TE MANATŪ WAKA
MINISTRY OF TRANSPORT

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Section	Description of ground
6(a)	as release would be likely to prejudice the security or defence of New Zealand or the international relations of the New Zealand Government
6(b)	as release would be likely to prejudice the entrusting of information to the Government of New Zealand on a basis of confidence by (i) the Government of any other country or any agency of such a Government; or (ii) any international organisation
6(c)	prejudice the maintenance of the law, including the prevention, investigation, and detection of offences, and the right to a fair trial
9(2)(a)	to protect the privacy of natural persons
9(2)(b)(ii)	to protect information where the making available of the information would be likely unreasonably to prejudice the commercial position of the person who supplied or who is the subject of the information
9(2)(ba)(i)	to protect information which is subject to an obligation of confidence or which any person has been or could be compelled to provide under the authority of any enactment, where the making available of the information would be likely to prejudice the supply of similar information, or information from the same source, and it is in the public
9(2)(ba)(ii)	to protect information which is subject to an obligation of confidence or which any person has been or could be compelled to provide under the authority of any enactment, where the making available of the information would be likely otherwise to damage the public interest
9(2)(f)(ii)	to maintain the constitutional conventions for the time being which protect collective and individual ministerial responsibility
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9(2)(h)	to maintain legal professional privilege
9(2)(i)	to enable a Minister of the Crown or any public service agency or organisation holding the information to carry out, without prejudice or disadvantage, commercial activities
9(2)(j)	to enable a Minister of the Crown or any public service agency or organisation holding the information to carry on, without prejudice or disadvantage, negotiations (including commercial and industrial negotiations)

Social and Distributional Impacts Appraisal

WIP DRAFT P02

Appendix number: E-H

24 November 2023

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1.Executive Summary

The Social and Distributional Impact (SDI) Appraisal has been developed to measure the social and distributional impacts of ALR (the Project), in line with Waka Kotahi guidance and drawing on industry best practice in terms of measuring social and equity impacts in transport project appraisals.

Social Impact Appraisal

The Social Impact Appraisal (SIA) considers the human experience of a transport system, focusing on local residents to assess social factors that are not already considered in traditional transport appraisals. Incorporating the social dimension into traditional transport appraisals is important because transport projects, particularly those of the magnitude of ALR, often have unexpected social implications.

The following social outcome categories are identified, each comprising several social impact indicators that are assessed as part of the Social Impact Appraisal (SIA):

1. **Community related outcomes**: including community severance, social connectedness, personal safety and fear of crime, and journey quality.
2. **Health related outcomes**: comprising health benefits arising from changes in levels of physical activity, impacts to active travellers arising from changes in the physical environment and benefits to society arising from prevention of road accidents and casualties.
3. **Accessibility outcomes**: covering the effects on the ability for people to travel and access the services they require.

The SIA is carried out in two phases. The **first phase** involves the completion of a social baseline study including scoping and an initial assessment of the social challenges in the area in relation to the nature of the Project. The **second phase** assesses identified social impacts of the Project. Where possible, impacts are quantified to appreciate their scale relative to other Project outcomes. When social impacts are considered to be of lesser importance or where sufficient data is unavailable to undertake a quantitative assessment, a qualitative appraisal is completed.

The results are presented on a seven-point scale, ranging from beneficial through neutral to adverse, to differentiate the relative impacts of different indicators. The separated light metro option and the street-running option are both appraised in relation to the Do Minimum Scenario, with key differences between options discussed in the narrative where appropriate. A high-level analysis is conducted to account for the social implications of the urban response. The following table summarises the approach taken to assess each of the impacts.

Table 1 SIA methodology

Impact category	Impact	Approach
Community-related outcomes	Community severance	A qualitative assessment of complementary measures proposed by the scheme (e.g., crossings and other suggested enhancements to cycling and pedestrian facilities along the route and at stations), along with a high-level analysis of traffic flow changes.
	Social connectedness	A high-level assessment derived from a site visit aimed at understanding community dynamics.

	Personal safety and fear of crime	A qualitative assessment of how the intervention impacts key security indicators (e.g., formal surveillance, informal surveillance, landscaping, lighting, and visibility, etc.)
	Journey quality	A qualitative assessment of key journey quality factors, including traveller care, traveller's views and traveller stress.
Health related outcomes	Health benefits arising from changes in levels of physical activity	A qualitative evaluation of the intervention's impact on physical activity, measured through changes in the total distance walked to and from public transport.
	Health benefits to active travel users arising from changes in the physical environment	A qualitative assessment of how the intervention encourages wider uptake of active travel, measured by changes in total active kilometres travelled across the corridor.
	Prevention of road accidents and casualties	An evaluation of the societal benefits resulting from the prevention of road accidents, based on changes in the number of crashes associated with the proposed intervention.
Accessibility outcomes	Changes in accessibility	A mixed quantitative and qualitative approach to assess the scheme's accessibility impact. The quantitative method involves creating a catchment area within a 10-minute walking distance for key stations. Overall benefits of accessibility are also evaluated by using the number of jobs accessible to zones within 30 and 45-minute journey times by public transport. The qualitative assessment focuses on analysing critical barriers that affect accessibility.

A summary of findings for the SIA is presented in the table below.

Table 2 SIA Findings

Impact category	Impact	Separated light metro	Street-running light rail
Community-related outcomes	Community severance	This option will deliver a **slight to moderately positive benefit**. The effects of traffic flow changes are not anticipated to be significant, but proposed pedestrian infrastructure changes are expected to enhance pedestrian connectivity and reduce severance.	This option will deliver a **slight to moderately positive benefit**. The benefit is anticipated to be slightly lower than the separated option, given that the route does not include a university station, meaning any proposed infrastructure in the area will not be delivered.
	Social connectedness	This option will have a **moderately beneficial impact**. High benefits are expected around Māngere Bridge and the Airport. Impacts are assumed to be lower in those areas of the corridor which are already being used for residential or community purposes, such as Dominion Junction and Māngere Town Centre. Neutral impacts are assumed for areas that are primarily used for industrial purposes (i.e., Airport Industrial). Māngere	There is assumed to be no variation in social connectedness compared to the separated light rail option, given that both schemes run through all key corridor sections that were assessed. The assessment of severance for the street-running option is therefore **moderately beneficial**.
	Personal safety and fear of crime	This option is likely to have a **moderately beneficial** influence on personal safety and fear of crime. Formal surveillance measures (e.g., CCTV monitoring) and informal surveillance instruments (e.g., design to encourage open visibility) are	It is assumed there will be no variation between options for those security indicators relating to station design and facilities. As a consequence, the security impact for this option is scored as **moderate beneficial**. However, this option is expected to perform slightly worse in terms of journey

		expected to enhance security for transport users.	time improvements between boarding and alighting stops, given it has a longer end-to-end travel time which may increase passengers' exposure to safety risks and crime.
	Journey quality	The overall journey quality impact for this option is likely to be **moderately beneficial.** The scheme design encompasses various elements aimed at enhancing the overall transport environment for passengers, pedestrians, and cyclists, leading to an improved user experience. Traveller care, traveller views and traveller stress are all expected to be improved.	The overall journey quality impact for this option is likely to be **moderately beneficial**. The street-running option is expected to generate slightly lower travel stress reduction benefits that the separated option, given that this option provides a longer end-to-end journey time.
Health related outcomes	Health benefits arising from changes in levels of physical activity	This option is expected to generate a **slight positive health benefit** through a small increase in the anticipated total active distance travelled to and from public transportation.	This option is expected to generate a **slight positive health benefit** through a small increase in the anticipated total active distance travelled to and from public transportation. Benefits are anticipated to be marginally smaller under this option given that the street running option is expected to generate a less significant modal shift from vehicles to public transport.
	Health benefits arising to active travel users arising from changes in the physical environment	This option is expected to generate a **slight positive** benefit through an increase in the total active kilometres travelled across the corridor.	This option is expected to generate a **slight positive** benefit through an increase in total active travel kilometres. The magnitude of impact is expected to be slightly lower due to anticipated land use changes facilitating the development of a slightly less dense urban form.
	Prevention of road accidents and casualties	This option is expected to result in a **slight positive benefit** associated with a reduction in annual road crash rates.	This option is expected to result in a **slight positive benefit** associated with a reduction in annual road crash rates. The street-running option is expected to generate a slightly lower reduction in crashes due to a smaller anticipated modal shift resulting in higher overall driving levels than the separated option.
Accessibility outcomes	Changes in accessibility	The accessibility impact for this option will be **moderately beneficial.** This option provides improved access to a higher proportion of the population. Likewise, it provides enhanced job accessibility. The appraisal based on the key barriers impacting on accessibility also indicates higher positive net impacts on accessibility for this option.	The accessibility impact for this option is expected to be **slightly beneficial.** This option is likely to result in a positive net impact on accessibility. However, the extent of this benefit is anticipated to be less compared to the separated option. This is because there is a smaller expected net increase in job accessibility by public transport, and station accessibility by foot is also lower.

