

FLATTENING PEAK TRAVEL TIME: MEASURES TO BETTER DISTRIBUTE TRAVEL DEMAND

DECEMBER | 2020

INTRODUCTION

The work in this paper commenced before the Covid-19 crisis. Since the pandemic, many quick and immediate measures were taken to ensure safety for commuters and some examples have been added to this paper. However, one of the key purposes of this paper is to inform readers of pre-pandemic methods related to distributing the crowd that could guide the post-pandemic recovery planning.

Across our sector, various organisations are exploring and implementing schemes to incentivise an adjustment in commuter behaviour with the hope of aiding improved services during the busiest times. This is being done by increasing usage during non-peak hours and thus distributing the rush hour crowds. In this Knowledge Brief, we will examine the easing of passenger loads to distribute the peak travel periods. We will take a closer look at case studies from around the world and inspect the approaches taken by these companies to tackle the congestion on public transport lines.



BACKGROUND

Before the Covid-19 crisis, the public transport sector saw opportunities to explore novel approaches to boost ridership around the world. However, more people on the transport network presented issues such as overcrowding, pressure on the public transport infrastructure and the subsequent poor quality of service. These challenges needed to be dealt with suitably to ensure that public transport would remain or become the chosen method of mobility. One particular manner of providing improved services had the potential of being a mass solution but it required adjustments to various economic and social activities.

Then, around late 2019 - early 2020, an outbreak of the Covid-19 virus was deemed a pandemic, forcing most

countries into a complete lockdown for a few months. While the world essentially shut down, public transport promptly adopted the recommended safety measures and heroically remained in service for essential trips. With fewer passengers due to the lockdown, demand management with the necessary confinements of frequent disinfection and recommended physical distancing was possible.

Depending on the situation, the severity of lockdown levels began changing globally. The conversations transitioned from focusing only on determined defence against the virus, to also laying a foundation for the future. It became evident that we would not be returning to a pre-pandemic world. At the time of writing this paper, the latest scientific studies stated that the virus spreads primarily through respiratory droplets and contact routes. This led many governments to recommend physical distancing as one of the fundamental ways to counter the virus in any public space, meaning that there would be a critical need to limit crowds and human density in urban areas.

Imposing physical distancing on public transport vehicles is unrealistic in the long-term for obvious reasons. The urgent need to create safe spaces for both passengers and transport workers while restoring faith in mass transport has provided an exceptional incentive for our solution: **Moving towards a different time schedule for some economic and social activities to distribute peak commute hours and better manage the demand in public transport networks.**



1 Currie, Graham. (2009). Exploring the impact of the “Free Before 7” campaign on reducing overcrowding on Melbourne’s trains. 32nd Australasian Transport Research Forum, ATRF 2009.

2 More information at: www.tfl.gov.uk

DIFFERENT TYPES OF PEAK TRAVEL

Before the pandemic, there were three main peaks that operators identified:



The **daily rush** with students trying to get to their establishments and employees wanting to get to their places of work. This generally extends over a chunk of the mornings and evenings. Large metropolitan cities like Melbourne are reportedly experiencing a situation of “peak spreading”. This means that peak hours are now beginning earlier and ending later. The spike is beginning to start as early as 06.00 and goes on until 10.00, and the evening peak ends at about 21.00, with a start at 15.00. In a bid to ease this crowding, Melbourne rolled out an Early Bird programme that made trains free if you touched on and off before 07.15 on a weekday¹. Early Bird subscribers were surveyed and it was found that while 67% had not changed their travel timing, 23% had purposely moved their departure time to travel earlier, and 10% were completely new passengers who took advantage of this scheme.



But of course, peak travel period occurs not just on a day-to-day basis but also seasonally. With public transport considered as one of the best ways to explore a city, there is a jump in ridership based on the **season for tourism**. The popularity of targeted tourist tickets and attraction passes that offer appealing ways of exploring a city, has also added to the human congestion on the networks. Expensive parking and paid road access to the city centre adds to the tourist preference for public transport over private vehicles to get around. While we surely must encourage this, capacity and demand have to be managed to ensure comfort and ease of operations especially during high peak times. London’s Underground² offers two different prices for peak and off-peak hours, to urge commuters like tourists who are usually not bound by a particular schedule, to travel outside of the key commute times. A visitor version of their popular Oyster card has been created that easily allows usage of multiple modes with one card. With the option of different modes available with this single card, tourists can choose which option works best for their needs to reach a particular site.



