



# Bicycle Use Propensity Index

Final Report. Prepared for the City of Melbourne

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Institute for  
*Sensible Transport*



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# Executive Summary

The Institute for Sensible Transport developed the *Bike Use Propensity Index* to identify spatial differences in latent demand for cycling in a city or region. The *Index* is based on eight Census collected variables that are statistically significant predictors of bike use. For this project, three maps have been produced at a different geographic level, providing a *relative propensity score* for each level. In sum, these maps provide a clear illustration of the spatial variation in propensity to cycle, at different spatial levels in Melbourne.

The *Propensity Index* can help guide future investment in cycling infrastructure by identifying the areas where the greatest uptake in cycling is likely to occur. Actions focusing on high propensity areas are likely to include infrastructure projects, but should also consider behaviour change initiatives and other support programs to encourage greater cycling.

In addition to the *Propensity Index*, an analysis of short distance car trips for the journey to work was also conducted, to help identify areas that had both high latent demand for cycling and a high level of car trips within a cyclable distance (<5km). This can assist in better understanding areas with high potential for mode shift from car to cycling.

## Key findings

The *Propensity Index* highlighted several key insights regarding spatial variation in latent demand for cycling. This section briefly identifies the key findings:

### City of Melbourne

- The western, Queen Vic and RMIT, and north-eastern areas of the Hoddle Grid recorded the highest propensity for bicycle use.
- Docklands and Southbank scored very high for bicycle use propensity.
- The suburbs of East Melbourne and Kensington recorded the lowest bicycle use propensity, relative to other parts of the City of Melbourne.

### Inner Melbourne Action Plan (IMAP) Area

- Across the IMAP area, the suburbs of South Yarra, Prahran, Fitzroy, Collingwood, St Kilda, Southbank and Docklands all scored high on the *Index*.
- The City of Maribyrnong scored lowest out of the IMAP councils, though pockets of Footscray fit within the middle quintiles.
- Analysis of short car trips in IMAP council areas found many parts of the western end of Stonnington, much of Port Phillip, areas of Richmond, Southbank, and Docklands all having a high concentration of car commutes less than 5km. These areas may see higher mode shift away from cars if targeted with infrastructure and behaviour change initiatives.

## Greater Melbourne

- At the Greater Melbourne scale, much of the inner-city scored in the top quintile, including almost all the SA1s within the Cities of Melbourne, Port Phillip, and Yarra. The western half of Stonnington and Footscray to Yarraville area within Maribyrnong LGA was also within the top quintile for bicycle use propensity.
- Other areas that scored high at the Greater Melbourne scale include the western half of Glen Eira, the southern halves of Moreland and Darebin, and the suburbs of Greensborough, Box Hill, Ringwood, Clayton, Mentone, and Frankston.

# 1. Methodology

The Institute for Sensible Transport have used 2016 Census data to develop a series of maps that offer an indication of the underlying propensity for bike use. This section provides an overview of the method used to create the *Index* and the associated mapping products.

## 1.1 Bike Use Propensity Index

The *Bike Use Propensity Index* combines eight variables, all of which are collected as part of the ABS Census. The statistical basis for the *Index* was developed through the collection of data on riding behaviour and demographic factors. This data was analysed using binary logistic regression in SPSS and STATA. The results, published in Transportation Research Part A (see Fishman, Washington, Haworth, & Watson, 2015) revealed that there are some statistically significant factors capable of predicting bike use.

The release of the 2016 Census data provides insights into how cycling latent demand varies across Melbourne. The following data sets have been derived from the Census and form the fundamental inputs for the development of the *Index*:

1. Residential population density, measured as people per hectare
2. Employment density measured as number of people working per hectare.
3. Density of young adults measured as number of people aged 18 - 34 per hectare.
4. Low motor vehicle ownership measured as number of households with zero or one cars per hectare.
5. Bicycle use - origin measured as number of people riding to work per hectare, by residential location.
6. Bicycle use - destination measured as number of people riding to work per hectare, by destination.
7. City-based employment - people who work within the Melbourne CBD SA2 per hectare, measured at origin.
8. Short car trips- destination measured as number of people driving to work between 0 and 5 km per hectare.

