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COVID-19 Cross-Group Benchmarking Review of Recent Activities: Public Report

Contents

Imperial College London
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Overview

The purpose of this document is to help operators optimise their response to the ongoing COVID-19 pandemic by sharing knowledge and experience from a wide range of organisations globally, including many of the largest operators in the world's major cities. The focus is on both short-term measures to deal with specific challenges arising from the pandemic in the present, as well as on longer-term impacts, such as the funding crisis or more permanent changes to travel patterns and behaviour, that operators are having to respond to and plan for.

This document summarises recent updates and key findings related to COVID-19, sourced from the benchmarking group members and activities within the groups: over 100 metro, rail, bus and light rail operators participate in the international benchmarking groups (see Appendix A for a list of benchmarking groups and members) managed through the Transport Strategy Centre (TSC) at Imperial College London.

All information provided is anonymised to respect confidentiality rules of the benchmarking groups (unless any information has been sourced publicly).

Full references of relevant literature on COVID-19 in the transport industry are provided at the end of this document, along with a short description for each piece of research.

ABBG COMET IMRBG IBBG GOAL ISBERG RIAMBIG

The public transport sector is showing signs of recovery from Omicron, however financial and economic conditions remain unfavourable and extremely uncertain looking ahead to the coming years

The public transport sector has had a tricky start to the new year with the Omicron variant bringing in a new set of challenges and renewed disruption to the industry. In this report we see that the latest wave of infections **reversed the strong recovery** in demand that public transport systems had seen globally by November and into December 2021. For example, metro system demand across all regions dropped by 30 to 40% between early December and end December/early January. Contrary to previous COVID-19 waves, January trends suggest that demand has generally **recovered more rapidly** than previous waves. This perhaps suggests that metros and cities have become more capable of adjusting to the changing requirements around COVID-19 and that demand responds more rapidly to restrictions easing at this stage in the pandemic.

On the supply side, the Omicron infection surge has impacted on operators' ability to run a full service: this report identifies several examples of **reduced service** temporarily introduced in January (e.g. weekend timetables, lower frequencies) due to the impact of rising infection rates on staffing. As we have seen in previous reports, many operators were already facing staffing challenges prior to the Omicron variant exacerbating conditions further.

Two years into the pandemic and the long-term funding picture of the public transport sector remains extremely uncertain. **Emergency funds** have played a crucial role in bridging the funding gap in the industry, thereby allowing operators to continue to deliver a safe and reliable service, all whilst supporting their city's economic recovery. With ridership expected to remain below pre-pandemic levels for some time and the lack of clarity around future availability of funding support, public transport organisations will be facing the significant challenge of balancing **budgetary pressures**: this report touches on COVID-19 fare policies adopted by operators as well as on non-fare revenue initiatives and opportunities sought to increase commercial revenue. Many public transport providers have explored various fare promotions and new ticketing strategies, both in response to changing travel habits as well as to provide an attractive offer to encourage demand back onto their networks. Newcastle Nexus' 'Take the Kids for Free' offer, for example, has been extremely popular, however many operators elsewhere who have introduced big discounts have not necessarily experienced the same level of success. This perhaps suggests that in some regions people have simply not returned to public transport travel and the discounted fares are resulting in lower revenues without the desired impact of encouraging demand growth.

Despite operators' own efforts to increase commercial revenues, a **long-term funding commitment** is likely to be necessary from governments: one example of a long-term funding commitment is provided by the US 'Infrastructure Investment and Jobs Act (November 2021) which commits to public transport funding for eight years. Without long-term financial aid, service cuts may be inevitable and would in turn present long-term risks both financially and operationally.

Omicron is a bump in the road to recovery but encouraging demand trends are seen in January 2022

Recent Metro Demand Trends

Average **metro ridership** by region as a proportion of pre COVID-19 demand *(weekday demand indexed to January or February 2020)* is shown in Figure 1. The graph is based on daily demand data that is collected in the COMET metro benchmarking group.

The **impact of the Omicron variant** on metro demand is clear across all regions, dropping to a global average of **53%** of pre-pandemic demand in the last week of December 2021, down from an average of **66%** earlier in the month. Contrary to previous waves of infection however, demand has generally seen a more **rapid return to an upward trend** in January 2022, except for the Asia/Pacific region where demand appears to be recovering from the effects of Omicron at a slower pace.

- In **Europe**, metro demand had recovered to **73%** of pre-pandemic demand in December before dropping to **58%** at the end of the month due to rising infection rates. Since this dip, demand has been on a gradual upward trend and recovered to **66%** by mid-January.
- In **Asia/Pacific**, metro demand dropped to levels below the European average for the first time in September and October 2021. Recent data suggests that metro demand in the region has once again dipped slightly below European levels at **60%** of pre-pandemic demand in mid-January. Across the regions, Asia/Pacific metro demand appears to be recovering more slowly from the effects of the Omicron wave.
- In **North America**, a similar story can be seen with demand dropping to an average of **25%** of pre-pandemic demand in early January, levels last seen in May 2021 for the region. Demand has since returned to **30%** in mid-January.
- In **Latin America**, average demand had been on a very steady recovery trajectory since March 2021. Similar to all other regions, December was a difficult month and average demand began to dip mid-month, eventually reaching a low of **47%** of pre-pandemic demand at the beginning of January. Demand has since returned to more positive levels and averaged **52%** by mid-January.

