



Sustainability in 2040: How did we get there?

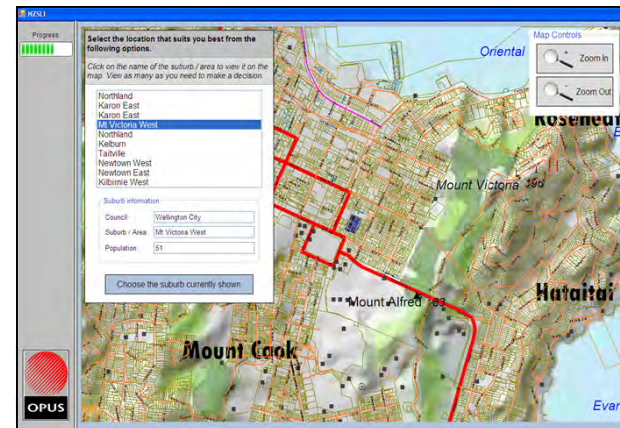
**Transport Energy and Urban Form:
Predicting future behaviour for a
low energy society**

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TEUF Residential Study Outline

1. Measuring existing settlement liveability
2. Developing realistic scenarios: CAPI methods
 - Research on residential densification (NZSLI)
3. Predicting Future Behaviour:
 - Transport Energy and Urban Form (TEUF)




Study 1: Evaluation of overseas scales of liveability

- Compared two scales of liveability in a sample of low, medium and high density areas in Auckland
 - Italian study
 - Perceived Residential Environmental Quality (PREQ)
 - American study
 - Perceived Environmental Quality Indices (PEQI)
- Attitudes to characteristics of an ideal neighbourhood including noise, accessibility, green areas, and recreational services.



Auckland sample results

Medium density	High density
vs low density: <ul style="list-style-type: none">• Better building volume• Better internal practicability• Better school services• Better commercial services	vs low density: <ul style="list-style-type: none">• Better external conditions• Better transport services
vs high density: <ul style="list-style-type: none">• Better security and tolerance• Better upkeep and care	vs medium density: <ul style="list-style-type: none">• Better perceived building aesthetics

- Low density did not rank significantly better on any scales
 - Medium density perceived as more satisfactory (not significant)
- 

Study 2: NZSLI

- NZ Settlement Liveability Index
 - Explored the effect of denser living scenarios on perceived home and neighbourhood liveability
 - 105 Lower Hutt home owners (67%) response rate
 - 2 key scenarios
 - Scenario 1: Home land area decrease (replacement home)
 - Scenario 2: Neighbourhood densification (neighbourhood shift)



Computer-Aided Personal Interview (CAPI)

- Why use this method?
 - Individualised participant scenarios
 - Deeper decision-making
 - Longer survey times, but less participant fatigue due to novel multimedia stimuli
 - Ability to integrate key database information
 - Census data
 - Household travel survey data



Use of mapping tools to establish key travel locations


NZSLI

Progress:

We now need you to find your house on this map of Wellington

Step 1: Use the map controls on the right to navigate around the map and find your house.


Step 2: When you have found your house, click and drag the picture of the house below onto your property.

 **Please ask for help if you are having trouble.**

Map Controls

- Zoom In
- Zoom Out
- Move

You can also zoom-in on a particular spot by clicking directly on the map

 Quick Zoom

[Start this page again](#)

OPUS

Rona Bay

Use of personalised scenarios: Based on GIS data

Now we need to check a few details about your house information:


Using freely available Land Information New Zealand (LINZ) data, the following information was found about your house:


Capital Value: \$ Land area: sq. metres

If these are not correct, or you do not believe they are accurate, please use the controls below to adjust the values until they are correct.

\$ sq. metres


<input type="button" value="- \$1,000"/>	<input type="button" value="+ \$1,000"/>	<input type="button" value="- 1"/>	<input type="button" value="+ 1"/>
<input type="button" value="- \$10,000"/>	<input type="button" value="+ \$10,000"/>	<input type="button" value="- 10"/>	<input type="button" value="+ 10"/>
<input type="button" value="- \$100,000"/>	<input type="button" value="+ \$100,000"/>	<input type="button" value="- 100"/>	<input type="button" value="+ 100"/>

 Click here when your details are correct



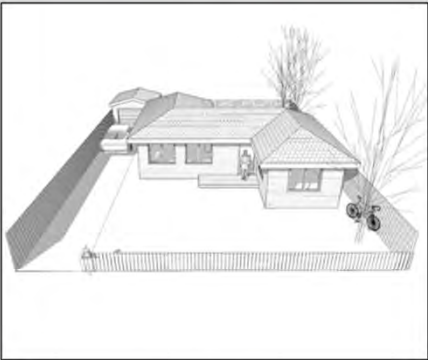
Tailored home information for greater realism

NZSLI


Progress: 

Now we need to find out what sort of home you live in.

Find the closest match to your house using the controls below to change the type and size of your building.
We realise the building may not look exactly like yours, the closest approximation is fine.