The *Bike Use Propensity Index* has been designed to show the variation in the *relative* propensity to cycle, at the highest possible level of spatial detail. As it is relative, it is not possible to compare areas of Melbourne, with areas of other cities.

The *Index* ranks each of the above attributes for the given study area from 1 to 5. This involves sorting the SA1's from highest to lowest (e.g. highest residential population density to lowest) and affixing the scores at 20% increments. Once each attribute has been ranked, they are then added together and scaled into a score out of 1. Geographic areas that rank in the bottom quintile receive a score of 0.2 for that attribute, while those in the top quintile receive 1.0, as shown in Table 1. The mapped values are aggregates of the attributes' scores.

**Table 1 Ranking system and Index categories**

Quintile	Index Score
5	1.0
4	0.8
3	0.6
2	0.4
1	0.2

SA1's that receive very high Index scores will have scored highly across all the variables included in the Index. In almost all cases, an SA1 that scores above 4.5 (out of 5) will have been in the top quintile in at least five variables. The higher the score, the higher the propensity for bicycle use, relative to all other SA1s within the study area. This report shows three different study areas: City of Melbourne, IMAP, and Greater Melbourne. The ranking and *Propensity Index* scores are *not* comparable between study areas, only *within* each map.

### 1.1.2 Index Creation - Maps

We have used ArcGIS to create individual maps. Each of these maps provide a visual illustration of variation in propensity to cycle, based on the eight factors identified above.

In each of these maps, the *Propensity Index* has been recalculated. This means that in each map, SA1's can only be compared to other SA1, *in that map*. Scores cannot be compared across maps.

# 2. City of Melbourne

This section shows the results for the *Propensity Index* for SA1s located within the municipal boundary of the City of Melbourne, shown in Figure 1. The areas of highest propensity include the SA1s bounding the north-eastern, Queen Vic and RMIT area, and western boundary of the Hoddle Grid. Areas of Docklands and Southbank also scored within the highest quintile. At the lowest end of the *Index*, the suburbs of Kensington and East Melbourne were found to have the least propensity for bicycle use in the City of Melbourne. In many cases, especially within the Hoddle Grid, the areas ranking highest are likely to indicate common destinations rather than trip origins. This may be useful to guide the development of end of trip facilities like parking, in addition to quality bicycle routes.

