ACTIVE TRAVEL STUDIES

Parkes, S, et al. 2024. The impact of Covid-19 road-space reallocation measures: Insights from the north of England. *Active Travel Studies: An Interdisciplinary Journal*, 4(1): 2, 1–21. DOI: https://doi.org/10.16997/ats.1444

RESEARCH ARTICLE

The Impact of COVID-19 Road-Space Reallocation Measures: Insights from the North of England

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In response to the Covid-19 pandemic, governments around the world initiated a programme of temporary road-space reallocation measures. These temporary measures helped to create more space for social distancing and encouraged an uptake in active travel (including walking and cycling). This paper examines the impact of the pandemic on travel behaviour in two contrasting local authorities in the North of England, and specifically, examines the deployment and impact of the temporary road-space measures introduced. This research shows that, overall, there was a substantial degree of change in usual travel behaviours amongst the sample in both locations; and this included modest shifts towards active modes (which were more pronounced in Sheffield). Notably, awareness of the temporary measures was high in both Lancashire and Sheffield (77.7% across the whole sample). Yet, actual use of the measures was relatively low (33.0%), although those using them held largely favourable views of their experiences. Increases in cycling were seen across both those who were aware of the measures and those who were not, but notably, the highest increases in cycling (for commuting, shopping, and leisure trips) were across those who were aware and then went on to use the temporary measures. For those not cycling pre-pandemic, there appears to be a positive relationship between beginning to cycle and use of the measures. In contrast, the temporary measures appeared to have little impact on levels of walking.

Keywords: Covid-19, road-space reallocation, temporary road-space measures, travel behaviour

1 Introduction

In March 2020, the growing crisis posed by the Covid-19 pandemic caused countries across the globe to initiate lockdowns of their populations to restrict the spread of the disease. In the UK, a nationwide lockdown was introduced on 23 March 2020. Over the course of the subsequent two months, mobility in the UK was dramatically reduced (Hadjidemetriou et al.,

2020). Throughout this period levels of driving, public transit, and walking were 60%, 80% and 60% less, respectively, than corresponding 2019 levels (*Ibid*).

This reduction in movement was a result of a "stay at home" order issued by the UK government requiring most of the population to restrict their movements, with only essential journeys such as shopping or healthcare allowed, and leisure trips largely restricted to once-daily local trips for exercise and recreation. Workers considered essential (e.g., those in healthcare or emergency services) were allowed to continue to travel but encouraged to avoid public transport to reduce the risk of Covid-19 transmission. Most other workers were required to work from home where possible, and if they were unable to do so, for example, those employed in shops or restaurants that closed temporarily due to the lockdown, and their employers signed up, they were placed on the government furlough scheme. This provided funds that enabled employers to continue to pay their employees whilst their businesses were forced into temporary closure or restricted activities. These initial strict restrictions began to be lifted in May 2020, but two further national lockdowns and other localised restrictions followed until all legal restrictions to self-isolate after a positive Covid test in England were lifted on 24 February 2022 (the other devolved administrations in the UK lifted their restrictions soon after).

These precautions in response to the Covid-19 pandemic created a notable change in mobilities (Abdullah et al., 2021; Borkowski et al., 2021; Shamshiripour et al., 2020). Following the removal of restrictions on movement many people simply returned to their pre-pandemic travel habits. For others, however, a "new normal" emerged with some new habits forming, helped in large part by a sustainment in the shift towards home working initiated during the pandemic (Bick et al., 2023; Hodder, 2020; Vyas, 2022). Despite many countries across the world now having re-opened and Covid-19 appearing as a distant memory, uncertainty over the final outturn with regards travel trends still exists.

This paper reports on a study on the impacts of the road-space reallocation measures introduced in two areas in northern England as part of the UK government's measures to support social distancing. The study had three aims:

- To understand the impact of Covid-19 on general travel behaviour in the study areas, has it accelerated existing trends or reversed these?
- To evaluate the impact of the road-space reallocations on travel behaviour, have they encouraged an additional shift towards active travel and is this temporary or permanent?
- To understand the longer-term impacts on travel behaviour, have work patterns changed, are people travelling less, to different destinations?

This paper focuses primarily on the second question, to understand to what extent the temporary measure influence travel behaviour during and immediately following the lockdown. The remainder of this section sets out the background to the study, the following section describes the methodology. Section 3 presents the results and discussion, and the final section offers some conclusions and reflection on the future use of temporary measures.

1.1 The introduction of temporary measures

As countries navigated the initial weeks of large-scale lockdowns in the Spring of 2020, it became apparent that a programme of road-space reallocation would need to be initiated. This would create more space for social distancing for pedestrians but also help encourage and support those no longer travelling by public transport to travel by active modes. The necessity of such a programme was a result of the entrenched imbalances in space provided for walking, cycling and other active modes (collectively referred to as "active travel"

throughout this paper) compared to that provided for motor vehicles (Nurse and Dunning, 2020). As a result, policymakers were forced to act to address this, at least in the short-term.

In the UK, efforts to introduce these temporary measures were supported and enabled through statutory guidance published by the UK government along with several temporary legislative changes giving increased powers to local authorities (Department for Transport, 2020c). Financial support was also provided through the Emergency Active Travel Fund (EATF), which was a repurposing of existing promised spending on cycling and buses (Department for Transport, 2020a). This provided – through two "tranches" or phases of funding – a total of £217.5 million to local authorities in England (Northern Ireland, Scotland, and Wales were funded separately by their devolved governments) to deliver these temporary interventions. The EATF was renamed the Active Travel Fund (ATF) for the second, more substantial, tranche of funding in England.

Local authorities responded rapidly at the onset of the pandemic to reallocate road space. Indeed, as Dunning and Nurse (2020) observed, the ability to quickly repurpose existing infrastructure was notable and demonstrable of the scale of change that can be achieved in the short-term, if required. Although not all local authorities moved quickly to implement these measures, with a considerable lag in some cases. Often, it was those with existing infrastructure that moved first, perhaps having a local policy disposition to promoting active travel. Considerable debate about the ambition, or over-ambition, of the measures followed between the "pro" and "anti" camps, with some measures being removed after a negative reception.

It is beyond the scope of this project to examine in significant detail broader UK responses to the pandemic with regards to active travel. However, a detailed account has been produced separately by the authors (Gore et al., 2021).

