

MABM Scenario Definition - Working from home and Employment

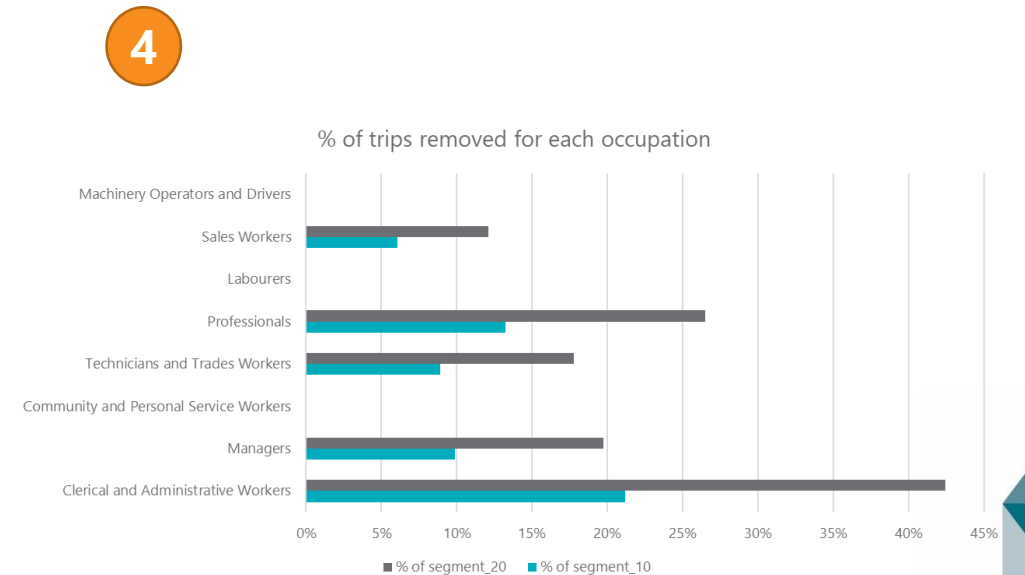
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1. Google data is used to ascertain overall reduction in work related travel (see right). No structural change assumed so all changes are assumed to be due to WFH rather than employment level changes.
2. DELWP¹ occupations that are not identified as WFH are removed from analysis.
3. Industry splits are derived from DJPR data by occupation based on the level of change in WFH suggested from pre to post-COVID19 and also adjusted to account for relative segment size in MABM. The combined weight as a % is used to determine the proportion of trips removed from each segment.
4. These proportions are then applied to the total trips in scope for removal and shown as percentages of each occupation segment as a sense check.

1	Core Scenario	Scenario
Working from home trip adjustment	Commuter travel reduced to 90% (10% reduction) of usual levels, industry assumptions as below	Commuter travel reduced to 80% (20% reduction) of usual levels, industry assumptions as below

Occupation	DELWP WFH occupation	Survey based weight	MABM segment size weight	Combined weight	Combined weight as %
Clerical and Administrative Workers	1	1.00	1.0	1.00	24%
Managers	1	0.46	1.2	0.55	13%
Community and Personal Service Workers	0	0.58	-	-	0%
Technicians and Trades Workers	1	0.42	0.9	0.38	9%
Professionals	1	0.63	3.1	1.95	48%
Labourers	0	0.31	-	-	0%
Sales Workers	1	0.29	0.7	0.20	5%
Machinery Operators and Drivers	0	0.23	-	-	0%



¹ DELWP applied Dingel and Neiman (2020) WFH occupation research to understand which occupations could work from home, the outcomes are adopted here

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FUEL PRICE

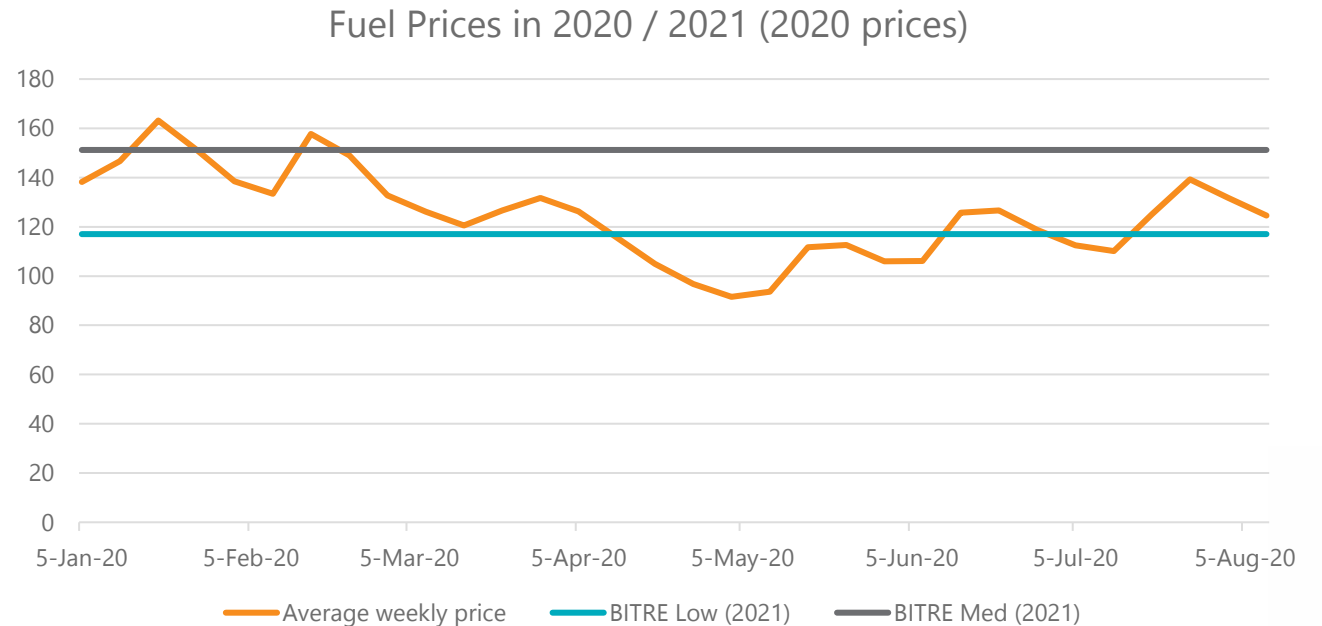
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MABM Scenario Definition – Fuel Price



- Our current assumption is that fuel prices may recover to pre-COVID levels within 6 months or be around 5 – 10 per cent lower.
- While COVID-19 has coincided with a significant drop in travel demand, this has not pushed fuel prices far outside previous forecasts.
- There are a number of concurrent events – including a fuel price war between Russia and Saudi Arabia in early March - which have had a major impact on fuel prices.
- Whilst a reduction could be applied, it is not clear that one is required.

	Core Scenario	Dialled-Up Scenario
Fuel Price	No Change	No Change

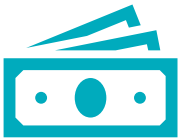


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AGENT INCOME

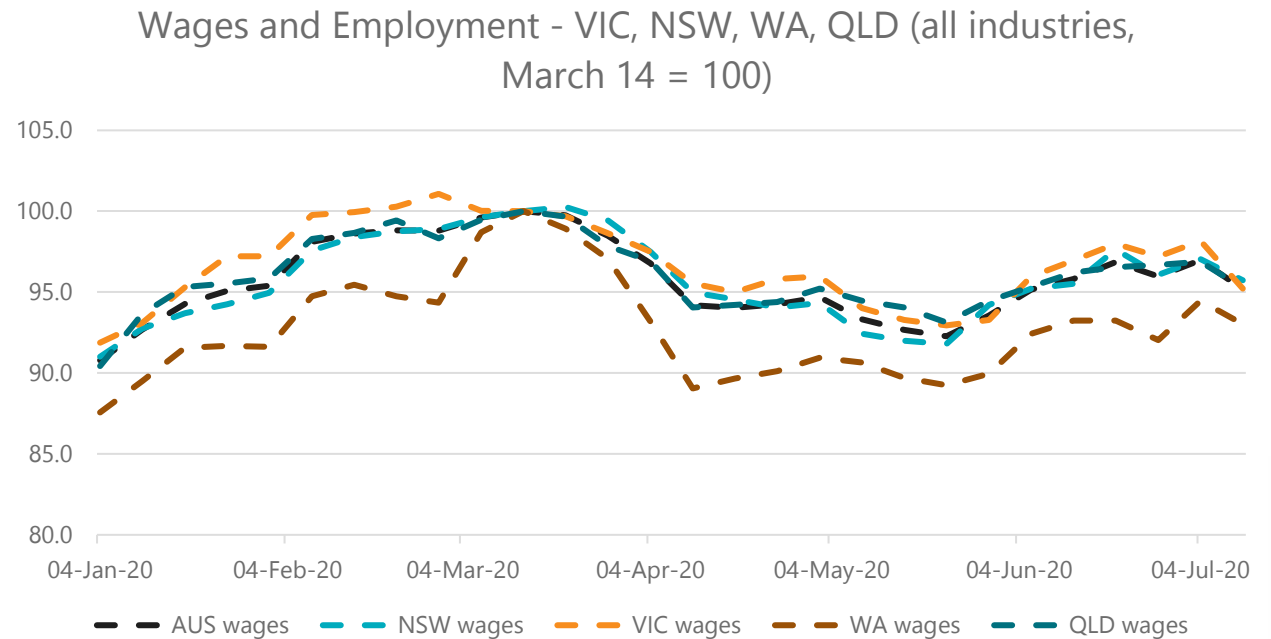
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MABM Scenario Definition – Agent Income



- Changes to income due to COVID-19 appear to be less than 10 per cent with the exception of WA.
- Mining income in WA has experienced large declines which were occurring prior to COVID-19. The reason for this is unclear.
- Data by industry shows large fluctuations. It is therefore not considered that strong enough evidence can be found to support a change in the income within the MABM.

	Core Scenario	Dialled-Up Scenario
Agent Income	No Change	No Change



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AIRPORT TRAVEL AND INTERNATIONAL STUDENTS

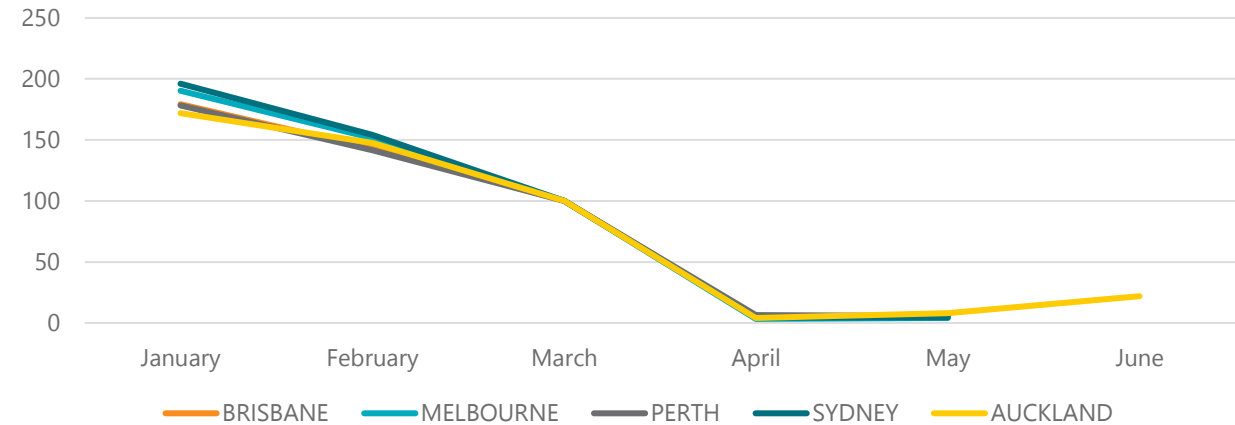
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Airport and visitor travel has been severely impacted by COVID-19

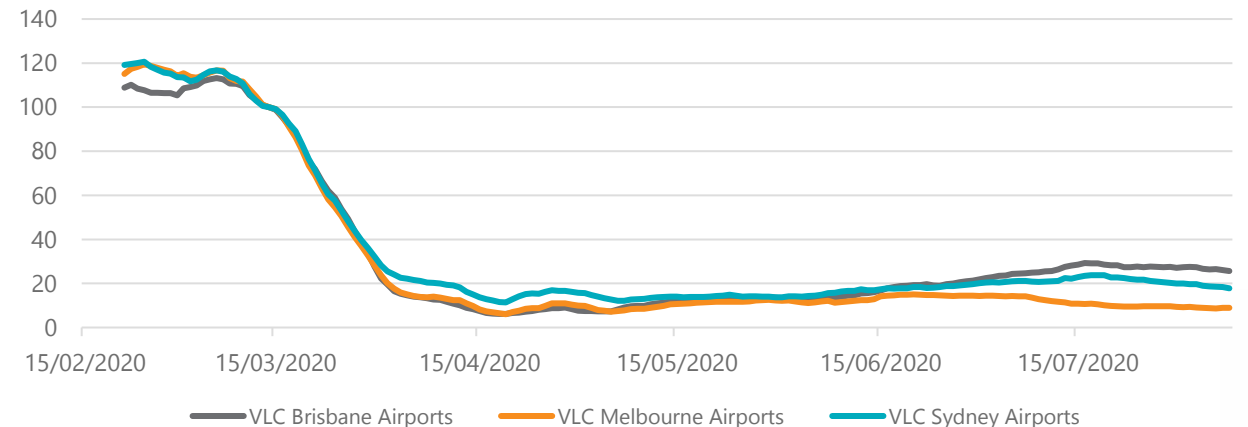


- As at May 2020, monthly total airport passengers was at less than 10 per cent for all major Australian cities (BITRE, 2020).
- Auckland experienced some recovery in June – driven almost entirely by domestic passengers.
- VLC LBS data shows since the week of March 14, travel to the airport declined by more than 80 per cent.
- In Brisbane, even with a significant drop in COVID-19 cases and relaxation of restrictions, the number of people travelling to the airport only sits at around 30 per cent of pre-COVID-19 levels.