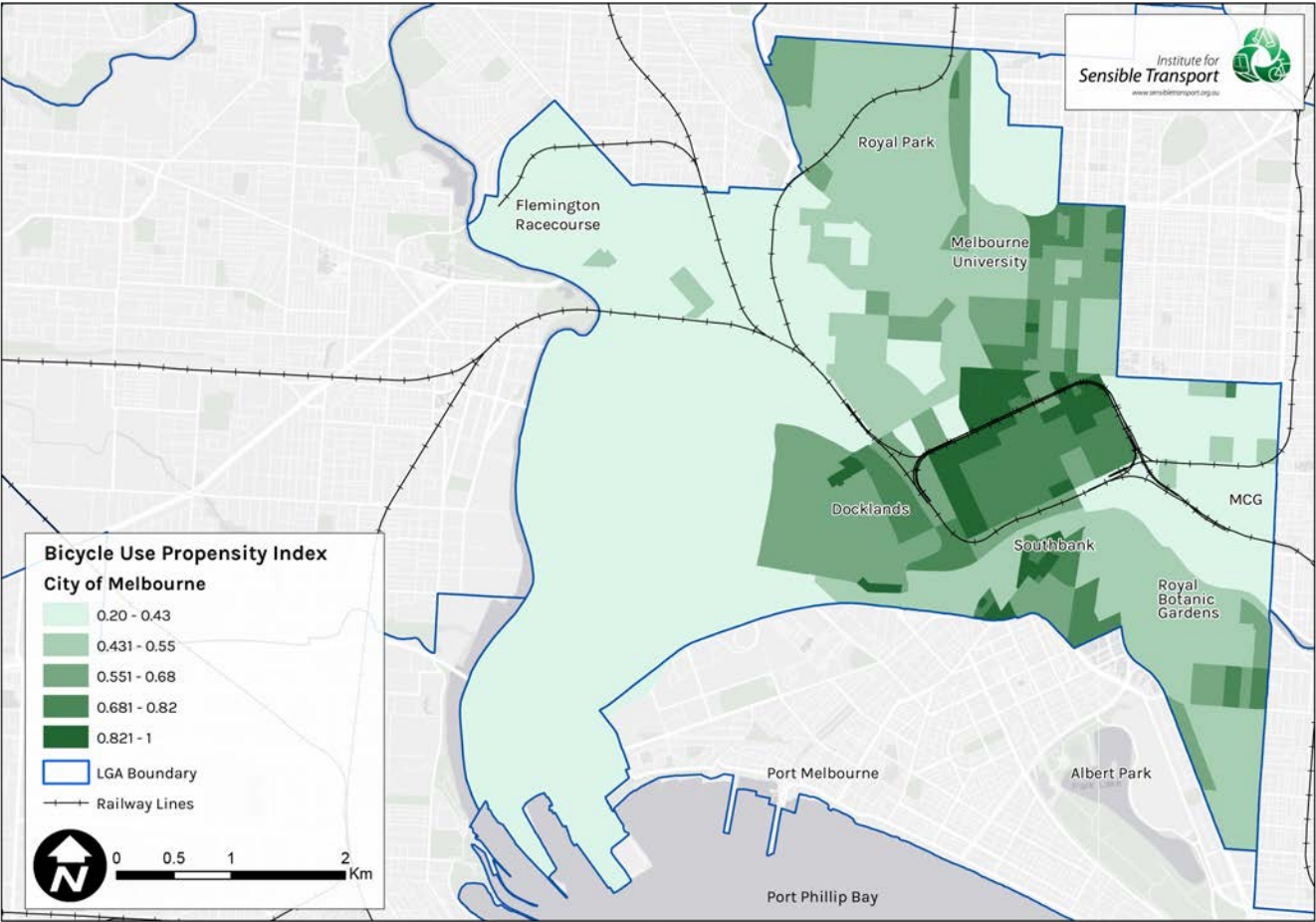


Figure 1 Bicycle Use Propensity Index - City of Melbourne

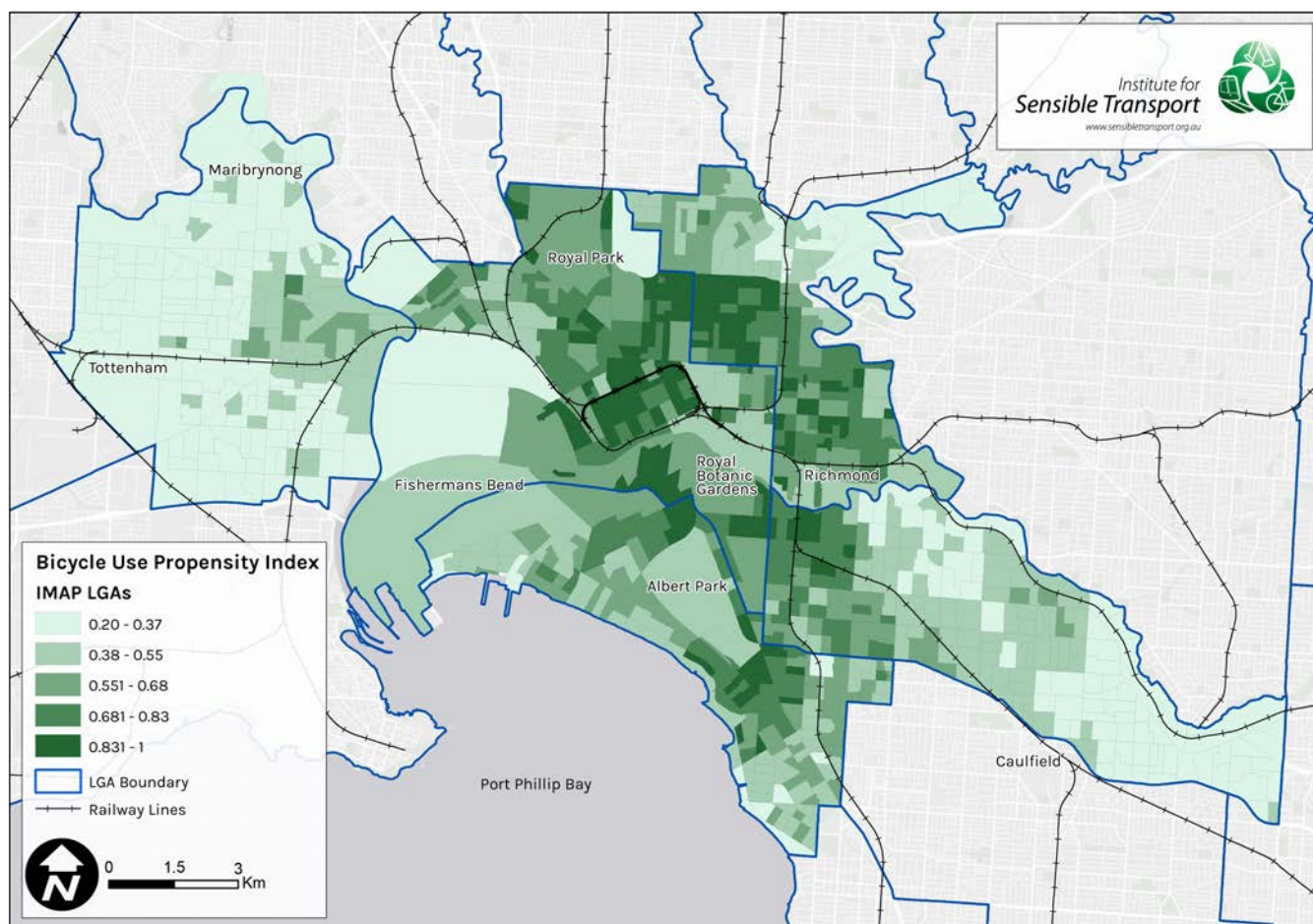


### 3. Inner Melbourne Action Plan

A separate *Propensity Index* was created for the inner-city municipalities that form the 'Inner Melbourne Action Plan' (IMAP). These municipalities are:

- City of Melbourne
- City of Port Phillip
- City of Yarra
- City of Stonnington
- City of Maribyrnong

The *Propensity Index* for the IMAP municipalities is shown in Figure 2. For the City of Port Phillip, the suburb of St Kilda has a concentration of SAIs in the highest and second highest quintiles. For the City of Yarra, most of the Fitzroy and Collingwood SAIs were found to be in the highest quintile, with pockets of Abbotsford and Richmond showing high propensity as well. For Stonnington, South Yarra and Prahran were found to have high propensity for bicycle use, relative to other IMAP councils. Maribyrnong scored lowest out of all the IMAP councils, though some SAIs within Footscray near the University and Hospital scored in the medium to high quintiles.



**Figure 2 Bicycle Use Propensity Index - IMAP**

The findings shown in Figure 2 will help guide cross-municipal bicycle infrastructure projects through linking areas of highest bicycle use propensity.

### 3.1 Short Car Trips

This section shows per hectare results for car trips less than 5 km for SA1s within the IMAP boundary. Areas with an overall high *Propensity Index* score and high short car use are likely to see a greater proportion of mode shift from cars to bicycles. The results, shown in Figure 3 highlight areas that are likely to be relatively easier to reduce car use. The City of Port Phillip recorded the most short car trips, relative to other IMAP councils. The western half of Stonnington also had high numbers of short car trips, as did Richmond for the City of Yarra. It is important to note that the areas with lower short car trips in Figure 3 do not necessarily indicate low overall car use, but rather that they likely have commutes in excess of 5 km. This is likely true for the eastern half of Stonnington and for Maribyrnong, where even CBD bound car trips are likely to exceed 5 km.

