



Glasgow's bikeshare scheme: trends in use

an analysis of scheme usage
between July 2014 and July 2022

Acknowledgments

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Executive summary

This study is based on an analysis of bicycle hires made by users of the Glasgow bikeshare schemeⁱ and takes in an eight-year period from the scheme's inception in July 2014 to the end of July 2022. Our aim is to provide a better understanding of how the scheme has developed and how it is used. We also focus on the potential health and environmental benefits of the scheme and how it may impact on transport inequalities in the city.

The development of Glasgow's bikeshare scheme is pertinent to a range of local and national transport policies which aim to encourage more people to walk, cycle, and take public transport as part of a shift away

from car use. If achieved at significant scale, such a shift has the potential to cut carbon emissions, reduce air pollution, contribute to better places, help address transport inequalities, and improve population health.

Glasgow's bikeshare scheme can make an important contribution to creating an active and sustainable transport system for the city. We outline ideas about how and where the scheme could be developed and expanded in the future. These are particularly relevant to Glasgow City Council's and Strathclyde Partnership for Transport (SPT)'s plans for a just transition to a low carbon sustainable transport system in the coming years.

Main findings

Initially concentrated in the centre and west of the city, the scheme has grown steadily in the last eight years and now extends to a much larger network across the city. There are now over 1,150 bikes in the scheme (10% of which are e-bikes) and 103 bike hire stations, making this the biggest bikeshare scheme in Scotland, and one of the largest in the UK outside of London. From the first year of the scheme, the number of hires has risen significantly; in the period August 2021-July 2022 there were nearly 325,000 hires, representing approximately a five-fold increase on 2014/15 figures. Relative usage of each bike has risen from 0.8 hires per bike per day in July 2014 to 1.3 hires per bike per day in July 2022.

In 2022, there were over 94,000 active users of the scheme – approximately 5% of UK current bikeshare usersⁱⁱ – and 21 organisations have had corporate membership under the current contract.

There is a marked seasonality in scheme use. The volume of hires peaks in the summer months and decreases over winter. Prior to the pandemic, winter hire volumes were just under half of those across the summer months.

ⁱ The scheme is currently badged as OVO Bikes Glasgow (OVO Energy is the main sponsor) but is operated by **nextbike by TIER**, who subcontract maintenance and movement of the bikes to Bike for Good, a local bike charity.

ⁱⁱ This is an approximate figure based on 94,467 current users of the Glasgow scheme at the end of 2022 (defined as having hired a bike in the last 120 days) divided by CoMoUK's figure of 1,753,899 active bikeshare members (defined as having hired a bike in the last 12 months) in the UK in March 2022²⁰.

Changes in patterns of use

We categorised bike hires into three broad groups: one-way peak-time journeys, one-way off-peak journeys and roundtrip journeys (where the bike was returned to the same station it was hired from). We then analysed hire patterns pre-COVID, during the COVID restrictions, and in the post-COVID period.

Pre-COVID

Before the pandemic, one-way hires on weekdays peaked in the mornings (8:30-10:30 am) and in the afternoons (5pm-8pm), and hires during these peak-time periods accounted for just over 40% of all hires. Most of these peak-time hires lasted under 20 minutes and showed a strong directional flow: into the city centre in the mornings and out from the city centre in the afternoon.

This suggests that these were predominantly commuting trips. One-way journeys outwith these peak times made up just under 50% of all hires and tended to be longer and show more diverse geographical patterns. A further 10% of all journeys were roundtrip hires and are assumed to have been predominantly for leisure.

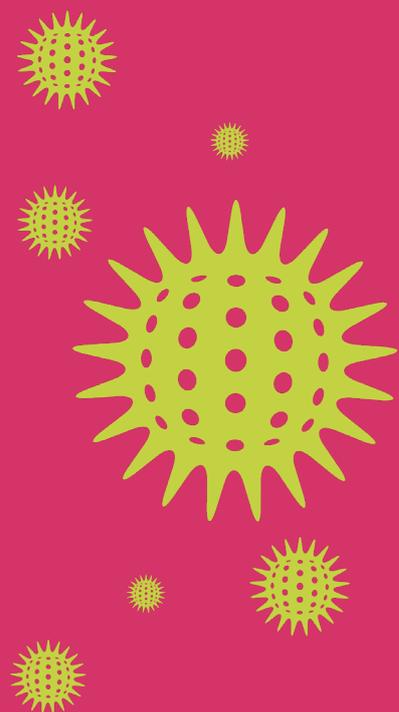
COVID impact

Unsurprisingly, during the pandemic lockdowns there were fewer peak-time hires. When comparing the hourly pattern of one-way hires on weekdays before, during, and in between the two pandemic lockdowns, we see that the weekday morning peak in hire volumes almost completely disappears during both lockdown periods. The number of off-peak journeys increased during the pandemic and there were many more roundtrip hires, probably for leisure, especially during the first lockdown.

Post-COVID

The most enduring change in the post-pandemic period has been the significant reduction in the number of hires taking place in the morning peak-time period, suggesting that there may be fewer commuters using the bikeshare scheme and/or commuting is taking place over a broader period of the day.

Overall, it appears as though the balance between hires that form part of a commute to a place of work and study, in comparison with other types of one-way journeys, has shifted as a result of COVID-related changes in working and studying patterns.



Commuters during traditional rush-hour periods are now less likely to use the scheme, but its popularity has grown significantly among those undertaking one-way hires at other times of the day.

There also appears to be a more complex pattern of cycling across the city post-pandemic, rather than predominantly into and out of the city centre, facilitated by the

geographic expansion of the scheme. This pattern may be being reinforced by a post-pandemic diversification of work locations (e.g., working from home and office) for many businesses and workers.

The significant expansion of the scheme over the past eight years has therefore made a bike hire trip a realistic and convenient option for a much wider variety of users than was the case at the outset of the scheme. The expansion of the city's cycle network infrastructure is also gradually helping to make cycling a more efficient and safer way of travelling across the city.

E-bikes

We were unable to analyse e-bike use separately, but figures provided by nextbike UK show that, in Glasgow, e-bike use accounted for 13% of all bike rentals in 2022. By the end of 2022, there were 159 e-bikes available in the Glasgow scheme.



Impacts on transport inequalities

For simple journeys bike hires are relatively cheap, if used on a 'pay-as-you-ride' basis or via a monthly or annual membership, compared to other forms of public transport. In the Glasgow scheme, hire on a 'pay-as-you-ride' basis costs £1 per 20 minutes, which compares favourably to the costs of a single fare on public transport. The scheme is dependent on having a smartphone and a bank account, but alternative membership models to provide cheap access to the bikeshare scheme (not dependent on having a bank account) have been trialled successfully on a project basis. The costs of public transport for people on low weekly income can be prohibitive, and bikeshare can offer a cheaper alternative to public transport for simple journeys.

The scheme has expanded its reach over time and station locations are now more evenly distributed in relation to area deprivation across the city. While initially there were more bikeshare stations in the centre and west end of the city, there are now more stations further out from the centre and more which are accessible to people living in deprived communities. Nevertheless, there are still no bike hire stations in almost half of Glasgow's neighbourhoods (see map on page 9).

Access to a bikeshare scheme can expand access to cycling for the many people who do not own a bike (55% of households in Scotland). Space to keep a bike is another barrier to increasing cycling. The bikeshare

scheme provides an alternative to bike ownership and avoids the need to buy, store and maintain a bike.

E-bikes have been shown to increase bicycle usage, to provide direct health benefits through physical activity, and have the potential to replace car use. The recent addition of e-bikes should encourage a greater range of people to access the scheme and enable longer journeys to be made with greater ease.

The bikeshare scheme may also be helping to address the gender gap in who cycles; previous GCPH research showed that a relatively high proportion of users of the Glasgow bikeshare scheme were women.

Health and environmental impacts

Increasing active travel, as this scheme has done, has many health and environmental co-benefits.

As the scheme has expanded, the number of bike hire journeys has increased significantly, and these are all essentially carbon-neutral journeys. If bike journeys replace car journeys, then carbon emissions and associated air pollution are reduced. We calculate that since its inception to the end of July 2022, just over 3.8 million kilometres have been cycled by users in Glasgow. Had all these journeys been made by car, they would have cumulatively contributed 650 tonnes of CO₂e over the eight years of the scheme.

These are notional carbon savings but do point to the potential of the scheme, if it is expanded further, to play a part in reducing Glasgow's carbon footprint. This is particularly important for the transport sector, where carbon emissions have remained stubbornly high.

The other potential benefit of the scheme is in relation to physical activity. We estimate that bikeshare users have spent 272,539 hours being active since the start of the scheme and potentially just under 180,000 people have achieved their daily recommended level of physical activity from use of the bikeshare scheme.ⁱⁱⁱ There may be other unmeasured benefits for regular users of the scheme, including weight-control, lower levels of sickness, and mental health benefits associated with active travel and active commuting. Indirect population health benefits may also accrue from reductions in traffic density and road noise, if car traffic in Glasgow is reduced and more people use the bikeshare scheme.



ⁱⁱⁱ These estimates exclude roundtrip hires for which we have no information on distances cycled.

Planners are now thinking about how to create more compact, liveable cities which reduce the need for car travel. Bikeshare schemes have a key role in achieving the 15 (or 20) minute city or neighbourhood, in which most services and activities are accessible within a 15-to-20-minute walk or cycle ride.

It is very clear that co-locating bike hire stations at railway stations is increasing bike hires and while we do not have the evidence about the impact on train use, it is at least plausible to say that the co-location of facilities is encouraging multi-modal journeys that are active and sustainable.

Recommendations for future scheme development

These recommendations are presented in the context of Glasgow City Council's and SPT's plans for transitioning to a low-carbon sustainable transport system.

1

There is an increased number of stations in the more deprived areas of the city, providing more equitable access to the scheme. However, to be an integral part of Glasgow's sustainable transport system, **there needs to be further expansion into the peripheral parts of Glasgow and better access for people living within Glasgow's most deprived areas.** Proportionately, there needs to be more bike hire stations in the more deprived areas of the city, because typically these are the areas with the lowest car ownership, the lowest level of bike ownership, and where transport poverty hits hardest.

2

If Glasgow's bikeshare scheme was **expanded beyond the city boundary into neighbouring local authorities,** it could have an even greater role in enabling short- to medium-distance journeys to be undertaken actively. An extended scheme could be **an integral part of a regional transport system linking with other public transport services and could be included in any future integrated ticketing solution for public transport services** – i.e., one ticket that covers all public transport, including bike hire.

3

The Glasgow scheme currently is only open to adults aged 18 years and over, but some schemes have made exceptions, allowing younger people to use the bikes. To increase usage and accessibility of the scheme, **consideration should be given to expanding membership to include younger adults aged 16 and 17.**

4

The current scheme requires access to a smartphone and a bank account, and these requirements can act as barriers to accessing it for some people. There have been projects that have successfully provided low-cost membership (including training and support) for individuals with a low income and those likely to face barriers to cycling. These types of complementary approaches can help to open up the scheme to those who perhaps have the most to gain from access to affordable cycling. The Council and other partners, including the Scottish Government, should be building on these examples and identifying ways to **make the bikeshare scheme as affordable and accessible as possible to those in most need.**

Further research

Our study has been limited to solely analysing hire data. Given the important part that Glasgow's bikeshare scheme has to play in making the shift to an active and sustainable transport system, better intelligence is needed on who uses the scheme and why. A survey and focus groups could be used to collect demographic data on users of the scheme, to find out what sort of trips the bikes are used for, and to gather users' views on the scheme. Other areas of interest to focus on might include barriers to use of the bikeshare scheme, perceptions of danger

and vulnerability in traffic, the extent to which people are combining bikeshare with other modes in their journeys, and whether the scheme is encouraging new cyclists or lapsed cyclists to return to cycling.

In our study, we were not able to analyse e-bike use due to limitations in the data we had access to, but, assuming a breakdown of hires by bike type is made available in future, it would be useful to examine patterns of e-bike use and to make comparisons to use of the manual bikes.



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Introduction

This report describes the growth and patterns of use of Glasgow's bikeshare scheme from July 2014 to July 2022^{iv}. The purpose of this work is to provide a better understanding of how the scheme has grown and evolved, and how it is used. The report also focuses on the impact of the scheme on transport inequalities in the city and the potential health and environmental benefits of the scheme. It is hoped this analysis will support planning further expansions of the scheme.

The development of Glasgow's bikeshare scheme is pertinent to a range of local and national transport policies which aim to encourage more people to walk, cycle, and travel on public transport as part of a shift

away from car use toward more active and sustainable travel. Such a shift, if achieved at a significant scale, has the potential to cut carbon emissions, to reduce air pollution, to contribute to better places and to improve population health.

In the next section of this report, prior to describing our analysis and findings, we outline the transport and sustainability policy context in Scotland, summarise current active travel trends, and describe the growth of bikeshare schemes in the UK. Additionally, given the extraordinary nature of the last two and a half years of the pandemic, we summarise the impact of COVID-19 on travel and transport, and more specifically on cycling and bikeshare use.

National and local policy

Increasing everyday walking and cycling in Scotland is seen as playing an important part in creating an active and sustainable transport system^{1,2}, improving population health³, reducing air pollution⁴, achieving Scotland's challenging Climate Change targets⁵, and in regenerating cities and town centres⁶.

In recent years, investment in active travel in Scotland has risen substantially, increasing from £39 million in 2017/18 to £100 million in 2020/21⁷. The latest Scottish Government commitment is to treble the active travel budget to at least £320 million by 2024/25, a figure which will represent 10% of the total transport budget⁸.

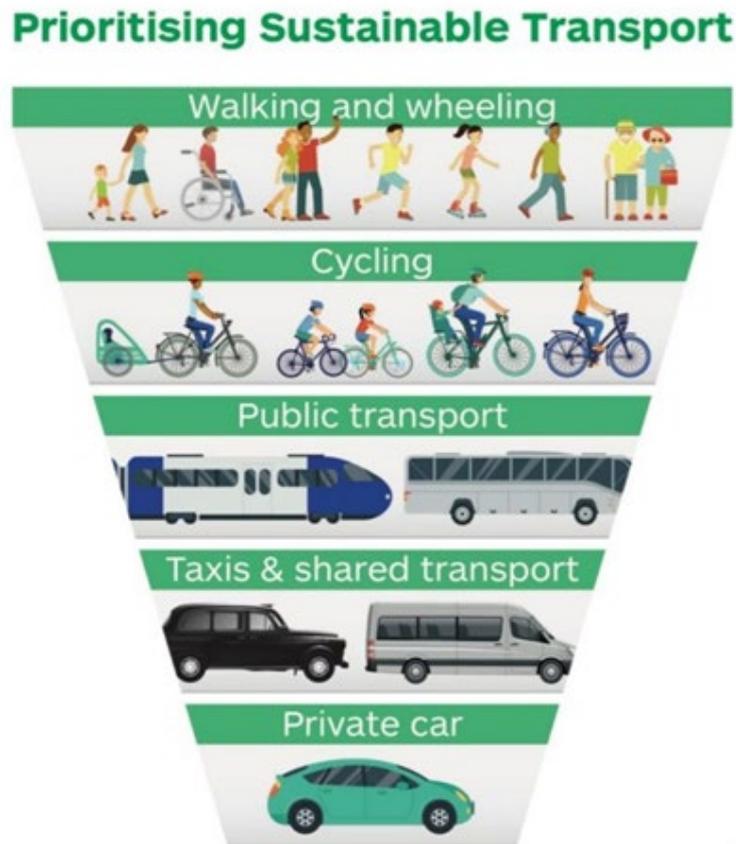
Most recently, in 2022, there has been a national consultation on a proposal to reduce car distances travelled in Scotland by 20% by 2030⁹. This proposal forms part of a range of policies that seek to reduce carbon emissions in the transport sector, where little progress on carbon reductions has been made to date¹⁰.

In Glasgow, the City Council has recently approved a Transport Strategy Policy Framework¹¹ and a linked Active Travel Strategy¹². Both aim to give priority to sustainable travel (see Figure 1) in order to encourage more journeys on foot and by bike and to create a transport system which contributes to a just transition to a net-zero carbon, clean and sustainable city.

^{iv} The scheme actually started in late June 2014, however, our analysis is from 1st July of that year until the end of July 2022.



Figure 1: Sustainable travel hierarchy



Source: National Transport Strategy

Active travel trends

Despite these commitments to active travel and increased spending on public transport, car use predominates for most journeys in Scotland and relatively few people choose to walk and cycle. In the period 1966-2011, car commuters rose from 21% to 69% of all commuters in Scotland, while commuters by bus and on foot both more than halved. Cycling commuters remained low, representing less than 2% of all commuters¹³. In 2011 the rate of commuting to work by bicycle in England was double that in Scotland (3.2% versus 1.6%)^{13, 14}.

In Scotland, cycling journeys as a proportion of all journeys remain low (1.2% in 2019), and cycling commutes represented only 2.7% of all journeys to work by employed adults not working from home in 2019¹⁵.

Within Scotland, cycle commuting rates are generally higher in cities than in rural areas¹⁶ but cycling rates in Scottish cities are lower than in many comparable European cities¹⁷.

More recent trends in Glasgow suggest that cycling rates into the city centre have increased over the last decade and even over the period of the pandemic¹⁸.

The majority of Scotland's population live in urban areas and a high proportion of trips are over short distances; 54% of all trips in Scotland in 2019 were under 5km and therefore could potentially have been cycled. However, as an example, only 1.7% of journeys under 5 miles (under 8km) were made by bike¹⁹.



There are wide inequalities in who cycles and who has access to a bike. For example, access to a bicycle in Scotland increases with household income and household size: 62% of households with an income of £50,000 or more have access to one or more bikes, compared to 19% of households with an income up to £10,000¹⁹.

Bikeshare schemes and details of the Glasgow scheme

In August 2021, it was reported that there were more than 10 million bicycles in bikeshare schemes across the world; 41% of all the active bikeshare schemes globally are in Europe²⁰. The Meddin Bike-sharing World Map shows that currently (December 2022), there are approximately 52 accredited bikeshare schemes operating across the UK^v with six of those in Scotland, one in Northern Ireland, two in Wales and the rest in England. The Santander scheme in London is by far the largest in the UK, and there are nearly 17,000 bikes available in London²¹.

Glasgow's bikeshare scheme was introduced to coincide with the Commonwealth Games in June 2014, as part of an effort to encourage active travel and public transport use to get to event venues. Glasgow City Council (GCC)

funded the start-up and development of the scheme. nextbike UK Ltd was awarded the initial contract for the operation and maintenance of the scheme and was awarded a second contract in February 2017 to expand the scheme over a seven-year period²². The scheme is badged as OVO Bikes Glasgow (OVO Energy is the main sponsor) but is operated by nextbike by TIER^{vi}, who subcontract maintenance and movement of the bikes to Bike for Good, a local bike charity^{vii}.

Initially, there were 400 bikes spread across 32 stations. The scheme has since grown to become one of the larger city schemes in the UK with 1,000 pedal bikes and 159 electric bikes spread across 103 operational stations, as of March 2023 (see Figures 2 and Map 1). In 2014, the original fleet were three-speed bikes. In

^v This figure does not include the many smaller regional and community run schemes across the UK.

^{vi} nextbike by TIER - nextbike UK Ltd merged with TIER Operations Ltd on 1st February 2023.

