How to get from Avalon to Berhampore: commuting and car ownership decisions in Wellington, NZ

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This project

- Goal: to explain how households make the joint decision:
  * How many vehicles should your household own?
  * How to get to work?
  * Where to live?
- Uses Ministry of Transport HTS survey data.
- Brings together Econometrics (Toby, Yiğit) and Geography (Mairéad).
- One research assistant (Richard Law) and a summer scholarship student (Tom Pettit – funded by Wellington City Council).
- Has considerable scope to be extended and to answer some interesting policy questions.

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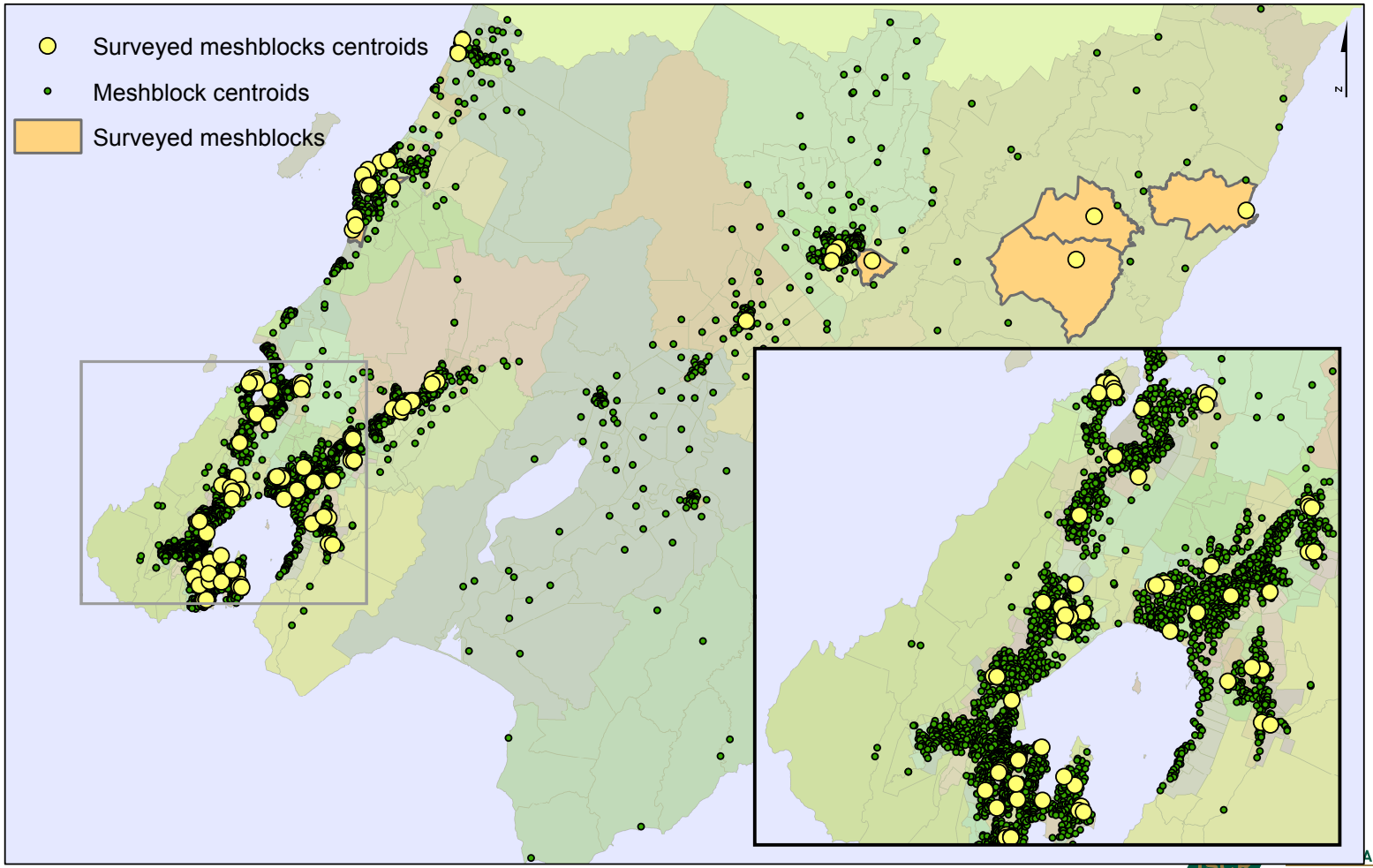
Survey data