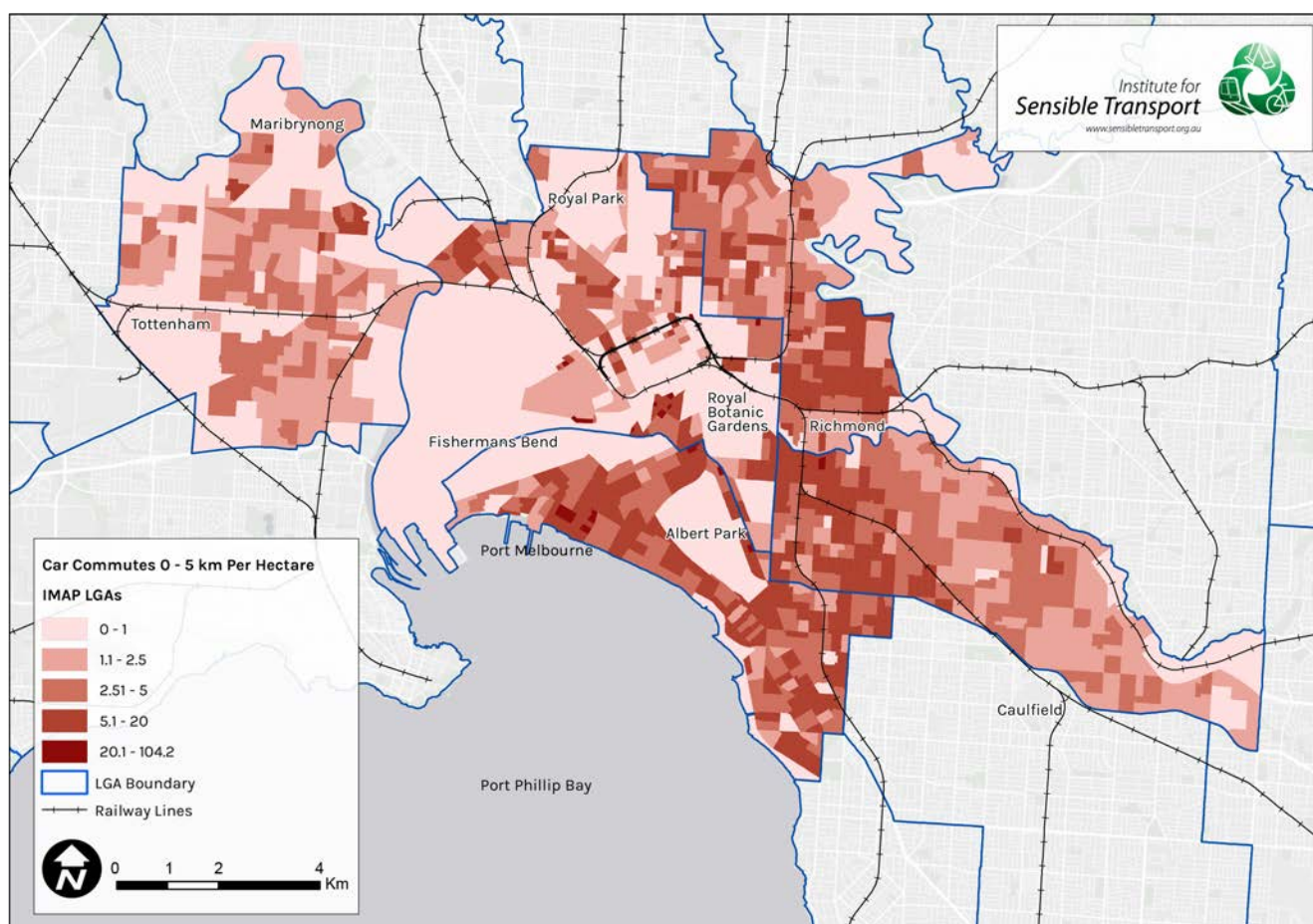


Figure 3 Short Car Trips 0 - 5 km - IMAP

## 4. Greater Melbourne

This section shows the *Propensity Index* for Greater Melbourne (shown in Figure 4), ranking all SA1s within the Urban Growth Boundary. At this level, much of the City of Melbourne, Port Phillip, and Yarra are found in the highest quintile of bicycle use propensity. The South Yarra – Windsor corridor in Stonnington, Footscray to Yarraville in Maribyrnong also falls within the highest quintile. Beyond the City of Melbourne and IMAP boundaries, the lower half of Darebin and Moreland largely falls within the highest quintile, as does the western half of Glen Eira. Outside the inner-city of Melbourne, other areas scoring high on the *Propensity Index* include the suburbs of Greensborough, Box Hill, Ringwood, Mentone, Clayton, and Frankston. This map is intended to help identify opportunities to link areas of high bicycle use propensity to each other and to key destinations through metropolitan scale bicycle projects (e.g. Strategic Cycling Corridors).

