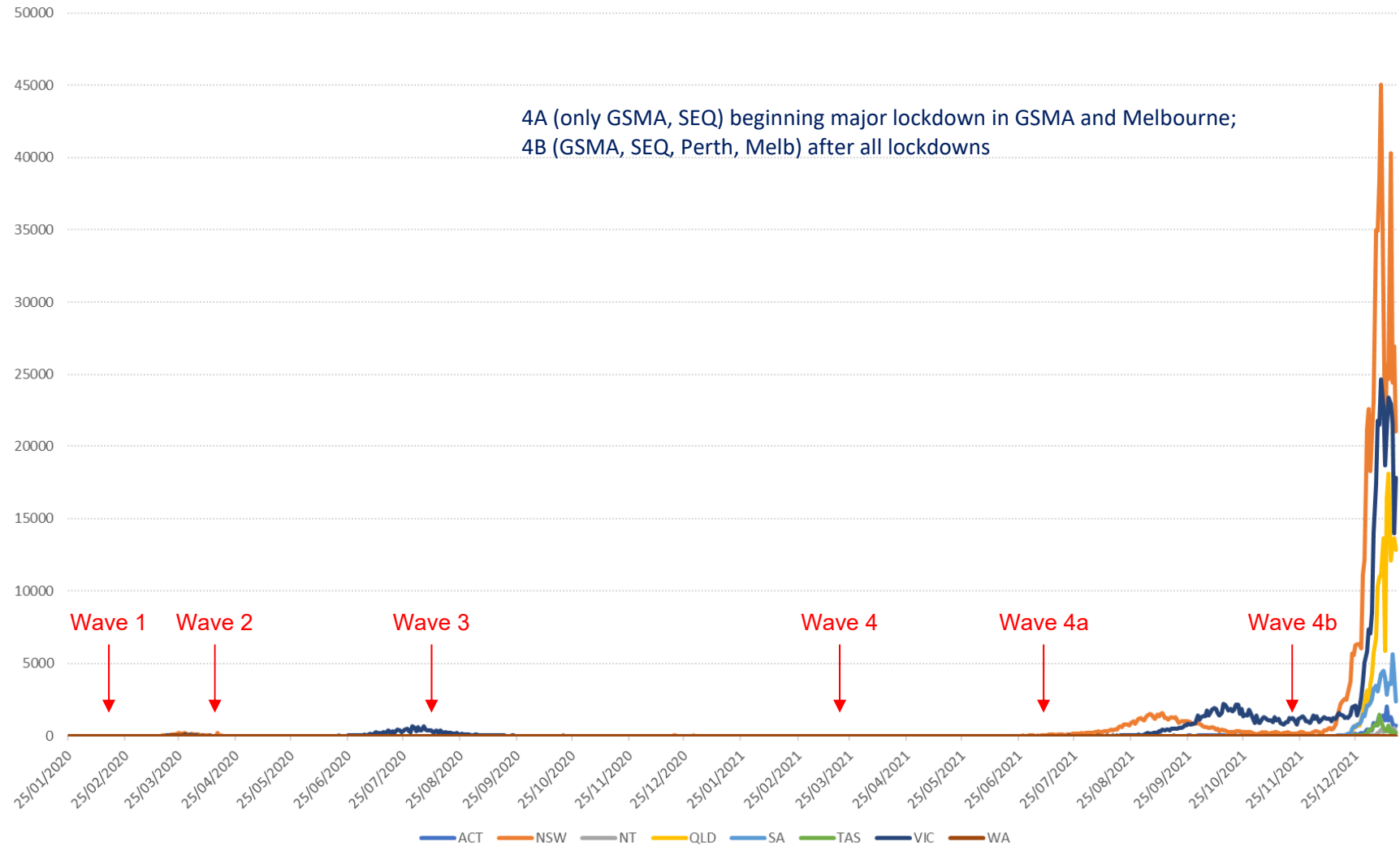
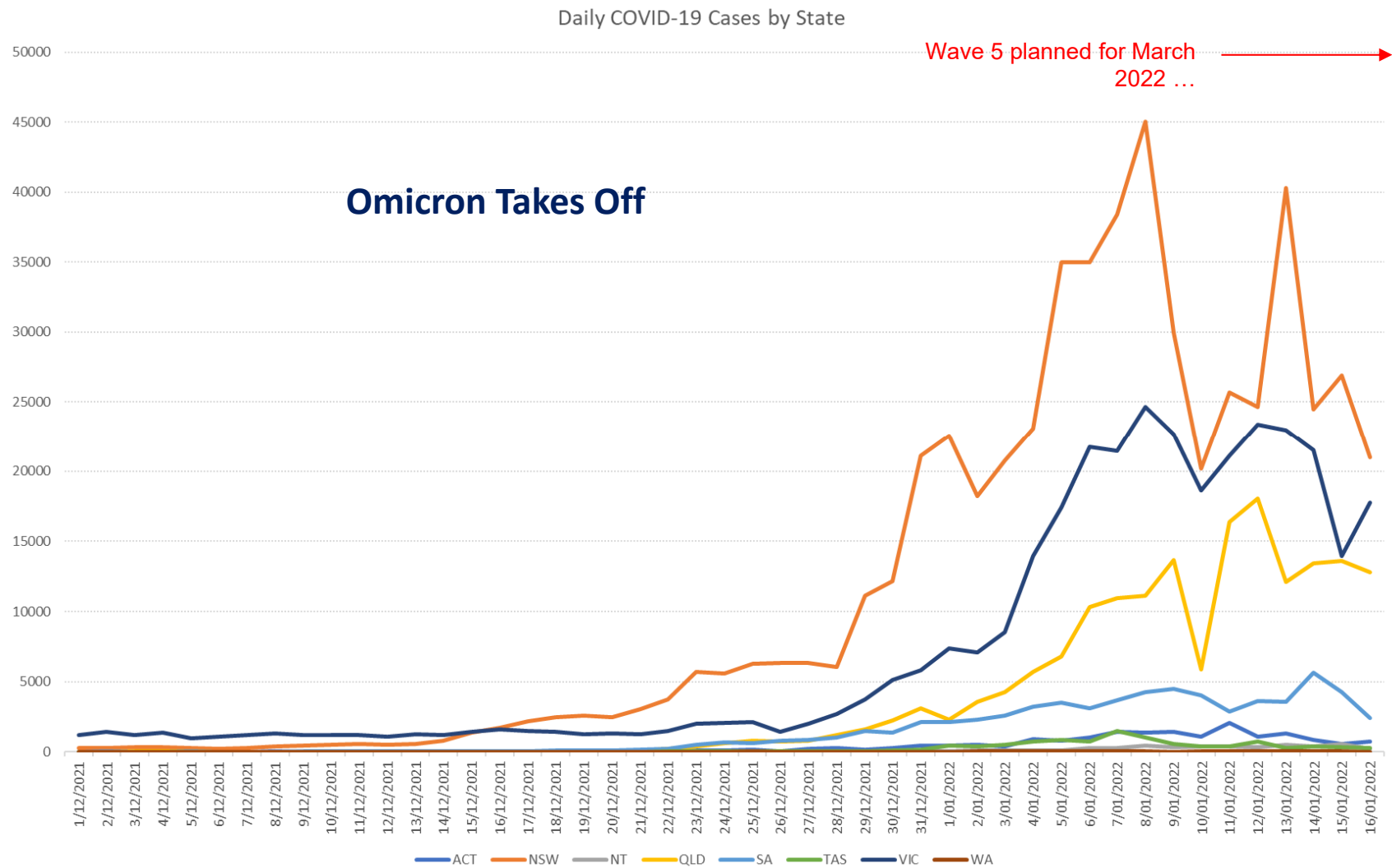




Daily COVID-19 Cases by State





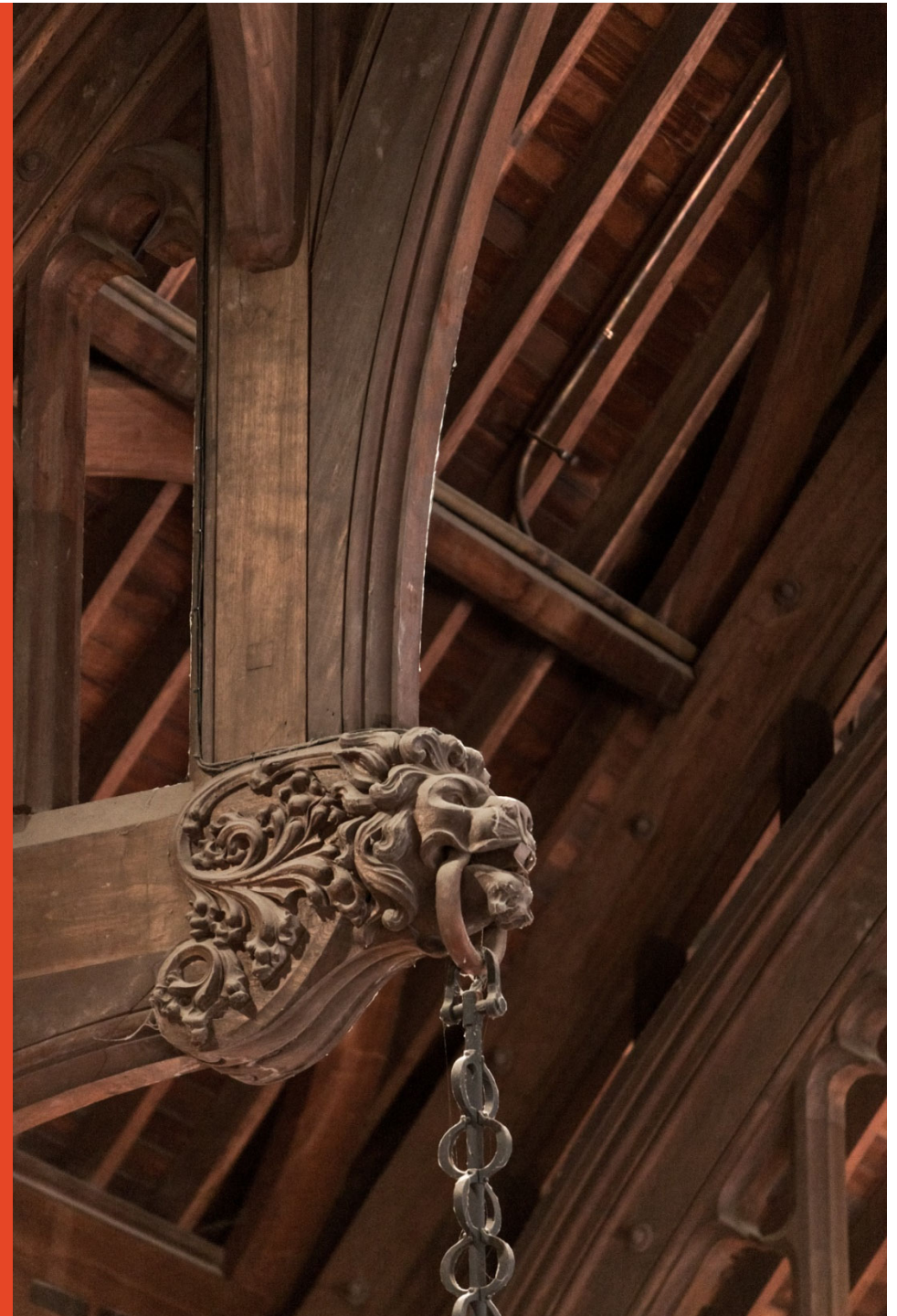
# Summary – WFH across the Waves

From Early 2020 to late 2021

22 months



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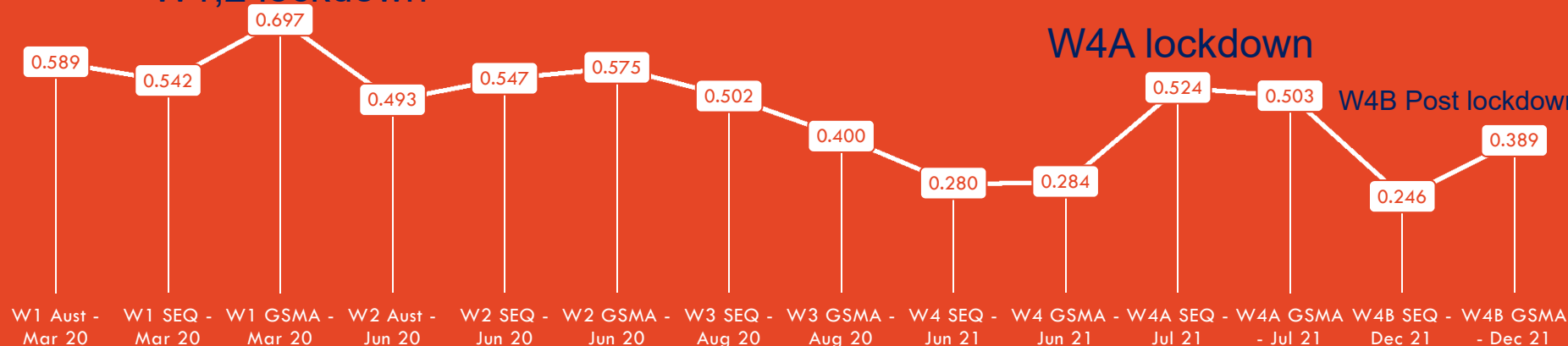
## PROPORTION OF DAYS WORKING THAT ARE WFH FROM WAVE 1 (MARCH 2020) TO WAVE 4B (DECEMBER 2021)

W1,2 lockdown

Note: Only SEQ and GSMA collected in Waves 4A and 4B

W4A lockdown

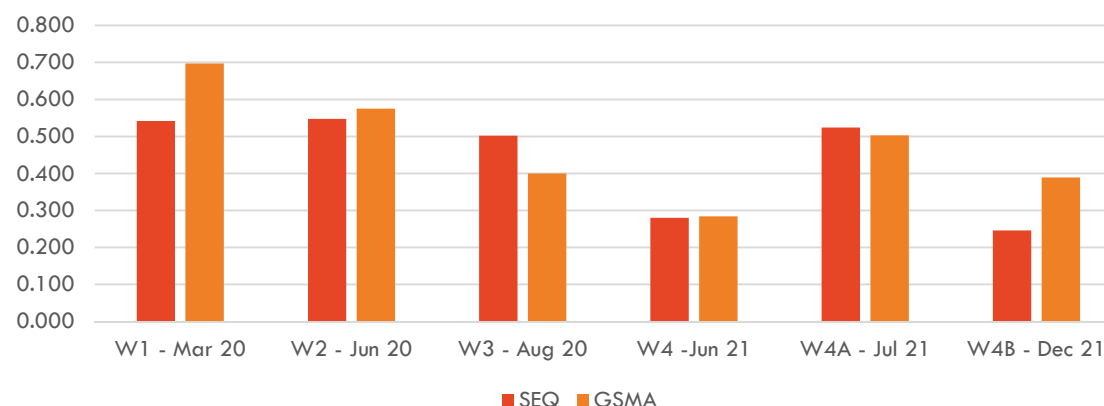
W4B Post lockdown



Proportion of Working Days WFH

|                   |       |
|-------------------|-------|
| W1 Aust - Mar 20  | 0.589 |
| W1 SEQ - Mar 20   | 0.542 |
| W1 GSMA - Mar 20  | 0.697 |
| W2 Aust - Jun 20  | 0.493 |
| W2 SEQ - Jun 20   | 0.547 |
| W2 GSMA - Jun 20  | 0.575 |
| W3 SEQ - Aug 20   | 0.502 |
| W3 GSMA - Aug 20  | 0.400 |
| W4 SEQ - Jun 21   | 0.280 |
| W4 GSMA - Jun 21  | 0.284 |
| W4A SEQ - Jul 21  | 0.524 |
| W4A GSMA - Jul 21 | 0.503 |
| W4B SEQ - Dec 21  | 0.246 |
| W4B GSMA - Dec 21 | 0.389 |

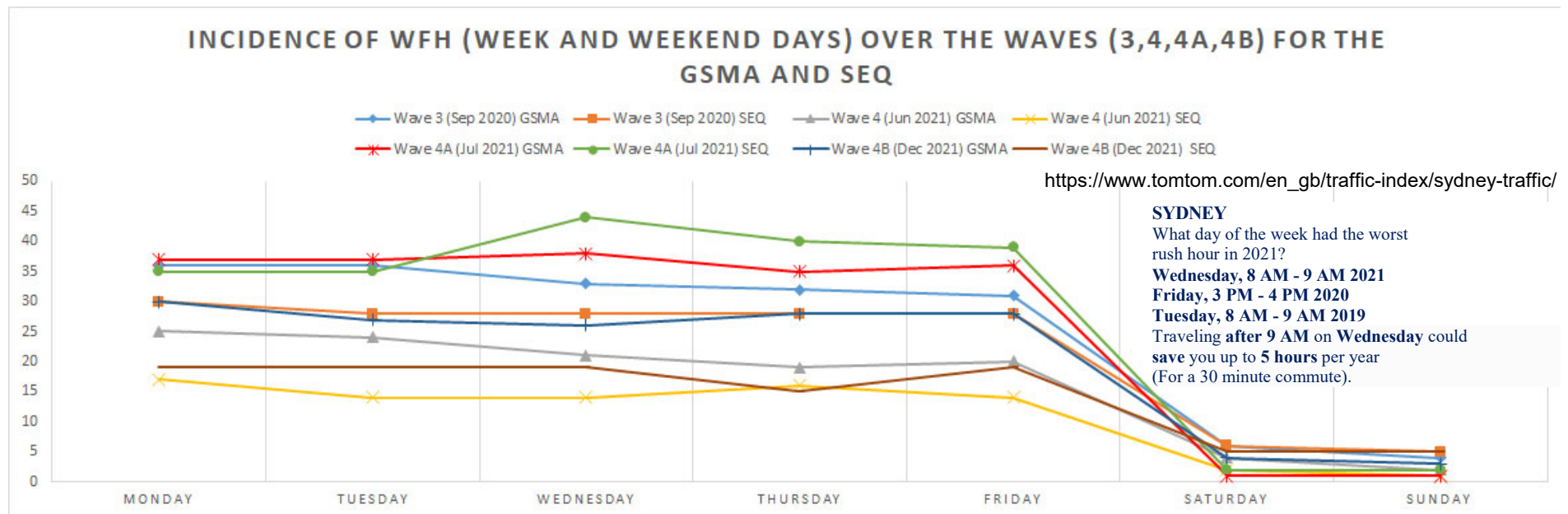
## PROPORTION OF DAYS WORKING THAT ARE WFH FROM WAVE 1 (MARCH 2020) TO WAVE 4B (DECEMBER 2021)



# WFH Incidence Across the Waves 3, 4, 4A, 4B for GSMA and SEQ

**Note: Only SEQ and GSMA collected in Waves 4A and 4B**

| % WFH     | Wave 3 (Sep 2020) GSMA | Wave 3 (Sep 2020) SEQ | Wave 4 (Jun 2021) GSMA | Wave 4 (Jun 2021) SEQ | Wave 4A (Jul 2021) GSMA | Wave 4A (Jul 2021) SEQ | Wave 4B (Dec 2021) GSMA | Wave 4B (Dec 2021) SEQ |
|-----------|------------------------|-----------------------|------------------------|-----------------------|-------------------------|------------------------|-------------------------|------------------------|
| Monday    | 36                     | 30                    | 25                     | 17                    | 37                      | 35                     | 30                      | 19                     |
| Tuesday   | 36                     | 28                    | 24                     | 14                    | 37                      | 35                     | 27                      | 19                     |
| Wednesday | 33                     | 28                    | 21                     | 14                    | 38                      | 44                     | 26                      | 19                     |
| Thursday  | 32                     | 28                    | 19                     | 16                    | 35                      | 40                     | 28                      | 15                     |
| Friday    | 31                     | 28                    | 20                     | 14                    | 36                      | 39                     | 28                      | 19                     |
| Saturday  | 6                      | 6                     | 4                      | 2                     | 1                       | 2                      | 4                       | 5                      |
| Sunday    | 4                      | 5                     | 2                      | 1                     | 1                       | 2                      | 3                       | 5                      |



W4B: SEQ (brown) quickly reducing WFH but GSMA (dark blue) hesitant; W4A lockdown (Green and Red); SEQ (Light Brown, Dark Brown, Yellow, Green) Less impacted than GSMA (Light Blue, Grey, Red, Dark Blue)

# **Lockdown Survey (Wave 4A)**

**June 2021 “Before”  
July 2021 “after”**

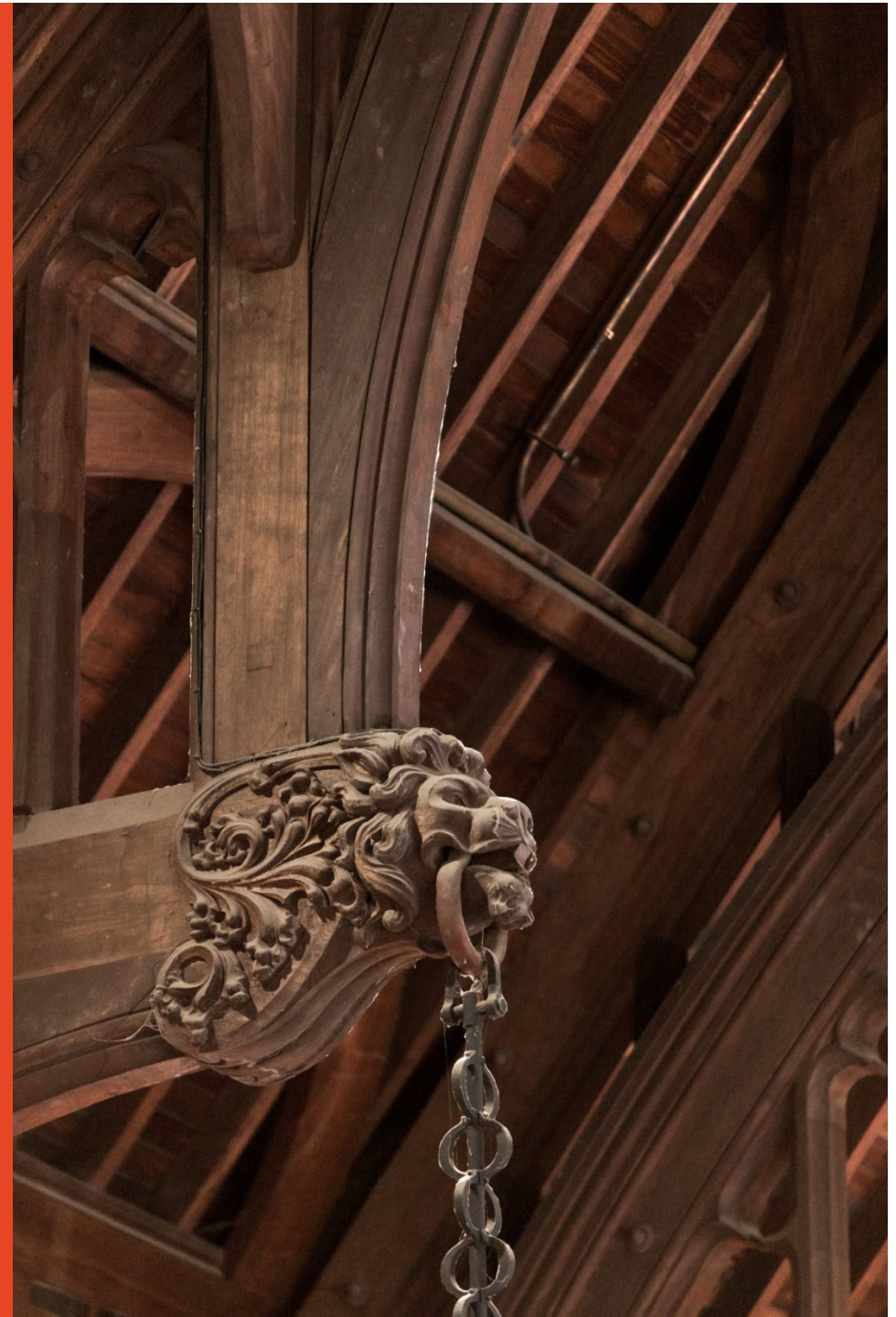
**Conducted in SEQ and GSMA**

**Primary focus on workers,  
especially “typical commuters”  
who would return to WFH due to  
the lockdowns.**

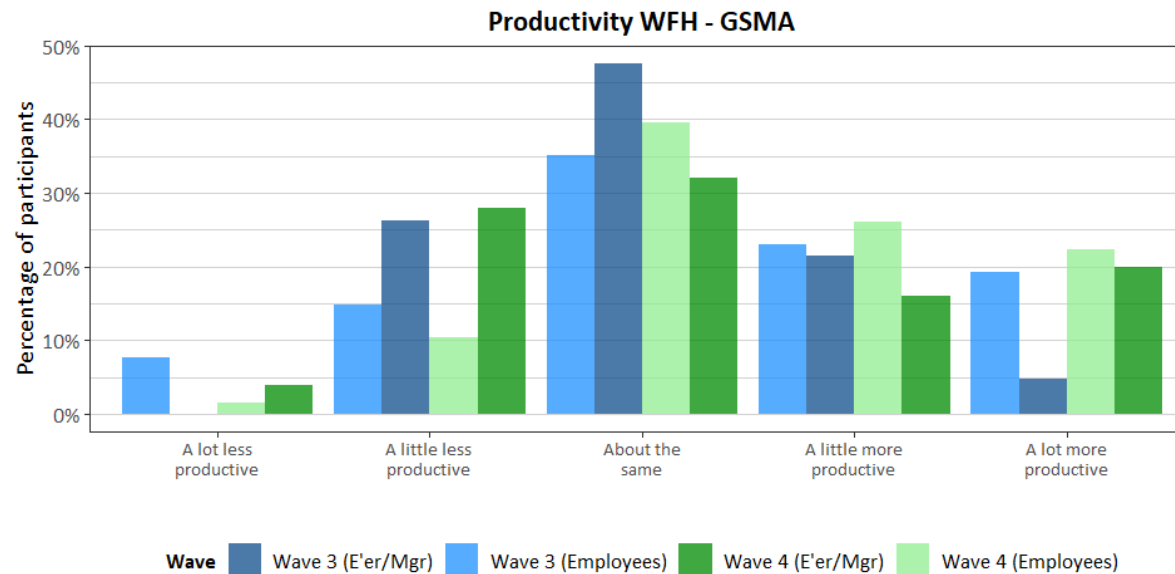
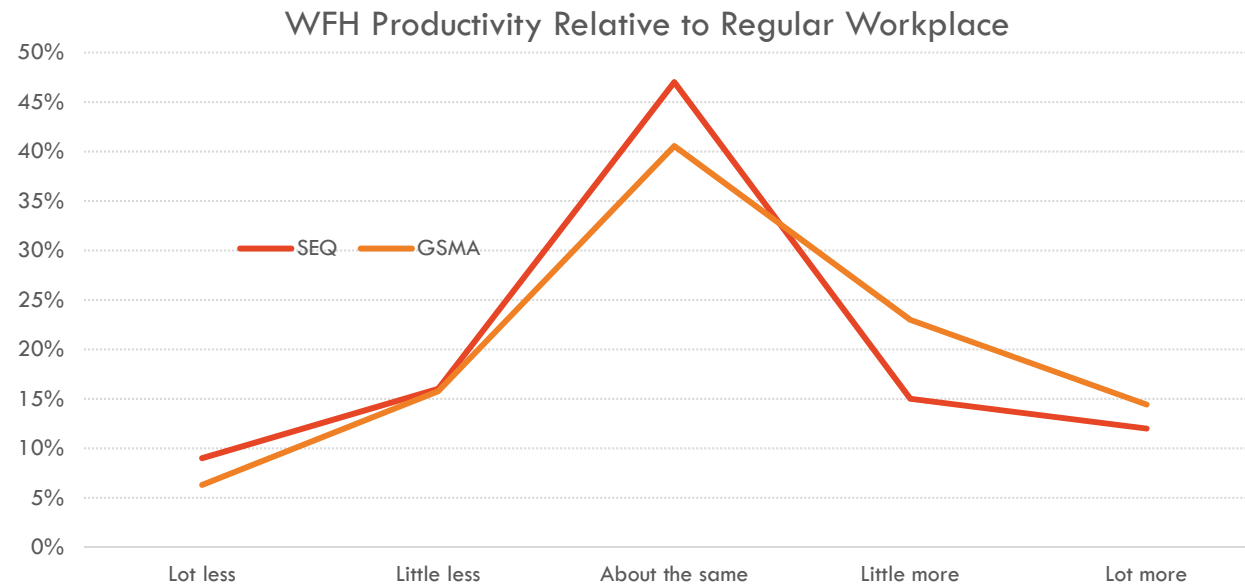
**Sample Size SEQ = 363  
Sample Size GSMA = 418**



