A Geospatial Comparison of Driving with Non-driving Transport Modes in Tāmaki Makaurau / Auckland

Joanne Daniel, Kathryn Ovenden

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Technical Report 2025/4

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Joanne Daniel, Kathryn Ovenden

Social and Economic Research and Evaluation
Strategic Advice and Research Unit
Policy Department

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Executive summary

Introduction

The purpose of this research project was to explore the ability and willingness of Aucklanders to shift some of their private vehicle trips to public transport, cycling or walking, and to inform interventions and services designed to encourage the use of non-driving transport modes. This report is the second report published from this research project.

The impetus for this research came from the development of the Transport Emissions Reduction Pathway (TERP),[1] which was adopted by Auckland Council in August 2022. The TERP gives effect to Te Tāruke-ā-Tāwhiri Auckland's Climate Plan, which committed Auckland to halving emissions by 2030 and achieving net zero emissions by 2050. Reaching this ambitious goal relies heavily on reducing transport emissions, with a clear focus on reducing private vehicle travel, making public transport competitive with driving and ensuring that walking and cycling are safe and attractive options.

The project was developed and undertaken by researchers from Auckland Council's Social and Economic Research and Evaluation team (SERE) and Transport Strategy team, in collaboration with Dynata, an independent research service provider. An online survey was conducted between 20 May and 13 June 2022, gathering data from a representative sample of Auckland drivers. Participants provided the start and end locations for their most recent driving trip starting at home and were asked to select the route on a map that best described their journey. The survey captured geospatial data, including trip distance, duration, elevation, and latitude/longitude coordinates for the driving trip. Google Maps equivalent data were generated for routes involving public transport, cycling and walking.

Results related to drivers' perceptions of using public transport, cycling, and walking compared to driving were published in March 2024 as an Auckland Council technical report.[2] The analysis presented in this report was undertaken by the lead author in partial fulfilment of a Master of Data Science at the University of Auckland, in an industry partnership between the University of Auckland and SERE. The analysis focuses on geospatial data collected in the survey. These data describe the origin and destination locations, distance, and duration of trips taken by car, and the Google Maps generated equivalent trips by public transport, cycling, and walking.

[1] See: https://www.aucklandcouncil.govt.nz/plans-projects-policies-reports-bylaws/our-plans-strategies/Pages/transport-emissions-reduction-pathway.aspx

[2] *Perceptions of public transport, cycling and walking among Auckland drivers*, TR2024/2. Report available at: https://knowledgeauckland.org.nz/publications/perceptions-of-public-transport-cycling-and-walking-among-auckland-drivers/

Approach

The survey collected 4448 complete responses from participants. Most trips involved a single destination while a small number included multiple stops. For simplicity multi-stop journeys were broken down into individual trips with a single destination for analysis. After data cleaning, 5233 trips are included in the analysis presented in this report.

To supplement the survey data, a shapefile for Statistical Area 3s (SA3) in Auckland was sourced from Stats NZ.[3] Data from Auckland Transport's Open GIS platform,[4] which included bus, train, and ferry stop locations, was used to assess the proximity of public transport stops to trip origins. The spatial data collected through the survey contained errors which resulted in re-fetching trip distances and durations for driving, public transport, cycling and walking using Google Maps to improve accuracy.

Key findings

The driving trips taken by survey participants averaged 15km in distance and 17 minutes in duration. There were variations in average trip distance and duration across the Auckland region. The analysis identified four zones of interest. Zone A describes a cluster of SA3s in northern Auckland, Zone B covers a group of SA3s near Auckland City Centre, Zone C includes some SA3s in eastern Auckland and zone D is a cluster of SA3s in southern Auckland near Pukekohe and Franklin.

Trips starting in zone B tended to be shorter, averaging 9km in distance and 13 minutes in duration. A radial pattern was observed with driving trip distances and durations increasing further away from Auckland City Centre. Driving trips that started in zone D were some of the longest average distances (32km) and durations (28 minutes). These findings highlight the regional variation in the travel behaviour of Aucklanders.

Public transport trips referred to here were generated by Google Maps using the origin and destination coordinates of participants' driving trips and are suggested alternative trips, not trips actually undertaken by participants. The average distance of a suggested public transport trip was 17km and took 57 minutes to complete.

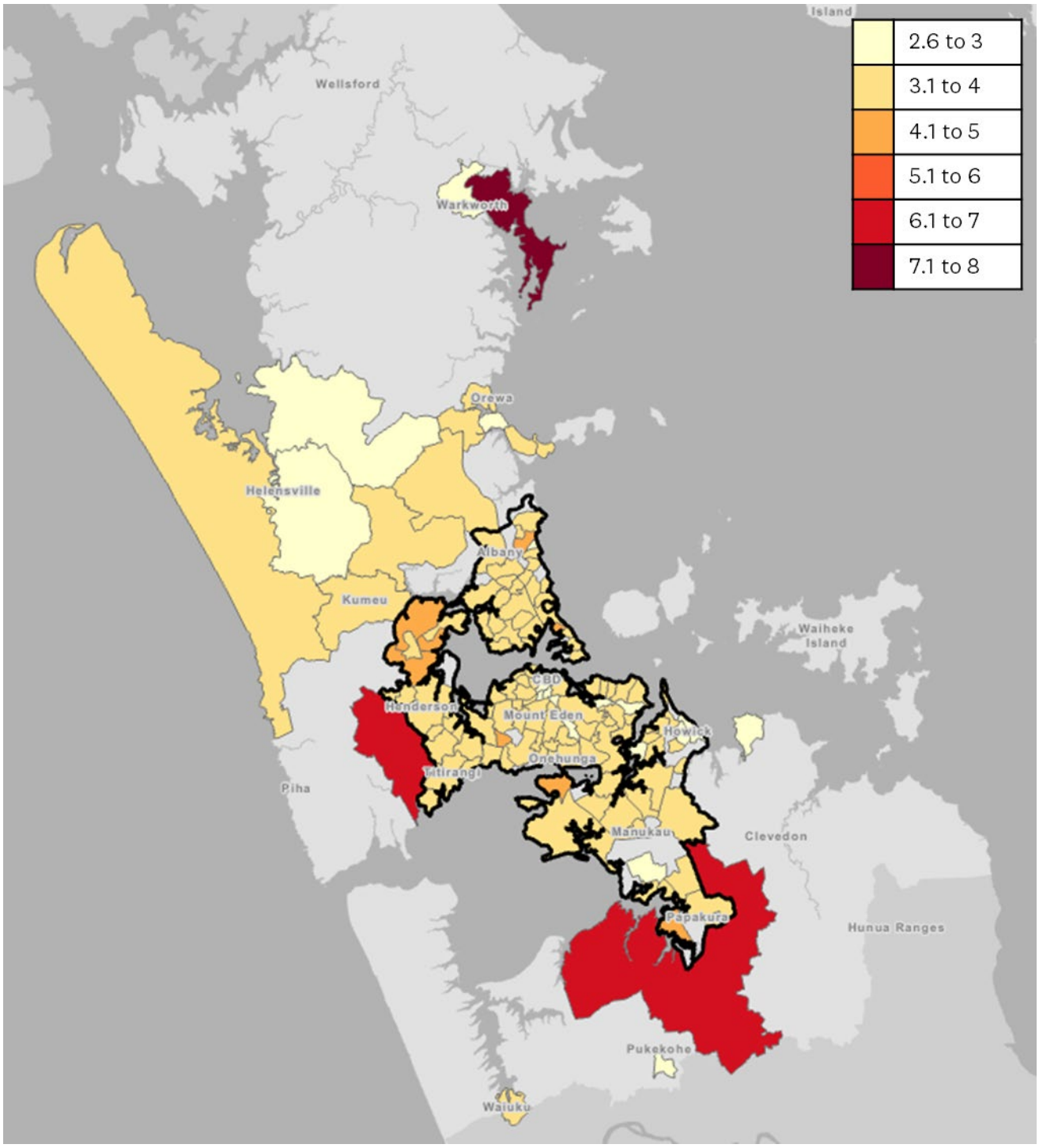
The distances of public transport trips followed similar patterns to driving trips with trips in zone B near the Auckland City Centre being shorter (10km), compared to those in zone D (41km).

Google Maps suggested equivalent trips by public transport originating in zone D had some of the longest average public transport trip durations, averaging 1 hour and 48 minutes. In contrast, public transport trips originating within zone A, zone B and around zone B had shorter trip durations, most falling within 20 to 60 minutes.

[3] Available at: https://datafinder.stats.govt.nz/layer/111235-statistical-area-3-higher-geographies-2023-generalised/
[4] Available at: https://data-atgis.opendata.arcgis.com/

A ratio was calculated to compare driving and public transport trip durations. On average, the duration of a public transport trip was 3.4 times longer than that of a driving trip (see Figure 1 for distribution of ratios across the region).

Figure 1: Ratio of public transport to driving trip duration (minutes), by SA3 trip origins



Analysis of the proximity of public transport stops to trip origins found that for 76 per cent of trips, the closest public transport stop was not serviced by a route[5] that would take the participant to their destination. However, this finding may be the due to public transport stops servicing routes going in the right direction are across the road. On average, the nearest public transport stop that was serviced by a route to the destination was located 433 metres (about 5 minutes walking) from the trip origin. The pattern of proximity to public transport stops was scattered across the region.

On average, cycling trips were found to cover the same distance as driving trips (a ratio of 1.0), but they took twice as long (a ratio of 2.0). The longer duration was due to differences in speeds and the impact of Google Maps routing for cycling trips. Google Maps tended to prioritise cycleways, paths through public parks, and smaller winding streets, while driving routes were directed along motorways and straight main roads. This approach that may enhance cyclist safety sometimes resulted in longer distances and consequently longer durations for cycling trips. However, some of cycling trips had shorter distances *and* durations compared to driving, typically when trip origins and destinations were near cycleways or involved 'shortcuts' through public park paths. This highlighted how well-placed cycling infrastructure could make cycling a safer and more efficient transport mode.

Discussion

While there have been several changes in Auckland's transport landscape since the survey was conducted in 2022, including updates to public transport services and increased patronage, and a change in transport-related political priorities, the findings remain relevant for those involved in planning Auckland's transport future.

This analysis highlights areas in Auckland where non-car transport modes are less competitive. Public transport is most competitive relative to driving in zone B near Auckland City Centre but poorer in zone D (near Pukekohe and Franklin), while cycling follows a similar pattern.

Achieving the emissions reduction goal of the TERP depends on making non-car modes competitive with driving, as Aucklanders need to perceive them as convenient and safe. The findings show that those living in zone B have the greatest potential to shift from driving to non-car modes, but improvements are needed across the region to make public transport and cycling more competitive with driving.

[5] Routes are inclusive of transfers between services.

Contents

1 Introduction

Transport is a major contributor to greenhouse gas emissions in Tāmaki Makaurau / Auckland, and enabling transport by walking, cycling, and public transport is a key component in reducing emissions. In 2022, it was estimated that transport emissions accounted for 45 per cent of the region's emissions[6]. Te Tāruke-ā-Tāwhiri: Auckland's Climate Plan[7] released in December 2020 commits Auckland to halving greenhouse gas emissions by 2030 and reaching net zero by 2050. Transport is one of the eight priorities in the plan, with a stated goal of a low carbon, safe transport system that delivers social, economic and health benefits for all.

In August 2022, Auckland Council adopted a Transport Emissions Reduction Pathway (TERP), which was a critical element of Te Tāruke-ā-Tāwhiri. The TERP outlined approaches aimed at making public transport competitive with driving and ensuring that walking and cycling were both safe and attractive transport modes.

In late 2021, while the TERP was being prepared, Auckland Council's Environment and Climate Change Committee requested further and more detailed research into people's willingness and ability to change travel behaviour, taking note of the equity implications of mode shift, the barriers people faced, and the importance of a 'just' transition.[8] This followed a progress update on the development of the Transport Emissions Reduction Plan.[9] As part of the response to this request, members of Auckland Council's Social and Economic Research and Evaluation team worked with the council's Transport Strategy team to design and deliver a survey that aimed to investigate the potential for Auckland drivers to shift from private vehicle trips to non-car modes of transport, such as cycling, walking or public transport. The survey was undertaken in May and June 2022.

Results related to drivers' perceptions of using public transport, cycling, and walking compared to driving collected in the survey were published in March 2024 as an Auckland Council technical report titled *Perceptions of public transport, cycling and walking among Auckland drivers*. This report is available on the Knowledge Auckland website.[10] The report finds that, compared with driving, public transport, walking, and cycling were perceived to be less convenient, more stressful, and less safe from crime and harassment for most participants. These results indicate the need for change to Auckland's transport system to make public transport competitive with driving, and for walking and cycling to be safe and attractive options, if the emissions goals outlined in the TERP were to be met.[11]

[6] Source: https://knowledgeauckland.org.nz/media/2534/tr2022-06-aucklands-greenhouse-gas-inventory-to-2019.pdf
[7] www.aucklandcouncil.govt.nz/plans-projects-policies-reports-bylaws/our-plans-strategies/topic-based-plans-strategies/environmental-plans-strategies/aucklands-climate-plan/Pages/default.aspx
[8] Source: https://infocouncil.aucklandcouncil.govt.nz/Open/2021/12/ECC_20211202_MIN_10127_WEB.html
[9] The Transport Emissions Reduction Plan was renamed the Transport Emissions Reduction Pathway when the policy was completed in August 2022.
[10] Report available at: https://knowledgeauckland.org.nz/publications/perceptions-of-public-transport-cycling-and-walking-among-auckland-drivers/
[11] Several unforeseen circumstances, including COVID-19-related restrictions, prevented the project findings from being completed in enough time to be fully incorporated into the development of the TERP. However, the results remain relevant for understanding Aucklanders' transport choices.

The analysis presented in this report was undertaken by the lead author in partial fulfilment of a Master of Data Science at the University of Auckland, in an industry partnership between the University of Auckland and the Social and Economic Research and Evaluation team at Auckland Council. The analysis focuses on geospatial data collected in the survey. These data describe the location, distance, and duration of trips taken by car by survey participants. This analysis aims to highlight spatial differences of non-car transport modes. It is hoped the findings will inform future transport infrastructure investments, particularly in areas where walking, cycling, or public transport options are less viable due to infrastructural barriers.

There have been changes to Auckland's public transport services (e.g. changes to bus routes[12], new western express routes[13] and Pukekohe train station re-opening[14]) and an increase in public transport patronage[15] since the survey was undertaken in 2022. Changes to public transport services are reflected in the re-fetched Google Maps route data analysed in this report, preventing comparison with participant perceptions. Nevertheless, the origins and destinations visited by participants are expected to represent travel patterns of this sample of Aucklanders.

1.1 Purpose of the study

The primary objective of the study was to investigate the potential for Auckland drivers to shift from private vehicle trips to non-car modes of transport, such as cycling, walking or public transport. It did so by conducting a survey asking a sample of Auckland residents who drove a private vehicle to describe their most recent driving trip from home, providing them with a public transport equivalent trip (produced by Google Maps), and asking them about their perception of travelling this same trip by public transport, cycling, and walking.

The research objectives were broad, and included:

- Compare the driving trip to non-car modes defined by Google Maps, in particular:
    - Identify and map trips where there is a negative perception of non-driving modes and trips that are substantially worse (e.g. longer in duration, higher in cost, or involve multiple transfers), to target service improvements
    - Identify and map trips where there is a negative perception of non-driving modes and trips are equal or better (e.g. shorter or equal in duration, lower or equal in cost) in order to target behavioural interventions to address misperceptions and change habits
- Identify suburbs, and sub-populations across Auckland where access to non-car modes is poorest
- Determine what percentage of driving trips could feasibly be replaced by public transport trips if services are sufficiently fast, frequent and reliable

[12] For example the OuterLink bus route: https://at.govt.nz/projects-initiatives/city-centre-projects-and-initiatives/central-crosstown-bus-changes
[13] See: https://at.govt.nz/about-us/news-events/media-centre/2024-media-releases/western-express-celebrates-exceptional-first-year
[14] See: https://ourauckland.aucklandcouncil.govt.nz/news/2025/02/pukekohe-train-a-relief-for-locals/
[15] See: https://at.govt.nz/about-us/news-events/media-centre/2024-media-releases/public-transport-hits-highest-usage-in-five-years

- Determine what percentage of driving trips could feasibly be replaced by e-bike trips.

The data collected by the survey was unable to achieve all these objectives due to challenges with the quality of aspects of the geospatial data.[16] To overcome these limitations, the analysis presented in this report involved re-fetching geospatial data and the use of additional data sources.

1.2 This report

This report focuses on the geospatial data related to driving, cycling, walking, and public transport trips, offering insights into the distances, durations, and competitiveness of these transport modes across different areas in Auckland. In doing so this report contributes to achieving one of the aims of this project to 'identify suburbs, and sub-populations across Auckland where access to non-car modes is poorest'. In this report 'access' to non-car modes is interpreted as the degree of competitiveness between car and non-car modes and is largely based on differences in trip duration.

This report first describes the methods used to collect and analyse data (Section 2). The following sections outline results of the geospatial analysis. They first describe driving trips (Section 3) before making comparisons between driving and public transport (Section 4), cycling (Section 5) and walking (Section 6). The report concludes with a discussion (Section 7).

Further technical details are provided in the appendices.

[16] Technical details of how the survey was programmed to calculate trips using non-car modes were not made available to Auckland Council, which prevented diagnosing and resolving errors in the survey dataset (e.g. public transport trips taking hundreds of hours).

2 Method

This section outlines the survey method as well as the method of geospatial analysis presented in this report.

2.1 Survey data collection

Between 20 May to 13 June 2022, an online survey of drivers in Auckland was undertaken that collected:

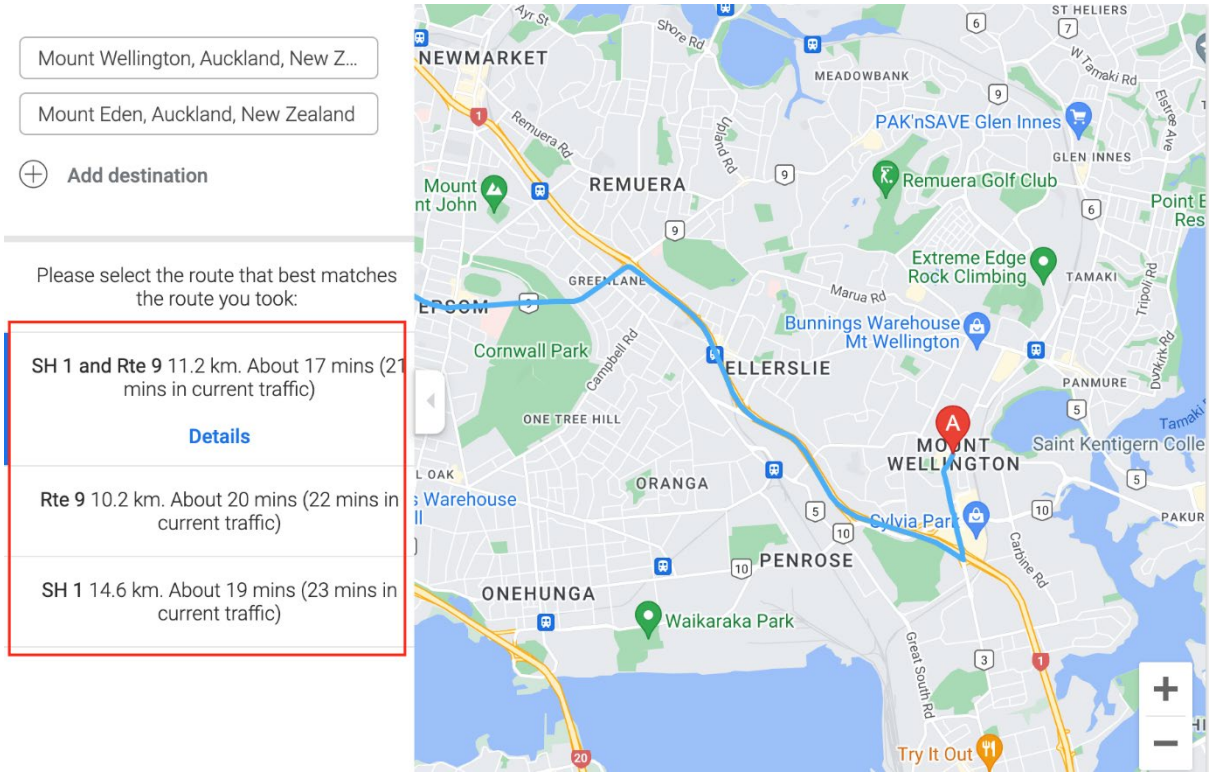
- information on the most recent car trip the participant had taken (including trip destination, purpose, time and day, and items transported)
- their perceptions about taking the same trip by another mode (public transport, cycling, or walking).

The survey was designed by the Social and Economic Research and Evaluation Team in collaboration with the Transport Strategy Team and Dynata, an independent research service provider, who programmed and administered the survey. The project design was reviewed by Auckland Council's Research Ethics Advisory Group (reference 001-2022).

The survey began by collecting information on the most recent car trip[17] participants had taken. Participants were shown a map and asked to enter their start and end locations in a search box, which placed pins and showed routes on the map. Participants could enter up to 10 stops in a trip generating a multi-stop journey. They were then asked to confirm which version of the route best matched their trip (see Figure 2 for an example). Completing this portion of the survey generated data about the driving trip and equivalent trips by non-car modes (e.g. duration, distance, elevation, as well as latitude/longitude coordinates for each transport mode version of the trip).

[17] In transport literature, it is common to distinguish between a 'trip' and a 'journey.' A trip refers to travelling from one location to another, whereas a journey comprises multiple trips to different locations, such as running errands or combining multiple stops during a single outing (i.e. trip chaining). In the context of this study, participants in the survey were asked to describe their most recent trip, which could, in some cases, include multiple stops, thereby more accurately reflecting a journey.

Figure 2: Survey map collecting information on driving trip



Participants were then asked a series of questions on their perceptions of public transport before being shown the equivalent trip by public transport, as calculated by Google Maps. Questions on perceptions of cycling and walking the trip followed (these were only asked if participants met certain criteria as described below). Participants were then asked some attitudinal questions and finally their demographic characteristics. The questionnaire is in Appendix 8.1.

Participants' responses to questions about their driving trip determined which later sections of the survey they were shown. Participants were not shown the series of questions about public transport, cycling, or walking if they indicated in the survey that they had limited mobility or a disability that made using these modes of transport very difficult or impossible.[18] Participants were shown the cycling questions if their driving distance was under 15km[19] and were shown the walking questions if their driving distance was under 5km.

Data collection was administered by Dynata, who manage an independent commercial research panel. At the time of data collection, New Zealand was coming to the end of the omicron COVID-19 variant outbreak and was in the orange traffic light setting which imposed some restrictions on use of public transport (e.g. face masks required indoors and on public transport).[20]

[18] Q15 and Q16 collected information about participant and passenger mobility (see Appendix 8.1 for the questionnaire).
[19] Note: the geospatial analysis of cycling trips presented in this report included only driving trips with a duration of 8km or less as this distance was later decided to be a more reasonable distance considering typical urban cycling distances and Auckland's varied terrain.
[20] https://www.policycommons.ac.nz/covid-19-policy-resources/covid-19-timeline/covid-19-timeline-2022/

2.2 Overview of survey participants

The sample consisted of members of Auckland Council's People's Panel,[21] as well as members of the Dynata panel who lived in Auckland. A total of 4448 complete responses were received, 3238 of which were from the People's Panel and the remaining 1210 responses were from the Dynata panel. A response rate of 1.3 per cent was achieved from the Dynata panel. These participants received $1 to complete the survey, as part of Dynata's incentive scheme. For the People's Panel, a response rate of 16 per cent was achieved and participants went in the draw to win one of four $100 e-gift vouchers. Broad quotas were applied across gender and age groups.

The demographic characteristics of survey participants (see Table 1) are generally representative of the population aged 15 and over. However, older and European ethnic group participants are over-represented relative to the total population. The results of this study therefore may not accurately represent some demographic groups such as younger people, those living in east, south and west Auckland, or those identifying as Māori and/or of Pacific and/or Asian ethnic groups.

[21] https://www.aucklandcouncil.govt.nz/have-your-say/have-your-say-through-peoples-panel/Pages/join-the-peoplespanel.aspx

Table 1: Survey participant demographics

	Count	Percentage (%)	Percentage (%) for Auckland region from 2023 Census†
Gender			
Male	2122	48	49
Female	2183	49	51
Another gender	18	0	0.4
Prefer not to say	125	3	NA
Age			
15-39	1046	24	46
40-59	1890	42	31
60+	1379	31	23
Prefer not to say	133	3	NA
Ethnicity (multiple choice, 'prefer not to say' excluded)			
European	3092	75	51
Māori	391	9	11
Pacific	187	5	14
Asian	707	17	31
Other	191	5	4‡
Area where participants live*			
North Auckland	1171	26	NA
West Auckland	782	18	NA
Central Auckland	1320	30	NA
East Auckland	484	11	NA
South Auckland	691	16	NA
Limited mobility or disability that makes the following very difficult or impossible (multiple choice)			
Using public transport	438	10	NA
Cycling	622	14	NA
Walking moderate or long distance	805	18	NA
No problems doing any of the above	3456	78	NA

*Note: Participants selected the area in which they live from the options displayed in the table as opposed to a suburb or statistical area with a defined geography. Participants may have varied interpretations as to the boundaries of East Auckland, for example, and may have inconsistently recorded their location.

†Note: Percentages displayed represented the Auckland population aged 15 years and over. Where Census data is not comparable to data collected in this survey 'NA' is stated in the table.

‡Note: 'Other' ethnicity combines the Census categories of 'Other', 'New Zealander' and 'Middle Eastern, Latin American, African'.

2.3 Geospatial data analysis

The geospatial data analysis presented in this report involved several steps and the incorporation of additional data sources. This section outlines the analysis process.

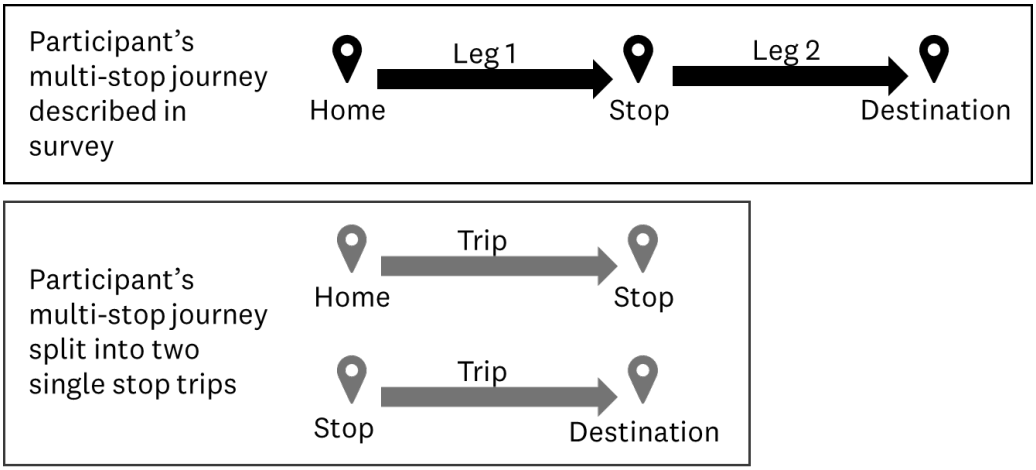
Data processing

A large proportion (89%) of participants in the survey described single-stop trips. These trips were reported as being between the participant's origin and a single destination, as captured in the map-based survey question (see Figure 2). The remaining 11 per cent of participants described a multi-stop journey involving between 2 and 10 stops (the survey allowed participants to include up to 10 stops when describing their trip). Seven per cent of participants' journeys involved 2 stops, 2 per cent had 3 stops and the remaining 2 per cent had 4 or more stops.

Multi-stop journeys described by participants in the survey were broken down into individual single-stop trips (see Figure 3). This data processing step was undertaken to make data analysis and visualisation of results feasible. The large amount of variance in multi-stop trips prevents summarising trip characteristics (i.e. distances and durations) at sub-regional spatial scales.

This resulted in the 4448 journeys described by participants equating to 5233 single-destination trips. An implication of this data processing is that the origin coordinates of all trips analysed are no longer the participant's home (or, as the questionnaire encouraged, a point near their home). For example, if a participant had one stop before their destination, the coordinates for this stop became the origin coordinates for the second trip that comprises their multi-stop journey.

Figure 3: Illustration of multi-stop journeys collected in survey broken down into single stop trips



An implication of this data processing was the detachment of spatial data describing survey participants driving trips and participants' responses to survey questions on perceptions of non-car modes. Through this processing unique identifiers of participants were not retained within the spatial dataset. This prevents comparisons between the characteristics of non-car modes (e.g. trip duration) and participants' perceptions of those modes (e.g. perceptions of how long the trip would take by public transport).

Geographical boundaries

In addition to the survey data collected, this analysis used Statistical Area 3 (SA3) shapefiles retrieved from Stats NZ.[22] SA3s combine smaller Statistical Area 2s into larger areas representing populations of 5000 to 10,000. The naming of SA3s generally aligns with a suburb, recognised place name or portion of a territorial authority.

These shapefiles were used to overlay trip data on regional maps, allowing for a polygon-based analysis (as opposed to individual points) of transport patterns across areas of Auckland. The analysis presented in this report focuses on trips within the Auckland region, categorised into SA3.

Origin and destination coordinates for trips were extracted from the driving route data. For some trips the final coordinates were incomplete, so the second-to-last coordinates were used. These coordinates were joined with SA3s.

Trips within the entire Auckland region, covering 194 SA3s, are included in the analysis presented in this report. This differs from the approach undertaken in the report *Perceptions of public transport, cycling and walking among Auckland drivers,* which restricted analysis to responses of trips within the Auckland Major Urban Area (MUA).[23, 24] Where possible, this report makes comparisons between trips originating inside and outside the MUA to evidence the differences in competitiveness car and non-car modes between these areas.

There are 153 SA3s within the Auckland MUA. Figure 4 shows the Auckland region with SA3 boundaries in relation to the MUA.

The number of trips represented by each SA3 in this analysis is not representative of the population residing within that SA3. The survey placed participation quotas on broad geographic areas for the Auckland region of northern, eastern, southern, western and central for results to be broadly representative of these areas (see Table 1).

The analysis found several SA3 clusters of interest. These SA3 clusters are referred to throughout this report as 'zones'. Figure 5 below shows the location of these zones named Zone A, Zone B, Zone C and Zone D.