Surveyed meshblocks centroids
Meshblock centroids
Surveyed meshblocks
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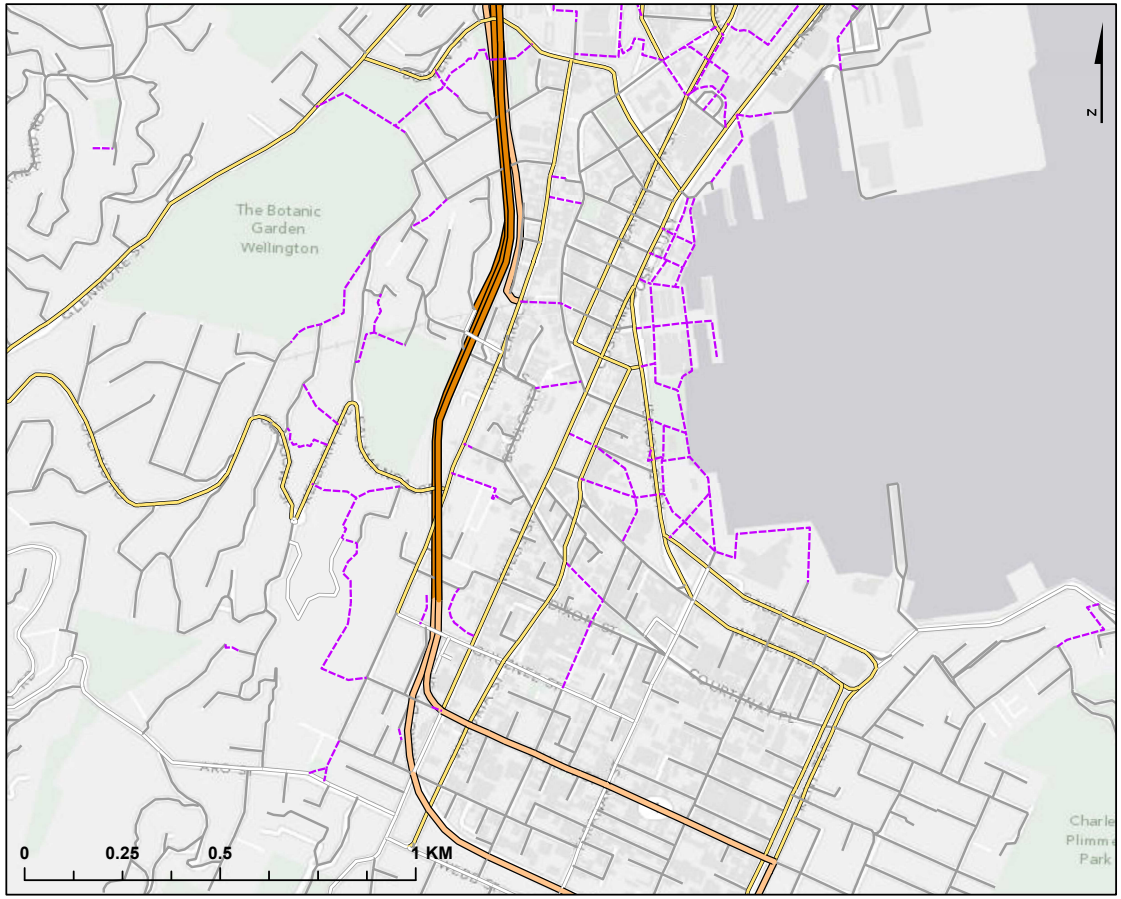
Road network



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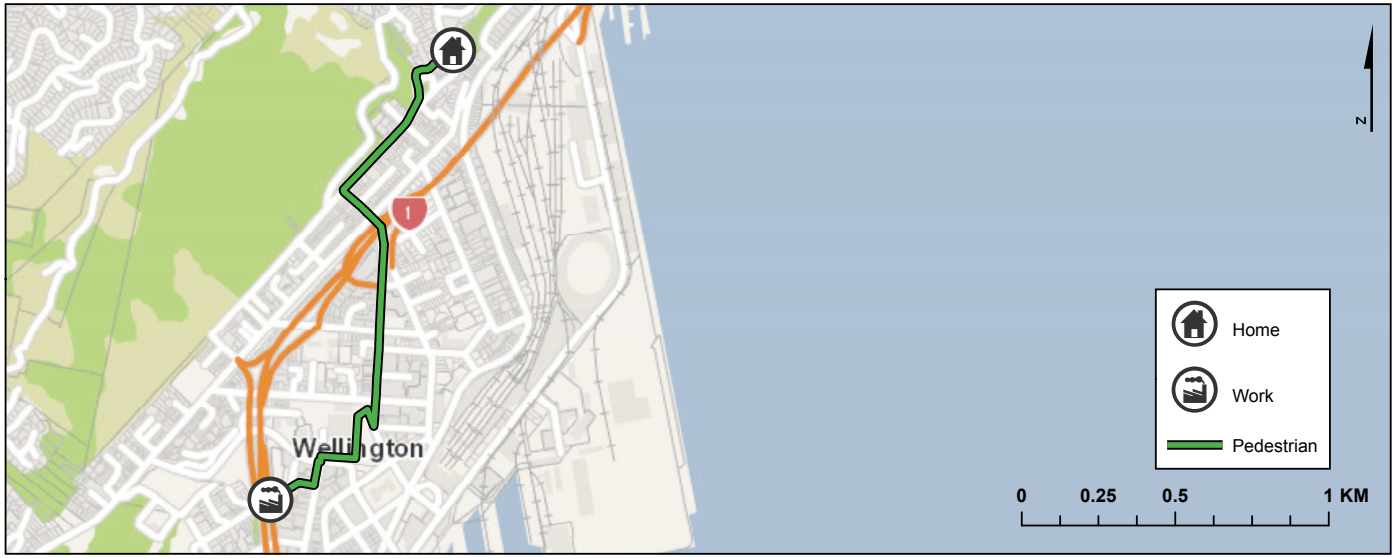
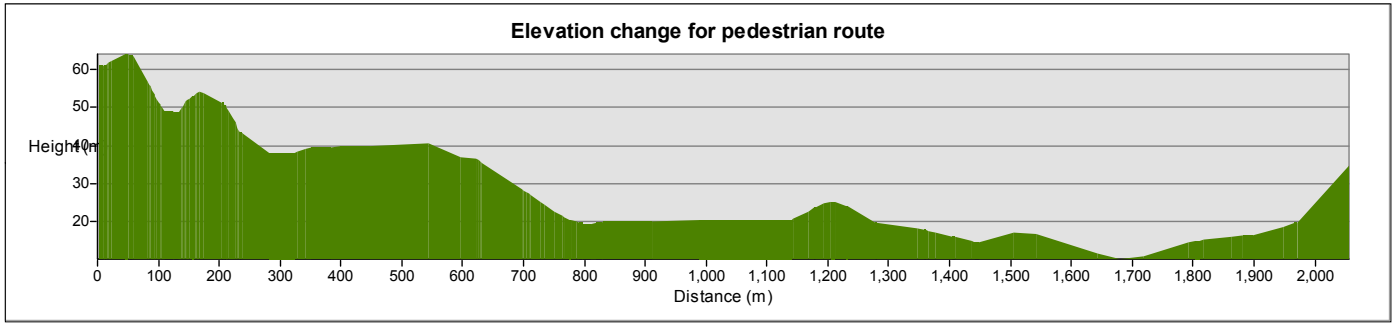
Pedestrian Route





