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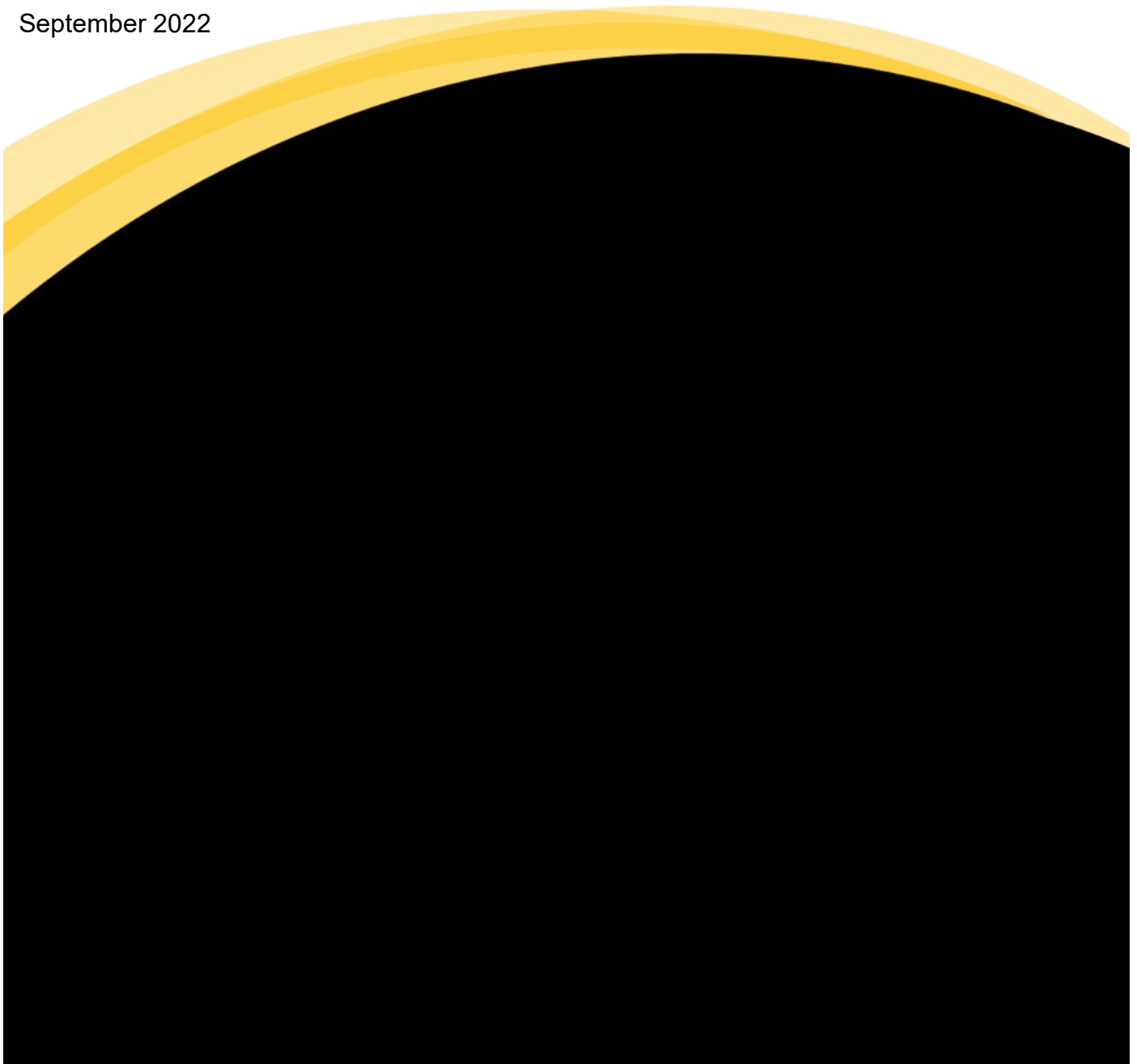
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Working from Home: Changes in Transport Demand – the Case of Greater Perth

Overview Report

September 2022



Working from Home: Changes in Transport Demand – the Case of Greater Perth

Overview Report

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About PATREC

The Planning and Transport Research Centre (PATREC) is a collaboration between the Government of Western Australia and local universities, constituted to conduct collaborative, applied research and teaching in support of policy in the connected spaces of transport and land use planning. The collaborating parties are: The University of Western Australia, Curtin University, Edith Cowan University, Department of Transport, Main Roads Western Australia, Western Australian Planning Commission and the Western Australian Local Government Association.

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Executive Summary

The COVID-19 pandemic has seen an acceleration in the rate of working from home (WFH) and elevated rates of WFH are expected to continue post-pandemic. WFH can be seen as one measure in a suite of travel demand management approaches that aim to reduce traffic congestion and thus defer expenditure on costly public infrastructure, with significant benefits to air quality, health and productivity.

The purpose of this research has been to provide in-depth knowledge on the spatial incidence of WFH, the extent of travel reduction that it can deliver and the associated productivity benefits. In understanding these aspects based on actual experience in Perth, there has also been an opportunity to develop a suite of policy initiatives designed to support the positive aspects of continued WFH, to capitalise on the wider benefits to society, while recognizing potential negative effects.

Three streams of research were undertaken to build knowledge on: Employer perspectives; Employee Perspectives; Travel patterns and scenarios to future travel based on different rates of WFH. The following questions were considered:

- the extent to which WFH has been undertaken and will continue;
- the productivity impact when WFH is compared to the workplace, from the perspectives of individuals, employers, and the economy at large;
- the proportion of reduced travel demand that is attributable to WFH;
- the utility of WFH as a future demand management tool for the mitigation of congestion on all transport networks;
- the potential for higher levels of WFH to enable expansions of the road network to be deferred or avoided;
- the policy initiatives that would be required if it became desirable to expand the level of WFH.

This report provides an overview of the key research components, including the objectives, research approach, key findings and insights for policy development. Greater detail and substantiation of these findings can be found in a series of detailed research reports (provided as Appendices to this Overview Report). This executive summary aims to synthesise the findings to provide a broad picture of the WFH impacts and potential.

Employer perspectives

The employers who were interviewed provided an understanding that the pandemic has seen a significant acceleration of WFH practice, especially compared to the pre-pandemic period, when WFH rates were minor. WFH, rather than determined by industry sector or occupation class, is determined more by the type of work task – such that all occupations have the potential to WFH for some of the time during the week. Not all employers, however, are in support of continued WFH, and WFH is less suited to those in new jobs or at the early career stage where working alongside colleagues for mentorship is needed. Nevertheless, WFH is now seen as part of the trend to provide flexible work arrangements as part of a modern business approach important to staff retention. Employers have noted that, unlike past concerns, staff productivity has been maintained or improved and this has built confidence in continued WFH. In addition, so called client-facing roles have been found to be possible to achieve via digital means rather than exclusively by face-to-face meetings.

The popular model for WFH has been the hybrid-model, usually with up to two days worked at home and the rest in the workplace. There have been changes in internal office floorspace requirements – in some cases contraction, but in others a demand for more floorspace, as a result of activity-based working and the need to improve physical distancing. There has been an interest in movement away from central office locations by some, with discussion around relocating to the suburbs closer to employees' homes. Also, use of shared workspaces in such locations (suburban work hubs) has been proposed.

Employers report that staff are keen on WFH to reduce commuting, with consequent benefits in extra time and energy for work, household tasks and exercise. Of note is that employers do not take responsibility for the work commute, particularly in terms of reducing the need to travel – although promoting this strong message of the benefits of not commuting in the light of the emergent climate change actions may see a shift in approach.

Employee perspectives

A higher proportion of white-collar workers WFH compared to blue-collar workers. It is not possible for all occupations to WFH, and only a quarter of those surveyed do so. Rather than distinguish WFH by occupation, a categorisation by roles relating to whether 'frontline' or 'flexible' may be more useful. There has been a strong preference by employees for remote and flexible work arrangements. As with employees, the view has been that the hybrid WFH model is the main option.

Where WFH occurred, it increased and commute trips reduced – to the order of 1 in 10 trips per week, or from 4.5 days to 4 days. Monday, Friday, and more recently Thursday were the highest WFH days observed in the Perth sample. Savings from not commuting were frequently converted to extra paid and domestic work and indoor recreation – both have productivity and well-being benefits.

For most, WFH improved measures of 'life satisfaction' and 'thriving'. Hybrid workers are likely to have the highest wellbeing and perform better when they have plentiful job resources (autonomy and support), manageable workloads, and styles of management and supervision to limit work-stress are addressed. This was true for both the workplace and home settings. For a smaller group there were challenges – evidenced by rates of anxiety and depression. Critical to resolving this was work-design, where the tendency for managers to closely monitor employees increased employee stress levels. It is critical that this aspect is addressed in management training if the wider societal benefits of WFH are to be achieved.

Transport demand

There has been an increase in road traffic since the onset of the pandemic, evident in inner city and inner suburban localities, but not in middle and outer suburbs. The increase can be attributed to several factors – population growth of 2.7% between June 2019 and June 2021; suspension of car parking fees in the central CBD area; and lower public transport (PT) patronage. Public transport patronage declined, associated in part to the aforementioned factors.

Since January 2022, road traffic volumes have returned to pre-pandemic levels (car parking fees have been reinstated), and public transport patronage is showing signs of recovery. Bus patronage is climbing more sharply than train, suggesting that sanitary concerns are less evident for bus passengers (also confirmed by the employee surveys) than for train passengers.

Increased levels of WFH have seen a reduction of 1 in 10 work commute trips. Given that a higher proportion of white-collar workers WFH, of note is that white collar workers reside predominantly in inner and middle ring suburbs (especially north of the river), where white-collar jobs are concentrated in city and inner suburban locations.

An important finding is that the WFH scenarios show significant transport system benefits which increase with higher WFH rates. There is a reduction in trip volumes, trip distance, travel time, and benefits remain even after scenarios for PT patronage reduction, replacement and rebound car trips are considered. Benefits are not only afforded to those that WFH, but also to those who continue to commute to work (through less congestion and faster journeys – although this may disbenefit public transport). Removing one-in-ten work commuting trips (the 10% WFH rate) has a \$204 million annual transport economic benefit for those remaining on the network and a \$395 million annual transport economic benefit to those who commute less due to WFH. The range for total transport system benefits of between \$198 million and \$783 million is based on an average individual benefit of \$3,530 per annum, which is a substantial saving.

Policy initiatives

A multi-disciplinary set of policy initiatives relevant to the Perth context are outlined, organised by policy sector: transport, environment, urban planning, infrastructure, and society (the latter including work and business practices), and to be considered as an integrated package. It is not within the scope of this research to test these initiatives; more longitudinal research would be required to illuminate their potential.

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1. Introduction

1.1. Background

Travel demand management (TDM) measures have been proposed since at least the mid-90s with the main aim of reducing traffic congestion. This in turn potentially defers the need for costly road infrastructure, with added benefits of increased road network reliability and improved air quality with positive health and productivity outcomes (Babb et al., 2014). While WFHⁱ has been widely promoted as a TDM strategy over the past two decades (Allen et al., 2015), the proportion of people telecommuting has not been large. In Western Australia the average homeworking rate was 3.4% of all employees, but with variation by occupation categoryⁱⁱ (Babb et al., 2017). The COVID-19 pandemic has changed this. Lockdown restrictions to reduce the virus spread have resulted in higher levels of working from home (WFH) arrangements for workers who can do so. With the effects of the pandemic still ongoing, and observations that some work can be completed from home with minimal negative consequences, an elevated level of WFH is expected to continue.

The COVID-19 pandemic's disruptive episode has highlighted a lack of in-depth knowledge on the spatial incidence of home-working, the extent of travel reduction, and the use of local facilities by those working from home. There has been a unique opportunity to build new knowledge on these issues, based on actual experience, and to develop approaches to perpetuate and mainstream some of the more positive behaviours and outcomes, in particular for employers, employees, transport infrastructure provision and macro-economic benefits.

1.2. Project aims and objectives

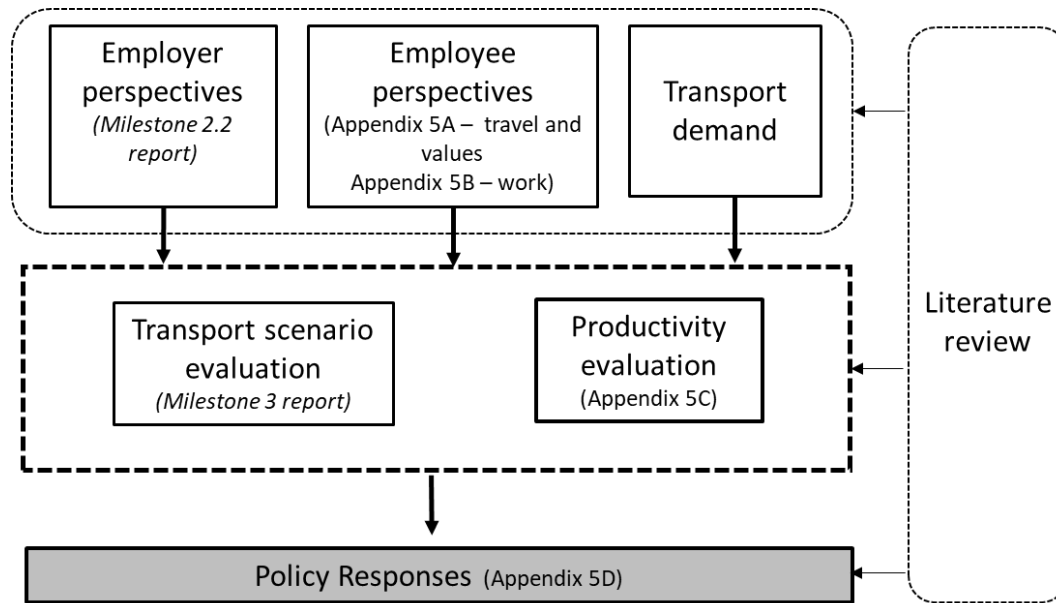
As part of an Australia-wide collaborative initiative, co-ordinated by the iMOVE Cooperative Research Centre (iMOVE), to assess the prevalence, impacts and possible future trajectory of WFH, the particular context and experience of Greater Perth was investigated by the Planning and Transport Research Centre (PATREC) during the period from late 2020 to mid-2022. The research funding has provided the opportunity to ascertain:

- the extent to which WFH has been undertaken and will continue;
- the productivity impact when WFH is compared to the workplace, from the perspectives of individuals, employers, and the economy at large;
- the proportion of reduced travel demand that is attributable to WFH;
- the utility of WFH as a future demand management tool for the mitigation of congestion on all transport networks;
- the potential for higher levels of WFH to enable expansions of the road network to be deferred or avoided;
- the policy initiatives that would be required if it became desirable to expand the level of WFH.

1.3. Research approach

The research approach was designed to provide an integrated package (Figure 1.1). This drew from three components of empirical research which fed into modelling of WFH impacts under different scenarios. This led to the development of the potential policy responses designed to support continued WFH as a travel demand management measure. A review of the literature also informed the research design and was used to set findings in a wider context.

Figure 1.1 Research approach and informing reports



The research employs a mixed methods (qualitative and quantitative analysis) to understand the potential for WFH, the benefits, enablers and barriers; to measure the proportion of reduced travel demand, attributable to WFH; to design futures/scenarios and ascertain the likely impact.

1.4. Perth’s experience of the pandemic

WFH practices varied during the pandemic depending on whether Perth or WA was in a period of mandatory lockdown. There have been 4 lockdown periods¹ since March 2020. In some of the post lockdown periods other restrictions such as wearing face masks in open and closed areas and on public transport had an impact on whether staff worked in the office or from home.

The public health directions varied for different lockdown periods. This included varying directions as to whether essential staff could continue in the workplace. One of the earliest health directions was for physical distance to be adopted within the workplace, requiring some businesses to reduce the number of staff who could attend the office at any one time. This had a bigger impact on businesses who had open-plan office arrangements.

The requirement to wear a mask also had a significant impact on the number of businesses that required staff to attend the office. Most businesses gave their staff the choice to work from home rather than attend the office and have to wear a mask all day. This also extended to those periods where mask wearing was required on public and on-demand transport. Some businesses restricted access to the workplace only to those tasks that could only be done on the premises (such as engineering workshops, laboratories etc), so that those staff had a reduced risk of infection from other staff.

