



Walkable Catchments Analysis at Auckland Train and Northern Busway Stations - 2013

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Walkable Catchments Analysis at Auckland Train and Northern Busway Stations - 2013

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Executive summary

In 2010, the Auckland Regional Transport Authority (ARTA, now Auckland Transport) commissioned a survey to examine if an 800-metre radius from Papatoetoe train station was representative of the walking distance for rail passengers. The findings from the Papatoetoe survey showed that the median walking distance to the train station was 1200 metres rather than the assumed 800 metres.

Based on the survey findings, Auckland Council's Research, Investigations and Monitoring Unit has sought to test for more evidence if an 800-metre radius walkable catchment area was representative of the walking distance for other train stations in Auckland.

Using a similar research methodology as the Papatoetoe train station survey, passengers arriving at New Lynn, Glen Innes and Mt Albert train stations were surveyed in March 2012.

The results of the three train station surveys showed that:

- more than 50 per cent of respondents walked further than 800 metres to get to a train station;
- more than 15 per cent of respondents walked further than 1500 metres to get to a train station; and
- walking is the most significant mode of travel for trips less than 2000 metres.

Due to only four train stations being surveyed, and given the generally low response rate of these surveys, RIMU decided additional research should be conducted to further test for evidence that an 800-metre radius is representative of the walkable catchment area for a train station in Auckland.

As a result, in March 2013 a further 12 train stations were surveyed along with five Northern Busway Stations.

The results of the 12 train station surveys show that:

- walking was the most common mode of arrival at nine of 12 stations. Ellerslie (73%) and Newmarket (69%) recorded the highest percentage of respondents walking to stations. Manurewa recorded the smallest percentage of respondents walking (41%)
- for trips under 2km, walking was the dominant mode of arrival at four stations: Glen Eden, Henderson, Newmarket and Ōtāhuhu
- at four stations more than 50 per cent of respondents walked further than 800 metres to get to a train station;
- at six stations more than 15 per cent of respondents walked further than 1500 metres to get to a train station; and

- Newmarket Station returned the lowest median walking distance to a train station with 446 metres. Ellerslie Station recorded a slightly higher median walking distance with 569 metres. The highest median walking distances were recorded at Papakura with 971 metres followed by Panmure with 917 metres
- Newmarket and Henderson are two dominant stations in terms of walking to the station. In particular, it is notable that at least 50 per cent of customers who walked, travelled from relative large catchment areas (3.4km for Henderson and 2.4km for Newmarket).

The results of the five bus station surveys show that:

- the median walking distance ranged from 588 metres at Akoranga to 2727 metres at Albany
- at four of the stations, 50 per cent of respondents walked further than 800 metres. The exception was the Akoranga Station, where over 80 per cent of respondents walked between 400-800 metres
- walking was the most significant mode of travel for trips less than 2000 metres at three stations, including Akoranga, Constellation and Smales Farm. In contrast, only a small number of respondents walked to the Albany (13%) and Sunnynook (14%) stations
- Smales Farm had the lowest median walking distance at 588 metres. That is, 50 per cent of the people who walked to Smales Farm bus station walked less than 588 metres, and the other 50 per cent walked more than 588 metres. Akoranga had a similar median walking distance of 590 metres. In contrast, the median walking distances to Constellation and Sunnynook were 1199 and 1141 metres. Meanwhile, the median walking distance to Albany was 2727 metres.

Overall, the results from the surveys show that an 800-metre radius is accurate for some stations, but underestimates the actual walking distance for others.

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1.0 Background

1.1 Walkable catchments and centres

A walkable catchment is the area covered by the walking distance that an average person will walk to get to meaningful destinations before considering other modes of transport.

A walkable catchment with a 400-metre radius is usually associated with a five-minute walk to a town or neighbourhood centre and an 800-metre radius is associated with a 10 minute walk to a regional centre or a place with a major transport service such as rail.

There is no definitive authority on why a walkable catchment should be 400 or 800 metres or any other distance, but what is commonly agreed is that the walkable catchment area is an easy walk for the average person.

Based on these distances, walkable catchments are usually drawn and represented as a perfect 400-metre or 800-metre circle over a centre, but in practice walkable catchments have irregular shapes because they cover the actual on-the-ground distance and not the linear (as the crow flies) distance as shown in figure 1.

Figure 1: Example of a walkable catchment



Source: (Urban Design Toolkit, Ministry for the Environment 2009)

The concept of walkable catchments is a widely recognised and used planning concept in New Zealand and overseas (Calthorpe 1993; Duany and Plater-Zyberk 1991; Ministry for the Environment 2009).

In the context of urban planning in Auckland, the 2012 Auckland Plan identifies a network of centres to accommodate the future population and employment growth in the region. In the plan, the centres will provide the focal points for communities, foster economic activity, support the public transport system and maximise investment in infrastructure. A centre is a defined area that comprises a concentrated mix of public and private activities, and is

supported and sustained by a surrounding residential area that is within an easy 10 minute walking distance to these activities (Auckland Council 2012).¹

While the distances may only vary by walking an additional 200-400m (or 2½ – 5 minutes) an additional 200m walk is a significant factor given that an 800m walkable catchment potentially includes 200ha of land and a 1000m walkable catchment potentially includes 300ha of land and a 1200m walkable catchment potentially includes 450ha of land.

1.2 Reasons for surveying busway and rail services users

The Auckland Plan also identifies a network of centres to accommodate the future population and employment growth in the region. In the plan, a centre is a defined area that comprises a concentrated mix of public and private activities, and is supported and sustained by a surrounding residential area and a public transport system that is within an easy 10minute/800m walking distance to these activities. If this works, this 10minute/800m template may be replicated throughout centres and major transport hubs in Auckland.

But is a 10minute/800m walk applicable for train stations in Auckland? Or are train users prepared to walk further than 10minutes/800m? This 10minute/800m design feature is being promoted (and if successful will be replicated around Auckland) without much scrutiny or evidence. As all cities are different, it may be that in Auckland, a city with urban development that continues to sprawl and is primarily a car-based development, may have a different willable catchment area greater than 10minutes/800m.

In terms of monitoring the above requirement, this project intends to test if the pedestrian mode share is the most significant mode type for short trips (less than 2km) to and from train stations and whether a 10minute/800m walk is representative of the catchment area for rail public transport in the Auckland region.

¹ As a guide, the Auckland Plan identifies a 10 minute walk as an example of an easy walking distance, but notes that there will be variations on this based on the size, role and function of different centres in the region. When detailed planning is undertaken in these centres, the actual walkable catchment (which will be influenced by subdivision, street and block pattern, and topography) is refined to reflect any constraints to accessibility to these centres.

1.3 Survey purpose

This project intends to test if the pedestrian mode share is the most significant mode type for short trips (less than 2km) to and from train stations and whether a 10minute/800m walk is representative of the catchment area for rail public transport in the Auckland region.

In summary, the purpose of this project is to:

- Determine whether or not an 800-metre radius circle (10minute walking distance) is representative of the catchment area for 12 train stations and 5 Northern Busway stations in the Auckland region;
- assess whether the values observed at Papatoetoe, New Lynn, Mt Albert and Glen Innes train stations are representative of other train stations in the region;
- develop a typology of train stations in the Auckland region; and
- conduct similar surveys at the five Busway Stations to identify how far bus passengers are travelling to a busway station.

In addition, the project seeks to investigate:

- if the currently accepted catchment areas of 800m for train stations are relevant to Auckland, and determine if it is universal across the region by surveying and analysing 12 train stations in the Auckland region; and
- if the currently accepted catchment areas of 800m for the Northern Busway stations are relevant to Auckland.

To gain an understanding of the distance travelled by passengers to/from 12 train stations and 5 Northern Busway stations in the region, a survey was conducted between 7am-7pm in March/April 2013.

This was an intercept survey conducted face-to-face, with the questionnaire filled in by surveyors at the train/bus station and a control count obtained to determine the response rate.

Given that Auckland Transport conducts an annual busway monitoring survey of passengers, there was an opportunity to include our questions into their survey and save on costs.

The busway stations include:

1. Akoranga
2. Smales Farm
3. Sunnynook
4. Constellation Park and Ride
5. Albany Park and Ride

Twelve train stations were surveyed in 2013. RIMU identified Onehunga, Ōtāhuhu, Manurewa and Pukekohe as important stations to survey as they are either inside the Southern Initiative area or have been identified as a priority centre for development in the Auckland Plan over the next three years. Initial discussions with the Transport Strategy Unit have identified the remainder of the stations to survey.

The 12 stations surveyed include:

1. Manurewa
2. Ōtāhuhu
3. Panmure
4. Papakura
5. Newmarket
6. Henderson
7. Onehunga
8. Pukekohe
9. Glen Eden
10. Meadowbank
11. Sturges Road
12. Ellerslie

1.4 Findings from previous train station surveys

To understand walking to public transport hubs better, ARTA (now Auckland Transport) commissioned a project in 2010 to test for evidence through a pilot survey if an 800-metre radius walking distance was representative of the walkable catchment area for rail public transport at Papatoetoe train station (Beca Infrastructure Ltd 2010).

Auckland Council followed this up with a further three stations in 2012. The results of these four surveys are included in this section.

Papatoetoe train station was identified as the sample train station and the survey was conducted on Tuesday 22 June 2010, 7am- 7pm. A total of 120 valid responses were obtained from people walking to the train station, which translates to a response rate of 11 per cent².

² A valid response is where a respondent provided an answer on how they got to the station (mode of travel) and the location (address) of where they left before coming to the station. The address is critical, as it determines the distance travelled to the train station.

Table 1: Median (50th) and 85th percentile walking distances to train stations

Train station	Walking distance for 50% (median) of respondents	Walking distance for 85% of respondents
Papatoetoe	1200m	2180m
New Lynn	1125m	2116m
Glen Innes	943m	1526m
Mt Albert	862m	1617m

The 50th (median) and 85th percentile walking distances to the four train stations are shown in Table 1. New Lynn and Papatoetoe train stations had similar median walking distances (1100-1200 metres) whereas Mt Albert and Glen Innes had median walking distances of around 850 – 950 metres.

That is, 50 per cent of respondents walked more than 1100-1200 metres to get to either New Lynn or Papatoetoe train station and 50 per cent walked further than 850 – 950 metres to get to Mt Albert and Glen Innes train stations.

To further understand how far people were walking to the train stations, the 85th percentile was also calculated. That is, 15 per cent of respondents walking to the train station walked more than 1500 - 2180 metres to get to a train station.

Table 2: Mode of travel to train stations

Mode of travel to train station	Papatoetoe	New Lynn	Glen Innes	Mt Albert
Walk	45%	33%	35%	71%
Car	51%	39%	53%	28%
Bus	2%	26%	12%	1%
Cycle	2%	1%	1%	0%

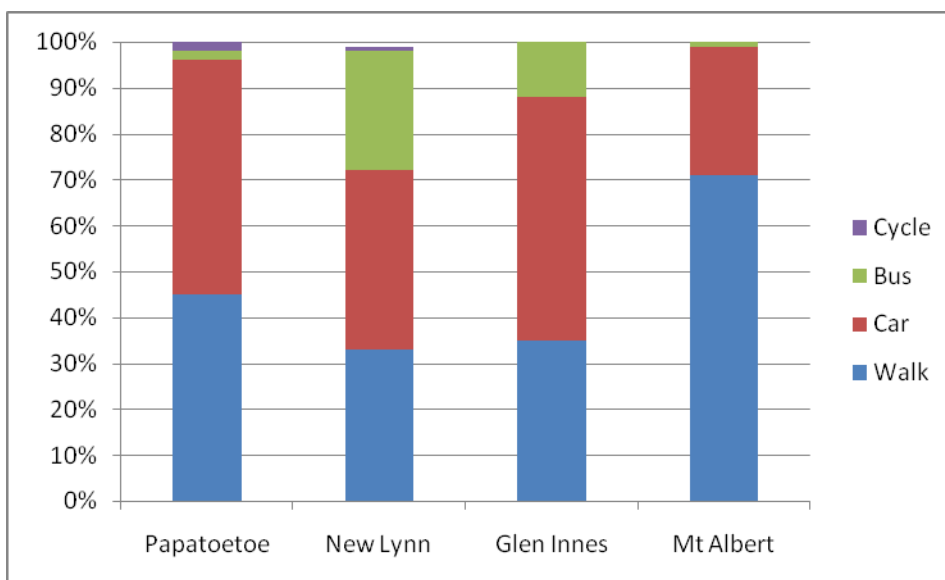
Base: n= 595

Figure 2 and table 2 shows the mode of travel used to get to the four original train stations. The predominant mode of travel to the train station was by car (either as a driver or as a passenger) or walking.