Total Airport Passengers (BITRE) 2020 (March = 100)



VLC Airport data (March 14 = 100, 7-day Moving Average)



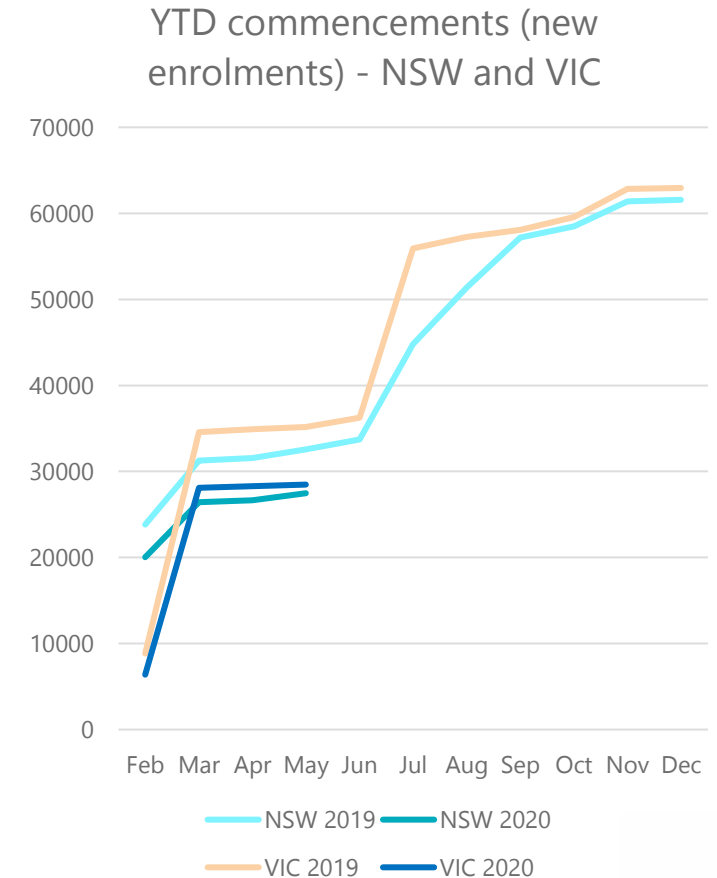


International Students

- International student visa approvals have declined by around 20% nationally (from financial year 18/19 to 19/20) while new enrolments (commencements) have declined by 16% (NSW) and 19% (VIC) relative to 2019 levels.
- International student numbers are likely to be more significantly impacted by in the second half of the year due to the ongoing pandemic.
- The Mitchell Institute reports that in April 2020 only 30 international students arrived or returned to Australia – compared to 46,480 in April 2019.
- In 2018, there were (Department of Education) 480k international students (30% of the total)
- A reasonable assumption would be that international student numbers would drop by at least 20%, although highly uncertain.

SA4s most affected by reduced international students

Area (SA4)	May 2020 reduction in international student population ⁸
Melbourne - Inner	- 13,650
Melbourne - South East	- 9,841
Sydney - City and Inner South	- 7,110
Sydney - Eastern Suburbs	- 5,695
Adelaide - Central and Hills	- 4,823
Sydney - Inner West	- 4,780
Sydney - Ryde	- 4,495
Sydney - Inner South West	- 4,335
Melbourne - Inner East	- 3,610
Brisbane - West	- 3,488
Perth - South East	- 3,425
Brisbane Inner City	- 3,401
Sydney - North Sydney and Hornsby	- 3,400
Melbourne - Inner South	- 3,190
Perth - Inner	- 3,138



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MABM Scenario Definition – Airport travel and international students



- According to airport passenger data, Melbourne airport usually has an approximate domestic to international travel split 70:30 (BITRE, 2020).
 - Core Scenario: 20% higher than Brisbane/ Auckland levels, equating to 50% of usual levels.
 - Dialled-Up Scenario: Based on July/ August Brisbane and Auckland levels.
- For international students, a reduction of 20% is assumed as a best case. In the absence of further information, a 60% reduction is assumed in the Dialled-Up case.
- All other trips associated with those agents identified as international students will also be removed.

	Core Scenario	Dialled-Up Scenario
Airport travel	50% of usual levels	30% of usual levels
International students	20% reduction	60% reduction

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COMMERCIAL VEHICLES

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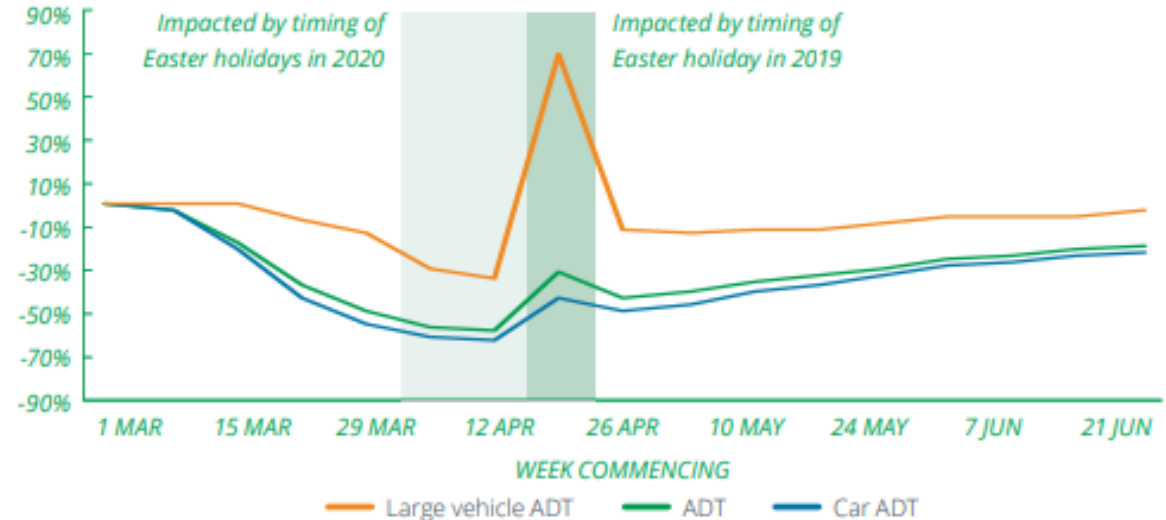
MABM Scenario Definition – Goods Vehicles



- There is little publicly available information on the impact of COVID-19 on commercial vehicle traffic.
- The general sentiment appears to be that an increased reliance on delivery of is likely to have resulted in an increase in commercial vehicle traffic.
- Transurban's recent Industry Report, *Urban Mobility Trends from COVID-19*, states that purchases made online in Australia increased by 41 per cent in April and continued to be elevated after the first lockdown ended with a 73 per cent increase in Sydney and 65 per cent increase in Brisbane relative to the same time in 2019.
- Transurban's traffic data (shown left) indicates that large vehicle traffic spiked heavily during April 2020 and has remained steady out till June.
- Further data to support any adjustment to this has not been found.
- No change is therefore recommended

	Core Scenario	Dialled-Up Scenario
Goods vehicle traffic	No change	No change

FIGURE 18. WEEKLY TRAFFIC PERFORMANCE BY VEHICLE CLASS



Source: Transurban: Urban Mobility Trends from COVID-19

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SUMMARY OF MABM SCENARIO DEFINITIONS

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COVID Scenario Assumptions Summary

		Core Scenario	Dialled-Up Scenario
Change in mode share	Car	~ 10 % increase	~ 15 % increase
	Public Transport	~ 30 % decrease	~ 50 % decrease
	Active	No change	No change
Working from home trip adjustment		Commuter travel reduced to 90% of usual levels	Commuter travel reduced to 80% of usual levels
Fuel Price		No Change	No Change
Agent Income		No Change	No Change
Airport travel		50% of usual levels	30% of usual levels
International students		20% reduction	60% reduction
Commercial vehicle traffic		No change	No change

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COVID Scenario Uncertainties

- **Consistency and quality of datasets**
 - VISTA – Sample size and sample weighting
 - Apple Maps – Limited validation, may be unreliable for active modes and regular short trips
 - Google Mobility data – validation of place based metrics difficult and unknown
- **Uncertainty of the future situation**
 - Vaccine development
 - New technology
 - Rapid easing of borders
 - Step backwards with new virus outbreaks
- **Assumptions**
 - Seasonality factors calculated from limited data
 - Very little good data on
 - WFH industry split

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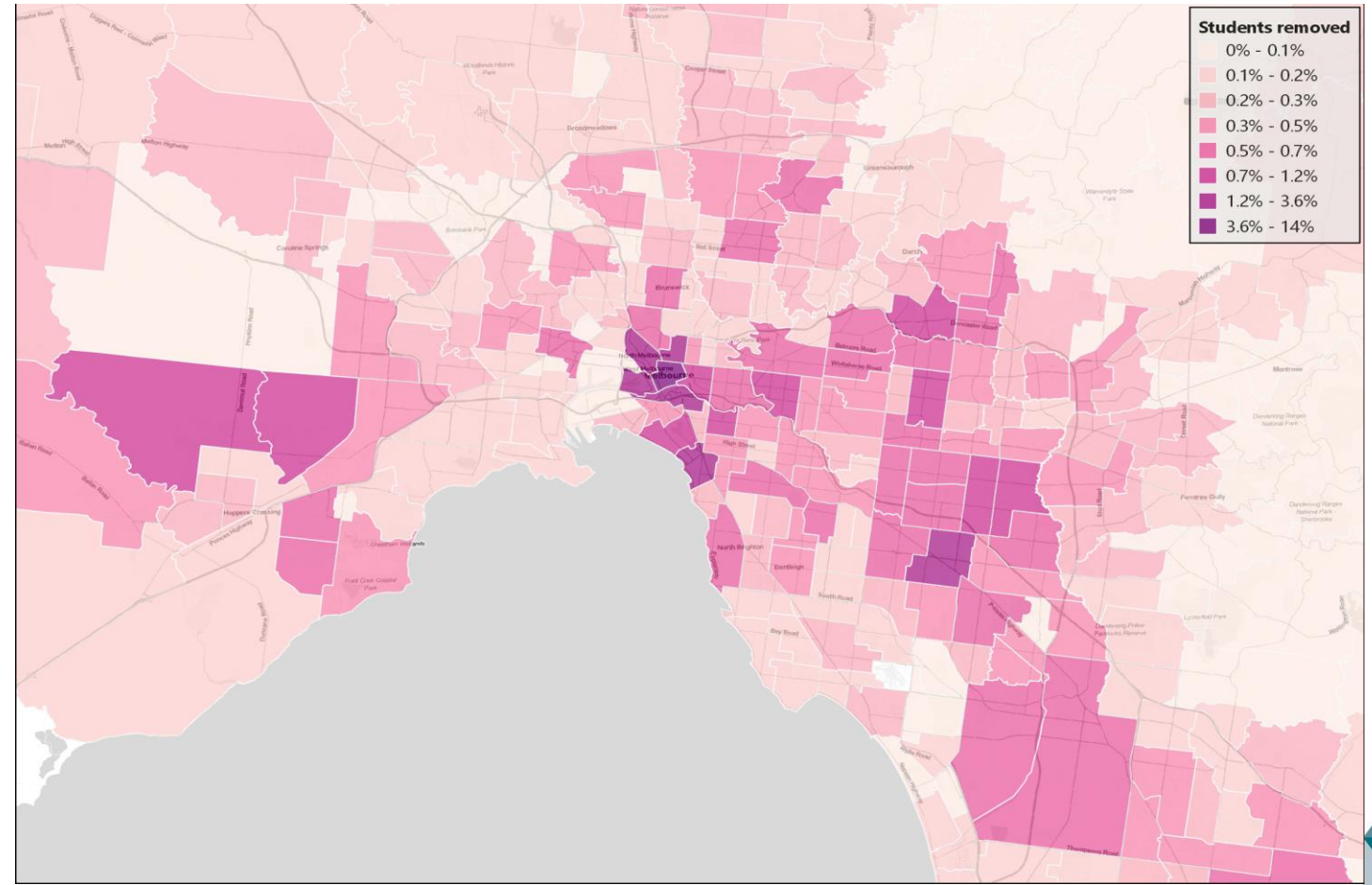
WFH adjustment application

- 10% and 20% scenario of agents set as WFH based on Slide 48
- All agents who are set to WFH will have
 - Business trips that are part of the commute tour removed
 - Work trips replaced by WFH and the mode set to walk_wfh effectively removing their trips from the network. Activity set to work_home, with activity scoring parameters copied from work. This ensures that the work activity is still present in MABM except with travel removed.
 - 'Other' trips that were part of the commute tour:
 - Initial mode changed to whatever mode of previous first leg was, i.e. previous mode outward from home
 - Activity locations re-distributed according to MABM process for assigning those destinations except with trip length drawn from observed 'other' trip length distribution of VISTA work-from-home agents.

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Student Adjustment (distribution)

- 19,831 tertiary students in total
- 5,949 overseas students (30%)
- 1,180 (20%) students removed in 'Core' scenario
- 3,565 (60%) removed in 'Dialled-Up' scenario



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Student and airport trip adjustment application

Student trip adjustment

- 10% and 20% scenario assumptions applied as per slide 48
- 30% of tertiary students across Melbourne assumed to be international (and removed) with the distribution of international students to be removed assumed based on census data by SA2.
- All trips (including non-education trips) removed for international students which have been removed.