2-3 Bedrooms



Section area: 350 square metres

Change building type

Apartment Terrace

Flat House

Colonial house


Adjust building size


My building is larger

Adjust section size

My section is smaller

My section is larger

Click continue when you are done. 



Scenario 1: Dislike of home densification

Home characteristic	Baseline		Densified		<i>t</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Size of home	8.57	2.22	6.14	3.28	7.10***
Space for possessions	8.38	2.06	5.89	3.27	7.78***
Ease of entertaining people	6.75	2.37	3.80	2.28	11.08***
Layout for lifestyle	7.09	2.21	3.80	2.36	11.12***
Size of lounge	8.32	2.23	6.89	3.01	4.52***
Distance to neighbours	7.44	2.61	3.80	3.18	11.07***
Size of outdoor living area	8.33	2.57	4.06	3.30	10.81***
Noise from neighbours	6.63	2.41	3.15	2.08	12.52***
Car parking on-road	5.99	3.22	2.89	2.59	11.00***
Privacy	6.65	2.37	2.70	2.04	15.61***
Need for additional room	6.79	2.99	4.57	3.19	6.46***
Overall Scale ^a	74.59	13.47	44.56	21.00	15.18***

Note: Items in bold are reverse scored; Overall scale does not include item "car parking on road"; * $p < .05$, ** $p < .01$, *** $p < .001$

- Older home owners and those with larger homes have relatively fewer barriers to home densification



Scenario 2: Neighbourhood densification and access

- Reduced access to key locations (e.g. work) and infrastructure (e.g. public transport, shops)

Changes in perceived liveability from actual home to location to chosen replacement neighbourhood

Neighbourhood characteristic	Baseline		Replacement		t (105)
	M	SD	M	SD	
Neighbourhood restricts lifestyle	1.89	0.62	2.66	1.07	-6.29 ***
Public transport poor	1.88	0.90	2.42	0.83	-4.87 ***
No peace and quiet	2.13	0.82	2.48	0.73	-3.16 **
Neighbourhood overpriced	2.91	0.79	3.13	0.73	-2.60 *
Buildings too tall	2.12	0.64	2.25	0.65	-1.60
Presence of graffiti and unpleasantness	2.67	1.06	2.73	0.93	-0.50
Little space between buildings	2.96	1.06	2.90	1.02	0.53
Occasionally see undesirable people	3.08	1.02	3.00	0.85	0.67
Residents look after neighbourhood	3.75	0.74	3.68	0.70	0.80
Buildings pleasant to look at	2.54	0.91	2.42	0.81	1.14
On-street parking readily available	3.34	1.30	3.08	1.06	1.58
Schools good reputation	3.74	0.82	3.54	0.68	2.02 *
CBD easily reached	4.24	0.58	3.55	1.01	5.92 ***
Anything found in local shops	3.98	0.78	3.36	0.96	6.54 ***
Convenient access to main activity	4.35	0.55	3.43	1.10	7.63 ***

Note: * $p < .05$. ** $p < .01$. *** $p < .001$; 1 = Strongly disagree, 5 = Strongly agree

Scenario 2: Neighbourhood densification and optimisation

- People already optimise their actual house location based on factors such as accessibility and transport (shortest path routines)

Descriptive statistics for distances via road between actual, replacement and ideal homes and key destinations

Destination type	Distance (km)					
	Actual		Replacement		Ideal	
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>
Main activity	6.84	7.14	16.07	15.18	13.21	11.44
Partner's main activity	4.48	5.41	15.79	15.26	12.2	11.69
Other activity	5.22	7.44	16.04	15.27	12.01	12.01



Scenario 2: Neighbourhood densification and social factors

- People may trade closer travel distances to maintain safe, friendly, clean neighbourhood environments

