service schedules).

The pandemic has accelerated the development of **crowding monitoring and information tools** amongst metros. At least nine metros have added crowding information in smart phone apps and journey planners during the pandemic, while four metros now also show real-time crowding information at stations and on trains. Metros have been able to use this data to develop service models for different recovery scenarios, and to enhance customer confidence. These will be important tools as restrictions are slowly lifted: maintaining a degree of social distancing whilst encouraging higher revenues by nudging passengers into less busy times, routes and train cars.

### 1.3 Safety Protocols

Metros have faced shared challenges in having to respond quickly to ensure public safety by **enhancing cleaning** and **establishing and enforcing new protocols** (e.g. requiring face coverings, distancing and cashless payments). Metros have also implemented new practices to protect staff (e.g. ensuring the continuous supply of protecting equipment, adjusting staff rosters to avoid mixing, automating cleaning and customer service tasks and managing- for the first time for many – office and vulnerable workers at home). With new policies and procedures comes the need communicate with staff and customers. Metros have rolled out major new campaigns to advise customers about changing travel rules. These safety protocols and communication efforts remain key as metros seek to restore customer confidence.

### 1.4 Staff Availability

While many metros adapted to their office-based staff working from home, the majority of metro staff do not have the option of working at home because of the nature of their work. **Absence rates** and the **actions taken to mitigate absence** varied widely. Asian metros experienced little impact on staff availability at all, maintaining near 100% availability throughout; while those in Latin America experienced a deep impact that remained at about 25% below normal throughout the first wave of the pandemic in 2020 owing in part to a broader criteria for defining vulnerability. European metros saw staff availability fall by 30% at its lowest point before recovering to around 15% by late September. North American metros were initially impacted by about 20-30% but recovered relatively quickly to 10%.

Train drivers typically had the lowest availability, while maintenance staff generally had the highest, with station staff often falling somewhere in between. Half of metros reassigned staff to new roles, paving the way for multifunctional job flexibility. For example, one South American metro developed a new multi-functional role with drivers trained in station and service issues, who supported stations that were understaffed.

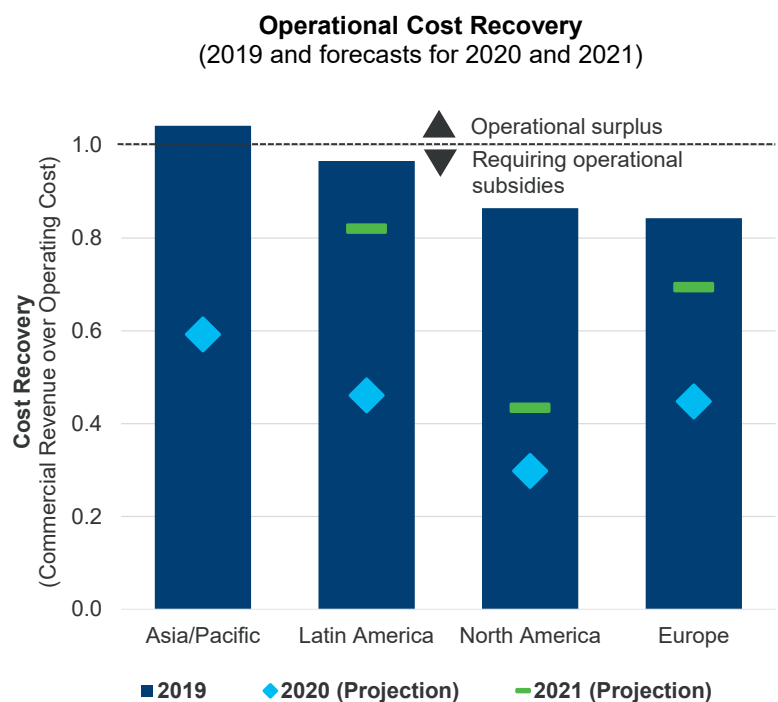
### 1.5 Financial Impacts

The key financial impact on metros has been the **loss of commercial revenues** linked to the dramatic declines in ridership. This led to an estimated average loss of 50% of fare revenue for 2020, ranging from only 10-20% in Asian metros where ridership has remained stronger to more than 75% in some North American metros where ridership remains very low. Non-fare revenues are also down in 2020 by an average of 36.3% (but as high as 70% in some European metros).