Zone A includes a cluster of SA3s in northern Auckland within the MUA boundary. Zone B includes some SA3s in central Auckland near to Auckland City Centre within the MUA boundary. Zone C includes a collection of SA3s in eastern Auckland. This zone transcends the MUA boundary including SA3s within and outside the boundary. Zone D is in southern Auckland focused on SA3s around Pukekohe and Franklin towards the west. The SA3s included in zone D are outside the MUA. The

[22] SA3 can be viewed on the Stats NZ Geographical Boundary Viewer: https://www.arcgis.com/apps/webappviewer/index.html?id=6f49867abe464f86ac7526552fe19787

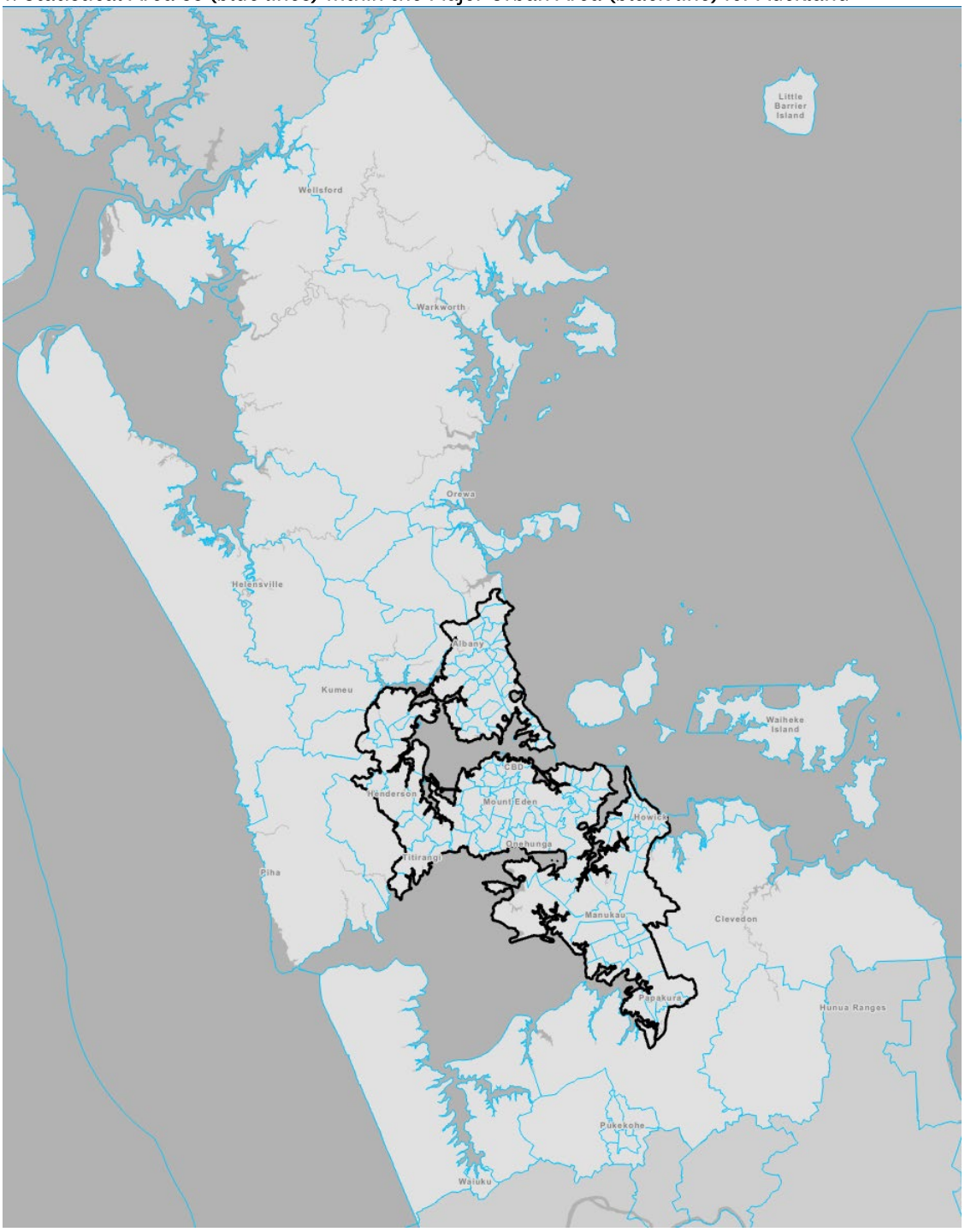
[23] Urban Rural boundaries can be viewed on the Stats NZ data finder website: https://datafinder.stats.govt.nz/layer/111198-urban-rural-2023-generalised/. Details on this classification can be found in the statistical standard documentation, available at: https://www.stats.govt.nz/assets/Methods/Statistical-standard-for-geographic-areas-2023/Statistical-standard-for-geographic-areas-2023.pdf

[24] This was done on request of the Auckland Council Transport Strategy team.

maps displaying data for zone D include SA3s around Papakura within the MUA because of maps being rectangular in shape. These SA3s around Papakura are not included within this zone of interest even though they are visible in the maps.

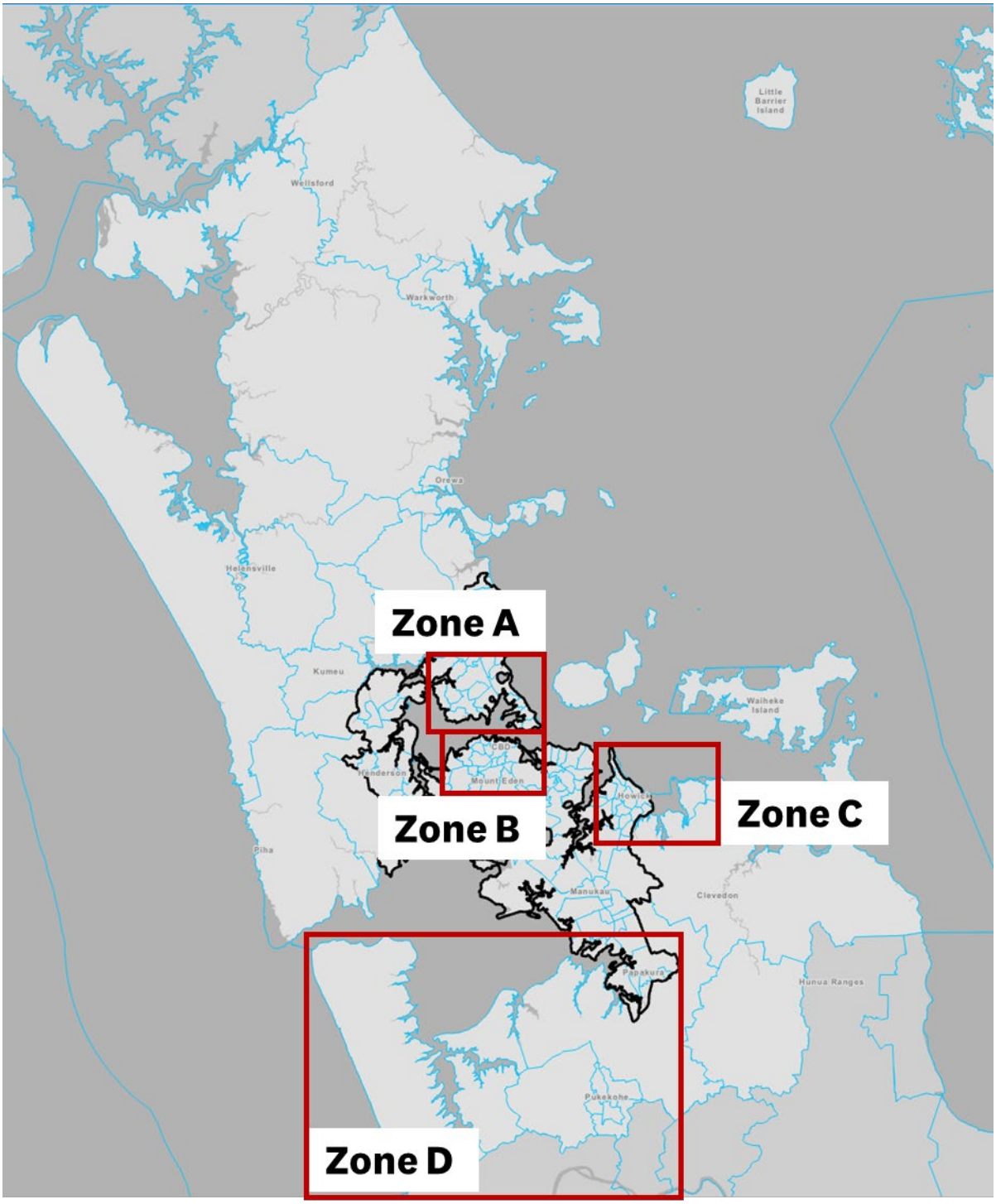
All SA3s regardless of number of trips represented by the sample size are included when characteristics of zones are reported. A minimum sample size of 10 trips is applied when reporting characteristics of individual SA3s, with the exception of describing outlier SA3s.

Figure 4: Statistical Area 3s (blue lines) within the Major Urban Area (black line) for Auckland



Note: Aotea / Great Barrier has been excluded from this map as no trips collected in the survey were on Aotea / Great Barrier.

Figure 5: Location of zones (red boxes with labels) containing SA3 clusters of interest in the Auckland region



Note: Aotea / Great Barrier has been excluded from this map as no trips collected in the survey were on Aotea / Great Barrier.

Google Maps route details

Trip distances and durations[25] for each mode of transport were re-fetched using the Google Maps API (see Appendix 8.2 for Python code). This step was undertaken due to anomalies in the survey data, such as trips having durations of several days. Re-fetching all geospatial data using the origin and destination coordinates for each driving trip greatly improved the quality of data. The revised trip data reflects the state of the transport network, according to Google Maps, at the time it was fetched in August 2024.[26]

Survey participants were shown a public transport route generated by Google Maps using the origin and destination coordinates of their driving trip (see questionnaire in Appendix 8.1, question 27). Re-fetching route details produced different public transport routes to those collected in the survey, due to changes in the public transport system between 2022 and 2024. This prevents making comparisons between the 2024 public transport route details and participants' perceptions of the route they were asked about in the survey in 2022. It also limits the ability to make comparisons about participants' perceptions of non-car modes more generally as the state of these modes have changed between survey data collection and re-fetching data for this report (e.g. changes to bus routes and location of cycleways).

Public transport data for 357 trips were found to be unavailable. A random sample of these trips was manually verified confirming that no public transport routes existed for the given pairs of origin and destination coordinates. For some of these trips the distance between the origin and destination coordinates was short (e.g. under 200m) resulting in Google Maps only providing information for driving, cycling or walking. For other trips there were no public transport stops deemed close enough for Google Maps to provide a public transport route option. Public transport analysis was undertaken on the remaining 4876 trips.

For cycling, the analysis presented in this report identified trips that could be considered feasible for cycling based on distance (less than or equal to 8km). To refine this dataset further, additional factors were considered to exclude trips based on the trip purpose (i.e. trips for the purpose of transporting items or people), transporting large items, and participants reporting physical constraints. After applying these criteria, the number of identified cycling trips was reduced to 921.

For walking, trips under 3km were analysed, again considering factors such as trip purpose and walking limitations.[27] Of the 717 trips initially identified as potentially walkable (having distances less than 3km), further filtering reduced these down to 353 trips. The selection criteria considered several factors, including reported difficulties in walking, carrying large bags, or trip reasons that involved an overnight journey, making walking impractical. This small sample size prevents detailed geospatial analysis of these trips.

[25] Note: trip durations for public transport trips are inclusive of wait times between services and time to travel between public transport stops.
[26] Time of day and day of week participants travelled were retained in re-fetching data.
[27] Note: these distances for cycling and walking are different to those applied to the survey logic for collecting information on perceptions.

The ratios of distances and durations between driving and each non-car mode of transport (cycling, walking, public transport) were calculated. These ratios provide insights into the effectiveness and efficiency of each mode relative to driving. By analysing these ratios, the study can highlight specific areas where non-car transport modes are competitive with driving and identify areas where significant improvements are necessary.

Public transport stops

Auckland Transport (AT) open GIS data[28] provided the location of public transport stops. Using this data, the Geopy library in Python and Open Street Map API, the nearest by walking public transport stops (bus, train, ferry) were calculated for each participant based on their trip origin coordinates.

Public transport trips were assessed for inclusion in the public transport stop analysis based on the proximity of nearby stops and the ratio of duration taken for a public transport trip versus a driving trip, with a threshold ratio of 2.5 times. This ratio was chosen based on findings from a study by Liao et al. (2020),[29] which used real-time traffic and public transport data to compare travel times in four cities: São Paulo, Stockholm, Sydney and Amsterdam. The study found that, on average, public transport trips take 1.4-2.6 times longer than driving. A ratio of 2.5 was deemed reasonable within this range, accounting for Auckland's transport network characteristics and the need for feasible public transport alternatives.

A note on the use of Google Maps

The analysis presented in this report uncovered several assumptions built into Google Maps, some of which result in limitations of using Google Maps for this kind of analysis.

Google Maps assumed that driving trips involved no walking between the vehicle and the trip origin or destination (i.e. that there was car parking exactly at the origin and destination coordinates). This was unlikely to be true for trips involving parking at a car park (e.g. at a mall or hospital) or trips into the city centre, where parking typically occurs in multi-storey car parks and walking is necessary, as minimal parking is available on city centre streets. This was also a challenge where origins and destinations were on, or near, motorways. In these situations, Google Maps could assume the origin of a driving trip was on a motorway rather than underneath a motorway bridge or on top of a motorway tunnel. This same error by Google Maps did not seem to occur for non-driving modes. The exclusion of walking to and from a car resulted in driving trip durations that were shorter than they would have been.

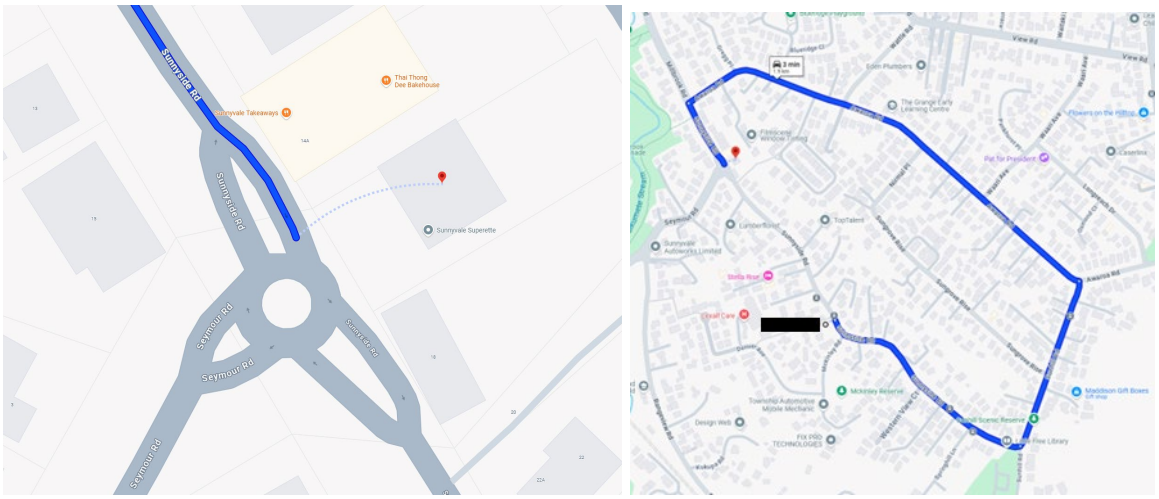
Google Maps also produced unexpected routes on occasion. This tended to happen when a trip origin was not on a road (such as in a car park or inside a mall) or if the trip origin was at an intersection. For example, as shown in Figure 6 the trip origin at a superette was at an intersection and Google Maps

[28] https://data-atgis.opendata.arcgis.com/

[29] Liao, Y., Gil, J., Pereira, R. H. M., Oke, T., Montavon, M., Tatem, A. J., and Di Muro, F. (2020). Disparities in travel times between car and transit: Spatiotemporal patterns in cities. Scientific Reports, 10, 4056. https://doi.org/10.1038/s41598-020-61077-0

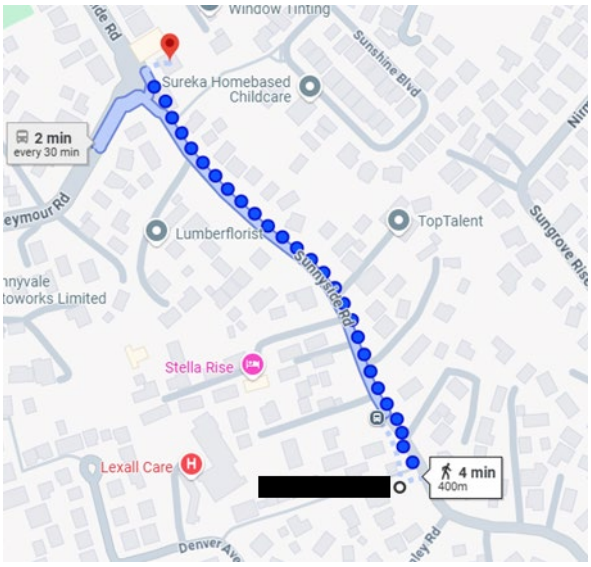
plotted a 3km loop route rather than providing a direct route to the destination, which was 400m southeast along Sunnyside Road.

Figure 6: Example of unexpecting routing due to trip origin at an intersection (left) and complete driving route (right)



When Google Maps plotted the public transport route for this driving trip it provided a more direct route along Sunnyside Road (see Figure 7). There was a bus route available for this trip. However, as it was a short distance and travelling to the bus stop required walking further away from the destination, Google Maps defaulted to walking as the mode of transport instead of public transport. The public transport distance and duration generated by Google Maps for short trips such as this tended to be for walking rather than for public transport.

Figure 7: Example of public transport routing



3 Driving trips

This section describes the 5233 driving trips undertaken by survey participants. When trips happened is described first, followed by where participants travelled to and from (location), the distance and duration of driving trips, and finally the reasons for trips.

3.1 When trips happened

Participants were asked to provide information about their most recent driving trip that started at their home. These trips occurred close to when participants completed the survey in May-June 2022. However, as explained in Section 2.3 the data presented in this report was fetched from Google Maps in 2024 using the coordinates for driving trips collected in the survey. The 11 per cent of participant trips that involved multiple stops were broken down into single stop trips resulting in trip origins that were not necessarily a residential address.

The largest numbers of driving trips described by participants occurred on a Wednesday, followed by Thursday (see Figure 8). These patterns might be influenced by the day most survey invitations were sent, which had been a Wednesday. People tend to participate in surveys shortly after receiving the invitation, potentially skewing the results towards activities and trips undertaken on that specific day.

Figure 8: Distribution of trips across days of the week (counts)

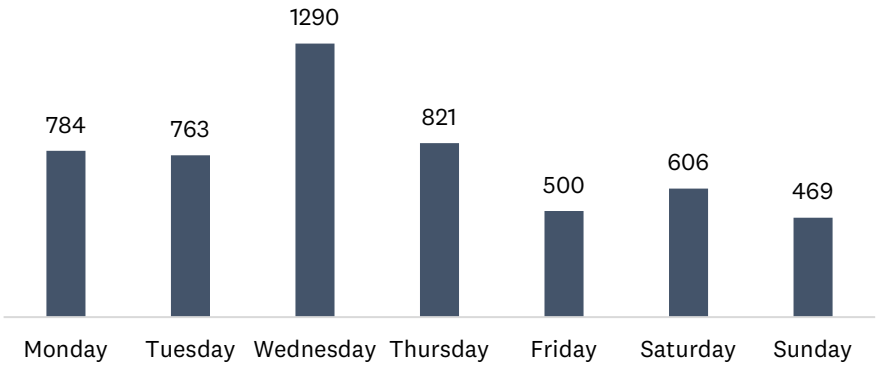
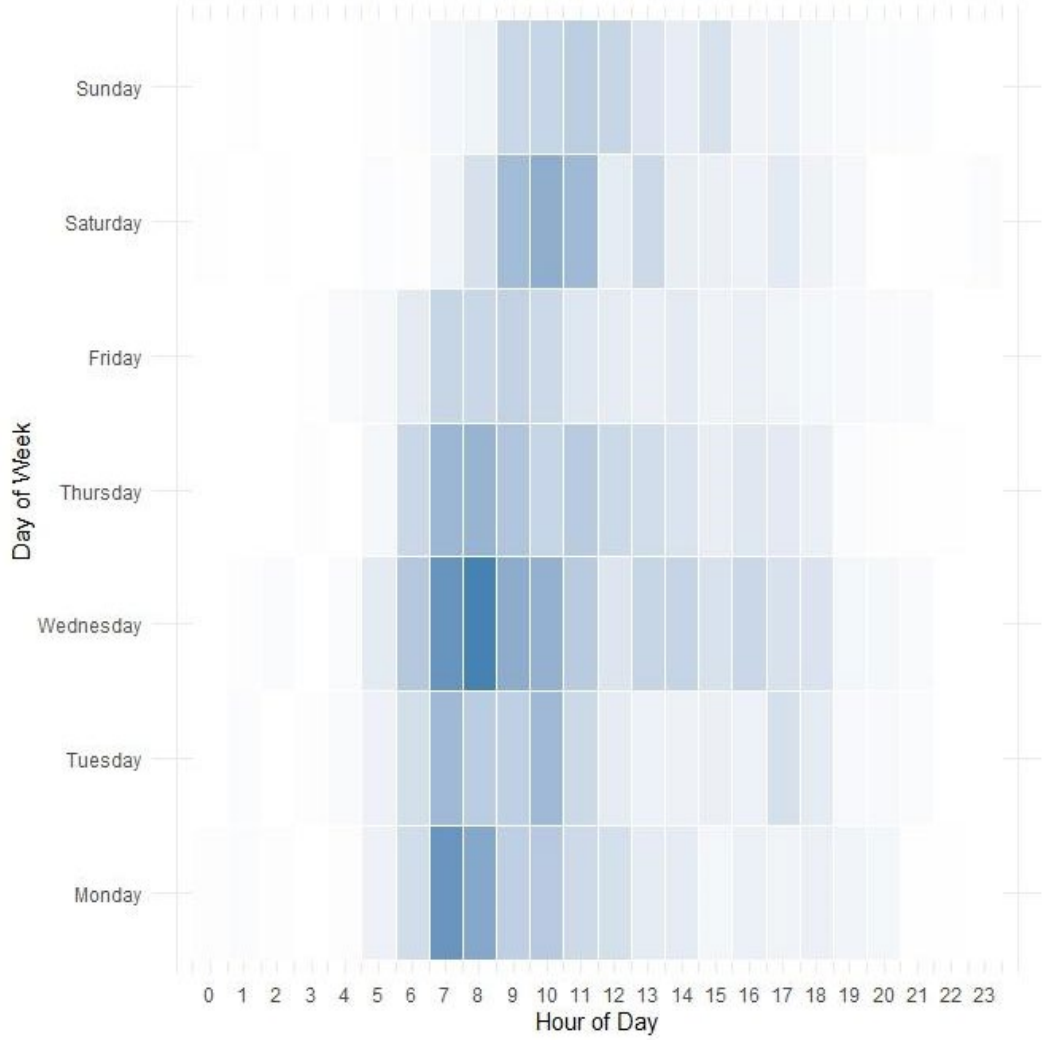


Figure 9 below illustrates the concentration of trips throughout the week, broken down by hour of the day. Darker shades of blue indicate a higher number of trips. The busiest period for trips occurred during weekday mornings, specifically between 7am and 9am. This suggests a strong morning commute pattern, particularly during midweek. There is a noticeable drop in trip activity during the afternoons and evenings on weekdays, likely reflecting the end of work-related travel. The survey asked participants about their most recent trip that departed from their home and so this is likely influencing the prevalence of morning travel.

On weekends, the number of trips reported is generally lower, with Saturday showing slightly more activity around late morning (9am to 11am) compared to Sunday. No particular afternoon or evening surge is visible on the weekends.

Overall, the chart suggests that trip demand is concentrated in the weekday morning hours, particularly for commute purposes, while reported weekend travel captured by the survey remains more evenly spread but less frequent throughout the day.

Figure 9: Number of trips by hour of day and day of week (counts)



Note: Darker shades of blue indicate a higher concentration of trips

3.2 Locations of trips

Origin and destination points for each trip were assigned to SA3s. There are 196 SA3s in the Auckland region. All but two of these (Oceanic Auckland Region West and Barrier Islands) have at least one trip origin or destination represented in this analysis.[30]

Two trips had origins in SA3s outside the Auckland region (and destinations within the region), and four trips had destinations in SA3s outside the Auckland region (with origins within the region). These SA3s (Tuakau, Pōkeno, and Waikato District North East) are in the Waikato District bordering

[30] Oceanic Auckland Region West covers the ocean to the west of the region and contains no residential land. Barrier Islands includes Aotea Great Barrier and surrounding islands.

Auckland (see Figure 10). These trips were not excluded from the dataset as they are small in number and demonstrate how Territorial Boundaries are not always meaningful to those living nearby.

Figure 10: SA3s on the Auckland and Waikato District border

Figure 11 and Figure 12 below show the 10 SA3s with the most trip origins and destinations. Auckland City Centre has both the most trip origins and destinations, followed by Henderson.

Trips with an origin of Auckland City Centre had destinations in 62 different SA3s. The most common destination for these trips was Auckland City Centre (15 trips), followed by Albany and Māngere (each with 8 trips). Trips with a destination in Auckland City Centre had origins in 118 different SA3s. The most common origins for these trips were Auckland City Centre, Mount Eden, and Remuera each with 15 trips.

Trips with an origin in Henderson had destinations in 49 SA3s. The most common destination was Henderson (27 trips) followed by Auckland City Centre (11 trips). Trips with a destination in Henderson had origins in 74 SA3s. The most common origin for trips with a Henderson destination were Henderson (27 trips) followed by Glen Eden (9 trips) and Waitākere East (7 trips).

Even though the most common origins and destinations for Auckland City Centre and Henderson are within the same SA3, this does not reflect a pattern across all trips. Only eight per cent of trips had origins and destinations within the same SA3. Most trips had origins and destinations in different SA3s.

Figure 11: Top 10 trip origin SA3s (counts)

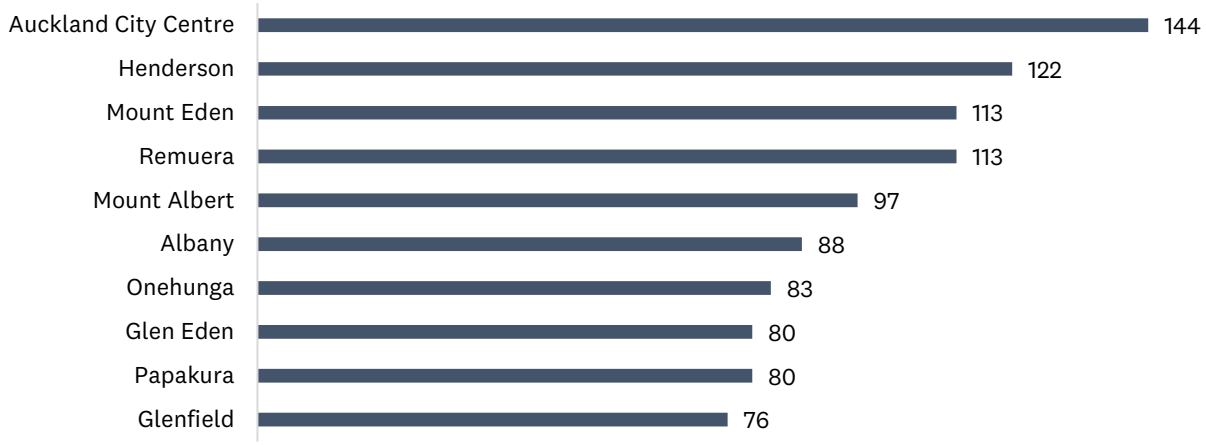
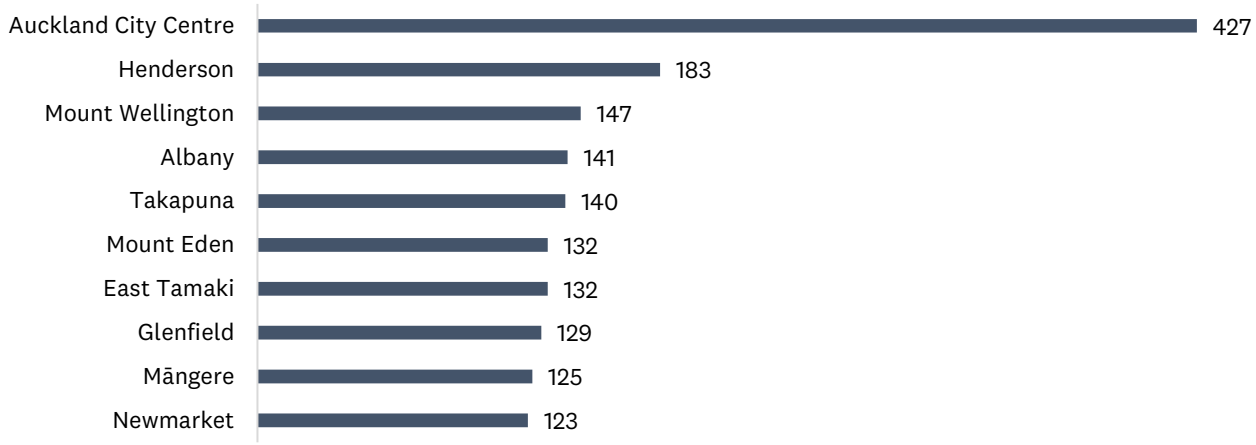


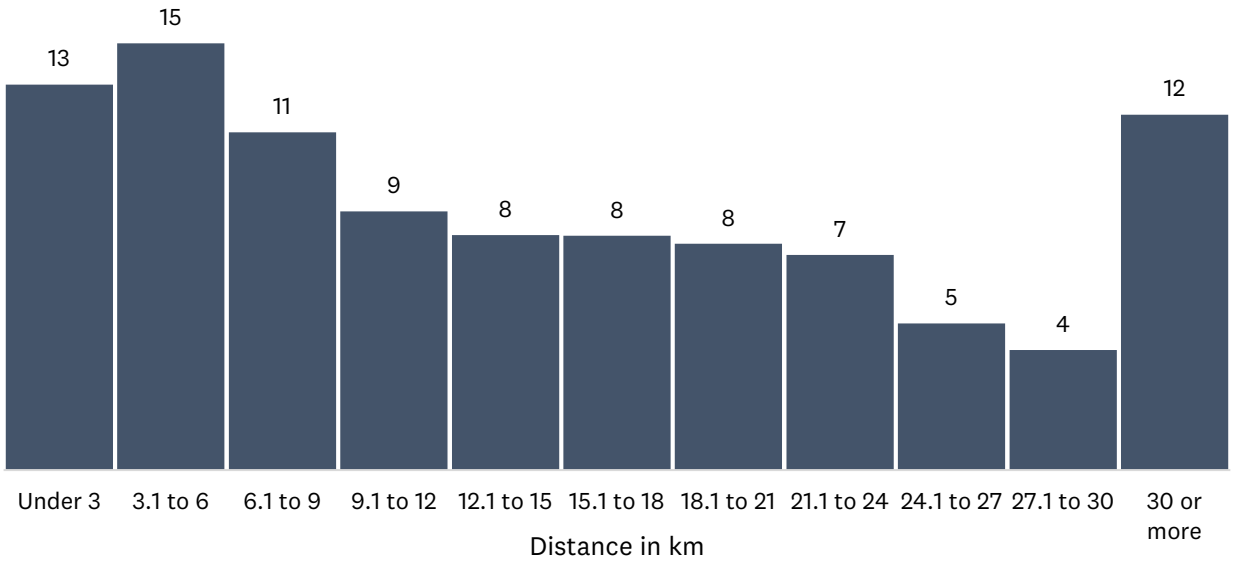
Figure 12: Top 10 trip destination SA3s (counts)



3.3 Distance of driving trips

Across all 5233 driving trips the average distance was 15km. Driving distances ranged between 0.02km (i.e. 20 metres) and 58km. 4569 trips had distances between 0.2km (i.e. 200 metres) and 30km, with only 628 trips (12%) longer than 30km. Figure 13 shows a histogram of driving trip distances. This illustrates that over half (56%) of driving trips were under 15km and 28 per cent under 6km.