Comparison of Recent Multi-Modal Demand Trends

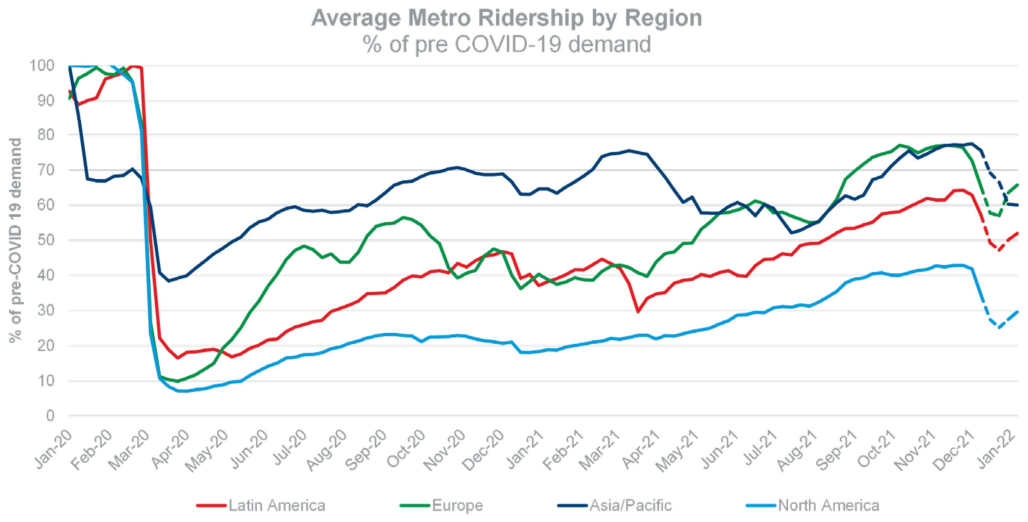
Figure 2 shows average **bus, light rail, suburban rail, and metro ridership** *(monthly total demand indexed to corresponding 2019 month)* by region, based on available data in the benchmarking groups and supplemental data from the US National Transit Database for US operators.

- In the **Asia/Pacific** region, September-December 2021 demand across the metro and rail modes had been recovering strongly from the dip seen toward the middle of 2021 as a result of new outbreaks and lockdown restrictions in many cities in the region. Bus demand has been slightly slower to respond. *Note that the metro selection for the Asia/Pacific region excludes metros in China and India, and the suburban rail and bus demand trends are based on a small sample.*
- In **North America**, multimodal demand trends across bus, rail, and metro are all showing strong growth in 2021. The effects of the Omicron wave can be seen towards the end of December for all modes.
  - The bus sector continues to lead demand recovery (60% of pre-pandemic demand on average in December), followed by light rail at 55%.
    - January bus demand is expected to have continued to be impacted by Omicron, partly due to the wave of infections affecting the region slightly later than some other regions (a month after the surge in Europe, for example).
  - Light rail and bus demand recovery levels have consistently remained above levels seen for metro and rail modes (by approximately 20%+).
  - Demand for suburban rail and metro is averaging

Figure 1:

Average metro ridership by region as % of pre COVID-19 demand

Source: TSC/COMET



between 40% to 44% of pre-pandemic demand based on December 2021 data.

- Demand recovery trends across modes in **Europe** follow a closely aligned trajectory. Demand recovery was seeing month-on-month growth prior to rising Omicron infections interrupting this trend towards the end of 2021. Ridership across bus, metro and suburban rail averaged between 68 to 74% of pre-pandemic demand between October and December 2021, with suburban rail demand starting to dip in October (albeit this trend is based on a small sample size).

Comparison of Recent Service Level Trends

Figure 2 also shows **average service levels by region by mode** as a proportion of pre COVID-19 service (*indexed to corresponding 2019 month*). Across the regions, service levels have remained high throughout the pandemic or have been restored to high levels.

- In the **Asia/Pacific** region, average bus service returned to pre-pandemic levels faster than metro service following the initial drop at the start of the pandemic. Bus service levels for the region have started to dip over 2021, whereas metro service levels have largely remained at high levels. Bus service shows a slight dip towards the end of 2021, reaching 61% on average for December. Suburban rail service has, on average, remained consistently high in Asia/Pacific throughout 2021, with 98% of pre-pandemic service in November 2021. *Note that the metro selection for the Asia/Pacific region excludes metros in China and India, and the suburban rail and bus demand trends are based on a small sample.*

