

COVID-19: Public transport disruptions and behaviour change

This rapid evidence review looks at the impact on public transportation of past crises and disruption. Our aim is not to provide a comprehensive discussion of the current crisis, but to provide a concise summary of relevant evidence that tells us what happened in the past and any lessons this holds for policy. This evidence may help those working in cities with a heavy reliance on public transport, or those managing public transport, to understand the medium- to long-term impact of some of these events on ridership.

Context

The COVID-19 crisis has disrupted transport and changed travel behaviours. The shift to working from home as well as concerns about spreading the virus mean that public transport ridership has fallen to as low as 10 per cent of its usual level in cities like London. Many have or are expected to shift to driving, cycling or walking. This has resulted in substantial revenue losses for public transport providers as well as changes to road use and has implications for congestion and pollution. As transport decision-makers try to adapt, they face considerable uncertainty about how long effects will persist and what will happen after lockdown restrictions are eased.

Many factors will determine whether journey patterns will revert to those seen pre-crisis. The fear and risk of infection¹ together with reduction in capacity² due to social distancing rules will play a role in demand for public transportation. Some users may temporarily switch to other transport modes. The current crisis may also lead to permanent changes in travel behaviour or more fundamental shifts in

1 <https://www.bbc.co.uk/news/business-52564351>

2 <https://www.bbc.co.uk/news/uk-england-london-52539585>

firm and household locations and working practices.^{3,4}

To help inform decision-makers, this rapid evidence review considers what we can learn about the effects on public transport from behavioural change following other disruptions to travel. We focus mostly on terrorist attacks (specifically the London bombings of 7 July 2005),⁵ but also consider the impact of strikes.

Disruption due to terrorism shares some similarities with the current crisis as it is a combination of physical disruption and fear of subsequent attacks. After the 2005 London bombings, 32 per cent of Londoners reported an intention to travel less and 46 per cent felt unsafe travelling by tube (Rubin et al., 2005). A [survey carried out by Ipsos MORI](#) two months later revealed that around half of Londoners thought that another terrorist attack was likely to take place shortly.

Things to consider

- Disruptions do lead some people to find new ways to get to work. It is an opportunity to encourage less-polluting methods of travel, but these changes may not be permanent unless they can be made faster or cheaper.
- Public transport ridership usually rebounds substantially in the medium term after a significant disruption, even when fear plays a role in the short term.
- Surveys (e.g. the [London Travel Demand Survey](#)), and secondary data sources (e.g. mobility trends from Apple, Google Mobility, WebTRIS, Transport for London Public Transport Journeys)⁶ may be useful in informing the policy response.
- It may also be helpful to think about measures to build confidence and trust in public transport.

3 <https://globalworkplaceanalytics.com/work-at-home-after-covid-19-our-forecast>

4 <https://www.bbc.co.uk/news/business-52414376>

5 We also searched for papers on other terrorist attacks such as September 11 and the Madrid bombings but could not find papers that met our evidence standards (see Evidence Annex)

6 Mobility trends from [Apple](#). Another source is [TomTom traffic data](#).

Findings from the evidence

Impact of the 2005 London bombings

- The number of tube journeys in central London decreased by around 16 percent between July 2005 and January 2006.
- The evidence shows a more significant reduction (22 per cent) between July and September 2005, partly explained by disruption with some stations closed. Excluding closed stations, there was a 14 per cent drop in the initial period
- The aggregate picture for London indicates an 8.3 per cent decrease in the number of underground journeys in the four months following the attacks, with journeys reduced until June 2006.
- Descriptive statistics suggests an increase in the use of bicycles and powered-two-wheelers, but not in the use of cars and taxis, and an increase in the number of cycling fatalities compared to 2005.⁷
- By January 2006 (six months after the attack), the number of underground journeys in central London appeared to have returned to pre-attack levels. But journeys had been growing before the bombings. Looking at stations outside of central London, there is a significant gap suggesting some persistence in effects.
- Finally, ridership for four of London's main hubs (King's Cross-St Pancras, Victoria, Waterloo, and Oxford Circus) decreased by 12 to 17 per cent between 2006 and 2009. This may indicate that some behavioural changes (e.g. a desire to avoid key hubs) may have persisted for up to three years following the bombings.

Responses to public transit strikes

- Commuters shifted to cycling and driving in response to public transit strikes in Rotterdam that took place between 2000 and 2011. During a strike day, the number of cycling trips increased by 18 per cent, and the number of car (driver and passenger) trips increase by 15.6 per cent. These shifts were not permanent.
- About 5 percent of underground commuters in London start travelling on a new route with lower travel times after underground strikes on 5 and 6 February 2014, with these shifts being permanent.