Further afield many major cities introduced measures, not just those traditionally associated with cycling such as Paris, which created almost 50 kilometres of temporary cycle lanes, but also places like Barcelona (over 20 kilometres) and Milan (around 35 kilometres).[1] Similar responses were also seen across the globe in places such as New York (NYC Department of Transport, 2021) and Bogotá (WHO, 2020). In many places these measures are seen as a first step in reducing private car use and improving air quality. Although not all of the temporary measures saw the same levels of success. A study in Lausanne and Geneva, Switzerland, found that around a third of cyclists were likely to cycle more as a result of the cycle lanes (Rérat et al., 2022). An Australian study found that the cycle lanes were "somewhat" or "extremely" important in increasing the level of cycling (Fuller et al., 2021). However, this was one of the least important factors, compared with fitness or social interaction, for example. This is in contrast to the experience of Thessaloniki, Greece, where the failure of the cycle lane led to its removal after 18 months (Katsavounidou et al., 2023). Using secondary data, Buehler and Pucher (2021) found widespread increases in cycling across the US, Europe and Australia, attributing much of this to leisure cycling (i.e., mostly occurring outside the working week), they conclude that this increase was supported by the "expansion and improvement of protected cycling infrastructure" (ibid: p.398).

In the UK, efforts to support more active travel because of the pandemic, coincided with a longer-term ambition to establish a step-change in the role of active travel in the wider transport system. In May 2020 the Government published a walking and cycling plan (*Gear Change*) which included a commitment for half of all trips in towns and cities to be made by active modes by 2030 (Department for Transport, 2020b).

1.2 Travel behaviour change and the pandemic

The sudden restriction to movement caused by the pandemic created a substantial shift in travel behaviour, and the impact of the Covid-19 pandemic was felt across all forms of mobility. The need to ensure social distancing and the imperative to stay at home to help

prevent the spread of the disease meant that there was a significant decline in mobilities generally (Hadjidemetriou et al., 2020), with large town and city centres seeing much reduced footfall (Enoch et al., 2022). Public transport was particularly hard hit by Covid-19, with shared mobilities not conducive to efforts to social distance (Kłos-Adamkiewicz and Gutowski, 2022). Indeed, governments largely encouraged a shift away from public transport at the height of the pandemic (e.g., Mason, 2020). Whilst levels of cycling were shown to have increased as a result of the pandemic (Buehler and Pucher, 2021), such levels have been difficult to maintain. In the medium-term, the anticipated return to normal has not played out quite as expected, with levels of car use not back to pre-pandemic levels (Anable et al., 2022; Department for Transport, 2023). Increased working from home is likely to be a factor with this, although there does remain some uncertainty as to what the longer-term picture will look like.

Whilst the Covid-19 pandemic presented an unprecedented degree of disruption, the approach used to study its impact builds from previous experience. Marsden et al. (2020) conceptualise transport disruptions as a breakdown of the activities that the transport system itself enables. Rather than examining the physical breakdown of a certain piece of infrastructure (i.e., a bridge closure), they argue it is important to examine the broader system of complex interdependencies that make it possible for people to undertake the activities of their daily life (*Ibid*). This might be travelling to work or school; completing shopping or leisure trips; or undertaking caring responsibilities for others. The disruption of the pandemic altered how travel was undertaken, with variable restrictions over the course of the two years creating a system that was in flux and therefore highly uncertain.

Large-scale planned and unplanned events have been increasingly studied, owing to the opportunities for change they present. These opportunities offer a chance to shift the population away from less desirable travel behaviours (specifically private passenger vehicle use) towards modes that are regarded as more sustainable, such as walking, cycling and public transport. For example, in examining a specific and large-scale disruption to travel (the London 2012 Games), Parkes et al. (2016) found that 54% of commuters in London made at least one change to their usual travel in response to the disruption. Notably, this work also highlighted how people exist in different stages of preparedness to change and this can influence their ultimate response to a disruption to their usual travel.

The impact of the pandemic on travel behaviour has played out across a sustained temporal dimension. For instance, Gutiérrez et al. (2020) examined public transport use in the shorter-term – when the messaging was to avoid public transport – and then in the medium and longer-term. This longer-term perspective considers the shift in focus from immediate concerns to thinking about the future impacts on public transport provision and funding, and how it might be integrated into a healthier and more sustainable future transport system.

Furthermore, responses to the pandemic have also been multifaceted, with a range of policies enacted. Indeed, transport policy responses to the pandemic have been varied and combinations of measures have been applied to help deliver the desired changes in behaviour. Shortall et al. (2021) categorised measures across three objectives: (1) avoidance of travel (e.g., work-from-home, stay-at-home orders); (2) modal shift (from public/shared); and (3) improvement of quality (more capacity, encourage masks in shared space).

In this paper, we examine specifically road-space reallocation measures, which falls into the "modal shift" category. Understandably, the introduction of such measures has garnered interest in the literature. Such road-space reallocation is of great interest to transport planners as it offers a quick and relatively low-cost approach to implementing measures to increase active travel, particularly when contrasted with the substantial costs of large-scale infrastructure projects (i.e., light-rail upgrades) (Dunning and Nurse, 2020).

Indeed, Covid-19 has prompted a discussion of how road-space is allocated across different modes of travel and whether the pandemic offers a turning point in this (Nurse and Dunning, 2020; Wright and Reardon, 2021), and more broadly, in terms of how we design our cities (Honey-Rosésa et al., 2020).

Attention in the literature has ranged from questions of how Covid-19 can prompt us to think differently about the way we travel around our cities, to what we allocate space for. Some research has focused on cycling specific issues (cf. Nikitas et al., 2021), whilst others have explored issues around equity of the provision of temporary interventions (Aldred et al., 2021; Firth et al., 2021; Fischer and Winters, 2021). This reflects the challenge of balancing the need to respond quickly in deploying interventions with ensuring existing inequalities in transport access are not exacerbated.

1.3 Case studies: Lancashire and Sheffield

To explore the impact of the temporary road-space reallocation measures, this study examined two contrasting local authorities in the North of England. Few studies have approached the introduction of temporary measures using a place-based approach such as this (cf. Anable et al., 2022; Firth et al., 2021; Fischer and Winters, 2021). A place-based approach explicitly considers the context when trying to understand the impact of interventions, for example, the existing physical infrastructure, geography, or local administrative structures. This compares with a one-size-fits-all approach, where local context is largely ignored.