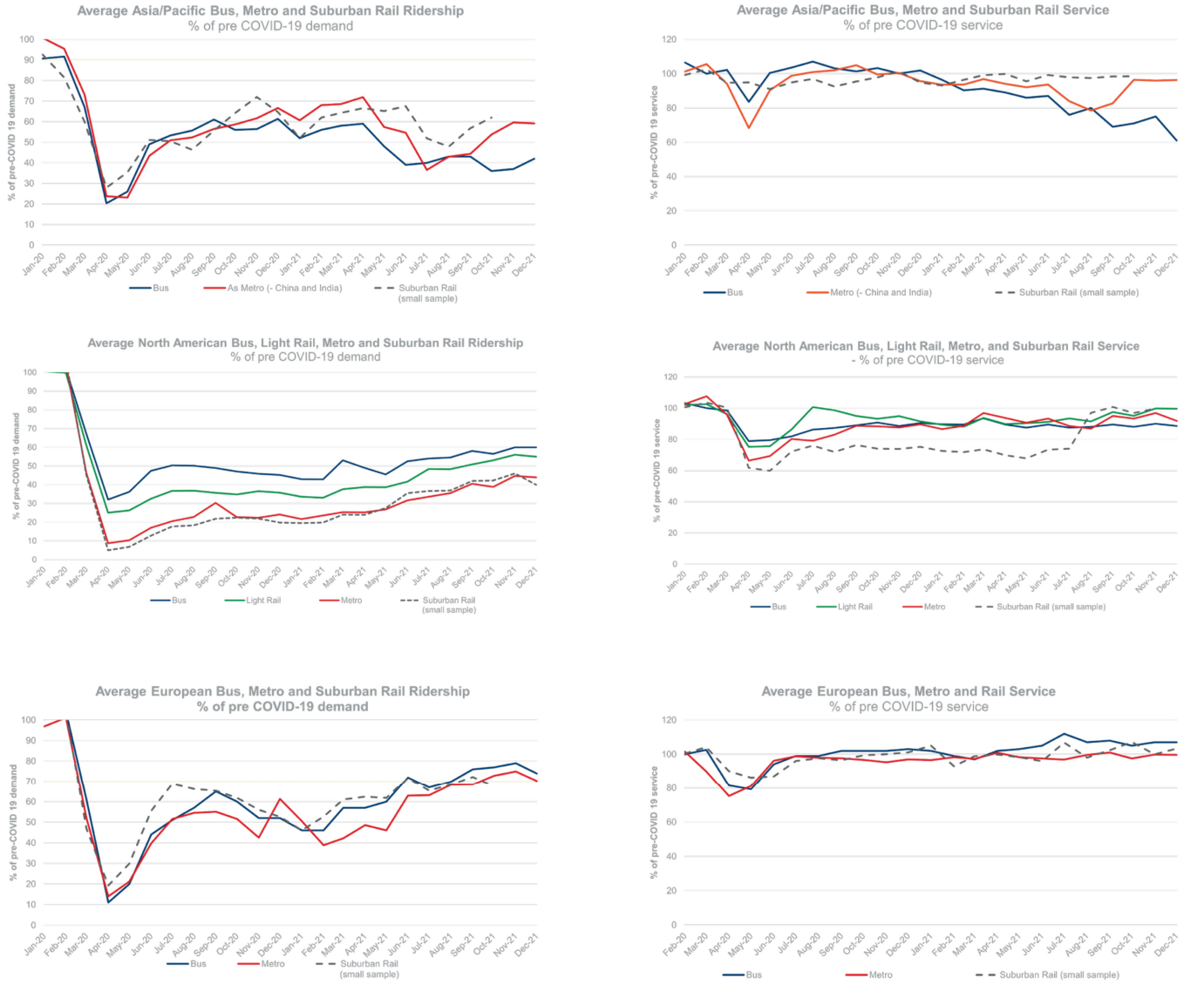


Figure 2:

Average ridership/service by mode/region as % of pre COVID-19 demand

Source: TSC bus, light rail, suburban rail and metro benchmarking groups / National Transit Database (Federal Transit Administration)

  - For January 2022, one metro operator announced a COVID-19 timetable (based on weekend service) to reduce the pressure on staffing.

- **North American light rail and suburban rail** service has, on average, remained high throughout the pandemic with service at pre-pandemic levels towards the end of 2021.
- **Bus service levels in North America** recovered to an average of around 90% very early on in the pandemic and have remained stable at this level since.
  - 2022 trends are likely to be impacted by the Omicron wave of infections with several operators implementing temporary service adjustments for January to mitigate driver availability issues:
    - One operator recently reported being able to run only 85% of service due to 25% of drivers being unavailable.
    - Similarly, a second operator reduced service by 10% due to Omicron-related driver shortage issues.
- **North American metro** service has, on average, exceeded 90% of pre-pandemic service for much of 2021.
  - This trend may continue or worsen in recent months due to the ongoing effects of Omicron:
    - One operator reports having to reduce scheduled weekday service by about 15% due to driver absenteeism.
- Across the bus, metro and rail modes, **service levels in Europe have consistently been kept high** throughout the pandemic and often exceeding pre-pandemic levels, in particular for bus and rail modes.
  - Similar to North America, more recent data for 2022 is likely to show a different picture:
    - A metro operator is having to reduce weekday service on 4 lines to 5-minute frequencies throughout the day.

Overall, service has, on average, been kept at high levels across the public transport sector up until now. Given current financial pressures facing the public transport industry, an obvious concern within the sector is that reducing service as part of a cost reduction strategy would reduce ridership recovery: **demand responds to the service** provided and therefore cutting services based on lower demand forecasts risks **constraining the recovery** and has **limited ability to generate savings in the short term**.

It remains to be seen how operators will be able to balance the financial and operational pressures that they will increasingly be facing over the coming years, and how service may be impacted.

A number of public transport organisations are already planning for or implementing service cuts:

- In London, Transport for London's funding agreement with the UK Government requires a reduction of the bus network by 4%, largely in areas of reduced demand (i.e. Inner London).
  - TfL carried out a service level review[1] as required in this funding deal which highlights the risks of service cuts and that this is not the right approach until there is a better understanding of post-COVID demand.
  - In addition, TfL note that service cuts risk undermining public confidence in the availability of services, inadvertently driving a car-led recovery:
    - Any service reductions undermine the shared local and national priorities on air quality, active travel and decarbonisation.
    - Service reductions will limit mode shift to public transport and also remove the industry confidence required to invest in people, skills, and innovation."
- In a further example, a North American bus operator plans to remove 6% of service hours from high-frequency routes and reallocate to routes where investment was deferred due to the pandemic.
- In New York, the MTA's Metro-North Railroad and Long Island Rail Road are considering potential service reductions of up to 50% to reduce costs. Options being considered include full or partial suspension of service on both weekdays and weekends, and peak service reductions to 20-30 minute or hourly frequencies.

In an opposite scenario and in line with TfL's concerns noted above, one North American operator is aiming to **restore service** as much as possible to **avoid hampering their ridership recovery** as demand increases. However, the operator notes that a key constraint to restoring service is their ability to recruit more drivers.

Public transport is facing growing budgetary pressures under current pandemic and financial circumstances

The COVID-19 pandemic has created large gaps in funding as ridership, and therefore revenue, dropped to low levels and remain below pre-pandemic levels two years into the crisis. A year ago, in the first edition of this report, we reported that the financial outlook in the public transport sector was extremely

uncertain and, unfortunately, this statement remains as valid now as it was then.

Although variable between operators, the impact of lower cost recovery ratios has resulted in a significant funding gap. This means that there is a strong need for financial aid, particularly for those reliant on a high proportion of commercial revenue from fares. Figure 3 clearly demonstrates the average funding gap experienced across a selection of international bus operators, based on ridership and service level data from the International Bus Benchmarking Group (relative to the same month in 2019).

The revenue side of the gap is multi-faceted and key factors affecting fare revenues are:

- **Changing travel patterns**: shifts in travel habits driven by the pandemic, such as increased home working and earlier peak hour periods, may negatively influence fare revenues.
- The **type of contract** that a public transport provider has with their authority: operators with a **gross cost** contracting arrangement have **no revenue risk**, and are therefore less directly impacted financially by lower ridership.
  - Oslo Sporveien and Ottawa OC Transpo, for example, are compensated for all lost fare revenue.
- The **homeworking culture** of cities: cities with a lower level of home working, for example, have returned to higher ridership levels.
- **COVID-19 fare policies**: fare suspensions, discounts (including those resulting from policies related to public transport equity), and freezes, alongside significantly reduced fare income, have further contributed to low cost recovery ratios.