¹ Lockdown periods in Western Australia: 1) 29 March to 28 April 2020 – WA wide; 2) 31 January to 5 February 2021 – Perth, Peel and South West regions; 3) 23 April to 28 April 2021 – Perth and Peel regions; 4) 29 June to 2 July 2021 – Perth and Peel regions.

1.5. The overview report

This report provides an overview of the whole research project, its findings, and reports a set of policy initiatives designed to support continued WFH in the interest of travel demand management. The following sections, organised by the main research components: employer perspectives; employee perspectives; travel; policy response, provide an overview – covering the research objectives research method, broad findings and key insights. Readers who wish to explore the detail of each research component are directed to the appendices (5A-D) and preceding milestone reports from which this overview report has been developed (Figure 1.1):

Appendices to this overview report:

- Appendix 5A: Olaru, D, Reed, T and Biermann, S 2022 Working from Home: Employee Perspectives - Travel and Values
- Appendix 5B: Knight, C 2022 Working from Home: Employee Perspectives – Work, September 2022
- Appendix 5C: Martinus, K and Smith, B 2022 Working from Home – Changes in Productivity
- Appendix 5D: Curtis, C and Scheurer, J 2022 Working from Home: Policy Response

Preceding project milestone reports:

- Milestone 2.2 report: Curtis, C 2021 Working from Home: Employer Perspectives
- Milestone 3 report: Smith, B, Reed, T and Biermann, S 2022 Working from home: Transport infrastructure demand - Scenario evaluation

2. Employer perspectives

2.1. Introduction

This component of the research project was centred on a series of in-depth interviews with Perth-based businesses. It was designed to gain an understanding of employer perspectives on WFH. The discussions centred on WFH practices and experiences before and during the pandemic², and on future plans. This included discussions about the business travel and transport policies for commute journeys and on any internal or external changes to business floorspace, such that they may bring about change in urban structure and future travel demand.

2.2. Method

Businesses were selected using three sources: the WA Land Use and Employment survey (conducted between 2015 and 2017) which provides a census of all businesses in WA; members of the Committee for Perth (by invitation); and by applying a snowballing technique to recruit more businesses. The aim was to ensure representation of businesses by industry type (focussing on those that had the potential to WFH), size (number of employees) and geography (inner city, suburban etc.). Twenty businesses from the Perth metropolitan area participated, offering a reasonable profile by industry type, size of business and geography. The interviews were conducted during June and July 2021 (two months after the first mandatory lockdown), each interview (conducted via video conference) lasted around one hour.

2.3. Findings

2.3.1. Preparedness

Most respondents noted that they were ill-prepared for a pandemic. Some had policies and procedures in place for hazard/crisis incident management and business continuity, but these did not envisage the impact of a pandemic, nor specifically address issues with WFH. Others, while reasonably prepared, still had to address several issues including IT, equipment and procedures.

Not every business had the capability for staff to access their systems remotely, nor secure IT access. There was an urgency to order equipment and furniture so that all staff could WFH. Businesses that already had well embedded WFH practices, also had to improve equipment given the potential OHS risks of prolonged WFH and had to switch to more robust video conferencing software.

Overall, businesses reflected that they transitioned very quickly to WFH, that they were impressed with their organisation and staff's ability to quickly respond and adapt.

2.3.2. Working from home practice prior to the pandemic

WFH practices prior to the pandemic were insignificant, involved very few staff, were rarely supported, and where they were supported, they were mostly permitted on an ad-hoc basis by the line manager. The culture of the organisation impacted WFH practice: the responses from interviewees was that where management relied on a culture of 'presenteeism', rather than on a performance-based approach with defined deliverables, WFH was frowned upon.

² Note that businesses were not asked to draw any distinction between their experiences of WFH under mandatory directives compared to voluntary.

2.3.3. Changes made since the first lockdown

The significant change has been an acceptance of an emerging WFH practice. There has been a variation in the return to the office in the Perth metropolitan area, with between 20% and 75% of staff returning for some days depending on the business.

Many businesses described WFH as simply an acceleration of a trend already in train, a trend building on models of flexible and activity-based working, related to diversity needs and considered to be reflective of the culture of the organisation based around fairness and equity and dictated by the type of people they wanted to attract.

The majority of businesses permitted full flexibility, allowing the employee to decide which days to WFH. This approach was more common for public sector employees. Not all staff enjoyed the opportunity to WFH. This seemed to relate to career life stage, or the extent to which the team were well established. Younger employees that had just started were more inclined to want to stay in the office in order to build up that rapport with their colleagues and benefit from mentoring. A hybrid model, with two full days WFH per week was the most common pattern. Mondays and Fridays were the most popular days to WFH.

WFH was often ‘task related’, tasks that required quiet uninterrupted time (report writing, accounts and budgeting and reviewing reports) were more suited. When employees were required to attend the office on a set day, it was related to the desire to encourage collaboration, attend staff meetings, and to build client relationships. Front-facing, or client-facing roles were the reason most often considered impediments to WFH. However, there were mixed views on this, with some noting that while traditionally it had been seen that these interactions should be done face-to-face, the experience of digital meetings during mandatory lockdowns demonstrated that this platform worked well. Face-to-face contact with clients had transitioned during this time to online web-based portals, with client expectations demanding this approach.

A key benefit for staff WFH was cited as avoiding the long commute into work. Most businesses reported that WFH had no observable negative impact on performance. Some noted that their staff were working longer hours as a result of working from home, which had prompted human resource departments to address the issue of healthy work-life balance.

WFH has resulted in changes to internal floorspace for many businesses, in some cases accommodating more staff in less space. A shift to activity-based internal space (using different spaces within the workplace depending on whether the activity is collaborative or solitary) has been significant. Most indicated that there would be no immediate floorspace or location change, others noted on lease expiry they would be seeking a change. Not every business saw the shift to activity-based working leading to a lower demand for floorspace. Some argued they need a larger area to maintain physical distance between staff.

There was an interest in utilising shared or co-worker spaces in cases where people could not work from home but did need to be closer to clients, and in cases of long travel distance to the CBD. While those in CBD locations stated they would most likely remain there in future, they also noted an interest in utilising suburban hubs closer to people’s homes, decentralised from the CBD – particularly in high-amenity locations (Scarborough, Cottesloe, Mandurah, Fremantle cited as examples), especially as commute times got longer.

Sustainable transport practices were not addressed by any business, and the majority did not have a transport or travel policy as regards commuting to work.

2.3.4. Future plans for WFH

Businesses noted that the experience of WFH had demonstrated that it was possible for their staff to quickly mobilise so that all could WFH in the event of the lockdown. Many noted the merits of a

hybrid WFH model. Advances in digital technology had facilitated WFH with for example, video conferencing becoming more seamless.

The need to resolve certain matters if WFH was to become common practice was clear, including HR policy procedures, work health and safety and financial incentives.

2.4. Employer perspectives - key insights

Key insights are as follows:

- Prior to the pandemic WFH practices were mainly insignificant.
- WA's first mandatory lockdown saw a major shift to WFH practices, and a need by businesses to equip and support staff to do so.
- As at mid-2021, there has been a significant acceleration of WFH practice with almost all businesses now practicing a hybrid WFH model (two days at home and three days in the office the most common work pattern).
- Where businesses required their staff to be in the workplace, they now embraced a more flexible working practice where it was permissible for staff to WFH on occasions.
- WFH was more suited to certain types of tasks, rather than being distinguished by occupation or industry type. The need for regular work-based social connection in order to build the workplace culture of the organisation was, and remains, necessary.
- Performance has not generally suffered with WFH. This has built confidence that WFH is effective. There were, instead, concerns with over-productivity in relation to staff working longer hours, which were being addressed as part of the business 'wellness' approaches.
- Businesses reported that staff were particularly keen on the hybrid WFH model since they could avoid a long commute into work on some days, giving them more energy and improving productivity.
- WFH practices have led to changes in workplaces with a shift to activity-based internal floor space layouts, seen as an acceleration of a trajectory to flexible working practices.
- The majority of businesses had no sustainable travel policy regarding the journey to work.
- The future of WFH practices appears to be a continuation of the new hybrid model, with operational policies being developed to support this approach.

2.5. Policy pointers

Recommendations following from this component of the research aimed at understanding and promoting WFH, in support of a range of societal benefits including:

- Examine the initiatives that could incentivise business to encourage hybrid working;
- Explore the role of urban planning in decentralising work places;
- Consider business responsibility for encouraging a reduction in the number of days a work commute is required;
- Create/ensure flexible work policies are in place to assist employees to work from home;

- Incentivise businesses to be more open to allowing employees to work from home to enable better utilisation of space and consideration of sustainability targets.

3. Employee perspectives

3.1. Introduction

This component of the research project was focussed on employee experiences of the pandemic. The aim was to investigate associations between individual circumstances, work and travel behaviour, as well as impacts of changes on transport network, and satisfaction and wellbeing, during the pandemic. The findings in relation to implications for WFH practices and commuting, and managerial and policy responses feed into other components of the research, including the transport scenario modelling.

There were two main foci:

a) employee work experiences in various locations (working from home, at the workplace, other locations, and mixed/hybrid) and its impact on performance (e.g., productivity) and wellbeing, enablers and barriers to WFH, and views on the future work and travel.

b) travel patterns with a focus on commuting and impact on time-use, mode share, travel distances and durations, use of services and deliveries and outcomes, such as satisfaction/wellbeing. Value-expressive attitudes to travel and socio-economic characteristics were applied as explanatory/control variables.

3.2. Method

The research drew from data collected from a three-wave survey of employees which were stratified by industry, type of occupation and workplace location. The commercial panel provider, Pure Profile, administered the online panel survey to all Perth and Peel panel members meeting two criteria: being over 18 and working ≥ 10 hours in the 'last week'. Recruitment sought representativeness by age group, industry and spatial distribution. The responses were collected via three modules: travel, work, values and socio-demographics, with an average duration of completion of 35 minutes.

Three waves of survey enabled changes over time to be examined:

- Wave 1 was carried out between May and June 2021, following the 3rd period of lockdown for the Perth and Peel regions between 23 April to 28 April 2021.
- Wave 2 was carried out three months after Wave 1 – between September and October 2021.
- Wave 3 was carried out between late February and mid-March 2022, which was the period just after state borders opened for Western Australia for the first time in two years, and when the Omicron cases began to surge. This was a period of high uncertainty reflecting the beginning of a new phase for WA which had experienced very few covid cases up until that point. Many persons opted to WFH in these circumstances.

A combination of descriptive statistics and longitudinal analyses was applied to the modules across the survey waves.

3.3. Characteristics of the sample

In wave 1 the sample comprised almost 2,800 respondents, about 1,500 responded to the survey in wave 2 and 750 completed wave 3. Sample attrition is a noticeable feature and the smaller sample sizes in later waves leads to lower power in all statistical tests. In all three waves there was a gender bias with more females (66%) than males (34%). Two in five respondents (43%)

were ‘couples with children’, one in four were ‘couples without children’, and one in eight a ‘lone person household’. In terms of age distribution, there is a marginal change in the sample, with fewer young respondents and more mature 45-54 years respondents participating in the later waves.

Just over one-third of the sample were employed by small businesses (less than 50 employees) and about the same proportion of the sample worked in large businesses (over 500 employees). Compared to the WA business size, this highlights a ‘sample bias’ towards employees from larger companies. In terms of employment status, the sample was dominated by those in paid employee full-time work (58%-65%), then those working as a paid employee part-time (29%-32%), only a small proportion were self-employed (5%-7%), with some describing their employment status as ‘other’ (3% to <1%).

Respondents were assigned to one of three occupation groups: ‘flexible’ (17%), ‘frontline/essential’ (40%), or ‘mixed’ (43%) (Table 3.1). This classification was employed in an effort to understand the possibility for a given occupation to work from home (WFH), and was confirmed by analysis of the data which showed a similar pattern of association ($p < 0.001$) between frontline occupations and working mostly in the workplace, and between mixed occupations and work either in the workplace or hybrid. Unsurprisingly, the flexible occupations are more evenly spread across the three locations.

Table 3.1 Classification of occupations (ANZSCO Major Occupation Groups) and industries (ANZSIC Divisions) by WFH potential

	Flexible	Mixed	Frontline/essential
Occupation	Managers and Professionals	Technicians, Trade Workers, Community and Personal Services, Clerical and Admin Workers, and Labourers	Machinery Operators and Drivers, and Sales
Industries	Electricity, Gas, Water, Waste Services; Wholesale Trade; Info and Media Communication; Financial and Insurance; Professional, Scientific, and Technical Services	Agriculture; Mining; Construction; Rental and Real Estate; Admin and Support; Public Admin; Education and Training; Arts and Recreation; Other	Health Care and Social Assistance, Retail; Manufacturing; Accommodation and Food; Transport, Postal, Warehousing

3.4. Employee work experiences

The findings are presented on the experiences of employees as they managed changes owing to the pandemic. The pattern of work is evaluated (in terms of location of work) and the experiences of work. This sub-component of the research is more fully described in Appendix 5B.

3.4.1. Work patterns

Work design has not changed substantially across waves. The only exception is in the number of hours worked, which increased over time (from a mean of 32.33 hours in wave 1, to 34.90 hours in wave 2 and 35.27 hours in wave 3).

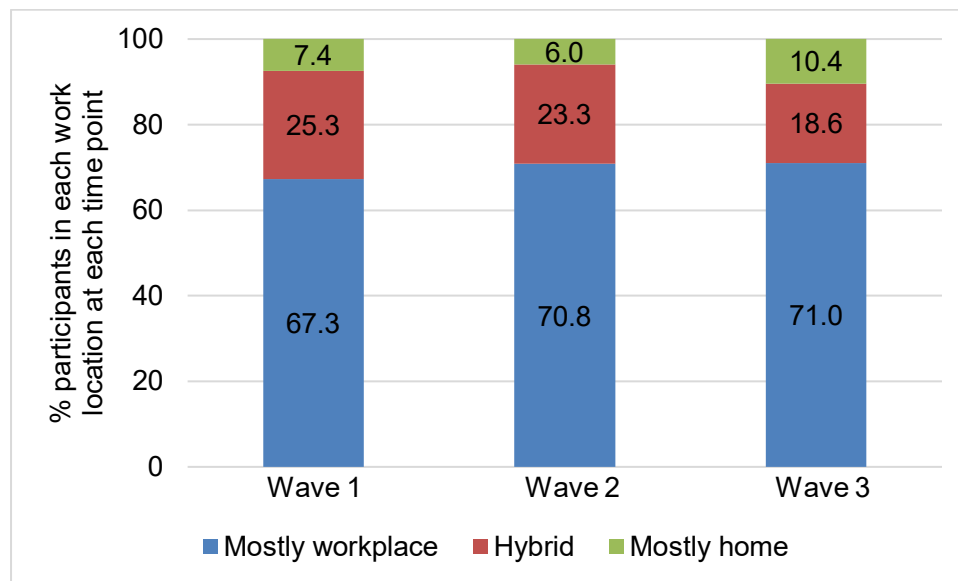
Respondents were classified based on their work location:

- i) mostly in the workplace (WPL);
- ii) mostly from home (WFH); and

iii) hybrid, referring to time spent working in the workplace and at home, whether that be part days or whole days.

The majority worked mostly at the workplace, the second largest group were classed as hybrid since they worked at home or at the workplace, the smallest group worked at home. Over the three survey waves there were increases in the number of people working mostly in the office and those mostly at home, but a decrease in the number of hybrid workers (Figure 3.1).