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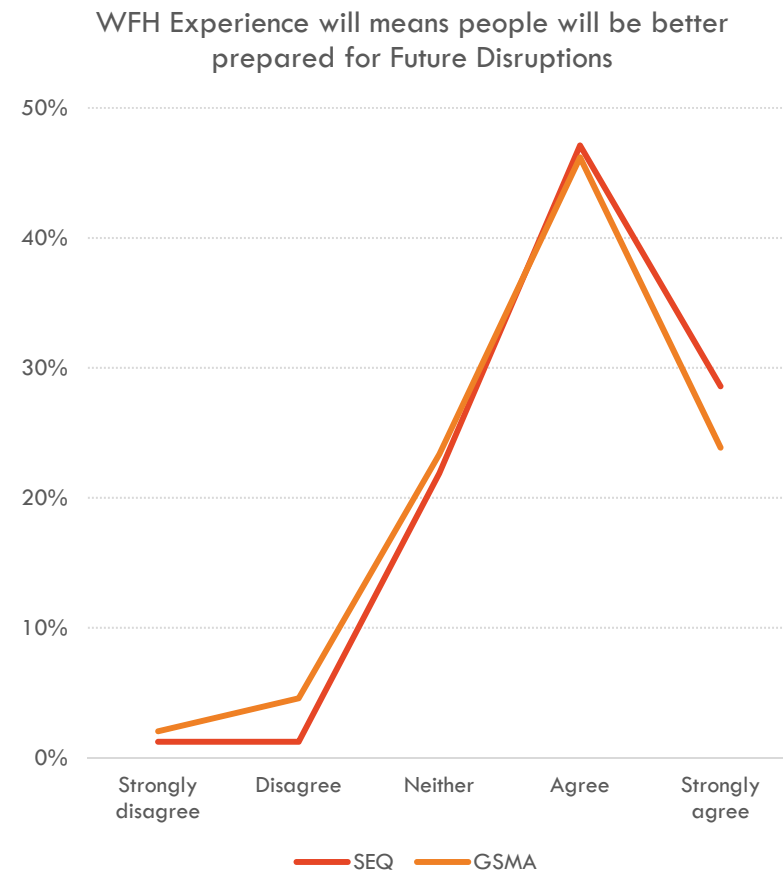
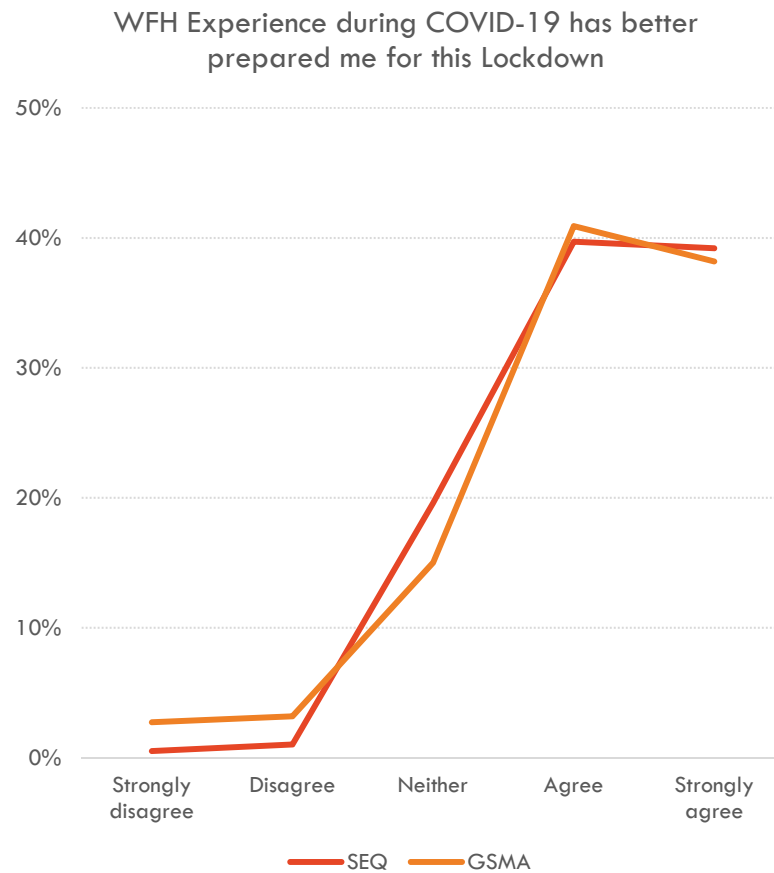


# Productivity Remains Robust! July 2021 (Wave 4A above and Waves 3 and 4 below)



# Effective WFH Habits Forming? (Wave 4A)

## “Voluntary or Shadow” Lockdown?



# Post Lockdown (NSW) Survey (Wave 4B)

**Nov/Dec 2021**

**Conducted in:**

**SEQ** (referred to as QLD)

**GSMA** (referred to as NSW)

**Perth** (referred to as WA)

**Melb.** (referred to as VIC)

**All Contacted:**

**Total = 2189**

**SEQ = 850**

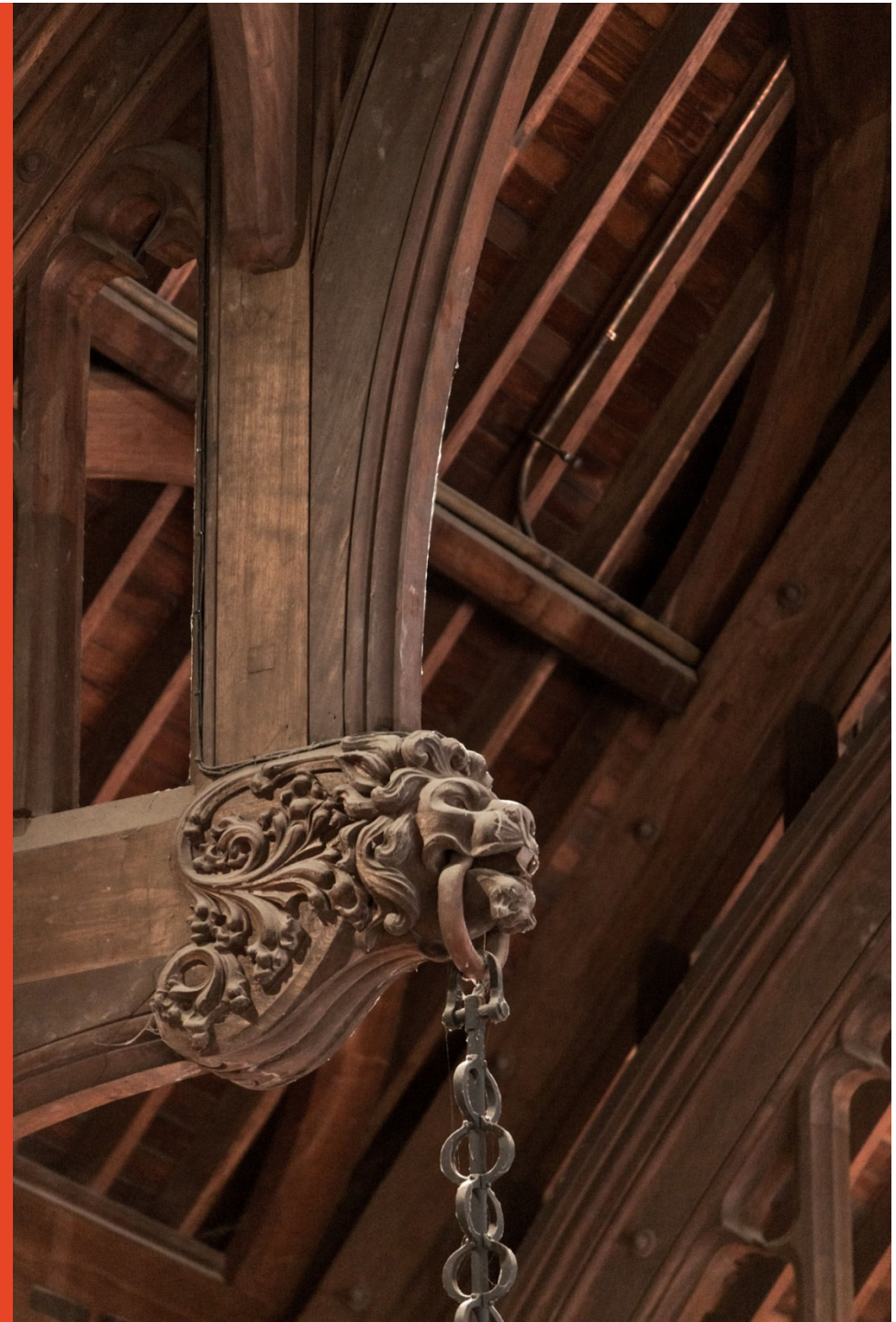
**GSMA = 678**

**Perth = 224**

**Melb. = 437**



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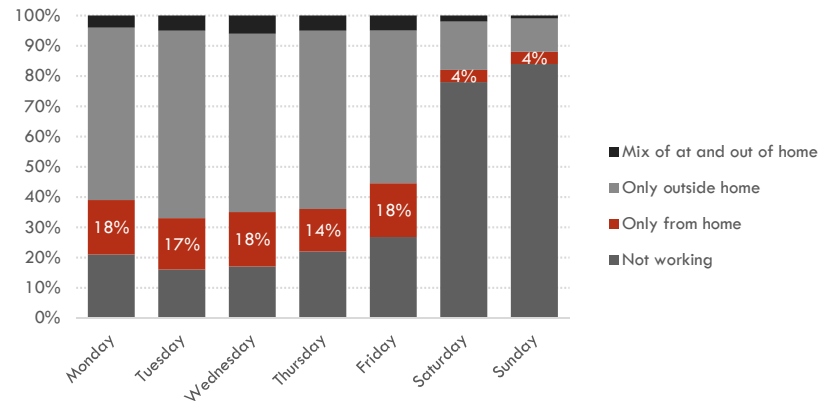


## Work Location by Day of Week Wave 4B: GSMA, SEQ, Perth, Melbourne

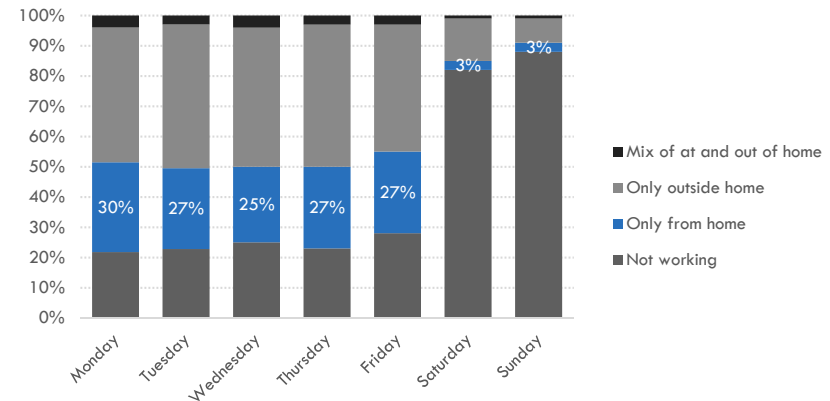
Note: W4B Average proportion of work days WFH: GSMA (NSW)=0.389, SEQ (QLD)=0.246

Wave 4A GSMA (NSW) = 0.524; SEQ (Qld) = 0.503

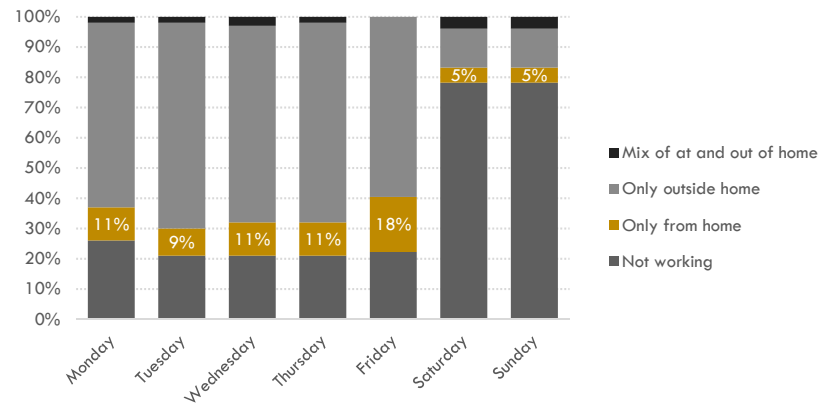
Work Location by Day - QLD



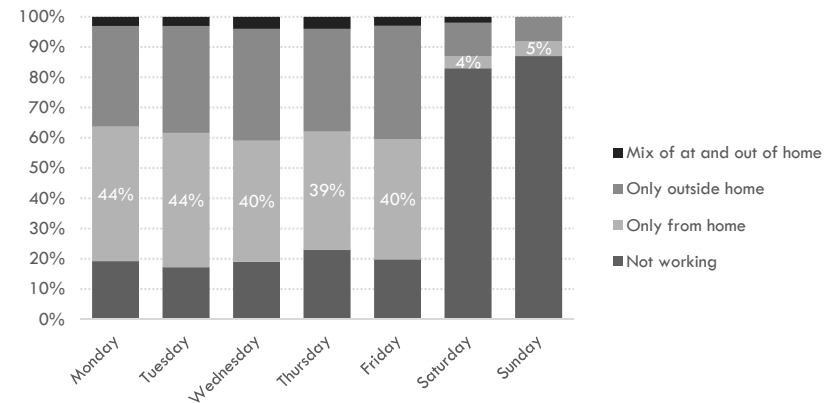
Work Location by Day - NSW



Work Location by Day - WA

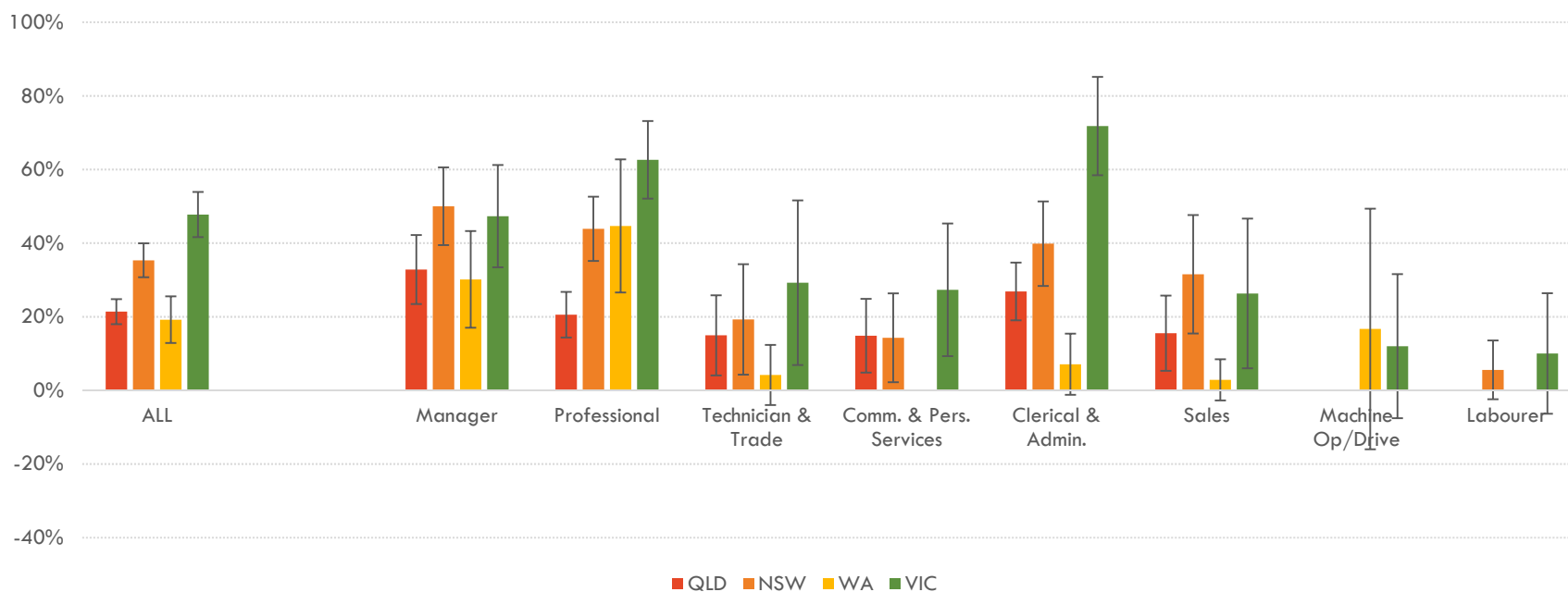


Work Location by Day - VIC



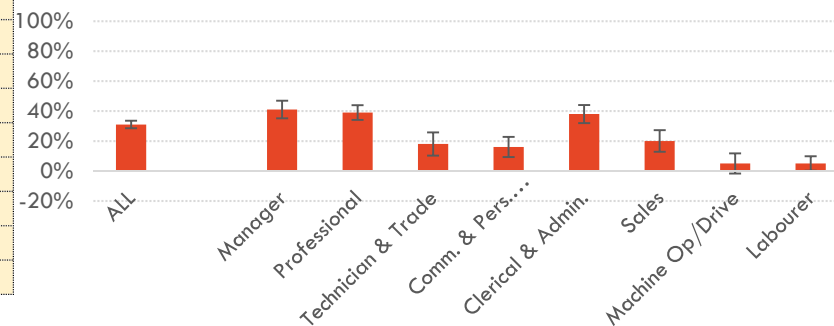
# Occupation Profiles Wave 4B

Proportion of Days WFH by State

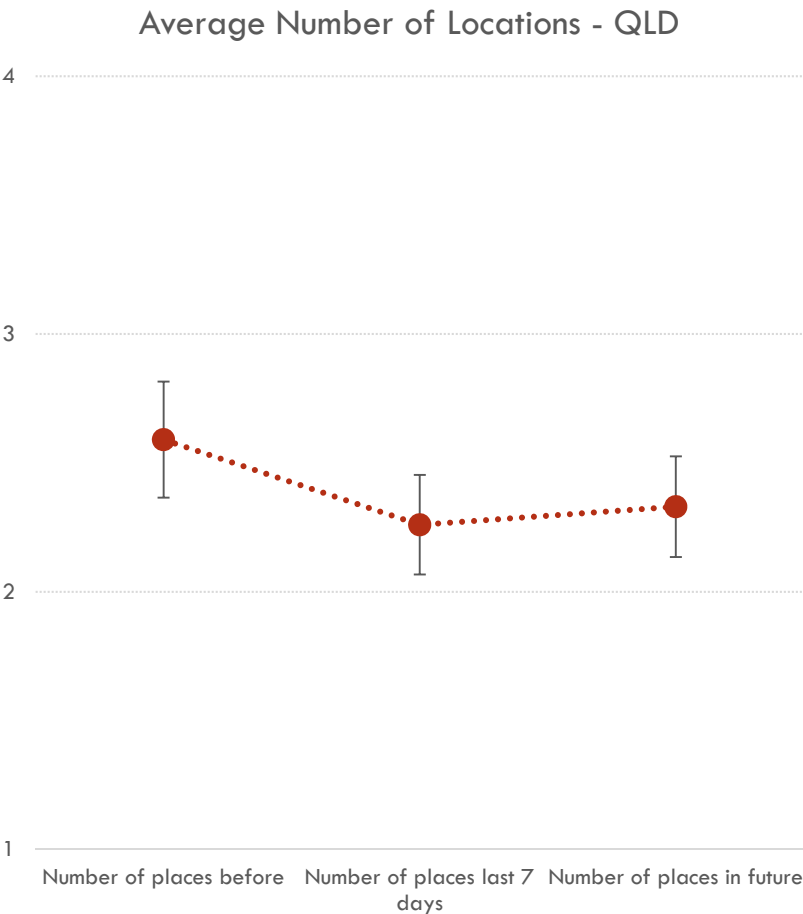
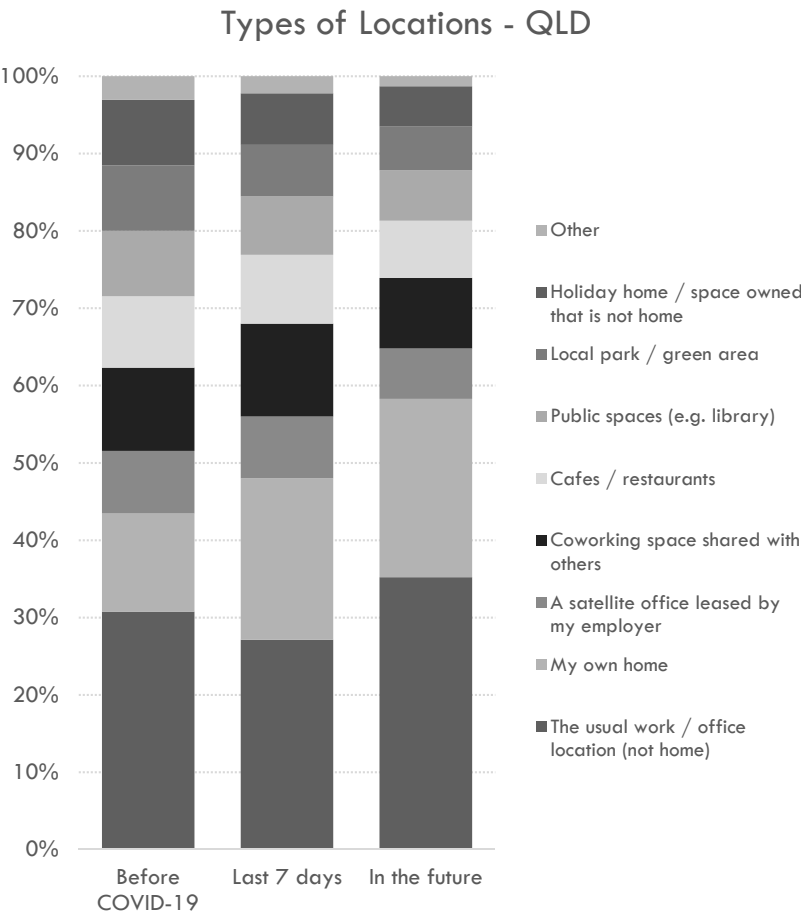


| % Days WFH by Occupation for all 4 States | Mean | Stdev | N    | 95% CI |
|-------------------------------------------|------|-------|------|--------|
| ALL                                       | 31%  | 42%   | 1094 | 2%     |
| Manager                                   | 41%  | 44%   | 212  | 6%     |
| Professional                              | 39%  | 44%   | 311  | 5%     |
| Technician & Trade                        | 18%  | 33%   | 70   | 8%     |
| Comm. & Pers. Services                    | 16%  | 34%   | 97   | 7%     |
| Clerical & Admin.                         | 38%  | 44%   | 204  | 6%     |
| Sales                                     | 20%  | 37%   | 100  | 7%     |
| Machine Op/Drive                          | 5%   | 22%   | 41   | 7%     |
| Labourer                                  | 5%   | 19%   | 59   | 5%     |