Conversely, **operating costs have been relatively unaffected** compared to revenues. Although many metros had some modest savings in 2020 due to reduced service levels and other changes, metros also had additional costs relating to enhanced cleaning and staff unavailability, which at least partially (or, in some cases fully) offset any savings. On average, metros who reported 2020 projections expect costs to be 3.1% lower than 2019.

This overall situation has created a significant **funding gap** – most metros, including those in Asia, are unlikely to be able to cover operating costs throughout 2020 and 2021 (Fig. 3).

Most metros did not make any changes to **fare levels or structures** during the pandemic, with a number of metros postponing planned fares increases. However, some metros made temporary fare changes during the year, either to encourage social



Source: Community of Metros/Transport Strategy Centre at Imperial College London

Figure 3: Projections of cost recovery for 2020/21 (estimates as of late 2020)

distancing (e.g. off-peak discounts in Sydney, suspension of concessions for younger and older customers in London) or to attract customers back (e.g. 20% fare rebate in Hong Kong, discounted day tickets for seniors in Tokyo and weekend leisure travel in Berlin). Funding agreements in London required fares to increase 2.6% in March 2021.

In response to the pandemic, the great majority of metros (but not all) have received some additional funding, most commonly **emergency funding** from governments (i.e., direct government grants/subsidies). Metros have also benefitted from government furlough schemes, tax reductions, deferred loan repayments, or authorisation to increase debt, such as via bonds. However, many funding agreements made earlier in 2020 have been depleted or are now running out, as the pandemic has continued longer than initially expected.

## 2. Implications for Metros

Based on COMET experience, there are several strategic implications of the COVID-19 pandemic for metros and their stakeholders, particularly transport authorities and governments that provide funding support.

### 2.1 Recovery is uncertain and will extend well beyond 2021

Despite the promise of vaccination, the ongoing evolution of the pandemic (e.g. new variants) as well as underlying societal changes (e.g. social distancing, homeworking and remote activities) and economic circumstances (e.g. unemployment, international tourism) make it clear that the **recovery period will be extended well beyond 2021**. This situation is extremely uncertain and dependent on several factors, including government policies relating to other modes and public transport funding, and how this relates to other objectives like environmental sustainability.