Figure 13: Driving trip distance in km (%) (n=5197)

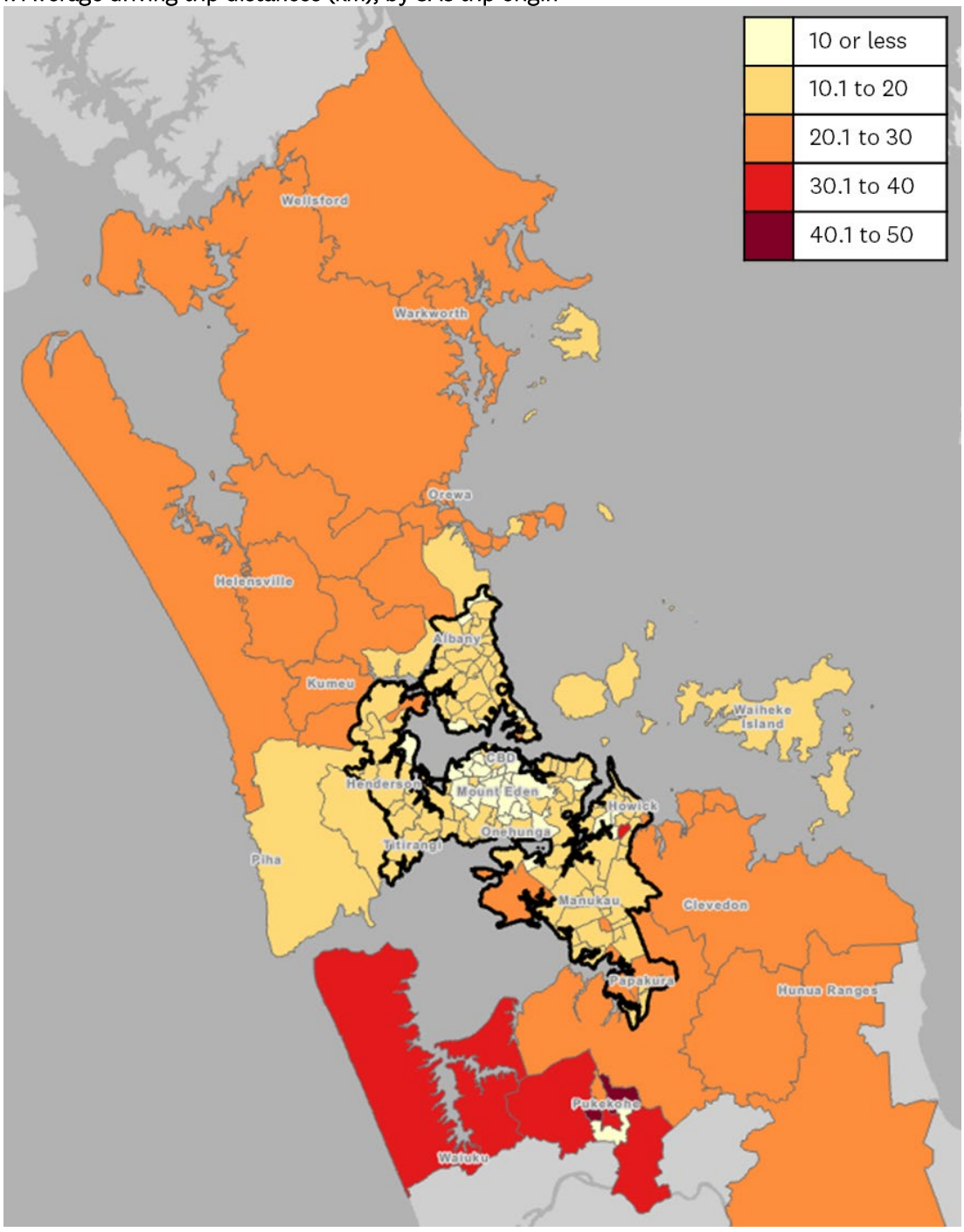


Note: 36 trips with distances under 200m excluded from chart.

Average driving trip distances varied by trip origin location (see Figure 14). There is a general pattern of shorter trip distances with origins near Auckland City Centre.

These results indicate that there is an imperfect relationship between the MUA boundary and driving trip distances. While trips within the MUA tended to be shorter in distance than trips outside it, there are some SA3s within the MUA boundary that are longer than those outside (e.g. see SA3s near Papakura in Figure 14) and vice versa with some SA3s outside having shorter distances (e.g. SA3s in western and northern Auckland).

Figure 14: Average driving trip distances (km), by SA3 trip origin



Note: Thick black outline shows Major Urban Area. Aotea / Great Barrier has been excluded from this map as no trips collected in the survey were on Aotea / Great Barrier.

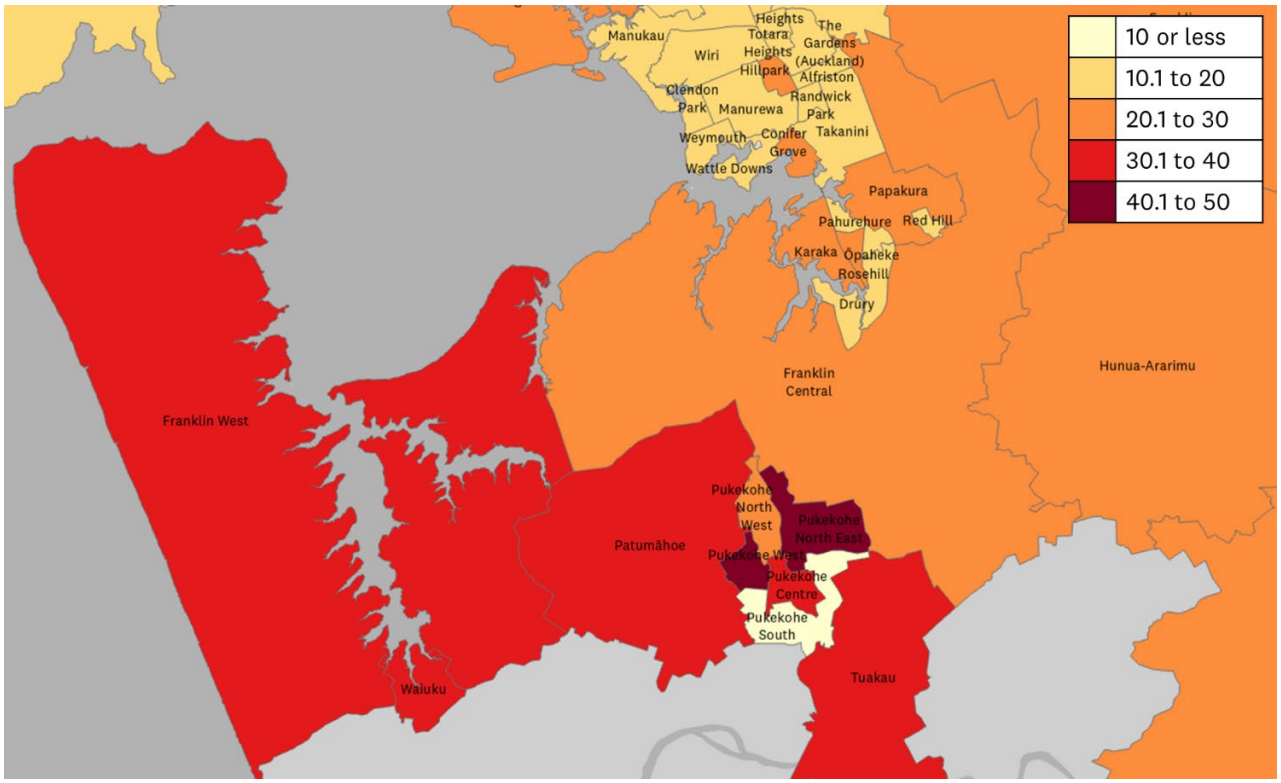
Zone D forms a cluster of SA3s with trip origins surrounding Pukekohe and to Franklin West in the west. This zone had the longest average driving trip distances (see Figure 15). This cluster represented 172 trips with a combined average distance of 32km. Trip distances ranged between 43km for trip origins in Pukekohe West and Pukekohe North East to 24km in Franklin Central. The one trip representing Pukekohe South was only 2km in distance. This outlier is reducing the total average driving distance from 35km to 32km.

Table 2: Average driving distances in zone D, by SA3 trip origin

Origin	Average driving distance (km)	Number of trips
Pukekohe West	43	2
Pukekohe North East	43	9
Tuakau*	37	1
Waiuku	37	28
Pukekohe Centre	36	47
Franklin West	35	32
Patumāhoe	31	14
Pukekohe North West	27	2
Franklin Central	24	36
Pukekohe South	2	1
Total	**32**	**172**

*Note: Tuakau is within the Waikato District.

Figure 15: Average driving trip distances (km), by SA3 trip origin in zone D



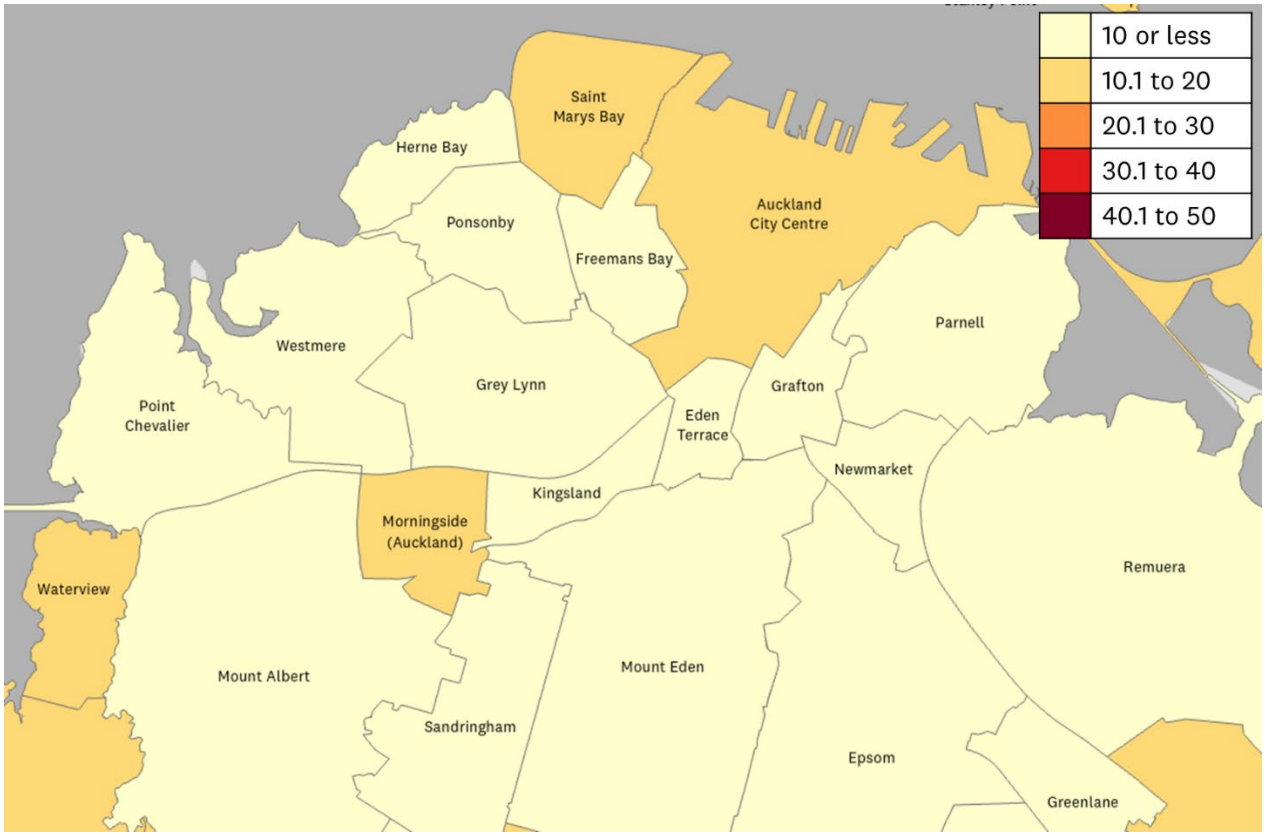
Note: Tuakau is within the Waikato District.

Conversely trips with the shortest driving trip distances had origins in zone B consisting of SA3s near Auckland City Centre (see Figure 16). Eden Terrace had trip origins with one of the lowest average driving distance of 7km. Nine SA3s in in this area had trip origins with an average driving distance of 8km and five had an average driving distance of 9km (see Table 3). On average the 798 trips with origins in one of these SA3s had an average driving distance of 9km.

Table 3: Average driving distances in zone B, by SA3 trip origin

Origin	Average driving distance (km)	Number of trips
Eden Terrace	7	33
Herne Bay	8	17
Remuera	8	113
Kingsland	8	20
Freemans Bay	8	45
Mount Eden	8	113
Sandringham	8	47
Grafton	8	15
Epsom	8	67
Ponsonby	8	18
Parnell	9	43
Newmarket	9	26
Grey Lynn	9	56
Westmere	9	20
Point Chevalier	9	40
Mount Albert	10	97
Morningside (Auckland)	11	16
Saint Marys Bay	14	12
Total	**9**	**798**

Figure 16: Average driving trip distances (km), by SA3 trip origin in zone B



There are only five SA3s not surrounding Auckland City Centre which had average driving trip distances of 7km or less. Combined these five SA3s represented 18 trips driving trips and are considered to be outliers that may be impacted by a small sample size. Te Atatū Peninsula (4 trips) located in western Auckland had an average driving trip distance of 1km, Pukekohe South (see location in Figure 15, 1 trip) had an average driving distance of 2km, Fairview Heights (3 trips) and Long Bay (4 trips) both located in northern Auckland had average driving distances of 5km, and Favona (6 trips) in southern Auckland had an average driving distance of 7km.

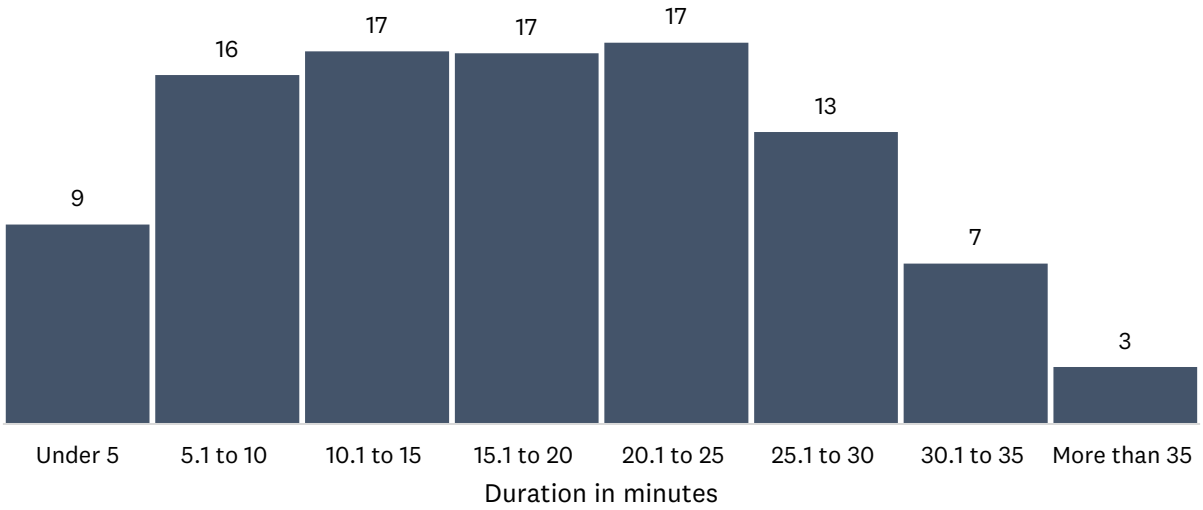
See Appendix 8.3 for a table of driving distance for all SA3s included in this analysis.

3.4 Duration of driving trips

Across all 5233 trips the average duration was 17 minutes and ranged between 5 seconds and 2 hours and 5 minutes. For the 5197 trips with driving distances longer than 200m, the average duration was 17 minutes, with the shortest duration being 23 seconds.

Eighty-one per cent of driving trips were between 5 and 30 minutes (see Figure 17). Only 136 driving trips, or three per cent of all trips, were more than 35 minutes in duration.

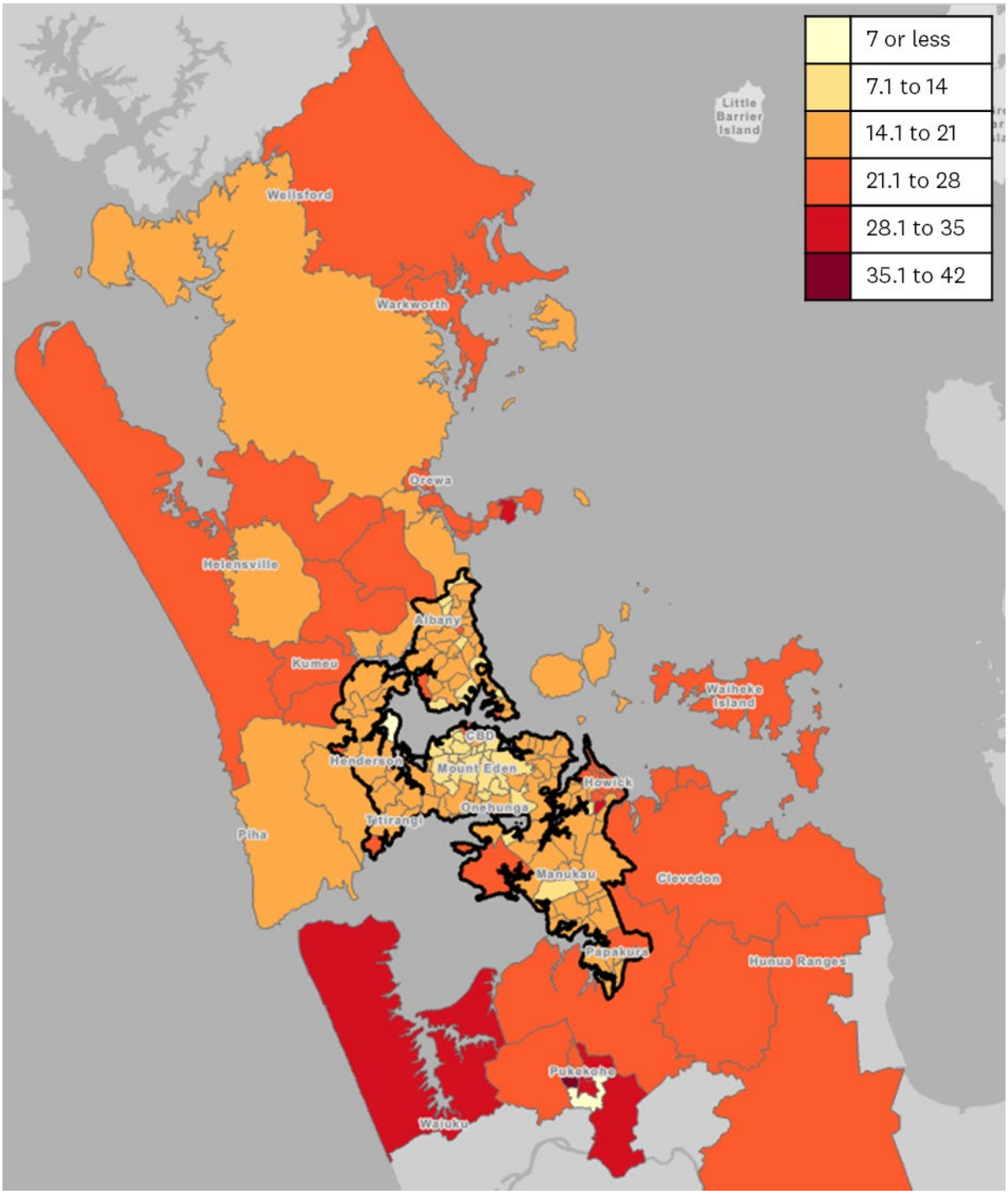
Figure 17: Histogram of driving trip duration in minutes (%) (n=5197)



Note: 36 trips with distances under 200m excluded from chart.

The variance in driving trip durations across trip origin SA3s reflected the pattern of driving distances described previously. Figure 18 shows SA3 trip origins near Auckland City Centre tended to have shorter average driving trip durations.

Figure 18: Average driving trip durations (minutes), by SA3 trip origin



Note: Thick black outline shows Major Urban Area. Aotea / Great Barrier has been excluded from this map as no trips collected in the survey were on Aotea / Great Barrier.

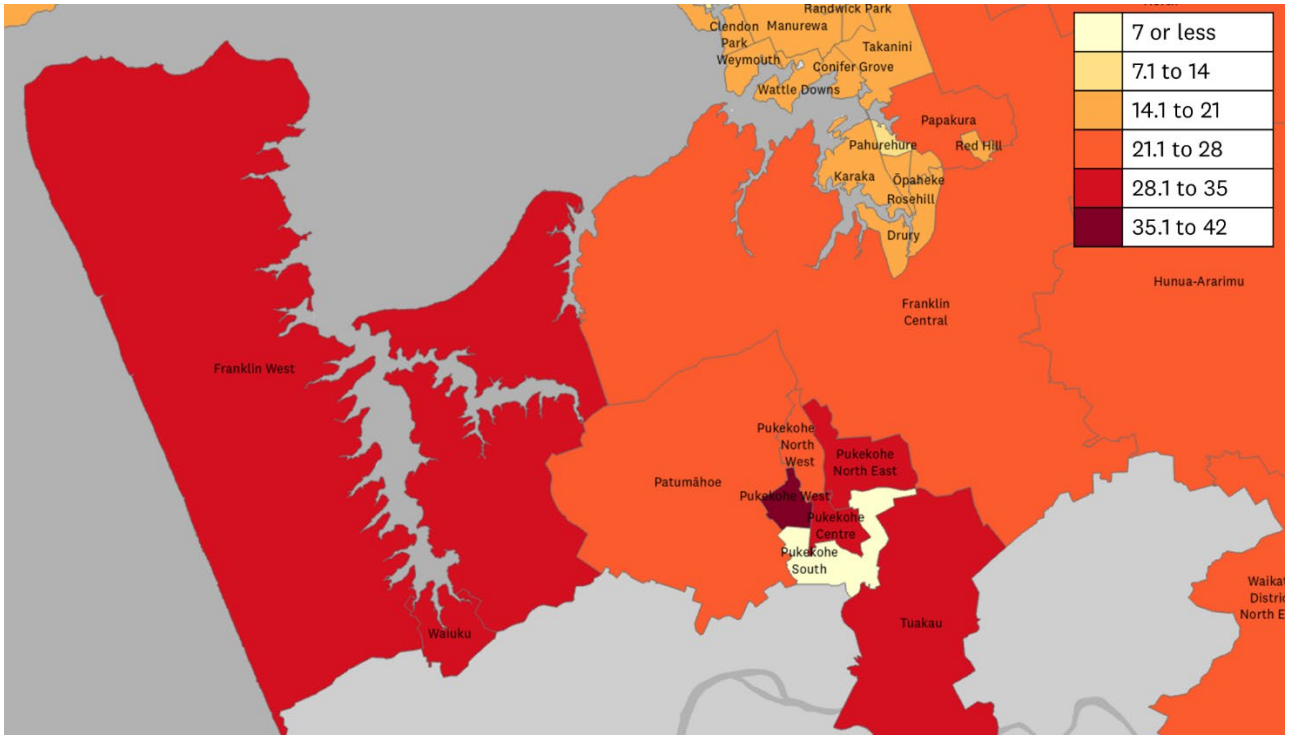
There was a correlation between relatively lengthy trip durations and long distances for trips originating in zone D SA3s (see Table 4 and Figure 19 for a map). The average driving trip duration for SA3 trip origins in zone D was 28 minutes when including Puekohe South representing one trip with a duration of 3 minutes. When Pukekohe South is excluded the average driving trip duration for zone D becomes 31 minutes, which is close to double the duration for the average driving trip duration for the region overall (17 minutes).

Table 4: Average driving durations in zone D, by SA3 trip origin

Origin	Average driving duration (min)	Number of trips
Pukekohe West	35	2
Pukekohe North East	34	9
Tuakau*	30	1
Waiuku	33	28
Pukekohe Centre	31	47
Franklin West	31	32
Patumāhoe	37	14
Pukekohe North West	23	2
Franklin Central	22	36
Pukekohe South	3	1
Total	**28**	**172**

*Note: Tuakau is within the Waikato District.

Figure 19: Average driving trip duration (minutes), by SA3 trip origin in zone D

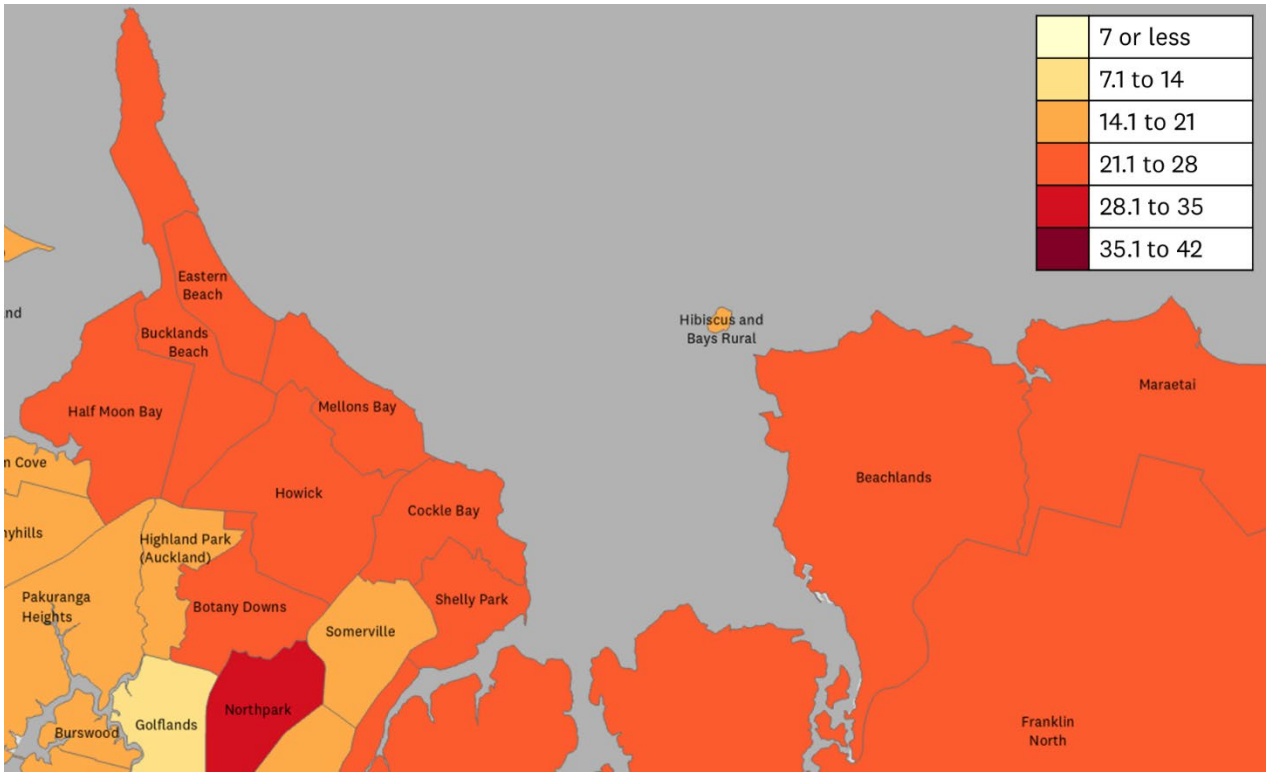


A cluster of trips with origins in eastern Auckland SA3s described as zone C also had long driving trip durations. The average driving trip duration for these trip origin SA3s ranged from 25 to 35 minutes, with an average of 27 minutes over 144 driving trips (see Table 5 and map in Figure 20).