Some significant findings of the previous surveys show that:

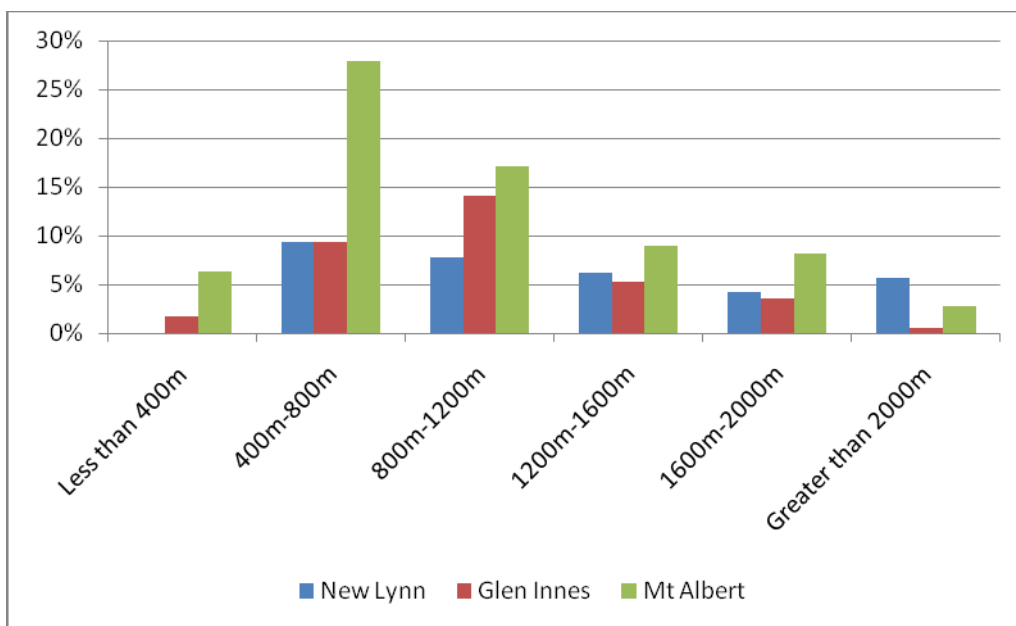
- Mt Albert had the highest proportion of respondents walking to the station (71%) with both New Lynn and Glen Innes showing similar proportions of people walking (33-35%).
- Glen Innes had the highest proportion of people arriving in a car (53%) followed by Papatoetoe (51%) then New Lynn (39%) and Mt Albert (28%).
- New Lynn had the highest proportion of respondents arriving by bus (26%) followed by Glen Innes (12%).

Figure 2: Mode of travel Papatoetoe, New Lynn, Glen Innes and Mt Albert train stations



Base: n=595

Figure 3: Distance walked to get to New Lynn, Glen Innes and Mt Albert train stations



Base: n=202

1.4.1 Trips under 2km

Figure 4 and table 3 show the proportion of trips that were less than two kilometres to a train station. Any distance greater than 2000 metres has been excluded in this analysis.

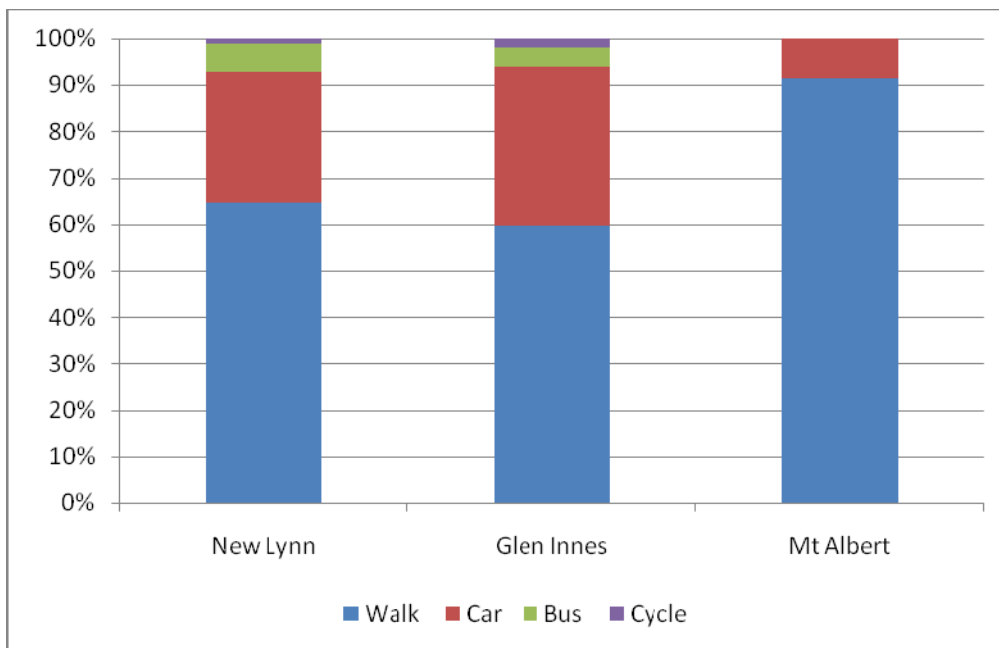
Overall, for trips less than 2000 metres to any one of the three train stations, walking was the most popular mode of travel.

The results for Mt Albert show that nearly all of the respondents (92%) walked to the train station, with the remaining respondents arriving by car (8%).

Walking to the train station was also the most popular mode of transport for respondents arriving at New Lynn and Glen Innes with both recording similar proportions of walkers (60%-65%).

The proportion of respondents arriving by car to New Lynn and Glen Innes train stations was also very similar (28%-34%).

Figure 4: Mode of travel for trips less than 2km to New Lynn, Glen Innes and Mt Albert train stations



Base: n=202

Table 3: Mode of travel to train stations for trips less than 2km

Mode of travel	New Lynn	Glen Innes	Mt Albert
Walk	65%	60%	92%
Car	28%	34%	8%
Bus	6%	4%	0%
Cycle	1%	2%	0%
Total	100%	100%	100%

Base: n= 262

1.5 Busway surveys

There are no known previous studies recording how far people travel to Northern Busway Stations in Auckland. Given that Auckland Transport conducts an annual busway monitoring survey of passengers, there was an opportunity to include our questions into their survey and save on costs. As part of this project, surveys were undertaken at the five Busway Stations to identify how far bus passengers are travelling to a busway station. This will help determine if the currently accepted catchment areas of 800m for the Northern Busway stations are relevant to Auckland.

2.0 Methods

2.1 Methodology

This section outlines the methodology used to gain an understanding of the mode and distance travelled by people using rail and bus transport. The approach for the 2013 survey is similar to that used for the 2012 survey to enable a comparison of results.

Identifying train stations to survey

The first task was to identify the train stations to survey. The focus was on relatively high-patronage stations but which has a mix of surrounding land-use conditions. Together with Papatoetoe, the basis for selecting any station was to build up a list of results for a cross-section of station types in Auckland. The 12 stations selected were agreed in conjunction with Auckland Council's Transport Strategy Unit.

Questionnaire

For the 2013 survey, changes were made to the 2012 questionnaire to simplify and reduce the time taken to complete a questionnaire, whilst still obtaining the critical information to identify the mode of transport and distance travelled to the station. The changes further simplified the survey by just asking four questions.

1. How did you get to the station?
2. What address did you just travel from?
3. What is the purpose of your trip?
4. Which station will you get off?

An example of the 2013 survey questionnaire is in Appendix 2.

Permission to survey

Permission to survey passengers at train stations was required from Auckland Transport for safety and operational reasons. Auckland Transport gave consent to survey at all 12 train stations based on the following conditions:

- the survey has to be conducted behind the yellow line (away from the train tracks);
- the survey should not obstruct any passengers; and
- the safety of both passengers and surveyors at a train station is paramount.

Train station site visit

A site visit of the 12 stations was conducted prior to the survey to gather information about the characteristics of each station. This included the size and location of the station platforms, and the location and the number of entry and exit points to and from the station platforms. This information was used to determine the number of surveyors required for each station.

Survey date

The 2013 surveys were undertaken through March on a single day for 12 hours from 7am to 7pm³. Surveys were not conducted on rainy days as this could influence the results. The actual survey dates are listed below/

Train Station	Date Surveyed
Pukekohe	Tuesday 12 March
Sturges Rd	Thursday 26 th March
Papakura	Thursday 7 th March
Manurewa	Wednesday 6 th March
Henderson	Tuesday 19 th March
Panmure	Wednesday 13 March
Ōtāhuhu	Tues 5 th March
Ellerslie	Thursday 14 th March
Glen Eden	Thursday 26 th March
Onehunga	Thursday 21 st March
Meadowbank	Wednesday 27 th March
Newmarket	Wednesday 20 th March

³ Conducting transport surveys in March is common, as it is traditionally a high patronage period as there are no public holidays in March, all students are back at school or tertiary institutions and most people are back at work.

Face to face interview

The technique employed to gather data for the project is essentially an intercept survey, whereby people are approached (intercepted) and asked to participate in the survey. If the respondent is willing, they are asked for a response to all the questions in the survey.

The objective of the survey was to obtain two critical pieces of information from a respondent. The first is “how did you get to the station?” and the second question is “what is the address that you left from before coming to the train station?” Answers to these two questions would make it possible to identify how passengers travelled to the train station and the distance they travelled. Only respondents arriving at a train station were included in the results.

Measuring the distance to a station

All responses were checked and are entered into an Excel spreadsheet. The data is then geo coded and to generate the walkable catchment maps using Network Analyst.

Busway survey

Questionnaire

For the 2013 survey, changes were made to the 2012 questionnaire to simplify and reduce the time taken to complete a questionnaire, whilst still obtaining the critical information to identify the mode of transport and distance travelled to the station. The changes further simplified the survey by just asking four questions.

1. How did you get to the station?
2. What address did you just travel from?
3. What is the purpose of your trip?
4. Which station will you get off?

A copy of the 2013 survey questionnaire is in Appendix 2.

Permission to survey

Auckland Transport conduct an annual busway monitoring survey of passengers, so there was an opportunity to include our questions in their survey and save on costs. This also meant RIMU did not require additional permission to survey.

Bus station site visit

A site visit of the five stations was conducted prior to the survey to gather information about the characteristics of each station. This included the size and location of the station platforms, and the location and the number of entry and exit points to and from the station platforms. This information was used to determine the number of surveyors required for each station.

Survey date

The 2013 surveys were undertaken in March on a single day for 12 hours from 7am to 7pm⁴. Surveys were not conducted on rainy days as this could influence the results. The Actual survey dates were

Bus Station	Survey Date
Akoranga	Wednesday 13th March
Albany	Wednesday 13th March
Constellation Drive	Wednesday 13th March
Smales Farm	Wednesday 13th March
Sunnynook	Wednesday 13th March

Face to face interview

The technique employed to gather data for the project is essentially an intercept survey, whereby people are approached (intercepted) and asked to participate in the survey. If the respondent is willing, they are asked for a response to all the questions in the survey.

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Measuring the distance to a station

All responses were checked and are entered into an Excel spreadsheet. The data is then geo coded and to generate the walkable catchment maps using Network Analyst.

⁴ Conducting transport surveys in March is common, as it is traditionally a high patronage period as there are no public holidays in March, all students are back at school or tertiary institutions and most people are back at work.

3.0 Results and discussion

3.1 Rail survey results

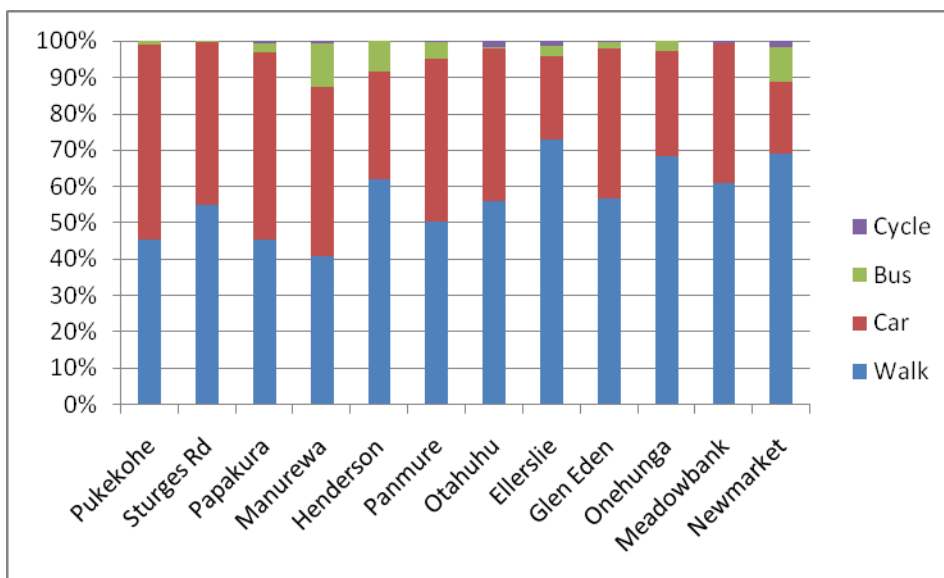
A total of 2669 responses were collected during the rail survey. Table 4 below summarises the number of responses by mode for the 12 stations.