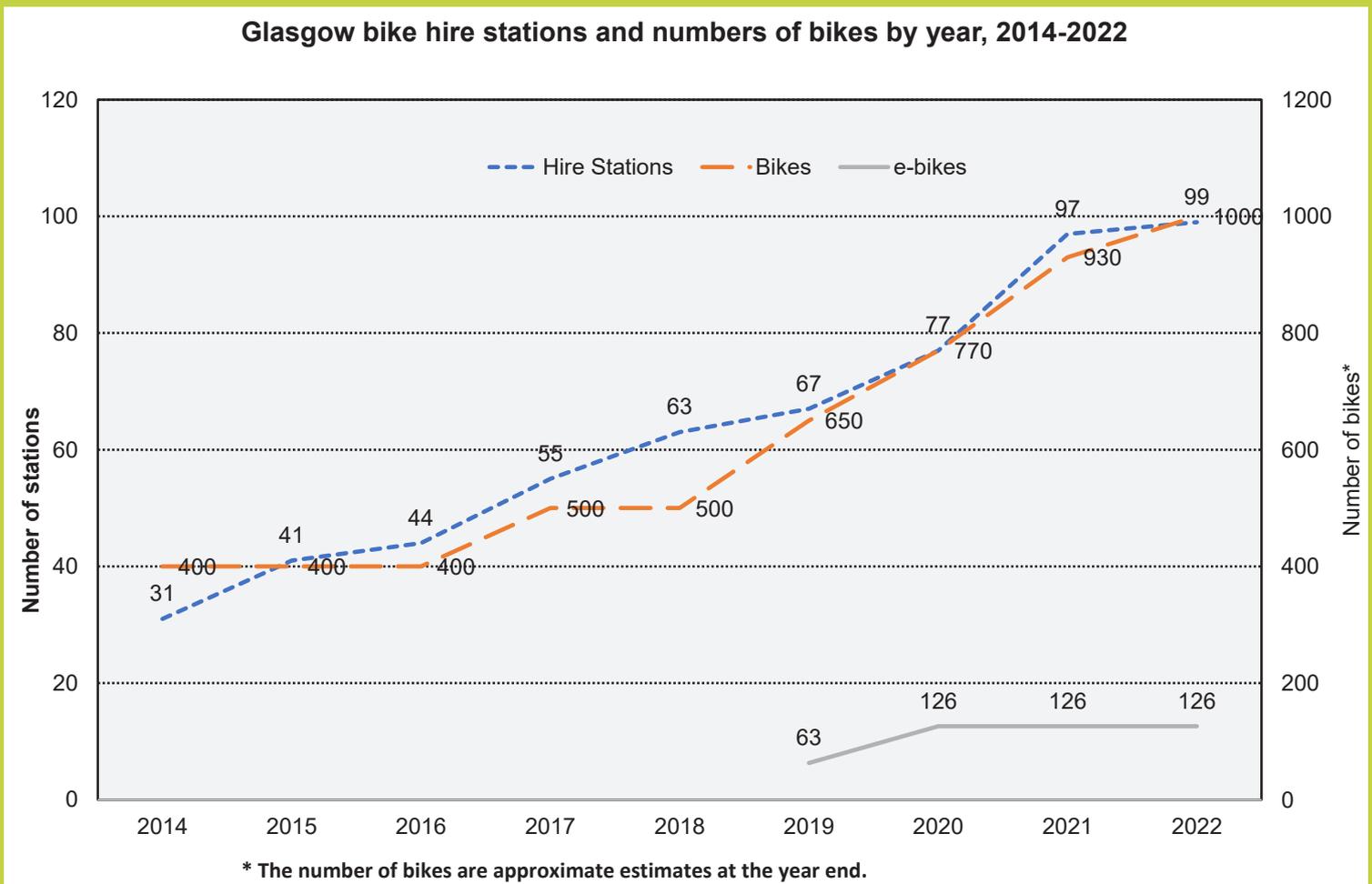
^{vii} Bike for Good refurbish and repair bikes and teach communities how to cycle and repair bicycles.

September 2017, Smartbike 1.0 bikes (seven-speed bikes) replaced the existing fleet. Electric Smartbike 2.0 (three speed) were introduced in October 2019. In 2021, Smartbike 2.0 bikes were added to the fleet. nextbike by TIER have a contractual agreement to add six cycle hire locations per year (up to 2024) and where possible GCC look to expand on this if external funding can be secured.

The Glasgow scheme involves initial registration and the payment of £5 deposit. Bikes can then be hired on a 'pay-as-you-ride' basis (£1 for first 20 minutes; £1 for additional 20 minutes). Monthly (£12) or annual (£78) membership can be

purchased, which includes free hire for the first 30 minutes and 50p for each additional 30 minutes. E-bikes are charged at higher rates – £2 for 20 minutes – and are not currently included in any memberships^{viii}. There is also corporate membership, where certain institutions (such as universities) pay for full or partial annual membership^{ix}. nextbike by TIER reported that at the end of 2022 there were 94,467 active customers in the Glasgow scheme – those who have hired a bike in the last 120 days. Corporate memberships began in 2018 and 21 corporate partnerships have existed during the contract. There are 5,928 customers subscribed via corporate memberships, 2,061 of whom had rented a bike within the last two months²³.

Figure 2: Growth in bike hire stations and bikes, 2014-2022

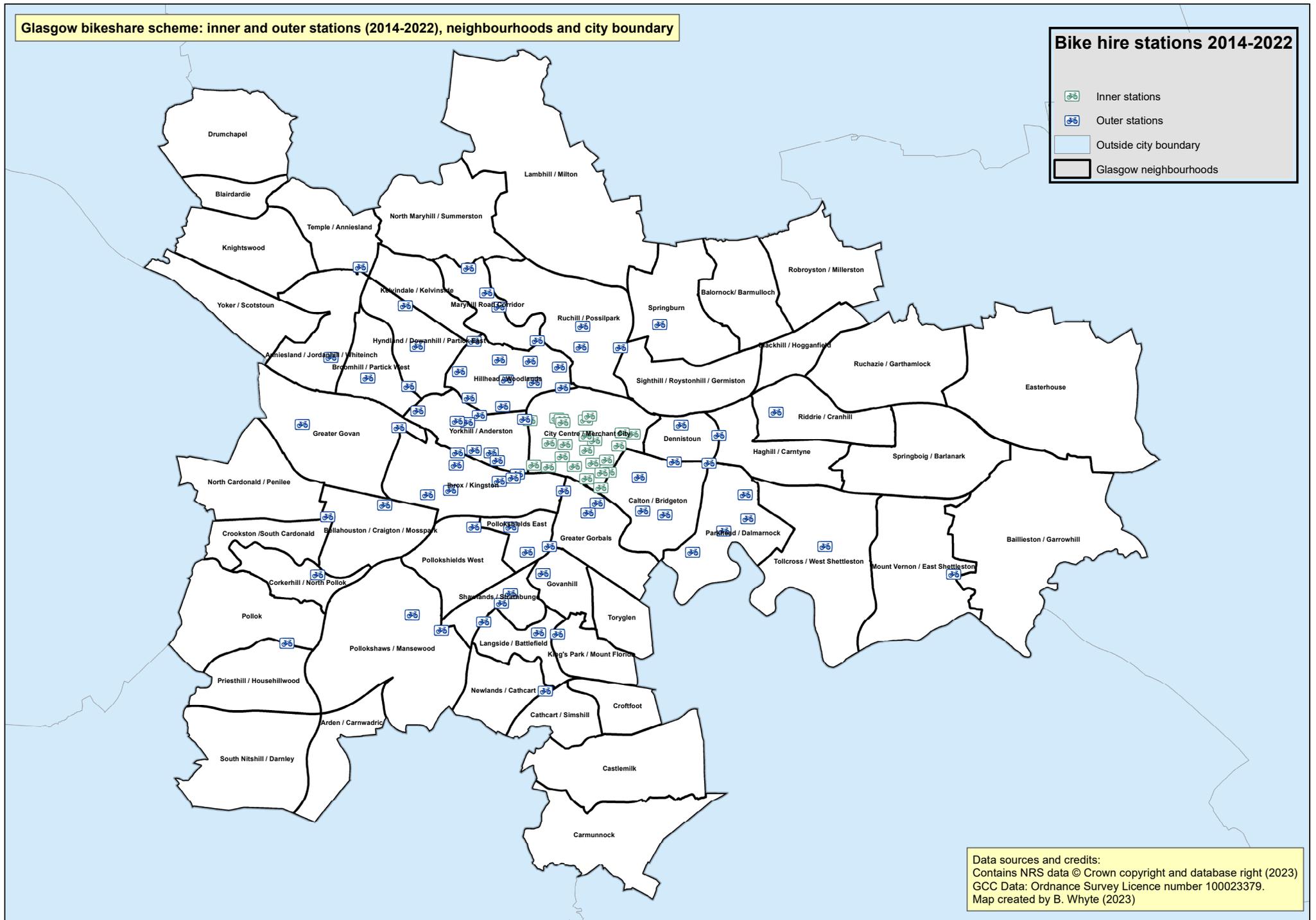


^{viii} Up-to-date information on the Glasgow bikeshare scheme and prices can be accessed [here](#).

^{ix} The University of Glasgow and the University of Strathclyde fund full membership, providing the first 60 minutes of all hires free for all staff and students.



Map 1: Glasgow bikeshare scheme: inner and outer stations



Bikeshare schemes are used for both commuting and leisure and have the potential to provide multiple health and environmental benefits. A recent survey of bikeshare users in the UK²⁴ found that:

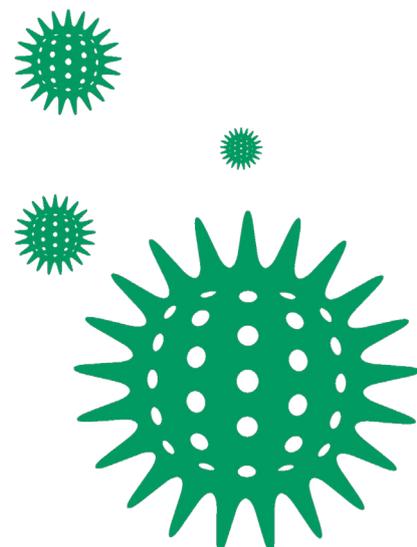
- ▶ Over half of bikeshare users said that bikeshare was the catalyst to start cycling again.
- ▶ 20% of respondents said that using bikeshare was the only moderate to vigorous physical activity they get on a regular weekly basis.
- ▶ On average there may be a reduction of 3.7 car miles and 1Kg of CO₂ per user every week.
- ▶ 34% of e-bike users said they were replacing car or taxi trips of more than 5 miles per week compared to 24% of non e-bike users.
- ▶ 53% of respondents would have used a car (as a driver or passenger) or taxi for their last trip if bikeshare had not been available.

▶ COVID-19 impact

COVID-19 was first reported at the end of 2019 in Wuhan, China and spread rapidly. On 11th March 2020, the World Health Organization (WHO) announced that the outbreak was a global pandemic. In the UK, restrictions on work and social movement started to be imposed from mid-March 2020 onwards. Shortly afterwards, further restrictions were announced, and people were advised to work from home, to stay at home except for essential trips to shops or for exercise, to keep two metres distant from other people when out of doors, and to self-isolate if they or someone in their household had COVID-19 symptoms. Contact with family and friends was restricted, travel was limited to local areas, public transport services and capacity were reduced, many shops and services closed, and daily exercise outside was limited to walking or cycling locally²⁵.

In the first six months of the pandemic, Transport Scotland reported that car traffic dropped to around 25% of 2019 levels

(before recovering to 91% of 2019 levels by the end of the period), while cycling activity was higher than in 2019 for most of the period. They attributed the latter to several factors, including people having more leisure time, feeling safer due to reduced road traffic, and better weather²⁶. While there were significant restrictions on extra-local travel during lockdown and Phases 1-2, by contrast, cycling for exercise was permitted throughout this period. The combination of these measures is likely to have reduced motorised traffic volumes and boosted cycling levels.



Evidence from England suggests that cycling for leisure and sport increased between mid-March and mid-May 2020, while cycling for travel reduced markedly²⁷. Cycling Scotland reported that there were 43% more cycling journeys between March and August 2020 compared to the same period in 2019²⁸. Analysis of a similar but broader range of cycle counters in Scotland showed that there was a large increase in cycling in the initial lockdown phase, particularly on leisure routes. Better weather and COVID-related restrictions were independently associated with increases in cycling²⁹.

In this early period of restrictions, measures were brought in to provide people with safe ways of travelling to avoid infection and active travel was prioritised. The Spaces for People programme was set up to fund temporary infrastructure to ensure safe and

socially-distanced active travel³⁰. The scheme funded local 20mph speed restrictions, road closures (to motorised vehicles), and the building of temporary segregated cycle and walking paths on roadways. In Glasgow, in order to encourage use of the bikeshare scheme during the pandemic, the first 30 minutes of a standard bike hire was provided at no cost to the hirer from 29th June 2020 until 28th March 2021³¹.

Worldwide, the COVID-19 pandemic led to reductions in hires in some places (e.g., London)³² and many schemes closing as commuting habits changed and revenues decreased²⁰. However, the opposite has been the case in Glasgow, where the scheme has been expanded significantly since the pandemic began; 350 ordinary bikes and 63 electric bikes have been added to the scheme since April 2020.



Aims and research questions

There are questions about both the long-term impact of Glasgow's bikeshare scheme on transport and travel choices in the city, and how the scheme contributes to the city's goals of creating an active and sustainable transport system, to reducing emissions and to improving population health. Our study set out to help answer these questions. To do so, we collected and analysed data from the beginning of the

Glasgow bikeshare scheme in July 2014 to July 2022.

The overarching aims of this study are to describe the growth and patterns of use of Glasgow's bikeshare scheme, to assess the scheme's impact on transport inequalities in the city, and to better understand its health and environmental benefits.

The following specific research questions are addressed:

- ▶ RQ1: How has the Glasgow bikeshare scheme expanded over time and what patterns of use have developed?
- ▶ RQ2: How has the COVID-19 pandemic changed patterns of use of the scheme?
- ▶ RQ3: What impacts has the scheme had on transport inequalities in the city?
- ▶ RQ4: How has the scheme impacted on health and environmental outcomes?



Methodology

This is a descriptive analysis of the characteristics of bicycle hires made by users of the Glasgow bikeshare scheme, from the scheme's inception in July 2014 to the end of July 2022 (the last date at which data was available during the final phases of this research). In total, this dataset extended to around 2 million entries spanning an eight-year period.

Data was provided directly by Glasgow City Council and also downloaded from a Glasgow City Council API^x, at three time points: August 2019; December 2021; and August 2022. The data downloaded at each of these three time points included slightly different variables, but the three datasets were harmonised to produce one coherent dataset and analysis.

While the exact variables available have changed over time, in the main they extended to:

- ▶ hire station
- ▶ hire date and time
- ▶ return station
- ▶ return date and time
- ▶ hire duration (in seconds/minutes)
- ▶ e-bike/standard bike (only since 2020)^{xi}

From these variables, we then determined or calculated:

- ▶ weekday of the hire
- ▶ hire and return easting and northing
- ▶ hire distance (straight-line and road network^{xii})
- ▶ whether the hire was roundtrip or one-way
- ▶ whether the hire was made during peak-time or off-peak travel hours

Data cleaning

The dataset was cleaned by removing:

- ▶ hires where the hire start date or time were invalid
- ▶ hires where either the start or return station were missing or invalid
- ▶ roundtrip hires which lasted under 5 minutes
- ▶ one-way hires which lasted under 1 minute

^x Initial downloads were provided as .CSV files by nextbike by TIER, whereas latterly the data was extracted from GCC's API.

^{xi} E-bike data was not consistent or complete and so we did not undertake any analysis of e-bikes trips. Some information on e-bikes use was provided by nextbike by TIER in their annual report and is referred to in the discussion.

^{xii} 30% was added to the straight-line distance between two bike hire stations to estimate the 'real' or road network distance, based on comparing the straight-line distance for a sample of hire journeys with Google map calculations of these journeys on the road network. This is analogous to the methodology used by Transport Scotland to calculate road network distances: <https://www.transport.gov.scot/publication/statistical-bulletin-transport-series-trn-2014-3-transport-and-travel-in-scotland-2013/j333840-72/>

A total of 13% of all data entries in the raw dataset were removed during data cleaning. Around 7% of entries had an invalid hire and/or return station location, including where the location was outside of Glasgow, a workshop, a transporter, or indicated the bike had gone missing.

Around a further 7% of entries in the dataset showed a bike being hired and then returned to the same station within 5 minutes. We excluded these hires on the basis that no meaningful journey could be made in this time frame and that these were almost certainly accidental hires. A very small number of hires had an invalid hire start date or time or were one-way and lasted under 1 minute; these were also excluded.

There are notable peaks in invalid data in summer 2014, when the scheme was first introduced, and in spring 2016, autumn 2017 and summer 2018 and throughout the first half 2021 when new bikes and stations were introduced. It is therefore likely that new bikes and new stations have a bedding-in period during which invalid data entries temporarily increases.

The number of invalid data entries also exhibits seasonality and broadly increases over time, as do the number of valid data entries, suggesting there is also a background level of invalid data in play. Overall, popular stations and relatively new stations are therefore more likely to contribute to invalid data than others.

Time period categorisation

Once cleaned, the data was split into pandemic-related time periods for analysis. These periods were determined by searching through historical changes in pandemic-related restriction policies for the Glasgow city area from March 2020 to July 2021.

We categorised the severity of restrictions in four areas we deemed to be most likely to influence bike hire use, which were: travel, hospitality and leisure, non-essential retail, and working from home.

Looking across these themes, we determined an overall level of the severity of restrictions acting upon the population of Glasgow, for each month between March 2020 and July 2021.

Severity of restrictions between March 2020 and July 2021

- Light: March 2020
- Severe: April-June 2020
- Moderate: July-August 2020
- Light: September 2020
- Moderate: October-December 2020
- Severe: January-March 2021
- Moderate: April 2021
- Light: May-July 2021

Following this categorisation, the overall pattern of bike hire use was mapped across these periods. We found that the most severe periods of restrictions, which were the two lockdown periods, showed quite different patterns of bike hires from the other periods. However, there was very little difference in patterns of scheme use between periods of Light and Moderate restrictions, although they were distinct from both the 'Lockdown', 'Pre-pandemic' and



‘Post-pandemic’ phases^{xiii}. The Light and Moderate restrictions categories were therefore collapsed into ‘Lockdown lead-in’, ‘Between lockdowns’ and ‘Lockdown lead-out’ phases, to create the following scheme:

Table 1: Pre-, during, and post-pandemic periods

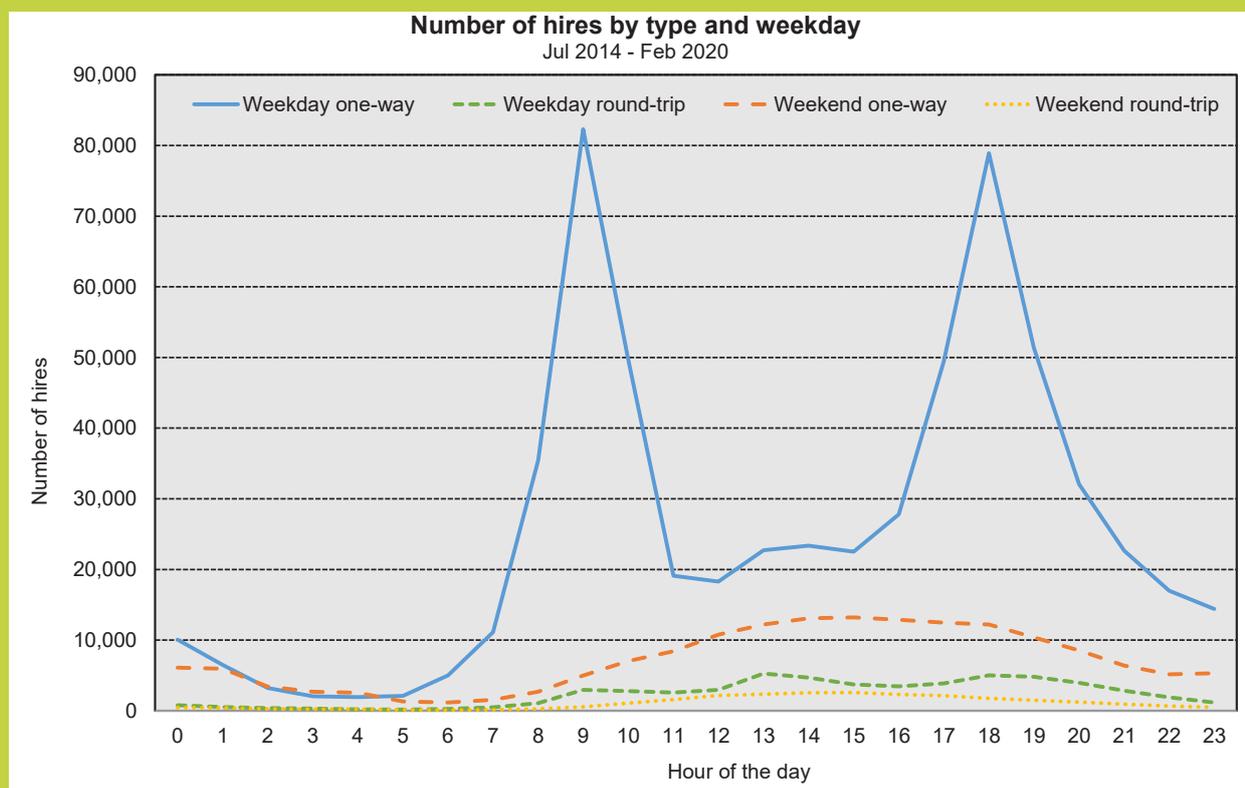
Pre-pandemic	Lockdown 1 lead-in	Lockdown 1	Between lockdowns	Lockdown 2	Lockdown 2 lead-out	Post-pandemic
Jul 2014 – Feb 2020	Mar 2020	Apr 2020 – Jun 2020	Jul 2020 – Dec 2020	Jan 2021 – Mar 2021	May 2021 – Jul 2021	Aug 2021 – Jul 2022

Hire type categorisation

There was a clear pattern of hires across the day and the working week prior to pandemic-related restrictions, for both one-way and roundtrip hires (Figure 3). Roundtrip hires are those where the bike was hired from and returned to the same station and one-way hires are those where the bike was returned to a different station from which it was hired.

On weekdays, roundtrip hires were spread fairly evenly across the daylight hours, while one-way hires showed marked rush-hour peaks at 9am and 6pm. This was in contrast to weekend hires, which showed a completely different daily pattern of a long slow early afternoon peak and a much slower late evening/early morning drop off in hire volumes for both roundtrip and one-way hires.

Figure 3: Hires by type and weekday/weekend



^{xiii} We use this term to denote the period in our study when the majority of COVID-19 related work and travel restrictions had been lifted.