Another reason for particularly busy networks during a specific time period are **events and special occasions**. Sports and concerts often attract people in the thousands from all parts of the city. Those attending the events generally arrive and leave at the same time. Operators want to ensure that waiting times are brought down to the minimum and that the experience to and from the venues are pleasant and preferred. When Rio de Janeiro hosted the World Cup Finals in 2014, more than 1.35 million tourists and football fans travelled to the city. To avoid congested public transport networks and road traffic, the local municipal government announced three days of public holiday to ensure travel to the venue was as effortless as possible³. By keeping those who would have travelled for regular commitments off the networks during this time, the public transport system had capacity to transfer fans back and forth.

In Antwerp, Belgium, to encourage the use of public transport to attend an event, Sportspalais, the sports and concert arena, provides return travel with the local operator, De Lijn, included in the entry ticket of the event for no extra cost⁴. The travellers only need to show the ticket



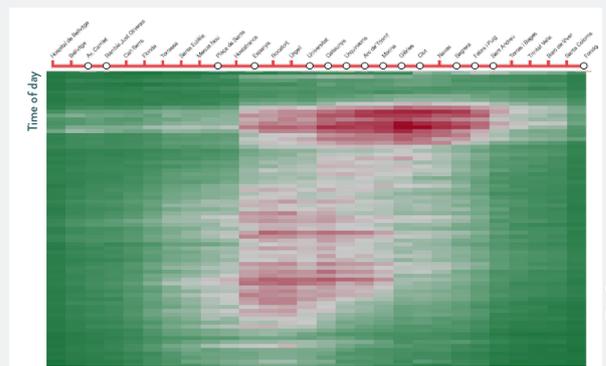
of the show, concert or game to travel for free by tram or bus to/from the arena. The passenger information system on the platform indicates how much time the next bus or tram will show up in so that travellers can wait back instead of riding in an overfull vehicle.

For the 2020 Tokyo Olympics⁵ (which have now been postponed to 2021), more than half a million people are being asked to work from home as a trial scheme to tackle issues with transit congestion. The Japanese government has launched a teleworking scheme to reduce the chaos and estimate that nearly 600,000 workers from 3,000 companies will take part in this trial. Every day, an expected 20 million people will use the networks.

MEASURES TO FLATTEN PEAK TRAVEL

Operators implement various methods to flatten the peak time. While some prefer the obvious choice of playing with the pricing, others use quota systems for seat reservations or even heat mapping to detect occupancy. Some like Glasgow subway in Scotland prefer to place the responsibility on passengers by advertising on their station entrances, website, and social media channels to encourage customers to travel around traditional high occupancy periods when possible.

Heatmaps can be a source of detecting peaks in a system.



Source: TMB

FARES

In New York, MTA offers peak and off-peak pricing. Off peak pricing is about 27% cheaper⁶. The aim was to use this separate pricing to increase the demand during the non-peak hours, thus also making use of the staff and equipment at these times.

Transport for New South Wales (TfNSW), Australia, proposed to make changes to fares for Opal Services in response to the pandemic. Opal fares are fares for train, bus,

3 Panjo & Spinetto, 2014. *Rio declares public holidays to cope with traffic in world cup*. Bloomberg.

4 More information at : www.delijn.be/en/evenementen/sportpaleis.html

5 Woodyatt & Ogura, 2019. *Tokyo commuters told to work from home to avoid Olympic transport nightmare*. CNN Travel.

6 More information at : www.new.mta.info/fares/lirr-metro-north

ferry, light rail and metro services on which an Opal card can be used. These services operate in Sydney Newcastle, the Central Coast, Wollongong, the Blue Mountains and Hunter regions. Off-peak fares on bus and light rail services were introduced and the discounts were increased from 30% to 50% until September 2020, to assist with the mandated social distancing on public transport. The 0-3km fare for peak travel on buses and light rail was raised by nearly one Australian Dollar (0.72 USD).