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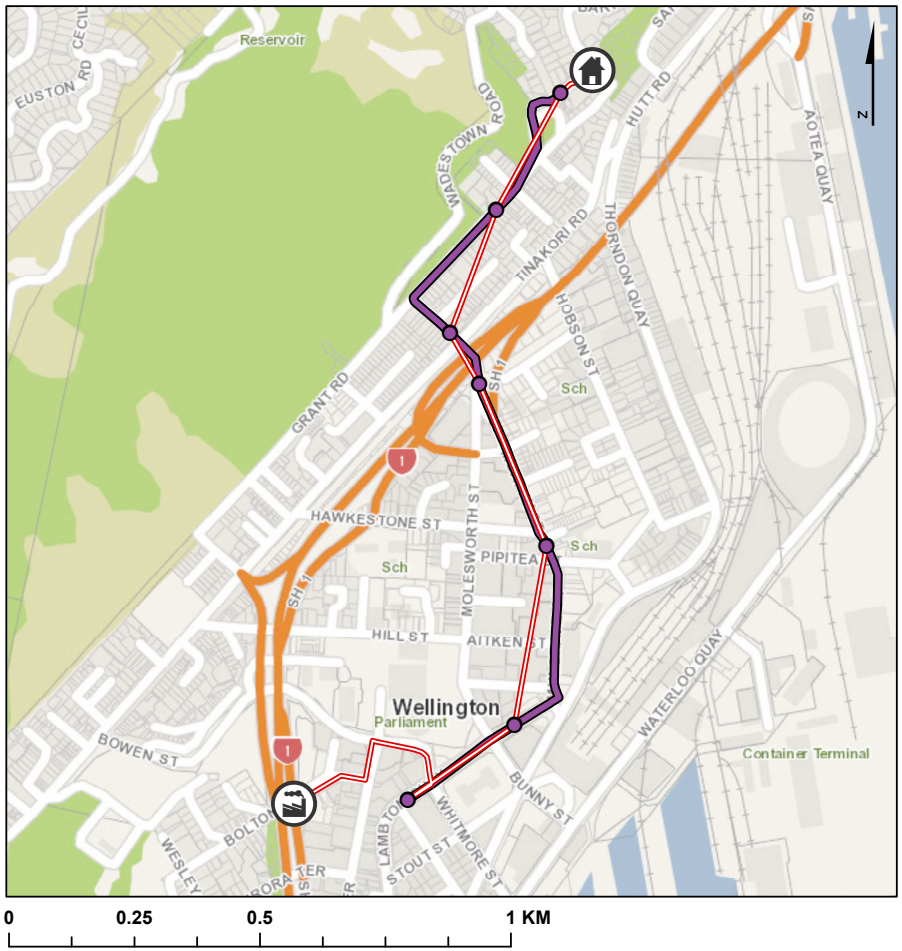
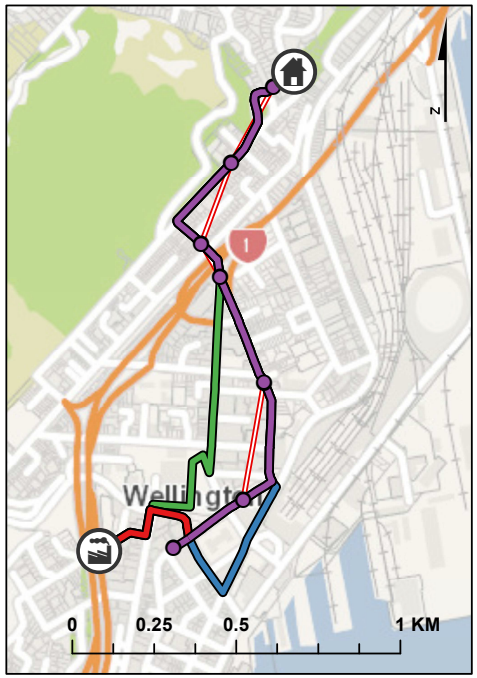
Public transport





