The development of demand responsive transport service for older people in NZ rural areas: Preliminary Case Study in Thames

Chan Kim / MSc, PhD
Waikato Institute of Technology

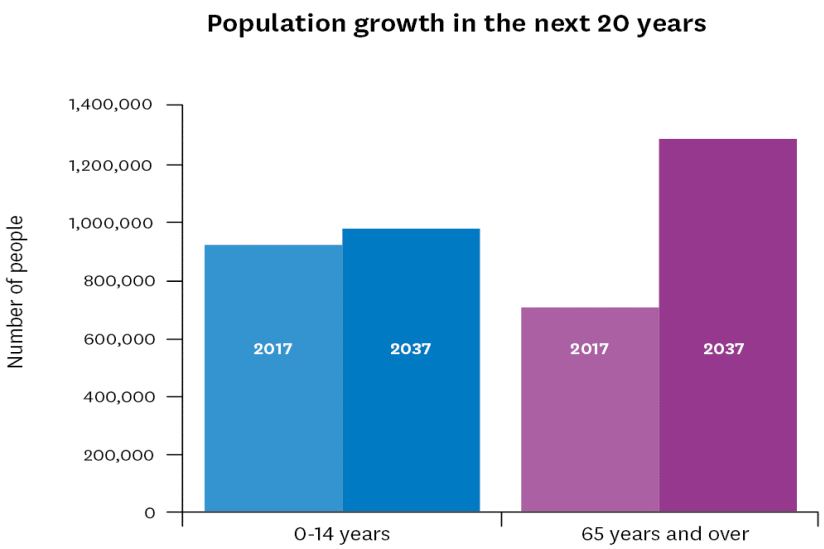
Wintec
WAIKATO INSTITUTE OF TECHNOLOGY
Te Kuratini o Waikato

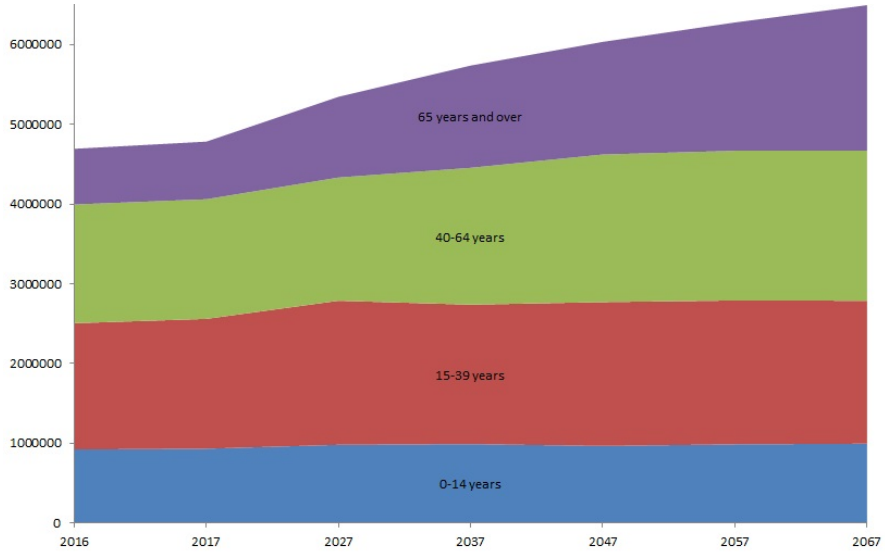
Introduction

- Research Background:
  - Trend of elderly population in NZ
  - Travel behavior (Modal share and trip purpose)
- Demand Responsive Transport Service
- Case Study: Thames, Waikato
  - Survey method and sample
  - Analysis
- Conclusion & Research Direction

Wintec
WAIKATO INSTITUTE OF TECHNOLOGY
Te Kuratini o Waikato

Background
Trend of Elderly Population in NZ





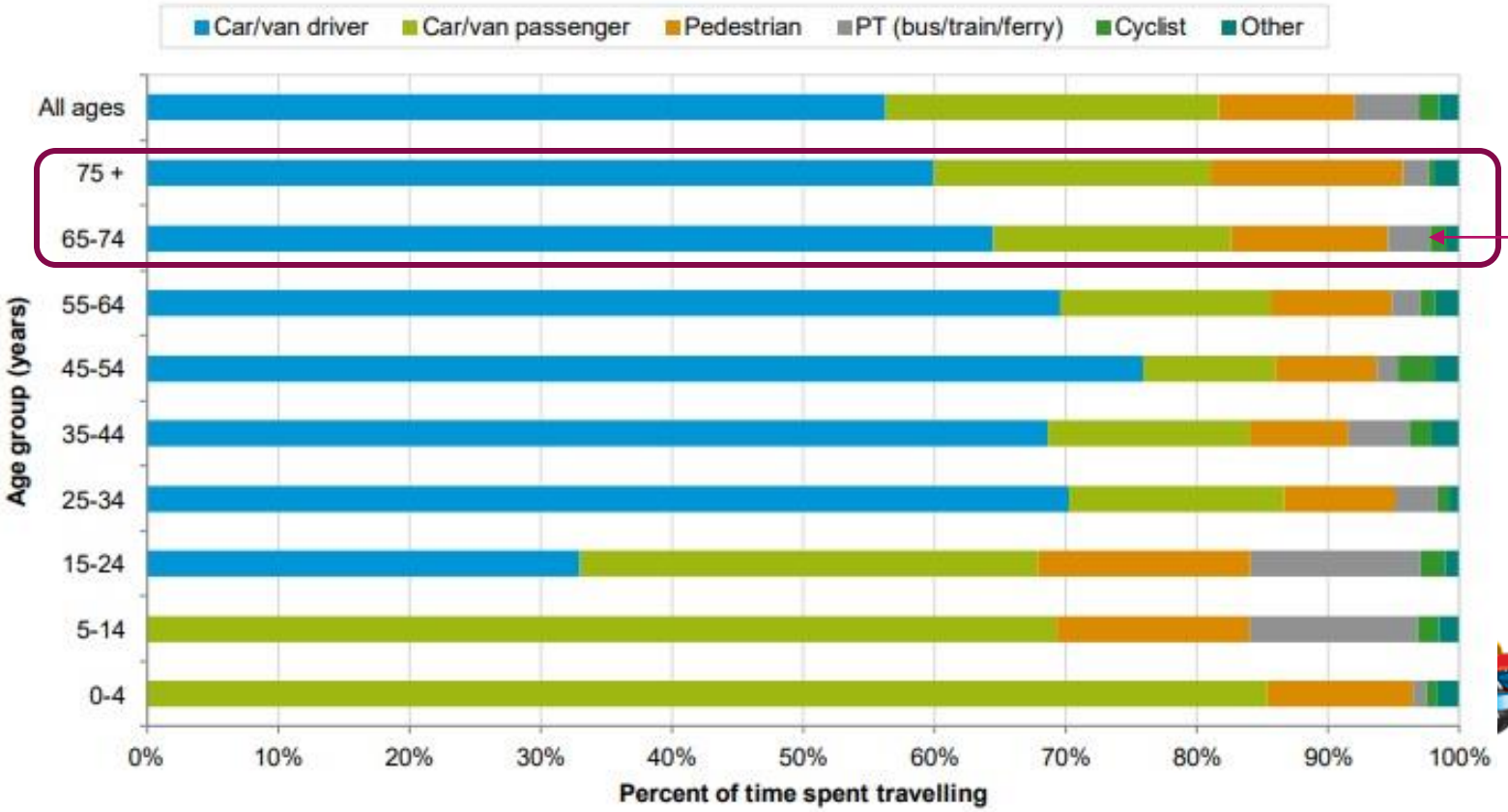
- The number of people aged 65 and over is **increasing**
- At the June of 2018, **747k people** were aged 65-plus
- Those aged 65 years and older will roughly **double** in 2046 with 1.3 - 1.5 million
- Or **23 %** of the total population, up from 12 % in 2016.