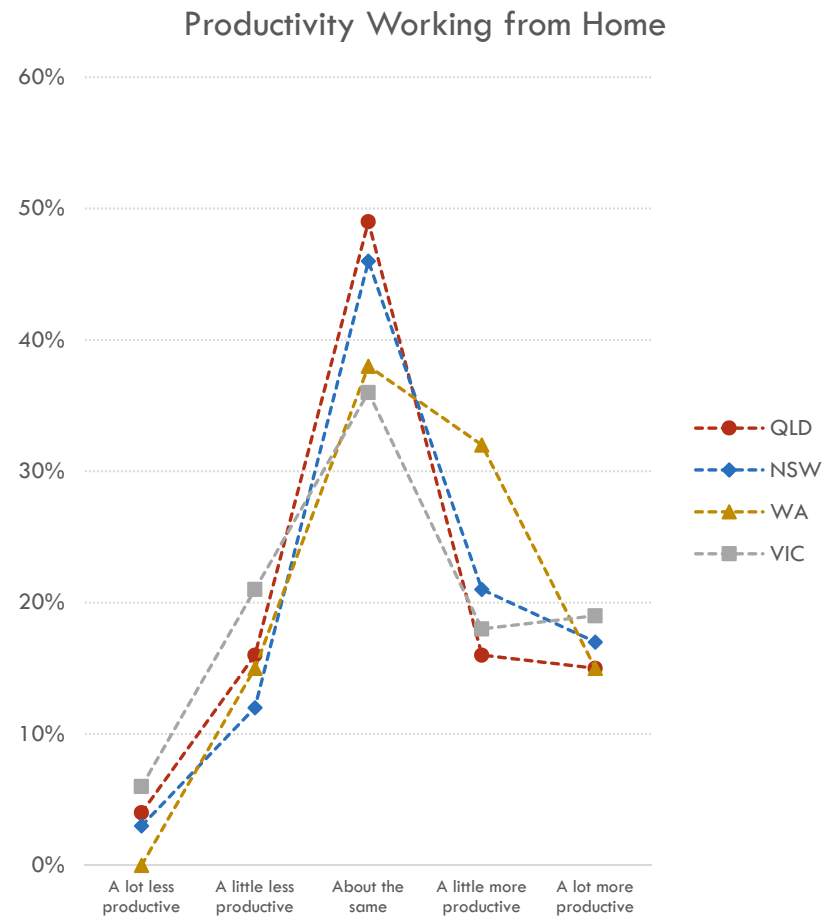
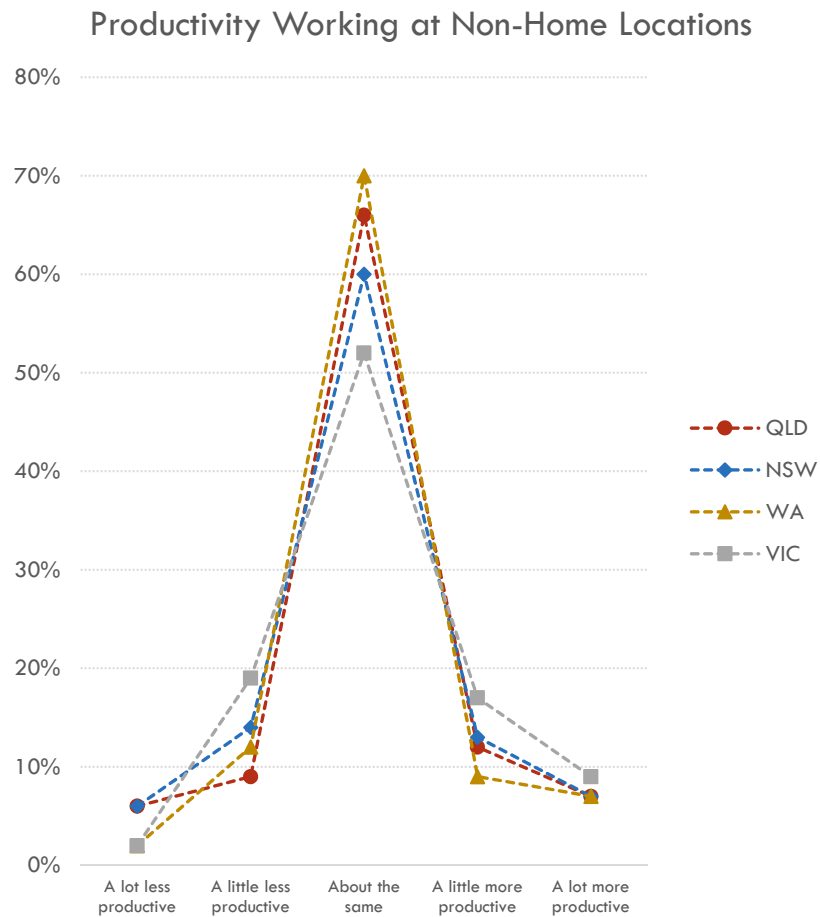
Proportion of Days WFH (all workers) All States



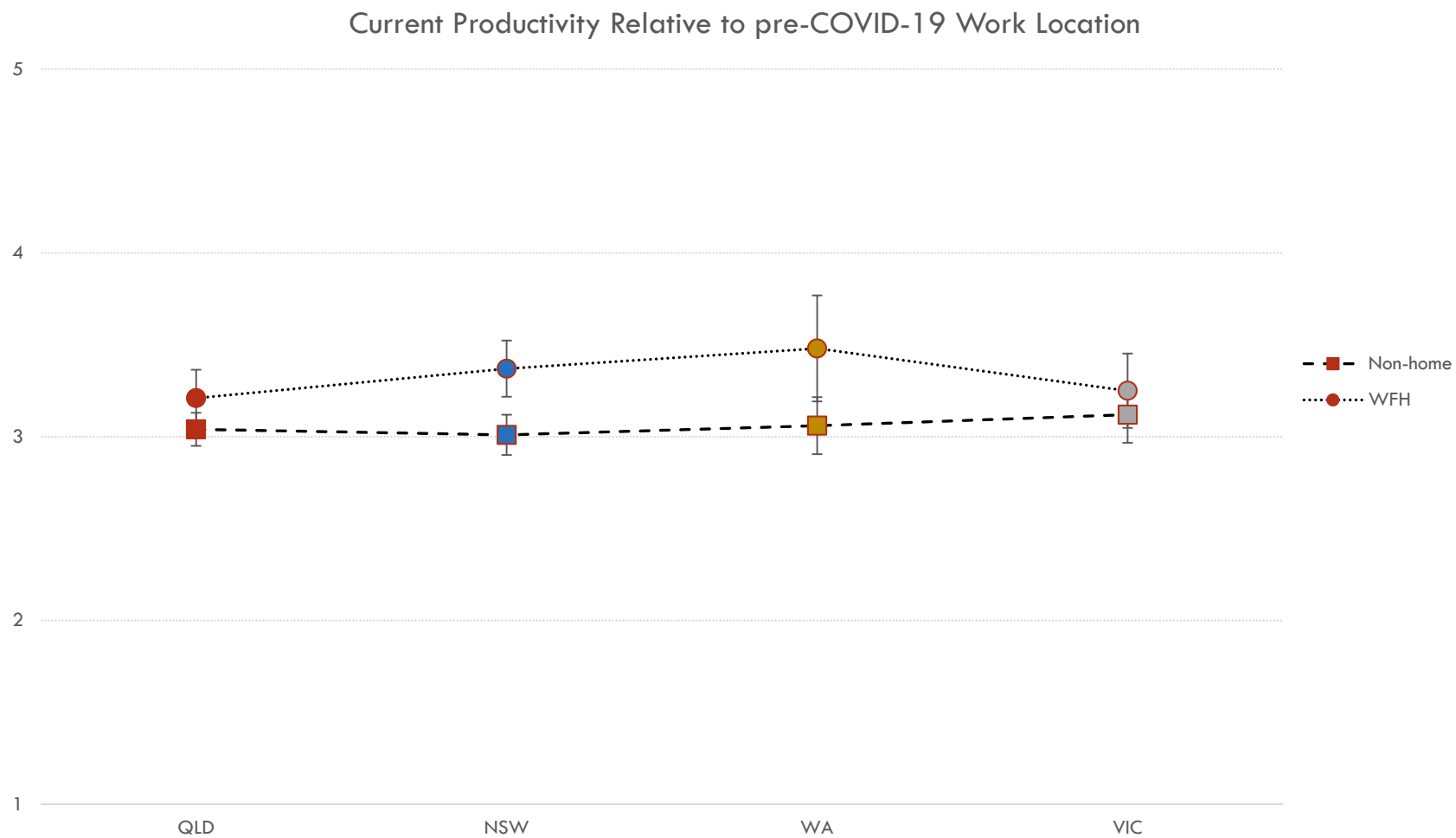
# Locations where People Complete Work (Have for each State)



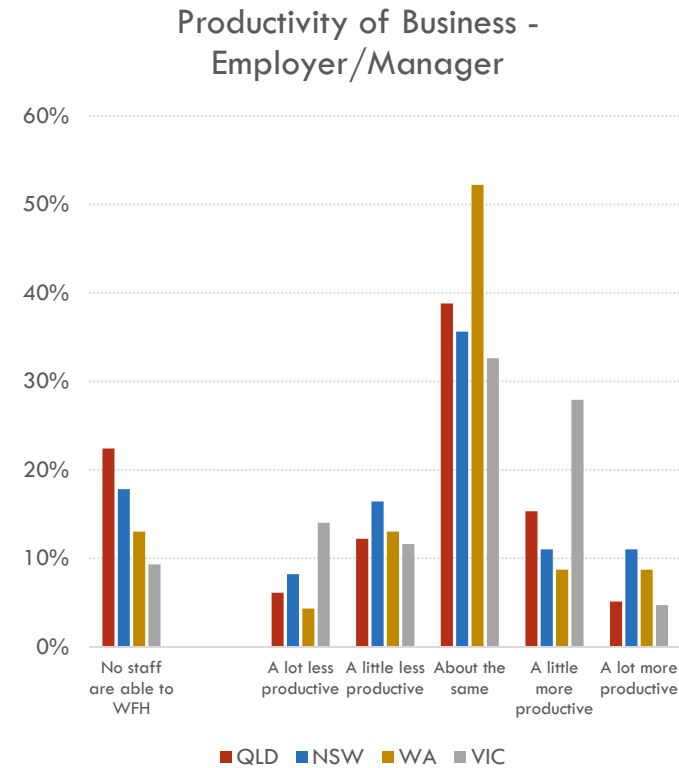
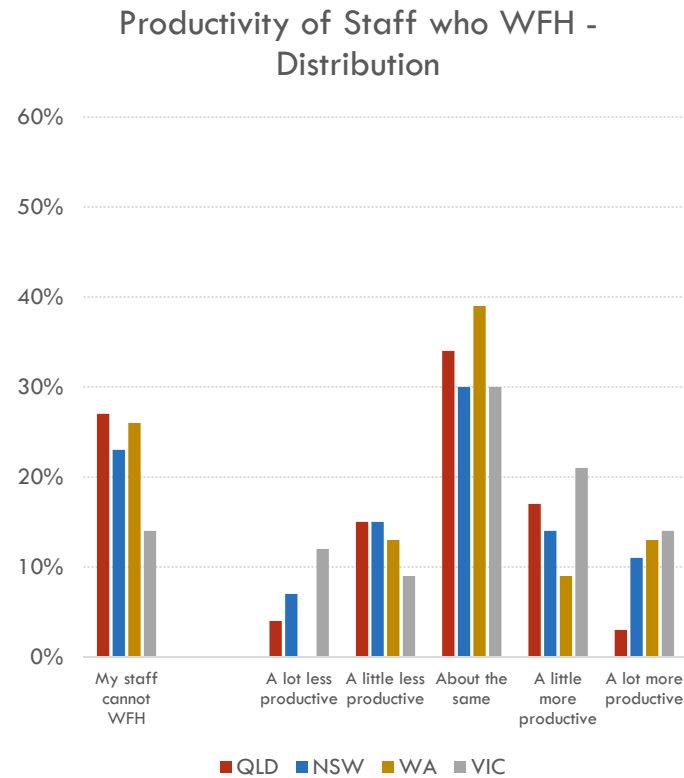
## Levels of Productivity Relative to Before COVID-19 Wave 4B



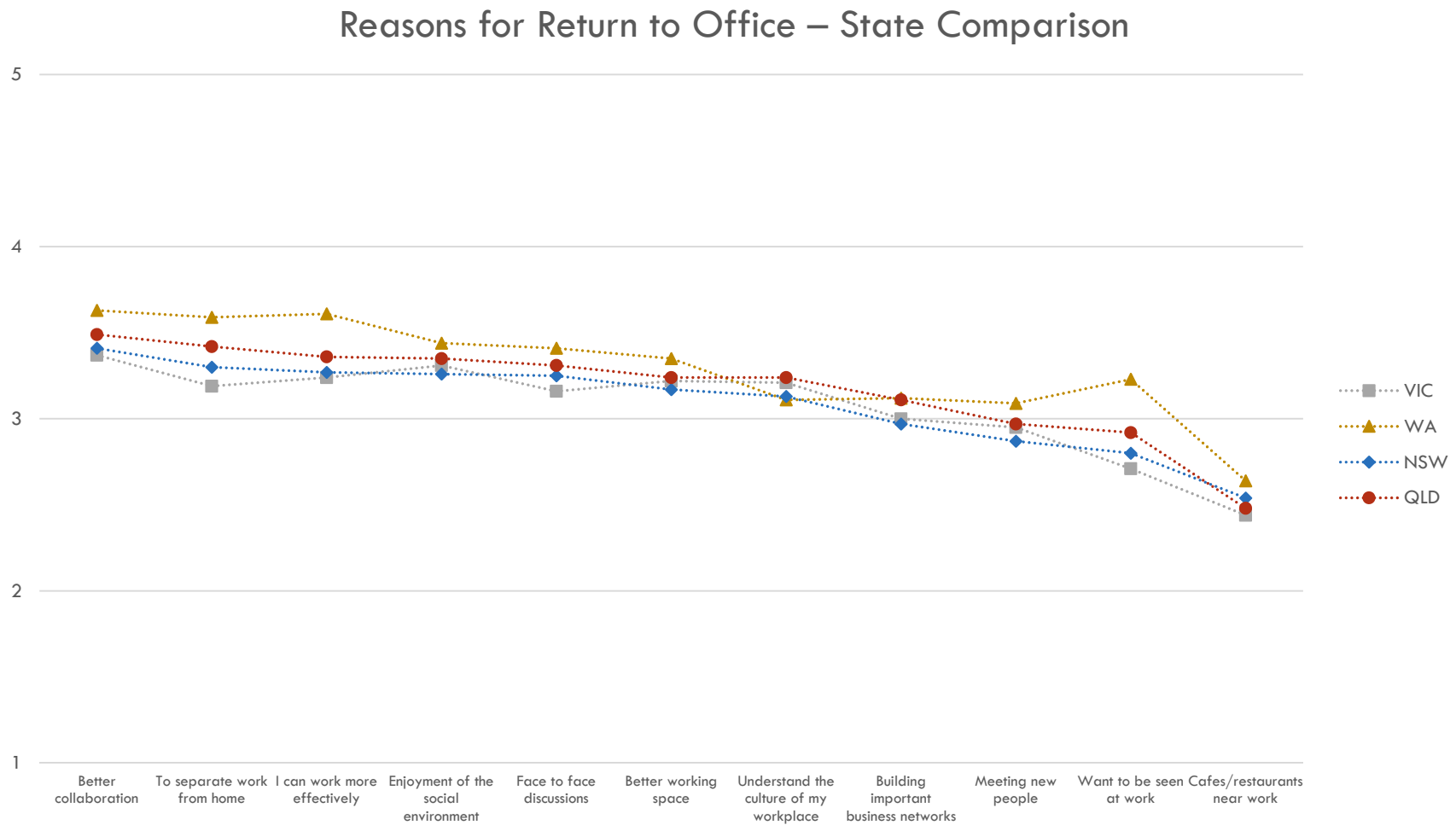
## Levels of Productivity Relative to Before COVID-19 Wave 4B



## Employer/Manager Assessment of (i) Relative Productivity (LHS) (ii) Productivity of Overall Business (RHS – less clear due to many factors and not WFH impact)



## Reasons For Return to the Office (1=not at all important; 3= moderately important; 5= extremely important)

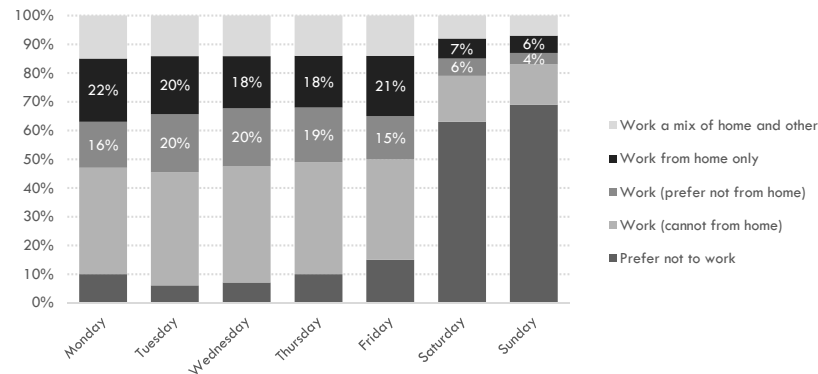


# Future Work Location by Day of Week (if No Restrictions) Wave 4B

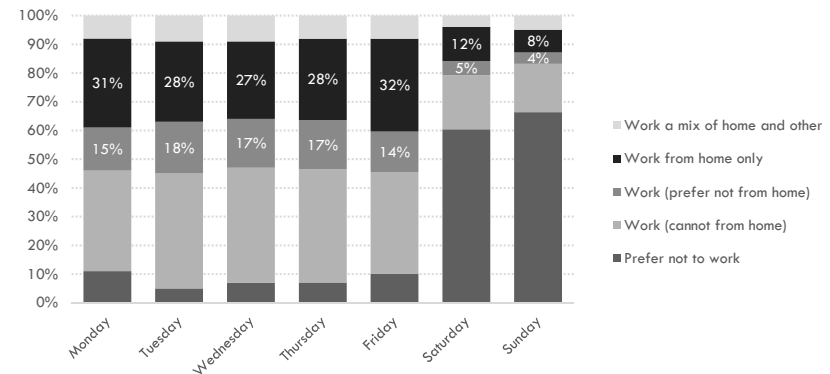
(Note: Pre-COVID-19 ~4.5%)

**Q: Have we found the Stability Value going forwards? (1-2 days a week)**

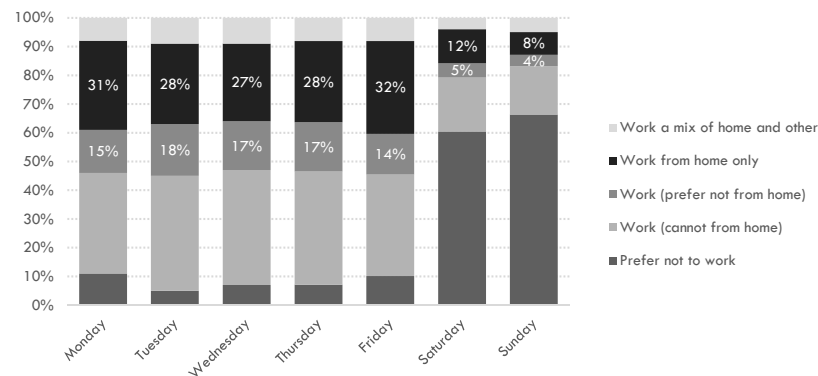
Future Work Locations (if no restrictions) - QLD



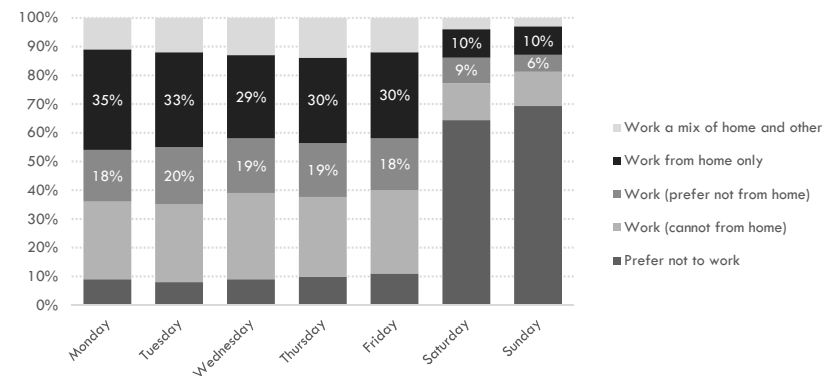
Future Work Locations (if no restrictions) - NSW



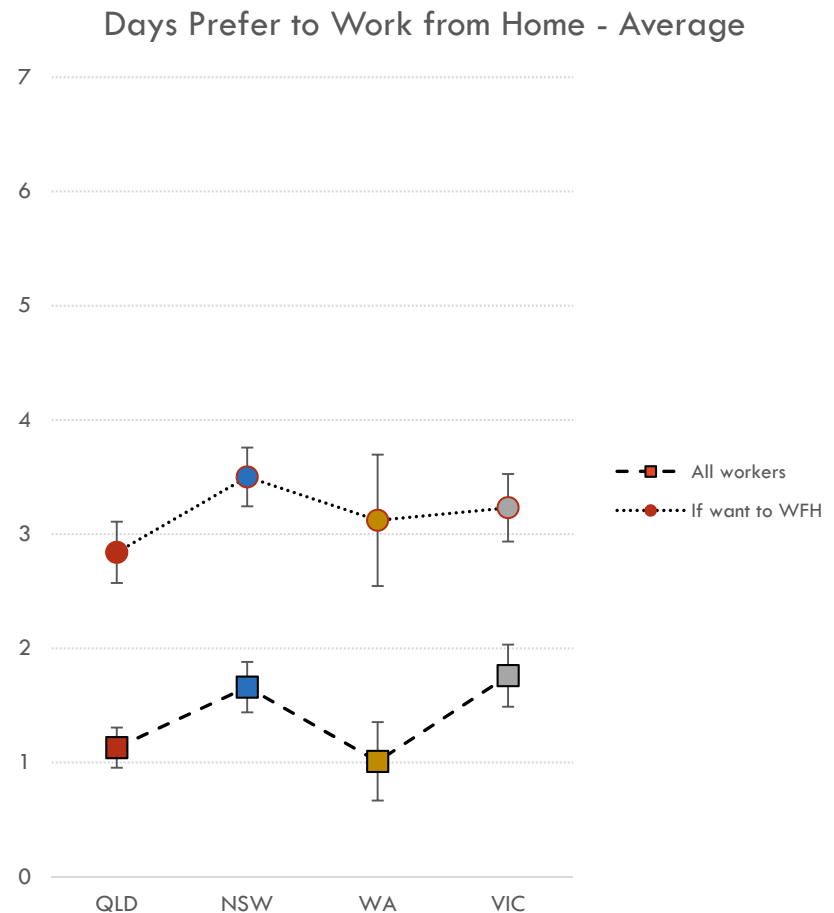
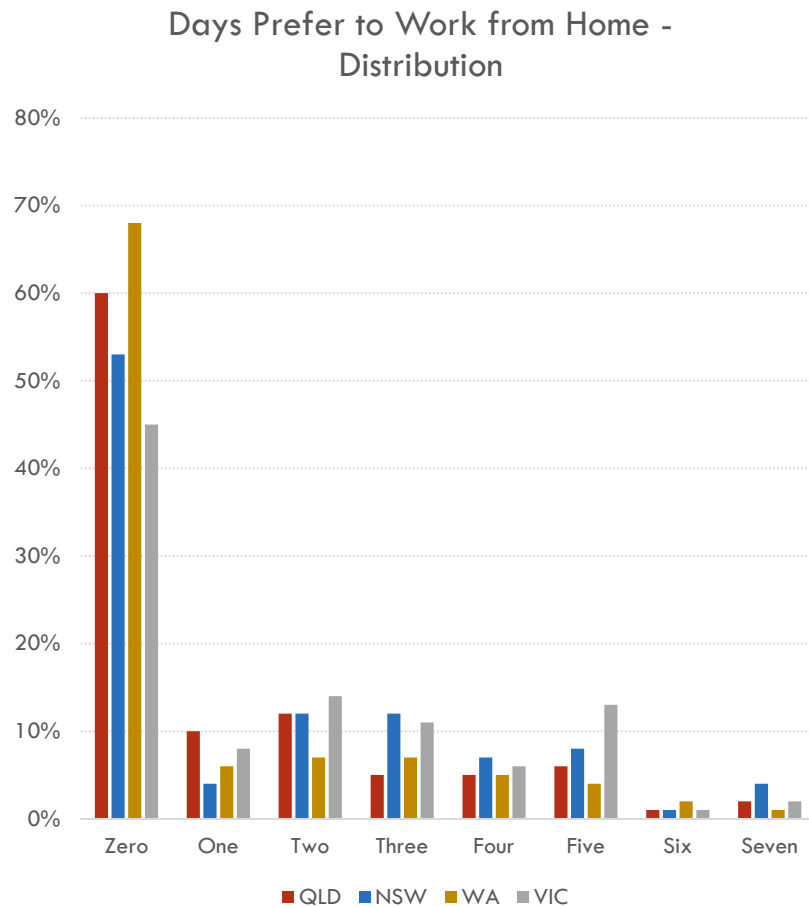
Future Work Locations (if no restrictions) - WA