Figure 3.1 Percentages in each work location group over time



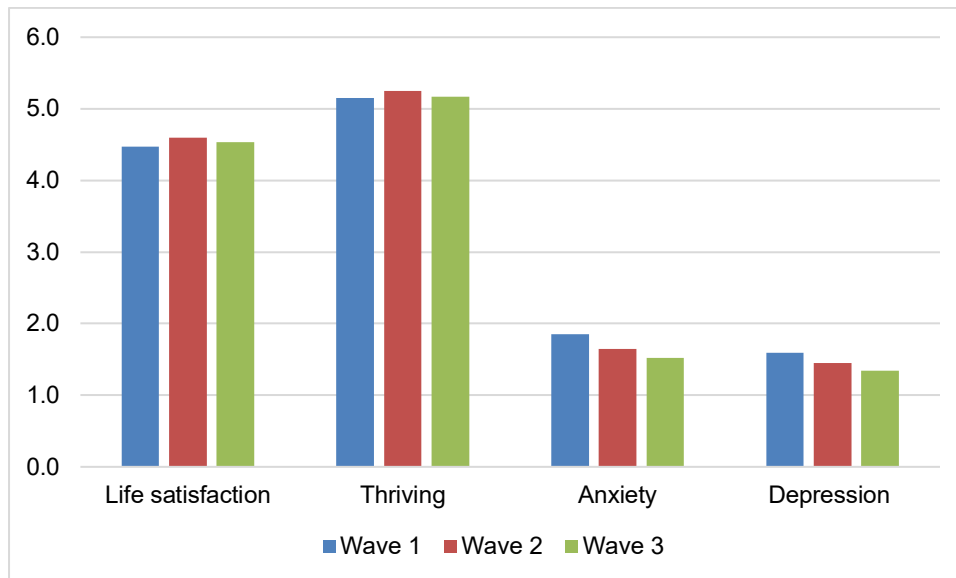
Work location depended on occupation and industry, with those in flexible occupations and industries more likely to remain hybrid. Those who stayed hybrid over the three time points had greater influence over where they worked and perceived that they were more proactive in relation to organising and completing their work tasks, than those who completed their work activities in the workplace.

An important finding is that the flexibility of WFH is desired by all occupations, with respondents expressing their preference to work from home (or remotely) more time (more than 29%) than they currently do (on average 16%). However, the WA sample consistently indicated a very low level of influence on their work location (less than 15% reported strong or very strong influence on the place of work).

3.4.2. Employee work experiences

Work experiences, wellbeing, and performance remained stable over the three waves with a higher proportion of respondents reporting positive experience ('life satisfaction' and 'thriving'). Experience of anxiety and depression were also reported, and these negative experiences significantly improved by Wave 3 compared to earlier waves (Figure 3.2). It should be noted that WA's borders opened on March 5th 2022, in the middle of wave 3 data collection, which could explain these results; for some, anxiety may have decreased due to the knowledge that they could travel again and reconnect with family and friends. In addition, the prevalence of Covid was lower than previously, and vaccination rates were very high, which could have reduced fear and anxiety related to catching the virus.

Figure 3.2 Mean scores for each general wellbeing outcome over time (Note. Life satisfaction and thriving were measured on a 7-point scale; anxiety and depression were measured on a 4-point scale)

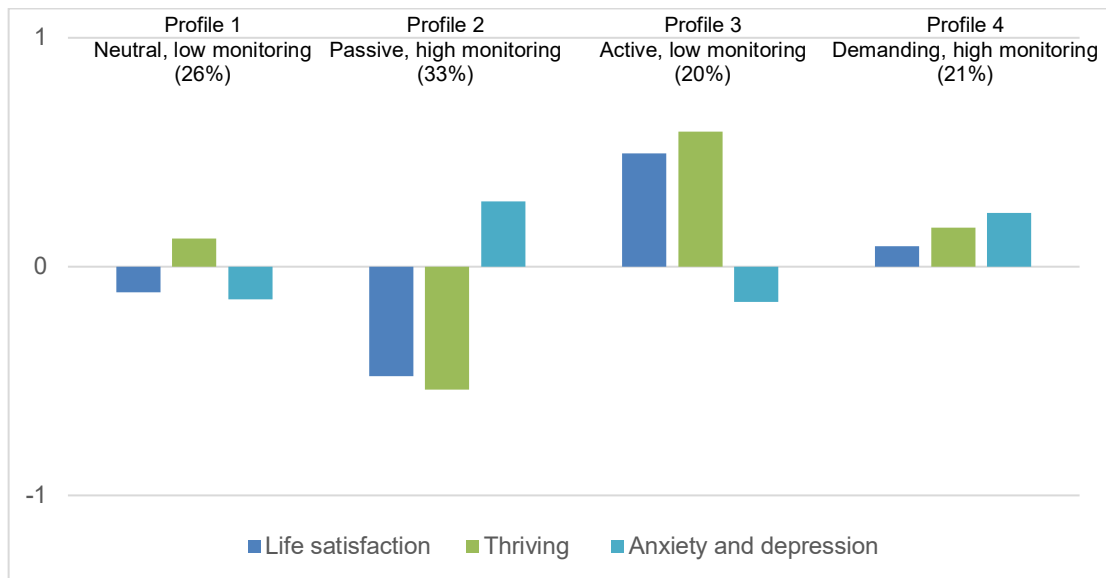


Colleague support was an important driver of job satisfaction, lower loneliness, and higher adaptivity and proactivity, while high home-work conflict drove burnout. Lower home-work conflict drove vigor, job satisfaction, proficiency and productivity. This concurs with established work design literature which shows that job resources drive positive outcomes and job demands drive negative outcomes.

For the group of hybrid workers, four work design profiles were observed – these were similar between the two work locations (home and workplace) but they varied in terms of work characteristics:

- 1) a profile low in close monitoring with average resources (autonomy and support) and workload (neutral, low monitoring profile);
- 2) a profile high in close monitoring with low resources and workload (passive, high monitoring profile);
- 3) a profile very low in monitoring with high resources and above average workload (active, low monitoring profile); and
- 4) a profile very high in monitoring with above average resources and the highest workload (demanding, high monitoring profile).

General wellbeing outcomes, life satisfaction and thriving, were predicted by profiles high in autonomy and support (profiles 3 & 4) whereas anxiety and depression were highest in profiles where close monitoring was highest (profiles 2 and 4), regardless of the level of job resources (Figure 3.3). This demonstrates that monitoring individuals can lead to stress, irrespective of the level of job resources. These are not effective for buffering the negative effect of close monitoring on wellbeing.

Figure 3.3 Relationships between the work-design profiles and work experience

3.5. Employee travel

In this section changes in travel behaviour over time are evaluated and the antecedents of travel and its immediate or more distant consequences/outcomes are identified, both for transport and for individuals (satisfaction and general wellbeing). This sub-component of the research is more fully described in Appendix 5A.

3.5.1. Commuting behaviour

Commute frequencies pre-COVID were reported at around 4.5 times per week and this reduced by around $\frac{1}{2}$ a day per week since the pandemic started. The commuting distance has reduced, while the commuting time appears to have increased by 3-4 minutes. Potential reasons that may explain this variation include: smaller sample sizes and stronger effect of the outliers in waves 2 and 3, and changes in travel modes; however, the increase may also reflect the increasing road congestion conditions between 2021 and 2022.

The majority of the sample were car users (driving and passengers), staying between 78% and 79% throughout survey waves. PT users took a 15.4% share in wave 1, reducing to 13.1% in wave 3. Active travel users also decreased (from 3.7% to 3.4%). Changes were not statistically significant, given the substantial variability in the samples each wave. It is important to note that the survey sample included substantially more PT riders than in the population, a reflection of the objective of the surveys (to capture commuting behaviour) and sample conditions (>10 hours' of weekly work last week, adequate coverage of all industries and occupations).

While commuting frequency has not changed significantly across the survey waves, the distribution of days indicates that more individuals WFH exclusively and fewer individuals commute 5+ days. Considering that before the COVID pandemic, about 57% of the respondents commuted 5 days a week and by wave 3 this percentage was 41%, the reduction in the number of times employees travelled to work is substantial.

Monday and Friday, and more recently (wave 3), Thursday, are the days with the highest WFH during the working week. This is consistent with commuting patterns reported in other Australian capital cities or inferred from aggregated data (e.g., Google mobility data).

In terms of main work location (workplace, hybrid mode, and WFH only), most respondents who commute into the workplace are from middle ring suburbs, while many WFH respondents are from outer suburbs. These findings contrast with Currie et al. (2021), who found stronger mode shift and decline in PT ridership in inner areas compared to middle and outer suburbs in Melbourne (the expected long-term drop off in PT commuting in the CBD was much larger, 20%, than overall, 6%). Spatial analysis of commuting patterns highlighted that the main origin-destination pairs preserved the focus on the CBD and the main activity centres (Mandurah, Rockingham, Fremantle, Armadale, Canning Vale, Morley, Midland, Osborne Park, Joondalup).

3.5.2. Non-commuting behaviour

The duration of trips for other non-work purposes (shopping or medical appointments) showed that, apart from education, there were no significant changes across the waves, primarily due to the substantial variation at each wave across the sample (including inter-state travel). The reduction in travel for education (the only significant change across waves) is explained by the decision of the tertiary education institutions to deliver online classes, especially at the beginning of the 2022 academic year, although that shifted in the second half of 2022. Across purposes, shopping for groceries, clothing, and medical appointments had the longest durations.

Working from home has led to changes in the daily use of time, with substantial variability in activities (Personal time, Employment, Education, Domestic, Childcare, Purchasing, Voluntary, Social, Recreation, Travel) between wave 1 and wave 3 ($p = 0.016$), particularly for those working mostly at home and in the hybrid mode. Re-optimising working arrangements has led to individual commuting time savings (on average 34 minutes/week) which were primarily converted to additional paid work, house matters, and indoors recreation, with no significant differences across the waves 2 and 3.

Overall, online deliveries are at higher levels than before the pandemic (e.g., 0.1 to 0.3 more food, groceries and home services deliveries/month and 0.28 to 0.54 more monthly deliveries for other purposes, such as clothing and electronics), which confirms the general increase in e-commerce world-wide. Online deliveries reduced, however, between 2021 and 2022, for food and groceries and home services, but slightly increased for deliveries for other purposes, e.g., clothing, electronics.

3.5.3. Predictive models for travel and WFH

To understand the likely effect of WFH on travel behaviour and personal wellbeing, a number of predictive models were estimated using various regression-based modelling techniques. These models investigated the relationships between a response variable (dependent variable), e.g., commuting frequency, mode of transport, or decision to travel to work on a particular day of the week and multiple predictors (independent variables). Structural equation models then combined the separate models, to better reflect the complexity of the associations.

The number of commuting trips and their duration depend not only on the socio-demographic circumstances, occupation (particularly those classified as frontline), and travel characteristics, but also on work patterns (number of hours WFH). The key insights from the predictive modelling that suggest a policy response if WFH is to be supported, are as follows:

- There is growing support for WFH practices and an increasing willingness to adopt WFH by different socio-economic segments.
- Work design characteristics (autonomy, workload, close monitoring, support from the managers and colleagues, suitability of the workplace, etc.) explain most of the variability in the proportion of WFH hours in wave 2 (i.e. Sept – Oct 2021), and the influence perceived by the respondent in choosing the location for work. Lack of colleague support

negatively affected the proportion of hours WFH. Limited influence on choice of work location is increasing the frequency of commuting and eroding overall life satisfaction.

- Those who WFH, to a larger extent, seem to have longer commutes.
- Car commuting is positively affected by the availability of free parking at the workplace and number of stops included in the commuting travel, but negatively affected by the proportion of hours WFH. This suggests that commutes including more stops are more likely to be by car, also employees who benefit from free parking are more likely to be encouraged/‘enticed’ to commute by car.
- Commuting by PT is also influenced by the availability of free parking at the workplace and number of stops included in the commuting travel, however in the opposite direction to car commuting.
- Free parking at work is associated with shorter commutes and the number of stops is increasing the commute.

The constant finding across all models for commuting or not commuting is the perceived level of flexibility (influence over choice of work location), which means that respondents with little flexibility in their work and who also perceive pressure from their employer, are continuing their commuting pattern, most probably requiring arrival at fixed times for work.

3.5.4. Barriers and enablers to working from home

Three open-ended questions were thematically coded to understand barriers and enablers to WFH:

- “What were some of the obstacles to getting your preferred mix of home/workplace paid work?”;
- “If you could work from home, are there any local facilities that would make it easier for you to do so?”; and
- “Please tell us about the impact COVID-19 had on your circumstances and your expectations about work and travel in the future.”

Of the barriers to WFH, the highest proportion of cited reasons concerned the nature of the work which made WFH not possible (around 40%). Management decisions and company policy accounted for around 23% of responses, of a similar order to those concerning personal decisions – such as child-care or a preference to work in the office. Around 12% of reasons related to inadequate infrastructure for WFH, such as size of the home or lack of company-provided IT equipment.

Of the enablers, better internet (reliability and speed) accounted for 26% of the responses. Then local facilities (libraries, home equipment stores, cafes, grocery, and food delivery services) were important.

3.6. Changes in productivity

The redistribution of time by workers who had reallocated commuting time to other activities through WFH practices was examined. The productivity analysis focuses on, firstly, the total time reallocated from commuting to work to more work hours, as an indicator of increased output, and secondly, the total time reallocated to non-work activities as a measure of productivity gains. The

underlying assumption being that commuting time is an unproductive component of work (cf. Barrero, Bloom and Davis, 2021).

The findings in this section of the research are based on data from the Wave 3 survey (February-March 2022). This sub-component of the research is more fully described in Appendix 5C.

In wave 3, the largest proportion of workers stated they worked mostly in the office last week (410 of 564 respondents), while 104 out of 564 worked a hybrid model and 50 out of 564 worked mostly at home. In this wave, self-reported WFH rates were approximately double the levels for the pre-COVID19 period.

Only those respondents who were engaged in paid employment were selected (466 respondents), as it was assumed that they were the group most likely to commute and therefore receive productivity savings when not commuting. Self-employed survey participants were excluded from the data used in this report as the focus was on the productivity in the workplace.

The survey included a question on household income where respondents were asked to indicate whether they were '(significantly) above', about the same or '(significantly) below' Australia's median gross income of \$120,000. This question provided the basis to calculate individual incomes by assuming: 1) there were 1.7 income earners per household (ABS, 2021) or, 2) the ratios between reported deciles of household income (ABS, 2021). Most respondents reported a gross household income of about the same (145 persons or 25%) or above (144 persons or 25%) the Australian median of \$120,000.

3.6.1. Commuting time reallocated to work

A third (34% of respondents, n=154) reported fewer commutes in wave 3 compared to pre-COVID19 times. The average one-way commute time for these respondents was 38.5 minutes, meaning that a non-commute day allowed for 77 minutes to be reallocated. Respondents reporting increased WFH days had longer commutes on average than the total sample (34 minutes).

Average WFH rates doubled from pre-COVID time rates, with respondents reallocating commuting time to paid work (40%) and non-paid work (60%) activities (ordered by housework, shopping and personal business at 20%, indoor recreation such as watching TV at 19%, and exercise/outdoor leisure at 13%).

The number of hours reallocated from commuting to work is reasonably stable over the five income classes, except for the 'significantly above' class which allocates more than one-hour.

Increases in WFH equated to a little over 1 hour (66 minutes) allocated to work with 82% (28% of all respondents) reallocating less than 2 hours to work. The average reallocation to work is equivalent \$45 per individual, the implication is that employees are contributing (possibly unpaid) hours to their job.

3.6.2. Commuting time reallocated to domestic or leisure activities

When productivity was measured by converting 'unproductive' commuting time into domestic or leisure activities, there was an implied productivity gain of 1.84% for the entire sample and 5.4% when only respondents who recorded greater WFH levels were considered.

3.7. Employee perspectives – key insights

- WFH is not possible in many occupations. Only around a quarter of employees in Wave 1 reported working a hybrid WFH model. This suggests that hybrid work is likely to remain an option only for some employees.

- Compared to the pre-pandemic period, WFH increased and commuting reduced.
- Monday, Friday, and in wave 3 Thursday, displayed the highest WFH³ rates. Wednesday has become the highest commuting day.
- Presence of free-parking and nearby parking is positively associated with car driving and negatively associated with public transport use.
- While the commuting time increased from wave 1 to wave 3, the total weekly commuting time reduced due to trip infrequency.
- Preferences for remote and flexible arrangements are strong – particularly in the ‘flexible’ occupations and industries.
- Savings from commuting time were primarily converted in extra work (both paid and domestic) and indoors recreation. This supports productivity benefits and improvements in observed in the employee wellbeing indicators.
- Based on respondent expectations, the frequency of WFH will continue to increase in the future, and frequency of commuting will continue to decrease, even if currently trends and observed changes in traffic volumes and ridership do not reflect a lower total transport demand.
- Whilst hybrid work comes with benefits such as reduced commuting stress and increased time for other activities, it also comes with challenges. These challenges include a tendency for managers to closely monitor employees thus increasing stress, or increased loneliness (if needs for support and connection are not met).