Bus stops
Home
Work
Bus
Modelled bus
Car
Pedestrian
Bicycle

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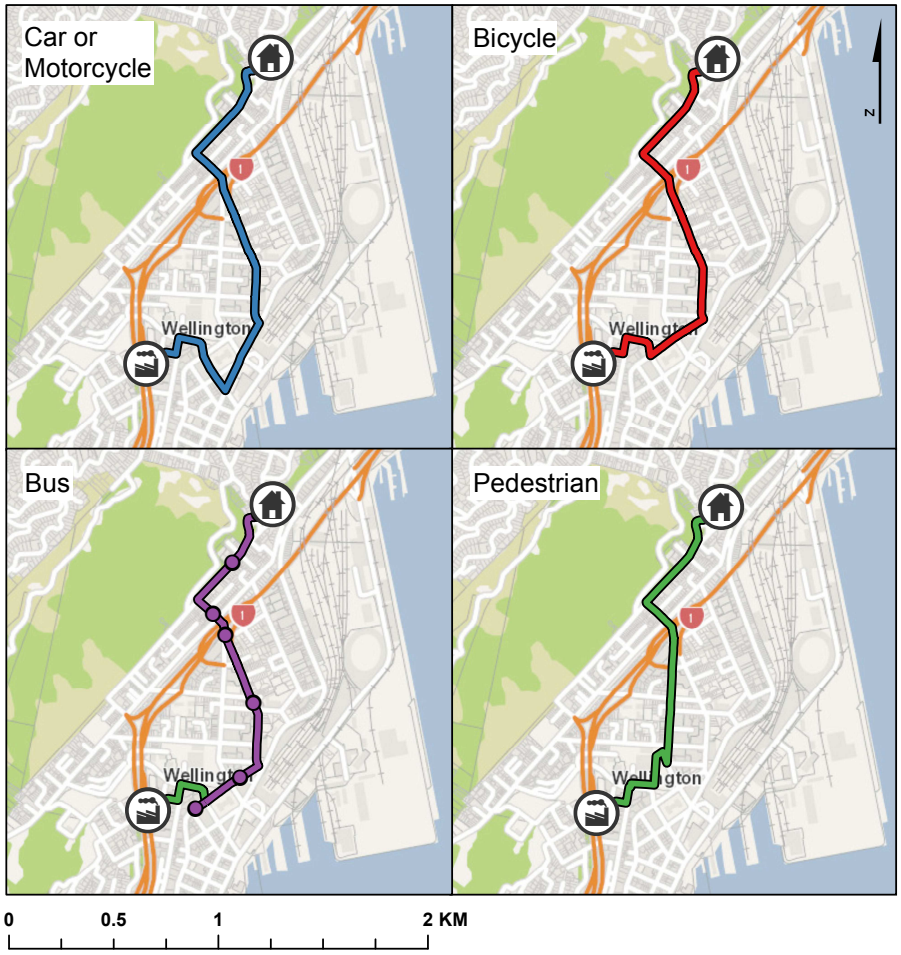
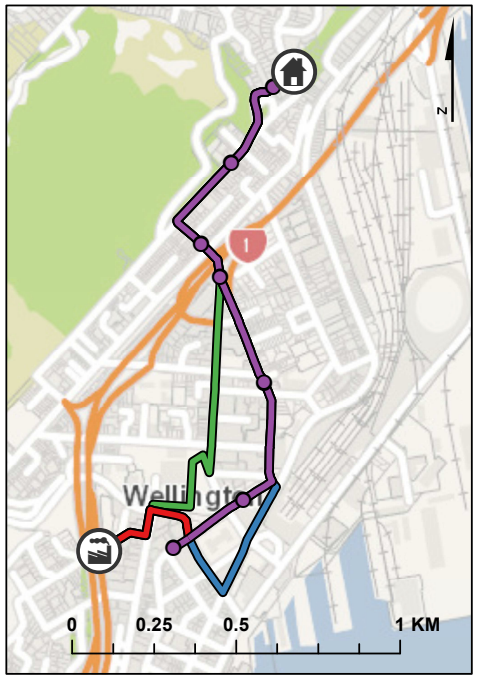
Commuting Modes





Bus
Pedestrian
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Bus stops
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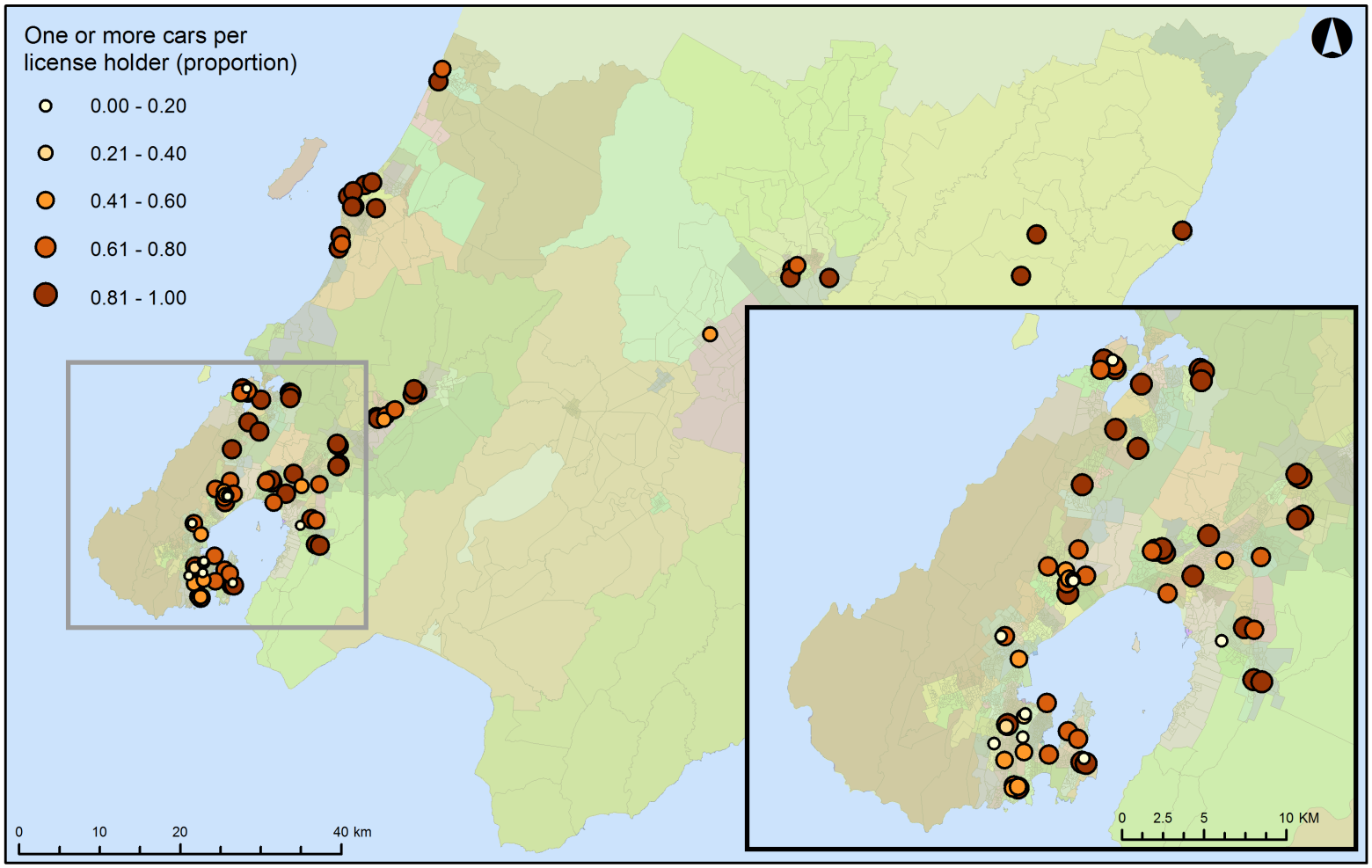
Discrete-Choice Logit Models

