

Social distancing is making public transport worse for the environment than cars – here's how to fix it

July 16 2020, by Thomas Woolley, Joshua Moore, Lucy Henley and Timothy Ostler



Credit: Travelerpix/Shutterstock

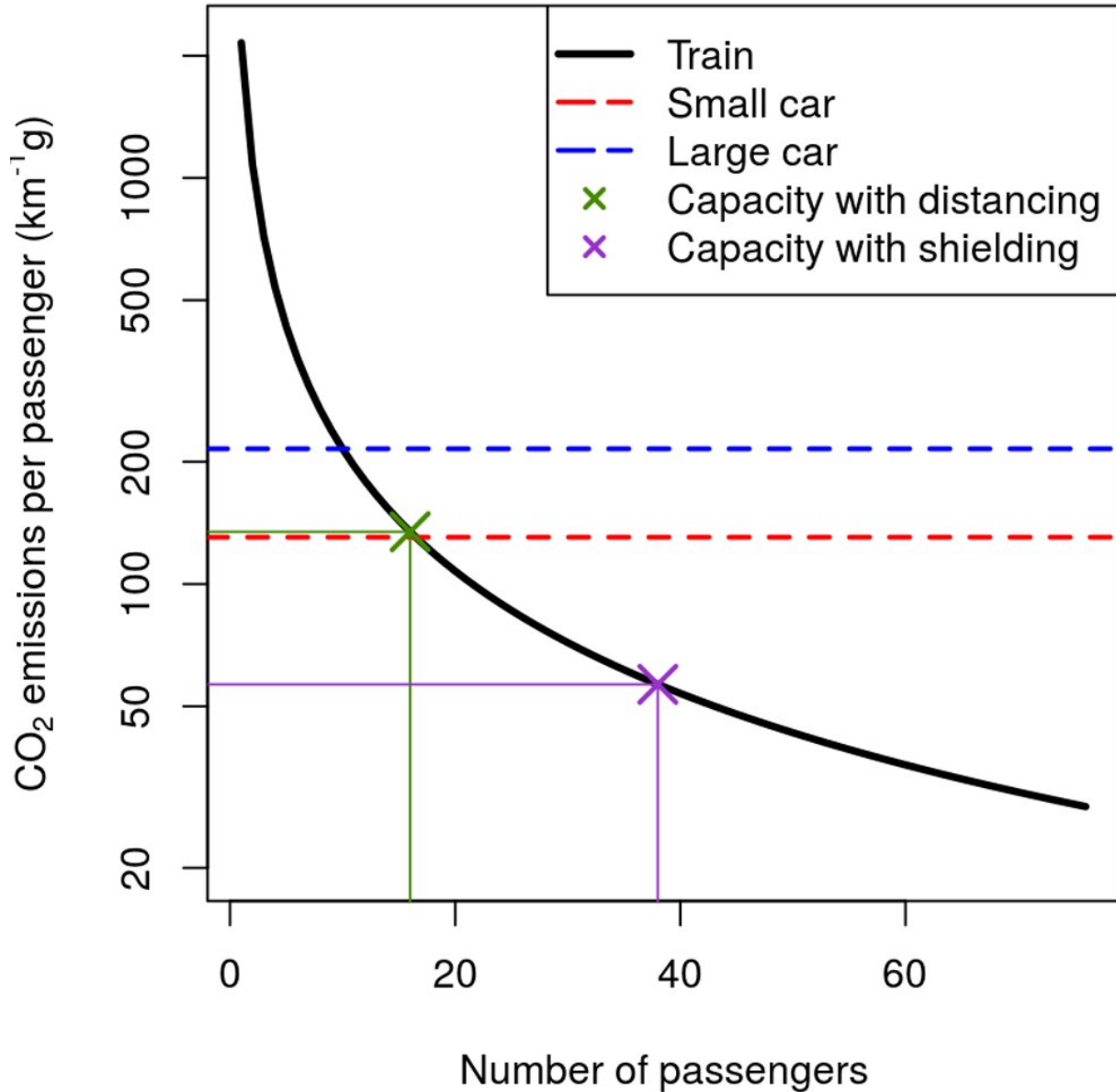
During lockdown, travel restrictions caused car and public transport use to plummet across the UK. On April 12 2020, the number of daily trips by car fell to [22%](#), compared to a typical day the year before. Public transport use dropped too. National Rail ticket sales were at [4%](#) of their pre-pandemic norm and bus ticket sales outside of London fell to [10%](#).

With [one-third of the world under lockdown](#) at one point, [travel restrictions](#) in different countries contributed to a global reduction in carbon dioxide (CO₂) emissions of 17% in April, compared to [2019](#). But as these measures have been relaxed, personal vehicle use has increased again, approaching 80% of typical levels by [mid-July](#). Unfortunately, public transport use remains low, with train ticket sales and buses outside of London still running at [16% and 31%](#) of normal, respectively.

