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Working from Home: Policy Response

APPENDIX 5D

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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

This report is part of a wider research project 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 suit of policy initiatives designed to support the positive aspects of continued WFH, to capitalise on the wider benefits to society. Three primary 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.

This report is an Appendix (5D) to the final project report: Working from Home: Changes in Transport Demand – the Case of Greater Perth - Overview Report. This report (Appendix 5D) contains technical details of the research sub-component: policy responses (Figure E1).

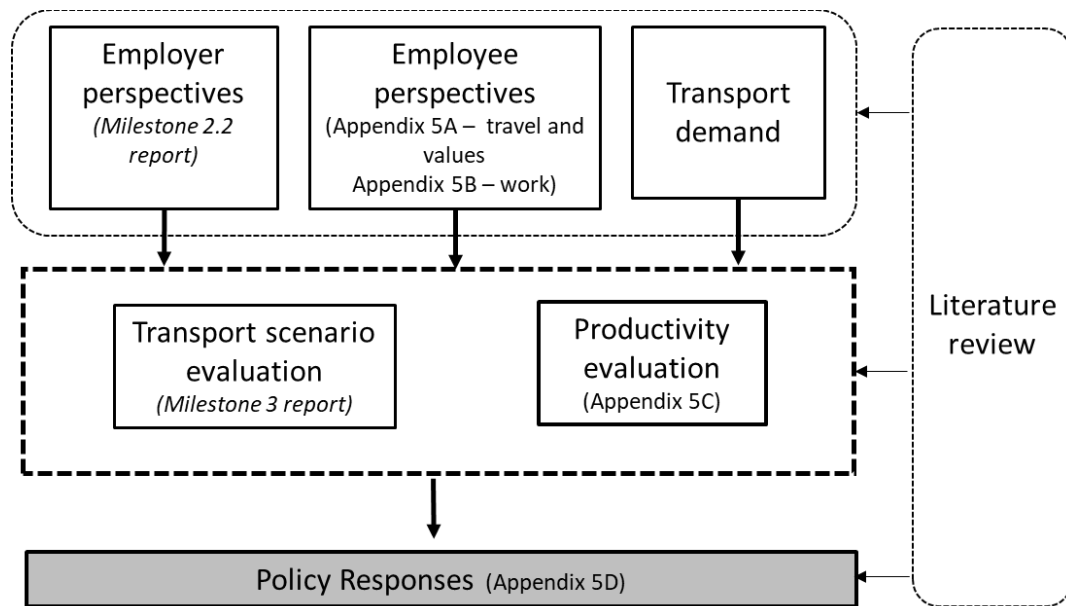


Figure E1 Research sub-components summarised in the Overview report with technical detail provided in previous milestone reports (indicated in italics) or as appendices (5A-D) to the Overview report

This report outlines a set of potential policy initiatives that could be designed to support a continuation of Work from Home (WFH) practices post-pandemic in the interests of reducing travel demand by private car. The policy initiatives have been developed with reference to the wider, recent, peer reviewed academic literature; from grey literature; from input from WA experts; and from the respective research tasks of the PATREC iMOVE team and its Steering Group.

The policy initiatives are grounded in the state of knowledge of the WFH experiences prior to and during the COVID-19 pandemic. This knowledge is drawn from global and national experience and from Western Australia. In this respect, due regard should be taken of the particular context (geographical, urban structure and housing conditions, mobility environment, social environment). At this stage of the emergence from the pandemic there is scant reporting of actual policy initiatives that have been implemented to support WFH, as a result some initiatives are derived more indirectly – some based on expert view derived from empirical research of the WFH experience, or from travel behaviour.

There is broad agreement in the literature that the potential for WFH is distributed unevenly across industries, business types and individuals. The post-pandemic period will likely see many businesses and employees in positions that are WFH-compatible, and in principle will likely adopt hybrid WFH models, where part of the working week is typically performed in a centralised

(traditional) office space and part at home or in a 'third place' environment. This practice will reduce the total volume of daily job commuting, though with critical spatial and temporal imbalances (WFH may be higher among CBD workers than others). A greater decline in public transport commuting than car commuting across a metropolitan area as a result of a greater WFH uptake, although this is by no means certain as society moves beyond the immediate bio-security concerns. More widespread WFH practices may result in higher rates of local travel in residential areas, though there is emerging evidence from diverse settings that this benefits walking more than motorised modes and may have the side effect of supporting a greater range of local services. Urban restructuring as a result of reduced home-work ties may occur both for residential and commercial floorspace.

It is clear from the review of literature, as well as the PATREC teams own research, that any large-scale uptake of WFH has widespread and not yet fully predictable repercussions on labour markets, settlement and mobility patterns, and society at large. This suggests the need for a multidisciplinary approach to policymaking. Such an approach needs to account for differences between urban and rural locations and between large and small businesses, with the aim of preparing a fairer and more inclusive set of opportunities between disparate actors with varying digital skills and organisational preparedness. Opportunities offered by a greater proliferation of WFH for reducing the carbon intensity of the economy, and travel, and in pursuing socio-economic and gender equity goals should be identified and incorporated into policy generation. While governments and public agencies have a proactive role in transition management, the private sector also have an important role to play in facilitating WFH where there are wider benefits.

The report outlines a multi-disciplinary set of policy initiatives that could assist in incentivising WFH practices in order that WFH can contribute to travel demand management. 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, the roles of the public and private sector in so doing, the use of financial incentives and disincentives, and consideration of the spatial consequences are indicated. 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

The project proposal described the research work required (text box below) in order to articulate a policy response capable of supporting continued working from home where it benefits personal travel reduction (distance travelled, increase in sustainable travel mode share and so on) and reduces demand for transport infrastructure investment.

C2 – Policy response

The policy response must be considered across the different institutional domains: home, neighbourhood/suburb, city and the wider institutional landscape. They should also consider the likely economic (usually measured in travel time savings and productivity increases), social (accessibility for all population groups, especially those now affected by unemployment), and environmental and health benefits (reduced pollution and noise, reduced accidents, lower use of non-renewables and energy, and promotion of active travel and healthier mobility options) (Rietveld, 2011; Fu et al., 2012).

The Delphi process (Cafiso et al., 2013) will include a group of experts from government departments, transport agencies, businesses/industry sector, who will independently provide estimates and outcomes of the WFH, as well as conditions necessary for WFH to occur. We envisage two-rounds with questionnaires and face-to-face interviews conducted with major stakeholders. The synthesis of group opinion from round 1 will be fed back to the participants for round 2. The possibility to revise/change answers between rounds is valuable: convergence of opinion will represent an indication that policy measures could be drawn and recommended to various organisations; areas of divergence also provide valuable insights into the sensitivity of potential policy responses.

The anticipated outcomes of this stage are: broad guidelines on the likely net savings of WFH, magnitude of WFH expected by industry and employees, recommendations for employers and transport agencies, as well as pathways to achieve traffic reductions and consequently decreased needs for further infrastructure investments.

2. Research Approach

In this report, the policy response has been drawn from several information sources. First, the research activities undertaken by the PATREC team as a whole:

Benefits	Research activity
Economic	1) Transport modelling to ascertain: travel time savings; vehicle operating cost saving; transport infrastructure savings. 2) Productivity increases: - WFH Business interviews; WFH Employee survey
Environmental	Transport modelling
Society	WFH Employees
Health & Wellbeing	Employee survey

These, together, provide estimates and outcomes expected of the WFH approach particularly in relation to understanding of the economic, social, environmental and health benefits of WFH. It is acknowledged that there are also disbenefits to WFH. The team’s research shows that while WFH works in many circumstances but not all, depending on work design, the individual’s circumstances

and preferences and so on. Awareness of these issues also assists in tailoring the policy response towards facilitating WFH.