Airport trip adjustment

- 10% and 20% scenario assumptions applied as per slide 48
- Airport trips removed uniformly across Melbourne

Car and public transport attractiveness

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- The target changes in attractiveness cannot be achieved perfectly due to a number of reasons
 - The changes in attractiveness (mode share) are based on Auckland mode shares where car mode share is lower. This means that whilst a 30% decrease in PT mode share is equal to a 10% increase in car mode share, this is not the case for Melbourne
 - MABM over estimates car mode share, this means that a 30% decrease in public transport mode share makes up less car mode share again.
 - The mode share impacts include the effect of reduced active mode share, since active trip mode share is not adjusted in our runs, the actual decrease in both modes should be slightly less.
- Targets (approximate) accounting for this are shown below*:

CORE	Pre-COVID			Post-COVID***			%change			Post-COVID Adjusted (total =100%)			Post-COVID % change (Target)		
	Car	Transit	Active	Drive (+10%)	Transit (-30%)	Active (0%**)	Car	Transit	Active	Car	Transit	Active	Car	Transit	Active
Melbourne (VISTA)	72%	10%	18%	79%	7%	19%	10%	-30%	5%	75%	6%	18%	5%	-33%	0%
Auckland	63%	9%	28%	69%	6%	25%				69%	6%	25%			
MABM	76%	8%	16%	83%	6%	17%	10%	-30%	6%	79%	6%	16%	4%	-34%	0%

Dialled-Up	Pre-COVID			Post-COVID			%change			Post-COVID Adjusted (ensuring total = 100%)			Post-COVID % change (Target)		
	Car	Transit	Active	Drive (+15%)	Transit (-50%)	Active (0%)	Car	Transit	Active	Drive	Transit	Active	Car	Transit	Active
Melbourne (VISTA)	72%	10%	18%	83%	5%	20%	15%	-50%	7%	77%	5%	18%	7%	-53%	0%
MABM	76%	8%	16%	87%	4%	17%	15%	-50%	9%	80%	4%	16%	6%	-54%	0%

*note that this analysis ignores approx. 1% of trips in MABM composed of other modes.

** this is the change required to keep the final target (last column) mode share change at 0% for Melbourne and MABM)

***the total is not controlled to 100% in this column

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CORE SCENARIO INPUT CHECKS

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Scenario input changes – Core

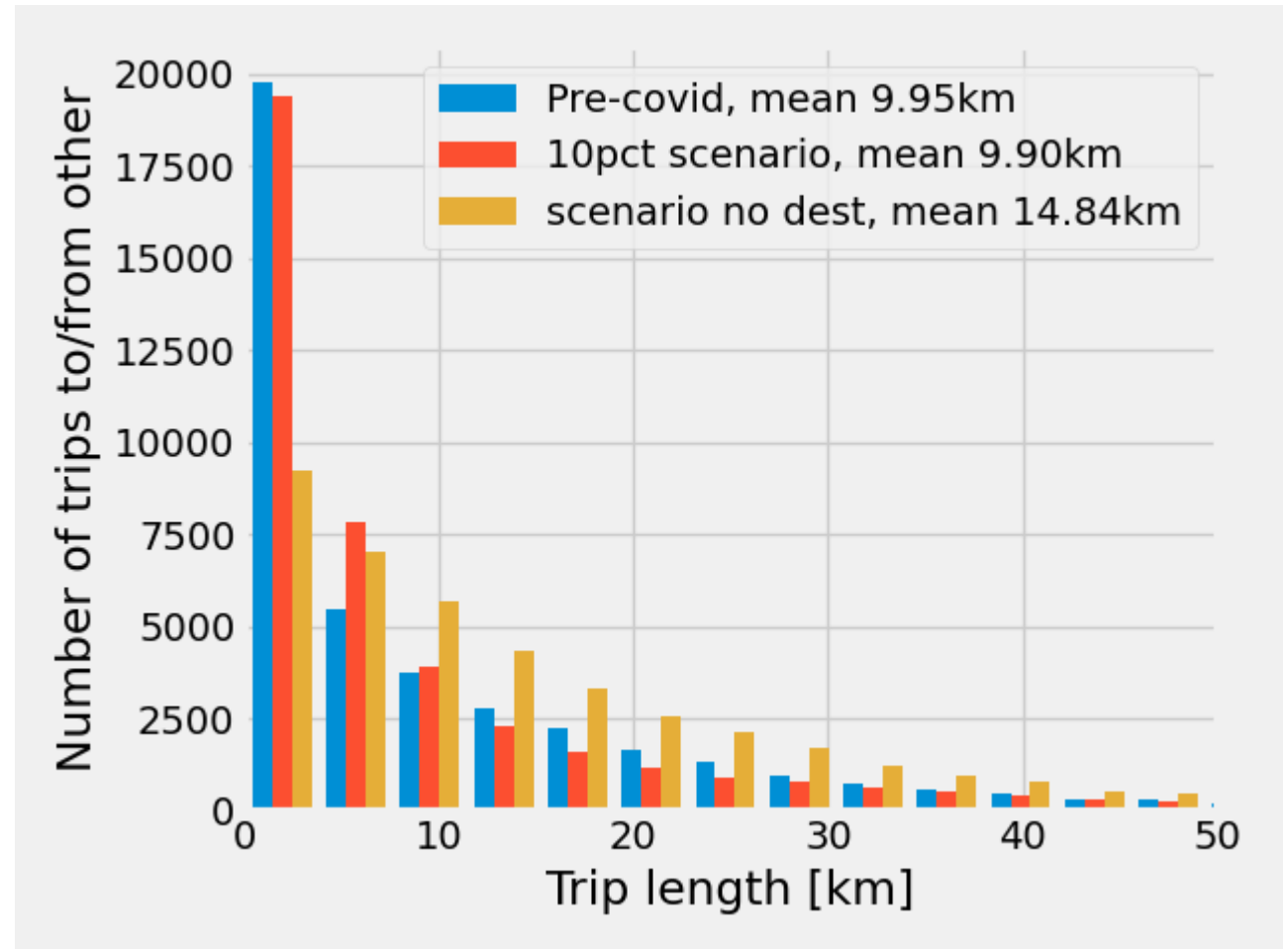
Area of adjustment	MABM 2018 trips	COVID Scenario trips	Difference	%difference	% of Total MABM 2018 trips
All trips	14,493,836	14,110,052	-383,784	-2.65%	-2.65%
Airport	76,432	38,216	-38,216	-50%	-0.25%
International students	72,420	58,092	-14,328	-20%	-0.10%
Work trips	2,233,308	2,010,204	-223,104	-9.99%	-1.54%
Business trips	398,212	380,024	-18,188	-4.57%	-0.13%
Other trips	4,419,140	4,416,652	-2,488	-0.06%	-0.02%

Note – ‘Other’ trips removed for international students

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Trip length distribution of altered other activities

- Very similar distribution for pre-covid (blue) and scenario (red), mean nearly identical
- Compare this with trip length distribution of hypothetical scenario where destinations of other activities were not changed (yellow): Longer mean trip length and distribution quite different.
- Shows that the trip length has been shortened through this adjustment.



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100 iterations run – mode share adjustment

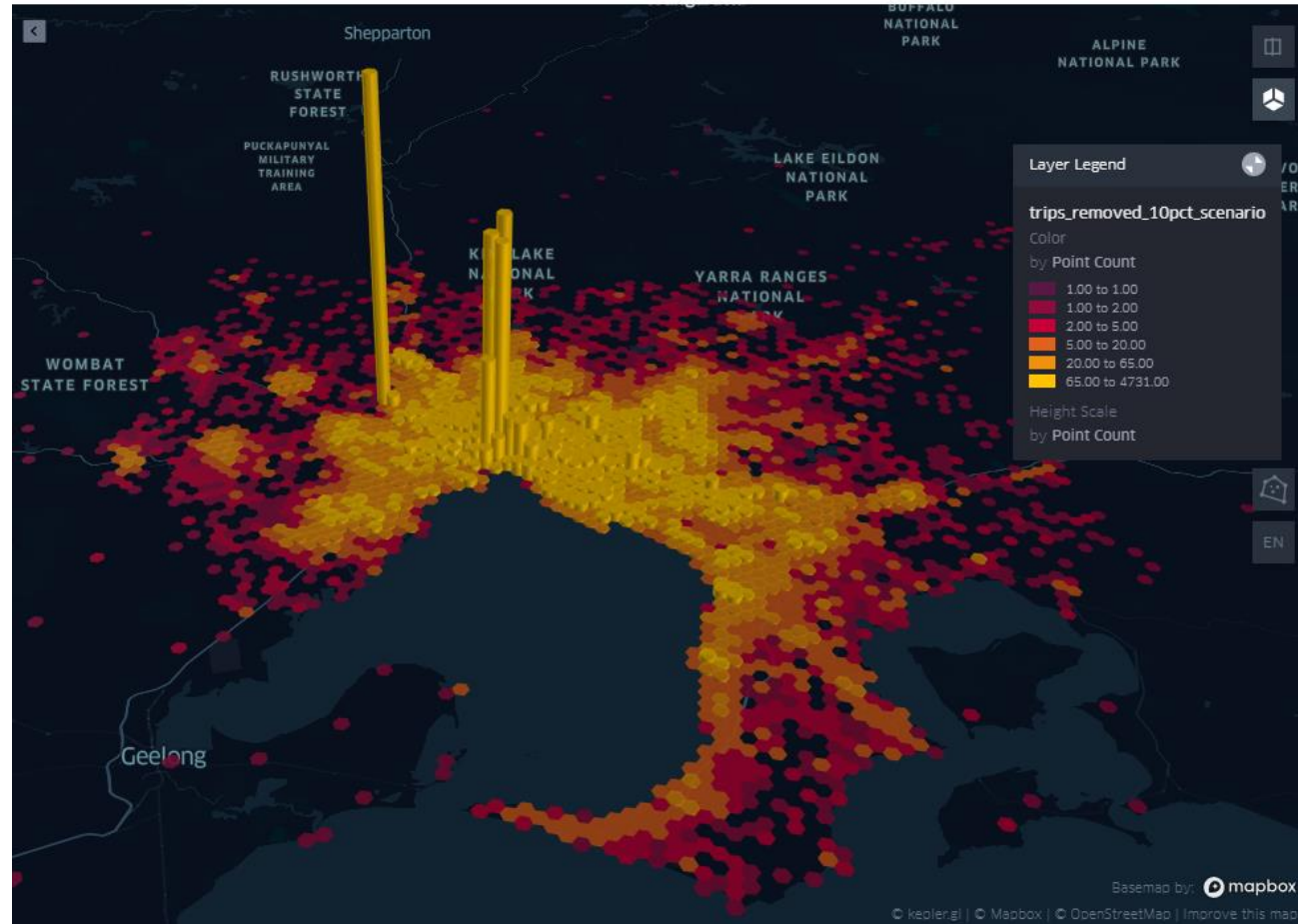
- Initial run for 100 iterations, 80 with innovations, we checked PT mode share following adjustment to ASC change.
- % Difference in mode share compared to 2018 MABM base scenario:

% change in mode share	PT ASC = -1.03 utils (reduced by 1.53)	PT ASC = -4.11 utils (reduced by 4.61)
Car	2.97%	5.06%
PT	-26.24%	-42.20%