Future Work Locations (if no restrictions) - VIC

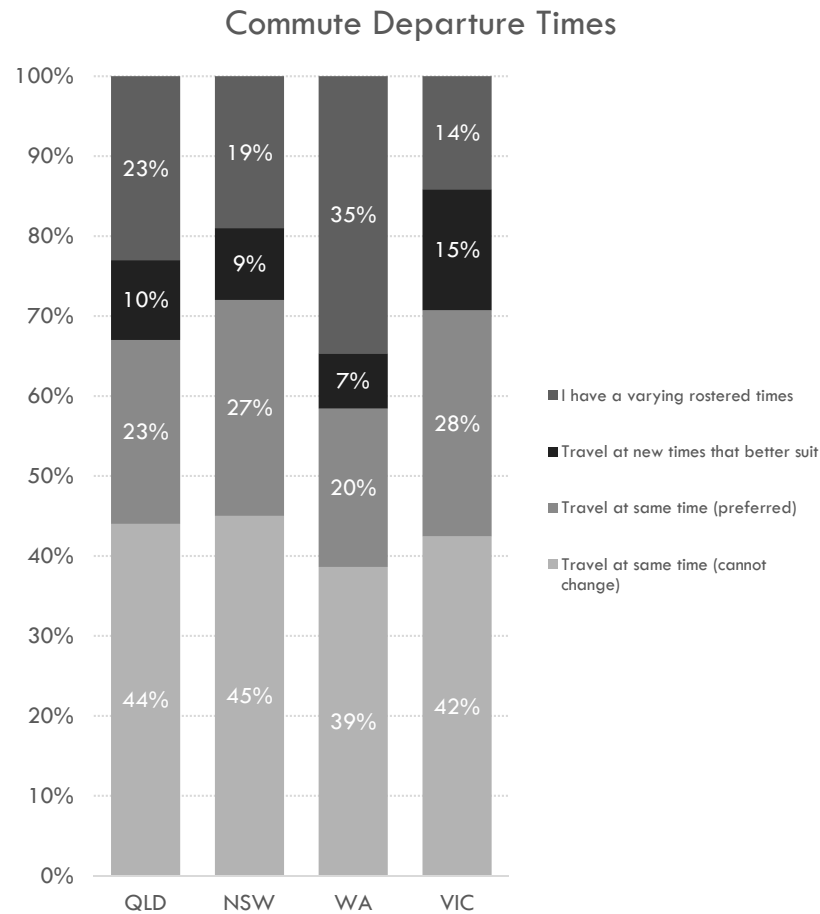


## Days of Preference to WFH –Wave 4B (Reinforces 1-2 days per week)



The dashed line is the average among all workers including those who want to WFH or not.  
The dotted line is the average among all workers who indicated they want to WFH at least one day a week.

## Flexibility in Commuting Departure Times (Flexibility percent ranges from a low of 28% GSMA to a high of 42% Perth)



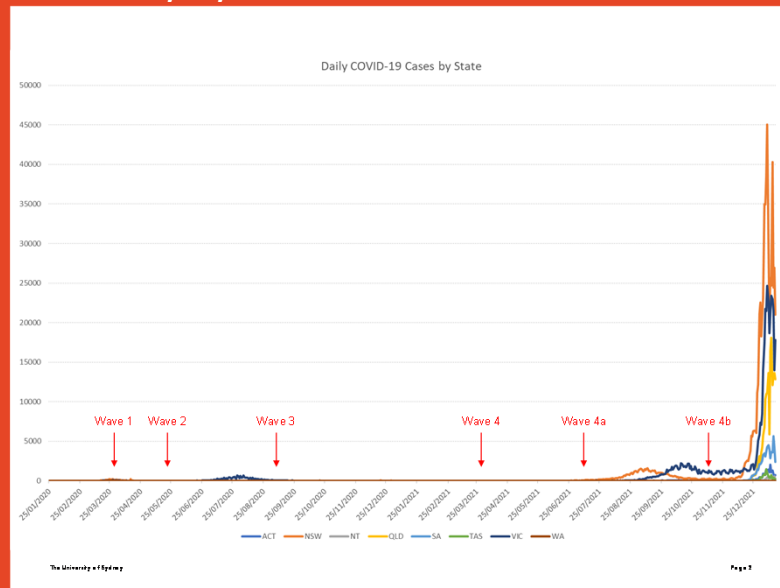
|                             |                     | QLD   | NSW   | WA    | VIC   |
|-----------------------------|---------------------|-------|-------|-------|-------|
| Time Leave<br>home for work | All before COVID-19 | 07.31 | 07.45 | 07.15 | 07.51 |
|                             | For those flexible  | 07.58 | 08.06 | 07.00 | 07.40 |
| Time Leave<br>work for home | All before COVID-19 | 16.15 | 16.14 | 16.30 | 16.14 |
|                             | For those flexible  | 16.03 | 16.10 | 16.00 | 16.50 |

# Exploring the link between working from home and how worthwhile the things that you do in life are during COVID-19

(Paper #21 on WellBeing)

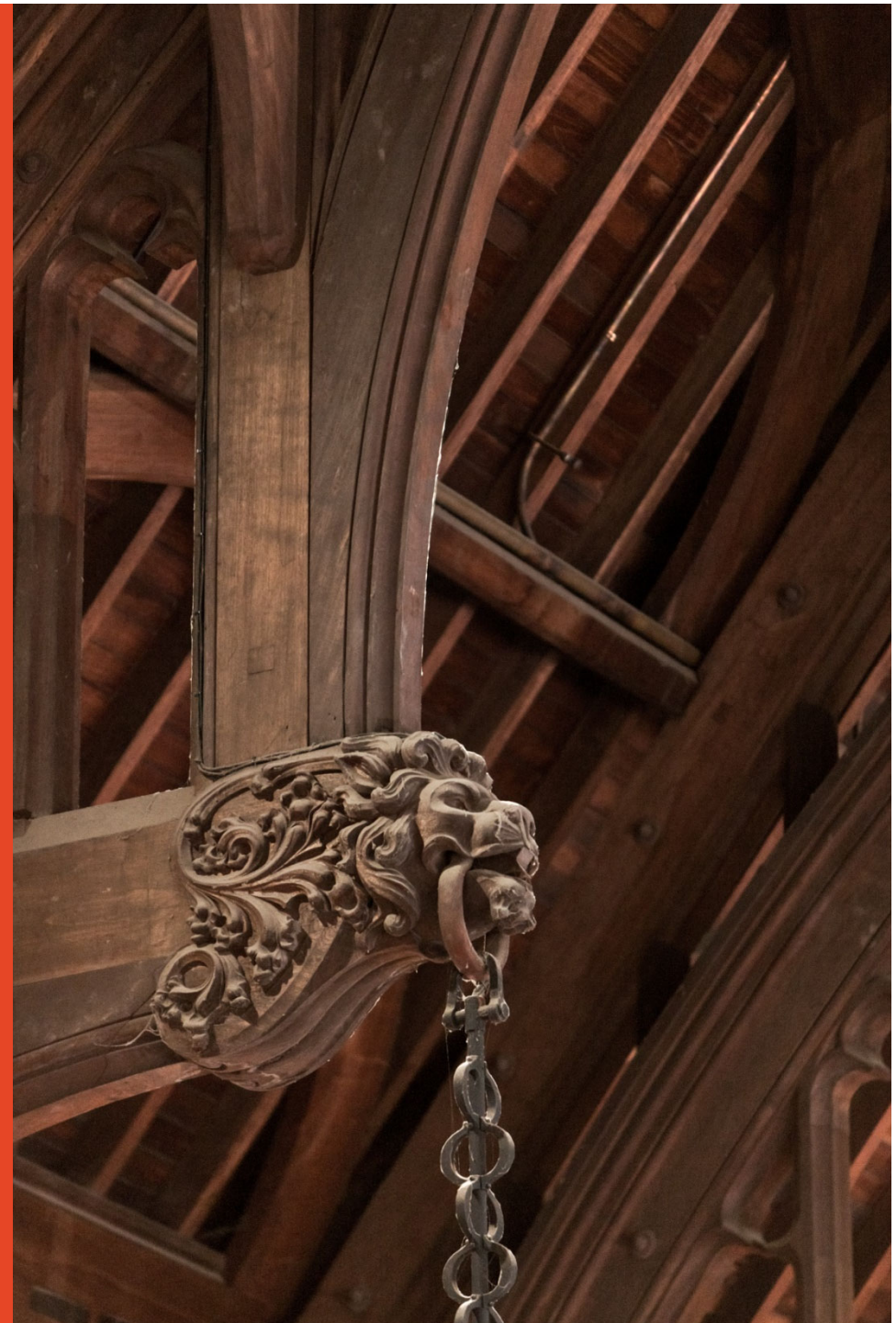
NSW (GSMA and Regional NSW)

Waves 3, 4, 4a

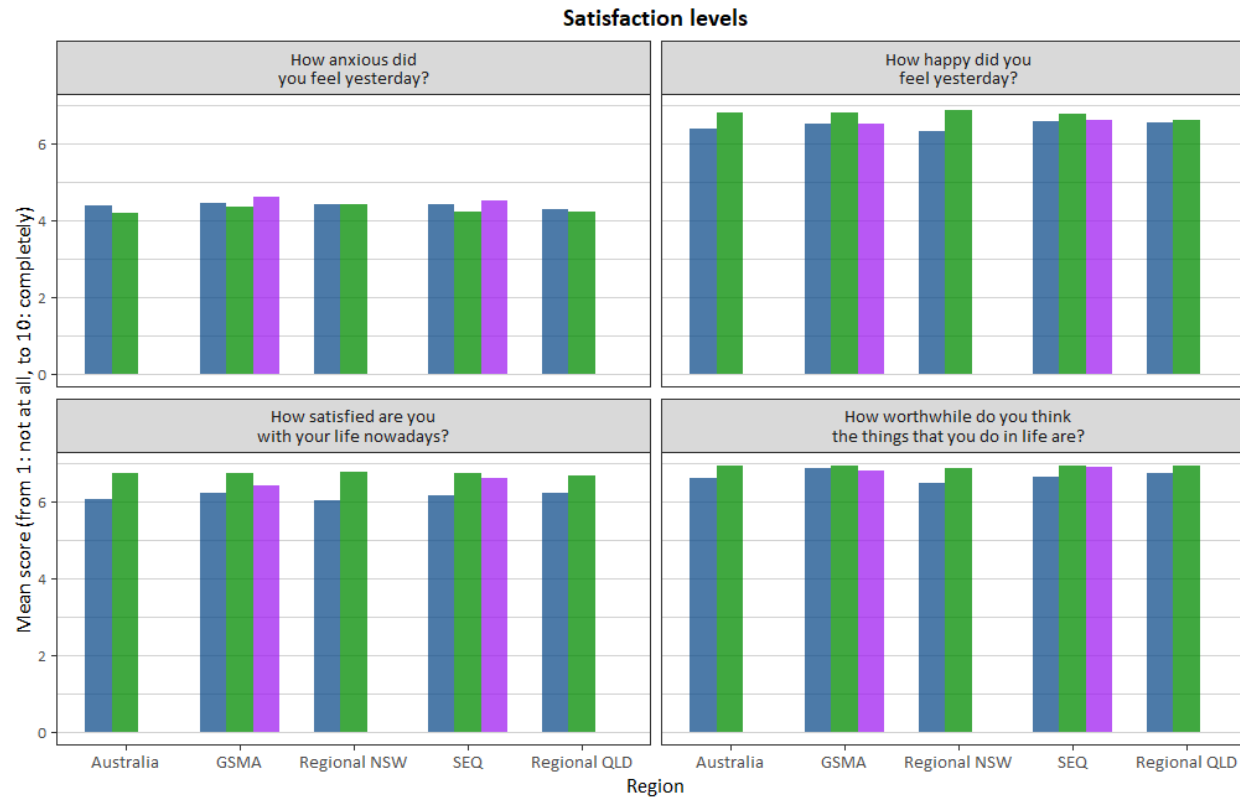


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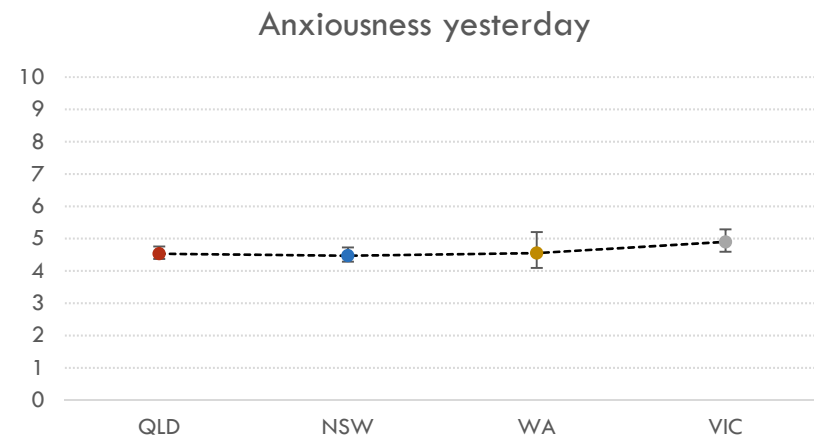
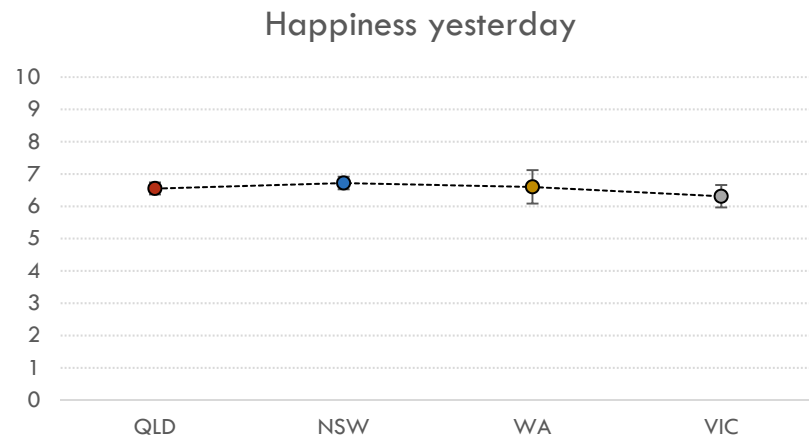
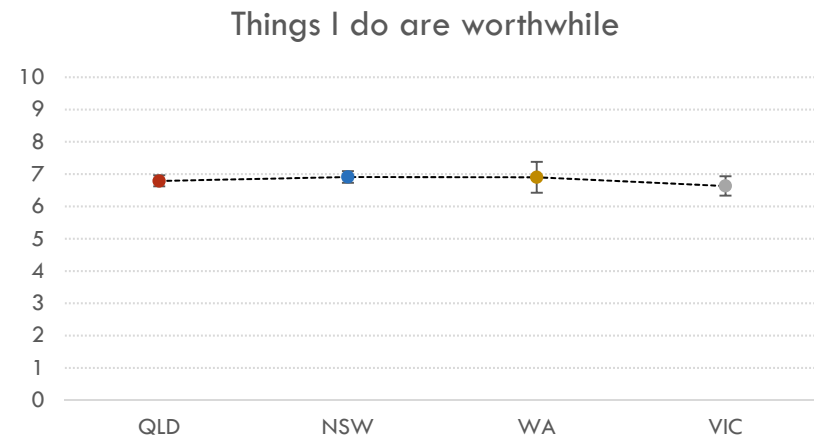
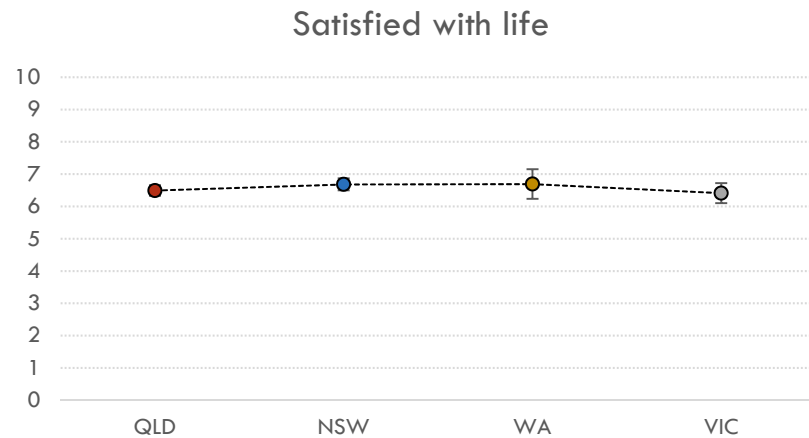


# Well-Being and Happiness: All Locations



| Wave <span style="color: blue;">■</span> Wave 3 <span style="color: green;">■</span> Wave 4 <span style="color: purple;">■</span> Wave 4a |         |          |          |
|-------------------------------------------------------------------------------------------------------------------------------------------|---------|----------|----------|
| Wave 3                                                                                                                                    | SatLife | SatWorth | SatHappy |
| SatLife                                                                                                                                   | 1       |          |          |
| SatWorth                                                                                                                                  | 0.75    | 1        |          |
| SatHappy                                                                                                                                  | 0.74    | 0.73     | 1        |
| SatAnx                                                                                                                                    | -0.23   | -0.16    | -0.32    |
| Wave 4                                                                                                                                    | SatLife | SatWorth | SatHappy |
| SatLife                                                                                                                                   | 1       |          |          |
| SatWorth                                                                                                                                  | 0.79    | 1        |          |
| SatHappy                                                                                                                                  | 0.74    | 0.74     | 1        |
| SatAnx                                                                                                                                    | -0.05   | -0.07    | -0.16    |

## Measures of Subjective Wellbeing Wave 4B by State Metro Areas



## We focussed on How worthwhile do you think the things that you do in life are during COVID-19 and working from home? (SatWorth)

- We investigated (using an ordered logit model) whether there is systematic behavioural link of SatWorth with
  - WFH,
  - reduced commuting linked to distance to work,
  - balancing work with non-work activities, and
  - various socio-economic characteristics.
- The evidence suggests that the opportunity to have reduced commuting activity linked to
  - WFH,
  - increased work-related productivity and
  - an improved balance between time spent on work and time spent not working,
- have all contributed in a positive way to improving the worth status of life, offsetting some of the negative consequences of the pandemic.

Hensher, D.A. and Beck, M. J. Exploring the link between working from home and how worthwhile the things that you do in life are during COVID-19, **Paper #21**. Submitted to *Transport Policy* 20 January 2022.

## Policy Take away

- While we would have preferred that the virus had not taken hold, we must look forward to use this ‘extreme event experience’ to obtain positive benefits to individuals, households and society more broadly.
- This position must recognise that mental health and well-being, including social exclusion has not gone away (see Stanley et al. 2021) and that it remains a high priority for governments as well as for business more generally;
  - however let us recognise that some good has come out of the pandemic to provide some directions to better support well-being that were not on offer before COVID-19.
- The policy implication is very clear; namely, to continue to ensure that people can work from home successfully, and know they are making a contribution while doing so.
- Meaningful work provides meaning to life.

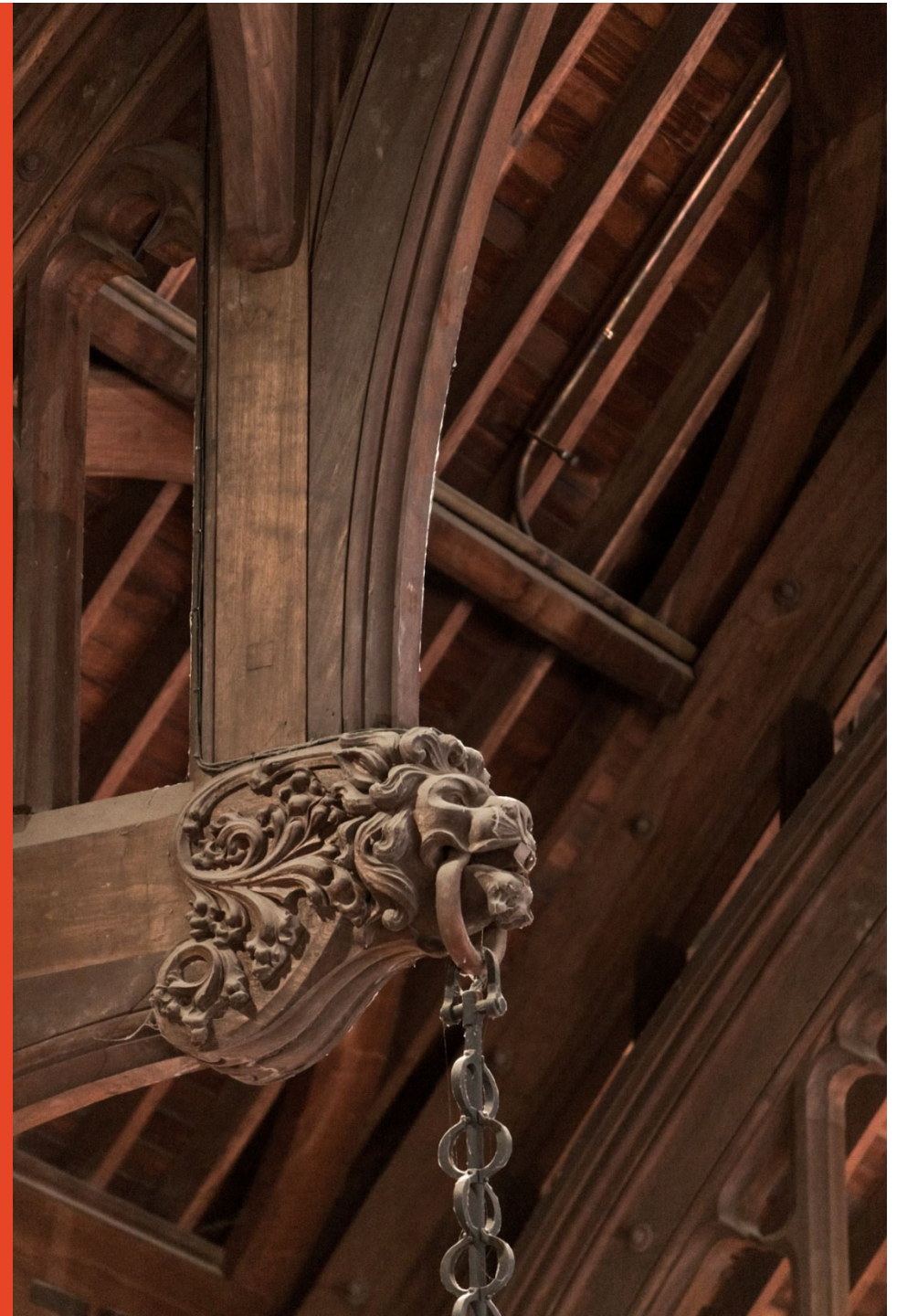
Stanley, J., Hensher, D.A., Stanley, J. and Vella-Brodrick, D. (2021) Valuing changes in wellbeing and its relevance for transport policy, *Transport Policy*, 110, 16-27.