Given the expertise and knowledge gained during this research project, the research team and steering group members were invited to respond to the Delphi question (below), and this was employed as a means of capturing the contribution of their research activities to potential policy instruments to incentivise WFH. Additional sources of information are derived from a literature search (including publications produced by iMOVE researchers), and from a Delphi survey of experts. The focus has been on what is needed to create the right conditions for WFH, acknowledging that for some people it won't be possible or beneficial to WFH home.

The Delphi intervention was planned to include two rounds. In round 1, experts were presented with the following scenario and question:

“There has been a significant increase in the number of employees working from home (or close to home) during the pandemic. This has potential benefits in traffic and reducing carbon emissions, productivity, and savings in infrastructure investment.

Given these benefits, we are keen to gather your expert opinion on what policy instruments could be employed to facilitate working from home or closer to home for some or all of each week.

You may like to comment on the role of public sector agencies (transport, town planning, environment, communications etc) as well as the role of the private sector. You may like to offer opinion on the use of financial incentives/disincentives (to business or employees); whether certain areas of the greater metropolitan area should be focussed on (in the context of travel demand management); land use and parking policy.”

The process was envisaged to entail a synthesis of the results from round one, focusing on areas of convergence and divergence, followed by a second round where experts are asked to reflect on the initial findings and revise their original answers if needed.

The experts invited included a selection of WA businesses, WA government agencies, professional bodies, and interest groups. The response to the invitation was very poor (only five responses out of 21) – the main reason indicated as time pressures and extended leave being taken as a result of WA's border opening after an extended period of closure. Due to the low response rate, only a single round of the Delphi process was undertaken, with the results from the respondents synthesised in the section below.

3. Issues arising from the WFH experience

In the development of the following policy response (Table 1), this report has drawn on a range of information sources as identified above (section 2). This information is utilised to both shape a set of policy initiatives aimed at supporting WFH practices in Greater Perth in the context of travel demand management and provide the rationale for their inclusion.

3.1. PATREC Research

The findings from the different research strands within the PATREC project have confirmed a significant shift to WFH practices as a response to the pandemic. The full research findings from the different research tasks are presented in a series of internal reports to the Steering Committee. In the following, the focus is on the key issues that have been uncovered which may either diminish the benefits of continued WFH practices post-pandemic or suggest opportunities to encourage WFH for which an appropriate policy response may support continued WFH practices.

3.1.1. Employer experience (Task A1)

The interviews with businesses based in Greater Perth confirmed that a hybrid WFH model was the most popular practice, most often involving working two days per week at home and the rest of the week in the workplace. Policy initiatives that can support the continuation of this practice are likely to have considerable benefit in the reduction of traffic congestion resulting from longer distance commuting.

The outcome in terms of property requirements has been mixed: some have maintained the same space but with fewer staff present in order to address bio-security concerns; some have re-organised space to allow for new ways of working (organised by work tasks) on the days staff work at the office. The fall in property vacancy rates (section 3.1.3 below) supports these findings. There has also been some reduction in space demands by some businesses – some have already downsized, and some may relocate out of the Perth CBD at lease renewal. Facilitating the dispersal of employment to suburban centres may reduce traffic congestion in the inner-city suburbs and also serve to activate mono-use activity centres in the middle and outer suburbs.

There is an emerging interest in use of shared workspaces/co-worker spaces in suburban centres as a means to support WFH. Promoting this workplace option may assist in supporting shorter work journeys, especially for those employees who are unable to WFH.

None of the businesses interviewed had a sustainable transport policy that addressed the work commute. Those businesses located in the CBD tended to limit provision of car parking to senior staff, although the WFH patterns freed up spaces for other staff to use these parking spaces that would not normally do so. A policy initiative to address staff commuting could encourage WFH and also reduce total distance travelled by private car for the work commute. Where staff travel longer distances into the CBD, this could see a considerable saving in traffic congestion, even when counterbalanced by increased local car travel while WFH.

3.1.2. Employee experience (Task A2)

The positive benefits of WFH depend on good ‘work design’, such that the benefits beyond time and money are seen. While WFH has many social benefits, the disadvantages are that some workers may be more closely monitored which can lead to work stress. WFH benefits can be experienced where employees are able to maintain the working day to only paid hours, but the interviews from the longitudinal WFH study showed that some people worked more hours and home / work boundaries blurred making it difficult to stop working. There was also reported a pressure for employees to be constantly available as emails arrived out of normal working hours. Policy initiatives that tackle these concerns are of significance if WFH practices are to succeed.

3.1.3. Travel patterns (Task B1 & B2)

During the travel restriction stage, WFH practices (including for some non-working / furlough) saw the number of commuters decrease dramatically. WA was unique, compared to the Eastern States, in the period mid-2020 to end of 2021 because local travel restrictions were not in place for most part. During this period two interesting phenomena were observed,

1. Property vacancy rates fell over the 12 months to 2021 and currently are lower than the pre-pandemic levels. A similar, but less dramatic, fall is noted in Adelaide. This trend is not reflected in the other major capitals - Sydney, Melbourne and Brisbane - all of which experienced long periods of local travel restrictions.

2. Traffic volumes and congestion increased over the course of the pandemic. Whilst the PATREC transport modelling work has not established where the increased traffic is coming from, the investigation has identified a switch away from public transport (PT) and service journeys that may have been part of a trip chain or are now undertaken because of the freed time.

These observations do not distract from the benefits of WFH. The PATREC research has found that there is considerable payoff to the individual, the time and money costs from a reduction in

the need to commute are substantial. In bigger cities where congestion is a major issue, out of pocket cost can be measured in the thousands and workers may benefit from an extra 'two working weeks' (60 minutes a day * 2 days a week over 46 weeks) in aggregate.

In aggregate, however, it is difficult to say to what degree WFH (by a portion of the workforce) is having directly on traffic. It is clear that the increase of WFH brought on by the COVID-19 pandemic has changed travel patterns throughout Perth markedly. Despite only low-volume outbreaks of the virus (until now) and minimal lockdowns, it is observed that public transport usage has decreased compared to historical levels whereas private vehicle (car) usage has increased in comparison. Anecdotally, people feel they are stuck in traffic more than before - which may be due to changes in travel behaviour, despite the decrease in commuting trips being more than offset by an increase in trips for different journey purposes. From a travel demand management perspective these issues must be addressed in any policy response if the other benefits of WFH are to be capitalised on.

3.1.4. Delphi survey of experts (Task C2)

Twenty-one organisations were invited to respond to the Delphi survey: five provided a response. Of these only two organisations provided a response that offered advice on potential policy initiatives. One other organisation disagreed with the idea of WFH and argued that for bio-security reasons they needed more CBD parking so that people did not have to commute by public transport. This response informed the initiative on parking.

3.2. Wider literature on policy initiatives in use /proposed to support WFH in the context of travel demand management

This section reviews a selection of policy reports and relevant academic and grey literature on the effects of WFH on urban structure and mobility that were published during or immediately before the COVID-19 pandemic. The aim was to establish the scope of any policy initiatives, either in use or proposed, that were designed to support WFH practices in the context of travel demand management.

The 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. As a result, most 'direct' policy initiatives implemented early in the pandemic have not yet been evaluated concerning their longer-term effects. Similarly, the results of modelling exercises discussed here, some predating the pandemic, have not yet been thoroughly tested against the real-world experiences supplied by the widespread enforced WFH practice during pandemic contact restrictions.