While it was not possible to determine the reason for a hire from this dataset, the time of day, day of the week and type of journey (whether one-way or roundtrip) provided some clues as to the likely function of any given hire.

These daily and weekly patterns pointed to three broad categories of hires, or journey types, as outlined below, which have been used to shape the analysis presented in this report.

- ▶ **Roundtrip leisure cycles**, which begin and end at the same location and occur on weekdays or weekends.
- ▶ **One-way peak-time cycles**, which take place during 8:30am-10:30am and 5pm-8pm on weekdays and which are assumed to be predominantly being made by people commuting to and from a place of work or study.
- ▶ **One-way off-peak cycles**, which are undertaken in order to get from A to B outside of peak times – these are likely to include some who travel to and from work/study outside of the scheme’s peak hours but will also include a substantial number of other functional cycle journeys (e.g., to a retail outlet, social call, place of leisure, etc.).

The caveat to this categorisation is that some roundtrip hires will, of course, be made to get from one place to another and then back again, although the pricing system of the hire scheme does discourage this. A proportion of roundtrip hires may also be as a result of hirers undocking a bike, discovering an issue with the bike and then re-docking it. We excluded all roundtrip hires of less than 5 minutes from this analysis to deal with the bulk of these failed/abandoned hires. However, bikes that do not re-dock correctly will persist in this analysis as longer-duration roundtrip hires and it is not possible to isolate and remove these hires from genuine hires or journeys. It should therefore be noted that 13% of roundtrips in 2019 (the last full year pre-pandemic) lasted more than 10 hours. This suggests a minority of roundtrips may be being made to travel to a destination and then back again, perhaps even overnight, or consist of bikes failing to re-dock correctly after an abandoned hire.

In defining peak-time and off-peak one-way cycle hires, we looked at the daily, weekday peak in hires over a three-year period before the onset of the pandemic and related restrictions. Across this period, the weekday peak in hires consistently fell between 8:30am-10:30am and 5pm-8pm, using a range of methods to identify ‘peak’ volumes.

We assume that these peak-time hires are predominantly made by people travelling to or from a place of work or study, particularly as there is a trend for these hires to flow into the city centre in the morning and out during the afternoon.

While we recognise that commuting journeys by no means account for all peak-time hires, it is clear that hires in these periods of weekdays were, on the whole, different from those undertaken at other times of the day and week. We have therefore used this broad definition to structure our analysis,



particularly in demonstrating the changes to hire patterns that took place during the pandemic and beyond.

This report looks at weekly/daily pattern of use for these three separate types of hire: roundtrip; one-way peak-time; and one-way off-peak. We look at the typical pattern of use across the day and week before pandemic-related restrictions came into

place for each of these three types of hires, before going on to explore changes in those patterns during and after the pandemic, from March 2020, until July 2022.

Finally, we provide a descriptive analysis of the geographic distribution of bikeshare stations across Glasgow and of the distribution of stations with respect to deprivation as the scheme has expanded.



Findings

This section outlines the number and pattern of hires from Glasgow's bikeshare scheme from its inception in July 2014 until July 2022, as well as estimating the impact of these hires on carbon emissions and levels of physical activity in the city.

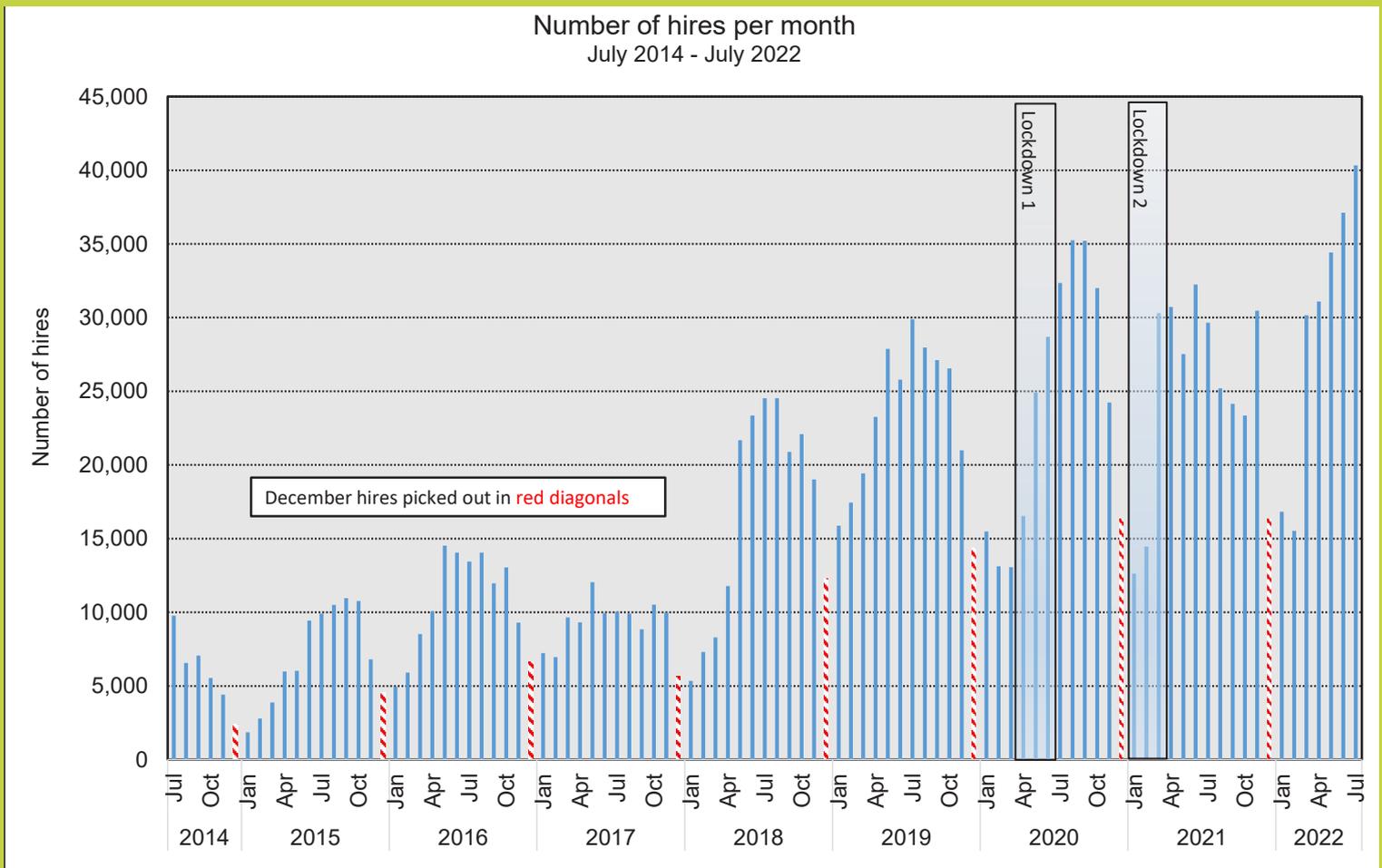
Overview of hires between 2014 and 2022

Since the beginning of the scheme in July 2014, there have been over 1.6 million bike hires. The number of hires has increased year on year, to reach just under 325,000 hires in the 12 months between August 2021 and July 2022. This is an almost five-fold increase, compared to the equivalent period in the first year of the scheme

(August 2014-July 2015), when there were just under 66,000 hires.

The number of hires per bike also increased over this period. In July 2022, there were an average of 1.3 hires per bike per day, compared with 0.8 hires per bike per day in July 2014.

Figure 4: Hires per month, July 2014 to July 2022



As can be seen in Figure 4 above, there is a marked seasonality in scheme use. The volume of hires peaks in the summer months (June-August) and decreases over winter (December-February), so that winter hire volumes were just under half of those across the summer months prior to the impacts of the pandemic on travel and leisure activity. The number of daylight hours and the frequency of wet, windy and icy weather are all likely to play a role in shaping this seasonality from year to year.

Overall, hire volumes during the first pandemic lockdown (April-June 2020) were similar to those during the same period in the previous year. However, hire volumes then rose substantially from July to October

2020 and then again over the latter half of the second lockdown, from mid-February to mid-April 2021.

Following the second lockdown, total hire volumes fell back to levels comparable with those pre-pandemic (in 2019). However, they began to rise again during Spring 2022, following a further expansion of the scheme in February that year.

It should also be noted that, between July 2020 and March 2021, the first 30 minutes of the bike hire was temporarily free, although it is difficult to disentangle the impacts of this incentive from those of the pandemic lockdowns, scheme expansion and seasonality in cycle hires.

Journey types

We have categorised hire journeys into three types as part of this analysis: roundtrip; one-way peak-time; and one-way off-peak. Looking across the past eight years of the scheme, the frequency and characteristics of each of these three types of hire has developed and changed, as summarised in the table below, which outlines their characteristics pre- and post-pandemic. These differences are explored in more detail in later sections of this report.

Table 2: Comparison of the characteristics of three types of bike hire journey (roundtrip, one-way peak-time and one-way off-peak) in the pre-pandemic (July 14-February 20) and post-pandemic (August 21-July 22) periods.

Type of hire	Proportion of all hires		Time of day/week		Duration		Distance ^{xiv}	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Roundtrip	10%	10%	68% occur on weekdays	66% occur on weekdays	48% over 1 hour	33% over 1 hour	-	
One-way peak-time morning	17%	7%	Defined as weekday mornings 8:30am-10:30am		80% under 20 mins	81% under 20 mins	2.7km	2.8km
One-way peak-time afternoon	25%	16%	Defined as weekday afternoons 5pm-8pm		69% under 20mins	70% under 20 mins		
One-way off-peak	48%	68%	63% occur on weekdays	66% occur on weekdays	66% under 20 mins	69% under 20 mins	2.6km	2.9km

^{xiv} Estimated road network distances.

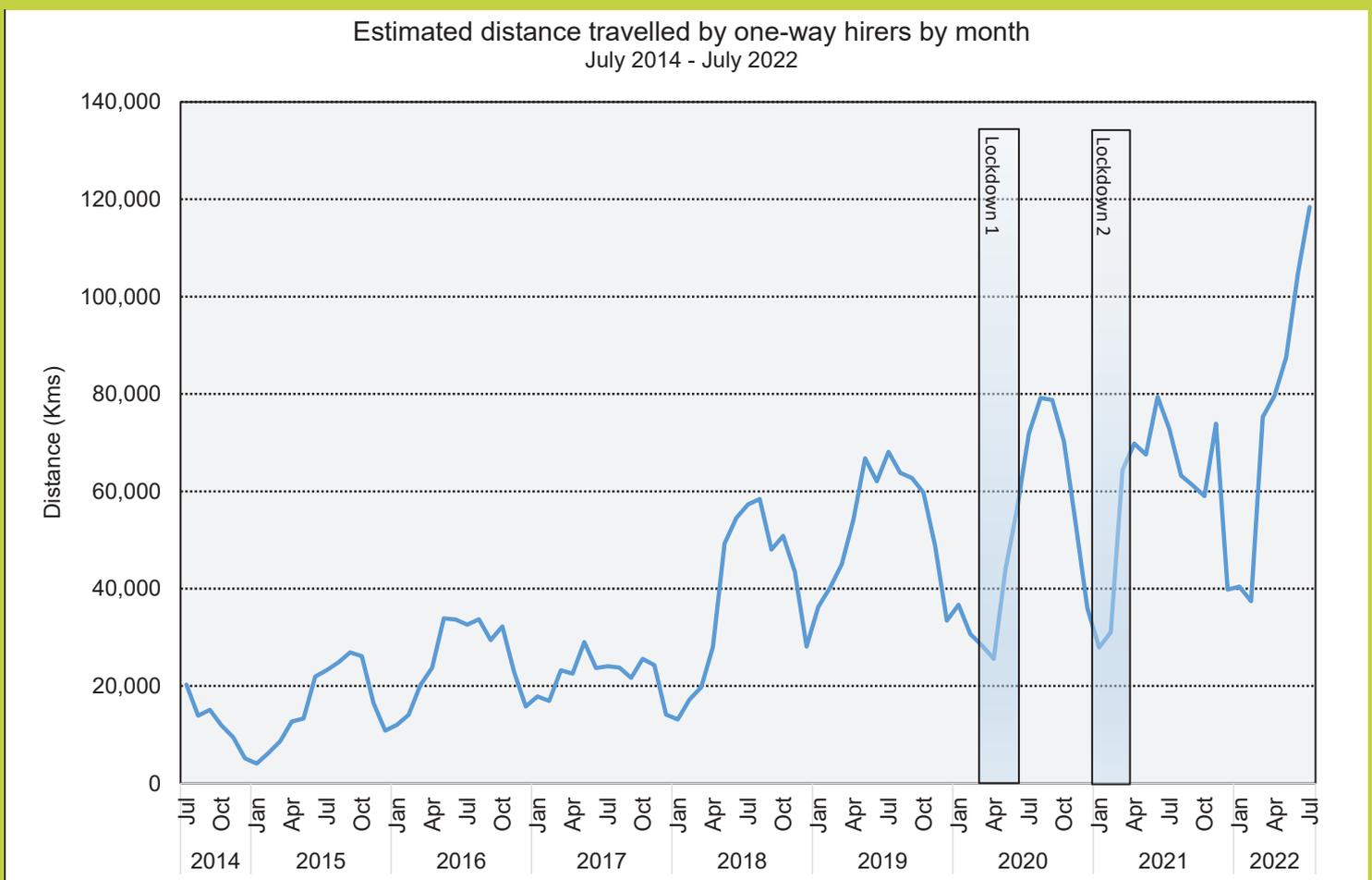
Overall, this table shows that peak-time morning hires have remained the same in duration but have become significantly less popular since the pandemic, while, conversely, off-peak hires have become slightly shorter in duration and significantly more popular. The proportion of roundtrip hires has remained remarkably constant through this shift, although they do appear to have become shorter, on the whole. All one-way hires have lengthened in the distance they cover.

Some of this will be due to changes in the ways in which people travel within and across Glasgow following the pandemic, related restrictions and new ways of working. Similarly, some will be due to changes in people’s reasons for using bike hire, including those that might have been triggered by travel experiences during the pandemic. Finally, some will be due to the significant expansion of the bike hire scheme during this period, both in terms of its popularity or reach within the population, as well as the number of bikes available and its geographical spread.

Contribution of the scheme to reducing carbon emissions

The total distance travelled by users of the scheme, from its inception in July 2014 to the end of July 2022, was just over 3.8 million kilometres (3,815,548 km). Figure 5 shows how the total real-world distance travelled by scheme users has increased over time.

Figure 5: Distances travelled per month by one-way hirers



If these journeys had been made by car, instead of by hire cycle, they would have cumulatively contributed 650 tonnes of CO2e over the eight years of the scheme.

This is the equivalent of 4,648 passenger flights from Glasgow to Paris^{xv}.

These figures only include one-way journeys because it is not possible to calculate the distance travelled by roundtrip hires, which made up around 12% of all hires. It also assumes that hirers cycled directly from their hire station to their return station without making any detours. We have also made an adjustment to reflect the real-world distance travelled rather than the straight-line distance between the hire and return station.

■ Contribution of the scheme to physical activity levels in Glasgow

We can use the estimated real-world distances travelled by one-way hirers to estimate the amount of time spent engaging in physical activity through the bikeshare scheme. Assuming that cyclists travelled at an average of 14km/h^{33, xvi}, bikeshare users have spent 272,539 hours being active since the start of the scheme.

This is the equivalent of 11,356 continuous days spent doing exercise, or 31 continuous years.

If we consider that the daily physical activity (PA) guideline for adults is 30 minutes of moderate exercise per day^{34, xvii}, this is broadly the equivalent of one 7km cycle, or a 3.5km return cycle per day. Since the beginning of Glasgow's bikeshare scheme, there have been 332,408 one-way journeys of 3.5km or more and 12,335 one-way



journeys of 7km or more (using estimated road network distances).

To illustrate the contribution this has made to the daily PA guidelines for people in Glasgow, if each 3.5km hire was one half of a return journey, then just over 161,000 people could have met the PA guideline through bike hire trips during this period. Added to the 12,335 hires that were of 7km (thus achieving the 30 min PA guideline), this equates to the scheme having potentially supported just under 180,000 people to reach their daily physical activity guidelines over the past seven years.

^{xv} For both of these calculations, we used the *Greenhouse gas reporting: conversion factors 2020* provided by the UK Government, available here: <https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2020>

^{xvi} This is the speed WHO have used in their HEAT tool. We did not use duration of hire for this calculation because that takes in docking time, while distance tells us something much more direct about exercise.

^{xvii} This is a daily approximation of one part of the actual guideline which recommends that, as a minimum, adults should accumulate at least 150 minutes (2 1/2 hours) of moderate intensity activity (such as brisk walking or cycling) per week.

Roundtrip hires: in-depth analysis

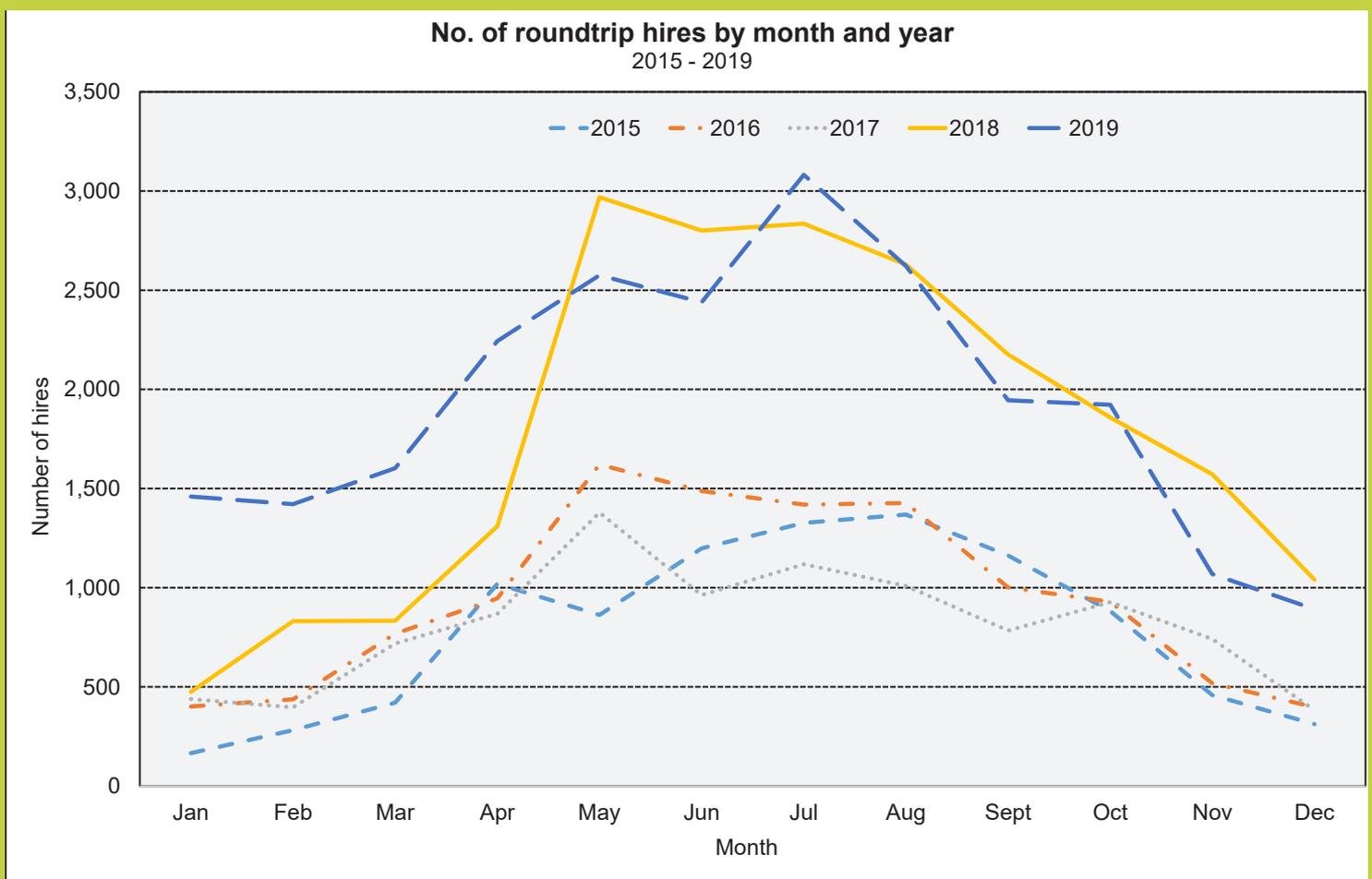
Almost 12% of all hires were roundtrips, from the inception of the scheme in July 2014 to the end of July 2022. The proportion of hires that were roundtrips was consistently around 10% between 2015 and 2019, but jumped to 18% in 2020 (which was the year that saw the most severe pandemic-related restrictions for the longest period of time), before trending back downwards again to 13% in 2021 and 10% in 2022. In years where there were no pandemic-related restrictions, roundtrip hires therefore made up one-in-ten of all hires in the scheme.