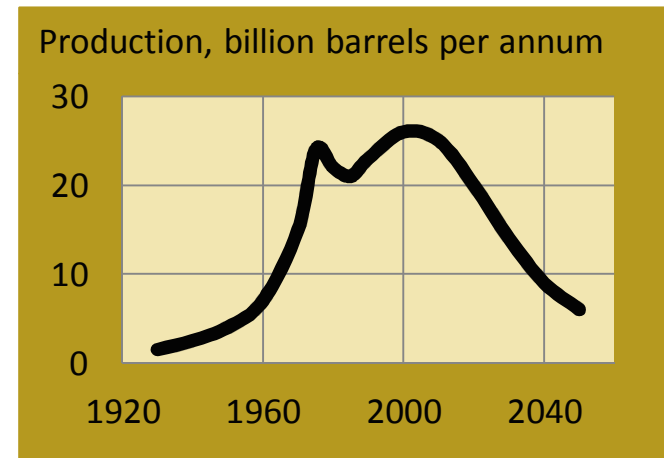
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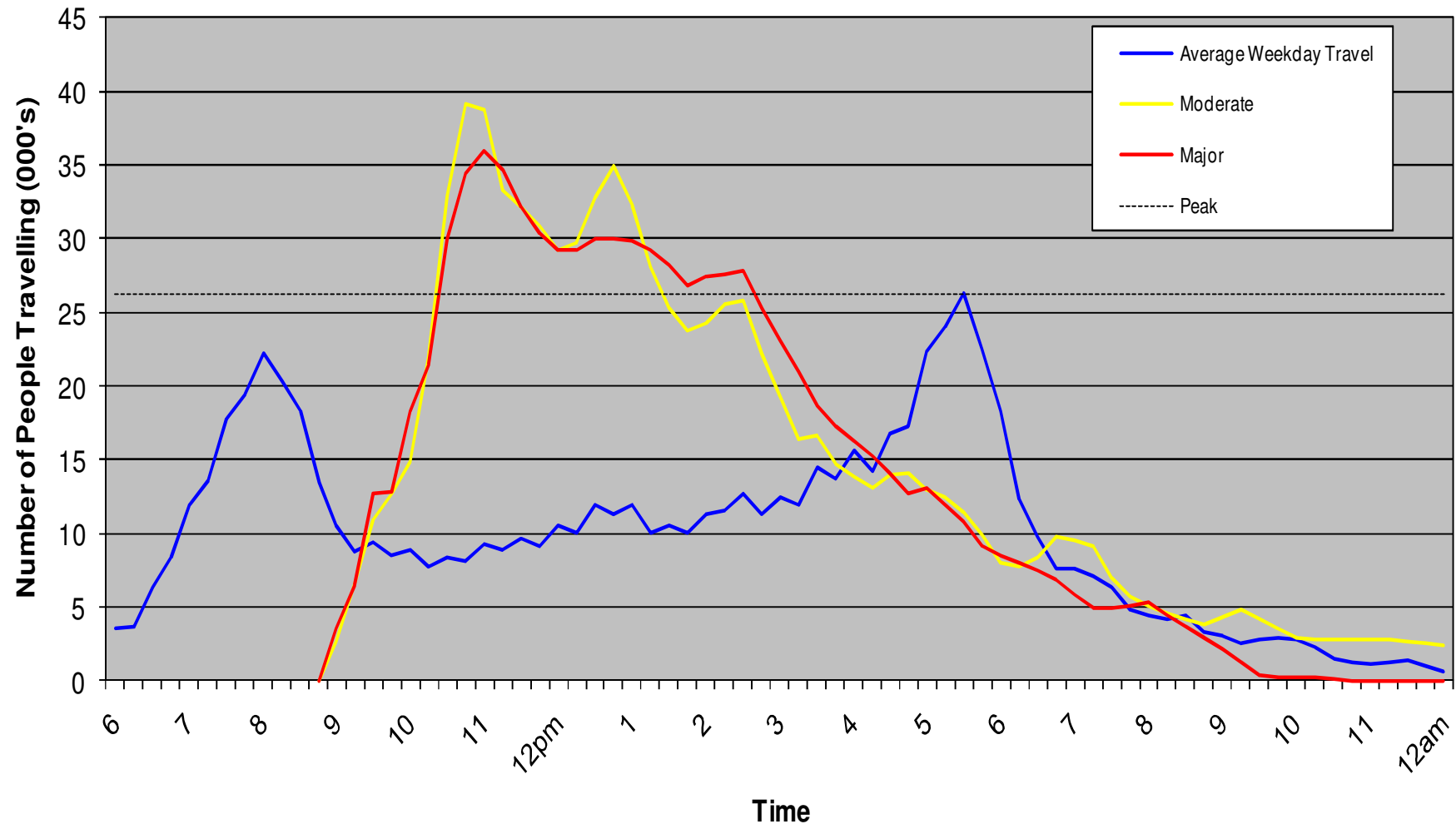
Study 3: Transport Energy and Urban Form

- How will our cities alter in response to changes in transport and transport energy?
- Ambitious experimental scenarios:
 - An increase in transport costs (“Peak oil” scenario)
 - Increased public transport network functionality
 - Forced change to denser settlement form
- Will urban densification become more acceptable under these scenarios?



Background: Predicting future behaviour

- How do we examine post-disaster travel behaviour?



Background: Predicting future behaviour

Successful validation of behaviour

- Simulation validation with 2007 Gisborne earthquake – validated travel behaviour findings
- 2011 Christchurch earthquake – large congestion issues and travel times of 3-4 times longer immediately after the quake