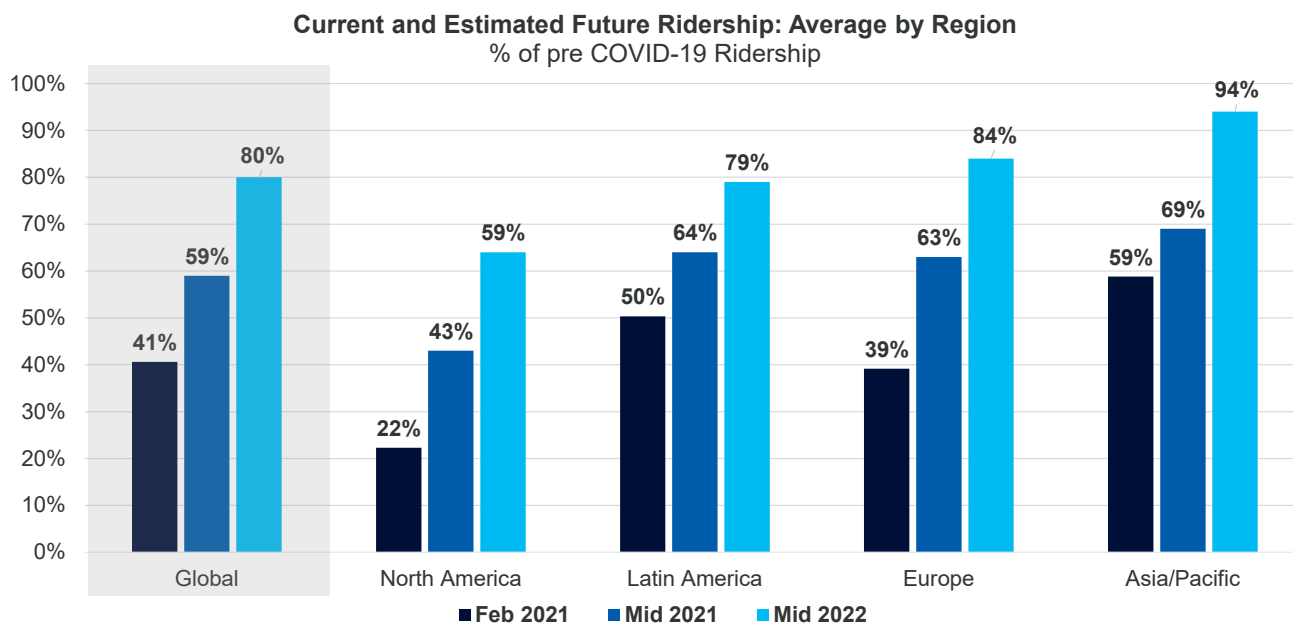


Figure 4: Projected future ridership by region, mid-2021 and mid-2022

Figure 4 reflects various metro expectations for ridership recovery – averaged and anonymised by continent. There is a **wide range of forecasts**. Asian/Pacific metros are most optimistic about recovery – on average forecasting a return to near 2019 levels by mid-2022. In contrast, North American metros are typically estimating ridership levels of just 60-70% of pre COVID-19 levels by 2022, with many not expecting a full return to pre COVID-19 ridership for the foreseeable future.

Some **new travel patterns** might be here to stay. More than ever, it is key for metros to understand their customers (both active and inactive) and adapt to their changing needs. A decline in the traditional five-days-a-week, 09:00 to 17:00 commuter will flatten peak demand – potentially reducing costs and optimising capacity utilisation in the longer term. Continuation of the trend for local travel would also even out the distribution of passengers across the network and require more investment in tangential neighbourhood connectivity and

integration with active modes. The new flexibility that metros have been forced to find, and their ongoing development of demand monitoring tools, will aid future contingency planning and service adaptability to meet this changing demand.

Table 1 below gives examples of some of the factors that may affect demand as the impact of the pandemic recedes, their potential magnitude and level of uncertainty. Many of these factors were already influencing demand pre COVID-19 (e.g. increased home working, online entertainment replacing trips to cinemas, etc), with the pandemic situation causing their effects to be magnified and accelerated.

Factor	Potential Magnitude	Level of Uncertainty	Impact
<b>Population</b>	Low	Low	Urban population size influences the overall potential number of trips within a city
<b>Population Density</b>	Low	Low	High density reduces the ease and attractiveness of home-working for residents, impacting the number of commuter trips
<b>Switch to domestic tourism</b>	Low	Medium	Changing numbers of domestic verses international tourists will impact the overall number of metro trips
<b>Traffic speeds/road space</b>	Medium	Medium	Greater road space for cars, walking and cycling, and reduced congestion could lead to mode shift away from the metro
<b>Location of Employment</b>	Medium	Medium	Employment in central business hubs is more conducive to metro use. Decentralisation of employment towards areas with lower metro connectivity would reduce the convenience of metro use
<b>Rebound (from inactivity)</b>	Medium	High	Inactivity during COVID-19 may result in 'catching up' on missed opportunities in the short term
<b>Remote services &amp; online entertainment</b>	Medium	High	Some trips may be replaced by leisure at home (e.g. online education, takeaways, online banking)
<b>Online shopping</b>	Medium	High	Some leisure trips may be replaced by online shopping
<b>Remote meetings (video conferencing)</b>	Medium	High	Some international and local business travel may be replaced by remote meetings
<b>Employment Levels</b>	High	Medium	Reduced employment would decrease the overall number of commuter and business trips and poor economic conditions ultimately reduce discretionary trips
<b>Disposable income</b>	High	Medium	Lower disposable income may impact consumer spending on shopping/leisure activities, and their related travel
<b>Home working/ education</b>	High	High	Some commute and education trips may be replaced by home working, depending on individual preferences and employer-based policies or expectations. Longer term, this may impact where people chose to live (within vs outside the city)
<b>Government Restrictions</b>	High	High	The scale/type of restrictions on everyday activities directly impacts metro demand for commuting, leisure and business
<b>Fear of the Virus</b>	High	High	The incidence of COVID-19 impacts people's willingness to use public transport. Prolonged fear of the virus may cause mode shift away from the metro in favour of private modes which more easily accommodate social distancing.