Sustained Government funding for the public transport sector is crucial to minimise long term financial and operational risks

Many public transport providers have received additional COVID-19 funding in various forms, most commonly:

- **Government grants** from central governments (i.e. federal or state level) and local governments (i.e. city or region level).
  - For example, the US and UK central governments have granted pandemic-related funding to public transport organisations.
    - Examples from the US include a USD $6 billion COVID-19 recovery grant for the MTA, and multiple rounds of emergency funding for Washington WMATA, due to expire in June 2023 (USD $704.7 million in FY2021, USD $762.6 million budgeted for FY2022, and USD $725.8 million budgeted for FY2023).
    - Vancouver TransLink received CAD $282 million in funding aid in 2021; however, no further financial support is assumed for 2022.
- **Employment schemes** have been available through some governments:
  - Dublin Bus, for example, benefited from Section 28B of the Emergency Measures in the Public Interest (COVID-19) Act 2020, which provided the **Employment Wage Subsidy Scheme**[2].
    - Note that Dublin Bus is no longer eligible for the scheme since entering a Gross Cost Contract in 2021.

Despite short-term COVID-19 funding aid and organisations' own efforts to bridge the funding gap, a slow and uncertain ridership recovery makes it necessary for a long-term funding commitment from governments. In the absence of stable fares and funding, there is a risk of long-term financial and operational difficulties:

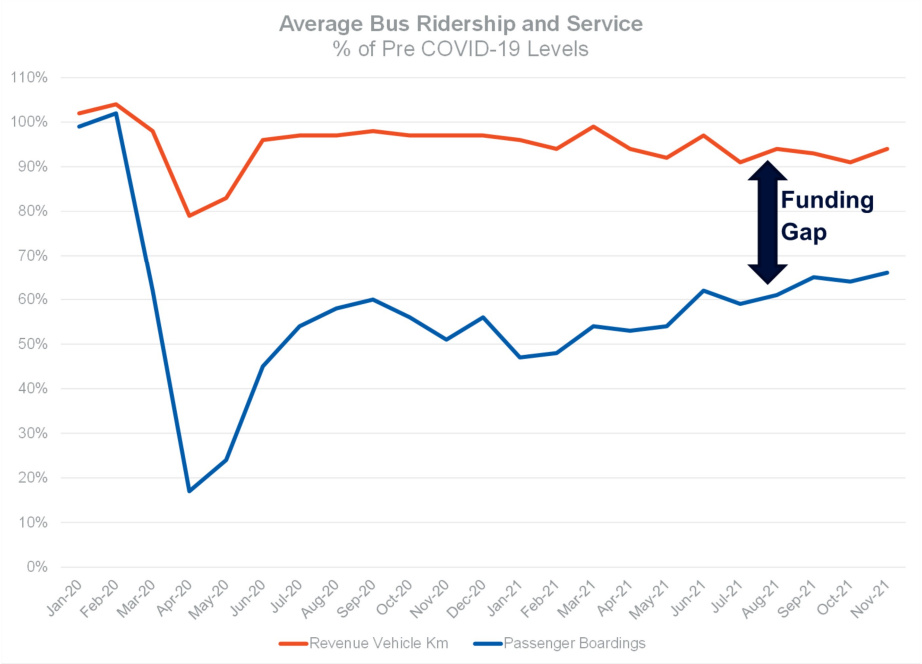


Figure 3:

Average bus ridership and service as % of pre COVID-19 demand

Source: IBBG

- Long-term planning for investment will be difficult;
- The quality of public transport services will fail to meet the rising expectations of the public; and
- Public transport operators risk a spiral of decline in quality of service due to falling real fares and insecure funding regimes.

COVID-19 fare policies: need to balance financial viability vs. affordable and attractive fares

There are often competing priorities between public transport provider and customers, and these are further exacerbated within a pandemic environment where financial pressures and attracting demand are key focus areas:

- On the operator side, fares should be **financially viable**, maintainable as populations and costs change, and **agile** to adapt to changing travel patterns.
- On the customer side, fares must be **clear**, with a transparent process, fares should be **affordable** and **attractive** (i.e. promoting the use of public transport).

The majority of public transport operators have endured **frozen fees** or at least kept fares low in 2020 and 2021.

- In Vancouver, for example, provincial funding has meant that it has been possible to cancel the planned 2020 increase.
  - In 2021, a fare increase of 2.3% was implemented (vs. the planned 4.1% increase) and will be kept low until 2024.
- In a European city, public transport operators are having to operate with frozen fares for a second consecutive year.
  - The rationale behind the fare freeze is to support the city's economy and its people, and to encourage demand recovery.
  - Growing pressures on the cost side related to higher service levels and associated costs (including energy costs) have led to the city's railway operator to start planning for cost efficiencies (e.g. reduction in off-peak service).

For many operators who are not in receipt of funding aid or where future funding is uncertain/due to expire, their fare pricing strategy is shifting towards increasing commercial revenues through **higher fares**.

- Given ongoing uncertainty around government funding support, Newcastle Nexus has been considering their options to achieve efficiencies:
  - The price of paper tickets will increase from 1st April 2022:
    - **+9.5%** for single and day paper tickets.
    - **+3%** for weekly/monthly/annual season tickets.
  - Smartcard and other concessionary ticket products will remain frozen.
  - *Note that Government funding for Newcastle Nexus had been due to end in March 2022, however the Government announced on 1st March 2022 a funding support package for a further six month period*[3].

Transport for London fares due to increase by 4.8% in March 2022

Fares on TfL services will rise by RPI+1 (4.8%)[4] in March 2022 to help TfL reach financial sustainability. This is in line with conditions of the emergency funding deal with the UK Government and follows a period of frozen fares for the first four years of the current Mayor of London's tenancy.

Many public transport operators continue to develop new fare strategies targeting both greater fare revenues as well as providing attractive ticketing options:

- Introducing **new ticket options** for hybrid workers or offering fare promotions to re-attract customers.
  - Berlin BVG has developed a **new flexible ticket option** (EUR €44) available throughout 2022.
    - Suitable for customers with a homeworking pattern averaging around 2-3 days at home.
    - Eight tickets valid for 24 hours each; unused tickets expire after 30 days.
  - Brussels STIB developed a **'100 journeys ticket'**[5] to accommodate increasing hybrid working patterns, as an alternative to the typical monthly or yearly season tickets. The ticket is valid for 90 days and priced at EUR €135.
  - Transport for New South Wales customers **gain credit** (up to AUS $3) on their Opal account when they transfer to public transport from rideshare services.
  - Seattle King County Metro launched **'Promo Codes'** to offer promotional free bus trips and on-demand trips.