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RUSSIA, MOSCOW

In Russia, Moscow Metro is also experimenting with a differentiated fare system. According to the Department of Transport, a discount during off-peak hours in the morning will be piloted on the busiest metro line. The experiment will last for 8-10 months in order to fully estimate the changes in passengers' behaviour. Currently, two options for discounts are being considered – 30% or 50% of the usual fare which stands as a single fare across all underground networks and on the Moscow Central Circle. During the testing period, the department plans to issue regular press releases on how the experiment is going on. If this practice is recognised as a success and encourages earlier trips on public transport, then this will be considered for other lines of the Moscow Metro.

MANCHESTER, UK

In Manchester, UK, 7,000 members of the public responded to the Mayor's Congestion Conversation online survey. It was found that the main cause of congestion was that too many people wanted to travel at the same time. With the strong backing of a political initiative, the Congestion Deal, Transport for Greater Manchester (TfGM) offered reduced pricing on its lines for a period of 45 days as a pilot⁷. To manage the demand, employers were encouraged and incentivised to introduce flexible start and finish times for their workforce to support travel outside of the usual commuter times and reduce congestion and crowding. This measure coincided with several others including a higher investment in trams, cycling and walking infrastructure.



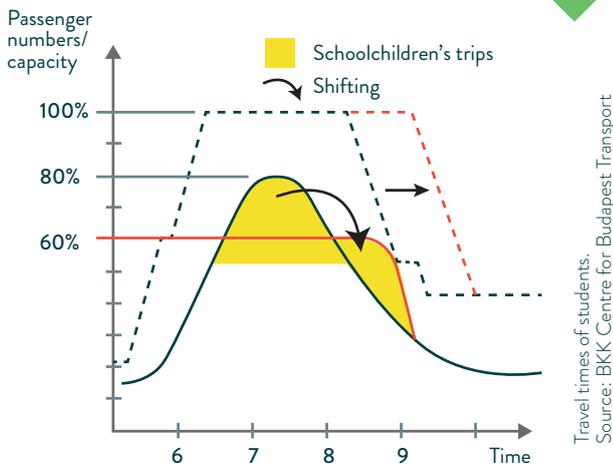
© Willmslow Road Cyclway

In Stuttgart, Germany, and the surrounding region, a monthly pass to travel after 09.00 is sold for about 23% cheaper than the alternative to encourage flattening the peak. The nearby Rhein-Main area in Germany also offers a post 09.00 ticket and a senior citizen ticket with assigned off-peak travel timings. Fully understanding that this may be constricting for some travellers, in Stuttgart the BestPrice app which allows post-commute payment was introduced to provide flexibility. Within the month, all the customer's journeys are cumulated and limited to the lowest price of the period. Using the BestPrice App, the customer can use public transport as often as possible after 09.00 to benefit from the cheaper fare. The app has proven to have a steering effect regarding travelling peaks and still ensures the customer's free choice.

7 Transport for Greater Manchester, 2018. *Mayor announces 'Congestion Deal' to encourage travel behaviour change.*

BUDAPEST, HUNGARY

In Budapest, Hungary, school and university students were identified as a group that could flatten the peak travel period. The highest peak was from 07:00-08:00 where, according to model calculations, about 34% of the passengers were school children. Of these, 80% were old enough to travel without an attendee so their trips could be more flexible. The graph below shows that, by introducing a system which enables travel in a later period for students, the occupancy could be decreased in the model by about 20% on a vehicle utilised to 80% capacity, and extending the peak hours to 09.00. A conclusion from the study so far is that adjusting and optimising passengers' schedule in order to bring about change in commuter behaviour is an innovative technique that could further help to distribute the demand during the course of the day, and would require close collaboration between the local government and operators.



Travel times of students.
Source: BKK Centre for Budapest Transport

However, while altering fares can be a great incentive around busy travel times, operators and authorities need to **monitor the changes** so that it does not increase the problem of busy services and poor quality of service. In Chengdu, capital of the Chinese Sichuan province, FFPT (free fare public transport) was implemented on 44 bus lines from 05.00-07.00 with the sole intention that travellers who were able to, would adapt their travel schedule. This became so popular that operators could not count how many travellers were actually using the services. Many commuters complained that there were so many users, that they were not able to get into the buses within the FFPT time frame⁸.