The review begins with a discussion on such pre-pandemic modelling as well as peer group research, outlining the state of knowledge and its limitations prior to the COVID-19 outbreak. In the next two sections, the variety of direct policies applied (by public agencies and by companies respectively) to stimulate and to manage the uptake of WFH are examined. Following this, an examination of literature where policy initiatives can be gleaned through an indirect approach by drawing on empirical studies undertaken to assess the impact of pandemic conditions on WFH and travel patterns, and on respondents' attitudes and expectations for the post-pandemic future.

The findings presented in this report cover a wide range of global locations, where pandemic experiences and policy responses varied: some places, such as Melbourne, were subjected to a succession of long, strict lockdowns enforcing WFH while others, such as Sweden, followed a more liberal regime of pandemic management based chiefly on recommendations. Locations also

differ in their housing conditions and the associated degree to which WFH is facilitated in private residences, and their 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 those from another. It is thought, however, that their presentation alongside each other provides an impression on the breadth of WFH policy and responses by decision makers, businesses and workers.

3.2.1. Effects of WFH on urban structure and mobility: An overview of pre-pandemic modelling and research

Academic inquiries into the impacts of working from home on cities and their transport date back as far as the 1970s. Of particular interest in the context of the COVID-19 pandemic are a range of modelling exercises undertaken during the years immediately prior to the outbreak. In the following, the work of Lennox (2020) in Australia, and of Larson and Zhao (2017) and Delventhal et al (2021) in the US is reviewed.

From a modelling exercise predating the pandemic, Lennox (2020) claims that WFH makes longer, less frequent commutes more acceptable and hence leads to the two parallel trends of residential decentralisation and job centralisation. Both trends respond to workers and employers placing less value on spatial proximity to each other in their locational choices. This may lead to workers choosing residential locations that offer better value for money (or greater proximity to non-work destinations), while businesses may take greater advantage of agglomeration economies in central locations, particularly as, as the author suggests, the property price gradient between centre and periphery might flatten. Such a trend might work as an antidote to inner urban gentrification and intensification: redevelopment activity in these areas may slow and both housing and office space become relatively more affordable. Lennox expects urban growth to slow in all but the largest Australian core cities, while accelerating in smaller towns within the commuter belt of employment centres. For settlements beyond these commuter belts, further decline may be a possibility.

‘There is especially strong job growth in central and secondary business districts of Sydney, Melbourne and Brisbane. Under our modelling assumptions, firms have undiminished incentives to agglomerate while doing so becomes less costly. Alternative modelling assumptions could reinforce or weaken this tendency. If firms required less floorspace because workers were present less often, agglomeration would become cheaper still. On the other, if WFH weakened productivity spillovers, benefits of agglomeration would be smaller.’ (Lennox, 2020, p18)

A significant emphasis is placed here on the effects of agglomeration on productivity, with the implicit assumption that face-to-face work formats tend to increase productivity while WFH formats tend to reduce it. In the words of Delventhal et al (2021):

The shift to telecommuting implies changes in the income both of workers and the owners of real estate. On the one hand, labour productivity is pushed upward as jobs leave peripheral areas, and employment in the most productive tracts increases. Productivity receives a further boost from the accompanying increase in spatial agglomeration externalities. Simultaneously, labour productivity is pushed downward because more employees work at home and teleworkers do not contribute to agglomeration.’ (Delventhal et al, 2021, ps).

These assumptions on productivity began to be tested extensively by other authors following the enforced WFH experiences of 2020, and this discussion is returned to below.

Lennox (2020) also hypothesises about the relative appeal of WFH-compatible jobs over non-WFH compatible jobs: as the former become more attractive due to the greater flexibility they offer workers in terms of locational choices and organisation of daily activities, they might be subject to slower wage growth than the latter. Such a trend would respond to widespread concerns voiced during the pandemic about the perceived underpayment of ‘essential workers’ (ie. people in non-WFH compatible jobs) in comparison to their WFH counterparts. It may also support an emerging

tendency for differentiation of residential location along this divide, a possibility previously raised in the work of Larson and Zhao (2017):

'However, there is also a clear sorting effect: workers choosing WFH occupations become more likely to reside in outer suburban and peri-urban areas while the reverse is true of those choosing non-WFH occupations. Non-working households also locate more centrally. WFH jobs increase everywhere but (with some localised exceptions) most strongly in inner suburban and central city areas.' (Lennox, 2020, p19)

Larson and Zhao (2017) conducted a simulation exercise on an idealised medium-sized metropolis in the US, while using a calibration technique to maintain some real-world resemblance to the cities of Charlotte (NC), Indianapolis (IN), Kansas City (MO) and San Antonio (TX). Their analysis is focussed on examining the impact of widespread WFH uptake on energy use, greenhouse gas emissions and individual welfare. Like Lennox (2020; see above), they anticipate that WFH acts as a disincentive for both workers and employers to seek spatial proximity to each other:

'The fall in transportation costs for both teleworkers and non-teleworkers reduces incentives to live near the CBD where housing costs are high, causing sprawl. This sprawl effect of telework lowers structure density while increasing average home size and the length of the average commute. Each of these indirect, general equilibrium effects tend to increase energy consumption, making the overall energy and greenhouse gas effects of telework uncertain.' (Larson and Zhao, 2017, p715)

Thus energy savings from fewer commutes may be outweighed by additional energy consumption associated with longer commutes and larger homes (in response to both the greater preference for peripheral locations where houses are typically larger, and the additional spatial requirements of telework within the home). Only in the case of a concurrent absolute or relative drop in wages (as discussed by Lennox, 2020, see above), net energy savings may eventuate.

Delventhal et al (2021) conducted a pre-pandemic quantitative model to gauge the impact of WFH (up to a rate of uptake of 33% of all jobs) on the metropolitan area of Los Angeles (CA). Their findings reverberate with both Larson and Zhao (2017) and Lennox (2020) in terms of residential decentralisation accompanied by job centralisation:

'Jobs relocate to the core of the urban area, while residents move to the periphery. The largest driver of this effect is workers who previously had to commute and can now work at home. They tend to move farther away from the urban core to locations with more affordable houses. This increases the demand for real estate in peripheral locations and lowers the demand in the core, pushing jobs from the suburbs into more central locations.' (Delventhal et al, 2021, p2)

The authors anticipate a net reduction in traffic congestion as WFH proliferate and that this translates into an expansion of residential choices while keeping commuting times constant suggest (in the Marchetti tradition):

'Average commuting times fall, while commuting distances increase. Since fewer workers commute, traffic congestion eases, which increases average speed of travel. Commuters take advantage of this and also move farther away from their workplaces to live in locations with lower real estate prices.' (ibid, p2).

There is a concomitant expected effect on the geography of property values:

Average real estate prices fall. As many workers move into distant suburbs, prices in the periphery increase. However, these price increases are more than offset by the decline of prices in the core. This decline is driven by two factors. The first is the decline in demand for residential real estate in core locations. The second is the reduced demand for on-site office space from workers who now telecommute. In the counterfactual where 33% of workers telecommute, average house prices fall by nearly 6%. (ibid, p 2)

However, some concerns remain concerning the applicability of each of these authors' findings from simulation exercises on the actual urban condition. For instance, Larson and Zhao's (2017) modelling makes highly homogenous assumptions on urban form and commuting behaviour: in their idealised city, all jobs appear to be located in the CBD while all residents are located outside the CBD, with the city growing concentrically towards a sharply delineated settlement fringe in response to increasing demand for residential space. No consideration is given to variations in amenity between residential neighbourhoods beyond their distance to the CBD as the city's employment centre. Further, all job commuting appears to occur by (petrol-powered) automobile, and commuting cost is only related to time and fuel cost with no consideration of costs (or capacity limits) of parking the vehicles at CBD destinations.