Distributional Impact Appraisal

The Distributional Impact Appraisal (DIA) examines how the benefits and costs of a transport project are distributed across different segments of society. It assesses whether this distribution is deemed fair and suitable. The purpose of this DIA is to identify and evaluate groups that are expected to benefit and those that are likely to be burdened by the ALR scheme. Particular attention is given to priority groups that may be socially or financially disadvantaged.

The following distributional indicators are assessed as part of the DIA:

1. **User benefits:** Including travel time savings for private vehicle and public transport users as well as vehicle operating costs and user charges where appropriate.
2. **Noise impacts:** Defined as the effects that ALR can have on the acoustic environment (upgrades or increases on noise levels).
3. **Air quality impacts:** Referring to the changes in the air pollution levels experienced by the local community. These impacts can either lead to a positive outcome, where pollution decreases and air quality improves, or a negative outcome, where pollution increases, resulting in a decline in air quality due to the scheme's implementation.
4. **Safety impacts:** Defined as changes in transport-related accidents, serious injuries and deaths occurring as a result of the intervention.
5. **Severance effects:** Covering the effects of ALR as a physical or psychological barrier separating communities of built-up areas.
6. **Security impacts:** Relating to the effects of ALR on the overall safety and security of transport users.
7. **Accessibility impacts:** Concerning benefits or disbenefits associated with alterations in accessibility to employment and other key destinations using public transport.
8. **Personal affordability:** Defined as the impact on the cost of travel resulting from ALR.

The approach to the appraisal of distributional impacts under the ALR scheme is based on UK's Department for Transport (DfT) Transport Appraisal Guidance (TAG) unit A4.2. TAG unit A4.2: Distributional Impact Appraisal provides best practice guidance and expert advice for the equity assessment of transport projects. It is worth noting that the recommended approach for the DIA relies extensively on the UK Transport Appraisal Guidance. Guidance from the UK is being used as New Zealand do not have detailed guidance on Distributional Impact Appraisal and UK guidance is considered as industry best practice.

Additional context and review have been taken from a recent report commissioned by Waka Kotahi investigating methods for identifying and assessing the distributional impacts of transport interventions[34]. This research work aimed to identify a preferred method for the Waka Kotahi Monetised Benefits and Costs Manual.

The DIA is carried out in two phases. The **first phase** involves the completion of an equity baseline assessment for ALR (referred to as an 'equity needs assessment'). It aims to identify the specific transportation needs of traditionally underserved communities and other important equity challenges in the area in relation to the nature of the Project. The baseline equity analysis includes the following activities:

1. *Identification of priority groups:* An analysis of the characteristics of people residing in the study area is undertaken through socio-demographic profiling at a disaggregated (SA2) level. 'Priority groups' are then defined based on individuals that ought to be considered in the DIA assessment. The proportion of people with priority characteristics (low-income, different ethnic backgrounds and other

protected characteristics) is evaluated for each small area in comparison to the national average.

2. *Description of the existing structural inequalities to tackle in the area:* A high-level analysis of the urban challenges (e.g., risk of displacement, limited public transport, limited vehicle ownership) and historic inequalities (e.g., historic disinvestment, environmental justice concerns) is conducted for the study area.
3. *Analysis of the travel behaviours and preferences of different demographic groups:* Based on the Household Travel Survey, the analysis accounts for the study of travel patterns of different demographic groups in the study area.
4. *Equity analysis of ALR:* An appropriate theoretical understanding of the impact of the project on equity is developed.

The **second phase** assesses identified distributional impacts using a three-step approach:

1. *Step 1 (Screening)* is aimed at identifying the likely impacts of each indicator to determine which indicators required further analysis through a full appraisal.
2. *Step 2 (Assessment)* consists of a detailed spatial analysis to confirm the geographical area impacted by the intervention. In this step, priority groups and key amenities/trip attractors in the impact area are also identified.
3. Finally, *Step 3 (Appraisal)* provides an assessment of the impact of each indicator on affected priority groups. The results are presented in a seven-point scale, ranging from beneficial to neutral or adverse, to differentiate the relative impacts of different indicators.

The DIA compares the Do Minimum, separated light metro and street-running light rail scenarios, with key differences between options discussed in the narrative where appropriate. A high-level analysis is conducted to account for the distributional implications of the urban response.

The following table summarises the approach taken to assess each of the distributional indicators.

Table 3 DIA methodology

Indicator	Approach
User benefits and affordability	A quantitative analysis using disaggregated appraisal outputs by zone from the MSM model[1]. User benefits include travel time savings for private vehicles and public transport and vehicle operating costs. An emphasis is placed on vehicle operating costs, quantified by the modelling exercise, in order to evaluate the distribution of monetary transport charges among income quintiles and other priority groups.
Noise	In the absence of quantitative noise data, the distributional noise analysis is conducted using traffic flow changes as a proxy for identifying impacts among priority groups that are particularly sensitive to noise.
Air quality	A quantitative analysis of the change in emissions from vehicles is calculated based on direct MSM outputs. Results from the vehicle emissions prediction model are distributed at the traffic link level to enable overlay with the socio-demographic profile data.
Safety	A quantitative analysis using outputs from the AFC MSM analysing traffic links as a proxy for safety impacts. The traffic link data are overlaid against the area socio-economic profile to spatially present how safety benefits are distributed among different priority groups.

[1] Transport modelling and demand forecasting is provided by the Auckland Forecasting Centre (AFC) using the Auckland Macro Strategic Model (MSM), a multi-modal travel demand model for the Tāmaki Makaurau Auckland region.

Severance	A combined quantitative and qualitative method to assess the severance impact of the different options. The quantitative analysis involves using MSM data to analyse links on the road network which experience significant change (>10%) in traffic flows.. The analysis considers the percentage of individuals within each priority group who reside in or utilise the area to illustrate the identified benefits or disadvantages that are specific to these groups. The qualitative approach examines the consequences of proposed changes to areas near stations, including infrastructure modifications and additional measures.
Security	A qualitative assessment based on changes to individual security indicators as identified in the SIA. Subsequently, a comprehensive assessment of the impact of the project is conducted to consider the relative importance of each security indicator across priority groups. An overall security improvement is then calculated with consideration for the estimated number of daily users and security score for each group.
Accessibility	Distributional accessibility impacts are evaluated from a two-fold perspective: • Accessibility to job locations: The number of jobs accessible for ALR travellers is calculated using MSM data. The outcome is presented by overlaying the spatial distribution of accessibility changes with the spatial distribution of priority groups to identify which groups receive an accessibility benefit from the project. • Accessibility to key destinations of importance for Māori and Pacific people: The equity analysis identifies key destinations of significant importance for Māori, including Marae, schools, health providers and key employment sites. Using these results, a catchment area is generated for distances within 45 minutes of key amenities and an assessment of the change in public transport isochrones us undertaken.

A summary of findings for the DIA is presented in the table below.

Table 4 DIA findings

Impact	Separated light metro	Street-running light rail
User benefits	The overall impact of user benefits for the separated option is assessed as **moderate to large beneficial**. Moderate benefits are anticipated for all income quintiles, except for income quintile 4 (the second-lowest income group). This group appears to be most favoured as they are experiencing a proportionally greater share of the total population benefit. A moderate positive effect is anticipated for Māori, while a large benefit is foreseen for the Pacific community.	The overall assessment of user benefits for the street-running option is appraised as **slight to moderate beneficial**. Overall, moderate benefits are expected for Māori and the lowest 20% of income earners, as the share of benefits aligns with their representation in the impact area. The distribution of benefits appears to favour the 20-40% income quintile (income quintile 4) and Pacific peoples. In contrast, income quintiles 3, 2, and 1 (the highest income earners) are projected to receive only slight user benefits.
Affordability	The overall impact of affordability for the separated option is assessed as **slight beneficial**. There are overall benefits resulting from a reduction in vehicle operating costs; however, these benefits are not evenly distributed across the income quintiles. The lowest income quintile (income quintile 5) receives disproportionately substantial benefits, while income quintiles 4 and 1 (comprising the highest income earners) receive comparatively modest benefits (slight benefits). All other income quintiles receive benefits in proportion	The overall impact of affordability for the street-running option is assessed as **slight adverse** as vehicle operating costs increase due to increase in congestion near the scheme. There are disbenefits across all income quintiles and they are not distributed proportionally among the income quintiles. Income quintile four (second lowest income group) and income quintile one (highest income earners) experience disproportionately large share of disbenefits. Income quintile five (lowest income earners) are anticipated