Table 5: Average driving durations in zone C, by SA3 trip origin

Origin	Average driving duration (min)	Number of trips
Northpark	35	6
Howick	27	31
Mellons Bay	27	13
Maraetai	26	8
Franklin North	25	31
Shelly Park	25	5
Beachlands	25	21
Bucklands Beach	25	29
Total	**27**	**144**

Figure 20: Average driving trip duration (minutes), by SA3 trip origin in zone C



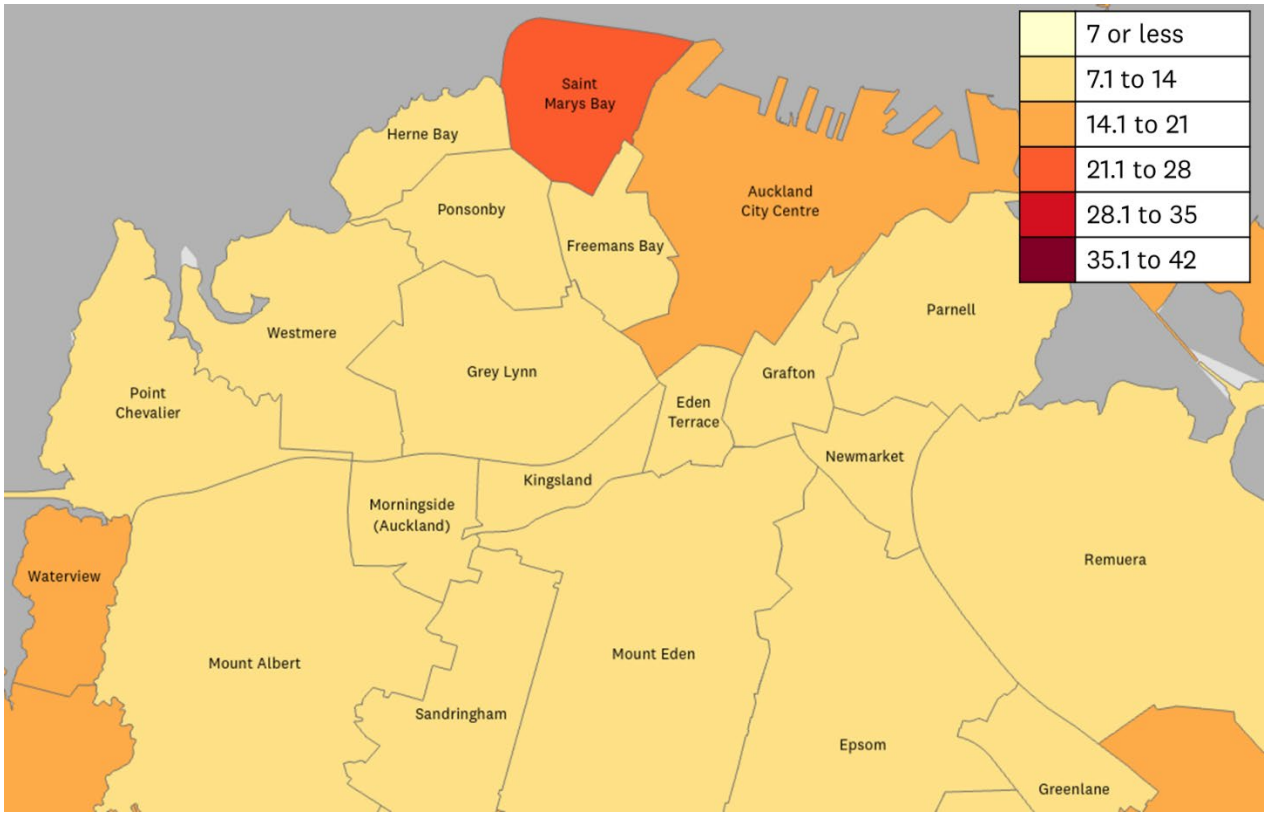
Trip origins in SA3s that had shorter average trip durations do not show an obvious spatial distribution. Considering SA3s with 10 or more trips, Wesley had the shortest average duration of 9 minutes. Penrose and Grafton both had the second shortest average driving trip duration at 11 minutes. Thirteen SA3 trip origins had an average driving trip duration of 12 minutes, 9 had 13 minutes, and 11 had 14 minutes. In general, SA3 trip origins with shorter driving trip durations tended

to be those in zone B (see Figure 21 and Table 6). Saint Marys Bay is an outlier of this trend with an average driving duration of 24 minutes.

Table 6: Average driving trip duration in zone B, by SA3 trip origin

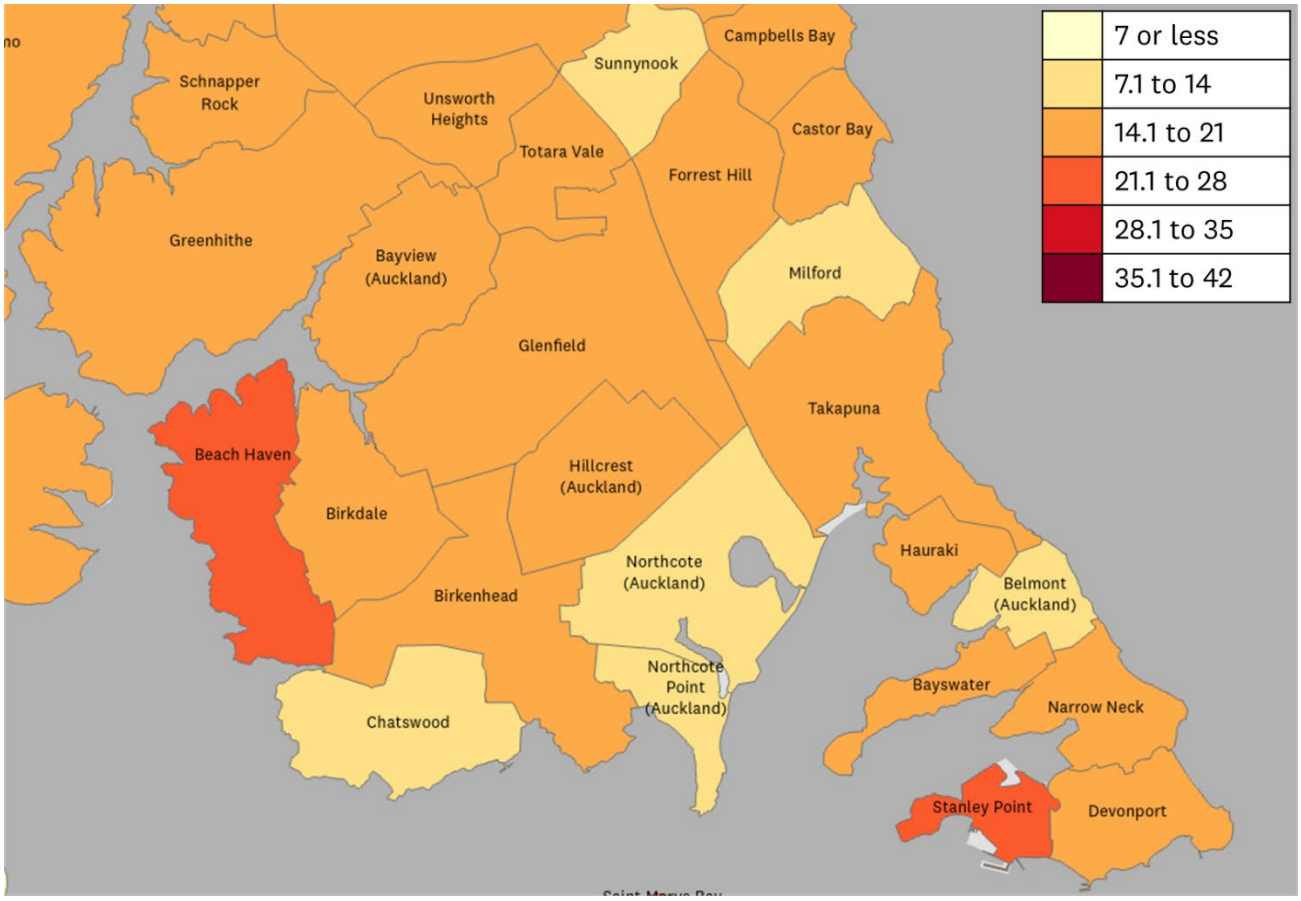
Origin	Average driving duration (km)	Number of trips
Freemans Bay	11	45
Eden Terrace	12	33
Remuera	12	113
Kingsland	12	20
Mount Eden	12	113
Sandringham	12	47
Grafton	12	15
Epsom	12	67
Point Chevalier	12	13
Herne Bay	13	17
Ponsonby	13	18
Parnell	13	43
Newmarket	13	26
Grey Lynn	12	56
Westmere	13	20
Morningside (Auckland)	13	16
Mount Albert	14	97
Saint Marys Bay	24	12
Total	**13**	**798**

Figure 21: Average driving trip duration (minutes), by SA3 trip origin surrounding Auckland City Centre



Several northern Auckland SA3 trip origins that form zone A had similar average driving durations to those in zone B. Belmont (17 trips) and Northcote Point (13 trips) had average driving durations of 12 minutes. Northcote (40 trips), Sunnynook (22 trips), and Milford (37 trips) had average driving durations of 13 minutes. Chatswood (13 trips) and Hillcrest (31 trips) had average driving durations of 14 minutes. However, as Figure 22 shows, these zone A SA3s are not all adjacent to one another and other SA3s in this area, such as Devonport (36 trips) and Beach Haven (42 trips), had longer average durations of 20 minutes and 21 minutes respectively.

Figure 22: Average driving trip duration (minutes), by SA3 trip origin in zone A



3.5 Reasons for trips

The survey asked participants about the reasons for their trip.[31] For simplicity of analysis these reasons have been grouped into three categories: work and education, leisure, and other reasons.[32] 'Work and education' includes going to work, study/education, and changed modes (e.g. drove a car to a park and ride carpark and then took a bus). 'Leisure' includes shopping, social visit/entertainment, sport or exercise, and sightseeing. 'Other' includes personal appointments, dropping off/picking up someone or something, volunteer work, overnight trip, and other.

Figures 20, 21 and 22 below display the top 10 destination SA3s for trips categorised as work and education, leisure, and other. Auckland City Centre stands out as the most common destination across all categories, with higher trip counts than other areas. The consistent presence of Auckland City Centre across all trip reasons highlights its prominence as a multifaceted destination for work and education, leisure and other activities amongst participants.

[31] See questionnaire in Appendix 8.1. Question 6 asked 'What were the reasons for your trip?' and participants could select multiple options. The survey did not allow participants to identify reasons for separate legs of their trip if they described a multi-stop journey.
[32] Classification into these categories retained the multiple response nature of the survey data collected.

Several other destinations emerged as notable locations for different trip purposes. In the work and education category, East Tamaki, Henderson, and Māngere show relatively high trip counts (see Figure 23). This suggests that these areas served as important employment and education centres.

For leisure trips, Albany, Henderson, and Mount Wellington were prominent, with Albany being the second most common destination after Auckland City Centre at 87 trips (see Figure 24). These areas may have been favoured for their shopping centres, recreational facilities, and parks. Compared with trips for work or education (see Figure 23), there were several areas with more than 60 trips reflecting a broader geographic spread for leisure destinations compared to work or education trips.

For other trip reasons Henderson, Mount Eden, and Epsom were the top destinations after Auckland City Centre (see Figure 25). Henderson had a strong presence across all categories, suggesting a versatile role as a destination. Epsom and Remuera, which were predominantly residential areas, appeared specifically in the 'other' category, possibly indicating trips related to healthcare or errands.

This distribution showed that while Auckland City Centre is a central hub, other areas around Auckland played distinct roles based on the type of trip, reflecting a complex pattern of movement throughout the region.

Figure 23: Work and education trip SA3 destinations (counts)

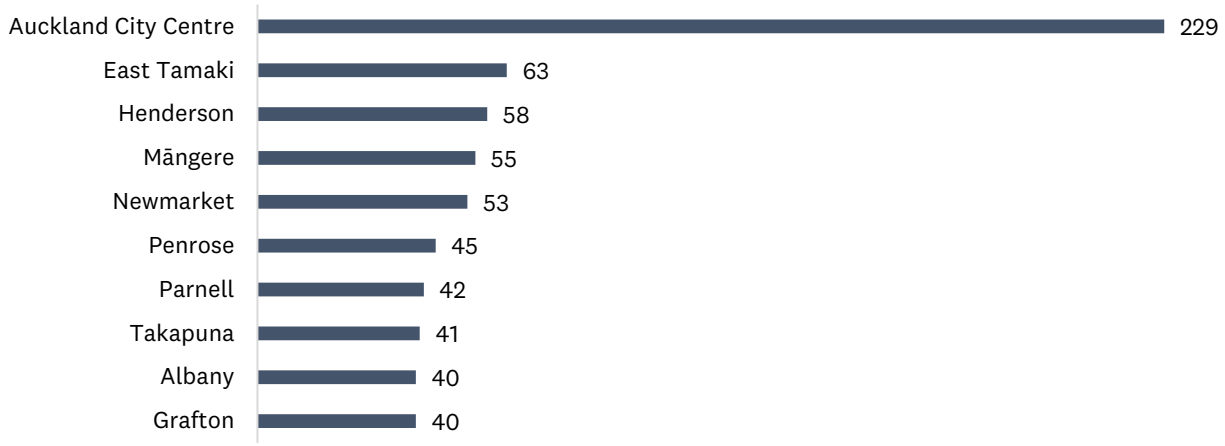


Figure 24: Leisure trip SA3 destinations (counts)

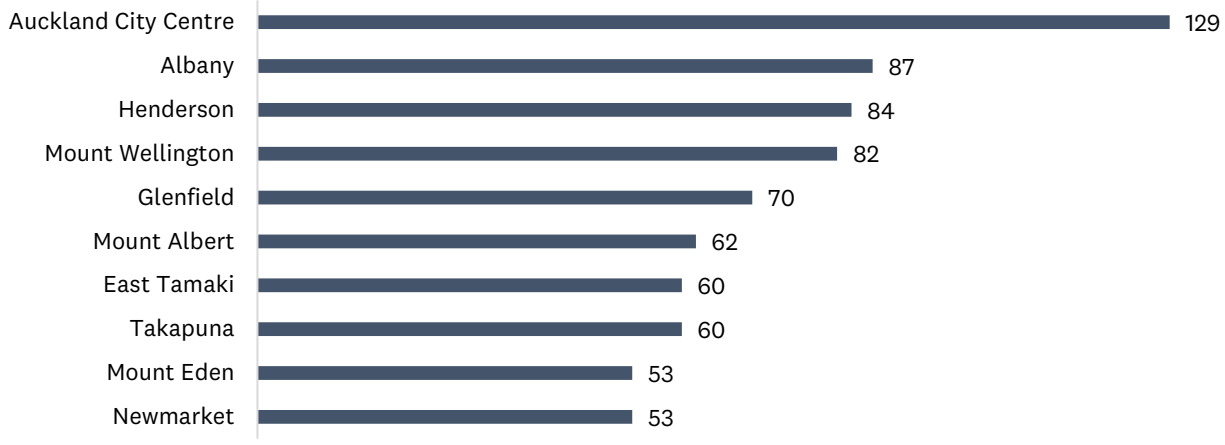
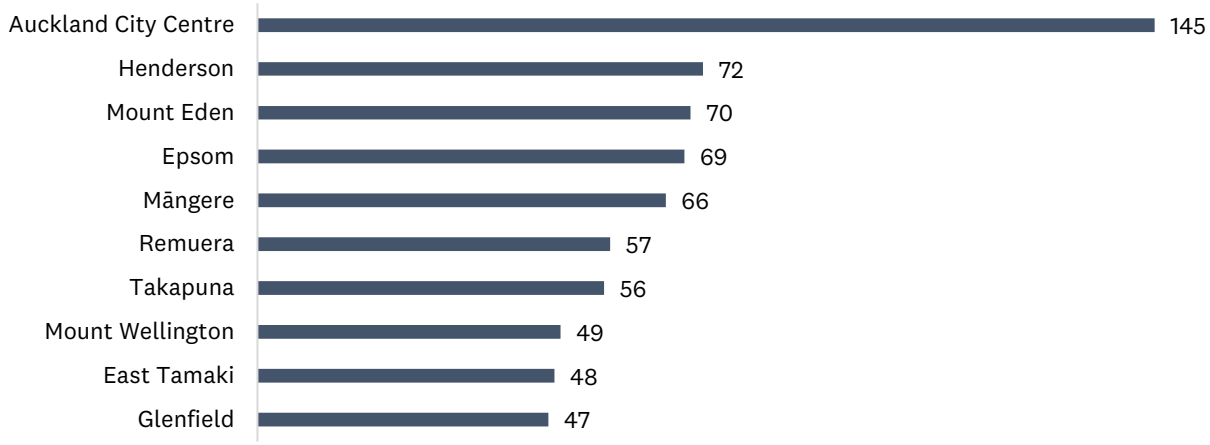


Figure 25: Other trip SA3 destinations (counts)



3.6 Summary

The driving trips analysed in this report were 15km in distance and 17 minutes in duration, on average. This analysis of driving trips displayed variance in the average trip distances and durations across the Auckland region. Driving trips close to Auckland City Centre in zone B tended to be shorter in distance and duration, whereas driving trips in zone D in southern Auckland had some of the longest distances and durations. A cluster of SA3 trip origins in zone C (eastern Auckland) was found to have longer driving trip distances, on average. SA3 trip origins in zone A (northern Auckland) had a wide range of average driving trip durations which did not cluster together as occurred elsewhere. Auckland City Centre and Henderson were found to be common destinations for a range of different trip reasons.

These findings demonstrate that the travel behaviour of Aucklanders varied across the region. This was likely influenced by the proximity of employment and amenities to residential areas. Those further away from work and education destinations were required to travel longer to reach these opportunities compared to those residing in SA3s near Auckland City Centre.

4 Public transport trips

Analysis was undertaken on the 4876 trips for which Google Maps could provide a public transport route. The trips described in this section were generated by Google Maps using the origin and destination coordinates of participants' driving trips and are suggested trips, not trips actually undertaken by participants.

There are three main modes of public transport in Auckland: bus, train and ferry. Google Maps produced a suggested public transport route by bus for most of the trips (4845 trips or 99%). Only 25 trips were by train and six trips by ferry.

Google Maps calculated the same distance and duration for both public transport and walking for 238 trips. For instance, a trip of 400 metres took 5 minutes whether completed by walking or public transport. As explained in Section 2.3, for short trips, Google Maps often suggests walking routes instead of public transport routes, since public transport is often not a logical choice for short distances when, for example, the distance to a public transport stop is further than the destination. When the recorded values for both modes match, it indicated that Google Maps is recommending walking over public transport. Although excluding these trips from the public transport analysis was not feasible, their limited number had minimal impact on the overall average values.

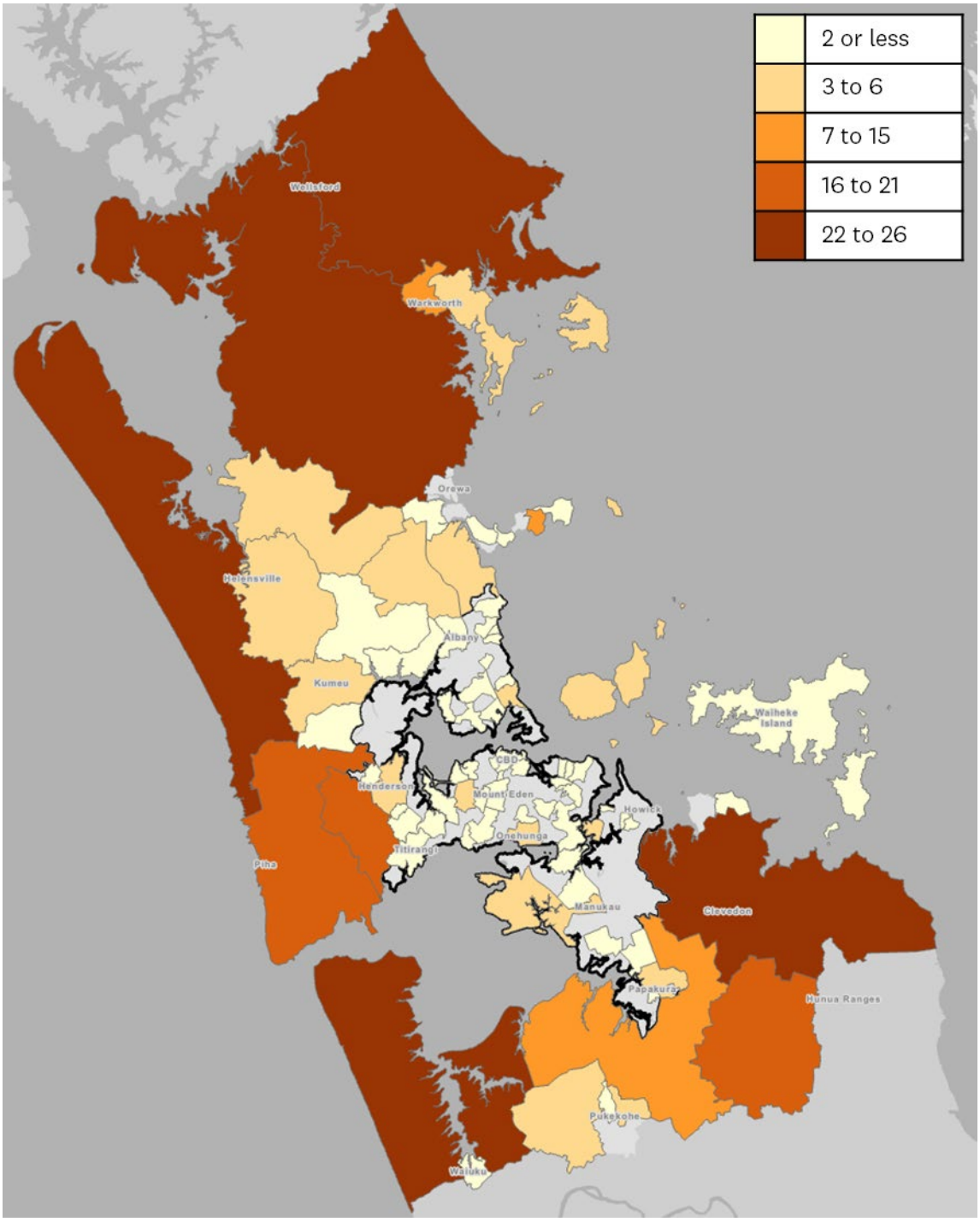
Eighty-five per cent (4139 trips) of the trips for which a public transport route could be generated had both origin and destination points within Auckland's MUA, while the remaining 15 per cent were outside the MUA. In this section comparisons are made between trips within and beyond the MUA.

This section explores public transport trips between the origin and destination points of the previously described driving trips. Section 4.1 first describes driving trips with no public transport routes available. It then describes the distance and duration of public transport trips. The following sections (4.2 to 4.5) compare the public transport trip distances and durations with driving trip distances and durations. Section 4.6 explores variance in trip duration across different times of day. Finally, section 4.7 provides an analysis of the proximity of public transport stops (i.e. bus stops, train stations, and ferry terminals) to trip origins.

4.1 Driving trips with no public transport route available

Google Maps was unable to generate a public transport equivalent route for 357 of the driving trips undertaken by survey participants. The SA3 origins of trips lacking a public transport equivalent routes are located throughout the Auckland region with larger numbers of trips in rural areas at the edges of the region (see Figure 26).

Figure 26: Count of driving trip origins without a public transport equivalent trip, by SA3 trip origin



4.2 Distance and duration of public transport trips

The average distance of a trip by public transport was 17km. This ranged from 0.02km (i.e. 20 metres) to 101km. For comparison, the average distance for a driving trip with an equivalent public transport route available was 14km,[33] and ranged from 20m to 58km. A total of 4848 trips had a public transport trip distance longer than 200m. The average distance of these trips by public transport was

[33] Note: the average driving distance for all trips, including those without a public transport route available, was 15km. See Section 3.3 for more details.

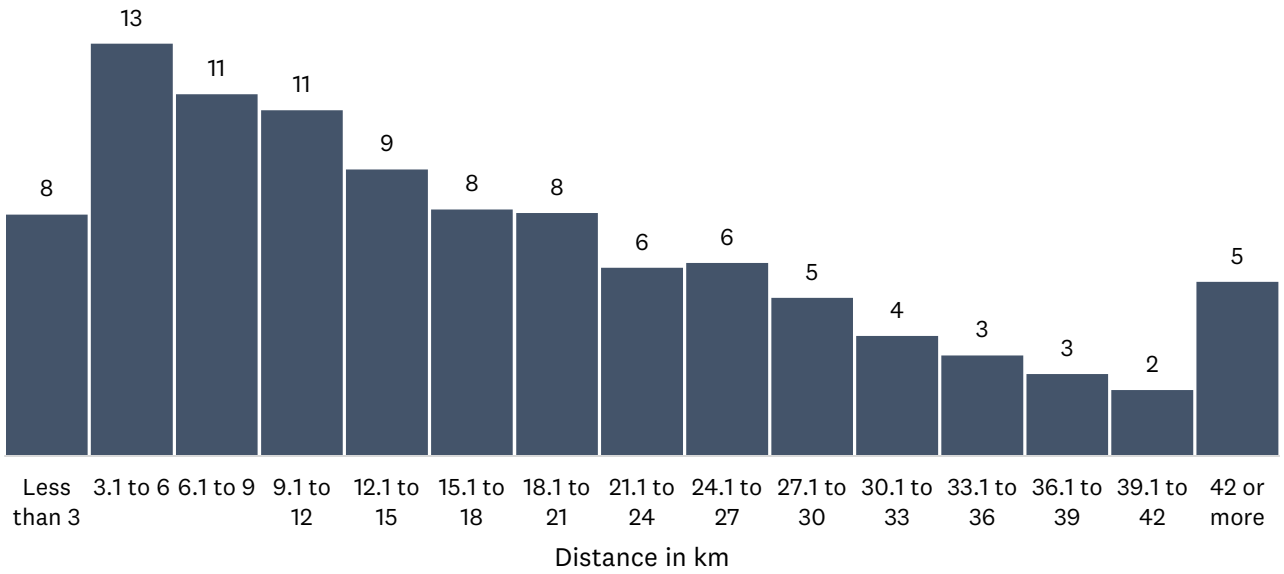
also 17km. Appendix 8.4 contains a table with the average public transport trip distance and duration for each SA3 trip origin.

The average trip duration for all 4876 trips with a public transport route was 57 minutes. This ranged from 28 seconds to 909 minutes (equivalent to 15 hours and 9 minutes). For comparison, the average duration for a driving trip that had a public transport route available was 17 minutes.[34] When considering only trips with a distance longer than 200m (4848 trips), the average public transport duration was 58 minutes, with 3 minutes being the shortest trip duration.

As mentioned earlier, 238 trips recorded as public transport likely actually represent walking as the mode of transport. These 238 trips had an average distance of 1km and duration of 13 minutes. When these were excluded from all other public transport trips, the average distance of the remaining 4638 trips was 18km and the average duration was 60 minutes.

Figure 27 displays a histogram of public transport trip distances, excluding the 238 trips that were likely made by walking. This demonstrates that the distance of trips was skewed towards shorter distances and a small number of longer distance trips were inflating the average distance. Forty-four per cent of public transport trips were between 3km and 15km in distance. Five per cent of trips (251 trips) had distances of 42km or more. Of these, 155 trips had distances between 42km and 50km, 75 trips were between 50km and 60km, 17 trips between 60km and 70km, 3 trips between 70km and 80km, and one trip was 101km.

Figure 27: Public transport trip distance in km (%) (n=4638)



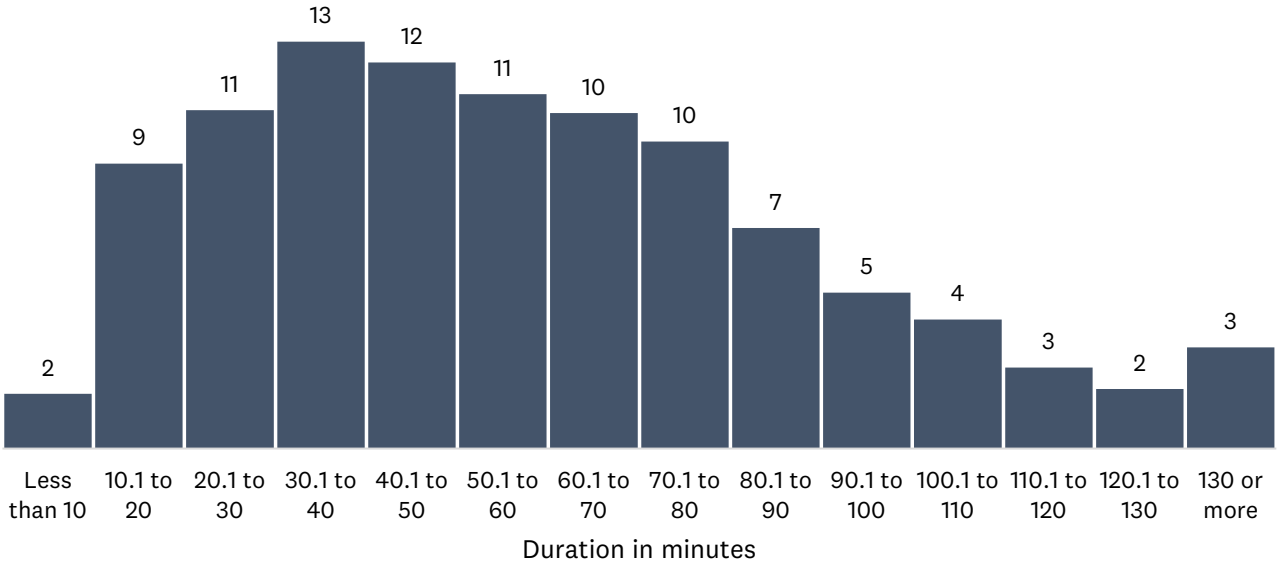
Note: Public transport trip distances under 200m and trips interpreted to be completed by walking are excluded.

Two-thirds (66%) of public transport trips were between 20 and 80 minutes in duration (see Figure 28). Eleven per cent of public transport trips were less than 20 minutes whereas 59 per cent of driving trips were less than 20 minutes (see Figure 17). As with trip distance, the duration of these

[34] Note: The average driving duration, including those without a public transport route available, was also 17 minutes. See Section 3.4 for more details.

trips was also skewed towards shorter durations. Three per cent of public transport trips were 130 minutes (2 hours and 10 minutes) or longer. One hundred of these trips were between 130 and 160 minutes, 21 trips were between 161 and 200 minutes, 15 trips were between 200 and 300 minutes, and 10 trips were longer than 300 minutes with the longest trip at 910 minutes (15 hours and 10 minutes). These outlier trips had little impact on the average public transport trip duration. For the 4406 public transport trips with a duration under 120 minutes, the average duration was 54 minutes (compared to 57 minutes for all trips).

Figure 28: Histogram of public transport trip duration in minutes (%) (n=4638)



Note: Public transport trip distances under 200m and trips interpreted to be completed by walking excluded from chart.