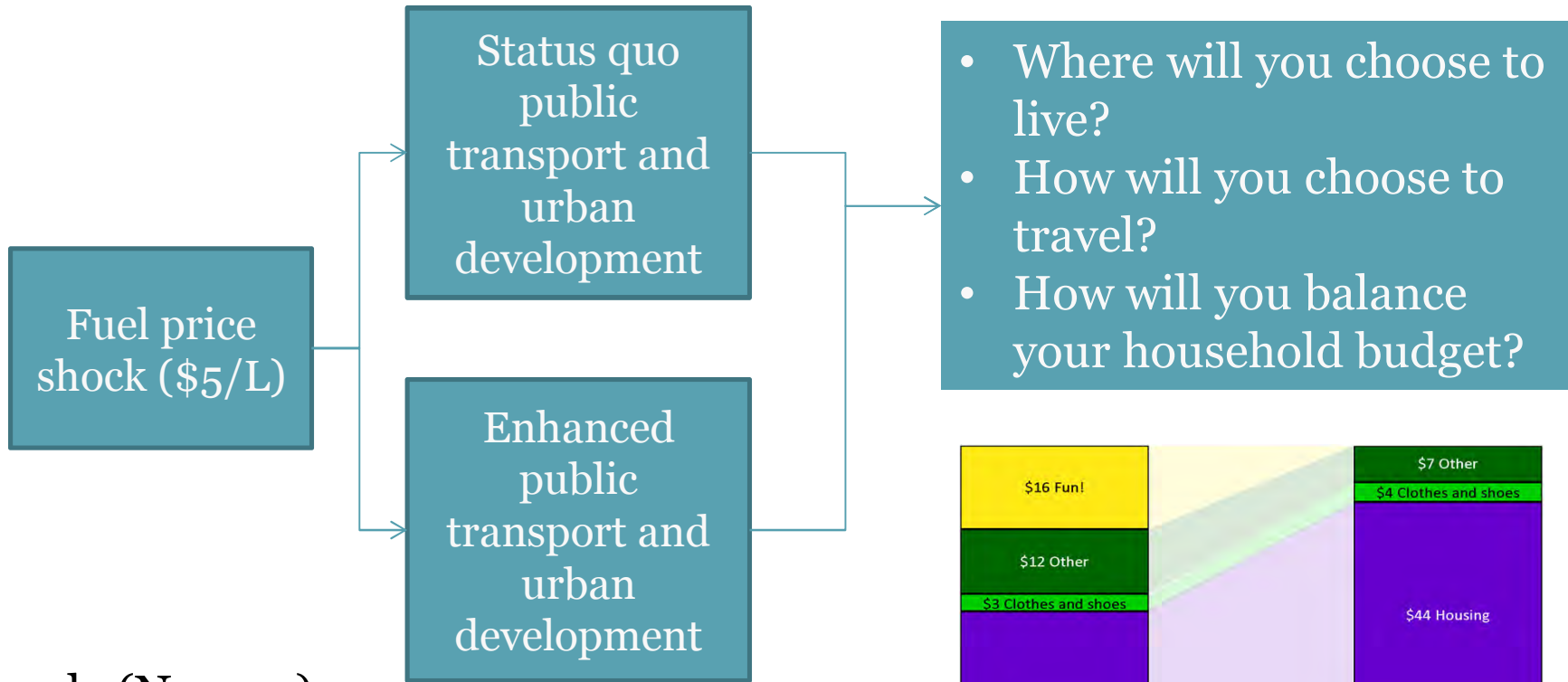


Benefits

- Allows for future rather than extrapolation from retrospective scenarios
- Exposure compensation



TEUF method



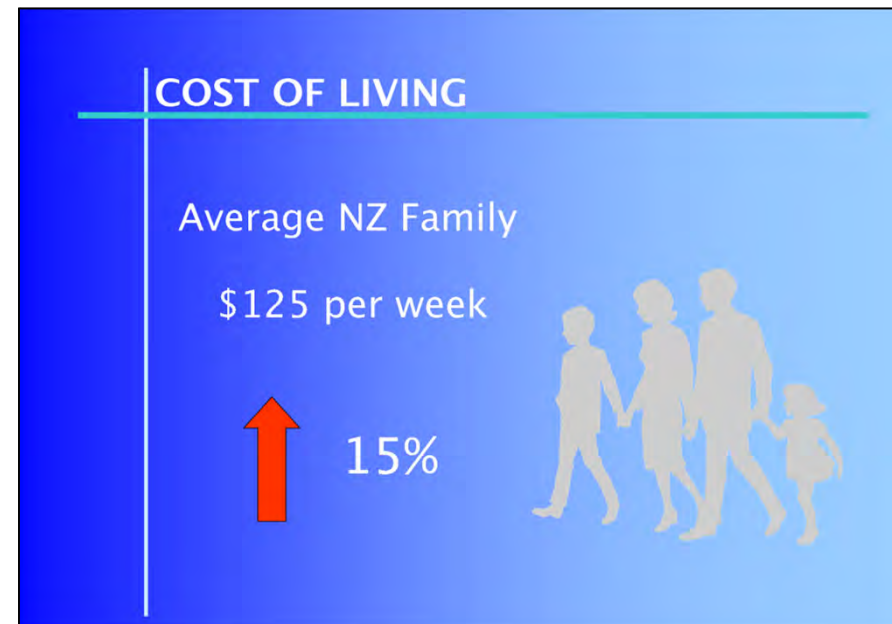
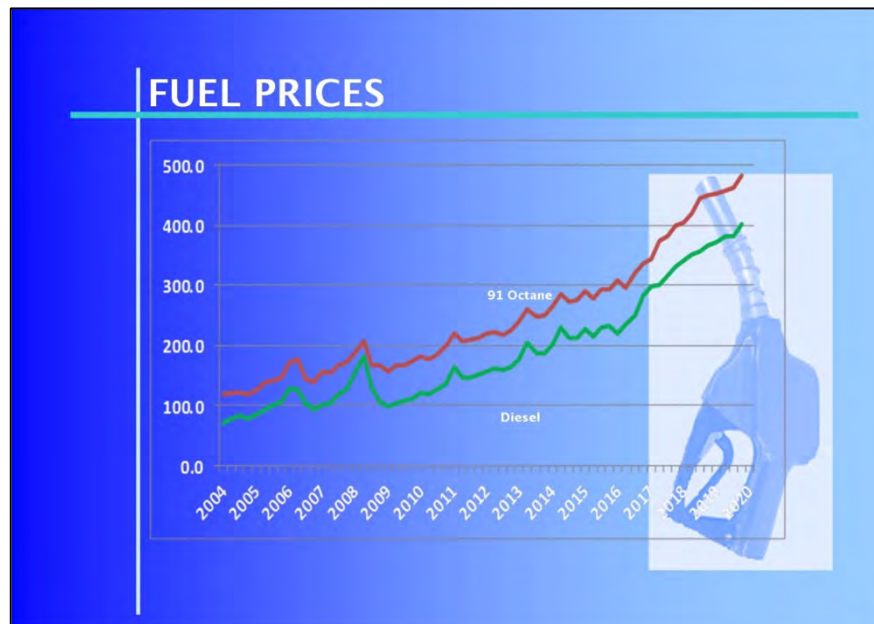
Sample (N = 141)