3.8. Policy pointers

Recommendations flowing from this component of the research include the following:

- Hybrid workers are likely to have the highest wellbeing indicator scores and perform better when they have plentiful job resources (autonomy and support), manageable workloads, and styles of management and supervision to limit work-stress are addressed, as well as addressing loneliness through programs of connection (especially with colleagues) and support. This was true for both the workplace and home settings.
- Creating flexible work policies within organisations helps to formalise the ability of employees to WFH, meaning that employees are able to ask for flexible working options regardless of whether their immediate manager supports it or not.
- Understanding the reduction of PT patronage since the pandemic began is key. Ridership is being potentially eroded WFH, fear of infection and the provision of free parking (among other things). ‘Stick’ (push-measures) such as reducing free parking and promoting other financial disincentives for car users, to reverse impacts on PT patronage may be warranted. Combined with the 2-zone fare cap introduced in Perth on January 1st, 2022, it is expected that medium to long distance trips, will be substantially cheaper by PT than car, thus offering a stimulus for reviving ridership.

³ or from other locations

- The WA respondents indicated that PT hygiene and risk of contamination were not the main reasons for switching to other modes, instead decisions on commuting related to trade-offs made between time and travel convenience and amount of WFH. The lack of significance of the crowding or social distancing on mode choice is context specific, as in WA, following the lockdowns, the government has not enacted shut-downs of PT or recommended the public avoid riding PT. In Mar-Apr 2020, PT services were reduced for a short period and after March 2022, some routes may have had reduced frequency due to driver COVID-19 related illness.
- Individual active transport became increasingly important during first months of the pandemic and is likely to continue in the future, thus integration of these modes as a first / last mile choice is expected to have positive flow on effects for PT. Promoting/enhancing PT as an enabler of multimodal trip chains, embedding active transport and electric mobility before or after a PT journey, is likely to be an effective boost to ridership. To this effect, better integrated traveller information systems are needed to guide PT riders, to inform them of seating capacity and how best to combine modes, as well as reducing the negative effects of delays (i.e. lack of reliability).
- Increasing the proportion of WFH (or from other locations) can be combined with work staggering to enable peak spreading. Data from the current PATHS survey would complement the current findings and benchmark the commuting behaviour with data just before the beginning of the pandemic. Peak spreading would benefit PT by increasing reliability, easing crowding, and increasing all day utilisation.
- Business decisions by managers, as well as by employees are critical to the achievement of these outcomes. To this end, companies could be incentivised to be more open to WFH and promote flexible working times, in addition to productivity and wellbeing effects, better utilisation of the space and consideration of sustainability targets may be achieved.
- The economic activity in the neighbourhoods and around workplaces (retail, hospitality, recreation, health) must be re-evaluated with potential to reduce congestion in the CBD.
- Increasing rates of WFH in the future means that traditional workplaces/offices will need a redesign and re-use/re-purpose. This also means that the functions of home, workplace, and school may have merged, and that centralised/decentralised structures of the city and information/electronic interactions must be re-considered.
- Attention should be paid to the individual values and attitudes, to capitalise on positive views of PT and the uptake of active travel and alleviate concerns or improve perceptions of PT being 'less convenient'. Related to this, the image of other shared modes (e.g., car-pooling) needs to be rebuilt as safe environments, with minimal risk of infections/contamination. This will counteract the trend of car traffic activity returning to the levels seen before the pandemic (or even higher), withdrawing the positive environmental impacts seen in 2020.
- An important effect of WFH is the overall increase in well-being. The increased relevance of non-monetary components of quality of life should be considered as a wider effect in evaluating transport options.
- Online home deliveries (representing substitutes for on-site shopping and some leisure activities) increased during the pandemic and their use may continue in the future at similar rates. Urban logistics and the courier, express and parcel segment have shown high growth rates compared with their role pre-COVID. A detailed analysis of non-work trips (enabled by the PATHS data) may clarify the extent of the substitution patterns.

4. Travel demand

4.1. Introduction

This component of the research examined recent trends in travel and travel impacts of WFH on the Perth transport network.

Scenarios were developed to explore travel behaviour responses concerning: 1) the magnitude of change in commuting and associated economic impacts for different levels of WFH; 2) mode shift away from public transport; and 3) 'replacement' and 'rebound' effects with shifts from commuting to 'other', non-commuting trips.

The scenarios (not forecasts) were intended as inputs for the 'policy development' component of the research, such that policy could be designed to shift network demands towards the outcomes of more desirable scenarios (i.e., those with higher social benefits).

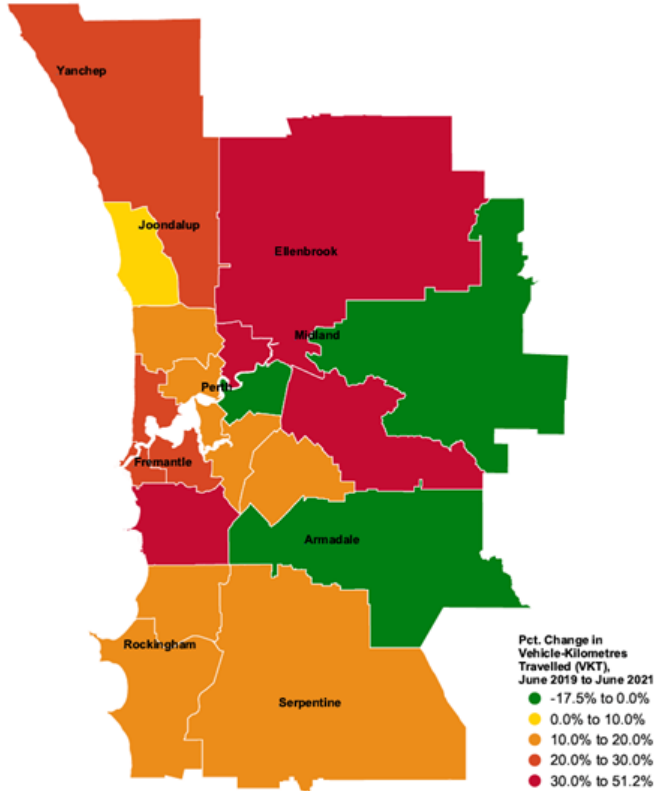
4.2. Travel demand before and during the pandemic

Secondary data was consulted and analysed to confirm any changes in Perth's transport network demand during the pandemic compared to pre-pandemic levels (2019). The aim was to quantify the size of any change, and to understand the changes on Perth's road and public transport networks.

Main Roads WA (MRWA, 2022) reports traffic volumes and speeds in 15-minute increments throughout the Perth Metropolitan State Road Network (PMSRN) on routes representing major arterial roads, freeways and highways. This source was consulted to understand the changes in vehicle-kilometres travelled (VKT) in periods prior to and during the COVID-19 pandemic.

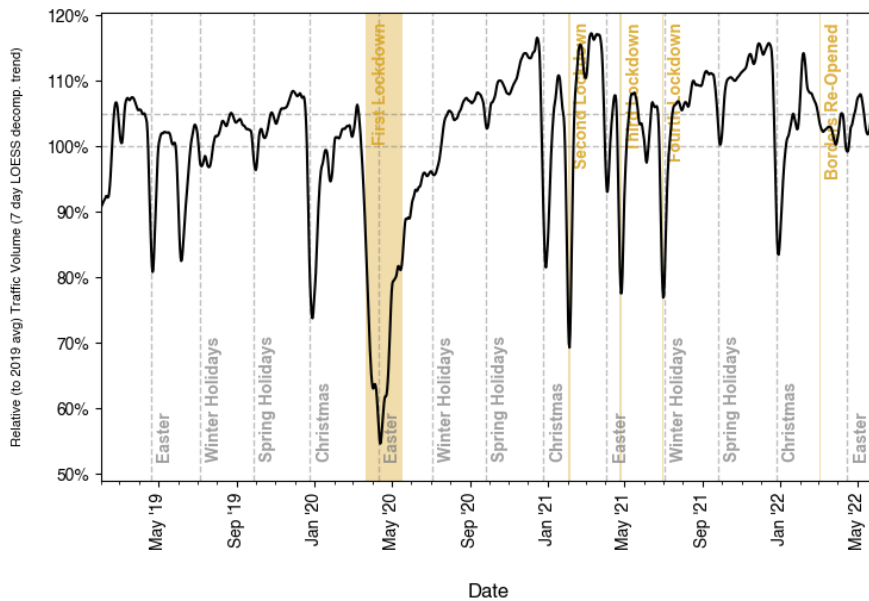
Between June 2019 and June 2021 VKT increased in some areas, but not all – indeed in some localities VKT decreased (Figure 4.1). It should be noted, however, that the population of Greater Perth is estimated to have grown during the pandemic from 2.086 million people (Australian Bureau of Statistics, 2020) in June 2019 to 2.142 million people in June 2021 (Australian Bureau of Statistics, 2022), an increase of 2.7%, which may have affected network utilisation. The increase in VKT is most notable in the inner-eastern suburbs; however, in early 2020, the NorthLink extension of Tonkin Highway opened, adding 22 route-kilometres to the PMSRN (Government of Western Australia, 2020), directing traffic onto the network that may have previously taken non-PMSRN roads. Nonetheless, it is pertinent to note the increase in road utilisation (as measured by VKT) in other areas, including the north-western corridor, western suburbs and inner-southwest, compared with the reductions in central and eastern areas. Additionally, it should be noted that charges to park in council-operated car parks in the Perth CBD were suspended during the pandemic period which may have induced car travel.

Figure 4.1 Percentage change in vehicle-kilometres travelled (VKT) per SA3 in June 2021, compared to June 2019 (Data source: Main Roads WA)



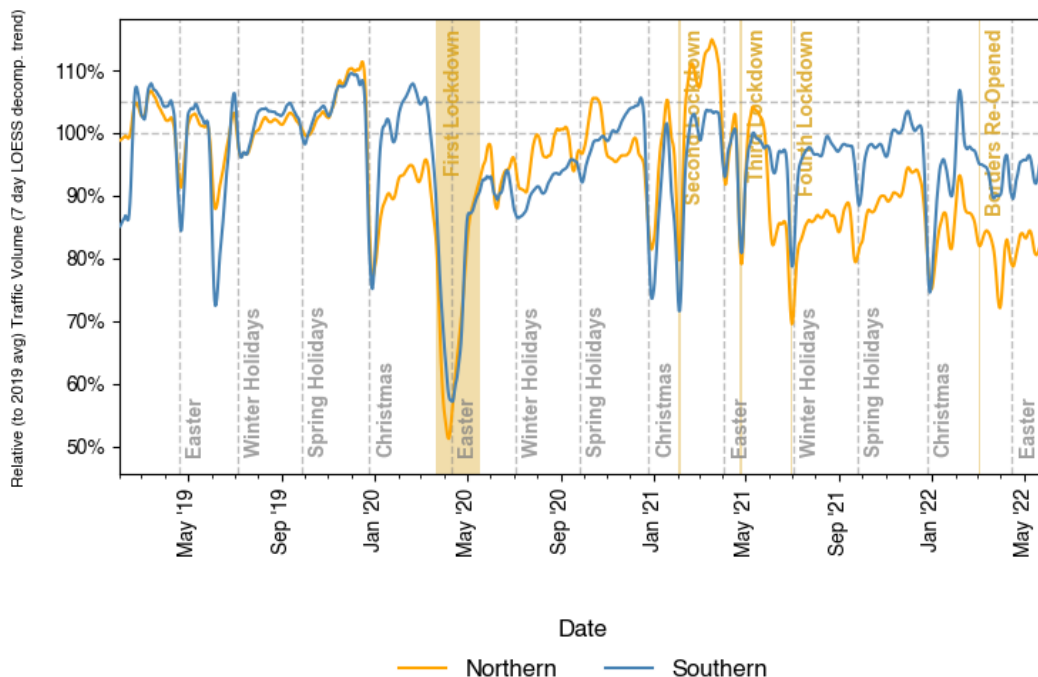
The major arterial road network across the Perth CBD cordon saw increases in vehicular traffic, starting gradually after the first lockdown and surpassing pre-COVID (2019) levels by June 2020 (Figure 4.2), with a decrease in traffic volumes during the four lockdown periods evident. Since the WA borders re-opened in March 2022, the upward trend in vehicular traffic is no longer evident – instead the traffic demand mirrors that of the pre-COVID period.

Figure 4.2 Average change in all day traffic volumes across Perth CBD cordons



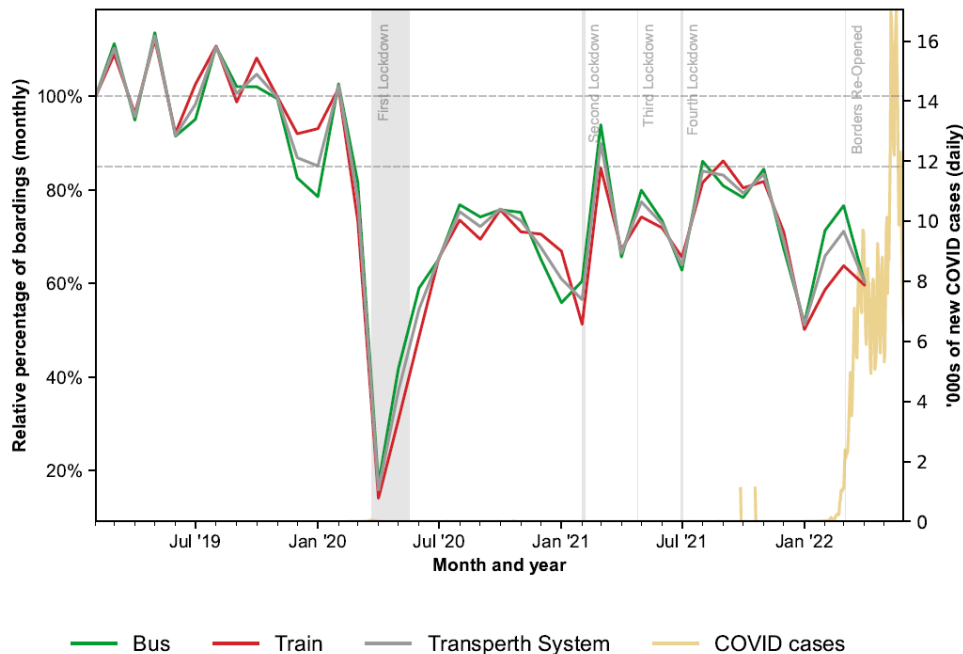
Suburban traffic volumes, on the other hand, have decreased during COVID compared to pre-COVID conditions (February 2019) (Figure 4.3). The trend is indicative of low levels of replacement trips during the day that were thought to have occurred with WFH participants making a higher level of localised trips, with cautionary note that the selected sites are on major arterials where the confidence in data quality is high. These data support the employee surveys, where respondents reported low incidence of rebound trips (trips that would otherwise been prevented due to the constraints of being at the workplace). Post Easter 2021, the volume of traffic in the northern suburbs was down 10% to 20% compared to pre-COVID. Whilst road works on the Mitchell Freeway may have diverted some through trips away from the data collection stations (Mitchell Freeway was purposefully removed as a primary data point), that alone would not account for the degree of change. There is no clear explanation for such a contrast between northern and southern suburb traffic volumes.

Figure 4.3 Average change in all day traffic volumes – selected suburban sites



With regard to PT utilisation, there has been a decline in patronage, especially in journeys towards Perth from defined catchment areas. This is supported by Public Transport Authority (PTA, 2022) data, which shows that monthly boardings for bus and train modes were 85% lower during late-2021, compared to boardings before COVID in February 2019 (Figure 4.4). Since January 2021 mask wearing on PT was mandatory, this may have contributed to some travellers avoiding PT. The recovery of bus ridership outpaced that of rail. This is supported by the employee survey whereby respondents report a focus on economic variables (cost and time) as the factors that keep them from returning to PT. It is possible that given the concentration of full-fare paying commuters on the rail network, the gap between bus and rail recovery is evidence of continued WFH habits among Perth’s commuters.

Figure 4.4 Relative change in monthly public transport boardings by mode and for the overall system, February 2019 (base) to April 2022 in relation to number of new COVID cases ('000) (Data source: PTA; WA Department of Health)



4.3. Scenarios for future travel demand based on increased Working from Home

Scenarios were modelled to examine the effect of differing levels of WFH on Perth’s transport network (private vehicle and PT). The scenarios were aimed to inform policymakers on the travel and economic outcomes of various levels of WFH and changes in commuting mode shares. The scenarios provide ‘what if’ possibilities, rather than forecasts or a study on the factors affecting the level of WFH.