# Time Allocation of Reduced Commuting Time during COVID-19 under Working from Home; Paper #18

Wave 4



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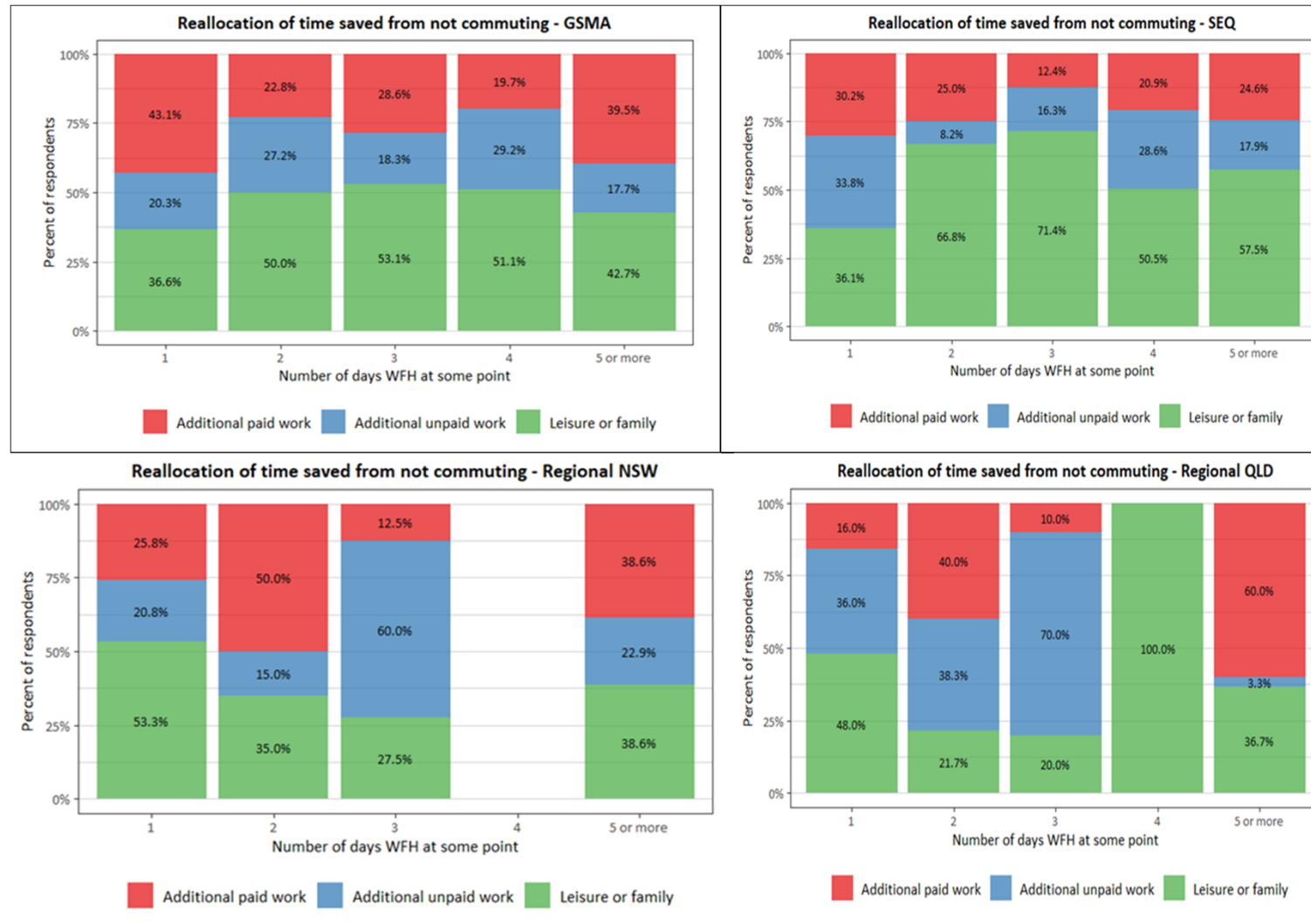


**Time Allocation: Thinking about working from home and the time saved from not commuting, how much of that time do you spend working versus using it for other activities that do not involve work? Wave 4 and only for those who actually ‘saved commuting’ time**

| Daily Savings                                                         | Total Sample      | QLD              | NSW               | GSMA              | Regional NSW     | SEQ               | Regional QLD     |
|-----------------------------------------------------------------------|-------------------|------------------|-------------------|-------------------|------------------|-------------------|------------------|
| Sample share (%)                                                      |                   | 38.89            | 61.11             | 53.70             | 7.41             | 33.70             | 5.19             |
| Commuting time saved (mins)                                           | 60.47<br>(107.42) | 60.48<br>(99.66) | 60.47<br>(112.17) | 63.23<br>(116.81) | 40.45<br>(67.31) | 58.46<br>(101.11) | 73.57<br>(89.68) |
| Commuting cost saved (\$)                                             | 8.19<br>(20.5)    | 11.31<br>(27.5)  | 6.28<br>(14.4)    | 6.94<br>(15.3)    | 1.81<br>(3.23)   | 11.46<br>(29.1)   | 10.3<br>(11.2)   |
| Time spent doing additional work that I receive pay for (%)           | 29.08<br>(32.74)  | 24.50<br>(31.63) | 31.99<br>(33.14)  | 32.10<br>(33.44)  | 31.25<br>(31.16) | 23.88<br>(31.23)  | 28.57<br>(34.24) |
| Time spent doing additional work for which I receive no extra pay (%) | 23.43<br>(28.23)  | 24.43<br>(31.18) | 22.80<br>(26.20)  | 22.01<br>(25.39)  | 28.50<br>(31.09) | 23.30<br>(30.59)  | 31.79<br>(34.25) |
| Time spent on leisure or family (%)                                   | 47.49<br>(36.10)  | 51.07<br>(38.94) | 45.21<br>(34.01)  | 45.89<br>(33.98)  | 40.25<br>(34.10) | 52.82<br>(38.32)  | 39.64<br>(41.40) |
| Days per week WFH only                                                | 2.61<br>(1.81)    | 2.39<br>(1.79)   | 2.76<br>(1.81)    | 2.84<br>(1.75)    | 2.15<br>(2.15)   | 2.41<br>(1.79)    | 2.29<br>(1.81)   |
| Days per week WFH at some point                                       | 3.01<br>(1.66)    | 2.74<br>(1.62)   | 3.19<br>(1.67)    | 3.19<br>(1.61)    | 3.20<br>(2.03)   | 2.77<br>(1.63)    | 2.57<br>(1.56)   |
| Days per week Work (from any location)                                | 4.28<br>(1.57)    | 4.24<br>(1.49)   | 4.31<br>(1.62)    | 4.31<br>(1.57)    | 4.30<br>(1.97)   | 4.21<br>(1.50)    | 4.43<br>(1.36)   |
| Proportion of days WFH only                                           | 0.62              | 0.57             | 0.66              | 0.68              | 0.51             | 0.57              | 0.58             |

- The findings are important in obtaining estimated time benefits from reduced commuting activity with such travel time being traded against work and against leisure, and what this might mean for the future travel, activity location, and lifestyle landscape.
  - Implications of Value of Travel Time.

## The incidence of work and leisure time as the number of days WFH varies Wave 4



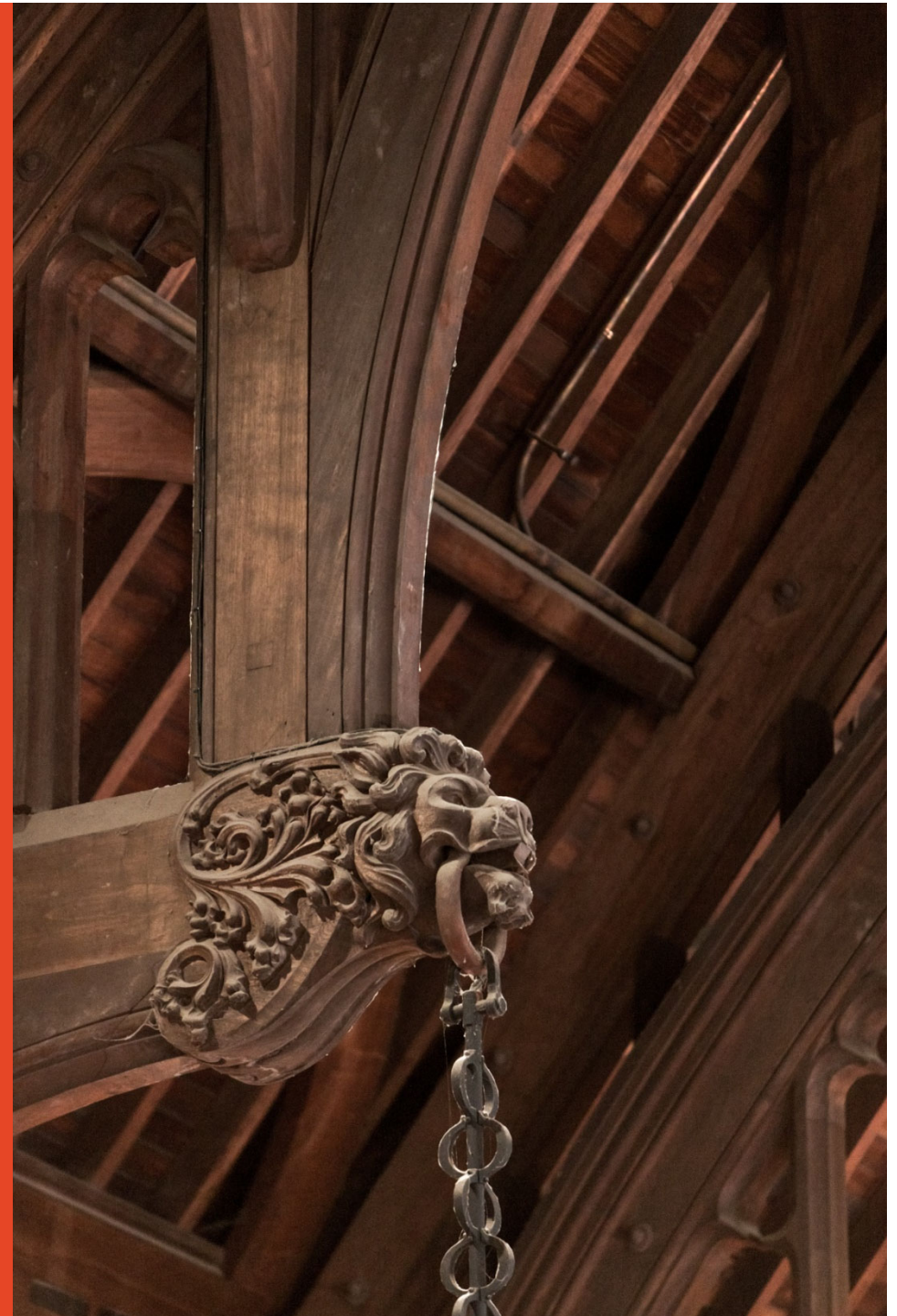
Hensher, D.A., Beck, M. and Balbontin, C. Time allocation of reduced commuting time during COVID-19 under working from home, **Paper #18**, submitted to *Journal of Transport Economics and Policy*, 29 September 2021, revised February 2022.

Drilling Down on Time Allocation of  
Reduced Commuting Time during  
COVID-19 under Working from  
Home and Travel Time adjustments  
in the commute

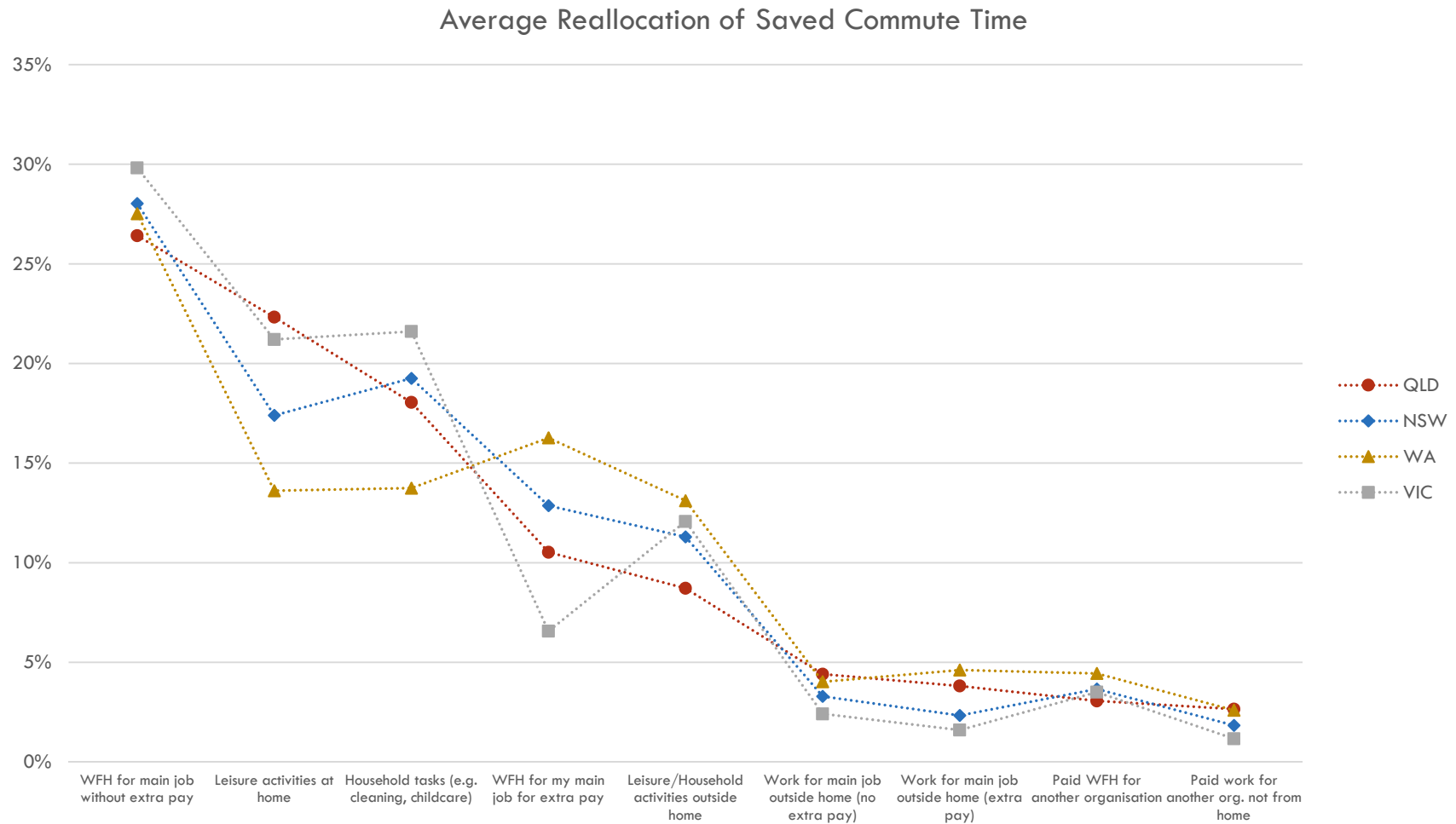
Wave 4B



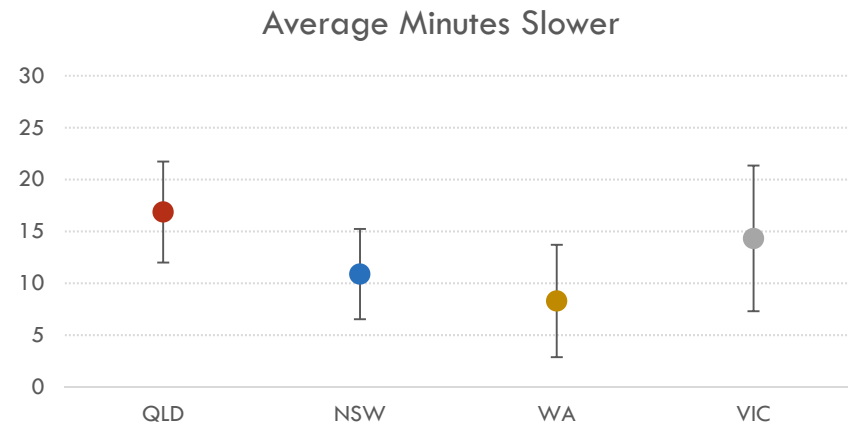
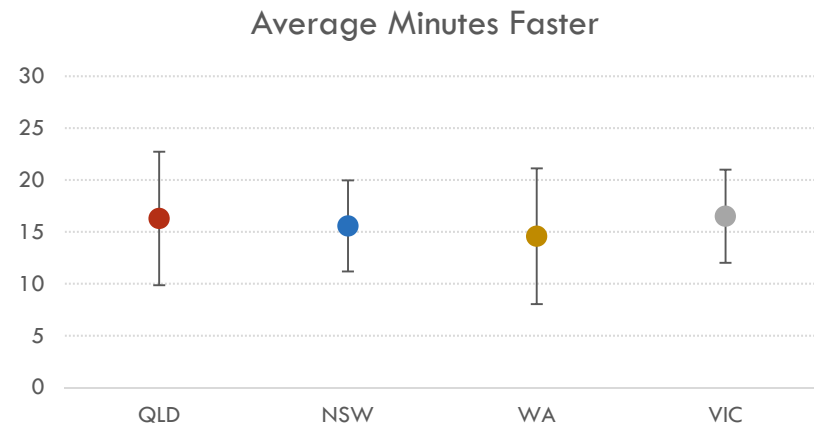
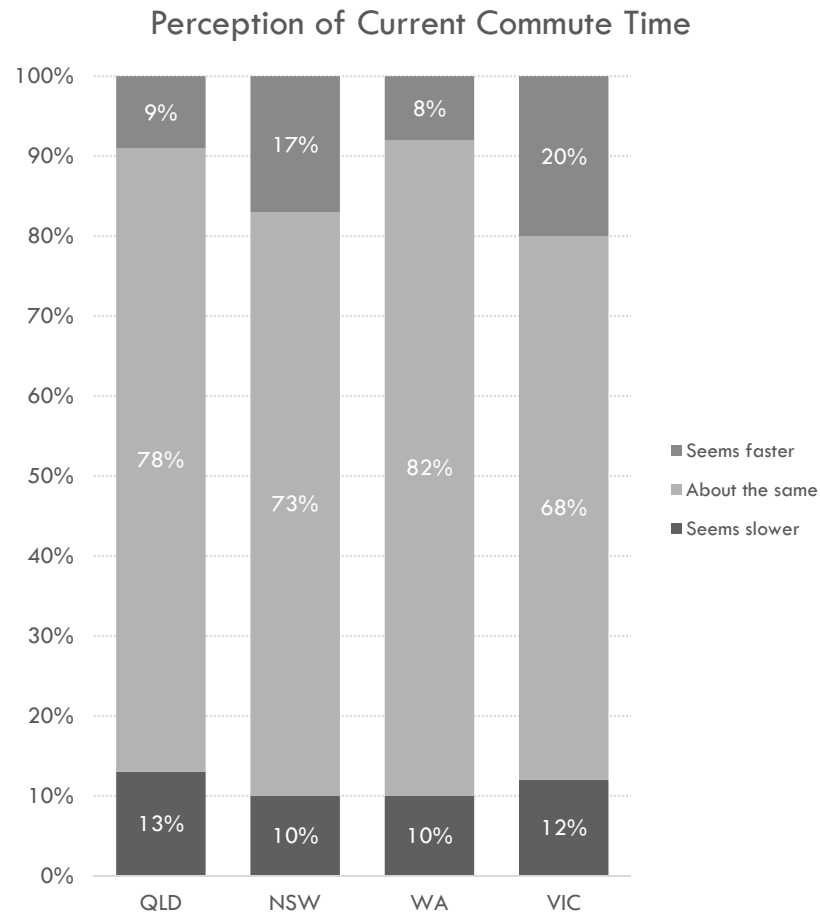
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## Reallocation of Saved Commute Time Wave 4B more detail on allocation time of Wave 4



## Duration of Current Commute (when made) Wave 4B



# The Modelling Approach

“What Modelling does is give you good direction and good vision.”

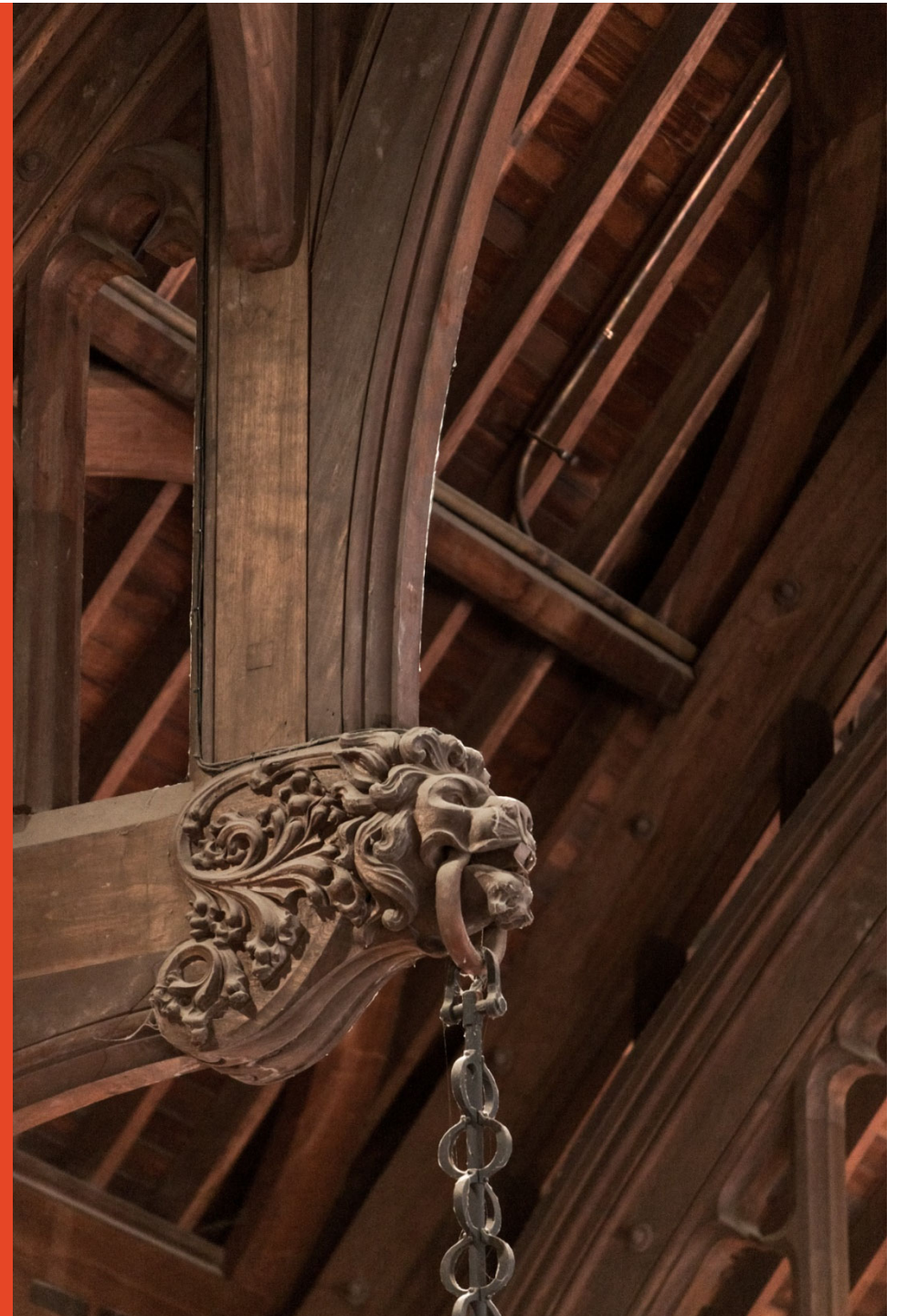
Premier of NSW, 6 September 2021

Wave 4 results

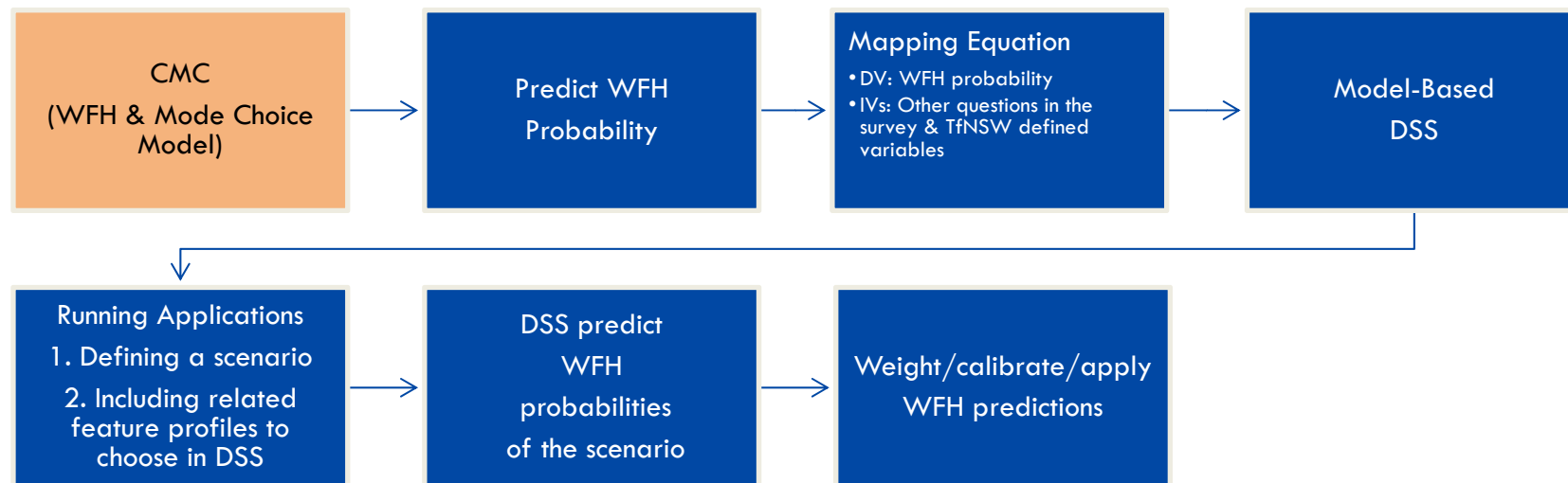
(previous seminar reported Wave 3 results)



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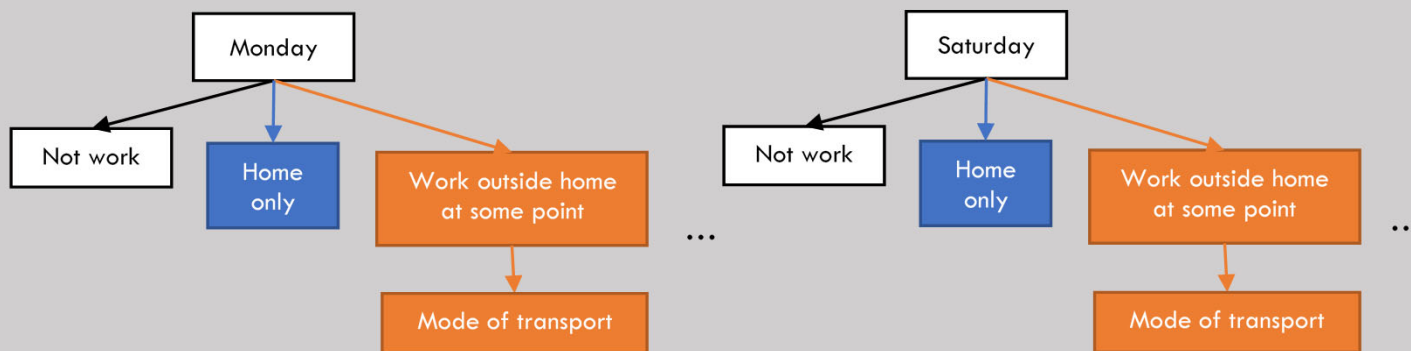
## ITLS Models & DSS and TfNSW Data & Statistics: Waves 3 (Sept 2020), 4 (June 2021) and 5 (March 2022) and 6 (?)