Table 4: Survey responses for all 12 train stations

Train Station	Car	Walk	Bus	Cycle	Total
Pukekohe	59	50	1	0	110
Sturges Rd	104	127	1	0	232
Papakura	146	128	7	2	283
Manurewa	115	100	29	2	246
Henderson	54	112	15	0	181
Panmure	93	104	9	1	207
Ōtāhuhu	76	102	1	3	182
Ellerslie	53	170	7	3	233
Glen Eden	125	171	5	1	302
Onehunga	42	99	4	0	145
Meadowbank	71	112	0	1	184
Newmarket	72	251	35	6	364
Total	1010	1526	114	19	2669

Base: n=2669

Figure 5: Mode of travel to train stations



Base: n=2669

Table 5: Mode of travel to station per cent

Train Station	Walk	Car	Bus	Cycle	Total
Pukekohe	45%	54%	1%	0%	100%
Sturges Rd	55%	45%	0%	0%	100%
Papakura	45%	52%	2%	1%	100%
Manurewa	41%	47%	12%	1%	100%
Henderson	62%	30%	8%	0%	100%
Panmure	50%	45%	4%	0%	100%
Ōtāhuhu	56%	42%	1%	2%	100%
Ellerslie	73%	23%	3%	1%	100%
Glen Eden	57%	41%	2%	0%	100%
Onehunga	68%	29%	3%	0%	100%
Meadowbank	61%	39%	0%	1%	100%
Newmarket	69%	20%	10%	2%	100%

Source: 2669

Comparing the 12 stations

The following section provides a general comparison of the 12 train stations. Detailed results of the individual stations are presented in section 3.2 -

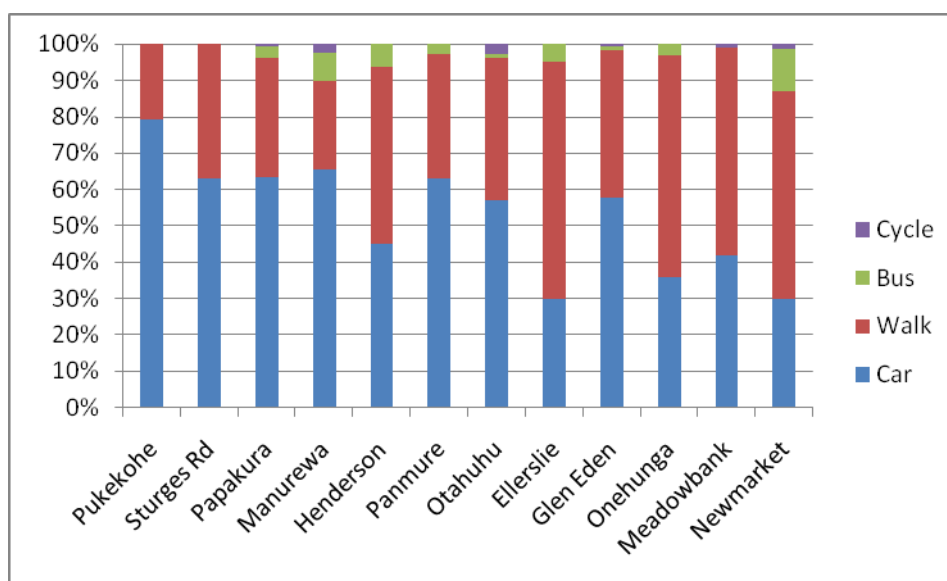
Figure 4 and table 4 shows the mode of travel used to get to a train station. Some significant findings of the 2013 results show that:

- Ellerslie had the highest proportion of respondents walking to the station (73%) with both Newmarket and Onehunga showing similar proportions of people walking (69-68%).
- Ellerslie and Newmarket had the highest number of respondents walking to the respective stations during the 7-9am period with 78, followed by Glen Eden with 73.
- Pukekohe had the highest proportion of people arriving in a car (54%) followed by Papakura (52%), and Manurewa (47%). Interestingly, respondents arriving by car to made up almost the rest of respondents (28%).
- Manurewa had the highest proportion of respondents arriving by bus (12%) followed by Newmarket (10%).

Table 6: Mode of travel between 7-9am

7-9am totals ONLY	Car	Walk	Bus	Cycle	Total
Pukekohe	19	5	0	0	43
Sturges Rd	63	37	0	0	163
Papakura	98	51	5	1	253
Manurewa	57	21	7	2	144
Henderson	36	39	5	0	116
Panmure	70	38	3	0	181
Ōtāhuhu	61	42	1	3	168
Ellerslie	36	78	6	0	156
Glen Eden	104	73	2	1	284
Onehunga	34	58	3	0	129
Meadowbank	41	56	0	1	139
Newmarket	41	78	16	2	178
Total	660	576	48	10	1954

Figure 6: Mode of travel between 7-9am



Base: n=1954

3.2 Mode and distance travelled to train stations

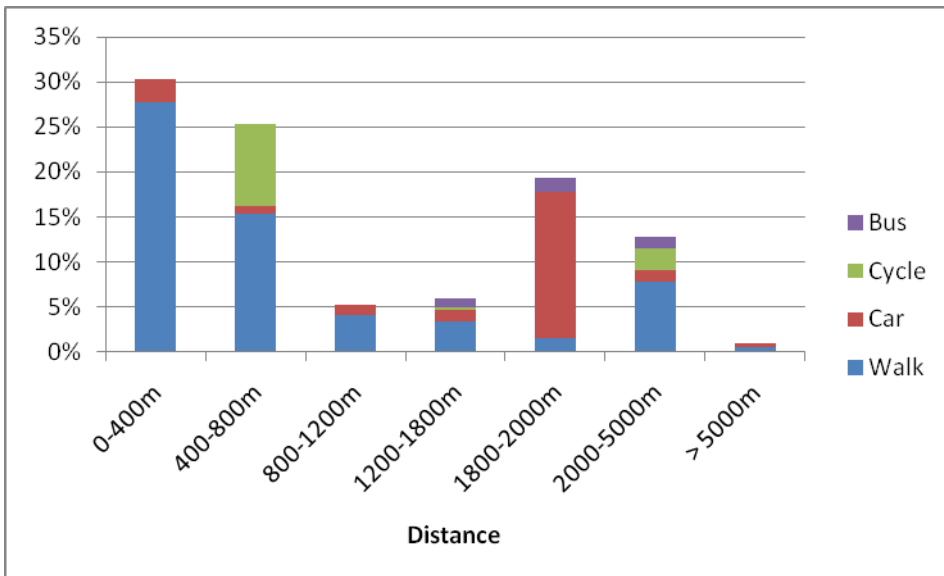
This section provides a general comparison of the 12 train stations. Figures 7-16 show the mode of travel used to get to a train station by distance interval. These numbers give a useful indication of the mode/distance split for each station, but they are only percentages. Therefore, it is important to refer to the sample size total underneath the graphs

Some significant findings of the 2013 results show that:

- At the Ellerslie Station, walking trips under 800m made up 49 per cent of total trips for all modes, followed by Newmarket (43%) and Ōtāhuhu (38%). Ōtāhuhu also had the highest percentage of respondents driving to the station for trips under 800m with 19 per cent.
- Panmure had the highest percentage of respondents walking to the respective stations for trips between 800-1200m (35%) followed by Meadowbank (21%). For this same distance interval, Onehunga had the highest percentage of respondents arriving by car (20%) followed by Pukekohe (13%).
- Glen Innes had the highest percentage of respondents walking between 1200-1800m to get to the station (24%). Papakura had the highest proportion of respondents arriving who walked between 1800-2000m. Ellerslie had the highest proportion of respondents who drove between 1200-1800m (11%).
- Across the 12 stations, walking trips between 1800-2000m were only a small percentage of total mode share.
- Onehunga had the highest percentage of respondents who walked between 2000-5000m (13%), followed by Ellerslie and Ōtāhuhu (12%). For trips between 2000-

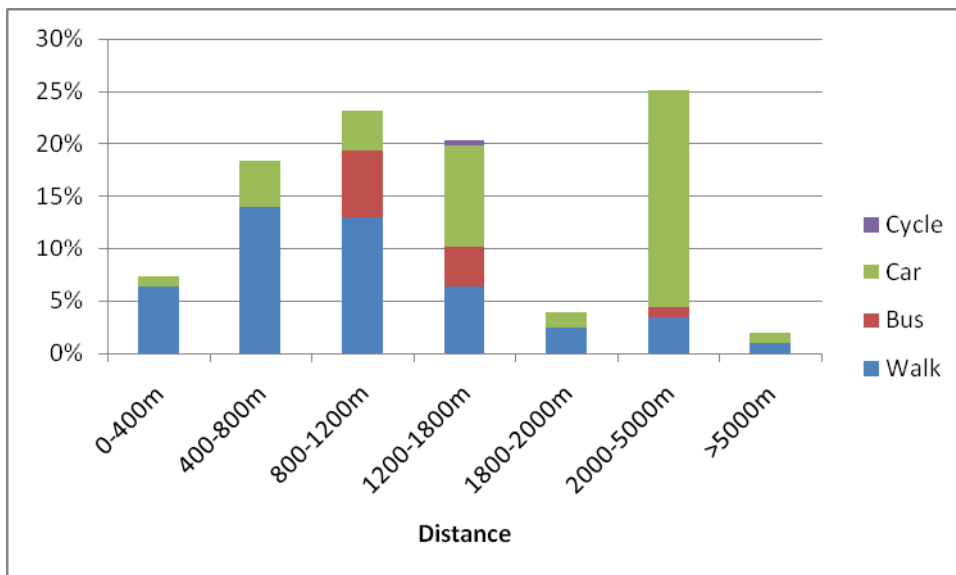
5000m, Glen Eden had the highest percentage of respondents arriving by car (32%) followed by Onehunga.