8 The Economic Times, 2012. *China makes bus travel free to encourage public transport.*

9 Zhang, et al., 2017. *Impact of real-time crowding information: A Stockholm metro pilot study.* Public Transport 9.

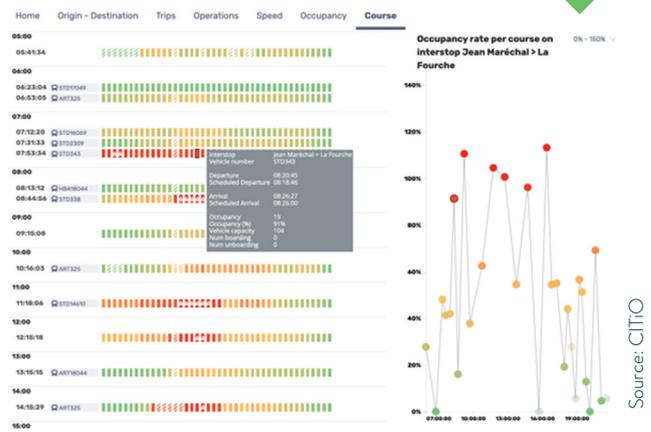
TECHNICAL SYSTEMS AND DYNAMIC INFORMATION

With the help of shared websites and apps, some operators are using **real-time crowding information** to tackle the issue.

Sweden's Stockholm Metro launched a pilot study where ridership data used during a test period found that the technology would help public transport operators and agencies to optimise the available train capacity and reduce crowding. Boarding distribution between the cars would be statistically impacted in a positive way. During the pilot, it was estimated that nearly 25% of the passengers determined their travel plans based on crowding information provided⁹.

PARIS, FRANCE

In France's greater Paris region, the SQYBUS bus operating company cooperated with CITIO, a provider of big data and artificial intelligence technologies, to help cities face the many challenges brought by growing urbanisation, to monitor the occupancy of vehicles. The challenge was to match the transport system with the demand as the lockdowns began to lift. CITIO's solution was to aggregate the ticketing and counting systems data, combined with operation data provided to calculate the occupancy in every single bus. This helped to continuously adapt services with respect to the Covid sanitary measures that were being put in place.



The Netherlands Railways (NS) uses historical data to fuel its journey planner, NS Reisplanner Xtra. Information about crowdedness is depicted on scale of one to three, with one being quite empty and three is crowded. Patrons can also use a feedback button to report the accuracy

of information provided. Customers are rewarded for avoiding crowded trains by receiving points that can be used for buying coffee or gift vouchers.

OPERATIONAL MEASURES

Closely related to technical systems, these measures do not flatten the peak, but help to **better distribute resources** where needed.



BARCELONA, SPAIN

In Barcelona, Spain, a skipping stops measure was implemented whereby some lines only stop in blue stops, others in yellow and all trains stop in the main stations. Changes can be implemented without infrastructure modifications. As a result, the capacity increased by 11% in a critical station and reduced the roundtrip time considerably. However, it is a challenge to help passengers understand that the gained travel time should not be lost by passengers missing their stop or blocking doors. Running shorter lines during times of low demand is a measure taken in many cities.

To relieve the pressure of congestion building on an individual mode, some operators offer **integrated ticketing** for a seamless and interconnected multimodal experience, including traveling with more than one form of transport on a single ticket.

With more than 48 million journeys annually, the Irish rail Iarnród Éireann is considering a seat reservation system for peak time travels to manage capacity. Although there are several measures being taken to help flatten the peak, the increase in the daily rush is the reason the Irish rail is considering taking this drastic measure. In many other European countries, reserving a seat is not enforced but it is recommended. With a seat reservation system, operators can control the number of travellers per car and on each vehicle.

In North America, San Francisco's BART used the economic theory of nudging to convince riders to change their behaviour. The incentive programme, BART Perks,

tested rewarding riders for their BART travel based on when they commute¹⁰. The **bonus system** was meant to encourage travel at non-peak hours, which also included before and after the daily rush and during the late evening and weekends. On average, participants received \$3 every month for this. Nudging states that even a small reward can lead to adjustments in behaviour, and the experiment with BART certainly proved this.

HONG KONG, HONG KONG SAR

The Octopus system in Hong Kong is a great example of a contact-less smart card system giving access to all forms of public transport using just one card. Many operators decided to establish this joint venture company to enhance the attractiveness of using public transport. Travellers are allowed to use six different modes, allowing them to easily interchange between these without having to buy new tickets. This reduces cash handling and waiting in lines to top off the card which, in the current pandemic scenario, would help reduce the risk of transfer of Coronavirus. With a variety of modes equally accessible in a simple manner, patrons have more options and the crowd can be better distributed.