(Source: Stats NZ, 2018)

Wintec
WAIKATO INSTITUTE OF TECHNOLOGY
Te Kuratini o Waikato

Background
Travel Behavior: Modal Share

- Driving **declines** to around 60-65 percent of mode share and walking and passenger mode share time **increases**



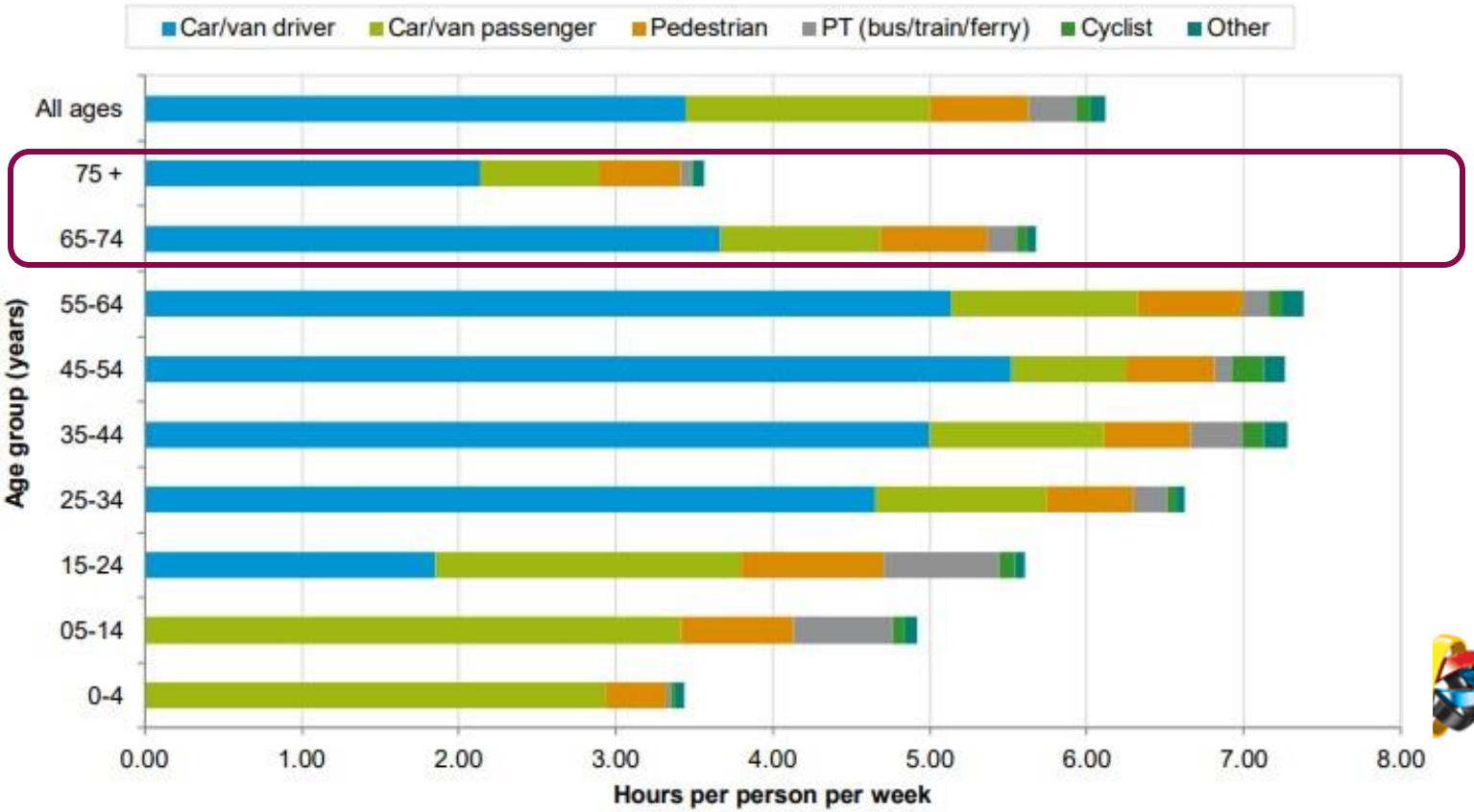
Use of PT increases (Age 65-74)

Source: MoT (2017)