Figure 7: Mode and distanced travelled to Newmarket Station



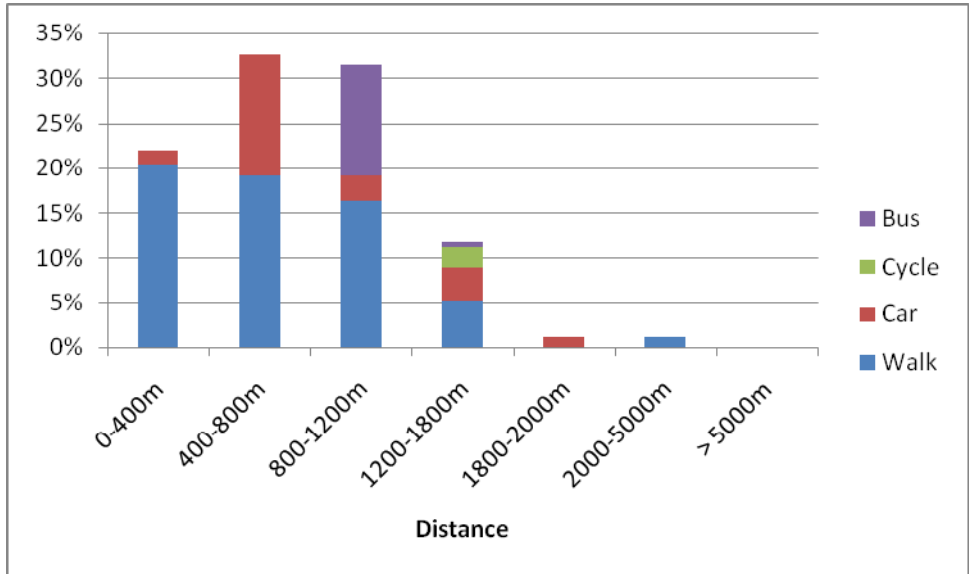
Base: n= 320

Figure 8: Mode and distance travelled to Manurewa Station



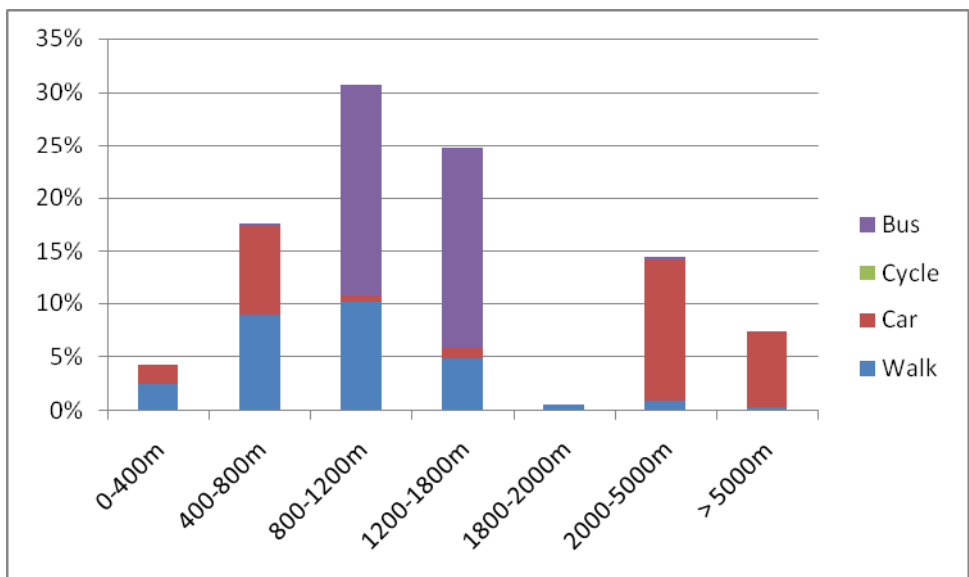
Base: n= 207

Figure 9: Mode and distance travelled to Meadowbank Station



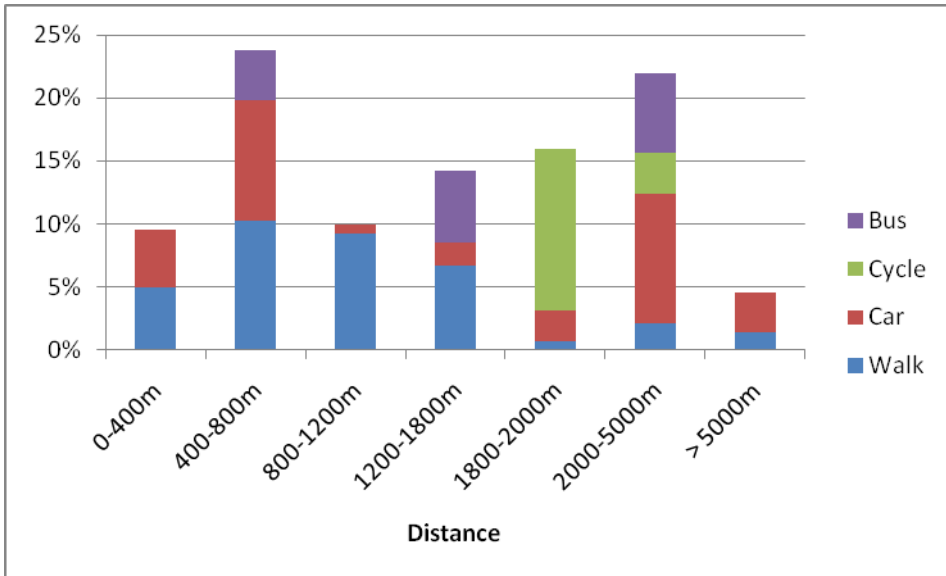
Base: n=178

Figure 10: Mode and distance travelled to Panmure Station



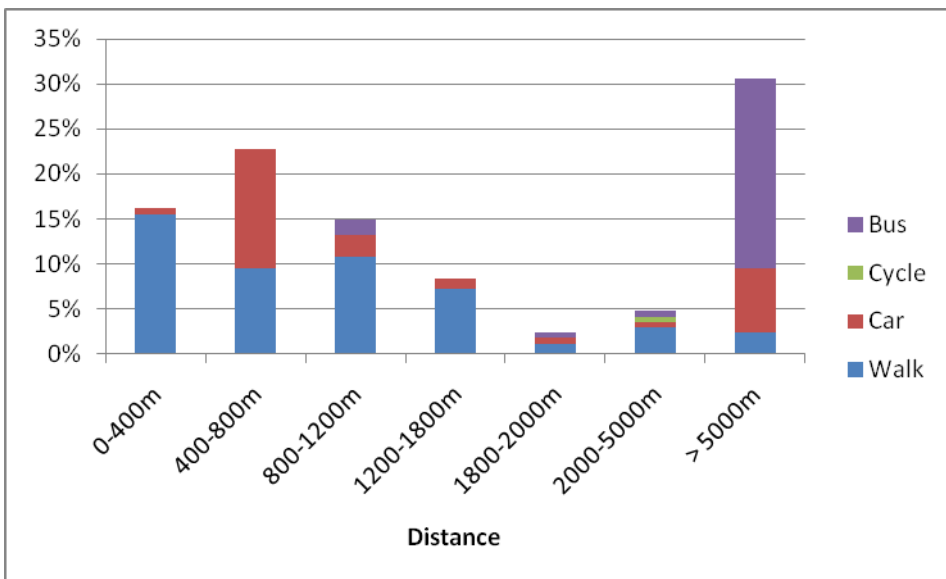
Base: n= 92

Figure 11: Mode and distance travelled to Papakura



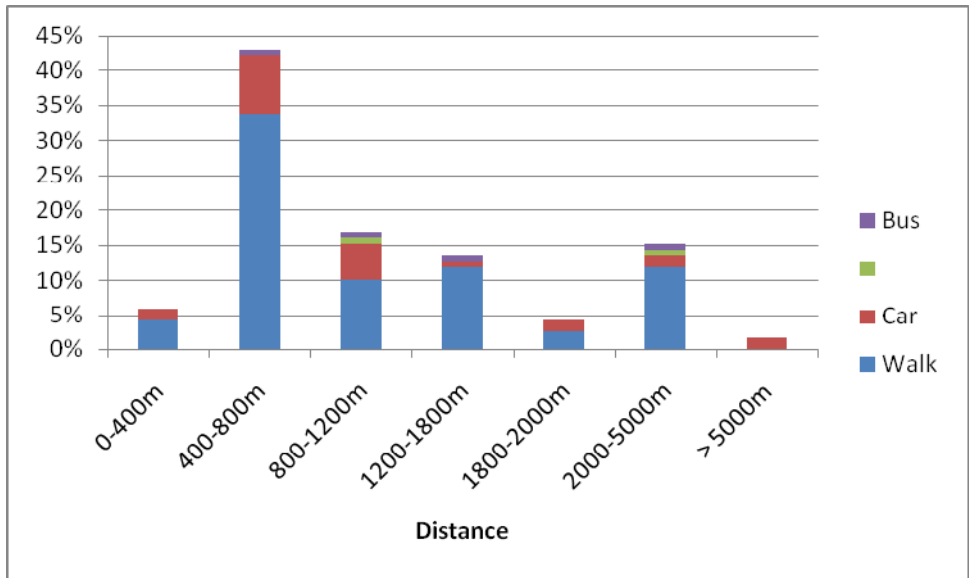
Base: n= 282

Figure 12: Mode and distance travelled to Henderson Station



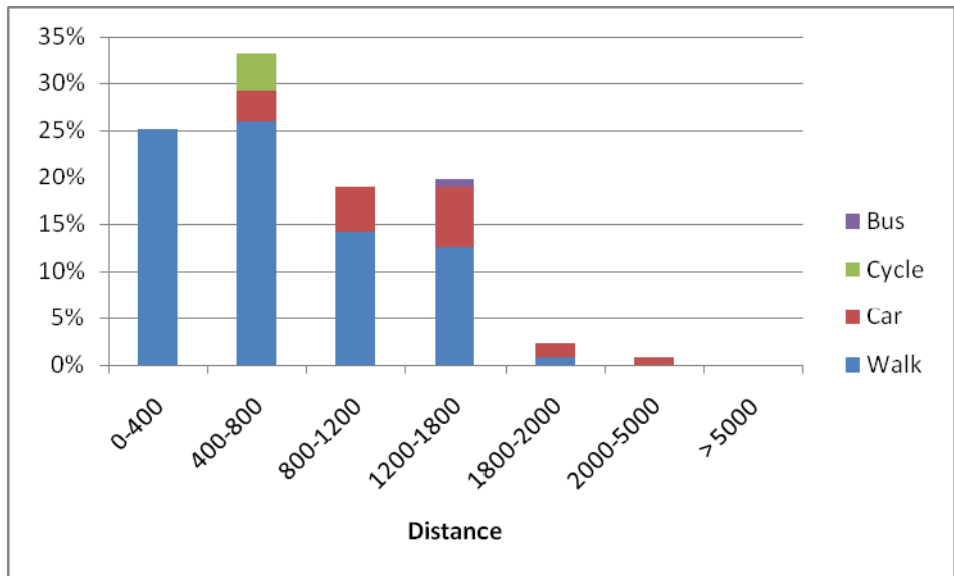
Base: n= 167

Figure 13: Mode and distance travelled to Ōtāhuhu Station



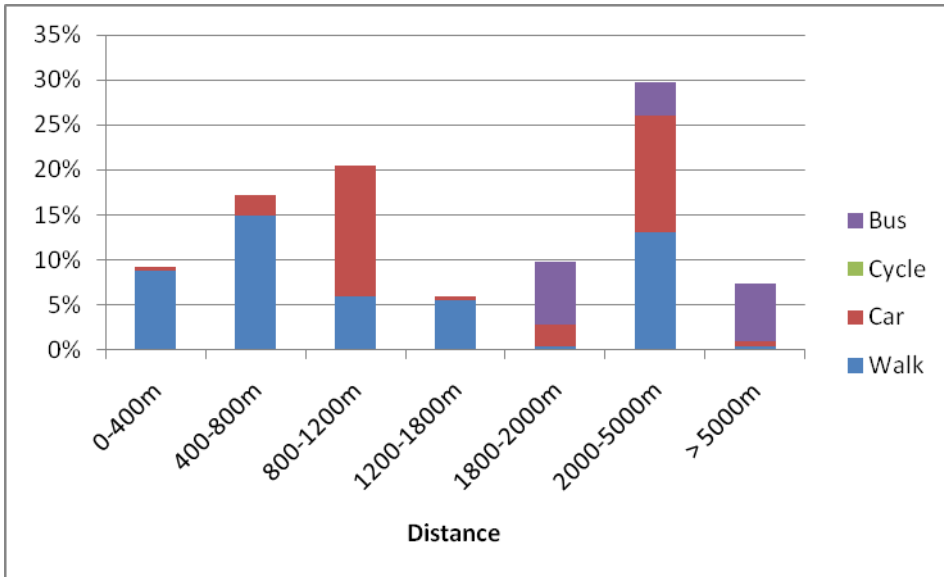
Base: n= 119

Figure 14: Mode and distance travelled to Ellerslie Station



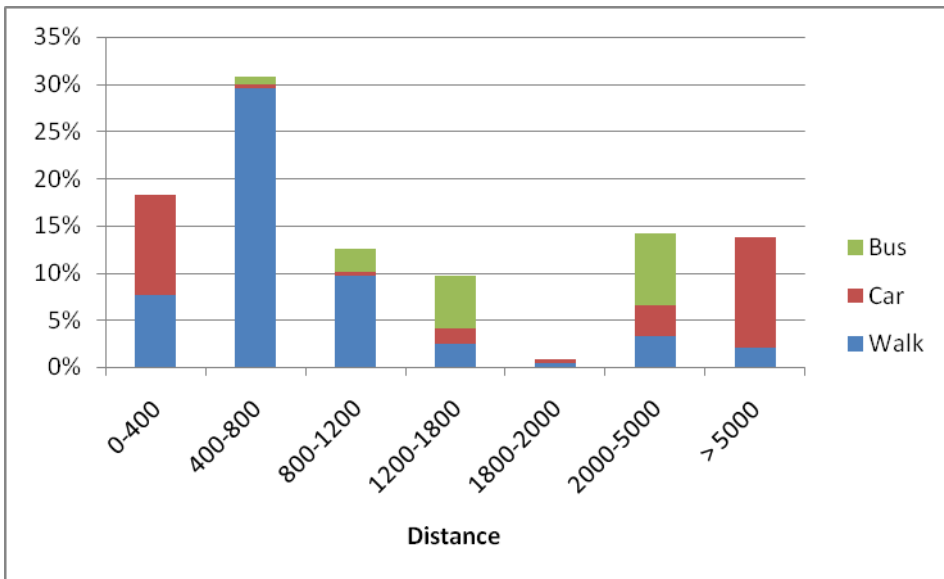
Base: n= 127

Figure 15: Mode and distance travelled to Onehunga Station



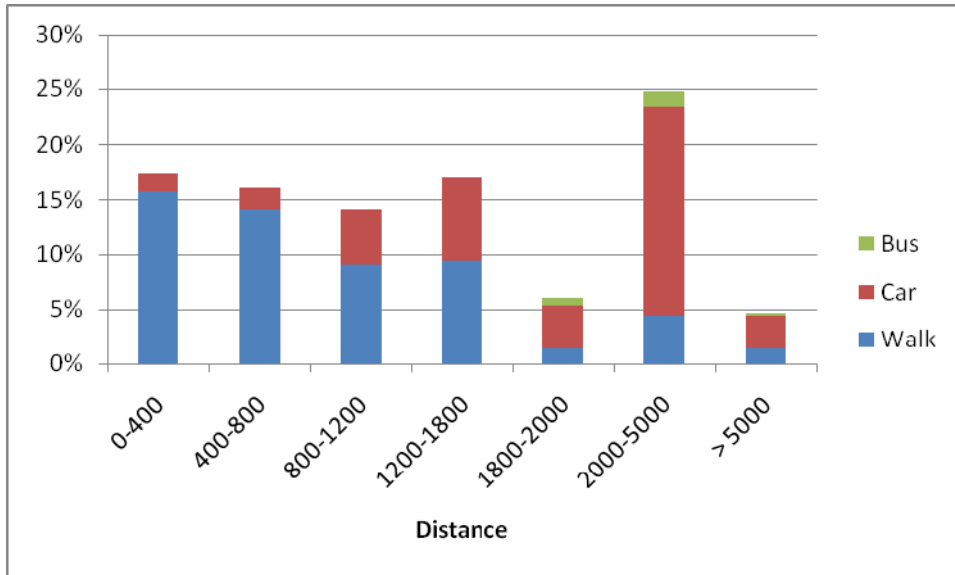
Base: n= 215

Figure 16: Mode and distance travelled to Sturges Road Station



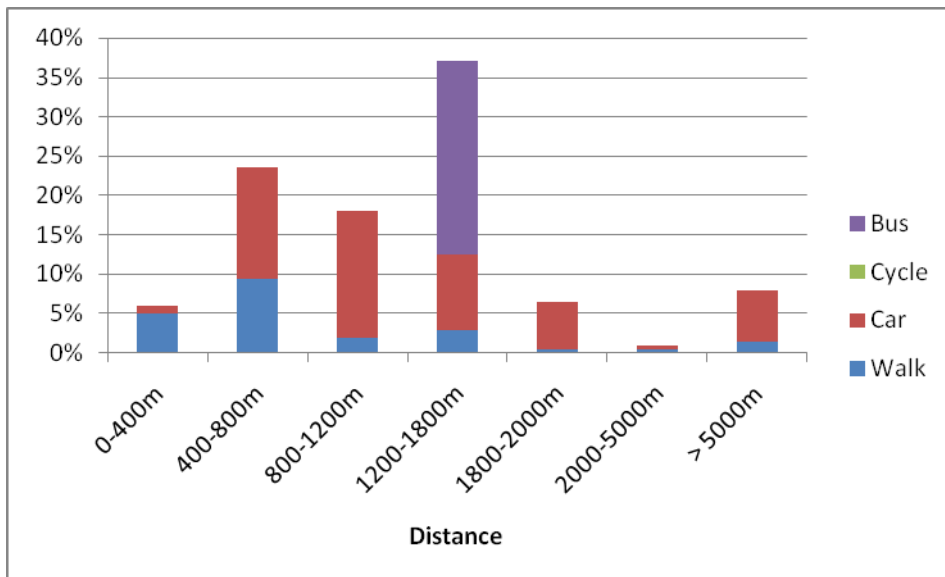
Base: n=248

Figure 17: Mode and distance travelled to Glen Eden Station



Base: n=299

Figure 18: Mode and distance travelled to Pukekohe Station



Base: n=200

3.3 Walking to the station

The information in this section is only based on the respondents who walked to a train station. All other modes of transport to the stations have been excluded so the analysis only focuses on people walking to a train station. The data includes walk distances for a whole 12 hour period capturing people both on their “inbound” trip and their “outbound” trip.

Table 7 shows the 50th (median), 85th percentile and mean and walking distances for all 12 stations surveyed in 2013. In addition, the 2010 Papatoetoe and 2012 walkable catchment train station survey data is included for comparison. Mean (or average) and median are statistical terms that have a somewhat similar role in terms of understanding the central tendency of a set of statistical scores. While an average has traditionally been a popular measure of a mid-point in a sample, it has the disadvantage of being affected by any single value being too high or too low compared to the rest of the sample. This is why a median is sometimes taken as a better measure of a mid point

The results show that the 50th (median) and 85th percentile walking distances for the 12 stations are quite different. The survey results show significant variation for median walking distance to each station. Papakura has the largest median walking distance of just under 971m, followed by Panmure with 917m. The responses from people walking to the 12 train stations have been collated and mapped to identify walkable catchment maps (see Appendix 5). The maps shows the 400-metre, 800-metre, 50th (median) and 85th percentile walking isochrones distances and where the respondents left before arriving at the train station.

Newmarket and Ellerslie stations had the lowest median walking distances with 569m and 446m respectively – well within the traditional 800m catchment distance. It should be noted that both Newmarket and Ellerslie are significant destination stations. There is some limited international evidence of reduced propensity to walk at the work destination of a public transport trip compared to the residential origin which could potentially be a factor at play in the shorter average walking distance at stations such as Newmarket and to a lesser extent Ellerslie (Washington Metropolitan Area Transit Authority 2006). Any future similar surveys could include a question about trip purpose in order to test whether this factor is significant in the Auckland context.

Overall, eight of the 12 stations recorded median walking distances within an 800m catchment, with four exceeding this distance. In addition, 85th percentile of all responses show that 15 per cent of all respondents were walking more than 1000 metres to get to a train station, with 15 per cent of respondents at Ōtāhuhu and Onehunga train station walking more than 2200 metres.

Table 7: Median (50th) and 85th percentile and mean walking distances to train stations

Train Station	Mean	Median	85 th Percentile
Ellerslie Station	720m	569m	1318m
Glen Eden Station	1035m	722m	1637m
Henderson Station	861m	756m	1531m
Manurewa Station	1259m	905m	1813m
Meadowbank Station	706m	552m	1074m
Newmarket Station	879m	446m	1903m
Onehunga Station	1308m	880m	2771m
Ōtāhuhu Station	1262m	791m	2258m
Panmure Station	1014m	917m	1369m
Papakura Station	1297m	971m	1465m
Pukekohe Station	1325m	800m	1468m
Sturges Station	1161m	640m	1171m
Papatoe (2010)	1072m	1200m	2180m
New Lynn(2012)	1347m	1125m	2116m