	to their share of the population (moderate benefits).	to experience the lowest share of disbenefits (slight adverse). The remaining income quintiles experience disbenefits in line with their share of the population and thus their impact has been appraised as moderate adverse.
Noise	This option will deliver **neutral** noise impacts for all priority groups.	This option will deliver **neutral** noise impacts. It is anticipated that the street-running option will generate more significant noise impacts given the scale of street-running intervention that is required. However, this assumption requires confirmation by a thorough noise model which can accurately quantify noise emissions and their effect on the surrounding environment and sensitive receptors.
Air quality	The overall impact of air quality is assessed as **moderately beneficial** for the separated option. Children, young adults and high-income earners are expected to experience moderate benefits resulting from a reduction in exposure to $PM_{2.5}$ and NO_x. The impact for low-income earners is expected to be slightly beneficial.	The overall impact of air quality is assessed as **slightly beneficial** for the street-running option. The impact is expected to be slightly less significant than the separated option, primarily because there are fewer net winners in the impact area. Young adults and low income earners are expected to experience moderate benefits from a reduction in exposure to $PM_{2.5}$ and NO_x. The impact is expected to be slight beneficial for high income earners and children.
Safety	This option is expected to have a **moderately beneficial** impact on all priority groups including cyclists, pedestrians and wheeled pedestrians.	The overall impact of safety under this option is **moderately beneficial.** The street-running option is expected to have a mixed impact on priority groups, ranging from large beneficial to slight beneficial. For Pacific peoples, there is larger proportional impact (large beneficial) and for cyclists there is a smaller proportional impact (slight beneficial).
Severance	A **moderate positive** severance impact is anticipated for this option. The analysis of changes in motorised traffic suggests this option will have a neutral severance impact across all priority groups. The station-based assessment indicates that this option will yield a positive outcome in terms of severance reduction, with moderate beneficial impacts.	A **moderate positive** severance impact is anticipated for this option. Based on the analysis of changes in motorised traffic, the street-running option is expected to have a slight beneficial impact for all priority groups, except for households without car access which are assessed as neutral. Analysis based on additional infrastructure indicates this option will generate moderate beneficial impacts, but the impact is anticipated to be slightly lower compared to the separated option, particularly in the University area.
Security	**Moderate security benefits** are expected under the separated option. The benefits are expected to be most acute for women, who make up the largest proportion of the study area and who are affected by the highest number of security indicators. The effect on young adults is also expected to be moderately beneficial. The impact is only slightly beneficial for older people, given the relatively low proportion of elderly	**Moderate security benefits** are expected under the street-running option. While the relative performance of each security indicator is nearly identical to the separated option, the magnitude of benefit is expected to be slightly lower under the street-running option. This is because a lower proportion of priority individuals falls within the security impact area, and because the separated option generates a slightly superior overall

	individuals that fall within the security impact area.	security benefit through greater anticipated improvements in the PT journey between boarding and alighting stops.
Accessibility	A **moderate positive** effect is anticipated for the separated option. Low-income earners, carers and people with disability are expected to experience large benefits, while high income earners, female and Māori people are expected to experience moderate benefits. There will be slight benefits for young adults and households without cars. The impact on the pacific community is appraised as neutral.	The street-running option will generate **slight positive** accessibility benefits. This option is expected to perform slightly worse than the separated option, as it does not provide the same level of benefit in terms of reaching jobs and accessing key destinations. Large benefits are expected for low-income earners, carers and people with a disability, while moderate benefits are anticipated for the highest 20% of income earners and females. Slight benefits are expected for young adults, households without a car and the Māori community. The impact on the Pacific community is appraised as neutral.

2.Introduction

2.1 Purpose of the report

Waka Kotahi guidance currently uses the Investment Decision-Making Framework (IDMF) to guide investment decisions and to determine how projects and programmes will be developed, prioritised and assessed for funding in the land transport system. Under this framework, the Economic Case component of a Business Case must contain a cost–benefit analysis (CBA). The CBA focuses on the total aggregated benefits and costs, while the distribution of benefits and burdens tends to be ignored[2].

In spite of this, IDMF guidance acknowledges the importance of equity effects and recommends a distributional impact analysis for any transport projects which impact the needs of transport disadvantaged populations:

"While an analysis of the distribution of benefits and costs among different groups of people is not required for economic efficiency analysis, evaluations of an activity should report the distribution of benefits and costs, particularly where they relate to the needs of transport disadvantaged populations". (Waka Kotahi, 2020, p. 16).

At present, Waka Kotahi guidance does not provide a clear solution for capturing distributional effects (Principal Economics, 2022). In addition, there is no consistent approach for assessing and managing social impacts of transport projects (with the exception of highway projects – see NZ Transport Agency, 2016).

The social and equity impacts of transport schemes are complex and typically involve complicated causal pathways, timescales and moral judgements, exacerbated by the lack of detailed evaluation guidance. There is progress to be made before these impacts can be included in economic appraisals in a mature way that allows for their comparison with economic and ecological effects.

Nevertheless, ALR represents a unique opportunity to address systematic discrimination and differences in transport outcomes among priority groups that may have different capabilities and needs. An equity analysis holds particular significance within the context of this project, given its key objective to establish an inclusive rapid transit system that enhances accessibility to employment, education and various socio-economic opportunities.

In response to this challenge, an approach has been developed to evaluate social and distributional impacts of ALR in a manner that is consistent with the progress made by Waka Kotahi, while simultaneously drawing from overseas experience and best practices for measuring the social and distributional impacts (SDIs) of transport appraisals.

The purpose of this report is to document the methodology and findings of the social and distributional appraisal work undertaken to support the ALR Economic Case. It includes an assessment of social impacts, as well as a distributional appraisal of benefits and disbenefits experienced by specific social groups. The appraisal combines quantitative data and analysis with qualitative, descriptive considerations to present a holistic view of the social and distributional impacts of the scheme. As per Waka Kotahi guidance, quantitative benefits are described in terms of methodology, measurement and in relation to baseline conditions.

The intention of this work is twofold. Firstly, the Social Impact Appraisal (SIA) considers the human experience of the transport system and the impact of ALR on social factors not

[2] Bueno, P. C., Vassallo, J. M., & Cheung, K. (2015). Bueno, P. C., Vassallo, J. M., & Cheung, K. (2015). Sustainability assessment of transport infrastructure projects: A review of existing tools and methods. Transport reviews, 35(5), 622-649.

considered in the CBA. Secondly, the Distributional Impact Appraisal (DIA) evaluates the variance of transport intervention impacts across different priority groups, including Māori and Pacific Peoples, women, children and the elderly.

Through comprehensive and frequent engagement with Te Tiriti Partnerships Business Case Team, this report also considers the range of transport impacts for Mana Whenua from a Māori distributional perspective. This engagement is an essential component of the SDI analysis and has been key to ensuring Māori needs, aspirations and opportunities are integrated into the Business Case.

3. Social Impact Appraisal

3.1 Purpose

For transport appraisals, social impacts are defined in the literature as changes in transport sources that positively or negatively influence the preferences, well-being, behaviour or perception of individuals, groups, social categories and society in general[3]. Conventional transport planning typically focuses on assessing economic and environmental objectives, while social impacts of transport schemes are often overlooked.

A failure to account for social impacts is problematic, as the concept of sustainability encompasses three major dimensions (namely the environmental, economic and social areas). By overlooking the social impacts and equity implications of transport schemes and policies, we are "fundamentally undermining quality of life and social well-being in our towns, cities and rural settlements"[4].

The Social Impact Appraisal (SIA) looks at the human experience of a transport system, focusing on local residents to assess social factors that are not already considered in traditional transport appraisals. Incorporating the social dimension in transport appraisals is of great importance as transport megaprojects often generate complex and unintended social consequences.

Countries are increasingly incorporating social assessments into their transport planning strategic objectives. In Australia, every State significant project is subject to a social impact assessment and guidance has been developed to assess the associated likely social impacts[5]. Similarly, the UK Department for Transport has published comprehensive guidance to provide methods to allow analysts to attempt to quantify and monetise social impacts in transport appraisals[6].

Nonetheless, as recognised in the literature, the appraisal of social impacts is complex as there are several different types of impacts, many of which are particularly difficult to estimate with any precision. In practice, there is little guidance for comprehensive analysis and most social assessments remain purely qualitative and superficial compared to the evaluation of other dimensions of sustainability.

In Aotearoa New Zealand, the Transport Outcomes Framework sets out a purpose for the country's transport system centred around the wellbeing of New Zealanders and the liveability of places. The five areas of this framework (inclusive access, healthy and safe people, economic prosperity, environmental sustainability, and resilience and security) recognise the breadth of impacts of the transport system across the three dimensions of sustainability, including social outcomes[7].

In addition, Waka Kotahi have developed a Social Impact Guide for NZ Transport Agency state highway schemes to identify, assess, rate and mitigate social impacts across the life of a project. However, the guidance is largely focused on mitigation of negative impacts and is not particularly applicable to other types of transport infrastructure[8].

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[3] Geurs, K. T., Boon, W., & Van Wee, B. (2009). Social impacts of transport: Literature review and the state of the practice of transport appraisal in the Netherlands and the United Kingdom. Transport reviews, 29(1), 69-90.

[4] Jones, P., & Lucas, K. (2012). The social consequences of transport decision-making: clarifying concepts, synthesising knowledge and assessing implications. Journal of transport geography, 21, 4-16.

[5] NSW Goverment . (2022). Social Impact Assessment Guideline.

[6] UK DfT. (2022). Social Impact Appraisal (TAG Unit 4-1).