Wintec
WAIKATO INSTITUTE OF TECHNOLOGY
Te Kuratini o Waikato

Background
Travel Behavior: Time Spent Travelling

- After age 65, the number of hours travelled per week **drops** dramatically

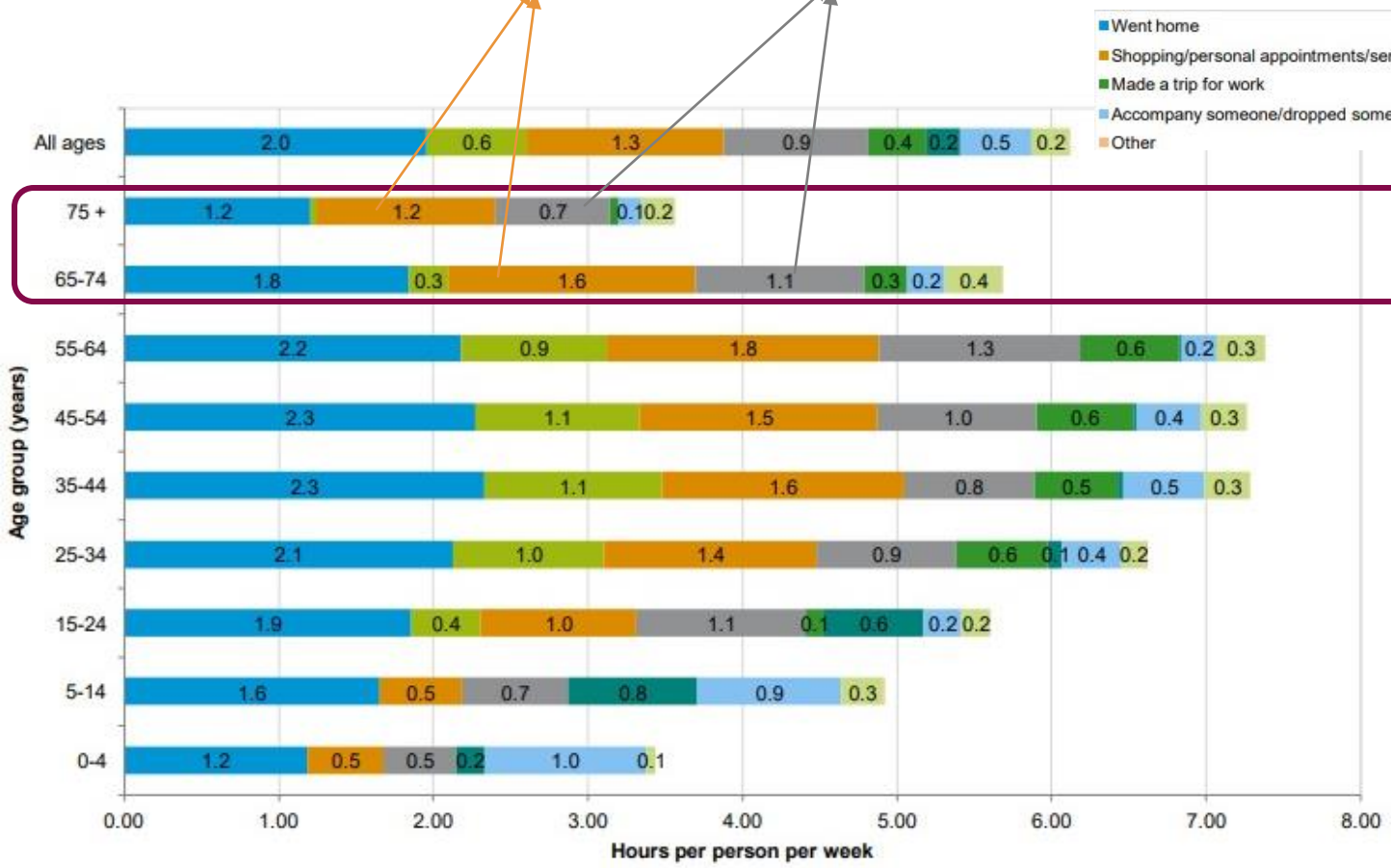


Source:
MoT (2017)

Wintec
WAIKATO INSTITUTE OF TECHNOLOGY
Te Kuratini o Waikato

Background
Travel Behavior: Trip Purpose

- Trip Purpose: **Shopping** and **Social** trips are **major components** of trip



Source:
MoT (2017)

Wintec
WAIKATO INSTITUTE OF TECHNOLOGY
Te Kuratini o Waikato

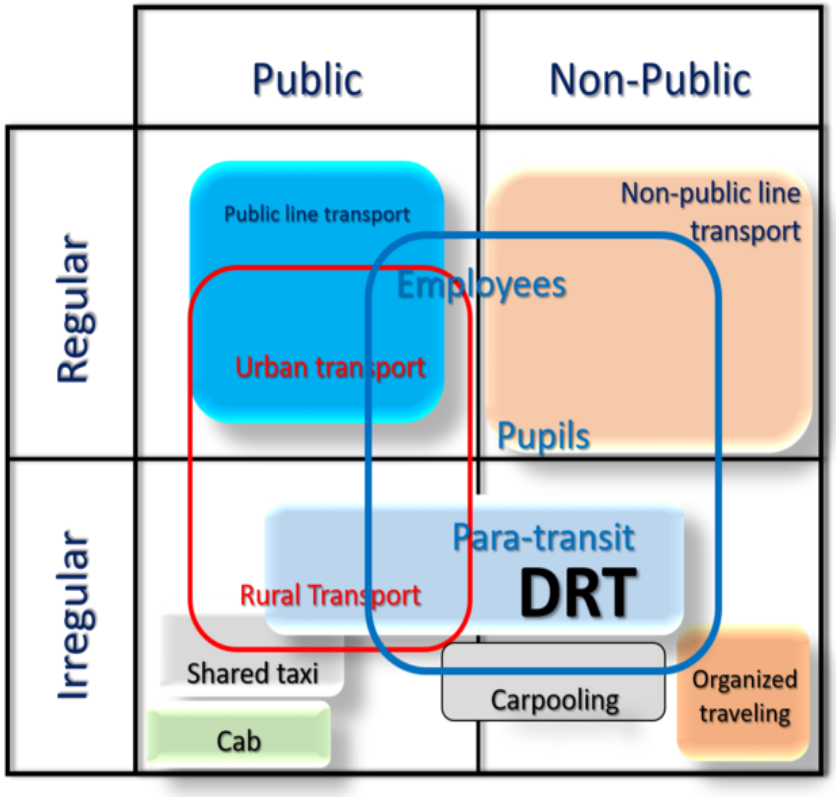
Demand Responsive Transport Service (DRTS) (aka, demand responsive transit)

- **Flexible routing** and **scheduling**, **Small or medium vehicles** (shared-ride mode), **Door-to-door** (pick-up and drop-off location)
- Provide a PT service for areas of **low passenger demand**, **special needs** passengers
- May fully **funded** or partially funded
  - U.S.: 1500 rural + 400 urban system
  - Switzerland: Publicar – operated in sparse populated areas (under 100 person/km^2)
  - U.K.: pick up at 'meeting point'
  - And many countries including, Australia, Canada, japan, etc.
  - In NZ, available in Katikati and Te Aroha (aka., Community vans)

Source: Elder Transportation Service
https://eldertransportaustin.com/demandresponsetransport/

Demand Responsive Transport Service (DRTS)

- **Mass Transport** Service: Transport Categories

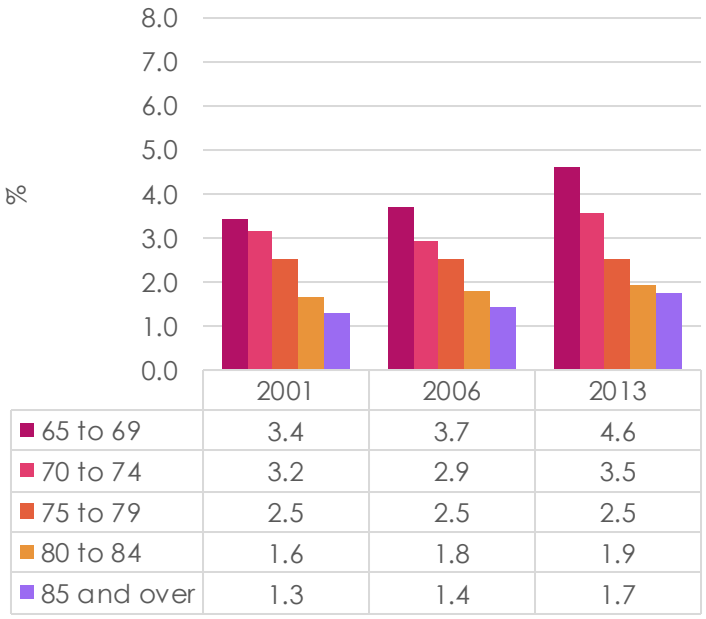


Source: Elder Transportation Service
https://eldertransportaustin.com/demandresponsetransport/