Glen Innes(2012)	1015m	943m	1526m
Mt Albert(2012)	952m	826m	1617m

This section provides a general comparison of the 12 train stations. Detailed results of the individual stations are presented in Appendix 3.

Table 8 shows the distance walked by survey respondents. For all 12 stations, most of the respondents walked between 400 – 1200 metres. It also shows that Newmarket had the highest proportion of respondents (46%) walking between 0-400m; Ōtāhuhu had the highest percentage of respondents walking 400-800m (45%), and Panmure the highest percentage of respondents walking(36%) 400-800m to get the station .

Table 8: Percentage Distance walked to get to 12 rail stations

Station	0-400m	400-800m	800-1200m	1200-1800m	1800-2000m	2000-5000m	>5000m	%	n=
Ellerslie	39%	26%	16%	14%	4%	2%	0%	100	166
Glen Eden	26%	27%	17%	18%	3%	6%	3%	100	165
Henderson	33%	20%	23%	15%	3%	6%	0%	100	79
Manurewa	14%	30%	28%	14%	5%	7%	2%	100	96
Meadowbank	33%	31%	26%	8%	0%	2%	0%	100	110
Newmarket	46%	25%	7%	6%	3%	13%	1%	100	194
Onehunga	18%	30%	12%	11%	1%	26%	1%	100	106
Ōtāhuhu	6%	45%	14%	16%	3%	16%	0%	100	88
Panmure	9%	32%	36%	17%	2%	3%	1%	100	92
Papakura	14%	29%	26%	19%	2%	6%	4%	100	100
Pukekohe	23%	43%	9%	14%	2%	2%	7%	100	44
Sturges Road	14%	54%	18%	4%	1%	6%	4%	100	136

Base: n= 1249

Table 9 shows the cumulative percentage of walking trips by distance. Cumulative percentage is another way of expressing frequency distribution. It calculates the percentage of the cumulative frequency within each interval, much as relative frequency distribution calculates the percentage of frequency (Statistics Canada 2013). The distances shown in the table represent the point at each percentage threshold is exceeded. For example, at the Ellerslie Station, 10 per cent of all customers who walked came from within 200m.

Station	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Ellerslie	200m	300m	475m	575m	700m	900m	1075m	1375m	1550m	2475m
Glen Eden	275m	475m	675m	975m	1200m	1500m	1825m	2125m	2450m	4975m
Henderson	600m	1100m	1825m	2900m	3400m	3550m	3850m	4005m	4400m	4975m
Manurewa	475m	750m	900m	1015m	1350m	1675m	2005m	2325m	3200m	4300m

Meadowbank	900m	975m	1200m	1225m	1275m	1450m	1500m	1675m	1750m	4600m
Newmarket	625m	1550m	1900m	2450m	2675m	2800m	3175m	3525m	4125m	4875m
Onehunga	475m	575m	750m	925m	1300m	1500m	2005m	2850m	3400m	4900m
Otahuhu	475m	600m	750m	925m	1300m	1500m	2005m	2850m	3400m	4900m
Panmure	475m	675m	825m	975m	1175m	1425m	2125m	3275m	3700m	4800m
Papakura	300m	650m	750m	1000m	1125m	1325m	1550m	1950m	2350m	4750m
Pukekohe	250m	NA ⁵	450m	775m	1075m	1375mm	1675m	2100m	2300m	3523m
Sturges Road	400m	500m	650m	725m	900m	1125m	1400m	1875m	2425m	4900m

Base: n= 1249

Table 9: Cumulative Percentage of walking trips by distance

Figures 19 and 20 show tables 8 and 9 in more detail, including distances where walking trips begin to increase or decrease. In particular, they show the share of walking trips that is sustained within certain levels of distance away from the train station. Curves that are closest to the left of the charts show stations that play a more local role, with smaller geographical catchments. Conversely, curves that are positioned further to the right of the charts show stations that have geographically larger catchments with a higher share of walking trips that is sustained by non-local demand. Differences between these curves may also reflect local variations in the role of the station where some places serve both a local and wider spatial role. For these two graphs graph, longer and straighter lines represent a higher percentage trips being around a particular distance. Lines with an arc curve indicate a more gradual increase for walking distances.⁶

In figure 19, three of the stations have a spike in trips between 400 and 800m before increasing more gradually. Henderson station is the exception, with a slow increase up until 3km followed by a steep increase.

⁵ Due to the small sample size at the Pukekohe Station, no distance could be calculated.

⁶ At several stations a small number of percentage respondents (mainly between 1-2%) walked further than 5km to the station. It seems unlikely that someone would walk more than 5km to a train station. However, the walking data was reviewed and no errors were found.

Figure 19: Cumulative % Distance curve for Western Line stations, Onehunga and Panmure Stations⁷

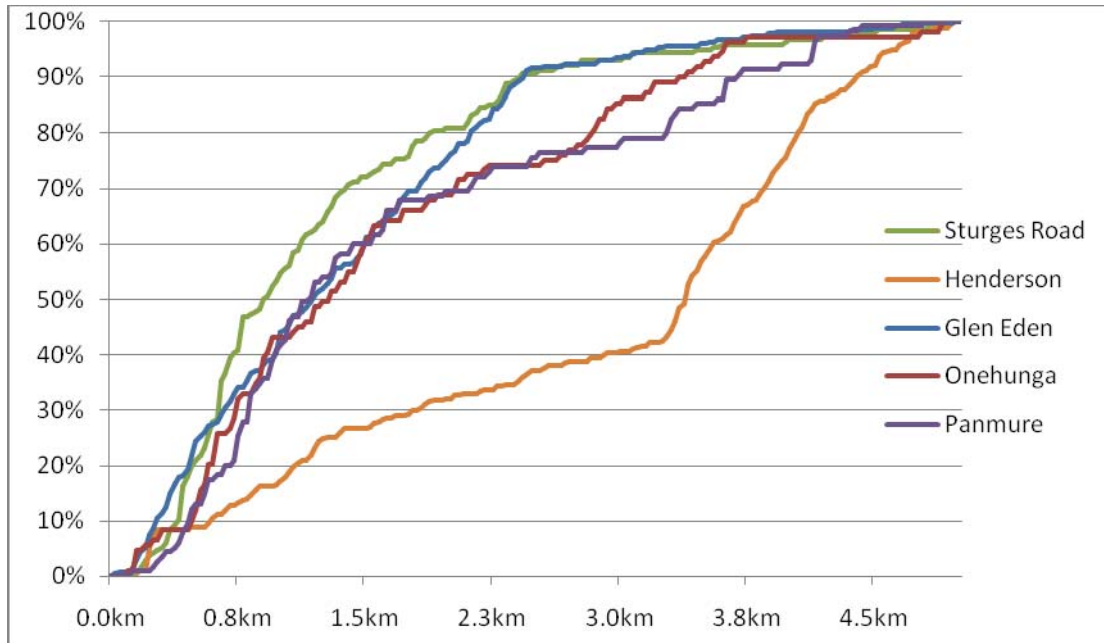


Figure 20 shows a range of walking patterns to seven Southern Line stations. At Ellerslie Station, for example, the graph line climbs steeply around 400m and continues until approximately 2km. At the Meadowbank Station, there is jump in respondents walking just after 800m. The other stations (except Newmarket) have more gradual distance curves.