Source: Metropolitan Transportation Authority

The MTA's new pilot fare programme is designed to provide a "more affordable, more flexible, more fair" travel offer

The Metropolitan Transportation Authority (MTA) in New York is launching its **pilot fare programme**[6] in February 2022, designed to encourage passengers back onto public transport.

New York City Transit (subway and bus):

- Customers will automatically be charged the best fare with OMNY, the new contactless fare payment system: fare capping means that customers will be entitled to free unlimited rides after 12 taps at the standard rate of USD $2.75 within the same calendar week (Monday to Sunday).
- Customers will be charged a maximum of USD $33 per week, which equates to the price of the previous seven-day unlimited-ride MetroCard, yet they will receive the same benefits without any up-front costs.

Long Island Rail Road and Metro-North Railroad

The pilot includes three promotional fares for the MTA's railroads:

- A **new 20-trip ticket** offers a 20% discount relative to 20 peak one-way fares. The 20-trip ticket is valid for 60 days.
- **Monthly** tickets are discounted by 10%.
- **CityTicket**, which offers a reduced, flat fare for rail travel within New York City on weekends, is extended to all weekday off-peak travel at a fare of USD $5. These tickets are valid on the date of purchase.

The trial is planned to run for at least four months, taking effect from February 2022. The MTA will evaluate the new fares' impact on operations, the customer experience and farebox revenue. If the pilot proves successful, the new fare structures could be extended or become permanent.

Further examples of fare promotions developed by public transport providers for 2022 are described below.

- Washington WMATA has been welcoming public feedback on **fare proposals**[7] for consideration by the Board of Directors in March 2022. The key elements of the proposals are:
  - USD $2 one-way trips after 9:30pm on weekdays
  - 11% discount on Monthly Unlimited Passes
  - 50% discount on the 7-Day Unlimited Pass at USD $29 (temporary fare promotion for up to six months)
  - USD $5 bonus for every USD $25 added to SmarTrip cards (temporary fare promotion for up to six months)
- In Kuala Lumpur, the My50 travel pass[8] has been introduced for 2022 to encourage the use of public transport and provide some financial relief to the public. The discounted travel pass (RM50) provides **30 days of unlimited travel** on Rapid KL services.
- Tokyo Metro is offering weekday and weekend promotions:
  - **Unlimited weekend travel** for JP¥2,000 per month (to be launched this coming spring)
  - **Incentive points** for off-peak travel (weekend and weekday daytime).

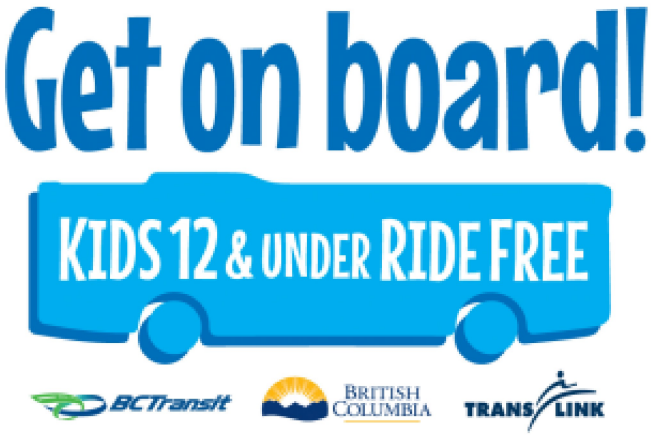
Concessionary fares are kept low or reduced, and children travel free on many transport systems

- Selected examples of heavily discounted concessionary fares are shown for Metro de Madrid and Brussels STIB:Metro de Madrid reduced its **30-day travel pass for the over 65s** from EUR €6.3 down to €3.3. The discounted ticket offer is largely driven by political ambitions.
- Brussels STIB has launched a **new annual season ticket for 18-24 year olds** at EUR €12. Previously, young people in this age group would pay the full fare and this promotional offer seeks to encourage public transport uptake in this age group.

Several operators have expanded their free travel offer for children:

Source: RapidKL

- Ottawa OC Transpo's **free child fare**[9] has been expanded to include **all children aged seven and under** from January 2022. Previously children up to the age of five were entitled to free travel.
- In Vancouver, the provincial government of British Columbia introduced **free travel for children up to the age of 12** as part of its 'Get on Board' initiative. The scheme was launched in September 2021.
- In the US, two bus operators in California launched free youth fare programmes in August/September 2021:
  - Omnitrans (San Bernardino) launched its **Free Fares for School** pilot[10] and OCTA (Orange County) offers a **Youth Ride Free** pass[11]. Both apply to K-12 students (i.e. Kindergarten to 12th grade students).
- Newcastle Nexus' offer[12] of **free travel for three children aged 11 and under per paying adult** continues to be offered in 2022.
  - The offer, initially introduced for weekends and bank holidays in January 2020, was expanded to cover all weekdays during the summer of 2021.
  - This family promotion has been hugely successful and is a great incentive to boost leisure travel and rebuild revenue.



Source: Government of British Columbia

Source: Newcastle Nexus

Alternative non fare revenue streams can provide opportunities to increase commercial revenue, including parking initiatives

The development of new non-fare revenue service is an option that some public transport operators are considering and implementing to reduce their funding gap:

- Washington WMATA's FY 2023 Business Plan includes identifying **innovative non-fare revenue opportunities**, particularly with regard to operating initiatives that *"ensure equity, enhance customer experience and operating efficiency"*:
  - **Recent parking initiatives**, for example, are expected to generate up to USD $3 million in additional revenue once ridership levels return. Initiatives include **lowering daily fees** at low utilisation parking facilities, and **increasing parking spaces leased** to non-transit users and for commercial uses.
  - Revenue from the remaining non-fare revenue streams relate largely to **advertising, joint development, fibre optics** and other non-transit revenues.
- A further example of generating revenue from parking facilities/depot space is from a European operator:
  - **Surplus bus garage capacity** has been used for commercial activities (e.g. renting out depot space for 3rd party urban logistics vehicles such as bicycles and trucks).