Based on the wave 1 employee survey it was estimated that one-in-ten daily private car commuting trips were removed from the network due to increased WFH levels—110,900 of 960,000 trips. Blue collar trips comprised 25% of these trips removed and white collar comprised the remaining 75%. PT trips were reduced by 17,400.

4.3.1. Method

The scenarios were developed by drawing on the findings from the ‘Employer and Employee perspectives’. The inputs are largely based on changes in WFH rates (from pre-COVID-19 to ‘last week’, during COVID-19) derived from the Wave 1 employee survey (conducted during May–June 2021).

Scenarios were modelled using the Department of Transport’s Strategic Transport Evaluation Model (STEM) which models traffic within the Perth metropolitan and Peel regions. The methodology used to develop and evaluate scenarios includes a description of the four-step transport model used, scenario-framing assumptions made and resulting scenarios formulated. The results of the scenarios are also run through the Strategic Transport Evaluation Model (STEM) and the adapted STEM-linked economic appraisal module in order to examine the relative performance of the various scenarios in terms of cost and benefits, highlighting some implications for WFH policy development, specifically relating to:

- trip volumes,
- trip distances, and
- trip durations.

STEM forecast for 2021 (based on the 2016 Census) with no COVID-19-related effects provided the modelling base case for the scenarios. The scenarios were run for the single year – 2021 – by adjusting the base for COVID-19-related effects.

Transport-related economic benefits for each scenario were calculated using the economic appraisal module linked to STEM. Economic benefits due to less traffic and congestion, lower vehicle operating costs, benefits to light and heavy commercial vehicles, and externalities such as lower crash rates and reduced noise and air pollution were considered. Broader economic benefits and costs beyond transport, such as negative impacts on businesses in the CBD, were not included.

Adjustments were made to the economic appraisal module to distinguish costs and benefits related to those accruing to:

- 1) travellers commuting less due to WFH, i.e., removal of trips from the network, and,
- 2) remaining/continuing travellers who would experience faster travel times due to fewer travellers on the network.

4.3.2. Scenario framing

Scenarios were framed using different combinations of assumptions in changes to commuting trip production and trip attraction for:

- white-collar and blue-collar workers,
- a mode shift from public transport to private vehicles (cars), and,
- shifts from commuting to ‘other’ (non-commuting) trip purposes.

The distinction between white and blue collar workers was made given that opportunities to WFH varied by occupation. Generally, white collar workers had greater flexibility to WFH (Table 4.1). The categorisation is a coarse distinction, given that the findings of WFH flexibility are found to be related more to work task, rather than necessarily occupation categories (see section 2).

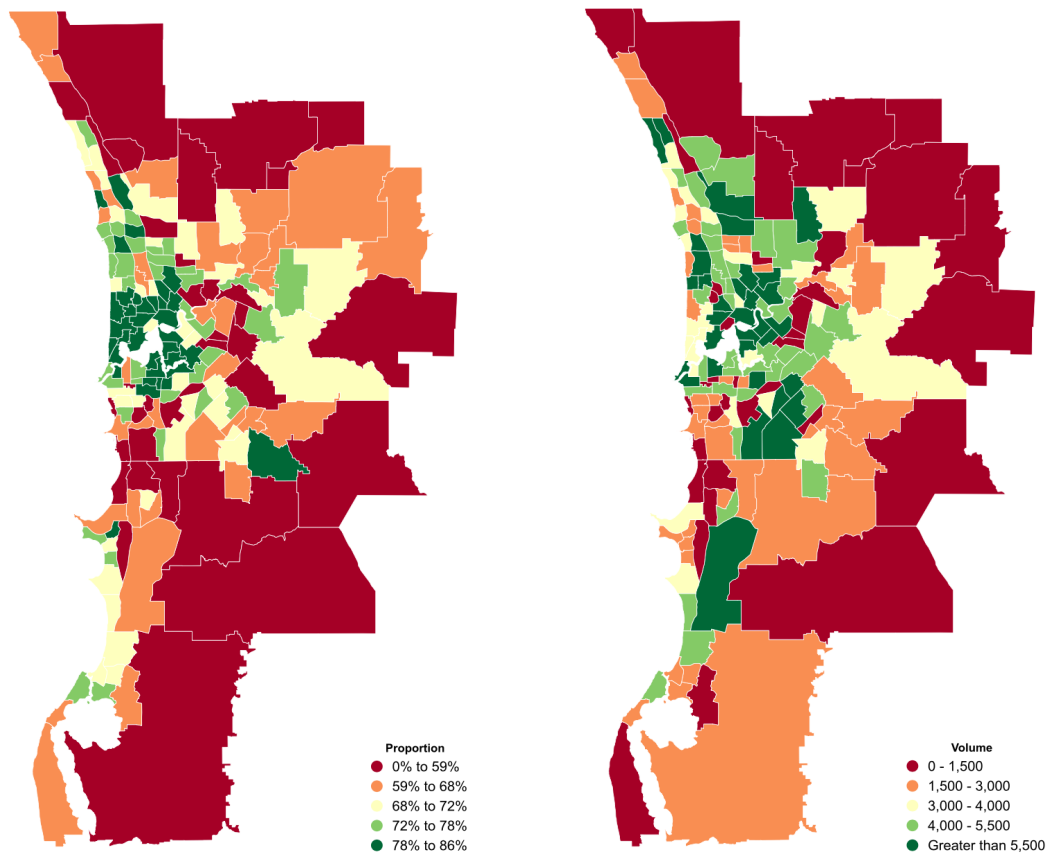
Table 4.1 Assumed WFH Rates based on Wave 1 employee survey results

Type of job	Average no. of commuting days ('pre-COVID')	Average no. of commuting days ('last week')	% WFH rate (per worker, per week)	Commuting trips removed from the network (per week, per job)
White collar	4.33	3.91	12.3%	1.08
Blue collar	4.61	4.22	9.4%	0.83

Figure 4.5 provides a visual representation of the proportion of white-collar jobs (attraction) within Perth for each region (with the balance being blue-collar jobs), and the location of residence

(production) of white-collar employees. The highest intensity of white-collar jobs is found predominantly in the inner suburbs, including the Perth CBD, and middle suburbs north of the river. White-collar workers reside in these same suburbs, but also extend to middle ring suburbs south of the river and outer suburbs north of the river. As such, in the middle to outer metropolitan areas, in some regions there is a mismatch between white-collar job intensity and the number of white-collar employed residents, suggesting that these residents travel between regions to work.

Figure 4.5 left: Proportion of white-collar jobs by STEM zone
right: Numbers of white-collar employees residing in each STEM zone



Three key assumptions were used to frame the scenarios:

- 1) The change in WFH rate (change in average number of commuting days per worker, per week, relative to before COVID) in wave 1 was about 11.5% (rounded to '10%' for scenario naming purposes), with 12.3% applied to white-collar workers and 9.4% to blue-collar workers, resulting in a commensurate number of commuting trips removed from the network⁴ (Table 4.1). Any WFH that occurred in the 'pre-COVID' is not factored in as a change.

⁴ The Wave 1 survey found white-collar workers had slightly higher WFH rates thus more commuting trips were removed from the network (1.08 trips per week per job removed) than blue-collar workers (0.83). To get from the weekly reduction in commuting trips based on the survey, to daily trip reduction, the change in commuting from 'pre-COVID' to 'last week' was applied to the daily trip volumes in STEM.

To further explore the impact of different rates of WFH, two further scenarios were included where these rates were a) doubled, and b) halved.

- 2) To take account of the observed decline in PT patronage during the pandemic (2021), two levels of PT mode share were considered:
 - a) the STEM 2021 base case pre-COVID level of approximately 8.2% of trips being on PT (of the total number of private vehicle and PT trips only), and,
 - b) a COVID-adjusted share based on the Wave 1 employee survey which indicated a 14% decrease in the number of PT commuting trips per week (rounded to 15% for scenario modelling purposes).
- 3) Assumptions about replacement / rebound trips by private vehicle with trips for other journey purposes. Observed traffic volumes, particularly on freeways, suggested that although private vehicle commuting trips may have declined due to WFH, additional non-commuting trips (such as for increased visits to supermarkets and pharmacies) were occurring. Two scenarios were developed to test the effects of a potential increase in non-commuting trips:
 - a) 'Replacement' trips were assumed to replace all commuting trips no longer undertaken due to WFH with 'other' (non-commuting) trips,
 - b) 'Rebound' trips were assumed to exceed the replacement of commuting trips with 'other' trips by also accounting for newly generated 'other' trips assumed to increase the total network trip volume by 2.5% from the base scenario.

In order to capture the different variables described above, eight scenarios were formed:

- Three scenarios examine only different increases in WFH rates (5%, 10% and 20%) in 2021 compared to the pre-COVID mode share – shown in yellow in the following graphics.
- Three further scenarios add the assumption of a consistent reduction of 15% in PT trips throughout the network to these different WFH rates (reflecting the downturn in patronage during 2021) – shown in orange in the graphics.
- Two additional scenarios capture the assumptions regarding 'replacement trips' and 'rebound trips' and are applied only to the 10% WFH scenario.

4.4. Results

4.4.1. WFH impact on trip volume

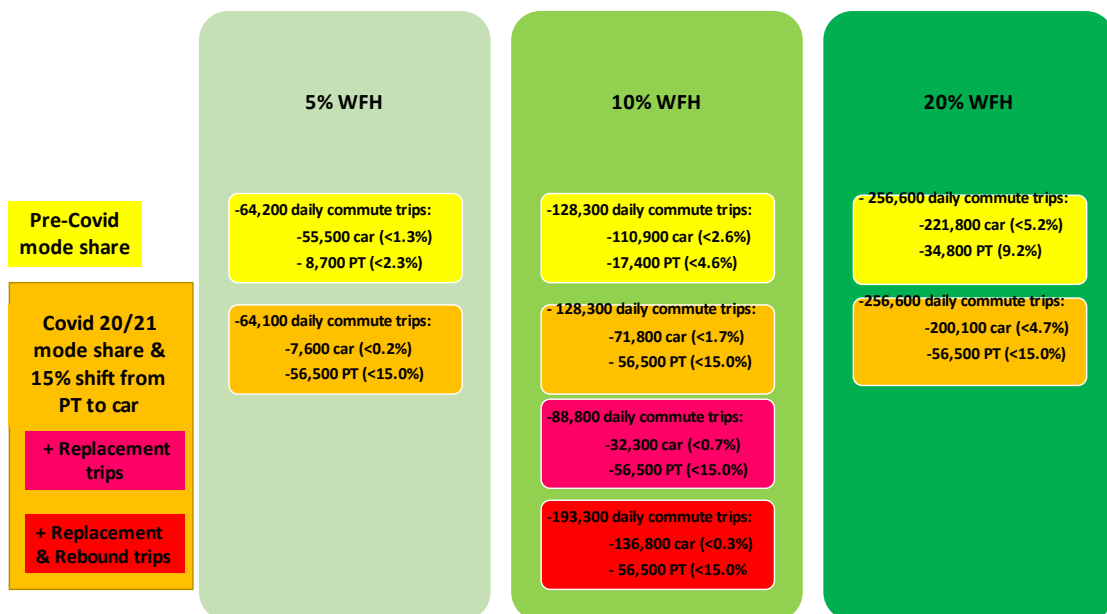
The DoT's 2021 STEM base provides a daily estimate of 4.6 million trips (all purposes, two-modes – i.e., private vehicle and public transport). Private vehicle trips comprise 91.8% (4.245 million trips) and public transport trips, 8.2% (377,000) of the all-purpose, in the two-mode total. Approximately 20% (920,000) of trips are for the work commute. For commuting, the two-mode share of PT is higher, at 13.5% (124,200 trips), and lower for private vehicle at 86.5% (795,800)⁵.

⁵ Note that the shares reflect two-modes, ignoring the 4% of commutes made by other modes.

The impact of increasing levels of WFH on trip volumes for each of the eight scenarios is shown in Figure 4.6. Compared to before COVID, the reduction in daily commute trips ranges between 64,200 trips and 256,000 trips. A far greater number of private vehicle trips are reduced than PT trips (range 55,000 to 221,800 depending on WFH rates). However, considering that there is a lower proportion of and volume of PT trips made for the work commute, compared to private vehicles, the overall impact of the trip reduction on public transport is higher than for private vehicles compared to the base case (in the 10% WFH scenario there is a 4.6% reduction in PT trips compared to a 2.6% reduction in private vehicle trips) given the relatively low number of PT trips compared to car trips.

In the scenarios that assume a decline in patronage of 15%, reductions in private vehicle trips continue to be evident (ranging between 7,600 and 200,100 depending on the WFH rate). This is also the case for the additional scenarios that assume commute private vehicle trips are replaced or rebound by non-commuting car trips.

Figure 4.6 Changes in daily trip volumes for each scenario (% shows variation from total trips in the base case)

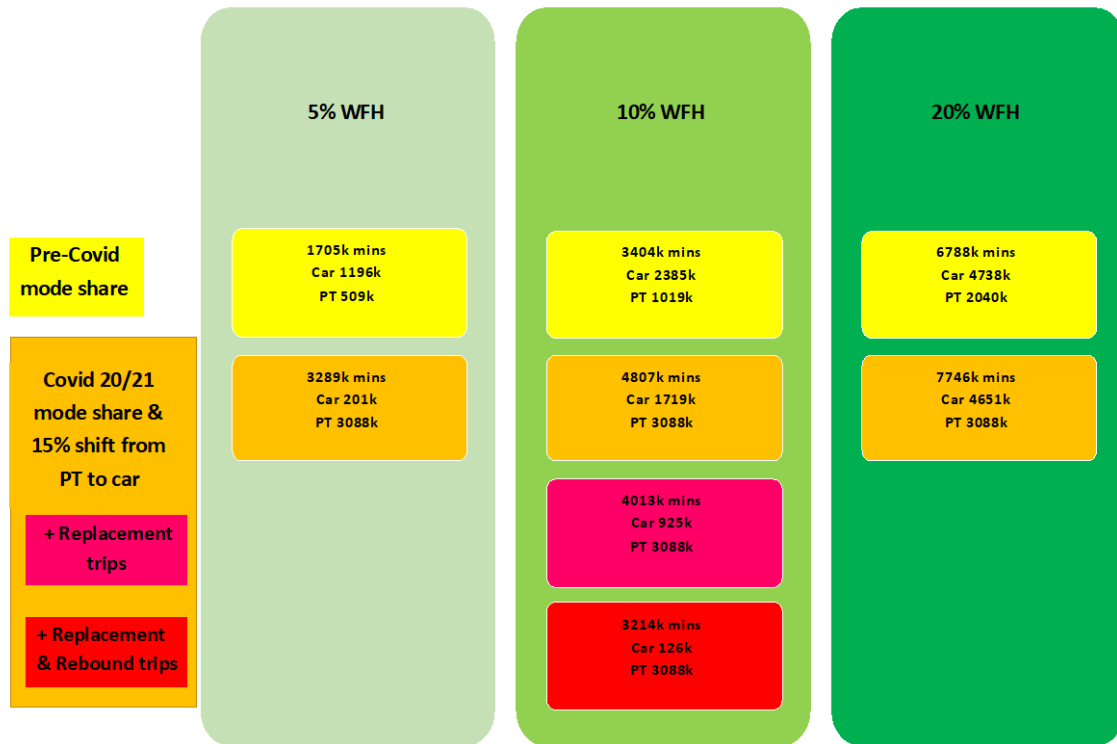


4.4.2. WFH impact on trip duration

The DoT's 2021 STEM base case provides a total daily travel time taken by private vehicles for all trip purposes across the network of 787,667 hours. Average commuting trip duration tends to be longer (20–22 minutes) than the average for all trips (10–12 minutes).