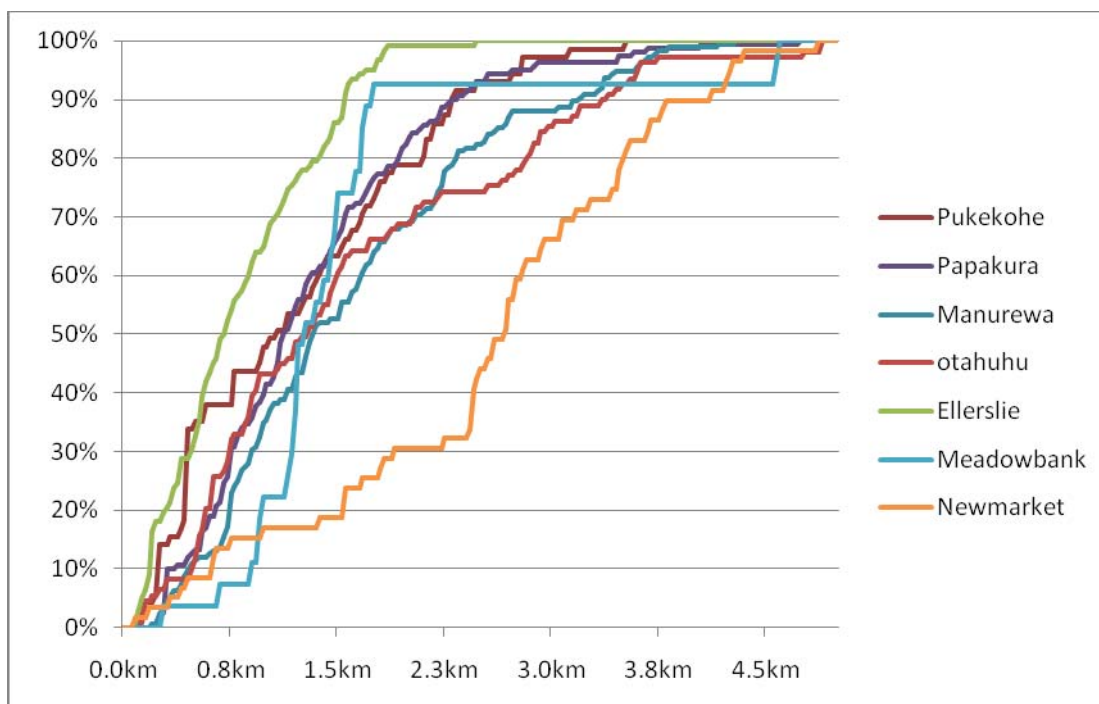
Newmarket (figure 20) and Henderson (figure 19) are two dominant stations in terms of walking to the station. The graph lines for both stations are significantly further to the right than the other stations. In particular, it is notable that at least 50 per cent of customers who walked travelled from relative large catchment areas (3.4 km for Henderson and 2.4km for Newmarket).⁸

Each station's distance from the Auckland CBD also recorded (see appendix 9). This was to establish if any patterns exist in regards to how far a station is from the city centre compared with its walking catchments. With the exception of Newmarket Stations (located approximately 3.8 km from the city with a larger catchment size), there is no clear pattern in terms of how far a station a station is from the city and the size of its walking catchments.

⁷ Onehunga Station is on the Onehunga line, while Panmure Station is on the Eastern line. Including the two stations on the same graph is not intended to provide specific comparisons with Western line Stations.

⁸ 50% was chosen based on what was observed in the data. Furthermore, 50% is a useful measure of compactness around stations.

Figure 20: Cumulative % Distance curve for Southern Line stations



3.4 Busway survey results

A total of 2205 responses were collected during the survey. Full details of the responses are in table 3. Table 9 below shows the number of survey responses by mode of arrival.

Table 10: Mode of travel to bus station

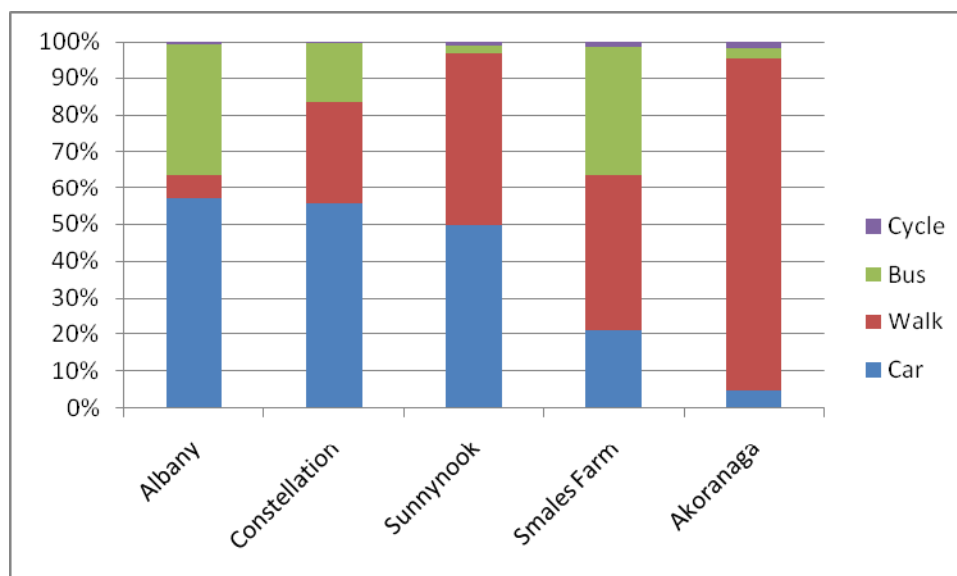
Bus Station	Car	Walk	Bus	Cycle	Total
Albany	358	42	223	4	627
Constellation	186	92	55	1	334
Sunnynook	181	170	10	3	364
Smales Farm	119	243	200	7	569
Akoranga	15	281	10	5	311

Base: n=2205

Table 9 and Figure 21 show the mode of travel used to get to the five busway stations. Some significant findings of the busway surveys show that:

- Akoranga had the highest proportion of respondents walking to the station (90%) followed by Sunnynook (47%) and Smales Farm (43%)
- Albany had the highest proportion of people in a car (57%) followed by Constellation (55%) and Sunnynook (50%).
- Albany had the highest proportion of respondents arriving by bus (36%) followed by Smales Farm (35%).

Figure 21: Mode of travel for all trips to busway stations



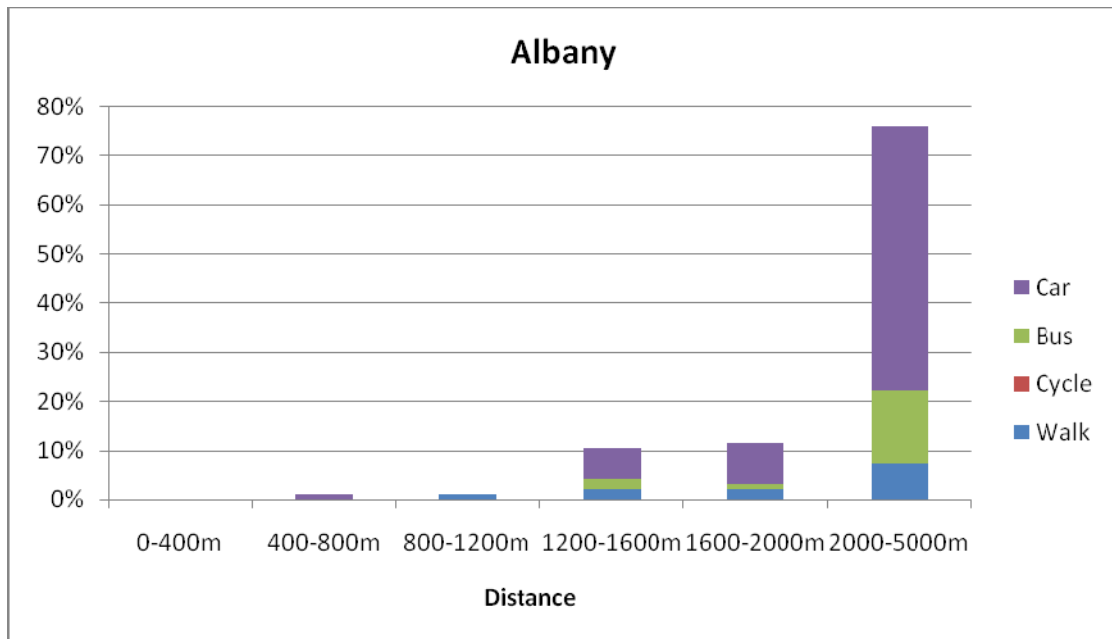
Base: n= 2205

3.5 Mode and distance travelled to busway stations

Figures 22 to 26 show the proportion of trips that were less than five kilometres to a busway station. The sample size is 983. Overall, for trips less than 2000m to three of the five stations, walking was the most popular mode of travel.

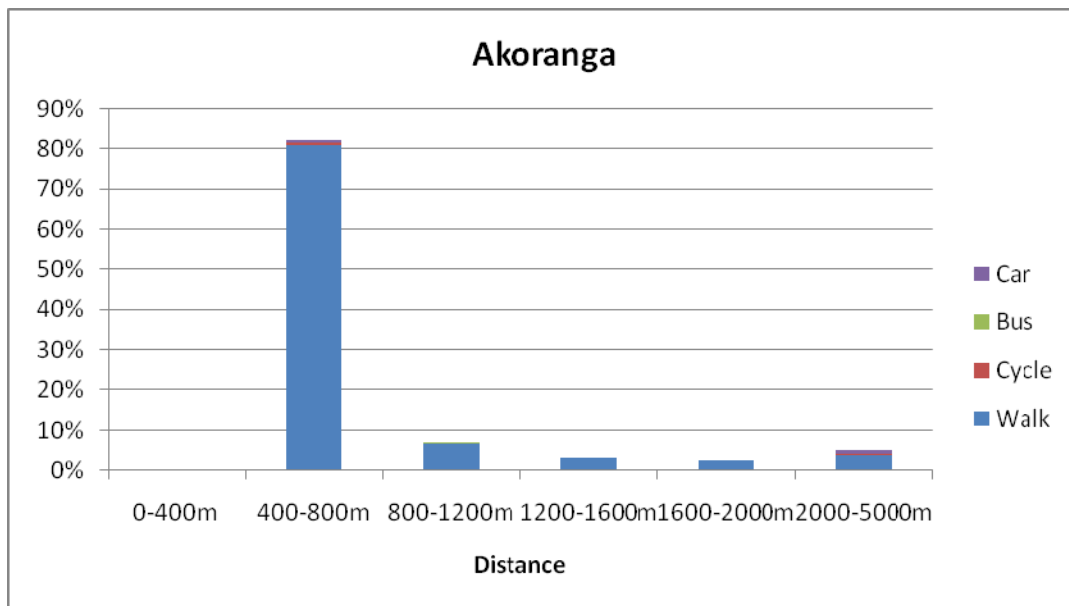
The results for Akoranga show that nearly all respondents (97%) walked to the bus station. Walking to the bus station was also the most popular mode of transport for respondents arriving at Constellation (65%), with the remaining respondents arriving mostly by car (5.6%). A relatively high proportion of respondents (66%) walked to Smales Farm Station, while 17.3 per cent bussed and 14.4 per cent drove. In contrast to these three stations, only a small number of respondents walked to Albany (13%) and Sunnynook (14%) stations.