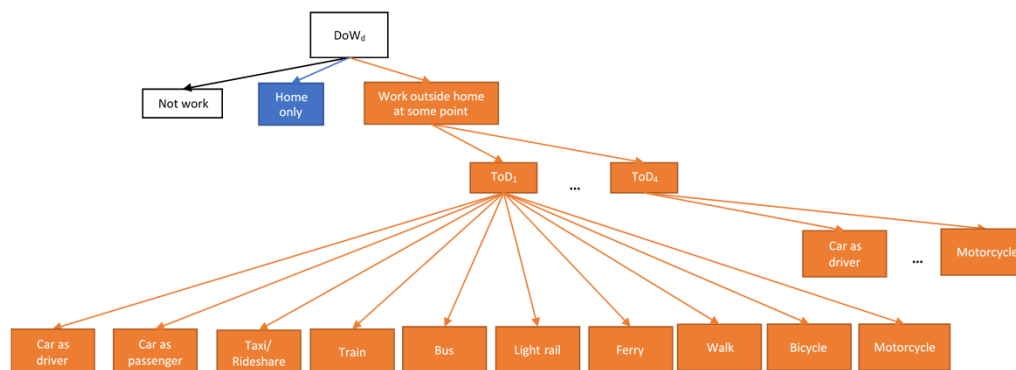
Hensher, D.A, Balbontin, C., Beck, M.J. and Wei, E.(2022) The Impact of working from home on modal commuting choice response during COVID-19: Implications for two metropolitan areas in Australia, **Paper #8** For a Special Issue on COVID-19 (edited by Hani Mahmassani and Patricia Mokhtarian), *Transportation Research Part A*, 155, 179-201.

# METHODOLOGY

Commuting for work travel activity for each **day of week**



The WFH model and mode choice models **will** be estimated simultaneously. This **WFH/Mode choice model** is defined by a maximum of 42 alternatives for each day of week  $d$  (including weekends). The alternatives are described in Table 1 below.



## Assumptions

We **will** assume that the reported travel time, costs, fuel, etc are the same for **all** ToDs. **Will** check once we get the final data.

| Alt <i>ij</i> | Description                        |
|---------------|------------------------------------|
| 1             | Not work                           |
| 2             | Work from home only                |
| 3             | Work outside home - car driver     |
| 4             | Work outside home - car passenger  |
| 5             | Work outside home - taxi/rideshare |

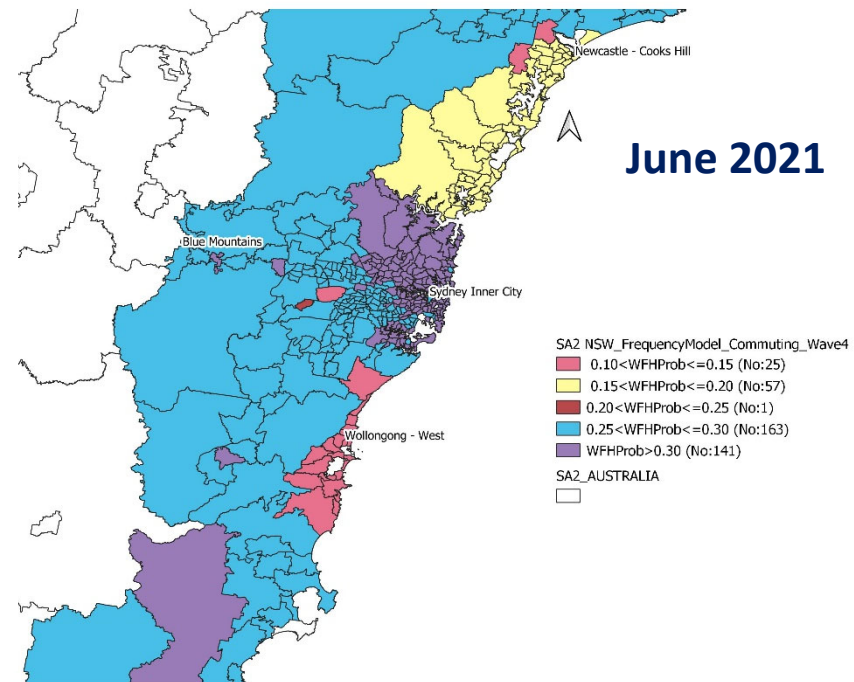
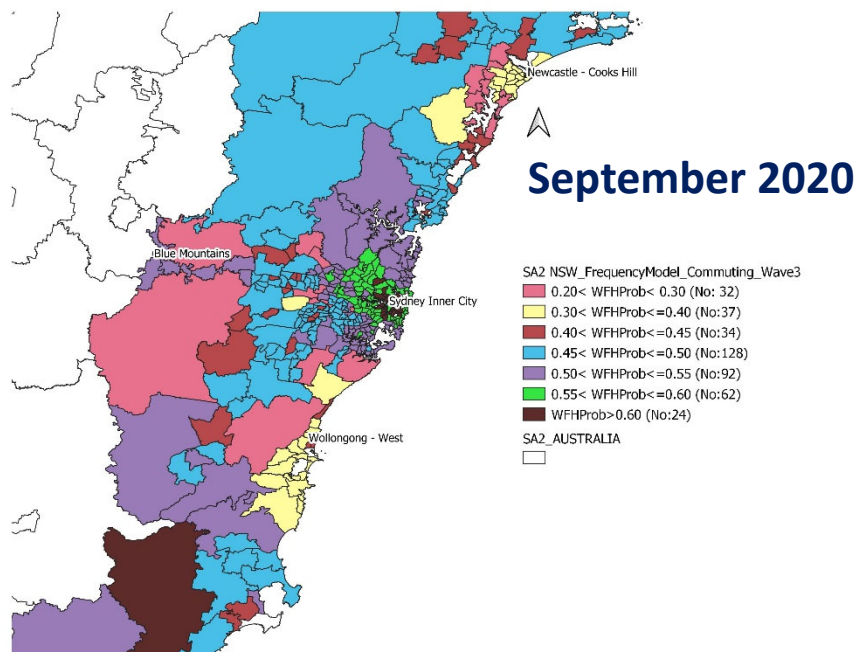
| Alt <i>ij</i> | Description                    |
|---------------|--------------------------------|
| 6             | Work outside home - train      |
| 7             | Work outside home - bus        |
| 8             | Work outside home - light rail |
| 9             | Work outside home - ferry      |
| 10            | Work outside home - walk       |

## Defining a Scenario (to obtain spatial incidence of WFH)

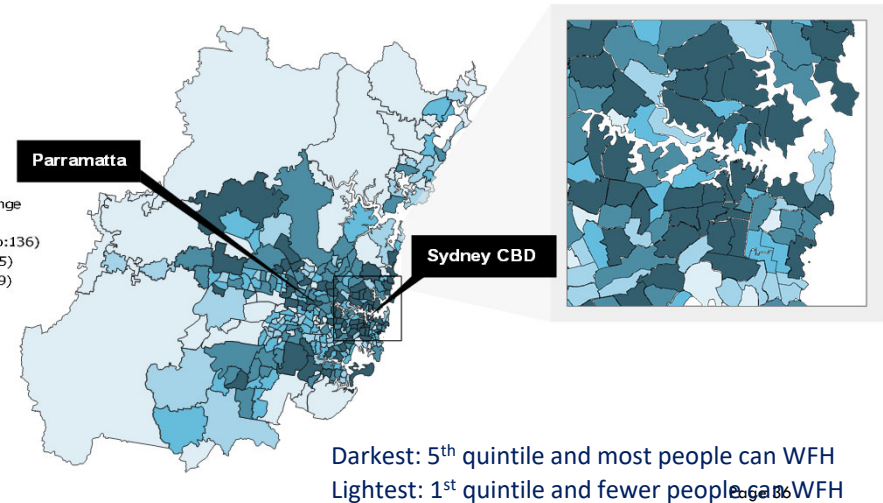
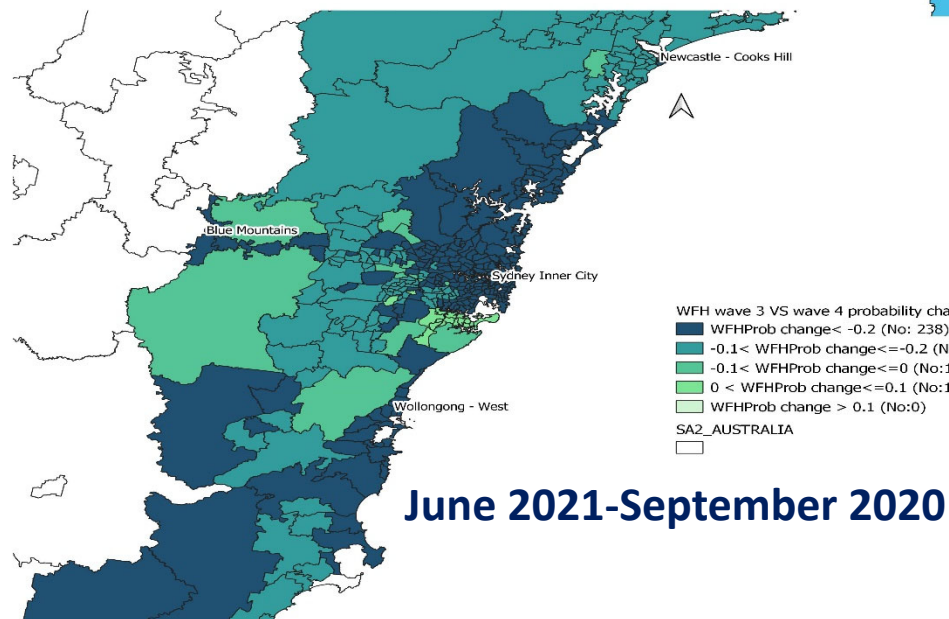
|     | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | D10 |
|-----|----|----|----|----|----|----|----|----|----|-----|
| O1  |    |    |    |    |    |    |    |    |    |     |
| O2  |    |    |    |    |    |    |    |    |    |     |
| O3  |    |    |    |    |    |    |    |    |    |     |
| O4  |    |    |    |    |    |    |    |    |    |     |
| O5  |    |    |    |    |    |    |    |    |    |     |
| O6  |    |    |    |    |    |    |    |    |    |     |
| O7  |    |    |    |    |    |    |    |    |    |     |
| O8  |    |    |    |    |    |    |    |    |    |     |
| O9  |    |    |    |    |    |    |    |    |    |     |
| O10 |    |    |    |    |    |    |    |    |    |     |

|                   | Scenario Defined by Features           |
|-------------------|----------------------------------------|
| Age               | 25% aged between 18 to 34...           |
| Income            | Average personal income \$59,000...    |
| Occupation        | 10% professionals, 5% managers...      |
| Education         | 60% secondary, 25% bachelor degrees... |
| Industry          | 35% in services, 15% in retail...      |
| Travel distance   | average commuting 14 kms               |
| More features ... |                                        |

# Probability of WFH by SA2 for GSMA, Waves 3 and 4 Also have for Regional Settings)

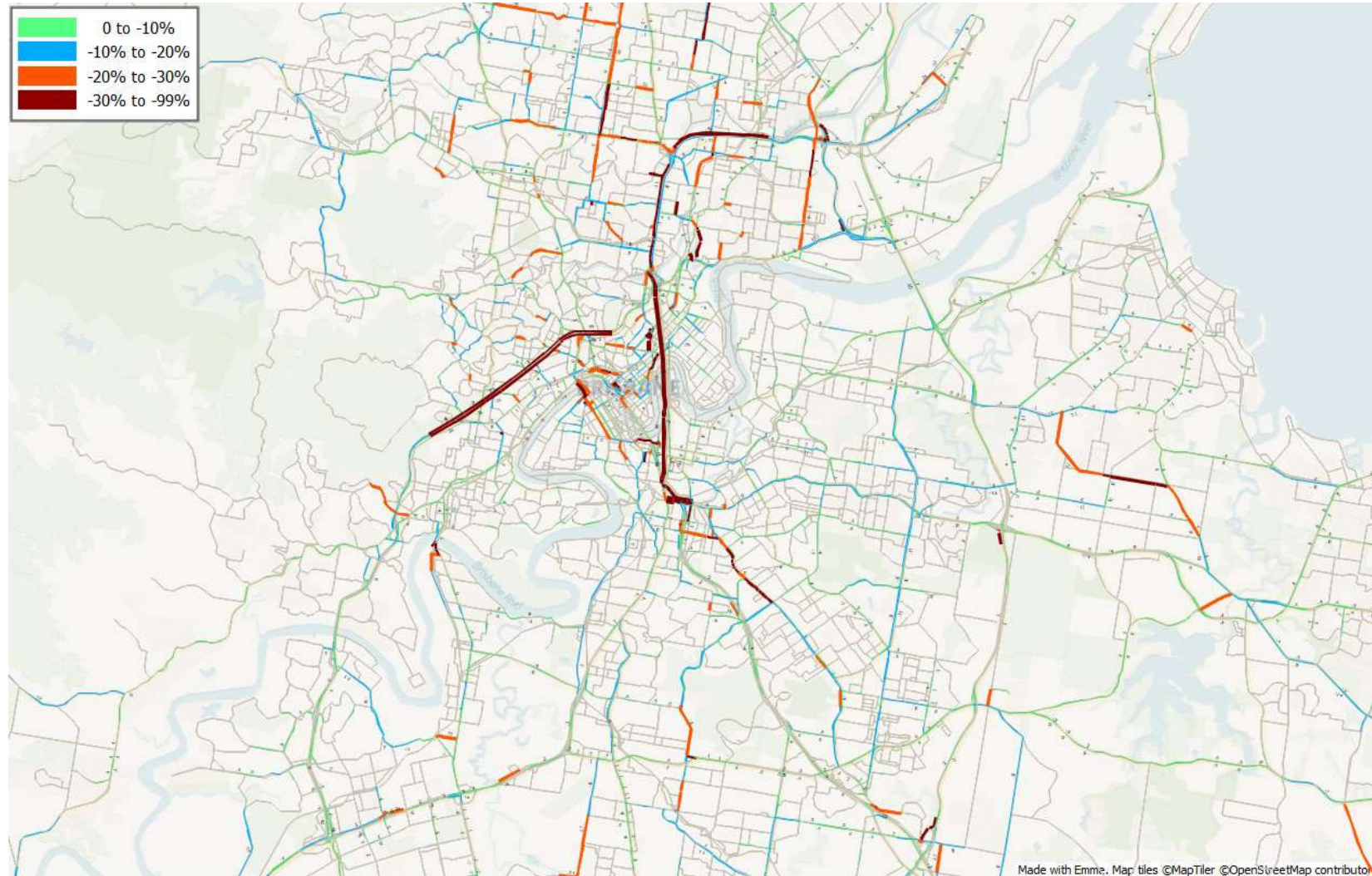


Source: Productivity Commission estimates using ABS (*Microdata: Census of Population and Housing, 2016*, Cat. no. 2037.0.30.001). SMA and not GSMA



## WFH Impact and a route level: An example in SEQ:

Road traffic decreases by less than 10% on most of the network. The exceptional changes on toll roads such Legacy Way, Clem 7 and Airport Link are due to sensitive route choice when tolls are involved



# **Post Lockdown (NSW) Survey (Wave 4B)**

**Nov/Dec 2021**

**Public Transport Concern  
We also have for Wave 4A  
but not reported herein**

## **All Contacted:**

**Total = 2189**

**SEQ = 850**

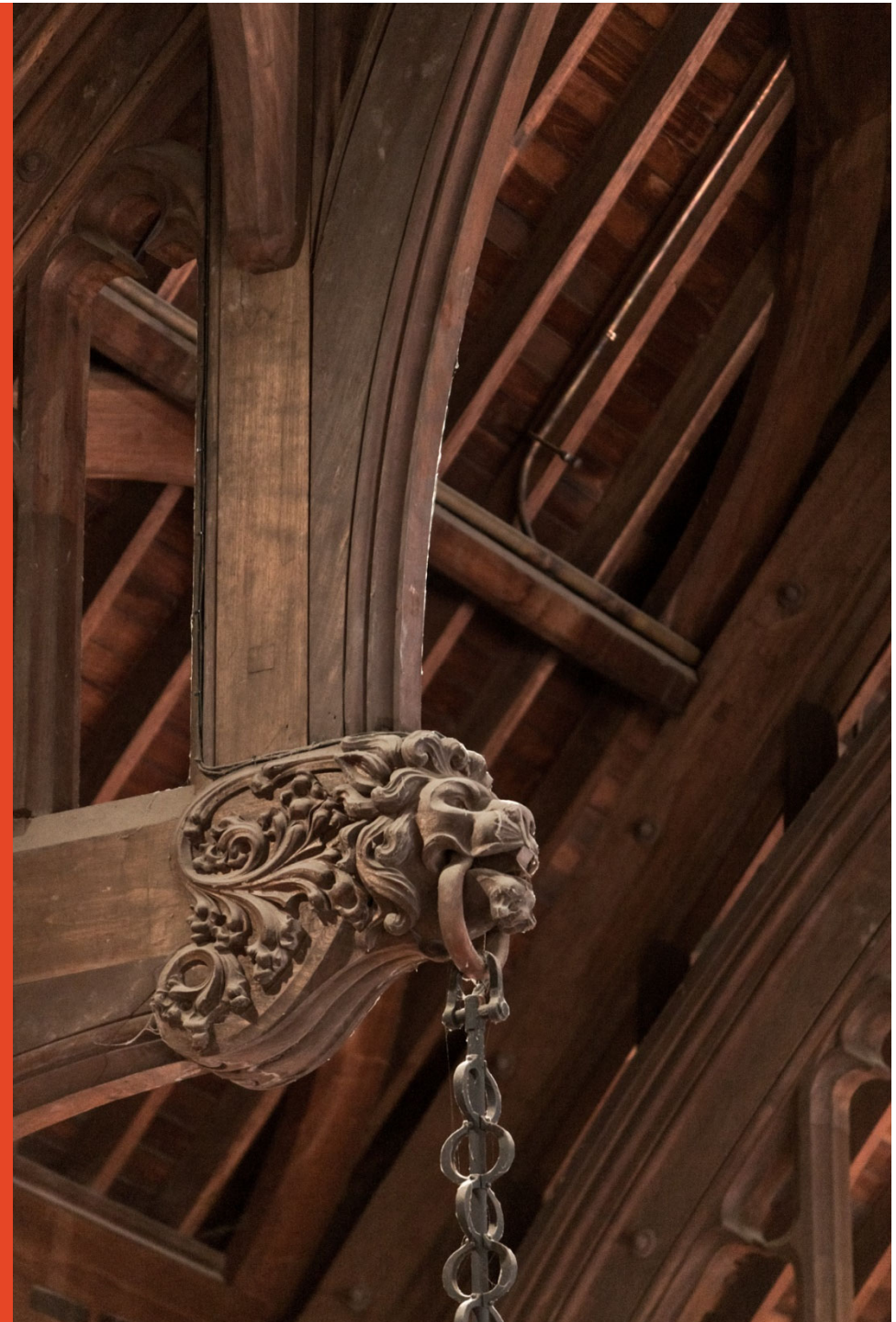
**GSMA = 678**

**Perth = 224**

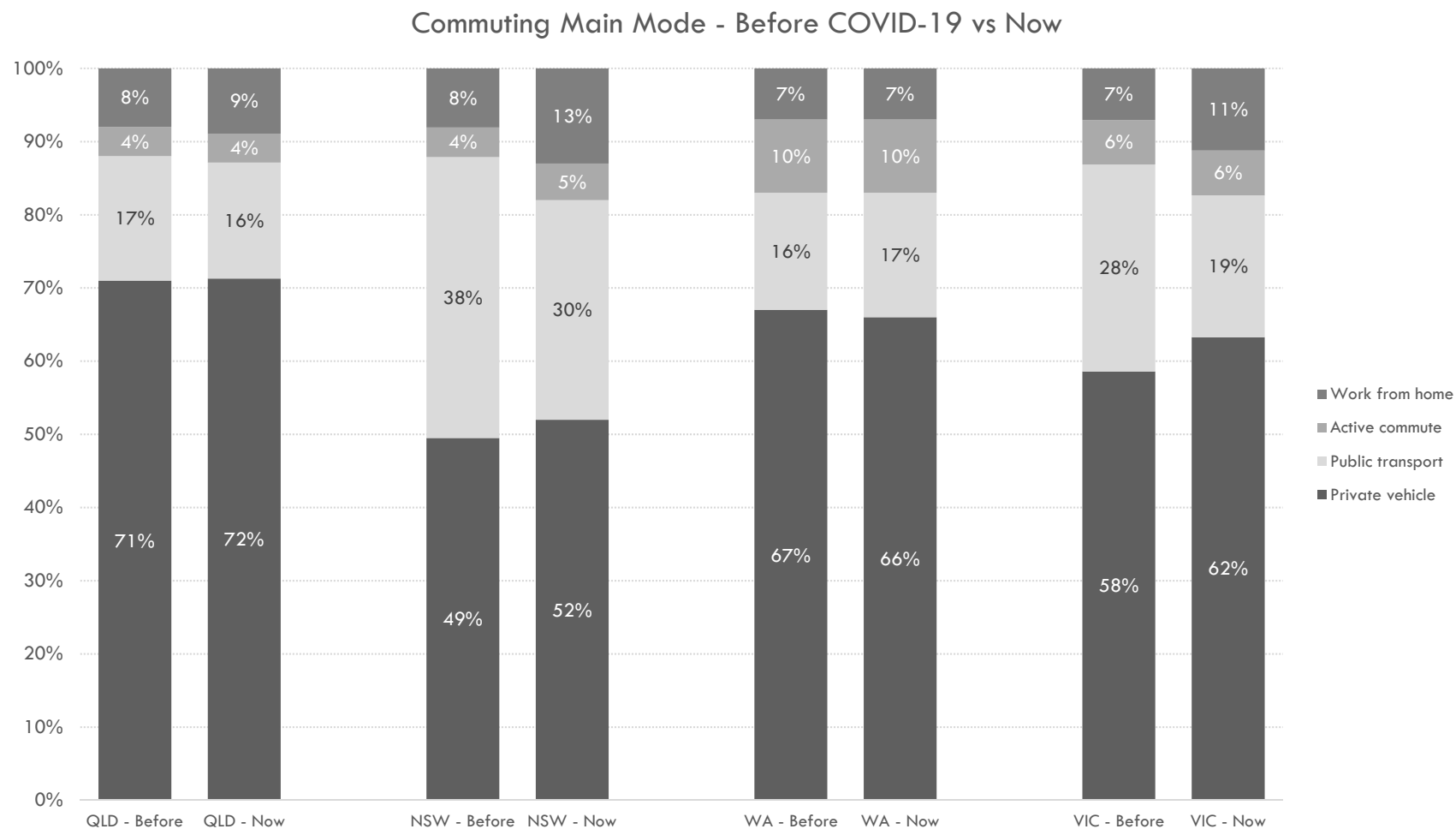
**Melb. = 437**



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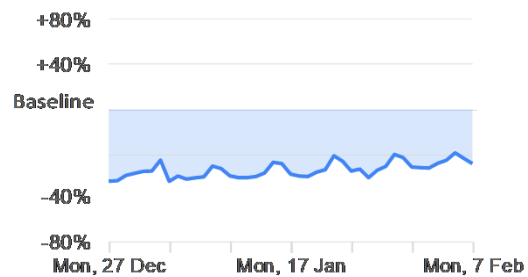
## Commuting Main Mode Wave 4B (Note: Example for GSMA: 24% lower than pre-COVID-19 but all trip purposes is about 35% lower)



# Profiling of Public Transport and Workplace Changes in 2022 since COVID-19 (Google Mobility) 3 Jan- 6 Feb 2020 = Baseline Jan 2002 cf Jan 2020 = 65% drop in GSMA