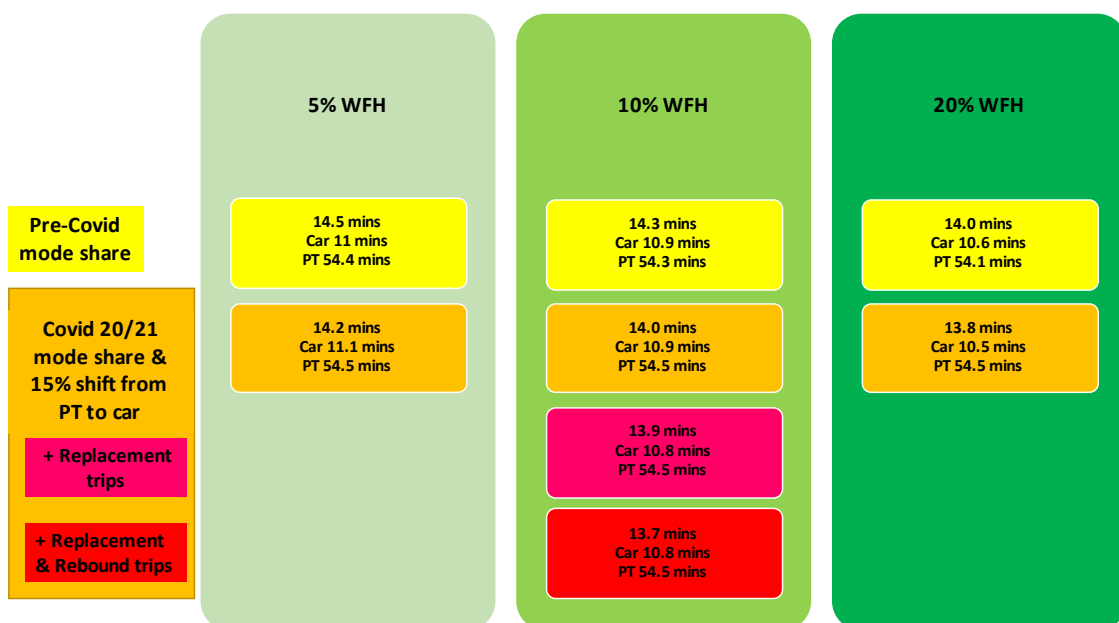
The impact of WFH on travel time across the network ranges between 28,417 hours and 113,133 hours, depending on the WFH rate (Figure 4.7). By way of example, a WFH rate of 10% sees a net travel time saving of 5% for private vehicle trips, due to faster network times for the commuters who do not WFH. For the same WFH rate and a lower PT patronage, there are still travel time savings of 3.6% (28,333 less hours) for private vehicle trips.

Figure 4.7 Daily travel time savings for each scenario (% shows variation from total trips in the base case)



The impact of WFH rates on trip duration can also be considered on an individual traveller basis, as opposed to the transport network as a whole (Figure 4.8). Here the range is between a trip time (one-way) saving of 14.2 minutes (if 5% WFH) and 13.8 minutes (if 20% WFH) and the 15% mode-shift from public transport to private vehicle is sustained.

Figure 4.8 Daily travel time savings on a one-way trip for individuals



4.4.3. WFH impact on trip distance

For the 2021 STEM base case, daily private vehicle travel distance was 37.15 million km⁶. Average commuting trip distance tends to be longer (15 km or 20–22 minutes) than the average for all trips (9 km or 10–12 minutes).

To understand the impact of the change in trip characteristics throughout the day, an additional analysis was undertaken for the '10% WFH & PT reduction' scenario across each of the four peak periods. Considering the proportion of trips and travel time for each peak period as a percentage of the daily total, provides some evidence of peak spreading for the WFH scenario. Whereas the total number of private vehicle trips decreased from the base case, by between 0.1 and 0.3%, in the case of the AM-peak, PM-peak and evening, the number of trips increased in the Interpeak period by 0.7%. The result is due to the WFH trips removed from the network being concentrated in the peak periods, but the shift from PT being applied uniformly across all time-of-day periods. Total travel time and average trip duration proportions also increased in the Interpeak period (by 1% and 0.2% respectively) while decreasing in all other peak periods.

4.4.4. Transport-related economic benefits of WFH

From these demand changes on the network, monetary benefits for the network were calculated for each scenario in terms of changes in travel time, reductions in vehicle operating costs, and externalities, such as reductions in traffic crashes and environmental benefits. Included in these network benefits are those accruing to travellers who remain on the network (Figure 4.9). Benefits to those removed from the network, i.e., no longer making commuting trips due to WFH, were calculated and presented separately (Figure 4.10).

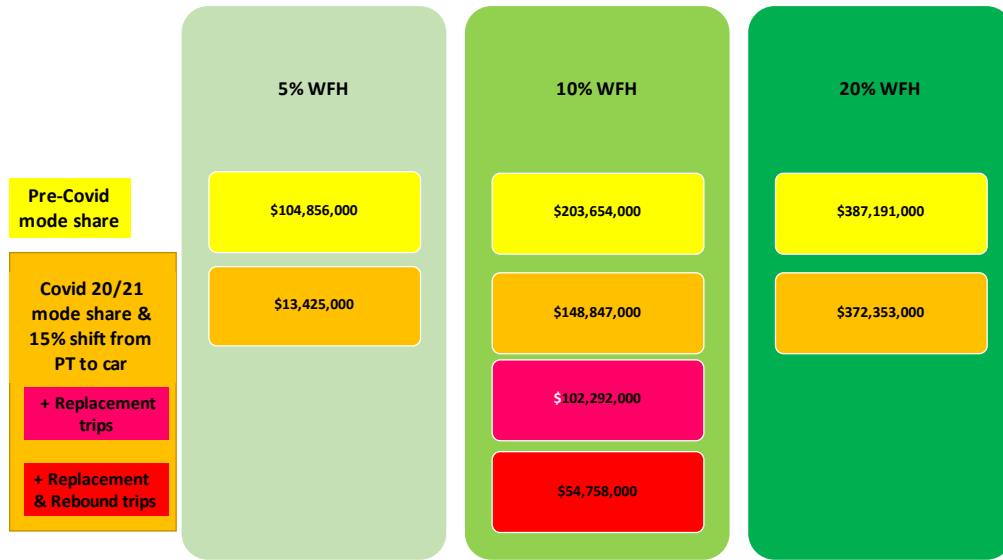
For the scenario based on observed WFH rates (10%) from the Wave 1 employee survey results, the total annual network benefits, including for remaining travellers on the road network (throughout the day and for all travel purposes), were approximately \$204 million, comprising transport externalities (\$93.2 million), private vehicle (\$72.5 million) and commercial vehicle (\$36.5 million) travel time and vehicle operating cost savings.

These figures come with a caveat that they are broad resource savings, rather than the willingness to pay for less commuting. Despite this, the overall annual benefits, representing reduced congestion and personal savings for WFH, are considerable and comparable to large infrastructure investments.

Adding the observed 15% mode shift from public transport (middle 3 scenarios) lowers the total benefits as these PT trips are diverted to private vehicles. While the difference in total number of trips between the two scenarios may seem minor (1%), this translates to a substantial reduction in network benefits (27%), indicating that even with a 10% reduction in commuting trips (for a 3% reduction in trips overall), a level of congestion remains.

⁶ Data for PT trips is not available – i.e., average O-D journey distance for PT.

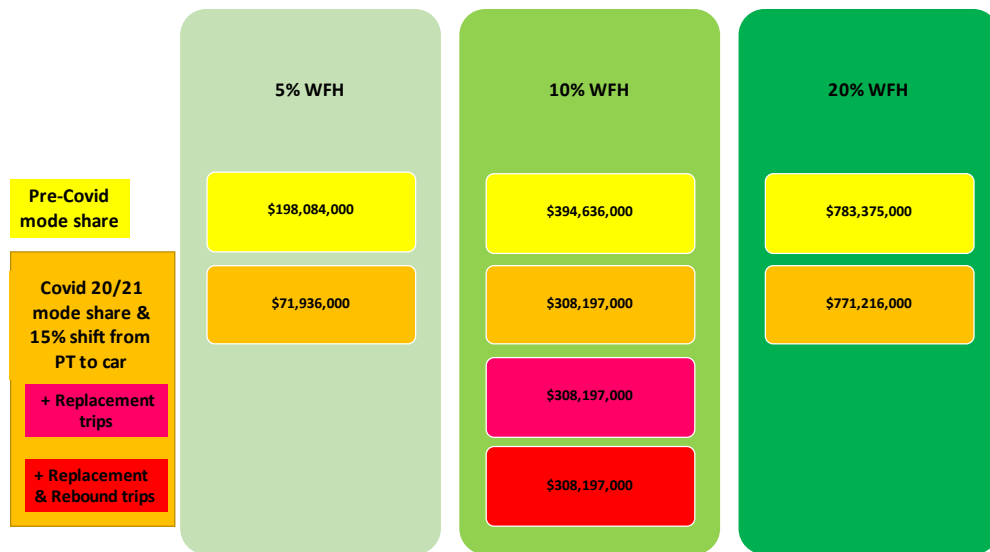
Figure 4.9 Total transport network benefits (not including private benefits to individuals)



Benefits can be attributed to those who no longer travel on the network as they are now WFH. The calculation of the benefits for trips removed from the network is based on resource cost-saving, i.e., fuel, other costs for the vehicle and time savings, resulting in considerably higher benefits attributed to the WFH segment (removed trips) than the network (continuing travellers). This is primarily because the marginal costs are applied over the duration of the whole trip. The range for total benefits between \$198 million and \$783 million, depending on WFH rate, is based on an average individual benefit of \$3,530 per annum. Considering only the 10% WFH rate, the range is between \$308 million and \$395 million depending on the impacts of a lower rate PT patronage and replacement / rebound trips.

The method does not consider individuals reallocating that time, possibly into other trips. Further conceptual and empirical studies are needed to address the transfer of travel time to WFH activities, such as additional working hours, indoor and outdoor leisure or making service trips for the household.

Figure 4.10 Total private benefits to individuals from WFH



Combining the network and private benefits, all scenarios deliver benefits even with PT trips shifted to private vehicles and commuting trips replaced and supplemented with 'other' trips.

4.4.5. Highlights from the scenario outputs

It is clear from the scenarios modelled that the benefits to the community of WFH are seen in reductions in travel time, distance and congestion. The higher the rate of WFH, the higher these benefits.

Factoring in the observed shift from PT during the pandemic period does negate some of these benefits that accrue to travellers remaining on the private vehicle and PT networks, but there are still benefits to be gained.

If it were the case that WFH leads to replacement of rebound travel (noting that the actual traffic volume data for suburban areas – Figure 4.2 – suggests this is not the case), the scenarios show that, despite the trip volume increasing overall, the negative impact on the network is not as great as the '5% WFH' scenarios. This is due to the trip purpose being 'other' trips which are generally shorter than commuting trips – such as school-drop off, trips to local work-hubs or libraries and to fitness centres.

WFH could benefit peak-spreading (a strategy that helps to make more efficient use of the private vehicle and PT networks throughout the day, thus avoiding the need to cater for high peaks in traffic). Considering the proportion of trips and travel time for each peak period as a percentage of the daily total, provides some evidence of peak spreading for the WFH scenario, particularly in the PM peak, and to a lesser extent the AM peak.

The choice to WFH not only benefits the individual (by saving on commute time and costs), but extends to others by reducing congestion on the road network at peak times. Removing one-in-ten commuting trips (the 10%WFH rate) has a \$204 million annual transport economic benefit for those remaining on the private vehicle and PT networks and a \$395 million annual transport economic benefit to those who commute less due to WFH.

4.5. Transport and travel – key insights

- In some localities there has been an increase in car traffic in the pandemic period compared to the period before -
 - Some of this increase is associated with an increase in the population of Greater Perth during the pandemic;
 - Increased traffic volumes are more pronounced within the inner suburbs, as evidenced by traffic crossing CDB cordons (note that car park fees in the CBD were dropped during this period);
 - In suburban locations traffic increased post lockdown 1, but since this time they have reflected pre-pandemic levels;
 - Traffic volumes are reverting to pre-COVID levels in the period since January 2022.
- Public patronage declined by 15% during the pandemic period, but since January 2022 is recovering:
 - Mask wearing was compulsory most of the pandemic period;
 - The period since school summer holidays 2022 saw a rise in PT patronage until the border re-opening and introduction of COVID to WA;
 - Bus patronage climbed more steeply than train, suggesting that sanitation issues are not of concern to travellers (confirmed by employee surveys);
- Increased levels of WFH have resulted in the reduction of 1 in 10 commute trips for each individual that WFH;
 - A higher proportion of white-collar workers WFH than blue-collar;
 - White collar workers reside predominantly in the inner and middle ring suburbs and northern suburbs;
 - White collar jobs are concentrated in city and inner suburban locations;
- WFH scenarios show significant transport benefits, with greater benefits as WFH rates increase;
 - There is a reduction in trip volumes, trip distance, travel time;
 - Transport benefits remain even after scenarios for PT patronage reduction, replacement and rebound car trips are considered;
 - Benefits are afforded to the community (through reductions in emissions etc), to those individuals who WFH, and to those individuals who continue to commute (through less congestion and faster journey speeds) – in relation to the latter this may contribute to induced traffic at the expense of PT;
 - WFH scenarios can be considered ‘worst case’ given the traffic data in the 2022 period is showing a return to pre-COVID traffic volumes while WFH continues, PT patronage is recovering, and replacement and rebound trips are not strongly evident in the employee survey.

4.6. Policy pointers

Recommendations flowing from this component of the research that could guide a policy response are as follows:

- At least a 10% shift to WFH is required to reduce road congestion from pre-COVID levels. WFH is beneficial in reducing commuting trips and time spent on the network, with all else being equal; Even a 5% WFH rate is beneficial for congestion abatement. However, when a 15% mode shift from public transport to private vehicle occurs as well as the 5% WFH rate, this benefit is negated.
- Policies to restore a shift back to PT commuting will be beneficial not only for congestion relief, but for pollution and emission reduction. Observed PT patronage reductions during the COVID-19 pandemic have countered some of the transport system benefits. While there is a reduction in trips due to a decrease in commuting due to WFH, the shifting of trips from PT to private vehicle trips negates this effect to an extent.
- Additional 'other' purpose private vehicle trips induced by WFH erode the benefits of reduced commuting trips. Including 'replacement' and 'rebound' trips has less of an impact on travel time and distance savings than volumes since trips for "other" purposes are on average shorter than commuting trips. All scenarios perform better than (before COVID) base case although the 'replacement' and 'rebound' scenario displays only marginally improved travel time and distance savings (similar to the '5% WFH + public transport shift' scenario). A key finding is that WFH rates need to increase to greater than 10% to counter the effects of shifts from public transport as well as 'replace' and 'rebound' trips.
- Pre-COVID demand management strategies to encourage PT use thus remain important despite there being fewer private vehicle commutes. PT is an important part of the mix in achieving network benefits. All scenarios revealed that the benefits accruing to travellers remaining on the private vehicle and PT networks were dampened by the observed 15% reduction in PT demand.
- There is a need to address the benefits of using WFH to spread peak-period travel. WFH results in some peak spreading, with benefits to the more efficient use of the transport system for those still travelling in the peak.
- There is a need to incentivise spreading WFH across all weekdays. Employee and Employer survey data indicated Monday and Friday as the most popular days to WFH, such that mid-week days may better resemble the effect of 5% scenarios and start- and end-of-week days better resemble the 20% scenarios. If WFH days were spread more evenly across the week, benefits closer to the 20% WFH scenario could be achieved throughout the week.
- Monitoring of WFH rates as part of future household travel surveys is necessary. Analysis of the Wave 2 and 3 survey data shows increased commuting rates for blue-collar workers since Wave 1 but decreased rates for white-collar workers. As such, overall, the commuting behaviour is trending towards the 20% scenarios. Continued monitoring and understanding of WFH behaviour, such as the time and day when workers commute, achieved through more frequent surveying, will ensure that modelling can best represent the reality on the ground as behaviours equilibrate to a 'new normal'.
- Monitoring of suburban and CBD cordon traffic volumes and PT patronage is essential to best direct WFH policy settings. Regular monitoring of traffic volumes and patronage at key locations and for key corridors is necessary to understand general trends and changes in private vehicle and PT utilisation to best respond to these in an agile manner and to establish optimal WFH scenarios.

5. Policy response

5.1. Introduction

The final component of the research project focussed on the development of a set of potential policy initiatives. They were based on three sources: delphi style interactions with local subject matter experts, developed through the evidence collected through the research components of the project, and, through a review of the wider literature.

The policy initiatives were designed to assist in the development of policies incentivising WFH practices to optimise transport system impacts. They are grounded in the state of knowledge of the WFH experiences prior to and during the COVID-19 pandemic, drawn from the research insights above and considered also in the context of global and national experience. At this stage of the emergence from the pandemic there is scant reporting in published literature of actual policy initiatives that have been implemented to support WFH, as a result some initiatives are derived more indirectly based on expert view derived from empirical research of the WFH experience.