[7] Waka Kotahi NZ Transport Agency . (2018). Transport Outcomes Framework.

[8] Waka Kotahi NZ Transport Agency . (2016). *Social impact guide*.

ALR presents a once in a lifetime opportunity to help shape Tāmaki Makaurau Auckland as it grows, enabling its people to thrive in a future that is increasingly defined by uncertainty and change. It will transform the lives of many by providing better access to education, jobs, and cultural amenities. The purpose of this appraisal is to evaluate, and quantify where possible, the social impacts of ALR, to allow for their consideration as part of the wider economic appraisal.

3.2 Methodology

ALR is expected to generate social impacts that will affect all individuals living and working along the route corridor, and across Tāmaki Makaurau Auckland's wider metropolitan area. Quantifying the social impacts of the scheme is crucial to appreciating their scale relative to other outcomes and allowing robust social values to be presented as part of the overall economic appraisal.

This section of the report presents and discusses the findings of the ALR Social Impact Appraisal, prepared with reference to:

1. The *Transport Outcomes Framework* developed by Waka Kotahi NZ Transport Agency.
2. The *Social Impact Guide* published by Waka Kotahi NZ Transport Agency in 2016. This guidance has been specifically developed for identifying, assessing and managing social impacts of state highway projects.
3. International best practice, including the *Social Impact Assessment Guideline for State Significant Projects* developed by the New South Wales (NSW) Government in Australia, and the *Social Impact Appraisal Guidance* (TAG Unit A4.1) published by the UK Department for Transport.

The **first phase** of the SIA involves the completion of a social baseline study to provide an initial assessment of the social challenges in the scheme area in relation the nature of the Project. This phase includes scoping and planning the SIA to identify the likely social impacts (both positive and negative) that will be derived from ALR and will form the basis for the SIA analysis.

The **second phase** assesses identified social impacts. When possible, impacts will be quantified in order to appreciate their scale relative to other Project outcomes. Where social impacts are considered to be of lesser importance or where sufficient data is unavailable to undertake a quantitative assessment, a qualitative approach will be undertaken using a seven-point scale ranging from large adverse through moderate to high positive. The findings of the second phase are presented in the Economic Case.

Key assumptions and limitations

As widely recognised in transport appraisal literature, the appraisal of social impacts is complex as there are several different types of impacts, many of which are difficult to estimate with any precision. The SIA methodology has been developed with an understanding that the analysis is limited by the data that is available to inform the assessment of each unique indicator. Several data challenges are anticipated, particularly for indicators that rely on differentiating qualitative aspects to inform their assessment. For example, factors such as lighting, landscaping and amenity provision which inform the appraisal of community-related outcomes are likely to rely on high-level assumptions and considerations, in lieu of qualitative data.

Additional consideration is given to account for the timeframe of the SIA. For social indicators that are expected to vary over time, only the impact in the project opening year (2031) is assessed. This is assumed to represent the worst-case scenario for indicators such

as severance and accessibility where benefits are expected to increase over time. Where possible, a cross-check of the final assessment is undertaken using future-year scenarios.

The SIA is intended to evaluate the societal benefits and disbenefits arising as indirect consequences of ALR. It is important to note that this appraisal exclusively concentrates on the operational impacts of the scheme and does not encompass assessments of potential social consequences stemming from construction activities.

In line with the Economic Case, two shortlisted transport options are appraised relative to the Do Minimum scenario. The Do Minimum articulates the expected future state without ALR[9]. The transport options comprise the separated light metro option and the street-running light rail option and both involve significant investment above the Do Minimum scenario. The separated light metro and street-running light rail options are appraised in relation to the Do Minimum scenario, with key differences between options discussed in the narrative where appropriate.

Recognising the Project as a combined transport and urban intervention, a high-level analysis is conducted to account for the social and distributional implications of the urban response. The findings of the SDI are reviewed in relation to the shortlisted urban interventions to identify how the proposed urban interventions may alter the social and distributional impacts of the transport investment.

3.3 Social baseline assessment

This chapter presents a baseline assessment of existing social conditions and characteristics in the area of social influence of ALR scheme (hereinafter referred to as the 'social locality'). It aims to understand the context of the social locality and identify potential social impacts of the Project.

The baseline analysis highlights specific local challenges that define certain components of the corridor, as well as giving consideration to the built and natural features of the social locality that are likely to be impacted. The assessment acts as a benchmark against which direct and indirect impacts of the Project can be predicted and analysed.

Context analysis

ALR is defined by a unique social locality within which major social impacts are expected to occur. Considering the scale and nature of the Project, the social locality extends significantly beyond the spatial corridor that has been defined for the delivery of the transport solution. A wide range of spatially dispersed and socially diverse people and communities sit within the Project's area of social influence, each of whom will experience different social impacts based on their unique identities, interests and needs.

The SIA considers all direct social impacts associated with the scheme, as well as any indirect effects that are anticipated to result from the Project's delivery. Direct impacts are those that relate to changes in social outcomes resulting from the provision of a new transport option. Indirect impacts, including land use effects and changes to the wider Auckland transport network, present their own unique benefits and challenges which are anticipated to generate important social outcomes for individuals within the social locality.

Acknowledging Auckland's diverse demographic context, the people which fall into the project's social locality reflect a wide range of cultural, social and personal characteristics. These important attributes will directly affect the way social impacts are realised and experienced. Several priority and historically disadvantaged groups are anticipated to be differentially impacted by the scheme as a consequence of their socio-economic, cultural,

[9] See Appendix E-A Technical Memo on Do Minimum for a detailed explanation.

racial, or other status. See the Distributional Impact Appraisal (Section 4) for a full identification of priority groups within the social locality.

Several specific social challenges which define certain components of the corridor are of relevance to ALR. In particular, transport inequity, access to housing, education, amenities and social infrastructure, and the community impacts of climate change have all been identified as key challenges. Further details on the key social challenges which characterise the locality of the CC2M corridor will be provided in the Social and Community Outcomes Framework.

Consideration is given to the various built and natural features within the social locality that may be impacted by the Project's delivery, and the tangible and intangible values that people may associate with these features. Kaitiakitanga, a vital aspect of Te Taiao for Mana Whenua, involves preserving and protecting the environment as a living entity with its own life force for future generations and signifies the deep connection between Mana Whenua and the environment.

While social impacts are appraised for a specific time period, the assessment is carried out with an understanding of the relevant social, cultural and demographic changes that are expected to unfold across the social locality and the broader Auckland region. As such, any social outcomes ought to be interpreted with an understanding of how the current context shapes the social impacts of the project and how this context is expected to shift as Tāmaki Makaurau Auckland continues on its current growth trajectory.

Impact categorisation

In the absence of specific guidance for the appraisal of social impacts of transport interventions in Aotearoa New Zealand, the identification of likely social impacts of ALR has been completed in accordance with the requirements set out in the *Transport Outcomes Framework* and based on best practice guidance published by the NSW Government and the UK Department for Transport. Waka Kotahi's guidance for the social assessment of highway interventions is also considered.

Four broad social outcome categories have been identified, each containing several social impact indicators that will be assessed though a variety of quantitative and qualitative methods.

Table 5 Social outcome categories identified for the SIA

Category	Likely impacts (Indicators)
Community related Outcomes	Community severance
	Social connectedness
	Personal safety and fear of crime
	Journey quality (real and perceived physical and social environment experienced while travelling)
Health-related outcomes	Health benefits to public transport (PT) users arising from changes in levels of physical activity
	Health benefits to active travel users arising from changes in the physical environment
	Benefits to society arising from prevention of road accidents and casualties
Accessibility outcomes	Effects on the ability for people to travel and access the services they require

The approach to the appraisal of each indicator is described in detail in Section 3.4.

Social Baseline

The objective of the baseline assessment is to comprehensively contextualise the current social conditions and characteristics within areas of influence of the social locality. The assessment highlights specific local challenges that define certain components of the corridor and considers the built and natural features surrounding the project area that may be impacted.