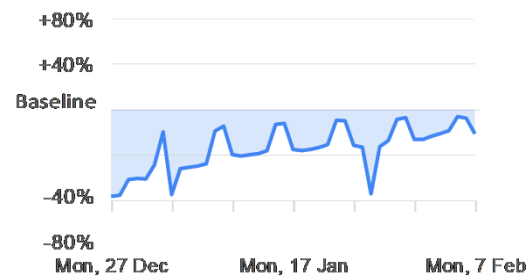
## Public transport

-48% compared to baseline



## Workplaces

-21% compared to baseline



NSW

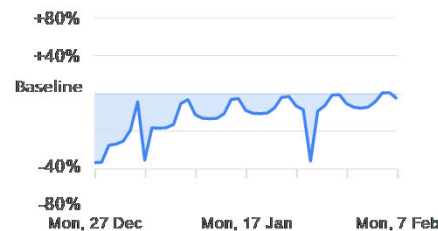
## Public transport

-44% compared to baseline



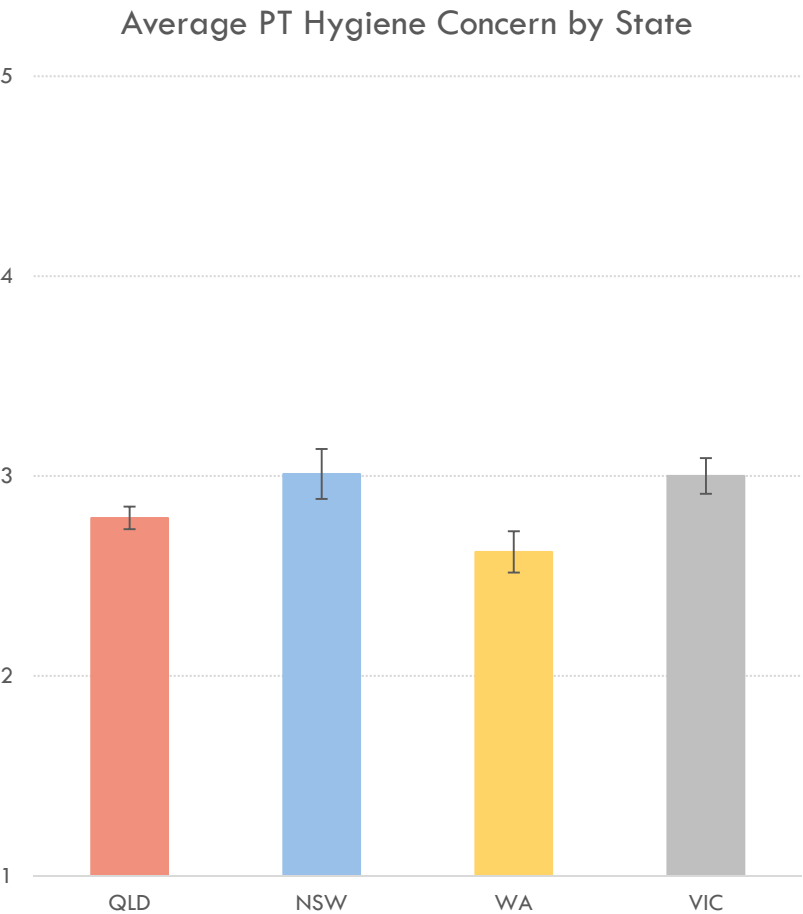
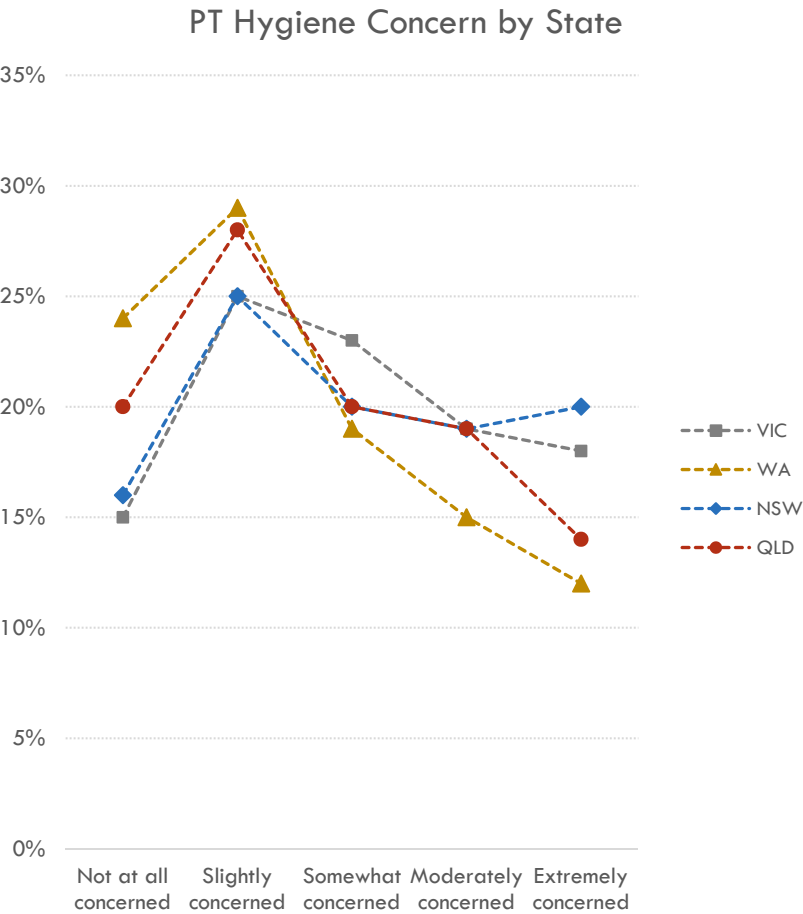
## Workplaces

-6% compared to baseline

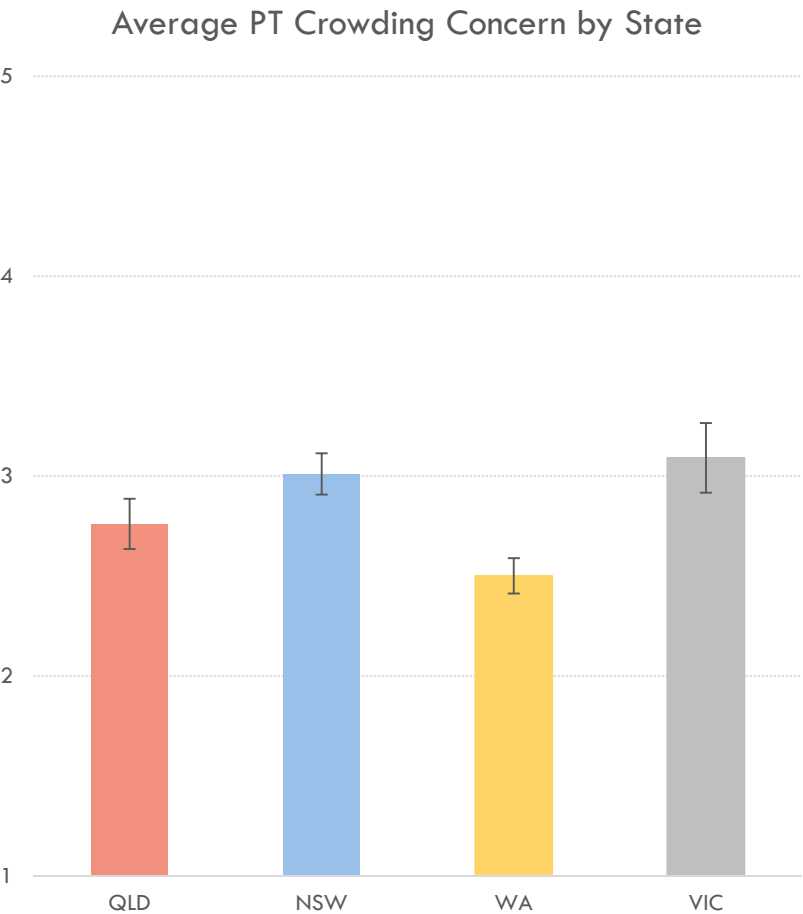
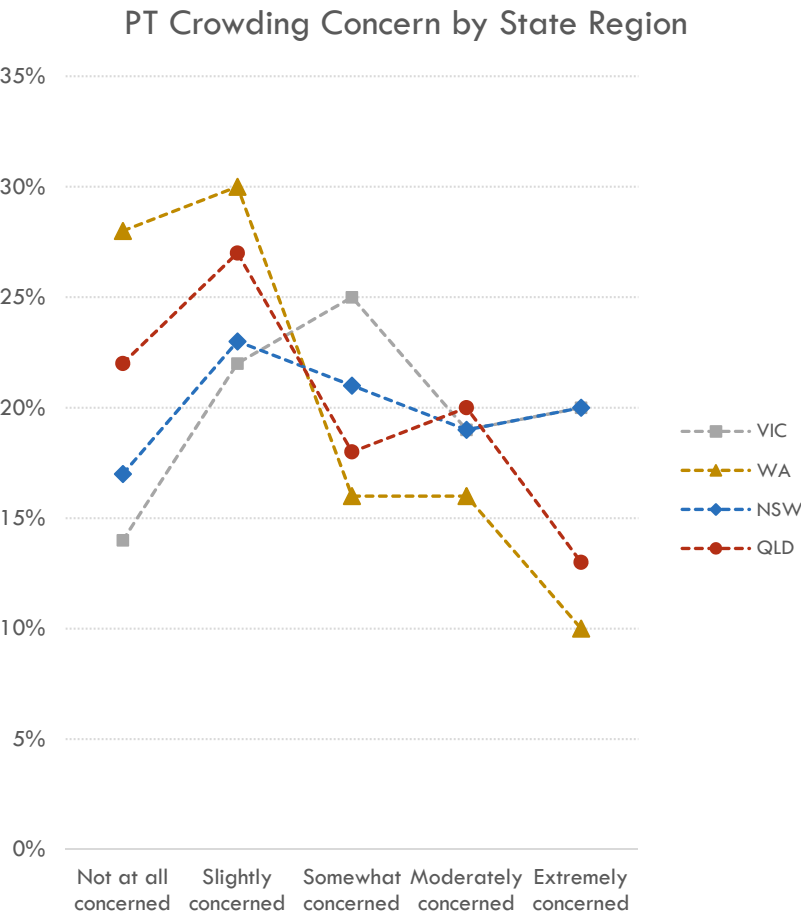


QLD

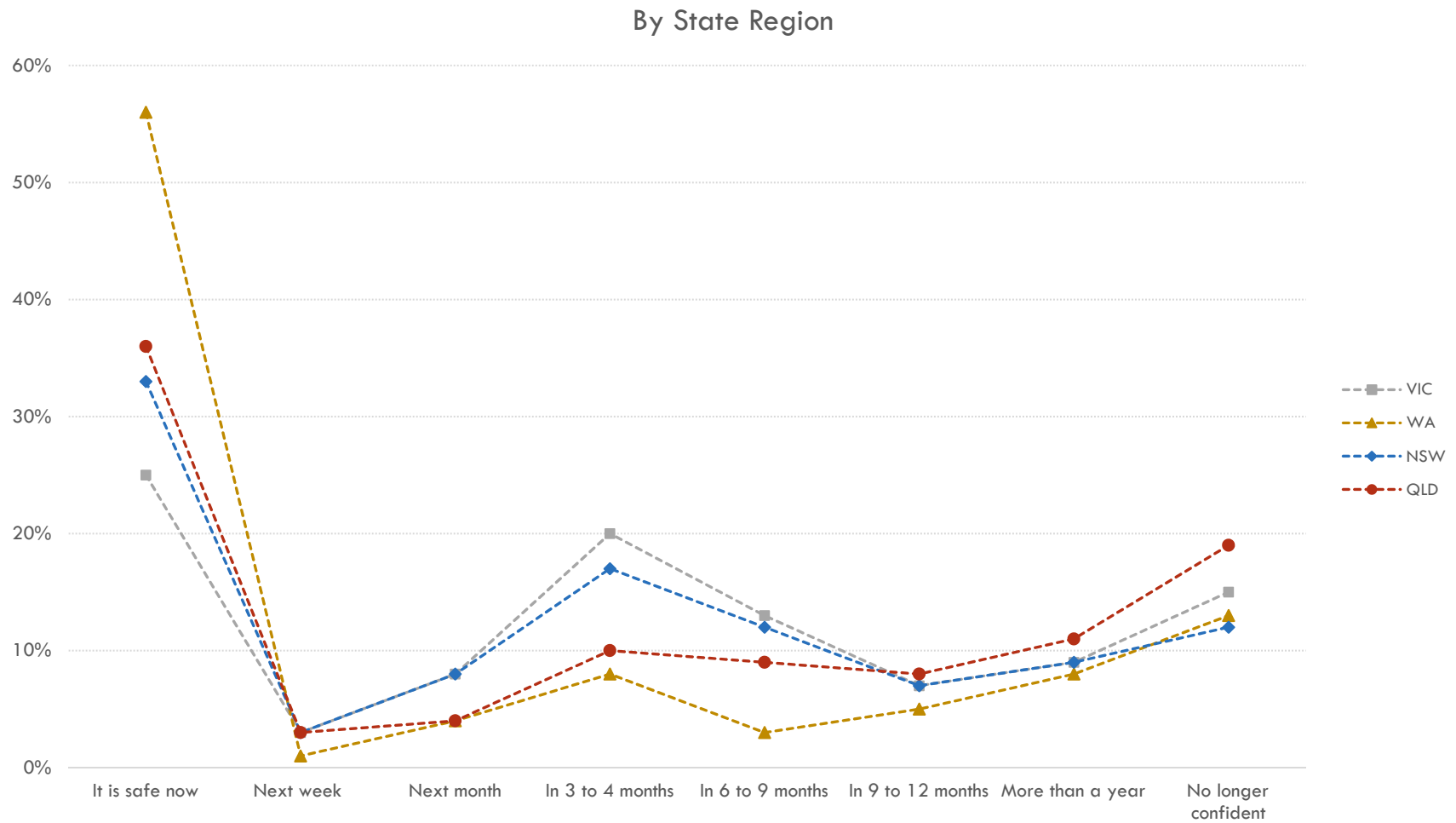
# Concern About Public Transport Hygiene Wave 4B



# Concern About Public Transport Crowding Wave 4B



# When Will Public Transport be Safe to Use? Wave 4B



# Longer Term Implications: What does this all suggest?

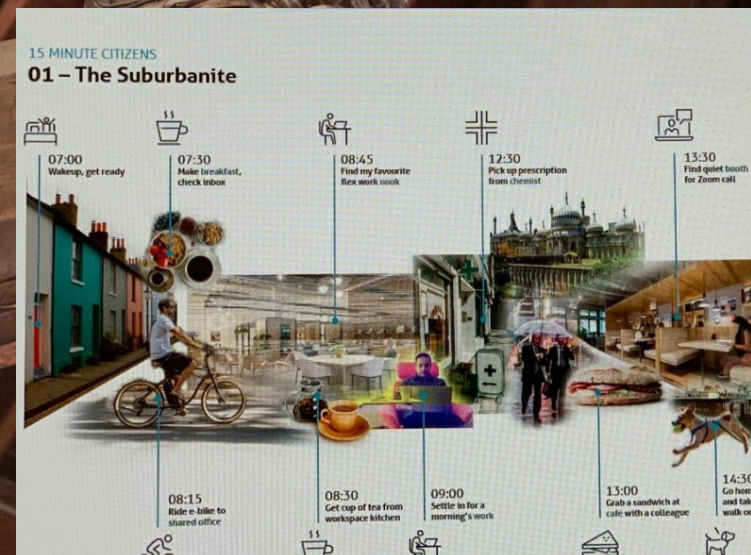
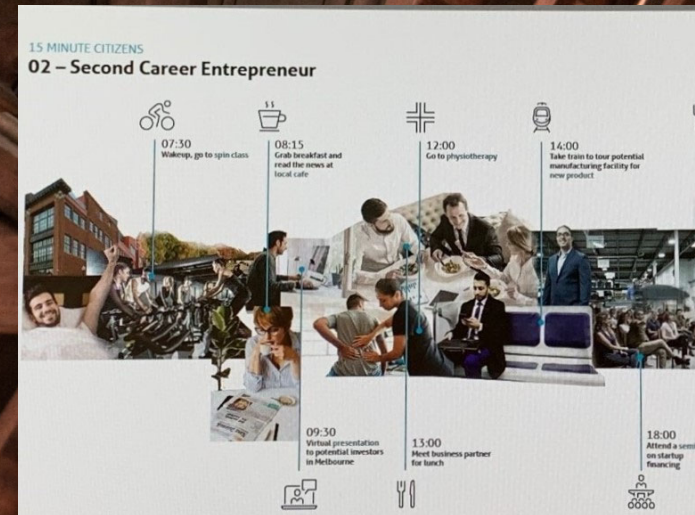
*“We always overestimate the change that will occur in the next two years and underestimate the change that will occur in the next ten. Don't let yourself be lulled into inaction.”*



Beck, M. J. and Hensher, D.A. (2021) Australia 6 months After COVID-19 Restrictions Part 1: Changes to Travel Activity and Attitude to Measures **Paper #7a**. *Transport Policy*, online 17 June 2021.  
Beck, M. J. and Hensher, D.A. (2021) Australia 6 months After COVID-19 Restrictions Part 2: The Impact of Working from Home **Paper #7b**. *Transport Policy*, online 17 June 2021.



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## Has COVID-19 helped or hindered?

Beck, M. J. and Hensher, D.A. Insights into Work from Home in Australia in 2020: Positives, Negatives and the Potential for Future Benefits to Transport and Society, **Paper # 11** submitted to a Special Issue on COVID-19 (edited by Hani Mahmassani and Patricia Mokhtarian), *Transportation Research Part A*, 12 January 2021, referees reports 25 May 2021, revised 1 June 2021.

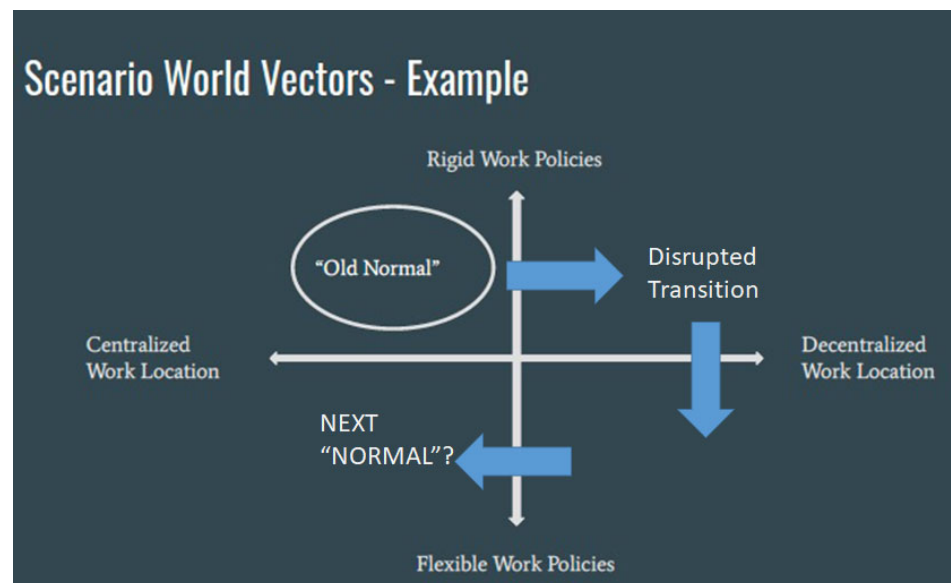
**“Delivered some unintended positive consequences” and “some negative ones”**

**“WFH/Remote working possibly the greatest transport policy lever we have had for many years”**

**‘Flexibility is here to stay’ and ‘employers who offer a balance of WFH and in office will attract more high-quality employees’ (The Future of Office Space Summit, 17 Feb 2021)**

**“Teleworking is one of the most popular Transportation Demand Management (TDM) strategies for reducing motor vehicle travel.”**

**“More than half 54% of employees surveyed around the world said they would consider leaving their jobs if they are not given some form of flexibility regarding where and when they work.” (Smarten Spaces)**



# The Big Accumulating Take Away Evidence: Structural Change

- *As I discussed on ABC 702 Sydney Radio, 9.15am 17 February 2022*
  - Five (5) key drivers of Change**
  - Public Transport nervousness
  - Voluntary (or shadow) lockdown and when travel, **use a car**
  - Purchase of 2<sup>nd</sup> and in some cases, a 1<sup>st</sup> car
  - WFH (or remote working) likely to be averaging 2 days (1-3) for many occupations and spatially sensitive:
    - Less sensitive to parking and fuel/toll prices
    - Improved support from employers for work/leisure life balance
  - WFH associated with suburbanisation effect:
    - More travel through the day, typically by car
    - Flattening the traditional peaks and growth in off-peak
    - Boom in work by tradies (huge numbers on roads, earning more, less sensitive to fuel and toll prices)
    - Growth in satellite offices (linked to 15-20 min city)
    - So called Central Business District (CBD) needs to be given new nomenclature as **Downtown Activity Precinct (DAP)** given unlikely return to pre-COVID-19 office activity
    - Staggered working hours as offices reduce capacity leading to increase in single-occupant car use.
  - This is likely to continue for sometime – a definite structural change
    - No signs of any re-pricing of car use (except maybe DBC for ECs when scalable but latter unlikely to have much impact)

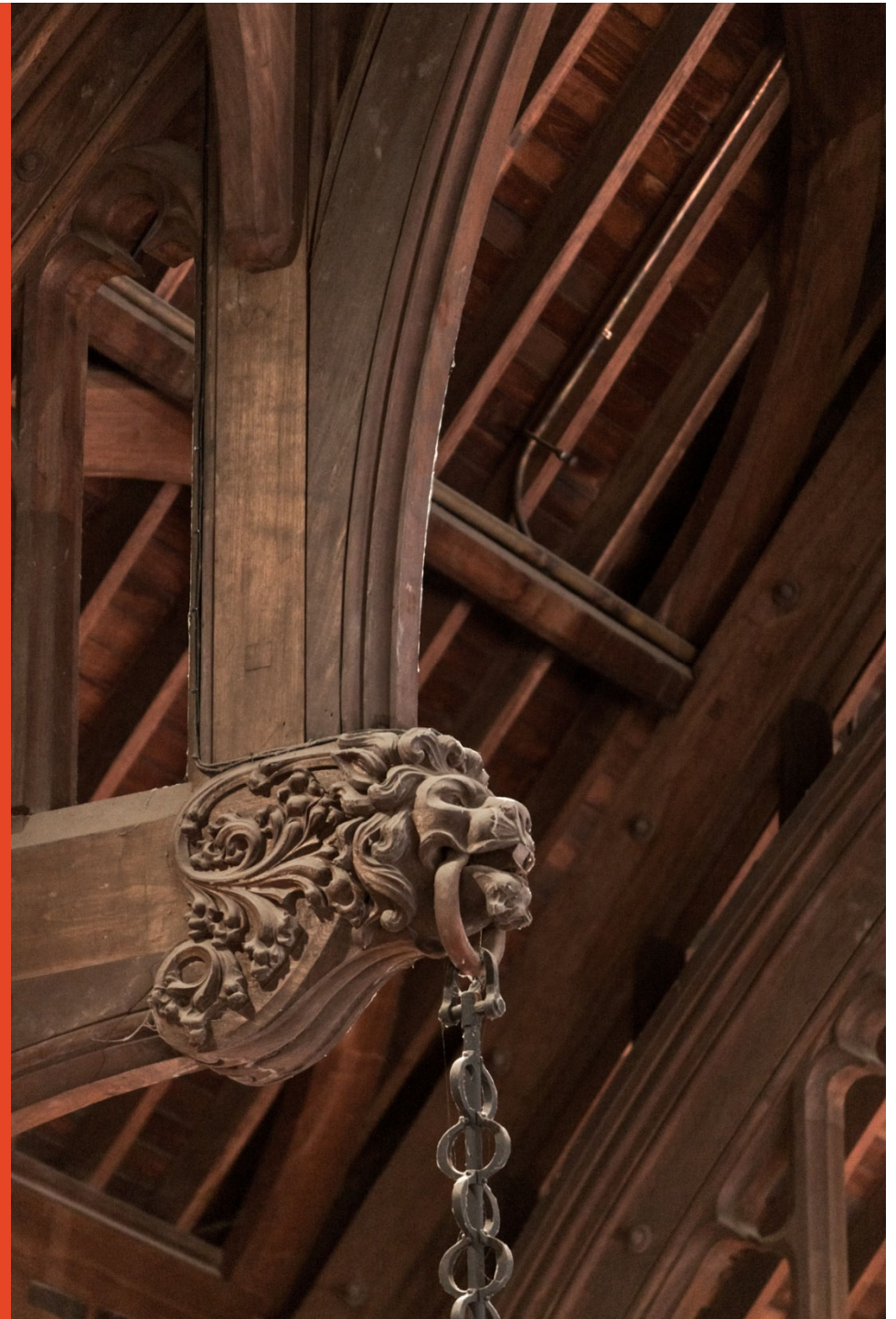
# Some final observations (and warnings!)