Lancashire, in the North-West of England, is a large non-metropolitan county with a population of 1.2 million distributed across a number of towns and cities of varying size surrounded by an extensive rural hinterland. In contrast, Sheffield is a deindustrialising city in South Yorkshire with a population of almost 600,000. As a city, Sheffield is considerably more compact than Lancashire, with nearly four times as many inhabitants per square kilometre. Data on the access to large (5000+ people) employment centres also demonstrates the diverging geographical structures of the two case-study locations (Department for Transport, 2021a). For inhabitants in Lancashire, average travel times to such employment centres before the pandemic were 31 minutes by bicycle and 17 minutes by car, whilst in Sheffield the equivalent figures were only 20 minutes by bicycle and 14 minutes by car (*Ibid*).

The motivation for examining these two case-study areas stems from a desire to explore the extent to which place-based perspectives can shed light on how best to approach efforts to help increase levels of active travel. Whilst these places have contrasting spatial structures, the type of measures introduced were broadly similar and included footpath widening; road pedestrianisation; road closures or restrictions to through traffic; rerouting of bus routes; temporary cycle/active travel lanes; and a low-traffic neighbourhood (in Sheffield).

Initially, Lancashire introduced 14 road-space reallocation measures, whilst Sheffield introduced seven. The Lancashire measures were weighted towards increasing cycling, with roads closed to vehicles, or restricted through traffic and temporary cycle lanes. Sheffield's measures were more balanced between walking and cycling, with greater use of footpath widening and pedestrianisation. the low-traffic-neighbourhood and closure to through traffic benefits both pedestrians and cyclists.

This difference in the measures introduced reflects to some extent the different geographical contexts, although half of the Lancashire interventions were in, or linked to, Preston, the county town. This of course means that many of the Lancashire measures, certainly outside Preston, operated in isolation, rather than as a network, or as improvements

to a network of existing infrastructure, in contrast to Sheffield. Sheffield also has a considerably higher population density than Preston, and a tram system that has been operating for almost three decades. These will undoubtedly have an impact on previous and evolving travel patterns.

This paper provides insights from this study of the road-space reallocation measures in these two local authorities, with data collected through a three-wave panel study. The remainder of the paper will first explain the methods in more detail. It will then present the findings and accompanying discussion, before presenting conclusions from this work.

2 Methodology

Covid-19 presented considerable challenges to researchers seeking to gather data from the public during the pandemic, and this study had to be adaptive to the changing situation. It was ultimately designed around fully online and remote data collection methods with the risks to researchers and participants at the time from face-to-face research too high. This approach was in line with practices across other research institutions at that time.

2.1 Survey design

To capture a longer-term perspective, reflecting the fluid nature of the pandemic situation at the time, a three-wave panel study was proposed. This collected data from the same participants across both case-study areas at three distinct points (see **Figure 1**). Ethical approval for this research was granted by Sheffield Hallam University's ethics committee (ref. ER26947774). The first survey wave was undertaken between September and October 2020. With this project being conceived and funded several months after the first national lockdown was initiated in the UK, it was impossible to collect a pre-pandemic baseline from respondents without asking them to provide this data retrospectively.

This first survey asked respondents to detail their travel behaviour for three distinct periods around the first national lockdown in the UK. This was pre-lockdown, during lockdown, and post-lockdown. The purposes of this were to understand the extent to which travel behaviours changed due to the pandemic, to evaluate the impact of the temporary road-space reallocation programme, and to explore behaviours as restrictions began to be lifted. Questions in this initial survey included mode choice and trip volumes, attitudes towards the temporary measures, barriers to behaviour changes, along with socio-demographic questions. Waves Two and Three of the panel study were designed as shorter, follow-up surveys to capture longer-term changes in behaviour. The brevity of these surveys compared to the first survey wave was an effort to minimise sample attrition. The survey approach was deemed more favourable than in-depth qualitative methods (e.g., remote interviews) due to the detailed data on travel behaviour and attitudes to temporary measures that were gathered. The data presented in this paper focuses primarily on data collected in the Wave One survey.

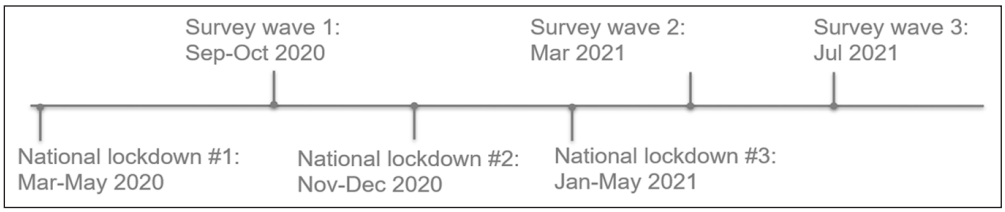

Figure 1: Panel study survey waves.

2.2 Sampling

At each wave, parallel surveys were deployed in both Lancashire and Sheffield that were identical except for location specific questions around the temporary measures introduced. The online survey tool Qualtrics was used to implement the surveys. A convenience sampling approach was utilised for the first survey wave, with the same participants then being sent the follow-up surveys (Waves Two and Three) owing to the panel approach adopted (see **Figure 1** for the timings of these). The convenience sampling approach was necessitated by the resource restrictions of the small, funded project that underpins this research, along with health and safety concerns due to the pandemic (e.g., face-to-face research being restricted).

Promotion of the survey to prospective participants was as broad as possible with the local authority partners distributing the online surveys across their mailing lists (each with thousands of subscribers). We also promoted the surveys through social media, our own networks (e.g., large local employers), and by approaching local community groups to distribute the survey across their own.

Whilst we sought to mitigate the risks by distributing the survey as widely as possible within our resource constraints, there are some acknowledged limitations in this sampling approach. Whilst the use of local authority mailing lists meant the survey was distributed widely across each area, the distribution of the survey as online-only risked underrepresenting those without access to the internet. In addition – as with other studies using a convenience sampling approach – there is a risk of self-selection bias within the sample.

Many of the respondents were still working from home (especially during the first survey period), it is therefore possible that they had not had an opportunity to try the temporary measures. Potentially this will have an impact on the representativeness of the sample who responded to the questions on the measures and on their travel choices.

In total, 1,555 responses were received across the two case-study areas in the first survey wave (see **Table 1**). Data were processed and cleaned with partial responses removed. Partial responses were identified as those not meeting a lower threshold of questions completed by the respondent that would enable analysis of their travel behaviour before, during and after the first national lockdown. A total of 1,084 valid responses remained once this initial processing was completed.