- Gender = 47.5% female
- Mean Age = 48.5 years
- Ethnicity = 84% European
- Employment = 83% full-time
- Mean household income = \$102,678



Fuel shock scenario

- News footage of continuing increases – now \$5/L
- Effects on the economy
- Interviews with the general public
- Shifts in behaviour

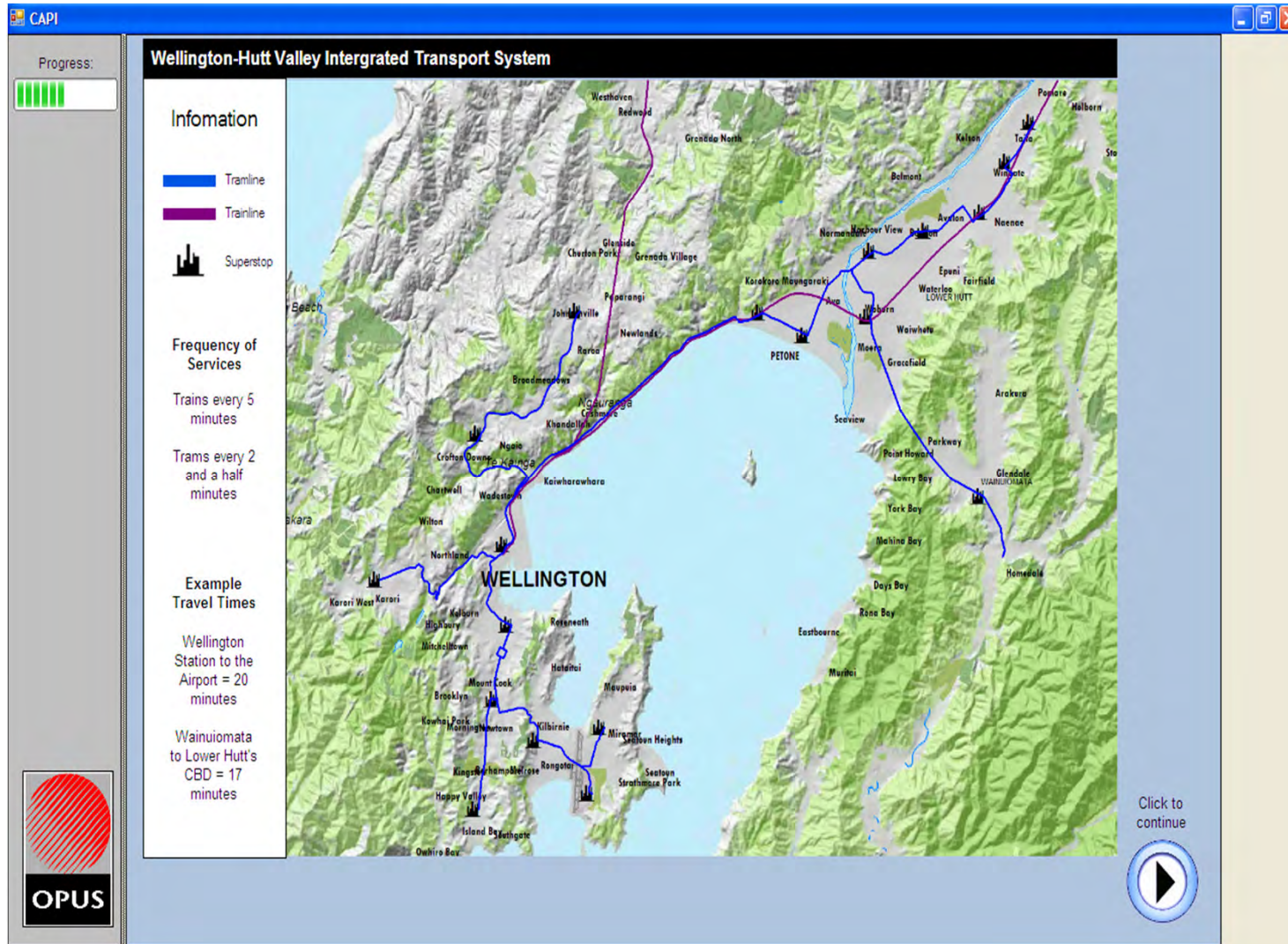


Enhanced public transport

- Animations of a new public transport system in the city
- Included trains, trams and buses and their running times
- Integrated ticketing



Enhanced public transport



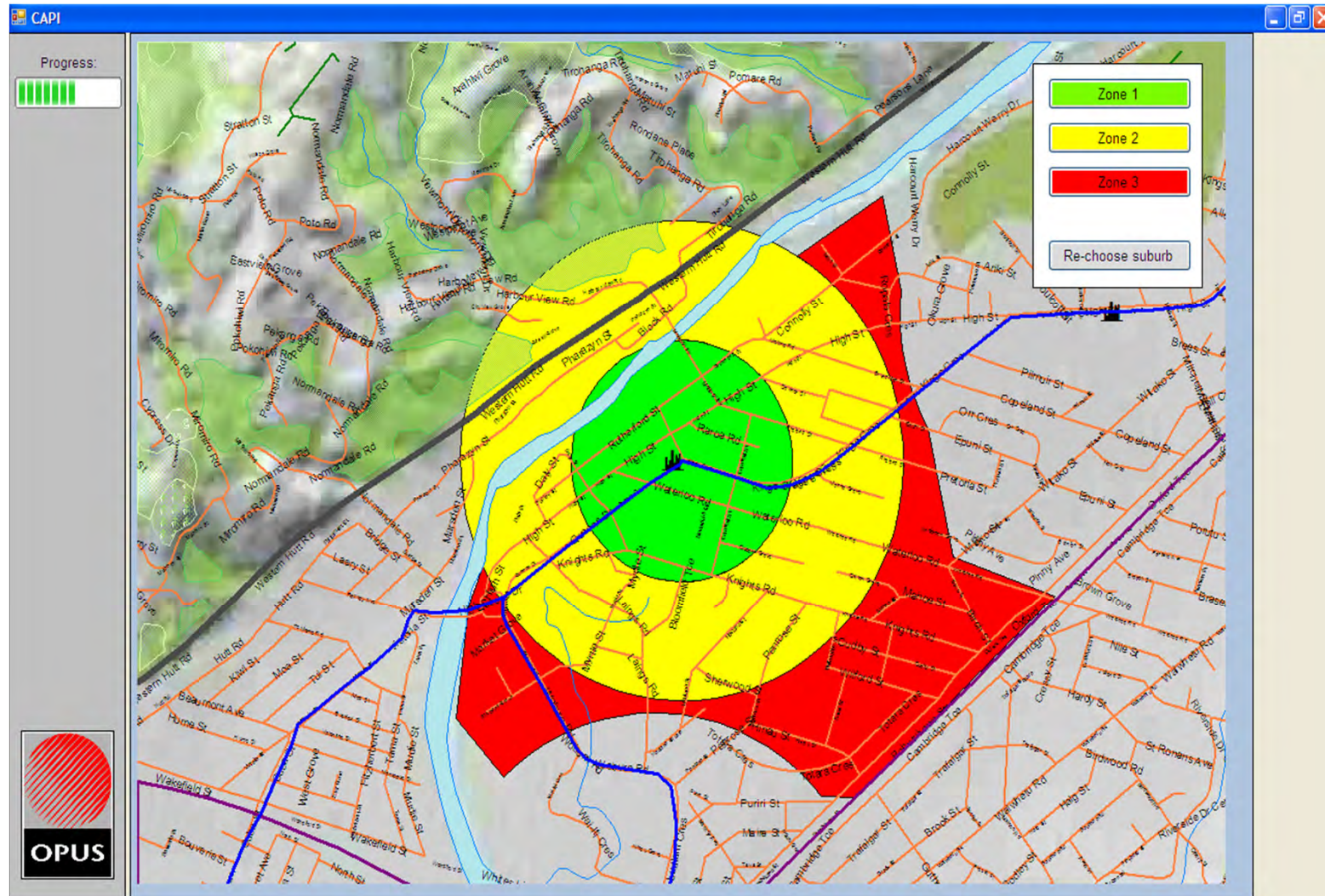
Bus Feeders –
Every 15 Mins
Light Rail –
Every 5 Mins

Average Wait for
Bus = 7.5 Mins
Average Wait for
Tram = 2.5 Mins

Airport to Railway
Station in 20
minutes



Transit oriented design around “Superstops”



Zone 3: Detached houses on subdivided sections (Infill)

- Superstop 7-8 minute bus ride; 50% of footprint
- High private vehicle ownership and use



Zone 2: Townhouse and terraced housing

- Superstop 7-8 minute walk; 40% of footprint
- Tram and bus available



Zone 1: Apartment blocks and divided houses

- Superstop 2-3 minute walk; 20% of footprint
- Train, tram and bus available



Key Findings:

How do people adjust to the fuel shock?