In the real world, the parameters that inform Larson and Zhao's model are likely to display significantly greater complexity. Employment in contemporary cities is highly dispersed beyond the CBD area (in large Australian cities, employment within the core municipality – typically incorporating the CBD as well as some adjacent areas – only accounts for between 16% and 21% of metropolitan employment; ABS Census 2016). Residential uses are increasingly evident within CBD areas. Residential areas anywhere in a metropolitan area offer plenty of location-specific amenities other than distance to CBD or housing cost that differentiate them from each other and might influence people's housing choices, ranging from proximity to natural attractions or other non-work destinations (particularly the residences of family members or friends) to the presence (or not) of desired social milieux, school, recreational and entertainment opportunities or suitable housing types. Lastly, not all commuting, and particularly not CBD commuting, occurs by automobile; in fact, the walkability or cycleability of a neighbourhood and/or the journey to work, or the accessibility to public transport also weigh on residents' locational choices while the prevalence of non-car job commuting has a clear influence on energy use and greenhouse emissions, as well as individual welfare (by enabling lower rates and hence lower costs of household car ownership). It is conceivable that full consideration of all these complicating factors may well contaminate Larson's and Zhao's (2017) neat assumptions into near-irrelevance for a valid assessment of the impact of WFH on the development trajectories of cities and their transport.

Delventhal et al (2021) acknowledge these constraints, not least as an outcome of their own modelling:

'Our quantitative model predicts considerable heterogeneity in outcomes that is not accounted for by the simple core-periphery continuum. Within the core, locations with high productivity gain jobs while less productive locations lose them. At all distances from the center, locations with better exogenous residential amenities either gain more or lose fewer residents than less attractive equidistant locations. Overall, the single monocentric dimension of distance from the center only accounts for about half of all variation in predicted outcomes.' (Delventhal et al, p2)

Lennox (2020) also points at limitations to congestion models attempting to gauge WFH effects, noting how Delventhal et al (2021) only considered regional variations in aggregate vehicle km as a proxy for the index while failing to account for public transport, which may play a significant role for longer-distance commutes into CBDs along regional rail corridors surrounding large Australian cities. With the exception of a brief and quite theoretical foray of Larson and Zhao (2017) into the effects of greenbelt policy and height limits, Lennox (2020) also points out that the effects of land use regulation on the pace, character and extent of residential (re)development and rural to urban conversion remain outside the consideration of the models. In this context, the author notes threats to biodiversity protection and natural disaster risk as constraints to further peri-urban expansion.

Two further caveats appear in Delventhal's et al (2021) work. First, the authors suggest that traffic congestion effects at the periphery may increase alongside with improving residential amenities as more telecommuters are present there and do more discretionary trips, which may mitigate other findings concerning relative attractiveness of residential locations in these areas. Second, the authors make mention of intangible, non-quantifiable welfare and productivity loss associated with telecommuting related to workers' social or psychological preferences against WFH, a topic

that is discussed further below in the context of empirical work during the pandemic-induced WFH surge.

To summarise:

- All three pre-pandemic modelling exercises anticipate that **both employers and employees will place less emphasis on the distance between home and workplace** when making locational choices as WFH practices proliferate.
- This may **take urban intensification pressure off residential areas in proximity to employment centres** and may **increase development pressure in peri-urban areas**, though it will do so selectively depending on other amenities as well as regulatory or natural constraints on development.
- **Demand for centralised office space will decrease** as more workers spend more time working remotely, **but simultaneously increase** as more firms seek to benefit from agglomeration effects facilitated by co-location with each other, thus vacating or weakening scattered employment locations and less productive employment clusters.
- The **number of commuting trips will decline** as more workdays are spent at home, **but their length may increase** as employers' and employees' locational decisions lead to growing distance between home and work. These two effects are asynchronous, and it cannot be predicted with certainty whether or not, and at what geographical scales, they will produce a net effect of reducing traffic congestion or effect modal shifts between car, public transport and/or active commuting over time.

Uncertainties over transport and mobility effects of WFH can be contextualised through behavioural studies that seek to learn about the mobility styles of remote workers. Two examples from the literature illustrate this approach.

In an Australian study based on survey of on Gold Coast residents working from home in 2016-17, Zenkteler et al (2019) take a stronger focus on home-based businesses than on employees of larger firms skipping office days in favour of WFH arrangements. Within this cohort, WFH appeared most popular among mature-aged, well-established professionals. Respondents were recruited online and geographically cluster in the (mixed-use) Southport and Robina neighbourhoods and the rapidly growing greenfield areas in the north of the city, but less so along the high-density coastal strip. Most respondents report that the nature of their work incurs low levels of car use either by themselves or by visiting clients/business associates – about half of them work exclusively online and do not necessarily rely on their locality for such connections. Respondents value the existence or development of a neighbourhood centre with WFH-supporting infrastructure ('third places'), house designs enabling WFH and walkable neighbourhood contexts. Less importance is placed on the ability to advertise the business on the residential property, conduct sales from home or allow unrestricted employee access to the premises (conditions typically constrained by zoning regulations in residential areas).

Eldér (2022) uses pre-pandemic data (2011-16) from the regular Swedish national travel survey (RVU) to determine the effect of WFH on mode choice and finds that teleworkers are more likely to walk (particularly for errands and leisure journeys) and less likely to cycle (particularly for commuting trips) compared to the full sample of employed respondents ($N=17,324$). The author contends that the survey methodology does not allow for the establishment of causal relationships between WFH and deviation effects from population-typical mode choice behaviour; rather, he suggests that WFH may act as an 'enabling' condition for greater uptake of active transport. This may partly be the result of 'selectivity bias' in that individuals may be concurrently pursuing WFH arrangements with their employers and walkable activity patterns in their use of urban space, in response to personal preferences. More longitudinal research would be required to illuminate this context further.

Both these studies detect elements in the mobility style aspirations of remote workers towards less car use and more walking than would be typical under the condition of a daily commute between home and office. This does not necessarily stand in contradiction to a willingness to move further from the centralised workspace when making residential relocation decisions enabled by the ability

to work from home, for example if a household moves from a car-dependent middle or outer suburb to a more traditionally structured peri-urban small town (see Lennox, 2020).

3.2.2. Direct public policy initiatives implemented to support WFH

Drawing from pandemic experiences across OECD countries and regions, Corbetta (2020) outlines a range of principles to inform WFH policies at all levels of government. In keeping with the findings of this literature review thus far, it is acknowledged that a large-scale uptake of WFH has widespread and not yet fully predictable repercussions on labour markets, settlement and mobility patterns, and society at large, calling for a multidisciplinary approach to policymaking. Such an approach needs to account for differences between urban and rural locations and between large and small businesses, with the aim of preparing a fairer and more inclusive set of opportunities between disparate actors with varying digital skills and organisational preparedness (see also Tokarchuk et al, 2021). Opportunities offered by a greater proliferation of WFH for reducing the carbon intensity of the economy and pursuing socio-economic and gender equity goals should be identified and incorporated into policy generation. Governments and public agencies have a proactive role in transition management and the collection of a suitable evidence base to support policymaking (Corbetta, 2020, p6).

Examples of policy initiatives taken by selected OECD jurisdictions around the issue of WFH during the pandemic include:

- Recommendations (or obligations) for WFH during peak pandemic phases;
- Adaptation and reform of labour regulations to facilitate WFH;
- Adaptation and reform of planning and building regulations to facilitate home-based businesses;
- Provision of digital platforms and training to enable remote working, particularly for small and medium businesses;
- Financial support to businesses to enable upgrades of ICT infrastructure;
- Grants and subsidised co-working spaces to attract remote workers to particular areas;
- Harmonisation of cross-border taxation, healthcare and visa rules to facilitate WFH across international borders (Corbetta, 2020, p20).

