Public transport and shared mobility during and after a social distancing society

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Planning and operations during and after the period of social distancing society will be particularly challenging for the public transport (PT) sector and for all shared modes in general. Whilst governments worldwide praise the vital role public transport plays during these challenging times, it is fair to say that the road ahead will be bumpy. As governments imposed COVID-19 lockdown restrictions, PT usage dropped substantially. In many cities worldwide, PT demand was down to 90% compared to the pre-COVID-19 times. As a result, services were reduced and some metro stations were closed (e.g. in London and Washington DC) to limit financial losses and to handle higher staff absence rates, whilst still providing services to people working in vital sectors. It was a difficult dilemma for the PT sector: providing essential services, whilst losing millions of Euros every month. In sharp contrast to normal circumstances, PT agencies and governments now advice to avoid public transport where possible, even with some countries now requiring passengers to wear personal protective equipment (PPE) such as face masks. How will public transport look like in this social distancing society? And how will it operate afterwards?

Contradiction in terms

One could consider social distancing in public transport as a contradiction in terms. Public transport (rightfully coined as 'mass transit' in the US) is designed to move large numbers of passengers from A to B in a fast, reliable and efficient way. When social distancing is required, vehicle capacities are reduced by approximately 75%, making efficiency and profitability very difficult, if not impossible.

Challenges are not limited to reduced train and bus capacities. Pedestrian flows within stations – especially in narrow (underground) stations – and crowds waiting at the platform are potentially even more challenging. In addition, the dwell process might become an issue as well. For example, the Dutch consultancy company Goudappel Coffeng estimates (based on simulations) that dwell times can increase up to fourfold when obeying social distancing during boarding and alighting. Longer dwell times and thus lower average speeds affect public transport negatively in two ways: it results in a lower quality of service for the passenger (longer journey times), but also in higher costs for the PT service provider to offer the same frequency (or: a lower frequency for a fixed fleet size, resulting in even longer waiting times).

During a pandemic, public transport also has the ungrateful role of contributing to the spread of the virus itself. Especially very busy lines with a variety in origins and destinations contribute to a high degree of contact between many different persons, who can potentially spread the virus further. In these so called 'contact networks', there is a risk that a virus can spread over large groups of people, even if the number of infected passengers would be low. We illustrate this in our case study in the Washington, DC, metro system based on smart card data [1]. Controlling these specific contact networks can help reducing the spread of the virus. This however implies that passengers have to limit their PT trips to specific routes and specific times of the day.

Mitigation measures

The big question for all public transport planners and researchers is to determine the package of mitigation measures required to adapt public transport to this 'new normal'. A plethora of measures can be observed in different countries: plastic driver protection shields, one-way systems in PT vehicles and stations, and of course recommending (e.g. UK) or mandating (e.g. Belgium, France, Germany, the Netherlands) passengers to cover

their faces. Several Chinese cities perform temperature checks at station entries, whilst MTR metros in Hong Kong run a peak timetable the whole day, to literally provide additional space.

However, the key to success will arguably be demand management: how can we make sure that passengers do not all use public transport at the same locations and times? We foresee that the - mandatory – experience with working and studying from home will result in a (small) reduction of people physically travelling for work, as well as in some peak spreading. Our research together with the Dutch Railways [2] shows that about 40% of the passengers intend to travel less often during the peaks after the pandemic. Demand management should not be limited to the public transport system itself, but especially target large employers and universities. At the moment that employees and students of these large organisations return to work or study with the same start and end times as pre-COVID, maintaining even a fraction of this 1.5m distance will become impossible in public transport.

Spreading passengers over time and space becomes thus essential. This principle is nothing new to the PT sector, as the traditional peak demand always resulted in an inefficient use of resources and lower quality of service. Nevertheless, the extent of this demand management is new. For example, during the 2012 Olympics in London, the aim of demand management was to achieve a 20% reduction in regular demand to accommodate the large increase in visitors. Today, in a social distancing society, the aim is that only 20% of the passengers use public transport. Demand management can be applied in several ways. In its simplest form, passengers are not allowed in the vehicle or station, in case of 'overcrowding'. However, this results in waiting and queuing passengers at stations or on the streets, thereby moving the problem to another location where it might be still difficult to keep distance. Another option is to select passengers based on travel purpose, (vital) working sector or risk group, but this requires active management. Pricing schemes could be used to incentivise passengers to travel in the off peak with discounts, although this did not solve all crowding issues in pre-COVID times. Other options can be the introduction of an optional or a mandatory reservation system, which enables to better predict and proactively manage anticipated crowding. Important issues hereby are inclusiveness and the 'digital divide': how to make sure that public transport remains accessible for all groups in our society?

Shared mobility services

Over the last years, an increasing attention could be observed for public transport in addition to walking and cycling, as a sustainable and spatially efficient alternative for private car use. In the Netherlands, use of the combination of public transport+bicycle grew steadily year-on-year. It remains an open question how this combined mode will develop in the coming years. Whilst it is the shared view of many transportation planners that cycling and walking will become more popular, it is unclear how this will look like for longer distances. It is not unlikely that private car use – being an enclosed area without other passengers and infection risks – will play a more important role here. In China, we can already observe the return *and* increase of road congestion.

Concerns over hygiene might reduce the usage of other shared mobility services, such as bicycle-sharing schemes. Individual demand-driven mobility systems such as Uber are at a crossroad. The 'shared' aspect of these systems can potentially discourage passengers, but these systems might be perceived as a relatively 'safer' alternative than regular public transport, potentially resulting in a demand surge. This 'new normal' might be the breakthrough for Mobility-as-a-Service (MaaS), as this enables and facilitates a smooth use of different (new) modes by providing an integrated platform for information and payments. In addition, there could be a role for MaaS platforms to facilitate a potential booking system for public transport, and to apply different fares and priorities for different sectors or risk groups.

Conclusions

Living in a period of a pandemic is challenging, for everybody. The public transport sector is being confronted with extremely big challenges which contradict entirely with the basic principles of the sector, namely to efficiently transport large numbers of passengers. Demand management, how counterintuitive it might seems, will play a key role now that private cars and ride-hailing services will be even more competitive. Now that selections and reservations are becoming increasingly important, this might be the opportunity for a breakthrough for MaaS platforms.

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[1] https://www.linkedin.com/pulse/virus-spreading-public-transport-networks-alarming-usual-krishnan/?trackingId=bZszOEiURe63stmPYKBB%2FQ%3D%3D

[2] https://www.tudelft.nl/en/2020/tu-delft/tu-delft-and-ns-study-the-impact-of-the-coronavirus-crisis-on-travel-behaviour/

Niels van Oort and Oded Cats jointly co-direct the Smart Public Transport Lab of the TU Delft in the Netherlands, where they perform scientific research together with 25 researchers and ≈20 students every year to improve public transport planning an operations. The lab collaborates closely with public transport agencies, governments and consultancies worldwide to address challenges in the public transport sector. For more information, see: http://www.smartptlab.tudelft.nl/

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