The baseline analysis presents a benchmark against which direct and indirect impacts can be predicted and analysed. The findings of the analysis are summarised below in relation to each of the predefined impact categories:

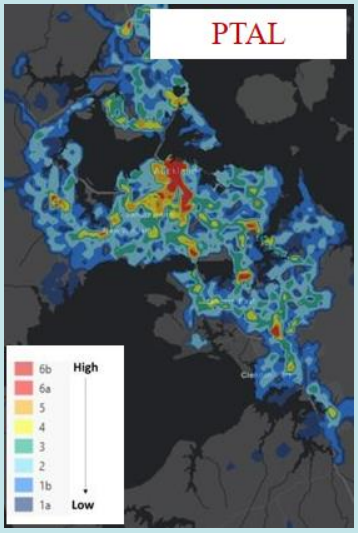
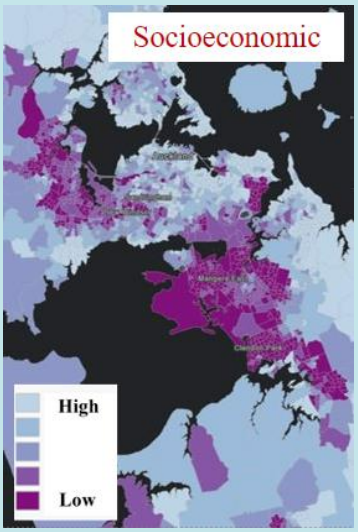
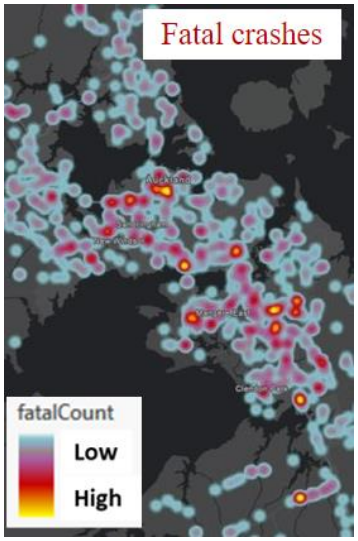
Table 6 Social baseline analysis

Category	Likely impacts (Indicators)	Baseline Assessment
Community Related Outcomes	Community severance	Several areas along Tāmaki Makaurau Auckland's existing pedestrian network are impacted by severance. Based on observational studies, the average waiting time for pedestrians at intersections in the city is 53 seconds[10]. Average waiting times in Tāmaki Makaurau Auckland are significantly greater than in Wellington (45 seconds) and more than double that in Christchurch (25 seconds). Given that average pedestrian journey times in Auckland are typically less than ten minutes, the delays experienced at intersections in Tāmaki Makaurau Auckland have a significant effect on overall pedestrian journey times in the city. This information on pedestrian journey wait times suggests that the severance effects associated with Tāmaki Makaurau Auckland's existing public transport network significantly impact the ability for individuals to engage with walking as a reliable and efficient mode of travel. The impact of severance is anticipated to be greatest in the city centre, where the most common form of travel is walking or jogging (47%). The proportion of pedestrians is significantly lower along the rest of the corridor (3%) and across wider Tāmaki Makaurau Auckland (4.3%)[11].
	Social connectedness	A high-level evaluation conducted during a site visit aimed at gaining insights into community dynamics across the social locality identified significant variation in levels of social connectedness along the corridor. Dominion Junction and Māngere Town Centre currently facilitate high levels of social interaction, given that these areas are primarily being used for residential or community purposes. Levels of social connectedness are assumed to be much lower in Māngere Bridge and the airport, areas which currently provide no access to friends, relationships and family, neither locally nor via existing public transport networks. The areas that surround Onehunga, Hayr Road and Wesley are also perceived to facilitate lower levels of social connectedness, although to a slightly lesser degree.

[10] Transportation Group NZ (2008). Reducing Pedestrian Delays at Traffic Signals. https://www.transportationgroup.nz/papers/2008/FullPapers/Vallyon,%20Chris%202.pdf. Accessed July 2023.
[11] Ministry of Transport (2018). Road deaths by region. https://www.transport.govt.nz/statistics-and-insights/safety-annual-statistics/sheet/regional-stats. Accessed July 2023.

	Personal safety and fear of crime	Levels of crime in Tāmaki Makaurau Auckland are differentiated across geographic segments along the corridor. The highest proportional rate of crime occurs in the city centre, while overall crime rates are significantly lower around the Airport, Mount Roskill, Onehunga and Māngere[12]. Perceptions of safety are therefore anticipated to be much lower in the city centre compared to other areas within the social locality. Residents of Tāmaki Makaurau Auckland have reported concerns for their safety when waiting at public transport hubs. Fear of crime is understood to be greatest at public bus stops and is experienced to a lesser degree at ferry terminals and train stations. Perceptions of safety within these areas is significantly worse after dark[13].
	Journey quality	The Auckland Transport Monthly Indicators Report presents key performance metrics for public transport, active travel and road vehicle use across the city. Several metrics are of relevance to current journey quality in Tāmaki Makaurau Auckland. In the January 2023 report, public transport punctuality (weighted across all PT modes) was measured at 96.5%[14] [15]. 91.6% of public transport passengers were satisfied with their PT performance[16][17]. For road vehicle travel, 59% of users were satisfied with the quality of their roads[18]. When evaluating journey quality factors, these results are regarded as benchmarks.

[12] Ministry of Transport (2018). Road deaths by region. https://www.transport.govt.nz/statistics-and-insights/safety-annual-statistics/sheet/regional-stats. Accessed July 2023.
[13] Auckland Design Manual. Aucklanddesignmanual.co.nz/design-subjects/design-safety/perceptions/guidance/POSAuckland#/design-subjects/design-safety/perceptions/guidance/POSAuckland/neighbourhoodsafety (retrieved July 2023)
[14] Punctuality is measured based on the percentage of total scheduled PT services leaving their origin stop no more than one minute early or five minutes late.
[15] Auckland Transport (2023). Monthly Transport Indicators – January 2023. https://at.govt.nz/media/1991327/business-report-monthly-indicators-report-attachment1-auckland-transport.pdf. Retrieved July 2023.
[16] Satisfaction is measured quarterly through face-to-face interviews and reported as a 12-month rolling average.
[17] Auckland Transport (2023). Monthly Transport Indicators – January 2023. https://at.govt.nz/media/1991327/business-report-monthly-indicators-report-attachment1-auckland-transport.pdf. Retrieved July 2023.
[18] Auckland Transport (2023). Monthly Transport Indicators – January 2023. https://at.govt.nz/media/1991327/business-report-monthly-indicators-report-attachment1-auckland-transport.pdf. Retrieved July 2023.

Accessibility outcomes	Effects on the ability for people to travel and access the services they require	 The Public Transport Accessibility Level (PTAL) map reveals that poor public transport provision is concentrated in the south of Tāmaki Makaurau Auckland. This suggests that people living in the south of the city have more difficulty when accessing key services and amenities.  These findings are verified by the socio-economic index, which assesses variation in health, education and transport access. It indicates that individuals residing in the southern part of Tāmaki Makaurau Auckland encounter greater challenges in accessing these essential services.
Health-related outcomes	Health benefits arising from changes in levels of physical activity Impact of mode on physical and mental health	 Tāmaki Makaurau Auckland is a heavily car-dominant city and private vehicle use is the primary form of travel within areas along the corridor. The highest proportion of driving occurs around the Airport (81% of all travel) and in Māngere (86% of all travel). Just 3% of travel within the corridor occurs through walking or jogging[19]. Low levels of physical activity are understood to lead to higher rates of obesity which can have detrimental effects on the overall health of the population. Tāmaki Makaurau Auckland has a high rate of childhood obesity, with one in seven children aged 2-14 years old classified as obese. Childhood obesity has a greater impact on Māori and Pacific children, along with those residing in regions characterized by lower levels of income. The rate of adult obesity has increased by 20% over the last decade and currently a third of Tāmaki Makaurau Auckland adults are obese. Despite investments into active mode schemes, adult physical activity is low, with less than half of adults meeting the recommended Ministry of Health guidelines[20]

[19] Statistics New Zealand (2018). Census 2018. https://www.stats.govt.nz/2018-census/. Retrieved July 2023.
[20] Healthy Auckland Together, 2019. healthyaucklandtogether.org.nz/assets/Uploads/Resources/HAT-scorecard-2019.pdf. Accessed July 2023.

	Benefits to society arising from prevention of road accidents and casualties	Geographically, the highest proportion of fatal accidents is registered in the south of Tāmaki Makaurau Auckland. The following table summarises the total number of reported road deaths and fatal/injury crashes in Tāmaki Makaurau Auckland between 2020 and 2018[21]. **Year** / **Road deaths** / **Road fatal and injury crashes** 2010 / 53 / 3220 2011 / 51 / 2950 2012 / 41 / 2885 2013 / 48 / 2817 2014 / 37 / 2623 2015 / 53 / 3048 2016 / 47 / 3122 2017 / 64 / 3584 2018 / 54 / 35 As recognised in the Transport Safety Strategy and action plan to 2030[22], Tāmaki Makaurau Auckland's road safety record has been deteriorating in recent years. Road safety performance in Tāmaki Makaurau Auckland has worsened at a faster rate than the national road deaths and serious injuries since 2014.

3.4 Social analysis

Community-related outcomes

Introduction

Community-related outcomes consider the impact of a transport intervention on the surrounding community, and any benefits or disbenefits relating to changes in the comfort and attractiveness of the area.

The movement of people and businesses into and out of the CC2M corridor in response to the scheme will have a significant impact on sense of place, community cohesion and community composition. The Project can play a significant role in addressing social exclusion by fostering community integration and creating opportunities for safe social interaction. This would be particularly true for people living in areas along the ALR route with lower socio-economic status that may have less viable transportation choices.

Several community-specific impacts are associated with ALR, including:

- Community severance
- Social connectedness
- Personal safety and fear of crime
- Journey quality

These impacts, and their relevance to ALR scheme, are described in detail below.