Empirical findings of researchers surveying businesses during the early stages of the pandemic confirm Corbetta's (2020) suggestion that significant diversity existed in the level of organisational preparedness for the shift to WFH. Belzunequi-Eraso and Erro-Garcés (2020) did an analysis of early corporate responses in terms of facilitating WFH at the onset of the pandemic in March 2020 in Spain, mostly relying on firms' public communications during this period. While the authors did not collect empirical material on urban or transport effects, they detect a significant level of unpreparedness with companies to scale up WFH from a practice circumstantially negotiated with particular employees or their representatives, to a broadly applied practice under the public restrictions introduced by pandemic management. This experience concurs with the findings from interviews with WA businesses conducted in 2021 (Curtis, 2021).

This contrasts with the findings of Hiselius and Arnfalk (2021) in Sweden, who investigated changes to business trips and workplace commuting among employees of public agencies during the relatively liberal COVID-19 regime in Sweden in April-May 2020. They find substantial reductions in business travel and uptake of WFH and conclude that the surveyed agencies were generally well-prepared to instigate such policies under the influence of an external shock, given WFH trends and the impetus to reduce business travel were already present prior to the pandemic.

Tokarchuk et al (2021) applied a questionnaire to Italian hi-tech firms in April 2020, receiving 179 valid responses. They echo the importance of 'organisational readiness' discussed by Belzunequi-Eraso and Erro-Garcés (2020) and Hiselius and Arnfalk (2021):

'Organisational readiness proved to be fundamental for defining the degree of adaptation of telework during the lockdown. Accumulated capabilities and resources together with a certain

degree of agility, allow firms to be more inclined to modify their functioning in the face of an unforeseen event and exploit the redefining strategy changes.’ (Tokarchuk et al, 2021, p8)

3.2.3. Direct workplace policy initiatives to support WFH

The way in which WFH is organised at the workplace level is of relevance to policy initiatives. Davis (2021) distinguishes five post-pandemic response categories ranging from ‘no WFH’ to ‘full WFH’, gleaned from conversations with business leaders and workplace strategists:

- **‘As it was’**: Employees return to the office and resume a regular nine-to-five routine. The office might be a bit more hygienic and flexible, but mostly this is the centralised office as it was before the pandemic.
- **‘Clubhouse’**: A hybrid model where employees visit the office when they need to collaborate and return home to do their focused work. The office serves as a social hub — the place people go to meet, socialise, and work together.
- **‘Activity-based working’**: Employees work from an office but don’t have an assigned desk. Instead, they spend their day moving between a variety of workspaces, such as meeting rooms, phone booths, hot desks, and lounges. Prior to the pandemic, most Australian activity-based offices had approximately eight desks for every 10 people (since people often worked elsewhere in the office). After the pandemic, firms are looking to reduce this to as low as five desks between 10 people, anticipating that many of their employees will be out of the office, working from home a couple of days per week.
- **‘Hub and spoke’**: Rather than travelling to a large office in the central business district, employees work from smaller satellite offices in the suburbs and neighbourhoods closer to where they live. This saves them the commute to a central office while still providing the benefits of face-to-face interaction with colleagues.
- **‘Fully virtual’**: Employees work from home — or anywhere else they like — allowing companies to give up expensive leases and build on what they started during the pandemic.’ (Davis, 2021)

Coleman and Ricker (2022) refer to a **‘hybrid workplace approach’** as the model that appears to emerge as the most popular among employers and employees as pandemic conditions fade (see also Vij et al, 2022; and Curtis, 2021). For employees, a hybrid approach typically involves part of the week spent in an office setting and part of the week spent at home or at a ‘third place’ (a setting such as a café, library or informal coworking space). Such arrangements may reflect the clubhouse, activity-based working and hub-and-spoke models from Davis’ (2021) categories above, though from Coleman and Ricker’s (2022) work there are further important considerations concerning the degree of employee autonomy and the organisation of team work:

‘Some of our clients are focused on a **choice-based model**, which empowers employees to determine when and where they are most productive to complete their work. In this model, employees might need to return to the office two or three days per week or they have ‘full choice’ in choosing when, why, and where they work in the office, based on minimal policy control.

‘A **schedule-based hybrid work model** features choreographed days of the week, or even on a monthly or quarterly basis, where leadership and employees are scheduled to intentionally overlap to coordinate meaningful time together. This allows teams to foster connections with new members and to build and rebuild social networks and capital with one another as well as work-related purposes.

‘In a **purpose-based model**, organizations look deeply into job function, role, and work-based processes and activities to prioritize those personas best suited to work fully or mostly remote, two to three days in the office, or most days in the office. This involves rethinking workspace planning solutions to focus on creating synergy with simultaneous different personas and purposes.’ (Coleman and Ricker, 2022)

It is noted that some combinations of approaches may come into conflict with each other – for example, a ‘hub-and-spoke’ approach assigning workers to suburban satellite offices based on the geographical locations of their residences (to minimise commuting times and distances) may clash with the desire to optimise the compilation of project-based teams, where necessary across such geographical divides, as implied in the purpose-based model.

3.2.4. Policy initiatives that may be derived indirectly from empirical research : Transport user surveys during pandemic enforced WFH periods

Beck et al (2020) did two empirical surveys during the first months of the pandemic (March/April and May/June 2020), with a particular emphasis on the question how greater uptake of WFH, and by whom and in which circumstances, might impact on road and public transport congestion in Australia. They stress the importance of employer and government support in managing the transition:

‘A positive experience with working from home, and the desire to do so more often, all increase the probability of working from home more often. Most important is the availability of an appropriate space to work from home. Any support that can be given to make the home more conducive to work in the short-term will improve the experience, productivity and thus incidence of work from home, and will likely make it a longer term lever in the congestion management tool kit.’ (Beck et al, 2020. p16)

The adaptation of the home has implications for house design and for the availability of high-quality internet access. Of further importance is the flexibility employees have whether to WFH, particularly the choice for a hybrid approach, and the policies instituted around WFH by their employer, down to a supportive attitude of managers in their supervision of staff who work remotely (Balbontin et al, 2022).

Currie et al (2021) examine commuting behaviour changes as a result of COVID-19 lockdowns in 2020 (revealed preference), and respondents’ expectations/intentions of future behaviour once the pandemic has ended (stated preference), on a sample of Melbourne residents. Their findings point to 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-pandemic levels metro-wide, and 123% higher for CBD workers). Critically, these shifts manifest in respondents’ expectations of declining public transport use while car (and bicycle) use is anticipated to grow slightly despite the greater proliferation of WFH. 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 – though the authors point out that 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 later (which could charitably be considered a much-needed ‘breather’ period in the fight against PT overcrowding). Conversely, traffic congestion will increase, including to and from the CBD, which (as the authors contend) might provide an impetus for faster mode shift back to PT contrary to respondents’ stated intentions, as the road and parking systems operate at the limit of their capacity.

The authors note that 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 but also reported by other researchers (Balbontin et al, 2022). On the basis of experiences from (smaller) epidemics in the past (such as SARS and MERS in Asian cities) however, Currie et al (2021) suggest that 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 (see also de Haas’ et al (2020) discussion of this issue in the context of habit formation below).

Beck et al (2020) reflect on the role of public agencies in facilitating a more permanent WFH trend in the interest of reducing journeys to work:

'If transport authorities wish to keep commuting trips at the current low levels, particularly given the modelled resistance to public transport that currently exists, then governments should encourage ongoing employer support (linked to sustainability goals) for working from home and for those organisations who are currently not allowing staff to do so, they should work with them to identify the barriers and help develop strategies to overcome them if indeed those barriers can be removed.' (Beck et al, 2020, p16)

For Balbontin et al (2022), one of the important policy messages is the recognition that WFH provides for work flexibility, an important condition for the attraction of employees, especially in a competitive employment market. This aspect was also stressed in PATREC's interviews with businesses in Greater Perth (Curtis, 2021). While WFH was challenging for some individuals during lockdown periods (when children were also being home schooled, and all household members were confined to home), outside of lockdown periods WFH may offer more opportunity for those with caring responsibilities and those who cannot travel to work, thus increasing employment opportunities. Offering WFH may also ensure that businesses attract staff in a highly competitive market.