There was a substantial drop in total responses between Waves One and Two. Respondents were asked for their permission to be recontacted for the subsequent waves and this limited the range of possible respondents. In Sheffield, for example, only 321 Wave One respondents opted into further survey waves. However, with 248 responses, there was a 77% response rate to Wave Two amongst this specific group, which is extremely positive. The two follow-up surveys were shorter in length to limit attrition and this brevity also led to only a small number of partial responses being received.

Table 1: Survey responses.

	Total responses			**Valid responses**		
	Lancashire	*Sheffield*	*Combined*	*Lancashire*	*Sheffield*	*Combined*
Wave One *Sep-Oct 2020*	787 (50.6%)	768 (49.4%)	1555	548 (50.6%)	536 (49.4%)	1084
Wave Two Mar 2021	109 (30.5%)	248 (69.5%)	357	109 (31.1%)	242 (68.9%)	351
Wave Three Jul 2021	67 (26.7%)	184 (73.3%)	251	67 (26.8%)	183 (73.2%)	250

3 Results and discussion

3.1 Characteristics of the sample

The sample achieved through the Wave One survey was equally split across the two local authorities; 50.6% of valid responses were from Lancashire and 49.4% from Sheffield. In terms of socio-demographic characteristics there were some differences between the two cohorts. More people identified as female in Lancashire (70.6%) than in Sheffield (56.1%). The Sheffield cohort was older (a quarter of respondents were over 65) and this also meant that a much greater proportion of the Sheffield cohort were retired (27.0%) compared to those in Lancashire (5.3%). The majority of participants in both cohorts were white with comparable proportions in each location (96.9% in Lancashire and 96.5% in Sheffield). These figures are outlined in **Table 2**.

Table 2: Sample characteristics by local authority.

	Lancashire % (n = 548)		**Sheffield % (n = 536)**		**Combined sample % (n = 1084)**	
	Sample	**Population[1]**	**Sample**	**Population[1]**		**England[1]**
Gender						
Female	70.6	50.9	56.1	50.7	63.5	51.0
Male	27.8	49.1	40.6	49.3	34.0	49.0
Prefer not to say/ other	1.6	–	3.4	–	2.5	–
Age						
16–24[2]	3.1	13.0	1.3	18.0	15.8	13.0
25–34	15.3	14.6	12.5	17.4	18.8	16.7
35–49	37.1	21.9	28.1	21.8	29.8	23.9
50–64	41.4	25.2	33.4	22.0	22.0	23.8
65–74	2.9	13.7	20.5	10.8	11.4	12.1
75+	0.2	11.6	4.2	10.0	2.2	10.5
Economic status						
Active: In employment	89.7	55.0	65.6	53.0	77.9	57.4
Active: Unemployed	2.0	2.9	4.5	4.0	3.2	3.5
Inactive	8.3	42.2	29.9	43.0	18.9	39.1
Ethnicity						
Asian/Asian British	1.4	8.1	0.9	9.6	1.1	9.6
Black/Black British	0.0	0.6	0.9	4.6	0.4	4.2
Mixed	1.0	1.6	1.5	3.5	1.2	3.0
Other	0.6	0.7	0.2	3.2	0.8	2.2
White	96.9	88.9	96.5	79.1	96.7	81.0

(Contd.)

Access to car						
Access to one vehicle	41.2	42.2	52.0	42.5	46.5	41.3
Access to two or more vehicles	50.9	37.4	31.2	28.3	41.2	35.2
No	8.0	20.3	16.8	29.2	12.3	23.5
Access to bicycle						
Yes	59.0	–	58.0	–	58.5	43.0
No	41.0	–	42.0	–	41.5	57.0

[1] Population data drawn from Census 2021.
[2] Census age categories have been used to report comparisons although only those aged 18+ were included in the study.
Note: Columns may not sum to 100 due to rounding.

The dependence on convenience sampling and using online only surveying – owing to resource limitations and the pandemic – created an enhanced risk that certain population groups would be underrepresented. Significant effort was made by the project team to promote the survey widely given concerns around ensuring representativeness. Community groups and charities operating in wards of each local authority that are typically underrepresented in research (e.g., those with higher levels of deprivation or higher levels of ethnic minority residents) were targeted to promote the survey, along with efforts by the local authorities' partners to promote the survey widely using their own mailing lists. In addition, the survey was presented as a broader travel survey rather than a specific "active travel" survey to avoid self-selection of those opposed to measures to restrict or reduce motor traffic (such as Low-Traffic Neighbourhoods) and risking biasing the sample as such.

Ultimately, there are some limitations to this sample that we acknowledge and therefore cannot claim it to be representative of the wider population. In **Table 2**, we have provided comparators for both case-study locations and at the national level. This helps to provide context around where the samples either align or diverge from the population. Despite these limitations, this research provides valuable and timely insights into the impacts of the pandemic and associated road-space reallocation measures, which will be explored in the remainder of this section.

3.2 The behavioural shift caused by the pandemic

The scale of the reduction in mobility caused by the pandemic was substantial. Nearly half of the overall sample (47%) reported working from home during the first lockdown. A further third (31%) reported travelling to their usual workplace or elsewhere.

Across the overall sample, there were substantial levels of change in behaviour in response to the first lockdown. Of those still making journeys to a place of work, 23.2% of the Lancashire respondents who commuted had made a change to how they travelled to work prior to the pandemic. In Sheffield, this shift was even greater with 52.8% of commuters changing modes.

For shopping trips, there was also a shift in usual behaviours but more equitable across the two case-study areas (31.6% in Lancashire and 42.1% in Sheffield). Leisure trips saw the highest degree of change in both areas. Nearly half (49.1%) of leisure travellers in Lancashire had changed their behaviour, compared to almost two-thirds (60.5%) in Sheffield. **Figures 2** and **3** visualise these differences for each location.