5.2. Policy initiatives

A multi-disciplinary set of policy initiatives are outlined below (Table 5.1). These initiatives are organised by policy sector: transport, environment, urban planning, infrastructure, and society (the latter including work and business practices). An explanation of how the suggested action could contribute to facilitating WFH is provided. The individual report 'Working from Home: Policy Response' (see Appendix 5D) extended the summary below by outlining the potential roles of the public and private sector, the use of financial incentives and disincentives, and consideration of the spatial consequences.

Critical to any implementation is to note that these policies need to be considered as a bundle – an integrated package - given the myriad of implications.

It is not within the scope of this research to test these initiatives; more longitudinal research would be required to illuminate their potential.

Table 5.1: Policy initiatives to support Working from Home in the context of travel demand management

	Sector / Initiative	How contribute to facilitating WFH
Transport		
T1	Carbon Reduction Plans – commuting focus	Businesses reported a lack of sustainable transport policies. A requirement for a carbon budget for each business with the requirement for carbon reduction would expose the extent to which work-commuting contributes to carbon emissions – this would highlight the need for business level climate mitigation actions.
T2	Parking strategies	Stronger controls/costs for private non-residential parking at key employment places may contribute to businesses reducing the number of car parking spaces available to employees (especially where this has increased in response to aversion to use PT for bio-security reasons).
T3	Encourage individuals who WFH to use environmentally friendly means of transport to access services in their local area.	WFH and greener local travel will lead to reduced emissions, although it may be offset to a certain extent by extra local journeys, overall the reduction in emissions is likely to be higher where longer distance work journeys by internal combustion engine private vehicle trips are replaced.
T4	Mondays and Fridays are prime candidates for lower work travel demand (notwithstanding potential increased leisure travel due to the proximity to the weekend).	Measures to balance commuting patterns across all weekdays may be warranted, given that the travel may be for other reasons and spatially oriented towards the fringes and regional areas.
T5	Amenity and safety on local roads should be revisited, with a greater focus on traffic control measures to address changes in local traffic flow.	Makes WFH more enticing (considering the potential breaks and the before-after work activities on local roads).
T6	Defer major infrastructure funding for roads which encourage private vehicle travel should be reconsidered.	Increased WFH will reduce the need for longer distance work commutes on the road network saving time and money for employees.
T7	Include Active Travel strategies (including public transport) within investment in key public infrastructure	Greater provision of infrastructure for walking and cycling and the provision of shared mobility will encourage use of local infrastructure and access to PT.
T8	Continue travel demand management policies for children's independent travel to school.	WFH may lead to an increase in local traffic, this measure will see the benefits on traffic and flow-on effects (pollution, lower accidents etc.), 'other' trips also need to be managed (see also T3 for non-commuting and non-educational journeys).

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	Sector / Initiative	How contribute to facilitating WFH
T9	Incentivise peak spreading – flexible start and finish time and part-day work at office (i.e., as well spreading the days at work across the whole week – see T4)	Staggered start/finish times in combination with part-day WFH will reduce traffic/PT congestion.
T10	Continue / accelerate conversion of road and parking space to pedestrian uses in busy centres	Discourage mode shifts back to private vehicles due to greater availability of road / parking capacity from a general decline in commuting.
T11	Reconfigure public transport network and services to better serve non-CBD travel	Increase PT mode share through greater competitiveness with the private car in local./sub-regional areas to counter potential rebound trips by private vehicle.
T12	Explore a congestion charge for private vehicle journeys into the inner suburbs and Perth CBD coupled with greater incentives for public transport use for journeys from outer suburbs to the CBD.	Increasing the cost of commuting by private vehicle into the central area with encourage WFH on some days and incentivise PT use for the work journey.
Environment		
E1	See T1 Carbon reduction plans	
E2	Australia's goal to have "net zero" emissions by 2050, it is paramount to encourage a reduction in single-occupant car trips.	A focus on policies for net zero emissions will also encourage WFH.
Urban Planning		
U1	Development of new shared work / co-worker spaces to encourage flexible working closer to home	Shared workspaces (SWS) have been successfully developed by the private sector, but mainly in the CBD. Creation of SWS in activity centres in middle and outer suburbs could support those who wish to work closer to home, but do not have suitable workspaces at home, those who dislike solitude of WFH, and also provide high quality ICT not always available at home. Would also activate suburbs and distribute office spaces to appeal to a wider group of employees.
U2	Office spaces can be redistributed (converted to co-working spaces) and companies could start offering a choice of places open to employees to use flexibly	May incentivise businesses to enable employees to WFH by bringing savings to the companies that rent out or sell assets in central areas and buy/rent elsewhere cheaper, but also from productivity gains. This may reduce not only the trip generation, but also the commuting distance.
U3	Reconfiguration of streets to support active travel, while promoting more 'local' activities in suburban areas and other cities/towns.	Make WFH more enticing (considering the potential breaks and the before-after work activities).

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	Sector / Initiative	How contribute to facilitating WFH
U4	Limit private vehicle travel by introducing congestion taxes on freeways to encourage public transport use.	Encourage WFH by reducing overall travel. Also, promoting PT use, especially given its competitiveness for longer trips along the North-South railway lines.
U5	Enable highly skilled workers to live quite remotely from work - less tied to living within commute	WFH has seen a separation between places of work and residence expanding over other professions and traditional office administration roles.
U6	Ensure that developers in new estates provide local services closer to residents	WFH enhanced with local services available.
U7	Regulatory reform to enable home-based businesses	Removal of exclusionary provisions between homes and workplaces in zoning, building and tenancy regulations.
U8	Attraction to and retention in region of digital / remote workers	Specific programs to strengthen underperforming / depopulating regions and towns as bases for digital and remote workers.
	Infrastructure	
I1	Upgrades to broadband and digital infrastructure	Make experience of WFH more reliable / consistent / accessible for those with limited connections. Consider privacy and cybersecurity challenges specific to WFH arrangements.
I2	Home workability	Increase availability of a home environment that provides the space and comfort, and relative absence of distractions, required for productive work.
I3	Better data on WFH	Create a new evidence base on WFH experiences to support relevant decision making and allow for better monitoring of WFH uptake and effects.
	Society	
S1	Encourage WFH to enhance participation in employment	WFH can allow those previously unable to travel to work (stay at home parents, some people with disability etc.) to participate in employment.
S2	Tax relief for employees WFH	Lower overall costs for workers via tax relief.! Care should be taken to avoid discriminating towards non-WFH compatible positions
S3	Work design	Ensure employers/ managers respect contracted work hours and boundaries between work time and personal time. Ensure adequate social communication and collaboration networks, access to necessary internal technological and information systems, managerial support, carefully managed monitoring (i.e., not 'checking up' on people, but 'checking in' to see how people are doing etc). Role clarity is needed. Provision made for networking, bringing on new starters etc.
S3	Workplace flexibility	Greater flexibility and autonomy for employees in choosing where they work with productivity and sustainability benefits for employers and potential for enhanced well-being of employees. Reduced commuting.

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	Sector / Initiative	How contribute to facilitating WFH
S4	Training to support managers managing those who WFH	Some employers have concerns about how to manage staff and productivity remotely. Training packages including good practice guides may assist.
S5	Deregulation of work hours or broaden the legal requirements to encourage more flexible working	Greater availability of flexible work practices for employees. Reduced commutes. Potential for enhanced well-being.
S6	Policies to prevent senior managers from closely monitoring individuals	Being closely monitored when WFH creates stress, meaning individuals may prefer to work in the office if they are going to be monitored closely at home.
S6	Financial incentives for WFH, such as a contribution towards overhead costs. (see also I2)	Would encourage individuals to work from home more. ! Could have discriminating effect on non-WFH compatible positions
S7	Employers to distinguish between different types of employees who WFH	The workforce (not only knowledge work) needs to be treated differently: time and digital nomads, who require full flexibility to work remotely (independently, freelancers); 'traditional workers', with a regular job requiring physical presence in the workplace for various reasons (use of equipment/tools, interaction with patients/ students/customers, etc.)
S8	Voluntary character of WFH	Ensure that WFH remains a genuine choice for employers and employees, safeguarding the innovation effect of face-to-face interaction and considering varying personal preferences towards WFH.
S9	Organisational readiness	Foster agility of firms or agencies to instigate or moderate WFH strategies in response to external shocks or other constraining factors.

6. Setting the Perth findings in the wider context

6.1. Introduction

The previous sections of the overview report set out the findings from the three research components for the WFH experience of Greater Perth prior to, and during the COVID-19 pandemic. In this section of the report, the Perth findings are set in the wider national and international context by providing a targeted summary overview. This has been developed with reference to the research teams earlier reviews of academic and other grey literature. The aim is to ascertain whether the Perth experience follows that of other localities, or otherwise.

The original source material was collated using a snowball system identifying peer-reviewed research undertaken during the pandemic from web searches, as well as frequently quoted material dating to the pre-pandemic period. At the time of writing (June 2022), research on pandemic impacts on the topic is ongoing and it is anticipated that more is yet to be published. Most material included here refers to the first pandemic year (2020) and does invariably not yet cover academic insight or policy responses inspired by the journey out of the pandemic that is now becoming more apparent.

The other studies referred to in this report cover a wide range of global locations, where pandemic experiences and policy responses varied: some places were subjected to a succession of long, strict lockdowns enforcing WFH while others, followed a more liberal regime of pandemic management based chiefly on recommendations. Locations also differ in their urban structure, and diversity of transport options (and the extent to which these were curtailed or otherwise restricted during the pandemic). Findings from one location are thus not immediately comparable to Greater Perth.

The analysis which follows is organised around the key findings, grouped by theme (Table 6.1) – note that where cells are empty in the table a corresponding finding was not available in the various literature reviews that have been undertaken during the project, it does not necessarily mean that the finding is unique to Perth.

6.2. The practice of WFH

The research project found a significant acceleration in WFH practice in Greater Perth compared to the pre-pandemic period. This is consistent with other Australian and American studies. Of note is a preference by employees to continue to WFH. It appears that office-based occupations/industries are more likely to be able to WFH, although in any occupation there are tasks that can be undertaken at home rather than on-site.

The most popular WFH model is a hybrid model (in Australia and the UK), where one or two days per week are worked at home. This approach is popular with both employees and employers. Comparing Perth, which had fairly limited lockdown periods, to other places such as Sydney which had longer periods of lockdown, it appears that the preference for a hybrid ½ days per week is consistent – albeit driven by different lockdown experiences.

A strong message is that staff productivity has been reported as being maintained or improved when WFH – consistent across studies in Australia, Europe and the UK.

6.3. Wellbeing

A number of empirical studies from the US and Europe concur with the Perth finding that WFH has been predominantly a positive experience (although not for remote education). Teleconferencing facilities have successfully substituted for face-to-face meetings.

WFH challenges included overwork and hence exhaustion – linked to poor work design.

6.4. Business relocation and changes to workspaces

There are mixed views in both the Perth study and others as to the extent to which workspaces will contract or expand, and whether businesses will locate away from the CBD in the suburbs or concentrate in the CBD. Here both the method of research and the location of the research are critical to the outcome. Studies based on modelling do not necessarily draw on empirical evidence for the assumptions made. Studies based in the US are based on a different urban structure to those based in Australia.

6.5. Commuting and travel

Saving commuting time and cost is one of the most important benefits to staff WFH – consistent between the Perth study and Australia wide. This is also translated to reductions in the number of commute trips made and to travel distance (although variation in urban structure and geographic size of the urban area will temper this result).

While trip purpose and frequency of non-work trips changed during lockdown periods, there is a need for newer data to confirm if this has remained.

A consistent finding between Perth and elsewhere has been the decline in public transport patronage to now around 80% patronage. Reasons for the decline vary according to differences in attitudes towards infection risk (not perceived a problem in Perth), parking regimes and reduced traffic congestion (as a result of fewer commute trips on the network). Going forward, some speculate that hybrid WFH will encourage car-commuting on office days, whereas in Perth both public transport patronage is recovering (consistent with the speculation for Melbourne) and traffic levels are returning to pre-COVID levels.

Reductions in trip volumes, trip distance and travel time are showing significant financial savings in Perth and Sydney.

Table 6.1 Key findings compared to other research

Finding	Statement/quote from other studies	Reference
<i>The practice of WFH</i>		
<p>Pandemic has seen a significant acceleration of WFH practice</p>	<p>Surveys of more than 30,000 Americans and found that 20% of full workdays are planned by employers to be supplied from home after the pandemic ends, compared with just 5% before</p> <p>since COVID-19 was declared a global pandemic, two in five Australians (41%) have commenced WFH, 24% are still WFH, and 13% were back in the office</p> <p>in September 2020, 70% of respondents who identified as WFH indicated they would prefer to continue doing so post-pandemic. In November ...though the share of WFH respondents fall, the preference to remain at home increased to 73% among those who still WFH</p> <p>the percentage of Australians WFH increased from 8% pre-COVID to about 40% in 2021. It is important to note that these percentages endured periods without government mandates to WFH. The Commission suggested that 'the rise in working from home represents a rapid discontinuation with previous practices, even allowing for the likelihood that the amount of work done from home will eventually settle somewhere between its pandemic and pre-pandemic levels</p> <p>Almost 1/4 of Australians felt safer at home and another 1/4 would not want to revert to full-time office-based employment.</p>	<p>Barrero et al, 2020</p> <p>Renton et al, 2020</p> <p>Wooden & Lim, 2020</p> <p>Productivity Commission (2021)</p> <p>Anders, 2020</p> <p>Australian Bureau of Statistics, 2021</p>

	<p>survey of industry found that 60% of firms expected to continue with current levels of WFH, with less than 10% of firms planning to return to pre-pandemic practices</p> <p>“[...] the world of work will undergo a significant shift toward hybrid work in the post-coronavirus disease world, making hybrid working to some extent the “new normal” at work.”</p> <p>“Many workers now work from their “workspace” of choice which includes home, office, and co-working spaces (depending on the work tasks they are entrusted with).”</p>	<p>Vyas, 2022</p>
<p>A higher proportion of white-collar workers WFH compared to blue-collar workers</p>	<p>Surveys conducted in AU during restriction periods, many respondents are notable white-collar workers</p> <p>While many are returning to the workplace after restrictions are being lifted, “pandemic-driven practices like hybrid work, WFH, remote work, flexible workplace/worktime, work anywhere, and work near home that persist. Businesses around the world will most likely continue to use them, particularly white-collar jobs.”</p> <ul style="list-style-type: none"> - “two out of three white-collar workers in Hong Kong still want to WFH, and companies are considering redesigning office space to accommodate hybrid work (Lam, 2021); - nationwide decision to allow white-collar workers to work from anywhere, giving them more control over their lives (BBC News, 2021a) - Some of the world’s most well-known firms, including Amazon, Apple, Google, Facebook, British Airways, Microsoft, and 	<p>Beck & Hensher, 2020a; Hensher et al., 2022; Currie et al., 2022</p> <p>Vyas, 2022</p>

	<p>Siemens AG, are inclined to adopt remote working in post-pandemic times (Hartmans, 2020; Siemens AG, 2020).”</p>	
<p>WFH, rather than determined by industry sector or occupation class, is determined more by the type of work task – such that all occupations have the potential to WFH for some of the time during the week</p>	<p>Analysis of 2000 activities and 800 occupations in 9 countries found that only up to a quarter of the workforce in advanced economies can WFH three to five days a week while the majority cannot work remotely, as their work either involves physical or manual activities or requires the use of fixed equipment, such as in agriculture and construction.</p> <p>There is an increase in the share of tasks that can be done from home, particularly in occupations that already permitted WFH, yet there are opportunities in all occupations.</p> <p>“For example, workers may chart out tasks to be performed in the formal office environment versus those that could be taken care of in a remote setting. [Then...] once reconstructing their work processes and identifying the tasks that can be done remotely, organizations should consider segments of workers and reclassify roles to identify employees’ suitability for exclusively WFH or hybrid remote working and on-site working.”</p>	<p>Lund et al., 2020</p> <p>Adam-Prassl et al., 2022</p> <p>Vyas (2022)</p>
<p>Not all employers, however, are in support of continued WFH</p>	<p>Since most employers and employees have been forced to experiment with WFH rather than plan, they have learned about its potential advantages and disadvantages. Investment in good working conditions, loneliness and difficult teamwork, erosion of the office culture, are making many employers reluctant to support extensive WFH.</p> <p>Managerial resistance is perhaps the biggest barrier to flexible work practices.</p>	<p>Barrero et al., 2021</p> <p>Beck & Hensher, 2022</p>