Figure 22: Mode and distance travelled to Albany Station



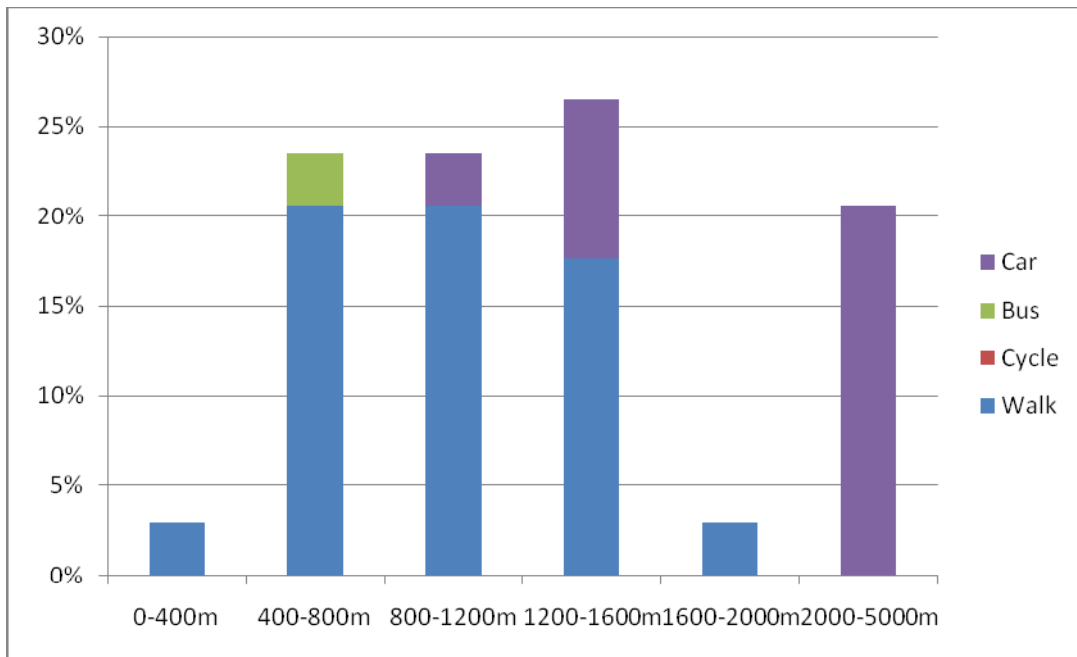
Base: n=95

Figure 23: Mode and distance travelled to Akoranga



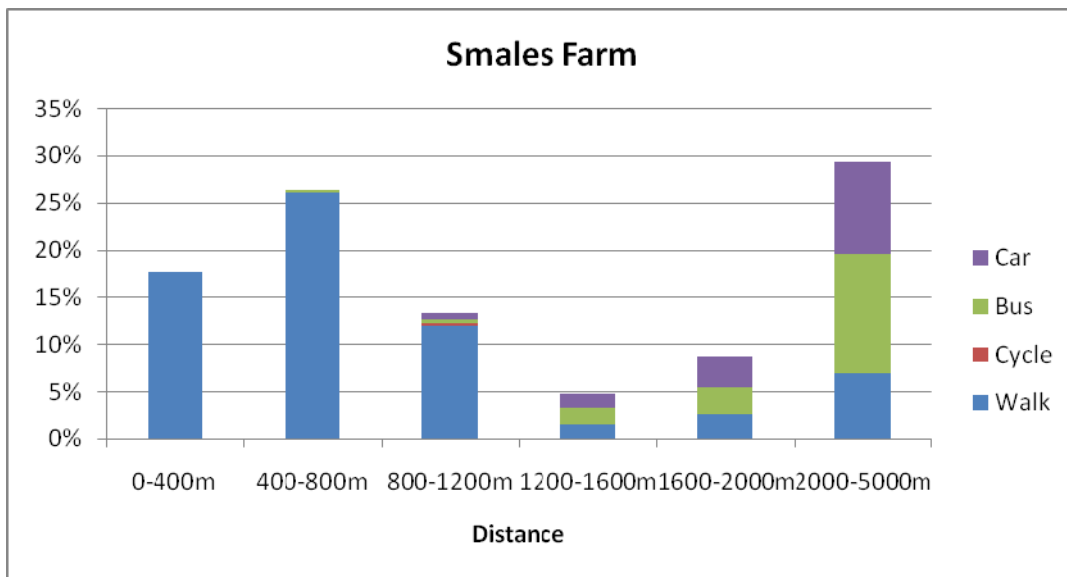
Base: n= 241

Figure 24: Mode and distance travelled to Constellation Station



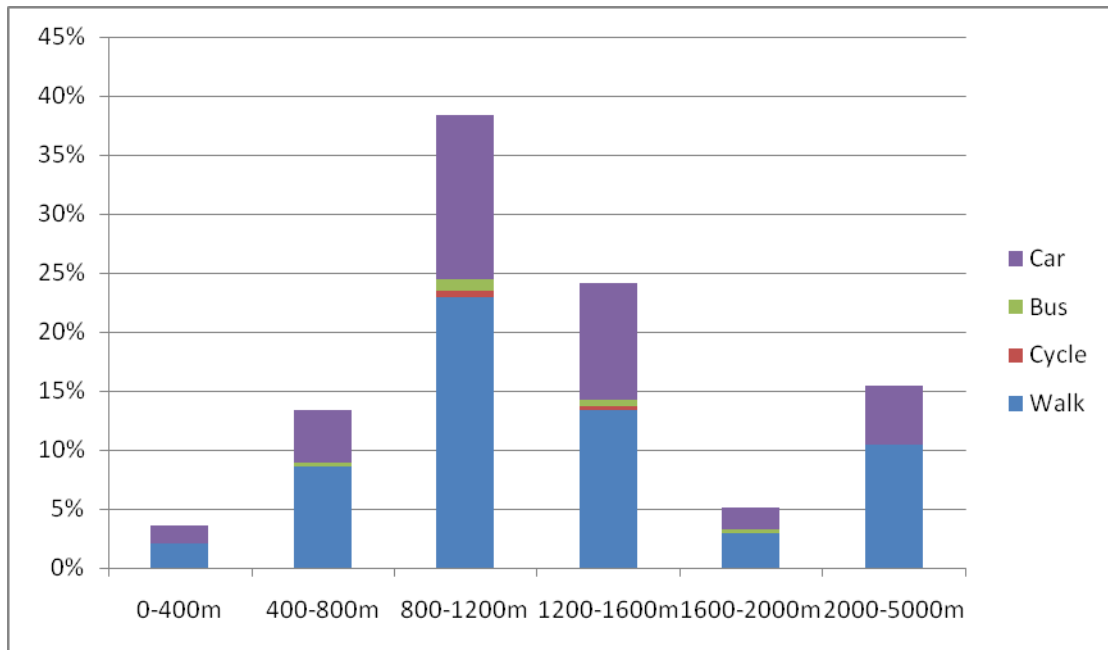
Base: n= 34

Figure 25: Mode and distance interval travelled to Smales Farm Station



Base: n= 277

Figure 26: Mode and distance travelled to Sunnynook Station



Base: n= 336

3.6 Walking to the station

The information in this section is only based on the respondents who walked to a bus station. All other modes of transport to the stations have been excluded so the analysis only focuses on people walking to a bus station. The data includes walk distances for a whole 12 hour period capturing people both on their “inbound” trip and their “outbound” trip. 1500 survey respondents provided addresses that were able to be geocoded.

Table 10 shows the 50th (median) and 85th percentile walking distances for five stations surveyed in 2013. This is the first time walking distance data has been collected for bus stations, so there is no opportunity for direct comparisons to be made. The responses from people walking to the five bus station have been collated and mapped to identify walkable catchment maps (see Appendix 6). The maps show the 400-metre, 800-metre, 50th (median) and 85th percentile walking isochrones distances and where the respondents left before arriving at the train station.

The results show that the 50th (median) and 85th percentile walking distances for the five stations are quite different.

Smales Farm had the lowest median walking distance at 588 metres. That is, 50 per cent of the people who walked to Smales Farm station walked less than 588 metres, and the other 50 per cent walked more than 588 metres. Akoranga had a similar median walking distance of 590 metres

In contrast, the median walking distances to Constellation and Sunnynook were 1199 and 1141 metres. Meanwhile, the median walking distance to Albany was 2727 metres. It should be noted that only 42 respondents walked to the Albany Station and 92 to the Constellation. The small sample size for these two stations limits the statistical significance of the respective average walking distances to the stations. It also suggests the Albany and to a lesser extent Constellation are outliers in terms of walking walk distance.

Overall, the 85th percentile of all responses show that 15 per cent of all respondents were walking more than 1200 metres to get to a station, with 15 per cent of respondents at Albany and Sunnynook bus stations walking more than 2100 metres.

Table 11: Median and 85th percentile walking distances to five bus stations

Sl. No.	Station Name	Travel Distance (m)		
		Mean	Median	85th Percentile
1	Albany	2499	2727	3378
2	Akoranga	764	590	946
3	Constellation	1000	978	1373
4	Smales Farm	916	588	1293
5	Sunnynook	1409	1141	2123

Base: n= 1500

3.7 Results for individual busway stations

The responses from people walking to the five busway stations have been collated and mapped to identify walkable catchment maps (see walkable station maps in Appendix 6). The sample size for this data is 655. This section presents a summary of findings for each station.

Table 12 shows the distance walked by respondents to the five stations. This table gives a basic indication of the range of distances people are walking to the station. Table 13 and Figures 27-32 describe these numbers in more detail.

Table 12: Distances walked to get to busway station

Station	0-400 m	400-800m	800-1200m	1200-1600m	1600-2000m	2000-5000m	%	n=
Albany	0%	0%	8%	17%	17%	58%	100%	12
Akoranga	0%	83%	7%	3%	3%	4%	100%	234
Constellation	5%	32%	32 %	27%	5%	0%	100%	22
Smales Farm	27%	39%	18%	2%	4%	10%	100%	184
Sunnynook	4%	13%	38%	24%	5%	17%	100%	203

Base: n= 655

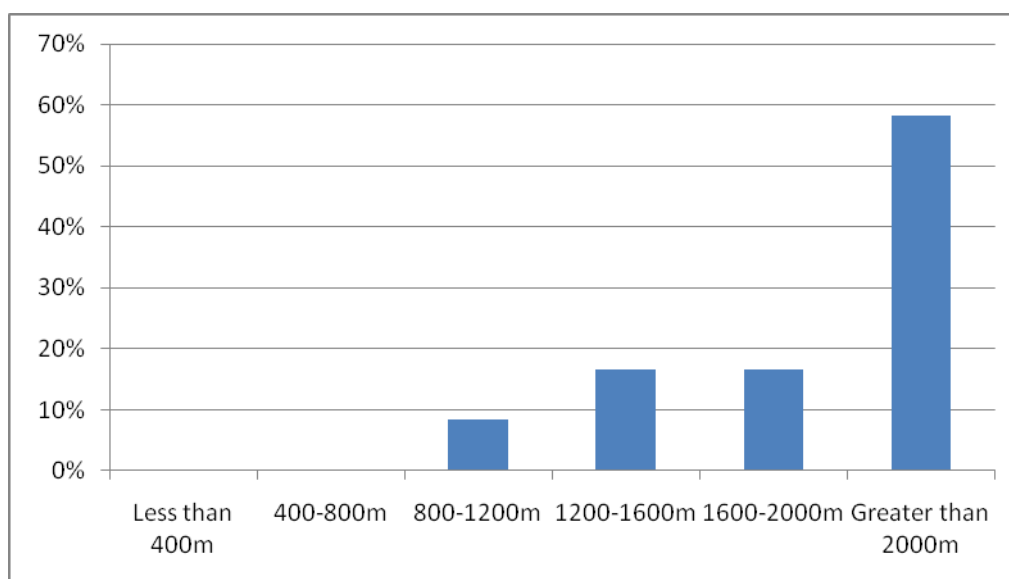
Table 13: Cumulative Percentage of walking trips by distance

Station	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Akoranga	NA ⁹	NA	NA	NA	NA	NA	NA	600m	1200m	3600m
Albany	1400m	1500m	1900m	2000m	2700m	3100m	3200m	3400m	3400m	3600m
Constellation	500m	700m	700m	900m	1000m	1100m	1300m	1400m	1400m	1800m
Smales Farm	NA ¹⁰	300m	NA	NA	600m	600m	1000m	1100m	2000m	4200m
Sunnynook	900m	1000m	1100m	1100	1200m	1400m	1500m	2000m	2900m	4700m

Base: n= 655

Table 13 shows the cumulative percentage of walking trips by distance. Cumulative percentage is another way of expressing frequency distribution. It calculates the percentage of the cumulative frequency within each interval, much as relative frequency distribution calculates the percentage of frequency (Statistics Canada). The distances shown in the table represent the point at each percentage threshold is exceeded. For example, at the Constellation Station, 10 per cent of all customers who walked came from within 500m

Figure 27: Distance walked to Albany Station



Base: n= 12

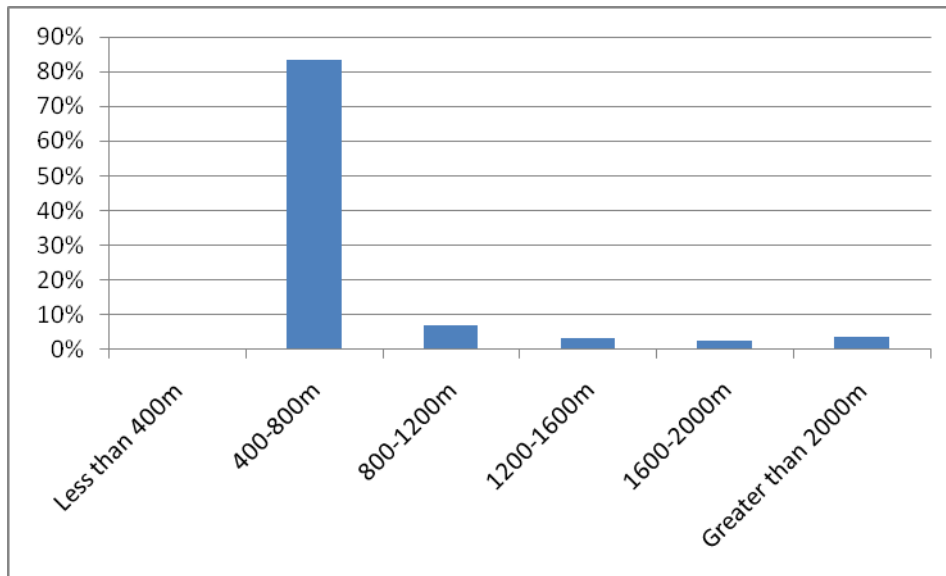
The majority (58%) of respondents walked further than 2000m to the Albany Station. The rest of the respondents mostly walked between 1200-1600m (17%) and 1200-1600m

⁹ Due to a small sample size, there are data gaps for Akoranga Station.

¹⁰ Due to a small sample size, there are data gaps for Smales Farm Station.

(17%). It is important to note that the number of people who walked to the Albany Station was relatively small at just 42.