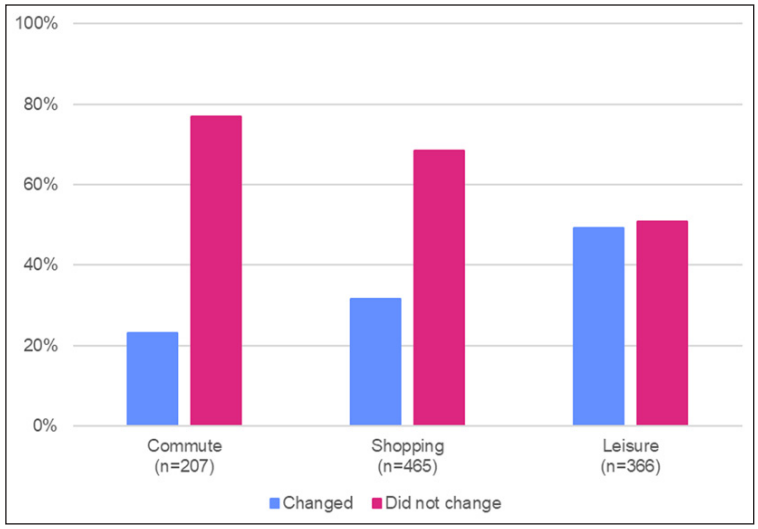

Figure 2: Changes made to usual mode of travel in Lancashire during the first lockdown.

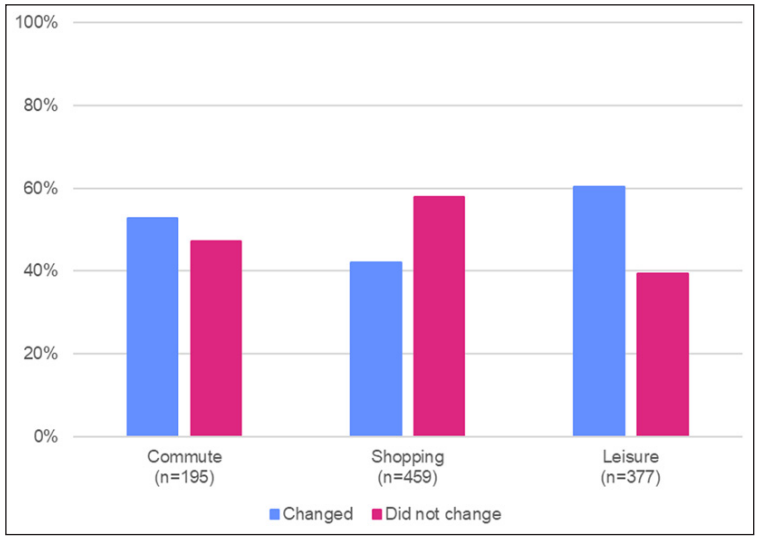

Figure 3: Changes made to usual mode of travel in Sheffield during the first lockdown.

3.3 Use and attitudes towards measures

The types of temporary road reallocation measures introduced across both Lancashire and Sheffield were quite similar. At the time the Wave One survey was deployed, Lancashire had 14 individual temporary measures in place and Sheffield had seven. Given Lancashire's more fragmented spatial structure as a non-metropolitan county council, these measures were more dispersed across different towns. Most of Sheffield's measures in contrast were situated in or close to the city centre.

Awareness of these measures was high amongst both the Lancashire and Sheffield cohorts (see **Table 3**). Overall, 77.7% of respondents were aware of at least one temporary measure

(86.9% in Sheffield, 68.6% in Lancashire). This difference is likely to be due to a combination of different factors. Firstly, that the national programme of road-space reallocation was high-profile at the beginning of the pandemic (both in national and local news). Secondly, Sheffield covers a smaller geographical area, so respondents were more likely to live closer to an intervention and although there were fewer measures they were concentrated in and around the city centre, rather than being dispersed around several locations (e.g., Lancaster, Ormskirk, Preston) as in Lancashire.

Actual use of the measures was in contrast quite low. Overall, 33.0% of respondents who were aware of the measures went on to use at least one of them as part of a journey. For respondents who were aware of the measures but did not use them, the most common response for not using them was that the measures were not on or near their usual route (36.6%), so they may have not regarded them as useful or relevant. A further 19.1% were not walking or cycling regularly and therefore did not use them.

Two-thirds of the overall sample did not use the measures, with over half of this group not doing so because of a lack of proximity to the measures themselves. This is perhaps contrary to expectations that people will travel out of their way to utilise new and improved infrastructure (Pritchard et al., 2019; Rissel et al., 2015). There are likely to be multiple facets of a journey that are traded off when comparing alternative routes (see for example, Dill and Gliebe, 2008; Prato et al., 2018). This may be explained by the relatively low number of measures deployed, particularly across Lancashire. Furthermore, given the presence of the pandemic and the fact that discretionary travel was discouraged or people were primarily working from home, it could be that they had little opportunity to actually make journeys to allow them to make use of the measures.

The follow-up surveys examined whether respondents had started using or continued to use any of the measures that were introduced by the council (of those that were still in use). Of those who were aware of the temporary measures at Wave One but did not use them, a fifth (20.7%) subsequently went on to use them at a later point. Of those who had used them at the time the first survey wave was issued, 81.6% reported continuing to utilise them at the time the second survey wave was circulated.

The use of specific measures was also variable within each case-study area. In Lancashire, there was overall a much lower use of the measures by the respondents compared to Sheffield (see **Table 4**). For most measures, only 1% or 2% of the sample reported using them. The exceptions to this were the Liverpool Road temporary cycle lane in South Ribble (3%), which provided a safe route to Preston city centre from a residential area, and the Fishergate closure in Preston (6%), one of the main shopping streets within the city centre. The spatial structure

Table 3: Awareness and use of the temporary measures, captured at Wave One.

	Lancashire (n = 548)	**Sheffield (n = 536)**	**Combined (n = 1084)**
Proportion aware of temporary measures	376 (68.6%)	466 (86.9%)	842 (77.7%)
Used the temporary measures	79 (21.0%)	199 (42.3%)	278 (33.0%)
Did not use: Not on or near my usual route	162 (43.1%)	146 (31.3%)	308 (36.6%)
Did not use: I do not regularly walk or cycle	91 (24.2%)	70 (15.0%)	161 (19.1%)
Did not use: Other	39 (10.4%)	40 (8.6%)	79 (9.4%)
No response	5 (1.3%)	11 (2.4%)	16 (1.9%)

Table 4: Use and rating of specific measures.