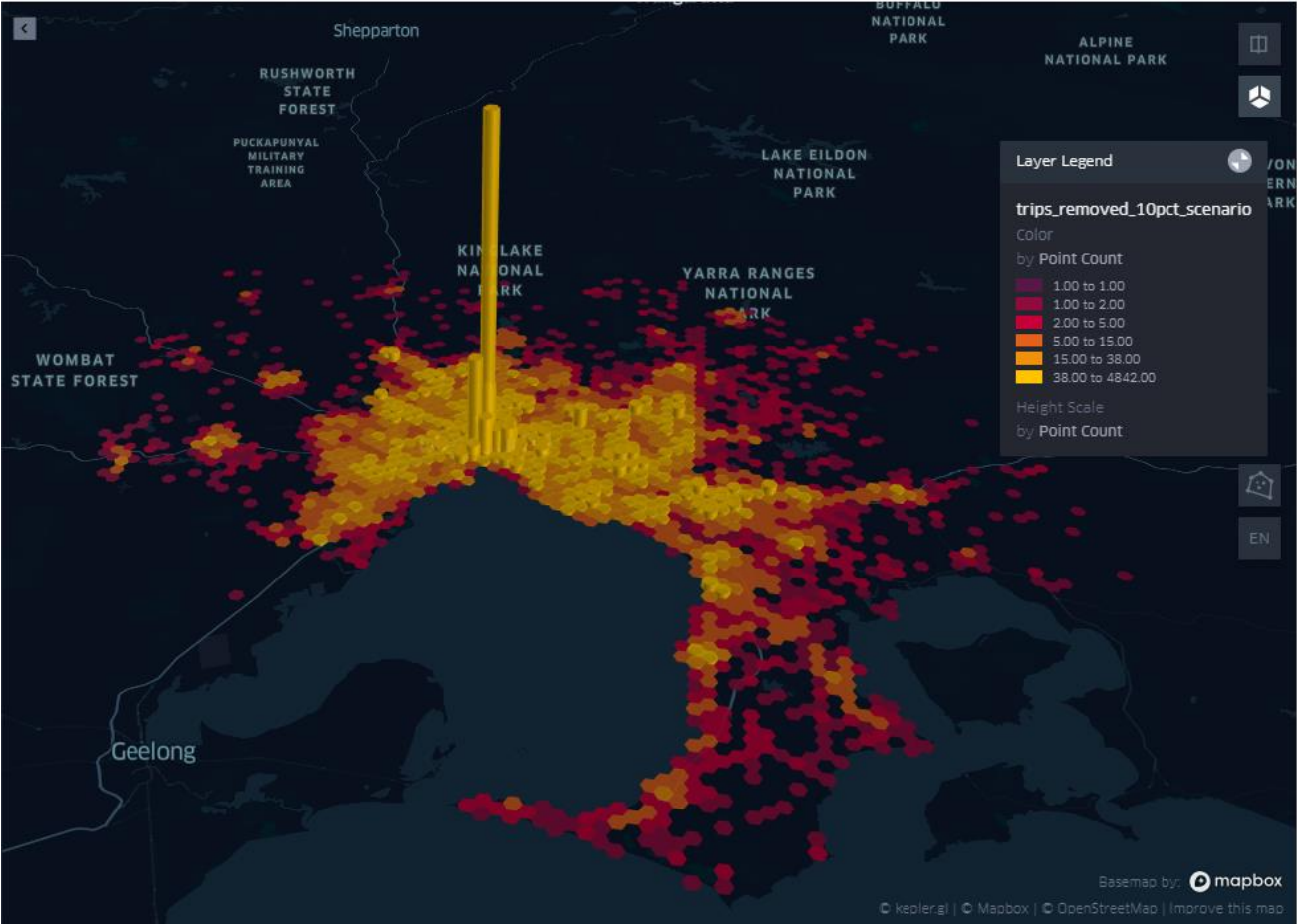
- Dollar equivalent of alternative-specific constant (ASC) change for person with mean income:
 - 1.53 utils correspond to about 10\$ for 185\$ of (working) day household income
 - 4.61 utils correspond to about 30\$ for 185\$ of (working) day household income
- Based on these results, we estimate that an adjustment by -1.89 utils (to -1.39 from 0.5) to in order to achieve a mode share decrease of 30%. This adjustment is equivalent to about \$12 at average income levels. This value will be used for the 'Core' run.

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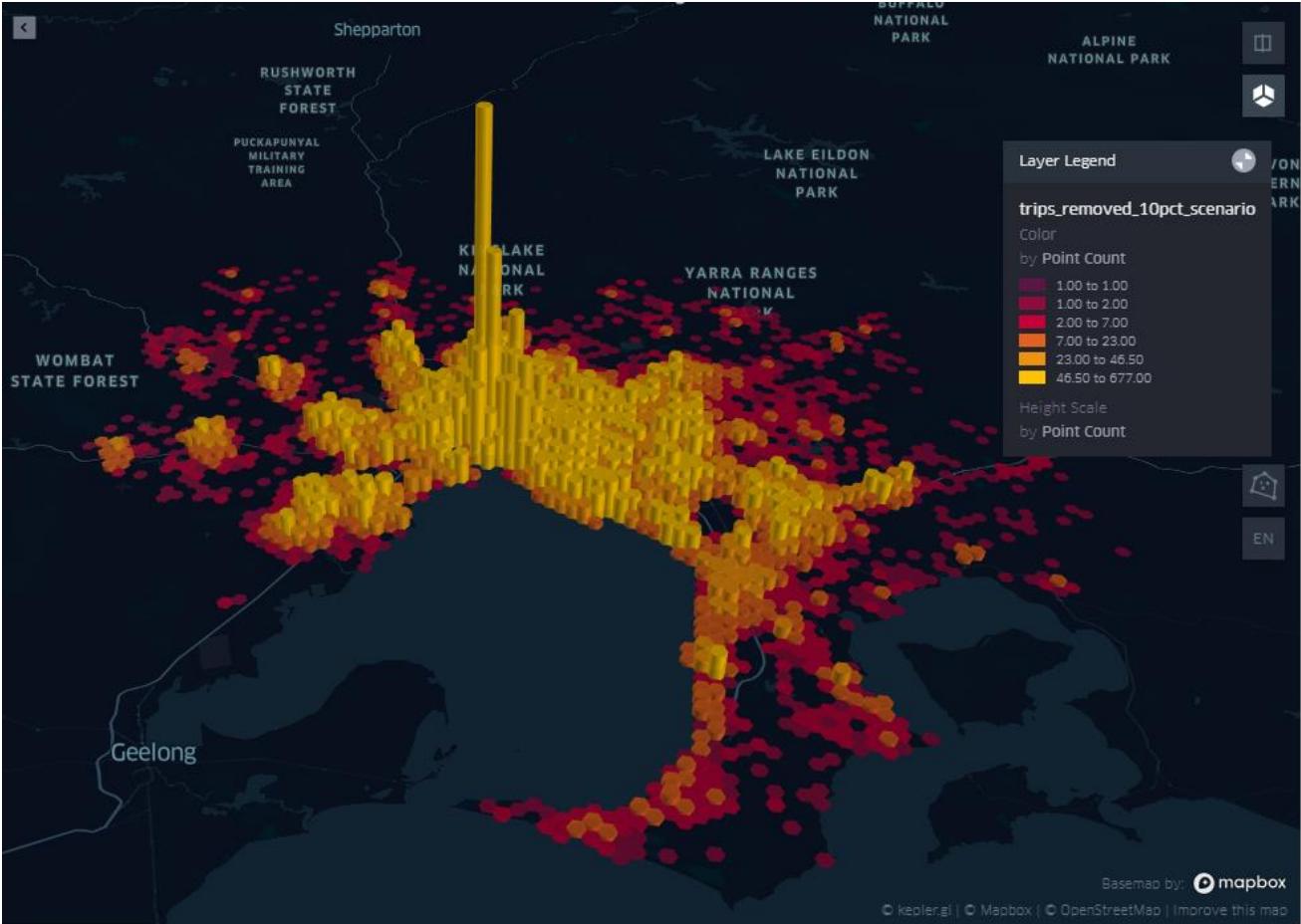
Removed trips by destination



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Removed trips with destination activity work

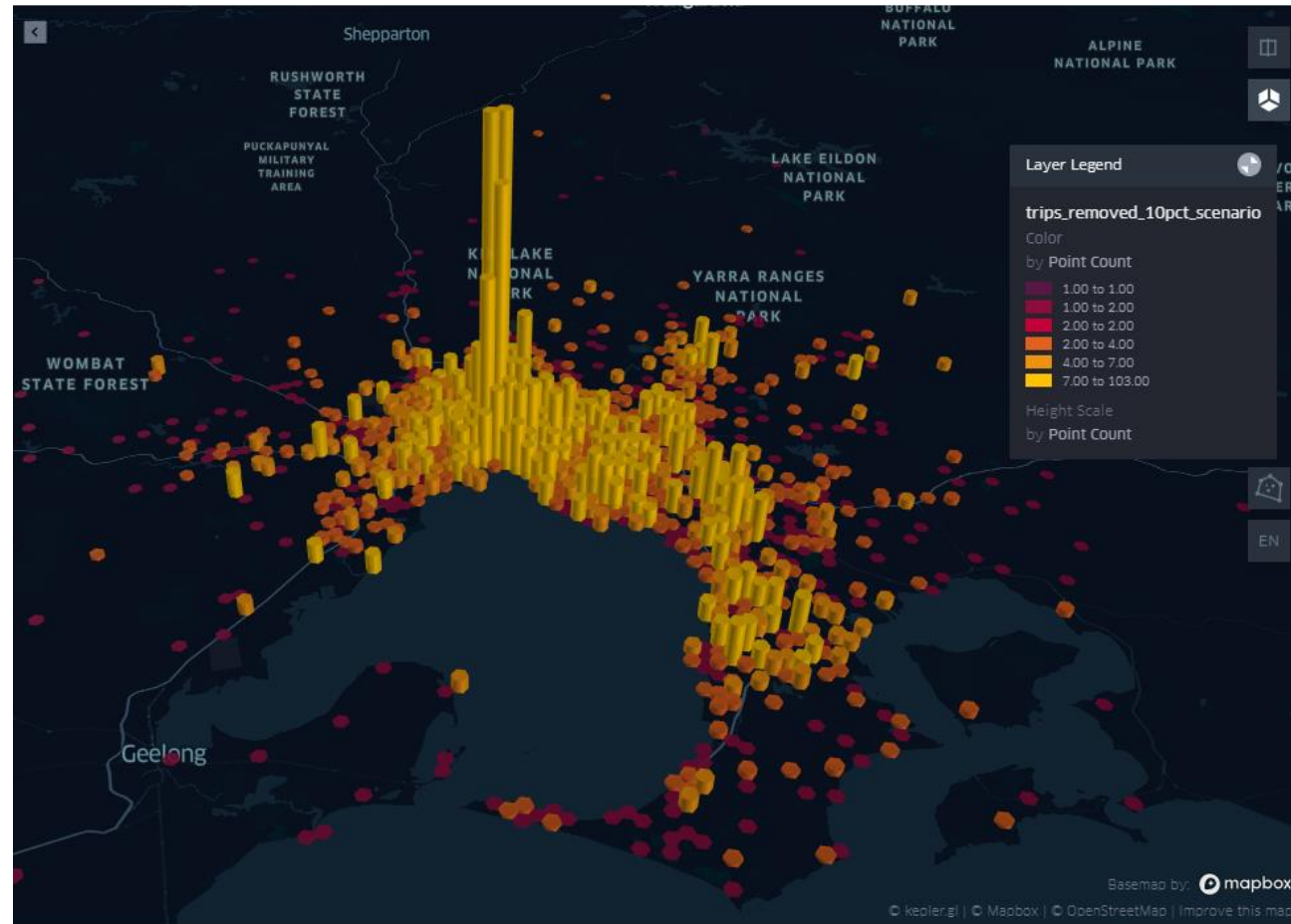


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Removed trips with origin activity home



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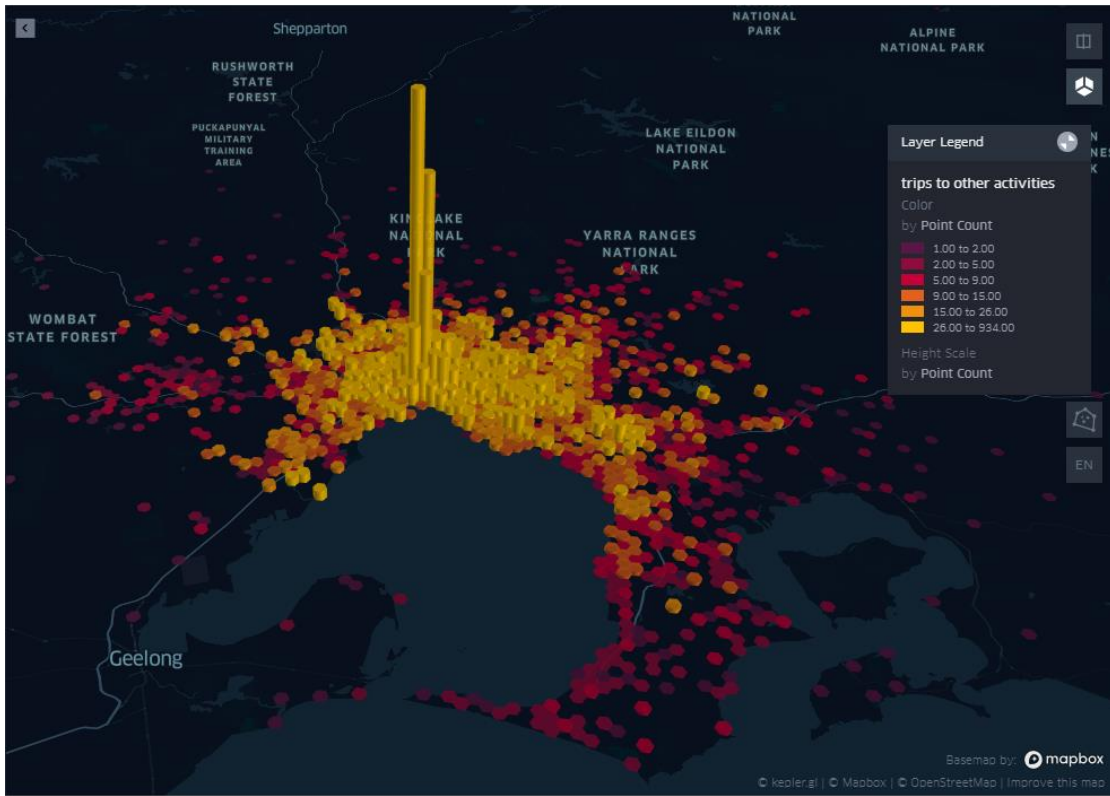
Removed trips with destination activity business