Some operators have developed revenue generating opportunities in combination with **tourist attractions**:

- Dublin Bus introduced the sale of third-party tickets on their commercial website[13] in 2021, in order to generate revenue from various tourist attractions.
- Tokyo Metro's one-day unlimited travel pass includes offers and discounts at popular tourist attractions[14].

Practical examples to manage COVID-19 operational challenges

This section summarises recent information on practical examples or decisions around practices being considered by transport operators to manage operational challenges arising from the COVID-19 pandemic.

Mandatory COVID-19 vaccination is a key feature of a new policy adopted by an Asian public transport provider

In November 2021, a public transport organisation in the Asia/Pacific region launched a new internal policy mandating a COVID-19 vaccination for all employees:

- All employees were required to comply with the policy by 6th December 2021, unless eligible for an exemption.
- All non-compliant staff had until 7th February 2022 to meet the requirements.
    - » Prior to this deadline, unvaccinated employees were entitled to take annual leave, long service leave or leave without pay

Availability of face masks/coverings on buses

Throughout the pandemic, it has not been common practice to provide customer face masks on-board buses (contrary to face masks being made available in metro stations for example). One example of an operator providing masks to customers on-board buses is Seattle KCM, and there are no plans to end this practice. In fact, Seattle KCM are considering providing higher grade face masks to surgical masks (e.g. KN95) to minimise the spread of the Omicron variant. This would, of course, have a cost implication.

A second bus operator, known to have provided customer face masks on buses, is New York City Transit. Although this initiative has largely ended, several depots continue to refill on-board mask dispensers on high ridership routes in the Bronx and Manhattan boroughs of the city. In addition, the MTA's "mask force" initiative is still running which involves staff and volunteers handing out masks across the bus, metro and rail modes.

Source: Seattle King County Metro

US federal mask requirement for public transport travel is extended by one month to April 2022

The US travel mask mandate, due to expire on 18th March 2022, has been extended to 18th April 2022[15]. This follows two previous extensions to the requirement.

Endnotes

1 https://content.tfl.gov.uk/financial-sustainability-plan-11-january-2021.pdf

2 https://www.citizensinformation.ie/en/employment/unemployment_and_redundancy/employment_support_scheme.html

3 https://www.nexus.org.uk/news/item/metro-secures-further-government-covid-funding-support-services-through-october

4 https://www.london.gov.uk/press-releases/mayoral/fares-on-tfl-services-will-rise-by-48-per-cent

5 https://www.stib-mivb.be/article.html?l=en&_guid=e02c4089-2d36-3910-7ba9-f5bbdabf8395

6 https://new.mta.info/press-release/mta-fare-change-pilot-begin-end-of-month

7 https://www.wmata.com/about/news/FY23-Budget-Public-Comment.cfm

8 https://myrapid.com.my/our-products/my50/

9 https://www.octranspo.com/en/news/article/no-charge-service-for-children-7-and-under

10 https://omnitrans.org/buy-a-pass/free-fares-for-school/

11 https://www.octa.net/Bus/Fares-and-Passes/Specialty-Passes/Youth-Pass/

12 https://www.nexus.org.uk/metro/take-kids-free

13 https://dodublin.ie/dublin-city-sightseeing-tours/partner-tours

14 https://chikatoku.enjoytokyo.jp/en/index.html#ancher_howto

15 https://www.tsa.gov/news/press/statements/2022/03/10/statement-regarding-face-mask-use-public-transportation

References

Relevant COVID-19 Literature

Barbieri DM, Lou B , Passavanti M, Hui C, Hoff I, et al. (2021) Impact of COVID-19 pandemic on mobility in ten countries and associated perceived risk for all transport modes. PLoS ONE 16(2): e0245886.
Description: A cross-country study researching the individual mobility patterns for all transport modes before and during restrictions. The study findings suggest that air and bus travel are perceived by the public to be the riskiest transport modes for COVID-19 transmission, and avoidance of public transport for commuting and non-commuting trips is found across all 10 countries included in the research.

Dai J, Liu Z, Li R (2021) Improving the subway attraction for the post-COVID-19 era: The role of fare-free public transport policy. Transport Policy.
Description: This paper reviews the impact of fare-free policies in three Chinese cities to attract passenger demand. The study identifies that the role of the fare-free policies in helping recover demand is limited and recommends the use of multi-pronged approaches in combination with fare-free policies.

Di Carlo P, Chiacchiaretta P, Sinjari B, Aruffo E, Stuppia L, De Laurenzi V, et al. (2020) Air and surface measurements of SARS-CoV-2 inside a bus during normal operation. PLoS ONE 15(11): e0235943
Description: Air and surfaces of buses in an Italian town were tested during regular operations with average passenger loads of 123 passengers per run. All air and surface samples tested negative for the presence of the Sars-Cov-2 virus, indicating the effectiveness of cleaning, ventilation, and social behaviour policies (i.e. social distancing and wearing of masks). It should be noted that the infection status of passengers at the time of testing was unknown.

Dong H, Ma S, Jia N, Tian J (2021) Understanding public transport satisfaction in post COVID-19 pandemic. Transport Policy, Elsevier.
Description: The aim of this research is to understand passengers' psychological responses to the pandemic over time as public transport begins to resume its operations with the pandemic almost entirely contained in China. A cross-sectional survey was conducted in eight cities of China where the public transport system had been temporarily closed because of the pandemic. The results indicated that (1) passengers' feelings of safety enhanced their overall satisfaction with regard to public transport, (2) state anxiety has a negative effect on perceived safety, (3) state anxiety increases as passengers are psychologically closer to the pandemic, and (4) passengers pay more attention to information that is psychologically closer to the pandemic and perceive lesser safety on public transport. These findings not only reveal the internal mechanisms behind how passengers perceive safety but may also provide insight for future disaster emergency management. Based on the results, some feasible suggestions are proposed to avoid the loss of ridership and help public transport systems recover.