Temporary measure	Location	Proportion of local sample used the measure (%)	Median rating
Lancashire			
Closed to vehicles	Fishergate (Preston)	6	Excellent
Temporary cycle lane	Liverpool Rd (South Ribble)	3	Good
Temporary cycle lane	Chapel St, Winckley Sq, Ribblesdale Pl (Preston)	2	Good
Temporary cycle lane	A6 South Road (Lancaster)	2	Good
Temporary cycle lane	Fylde Rd (Preston)	2	Good
Restricted through traffic	Fletcher Rd (Preston)	1	Good
Restricted through traffic	Fishwick Parade (Preston)	1	Good
Restricted through traffic	Frenchwood Av (Preston)	1	Good
Closed to vehicles	Dalton Sq (Lancaster)	1	Good
Restricted through traffic	Shady Ln, Nell Ln (South Ribble)	1	Good
Footpath widened	Railway Rd (W. Lancashire)	1	Good
Closed to vehicles	Moor St, Railway Rd (W. Lancashire)	1	Good
Temporary cycle lane	St Helen's Rd (W. Lancashire)	0	Good
Closed to vehicles	Ruff Ln, St. Helen's Rd (W. Lancashire)	0	Good
Sheffield			
Pedestrianisation	Division St	23	Excellent
Closure to vehicles and footpath widening	Pinstone St	23	Excellent
Temporary cycle path	A61 Shalesmoor	18	Excellent
Low-traffic neighbourhood	Kelham Island	15	Excellent
Pedestrianisation and footpath widening	Broomhill	15	Good
Temporary cycle path	Attercliffe Rd (Five Weirs Walk link)	10	Good
Closure to vehicles	Upper Charles St	8	Good

Note: Attitudinal data on the measures introduced was ordinal and we therefore are reporting the median values.

of Lancashire, being a county council spread over 2,894 sq. km (Lancashire County Council, 2023) means that measures were more dispersed, and it was likely that individuals may only experience one such measure.

The use of measures by the Sheffield cohort was greater in comparison to Lancashire and this may be a reflection of the increased likelihood of encountering multiple measures, particularly if navigating the city centre where the majority were located. Nearly a quarter of the Sheffield sample (23%) had made use of the Division Street pedestrianisation (which involved a closure to motor traffic of a section of a popular shopping street. The same proportion using the Pinstone Street closure, which widened the footpath along a popular route connecting two shopping areas. The A61 Shalesmoor temporary cycle lane ran along a section of the ring-road and involved the removal of a traffic lane up to a busy junction. This was removed only a few months after being installed but was well utilised during this time, with 18% of the Sheffield sample reporting having used it.

A challenge with the rapid deployment of such temporary measures is how they integrate with existing infrastructure. For example, Dunning et al. (2021) undertook video analysis of cycling journeys along temporary infrastructure in the Liverpool City Region and identified issues including the lack of connectedness with the existing infrastructure and the quality of the existing road surface. Whilst it is beyond the scope of this paper to explore this for our case-studies, it is likely – given the disjointed nature of the measures introduced – that similar challenges were experienced in both Lancashire and Sheffield.

To establish the quality and value of the temporary measures, the respondents who had used them were asked to rate their quality. A scale of 1 to 5 was provided (1 = Excellent and 5 = Poor) with respondents providing a score for each one they had used. Median scores were calculated based on this to give the average rating. All measures were rated either Good or Excellent. A trend was observed in the data that those measures rated Excellent were also the most used measures, which suggests a possible relationship between the perceived quality of temporary measure and frequency of use. It is worth noting that there is potential for self-selection bias – discussed in the methodology section – to be a factor here. Specifically, whether those using the measures are predisposed to have favourable views of them regardless of their actual experiences, because they are supportive of such interventions. However, if this analysis was opened beyond those who had experienced the measures themselves then there is equally a risk that those with unfavourable views of such interventions biasing the results, without actually having experienced them.

3.4 Impacts of temporary measures on travel behaviour

3.4.1 Cycling

The evidence above demonstrates that respondents had broadly positive attitudes towards the temporary measures and were supportive of more deliberate urban design to prioritise pedestrians. However, it is important to understand whether the introduction of measures actually led to an increase in cycling (and walking).

Analysis showed that the uptake of cycling during the first lockdown (for those who had not previously cycled), was higher in those who had used at least one of the temporary measures (8.0%), than those who had not used any (1.4%). To test whether this difference might be due to the existence of the temporary measures a chi-square test was performed. This indicated that there was a significant association between use of the measures and starting cycling for commuting (x^2 (1) = 19.521, $p < .001$) with respondents 6.29 times more likely to have taken up cycling if they used the temporary measures. Tests for leisure trips (x^2 (1) = 40.863, $p < .001$; 7.50 times more likely) and shopping trips (x^2 (1) = 49.412, $p < .001$; 10.93 times more likely), showed comparable results.

This relationship is further highlighted in **Figure 4**, which shows the increase in respondent's who cycled during the first lockdown period compared to their pre-pandemic travel. This clearly indicates a trend that those who were aware of and had used the measures saw a larger increase in cycling for all three purposes shown than the other three groups.

This suggests that the temporary measures did have some impact during lockdown for the respondents. The extent to which these trends persist is also of interest. **Figure 5** shows the increase in cycling between pre-pandemic and post the first lockdown and demonstrates how

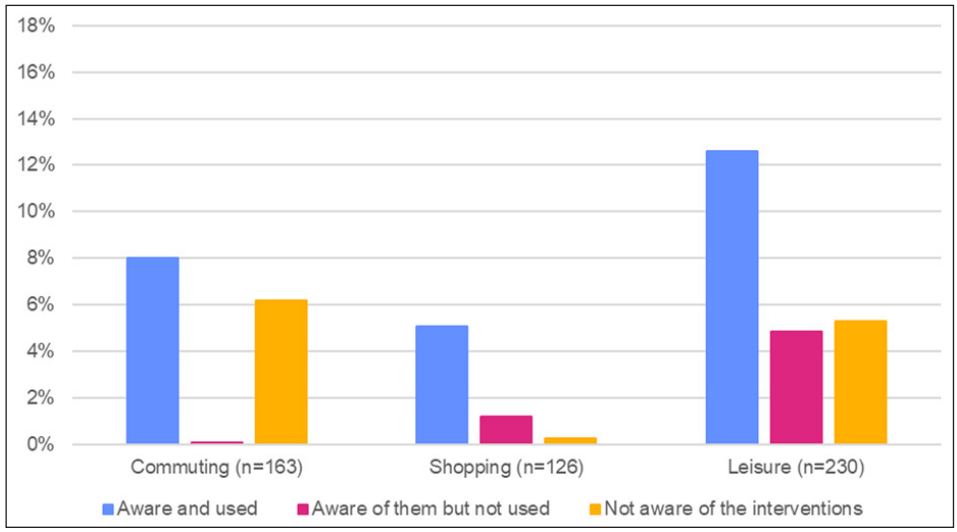

Figure 4: Percentage increase in cycling between pre-pandemic levels and during the first lockdown.