Table 1: Factors impacting global metro demand recovery. Adapted from TSC Scenario Planning Work for the Rail Delivery Group (association of the UK railway industry)

## 2.2 Metros will remain essential for cities

Prior to the pandemic, metros were expanding at a rapid rate. In 2019, COMET metros combined carried over 30 billion passenger journeys on more than 46 million train services across more than 7,800 km of network, and metro ridership was growing at 3.2% each year. During the pandemic, metros have continued to provide essential transport for significant numbers of people. Even at much lower demand **metros still provide critical urban mobility** – in New York, for example, 30% of normal still means 1.8 million daily trips. Whilst increased homeworking may reduce commuter demand overall, many professions are less amenable to homeworking and commuting often makes up less than 50% of metro demand, limiting the overall impact on demand.

It is clear that metros are still essential for cities. Metros are **key to a green and equitable recovery**. They enable cities to be highly productive and provide a high quality of life to citizens, within a managed carbon footprint. Cities are usually a net exporter of tax receipts to the rest of the economy, and these urban agglomeration benefits arising from higher productivity rely on the accessibility provided by good public transport systems. Encumbered accessibility to cities through reduced services and increased fares could have negative wider economic outcomes. Reduced metro provision could therefore significantly harm the economic ecosystems of cities at a time when they need to recover. Moreover, the range of outcomes in terms of demand is so uncertain that overreacting now and withdrawing support for public transport could have long-lasting, negative outcomes for cities that become very costly to reverse.

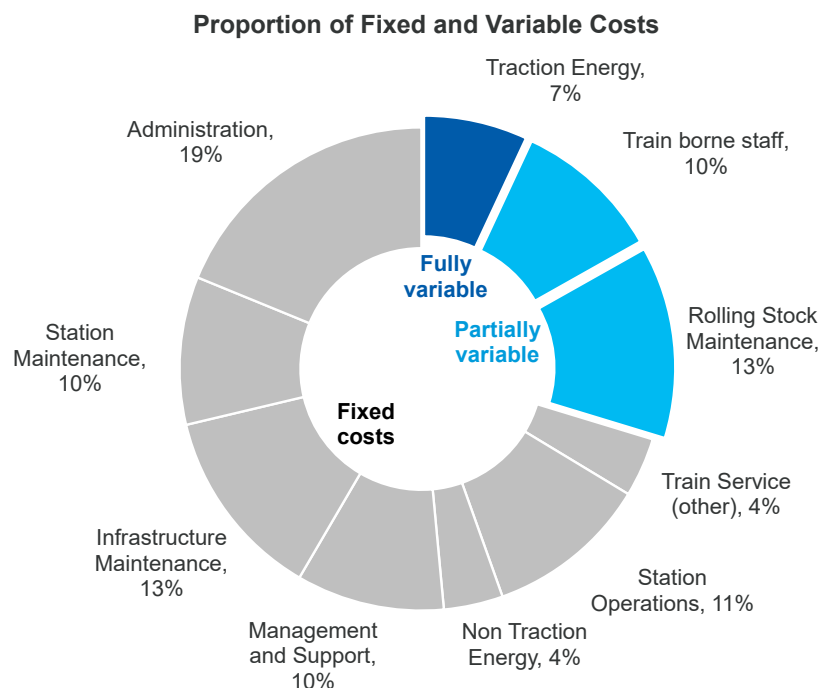
## 2.3 Metro costs cannot be cut to match falling revenues

It is important to recognise that metros (as infrastructure-heavy systems) have very **high proportions of fixed costs**.

Using COMET KPI data, Figure 5 shows the distribution of operating costs by category for the average metro. In the short run, more than three-quarters of costs are fixed (with only traction energy costs assumed to be fully variable). In the medium term (2-3 years or more) more metro costs are adjustable, such as through changes to staffing or procurement models, but costs are still estimated to be more than half fixed – 58% on average. This means that reducing service levels is likely to result in only very small savings, with major impacts on demand and revenue.