Are people willing to shift to public transport?

- 15% shift of total trips to PT after fuel shock
- Increased PT uptake for all trip types
- Including recreational trips


Are people willing to reduce Car Reliance?

- Living by PT alone almost doubles: 5% -> 9.2%
- Reduction in number of cars per household, with 1 in 5 households decreasing the number of cars
 - Applied to Auckland: Effectively this would reduce the number of cars by 100,000



Willingness to do other common fuel-saving behaviours

Other behavioural adaptations	% Agree
Drive more fuel efficiently	70.7
Increase walking/cycling	70.3
Change vehicle (e.g. alternative fuel)	64.5
Shop closer	53.6
Social activities closer	51.1
Car pool	38.4
Recreate closer	38.0
Work from home	32.8
Children to closer school	25.0
Work closer	13.1



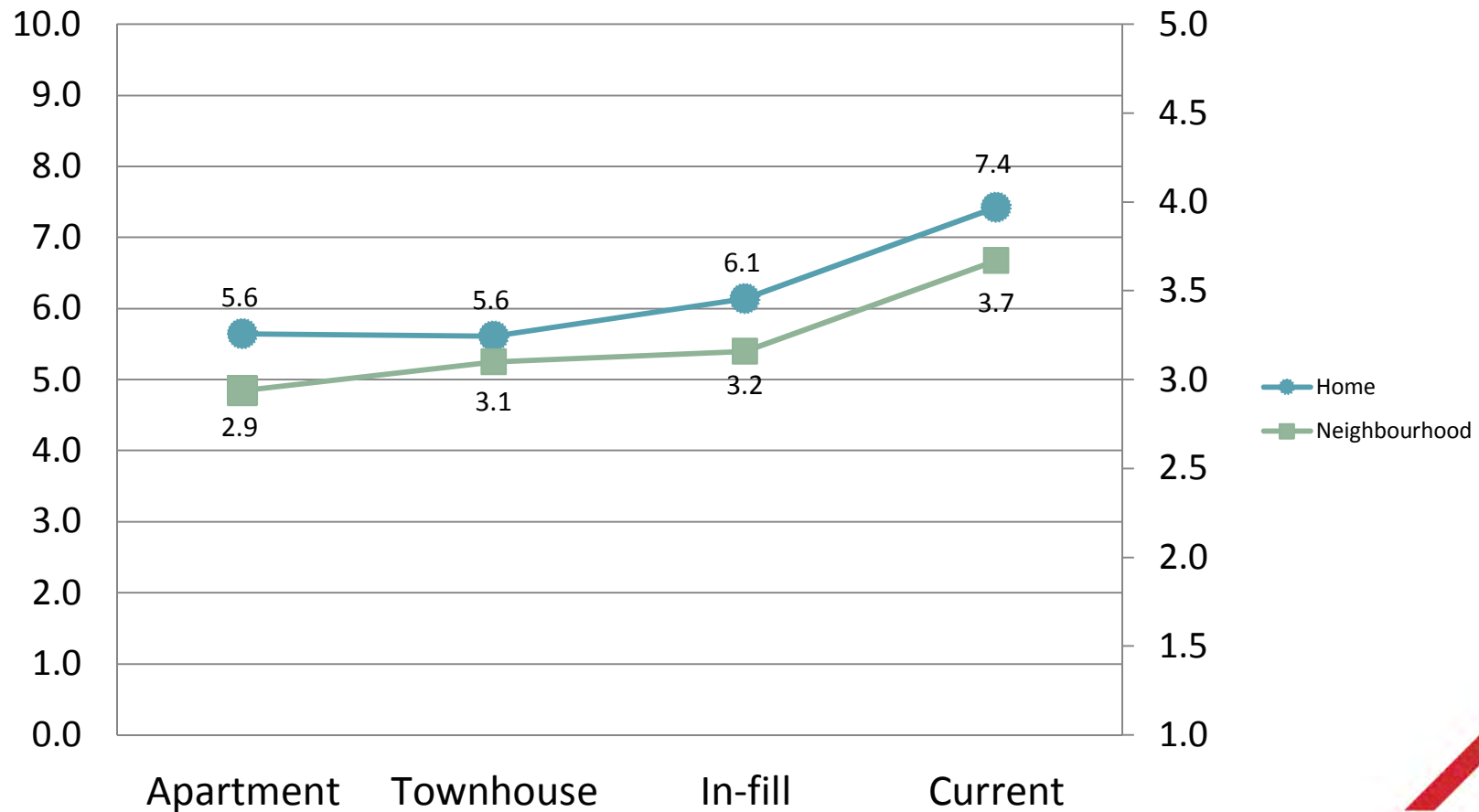
How do people re-adjust?