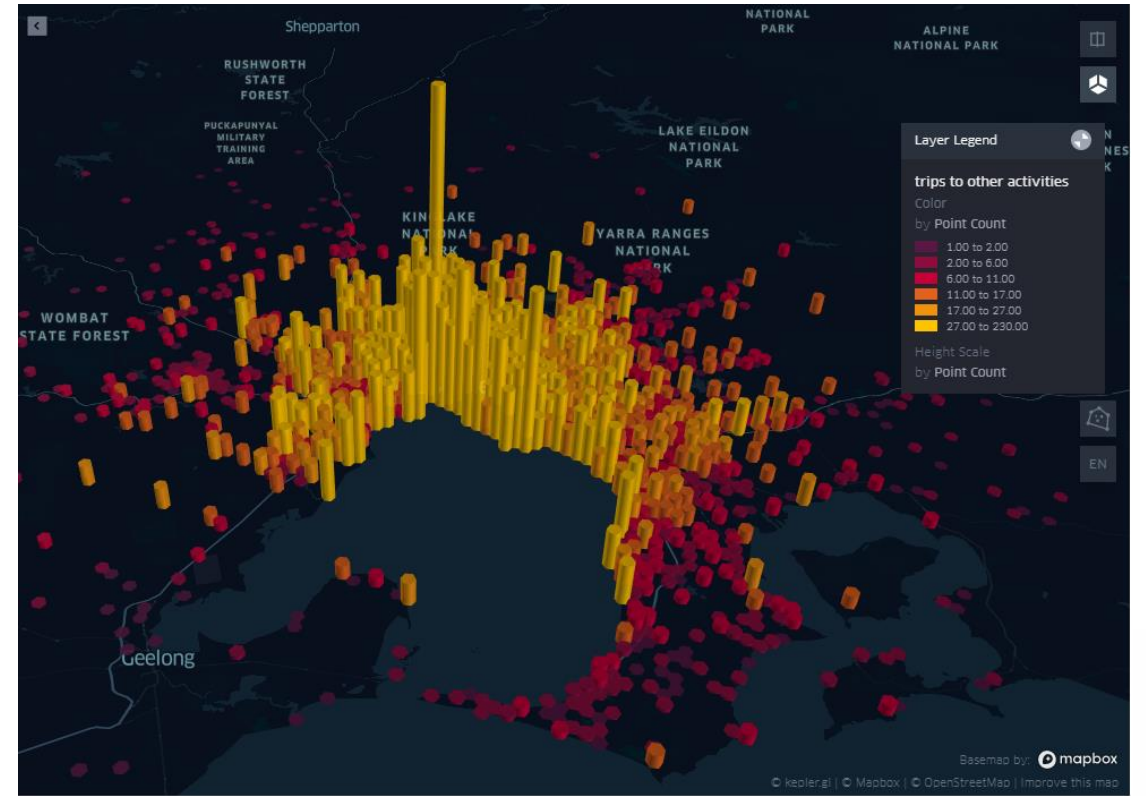
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Previous trips to other activities

Pre-COVID



'Core' scenario



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DIALLED-UP SCENARIO INPUT CHECKS

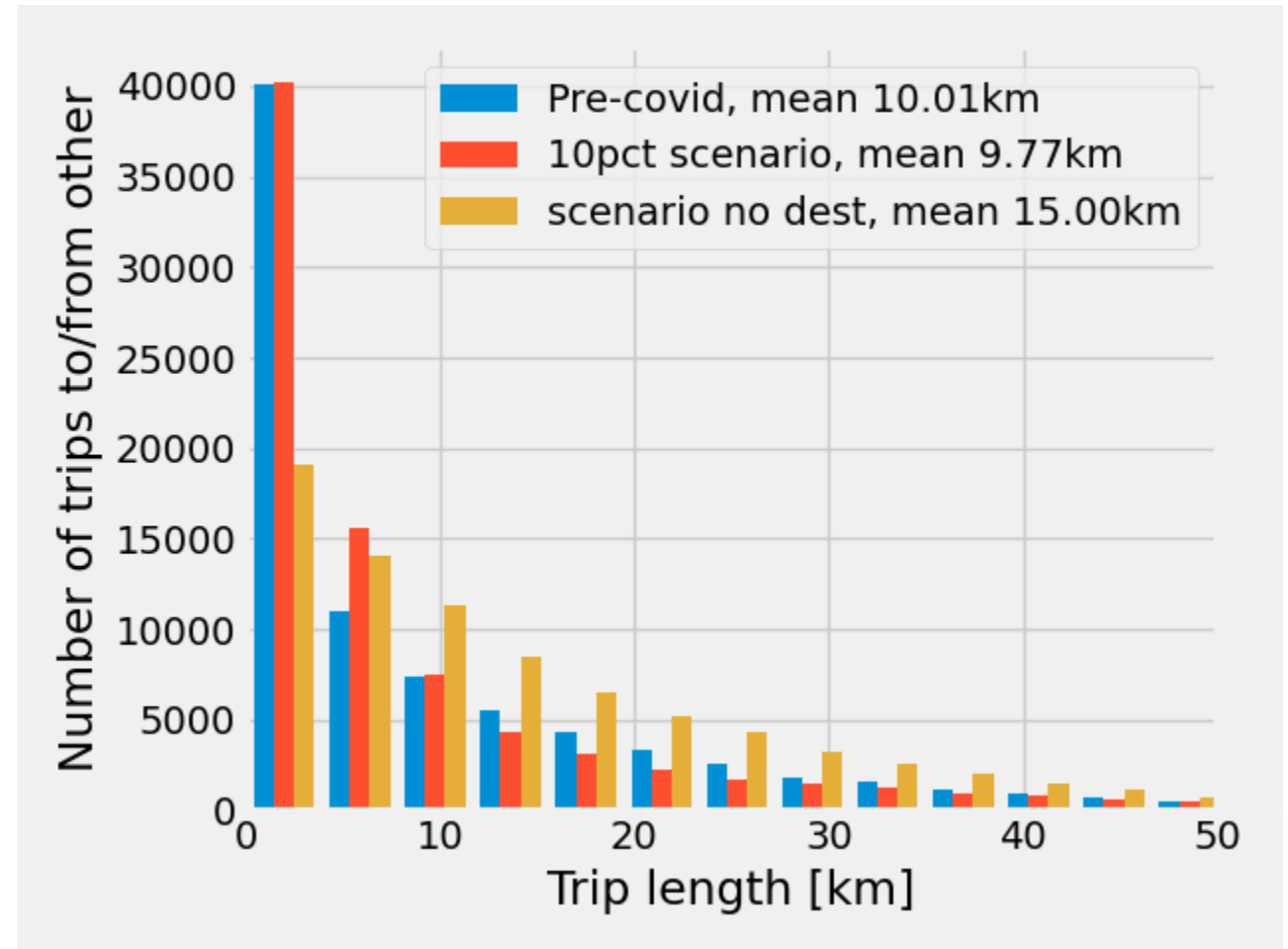
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Scenario input changes – Dialed-Up

Area of adjustment	MABM 2018 trips	COVID Scenario trips	Difference	%difference	% of Total MABM 2018 trips
All Trips	14,493,836	13,731,544	-762,292	-5.26%	-5.26%
Airport	76,432	22,928	-53,504	-70%	-0.37%
International Students	72,420	28,612	-43,808	-60%	-0.30%
Work trips	2,233,308	1,785,356	-447,952	-20.06%	-3.09%
Business trips	398,212	360,668	-37,544	-9.43%	-0.26%
Other trips	4,419,140	4,411,392	-7,748	-0.18%	-0.05%

Note – ‘Other’ trips removed for international students

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Trip length distribution of trips to/from altered other activities

- Very similar distribution for pre-covid (blue) and scenario (red), mean nearly identical
- Compare this with trip length distribution of hypothetical scenario where destinations of other activities were not changed (yellow): Longer mean trip length and distribution quite different.
- Shows that the trip length has been shortened through this adjustment.



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100 iterations run – mode share adjustment

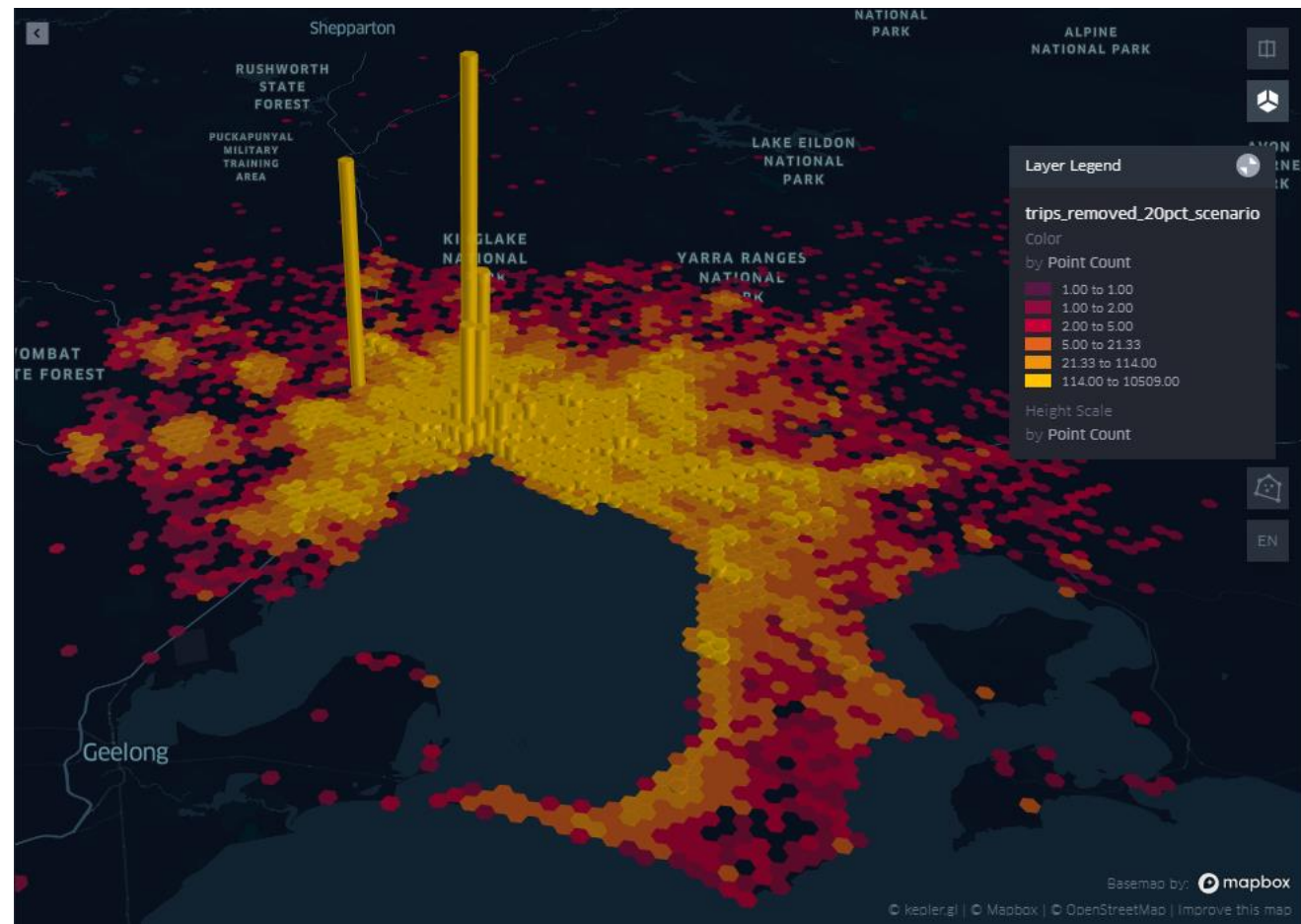
- Initial run for 100 iterations, 80 with innovations, check PT mode share adjustment to ASC change.
- % Difference in mode share compared to 2018 MABM base scenario:

% change in mode share	PT ASC = -4.11 utils (reduced by 4.61)	PT ASC = -8.67 (reduced by 9.17 utils)
Car	5.83	7.12
PT	-51.87	-61.43

- Dollar equivalent of alternative-specific constant (ASC) change for person with mean income:
 - 4.61 utils correspond to about 30\$ at 185\$ of (working) day household income
 - 9.17 utils correspond to 60\$ at 185\$ of (working) day household income
- Based on these results, we estimate that an adjustment by -4.199 utils (to -3.699 from 0.5) will achieve a mode share decrease of 50%. This adjustment is equivalent to about \$27.5 at average income levels. This value will be used for the Dialled-Up run.