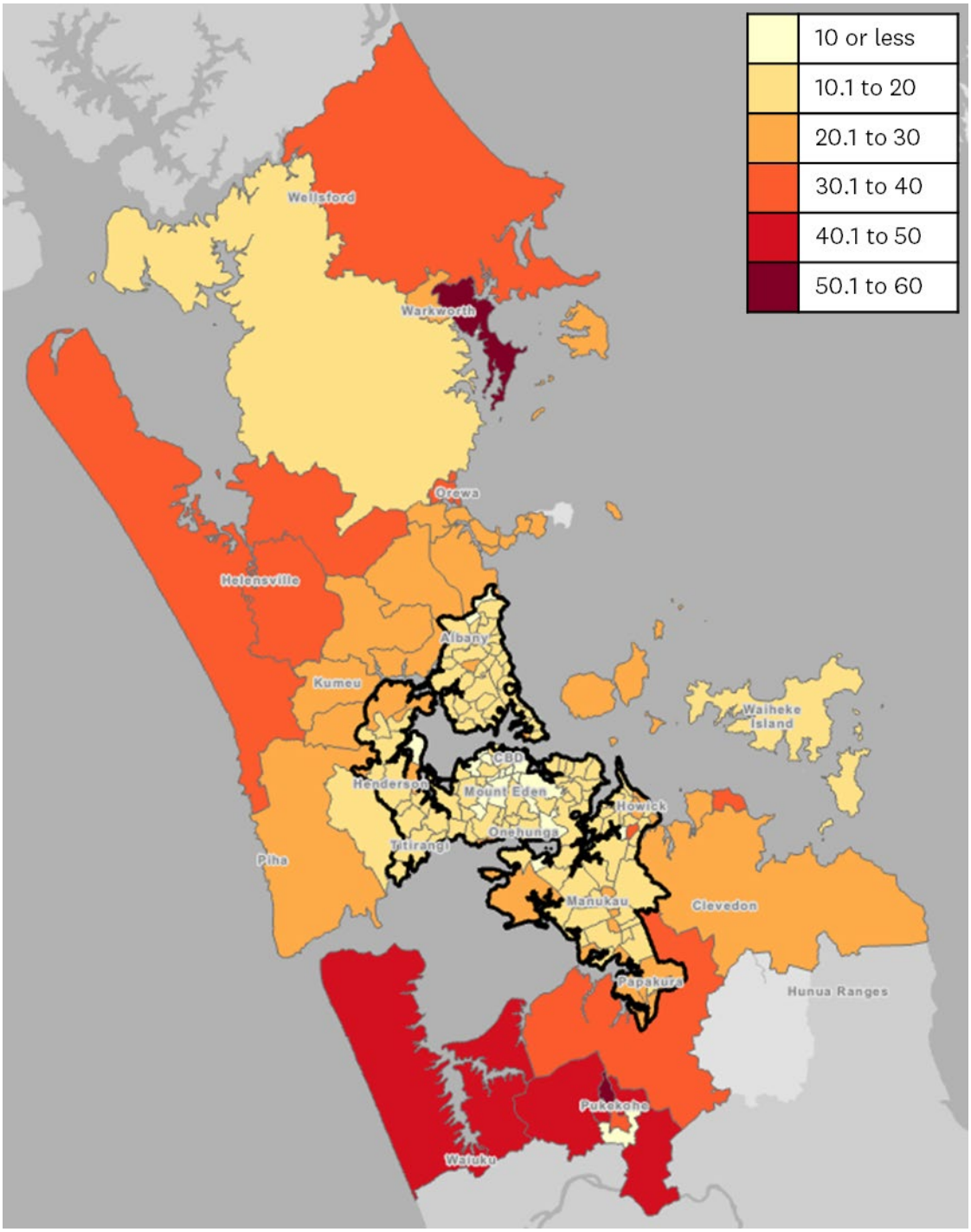
4.3 Spatial differences in public transport trip distances

This section explores spatial differences in the distances of public transport trips across the Auckland region. The analysis presented includes all 4876 trips.

Trips within the MUA had an average public transport distance of 14km, compared with an average driving trip distance of 12km. Trips outside the MUA had an average public transport distance of 32km, compared with an average driving trip distance of 25km. This finding suggests that public transport routes within the MUA are more direct than those outside the MUA.

Figure 29 shows the average public transport trip distance for each SA3 trip origin. There is a general trend of shorter trip distances closer to Auckland City Centre.

Figure 29: Average public transport trip distances (km), by SA3 trip origin



Note: Thick black outline shows Major Urban Area. Aotea / Great Barrier has been excluded from this map as no trips collected in the survey were on Aotea / Great Barrier.

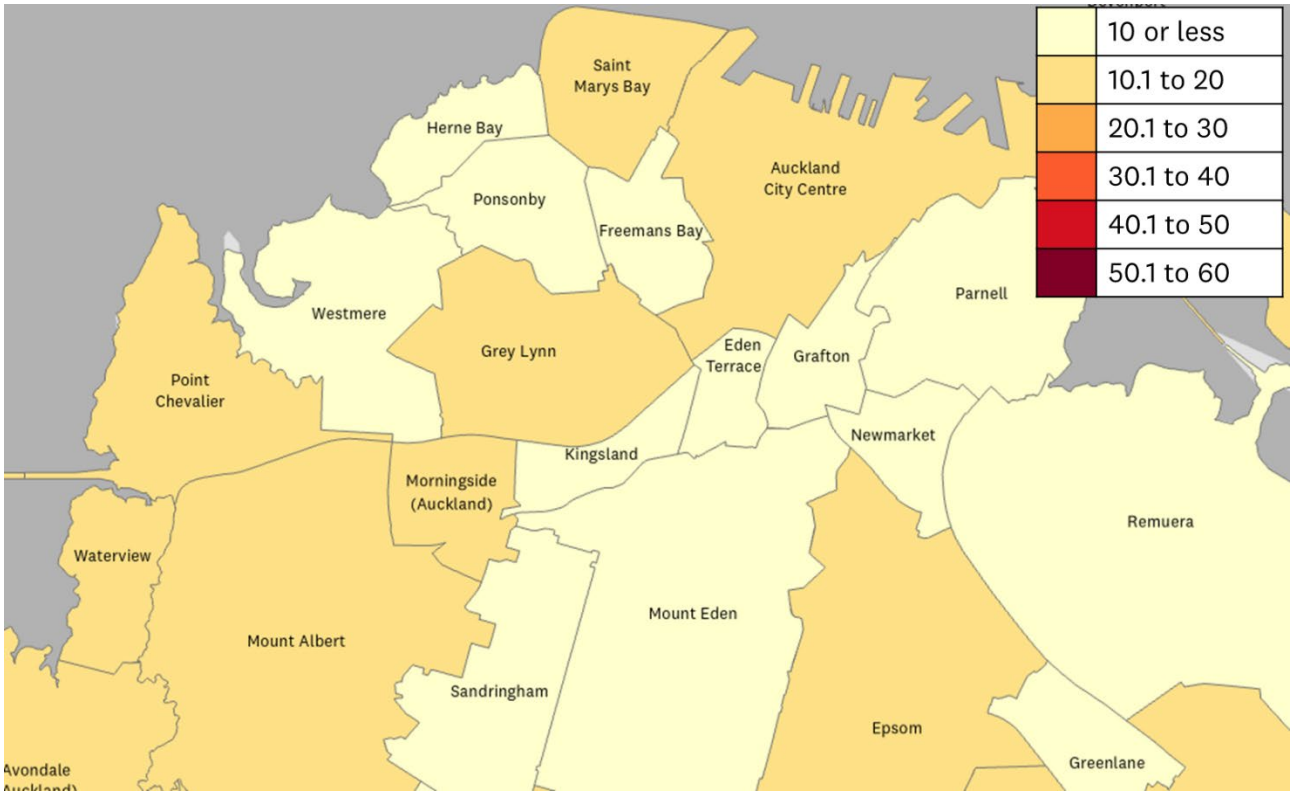
Trip origin SA3s with the shortest average public transport trip distances tended to be those in zone B (see Figure 30), which also had some of the shortest driving trip distances. The average public transport trip distance for these trips originating in zone B was 10km (see Table 7).

The average public transport trip distance for trips originating in Eden Terrace was 7km, one of the shortest average public transport distances for SA3 trip origins across the Auckland region. Te Atatū Peninsula (4 trips) and Pukekohe South (1 trip) had an average distance of 1km, while Long Bay (4 trips) had an average distance of 6km.

Table 7: Average public transport distances in zone B, by SA3 trip origin

Origin	Average public transport distance (km)	Number of trips
Eden Terrace	7	32
Freemans Bay	8	44
Sandringham	8	45
Grafton	8	15
Herne Bay	9	17
Remuera	9	113
Kingsland	9	20
Mount Eden	9	112
Ponsonby	9	18
Parnell	9	42
Epsom	10	67
Newmarket	10	26
Grey Lynn	10	56
Westmere	10	19
Mount Albert	11	94
Point Chevalier	11	39
Morningside (Auckland)	13	16
Saint Marys Bay	15	12
Total	**10**	**787**

Figure 30: Average public transport trip distance (km), by SA3 trip origin in zone B



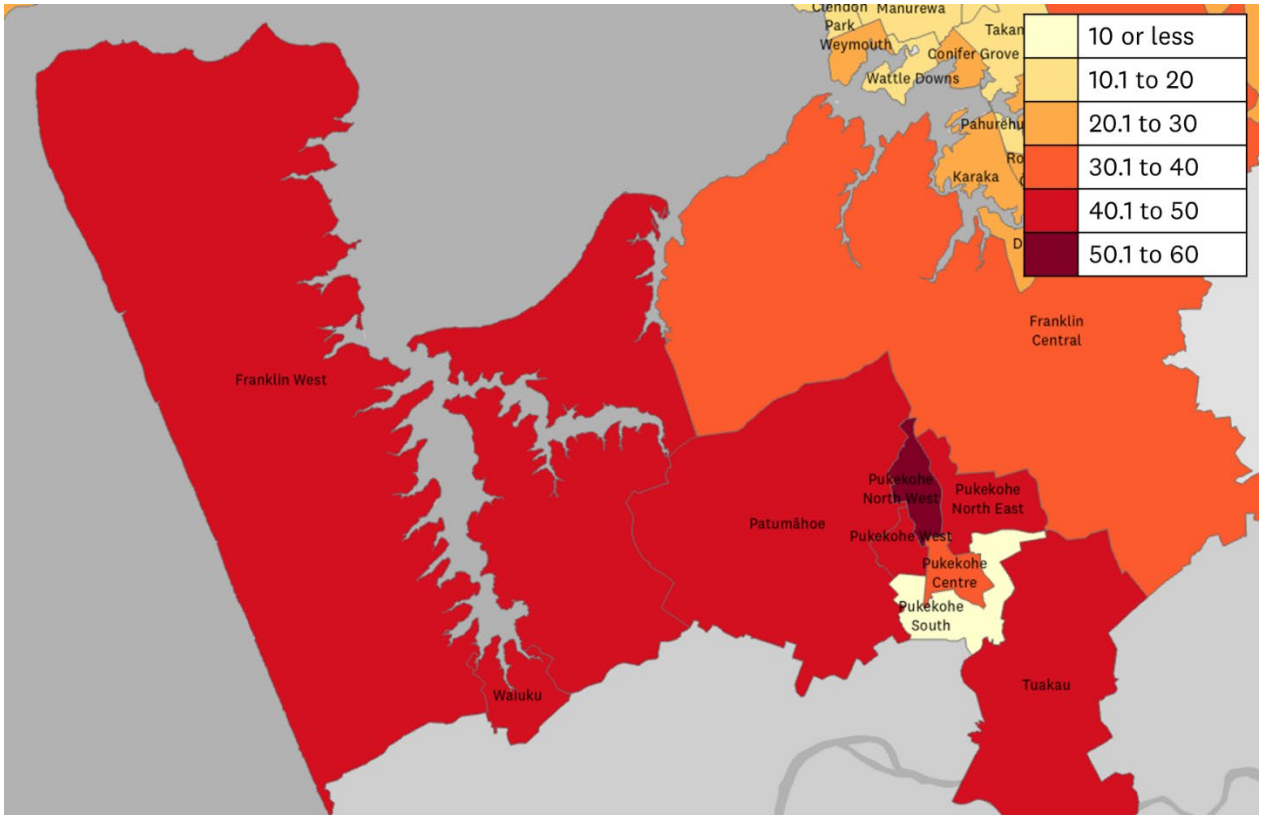
Conversely, trip origin SA3s with the longest average public transport trip distances tended to be those in zone D (see Figure 31), which were found to have some of the longest driving trip distances. Table 8 shows the average distance for public transport originating in zone D. The average public transport trip distance was 41km across the 124 public transport trips originating in these SA3s. When Pukekohe South is excluded the remaining SA3s have an average public transport distance of 45km.

Table 8: Average public transport distances in zone D, by SA3 trip origin

Origin	Average public transport distance (km)	Number of trips
Pukekohe North West	50	1
Pukekohe West	49	2
Waiuku	49	27
Tuakau*	47	1
Patumāhoe	47	10
Pukekohe North East	46	5
Franklin West	44	9
Pukekohe Centre	39	47
Franklin Central	36	21
Pukekohe South	1	1
Total	**41**	**124**

*Note: Tuakau is within the Waikato District.

Figure 31: Average public transport trip distance (km), by SA3 trip origin in zone D



Note: Tuakau is within the Waikato District.

4.4 Public transport to driving trip distance ratio

A ratio was calculated to facilitate comparison between the distance of public transport and driving trips. A ratio of 1 indicates public transport and driving trips had the same distance. Values greater than 1 indicate public transport trips had longer distances than driving, and values less than 1 indicate public transport trips had shorter distances than driving trips.

The average ratio across all 4638 trips with an equivalent public transport route was 1.2.[35] In other words, public transport trips had distances 1.2 times greater than driving trip distances on average. For individual trips, this ratio ranged between 0.3 (i.e. the public transport trip distance is 0.3 times the driving trip distance) to 8.9 (i.e. the public transport trip distance is 8.9 times greater than the driving trip).

Trips with driving trip distances longer than public transport trip distances (i.e. ratios under 1) demonstrate how Google Maps routing prioritises use of motorways. Travel by motorway tends to have a shorter duration, even with a much longer distance, compared to a more direct route travelled by streets. This prioritisation of motorway travel was especially evident where trip origins and destinations were located near motorway on and off ramps. There will be some instances where public transport routes are shorter distances than driving on the road network allows such as ferry routes and some train routes

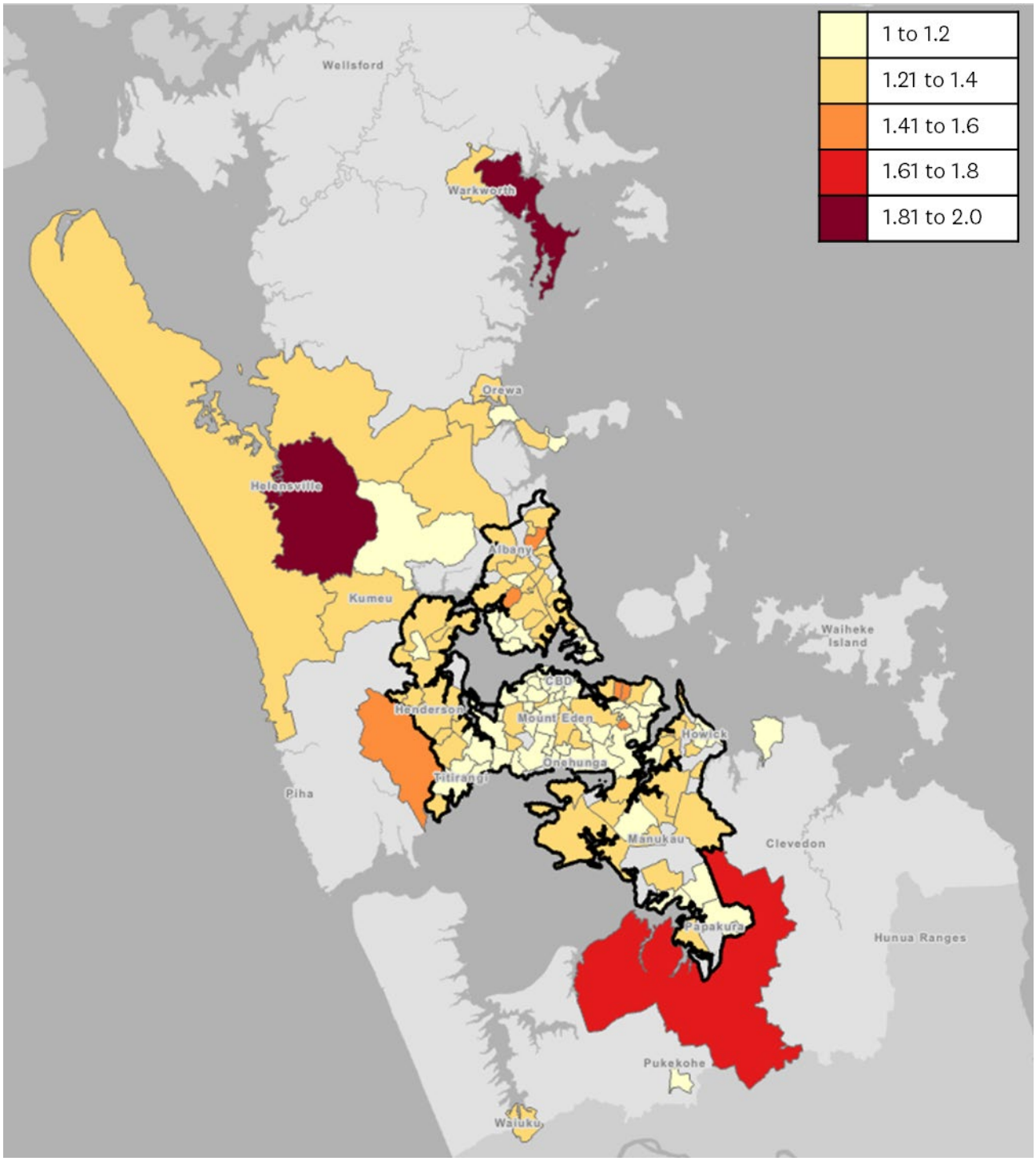
The ratio for public transport to driving trips within the MUA was 1.2 while trips outside the MUA had a ratio of 1.3.

Average public transport to driving trip distance ratios varied across SA3 trip origins. Hillsborough (27 trips) in central Auckland had the lowest average ratio of 1.0[36], while Mahurangi Peninsula[37] (16 trips) in northern Auckland had the highest average ratio of 1.9[38].

Ratios for SA3 trip origins do not appear to cluster and form larger spatial areas with similar values, unlike distances and durations for trips reported in the previous section. There is a pattern of SA3 trip origins closer to Auckland City Centre with lower ratios compared with those further away (see Figure 32).

[35] This excludes the 238 trips for which the 'public transport' route mode was interpreted to be walking.
[36] Lowest of SA3 trip origins with at least 10 trips origins.
[37] Mahurangi Peninsula (17 trips) in northern Auckland was the SA3 trip origin location with the longest average public transport trip distance at 53km. Mahurangi Peninsula and these southern Auckland SA3s are all outside of the MUA.
[38] Hibiscus and Bays in northern Auckland had an average ratio of 2.0, however, this represents only 7 trips.

Figure 32: Ratio of public transport to driving trip distance (km), by SA3 trip origin



Note: Thick black outline shows Major Urban Area. Aotea / Great Barrier has been excluded from this map as no trips collected in the survey were on Aotea / Great Barrier. Map shows SA3 with 10 or more trips.

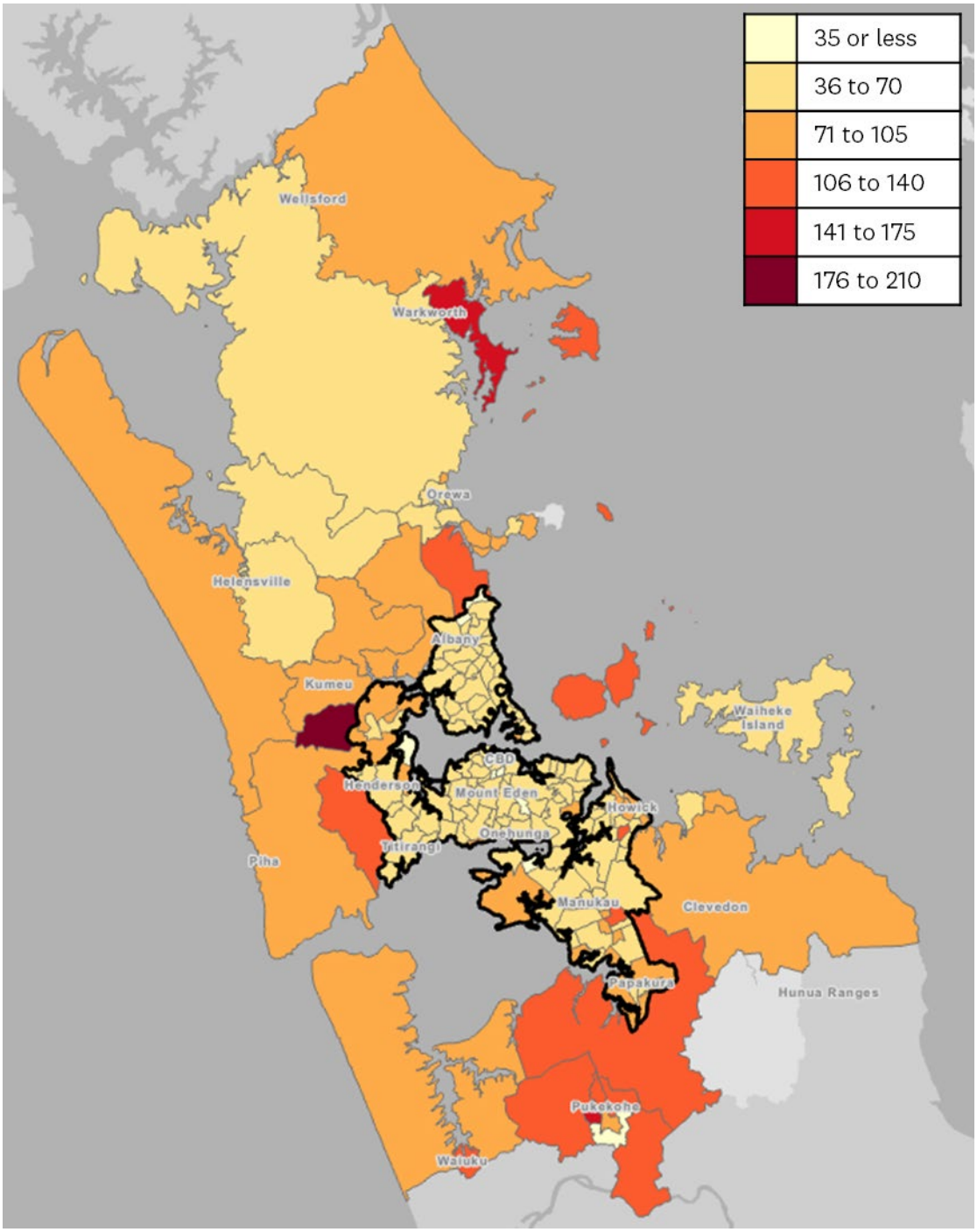
4.5 Spatial differences in public transport trip durations

This section explores spatial differences in the duration of public transport trips across the Auckland region. The analysis presented includes all 4876 trips.

Public transport trips within the MUA (4139 trips) had an average duration of 51 minutes, while those outside this area (737 trips) had an average duration of 91 minutes. The difference in public transport trip distances within and outside the MUA alone are unlikely to account for these differences in trip duration. Trips outside the MUA may be longer in duration as the result of transfers between services involving walking between public transport stops and waiting for the connecting services.

SA3 trip origins with the shortest average public transport trip durations were in zone B (see Figure 33). Most SA3 trip origins within the MUA had average trip durations of 70 minutes or less. However, unlike the pattern of average public transport distances displayed in Figure 29, the pattern of longer durations further from Auckland City Centre was less consistent. SA3 trip origins adjacent to the MUA boundary had some of the longest average public transport trip durations, creating a 'donut' pattern of longer trip durations, with shorter durations outside this ring. Franklin Central (southern Auckland), Hibiscus and Bays Rural (northern Auckland), and Waitākere East (western Auckland) all had average public transport trip durations between 105 to 140 minutes. In contrast, SA3 trip origins such as Franklin North (southern Auckland), Silverdale (northern Auckland), and Waitākere West (western Auckland), located further from Auckland City Centre beyond this 'donut', had shorter average public transport trip durations. This may be the result of the Rapid Transit Network (rail and Northern Busway) servicing these SA3s.

Figure 33: Public transport trip average durations (minutes), by SA3 trip origin



Note: Thick black outline shows Major Urban Area. Aotea / Great Barrier has been excluded from this map as no trips collected in the survey were on Aotea / Great Barrier.

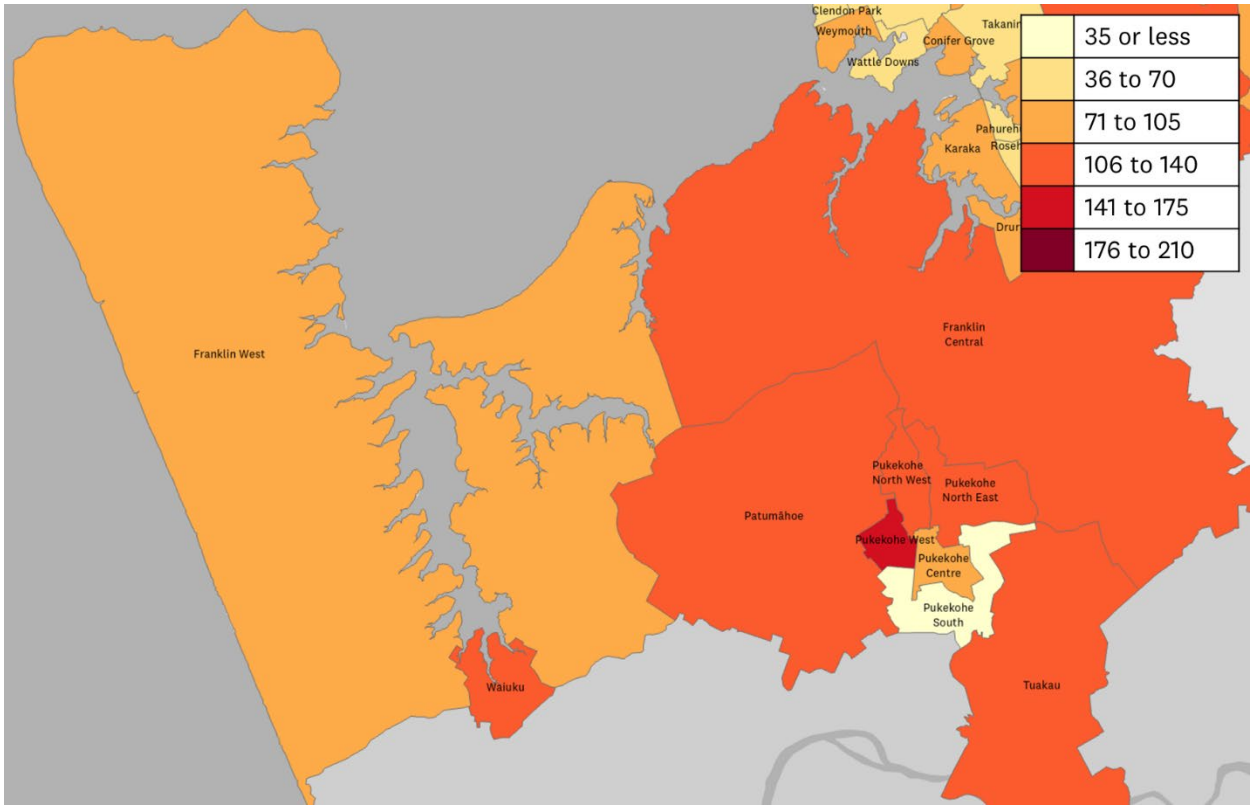
As with public transport distances, a cluster of SA3 trip origins in zone D had some of the longest public transport trip durations (see Table 9 and Figure 34). The average public transport trip duration for the 123 trips originating in a zone D SA3 was 108 minutes (1 hour and 48 minutes). In contrast, the average driving trip duration for this zone was 28 minutes. Pukekohe South was an outlier in this area, representing one trip, with a duration of 20 minutes. When Pukekohe South is excluded from zone D the average public transport duration becomes 117 minutes (1 hour and 57 minutes).

Table 9: Average public transport durations in zone D, by SA3 trip origin

Origin	Average public transport duration (minutes)	Number of trips
Pukekohe West	141	2
Pukekohe North West	132	1
Franklin Central	129	21
Tuakau*	126	1
Waiuku	115	27
Pukekohe North East	115	5
Patumāhoe	110	10
Franklin West	99	9
Pukekohe Centre	88	47
Pukekohe South	20	1
Total	**108**	**124**

*Note: Tuakau is within the Waikato District.

Figure 34: Average public transport trip duration (minutes), by SA3s trip origins in zone D



Note: Tuakau is within the Waikato District.