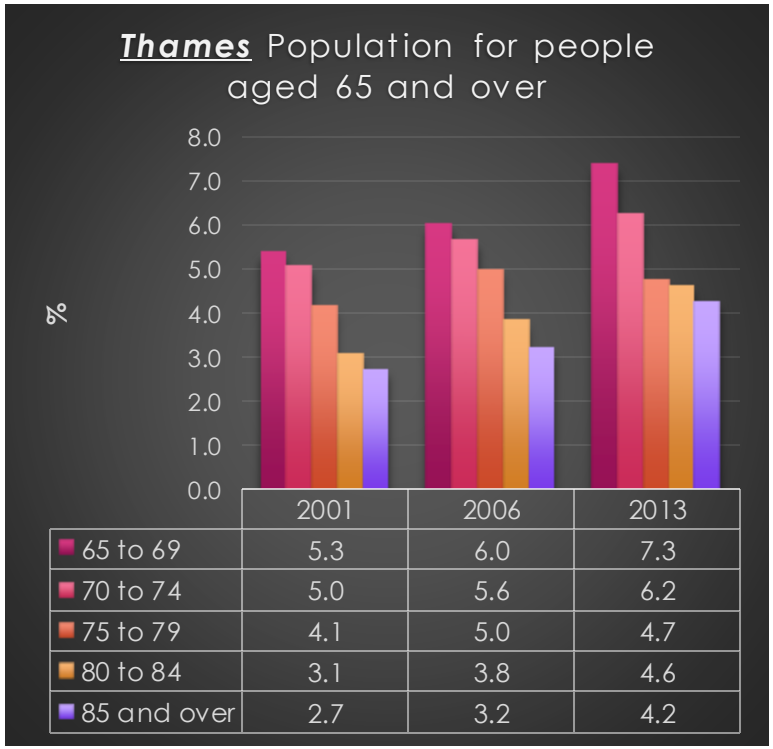
Case Study: Thames, Waikato

- The gateway to the **Coromandel Peninsula**
- Approximately **1 to 1.5 hours**' drive from Auckland, Hamilton, and Tauranga
- **Cheaper** housing and living costs, an attractive location to retire to
- The population for people aged 65 and over in Thames is **increasing**
- PT in Thames is not adapting fast enough to meet future demand due to the growing elderly population.

Case Study: Thames, Waikato



	2001	2006	2013
65 to 69	3.4	3.7	4.6
70 to 74	3.2	2.9	3.5
75 to 79	2.5	2.5	2.5
80 to 84	1.6	1.8	1.9
85 and over	1.3	1.4	1.7



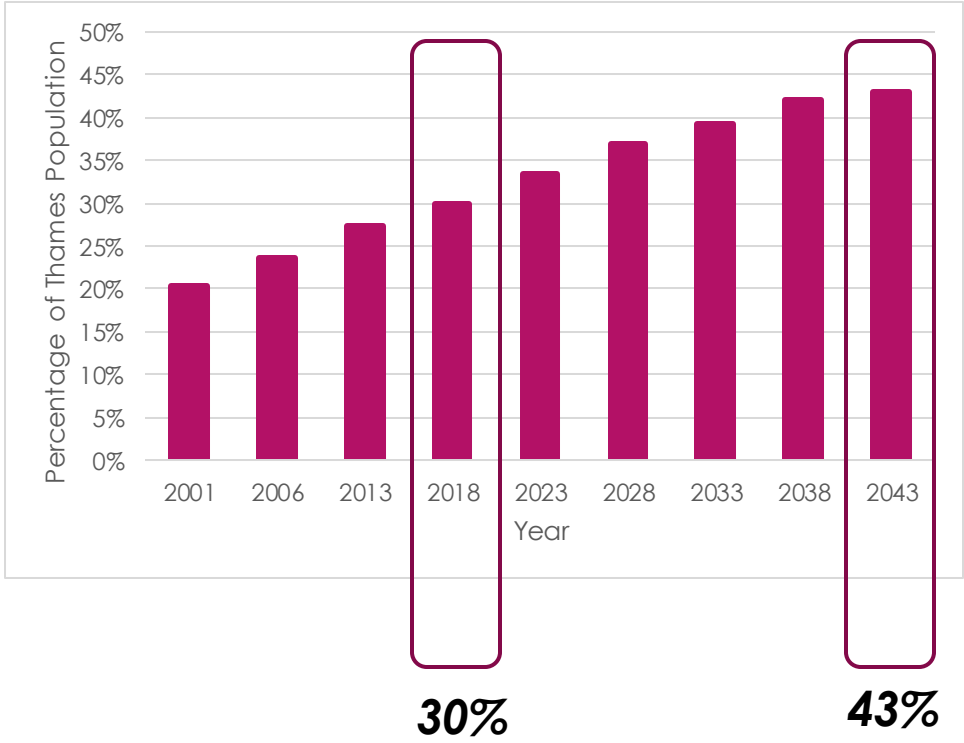
	2001	2006	2013
65 to 69	5.3	6.0	7.3
70 to 74	5.0	5.6	6.2
75 to 79	4.1	5.0	4.7
80 to 84	3.1	3.8	4.6
85 and over	2.7	3.2	4.2

Thames has a **growing** elderly population

Case Study: Thames, Waikato

- **Few PT** options available currently (Taxi and Thames Connector Bus*)
- Due to **steep topography** some forms of transport are not suitable for all people (50/50 Flat to steep)
- Current public transport is either **too expensive**, **schedule based** (buses) and not all door to door

**6 month trial service + one year contract, urban service only*



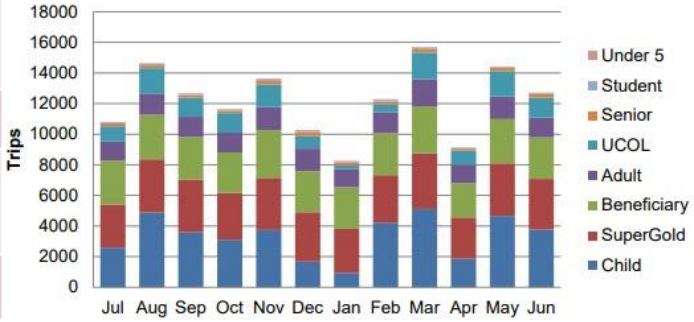
RECAP: Travel Behavior of Elderly

- Jansuwan et al. (2013)
  - Make more frequent **short trips**
  - Travel mode for **social or recreational** trips
  - High **reliance on private vehicles** (help from family)
- Rahman et al. (2016)
  - **Most** preferred mode use option: **volunteer driver with the shuttle bus**
  - **Least** preferred mode use option: pre-paid taxi and **bus**
- Schwarzlose et al. (2014)
  - **High willingness-to-pay for a flexible PT service**