- The drive to force workers back into the CBD is counterproductive and will eliminate any possible gains in WFH as a mechanism for TDM
- Any desire to boost economic activity in the CBD (DAP) will likely cannibalise small business income in the suburban areas where there has been some substitution of activity
- The balance for those that can WFH seems to be a desire to WFH around 40% of the time 60% from the office (to capture the benefits of both)
  - Many employees see the benefit of the hybrid model
- A hybrid model should still support economic activity, but the value proposition of the CBD will need to be revised beyond just being a place of offices as a DAP
- Any move towards staggering work hours will need active rather than passive intervention rather,
  - as there are constraints on many households given the composition of household trips

# Looking Ahead

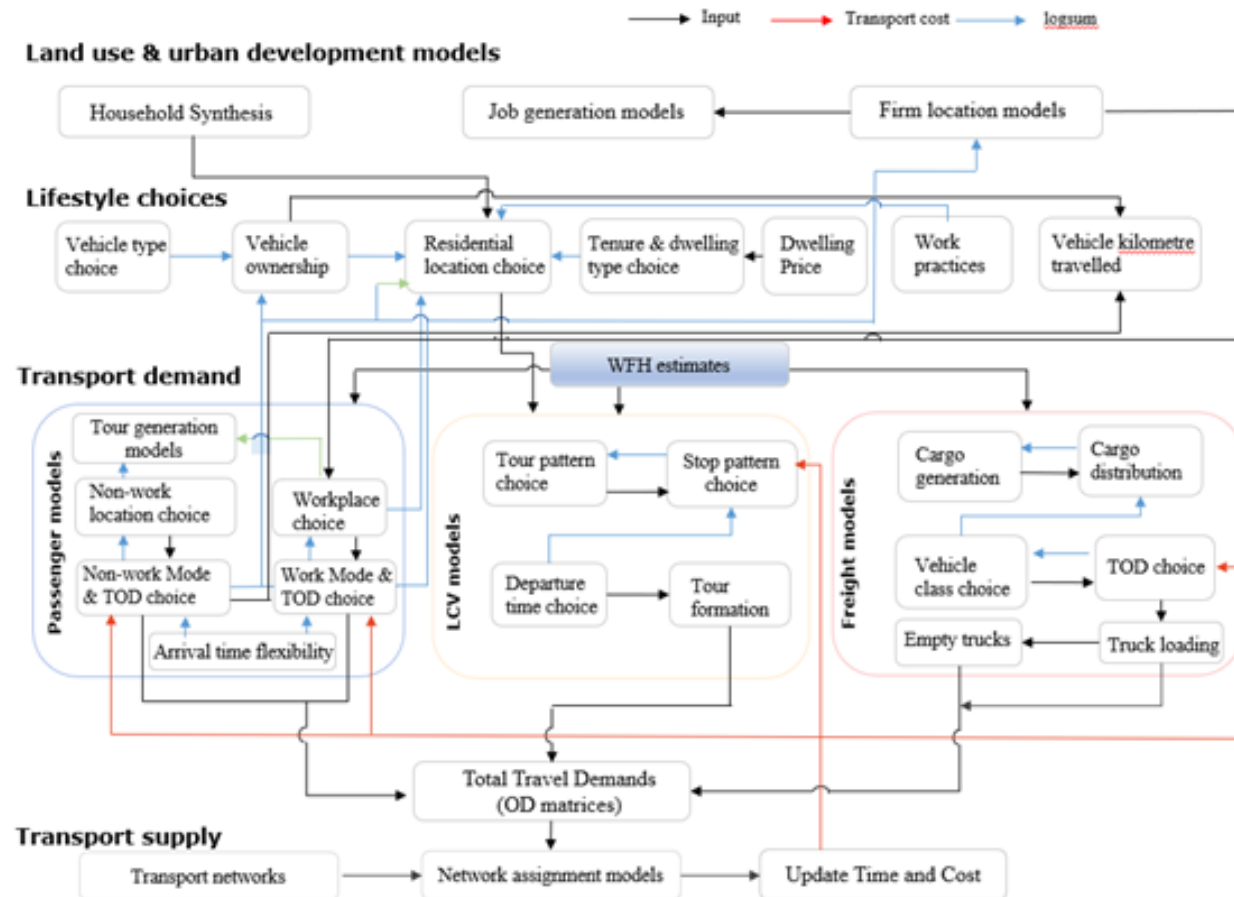


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## Tracing changes in accessibility on location responses: and where WFH impacts fit in MetroScan (GSMA)- very fast runs <40 mins on HPC

The demand-side behavioural model system for passenger, light commercial, and freight travel activity. Built in is Freight, WFH, Electric car transition.....numerous outputs; agglomeration, social exclusion, well-being...



## MetroScan W/Wo WFH 2023 predictions

|                                                           | Base (before WFH) | Allowing for WFH | Percentage change |
|-----------------------------------------------------------|-------------------|------------------|-------------------|
| <b>Modal Activity per annum (all trip purposes):</b>      |                   |                  |                   |
| Car drive alone                                           | 3,063,173,050     | 2,723,910,852    | -11.076           |
| Car with passengers                                       | 1,650,606,668     | 1,344,940,034    | -18.518           |
| Bus                                                       | 194,705,461       | 123,841,331      | -36.396           |
| Train                                                     | 252,787,164       | 157,911,904      | -37.532           |
| Total motorised modes                                     | 5,161,272,343     | 4,350,604,121    | -15.707           |
| <b>Modal shares (all trip purposes):</b>                  |                   |                  |                   |
| Car drive alone                                           | 59.35%            | 62.61%           | 5.59              |
| Car with passengers                                       | 31.98%            | 30.91%           | -3.257            |
| Bus                                                       | 3.775             | 2.85%            | -24.36            |
| Train                                                     | 4.90%             | 3.63%            | -25.753           |
| <b>Passenger Vehicles:</b>                                |                   |                  |                   |
| Total daily car kms                                       | 252,725,288       | 225,630,166      |                   |
| Total revenue for PT use (\$pa)                           | 1,482,019,696     | 934,644,336      | -36.934           |
| Total revenue from parking (\$pa)                         | 302,715,424       | 297,595,277      | -1.691            |
| Total government revenue for GST                          | 64,381,101,223    | 57,478,690,186   | -10.721           |
| Total revenue from toll roads (\$)                        | 867,317,568       | 630,402,688      | -27.316           |
| Total annual auto VKM (\$)                                | 9,165,032,041     | 8,182,432,845    | -10.721           |
| Total government revenue from fuel excise (\$pa)          | 3,302,013,595     | 2,947,998,912    | -10.721           |
| Generalised cost per annum for PT (\$pa)                  | 9,726,699,697     | 5,824,402,874    | -40.119           |
| Generalised cost per annum for car (\$pa)                 | 104,504,496,348   | 85,685,930,808   | -18.007           |
| Generalised cost per person trip for PT (\$pa)            | 21.736            | 20.672           | -4.895            |
| Generalised cost per person trip for car (\$pa)           | 22.17             | 21.059           | -5.011            |
| Generalised cost per person trip car & PT (\$pa)          | 22.115            | 21.023           | -4.938            |
| <b>Freight Vehicles:</b>                                  |                   |                  |                   |
| Total government revenue from fuel excise (\$pa)          | 1,162,090,474     | 1,168,269,296    | 0.532             |
| Annual Total distance travelled Articulated               | 3,478,798,038     | 3,497,879,878    | 0.549             |
| Annual Total distance travelled Rigid                     | 2,331,654,333     | 2,343,466,600    | 0.507             |
| Generalised cost per trip for freight                     | 126,303           | 123,487          | 0.532             |
| Freight User benefit (\$pa)                               | 96,329,301        |                  |                   |
| <b>Emissions and Pollution:</b>                           |                   |                  |                   |
| Total CO <sub>2</sub> for passenger and freight movements | 16,746,997,718    | 15,414,134,454   | -7.959            |
| Total CO <sub>2</sub> for passenger movements             | 12,432,062,391    | 11,099,199,128   | -10.721           |
| Total annual carbon dioxide for trucks                    | 4,314,935,327     | 4,337,961,459    | 0.534             |
| Total annual local air pollution costs for trucks         | 2,674,467,833     | 2,688,976,524    | 0.542             |

## Publications from Working from Home (WFH) Project, 2020-2022

Version: 31 January 2022

### Published

- Beck, M. and Hensher, D.A. (2020) Insights into the Impact of Covid-19 on Household Travel, Work, Activities and Shopping in Australia – the early days under restrictions, **Paper #1**, *Transport Policy*, 96, 76-93. <https://doi.org/10.1016/j.tranpol.2020.07.001> (one of top most downloaded papers in the journal).
- Hensher, D.A., Beck, M. J. and Wei, E. (2021) Working from home and its implications for strategic transport modelling based on the early days of the COVID-19 pandemic, **Paper #2**, *Transportation Research Part A*, 148, 64-78.
- Beck, M. J., Hensher, D.A. and Wei, E. (2020) Slowly coming out of COVID-19 restrictions in Australia: implications for working from home and commuting trips by car and public transport, **Paper #3**, *Journal of Transport Geography*, 88, 102466.
- Beck, M. and Hensher, D.A. (2020) Insights into the impact of COVID-19 on household travel and activities in Australia – the early days of easing restrictions, **Paper #4**, *Transport Policy*, 99, 95-119. Online 19 August 2020 <https://doi.org/10.1016/j.tranpol.2020.08.004>.
- Hensher, D.A., Wei, E., Beck, M.J. and Balbontin, C. (2021) The impact of COVID-19 on the time and monetary cost outlays for commuting - the case of the Greater Sydney Metropolitan Area after three months of restrictions, **Paper #5**, *Transport Policy*, 101, 71-80.
- Beck, M.J. and Hensher, D.A. (2020) What does the changing incidence of Working from Home (WFH) tell us about Future Transport and Land Use Agendas? *Transport Reviews*, 41(3). (Shortened version for *The Conversation*, November 2020 to accompany Academy of Social Sciences Australia (ASSA) podcast). <https://doi.org/10.1080/01441647.2020.1848141>. Also <https://theconversation.com/covid-has-proved-working-from-home-is-the-best-policy-to-beat-congestion-148926>
- Beck, M. J. and Hensher, D.A. (2021) Australia 6 months After COVID-19 Restrictions Part 1: Changes to Travel Activity and Attitude to Measures **Paper #7a**. *Transport Policy*, online 17 June 2021.
- Beck, M. J. and Hensher, D.A. (2021) Australia 6 months After COVID-19 Restrictions Part 2: The Impact of Working from Home **Paper #7b**. *Transport Policy*, online 17 June 2021.
- Hensher, D.A., Balbontin, C., Beck, M.J. and Wei, E. (2022) The Impact of working from home on modal commuting choice response during COVID-19: Implications for two metropolitan areas in Australia, **Paper #8** For a Special Issue on COVID-19 (edited by Hani Mahmassani and Patricia Mokhtarian), *Transportation Research Part A*, 155, 179-201.
- Beck, M.J., Hensher, D.A., and Nelson, J.D. (2021) Public transport trends in Australia during the COVID-19 pandemic: an investigation of level of concern as a driver for use, **Paper #9**, *Journal of Transport Geography*, online 96, 103167.
- Hensher, D.A., Beck, M.J. and Balbontin, C. (2021) What does the quantum of working from home do to the value of commuting time used in transport appraisal? **Paper #10**, *Transportation Research Part A*, 153, 35-51.
- Balbontin, C., Hensher, D.A., Beck, M.J., Giesen, R., Basnak, P. (2021) Valjejo-Borda, J.A., Venter, C. Impact of COVID-19 on the number of days working from home and commuting travel: A cross-cultural comparison between Australia, South America and South Africa, **Paper #12**, *Journal of Transport Geography*, 96, 103188
- Hensher, D.A., Beck, M.J., Nelson, J.D. and Balbontin, C. (2022) Reducing congestion and crowding with WFH, in Mulley, C. and Attard, M. (editors) *Transport and Pandemic Experiences*, Emerald Press, **Paper #14**.

### Full Drafts not yet published

- Vallejo-Borda, J.A., Lira, B.M., Basnak, P., Reyes-Saldías, J.P., Giesen, R., de Dios Ortúzar, J., Hensher, D.A., and Beck, M.J. Characterising public transport shifting to active and private modes in South American capitals during the Covid-19 pandemic, **Paper #6**. Submitted to a Special Issue on COVID-19 (edited by Hani Mahmassani and Patricia Mokhtarian), *Transportation Research Part A*, January 2020.
- Beck, M. J. and Hensher, D.A. Insights into Work from Home in Australia in 2020: Positives, Negatives and the Potential for Future Benefits to Transport and Society, **Paper # 11** submitted to a Special Issue on COVID-19 (edited by Hani Mahmassani and Patricia Mokhtarian), *Transportation Research Part A*, 12 January 2021, referees reports 25 May 2021, revised 1 June 2021.
- Balbontin, C., Hensher, D.A. and Beck, M. J. Relationship between commuting and non-commuting travel activity under the growing incidence of working from home and people's attitudes towards COVID-19, **Paper #15**, submitted to *Transportation* 6 July 2021

- Jose Agustin Vallejo-Borda, Ricardo Giesen, Beatriz Mella Lira, Paul Basnak, José P. Reyes, Francisco Pasqual, Guillermo Petzhold, Matthew J. Beck, Juan de Dios Ortúzar, David A. Hensher. **Paper #16**, Characterizing public transport shifting to active and private modes in Brazil during the Covid-19 pandemic, 4 May 2021.
- Hensher, D.A., Beck, M. and Balbontin, C. Time allocation of reduced commuting time during COVID-19 under working from home, **Paper #18**, submitted to *Journal of Transport Economics and Policy*, 29 September 2021.
- Hensher, D.A., Wei, E., and Liu, W. Accounting for the spatial incidence of working from home in MetroScan - an integrated transport and land model system, **Paper #19**, submitted to *Transportation Research Part A*, 5 November 2021.
- Balbontin, C., Hensher, D.A. and Beck, M. J. Balbontin, C. Advanced modelling of commuter choice model and work from home during COVID-19 restrictions in Australia **Paper #13**, early version presented at the 2021 *International Choice Modelling Conference* online and Chilean Transport Research Conference, 23 May 2021, submitted to *Transportation Research Part E*, 1 December 2021.
- Beck, M.J., Nelson, J., and Hensher, D.A. Restoring Confidence in Public Transport post Delta COVID-19 Lockdowns: Identifying User Segments and Policies to Restore Confidence, **Paper #20**, submitted to *International Journal of Sustainable Transportation*, November 2021.
- Hensher, D.A. and Beck, M. J. Exploring the link between working from home and how worthwhile the things that you do in life are during COVID-19, **Paper #21**. Submitted to *Transport Policy* 20 January 2022.

### In Progress

- Beck, M.J. and Hensher, D.A. Wave 4 descriptive assessment and comparison with previous waves, **Paper #17**.
- Balbontin, C., Hensher, D.A. and Beck, M. J. Attitudes and perception towards COVID-19 and work from home and its impact on travel behaviour in 2020 versus 2021 in Australia, paper prepared for the *International Choice Modelling Conference*, Iceland 2022. **Paper #22**.
- Beck, M.J., Nelson, J. and Hensher, D.A. COVID-19 and public transport response and challenges, for *COVID-19: Implications for Policy and Planning*, edited by Veronique Van Acker, Patricia L. Mokhtarian, and Sangho Choo; Elsevier book series "Advances in Transport Policy and Planning" **Paper #23** (<https://www.elsevier.com/books/book-series/advances-in-transport-policy-and-planning>).
- Balbontin, C., Hensher, D.A. and Beck, M. J. The influence of WFH in the number of commuting and non-commuting trips during 2020 and 2021 pre- and post-lockdown in Australia, paper prepared for *17<sup>th</sup> International Conference on Competition and Ownership of Land Passenger Transport* (Thredbo 17), Kobe, Japan, September 2021. Conference deferred to 2022. **Paper #24**.
- Hensher, D.A., Beck, M. J., Balbontin, C. Working from home and what it means for the future provision of transport services and infrastructure, paper prepared for *17<sup>th</sup> International Conference on Competition and Ownership of Land Passenger Transport* (Thredbo 17), Kobe, Japan, September 2021. (Abstract submitted November 2020). Conference deferred to 2022. **Paper #25**.
- Beck, M.J., Hensher, D.A. and Balbontin, C. Working from home changes over 10 months during the COVID-19 Pandemic: a contrast between metropolitan and regional locations. **Paper #26**.
- Beck, M.J., Hensher, D.A. and Balbontin, C. Contrasts during COVID-19 over four time points (Waves 1 to 4). **Paper #27**.
- Balbontin, C., Hensher, D.A. and Beck, M. J., Venter, C. and PUC Comparison of Wave 4 Australia and Wave 2 Latin America and South Africa, **Paper #28**.
- Venter, C. and Balbontin C.A. only models, **Paper #29**.

### Podcasts

- <https://roadsaustralia.buzzsprout.com/1010266/4124777-mobility-as-a-service-maas-where-to-next> ASSA: Academy of Social Sciences Australia (ASSA)
- <https://seriouslysocial.org.au/podcasts/how-avoiding-the-commute-is-making-us-happier-2/>
- <https://soundcloud.com/sydneybusinessinsights/corona-business-insights-urban-mobility>
- <https://www.sydney.edu.au/content/dam/corporate/podcasts/business-school/the-early-days-of-the-pandemic.mp3>

### Webinars

- Australian Institute of Transport Planning and Management (AITPM) PRESENTATIONS 8 October 2020: <https://www.youtube.com/watch?v=qDNDox3oPhU>
- Q&A 15 October 2020: <https://youtu.be/aUr3Y5E0x4w>
- ACSPRI 2020 Conference on Social Science Methodology: the Australian Consortium for Social and Political Research, Inc. 3 December 2020
- Engineers Australia, *Transport Australia Society 3 February 2021*: <https://www.engineersaustralia.org.au/event/2021/01/integrating-multi-modal-end-end-journey-transportation-and-their-interaction-34826>
- TNSW's TDM Session #3: iMOVE/ ITLS speakers Wed 7/07/2021 12:00 PM - 1:45 PM. TDM talk for the AITPM group. This is the third talk in our four part TDM series. <https://youtu.be/rBcl3IXewOU>
- Third online free Bridging Transport Researcher (BTR) conference (5<sup>th</sup> & 6<sup>th</sup> August).
- AUSTRALIAN INSTITUTE OF TRAFFIC PLANNING AND MANAGEMENT LTD**
- Meeting agenda of 2021 transport modelling knowledge sharing workshop
- Meeting location: Online via MS Teams, 17 August 2021
- AITPM National Conference Plenary session (David Hensher) speakers at the AITPM National Conference 1 on a "Impact of COVID on mobility, place-making, shared mobility models or other interesting and innovative solutions to the 'new normal'". Online 6 September 2021.
- ITANZ webinar 9 March 2022

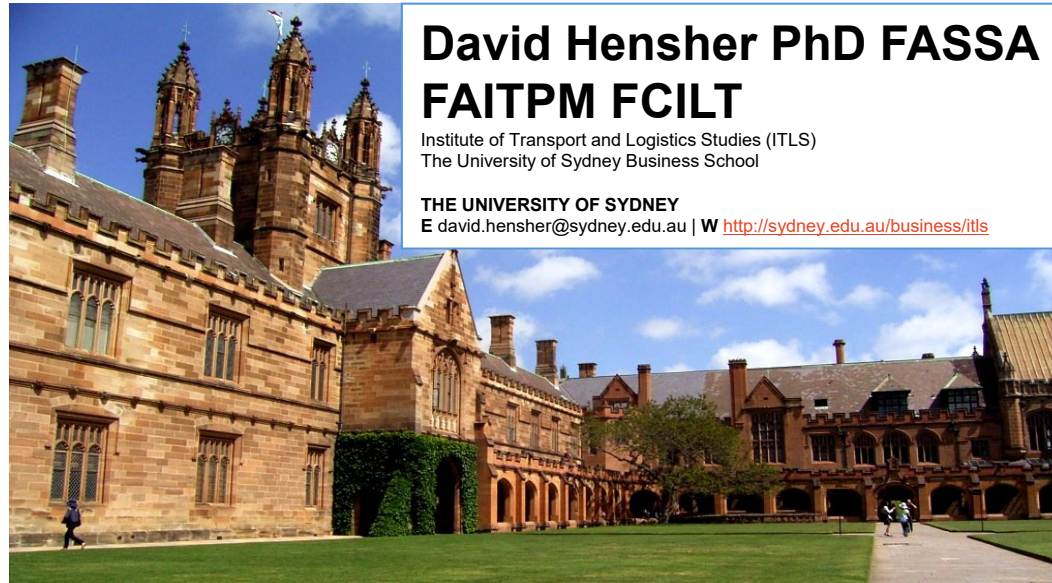
### Other Material

- <https://www.sydney.edu.au/business/news-and-events/news/2020/12/07/what-might-the-changing-incidence-of-working-from-home--wfh--tel.html>
- <https://imoveaustralia.com/project/working-from-home-revising-metro-strategic-transport-models/>

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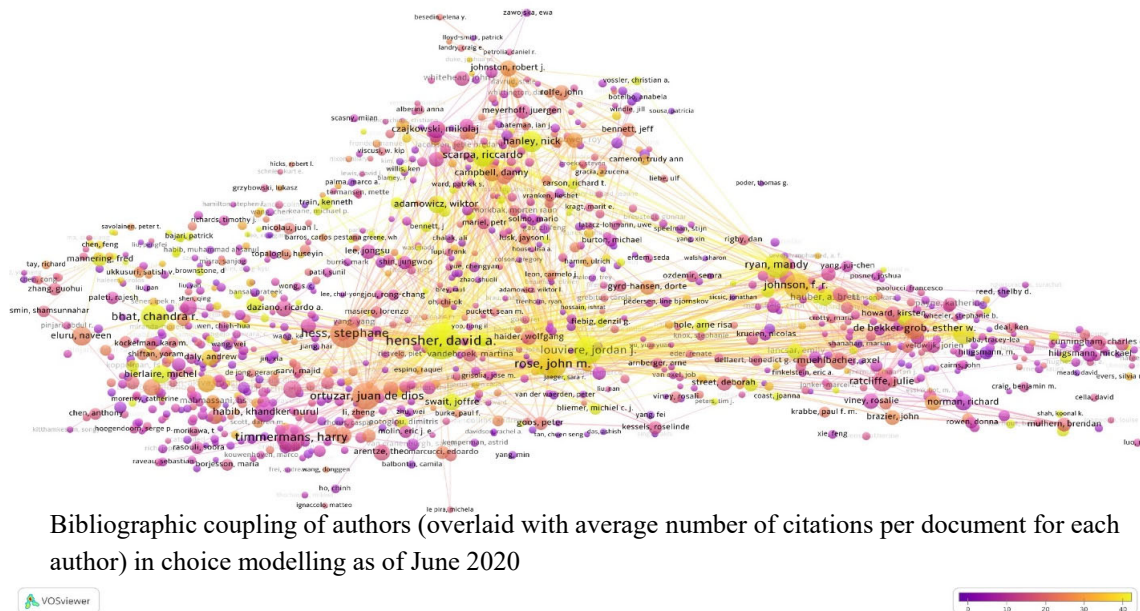


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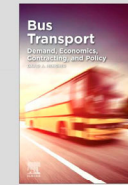
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Bibliographic coupling of authors (overlaid with average number of citations per document for each author) in choice modelling as of June 2020



### Bus Transport

Demand, Economics, Contracting, and Policy

David A. Hensher, Institute of Transport and Logistics Studies, The University of Sydney Business School, Australia

ISBN: 978-0-12-820132-0  
VOLUME:  
EDITION: 1  
PUB DATE:  
LIST PRICE: RRP AUD 195, RRP NZD 255  
FORMAT: Paperback  
TRIM: 8.5w x 10.875h  
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### Understanding Mobility as a Service (MaaS)

Past, Present and Future

David A. Hensher, Institute of Transport and Logistics Studies, The University of Sydney Business School, Australia; Carsten W. Meyer, Institute of Transport and Logistics Studies, The University of Sydney Business School, Australia; John D. Nelson, Institute of Transport and Logistics Studies, The University of Sydney Business School, Australia; Chris H. Ho, Institute of Transport and Logistics Studies, The University of Sydney Business School, Australia; Golan Benel, Institute of Transport and Logistics Studies, The University of Sydney Business School, Australia; and Chaima University, Sweden, and Yale Wang, Institute of Transport and Logistics Studies, The University of Sydney Business School, Australia

ISBN: 978-0-12-820044-5  
EDITION: 1  
PUB DATE: July 2020  
LIST PRICE: RRP AUD 195, RRP NZD 255  
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The widespread adoption of smartphones, ride-sharing and car-sharing have disrupted the transport sector. In cities around the world, new mobility services are both welcomed and challenged by regulators and incumbent operators. Mobility as a Service (MaaS) is an ecosystem designed to deliver collaborative and connected mobility services in a society increasingly embracing a sharing culture. It is at the center of this disruption.

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Written by the leading thinkers in the field for researchers, practitioners, and policy makers, *Understanding Mobility as a Service (MaaS): Past, Present and Future* serves as a single source on all the current and evolving developments, debates, and challenges.

The authors dedicate this book as a contribution to the Volvo Research and Educational Foundations (VREF) Bus Rapid Transit (BRT+) Centre of Excellence (<http://www.brtcd.com>) and the iMOVE Cooperative Research Centre (CRC) (<http://www.imoveaustralia.com>).



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