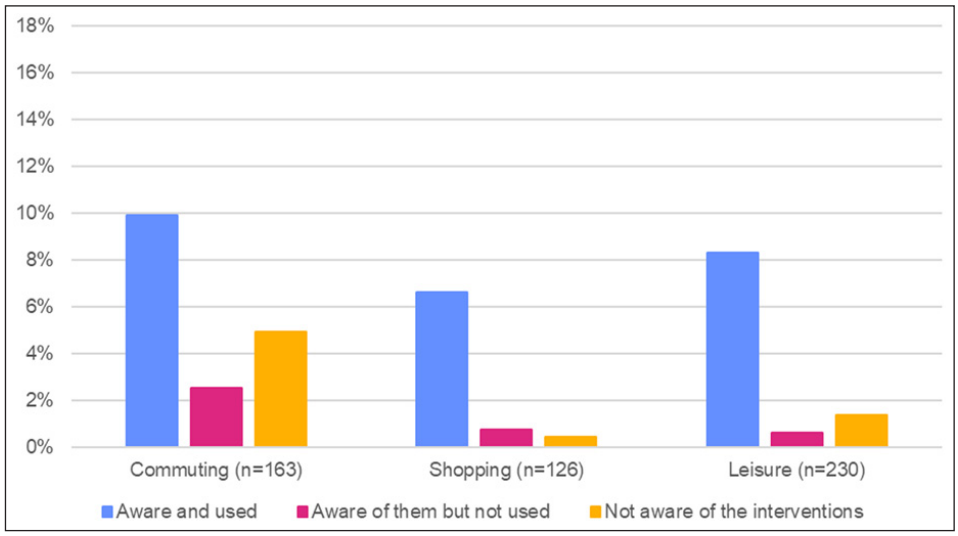

Figure 5: Percentage increase in cycling between pre-pandemic levels and post-lockdown.

those respondents both aware and using the temporary measures saw greater increases in cycling levels.

It is worth noting that these trends are also likely to be part of a wider story. Interestingly there was also an increase in commuter cycling for those who were aware of but had not used them and increases in both commuter and leisure cycling for those who were not aware of the road-space reallocation (see **Figure 5**). This would suggest that even without the measures there would have been some increase in cycling. There are several factors that may have contributed to the increase in the "not aware" group. Firstly, there were significantly lower traffic levels during the first lockdown, as a result many people would have considered it safer to cycle, particularly those with some cycling experience. Secondly, even if they were unaware of any local measures (in some Lancashire locations there were no "local" measures), there was significant coverage by the national news media to raise awareness of the increase in popularity of cycling nationally during this period, which may have encouraged others to consider cycling or start cycling again.

3.4.2 Walking

Although there were fewer temporary measures introduced to facilitate social distancing, and these were largely in town and city centres, there was still a change in the level of walking during and post-lockdown, although the picture was different from that for cycling.

Figure 6 shows that the largest increase in walking within the sample was for leisure trips during the first lockdown period, which is perhaps unsurprising as the "stay at home" directive applied to leisure as well as working, and leisure trips were only permitted near to home. Walking around local areas and greenspaces provided easy access to outdoor exercise that was strictly limited to once a day under the lockdown regulations.

There was also an increase in the number of shopping trips. This may indicate that large weekly shopping trips by car were replaced by more frequent trips to local shops: certainly responses to the survey indicated that many changed their normal shopping (over 80%) and

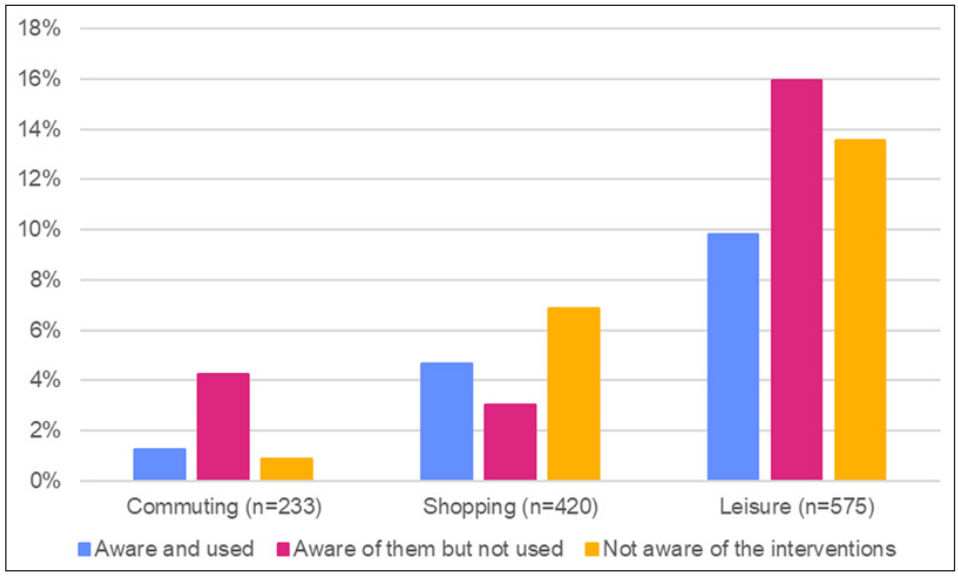

Figure 6: Percentage increase in walking between pre-pandemic levels and during the first lockdown.

leisure (over 60%) destinations during the lockdown period. However, it is unlikely, given the data presented, that the increases in walking during the lockdown period were associated with the introduction of the temporary measures.
Unlike cycling, the levels of walking fell after the lockdown period, although for leisure and shopping they remained above pre-pandemic levels. This is unsurprising given around half of respondents indicated that they were still maintaining their lockdown habits in terms of leisure and shopping destinations.

It is likely that a combination of factors encouraged the shift to cycling and walking and that these vary depending on the journey purpose. However, in the case of cycling, the temporary measures were certainly an important factor in this.