Another critically important point is that metros are **long-term** in nature. Fixed infrastructure constructed well over 100 years ago is still in service in several cities, it is common for metro trains to operate for 40 years or more, and major projects take many years to plan and deliver. Because of this, investment decisions made now have implications that stretch many decades into the future.

Given these high fixed costs and the long-term impacts of metros on the economic and environmental vitality of cities, it is far better to maximise the benefits (including passenger revenues) than to try and minimise costs. Metros should therefore avoid service cuts that cost more to the wider city/economy than they save.



Source: Community of Metros/Transport Strategy Centre at Imperial College London

Figure 5: Metro fixed and variable costs- Short run (1-2 years) for the average COMET metro



## 2.4 Additional government support is required – as part of a long-term strategy

Essentially all metros – even those among the 30% that were operationally profitable pre COVID-19 – **will need subsidies** in some form for the short term while the pandemic situation continues and during the elongated recovery. This is to ensure continuity of service (for essential travel) and to spur the wider recovery of cities. COMET benchmarking has historically shown the critical importance of **sustainable fares policies** for metros, but future fare changes will need to consider the wider context and carefully balance attracting riders with raising revenues from fares, commercial revenues and possibly new dedicated, hypothecated sources of taxation.

Pre-pandemic, it was frequently argued that fares should not be allowed to fall relative to inflation. However, two factors may fundamentally change this long-held proposition; first post-pandemic demand may be much more sensitive to price than in 2019 (for example, suburban commuters who pay distanced based fares, but have the option to work from home); second cheaper access to cities may be necessary to support their recovery and ultimate survival. In the context of extreme uncertainty surrounding reduced demand, changing customer needs, and economic hardship, significant fare rises to meet budget deficits could be counter-productive for the metro and fragile city economies.

New and increased traditional sources of non-fare funding will have to be sought by both metros and governments. Federal or state level support may be necessary to supplement city and regional funding in the next few years. For many cities, this may be an opportunity to accelerate plans for road charging, such as based on pollution or congestion. Traffic speeds may be faster, further eroding the metro's competitive position, but the reallocation of road space for active transport modes such as cycling and walking may further enhance the liveability, sustainability and economic revival of cities.

Decisions about metro funding have a very long lifespan and long-lasting outcomes. There is huge risk in sharp, short-term decisions being made that cause lasting harm to cities or a lifetime to undo. This is always a problem for metros, in contrast with inherently short-term political decisions. Given this, and the extremely high level of uncertainty about the future, it is important to **not overreact in the short term, but to support metros throughout the pandemic recovery period**. This includes **sustaining and even increasing investment programmes** to modernise existing systems and build extensions (taking advantage of lower interest rates and the need for economic stimulus) to enable the best possible recovery. While the COVID-19 pandemic has had major short-term impacts on metros across the world, it is essential to support the metro's recovery and continue the long-term work of renewing and modernising metros for generations to come.

# More about the Authors

This paper has been prepared by the Transport Strategy Centre (TSC) at Imperial College London, providing independent analysis by researchers from the TSC. The authors would like to acknowledge the very valuable contributions to this paper from the entire TSC staff team as well as COMET member metros.

Imperial College is focused on science and technology and frequently ranked among the top 10 universities in the world. The TSC is part of the Centre for Transport Studies in the Department of Civil and Environmental Engineering. Founded in 1992 by British Rail, the TSC is a leading research centre in the field of public transport, specialising in research in public transport operations and engineering, statistical modelling, and transport economics. Its core activities are focused on international transport benchmarking, which consist of nine consortia of more than 100 transport operators across the world.

The TSC facilitates and manages the Community of Metros (COMET), an international community of 42 metro systems in 39 cities around the world (formerly known as the CoMET and Nova groups). The Community of Metros was founded in 1994 by five large metros (London, Paris, New York, Berlin, and Hong Kong) and expanded with the Nova Group of Metros in 1998. Newcastle Nexus was a founding member of Nova. The current members of COMET are shown in the map below.