While more people opt for travel by car and [private transport](#), the number of passengers that trains and buses can carry has also been reduced to meet social distancing guidelines. This means that people from different households must keep one to two metres apart. So, once a seat is taken, surrounding seats must be left empty.

This has had a profound effect on the climate impact of [train](#) and [car](#) travel. When running at normal capacity, public transport is more environmentally friendly than travelling by car. Although a train or bus can produce more CO₂ than a car, they transport far more people, so emissions per person are lower overall.

But under social distancing conditions, and assuming that any unfilled seats correspond to a commuter driving to work instead, diesel-powered public transport produces more CO₂ emissions per passenger than a small car.



Emissions per passenger of a variety of modes of transport with a social distance of two metres. Credit: Henley, Moore and Ostler, Author provided

Keeping pandemic public transport green

So how best to pack public transport given the fixed space and social

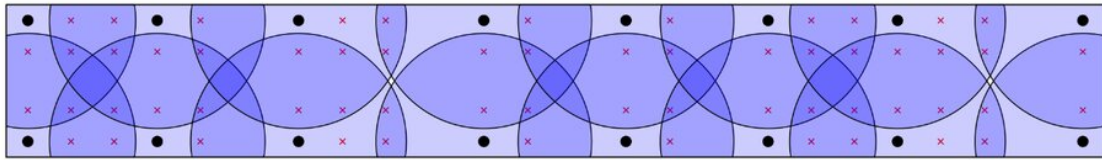
distancing guidelines? We designed an [app](#) that optimises the number, and seating arrangement, of people who can safely use public transport. The app allows a public transport company to see the optimal spacing strategy in various scenarios of social distancing and includes the option of using plastic shielding for increased isolation.

The calculation works by trying to fill in passengers from the back of the train, putting the first passenger in the first seat. The app then draws a social distancing bubble around the passenger. Other seats that are inside the bubble cannot be used, so they're ignored and the next passenger is put in the next available seat. This process is repeated until all seats are either filled or designated as empty. This is known as a greedy algorithm—it doesn't consider all seats at the same time, it just chooses the next available seat.

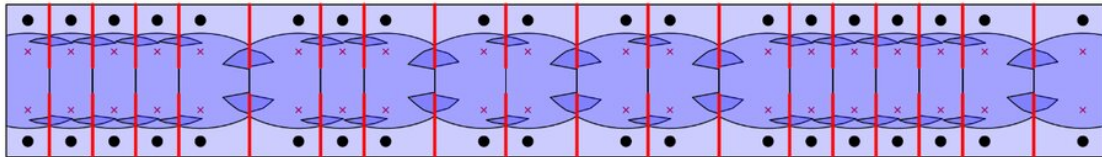
The app is currently fixed to one carriage size, and so it's mainly useful for public transport companies making planning decisions. But it's [open-source](#), which means it could be extended to include different carriage designs and sizes and allow passengers to input which seats in their carriage are taken, so the app can advise which is the safest seat for them to choose.

In South Wales, the most commonly used train is the class 150 diesel engine, which was made in the 1980s. If a company using these trains can encourage at least ten passengers per carriage to use their service, then they will be more efficient than a large car. But trains using these inefficient diesel engines require a minimum of 17 passengers to be more environmentally friendly than a small car. Without the use of plastic shielding between seats though, a train carriage can only support a maximum of 16 socially distanced passengers.

Available seats with social distancing measures
Capacity of 1 train carriage is 16 passengers with social distancing.



Available seats with social distancing measures and shielding
Capacity of 1 train carriage is 38 passengers with shielding.



Optimal seating with plastic shielding (top) and with plastic shielding (bottom).
Credit: Henley, Moore and Ostler, Author provided

Including plastic shielding in carriages can increase the maximum number of passengers in a single carriage to 38, making the emissions per [passenger](#) much lower than a small car.

Road transport makes up around [20%](#) of the UK's greenhouse gas emissions. Reducing this is key to the country's strategy for meeting net zero emission targets, and public transport should play a leading role in this effort. But for that to happen, there will need to be significant changes to keep passengers safe during the pandemic while preserving the environmental benefits of bus and train travel.

Social distancing measures would either need to be reduced, while increasing other [safety measures](#), such as mask wearing and regular cleaning, or plastic shields would need to be added between seats in train

and bus carriages. Investment in lower emission engines could also help drive a transition towards more fuel-efficient public [transport](#).

Our research should serve as a warning. As lockdown measures continue to be relaxed, more people will travel for work and leisure, increasing demand for [public transport](#). If these services are ramped up without adding more protective measures, trains and buses could operate at a significant financial loss, while negating any benefits for the environment.

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