Shamshirpour's et al (2020) work is based on a combined revealed/stated preference survey in Chicago from April to June 2020. The survey did not collect travel profiles; rather it focussed on demographic indicators and attitudinal data, with a focus on equity considerations – particularly concerning the far greater exposure of lower socio-economic groups to infection risks (through greater dependence on non-WFH compatible jobs and on travel by transit) as well as secondary effects (such as pandemic-related income instability). The authors note predominantly positive WFH experiences among respondents but stress the importance of 'home workability', ie. the availability of a home environment that provides the space, comfort and equipment, and relative absence of distractions, required for productive work. Among transport modes, respondents considered PT and taxis or ride-hailing/ride-sharing services the riskiest in pandemic conditions, and private vehicles, bicycles and other micromobility devices, and walking the least risky. Like de Haas et al (2020, see below), the authors reveal a widespread disposition among respondents to reduce air travel even beyond the duration of the pandemic (43% of respondents versus 14% who state that they intend to increase it), with discomfort sharing space with strangers mentioned by 48% of respondents.

3.2.5. Policy initiatives that may be derived indirectly: research on the aggregate effects of WFH on travel behaviour

Reiffer et al (2021) analyse longitudinal data from the German Mobility Panel, an annual travel diary with supplementary questions from a fixed cohort of 1,800-2,000 households throughout the country (de Haas et al (2020) use a similar sample frame in the Netherlands, discussed below). The data analysed was taken in 2018, 2019 and 2020 (northern autumn of each year; in 2020, there was no strict lockdown in place in Germany at this time) and showed 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% (p37). There is a strong coincidence of respondents' personal preferences for WFH and the degree to which their employer enables (or not) the practice, suggesting that at least some of the increase in WFH may be the result of ongoing shifts in workplace relations rather than merely enforced by pandemic circumstances.

Other data items show that WFH-induced travel reductions during 2020 were more likely to occur for respondents using the car for commuting, and for respondents with higher educational and economic status, pointing at the notion that pandemic WFH may have been partly an expression of socio-economic privilege (in that employees of lower educational or economic status are more

likely to work in jobs without a WFH option, and more likely to use public transport to travel there, all of which would have translated into greater infection risk at the peak of the pandemic). The authors find a positive correlation between commuting distance and WFH uptake, though with the qualification that this does not hold for employees whose workplaces are located at the urban periphery. There is a greater likelihood for households with children under 10 years of age to embrace WFH, while respondents in sole-person households are more likely to return to office settings when pandemic restrictions are lifted.

De Haas et al (2020) use the Dutch mobility panel, a nationwide representative cohort that regularly supplies travel behaviour data (see Reiffer et al (2021) above for a similar approach in the German context) and query whether the COVID-19 lockdowns provide a 'window of opportunity' to prompt changes in work and travel habits and behaviour. 2020 data was taken during the height of the 'intelligent lockdown' in the Netherlands (March-April 2020) and correspondingly shows drastic reductions in travel activity: average daily trips per person dropped from 2.7 to 1.2, the share of respondents who didn't leave their home at all on a given day increased from 20% to 50%, and average travel distance decreased from 31 to 10 km per person per day. Twenty-five percent of the remaining journeys were circular walking and cycling trips without an out-of-home destination (up from 7% before the pandemic). In addition, attitudes about WFH, out-of-home activities and transport were surveyed. 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. Between 75% and 80% of respondents expect their travel behaviour and mode choices to eventually revert to pre-pandemic patterns; however, twenty percent expect to walk and cycle more while a similar proportion expect to fly less (for car and ground public transport use, future expectations for increases/decreases are relatively even in number, with a very slight shift away from PT and towards cars – compare that to the much more significant intended shift found by Currie et al (2021) for Melbourne). Similar to Currie et al (2021) and Shamshiripour et al (2020; see above), the authors find that negative attitudes about public transport use surged during the pandemic, which they attribute largely to the infection risk and to associated government recommendations to avoid PT whenever possible.

Ton et al (2022) also observe that WFH-induced travel behaviour changes in the Netherlands affected public transport more than the car. The authors conducted a two-stage survey on travel behaviour (April and June 2020, representing the peak of the lockdown and the post-lockdown 'new normality') using a pre-existing NS panel of rail travellers (80,000 members) providing regular voluntary travel data (this panel differs from the Dutch mobility panel used by de Haas et al (2020) discussed above). Of these, just over 30,000 participated in both surveys and just over 10,000 self-identified as regular WFH participants in both survey stages, and a further more than 3,000 in one of the survey stages (together making up 71% of employed respondents; p58-60).

The authors conduct 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 public transport use lower. Only the two smallest cohorts (16%) report the reverse: less WFH and more intended PT use once the pandemic passes (p64-68).

PT revenue may drop as a result, which might reduce the viability of services. Conversely, more WFH if timed well (by joint initiatives from employers and public agencies) could reduce peak hour demand for PT and thus smoothen the patronage curve over the day and week.

3.2.6. Summary: WFH policies and their effects

There is broad agreement in the literature that the potential for WFH is distributed unevenly across industries, business types and individuals. While the pandemic has provided a real-life laboratory to maximise the share of WFH across society and the economy, the post-pandemic period will likely see a return to an intermediate position. Many businesses and workers in positions that are WFH-compatible in principle will likely adopt hybrid models, where part of the working week is typically performed in a centralised (traditional) office space and part at home or in a ‘third place’ environment.

Such practice will reduce the total volume of daily job commuting, though with critical spatial and temporal imbalances. Emerging trends suggest that WFH may be higher among CBD workers than others, as the proportion of WFH-compatible jobs tends to be greater in CBDs than elsewhere, and the required organisational preparedness and digital skills among the workforce more widespread. This circumstance is associated with a greater decline in public transport commuting (which is generally most competitive for CBD destinations) than car commuting across a metropolitan area as a result of a greater WFH uptake (Currie et al, 2021). Simultaneously, WFH practices may concentrate on particular days of the week (particularly Mondays and Fridays) over others, producing greater variation in daily commuting travel volumes (see Ton et al, 2022; Vij et al, 2022).

Policies to mitigate the risk of mode shift away from public transport towards the car in these conditions include a reconfiguration of public transport networks and services to better support non CBD-related travel, and to include more attractive offers to occasional commuters in the fare system. Continuing (and where appropriate, accelerate) existing policies to limit and convert road and parking space to people-oriented uses in CBDs and other employment centres would disincentivise a return to car access both for existing employment uses as their floorspace contracts, and for new uses that may occupy the vacated floorspace in the future.

More widespread WFH practices may result in higher rates of local travel in residential areas, though there is emerging evidence from diverse settings that this benefits walking more than motorised modes and may have the side effect of supporting a greater range of local services (Zenkeler et al, 2019; de Haas et al, 2020; Eildér, 2022). Policies to support such trends include more dedicated infrastructure and priority measures for pedestrians and cyclists over cars in residential areas, and greater financial and/or regulatory support for non-residential neighbourhood facilities to cluster into community hubs including ‘third places’.

4. Potential Policy Initiatives

Drawing on the above sources, table 1 outlines the range of policy initiatives that could assist in incentivising WFH practices.

These initiatives are organised by policy sector: transport, environment and society (the latter including work and business practices).