In Singapore, the INSINC (Incentives for Singapore Commuters) programme is a system of **credits as an incentive** used specifically to shift the peak. Due to this programme, the peak deviated by 7.49%. Commuters earn loyalty points based on the distance of their journeys on weekdays. If one travels outside of the daily rush period, they receive three times the credit. The credits are then redeemable for prizes or for cash at a fixed exchange rate. 1,000 credits = one Singapore Dollar (0.74 USD). Passengers can earn bonus credits if they get their friends to sign up. INSINC uses an innovative social element where friends are displayed in a list where those who have travelled off-peak the most receive a higher ranking.

10 Bay Area Rapid Transit, 2017. *Incentives shift BART riders out of the morning rush.*

東京メトロ【公式】 @tokyometro_info · Jan 23, 2019
 みんなでおそばをゲットしよう！時差Biz期間中、東西線早起きキャンペーンに6,886人（1月22日現在）のお客様に、継続的にご参加いただいています！現在のところ、時差Biz期間全日ご参加いただいたお客様に、めとろ庵で使用できる「かきあげそば引換券」をプレゼント！明日もキャンペーンに参加しよう！



TOKYO, JAPAN

Tokyo Metro introduced an unusual incentive to get travellers to commute during the off-peak hours: free soba noodles and tempura¹¹! Who can decline free food? The Tozai line is one of the most congested in Japan's capital operating at 199% capacity at its peak. Those who travelled before rush hour and continued to do so for 10 consecutive days were given free food vouchers from local restaurants. It was expected that 2,000 commuters would change their travel timings to benefit from this campaign. But only a few days in, more than 7,000 commuters participated in this wildly successful incentive programme

Regulations and policies play a part in flattening the peak travel period as well. In China's largest city, Shanghai, residents above the age of 70 were able to travel for free at any time of the day¹². However, because of this, there were an increasing number of complaints from commuters regarding public transport resources during the daily rush being under pressure. Soon enough the policy had to be changed so that senior citizens were not encouraged to travel at peak hours unless necessary. Different types of subsidies based on age were offered instead of the previous full free fare model.

CONCLUSION

Overcrowded vehicles are irritating for commuters and can pose safety risks. This was true even before the Covid-19 pandemic. From a health perspective, it is vital that commuters feel comfortable and safe on public transport infrastructure. Imposing

physical distancing is not a long-term solution to reducing crowds. Operators and authorities would benefit from the assurance of physical distancing, not only on public transport, but also in all public spaces if they can provide incentives for social and economic activities to adjust and distribute their start and end timings throughout the day.

For operators, customer satisfaction related to overcrowding is poor and generates a negative association with the services offered. A coordination of several different actors is needed to ensure the reduction of crowds and flattening of the peak travel period. When vehicles are not overfull, operations run more smoothly: Headway time is maintained, and delays are reduced when the time taken to enter and exit vehicles are not extended due to the high number of passengers. More time and space can be given to disinfection of the vehicles. If the demand is distributed throughout the day, the total number of vehicles needed would reduce and staff too would be less stressed to maintain operations.



With the current conversation revolving around how to rebuild trust in our services and bring back our commuters to a safe environment after the lockdowns around the world are lifted, distributing the demand and managing the capacity of public transport usage is one viable and vital solution. We stand to learn from the multiple examples shared from the experience of staggering commuting journeys to reduce overcrowding on our networks. Not only will this help the operational process, but it will also provide an essential way of reducing the spread of coronavirus and other potential diseases on public transport infrastructure.

11 Livni, 2019. Tokyo's subway is offering free soba to flexible commuters. Quartz.

12 Beijing Review, 2016. Should the elderly ride for free on public transport systems?

This is an official Knowledge Brief of UITP, the International Association of Public Transport. UITP has more than 1,800 member companies in 100 countries throughout the world and represents the interests of key players in this sector. Its membership includes transport authorities, operators, both private and public, in all modes of collective passenger transport, and the industry. UITP addresses the economic, technical, organisation and management aspects of passenger transport, as well as the development of policy for mobility and public transport worldwide.

This Knowledge Brief was prepared by [UITP Marketing Committee](#).
We thank all our members for their contributions to the paper



DECEMBER | 2020



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