- Model individuals making a choice between alternatives.
- Individuals receive *utility* from different choices.
- Individuals make choices which give them the highest utility.
- Utility from a choice may be related to:
  - Characteristics of a choice (e.g. how long does it take to get to work if I walk?).
  - Characteristics of an individual (e.g. I am a year older).
  - Characteristics of an individual (e.g. I don't have a drivers licence, how does that affect my utility from driving?).

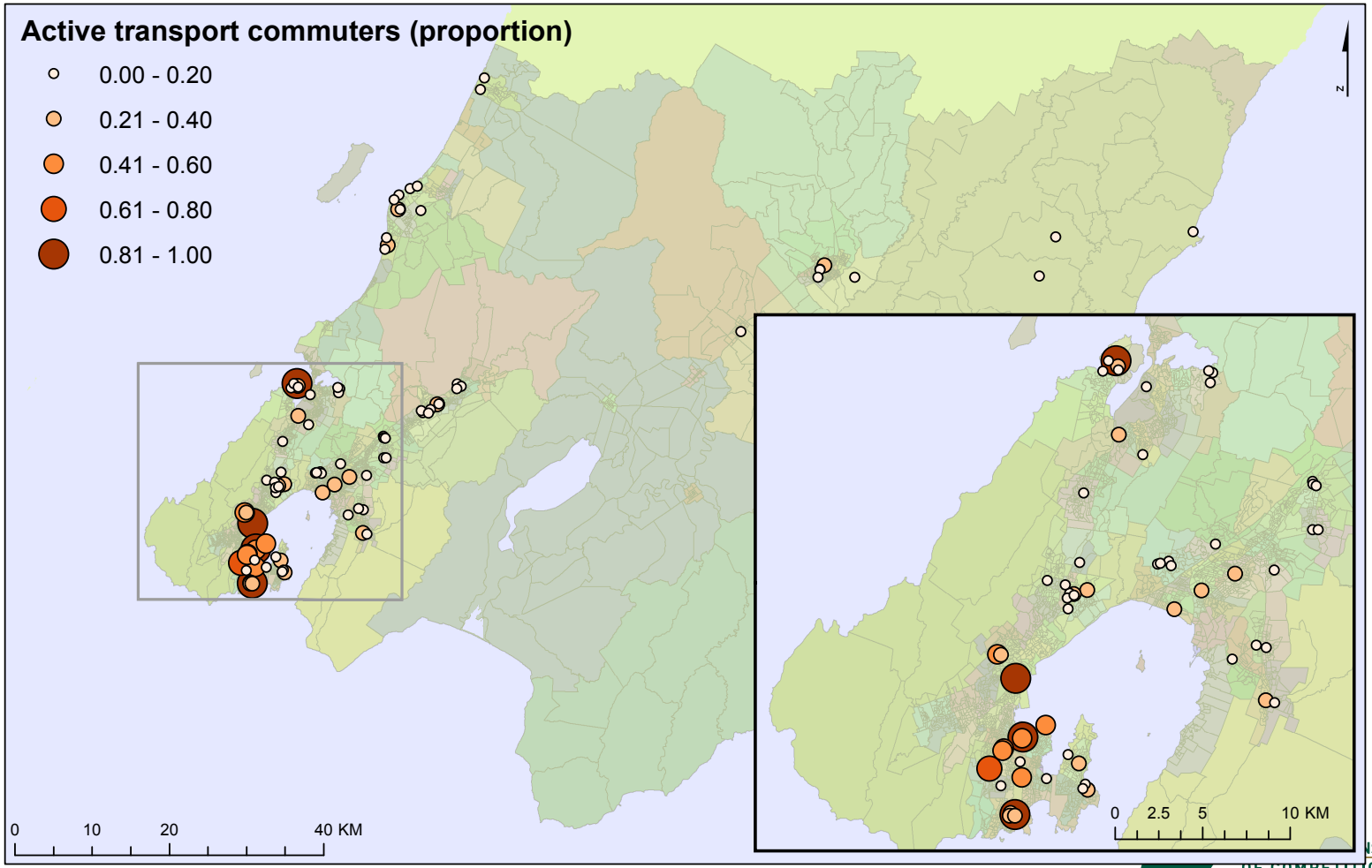
Discrete Choices

- Commuting mode:
  - Active Transport – Walking over short distances, cycling over longer distances (22.5 minute penalty on cycling).
  - Driving.
  - Public Transport – Walking to station *or* driving to station if station has park and ride (10 minute penalty for PT with driving).
- PT and AT modes had to be combined, since otherwise, our sample would have too few observations e.g. for cycling.
- Similarly, we had to combine numbers of cars, since there were few instances with zero cars.