Pre-pandemic patterns

Roundtrip hires had a distinct seasonality (Figure 6), in that 37% of all roundtrips between 2015 and 2019 were made during the summer months (June-August), while only 12% were made during the winter months (December-February). Although

these seasonal patterns varied slightly from year to year, they were broadly consistent over time, as well as across weekdays and weekends. The seasonality in roundtrip hires was stronger than for both peak-time and off-peak one-way journeys.

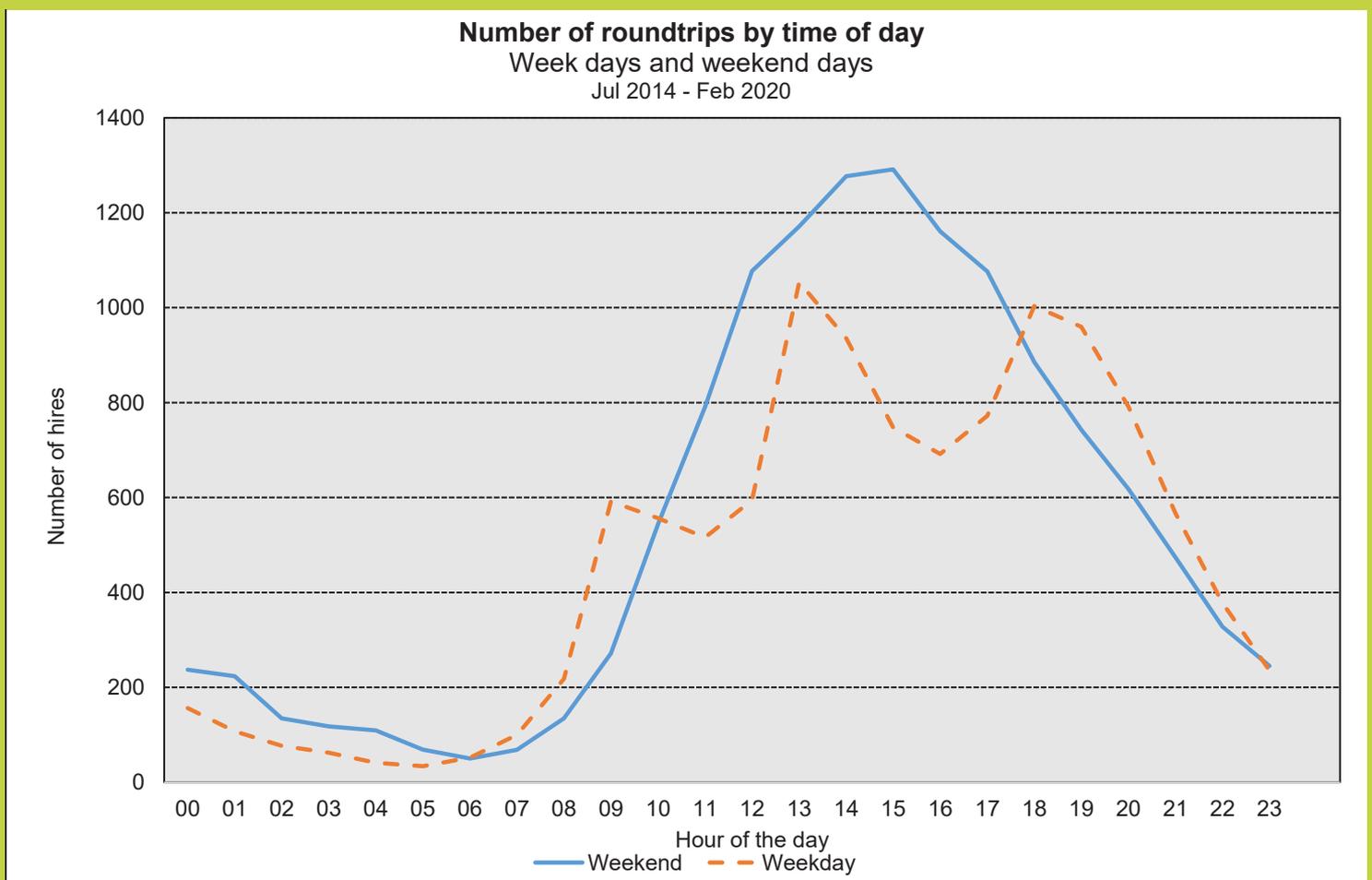
Figure 6: Roundtrip hires by month and year, 2015-2019



Around half of roundtrip hires (47% on weekdays and 52% on weekends) lasted between 30 minutes and 3 hours. Roundtrip hires were slightly more likely to last under 30 minutes on weekdays and over 1 hour on weekends, but the differences in hire duration were very slight. What is striking, however, is the difference in the time of day at which roundtrip hires were made when comparing weekdays with weekends (see Figure 7).

On weekends, there was a slow, gradual rise in the number of hires across the course of the day, which peaked at around 2-3pm. On weekdays, however, there were three distinct peaks in the number of hires across the course of the day, with a lesser peak at 9am, and two larger, equal peaks around 1pm and 6-7pm. Roundtrips in the weekday morning peak were much more likely to be of shorter duration (under 20 minutes), while those later on in the day were more likely to be longer.

Figure 7: Roundtrips by time of day, weekday vs weekend day



Some stations were two to three times more likely to be used to hire a bike for a roundtrip journey on a weekday, when compared with a weekend. Those more likely to be used on weekdays were all located within Glasgow city centre, with the exception of the Queen Elizabeth

University Hospital station in Govan and one of the University of Glasgow hire stations. Those more likely to be used for roundtrips at the weekend were all in peripheral locations, comprising a mixture of stations adjacent to parks and those adjacent to peripheral transport hubs.

Change in patterns during and between the two lockdowns

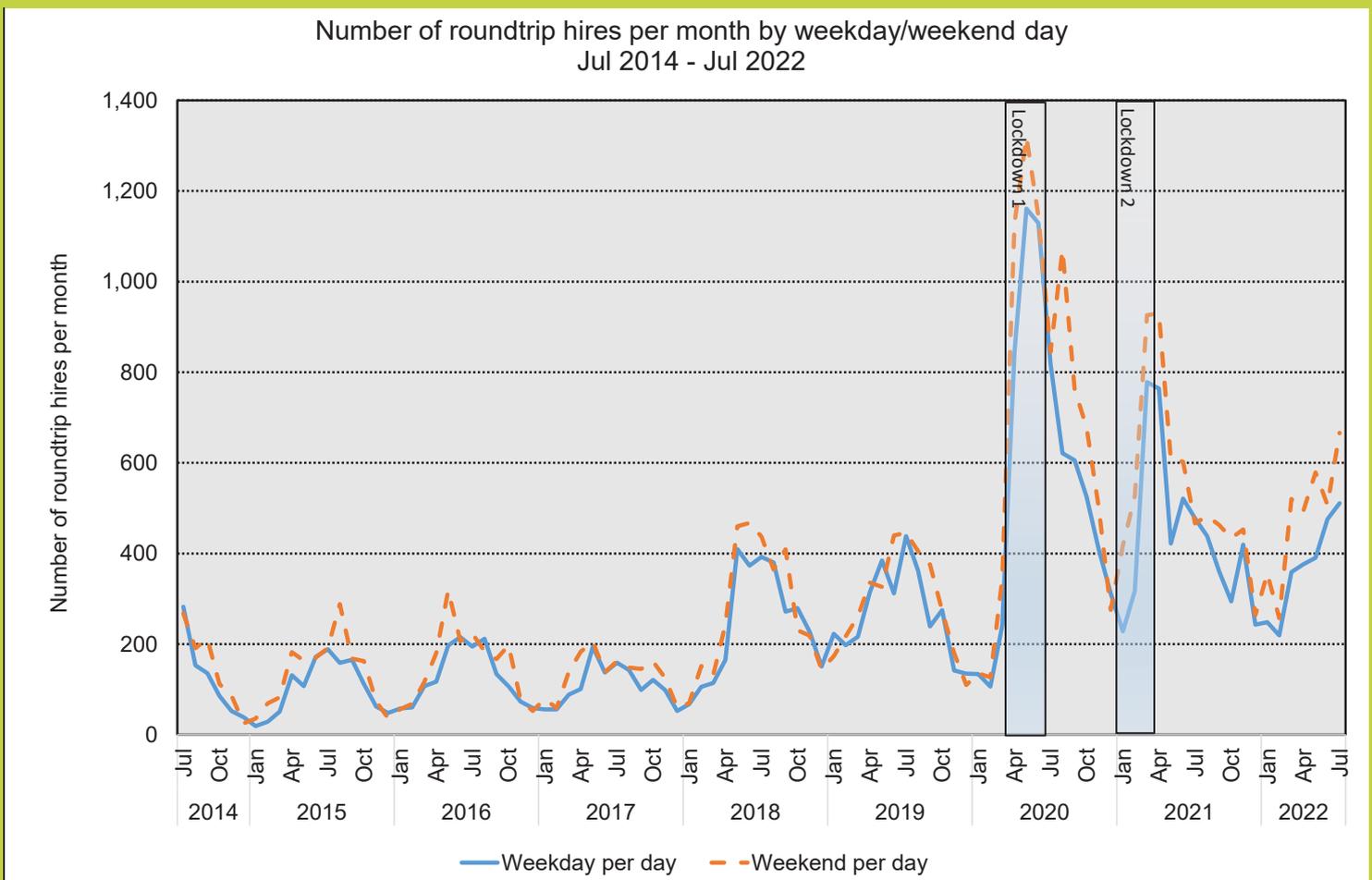
Roundtrip journeys became significantly more frequent from the start of the pandemic restrictions at the end of March 2020. There were 22,860 roundtrip hires during the first pandemic lockdown (April-June 2020), compared with just 7,260 for the same period in 2019, which constitutes a greater than three-fold increase (Figure 8).

The largest relative increase was in hires of 1-3 and 3-6 hours long, of which there were four to five times more during the first lockdown than in April-June 2019. The second lockdown showed a similar pattern, with roundtrip hire rates in January-March 2021 almost three times the volume in January-March 2020.

In between these two lockdowns, monthly roundtrip hire volumes remained high, not falling below twice the 2019 rate, and only beginning to approach 2019 levels from May 2021.

As might be expected, some hire locations experienced a much greater uplift in roundtrip hire rates than others during the two lockdowns. Some stations, such as Mount Florida, Shawlands and Emirates Arena demonstrated increases of eight to nine times their 2019 hire rates in the first lockdown, while others, such as Waterloo Street in the city centre and the University of Glasgow saw roundtrip hire rates slashed to one-quarter to one-third of their 2019 rates.

Figure 8: Roundtrip hires, 2014-2022



The pattern of roundtrip hires across the day during weekends did not change during the pandemic: throughout this period, and when looking specifically at the lockdown periods, the number of weekend roundtrips continued to demonstrate a slow, gradual rise to an early afternoon peak. The only notable difference is that, during the lockdown

periods, hires during the late evening and early hours of the morning were significantly less likely, reflecting the closure of late-night social venues and curfews on those that were open. Conversely, the daily pattern of roundtrip hires on weekdays shifted to look much more similar to that on weekends during both the first and second lockdowns.

Post-pandemic patterns

By late summer 2021 the volume of roundtrip hires had returned to levels similar to those seen in 2019, before the pandemic. However, the number of roundtrip hires over winter 2021/22 was significantly higher than that over 2019/20 and hires rose steeply through spring 2022, following an expansion of the scheme in February that year.

Weekday roundtrip hire volumes in the first half of 2022 were 25% higher than those in the first half of 2019, while weekend roundtrip hire volumes were almost 60% higher than those in 2019. This suggests that leisure use of hire cycles became more popular during pandemic lockdowns, presumably driven by a lack of alternative leisure activities, but that this popularity has endured well beyond the necessity of those restrictive periods.

The daily pattern of hires across weekdays had returned to the pre-pandemic pattern by May 2021, with a slow, steady rise to a 6pm evening peak, with two smaller peaks around lunchtime and early morning. However, the number of roundtrip hires lasting under 30 minutes had increased substantially compared with those before the pandemic began, while those lasting over 3 hours had decreased.



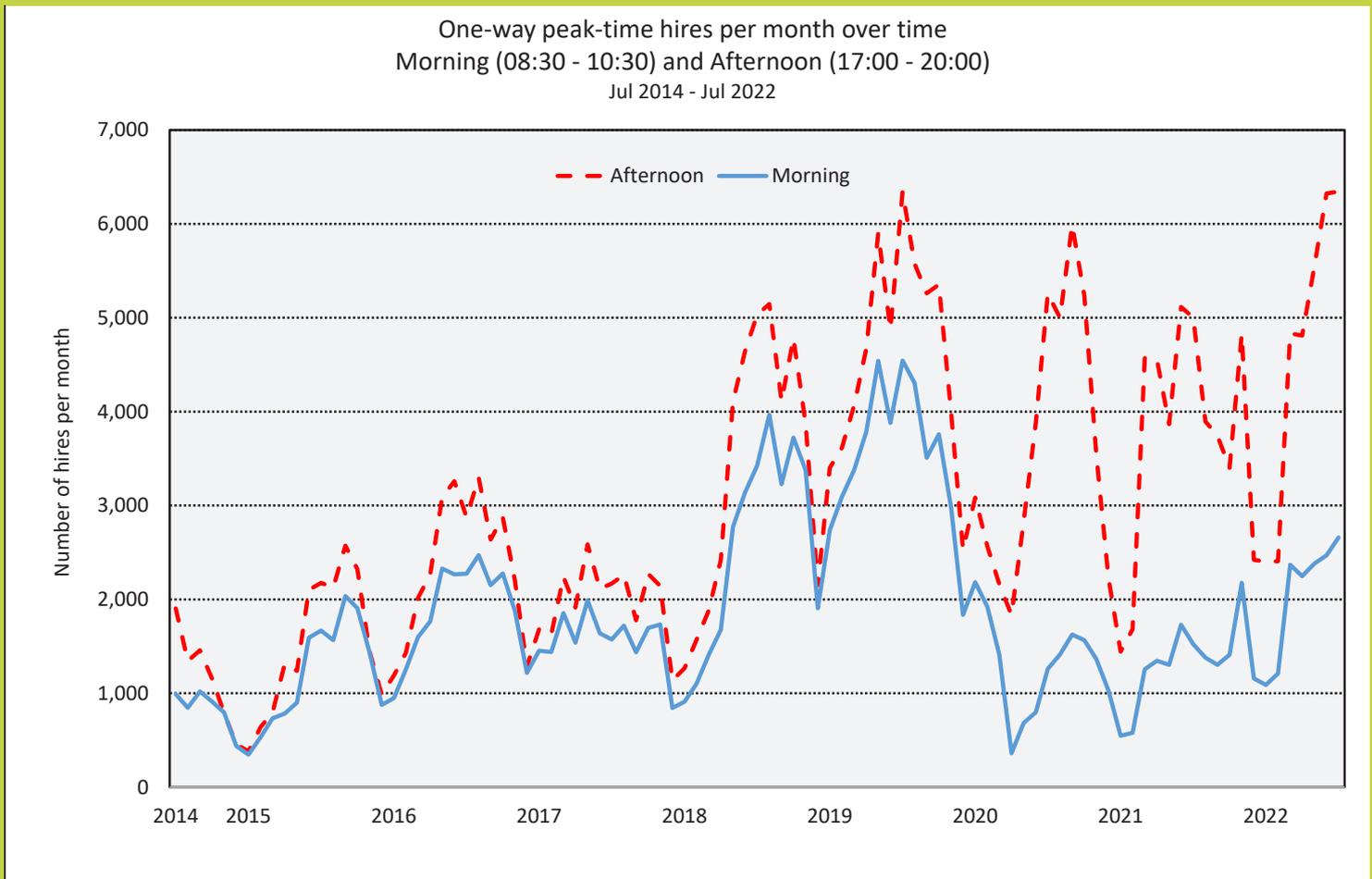
Some 44% of all roundtrips lasted under 30 minutes between August 2021 and July 2022, compared with 29% prior to the pandemic.



One-way, peak-time hires: in-depth analysis

These are one-way hires that began during the weekday peak hours of 8:30-10:30am and 5-8pm, and are assumed to be predominantly undertaken by people commuting to or from a place of work or study. Figure 9 shows how the volume of these hires changed over time between July 2014 to July 2022.

Figure 9: One-way peak-time hires, 2014-2022



Pre-pandemic patterns

There were a total of 317,520 one-way peak-time hires undertaken between July 2014 and February 2020, and Figure 9 above shows how their volume increased significantly between 2014 and 2019. There was a 38% increase in the number of weekday peak-time hires between 2018 (71,600) and 2019 (97,940) alone.

Across the pre-pandemic period, three quarters of peak-time hires lasted under 20 minutes and only 10% lasted longer than half an hour – and half of those lasted under 1 hour. On average, hirers cycled 2.6km.

Peak-time hires show a distinct seasonality, although to a lesser extent than roundtrip hires. The volume of peak-time hires across the winter months (December-February) in 2015-2019 was around half the volume in the summer months (June-August). This compares with winter roundtrip hires being around one third of the level of summer roundtrip hires and suggests that commuting hirers are less influenced by seasonality than leisure cyclists.



Shorter hires (under 20 minutes) made up a slightly greater proportion of all peak-time hires in the winter months than in the summer months, suggesting that those travelling longer distances are less likely to cycle than use another mode of transport in the winter than in the summer. Scheme users may also undertake a shorter portion of their journey by hire cycle in winter due to poor weather or fewer daylight hours. The average distance of winter peak-time journeys confirms this, being 2.6km compared with 2.7km over the summer months (estimated real-world distances).

In terms of days of the week, there was a slightly greater volume of peak-time hires on Tuesdays, Wednesdays and Thursdays than on Mondays and Fridays, when volumes were around 10% lower than on the middle three days of the week. This was predominantly driven by relatively low numbers of peak-time hires on Monday mornings and Friday afternoons.

There was significant variation in the proportion of hires that began during peak hours by hire location, with peak-time hires making up over half of all hires at some stations and less than a quarter at others. Just under one quarter of all peak-time hires made from centrally located stations began in the morning peak period, while just over three quarters began in the afternoon peak period. For non-centrally located stations, there was a much more even split between morning and afternoon peak hires (56% and 44% respectively). There is therefore a distinct 'flow in' of traffic to central stations during the morning and a 'flow out' during the afternoon, but this was not the case for peripheral stations.

The table and map below (Table 3 and Map 2) show the ten most popular peak-time journeys made between July 2014 and February 2020. As can be seen from the table, four return routes make up eight out of ten of these most popular journeys, and the Broomielaw station features as either an origin or destination in six out of ten of these routes. Eight out of ten routes include at least one station in a city centre location.

Together, hires on these ten journeys accounted for almost 8% of all peak-time journeys in the scheme, which is notable given that there were over 2600 possible journey combinations by the end of 2019.