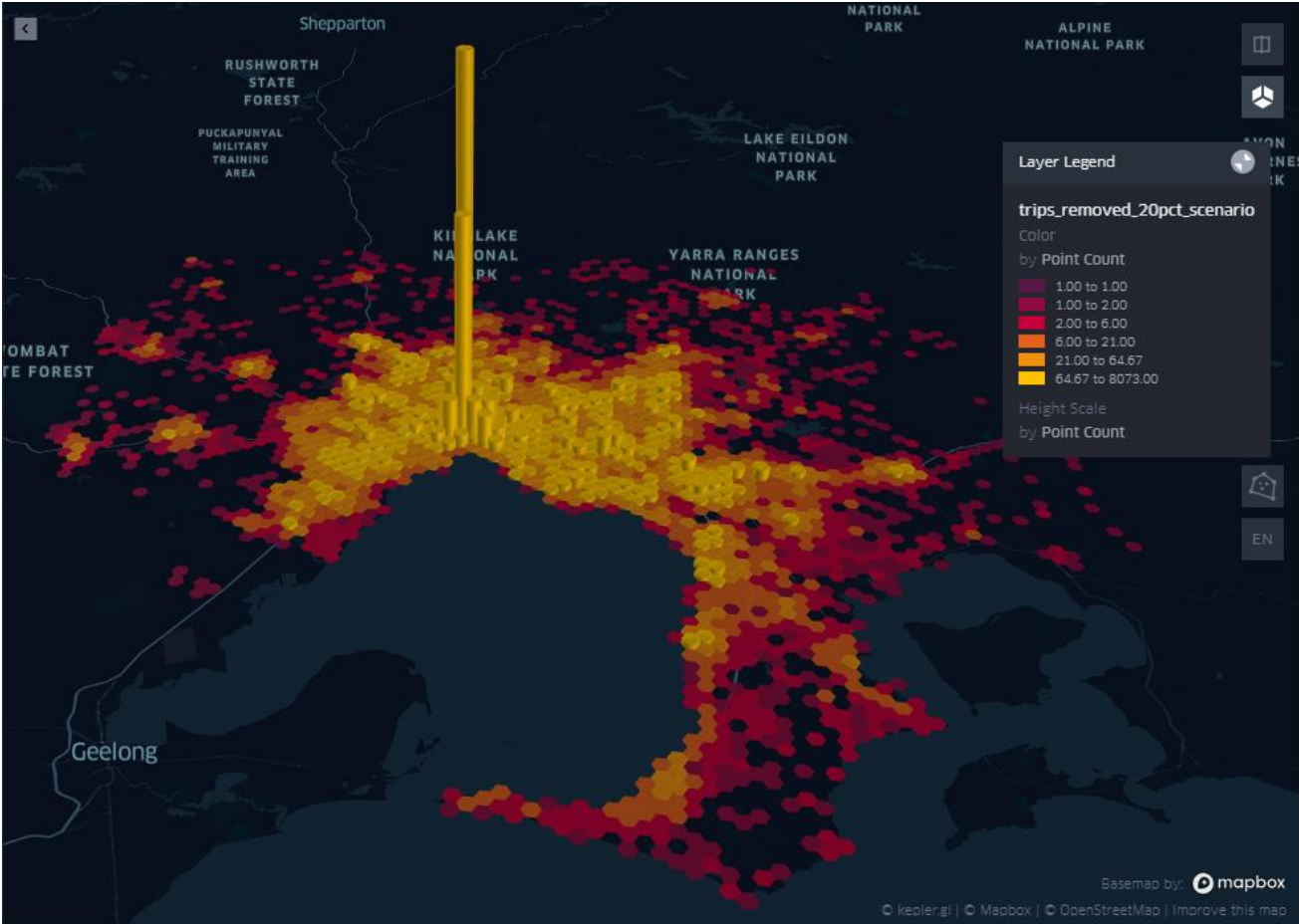
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Removed trips by destination



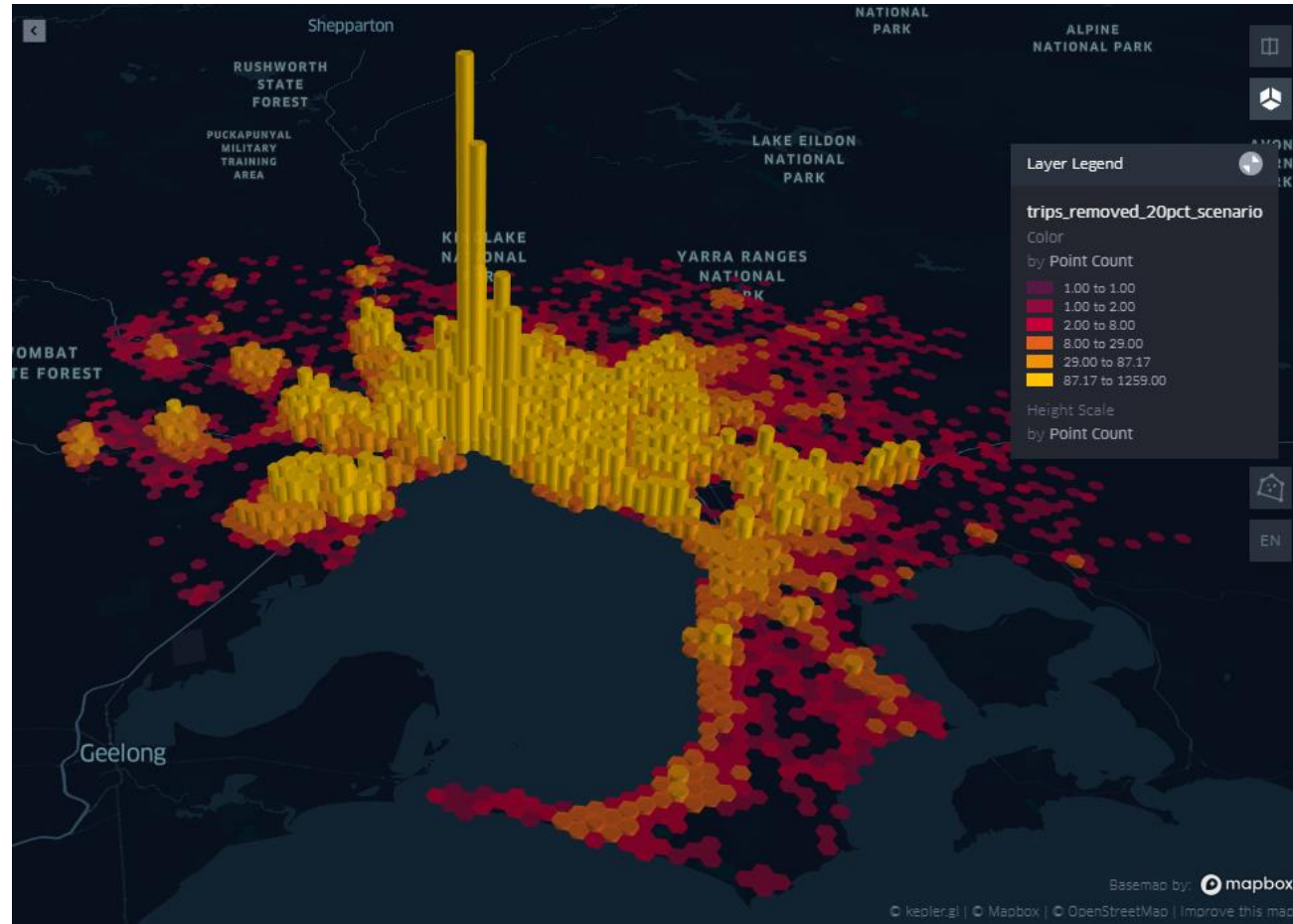
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Removed trips with destination activity work



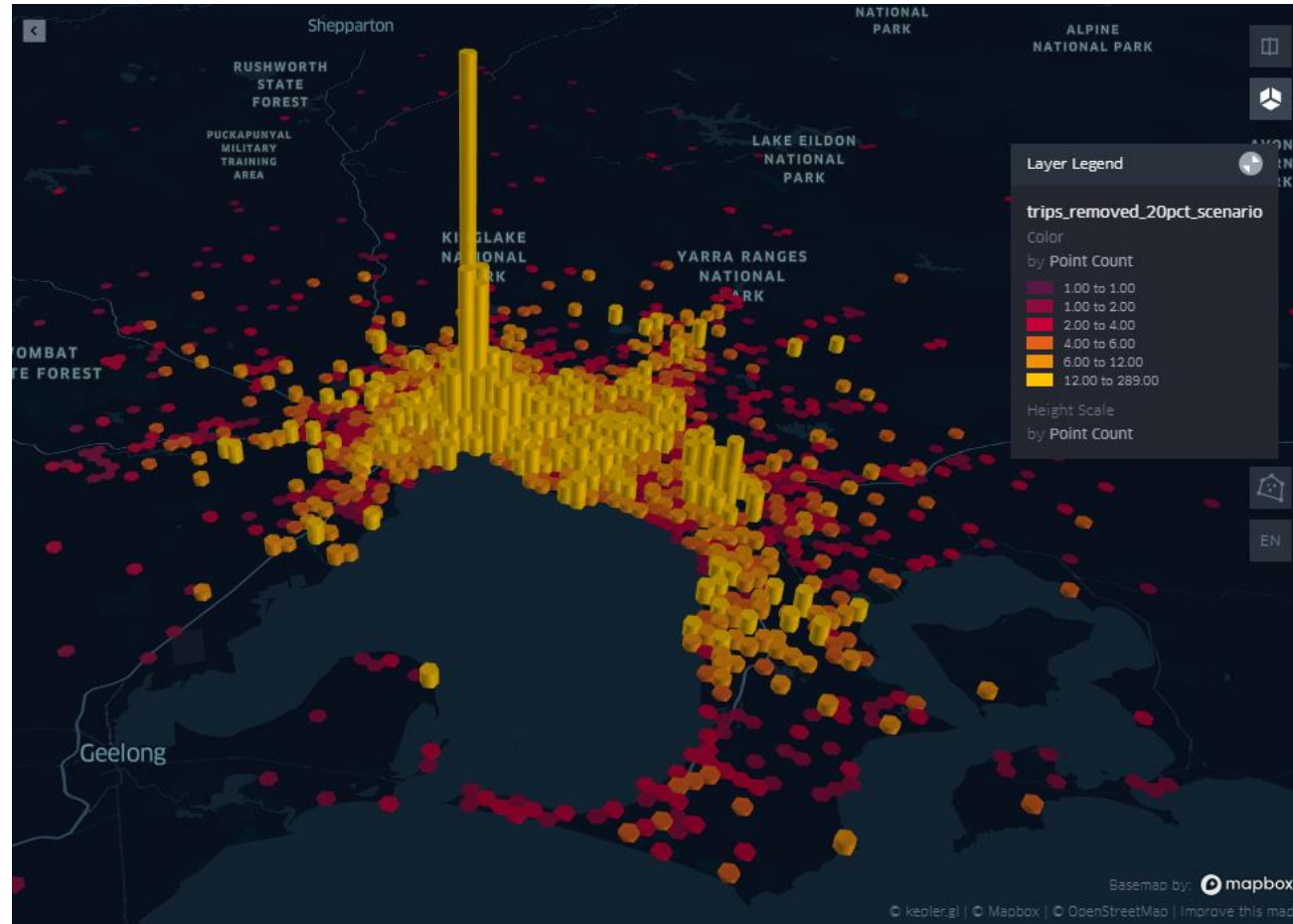
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Removed trips with origin activity home



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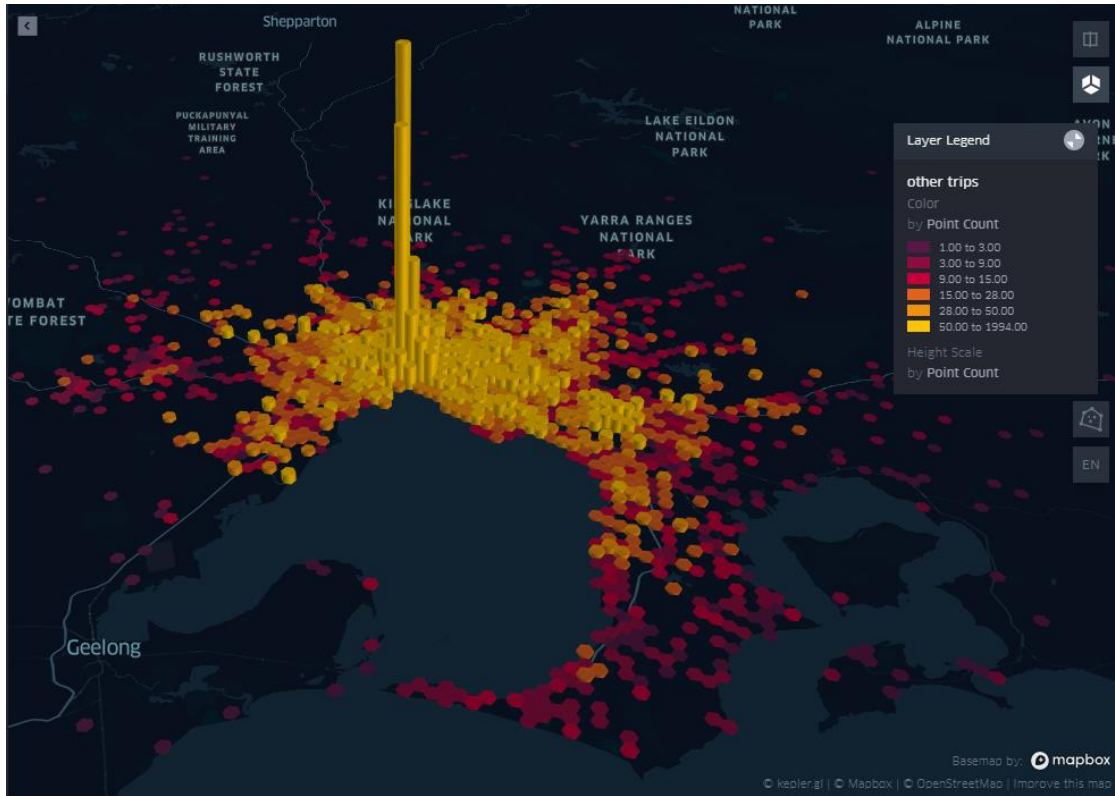
Removed trips with destination activity business