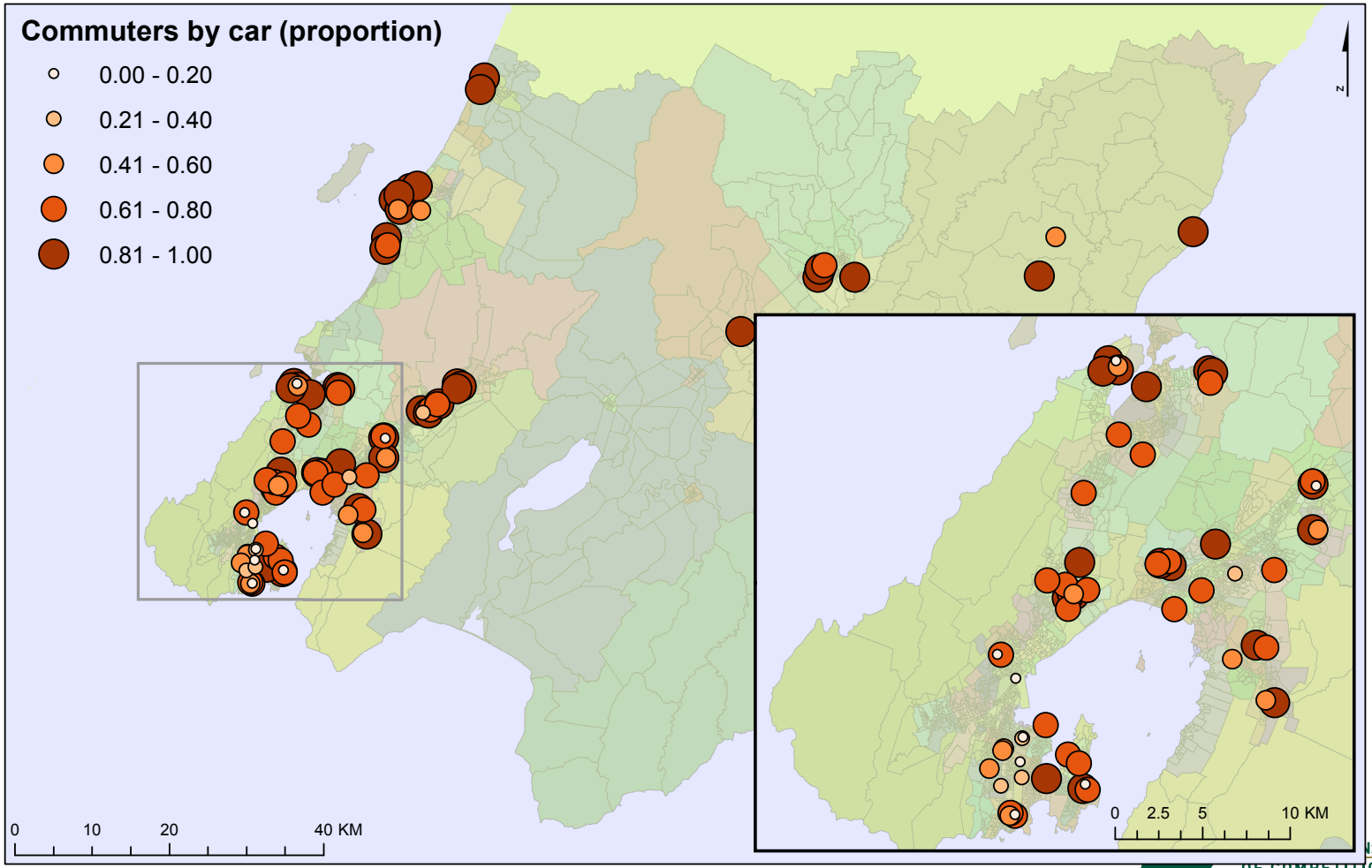
Household car ownership



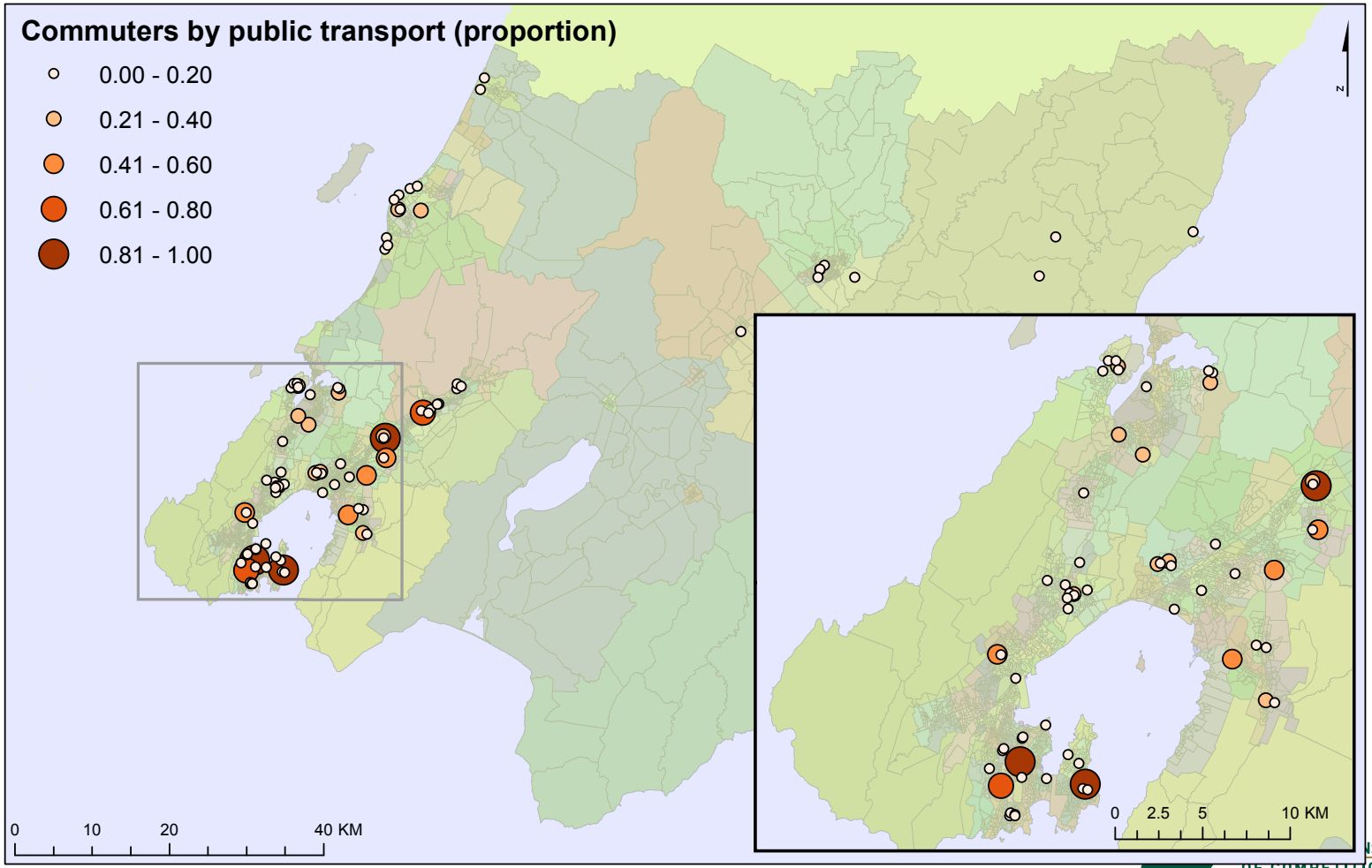
Participants who commute by active transport



Participants who commute by car



Participants who commute by public transport



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What variables are used in our analysis?

List of predictors:

- Alternative-specific variables:
  * *Time taken*: commuting time,
  * *Cost*: cost of commuting,
  * *Distance*: distance of commute,
- Alternative-invariant variables:
  * *Workers, Non-workers*: number of adults in the HH who do/do not have a main job,
  * *DT*: dummy variable ($= 1$ if work location is in the downtown),
  * *Sub 30 min walk*: dummy variable ($= 1$ if time taken to walk to work is less than 30 minutes).
  * *Income 100K+*: dummy variable ($= 1$ if income \$100 000 or more).
  * *Women*: dummy variable ($= 1$ if female).
  * *Single women*: dummy variable ($= 1$ if female living alone).
  * *No licence*: dummy variable ($= 1$ if person has no drivers licence).
  * *Age*: age of individual,

Regression Results

Variable	Coeff.	T-stat
Time taken	-0.057078	-5.5716
Time taken^2	7.2471e-05	2.2644
Cost	-0.025598	-4.0394
Distance	-0.00010238	-1.9979
Non workers * High	-0.30527	-3.3676
Workers * High	-0.43202	-4.3497
DT * Drive	-2.7233	-13.645
Sub 30 min walk *AT	1.3005	4.4017
Income 100K+ * Cost	0.007695	0.88764
Single Women * High * PT	-0.038886	-0.097077
Single Women * High * AT	0.91621	2.0676