An explanation of how the suggested action could contribute to facilitating WFH, the roles of the public and private sector in so doing, the use of financial incentives and disincentives, and consideration of the spatial consequences are indicated.

Table 1: Policy initiatives to support Working from Home in the context of travel demand management

	Sector / Initiative	How contribute to facilitating WFH	Role of public sector	Role of the private sector	Use of financial incentives / disincentives	Spatial Areas prioritised	Data Source
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 action.	Development of carbon budget strategy.	Auditing carbon outputs of the business and responsibility for carbon reduction.	Could incentivise business to reduce commuting by car. Could enhance the attractiveness of the employer.	Central business district and other localities where metropolitan-wide public transport accessibility is good.	Interviews with WA businesses (Task A1)

	Sector / Initiative	How contribute to facilitating WFH	Role of public sector	Role of the private sector	Use of financial incentives / disincentives	Spatial Areas prioritised	Data Source
T2	Parking strategy	Stronger controls/costs for private non-residential parking 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).	Parking strategy		Could incentivise business to reduce commuting by car.	Central business district ¹ and other localities where metropolitan-wide public transport accessibility is good.	Interviews with WA businesses (Task A1); Delphi survey

¹ Note that while there is an existing Perth Parking Management Area for the CBD, interviews with businesses suggest that this may need strengthening to increase effectiveness.

	Sector / Initiative	How contribute to facilitating WFH	Role of public sector	Role of the private sector	Use of financial incentives / disincentives	Spatial Areas prioritised	Data Source
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 are replaced.	Maintain and build more cycleways to local services. Increase/provide bike parking at local services. Promote active transport and shared micro-mobility via the media. Provide local bus services and, or demand responsive transport to connect outer suburbs.	Active transport provision in development proposals.		Middle and Outer suburban location	Employee Survey A2; Infrastructure demand B1.
T4	Mondays and Fridays are prime candidates for lower work travel demand (notwithstanding potential increased leisure travel due to the proximity to weekend).	Measures to change the commuting patterns may be warranted, given that the travel may be for other reasons and spatially oriented towards the fringes and regional.	Promotions for using PT and active transport during those days may work better than during 'normal' commuting days (when the fear for contamination due to low social distancing is higher). Bundles with local shared mobility offerings (bicycles, e-scooters) should be considered.	Consideration of fixed WFH days for staff.	PT fares/ congestion charges with temporal variation.		Employee Survey A2; Infrastructure demand B1. Ton et al (2022) Vij et al (2022)

	Sector / Initiative	How contribute to facilitating WFH	Role of public sector	Role of the private sector	Use of financial incentives / disincentives	Spatial Areas prioritised	Data Source
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.	Make WFH more enticing (considering the potential breaks and the before-after work activities)	Identification of roads where increased flow is serving as a disincentive for use as well as works for remediation of this.			Local neighbourhoods/suburbs	Infrastructure demand B1. Zenkteleter et al (2019)
T6	Defer major infrastructure funding for roads which encourage car travel should be reconsidered.	Increased WFH will reduce the need for longer distance work commutes	Promotions or other incentives to encourage the use of alternative modes such as shared mobility, active travel and public transport.			Greater Perth – major arterial roads.	Infrastructure demand B1.
T7	Include Active Travel strategies (including public transport) within investment in key public infrastructure	Provision of infrastructure for walking and cycling and the provision of shared mobility to further encourage use of local infrastructure and access to PT	Investment.			Greater Perth	Zenkteleter et al (2019)

	Sector / Initiative	How contribute to facilitating WFH	Role of public sector	Role of the private sector	Use of financial incentives / disincentives	Spatial Areas prioritised	Data Source
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.	Advocacy. Promotion			Greater Perth	PATREC Steering Committee
T9	Introduce peak spreading – flexible start and finish time and part-day work at office (ie as well spreading the days at work across the whole week – see T4)	Staggered start/finish times in combination with part-day WFH to reduce traffic/PT congestion	Travel Demand Management Strategy.	Promotion.	PT fares/ congestion charges with temporal variation.	Greater Perth	Infrastructure demand B1. Ton et al (2022)
T10	Continue / accelerate conversion of road and parking space to pedestrian uses in busy centres	Discourage mode shifts back to cars due to greater availability of road / parking capacity from a general decline in commuting	Urban design and traffic management strategy		Could include reforms to parking fees (see T2)	Perth CBD and some suburban centres	PATREC Steering Committee

	Sector / Initiative	How contribute to facilitating WFH	Role of public sector	Role of the private sector	Use of financial incentives / disincentives	Spatial Areas prioritised	Data Source
T11	Reconfigure public transport network and services to better serve non-CBD travel	Increase PT mode share through greater competitiveness with the car on more trip relations	Public transport network and service planning		Could include reforms to the fare system (see T4 and T9)	Particularly inner-middle Perth	PATREC Steering Committee
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	While EV's help with this goal, they do not solve congestion. In congestion conditions, ICE vehicles produce more emissions because of idling. Encouraging walkable neighbourhoods where most everyday tasks can be achieved without the need to use single-occupant transport should be a priority.	See also T1.		Greater Perth.	PATREC Steering Committee

	Sector / Initiative	How contribute to facilitating WFH	Role of public sector	Role of the private sector	Use of financial incentives / disincentives	Spatial Areas prioritised	Data Source
Urban Planning							
U1	Development of new shared work / co-worker spaces	<p>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.</p> <p>Would also activate suburbs and distribute office spaces to appeal to a wider group of employees.</p>	<p>Local planning strategies to identify suitable locations.</p> <p>Advice</p> <p>Leadership / promotion / advocacy</p>	<p>Development companies</p> <p>Advice</p> <p>Leadership / promotion / advocacy</p>	Local government could incentivise.	Focus on currently unserved non-CBD locations in order to support WFH closer to home and reduce commute trip lengths	<p>Interviews with WA businesses (Task A1).</p> <p>Hensher team.</p> <p>Zenkter et al (2019)</p> <p>Vij et al (2022)</p>

	Sector / Initiative	How contribute to facilitating WFH	Role of public sector	Role of the private sector	Use of financial incentives / disincentives	Spatial Areas prioritised	Data Source
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 bring savings to the companies from renting out or selling assets in central areas and buying/renting elsewhere cheaper, but also from productivity gains. This may reduce not only the trip generation, but also the commuting distance.	Local planning strategies to identify suitable locations.	Yes	Local government could incentivise.	Greater Perth	Interviews with WA businesses (Task A1). Lennox (2020)
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)					PATREC team Zenkteleter et al (2019)
U4	Limit car travel by introducing congestion taxes on freeways to encourage public transport use.	Encourage WFH	Transport strategy		Yes	Greater Perth	PATREC team

	Sector / Initiative	How contribute to facilitating WFH	Role of public sector	Role of the private sector	Use of financial incentives / disincentives	Spatial Areas prioritised	Data Source
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	Taxation possibilities Regional Centre / outer suburban centre infrastructure to be enhanced			Outer suburbs, Regional Centres	PATREC team Lennox (2020)
U6	Ensure that developers in new estates provide local services closer to residents	WFH enhanced with local services available	Local Planning Strategy			Greater Perth	PATREC team Zenkteler et al (2019)
U7	Regulatory reform to enable home-based businesses	Removal of exclusionary provisions between homes and workplaces in zoning, building and tenancy regulations	Local/regional governments	Potential role for housing associations		Residential and other traditionally monofunctional areas	Corbetta (2020)

	Sector / Initiative	How contribute to facilitating WFH	Role of public sector	Role of the private sector	Use of financial incentives / disincentives	Spatial Areas prioritised	Data Source
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	Relocation grants to individuals, subsidised homes and co-working spaces Improvements to IT infrastructure (see I1) Special 'digital nomad' visa categories for foreign start-up entrepreneurs, 'e-residency' (Estonia)		Yes	Regional and remote areas	Corbetta (2020)
	Infrastructure						