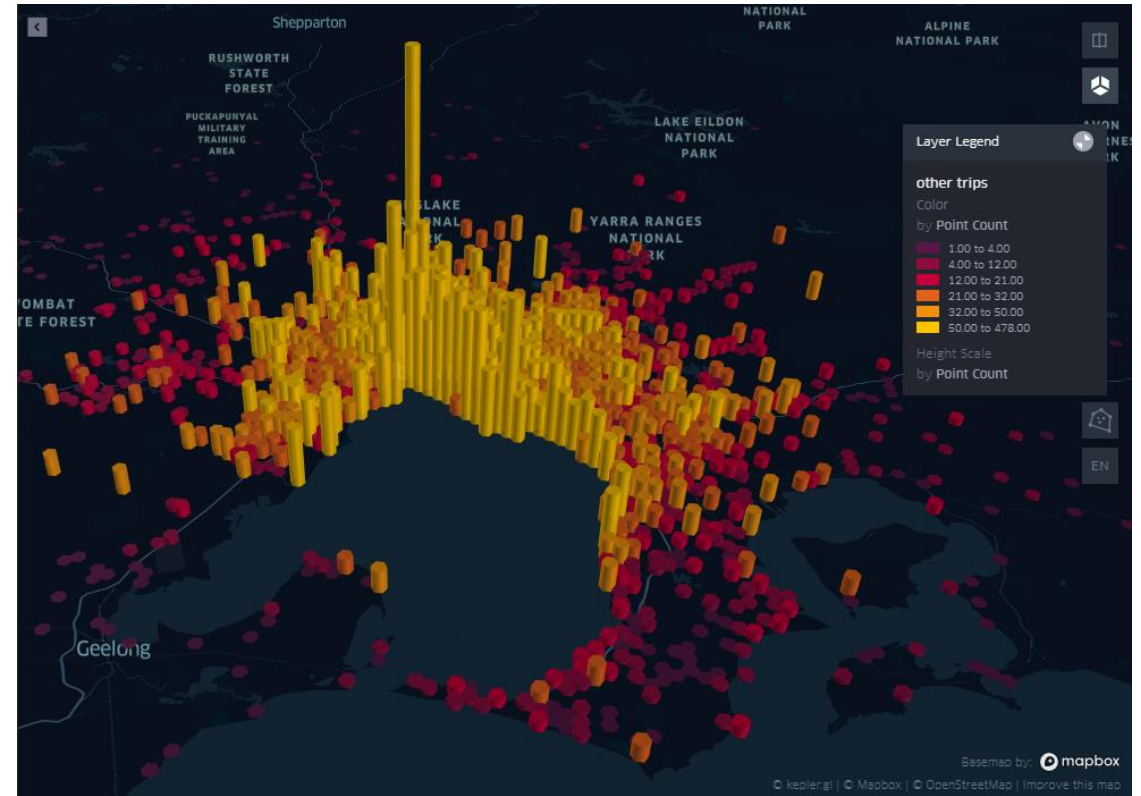
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Previous trips to other activities

Pre-COVID



Dialled-Up scenario



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POLICY SCENARIO TEST - SENSE CHECK

16 OCTOBER 2020

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RUN 1_Active Shift Scenario Impact Summary (1)

- 265,584 (+49%) trips added to 542,232** active trips.
- Long trips removed successfully
 - Active trips increased from 257,660 to 399,864 (+55%)
 - 142,204 trips removed out of 720,016 total car and public transport trips (between 1 and 8.7km)
- Shortfall in short trips (i.e. walk) added of 113,627 or 52% (of target)
 - Active trips increased from 284,572 to 407,952 (+43%)*
 - Shortfall in all time periods
- Most trips are removed from car in line with starting mode share

* The 'Active trips' number includes only trips <1km, excludes trips between 1km and 2km, whereas the total added includes some trips from 1km to 2km.

**These are only those active trips that are <8.7km in trip length

Total trips to be switched

	Active	Car and PT
Starting	568,816	1,829,480
Target to remove/ add (2/3)	379,211	379,211
%	67%	21%
Actually added	265,584	265,584
%	47%	15%

Short trip breakdown

	Trips added	% of total	Constraint (VISTA)
1km	98,704	80%	
1-1.5km	18,504	15%	18,504
1.5-2km	6,172	5%	6,172
Total	123,380	100%	24,676
Target	237,007		
Shortfall	113,627 (-52%)		

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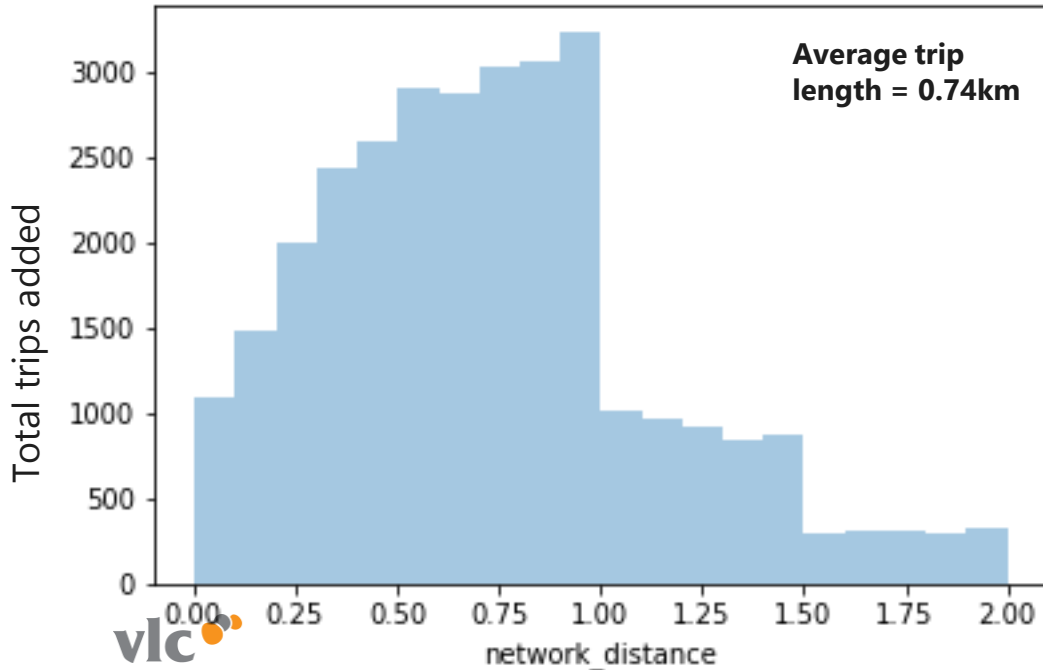
RUN 1_Active Shift Scenario Impact Summary (2)

- Most trips are removed from car in line with starting mode share
- The average length of long trips added is 4.41km, for short trips it is 0.74km and the maximum trip length is 2.0km

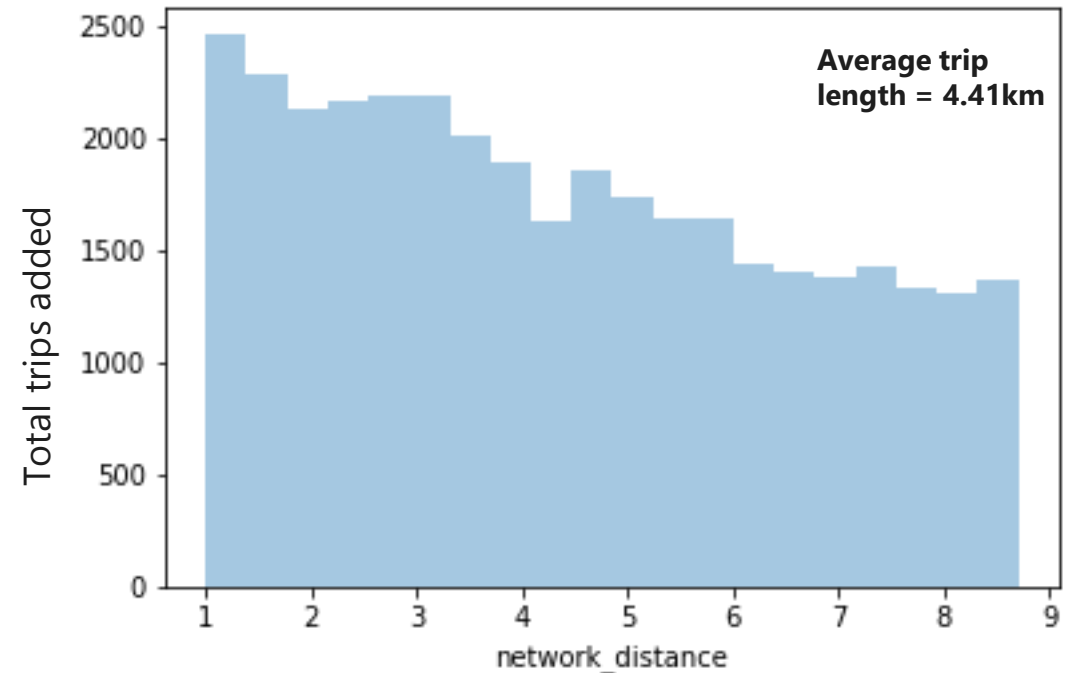
Mode share of trips changed (0 to 8.7km)

Mode Split	Core Scenario		Run 1 trips removed			
	Short	Long	AM	IP	PM	OP
Car	97.9%	75.3%	80.6%	85.9%	80.5%	87.9%
PT	2.1%	24.7%	19.4%	14.1%	19.5%	12.1%

Trip length distribution associated with short trips added (<1km)



Trip length distribution associated with long trips added (1km to 8.7km)



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RUN 1_Active Shift Scenario Impact Summary - (Spatial distribution of trips removed from PT and Car (<8.7 km))

Trips removed as % of total in zone	AM	IP	PM	OP
To Region Split				
East				
Inner Metro	13.9%	25.0%	20.9%	12.9%
Inner South East	13.9%	11.4%	6.1%	10.7%
Middle East		0.0%	0.0%	0.0%
Middle North	11.9%	9.6%	6.3%	9.8%
Middle West	9.7%	8.5%	5.8%	7.2%
North				
Outer North West				
South				
West				
From Region Split				
East				
Inner Metro	24.4%	20.5%	10.8%	17.9%
Inner South East	7.7%	13.4%	12.6%	7.7%
Middle East		0.1%		
Middle North	8.3%	12.2%	12.4%	7.3%
Middle West	8.0%	9.9%	8.5%	6.1%
North				
Outer North West				
South				
West				

- No single zone with an excessive % of trips removed
- Highest % from Inner Metro
- Therefore looks sensible

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RUN 1_Active Shift Scenario Impact Summary - (Spatial distribution of trips removed from PT and Car (<8.7 km))

Proportion of trips shifted To/From each region	AM	IP	PM	OP
To Region Split				
East				
Inner Metro	39,964 (90%)	103,960 (85%)	28,116 (79%)	53,060 (84%)
Inner South East	2,936 (7%)	10,116 (8%)	3,888 (11%)	5,700 (9%)
Middle East	(0%)	(0%)	(0%)	(0%)
Middle North	896 (2%)	4,564 (4%)	2,164 (6%)	2,748 (4%)
Middle West	708 (2%)	3,548 (3%)	1,576 (4%)	1,560 (2%)
North				
Outer North West				
South				
West				
TOTAL	44,504 (100%)	122,188 (100%)	35,744 (100%)	63,068 (100%)
From Region Split				
East				
Inner Metro	34,348 (77%)	107,608 (88%)	31,568 (88%)	52,012 (82%)
Inner South East	5,148 (12%)	8,412 (7%)	2,552 (7%)	5,868 (9%)
Middle East	(0%)	(0%)	(0%)	(0%)
Middle North	2,928 (7%)	3,576 (3%)	1,032 (3%)	3,136 (5%)
Middle West	2,084 (5%)	2,596 (2%)	612 (2%)	2,060 (3%)
North				
Outer North West				
South				
West				
TOTAL	44,508 (100%)	122,192 (100%)	35,764 (100%)	63,076 (100%)

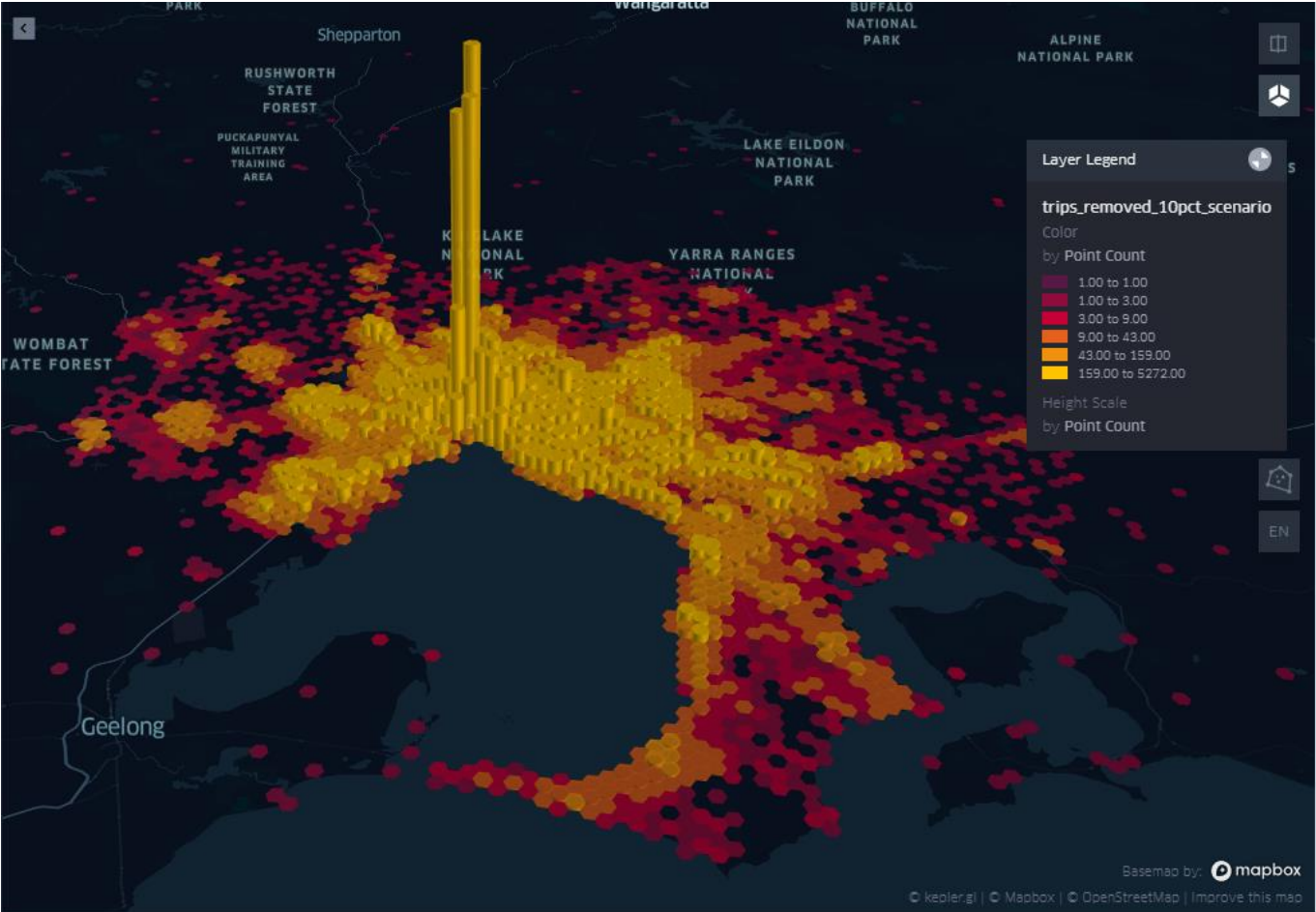
- Inner Metro has the highest change in trips
- Highest % from Inner Metro
- Therefore looks sensible