- Average household budget increase of about 12%
- Large behavioural response based on fuel shock:
 1. Significant reduction in transport operating costs (e.g. increase of PT trips by 15%)
 2. Reduction in household mortgage/rent (living denser)
 3. Able to maintain entertainment/savings


Cost Type	Baseline		Future Shock Scenario		Adjusted Future		Reduction
	\$	%	\$	%	\$	%	%
Transport Operating	88.91	6.3%	219.81	15.5%	146.73	10.4%	-5.2%
Transport Purchase	22.00	1.6%	16.78	1.2%	16.78	1.2%	0.0%
Household Purchase	292.06	20.7%	298.14	21.1%	230.79	16.3%	-4.8%
Household Operating	285.17	20.2%	290.29	20.5%	279.08	19.7%	-0.8%
Food	242.46	17.2%	257.88	18.2%	257.23	18.2%	0.0%
Education/Health	60.64	4.3%	62.47	4.4%	68.85	4.9%	0.5%
Clothes	59.75	4.2%	58.48	4.1%	60.74	4.3%	0.2%
Entertainment/Savings	362.75	25.7%	367.91	26.0%	353.55	25.0%	-1.0%
Total	1413.75	100.0%	1586.63	112.2%	1413.75	100.0%	-12.2%

Acceptance of denser living

Home and Neighbourhood Liveability by Current and New location



If you build it will they come?

- People were relatively insensitive to the enhanced PT scenario (e.g. perceived liveability)
 - Do people simply not value enhanced PT?
 - No...Regular PT Commuters are more confident in reducing their car ownership in the enhanced PT scenario
 - Also...Better adaptation in the PT Enhanced Scenario: Significantly reducing their costs and offsetting the need to reduce their Recreation/Savings money
 - Insensitivity could be for several reasons...
 - People were more focussed on economic drivers
 - Base knowledge of existing PT is low
 - Scenarios were not rich enough in detail
 - High ratings of existing PT in Wellington sample, may work better elsewhere
- 

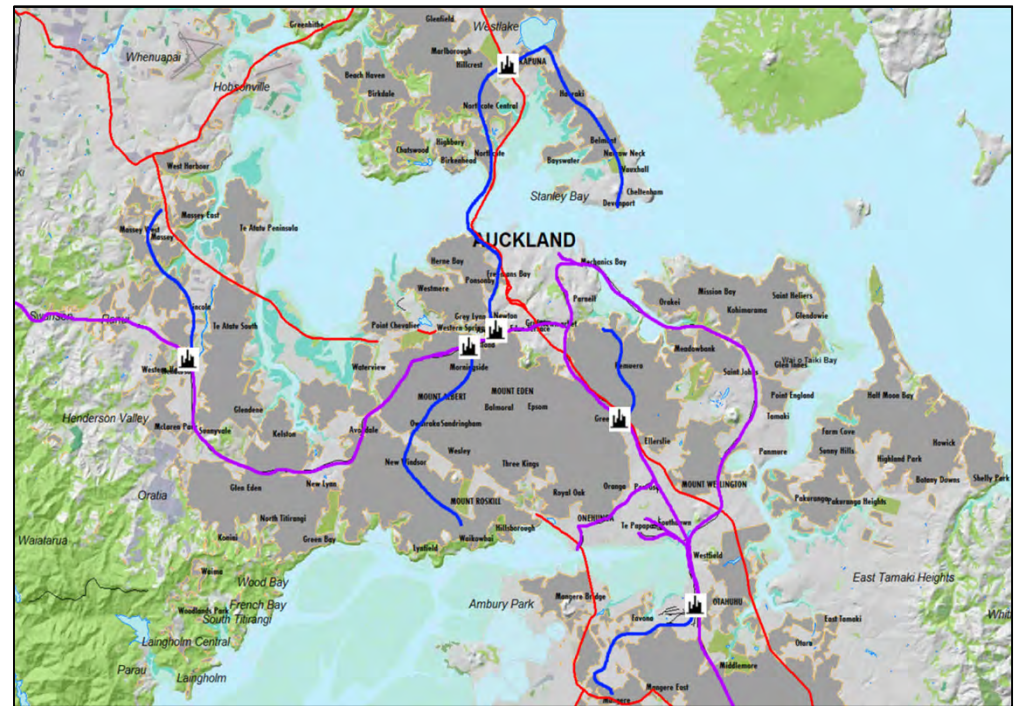
Who is resilient to a “shock”?

- Who was better able to retain their Entertainment/Savings on their household budget?
 - Those in the PT enhanced scenario
 - The high decile group
- Perceived liveability was not influenced by decile group
 - Except baseline/current home liveability, which was lower for the medium decile compared with the high decile group



Summary

- A “shock” that makes the car more difficult does encourage shift to PT
- In-fill types of housing are more acceptable
- People will adjust to lower energy living when it is the rational choice
- CAPI provides a method to test what we want from our cities in the future
 - Delivers realistic scenarios
 - Measures trade-offs
 - Effective economic tool



Ease of Application to Auckland?