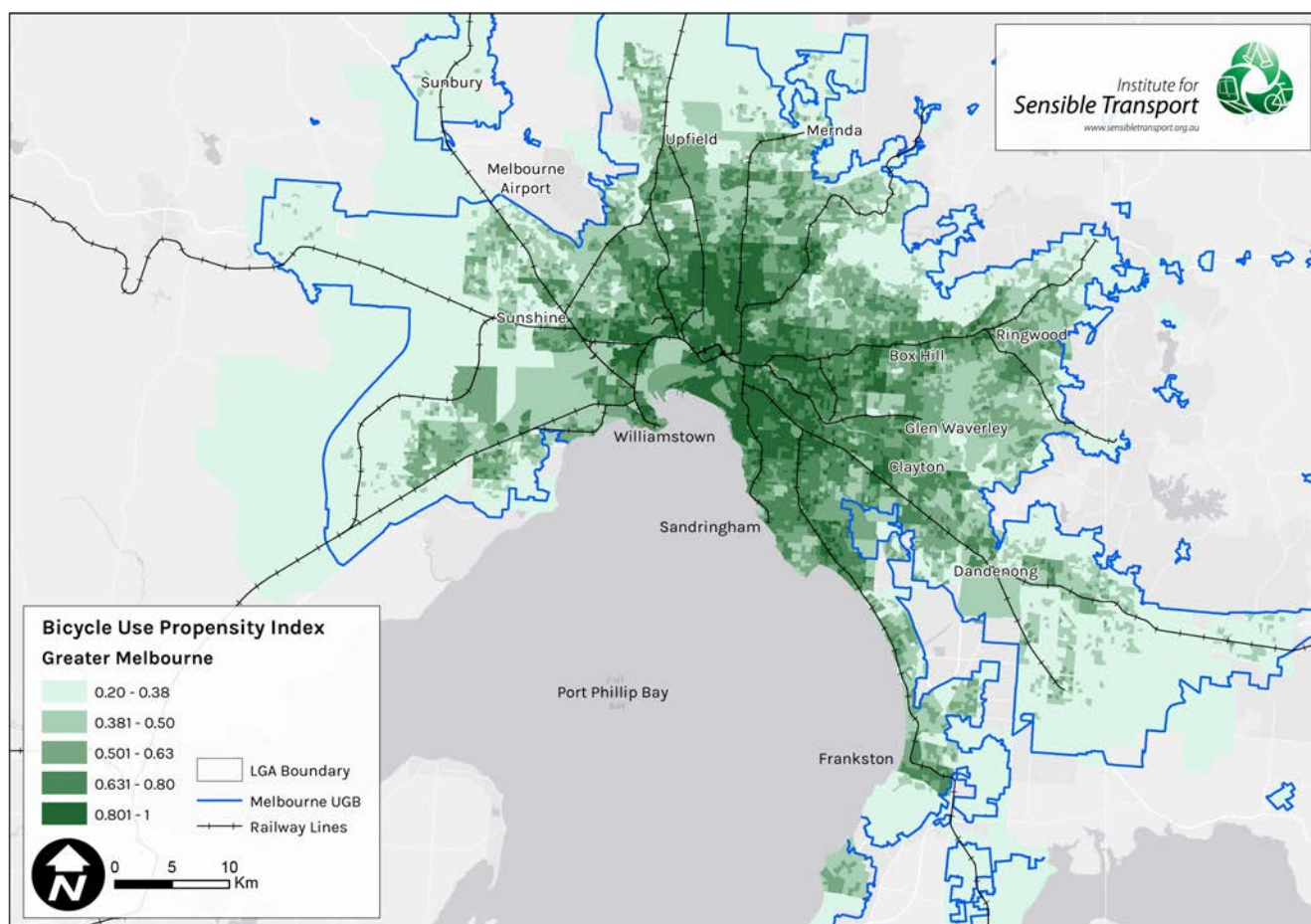


Figure 4 Bicycle Use Propensity Index - Greater Melbourne



# 5. CBD-Based Workers

Figure 5 shows where CBD-based workers live, by SA1. The red ‘pie’ shapes highlight the total number of workers within 7km of the CBD, carved up into eight segments. In total, there are 65,726 people that work in the Melbourne CBD and live within 7km of the CBD. Several ‘hot-spots’ of CBD workers can be found in the eastern end of Abbotsford, near Ikea, the Forest Hill precinct in South Yarra, Southbank, and Docklands. The inner-north suburbs had the highest number of CBD workers across the 7km slice, with just over 12,000. The next highest slice was found along the St Kilda Road corridor and into Prahran and Windsor.

This map is intended to help guide further investigation into radial bicycle infrastructure to support CBD bicycle commutes, as 7km is considered the average distance most people not accustomed to regular recycling will consider for a bicycle commute.