RECAP: Thames PT service

- Thames Connector Bus **6-month Trial** User Data

Month:	Dec	Jan	Feb	Mar	Apr	May	Avg.
Non super gold card user	287	366	247	218	361	282	**294**
Super gold card users (users aged 65 plus)	577	517	509	657	597	611	**578**
Total Number of users	864	883	756	875	958	893	**872**
% of users over 65 in age	67%	59%	67%	75%	62%	68%	**66%**
Avg. number of 65+ /day	19	17	18	21	20	20	**19**



- % of users over 65 in age (2016-17: **Horizons Regional Council**)
  - Palmerston North: **4.8%** (50,668)
  - Whanganui: **26.4%** (38,396)
  - Feilding: **9.9%** (8,686)
  - Ashhurst: **12.1%** (676)

Research Questions & Methodology

- Research Question
  - Investigate the **modes of transport available** to the aging population in NZ medium/small town and rural
  - Explores the **requirements** to complete the Transport for the Elderly
  - Determine the most **effective methods of transport** for people aged over 65
- Methodology
  - 2 surveys: Revealed Preference, Stated Preference
  - **Econometric Modelling**

Methodology
: Rank-ordered logit (ROL) model

- Extended from **conditional logit model**(McFadden, 1974; Beggs et al., 1981; Hausman and Ruud, 1987; Pundj and Staelin, 1978; Chapman and Staelin, 1982; and Allison and Christakis, 1994)

$$Pr(U_1 > U_2 > \cdots > U_j) = Pr(U_1 > U_j, j = 1, 2, \cdots, J) \bullet Pr(U_2 > U_j, j = 3, 4, \cdots, J) \bullet \cdots \bullet Pr(U_{J-1} > U_J)$$

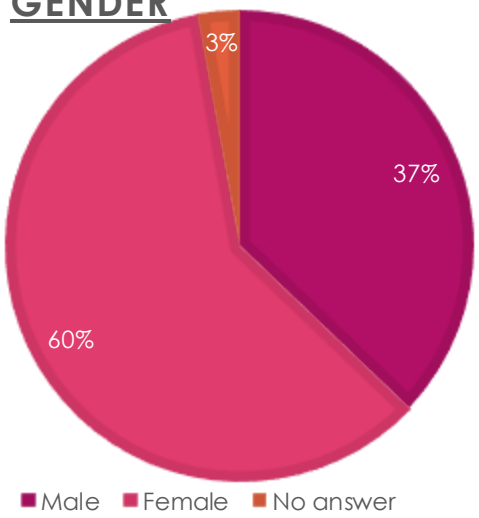
$$= \frac{e^{V_1}}{\sum_{j=1}^{J} e^{V_j}} \bullet \frac{e^{V_2}}{\sum_{j=2}^{J} e^{V_j}} \bullet \cdots \bullet \frac{e^{V_{J-1}}}{e^{V_{J-1}} + e^{V_J}} = \prod_{j=1}^{J=1} \left[\frac{e^{V_J}}{\sum_{m=j}^{J} e^{V_m}} \right]$$

$$Pr\left(U_1 > U_2 > \cdots > U_K, K \leq J \right) = \prod_{j=1}^{K} \left[\frac{e^{V_j}}{\sum_{k=j}^{K} e^{V_k}} \right]$$

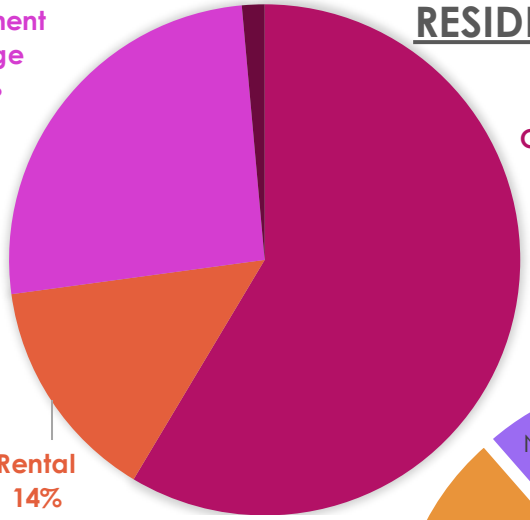
- ROL model can be estimated by SAS® statistical analysis software