	<p>Low self-confidence of managers in their ability to manage workers remotely undermine the support for WFH.</p>	Parker et al., 2022
<p>WFH is less suited to those in new jobs or at the early career stage</p>	<p>A combination of home and office working is expected to become the norm, or at least something the employees would request from their employers. Using interviews with 26 young employees, they were classified in three distinct categories of COVID-related disruption: Stable, Delayed or Accelerated. While majority was Stable, many consider moving further away from the city centre due to the prospect of commuting less frequently.</p> <p>WFH may affect newly hired/early career, who require more training and mentoring, also being at a life stage that may involve distinct and more demanding work-home life roles (caregiving, housework).</p>	<p>Delbosc & McCarthy, 2021</p> <p>Chen, 2021; CNN, 2022</p>
<p>WFH part of a trend to provide flexible work arrangements as part of a modern business approach</p>	<p>Half of employed Australians considered their employers have used [the pandemic period] to realise the gains of working flexibly</p> <p>Hybrid is likely to become mainstream, wellbeing a key metric, managers' roles are changing, and gen Z has expectations for in-person work experiences.</p>	<p>Renton et al, 2020</p> <p>https://www.gartner.com/smarterwithgartner/9-future-of-work-trends-post-COVID-19</p>
<p>Client-facing roles have been found to be possible to achieve via digital means rather than exclusively by face-to-face meetings</p>	<p>Telehealth, education, meetings, have changed during the pandemic and they are deemed not only safe, but also successful ways of interaction/collaboration, across time zones/at distance. However, they require the digital maturity and adaptation to new systems or routines.</p>	Schoch et al, 2022
<p>Popular model for WFH has been the hybrid-model, usually with two days worked at home and the rest in the workplace</p>	<p>A rising number of workers in some occupation classes WFH for one of two days/week (AU survey)</p> <p>Business leaders surveyed indicated concerns around workplace culture, motivation and innovation as</p>	Beck & Hensher, 2020a, 2020b

	<p>important reasons to bring workers onsite three or more days per week</p> <p>the future of work is likely to be hybrid, with 61% of Australians preferring a mix of WFH and on-site work.</p> <p>some of Australia’s largest companies revealed that while 64% of employees prefer a hybrid model that involved at least some WFH, employers expected that this will only be feasible to 40% of their workforce</p> <p>recent observation that as restrictions ease, appetite for high levels of WFH (80% of the working days or more) have tended to decrease</p> <p>partial reversal of WFH level is also observed in the U.K in a similar survey</p> <p>Spatial effects and contextual differences shape the hybrid mode (“Lesson 2: The local situation and individually perceived control matter”)</p>	<p>Barrero, 2021</p> <p>Renton et al, 2020</p> <p>Mattey et al., 2020</p> <p>Beck & Hensher, 2020b</p> <p>Taneja et al., 2021.</p> <p>Susilo et al, 2021</p>
<p>Staff productivity has been maintained or improved and this has built confidence in continued WFH</p>	<p>Among those who can WFH, little change in productivity was perceived, and almost double the number of respondents find working from home to be a lot more productive (12%) than a lot less (7%)</p> <p>surveys conducted in Australia, France, Germany, Italy and the U.K with 70% of employees saying they are more productive from home and 38% saying they work even longer hours</p> <p>Many employees are more productive when WFH because the flexible arrangements allow them to manage their working time and place on their own.</p>	<p>Beck & Hensher, 2020b</p> <p>NAB, 2020</p> <p>Barrero et al, 2021; Vyas, 2022; Parker et al, 2022</p>

Wellbeing		
<p>WFH improved measures of 'life satisfaction' and 'thriving'.</p>	<p>Survey in Chicago, April – June 2020, found predominantly positive WFH experiences among respondents, but stress the importance of 'home workability', i.e. the availability of a home environment that provides the space, comfort and equipment, and relative absence of distractions, required for productive work.</p> <p>Dutch mobility panel, data from March – April, 2020, A majority of respondents expressed positive experiences with WFH arrangements and the substitution of teleconferencing for face-to-face meetings in a work context; opinions about activities having moved online were more evenly divided in a social context and predominantly negative in an educational context. Twenty-eight percent of respondents expect to increase WFH after the pandemic compared to before the pandemic; thirty-seven percent say the same about remote meetings, but only 13% about online educational settings.</p> <p>Netherlands, two-stage survey April – June 2020 - a cluster analysis of six cohorts among employed respondents, differentiated by WFH uptake during the pandemic stages and corresponding attitudes. Among the three largest cohorts with the most positive responses to WFH (a combined 71% of the sample), there is a widespread expectation that their level of WFH practice will permanently remain higher than before the pandemic, and their PT use lower. Only the two smallest cohorts (16%) report the reverse: less WFH and more intended PT use once the pandemic passes (pp.64-68).</p> <p>"better outcomes for their health, family, and overall well-being. While many have adjusted to and enjoyed this</p>	<p>Shamshiripour et al., 2020</p> <p>de Haas et al., 2020</p> <p>Ton et al, 2022</p> <p>Vyas, 2022; Platts et al, 2022</p>

	<p>change, others have had challenges in drawing a line between working and non-working hours. ..The likelihood is high for a number of employees to experience increased working hours, as well as increased work-life conflict. For example, in today's hyper-connected world, many remote working employees are expected to respond to urgent tasks as well as after-work emails, resulting in a blur between work and leisure.”</p>	
<p>Smaller group there were challenges – evidenced by rates of anxiety and depression. Critical to resolving this was work-design, where the tendency for managers to closely monitor employees thus increased stress</p>	<p>Surveys from Japanese manufacturing firms found that workers who worked from home experienced productivity declines primarily due to poor WFH setup and communication difficulties But, mental health of workers who are able to WFH is significantly better than that of workers who are unable to do so</p> <p>The effects of WFH may reflect the ability to adapt to new practices, the support from the institution and the circumstances at home. As such, certain types of individuals may experience more severe negative effects, if support from the manager and colleagues is reduced and the work-home conflict elevated. Stringency/lack of flexibility is always negatively correlated with wellbeing.</p> <p>ill-designed WFH arrangements could also lead to overwork and blur the boundaries between work and home. For example, about 54% of the respondents from Microsoft (2021)'s large-scale survey felt overworked and 39% reported exhaustion</p>	<p>Kitagawa et al, 2021</p> <p>Schifano et al, 2021; Wang et al, 2021</p> <p>Microsoft, 2021</p>
<p>Relocation and Changes to work spaces</p>		

<p>There have been changes in internal floorspace requirements – in some cases contraction, but in others a demand for more floorspace, as a result of activity-based working and the need to improve physical distancing</p>	<p>Businesses report that WFH is a viable option to reduce the cost of office space provision</p> <p>“[...] to maintain productivity and collaboration organizations should design workspaces that support workers both remotely and on-site, with tools such as virtual whiteboards and videoconferences.”</p>	<p>Beck & Hensher, 2020c</p> <p>Vyas, 2022</p>
<p>There is an interest in movement away from central office locations by some, with discussion around relocating to the suburbs closer to employees’ homes.</p>	<p>Models for the US metro areas revealed and increase in WFH would accelerate trends of jobs moving to the core of cities and residents to outer suburbs.</p> <p>Office space managers expect a 36% increase in worktime outside their offices</p> <p>Office vacancy rates in the US are predicted to rise to 20.2% by the end of 2022 compared to 16.8% at the end of 2019.</p> <p>Estimates of reductions in spending in major US city centres by at least 5 to 10% relative to pre-pandemic situation due to shift to WFH</p> <p>WFH could open up opportunities for the revitalisation of Aus suburbia</p> <p>“Companies are taking advantage of the demand for hybrid work to save the cost of renting an office (BBC News, 2021b). In addition to the relocation of workplaces from major cities to cheaper places, it is also believed that there will be a radical transition in urban life, where remote-working employees will migrate out of business capitals to cities with more affordable rentals and living costs (Lund et al., 2021), owing largely to the prevalence of remote working.”</p>	<p>Delventhal et al. 2020</p> <p>Lund et al, 2020</p> <p>Davidson, 2020</p> <p>Barrero et al, 2021</p> <p>Salt, 2021</p> <p>Vyas, 2022</p>

<p>There is also interest in use of shared workspaces in such locations</p>	<p>An intermediate between WFH and office work could be the introduction of co-working spaces located between home and work spaces</p> <p>“Others are evaluating the possibility of renting co-working spaces.” ...“Co-working spaces, flexible leases, flex space, and remote work seem to be examples of post-coronavirus disease options.”</p>	<p>Babb et al, 2018</p> <p>Vyas, 2022</p>
<p>Commuting</p>		
<p>Staff are keen on WFH in order to reduce commuting, with consequent benefits in extra time and energy for work, household tasks and exercise</p>	<p>Surveys in Australia during the pandemic suggest the most important benefit of WFH perceived by workers is not having to commute often (and more flexible work schedules) avoid the need for stressful and costly commutes</p> <p>Commuting time and cost saving is the highest ranked WFH benefit by Aus workers in multiple survey rounds</p>	<p>Beck & Hensher, 2020b, 2020c; Currie et al, 2021</p> <p>Beck & Hensher, 2020a, 2020b, 2020c</p>
<p>Employers do not take responsibility for the work commute in relation to a societal responsibility for reducing the need to travel</p>		
<p>Where WFH occurred, it increased and commute trips reduced – to the order of 1 in 10 trips per week</p>	<p>Longitudinal data from the German Mobility Panel - noted an already underlying trend to greater use of WFH accelerating, as a result of the pandemic (the share of respondents participating in telework at least occasionally grew from 28.5% in 2018 to 33.0% in 2019 and further to 48.5% in 2020; p37). This corresponds to a reported reduction of weekly trips from 15.7 per person to 12.1 between 2019 and 2020, and of travel distance by 31% (p.37).</p>	<p>Reiffer et al., 2021</p> <p>Beck, M., Hensher, D.A., & Wei, E. (2021)</p>

	<p>WFH, increased from 0.86 days per week pre-COVID to 1.7 days post-COVID.</p> <p>WFH volume 75% higher than pre-COVID levels</p>	Currie et al 2021
<p>Savings from not commuting were converted to extra paid and domestic work and indoor recreation – both have productivity and well-being benefits</p>	<p>US analysis suggests that time saved from avoiding the commute is a measurable productivity gain</p> <p>Most notable has been the amount of trust demonstrated by employers for employees to WFH (at least to some extent going forward) linked to increased productivity, and employees seeing WFH as an opportunity to reduce the stress of commuting and opening up greater quality time with family and friends, especially when aligned with more flexible working hours</p>	<p>Barrero et al 2021</p> <p>Hensher et al, 2022</p>
Traffic volumes		
<p>An increase in car traffic during the pandemic, evident in inner city and inner suburban localities, but not in middle and outer suburbs – attributed to:</p>	<p>During March-April 2020 a survey across all AU documented a 53% reduction in the numbers of trips made by households per week (from 17 trips to 8 per week pre-pandemic).</p> <p>During period 13 April to 25 May 2020 WA recoded a 19% decrease in retail and recreation trips, 51% fewer trips to parks, 45% reduction on PT trips, 12% less JTW but 10% increase in homebased activities and 4% increase in visits to supermarkets and pharmacies</p> <p>Infrastructure Victoria modelled possible post-lockdown recovery scenarios for Melbourne’s inner metropolitan area, noting that the significant shift away from public transport will more than offset any expected congestion relief from the assumed higher WFH levels</p>	<p>Beck & Hensher 2020a</p> <p>Google, 2020</p> <p>Infrastructure Victoria, 2021</p>

<p><i>Car park fees suspended in the central area</i></p>	<p>Capital cities have used parking incentives to bring the community back to the CBD</p> <p>Melbourne</p> <p>Adelaide</p>	<p>https://www.timeout.com/melbourne/news/melbourne-city-council-brings-back-5-parking-in-the-city-102621</p> <p>https://7news.com.au/news/vic/city-of-melbourne-council-suspends-parking-restrictions-under-stage-4-lockdown-c-1239924</p> <p>https://citymag.indaily.com.au/happening/city-councillors-support-a-new-car-centric-transport-incentive-to-boost-visitation/</p>
<p><i>Perceived sanitary concerns with public transport</i></p>	<p>Infection risk was among the three most frequently stated reasons for respondents' reluctance to use PT (alongside overcrowding and night time safety), a concern never recorded as prominently in pre-pandemic surveys,</p> <p>Above also reported by other researchers who reported on experiences in the Australian eastern states</p> <p>Hygienic reluctance to PT use may fade rapidly once the crisis is widely perceived as overcome and it has once again become commonplace for people to mingle in any type of enclosed space without taking protective measures</p>	<p>Currie et al, 2021</p> <p>Balbontin et al., 2022</p> <p>Currie et al, 2021</p>
<p>Since Jan 2022 car traffic volumes have returned to pre-pandemic levels (car parking fees are again in place),</p>	<p>Cities further along the recovery pathway experiencing higher congestion levels than pre-COVID</p>	<p>Deloitte, 2021</p>
<p>Public transport patronage declined during the pandemic</p>	<p>In the first 6 months of 2020 rail travel in Australia and NZ dropped by 268 million trips (average 33 million trips each month)</p>	<p>Australasian Railway Association, 2020.</p> <p>UITP ANZ, 2020.</p>

	<p>During lockdown periods patronage dropped to 80-90% in major cities of China, US, Iran, and 70% for some operators in UK</p> <p>PT trips in Sydney and Melbourne were down by 80% in mid-April 2020</p>	PWC, 2020
<p>Public transport patronage is showing signs of recovery</p>	<p>In Australia and New Zealand, private transport recovered much faster than public transport: In June 2020, public transport usage was 55% down from 2019, while use of toll roads was only 20% lower than the previous year</p> <p>Commuters who were previously public-transport users might be more willing to tolerate traffic congestion and parking costs for two to three days a week, private car usage for commuting is expected to increase</p> <p>In Melbourne, public transport use for journeys to work is expected to recover to 80% of pre-pandemic levels – an experience roughly matched in comparable international cities – general population and job growth in Melbourne will mean that the absolute level of pre-pandemic public transport use will again be reached only seven years late</p>	<p>Australasian Railway Association, 2020</p> <p>Hensher et al., 2021a</p> <p>Currie et al, 2021</p>
<p>WFH scenarios show significant transport benefits which increase with higher WFH rates. There is a reduction in:</p>		
<p><i>Ttrip volumes,</i></p>	<p>A Melbourne survey found a 6% long-term reduction in metropolitan-wide job commuting and a 20% reduction in CBD commuting due to lasting WFH effects and employment changes (post-pandemic WFH as per respondents' intentions is quantified at 75% over pre-</p>	Currie et al, 2021

	pandemic levels metro-wide, and 123% higher for CBD workers)	
<i>Trip distance</i>	In the US people who have the opportunity to work from home are usually higher paid and have longer commutes	Barrero et al 2021
<i>Travel time</i>	In NSW, an average reduction of 77 minutes per commute for one day a week equated to 3.8 weeks more free time for the employee (although it should be noted that some of this is invested in working longer hours) and \$850 savings per year in out-of-pocket costs While these figures may be somewhat lower for Perth, there remains a positive benefit due to reduced travel for those who can WFH.	Beck & Hensher, 2021
Benefits remain even after scenarios for PT patronage reduction, replacement and rebound car trips are considered		
<i>Economic value of WFH</i>		
Removing one-in-ten commuting trips (the 10% WFH rate) has a \$204 million annual transport economic benefit for those remaining on the network and a \$395 million annual transport economic benefit to those who commute less due to WFH	In Sydney metro area... the estimated annual travel time reduction for car and PT commuters is \$5.6 billion, a 54% reduction compared to pre-pandemic... a saving of about 1% of the 2019-20 gross state product of NSW... corresponding monetary cost is \$2.9 billion.... Much of this...attributable to reductions in congestion cost	Hensher et al, 2021b

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ⁱ Drawing on data from the HILDA Survey (Household, Income and Labour Dynamics in Australia), only 5% of workers could be classified as ‘home workers’ defined as working the majority of time from home (Wooden & Fok, 2013). Dockery and Bawa (2014), also using HILDA data, report around 17% of Australians work some of their hours from home (on average 7.7 hours per week).

ⁱⁱ WFH rates by occupation category: Administrative workers (6.3%), Manager (5.0%) and professionals (4.8%) having greater proportions of homeworkers as compared to other occupation groups.