	Sector / Initiative	How contribute to facilitating WFH	Role of public sector	Role of the private sector	Use of financial incentives / disincentives	Spatial Areas prioritised	Data Source
11	Upgrades to broadband and digital infrastructure	<p>Make experience of WFH more reliable / consistent / accessible for those with limited connections.</p> <p>Consider privacy and cybersecurity challenges specific to WFH arrangements</p>	<p>Advocacy.</p> <p>Funding.</p> <p>Facilitate the widespread availability of reliable and affordable internet access as WFH is reliant on this.</p> <p>Instigation of digital services platforms to support SME with limited in-house IT capabilities</p>	<p>Advocacy</p> <p>Funding</p>	Public grants to SME for IT investment	Greater Perth / WA	<p>Employee Survey A2;</p> <p>Delphi Survey</p> <p>Corbetta (2020)</p> <p>Shamshiripour et al (2020)</p> <p>Vij et al (2022)</p>
12	Home workability	Availability of a home environment that provides the space and comfort, and relative absence of distractions, required for productive work.	<p>Adapt regulatory standards for WFH-friendly home design and IT infrastructure in homes.</p> <p>Provide adequate childcare closer to homes.</p>	<p>Provide financial incentives for WFH-friendly home design and IT infrastructure in homes</p>	Yes (support for home office space, IT equipment, higher energy bills)		<p>Shamshiripour et al (2020)</p> <p>Vij et al (2022)</p>
13	Better data on WFH	Create a new evidence base on WFH to support relevant decision making and allow for better monitoring of WFH uptake and effects	<p>Include WFH elements in labour data collection and publish broader metrics on WFH through statistical agencies</p>				Corbetta (2020)

	Sector / Initiative	How contribute to facilitating WFH	Role of public sector	Role of the private sector	Use of financial incentives / disincentives	Spatial Areas prioritised	Data Source
	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.	Advocacy Government-facilitated distance learning platforms to upskill workers	Advocacy and Employment strategy Specialised training for groups with low IT skills, particularly in regional areas		Greater Perth Regional WA	Delphi Survey Corbetta (2020) Vij et al (2022)
S2	Tax relief for employees WFH	Lower overall costs for workers via tax relief ! Could act discriminatingly towards non-WFH compatible positions	Adjusting taxation settings	Advising on occupations that could benefit most.	Would apply. Currently capped at \$300 of costs for non-explainable work related expenses. Depreciation for items over \$300	Greater Perth / WA	PATREC Steering group

	Sector / Initiative	How contribute to facilitating WFH	Role of public sector	Role of the private sector	Use of financial incentives / disincentives	Spatial Areas prioritised	Data Source
S3	Work design	<p>Ensure employers/ managers respect contracted work hours and boundaries between work time and personal time.</p> <p>Ensure adequate social communication and collaboration networks, access to necessary internal technological and information systems, managerial support, carefully managed monitoring (ie not 'checking up' on people, but 'checking in' to see how people are doing etc).</p> <p>Role clarity is needed.</p> <p>Provision made for networking, bringing on new starters etc.</p>	<p>Make clear the work health and safety obligations on both employers and employees when WFH is used.</p> <p>Relaxation of OHS standards applying in the home (compared to the office).</p> <p>Institute 'right to disconnect' (for work-related communication outside working hours)</p>	Advocacy and Employment strategy		Greater Perth / WA	<p>Employee Survey A2;</p> <p>Belzunequi-Eraso and Erro-Garcés (2020)</p> <p>Hiselius and Arnfalk (2021)</p> <p>Tokarchuk et al (2021)</p> <p>Shamshiripour et al (2020)</p> <p>Vij et al (2022)</p>

	Sector / Initiative	How contribute to facilitating WFH	Role of public sector	Role of the private sector	Use of financial incentives / disincentives	Spatial Areas prioritised	Data Source
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.	<p>Government Departments have a major role in setting the trend/ shaping the way forward by pursuing best WFH practice within their own organisation.</p> <p>LGAs may wish to be involved depending on the workplaces or number of employees in their locality.</p> <p>Regulation for more flexible working arrangement enshrined sustainability provisions in state law with exemptions for sectors unable to comply. Could promote this, but unlikely to fund unless productivity or sustainability benefits could be quantified and influenced at scale.</p>	<p>Used to derive productivity and sustainability benefits.</p> <p>Advising on sectors that could benefit most.</p> <p>Leadership / promotion / advocacy</p>	Could apply but might require significant administration and requirements would need to be stringent to prevent blowout and flexible to be meaningful.	<p>Areas where employers had high emission profiles.</p> <p>Areas where interested organisations were located / high number of employees.</p> <p>Greater Perth</p>	<p>PATREC Steering group;</p> <p>Employee Survey A2;</p> <p>Hensher team.</p> <p>Beck et al (2020)</p> <p>Lennox (2020)</p> <p>Larson and Zhao (2017)</p> <p>Delventhal et al (2021)</p> <p>Vij et al (2022)</p>

	Sector / Initiative	How contribute to facilitating WFH	Role of public sector	Role of the private sector	Use of financial incentives / disincentives	Spatial Areas prioritised	Data Source
S4	Training to support managers managing WFHers	Some employers have concerns about how to manage staff and productivity remotely. Training packages including good practice guides may assist.	Public sector good practice guide	Private Sector training companies Create online alternatives to 'serendipitous' F2F meetings to foster team spirit and knowledge sharing		Greater Perth / WA	Interviews with WA businesses (Task A1); Hensher team Vij et al (2022)
S5	Deregulation of work hours or broaden the legal requirements to encourage more flexible working	Greater availability for employees. Reduced commutes. Potential for enhanced well being	Fair work legislation – via awards Institute 'right to remote working' (cf. German legislation) Adaptation of relevant labour regulations	Advice Leadership / promotion / advocacy Social partnership (businesses / unions)	No	Greater Perth / WA	PATREC Steering group Corbetta (2020) Vij et al (2022)
S6	Policies to prevent senior managers from closely monitoring individuals	Beneficial as 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.		Advice Leadership / promotion / advocacy		Greater Perth / WA	Employee Survey A2; Vij et al (2022)

	Sector / Initiative	How contribute to facilitating WFH	Role of public sector	Role of the private sector	Use of financial incentives / disincentives	Spatial Areas prioritised	Data Source
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	Microcredit schemes for home-based businesses	Financial incentive / employment contract	Public grants to SME for IT investment (see also I1)	Greater Perth / WA	Employee Survey A2; Corbetta (2020) Vij et al (2022)
S7	Employers to distinguish between different types of WFHers	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.),.	Guidelines Address regulatory gaps (taxation, health care, superannuation, labour standards) for cross-border WFH employees	Organisations need to specify roles for all these types of positions and their WFH possibilities.		Greater Perth / WA	PATREC Steering group Corbetta (2020) Vij et al (2022)

	Sector / Initiative	How contribute to facilitating WFH	Role of public sector	Role of the private sector	Use of financial incentives / disincentives	Spatial Areas prioritised	Data Source
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 taking into account varying personal preferences towards WFH		Determine an 'optimal level' of balancing WFH and F2F work practices			Vij et al (2022)
S9	Organisational readiness	Agility of firms or agencies to instigate or moderate WFH strategies in response to external shocks or other constraining factors	Guidelines	Social partnership (businesses / unions)			Interviews with WA businesses (Task A1) Belzunequi-Eraso and Erro-Garcés (2020) Hiselius and Arnfalk (2021) Tokarchuk et al (2021)

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