Women * High * PT	0.69926	2.9714
Women * High * AT	0.42929	1.3882
No licence * Drive	-1.9952	-6.226
Const. (Low, Drive)	-0.28839	-0.47633
Const. (Low, PT)	-0.10019	-0.18154
Const. (High, AT)	-0.062689	-0.10089
Const. (High, Drive)	1.6618	2.7052
Const. (High, PT)	-0.87604	-1.4047
Age (Low, Drive)	0.02927	2.3056
Age (Low, PT)	-0.0019557	-0.13769
Age (High, AT)	0.015878	1.0875
Age (High, Drive)	0.040076	3.4696
Age (High, PT)	0.036056	2.608

Table: Discrete choice model

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Regression Results (contd.)

- Commute times are *very* important for individuals (but marginally less so for longer commutes).
- Working downtown is a disincentive to driving.
- Larger households have economies of scale in car ownership.
- Active transport is very popular for short (walkable) distances.
- Single women often own cars but don't use them to commute.
- Women will use PT even when a car is available (high, PT).
- Most people like (high, drive) combination.
- Older commuters more likely to choose (low, Drive), (high, PT) or (high, Drive).
- Not (as) important: number of children, income, ethnicity.

Methodology

- Consider the effects of commute times on property prices.
- Specifically: examine public transport travel times to Cuba Street & Manner's Mall.
- Control for a range of things that may affect prices:
  - Number of bedrooms.
  - Vintage of house.
  - Vegetation coverage (dense, sparse, none).