[21] Ministry of Transport (2018). Road deaths by region. https://www.transport.govt.nz/statistics-and-insights/safety-annual-statistics/sheet/regional-stats. Accessed July 2023.
[22] Vision Zero for Tāmaki Makaurau. vision-zero-for-tamaki-makaurau-compressed.pdf (at.govt.nz). Accessed August 2023.

Community Severance

Community severance describes the effect of transport infrastructure and related changes to motorised traffic as a physical or psychological barrier separating residents from facilities and services they use within their community[23]. It considers both physical and percieved barriers, and primarily concerns those using non-motorised modes, particularly pedestrians. Community severance includes:

- The separation of people from facilities, services and social networks they wish to use within their community;
- Changes in the comfort and attractiveness of areas; and
- People changing travel patterns due to the physical traffic flow and/or psychological barriers created by transport corridors.

The inclusion of better integrated cycling and pedestrian facilities along the ALR route and around stations is anticipated to reduce severance by facilitating better movement with and across communities. On the contrary, the infrastructure required to deliver the Project may generate barriers that reduces the ability for individuals to access services and faciltiies.

Social Connectedness

Social connectedness considers the interactions, relationships and networks between people, and the benefits that these relationships bring to the individual and to society. Transport influences the social connections people can maintain by determining where they can go, who they see, when they see them and how long it takes them to get there[24].

The provision of a new transport option through the delivery of ALR is expected to enhance social connectedness by enabling more regular and consistent contact between individuals. It is anticipated to enable a better way of life through improving access to friends, relationships and family.

Personal Safety and Fear of Crime

Transport interventions may affect the level of safety that is experienced by transport users. Security concerns are typically greatest in circumstances where individuals are more vulnerable to crime, such as when required to leave their vehicle, when stopped or when travelling at a low speed. For public transport users, the requirement to stop at and pass through stations raises several key security issues. Security considerations relating to station characteristics are of particular relevance to the ALR scheme.

The implementation of ALR is likely to impact the safety and security of public transport users. In particular, it is anticipated that the introduction of the scheme will influence traffic and pedestrian safety, through design elements, operational practices of the system, and the preexisting urban landscape. In addition, the presence of the new system may bear implications for crime rates in the surrounding areas.

Journey Quality

Journey quality measures the real and perceived physical and social environment experienced while travelling. Journey quality can include factors such as public information provision, provisions for accessibility and crowding. These factors may have an important influence on the travel choices made by individuals, whereby transport interventions that improve the quality of an individual's journey may induce a different mode choice. In most cases, travel is a derived demand arising from individuals desire to access other services or

[23] Anciaes, P. R., Jones, P., & Mindell, J. S. (2016). Community severance: where is it found and at what cost?. Transport Reviews, 36(3), 293-317.
[24] Marsh, K., & Watts, C. (2012). Literature review on community severance and social connectedness: definitions, pathways and measurement. NZ Transp. Agency Retrieved March, 17, 2015.

engage in other activities. Therefore, it is important that journeys are made simple and easy to improve traveller's perceptions of their physical and social environment while travelling.

The ALR scheme is expected to generate a significant modal shift from private vehicles to public transport. Given the significance of journey quality factors in influencing individual travel choice, poor quality services and amenities could deter passengers from choosing to travel using public transport over a car, thus reducing the overall impact of the intervention.

Approach

The community-related outcomes category comprises several indicators. The approach taken to assess each sub-category is summarised in the table below.

Table 7 Approach for the appraisal of community related benefits

Indicator	Proposed approach
Community severance	An assessment is undertaken to identify the effect of the scheme as a physical or psychological barrier separating residents from facilities and services they use within their community. Severance can be affected by changes to traffic flows or through substantial physical changes in transport infrastructure. As a result, the assessment is focused on the following questions: 1. Do changes in traffic flows resulting from the scheme cause or remove a barrier between residents and community facilities and services? 2. Does the scheme infrastructure cause or remove a physical barrier between residents and community facilities and services?
Social connectedness	Impacts on existing social interactions, relationships, and networks are assessed through a high-level qualitative evaluation conducted during a site visit aimed at gaining insights into the community dynamics. An analysis of the impact of the Project is subsequently conducted based on these findings.
Personal safety and fear of crime	A qualitative assessment is undertaken to identify impacts to personal safety and fear of crime through evaluating key security indicators that are to be delivered through the Project (e.g., formal surveillance, informal surveillance, landscaping, lighting, etc.)
Journey Quality	Journey quality is evaluated through a qualitative assessment of key journey quality factors. For the purpose of this assessment, key journey quality impacts are divided into three groups: 1. **Traveller care:** including aspects such as cleanliness, level of facilities, information and the general transport environment. 2. **Traveller's views:** represent the view and pleasantness of the external surroundings in the duration of the journeys. 3. **Traveller stress:** including frustration, fear of collisions and route uncertainty.

Outcomes

Community Severance

(a) Analysis based on changes in traffic flows

For the traffic-based severance analysis, an assessment was carried out to identify links on Tāmaki Makaurau Auckland's road network that are expected to experience a significant change (+/-10%) in traffic flows because of the Project.

Separated Light Rail

Figure 1 shows the assessment of the separated option by link, categorised as beneficial if traffic flow reduces and adverse if traffic flow increases[25]. The changes in traffic are calculated directly from the MSM which compares each transport option against the Do Minimum scenario.

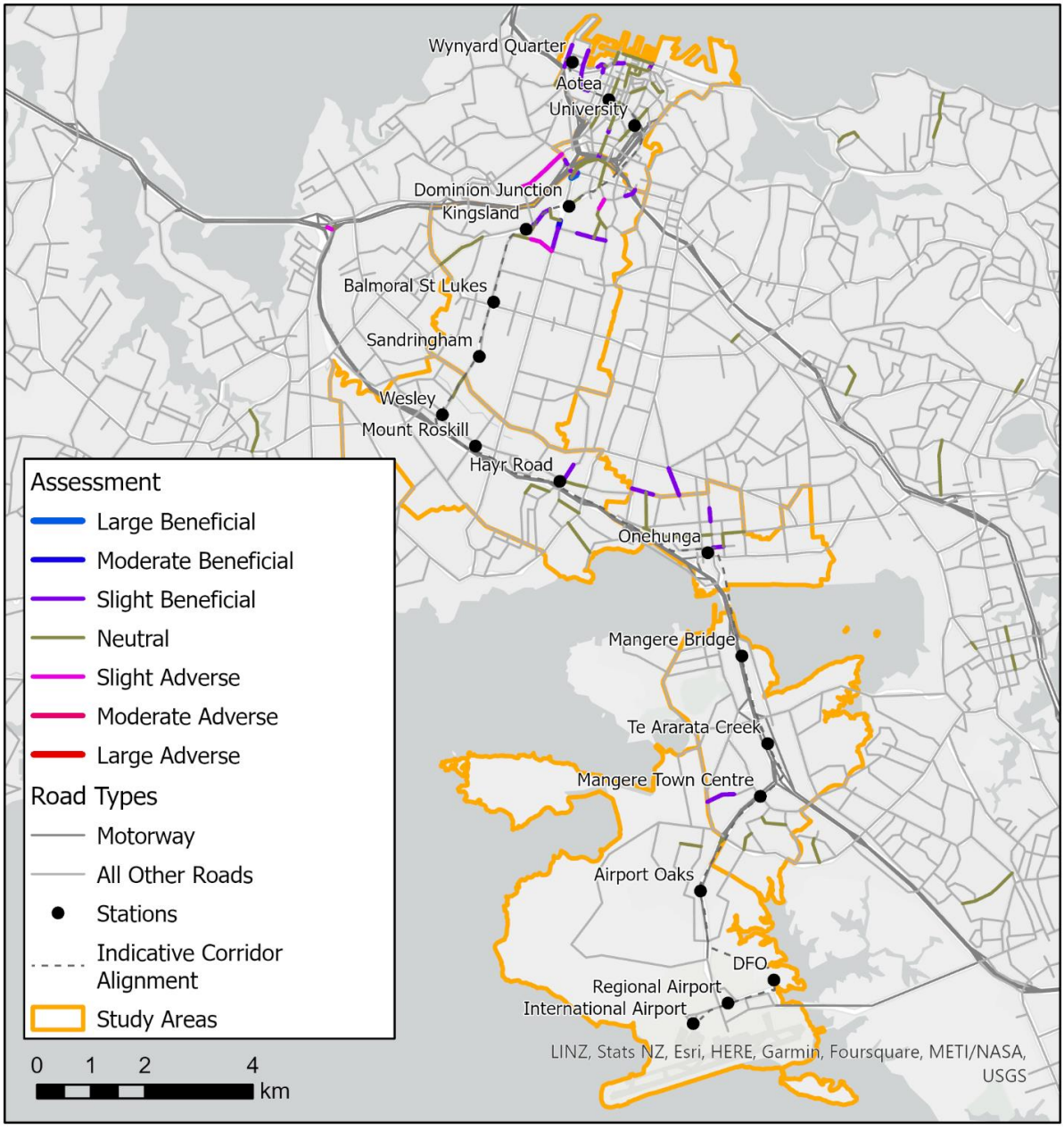


Figure 1 – Separated light metro: traffic flow-based severance assessment

[25] Further details on the classification of each link are provided in section 4.4 – Severance assessment.