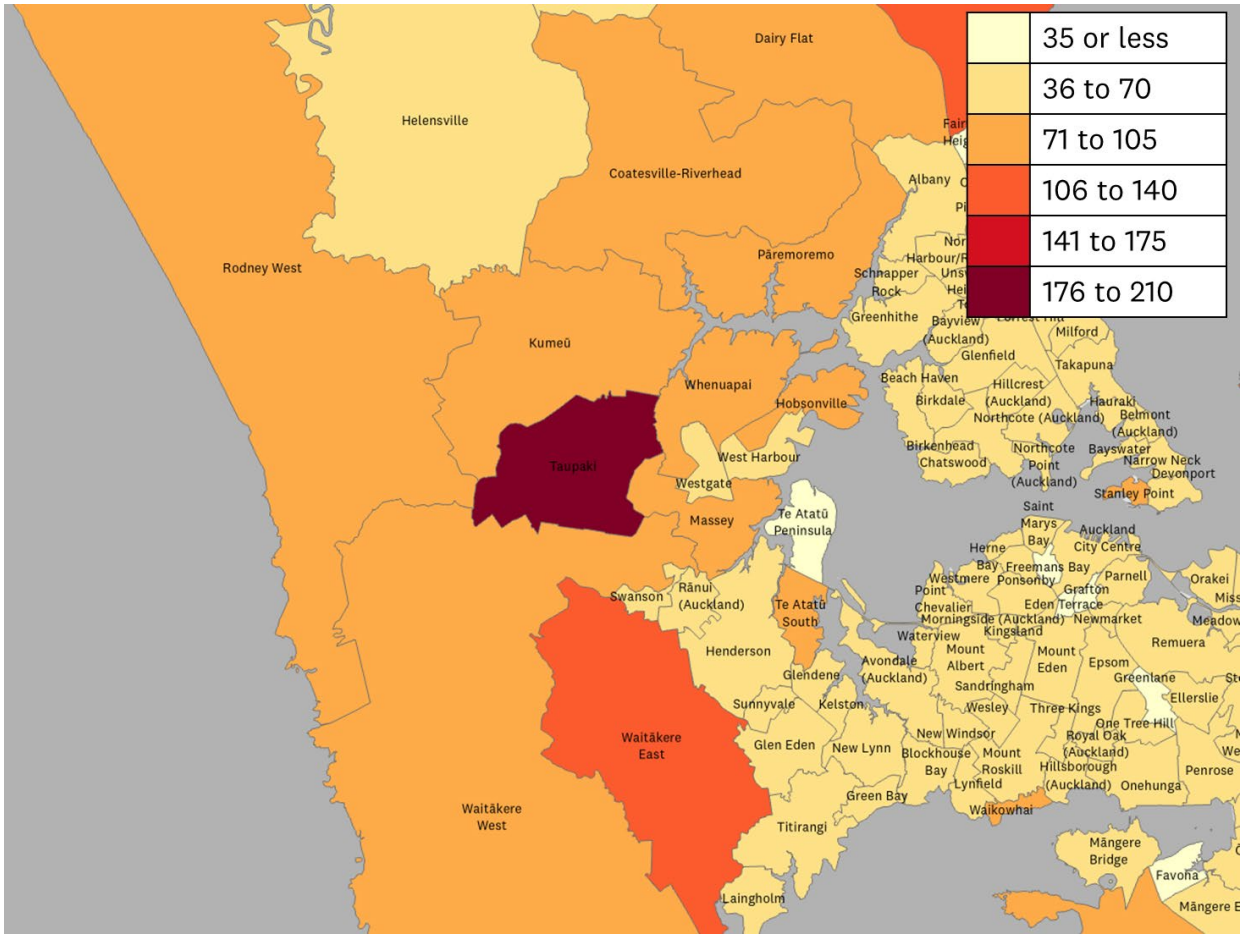
Several SA3 trip origins in western and northern Auckland also had longer public transport trip durations (see Table 10 and Figure 35). These SA3 trip origins accounted for 206 public transport trips with an average duration of 95 minutes (1 hour and 35 minutes). Taupaki represented a single trip with a notably long public transport trip duration of 182 minutes (3 hours and 2 minutes) which

was much longer than the second highest public transport trip duration in Waitākere East at 108 minutes (1 hour and 48 minutes). When Taupaki was excluded from these SA3 trip origins the average public transport trip duration dropped to 86 minutes (1 hour and 26 minutes).

Table 10: Average public transport duration in western and northern Auckland, by SA3 trip origin

Origin	Average public transport duration (minutes)	Number of trips
Taupaki	182	1
Waitākere East	108	18
Pāremoremo	99	2
Waitākere West	90	6
Kumeū	87	40
Dairy Flat	84	14
Rodney West	83	16
Whenuapai	83	21
Coatesville-Riverhead	78	11
Hobsonville	77	46
Massey	70	31
Total	**95**	**206**

Figure 35: Average public transport trip duration (minutes), by SA3 trip origins in western and northern Auckland

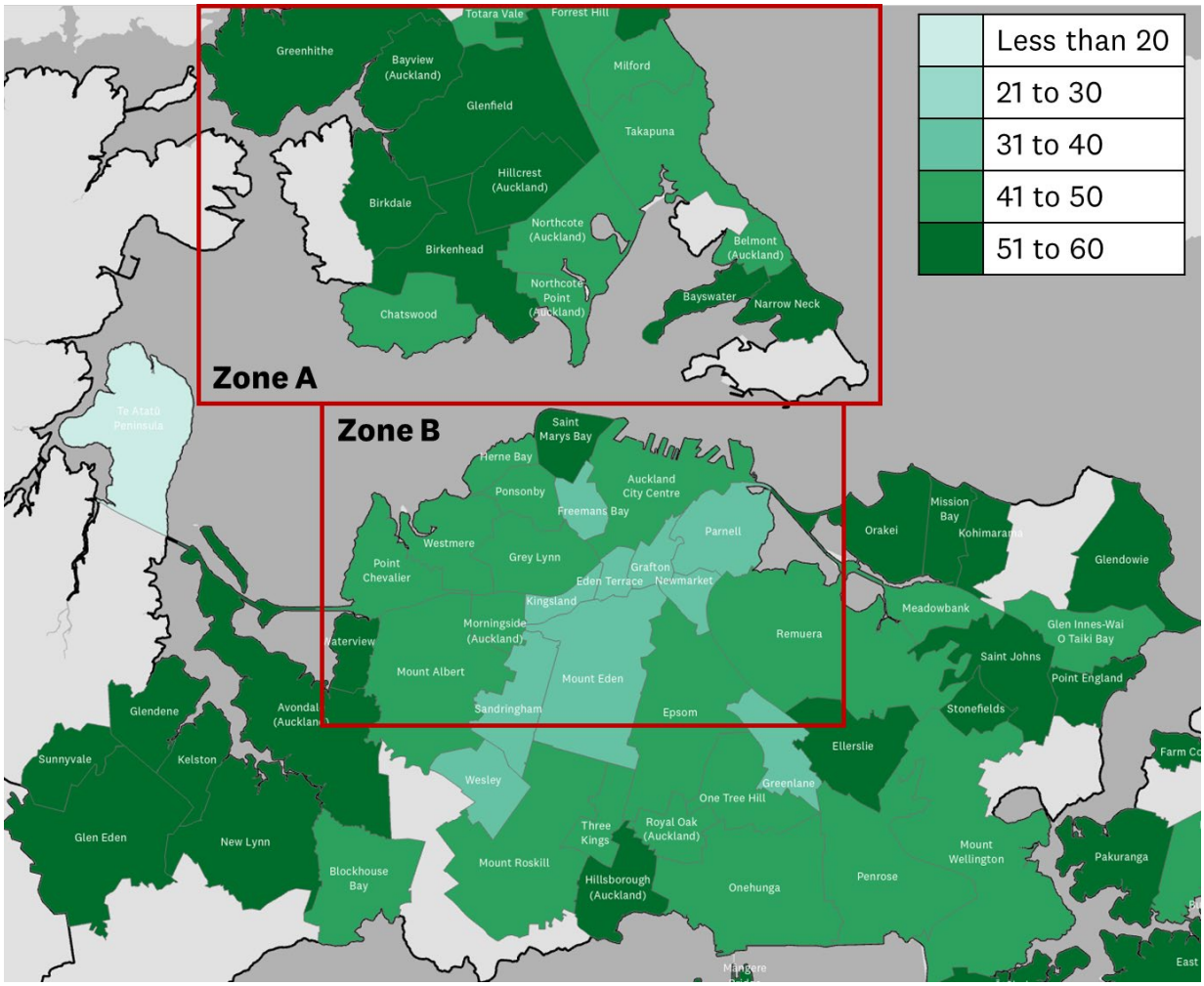


Public transport trip durations with originating in SA3s in zone B (and surrounding this zone described previously) and SA3s within zone A were generally shorter. Figure 36 shows the public transport trip durations for these SA3 trip origins. The scale used in this map is different to other maps shown in this section and a green colour scheme is used to make this clear. Many SA3s trip origins within this region have average public transport trip durations less than 70 minutes (the second to smallest value range for other maps in this section) resulting in these SA3 showing little variation using a scale with larger buckets.

A strip of SA3 trip origins between Parnell and Wesley had average public transport trip durations ranging from 20 and 30 minutes. Freemans Bay, located near this strip and Auckland City Centre, also had an average trip duration of 34 minutes.

SA3 trip origins in zone A had average public transport trip durations between 40 and 60 minutes. Another cluster of SA3 trip origins to the western edge of zone B (New Lynn, Glen Eden, Avondale (Auckland), Kelston, Glendene, and Sunnyvale) had average public transport trip durations ranging from 50 and 60 minutes.

Figure 36: Average public transport trip duration (minutes), by SA3 trip origins in zone A, zone B and surrounding zone B



Note: only SA3s with an average public transport trip distance under 60 minutes are shown.

4.6 Public transport to driving trip duration ratio

A ratio was calculated to facilitate the comparison between public transport and driving trip durations. A ratio of 1 indicates public transport and driving trips had the same duration. Values greater than 1 indicate public transport trips with longer durations than driving, and values less than 1 indicate public transport trips with shorter durations than driving.

The average ratio across all 4638 trips with an equivalent public transport route was 3.4.[39] In other words, public transport trips had durations 3.4 times greater than driving trip durations, on average. For individual trips, this ratio ranged from 0.4 (i.e. the public transport trip duration is 0.4 times that of the driving trip) to 72 (i.e. the public transport trip duration is 72 times longer than the driving trip). Twenty-three trips had ratios greater than 10 and could be considered outliers. However, the small number of these outlier trips had no impact on the average ratio across all trips. The average ratio for the 4615 trips with ratios less than 10 also remained at 3.4.

[39] This excludes the 238 trips for which the 'public transport' route mode is interpreted to be walking.

The ratio for public transport to driving trips within the MUA is 3.4, while trips outside the MUA have a ratio of 4.0. Public transport trips outside the MUA having longer durations relative to driving aligned with expectations that the public transport system would be more competitive with driving within the MUA. This finding supports the rationale for limiting the analysis of perception results from the survey to trips within the MUA.[40]

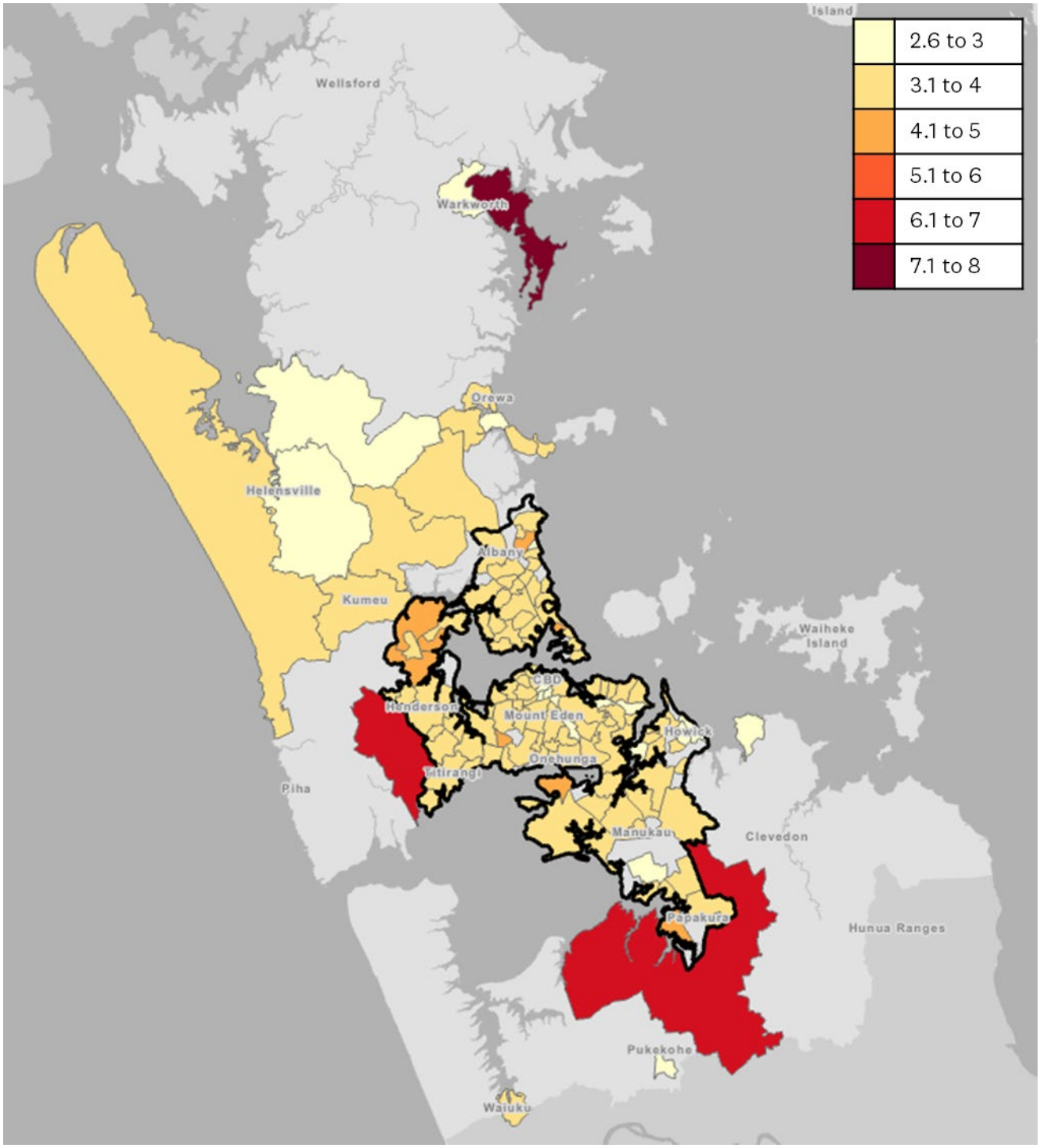
Ratios for SA3 trip origins did not cluster to form larger spatial areas with similar values, unlike the distances and durations for trips reported on in the previous section. A pattern emerged where SA3 trip origins closer to Auckland City Centre had lower ratios compared to those further away (see Figure 37). However, some SA3 trip origins with the lowest average ratios were located far from Auckland City Centre. Helensville (north western Auckland, 22 trips) and Beachlands (eastern Auckland, 21 trips) had the lowest average ratio of 2.6.[41] Mahurangi Peninsula (16 trips) in northern Auckland had the highest average ratio of 7.3.[42]

[40] *Perceptions of public transport, cycling and walking among Auckland drivers,* TR2024/2 . Report available at: https://knowledgeauckland.org.nz/publications/perceptions-of-public-transport-cycling-and-walking-among-auckland-drivers/

[41] Lowest of SA3s with at least 10 trip origins.

[42] The SA3 Hibiscus and Bays in north Auckland had an average ratio of 10.9, however, this represents only 7 trips.

Figure 37: Ratio of public transport to driving trip duration (minutes), by SA3 trip origins



Note: Thick black outline shows Major Urban Area. Aotea / Great Barrier has been excluded from this map as no trips collected in the survey were on Aotea / Great Barrier. Map shows only SA3 with 10 or more trips.

Liao et al. (2020, op. cit.) conducted an analysis of trip durations comparing driving and public transport modes in four cities: São Paulo, Brazil; Stockholm, Sweden; Sydney, Australia; and Amsterdam, The Netherlands). They found that on average public transport took 1.4 to 2.6 times longer than driving, with public transport generally taking twice as long as driving. Using this as a benchmark, the trips included in this analysis of Auckland showed that public transport took 3.4 times longer than driving, which was notably greater than the 2 times as long reported in the other

cities. There are several reasons why Auckland differs from these other cities such as fewer rapid transport options (e.g. metro, light rail), less priority on roads for public transport, and lower frequency of services on many routes.

Other findings from this study are also reflected in the results of this analysis for Auckland. Liao et al. (2020, op. cit.) noted that public transport could be faster than driving for short distances (under 3km) and that in areas surrounding city centres the disparity between public transport and driving was smaller.

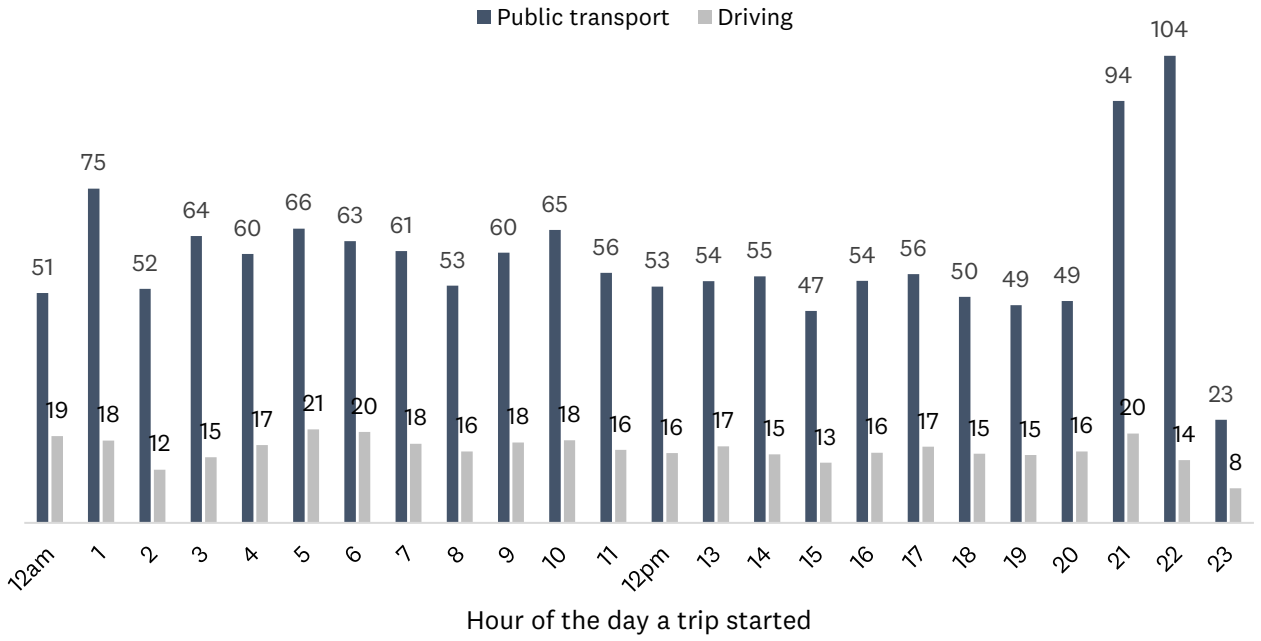
4.7 Time of day differences in public transport trip duration

The duration of public transport trips averaged between 49 to 65 minutes throughout most times of the day (see Figure 38). A small number of trips, those starting between 9pm and 10pm (27 trips), had longer average durations (94 minutes and 104 minutes, respectively). Public transport trips in the afternoon saw average durations trending downwards reaching 50 minutes and less by 6pm.

The duration of driving trips showed a similar pattern, remaining consistent throughout different times of day. Like public transport trip durations, driving trips in the afternoon were slightly shorter compared to those in the morning.

Both public transport and driving trip durations appeared to be unaffected by a 'rush hour' which one might expect to result in longer trip durations between 7am and 10am. The data fetched using the Google Maps API determined trip durations based on the time of day and day of the week driving trips were undertaken by participants.

Figure 38: Average public transport and driving trip duration (minutes), by time of day trip begins



Note: small numbers of trips have start times before 5am and after 7pm. Average durations for trips starting at these times should be considered indicative only.

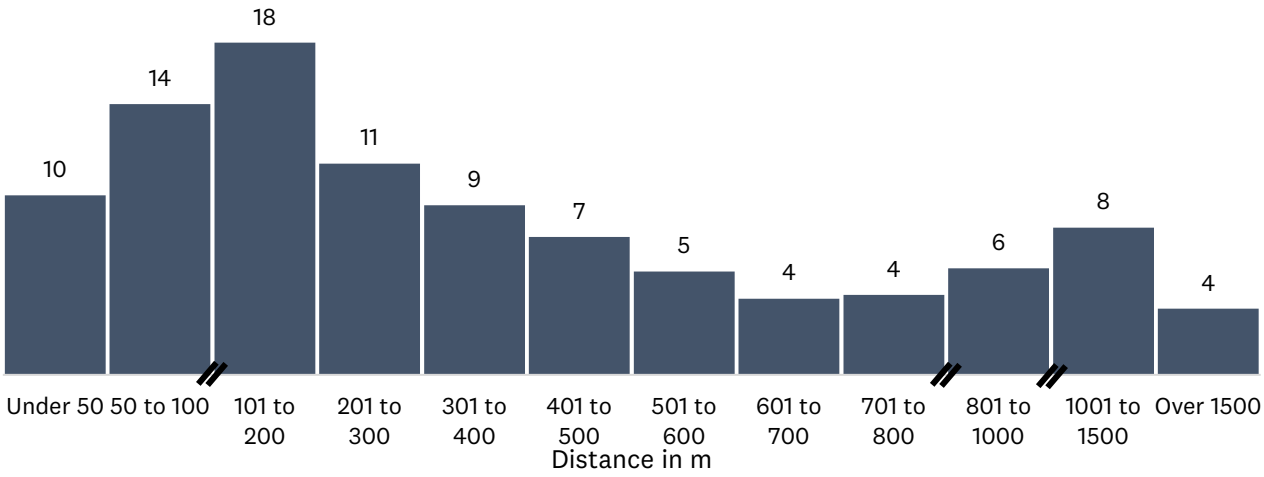
4.8 Public transport stop proximity to trip origins

Analysis was conducted on the proximity of trip origins to public transport stops using Auckland Transport data on public transport stop locations. This analysis covered 4638 public transport trips, excluding the 238 trips where the public transport and walking distance and duration values were identical. The analysis identified the nearest public transport stop (bus stop, train station, or ferry terminal) to the trip origin as well as the nearest public transport stop serviced by a route that could take the participant to their destination. Since 99 per cent of public transport trips were by bus, the results primarily focused on proximity to bus stops.

For 76 per cent of public transport trips, the nearest public transport stop to the trip origin was not serviced by a route that could transport a participant to their destination. This means that 76 per cent of participants, if they were to complete their driving trip using public transport, would need to walk a longer distance to a public transport stop that could take them to their destination. This could be in part explained by many bus stops existing in pairs with a bus stop on either side of a road servicing routes travelling in opposite directions. On average, participants whose nearest stop was not serviced by a relevant route would need to walk an additional 184 metres (approximately 2 minutes[43]) to reach a stop with a route going to their destination.

On average, the public transport stop serviced by a relevant route was 433m (about 5 minutes) from the trip origin.[44] The distances between trip origins and public transport stops ranged from 1m to 4km (58 minutes). Sixty-nine per cent of trips had a public transport stop within 500m (6 minutes) walking distance of the trip origin, and 24 per cent had a stop within 200m (2 minutes). Only 12 per cent of trips had a public transport stop further than 1km (12 minutes) away from the trip origin.

Figure 39: Distance from trip origin to public transport stop in metres (%) (n=4638)



Note: Public transport trip distances under 200m and trips interpreted to be completed by walking excluded from chart. Double slash indicates changes in histogram bucket range.

[43] Google Maps uses an average walking speed of 5km/h to determine walking durations. This walking speed is used to estimate walking durations to public transport stops.
[44] Auckland's Regional Public Transport Plan 2023-2031 has a performance measure of the proportion of the Auckland population within 500m of a stop on a rapid or frequent service. Available at: https://at.govt.nz/media/2czpcmqb/aucklands-regional-public-transport-plan-2023-2031-adopted-november-2023.pdf, see page 89.

The distances between trip origins and public transport stops varied across SA3 trip origins. Among the SA3s with 10 or more trip origins, Newmarket (26 trips) had the shortest average distance between the trip origin and the public transport stop, at 142m (2 minutes).

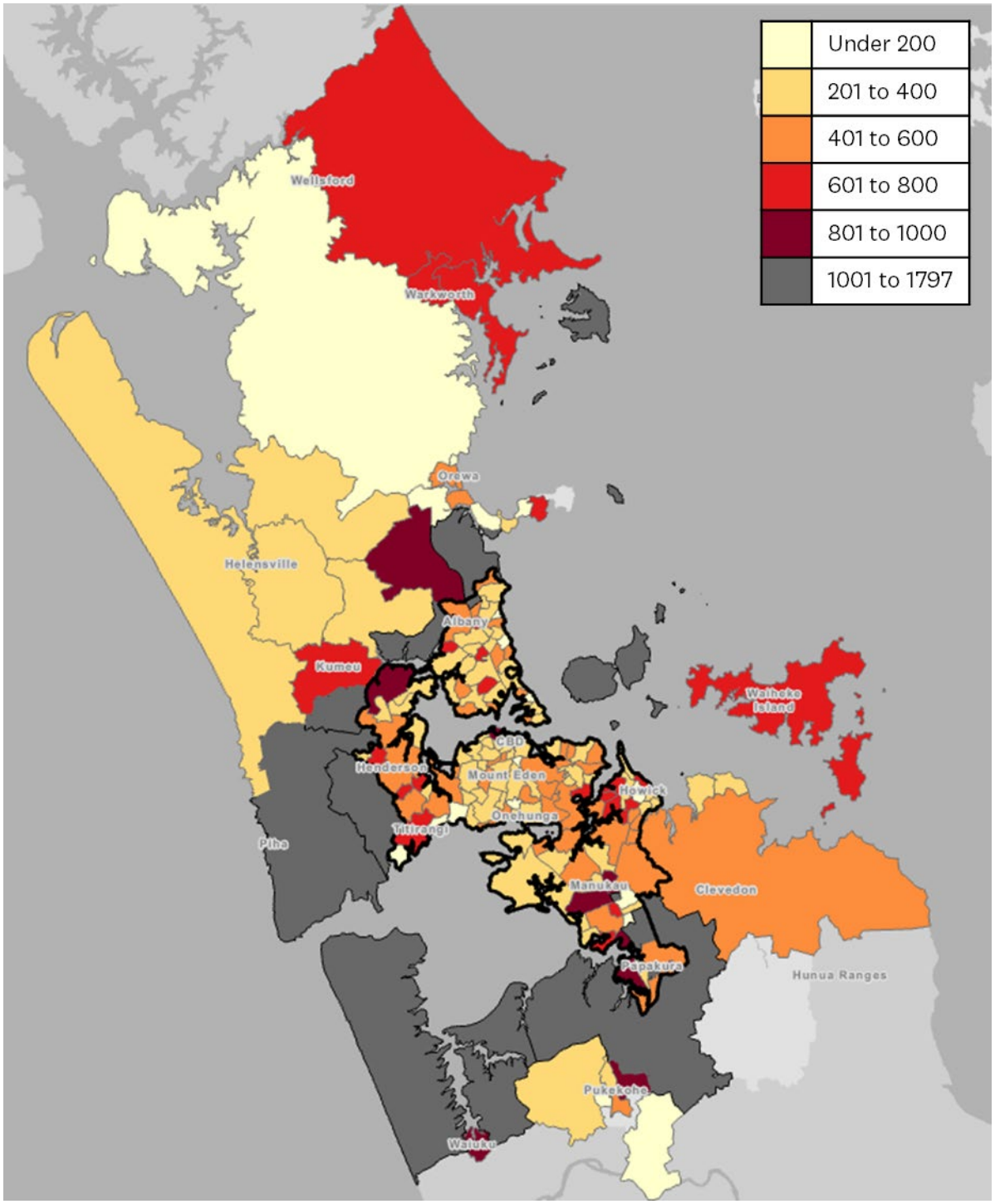
Three SA3 trip origins representing 10 or more trips had average distances greater than 1km. Waitākere East (18 trips) had the longest average distance at 1.8km (22 minutes), followed by Franklin Central (19 trips) with an average distance of 1.2km (14 minutes), and Takanini with an average distance of 1.1km (13 minutes). Waitākere East and Franklin Central are largely rural areas which explains their long distances. Takanini is served by AT Local, an Auckland Transport delivered ride share programme[45], which could be seen to mitigate an underservice of standard public transport.

Figure 40 illustrates the average distance between a trip origin and public transport stop for SA3 trip origins. Twelve SA3 trip origins have distances between 1km and 1.787km and these are shown in dark grey in the map.

At a regional level, the expected pattern of shorter total trip distances and durations closer to Auckland City Centre and longer distances further away is not clearly reflected in Figure 40. Many SA3 trip origins near Auckland City Centre had distances between 201m and 400m, similar to several SA3 trip origins in northern Auckland.

[45] See: https://at.govt.nz/bus-train-ferry/bus-services/at-local

Figure 40: Average distance between trip origin and public transport stop (metres), by SA3 trip origins



Note: Thick black outline shows Major Urban Area. Aotea / Great Barrier has been excluded from this map as no trips collected in the survey were on Aotea / Great Barrier.

4.9 Summary

The average distance of a public transport trip was 17km, and the average duration was 57 minutes, as calculated by Google Maps. The patterns of public transport trip distances closely mirrored those of driving trips, with shorter distances in zone B and longer distances in zone D. On average, public transport trips were 1.2 times longer in distance than driving trips with little difference between trips within and outside the MUA.

The duration of public transport trips, however, displayed a different pattern. A slight ‘donut’ shape emerged around the boundary of the MUA, where public transport trip durations were longer. This disrupted the typical radial pattern seen with driving durations, where trip durations tend to be shorter near Auckland City Centre and increase as one moves further out. SA3 trip origins in zone D are found to have some of the longest average public transport trip durations, while SA3 trip origins in zones A, zone B and surrounding zone B had shorter durations. On average, public transport trips took 3.4 times longer than driving trips. Trip origins closer to Auckland City Centre had a more competitive ratio compared to those located further away.

On average, the nearest public transport stop serviced by a route going to the destination was 433 metres (about 5 minutes walking) from the trip origin. The distribution of public transport stops across the region was scattered, with no clear concentration in particular areas.

5 Cycling

Of the total trips analysed, 1857 were identified by the researchers as potentially suitable for cycling based on a distance threshold of less than 8km. This threshold was set considering typical urban cycling distances and Auckland's varied terrain. To refine this dataset further, additional factors were taken into account, including trip purpose (whether for transporting items or people), transporting large items, and participants reporting physical constraints. After applying these criteria, the number of identified cycling trips was reduced to 921. This relatively small sample size meant that two-thirds of the SA3 trip origins represented 10 or fewer trips, limiting the ability to conduct a detailed analysis of cycling trips at the SA3 level. As a result, most of the analysis presented in this section was conducted at the regional level.