Results

Variable	Coeff.	T-stat
Inherent Home Value	$172,110.00	2.555
Each Weekday PT Service	$186.90	2.854
Each Weekend PT Service	-$183.82	-1.612
Additional minute to Cuba Mall(via PT)	-$6,708.30	-15.081
% point of no vegetation(Urban Retail Proxy)	-$129.71	-0.610
% Point of dense vegetation	$402.86	1.666
Each bedroom	$210,990.00	11.044
Meshblock Structure Age - 1890s	$80,055.00	1.896
Meshblock Structure Age - 1900s	-$31,622.00	-1.077
Meshblock Structure Age - 1910s	-$1,007.00	-0.032
Meshblock Structure Age - 1920s	-$22,491.00	-0.854
Meshblock Structure Age - 1930s	-$26,691.00	-0.955
Meshblock Structure Age - 1940s	-$108,670.00	-3.900
Meshblock Structure Age - 1950s	-$145,880.00	-5.531
Meshblock Structure Age - 1960s	-$141,100.00	-5.556
Meshblock Structure Age - 1970s	-$123,060.00	-4.603
Meshblock Structure Age - 1980s	-$126,170.00	-3.967
Meshblock Structure Age - 1990s	-$52,027.00	-1.536

Table: House values in Wellington City and Lower Hutt

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Results (contd.)

- People like:
  - Being close to downtown (as measured by commute times). Improving commute times improves house values.
  - Being on the city fringe (dense vegetation).
  - Very old houses *or* very new houses (but not old-ish houses).

Extensions: Modelling

- Currently working on the residential location decision.
  * Challenging, because choice set expands by $\simeq$ 200 area units the household could live in.
  * Currently have preliminary commute times, implementing choice model.

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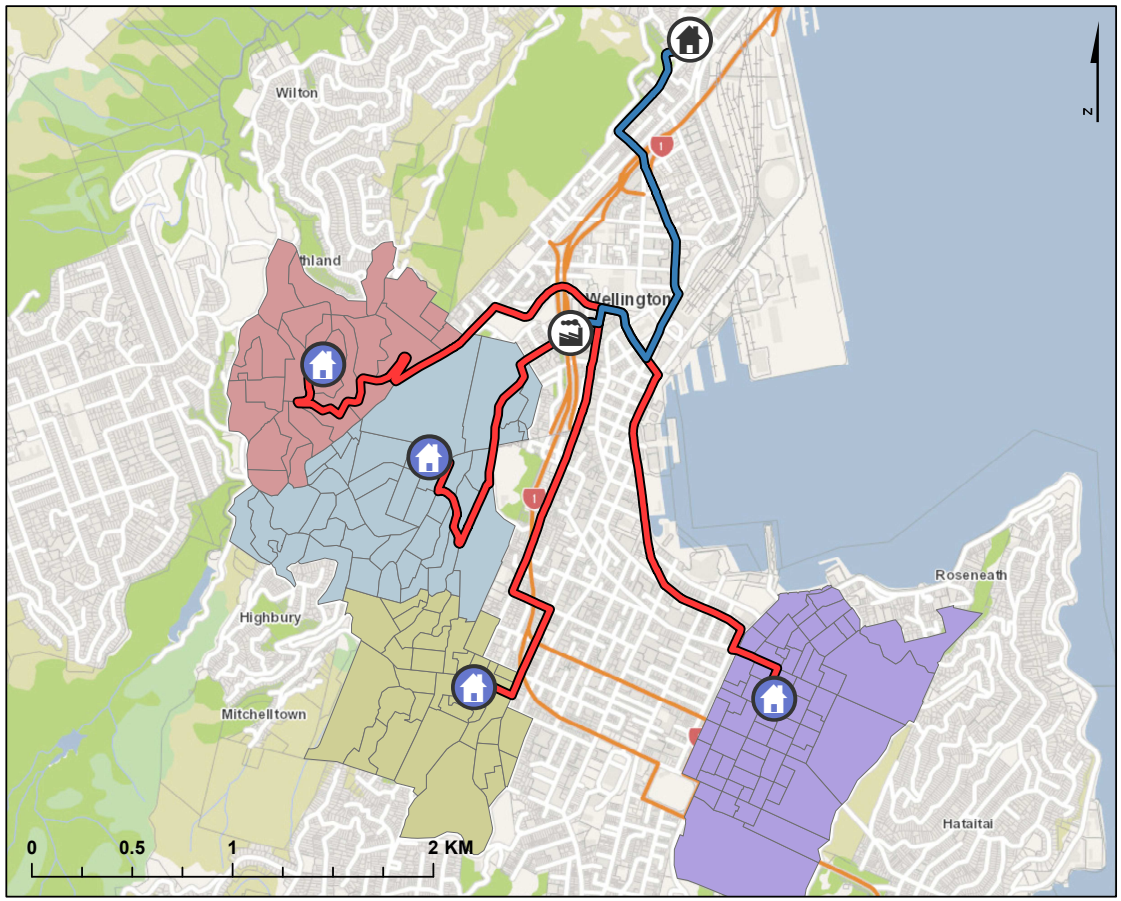
Alternative residential locations



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Extensions: Modelling (contd.)

- Breaking choice between individual and household.
  * e.g. individuals can commute by different modes, but household has common location/car ownership,
  * Update the model so the distribution of alternatives for individuals in the same HH can be combined to determine the HH car ownership level.

Extensions: Data

- Parking issues:
  * Currently controlled by a "Downtown Driving" variable.
  * Modelling parking accessibility?
- Travel issues:
  * Commute times are "optimistic" given rush-hour performance. Delays for intersections?
  * Data on actual top speeds during peak hours? Fuel efficiency?
  * Wait times for buses/trains?

Potential Applications

- How do changing commute times affect household mode choice?
  - Widening roads (improves driving) versus more frequent/faster public transport.
- How do petrol price changes affect car ownership/mode choice?

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