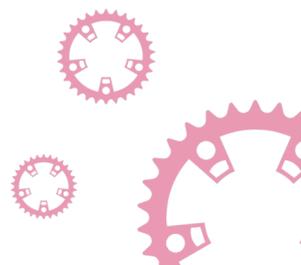
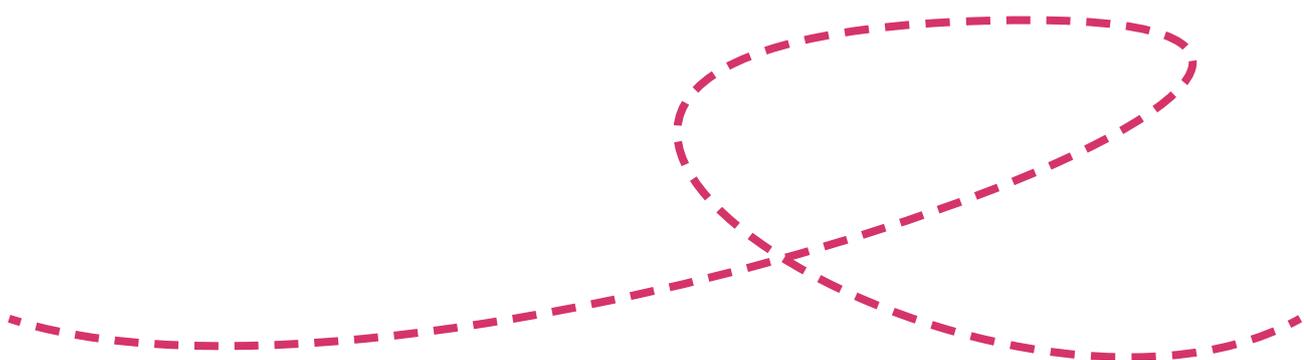


Table 3^{xviii} : Ten most frequent one-way peak-time hire journeys, July 2014-February 2022

Start station	End station	No. of peak-time hires Jul 14 – Feb 20
St Enoch Square	Glasgow Green	3031
Glasgow Green	St Enoch Square	2809
Glasgow Science Centre	Broomielaw	2910
Broomielaw	Glasgow Science Centre	2760
Paisley Road Toll	Broomielaw	2563
Broomielaw	Paisley Road Toll	1920
Partick Interchange	Glasgow Science Centre	2429
Glasgow Science Centre	Partick Interchange	1882
Shields Road	Broomielaw	1987
Glasgow Green	Broomielaw	1848

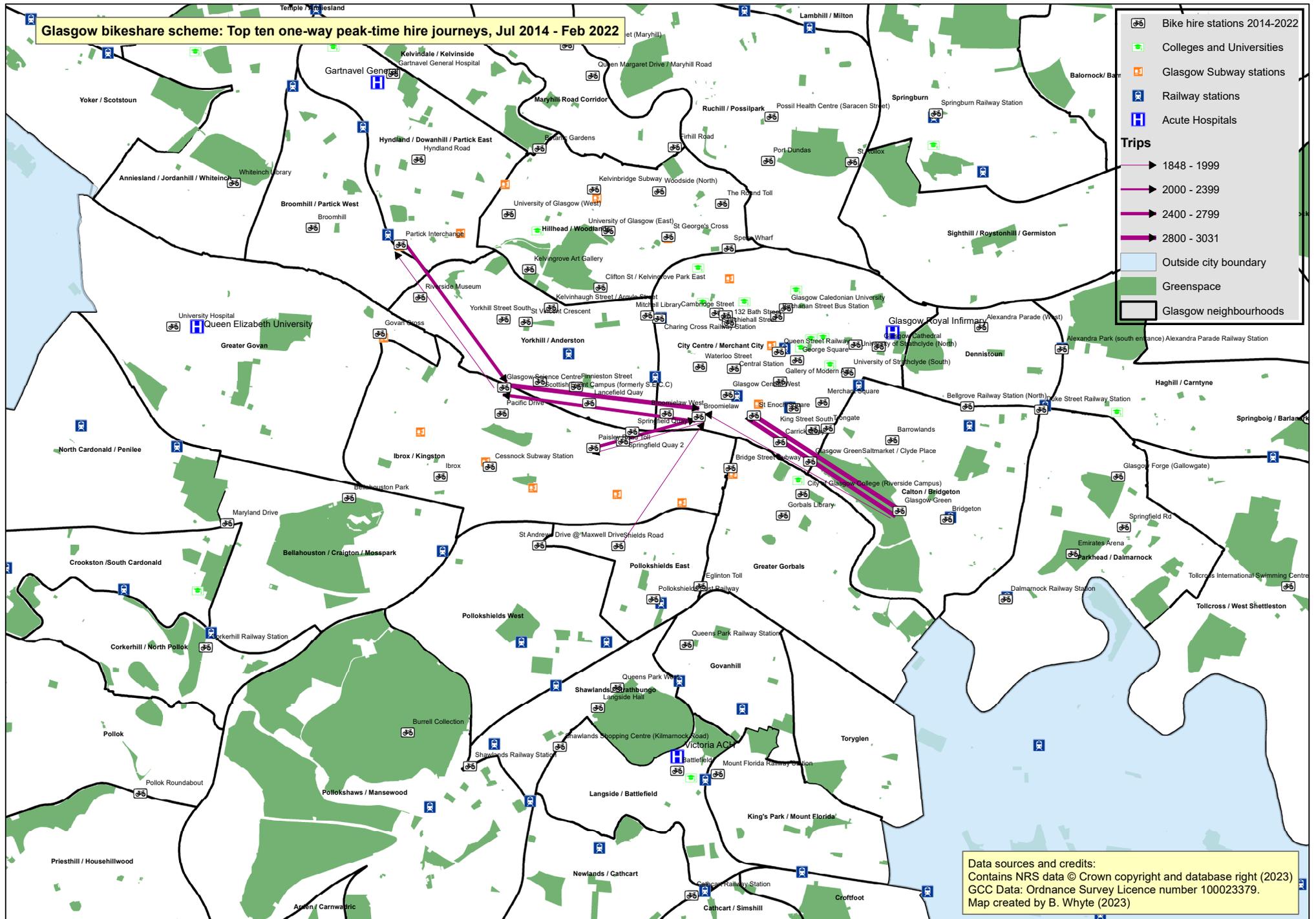
The average estimated real-world distance travelled by peak-time hirers during the pre-pandemic period was 2.7km, which was the same whether the hire began in the morning or afternoon peak. Around one-third of peak-time hires were under 2km long, a further third were between 2 and 3km, and the vast majority of the remaining third were between 3 and 5km long.

These distances assume that the hirer cycled directly from one station to another (by estimating the real-world distance from the straight-line distance between two stations), without making a detour to another location. They therefore underestimate the actual distances travelled. The total estimated distance covered by peak-time hirers during this period was at least 846,340km, or 410km per day.



^{xviii} Hire journeys that are the reverse of each other have been colour coded the same and placed together.

Map 2: Map of ten most frequent one-way peak-time hire journeys, July 2014-February 2022



Change in patterns during and between the two lockdowns

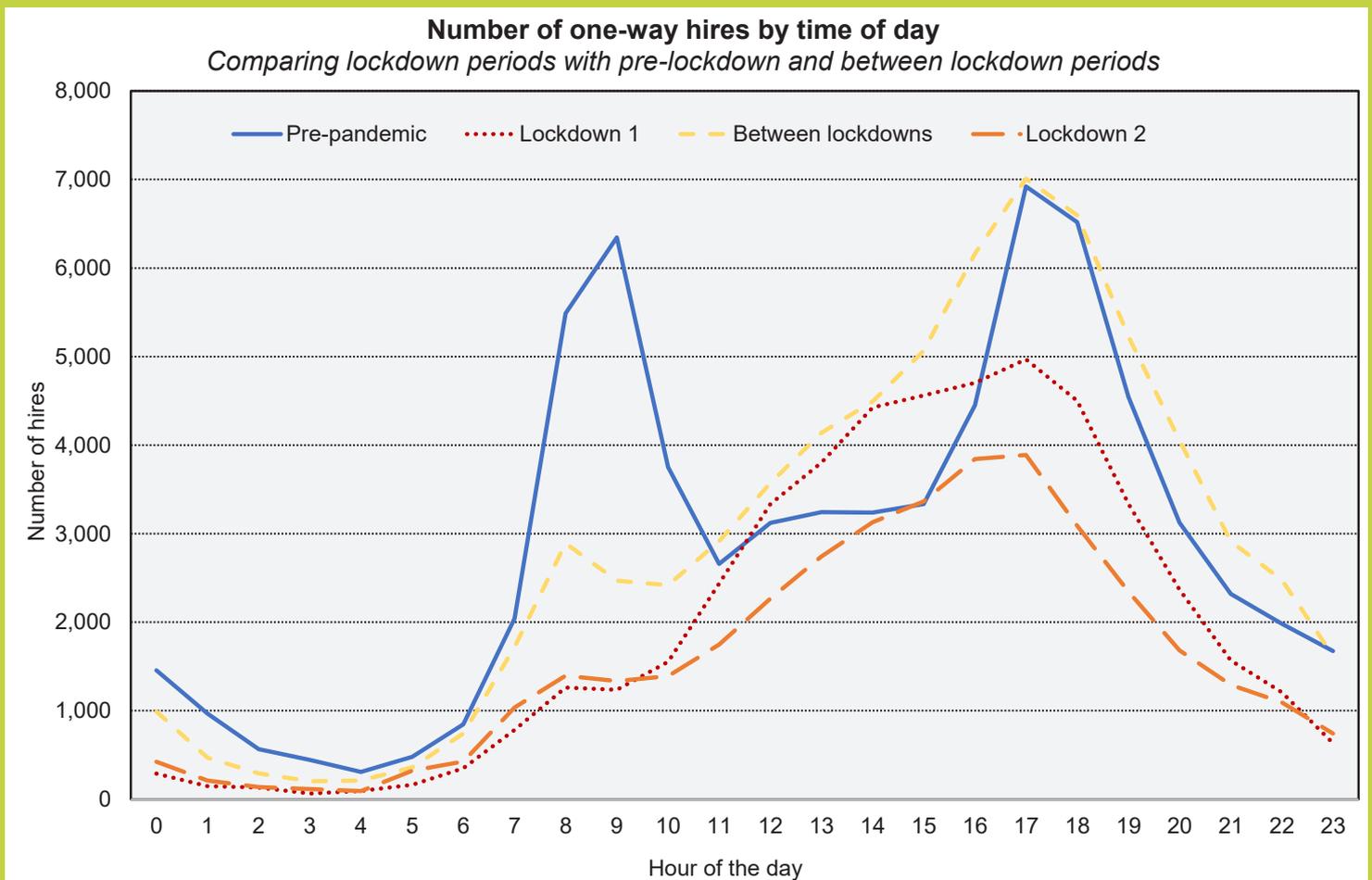
The total volume of peak-time hires fell dramatically during the two pandemic lockdowns. In April and May 2020, peak-time hires were one-quarter to one-third of the volume they had been the previous year, rising to half of the previous year's volume by the end of the first lockdown in June 2020.

Similarly, but less dramatically, volumes during the second lockdown in January and February 2021 were 40-50% of those the previous year, while March 2021 volumes were 78% of those in March 2019 (the most recent 'typical' March). In between these two lockdowns, peak-time hire volumes were closest to their pre-pandemic levels in September 2020 (the month with the fewest pandemic-related

restrictions) but had still only recovered to 87% of the volumes seen in September 2019.

While striking, these overall volumes mask a significant change in the daily pattern of one-way hires during this period (Figure 10). If we break these volumes down into weekday morning and afternoon peak windows, we see that while the volume of hires in the afternoon peak (5-8pm) recovered to pre-pandemic levels between the two lockdowns, the volume of hires taking place in the morning peak (8:30-10:30am) was still only around 30% of that the previous year. Even by September 2020, morning hire volumes were only 46% of those in September 2019, while afternoon hire volumes had risen to 113% of those the previous year. A similar pattern occurred at the end of the second lockdown.

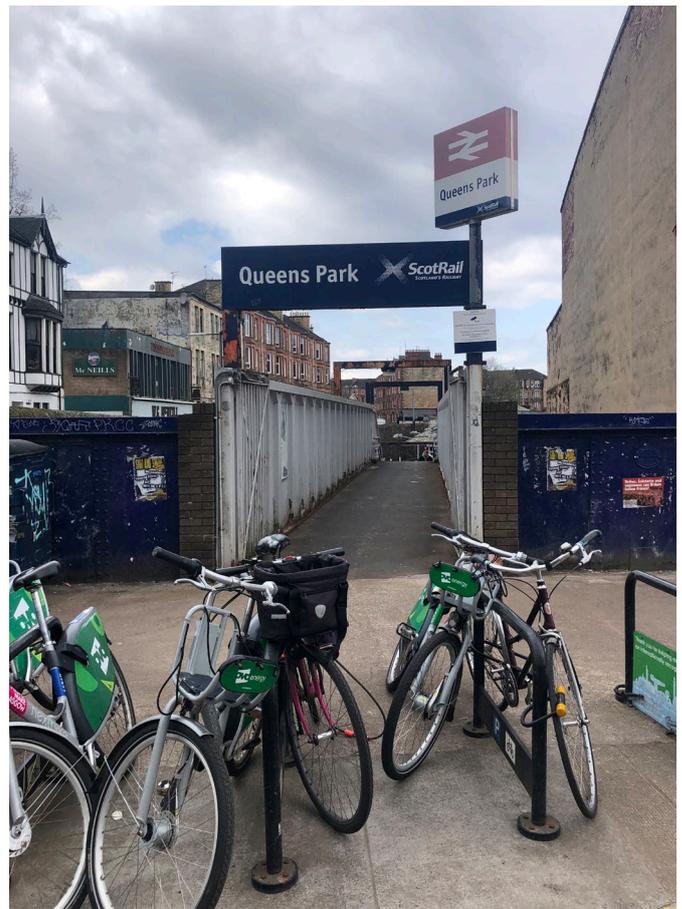
Figure 10: One-way weekday hires by time of day and by COVID restrictions



If we compare the hourly pattern of one-way hires on weekdays before, during and in between lockdowns, we see that the weekday morning peak in hire volumes almost completely disappears during both lockdown periods. While it makes some minimal recovery in between the two lockdowns, this does not constitute a return to the pre-pandemic one-way weekday hire pattern. Indeed, the daily pattern of one-way weekday hires during the pandemic resembles the pre-pandemic weekend daily pattern to a much greater extent than it does the pre-pandemic weekday pattern.

This change is also reflected in the typical duration of peak-time hires, which lengthened dramatically. During the first lockdown, only 34% of morning and 22% of afternoon peak-time hires lasted less than 20 minutes, compared with 85% (morning) and 71% (afternoon) pre-pandemic (March 2019-February 2020). While hire durations did shorten again after the first lockdown, they remained longer than before, with around 70% of morning hires and around 60% of afternoon hires lasting less than 20 minutes from July 2020 right through to the end of the second lockdown.

The lengthening of hires during this period is not, however, reflected in significantly longer distances between start and return hire stations. There was only a 9% increase in the average distance between stations for morning peak-time hires during the first lockdown and a 6% decrease in the distance for afternoon peak-time hires. On average, hire distances remained the same. This suggests that hirers were making more complex journeys involving multiple stops and/or were more inclined to stop off on their journey without docking their bike (particularly in the afternoon peak), rather than simply making longer single journeys than pre-pandemic.



Finally, we can consider the locations at which peak-time hires were made during the pandemic. While the vast majority of stations showed a dramatic decrease in hire rates during the first lockdown, a handful of stations demonstrated a significant increase in afternoon peak hires (while their morning peak-time hires decreased). All of these stations were located outside of the city centre. For example, Queens Park West saw a fall of around 80% in morning peak-time hire volumes when comparing the first lockdown with April-June 2019, while afternoon peak-time hires increased to over six times their 2019 level.

Overall, this pattern of peak-time use during the pandemic indicates a shift towards one-way hires that more closely resemble those made during weekends pre-pandemic than during weekdays.

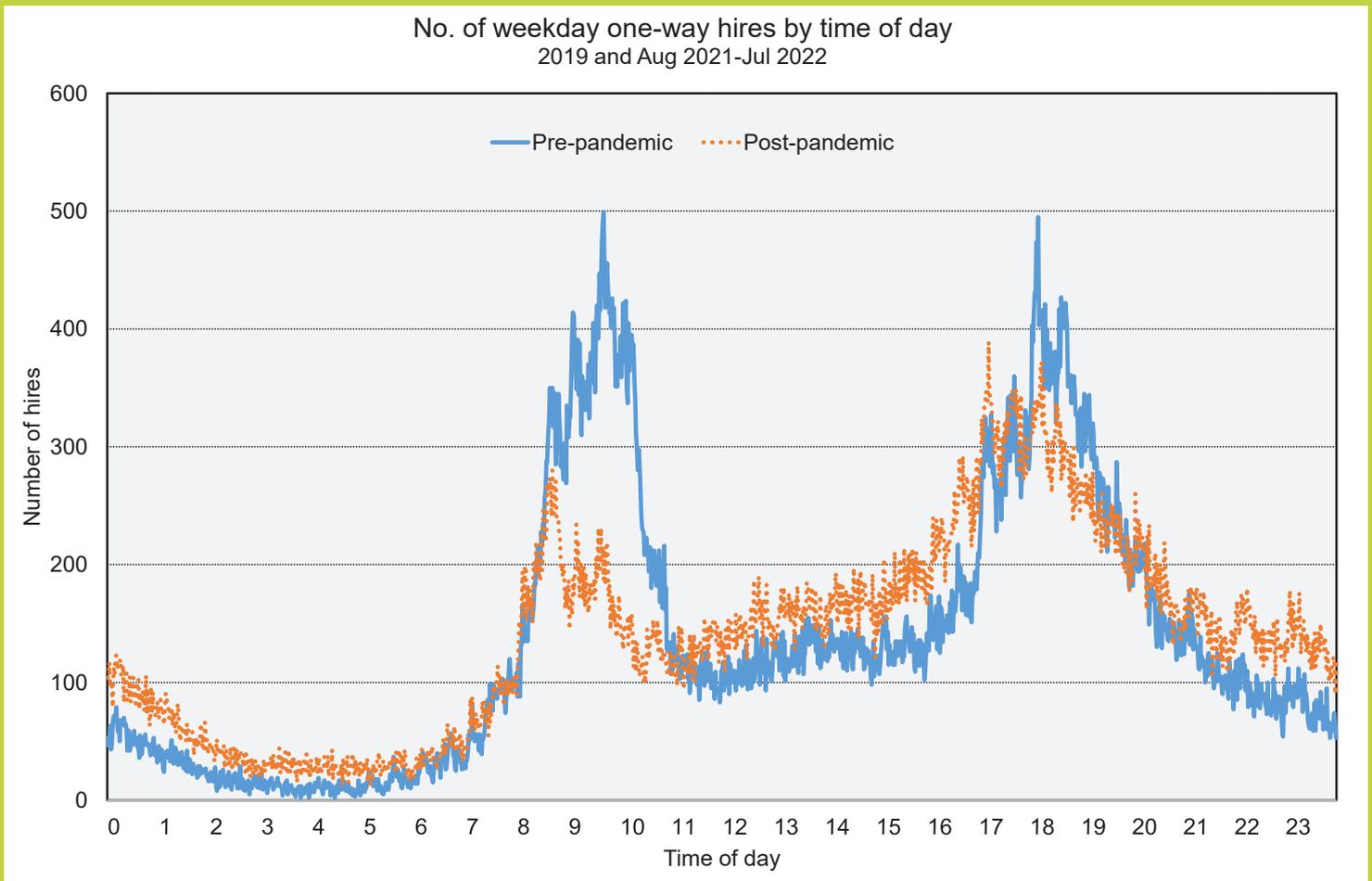


Post-pandemic patterns

The most striking, enduring change in the post-pandemic period was the significant reduction in the number of hires taking place in the morning peak-time period. Between August 2021 and July 2022, hire volumes in the morning peak were 51% of those in 2019, while volumes across the

afternoon peak were 92% of those in 2019 (Figure 11). This reflects a significant and apparently permanent shift in the pattern of one-way hires across the day on weekdays, and has occurred in spite of the fact that overall hire volumes rose substantially between 2019/20 and 2021/22.

Figure 11: Weekday one-way hires by time of day



Prior to the pandemic, the weekday pattern of hires had two distinct peaks, during the morning and afternoon rush-hour periods. Following the pandemic, this pattern consisted of a much smaller morning peak, followed by a slow, steady rise across the afternoon, before slowly tailing off into the evening.

The average distance of peak-time hires was slightly longer post-pandemic than pre-pandemic, with winter hires averaging 2.7km and summer hires averaging 3.1km. Hire durations, however, were on average slightly shorter than pre-pandemic, but this was primarily due to a reduction in long hires (over 1 hour), rather than the bulk of hires being

shorter in duration. While three quarters of peak-time hires lasted under 20 minutes in the post-pandemic period (the same as pre-pandemic), only a 4% lasted over 1 hour (compared with 15% pre-pandemic).

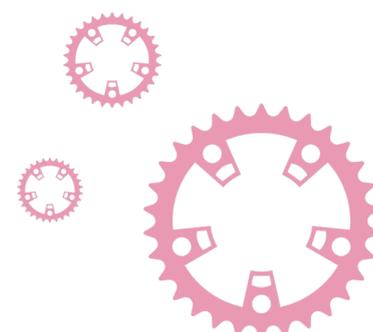
Finally, we can consider the most popular routes taken by peak-time hirers post-pandemic. Table 4 and Map 3 below show the top ten routes between August 2021 and July 2022.