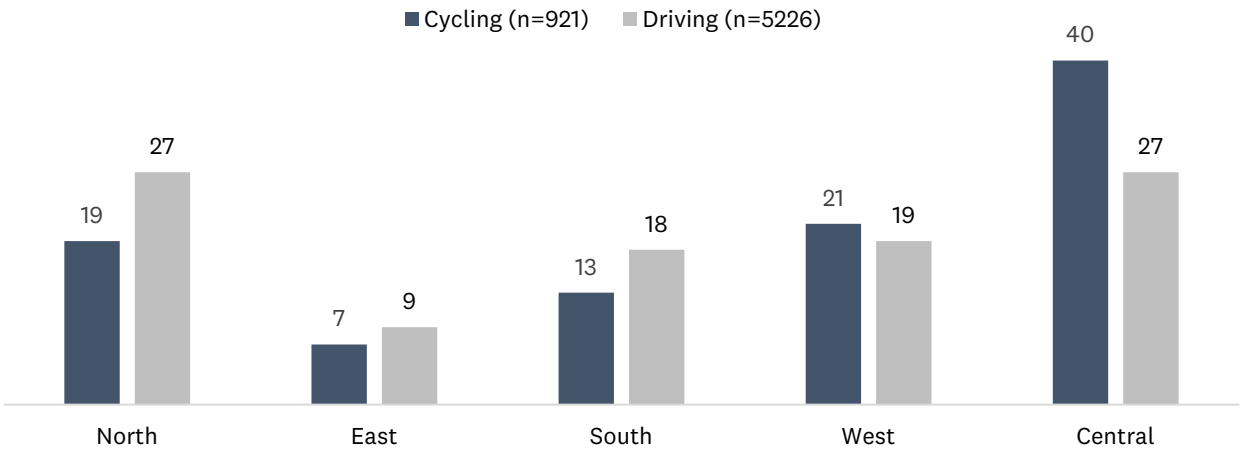
The trips described in this section were generated by Google Maps using the origin and destination coordinates of participants' driving trips and are suggested alternative trips, not trips actually undertaken by participants.

This section first examines origins and destinations of cycling trips, followed by their distances and durations, and then compares cycling trips with driving trips.

5.1 Location of trip

Forty per cent of trips that met the criteria for cycling had trip origins in central Auckland SA3s. As Figure 41 shows 22 per cent of cycling trips originated in western Auckland, 19 per cent in northern Auckland, 13 per cent in southern Auckland and the remaining 7 per cent in eastern Auckland. When compared with the proportions of driving trips from each area in the region, the proportion of cycling trips in central Auckland (40% of all cycling trips) was higher than the proportion of driving trips in this same area (27%). This suggests that trips originating in central Auckland were the most likely to meet the criteria set for this analysis.

Figure 41: Trip origin for cycling and driving trips, by area (%)



SA3 trip origins for cycling trips are most commonly within central Auckland. Remuera had the highest number of trip origins (47 trips), followed by Mount Eden (40 trips) and Auckland City Centre (31 trips) (see Figure 42). Auckland City Centre was also the most frequent destination for cycling trips (77 trips), followed by Henderson (38 trips) (see Figure 43).

Figure 42: Top 10 cycling trip origin SA3s (counts)

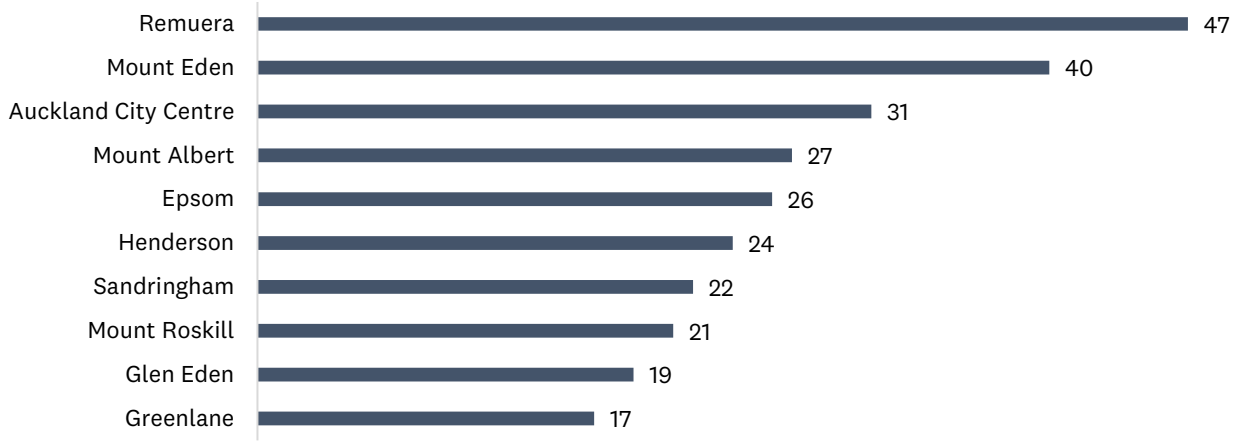
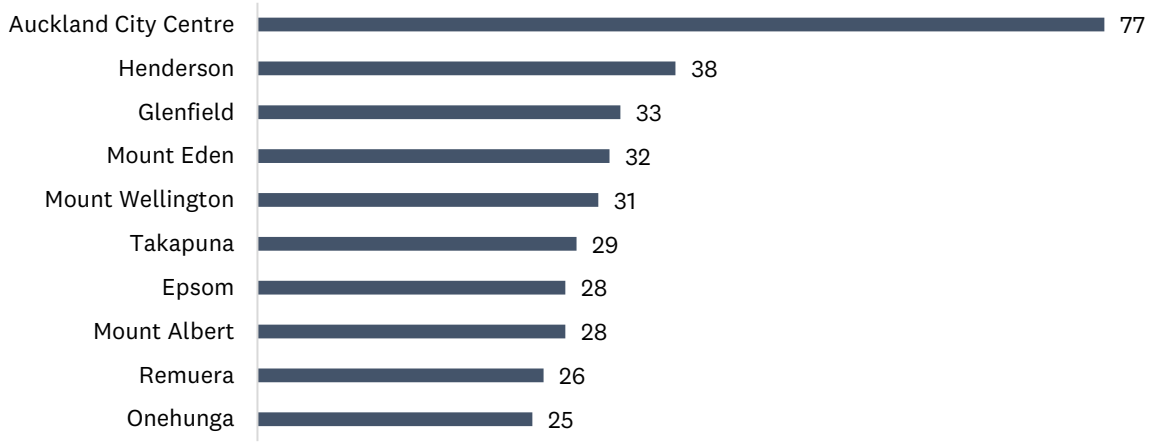


Figure 43: Top 10 cycling trip destination SA3s (counts)



5.2 Distance and duration of cycling trips

The average distance of a cycling trip suggested by Google maps was 4.1km with an average duration of 16 minutes.[46] This average finding should be considered in the context of the maximum cycling trip duration being capped at 8km.

There was little spatial variation across areas in the region. Trips originating in central Auckland had the shortest average cycling trip distance at 3.9km while trip origins in eastern and southern Auckland had average cycling distances of 4.5km. Cycling trip durations were also similar across areas with trip origins in central, southern and western Auckland averaging 16 minutes, eastern Auckland averaging 17 minutes and northern Auckland averaging 18 minutes.

[46] Google Maps calculates cycling duration using a cycling speed of 16km/h and makes some adjustments for gradient and intersections.

5.3 Cycling to driving trip distance and duration ratios

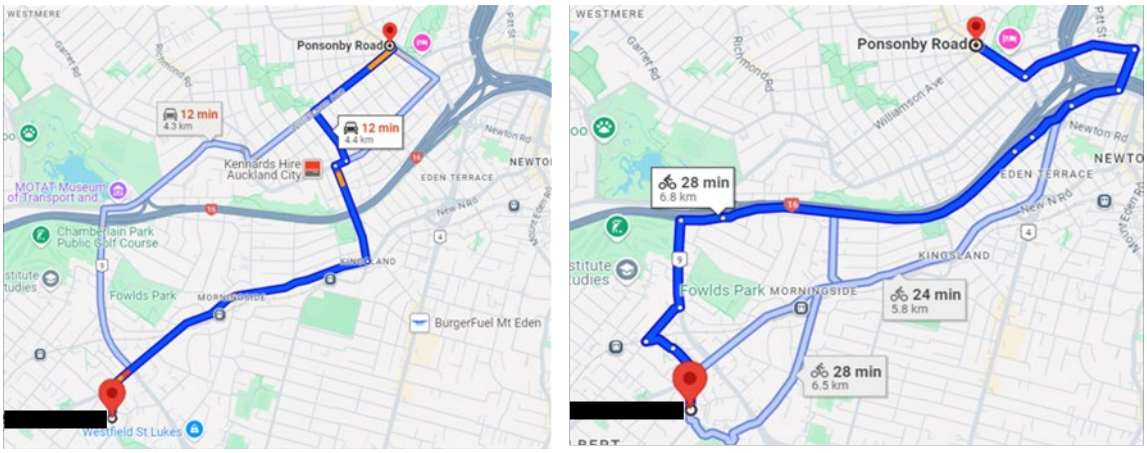
A ratio was calculated to facilitate the comparison between cycling and driving trip distances and durations. A ratio of 1 indicates cycling and driving trips with the same distance or duration. Values greater than 1 indicate that cycling trips were longer, while values less than 1 indicate that cycling trips with shorter than driving trips.

The average cycling-to-driving distance ratio for the 921 trips included in the analysis was 1.0, meaning the distances for cycling and driving trips were, on average, the same across all areas of the Auckland region. The cycling-to-driving distance ratio for individual trips ranged from 0.3 to 1.9. Twenty-one per cent (n=192) of trips had a ratio of 1 where the cycling and driving trip distances were the same.

Thirty-eight per cent (n=352) of cycling trips had a distance ratio less than 1 meaning these cycling trips were shorter than their driving counterparts. This may be attributed to cycle routes using off-road cycle paths or routes through parks. For driving, Google Maps often prioritises motorways, resulting in longer driving distances. For short trips (under 1km), it becomes more noticeable that Google Maps may route driving trips to turn around at roundabouts instead of making U-turns when it determines that the trip origin is on the wrong side of the road. This routing choice can result in a longer driving distance.

Forty-one per cent (n=337) of cycling trips had a distance ratio greater than 1 meaning the distances were longer than the driving trip distance. This could be due to Google Maps choosing routes along minor streets (which are assumed to have less traffic), cycleways, or through public parks, which can be less direct than major roads (see Figure 44).

Figure 44: Example of driving trip routed along streets (left), and cycling trip routed along cycleway (right)



The average cycling to driving trip duration ratio was 2.0, consistent across all areas of the Auckland region. This means, on average, completing a trip by cycling took twice as long as driving. The cycling to driving duration ratio for individual trips ranged from 0.4 to 5.3.

Twenty-four trips had a cycling to driving trip duration ratio less of than 1, meaning the cycling trip was shorter in duration than driving. Of these, twenty were shorter than 1km in distance, and Google

Maps use of cycle lanes and routes through parks likely explains why cycling was faster in most of these cases.

For the remaining trips, the cycling to driving duration ratios were greater than 1, indicating that cycling took longer than driving. When the distance of each route were similar this ratio could be explained by the relatively slower speeds of cycling compared with driving. In cases where cycling routes were longer than driving routes, as explained earlier, the cycling duration was proportionally greater than the driving duration.

5.4 Summary

Forty per cent of trips that could be completed by cycling had trip origins within central Auckland. Remuera and Mount Eden SA3s had the highest number of cycling trip origins.

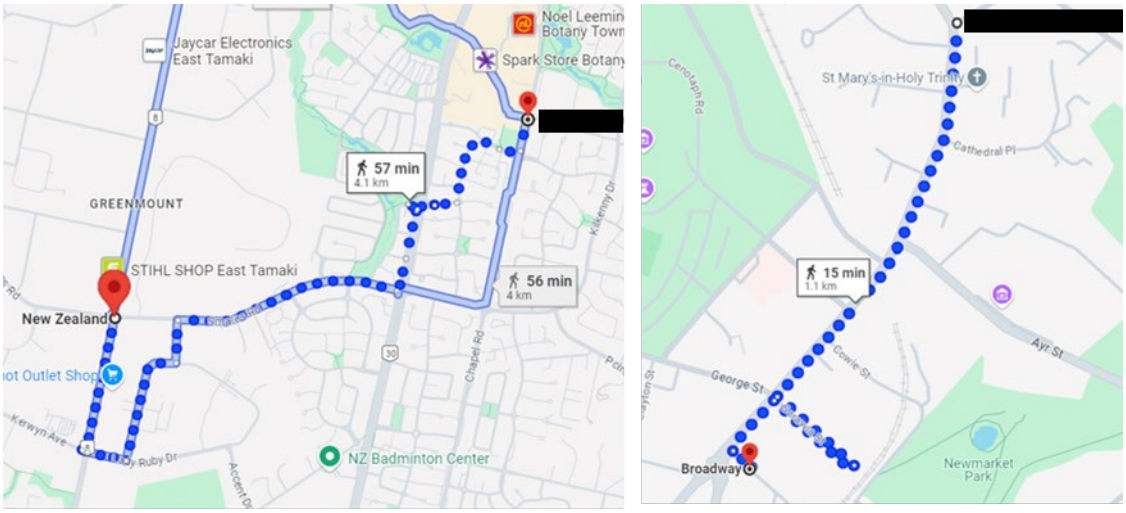
The average distance of a cycling trip, with a maximum distance of 8km, is 4.1km and has an average duration of 16 minutes. A ratio was calculated to compared cycling and driving trip durations and distances. On average, cycling trips were the same distance as driving trips (a ratio of 1.0), but they took twice as long as driving trips (a ratio of 2.0). This comparative analysis highlighted the impact of Google Maps routing for cycling trips which tended to prioritise cycleways, paths through public parks, and smaller winding streets, while driving routes were directed along motorways and straight main roads. While this routing approach may enhance cyclist safety, it could increase the distance and, consequently, the duration of cycling trips. Expanding cycling infrastructure could help reduce cycling trip distances and durations and continue to prioritise cyclist safety.

6 Walking

Of the 717 trips initially identified as potentially walkable (having distances less than 3km), further analysis filtered these down to 353 trips. The selection criteria considered several factors, including reported difficulties in walking, carrying large bags, or trip reasons that involved an overnight journey, making walking impractical. This small sample size prevents detailed geospatial analysis of these trips.

On average, these walking trips took six times longer than driving with much of this difference attributed to the slower speed of walking compared to driving. In some cases, Google Maps' walking routes were found to be unusually long, resulting in longer routes than those for driving (see Figure 45). These routes may be the result of a missing pedestrian route within Google Maps to indicate that pedestrian crossings and footpaths along the side of roads are present.

Figure 45: Example Google Maps walking routes



Henderson SA3 had the most trip origins (17 trips), followed by Remuera with 16 trips, and Onehunga with 14 trips. Although Auckland City Centre was expected to have high walkability and was the origin for the greatest number of driving trips in this study, it accounted for only 12 walking trips, representing just 7 per cent of all trips originating in the area. This may be due to many trips originating from the Auckland City Centre having distances longer than 3km which excluded them from the walking analysis.

7 Discussion

This report presents an analysis of geospatial data representing travel patterns of survey participants, which is indicative of travel patterns of Aucklanders. This report contributes to achieving the aims of this study by 'identify suburbs, and sub-populations across Auckland where access to non-car modes is poorest', where access is interpreted as the degree of competitiveness of non-car modes using trip duration as a metric.

Since the survey was undertaken in 2022 there have been several changes to the broader transport context in Auckland, however it is hoped that the findings presented here, and in the previously published report from this survey, are of use and interest to those designing and planning Auckland's transport futures.

One change has been to some of Auckland's public transport services and an increase in public transport patronage since the survey was undertaken in 2022 (as mentioned in the introduction). Another change has been in broader transport policy and priorities. The original intention of the study was to inform the implementation of the Transport Emissions Reduction Pathway (TERP), although Auckland's transport emissions trends indicate that the region is not on track to achieve targets in the TERP or Te Tāruke-ā-Tāwhiri Auckland's Climate Plan.

However, this analysis contributes to the original objectives of the study by identifying areas across Auckland where the competitiveness of non-car modes relative to driving is poorest. The analysis suggests the competitiveness of public transport is 'best' in zone B surrounding Auckland's City Centre and is 'poorer' in zone D (a cluster of SA3s near Pukekohe and Franklin). Overcoming these spatial differences, particularly in public transport services, could contribute to more equitable outcomes for Aucklanders.

The emissions reduction outcomes of the TERP and Vehicle Kilometres Travelled Reduction (VKT Reduction) Programme are reliant on non-car modes being perceived by Aucklanders as competitive with driving and thereby encouraging a mode shift. The previously published report from this survey demonstrated that non-car modes need to be perceived as convenient and safe in order for Aucklanders to travel by non-car modes. This geospatial analysis demonstrates that Aucklanders starting trips in zone B (near Auckland City Centre) have greatest potential to shift from driving to public transport or cycling, especially compared to those in zone D (near Pukekohe and Franklin). However, at best across the Auckland region a public transport trip is 2.6 times longer than driving on average for SA3 trip origins[47] and on average is 3.4 times longer than driving. Improvements to the non-car transport system are required to make these modes competitive with driving.

[47] A ratio of 2.6 is the lowest value for the Auckland region for SA3 trip origins representing at least 10 trips.

8 Appendices

8.1 Questionnaire

Introduction

Th s survey asks about your travel within Auckland. As part of this you will be asked to tell us about a recent trip you took from your home to another location and the different things you thought about while doing so.

[Area]

Which of the following best describes the area within the Auckland region that you live in?

Answer	Value	Logic
North Auckland	1	Continue
West Auckland	2	Continue
Central Auckland	3	Continue
East Auckland	4	Continue
South Auckland	5	Continue
I am not living in Auckland region	6	DNQ

[Q1]

Have you driven yourself, or been by someone else in a private vehicle (e.g. car, ute, or van which you or someone you know owns) from your home to another location in Auckland any time in the last two weeks?

Answer	Value	Logic
Yes	1	Continue
No	2	DNQ
I don't know	3	DNQ

We are interested in knowing a little more about the most recent time you drove a private vehicle from your home to another location within Auckland.

[Q3]

What day of the week did you take this trip?

Answer	Value	Logic
Monday	1	Continue
Tuesday	2	Continue
Wednesday	3	Continue
Thursday	4	Continue
Friday	5	Continue
Saturday	6	Continue
Sunday	7	Continue

What time of day did you start the trip? *(Please estimate if you cannot remember exactly)*

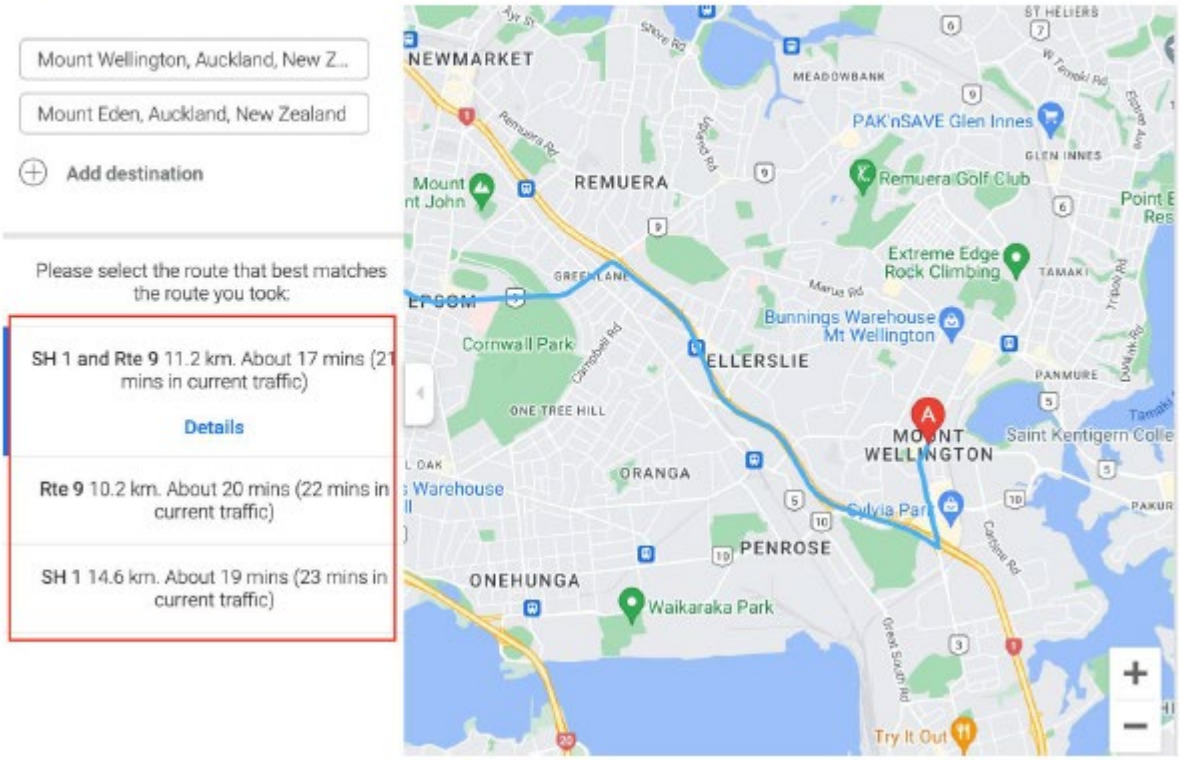
Answer	Variable name	Logic
[Hours]	Q4x1c1	Continue
[Minutes]	Q4x2c2	DNQ

To make it easier for you to tell us about where you went the last time you drove a private vehicle from your home to another location within Auckland, we would like to know about your travel only in one direction: from your home to your destination.

Please type the locations where you started and ended your trip, and any stops you made along the way, into the address boxes.

Once you have typed a location you can drag and move the pin on the map.

Important notes
We will keep this information confidential. If you do not wish to provide specific locations, please feel free to move the pointer on the map slightly away from the actual address.
Stops refer to things that you did on the way to your destination like dropping kids off at school, or running other errands, while you were on the way to somewhere else. Please include these on the map below.
If your trip involved parking and transferring to a different mode (e.g. a bus), please only enter the driving portion of your trip.



Variables extracted from pin placement and selecting route that best matches on map above. Date of driving trip and alternative modes is 42 days into the future, date stated in futureDater.

Variable name	Notes
Q2r1	Trip origin
Q2r2	
Q2r3	
Q2r4 ... Q2r10	Highest number is trip destination
placeIDr1 ... placeIDr2	
travelOutsideAkl	Binary
drivingDistance	11.2km from above example
drivingDuration	17min from above example. Used to generate arrival time for use in Q27
arrivalDater1 ... arrivalDater2	Date/time used to fill arrival in Q27
futureDater2	Date 42 days, 6 weeks into the future for use in Q27
drivingGeospatialr1 ... drivingGeospatialr9	
drivingShareURL	
cyclingDistance	DISPLAY Q29-37 **cycling** IF <=15km
cyclingDuration	
cyclingGeospatialr1 ... cyclingGeospatialr9	
cyclingShareURL	
cyclingElevGain	
cyclingElevLoss	
walkingDistance	DISPLAY Q17-Q28 **PT** IF >1.5km (i.e. walking distance too long to just walk) DISPLAY Q29
walkingDuration	
walkingGeospatialr1 ... walkingGeospatialr9	
walkingShareURL	
walkingElevGain	
walkingElevLoss	
transitDurationr1 ... transitDurationr9	
transitDistancer1 ... transitDistancer9	
transitNumPTr1 ... transitNumPTr9	
transitTotalWalkTimer1 ... transitTotalWalkTimer9	
transitOrigWalkTimer1 ... transitOrigWalkTimer9	
transitOrigWalkDistancer1 ... transitOrigWalkDistancer9	
transitServiceTransferr1 ... transitServiceTransferr9	
transitDestWalkTimer1 ... transitDestWalkTimer9	
transitDestWalkDistancer1 ... transitDestWalkDistancer9	
transitGeospatialr1 ... transitGeospatialr9	
transitShareURLr1 ... transitShareURLr9	
transitValid	DISPLAY Q17-Q28 **PT**

transitTotalDuration	
transitTotalDistance	

Approximately how long did the trip take, from the start of your trip to the destination?

Answer	Variable name	Logic
[Hours]	Q5x1c1	Continue
[Minutes]	Q5x1c2	Continue
Not sure/I don't know	Q5exNewr99	Continue

[$Q6]

What were the reasons for your trip?

Answer	Variable name	Logic
Went to work	Q6r1	Continue
Shopping	Q6r2	Continue
Social visit/entertainment	Q6r3	Continue
Study/education	Q6r4	Continue
Personal appointments/services e.g. doctor, library, hairdressers, banks, government appointments	Q6r5	Continue
Dropped someone off/picked someone up	Q6r6	Continue
Picked up something/dropped off something	Q6r7	Continue
To go to sport or exercise activity	Q6r8	Continue
To go sightseeing	Q6r9	Continue
Volunteer work	Q6r10	Continue
Overnight trip e.g. second home, motel, bach	Q6r11	Continue
Changed modes (e.g. drove to a bus stop and took the bus)	Q6r12	Continue
Other, please specify	Q6r13 Q6r13oe	Continue

[Q7]

How many passengers, if any, did you travel with for all or part of your trip?

Answer	Value	Logic
I travelled by myself	1	SKIP to Q9
1 other person	2	Continue
2 other people	3	Continue
3 other people	4	Continue
4 other people	5	Continue
5 or more	6	Continue

[Q8]

How many of these passengers were children (aged 15 or under)?

Answer	Value	Logic
None	1	Continue
1	2	Continue
2	3	Continue
3	4	Continue

4	5	Continue
5 or more	6	Continue

[Q9]
Did you pay for parking at your final destination?

Answer	Value	Logic
Yes	1	Continue
No, I parked for free	2	SKIP to Q10
No, I did not park	3	SKIP to Q10

[Q10]
Where did you park?

Answer	Value	Logic
In an off-street car park (e.g. a Wilsons car park)	1	Continue
On the street – with a time limit	2	Continue
On the street – without a time limit	3	Continue
Park & Ride	4	Continue
Other, please specify	5 Q10r5oe	Continue

[$Q11]
What did you take with you or transport as part of this trip? (Select all that apply)

Answer	Variable name	Logic
Small item(s) (e.g. phone, book or handbag)	Q11r1	Continue
Medium-sized item(s) (e.g. requiring a shopping bag or two)	Q11r2	Continue
Large item(s) (e.g. requiring more than one person, or more than one trip to unload the items out of my vehicle)	Q11r3	Continue
Nothing	Q11r4	Continue

[Q12]
What type of vehicle did you drive for this trip?

Answer	Value	Logic
Petrol vehicle	1	Continue
Diesel vehicle	2	Continue
Hybrid	3	Continue
Plug-in hybrid electric vehicle (PHEV)	4	Continue
Battery electric vehicle (BEV)	5	Continue
Other	6	Continue
I don't know	7	Continue

[Q13]
Approximately how much do you think the trip cost?

Answer	Variable name	Logic

[value]	Q13r1 Q13Nr1	Continue
Not sure/don't know	noanswerQ13_r99	SKIP to Q15

[$Q14]
What were you thinking about when you came up with the cost above? (Select all that apply)

Answer	Value	Logic
Petrol/diesel	Q14r1	Continue
Parking	Q14r2	Continue
Wear and tear (e.g. tyres)	Q14r3	Continue
Regular maintenance costs	Q14r4	Continue
Vehicle insurance	Q14r5	Continue
Warrant of Fitness (WOF) and vehicle licensing (rego)	Q14r6	Continue
Depreciation of vehicle's value	Q14r7	Continue
Cost of finance for the car	Q14r8	Continue
Road User Charges (RUCs, for diesel vehicles)	Q14r9	Continue
Electricity for my electric vehicle	Q14r10	Continue
Other, please specify	Q14r11 Q14r11oe	Continue

[$Q15]
Do you [or any of the passengers who were with you on your last trip] have limited mobility or a disability that makes it very difficult or impossible for [any of] you to do any of the following? (Select all that apply)

Answer	Variable name	Logic
Using public transport	Q15r1	SKIP to Q17 (SKIP PT section)
Cycling	Q15r2	SKIP to Q17 (SKIP cycling section)
Walking moderate or long distances	Q15r3	Continue
No, I [we] have no problems doing any of the above	Q15r4	SKIP to Q17

[Q16]
Do you [or any of the passengers who were with you on your last trip] have a wheelchair or mobility scooter that enables you [or them] to travel 'walking distances'?

Answer	Value	Logic
Yes	1	Continue
No	2	Continue (SKIP waking section)
I don't know	3	Continue

[Qual1]
[dFlagQual1]
Please select "Strongly agree" from the list below. This is a quality check question.

Answer	Value	Logic
1.Strongly disagree	1	Continue
2.Somewhat disagree	2	Continue
3.Neither agree or disagree	3	Continue
4.Somewhat agree	4	Continue
5.Strongly agree	5	Continue

PT

See display and SKIP conditions

The following questions ask about your thoughts on using public transport rather than driving for the trip you described earlier.

The questions below ask you what you think your trip would have been like if you had taken public transport.

Approximately how long do you think the trip would have taken (thinking of your total travel time from leaving the house to getting to your destination)?

Answer	Variable name	Logic
[Hours]	Q17x1c1	Continue
[Minutes]	Q17x2c2	Continue
Not sure/don't know	Q17exNewr99	Continue

Approximately how much do you think the trip would have cost[per person] (noting that public transport currently has half price fares)?

Answer	Variable name	Logic
[value]	Q18Nr1	Continue
Not sure/don't know	Q18Nexr99	Continue

[Q19]

How convenient do you think the trip would have been?

Answer	Value	Logic
Much less convenient than driving	1	Continue
Slightly less convenient than driving	3	Continue
Similar convenience	4	SKIP to Q21
Slightly more convenient than driving	5	SKIP to Q21
Much more convenient than driving	7	SKIP to Q21
Not sure/don't know	8	SKIP to Q21

[$Q20]

You mentioned above that taking public transport would be less convenient than driving. What makes you say that? (Select all that apply)

Answer	Variable name	Logic
Few or no services run to my destination	Q20r1	Continue
It's too hard to plan the trip (e.g. to work out which services to take, when, and where from)	Q20r2	Continue

It's too hard to get to/from the stops	Q20r3	Continue
The services are too infrequent	Q20r4	Continue
The services are too unreliable	Q20r5	Continue
The services are too slow	Q20r6	Continue
I have to transfer between more than one bus/train/ferry	Q20r7	Continue
It is too hard to carry the things I need to take with me	Q20r8	Continue
It is harder to travel in a group by public transport	Q20r9	Continue
I'm concerned about COVID and I feel more exposed taking public transport	Q20r10	Continue
I dislike having to wear a mask on public transport	Q20r11	Continue
Other, please specify	Q20r12 Q20r12oe	Continue

NOTE scale to be inverted

[Q21]

How stressful do you think the trip would have been?

Answer	Value	Logic
Much more stressful than driving	7	Continue
Slightly more stressful than driving	5	Continue
Similar stress	4	Continue
Slightly less stressful than driving	3	Continue
Much less stressful than driving	1	Continue
Not sure/don't know	8	Continue

[Q22]

How safe from crime and harassment do you think you would have felt?

Answer	Value	Logic
Much less safe than driving	1	Continue
Slightly less safe than driving	3	Continue
Similar safety	4	Continue
Slightly safer than driving	5	Continue
Much safer than driving	7	Continue
Not sure/don't know	8	Continue

[Q23]

How safe from catching COVID-19 do you think you would have felt?