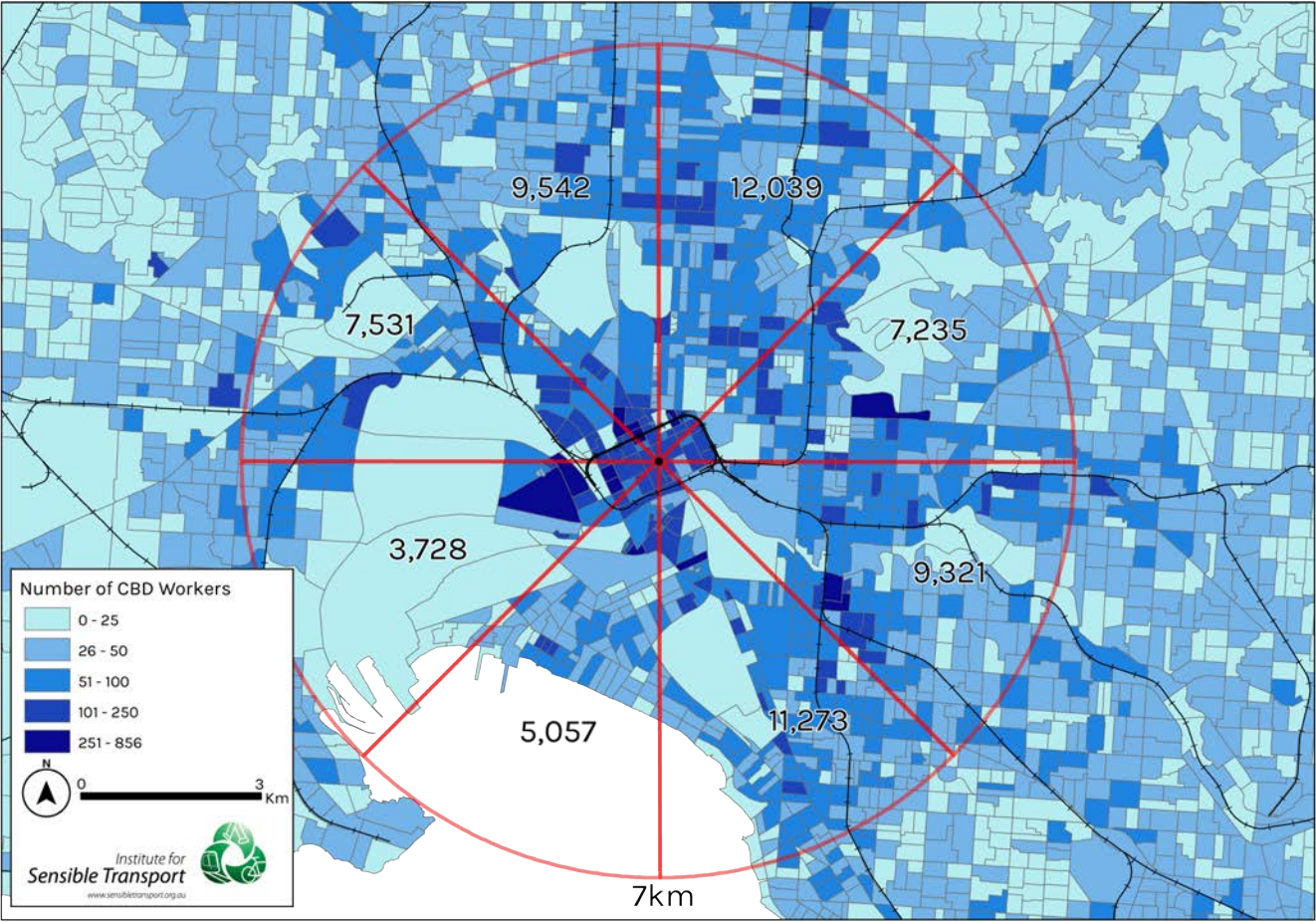


Figure 5 CBD-Based Workers by Residence

## 6. Next Steps

Following the *Propensity Index* analysis, we propose a number of steps that the City of Melbourne, and other IMAP members could take to accelerate the implementation of bicycle infrastructure to support existing and future bicycle riders. This section briefly discusses each proposed step:

1. **Infrastructure gap analysis:** The existing and proposed bicycle networks should be analysed with the *Bicycle Use Propensity Index* to determine gaps in the network to support high propensity areas. This should include the level of infrastructure and opportunities to link high propensity areas to key destinations, such as employment centres and transport hubs.
2. **Existing bicycle use:** Further work should be undertaken to determine existing bicycle use in all of the areas shown in this report, but high propensity areas in particular. This should include non-work trips currently captured by the Census. In-ground bicycle counters and app-based travel tracking should be considered to enhance local and state government's understanding of baseline bicycle use. This is critical not just to help plan future infrastructure, but also to allow for robust evaluations of the impact of new infrastructure (before/after counts).
3. **Focused community research:** Focused community consultation within high propensity areas would offer insights into specific barriers preventing prospective bicycle users from riding. Qualitative feedback would allow better understanding of non-infrastructure-based programs to increase bicycle usage.