4 Conclusions

In 2020, the onset of the Covid-19 pandemic and the introduction of associated lockdown restrictions involved a sudden change in circumstances that forced people to modify their travel behaviour for all purposes. During this period a key feature was the reduction in the overall number of journeys (with some people not making any trips at all, e.g., those who were shielding or self-isolating). For those journeys that did take place there was inevitably a switch between certain modes, given that the advice was to avoid public transport where possible and not to venture too far from home for leisure or shopping trips. Between a third and two-thirds of survey respondents used different modes for the latter two purposes than in the pre-pandemic period. This contrasts with the findings of Fuller et al. (2021) undertaken in Australia, where there was no increase in cycling for transport (e.g., commuting and shopping), but some increase in cycling for leisure, with little importance being attributed to the existence of pop-up cycle lanes in encouraging this. There are two factors that are likely to have contributed to this difference in behaviour. Firstly, the Fuller et al. study reports a significant decrease in working hours and an increase in working from home, both of which will impact on the number of commuting journeys undertaken. Secondly, their survey purposely targeted existing cyclists, who are, presumably, already acclimatised to cycling conditions in their local area and therefore less influenced by the introduction of the new cycling infrastructure. More generally, Becker et al. (2022) observed that across a selection of European cities bicycle and car use increased across the pandemic, whilst public transport and multimodal travel decreased.

The higher proportions switching modes in Sheffield compared to Lancashire relate mainly to its relatively compact urban form, providing readier access to local retail and recreational facilities than the polycentric, rural-framed geography that characterises the latter case study area. While these changes in mode varied in their fine detail by place and purpose, the main shifts were inevitably distributed between private motor vehicles on the one hand and active travel modes (cycling and/or walking) on the other, with some trips combining both.

The easing of restrictions during the inter-lockdown period meant that there was a release of suppressed demand, manifesting in an upsurge in the number of journeys, but in a context where public transport use was still discouraged. The ability (and in some cases need, in the case of longer distance commuting) to travel further meant that private car usage persisted or even grew, but attrition amongst those who had taken up active travel during lockdown was relatively muted. This held for commuting as much as for shopping or leisure, and may be due to survey responses in the second and third waves relating to the spring and summer months. Certainly, the inflexibility of timing with respect to commuting trips compared to shopping or leisure might prompt some reduction in active travel choice linked to less predictable weather conditions during winter. Nevertheless, there is evidence that some changes

have sustained in the medium-term at least (Anable et al., 2022; Department for Transport, 2023).

An important element in attempting to encourage people to take up – and stick with – active travel (especially cycling) was the rapid installation of road-space reallocation measures in both case study areas. Increases in cycling were seen across both those who were aware of the measures and those who were not, but notably, the highest increases in cycling (for commuting, shopping, and leisure trips) were across those who were aware and then went on to use the temporary measures. Statistical analysis (chi-square tests) indicated that there was a statistically significant likelihood that those using the measures had started cycling during the pandemic suggesting that the measures had a role to play in enabling higher levels of cycling. Although the switch to active modes in both case-study areas was relatively modest, it does illustrate what can be achieved at small scale and over a short period of time. Evidence from this research showed that measures were generally well received and those receiving higher ratings in terms of quality attracted the highest levels of use. For many users though, the lack of proximity of the measures to their routes meant they did not use them. This links to a wider problem observed during the pandemic in deploying temporary measures that were sparse and disconnected from existing infrastructure (Dunning et al., 2021), which inevitably limits their potential impact and utilisation. Although Rérat et al. (2022) in their study of cycling behaviour in Lausanne and Geneva found some evidence of cyclists modifying their routes to take advantage of the temporary cycle lanes. In Geneva, the authorities worked to create "a safe and legible network [which] covers the whole city centre", whilst Lausanne "concentrated its efforts on the main axes entering the city centre" (Ibid: p.4). In both cases this would have likely created functional infrastructure that would attract use. This contrasts with the more piecemeal approach, especially in Lancashire where the interventions were dispersed across several towns, and tended to be built where it was less likely to impede motorised traffic, rather than where it was needed. The longer-term impact remains uncertain, with the risk that removal of temporary measures then has a deterrent effect on people continuing with active travel, or stunts the momentum gained during the pandemic. In policy terms, therefore, the use of such measures could be a rapid and low-cost stopgap whilst funding is being assembled to install more state-of-the-art permanent facilities – or as experimental schemes to see how they work for active travellers and vehicular traffic alike – all in the interests of encouraging more people to adopt active travel modes for some or all their journeys.

Despite the world having opened up significantly since the onset of Covid-19, the full long-term impact of the pandemic on travel behaviour remains to be seen and there continues to be considerable uncertainty. Recently, more medium-term evidence has begun to emerge suggesting that the return to pre-pandemic habits has begun to slow and plateau (Anable et al., 2022). There also remains uncertainty and on-going conflict around what we want our post-pandemic transport systems to look like, particularly in the context of transport decarbonisation (Department for Transport, 2021b). The study reported here implies that any approach needs to take account of local geographies. The differences in the spatial frames of the two study areas have impacted on both the level of change and the use of the measures, with more pronounced shifts in Sheffield compared to Lancashire. Although there are more nuanced factors at play in the two areas, the contrast between the monocentric urban morphology of Sheffield and the dispersed and polycentric nature of Lancashire has certainly played an important role in their experiences of changing travel behaviour during the pandemic. In sum it implies that there is no "one mix fits all" solution, and that places with varied spatial frames where longer journeys are often necessary require a bespoke set of measures

that perhaps invoke hybrid responses to promote trips with an element of active travel, rather than merely seeking outright modal shifts.

Data Accessibility Statement

Data used in this research project has not been made available due to participant data protection.

Notes

[1] An overview of the Covid-19 cycling measures implemented across cities in Europe can be found at https://ecf.com/dashboard.

Acknowledgements

The authors would like to express their gratitude to DecarboN8 for funding this research and the broader DecarboN8 Network for the support provided. We would also like to thank Mary Lawler of the University of Central Lancashire for her support on the early stages of this research.

Funding Information

This project was supported by DecarboN8. DecarboN8 is funded by UK Research and Innovation, grant agreement EP/S032002/1.

Competing Interests

The authors have no competing interests to declare.

Author Contributions

Author 1: conceptualisation, methodology; formal analysis; resources; data Curation; writing; visualisation; supervision; project administration; funding acquisition. Author 2: conceptualisation, methodology; formal analysis; resources; data curation; writing; visualisation; supervision; project administration; funding acquisition. Author 3: methodology; formal analysis; writing, review and editing.

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How to cite this article: Parkes, S., Weston, R. and Gore, T. 2024. The impact of Covid-19 road-space reallocation measures: Insights from the north of England. *Active Travel Studies: An Interdisciplinary Journal*, 4(1): 2, 1–21. DOI: https://doi.org/10.16997/ats.1444

Submitted: 04 April 2023 **Accepted:** 19 March 2024 **Published:** 02 July 2024