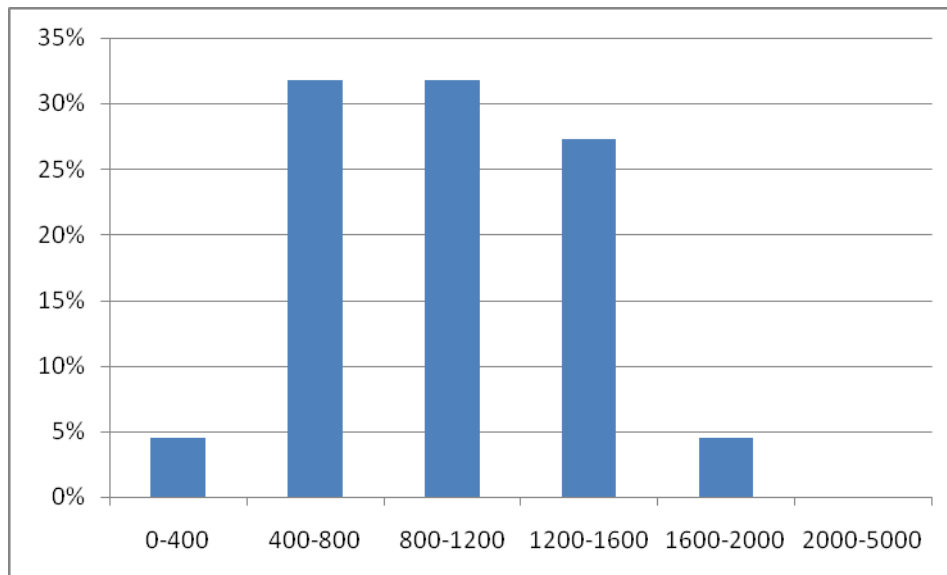
Figure 28: Distance walked to Akoranga Station



Base: n= 234

Figure 27 shows that the majority of respondents walked between 400-800m to the Akoranga Station. Based on the map in Appendix 4, the majority of respondents appear to be travelling to this station from the AUT North Shore Campus on Akoranga Drive.

Figure 29: Distance walked to Constellation Drive

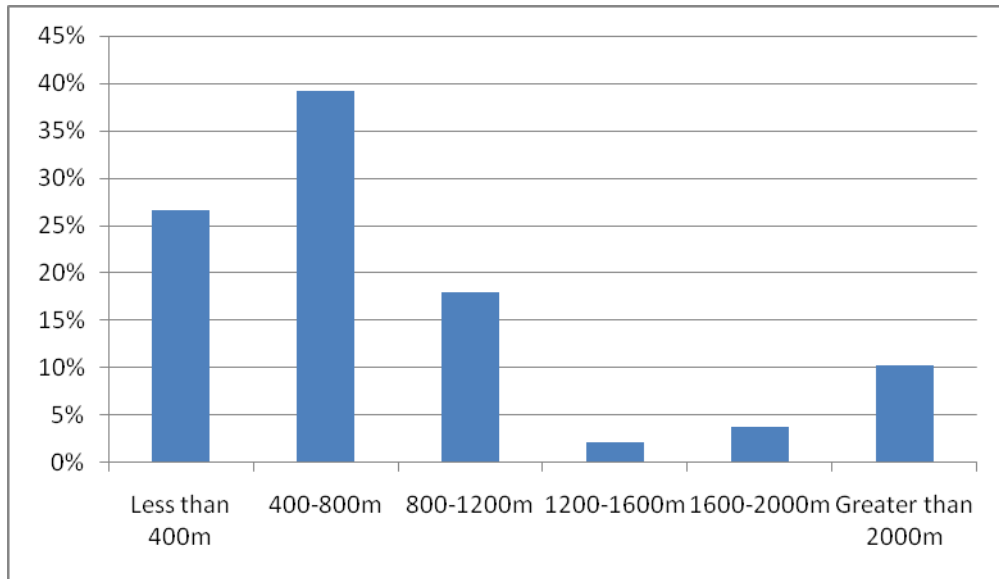


Base: n= 22

Figure 28 shows that that over 60 per cent of people walked further than 800m to get to the Constellation Drive Station. Of the 92 people who walked, 32 per cent walked

between 1200-1600m and 28 per cent walked 800-1200m. Most of these people came from the west of the station.

Figure 30: Distance walked to Smales Farm Station

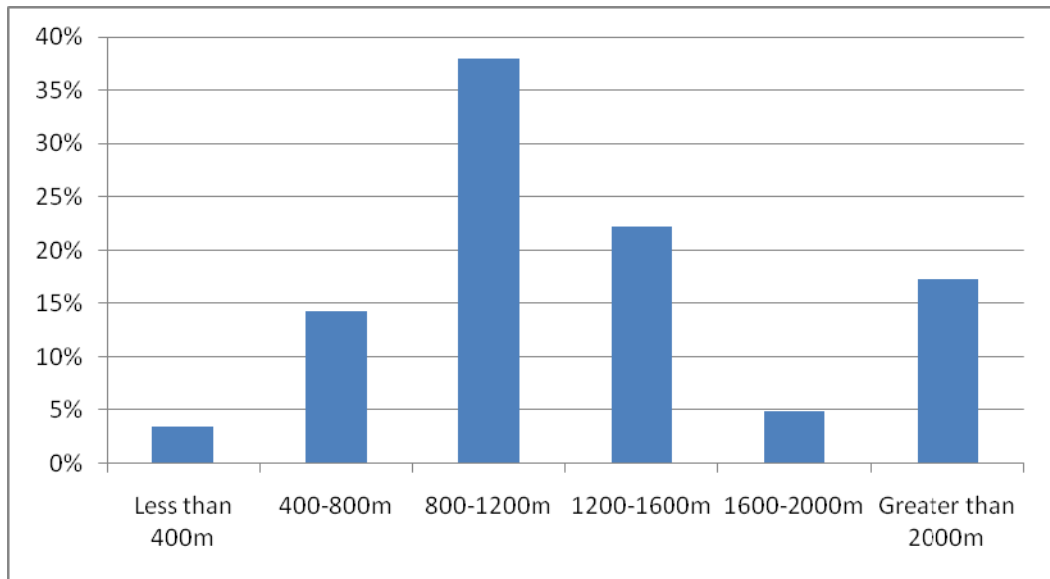


Base: n=184

Figure 28 shows that 66 per cent of respondents walked from within an 800m catchment. In addition, 18 per cent of respondents walked between 800-1200m, with a noticeable cluster to the north and south-east of the Station.

For the Sunnynook Station, 38 per cent of respondents walked 800-1200m, followed by 22 per cent who walked 1200-1600m and 17 per cent who walked further than 2000m. At 800m, most respondents came from the east of the station. The median walk distance to Sunnynook Station was calculated as 1143m. Within this catchment, the most people came from west of the station, while significant numbers also came from the east and north.

Figure 31: Distance walked to Sunnynook Station



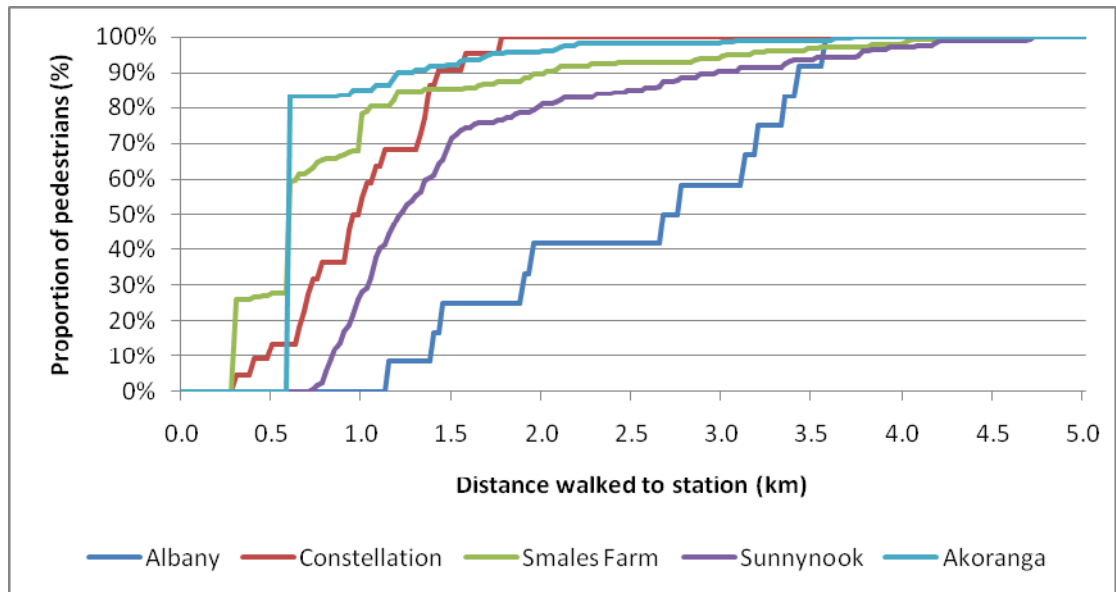
Base: n=203

Figure 32 shows the share of walking trips that is sustained within certain levels of distance away from the busway stations. Curves that are closest to the left of the charts show stations that play a more local role, with smaller geographical catchments. Conversely, curves that are positioned further to the right of the charts show stations that have geographically larger catchments with a higher share of walking trips that is sustained by non-local demand. Differences between these curves may also reflect local variations in the role of the station where some places serve both a local and wider spatial role.

The graph line for Albany is significantly further to the right than the other stations; (over 50 per cent walked further than 2700m) suggesting customers are walking from a larger catchment.¹¹ It should be noted though, that only 12 of the 42 respondents who walked to Albany Station provided their address, which is significantly lower than for the other stations.

Longer and straighter graph lines represent a higher percentage trips being around a particular distance. This is evident for Akoranga where over 80 per cent of walking trips were less than 600m and Smales Farm where 60 per cent of trips were under 600m. Lines with more of a curve or arc indicate a more even distribution for walking distances, as shown by the line for Sunnynook Station.

Figure 32: Distance curve for walking trips to busway stations



Base: n= 655

Each station’s distance from the Auckland CBD also recorded (see appendix 9). This was to establish if any patterns exist in regards to how far a station is from the city centre compared with its walking catchments. It is interesting to note that that the two stations closest to the CBD (Akoranga and Smales Farm) have two of the smallest walking catchments. At both these stations, for example, 80 per cent of walking trips are sustained from within 1km. It should be noted that Akoranga is close to a University Campus and Smales Farm is surrounded by offices and a number of schools, which may explain these station’s smaller catchment sizes

4.0 Summary and recommendations

The purpose of this research was to test for evidence if an 800-metre radius is representative of the walkable catchment area for 12 train stations and five bus stations in Auckland and compare the findings with those in the 2012 survey and the 2010 Papatoetoe Train Station Survey.

The results of the 12 train station surveys show that:

- Walking was the most common mode of arrival at nine of 12 stations. Ellerslie (73%) and Newmarket (69%) recorded the highest percentage of respondents walking to stations. Manurewa recorded the small percentage of respondents walking 41 per cent
- For trips under 2km, walking was the dominant mode of arrival at four stations: Glen Eden, Henderson, Ōtāhuhu and Newmarket.
- At four stations more than 50 per cent of respondents walked further than 800 metres to get to a train station;
- At eleven stations more than 15 per cent of respondents walked further than 1500 metres to get to a train station; and
- Newmarket Station returned the lowest median walking distance to a train station with 446 metres. Ellerslie Station recorded a slightly higher median walking distance with 569 metres. The highest median walking distances were recorded at Papakura with 971 metres followed by Panmure with 917 metres.

Despite the median walking distances to the Newmarket and Ellerslie train stations being close to the 800-metre radius distance, a significant number of respondents walked greater distances than 800 metres to get to the train station.

- Newmarket and Henderson are two dominant stations in terms of walking to the station. In particular, it is notable that at least 50 per cent of customers who walked travelled from relative large catchment areas (3.4 km for Henderson and 2.4km for Newmarket).

The results of the five bus station surveys show that:

- The median walking distance ranged from 588m at Akoranga to 2727m at Albany
- At five of the stations, 50 per cent of respondents walked further than 800m. The exception was the Akoranga Station, where over 80 per cent of respondents walked between 400-800m.
- Walking was the most significant mode of travel for trips less than 2000 metres at three stations, including Akoranga, Constellation and Smales Farm. In contrast, only a small number of respondents walked to the Albany (13%) and Sunnynook (14%) stations.
- Smales Farm had the lowest median walking distance at 588 metres. That is, 50 per cent of the people who walked to Smales Farm train station walked less than 588 metres, and the

other 50 per cent walked more than 588 metres. Akoranga had a similar median walking distance of 590 metres. In contrast, the median walking distances to Constellation and Sunnynook were 1199 and 1141 metres. Meanwhile, the median walking distance to Albany was 2727.

Overall, the results from the surveys show that an 800-metre radius is accurate for some stations, but underestimates the actual walking distances for others.

The 2013 rail and bus survey adds to the small amount of existing data. While the results to date are not conclusive in terms of an 800-metre walking distance being representative of a walkable catchment area for a train or busway station in Auckland, the findings from the surveys do show that those currently using these train and busway stations are in some cases prepared to walk further than 800 metres to get to a station.

Any additional survey data will be useful for developing a typology of walkable catchments for train stations in Auckland. This typology would essentially be used to classify and group the train stations based on a set of characteristics. An example of these characteristics may include the location, surrounding land use, topography, availability of parking and accessibility issues for each station.

Walkable catchments for centres are not fixed and should not be, as over time the centres will evolve and change. When this happens, there are opportunities for research similar to that described in this report to help inform and guide future policy approaches that determine these walkable catchments.

Based on these findings, it is recommended that:

- Further surveys be carried out to test for more evidence if an 800-metre radius is representative of the walkable catchment area of other train stations in Auckland; and
- The data collected in the surveys is used to develop a typology of walkable catchments for train stations in Auckland.

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