Table 4: Ten most frequent one-way peak-time hire journeys, August 2021-July 2022

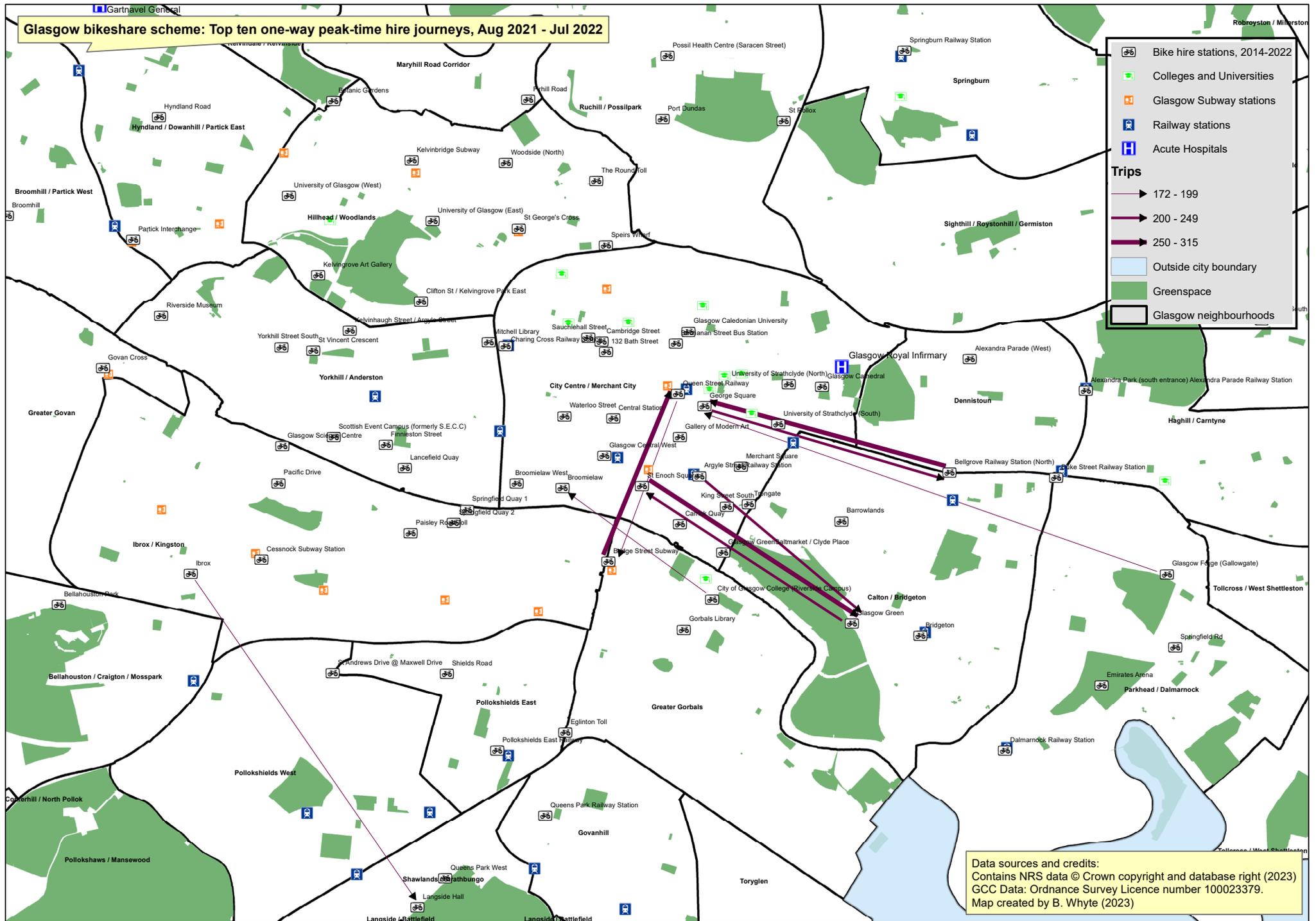
Start station	End station	No. of peak-time hires Aug 21 – Jul 22
Bellgrove Railway Station	George Square	315
St Enoch Square	Glasgow Green	281
Bridge Street Subway	Queen Street Railway	256
Glasgow Green	St Enoch Square	239
George Square	Bellgrove Railway Station	237
Argyle Street Railway Station	Glasgow Green	208
Queen Street Railway	Bridge Street Subway	192
City of Glasgow College	Broomielaw	183
Glasgow Forge (Gallowgate)	George Square	181
Ibrox	Langside Hall	172

When we compare this table to that pre-pandemic (Table 3 on p.34), there is only one route that appeared in this table pre-pandemic (St Enoch Square to Glasgow Green) which remains in the top ten post-pandemic. The previous top ten journeys in the pre-pandemic period have mainly been replaced by journeys between the city centre and the Southside and East End of the city.

There is therefore much greater diversity in these top ten routes than was previously the case. Journeys on these top ten routes make up only 3% of all peak-time hires during this period, compared with 8% pre-pandemic. This may reflect the expansion of the scheme in the intervening period, as much as a change in the ways in which the scheme is used.



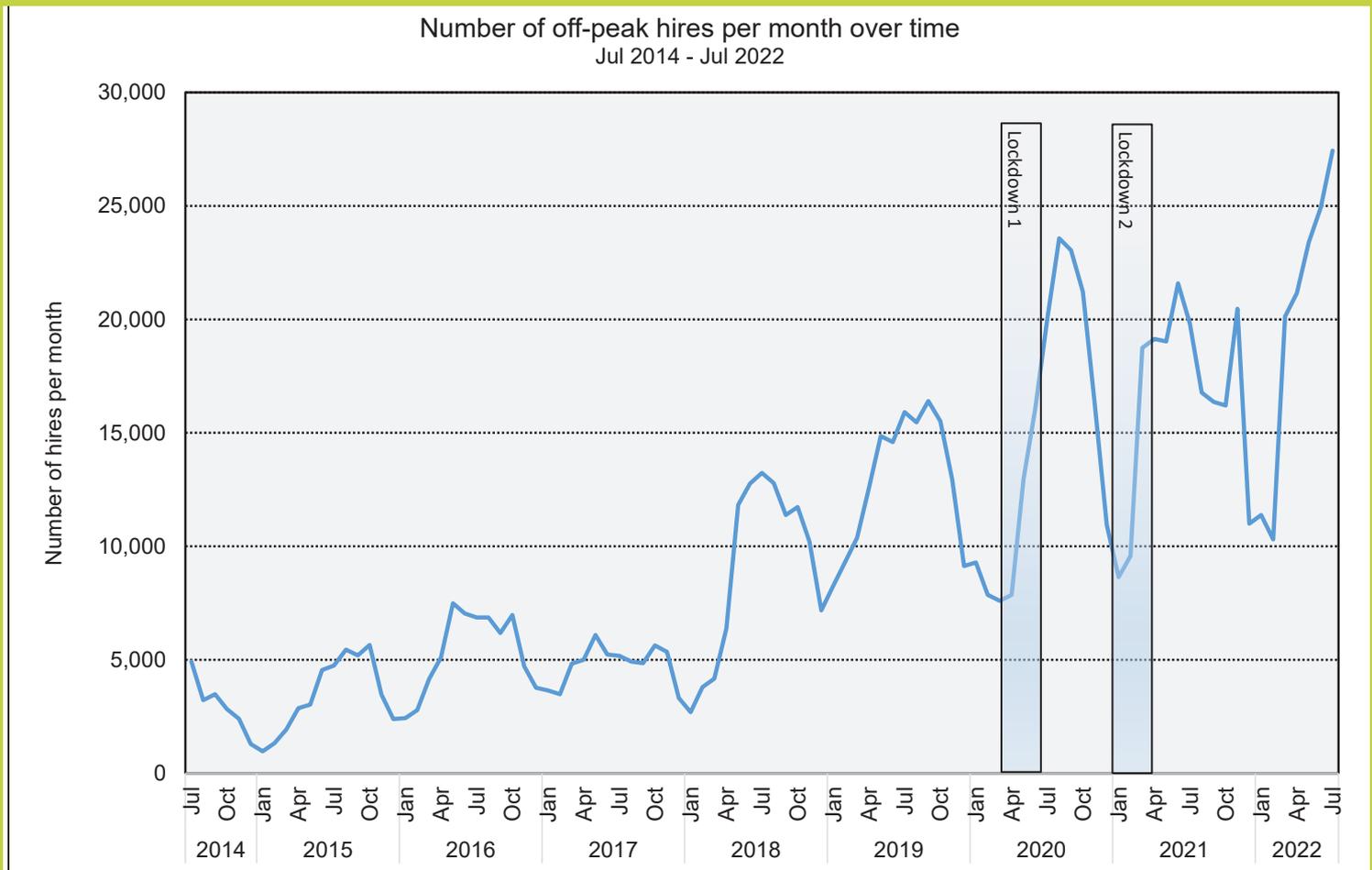
Map 3: Map of ten most frequent one-way peak-time hire journeys, August 2021-July 2022



One-way, off-peak hires: in-depth analysis

These are one-way hires that begin at any time other than on weekdays 8:30-10:30am or 5-8pm. The number of these hires has increased significantly as the scheme has expanded, as shown in Figure 12.

Figure 12: Off-peak hires per month, 2014-2022



Pre-pandemic patterns

One-way off-peak hires made up just over half of the hires in the scheme between July 2014 and February 2020. They totalled over 462,260 hires during this period, including 155,320 hires that took place in 2019 alone, which was an increase of 44% over 2018 volumes. This is a greater increase than we saw for peak-time hires over the same period. Seasonality in off-peak hires was much more similar to peak-time hires than

roundtrip hires, in that the volume of hires in the winter months is just under half that in the summer months.

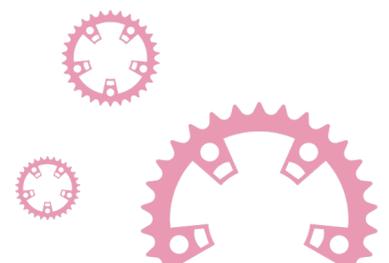
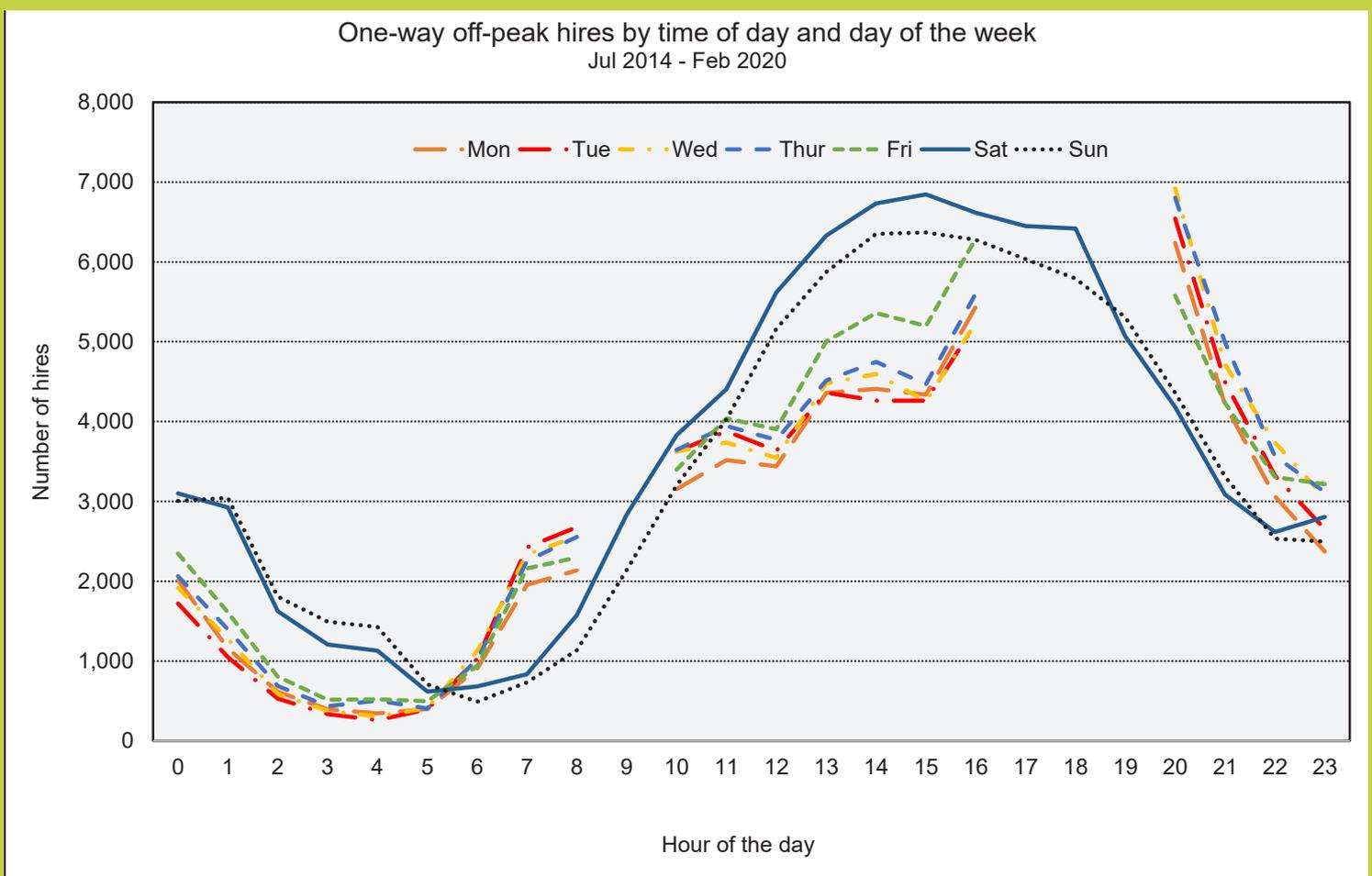
One-way off-peak hires are assumed to be predominantly being carried out by people making functional but not necessarily commuting journeys, although we recognise that they are likely to take in a significant number of those travelling to or from a place of

work or study outside of peak hours. These journeys were more likely to be of longer duration than peak-time hires, with just under two thirds of off-peak hires lasting less than 20 minutes, compared with three quarters of peak-time hires.

Off-peak journey volumes increase as the working week progresses, so that volumes on Fridays are some 10% higher than on Mondays. Figure 13 below shows a higher volume of one-way hires in the early to mid-afternoon on a Friday than on other weekdays, so this may be associated with people commuting home from an earlier finish on Fridays than other weekdays.



Figure 13: One-way off-peak hires by time of day and day of week



Some stations were much more likely to be the origin of an off-peak hire than others, with off-peak hires making up as little as one-third of hires at some stations and over two-thirds of hires at others. However, there does not appear to be any pattern as to which stations were more or less likely to do so. As with peak-time hires, just under two-fifths of all off-peak hires originated at centrally located hire stations.

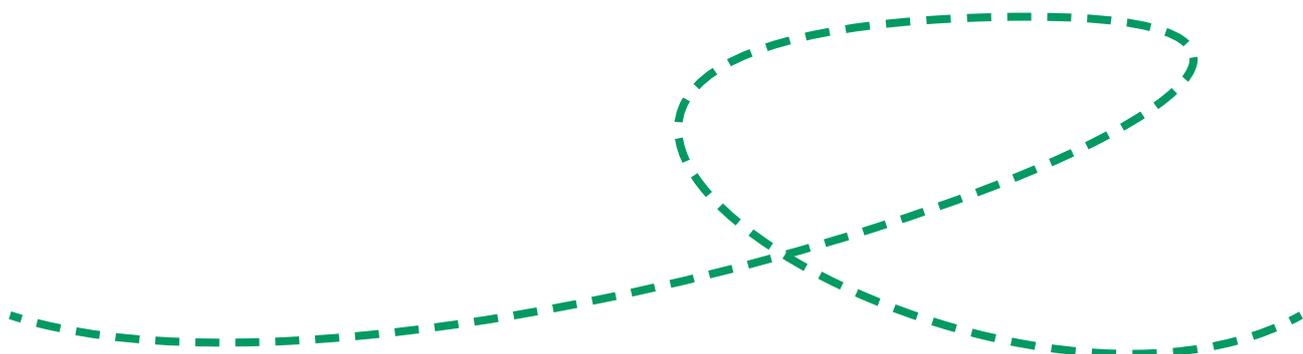
Looking at the ten most popular off-peak journeys (Table 5, Map 4), we see greater

diversity than among the most popular peak-time journeys. While the route between St Enoch Square and Glasgow Green again tops the table, the remaining journeys are more likely to originate or terminate in the east and west ends of the city. These ten journeys made up 5% of all off-peak hires between July 2014 and February 2020.

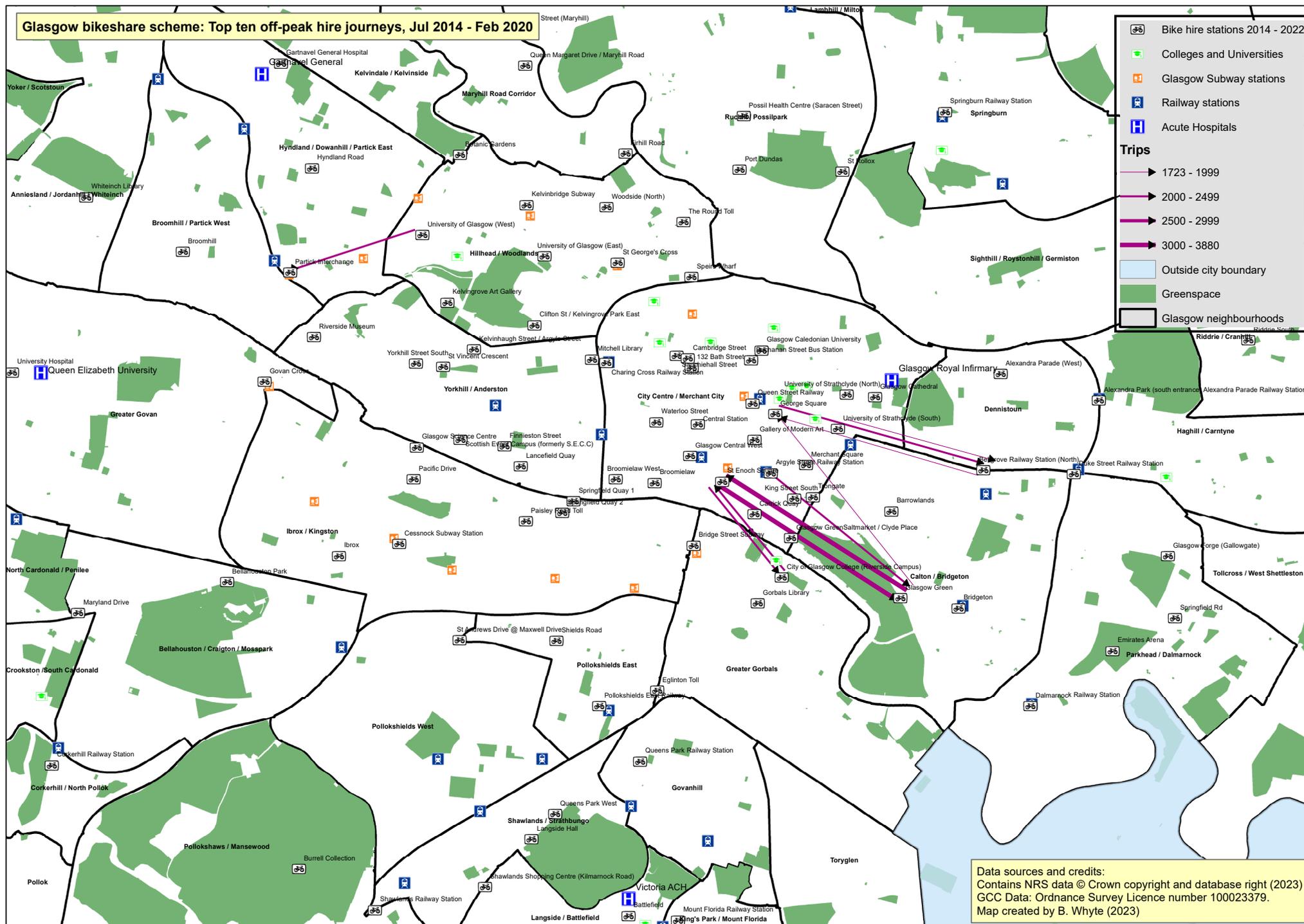
The map (p.44) illustrates the importance of students and staff using the bikes to travel to universities and colleges, particularly to and from the east of the city.

Table 5: Ten most frequent off-peak hire journeys, July 2014-February 2020

Start station	End station	No. of peak-time hires Jul 14 – Feb 20
Glasgow Green	St Enoch Square	3880
St Enoch Square	Glasgow Green	3408
City of Glasgow College	St Enoch Square	2307
St Enoch Square	City of Glasgow College	2139
George Square	Bellgrove Railway Station	2293
Bellgrove Railway Station	George Square	1766
University of Glasgow (West)	Partick Interchange	2453
Argyle Street Railway Station	Glasgow Green	2003
Glasgow Green	George Square	1862
University of Strathclyde (South)	Bellgrove Railway Station	1723



Map 4: Map of ten most frequent off-peak hire journeys, July 2014-February 2020



If we look only at weekend off-peak journeys, the two university routes (as well as the journey from Glasgow Green to George Square) drop off the table, to be replaced by inner city routes. This suggests that a substantial proportion of off-peak journeys on weekdays are being made to a place of study, outside of typical 'office hours' peak travel times.

Change in patterns during and between the two lockdowns

The initial impact of the first lockdown (April-June 2020) was a significant decrease in off-peak hire rates, so that volumes in April 2020 were only two-thirds of those in April 2019. However, by June 2020 (the final month of the first lockdown), hire rates had surpassed those in June 2019. They continued to climb through the summer and remained significantly higher than 2019 rates until the start of the second lockdown. In total, there were 35% more off-peak hires across July-December 2020 (i.e., between the two lockdowns) than in the same period in 2019. This increase persisted across the second lockdown and through to July 2021.

A comparison of the time of day at which off-peak hires took place during the first lockdown with the pre-pandemic period shows that there were some significant changes. While weekday evening hires demonstrated a dramatic decrease, these were replaced by weekday early afternoon hires. Patterns on weekends remained broadly the same.

By the end of the second lockdown in May 2021, weekday evening hire rates had returned to pre-pandemic norms, but early morning and early afternoon weekday hire rates sat above the rates in both the pre-pandemic period and the first lockdown.

Finally, if we look at the distances travelled by off-peak users of the scheme, the average distance travelled was very similar to that travelled by any peak-time users – an average of 2.6km per hire – although off-peak journeys were slightly more likely to be under 1km and slightly less likely to be between 2 and 4km in distance. In total, off-peak hirers travelled at least 1.18 million km between July 2014 and February 2020, or at least 580km per day.