Answer	Value	Logic
Much lower feeling of safety than driving	1	Continue
Slightly lower feeling of safety than driving	3	Continue
Similar feeling of safety	4	Continue
Slightly greater feeling of safety than driving	5	Continue
Much greater feeling of safety than driving	7	Continue
Not sure/don't know	8	Continue

[Q24]
If public transport was fast, frequent and reliable for this trip (and COVID-19 was no longer a problem), would it be feasible for you to take it in the future?

Answer	Value	Logic
Yes	1	Continue
No	2	Continue
Maybe	3	Continue
Don't know	4	Continue

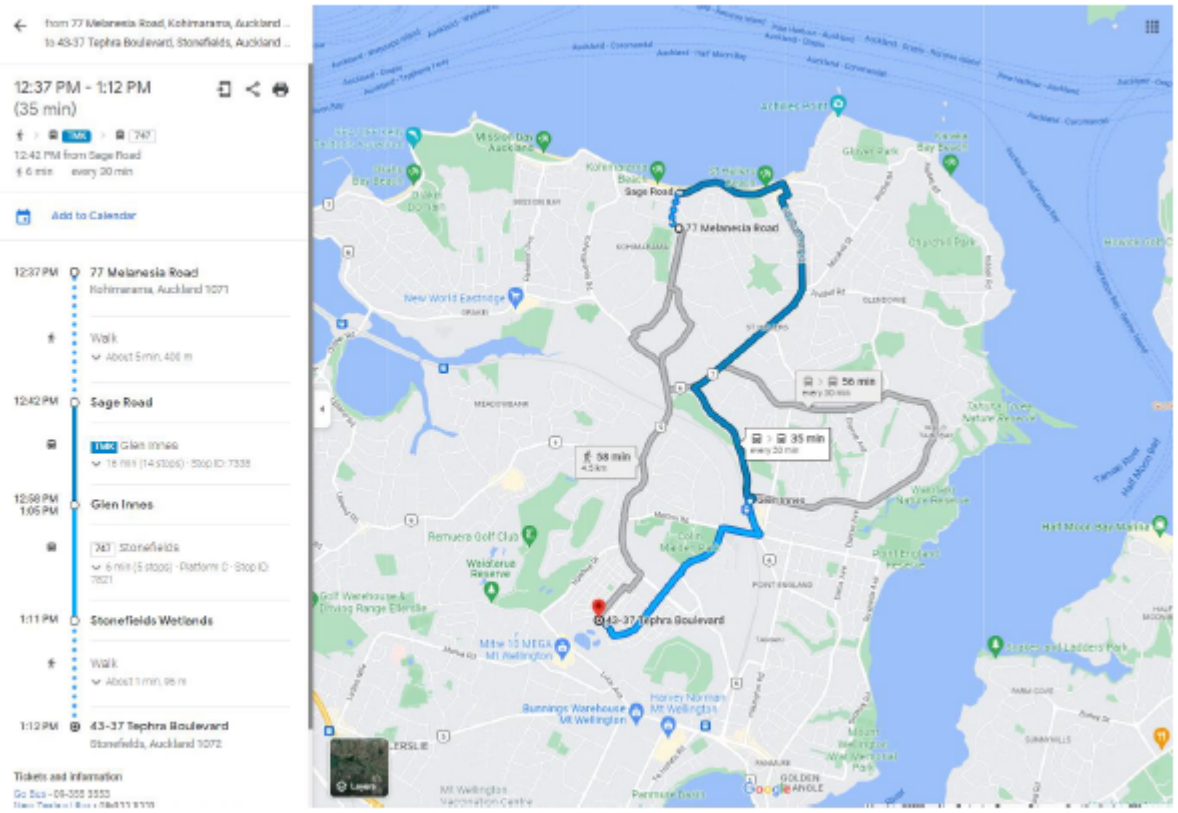
[Q25]
In the last 4 weeks, how often have you taken public transport?

Answer	Value	Logic
Not at all	1	Continue
Occasionally (one time or less per week)	2	Continue
Regularly (two or more times per week)	3	Continue
Don't know	4	Continue

[Q26]
Has COVID-19 influenced how much you use public transport?

Answer	Value	Logic
Yes, I use it more often	1	Continue
Yes, I use less often	2	Continue
No, I use it same amount	3	Continue
Don't know	4	Continue

The picture below shows the public transport option Google Maps suggests for your trip, in order to arrive at the same time as you did for your car trip.



Map above generated using a duplicated version of variables extracted from pin-dropping map duplicate variable name set denoted with suffix V2. Arrival time (arrivalDater2) generated from drivingDuration+futureDater2. Map displays trip 42 days/6 weeks in future of Q3. Date of actual trip is calculated from the survey start date plus X days into the past e.g. if survey started on a Friday and the trip was on a Wednesday the date of the trip shown for PT alternatives is 6 weeks into the future from the Wednesday prior to starting the survey.

NOTE scale to be inverted

[Q27]

Looking at the info above, how likely are you to take this trip using public transport?

Answer	Value	Logic
Very likely	1	Continue
Somewhat likely	2	Continue
Neutral	3	Continue
Somewhat unlikely	4	Continue
Very unlikely	5	Continue
Not sure	6	Continue

Why do you say that?

Answer	Variable name	Logic
[Open]	Q28	Continue

Cycling

The following questions ask about your thoughts on cycling.

[$Q29]

Do you have access to either of the following that you are able to use for cycling in general?

Answer	Variable name	Logic
A regular push bike	Q29r1	SKIP to Q31
An e-bike	Q29r2	SKIP to Q31 (DISPLAY Q38)
Neither	Q29r3	Continue

[Q30]
Would you consider using a bike (either regular bike or e-bike) for at least some trips if you had access to one?

Answer	Value	Logic
Yes	1	Continue
Maybe	2	Continue
No, I would never consider riding a bike	3	SKIP to Q38

[Q31]
Would it have been possible to take the trip you described earlier by regular push bike or e-bike (assuming you [and everyone you were travelling with (Q7=2-6)] had one available and ready to use)?

Answer	Value	Logic
Yes, it would be possible on both a regular bike and e-bike	1	SKIP to Q33
Yes, it would be possible on an e-bike but not a regular bike	2	Continue
No, it would not have been possible on either	3	Continue
Not sure / maybe	4	Continue

[$Q32]
Why do you say that?

Answer	Variable name	Logic
Cycling this route is unsafe	Q32r1	Continue
The roads are too busy	Q32r2	Continue
There are no cycle ways for this route	Q32r3	Continue
My fitness level is not good enough	Q32r4	Continue
I am not confident or experienced with cycling	Q32r5	Continue
It is too hilly	Q32r6	Continue
No bike parking/storage at destination	Q32r8	Continue
Other, please specify	Q32r7 Q32r7oe	Continue

If you [and everyone you were travelling with] had cycled for your most recent trip (imagining you had access to a bike [bikes]), rather than driving, how do you think it would have compared on the following dimensions?

Please answer the following thinking about riding [a regular push bike/an e-bike]. If you are unsure of the answer for any of these question please answer 'don't know'.

NOTE: 50/50 sample shown 'regular push bike' or 'e-bike'. Split analysis required for all following cycling questions. Add dSample to reduced dataset.

Variable name	Note
hAvailSampler1	Shown 'regular push bike'
hAvailSampler2	Shown 'e-bike'
dSample	Two values, one for 'regular push bike' and one for 'e-bike'

Approximately how long do you think the trip would have taken (thinking of your total travel time from leaving the house to getting to your destination)?

Answer	Variable name	Logic
[Hours]	Q33x1c1 ~~Q33r1~~	Continue
[Minutes]	Q33x2c2 ~~Q33r2~~	Continue
Not sure/don't know	Q33exr99	Continue

[Q34]
How convenient do you think the trip would have been?

Answer	Value	Logic
Much less convenient than driving	1	Continue
Slightly less convenient than driving	3	Continue
Similar convenience	4	SKIP to Q21
Slightly more convenient than driving	5	SKIP to Q21
Much more convenient than driving	7	SKIP to Q21
Not sure/don't know	8	SKIP to Q21

[Q35]
How stressful do you think the trip would have been?

Answer	Value	Logic
Much more stressful than driving	7	Continue
Slightly more stressful than driving	5	Continue
Similar stress	4	Continue
Slightly less stressful than driving	3	Continue
Much less stressful than driving	1	Continue
Not sure/don't know	8	Continue

[Q36]
How safe from crime and harassment do you think you would have felt?

Answer	Value	Logic
Much less safe than driving	1	Continue
Slightly less safe than driving	3	Continue
Similar safety	4	Continue
Slightly safer than driving	5	Continue
Much safer than driving	7	Continue
Not sure/don't know	8	Continue

[Q37]

How safe from injury do you think you would have felt?

Answer	Value	Logic
Much lower feeling of safety than driving	1	Continue
Slightly lower feeling of safety than driving	3	Continue
Similar feeling of safety	4	Continue
Slightly greater feeling of safety than driving	5	Continue
Much greater feeling of safety than driving	7	Continue
Not sure/don't know	8	Continue

DISPLAY IF Q29r2=0 (doesn't have an e-bike)

[Q38]

If you had access to an e-bike, would it be feasible for you to cycle this trip in the future?

Answer	Value	Logic
Yes	1	Continue
No	2	Continue
Maybe	3	Continue
Don't know	4	Continue

Walking

The following questions ask about your thoughts on walking [wheeling (e.g. by wheelchair or mobility scooter)] rather than driving for the trip you described earlier.

If you had walked [wheeled] for your most recent trip, rather than driving, how do you think it would have compared on the following dimensions?

Approximately how long do you think the trip would have taken (thinking of your total travel time from leaving the house to getting to your destination)?

Answer	Variable name	Logic
[Hours]	Q39x1c1	Continue
[Minutes]	Q39x2c2	Continue
Not sure/don't know	Q39exNew1r100	SKIP to #Q44
Trip impossible via walking [wheeling]	Q39exNewr99	SKIP to #Q44

[Q40]

How convenient do you think the trip would have been?

Answer	Value	Logic
Much less convenient than driving	1	Continue
Slightly less convenient than driving	3	Continue
Similar convenience	4	Continue
Slightly more convenient than driving	5	Continue
Much more convenient than driving	7	Continue
Not sure/don't know	8	Continue

[Q41]

How stressful do you think the trip would have been?

Answer	Value	Logic
Much more stressful than driving	7	Continue
Slightly more stressful than driving	5	Continue
Similar stress	4	Continue
Slightly less stressful than driving	3	Continue
Much less stressful than driving	1	Continue
Not sure/don't know	8	Continue

[Q42]
How safe from crime and harassment do you think you would have felt?

Answer	Value	Logic
Much less safe than driving	1	Continue
Slightly less safe than driving	3	Continue
Similar safety	4	Continue
Slightly safer than driving	5	Continue
Much safer than driving	7	Continue
Not sure/don't know	8	Continue

[Q43]
How safe from injury do you think you would have felt?

Answer	Value	Logic
Much lower feeling of safety than driving	1	Continue
Slightly lower feeling of safety than driving	3	Continue
Similar feeling of safety	4	Continue
Slightly greater feeling of safety than driving	5	Continue
Much greater feeling of safety than driving	7	Continue
Not sure/don't know	8	Continue

Attitudes

The following questions ask about your general attitudes toward driving.
[#Q44]
Please rate how much you agree or disagree with the statements below.

Statement	Variable name
I love driving in Auckland	Q44r1
I find driving in Auckland stressful	Q44r2
A vehicle provides status and prestige	Q44r3
People close to me take public transport in Auckland	Q44r4
People close to me cycle in Auckland	Q44r5

Answer	Value	Logic
Strongly disagree	1	Continue
Disagree	2	Continue
Neutral	3	Continue
Agree	4	Continue
Strongly agree	5	Continue

Don't know / Not applicable	99	Continue

Thinking about people who commuted into Auckland's city centre for work prior to COVID-19, what percentage of these commuters do you think drove (as opposed to taking public transport, cycling or walking)?

Answer	Variable name	Logic
Percentage value	Q45	Continue

[Qual2]
[dFlagQual2]
Please select "Slightly familiar" from the list below. This is a quality check question.

Answer	Value	Logic
1.Not at all familiar	1	Continue
2.Slightly familiar	2	Continue
3.Moderately familiar	3	Continue
4.Very familiar	4	Continue
5.Extremely familiar	5	Continue

Demographics

The final questions ask a bit more about you and your household.

How many vehicles does your household have available to use?

Answer	Variable name	Logic
Drop down 0-10	Q46	Continue IF =0 SKIP to Q48

How many of these are electric vehicles (EVs) or hybrids?

Answer	Variable name	Logic
Drop down 1-10	Q47	Continue
Don't know	noanswerQ47_r99	

[Q48]
What is your gender?

Answer	Value	Logic
Male	1	Continue
Female	2	Continue
Another gender	3	Continue
Prefer not to say	4	Continue

[Q49]
Are you...

Answer	Value	Logic
15-19 years	1	Continue
20-24 years	2	Continue

25-29 years	3	Continue
30-34 years	4	Continue
35-39 years	5	Continue
40-44 years	6	Continue
45-49 years	7	Continue
50-54 years	8	Continue
55-59 years	9	Continue
60-64 years	10	Continue
65-69 years	11	Continue
70-74 years	12	Continue
75+ years	13	Continue
Prefer not to say	14	Continue

[DummyAge]

Answer	Value
15-39	1
40-59	2
60+	3

Which ethnic group, or groups, do you belong to? (Select all that apply)

Answer	Variable name	Logic
New Zealand European / Pākehā	Q50r1	Continue
Māori	Q50r2	Continue
Samoan	Q50r3	Continue
Cook Islands Māori	Q50r4	Continue
Tongan	Q50r5	Continue
Niuean	Q50r6	Continue
Chinese	Q50r7	Continue
Indian	Q50r8	Continue
Prefer not to say	Q50r9	Exclusive Continue
Other, please specify	Q50r10 Q50r10oe	Continue
Don't know	Q50r11	Exclusive Continue

How many people live in your household, including yourself?

Answer	Variable name	Logic
Drop down 1-30	Q51	Continue

How many fully licensed drivers live in your household, including yourself?

Answer	Variable name	Logic
Drop down 0-30	Q52	Continue

[Q53]

Which best describes your household's annual income (from all sources) before tax?

Answer	Value	Logic
$20,000 or less	1	Continue
$20,001 - $60,000	2	Continue
$60,001 - $100,000	3	Continue
$100,001 - $150,000	4	Continue
$150,001 - $200,000	5	Continue
$200,001 or more	6	Continue
Prefer not to say	7	Continue
Don't know	8	Continue

Thank you for completing this survey. If you have any other comments, please write them here:

Answer	Variable name	Logic
Open	Q54	Continue

End

Thank you for completing this survey. The results will be used by Auckland Council and Auckland Transport in the development of Auckland's Transport Emissions Reduction Plan. The plan is designed to meet the emissions reduction goals in Te Tāruke-ā-Tāwhiri: Auckland's Climate Plan, and seeks to create a city where everyone can get around sustainably.

OR

Thank you for your feedback!

You have been automatically entered into the prize draw, if you are a prize winner we will let you know. Good luck!

How we will use the results

Te Tāruke-ā-Tāwhiri: Auckland's Climate Plan commits Auckland to halving emissions by 2030 and reaching net zero emissions by 2050.

The feedback from this survey will help us understand what percentage of trips could be taken by public transport, cycling or walking. The results will be used by Auckland Council and Auckland Transport to target public transport, walking and cycling improvements where they are needed most.

Ngā mihi,
Allanah
The People's Panel team

8.2 Python code to re-fetch trip distances and durations

```
import pandas as pd
import googlemaps
import ast

results_df = pd.read_excel('nearest_AT_stop.xlsx')
```

```
gmaps = googlemaps.Client(key='')
```

```
def compute_api_driving_distance_and_duration(row):
    try:
        origin = ast.literal_eval(row['trip_origin_coords'])
        destination = ast.literal_eval(row['trip_dest_coords'])

        # Get the distance using the walking mode
        result = gmaps.distance_matrix(origins=origin, destinations=destination, mode='driving')

        # Extract the distance in meters
        if result['rows'][0]['elements'][0]['status'] == 'OK':
            distance_meters = result['rows'][0]['elements'][0]['distance']['value']  # Distance in meters
            duration_seconds = result['rows'][0]['elements'][0]['duration']['value']
        else:
            distance_meters = None  # Handle cases where no distance is returned
            duration_seconds = None

    except Exception as e:
        # Handle any other exceptions that might occur
        print(f"Error processing row: {row['trip_origin_coords']}, {row['trip_dest_coords']}: {e}")
        distance_meters = None  # Set distance to None if an error occurs
        duration_seconds = None

    return pd.Series([distance_meters, duration_seconds])

# Apply the function to compute distances and store in a new column
results_df[['trip_driving_dist', 'trip_driving_duration']] = results_df.apply(compute_api_driving_distance_and_duration,
                                                                              axis=1)
```

8.3 Driving trip distance and duration by Statistical Area 3

Origin Statistical Area 3	Count of trips	Average driving distance (km)	Average driving duration (min)
Albany	88	14	16
Alfriston	3	15	16
Army Bay	1	23	28
Auckland City Centre	144	13	16
Avondale (Auckland)	62	12	15
Bayswater	10	12	17
Bayview (Auckland)	19	11	15
Beach Haven	42	16	21
Beachlands	21	22	25
Belmont (Auckland)	17	9	12
Birkdale	41	13	17
Birkenhead	50	14	17
Blockhouse Bay	45	11	16
Botany Downs	23	16	23
Browns Bay	28	16	17
Bucklands Beach	29	17	25
Burswood	2	14	18
Campbells Bay	9	15	16
Castor Bay	16	14	16
Chatswood	13	10	14
Clendon Park	9	11	14
Clover Park	5	16	16
Coatesville-Riverhead	13	22	23
Cockle Bay	11	14	22
Conifer Grove	12	21	20
Dairy Flat	19	22	23
Dannemora	12	16	20
Devonport	36	15	20
Drury	5	19	20
East Tamaki	57	14	17
East Tamaki Heights	9	15	19
Eastern Beach	6	13	22
Eden Terrace	33	7	12
Ellerslie	53	12	15
Epsom	67	8	12
Fairview Heights	3	5	8
Farm Cove	13	14	18
Favona	6	7	9
Flat Bush	69	16	20
Forrest Hill	18	14	14
Franklin Central	36	24	22

Origin Statistical Area 3	Count of trips	Average driving distance (km)	Average driving duration (min)
Franklin North	31	23	25
Franklin West	32	35	31
Freemans Bay	45	8	11
Glen Eden	80	12	17
Glen Innes-Wai O Taiki Bay	22	9	16
Glendene	22	11	16
Glendowie	29	13	21
Glenfield	76	12	15
Golflands	8	9	13
Goodwood Heights	7	13	15
Grafton	15	8	12
Green Bay	15	14	19
Greenhithe	35	15	16
Greenlane	33	8	12
Grey Lynn	56	9	12
Gulf Harbour	18	27	29
Half Moon Bay	31	14	21
Hatfields Beach	5	26	23
Hauraki	15	15	15
Helensville	27	21	20
Henderson	122	15	18
Herne Bay	17	8	13
Hibiscus and Bays Rural	11	17	19
Highland Park (Auckland)	11	9	15
Hillcrest (Auckland)	31	12	14
Hillpark	5	22	20
Hillsborough (Auckland)	28	11	14
Hobsonville	46	21	21
Howick	31	18	27
Hunua-Ararimu	17	28	27
Inlets Auckland	2	12	17
Karaka	13	20	19
Kaukapakapa-Waitoki	16	26	24
Kelston	13	12	16
Kingsland	20	8	12
Kohimarama	17	12	19
Kumeū	43	23	23
Laingholm	12	14	22
Long Bay	4	5	9
Lynfield	22	16	19
Mahurangi Peninsula	23	27	23
Mairangi Bay	15	14	16
Māngere	39	21	22

Origin Statistical Area 3	Count of trips	Average driving distance (km)	Average driving duration (min)
Māngere Bridge	38	13	15
Māngere East	20	13	17
Manly	16	23	23
Manukau	33	16	17
Manurewa	53	15	18
Maraetai	8	23	26
Massey	31	15	16
Meadowbank	24	13	17
Mellons Bay	13	19	27
Milford	37	10	13
Mission Bay	22	12	17
Morningside (Auckland)	16	11	13
Mount Albert	97	10	14
Mount Eden	113	8	12
Mount Roskill	72	10	14
Mount Wellington	70	11	15
Murrays Bay	22	15	17
Narrow Neck	16	11	15
New Lynn	65	12	17
New Windsor	20	15	16
Newmarket	26	9	13
North Harbour/Rosedale	33	13	14
Northcote (Auckland)	40	11	13
Northcote Point (Auckland)	13	9	12
Northcross	12	16	17
Northpark	6	33	35
Oceanic Auckland Region East	2	22	63
One Tree Hill	24	10	12
Onehunga	83	12	14
Ōpaheke	3	19	18
Orakei	22	10	15
Orewa	63	26	21
Ōtāhuhu	23	14	17
Ōtara	22	14	16
Oteha	7	13	14
Pahurehure	3	11	12
Pakuranga	40	16	20
Pakuranga Heights	16	9	15
Panmure	16	11	17
Papakura	80	25	24
Papatoetoe	57	14	16

Origin Statistical Area 3	Count of trips	Average driving distance (km)	Average driving duration (min)
Pāremoremo	3	16	19
Parnell	43	9	13
Patumāhoe	14	31	27
Penrose	12	9	11
Pinehill	8	17	18
Point Chevalier	40	9	14
Point England	11	13	19
Ponsonby	18	8	13
Pukekohe Centre	47	36	31
Pukekohe North East	9	43	34
Pukekohe North West	2	27	23
Pukekohe South	1	2	3
Pukekohe West	2	43	35
Randwick Park	5	13	15
Rānui (Auckland)	29	16	19
Red Beach	28	25	22
Red Hill	2	13	17
Remuera	113	8	12
Rodney East	28	21	19
Rodney North	35	26	24
Rodney West	41	24	25
Rosehill	6	21	20
Rothesay Bay	12	17	17
Royal Oak (Auckland)	24	9	12
Saint Heliers	58	12	18
Saint Johns	36	13	17
Saint Marys Bay	12	14	24
Sandringham	47	8	12
Schnapper Rock	7	14	15
Shelly Park	5	20	25
Silverdale (Auckland)	36	23	19
Somerville	11	13	20
Stanley Point	3	24	25
Stanmore Bay	43	24	23
Stonefields	15	11	16
Sunnyhills	14	13	19
Sunnynook	22	12	13
Sunnyvale	16	13	17
Swanson	18	18	21
Takanini	41	16	17
Takapuna	60	14	15
Taupaki	3	23	26
Te Atatū Peninsula	4	1	3

Origin Statistical Area 3	Count of trips	Average driving distance (km)	Average driving duration (min)
Te Atatū South	39	17	19
The Gardens (Auckland)	9	13	15
Three Kings	16	11	15
Tindalls-Matakatia	4	19	22
Titirangi	73	13	19
Torbay-Waiake	60	16	18
Tōtara Heights	6	17	18
Tōtara Vale	16	11	14
Tuakau	1	37	30
Unsworth Heights	11	19	19
Wade Heads-Arkles Bay	5	21	21
Waiheke Island	11	10	21
Waikato District North East	1	29	25
Waikowhai	7	19	19
Waitākere East	37	14	19
Waitākere West	27	17	20
Waiuku	28	37	33
Warkworth	31	29	21
Waterview	14	11	15
Wattle Downs	22	17	19
Wesley	10	8	9
West Harbour	32	14	16
Westgate	32	17	17
Westmere	20	9	13
Weymouth	10	16	21
Whenuapai	21	19	19
Windsor Park	4	20	22
Wiri	10	12	14

8.4 Public transport trip distance and duration by Statistical Area 3

Origin Statistical Area 3	Count of trips	Average public transport distance (km)	Average public transport duration (min)
Albany	86	18	55
Alfriston	3	20	69
Auckland City Centre	142	14	43
Avondale (Auckland)	61	14	55
Bayswater	10	15	56
Bayview (Auckland)	19	15	57
Beach Haven	40	19	65
Beachlands	21	26	67
Belmont (Auckland)	17	11	41
Birkdale	41	15	54
Birkenhead	49	15	54
Blockhouse Bay	45	12	48
Botany Downs	22	18	67
Browns Bay	27	19	63
Bucklands Beach	29	19	71
Burswood	2	11	51
Campbells Bay	9	18	61
Castor Bay	16	16	58
Chatswood	13	10	43
Clendon Park	9	14	43
Clover Park	5	22	67
Coatesville-Riverhead	11	29	78
Cockle Bay	11	16	61
Conifer Grove	12	24	73
Dairy Flat	14	28	84
Dannemora	12	17	57
Devonport	36	16	62
Drury	5	23	75
East Tamaki	57	15	55
East Tamaki Heights	9	16	68
Eastern Beach	6	16	58
Eden Terrace	32	7	32
Ellerslie	52	13	51
Epsom	67	10	47
Fairview Heights	3	7	34
Farm Cove	11	15	57
Favona	6	9	33
Flat Bush	69	20	69
Forrest Hill	18	15	49

Origin Statistical Area 3	Count of trips	Average public transport distance (km)	Average public transport duration (min)
Franklin Central	21	36	129
Franklin North	9	24	77
Franklin West	9	44	99
Freemans Bay	44	8	34
Glen Eden	79	14	57
Glen Innes-Wai O Taiki Bay	22	10	42
Glendene	22	14	56
Glendowie	29	15	59
Glenfield	74	14	50
Golflands	8	9	41
Goodwood Heights	7	16	61
Grafton	15	8	33
Green Bay	15	16	62
Greenhithe	35	19	58
Greenlane	33	8	35
Grey Lynn	56	10	41
Gulf Harbour	5	29	89
Half Moon Bay	31	17	64
Hatfields Beach	5	31	85
Hauraki	15	18	61
Helensville	23	38	52
Henderson	116	17	63
Herne Bay	17	9	40
Hibiscus and Bays Rural	8	23	135
Highland Park (Auckland)	10	11	44
Hillcrest (Auckland)	31	14	51
Hillpark	5	25	74
Hillsborough (Auckland)	28	11	56
Hobsonville	46	26	77
Howick	31	21	71
Inlets Auckland	1	5	23
Karaka	13	25	76
Kaukapakapa-Waitoki	11	32	68
Kelston	13	14	55
Kingsland	20	9	37
Kohimarama	16	15	58
Kumeū	40	28	87
Laingholm	12	18	68
Long Bay	4	6	25
Lynfield	20	15	60
Mahurangi Peninsula	17	53	163
Mairangi Bay	15	17	54
Māngere	36	24	83

Origin Statistical Area 3	Count of trips	Average public transport distance (km)	Average public transport duration (min)
MāngereBridge	38	16	58
MāngereEast	20	15	56
Manly	14	27	72
Manukau	30	19	52
Manurewa	52	17	51
Maraetai	7	33	74
Massey	31	19	70
Meadowbank	22	11	45
Mellons Bay	13	22	80
Milford	36	13	43
Mission Bay	20	14	50
Morningside (Auckland)	16	13	45
Mount Albert	94	11	45
Mount Eden	112	9	38
Mount Roskill	71	11	45
Mount Wellington	69	12	47
Murrays Bay	21	17	55
Narrow Neck	16	12	55
New Lynn	64	13	50
New Windsor	20	18	67
Newmarket	26	10	35
North Harbour/Rosedale	33	16	48
Northcote (Auckland)	39	12	44
Northcote Point (Auckland)	13	10	44
Northcross	12	18	53
Northpark	6	33	109
Oceanic Auckland Region East	1	23	49
One Tree Hill	23	11	44
Onehunga	78	13	45
Ōpaheke	2	13	41
Orakei	22	13	58
Orewa	63	31	70
Ōtāhuhu	22	15	59
Ōtara	22	17	60
Oteha	7	16	48
Pahurehure	3	12	37
Pakuranga	37	16	57
Pakuranga Heights	16	12	48
Panmure	16	13	73
Papakura	76	27	80
Papatoetoe	55	15	51

Origin Statistical Area 3	Count of trips	Average public transport distance (km)	Average public transport duration (min)
Pāremoremo	2	24	99
Parnell	42	9	37
Patumāhoe	10	47	111
Penrose	12	10	40
Pinehill	8	22	63
Point Chevalier	39	11	43
Point England	11	16	60
Ponsonby	18	9	41
Pukekohe Centre	47	39	88
Pukekohe North East	5	46	115
Pukekohe North West	1	50	132
Pukekohe South	1	1	20
Pukekohe West	2	49	141
Randwick Park	5	17	71
Rānui (Auckland)	27	19	63
Red Beach	28	28	61
Red Hill	2	15	72
Remuera	113	9	44
Rodney East	5	20	61
Rodney North	9	33	94
Rodney West	16	32	83
Rosehill	6	22	62
Rothesay Bay	11	16	47
Royal Oak (Auckland)	24	12	42
Saint Heliers	57	16	70
Saint Johns	34	13	51
Saint Marys Bay	12	15	53
Sandringham	45	8	36
Schnapper Rock	7	18	59
Shelly Park	5	24	78
Silverdale (Auckland)	35	28	66
Somerville	11	16	56
Stanley Point	3	24	94
Stanmore Bay	42	29	74
Stonefields	15	15	59
Sunnyhills	14	16	62
Sunnynook	21	13	44
Sunnyvale	15	15	52
Swanson	18	23	69
Takanini	39	18	58
Takapuna	56	15	45
Taupaki	1	27	182
Te Atatū Peninsula	4	1	8

Origin Statistical Area 3	Count of trips	Average public transport distance (km)	Average public transport duration (min)
Te Atatū South	39	21	71
The Gardens (Auckland)	9	19	133
Three Kings	16	12	46
Tindalls-Matakatia	4	25	66
Titirangi	71	15	62
Torbay-Waiake	59	19	58
Tōtara Heights	6	22	75
Tōtara Vale	16	13	48
Tuakau	1	47	126
Unsworth Heights	11	21	64
Wade Heads-Arkles Bay	5	25	94
Waiheke Island	10	12	41
Waikowhai	7	20	90
Waitākere East	18	19	108
Waitākere West	6	24	90
Waiuku	27	49	115
Warkworth	17	20	39
Waterview	14	13	53
Wattle Downs	22	19	68
Wesley	10	9	39
West Harbour	32	18	68
Westgate	32	19	59
Westmere	19	10	44
Weymouth	10	21	71
Whenuapai	21	26	83
Windsor Park	4	19	58
Wiri	10	15	57

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