Gkiotsalitis K (2021) Public transport planning adaption under the COVID-19 pandemic crisis: literature review of research needs and directions. Transport Reviews, Volume 41, Issue 3, Taylor and Francis.
Description: This literature review aims to systematically review and synthesise the literature on the impacts of COVID-19 on public transport to identify the need to adjust planning measures, and, on the other hand, the existing methods for public transport planning at the strategic, tactical and operational level. Intervention measures that can support public transport service providers in planning their services in the post-shutdown phase and their respective modelling development requirements are identified. This can support the transition from the initial ad-hoc planning practices to a more evidence-based decision making.

Ku, D., Yeon, C., Lee, S., Lee, K., et al. (2021) Safe traveling in public transport amid COVID-19. Science Advances, Volume 7, Issue 43.
Description: Simulation of the exposure to infection on public transport and analysis of the risk of infection in an environment where mandatory prevention measures are in place. The simulation finds that the mandatory wearing of masks provides a similar effect to a 2m social distance in preventing COVID-19, whereas social distancing with masks during peak hours reduces infection rates by 93.5% and 98.1%, respectively.

Hörcher, D., Singh, R., Graham, DJ., (2021) Social distancing in public transport: Mobilising new technologies for demand management under the Covid-19 crisis. Transportation.
Description: This paper reviews the literature of five demand management methods to enforce social distancing on public transport and the practical applicability of each method: 1. inflow control with queueing, 2. time and space dependent pricing, 3. capacity reservation with advance booking, 4. slot auctioning, and 5. tradeable travel permit schemes.

Hunt, M. (2020) Covid-19 Transmission Rates on Rail, Technical report, RSSB.
Description: A recent report by the UK Rail Safety and Standards Board (RSSB) estimated the infection risk on UK rail as a function of the inter-personal contact risk, the number of contacts per journey, and any mitigating factors. The risk of infection was estimated to be 1 in 11,000 journeys or 0.009% per journey. The report was published in August 2020, and so infection parameters were based on disease dynamics at that

time. Since then, infection dynamics have altered with the introduction of new variants, and the RSSB acknowledges that the quoted infection risk is likely to increase.

Moreno, T. et al (2021) Tracing surface and airborne SARS-CoV-2 RNA inside public buses and subway trains. Environment International 147 (106326) 1-11.

Description: Air and surfaces of buses and subway trains in Barcelona were tested - 30 out of 82 air and surface samples showed evidence of target RNA genes of the Sars-Cov-2 virus, with surface swabs showing more positive results than air samples. After bus cleaning, there was a reduction in positive surface swab samples, however 4 from 30 samples still yielded positive results. Further testing on the efficacy of cleaning is recommended.

Mutambudzi, M. et al. (2020) Occupation and risk of severe COVID-19: prospective cohort study of 120 075 UK Biobank participants. Occupational and Environmental Medicine.
Description: Research identifies that essential workers have a higher risk of severe illness from COVID-19. Risk to public transport workers is found to be double that of non-essential workers.

Tardivo A , Zanuy AC , and Martin CS (2021) COVID-19 Impact on Transport: A Paper from the Railways' Systems Research Perspective. Transportation Research Record.
Description: Analysis of the impact of the COVID-19 pandemic on the rail sector identifies resilience, return, reimagination, reform, and research, as the necessary steps to provide service and enhance rail competitiveness and resilience in the event of future crises.

Yabe, T., Tsubouchi, K., Fujiwara, N. et al. (2020) Non-compulsory measures sufficiently reduced human mobility in Tokyo during the COVID-19 epidemic. Scientific Reports 10, 18053.
Description: A study of mobility patterns in Japan showed that reductions in mobility (attributed to soft lockdown policies) were associated with reductions in the case reproduction number.

Zachreson C, Mitchell L, Lydeamore MJ, Rebuli N, Tomko M, Geard N. (2021) Risk mapping for COVID-19 outbreaks in Australia using mobility data. Journal of the Royal Society Interface 18: 20200657.
Description: COVID-19 outbreaks in Australia were found to be well predicted by mobility data - especially at locations associated with habitual travel patterns e.g. workplaces.

Contact us

The TSC at Imperial College London

The Transport Strategy Centre (TSC), previously known as The Railway and Transport Strategy Centre, was established in 1992 as a centre of excellence serving the railway industry on strategic, economic and technology issues. Today, the TSC is a globally recognised team specialising in performance benchmarking, research and policy for industry and government.

The Applied Research Team within the TSC works directly with industry to improve performance in public transport worldwide, based on a systematic process managed and facilitated by the TSC through multi-year international benchmarking projects.

Imperial College London is a global university with a world-class reputation in science, engineering, business and medicine. Well known for its excellence in teaching and research, Imperial College London is consistently rated in the top 10 universities worldwide.

Thank you for reading this report.

For any enquiries or if your organisation has any COVID-19 news items that you wish to share in a future report, please contact the TSC.

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Appendix A

List of Benchmarking Groups and Members

COMET
Community of Metros
Benchmarking Group

American Metros

- Metrovías (Buenos Aires – Argentina)
- Washington Metropolitan Area Transit Authority (WMATA – United States)
- Sistema de Transporte Colectivo (STC – Mexico City)
- Société de transport de Montréal (STM – Canada)
- MTA New York City Transit (NYCT – United States)
- Ottawa-Carleton Transportation Commission (OC Transpo – Canada)
- Rio de Janeiro (Metrô Rio – Brazil)
- Metro de Santiago (Santiago – Chile)
- Bay Area Rapid Transit (BART – United States)
- Companhia do Metropolitano de São Paulo – Metrô (MSP – Brazil)
- Toronto Transit Commission (TTC – Canada)
- SkyTrain (BCRTC – Canada)

European Metros

- Transports Metropolitans de Barcelona (TMB – Spain)
- Berliner Verkehrsbetriebe (BVG – Germany)
- Société des Transports Intercommunaux de Bruxelles (STIB – Belgium)
- Docklands Light Railway (DLR – United Kingdom)
- Metro Istanbul San. Ve Tic. A.S. (Metro Istanbul – Turkey)
- Metropolitano de Lisboa (ML – Portugal)
- London Underground Limited (LUL – United Kingdom)
- Metro de Madrid (Spain)
- Tyne and Wear Metro, (Nexus – United Kingdom)
- Oslo Sporveien (Norway)
- Régie Autonome des Transports Parisiens Métro (RATP Métro – France)
- Régie Autonome des Transports Parisiens RER (RATP RER – France)