4. **Targeted interventions:** The high-propensity areas should be considered for targeted interventions to boost bicycle use and act as test beds for pilot projects prior to widespread roll out. Experimental, innovative designs may offer applicability to high propensity sites, as these areas offer the demographic and density characteristics that support 'game changing' infrastructure solutions. These areas offer the highest likelihood of high returns on investment and high engagement from the community. Pilot programs in these areas could be used to as examples to advocate to other parts of the community.



## 7. Conclusion

This report has identified how latent demand for cycling varies spatially, across different scales of Melbourne: City of Melbourne, IMAP councils, and Greater Melbourne. Each map offers a different lens to consider areas of high latent demand for cycling. At the City of Melbourne level map in Figure 1, the results indicate where higher support for end-of-trip facilities and bicycle parking may provide the most benefit, in addition to high quality, protected bicycle infrastructure. At the IMAP level, Figure 2 may help identify strategic cross-municipal routes likely to see higher usage. Additional analysis in Figure 3 shows the areas with high concentrations of car commutes less than 5 km. These areas are likely to see the biggest mode shift away from cars if targeted with infrastructure and behaviour change programs. At the Greater Melbourne scale in Figure 4, areas are identified that would see bicycle use uptake for metropolitan-scale routes and routes connecting to key destinations. These are primarily, but not solely within inner Melbourne.

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