Revealed Preference Survey : Sample Data

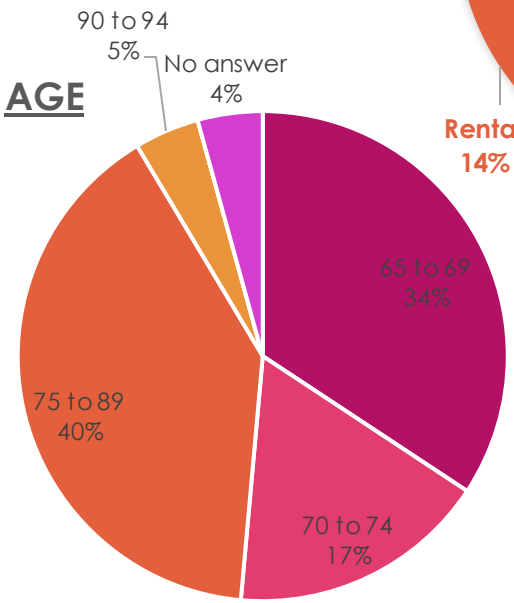
GENDER



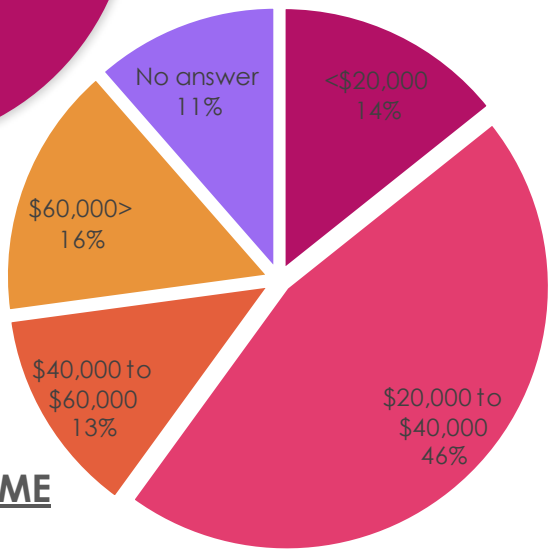
RESIDENCE TYPE



AGE

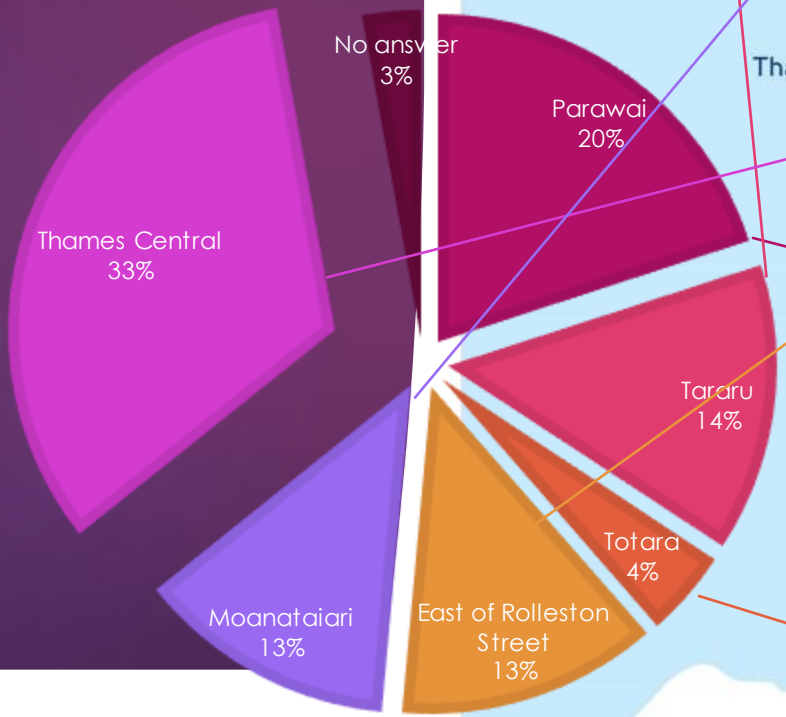


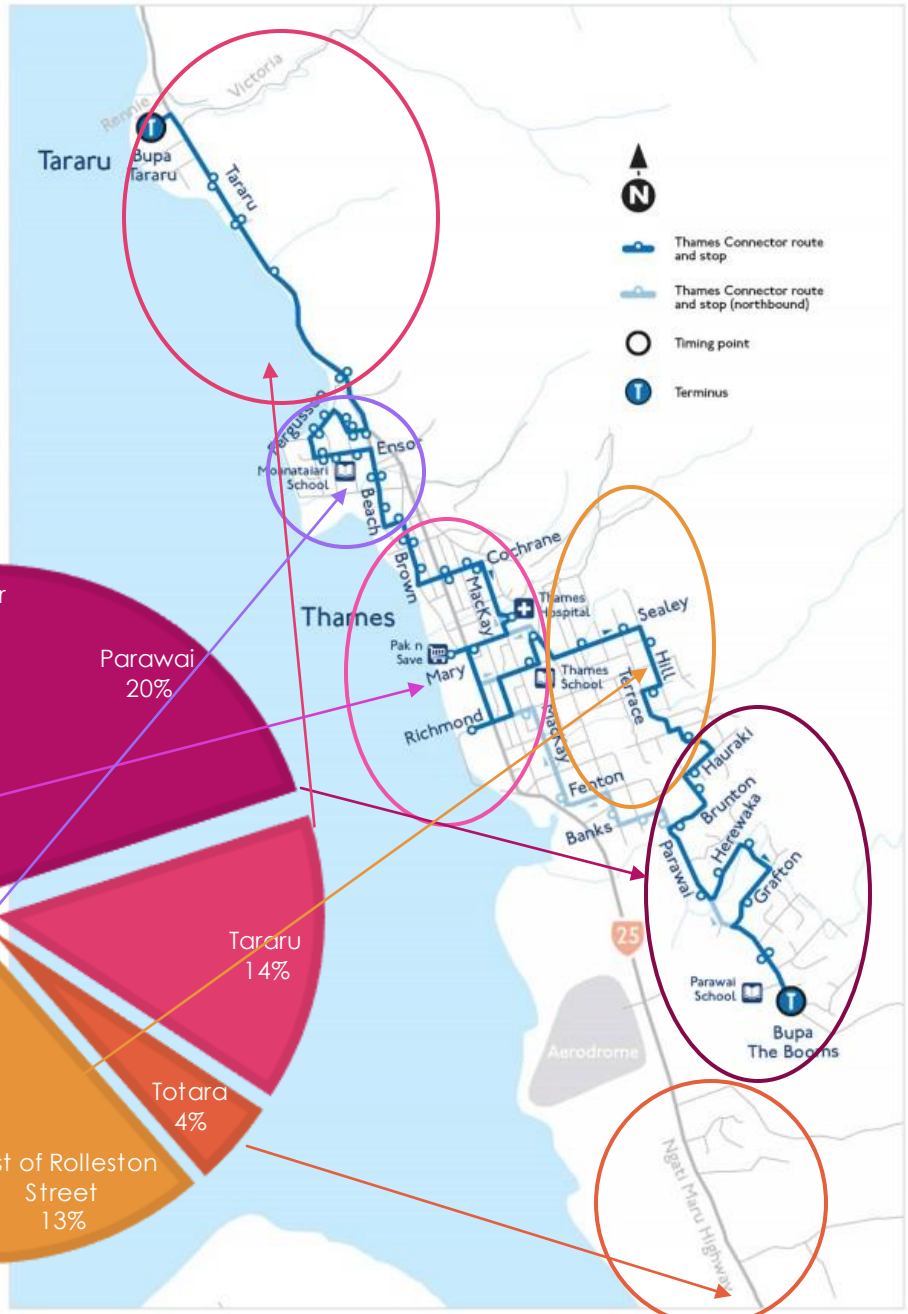
INCOME



Revealed Preference Survey

LOCATION OF RESIDENCE





Analysis: Trip Pattern

Trip Destination

Destination	Trip/week	Rank
Shopping	1.91	**1**
Medical	0.32	5
Social (Family/Friend/church)	1.55	**2**
Recreation	0.42	3
Other	0.35	4
Total Average Trip	4.54	

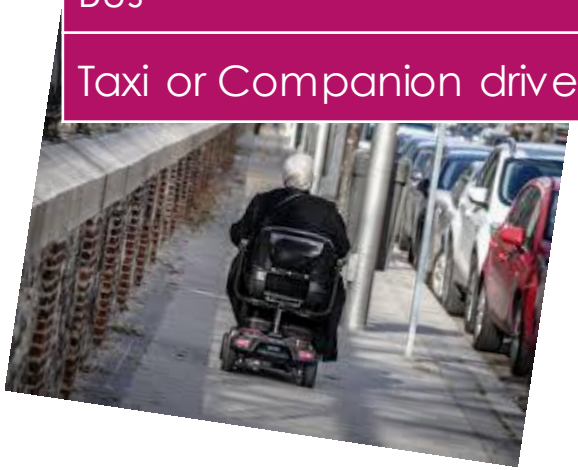
Use of Mode (Overall)