The volume of one-way journeys on weekends was also greater than in pre-pandemic, across the course of the whole day; the pattern was the same, but the volume had increased.

The duration of off-peak hires lengthened significantly during the first lockdown and, to a much lesser extent, in the second lockdown. During the first lockdown, only just over half of all off-peak hires lasted under 30 minutes, compared with 82% in April-June 2019. However, this was not reflected in a lengthening of the average distance between start and return stations. By July 2020, the proportion of off-peak hires lasting less than 30 minutes had risen to just under three-quarters, where it remained throughout the second lockdown and the period immediately thereafter.



Post-pandemic patterns

The number of off-peak journeys continued to climb between August 2021 and July 2022 and was higher than both during the pandemic and the pre-pandemic period. There were almost 220,000 (219,550) off-peak hire journeys made during August 21-July 22, which was 1.4 times the number made in the 12 months immediately prior to the pandemic. The increase is most striking from March 2022 onwards, following an expansion of the scheme in the previous month.

Off-peak hires in the post-pandemic period were more likely to be shorter in duration than before, with 69% under 20 minutes long (compared with 64% pre-pandemic). The average distance of off-peak hires in

this period was 2.9km. So, while hire durations were, on average, shorter post-pandemic, hirers were actually cycling greater distances than pre-pandemic. This suggests that traffic and the quality of the route taken by hirers is likely to have a significant impact on the time it takes them to cycle a certain distance, given that we would expect the reverse of this relationship to be true. Indeed, there were some significant improvements made to the cycling transport infrastructure around Glasgow, both during and after the pandemic, much of which has been integrated with the location of bike hire stations.

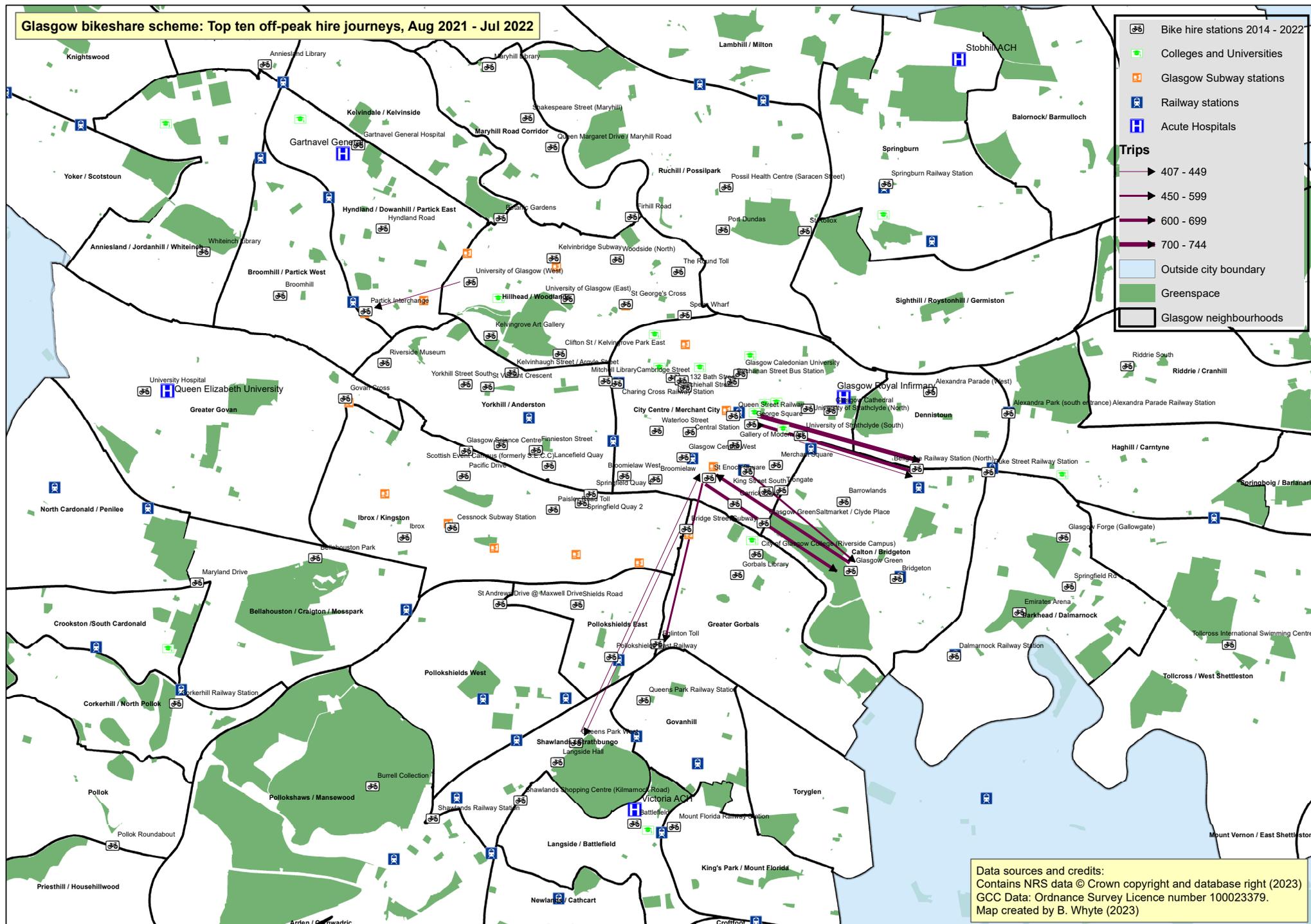
Finally, we can look at the top ten routes for off-peak hirers post-pandemic, which are shown in Table 6 and Map 5 below.

Table 6: Ten most frequent off-peak hire journeys August 2021-July 2022

Start station	End station	No. of peak-time hires Aug 21 – Jul 22
George Square	Bellgrove Railway Station	744
Bellgrove Railway Station	George Square	675
Glasgow Green	St Enoch Square	622
St Enoch Square	Glasgow Green	614
Argyle Street Railway Station	Glasgow Green	461
St Enoch Square	Eglington Toll	453
Queens Park Railway Station	St Enoch Square	436
University of Glasgow (West)	Partick Interchange	421
University of Strathclyde (South)	Bellgrove Railway Station	411
Bridge Street Subway	Queens Park Railway Station	407



Map 5: Map of ten most frequent off-peak hire journeys August 2021-July 2022



If we compare this to the top ten routes pre-pandemic, there are very few substantive differences. Some routes (most notably the route between George Square and Bellgrove Railway Station) have moved up the table, whilst others (for example, the route between the University of Glasgow and Partick Interchange) have moved down.

The routes from St Enoch Square to Eglinton Toll and from Queens Park Railway Station to St Enoch Square are new to the table, indicating that stations on the southside of the city now play a much more prominent role in off-peak hires than

before the pandemic. This is, at least in part, due to a significant expansion of the scheme in the southside. New infrastructure may also be important. Queens Park Railway station and Eglinton Toll are both adjacent to the South City Way and link into the city centre. The map shows the importance of the scheme in the east of the city, for students across the city and of transport hubs like Partick and St Enoch. These top ten journeys made up 2.4% of all off-peak hires between August 2021 and July 2022, half the ratio before the pandemic. As with peak-time hires, this suggests that there has been a significant diversification in the routes taken by off-peak hirers, in line with the scheme's expansion.

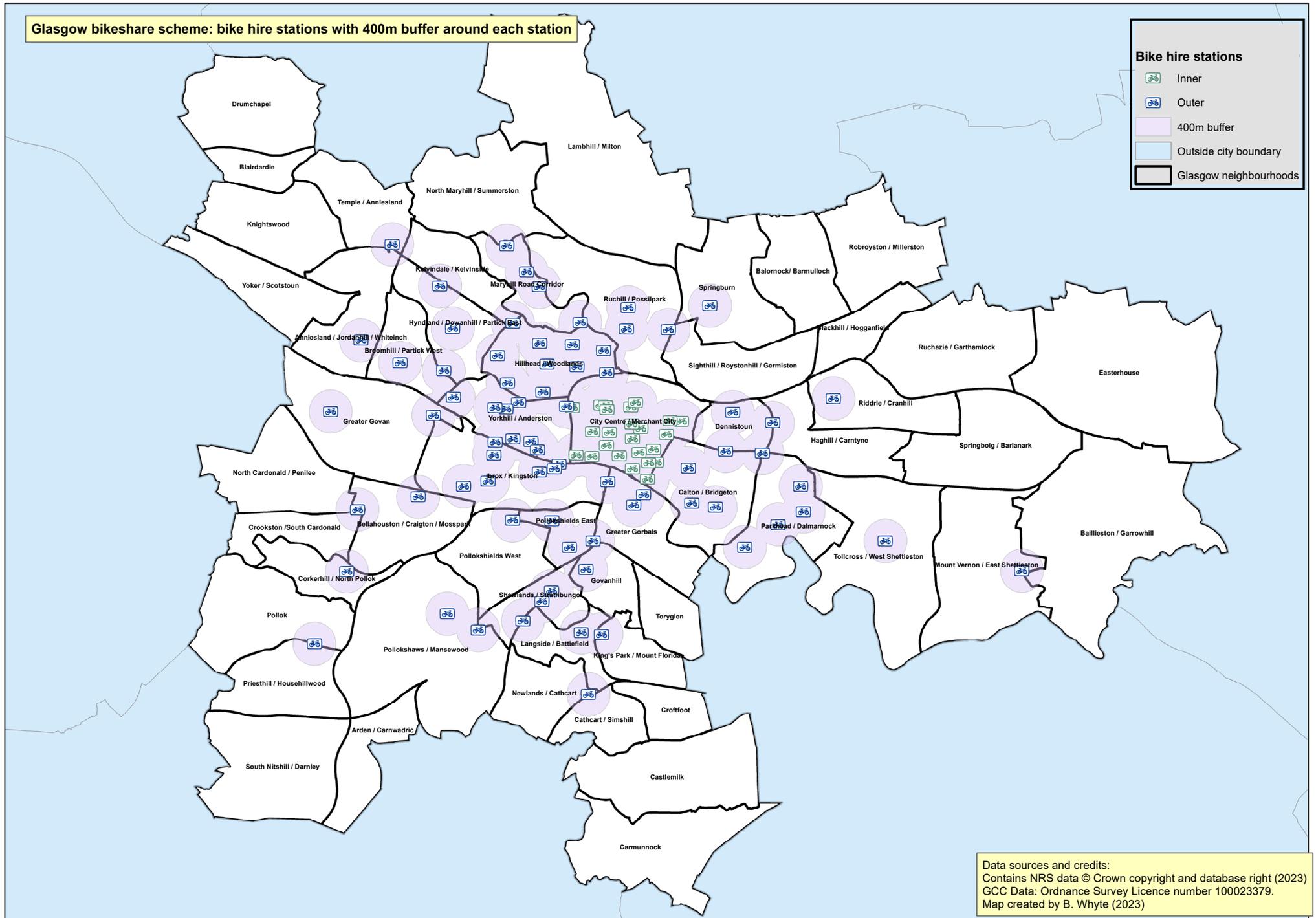
Geographic distribution of bike hire stations

By June 2022, there were 99 active bike hire stations in the Glasgow scheme. As might be expected, there is a concentration of stations in the city centre area with 24 stations situated in the City Centre and Merchant City neighbourhoods. The scheme has expanded its reach over time but there are still no bike hire stations in almost half of Glasgow's neighbourhoods – 27 of the 56 neighbourhoods in Glasgow, representing a population of 265,000 in total (42% of Glasgow's population) – and a further 15 neighbourhoods only have one bike hire station.

Map 6 illustrates the distribution of bike hire stations across Glasgow with a 400m shaded buffer around each station to illustrate how convenient it is to walk to one of the stations in different parts of the city. The map clearly illustrates the concentration of stations in the city centre and surrounding neighbourhoods, and the dearth of bike hire stations in peripheral areas, particularly in the east, north west, south west and south east of the city.



Map 6: Bike hire stations with 400m buffer around each station



Distribution by area deprivation

In 2014, when the scheme was established, over half the bike hire stations (18 out of 32) were situated in the least deprived half of the city – deprivation deciles 6-10 (Figure 14).

Figure 14: Distribution of bike hire stations by deprivation, 2014

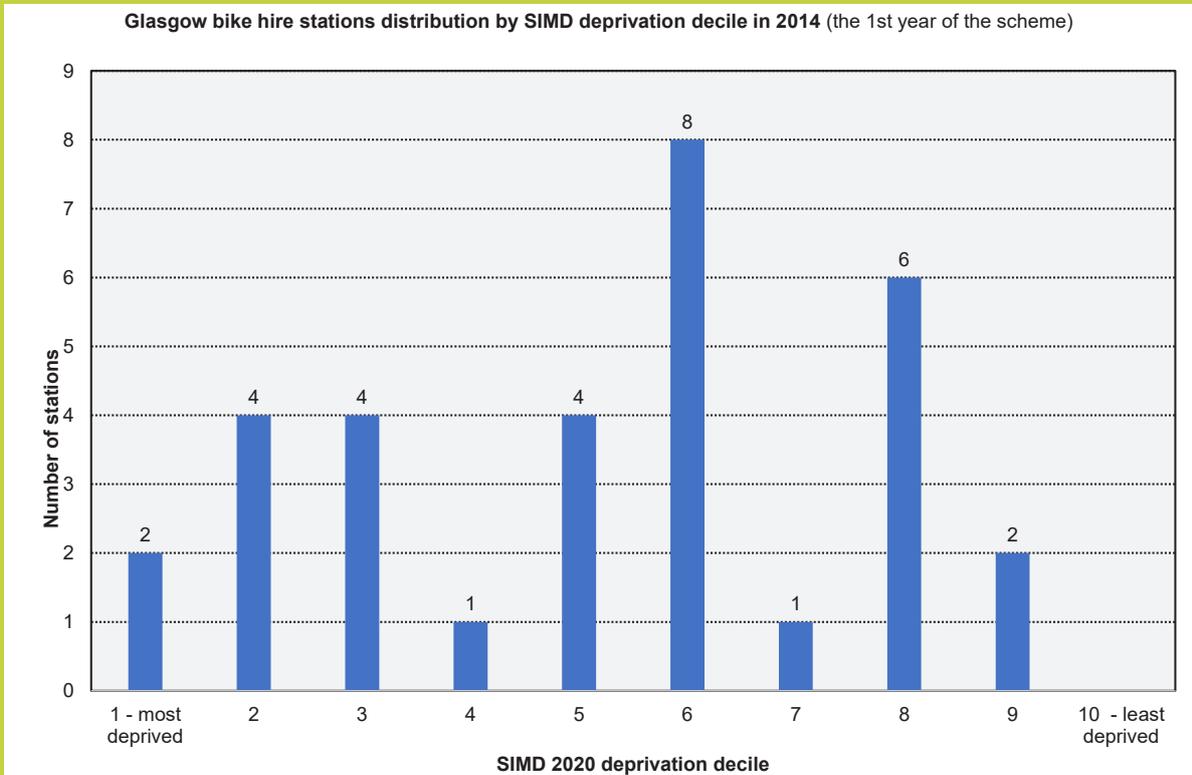


Figure 15: Bike hire stations installed in the period 2019-2022 by deprivation decile

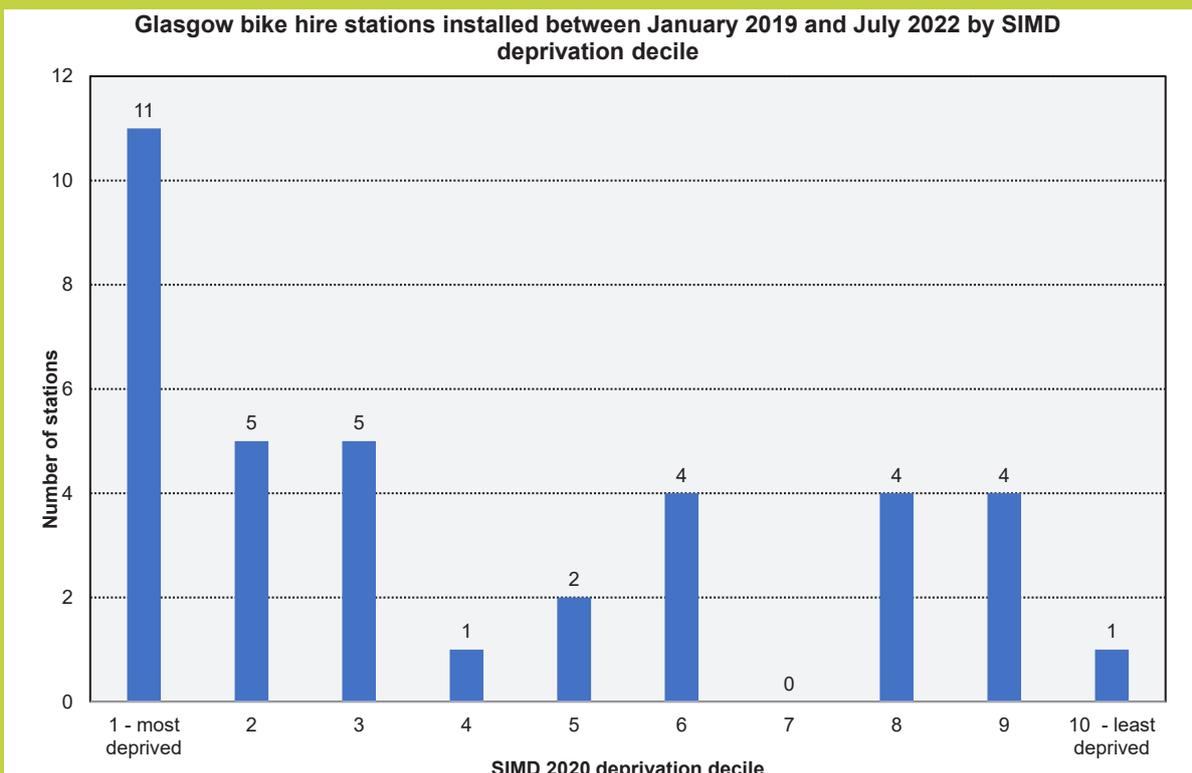
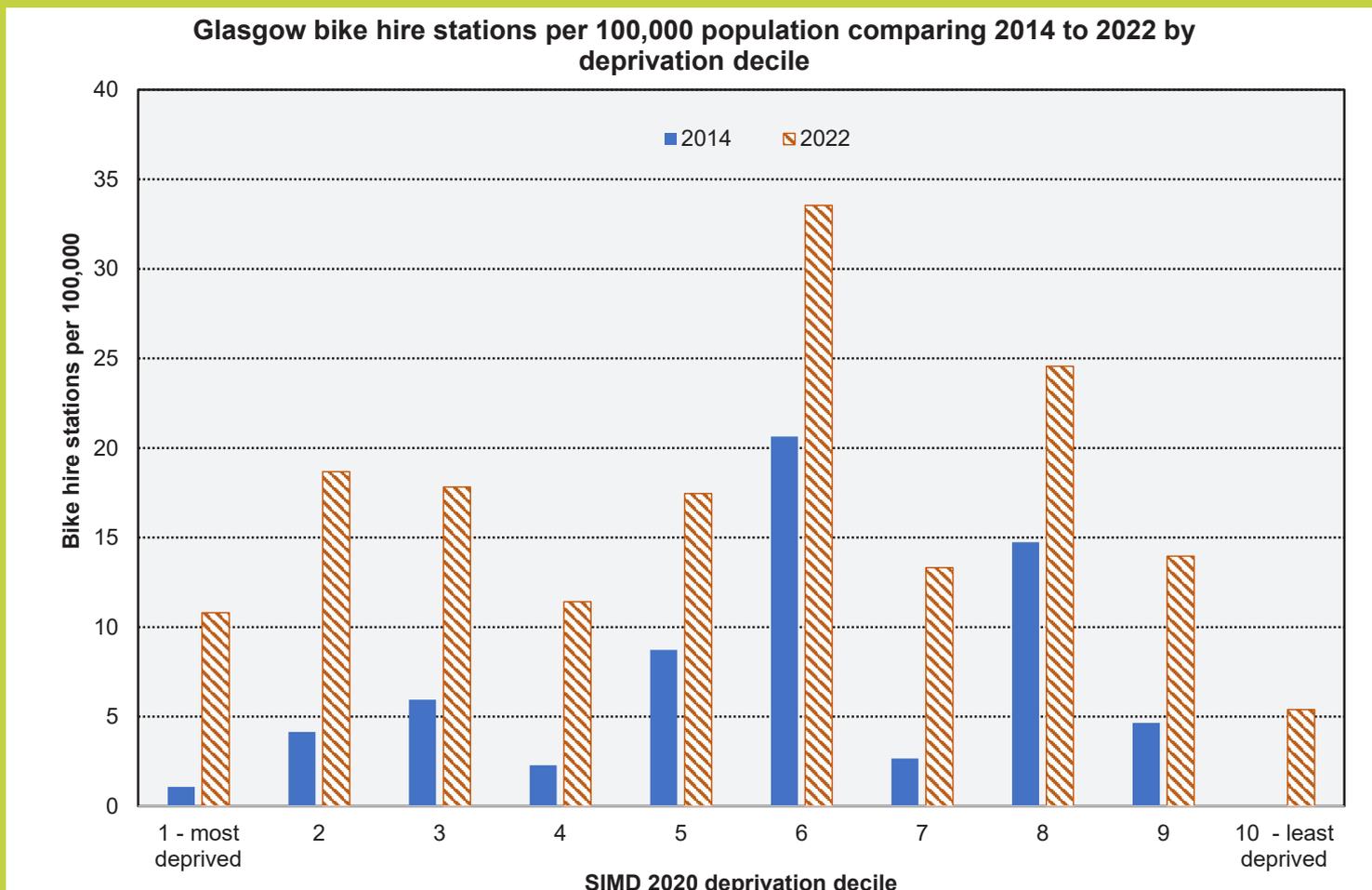


Figure 16: Bike hire stations per 100,000 population comparing 2014 to 2022 by deprivation decile



Nevertheless, after an initial phase when the scheme was more prominent in the least deprived areas of the city, later expansions were much more focused on the more deprived parts of the city. By way of illustration, in the three and a half year period between January 2019-July 2022, 24 out of the 37 stations introduced were situated in the most deprived half of the city, represented by deprivation deciles 1-5 (Figure 15).