The map above (Figure 1) suggests that the separated light metro scheme is expected to reduce severance in some areas of the corridor and increase severance in others. Roads around the city centre, and particularly around Wynyard Quarter, are expected to experience a slight improvement in severance through reductions in traffic flows associated with the Project. This change is expected to be particularly beneficial for pedestrians, given that walking is one of the most common form of travel in the city centre. Onehunga and Māngere are also expected to experience slight severance improvements. A reduction in traffic flow around these areas is expected to enhance pedestrian experience and increase the active mode share.

Based on the above assessment, traffic flow is expected to increase in certain areas that surround Dominion Junction, producing a slight adverse severance effect. However, severance is expected to be slightly reduced along the roads that sit within the direct vicinity of the station. The remainder of the route is not expected to be significantly impacted.

Street running light rail

Figure 2 presents the traffic flow assessment for the street running option by link, categorised as beneficial (if traffic reduces) and adverse (if traffic increases)[26]. The changes in traffic are calculated directly from the MSM which compares each option against the Do Minimum scenario.

[26] Further details on the classification of each link are provided in section 4.4 (severance assessment).

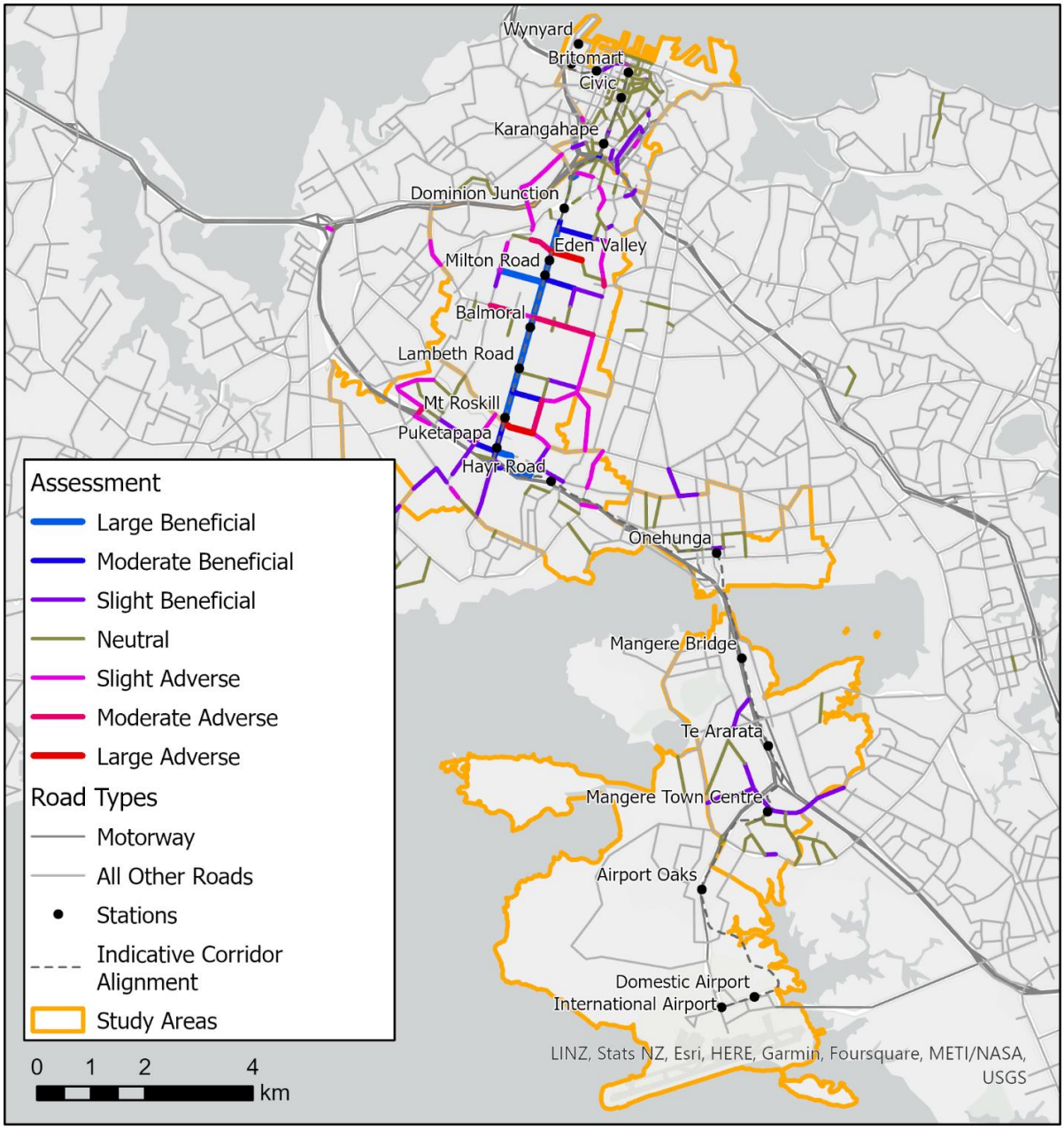


Figure 2 – Street-running metro traffic flow-based severance assessment

Based on the results of the traffic flow assessment presented in Figure 2, the scheme is expected to significantly reduce severance in several areas of the corridor, and slightly increase severance in others. Areas along the Isthmus from Eden Valley to Puketāpapa are expected to experience large beneficial traffic flow reductions, including around Puketāpapa station and along the route. Slight beneficial impacts are expected around Onehunga, Māngere Bridge, Māngere Town Centre and the University area.

This option is expected to generate adverse traffic impacts on roads along the Isthmus which are not directly linked to stations. In particular, the roads which surround Eden Valley, Balmoral and Mount Roskill are expected to experience moderate and large adverse impacts because of the delivery of the Scheme. Roads which surround Dominion Junction are expected to experience slight adverse impacts.

As a supplementary analysis, the traffic flow impact has been studied in relation to key stations (University, Dominion Junction, Kingsland, Māngere Bridge, Te Ararata, Māngere Town Centre, and Airport Oaks) that contain significant new walking links and major catchment differences. Table 8 below provides a summary of anticipated severance impacts, derived from a high-level analysis of changes in traffic patterns within the vicinity of these areas.

Table 8 Analysis of changes in motorised traffic resulting from new walking links and major catchment interventions.

Corridor Area	Separated light metro	Street-running light rail
University	Interventions are not anticipated to have a significant impact on traffic flow. The impact on severance is therefore appraised as **neutral.**	The option does not include a station at University so it is not appraised.
Dominion Junction	A **slight beneficial** impact is anticipated based on a slight reduction in traffic flow on roads around the station.	The impact is expected to be **neutral** under the street-running option.
Kingsland	A **slight beneficial** impact is anticipated based on marginal reductions in traffic congestion on roads surrounding the station.	No major interventions are planned in this area so it is not appraised.
Māngere Bridge	Interventions are not anticipated to have a significant impact on traffic flow. The impact on severance is therefore appraised as **neutral.**	Interventions are not anticipated to have a significant impact on traffic flow. The impact on severance is therefore appraised as **neutral.**
Te Ararata	Interventions are not anticipated to have a significant impact on traffic flow. The impact on severance is therefore appraised as **neutral.**	Interventions are not anticipated to have a significant impact on traffic flow. The impact on severance is therefore appraised as **neutral.**
Māngere Town Centre	Interventions are not anticipated to have a significant impact on traffic flow. The impact on severance is therefore appraised as **neutral.**	Interventions are anticipated to slightly reduce traffic flow on roads around the town centre, resulting in a **slight beneficial** impact.

A reduction in traffic flow in the areas identified above is expected to reduce severance, enhancing the interactions, relationships and networks that people have with others and the benefit these relationships can bring to an individual and to society. Reducing severance is expected to bring numerous social benefits that contribute to the well-being and connectivity of communities.

The benefits derived from traffic flow reductions will be slightly more significant under the separated light metro scenario, given that major interventions around the University and Kingsland stations which form part of the separated route are not included under the street-running scenario. As such, no traffic flow changes are expected around these areas and the magnitude of severance reduction will be slightly lower in the street-running scenario than under the separated route.

The areas in where traffic flows are expected to stay unaffected will not realise any additional social benefits. It should be noted that this conclusion is partial, as the analysis in this section solely considers how motorised traffic can improve severance or create divisions among spaces and people in Auckland.

(b) Analysis from the station-based assessment

Several proposed changes to areas around stations are anticipated to deliver social benefits through reducing the impact of severance. The planned infrastructure measures for each corridor area, and their anticipated impact on severance, are summarised in the table below.