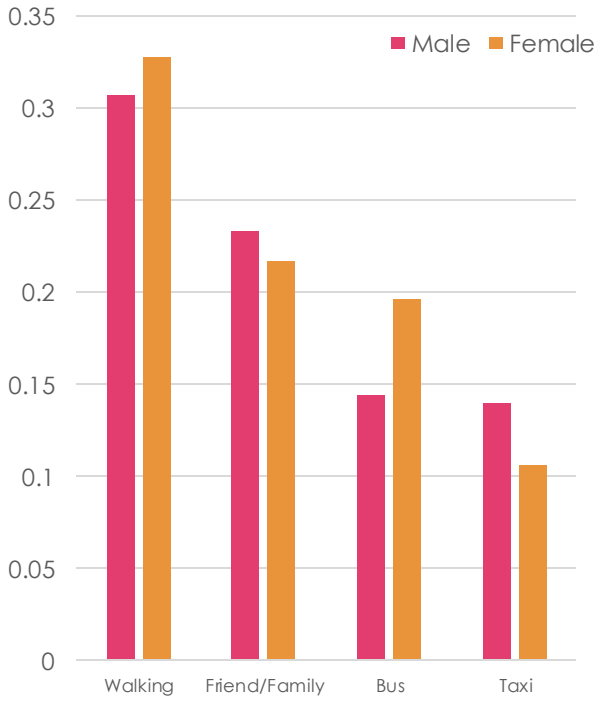
Mode	Trip/week	Rank
Own vehicle	4.03	**1**
Bus	0.32	3
Taxi	0.13	5
Walking	0.52	2
Cycling	0.04	7
Mobility Scooter	0.15	4
Friend and Family	0.07	6

Analysis: Travel behavior

- Use of the **Alternative Mode**: Non-vehicle Owner

Alternative Mode	Weighted Average (%)	Rank
Walking (include Mobility scooter)	36.9	**1**
Friend/Family support	26.0	2
Bus	19.6	3
Taxi or Companion driver service	13.7	4

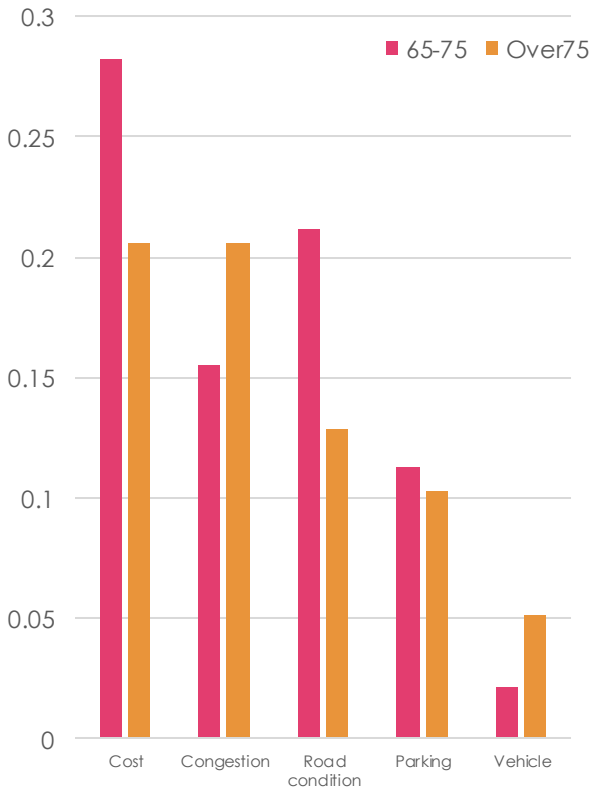




Analysis: Travel behavior

- The main reason you **stopped** driving (**vehicle and road factors**)

Alternative Mode	Weighted Average (%)	Rank
Operating costs of owning a vehicle	26.5	**1**
Dealing with traffic congestion	18.0	3
Poor road conditions	18.9	2
Lack of parking/ difficulty parking	11.3	4
Design and comfort of your vehicle	3.3	5



Analysis: Travel behavior

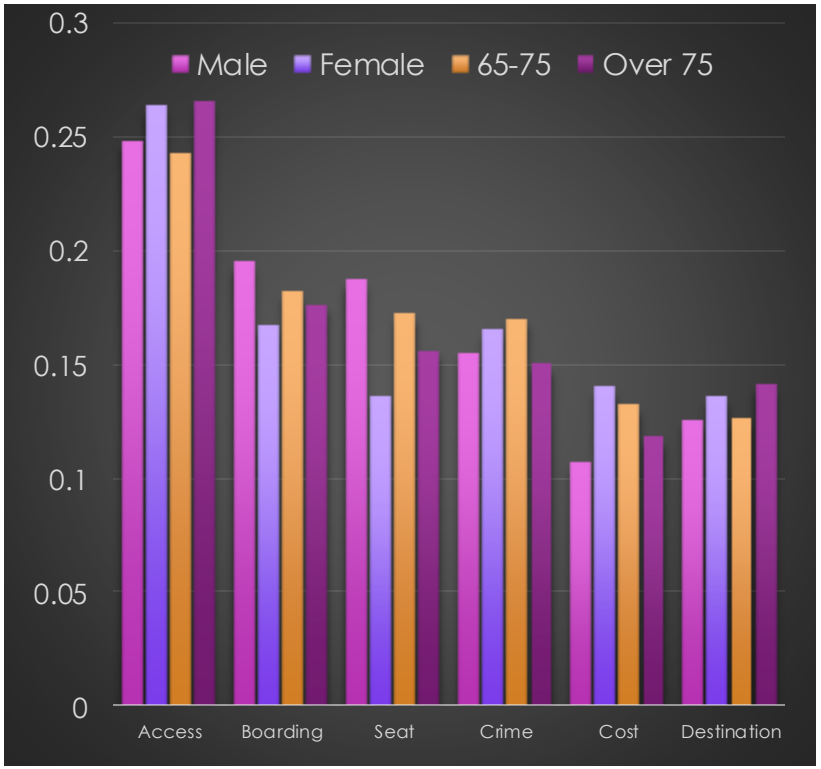
- The main reason you **stopped** driving (**physical factors**)

Alternative Mode	Weighted Average (%)	Rank
Worried about getting lost	22.7	**2**
Concerned with other driver's behavior	13.7	4
Health reasons (poor eyesight etc)	23.6	**1**
Confidence with driving	8.1	5
Traffic moves too fast	15.6	3