Comparing the rate of bike hire stations per 100,000 population by deprivation decile

between the start of the scheme in 2014 and 2022 shows that access to the scheme has been improved in the more deprived parts of the city, and station locations are more evenly distributed in relation to area deprivation across the city as whole (Figure 16)^{xix}.

However, two of the least deprived deciles (deciles 6 and 8) have the highest proportion of stations to population, showing there is still a need to provide fairer access by expanding the number of stations in the more deprived parts of the city.

^{xix} This is a simple but crude analysis based on categorising the deprivation status of each bike station location to the data zone in which they are situated.

Discussion

► How has the Glasgow bikeshare scheme expanded over time and what patterns of use have developed?

The scheme has grown significantly over the past eight years, in terms of the number of stations, the geographical spread of stations, the number of bikes available in the scheme and the number of journeys undertaken daily on scheme bikes. There are now over 1,150 bikes in the scheme (10% of which are e-bikes) and over 100 bike hire stations, making this the biggest bikeshare scheme in Scotland and one of the largest in the UK outside of London. While in the first year of the scheme (August 2014-July 2015) there were just under 66,000 hires, over an eight-year period this rose to nearly 325,000 hires (August 2021-July 2022), representing approximately a five-fold increase. Relative usage of each bike rose also from 0.8 hires per bike per day in July 2014 to 1.3 hires per bike per day in July 2022 – another indication of the increased popularity of the scheme. In 2022, there were over 94,000 active users of the scheme – approximately 5% of UK current bikeshare users^{xx} – and 21 organisations have taken out corporate membership under the current contract.

Before the pandemic, bike hire patterns showed clear weekday peaks in hires between 8:30am and 10:30am and then again between 5pm and 8pm, during which just over 40% of all hires took place. The vast majority of these hires lasted under 20 minutes and showed a strong directional flow, with journeys tending to take place into the city centre in the mornings and out

from the city centre in the afternoon. One-way journeys outwith these peak-times made up just under 50% of all hires, and tended to be longer and show more diverse geographical patterns. A further 10% of all journeys were roundtrip hires and are assumed to have been predominantly undertaken for leisure purposes.

There is a marked seasonality in scheme use. The volume of hires peaks in the summer months (June-August) and decreases over winter (December-February). Prior to the pandemic, winter hire volumes were just under half of those across the summer months. The variation in hours of daylight and the frequency of wet, windy, and icy weather are all likely to influence this seasonality from year to year. Good maintenance and gritting of cycle routes will play a part, and winter maintenance plans now prioritise segregated and national cycle routes for gritting, which should support greater winter cycling³⁵.

We were unable to analyse e-bike use separately with the data we had, but nextbike by TIER have provided some simple tables which show that e-bike use accounted for 13% of all bike rentals in 2022²³. By the end of 2022, there were 159 e-bikes available in the Glasgow scheme.

Finally, the growth of Glasgow's scheme is in sharp contrast to the closure of bikeshare schemes in other cities like Edinburgh³⁶, Newcastle³⁷, Manchester³⁸ and Dumfries³⁹,

^{xx} This is an approximate figure based on 94,467 current users of the Glasgow scheme at the end of 2022 (defined as having hired a bike in the last 120 days) divided by CoMoUK's figure of 1,753,899 active bikeshare members (defined as having hired a bike in the last 12 months) in the UK in March 2022²⁰.

where the financial viability of schemes has been adversely affected by theft and vandalism and, in the case of Dumfries, low uptake. The planned steady growth of

the Glasgow scheme, the partnership between Glasgow City Council, nextbike by TIER and Bike for Good, and strong local demand have all contributed to the scheme's success.

► How has the COVID-19 pandemic changed patterns of use of the scheme?

To answer this question, we discuss the three main types of trips we categorised: one-way peak-time hires; one-way off-peak hires; and roundtrip hires.

► *One-way, peak-time hires*

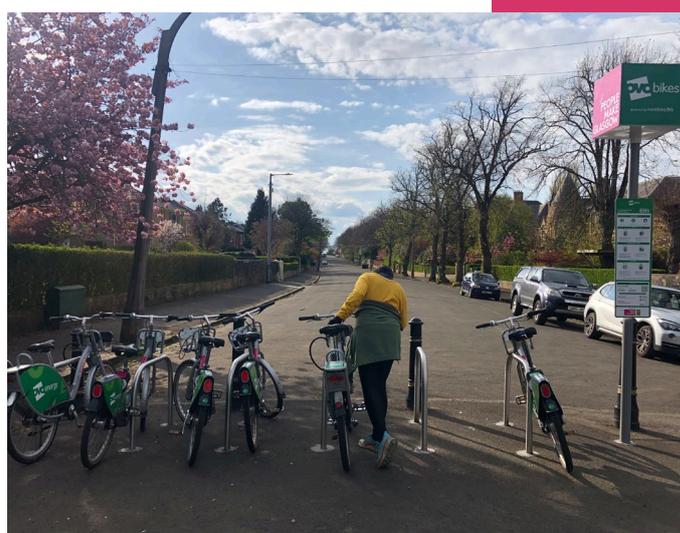
One-way morning peak-time hires made up 17% of all hires in the pre-pandemic period, but by the post-pandemic period had dropped to 7% of all hires. There was also a drop in one-way afternoon peak-time hires over the same period, which reduced from 25% to 16% of all hires post-pandemic. This illustrates one of the key changes in the pattern of hires, and of work, that can be attributed to the pandemic period.

Prior to the pandemic, the weekday pattern of one-way hires had two distinct peaks, during the morning and afternoon 'rush-hour' periods. Unsurprisingly during the lockdowns, given the restrictions on work and travel, there were fewer peak-time hires. Additionally, comparing the hourly pattern of one-way hires on weekdays before, during, and in between lockdowns, we see that the weekday morning peak in hire volumes almost completely disappears during both lockdown periods.

Following the pandemic, the morning weekday peak in one-way hires remains but is muted, while there is a slow, steady rise across the afternoon, before slowly tailing off into the evening. Overall, the changed patterns of peak-time use, which

began during the pandemic, indicate a shift towards one-way hires that more closely resemble those made during weekends pre-pandemic than during weekdays.

The most striking, enduring change in the post-pandemic period has been the significant reduction in the number of hires taking place in the morning peak-time period. This suggests that there may be fewer commuters using the bikeshare scheme and/or commuting is taking place over a broader period of the day, including outside of pre-pandemic peak-time hours.



► **One-way, off-peak hires**

These are assumed to be predominantly being carried out by people making functional but not necessarily commuting journeys, although we recognise that they are likely to take in a significant number of those travelling to or from a place of work or study outside of peak hours. These journeys have become more frequent than they were prior to the pandemic. One-way off-peak hires made up 48% of all hires in the pre-pandemic period, but by the post-pandemic period had risen to account for 61% of all hires.

The number of off-peak journeys increased during the pandemic and continued to climb between August 2021 and July 2022. There were just under 220,000 off-peak hire journeys made during August 2021-July 2022, which was 1.4 times the number made in the 12 months immediately prior to the pandemic. The increase is most striking from March 2022 onwards, following an

expansion of the scheme in the previous month.

All one-way hires, whether off-peak or at peak times, have lengthened in distance but broadly stayed the same in duration. Longer journey distances are likely to reflect the geographical expansion of the scheme. As many new hire stations have been positioned along newly constructed, dedicated cycle routes (e.g., adjacent to the South and South West City Ways), this suggests that infrastructure is improving the time-efficiency of cycling for one-way journeys, as well as enabling longer distances to be cycled.

The number of very long one-way hires has decreased, although this may reflect price rises in the scheme and users becoming more aware of the costs associated with using the scheme over time, as well as more adept at locking the bikes once their hire is complete.

► **Roundtrip hires**

During the pandemic there were many more roundtrip hires, probably for leisure, especially during the first lockdown. The proportion of hires that were roundtrips was consistently around 10% between 2015 and 2019, but jumped to 18% in 2020, which was the year in which the most severe restrictions of the pandemic were in place, for the longest period of time. Both leisure cycling across Scotland and use of the Edinburgh bike hire scheme^{xxi} increased during this time period, the latter associated with more roundtrips and a longer afternoon peak for hires²⁸.

Weekday roundtrip hire volumes in the first half of 2022 were 25% higher than those in the first half of 2019 (pre-pandemic), while weekend roundtrip hire volumes were almost 60% higher than those in 2019. This suggests that the popularity of leisure uses of hire cycles, which peaked during pandemic lockdowns, partly driven by a lack of alternative leisure activities, has been sustained. Winter roundtrip hires dropped to around one-third of the level of summer roundtrip hires, which suggests that leisure cyclists are more influenced by winter seasonal factors like cold weather, rain/snow, and lack of light than commuting cyclists.

^{xxi} City of Edinburgh's Just Eat bikeshare scheme subsequently closed down in September 2021.

Overall, it appears as though the balance between work/study cycle commuting and other functional/leisure cycling has shifted significantly as a result of COVID-related changes in working patterns. Commuters during the traditional rush-hour period are now less likely to use the scheme, but its popularity has grown significantly among those undertaking other types of hires. There may well be a much more complex pattern of cycling across the city, rather than into the city centre and back out again, facilitated by the geographic expansion of the scheme and the diversification of work locations (e.g., working from home and office) for many businesses and workers.

This is likely to be enhanced by Glasgow's largely radial rail infrastructure which makes journeys across the city complex

and relatively expensive on public transport, compared with journeys into/out from the city centre. In contrast, the relative cheapness of bike hire and increasing accessibility of bike hire stations, often close to train stations, may make bike hire even more appealing for these types of journeys in particular.

Some of the changes observed in use of the bikeshare scheme may reflect a fundamental post-pandemic change in daily patterns of work and travel, especially a possible reduction in commuting travel into and out from the city centre. Additionally, the significant expansion of the scheme has made a bike hire trip a realistic and convenient option for a much wider variety of users. The expansion of the city's cycle network is also gradually helping to make cycling a more efficient and safer way of travelling across the city.

► What impacts has the scheme had on transport inequalities in the city?

Bike hires are relatively cheap if used on a 'pay-as-you-ride' basis, or via a monthly or annual membership, compared to other forms of public transport for many simple journeys. Bike hire on a 'pay-as-you-ride' basis costs £1 per 20 minutes, which compares favourably to the costs of a single fare on public transport, which start from £1.80 for a single short journey on a train or a bus and cost £1.55 for an adult single on the Glasgow Subway.

The scheme is dependent on having a smartphone and a bank account, but alternative membership models to provide cheap access to the bikeshare scheme (not dependent on having a bank account) have been trialled successfully on a project basis⁴⁰. This project, Bikes for All, encouraged people from under-represented groups to participate in

cycling and successfully recruited people from minority population groups, people from deprived areas and a large number of asylum seekers and refugees.



It is worth noting that UK Government financial provision for asylum seekers and failed asylum seekers (and any dependants) to cover essential living needs is set at just over £40 per person per week and, of this, £4.70 per week has been assessed as sufficient for essential travel needs⁴¹. Clearly, the costs of public transport for people on low weekly income, like asylum seekers, can be prohibitive and bikeshare can offer a cheaper alternative to public transport for simple journeys. This is reflected in responses to a recent survey of UK bikeshare users, which showed that 43% of users who responded were on an income of less than £20,000 a year, and 13% on an income of less than £10,000 per year²⁴.

It is important that Glasgow's bikeshare scheme is not only affordable, but locally accessible to those who might benefit most from it.

The scheme has expanded its reach over time and station locations are now more evenly distributed in relation to area deprivation across the city. While initially there were more bikeshare stations in the centre and west end of the city, there are now more stations further out from the centre, and more which are accessible to people living in deprived communities.

Nevertheless, there are still no bike hire stations in almost half of Glasgow's neighbourhoods (27 out of the 56 neighbourhoods in Glasgow). There is therefore considerable potential to expand the scheme across the city and to ultimately provide bikeshare access for the whole of Glasgow's population.

Moreover, many of the neighbourhoods without a bike hire station are amongst the most deprived in Glasgow: eight out of the ten neighbourhoods with the highest levels of income deprivation in the city are not served by the bike hire scheme, and six out of the ten neighbourhoods with the highest levels of employment deprivation have no bike hire stations. Additionally, in 12 of the 27 neighbourhoods without a bike station, less than 50% of households have a car^{xxii} and these are areas which would stand to gain most from a geographic expansion of the scheme.

Access to a bikeshare scheme can expand access to cycling for the many people who do not own a bike. In Scotland, 55% of households do not own a bike and access is much higher in higher income groups; 73% of households with an income of £50,000 or more have access to one or more bike, which is double the rate of access among households with incomes lower than £25,000⁴². Space to keep a bike is another barrier to increasing cycling. The latter is a particular issue in Glasgow, where over 70% of the population live in flats and tenements^{xxiii} which have limited space for bike storage.

The bikeshare scheme provides an alternative to bike ownership and avoids the need to buy, store, and maintain a bike.

E-bikes have been shown to increase bicycle usage, to provide direct health benefits through physical activity, and have the potential to replace car use⁴³. The recent addition of e-bikes should encourage more people to access the scheme and will enable longer journeys to be made with greater ease.

^{xxii} Based on 2011 Census figures.

^{xxiii} https://www.understandingglasgow.com/indicators/environment/housing/housing_type



The bikeshare scheme may also be helping to address the gender gap in who cycles. Earlier research showed that a relatively high proportion of users of the Glasgow bikeshare scheme were women⁴⁴, and this appears to be a commonly observed pattern across UK bikeshare schemes²⁴.



► How has the scheme impacted on health and environmental outcomes?

It is difficult to be definitive about the health and environmental impacts of Glasgow's bikeshare scheme based on the limited data from our study, but increasing active travel, as this scheme has done, has many health and environmental co-benefits^{13, 45}.

As the scheme has expanded, the number of bike hire journeys has increased significantly and these are all essentially carbon neutral journeys. If bike journeys replace car journeys, then carbon emissions and associated air pollution are reduced, and there are direct health benefits to those who are cycling.

We calculate that since its inception to the end of July 2022, just over 3.8 million kilometres have been cycled by users in Glasgow.

Had all these journeys been made by car, instead of by hire cycle, they would have cumulatively contributed 650 tonnes of CO₂e over the eight years of the scheme. This is likely to be a considerable over-estimate of the number of car journeys foregone but these notional carbon savings do point to the potential of the scheme, if it

is expanded further, to play a part in reducing Glasgow's carbon footprint. This is particularly important for the transport sector where carbon emissions have remained stubbornly high.

The other benefit we have looked at is in relation to physical activity, where we have applied real-world distances travelled by one-way hirers to estimate the amount of time spent engaging in physical activity through the bikeshare scheme.

Bikeshare users have spent 272,539 hours being active since the start of the scheme. This is the equivalent of 11,356 continuous days spent doing exercise (or 31 years).

In relation to the daily physical activity guidelines of at least 30 minutes of moderate exercise per day, this equates to one 7km cycle or, if we assume these are daily commutes from home to work and back, a 3.5km return cycle per day. On this basis, since the beginning of Glasgow's bikeshare scheme, potentially just under 180,000 people have achieved their daily recommended

level of physical activity from use of the bikeshare scheme.

There may be other unmeasured benefits for regular users of the scheme, including weight-control⁴⁶, lower levels of sickness⁴⁷, and mental health benefits associated with active travel and active commuting⁴⁸. Indirect population health benefits could accrue from reductions in traffic density and road noise if car traffic in Glasgow is reduced, in line with the Council's targets^{xxiv, 49}, and more people use the bikeshare scheme.

Planners are now thinking about how to create more compact, walkable, and attractive cities which reduce the need for car travel. Bikeshare schemes have a key role in achieving the 15 (or 20) minute city or neighbourhood, in which most services and activities are accessible within a 15-20 minute walk or cycle ride⁵⁰.

Nevertheless, the full potential of the bikeshare scheme to provide social, health, and environmental co-benefits

has still to be realised. Alongside improved access to affordable public transport, the bikeshare scheme has a role to play in reducing car ownership and car journeys, and can contribute to the creation of a regional active and sustainable transport network⁵¹. Expanding the scheme beyond the city boundaries into neighbouring local authorities would enable many more short- to medium-distance journeys to be undertaken actively and/or in combination with other sustainable transport modes.

Any future integration of public transport ticketing to enable combined journeys using one ticket on any form of public transport should encompass use of the bikeshare scheme⁵¹. Many of the most popular bike hire stations are located close to train and subway stops, encouraging commuters and others to cycle the "last-mile" of their journey. Bikeshare users in Manchester combined or saw the potential to combine bikeshare with a train journey, but this is dependent on good connectivity at public transport interchanges⁵². As Glasgow City Region develops its plans for mass transit across the region⁵³, an expanded bikeshare scheme should be an integral part of a future Glasgow Metro.



^{xxiv} Policy 8: The Council will work with partners to aim to reduce car vehicle kilometres in the city by at least 30% by 2030, strongly contributing to the national target of 20% for Scotland as a whole. (GCC Transport Strategy, 2022)

Recommendations

1

Our study has highlighted how Glasgow's bikeshare scheme has grown over time and become an increasingly important component of Glasgow's transport system. The scheme has spread from the centre and west of the city in the last eight years and provides much better geographical coverage across the city, but has yet to reach its outer peripheries. There is an increased number of stations now in the more deprived areas of the city, providing more equitable access to the scheme. However, for the scheme to be an effective part of Glasgow's sustainable transport system, **there needs to be further expansion into the peripheral parts of the city and better access for people living within Glasgow's most deprived areas.** There is a strong argument that, proportionately, there should be more bike hire stations in the more deprived areas of the city because typically these are the areas with the lowest car ownership, the lowest level of bike ownership, and where transport poverty hits hardest.

2

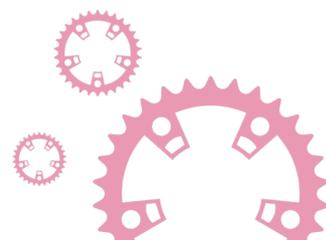
The Glasgow bikeshare scheme should not stop at the city boundary and, if **expanded into neighbouring local authorities**, the scheme could have an important role in enabling more short- to medium-distance journeys to be undertaken actively. The scheme **should be an integral part of a regional transport system linking with other public transport services**, and should **be included in any future integrated ticketing solution for public transport services** – i.e., one ticket that covers all public transport, including bike hire.

3

Currently, the Glasgow scheme is only open to adults aged 18 years and over, but some schemes have made exceptions allowing younger people to use the bikes. To increase usage and accessibility of the scheme, **consideration should be given to expanding membership to include younger adults aged 16 and 17.**

4

The current scheme requires access to a smartphone and a bank account. However, as noted earlier, pilot projects have successfully provided low-cost membership (including training and support) to asylum seekers and refugees, people from low income groups, and communities likely to face barriers to cycling. This type of approach is an effective way of opening up the scheme to communities who have the most to gain from access to affordable cycling, thus addressing transport poverty. The Council and other partners, including the Scottish Government, should be building on these examples and **identifying ways to make the bikeshare scheme as affordable and accessible as possible to those in most need.**



5

Our study has been limited to solely analysing hire data. Given the important part that Glasgow's bikeshare scheme has to play in making the shift to an active and sustainable transport system, **better intelligence is needed on who uses the scheme and why**. A survey and focus groups could be used to collect demographic data on users of the scheme, **to find out what sort of trips the bikes are used for, and to gather users' views on the scheme**. Other areas of interest to focus on might include barriers to use of the bikeshare scheme, **perceptions of danger and vulnerability in traffic, the extent to which people are combining bikeshare with other modes in their journeys, and whether the scheme is encouraging new cyclists or lapsed cyclists to return to cycling**.

6

In our study we were not able to analyse e-bike use due to limitations in the data we had access to, but, assuming a breakdown of hires by bike type is made available in future, **it would be useful to examine patterns of e-bike use and to make comparisons to use of the manual bikes**.



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