⁷ Fasolo, B., Zhifang, N. and Phillips, L.D., (2008). "A study of the impact of the July Bombings on Londoners' travel behaviour" Non-published Research Reports. Paper 17

Evidence annex

We looked for evidence on the effect of terrorist attacks and strikes on public transport usage and behavioural responses. We focused on evidence from the OECD, in English. We considered any study that provided before-and-after comparisons or cross-sectional studies that control for other supply/demand factors (that is were classified as [SMS2 or above](#)). We found eight studies that are SMS2 or above. We found two SMS1 papers, one on the September 11 attacks and another on the Madrid bombings, which we did not include in our review.

Behavioural responses to July 2005 London bombings

Study 1 (SMS 3) looks at the effects of the July 2005 London bombings on house prices, new firm location, and ridership at the four main London transport hubs. The study uses the UK Land Registry data, UK Companies House data and Bureau Van Dijk's Amadeus data. The empirical strategy is based on two difference-in-difference specifications. The first is based on comparing outcomes (i.e. prices, new firms, and ridership) in an inner ring (surrounding the main rail stations) with an outer ring before and after the attacks. The second instead uses the surroundings of secondary stations for the control group. The study finds that transit ridership decreased by around 12 per cent one year after the attacks, and that these effects persist in the following three years. The study also finds a 6 per cent decrease in house prices a year after the attacks for dwellings surrounding the major transport hubs relative to dwellings located in control areas. This effect vanishes after two years. Finally, the study shows that firms are less likely to locate near the main hubs, while existing firms experienced a decrease on earnings.

Manelici, I. (2017). "Terrorism and the Value of Proximity to Public Transportation: Evidence from the London Bombings" *Journal of Urban Economics*, vol.102, pp. 52-75

Study 2 (SMS3) looks at the effects of the 2005 London bombings on the number of tube journeys provided by Transport for London and on daily police reports of crime provided by the Metropolitan Police Service. The study uses a difference-in-differences strategy that compares several boroughs located in central and inner London (the treatment group) with the remaining boroughs used as controls, before and after the attacks. The study shows a 22 per cent decrease in the total number of journeys in the six weeks after the attack in the treatment group (relative to the control group). The large effects are partly explained by modal shifts due to tube disruptions in the four weeks after the attacks. When considering only open stations, the number of journeys in treated boroughs fell by 13 per cent relative to the control group. Despite the number of journeys in the treated boroughs returning to pre-attacks levels by the end of the year, there is still a systematic difference of 10.3 per cent between treated and control boroughs. This suggests a persistent effect of the terror attacks (against a background of growing numbers across the system as a whole).

Draca, M., Machin, S., Witt, R., (2011). "Panic on the streets of London: police, crime, and the July 2005 terror attacks" *American Economic Review*, vol. 101, pp. 2157–2181.

Study 3 (SMS2) looks at the effect of the July 2005 London bombings on London underground passenger journeys. The study uses weekly and monthly passenger journey data for 2001-2007 and runs time-series analysis that controls for demand-side factors (e.g. economic conditions) and supply-side factors (e.g. station closures). The study finds that underground passenger survey numbers decreased by 8.3 per cent for four months after the attacks. The study also shows that both supply-side and demand-side factors cannot fully account for passenger journey reductions, suggesting that the perception of risk of terror may play a role.

Prager, F., Ryan, G., Asay, B., Lee, B., von Winterfeldt, D., (2011). "Exploring reductions in London underground passenger journeys following the July 2005 bombings" *Risk Analysis*, vol. 31 (5), pp. 773–786.

Behavioural responses to strikes

Study 4 (SMS2) looks at the effect of public transit strikes on travel times, car, and bicycle flow in the city of Rotterdam and the effect of 16 public transit strikes that took place between 2001 and 2011. Using a regression that controls for several demand factors, the study finds that travel times increased mainly on inner city roads and in the rush hour. Also, it shows that these strikes induce commuters to shift to other transport modes with similar increases in the number of cyclists and car travellers.

Adler, M.W., and van Ommeren, J.N. (2016). "Does public transit reduce car travel externalities? Quasi-natural experiments' evidence from transit strikes" *Journal of Urban Economics*, vol 92, pp. 106-119.

Study 5 (SMS 3) looks at the effect of underground strikes on commuters in terms of their optimal route decision in London. The study uses data from user Oyster Card journeys (with anonymised identifier) which provides the station of entry and the station of exit together with the check-in and check-out time of each trip. It uses a difference-in-differences methodology where the treatment group is defined as commuters that face station closures of their modal station during the strike. The study finds that commuters deviate from their modal journey to their optimal route after the strike. These effects appear to be permanent.

Larcom, S., Rauch, F., and Willems, T. (2017). "The benefits of forced experimentation: striking evidence from the London underground network" *The Quarterly Journal of Economics*, Oxford University Press, vol. 132(4), pp. 2019-2055.

This work is published by the What Works Centre for Local Economic Growth, which is funded by a grant from the Economic and Social Research Council, the Department for Business, Energy and Industrial Strategy, the Ministry of Housing, Communities & Local Government, and the Department for Transport. The support of the Funders is acknowledged. The views expressed are those of the Centre and do not represent the views of the Funders.

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June 2020

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