Analysis: Travel behavior

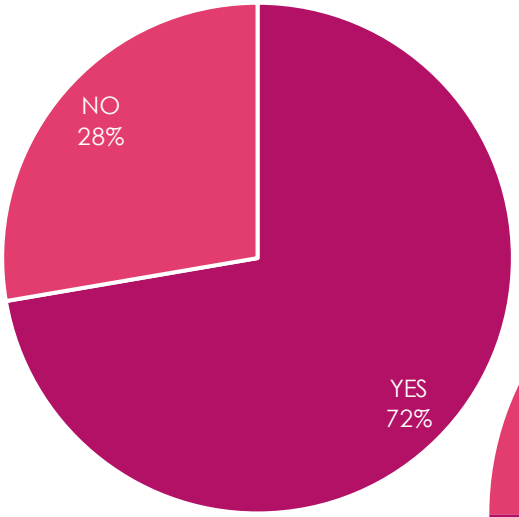
- Perception for **use of the Public Transport** (constraints)

Alternative Mode	Weighted Average (%)	Rank
Accessibility (getting to the stop)	20.7	**1**
Difficulty boarding	16.6	3
Being able to get a seat	15.9	4
Being worried about crime	17.9	2
Public transportation is too expensive	14.1	**6**
Public transportation doesn't go where I need to go	15.3	5



Analysis: DRPT Service

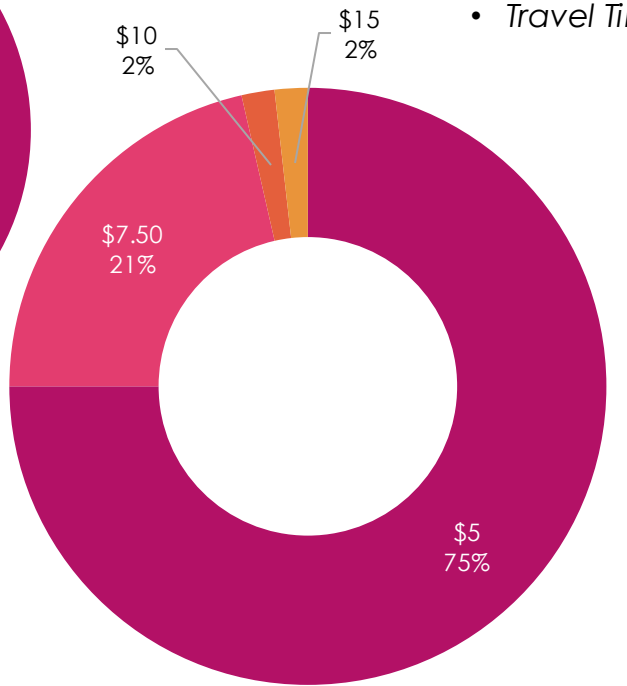
- Perception for the **use of Demand Responsive PT** service



Example of Trip:

From Tararu to the Thames Civic Centre on Mary St.

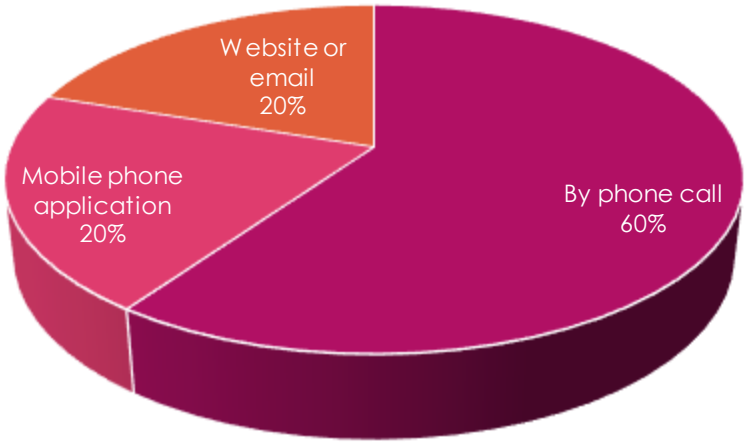
- *Total Distance: 3.7 km*
- *Travel Time: 5 minutes*



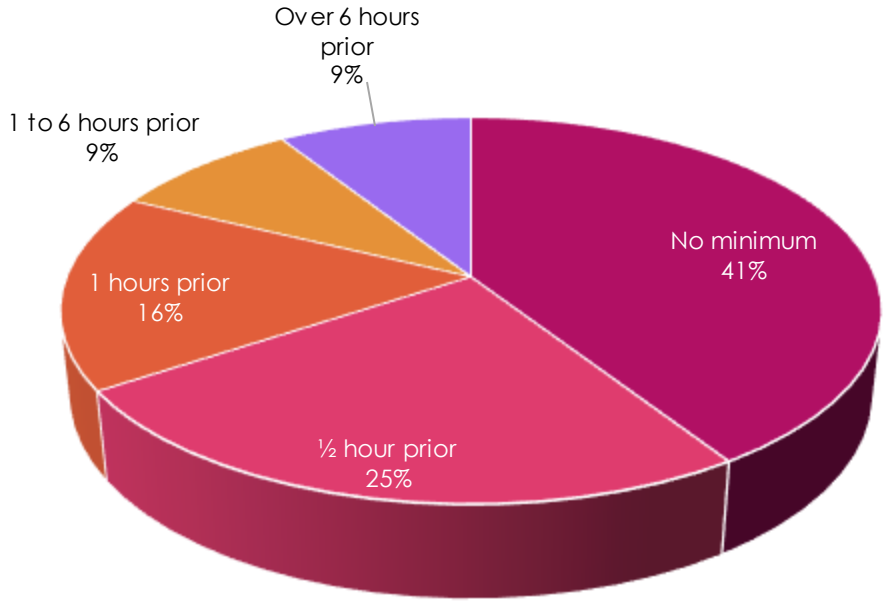
Analysis: DRPT Service

- **System Requirements** for the Demand Responsive PT service

Booking Method



Minimum Booking Time



Conclusion

- Preliminary Survey Analysis shows that the majority of people surveyed would consider using a **DRPT service**, if they could no longer drive their own vehicle.
- There will be a greater need for more **flexible PT** options in small towns as the population ages.
- **Accessibility** is one of the biggest reasons why existing public transport needs to be improved to meet the growing demands for public transport for people aged over 65.
- '**Tailored**' operational plan required regarding
  - Operation hours, booking time, etc

Limitation & Research Direction

- Sample size, the **location of sample** collected
- **Discrete choice (Behaviour) models** allow researchers to analyse and predict how people's choices are influenced by their personal characteristics and by the alternatives available to them
- Apply operational options to estimates the demand changes in comparison with the 'do-nothing' policy
  - **Decreasing service fare** for DRPT (or Increasing subsidies)
  - **Increasing service frequency** (or service area)
- Measure **Willingness-to-pay (WTP)** to evaluate elasticity of elderly demand based on new service

Thank you

QUESTIONS OR COMMENTS