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RUN 2_Work Shift Scenario Input Trips Summary

Area of adjustment	'Core' Scenario	Policy test 2	Difference	%difference	% of Total 'Core' scenario trips
All Trips	14,110,052	13,607,476	-502,576	-4%	-3.6%
Airport	38,216	38,216	0	0%	0%
International Students	58,092	58,092	0	0%	0%
Work trips	2,010,204	1,675,352	-334,852	-17%	-2.4%
Business trips	380,024	352,736	-27,288	-7%	-0.2%
Other trips	4,416,652	4,416,652	0	0%	0.0%

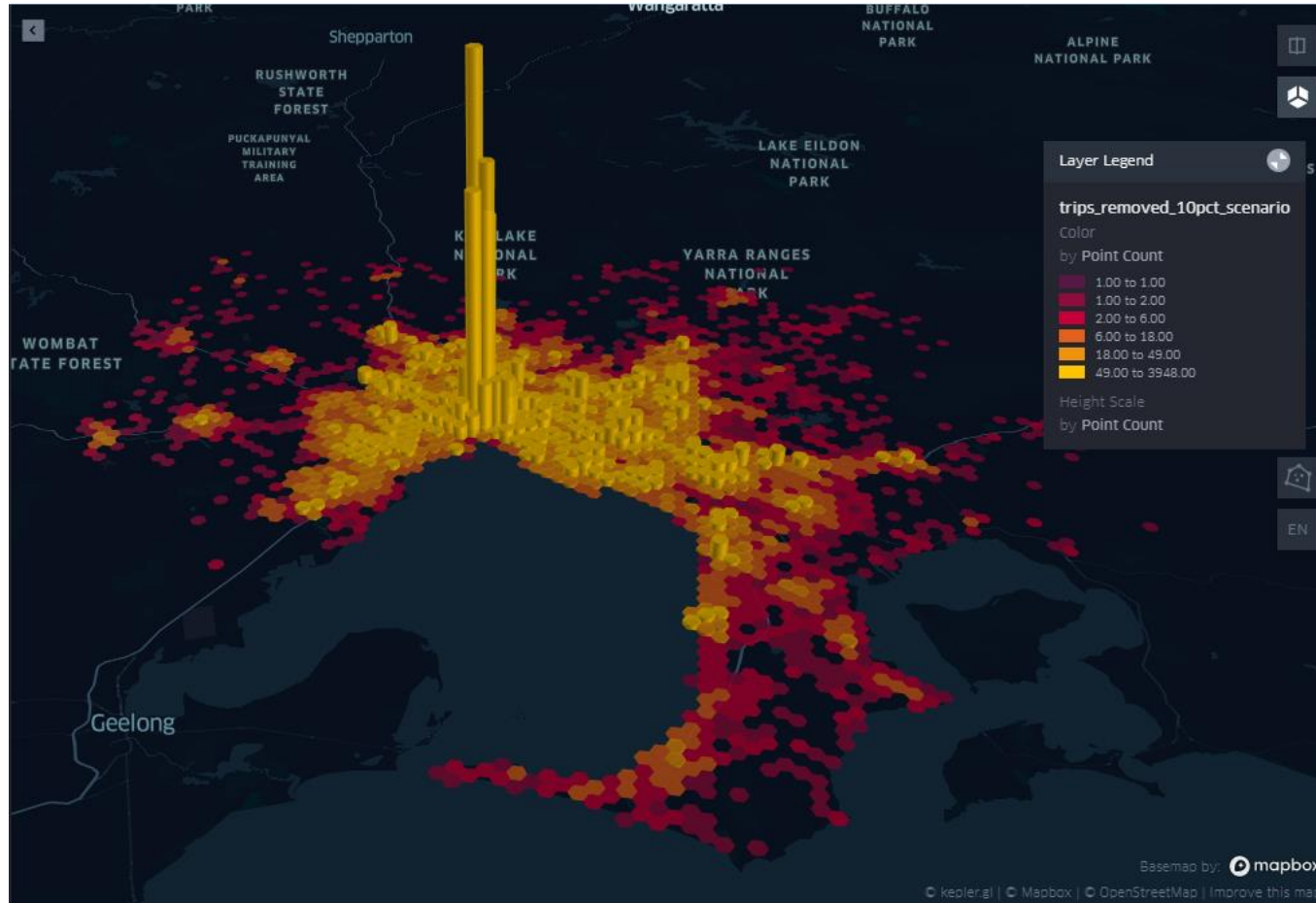
Note – 'Other' trips removed for international students

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Removed trips by destination (vs 'Core' scenario)



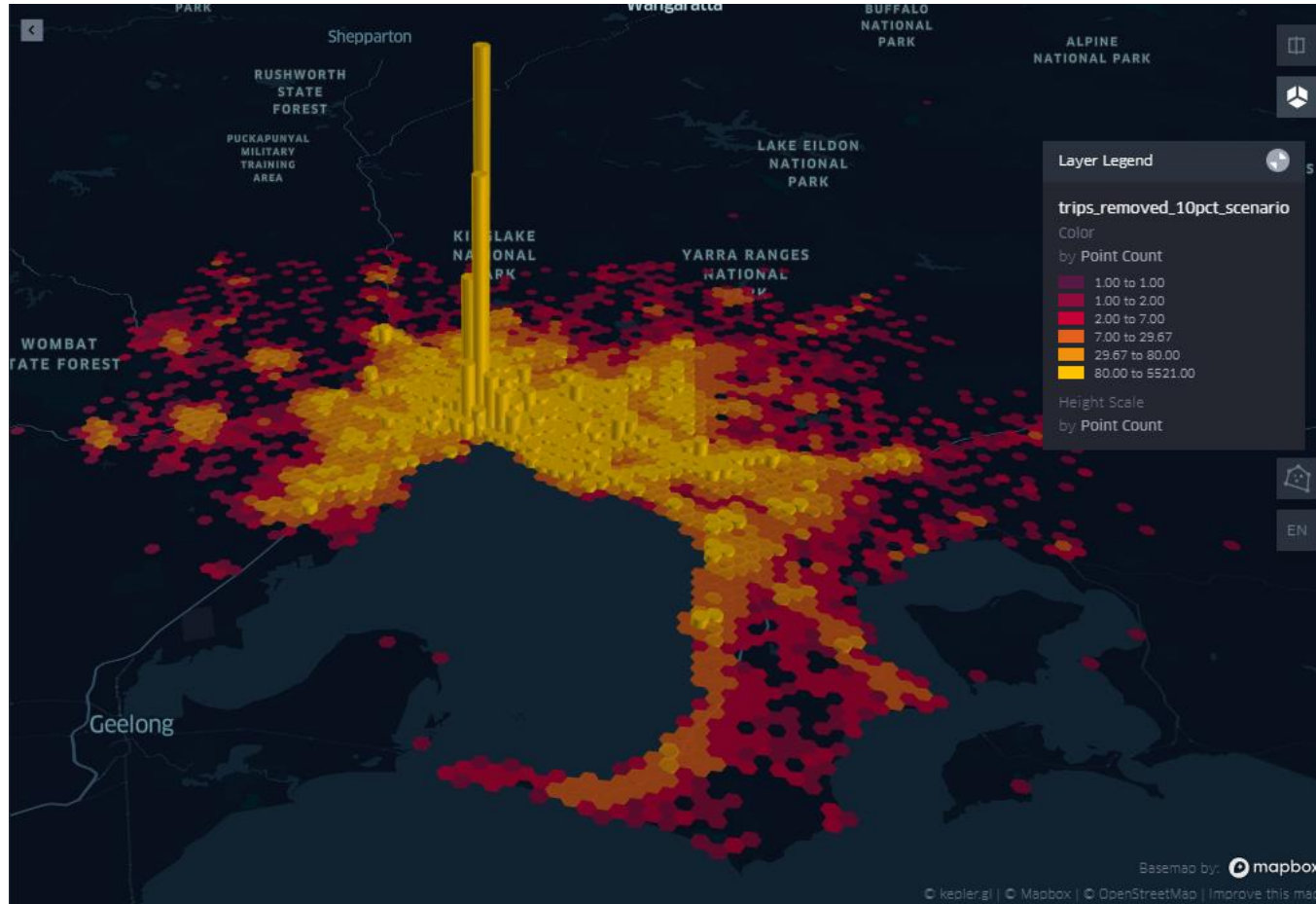
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Removed trips with destination activity work (vs 'Core' scenario)

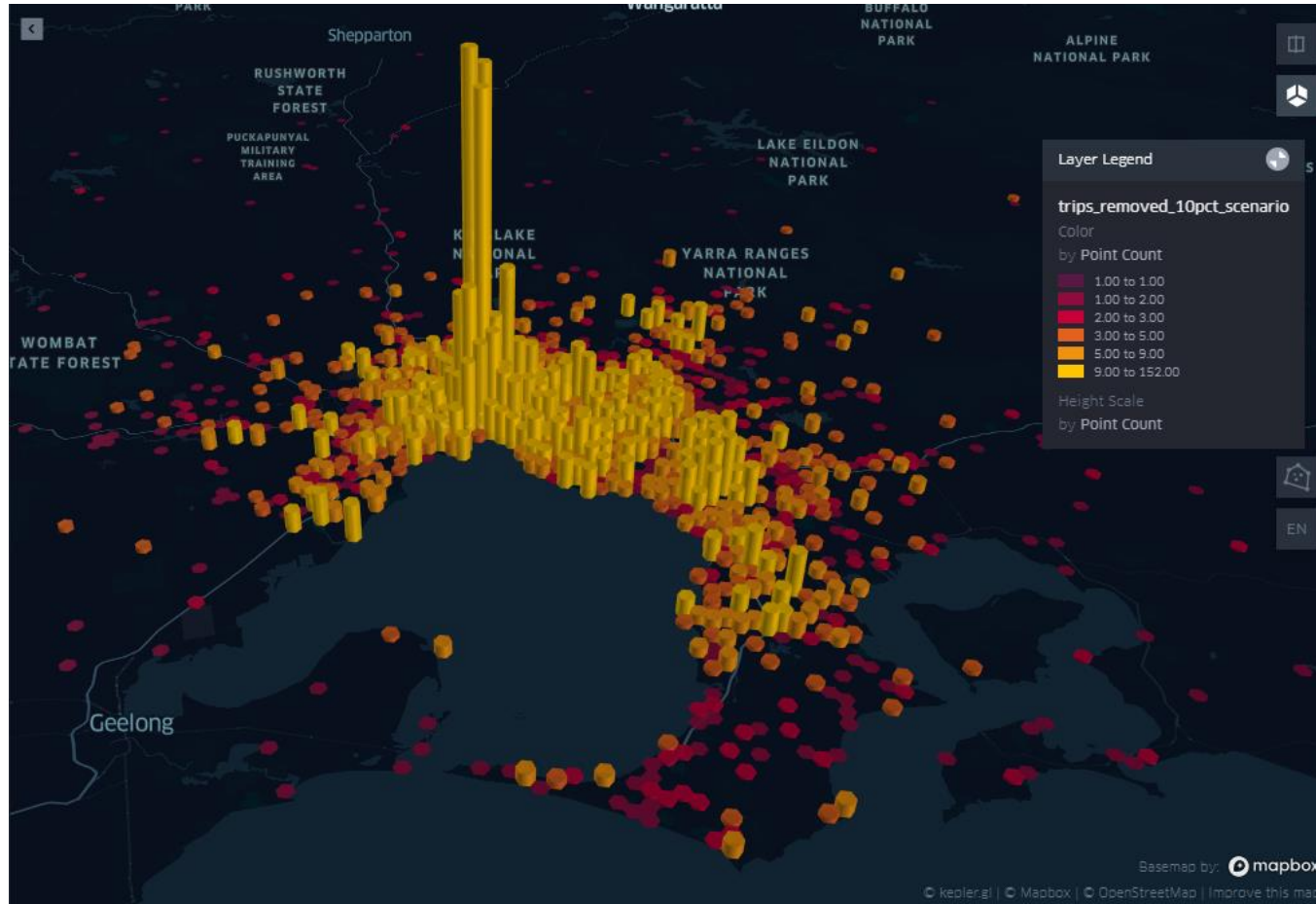


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Removed trips with origin activity home (vs 'Core' scenario)



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Removed trips with destination activity business (vs 'Core' scenario)



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