Asian Metros

- Bangalore Metro Rail Corporation Limited (BMRC – India)
- Bangkok Expressway and Metro Public Company (BEM – Thailand)
- Beijing Mass Transit Railway Operation Corp. (BMTROC – China)
- Delhi Metro Rail Corporation Ltd (DMRC – India)
- Roads and Transport Authority (RTA – United Arab Emirates)
- Guangzhou Metro Corporation (GMC – China)
- MTR Corporation Limited (MTR – Hong Kong)
- Jakarta MRT (Indonesia)
- Nanjing Metro Operation Corp. (China)
- Seoul Metro (South Korea)
- Shenzhen Metro Operation Corp. Ltd (China)
- Singapore Mass Rapid Transit Corporation Ltd (SMRT – Singapore)

- Shanghai Shentong Metro Group (SSMG – China)
- Syarikat Prasarana Negara Berhad (RapidKL – Malaysia)
- Taipei Rapid Transit Corporation (TRTC – Taiwan)
- Tokyo Metro Co., Ltd. (Japan)
- Sydney Metro (Australia)
- Sydney Trains (Australia)

ISBERG
International Suburban Rail Benchmarking Group

- Ferrocarrils de la Generalitat de Catalunya (FGC – Spain)
- Queensland Rail (Australia)
- S-Tog, Danish State Railways (DSB – Denmark)
- PRASA – Metrorail (South Africa)
- MTR Hong Kong (East Rail, West Rail, Tuen Ma & Tung Chung Lines – Hong Kong)
- MTA Long Island Rail Road (LIRR – United States)
- London Overground – London Rail (United Kingdom)
- Metro Trains Melbourne (Australia)
- MTA Metro-North Railroad (United States)
- S-Bahn Munich, Deutsche Bahn (DB) Regio (Germany)
- Commuter Rail, Vygruppen (Vy – Norway)
- Bay Area Rapid Transit (BART – United States)
- Sydney Trains (Australia)

IMRBG
International Mainline Rail Benchmarking Group

- Danish State Railways (DSB - Denmark)
- Irish Rail (Ireland)
- Nederlandse Spoorwegen (NS – Netherlands)
- Société nationale des chemins de fer belges (SNCB – Belgium)
- New South Wales TrainLink (New South Wales, Australia)
- Via Rail Canada (Canada)
- V/Line (Victoria, Australia)

GOAL
Benchmarking Group of North American Light Rail Systems

- Niagara Frontier Transportation Authority (NFTA – Buffalo, NY)
- Maryland Transit Administration (MTA Maryland – Baltimore, MD)
- Calgary Transit (C Train – Calgary, AB)
- Charlotte Area Transit System (CATS – Charlotte, NC)
- Dallas Area Rapid Transit (DART – Dallas, TX)
- Edmonton Transit System (ETS – Edmonton, AB)
- Hampton Roads Transit (HRT – Norfolk, VA)
- Ottawa-Carleton Transportation Commission (OCTranspo – Ottawa, ON)
- Pittsburgh PAAC (The T – Pittsburgh, PA)
- Tri-County Metropolitan Transportation District (TriMet – Portland, OR)
- San Diego Metropolitan Transit System (MTS – San Diego, CA)
- Sound Transit (ST– Seattle, WA)
- Toronto Transit Commission (TTC – Toronto, ON)
- Utah Transit Authority (UTA – Salt Lake City, UT)

International Bus Benchmarking Group

- Transports Metropolitans de Barcelona (TMB, Barcelona)
- Société des Transports Intercommunaux de Bruxelles (STIB, Brussels)
- Dublin Bus (Dublin)
- IETT Isletmeleri Genel Müdürlügü (IETT, Istanbul)
- Rapid Bus Sdn Bhd (Rapid Bus, Kuala Lumpur)
- Companhia Carris de Ferro de Lisboa (Carris, Lisbon)
- London Buses (LBSL, London)
- Societe de Transport de Montréal (STM, Montréal)
- MTA – New York City Transit (NYCT) & MTA Bus (New York)
- Régie Autonome des Transports Parisiens (RATP, Paris)
- King County Metro Transit (KCM, Seattle)
- SMRT Buses (Singapore)
- Coast Mountain Bus Company (CMBC, Vancouver)

American Bus Benchmarking Group

- Capital Metropolitan Transportation Authority (Cap Metro – Austin, TX)
- Niagara Frontier Transportation Authority (NFTA – Buffalo, NY)
- Charlotte Area Transit Systems (CATS – Charlotte, NC)
- Dallas Area Rapid Transit (DART – Dallas, TX)
- Des Moines Area Regional Transit Authority (DART – Des Moines, IA)
- Greater Dayton Regional Transit Authority (GDRTA – Dayton, OH)
- Lane Transit District (LTD – Eugene, OR)
- Mass Transportation Authority (MTA – Flint, Michigan)
- Foothill Transit (San Gabriel Valley, LA County, CA)
- Hampton Roads Transit (HRT – Hampton, VA)
- Jacksonville Transportation Authority (JTA – Jacksonville, FL)
- Milwaukee County Transit System (MCTS – Milwaukee, WI)
- Orange County Transportation Authority (OCTA)
- Pittsburgh PAAC (Port Authority – Pittsburgh, PA)
- Regional Transit Service (RTS – Rochester, NY)
- Rhode Island Public Transit Authority (RIPTA – Providence, RI)
- Greater Richmond Transit Company (GRTC, Richmond, VA)
- Omnitrans (San Bernardino, CA)
- San Joaquin Regional Transit District (RTD – Stockton, CA)
- Pinellas Suncoast Transit Authority (PSTA – St. Petersburg, FL)
- Spokane Transit Authority (STA – Spokane, WA)
- Utah Transit Authority (UTA – Salt Lake City, UT)
- Clark County Public Transportation Benefit Area (C-TRAN – Vancouver, WA)

Railway Infrastructure Asset Management Benchmarking Group

- Queensland Rail (Brisbane, Australia)
- KiwiRail (New Zealand)
- Public Transport Authority Perth (Perth, Australia)
- Sydney Trains (Sydney, Australia)