The assessment is only undertaken for pedestrians and is graded using the following guidelines:

- The overall assessment is likely to be **neutral** if increases in severance are broadly balanced by relief of severance.
- The overall assessment is likely to be **slight** where changes in severance is slight or the total numbers of people affected across all levels of severance is low.
- The overall assessment is likely to be **large** where changes in severance is large and a moderate or high number of people are affected, or when the total number of people affected across all levels of severance is high.
- The overall assessment is likely to be **moderate** in all other cases.

Table 9 Analysis of infrastructure and other complementary measures

Corridor Area	Proposed Improvement	Separated LM	Street-running LR	Comments
University	New pedestrian bridge	Moderate beneficial	Neutral	The Symonds St area in the University district presents several challenges in terms of space and accessibility, due to the high volume of pedestrians and buses that move through the area. The proposed pedestrian bridge will significantly improve walking/cycling access by providing access across SH16 to the Domain and Hospital, via the Grafton Road motorway overbridge. This is anticipated to provide a safe and dedicated crossing for pedestrians and thus delivering severance improvement. The street-running option does not stop at the University area so the new pedestrian bridge is not expected to be delivered. As such, improvements to severance are anticipated to be neutral under the street-running option.
Dominion Junction	New junction layout	Moderate beneficial	Moderate beneficial	The new junction layout at Dominion Junction will be designed to enhance pedestrian priority and to encourage pedestrian journeys into the area. Replacement of the flyovers and underpasses with at-grade signalised intersection, including safe and convenient pedestrian crossings, protected cycle lanes and targeted bus priority, are expected to enable safe and convenient access to and from the ALR station from all directions. The proposed junction will still require pedestrians to cross major roads, but the route will be improved, thus reducing severance impacts overall.

				The new junction layout will be adopted under both options, thus resulting in comparable severance improvements.
Kingsland	General improvements	Slight beneficial	Slight beneficial	Several minor improvements, including proposals for cycle lanes, bus stops and pedestrian crossings, are expected to enhance pedestrian connectivity to the station and connection to Eden Park. It is foreseen that these modifications will reduce severance while enhancing the overall ambiance for pedestrians and cyclists alike. The impact is anticipated to be the same under both options.
Māngere Bridge	New pedestrian/cycle bridge	Slight beneficial	Slight beneficial	A new 5m wide pedestrian-cycle bridge is proposed over the Southwestern Motorway to replace an existing bridge that will be affected by the ALR alignment. Severance improvements will be relatively small given the presence of an existing footbridge 300m south of the proposed development. Proposed active travel routes and enhanced walking links are anticipated to play a role in decreasing severance for active travellers within the area. The new bridge will be adopted under both options, thus resulting in comparable severance improvements.
Te Ararata	New pedestrian/cycle bridge	Slight beneficial	Slight beneficial	A new 5m wide pedestrian-cycle bridge is proposed over the Southwestern Motorway to replace an existing bridge to allow for safe pedestrian and cycle connectivity across the SH-20. The new bridge is expected to deliver severance improvements for some residents as it could reduce their separation from facilities and services. Likewise, proposed walking network improvements are anticipated to mitigate the effects of severance. The new bridge will be adopted under both options, thus resulting in comparable severance improvements.
Māngere Town Centre	Re-design of Bader Drive and new pedestrian bridge	Large beneficial	Large beneficial	A new station plaza bridge is intended to replace the existing facilities on Bader Drive, including pedestrian, cycling and traffic infrastructure. The current road infrastructure is unattractive and not used by pedestrians, primarily due to the physical and psychological barriers it imposes. The planned redesign aims to effectively alleviate this severance issue, thereby establishing an improved pedestrian environment. This redesign is anticipated to

				foster increased pedestrian mobility, freedom of movement, and safety. The re-design will be adopted under both options, thus resulting in comparable severance improvements.
Airport Oaks	New 5m wide footbridge over George Bolt Memorial Drive	Slight beneficial	Slight beneficial	The provision of a new 5m-wide bridge for walking and cycling will enable east – west journeys which are currently prevented by the motorway. However, it is worth noting that the bridge's elevation is substantial, and the nearest road crossing is situated 1km away from the bridge. As a result, the impact on the improvement of severance is projected to be constrained. Furthermore, there are no foreseen enhancements to the walking and cycling infrastructure within the vicinity. The new bridge will be adopted under both options, thus resulting in comparable severance improvements.

(c) Summary of findings

At the scheme-wide level, the severance analysis suggests that both options will deliver a **slightly to moderately beneficial impact** through reducing severance. The effects of motorised traffic are not anticipated to be significant, given that Dominion Junction and Kingsland are the only two station areas that are expected to experience any traffic flow improvements. However, the proposed pedestrian infrastructure changes are expected to deliver severance improvements across all key station areas.

For the separated option, the overall extent of the benefit is anticipated to be moderate, given that the proposed infrastructure improvements are expected to enhance pedestrian connectivity. This enhancement will facilitate social interactions and gatherings, while also stimulating increased utilisation of the public transportation system.

The severance benefit is expected to be slightly lower under the street-running option given that the route does not include a university station, meaning any proposed infrastructure in this area will not be delivered.

Social Connectedness

(a) Analysis of impacts on social connectedness

A high-level qualitative evaluation of key corridor segments was undertaken to identify areas for which there was significant potential to improve social connectedness through the delivery of the Project. The evaluation was carried out based on findings from a site visit aimed at gaining insights into the community dynamics of key areas along the corridor.

Each area was scored based on its potential to improve quality of life through enhancing connectivity between friends, relationships and family. The results of the qualitative assessment are presented in Table 10.

Table 10 Analysis of impacts on social connections

Corridor Area	Separated LM	Street-running LR	Comments
City Centre	Slight beneficial	Slight beneficial	Limited improvements are anticipated as the city centre area already facilitates high levels of social

			connectedness. The anticipated effect is foreseen to be identical for both options.
Isthmus	Slight beneficial	Slight beneficial	Limited improvements are anticipated as areas along the Isthmus already facilitates high levels of social connectedness. The anticipated effect is foreseen to be identical for both options.
Mount Roskill	Moderate beneficial	Moderate beneficial	Slight improvements are expected. The area has no visible access advantages or disadvantages and road access via highways is strong. However, there is a slight lack of access to other neighbourhoods via public transport. The anticipated effect is foreseen to be identical for both options.
Onehunga	Moderate beneficial	Moderate beneficial	Slight improvements are expected, particularly in South Onehunga which is not strongly associated as a family community area (unlike North Onehunga). The anticipated effect is foreseen to be identical for both options.
Māngere	Moderate beneficial	Moderate beneficial	Slight improvements are expected. Access to family networks in the local area is strong, but access to other areas of the corridor could be improved. The anticipated effect is foreseen to be identical for both options.
Airport	High beneficial	High beneficial	Significant improvements are expected around the airport, an area which currently provides no access to friends, relationships and family. The anticipated effect is foreseen to be identical for both options.

(b) Summary of findings

At a scheme-wide level, the findings of the qualitative assessment suggest that both options will bring a **moderate improvement** in social connectedness. However, the magnitude of the impact is differentiated across the corridor based on the extent to which each area is already facilitating connection and interaction between individuals.

In particular, the Project is expected to generate significant positive impacts around the airport, an area which currently provides no access to friends, relationships and family, neither locally nor via existing public transport or active travel networks. Moderate positive impacts are also expected in Mount Roskill, Onehunga and Māngere, areas which currently facilitate relatively strong levels of social connectedness among local residents but which suffer from limited access to other neighbourhoods along the corridor.

Impacts are assumed to be lower in those areas of the corridor which are already being used for residential or community purposes. The City Centre and Isthmus currently facilitate substantial levels of social interaction and interpersonal relationships among individuals. Consequently, the projected impact of the scheme is deemed to be minimal.

It is assumed that there will be no variation between the separated light metro and street running light rail options, given that both options run through all key corridor segments that were assessed.

It should be noted that the appraisal of social connectedness is complex as there are several factors that influence social interactions, many of which are difficult to estimate with precision or certainty. Acknowledging this, the above assessment ought to be interpreted with an understanding of its limitations in relying on high-level assumptions and considerations, in lieu of quantitative data.

Personal Safety and Fear of Crime (Security)

The design of stations and their surrounding areas seeks to ensure safe provisions for ALR passengers. These provisions will generate safety improvements for existing public transport users as well as individuals that choose to shift their mode of travel from private vehicle to rail in response to the scheme. Interventions that improve the safety of station areas will also benefit pedestrians and cyclists that move within the ALR corridor.

(a) Analysis of changes to key security indicators

A qualitative description of changes to key security indicators is presented in the table below.

Table 11 Security assessment

Security indicators	Separated LM	Street-running LR	Comments
Site perimeters, entrances and exits	High beneficial	High beneficial	As per the Basis of Design, a minimum of 3-metres of entry canopy headroom is required at all station entries. Canopies must be sufficiently sized to prevent wind driven rain from entering the station. All entrances are to be treated as Waharoa (gateways with cultural design narratives that differentiate each station). Corridor fencing height will be 2.1-2.4 metres in urban areas – this is the minimum fence height required for low-risk areas. A corridor fence height of 3 metres will be delivered in high-risk areas. The design of the stations with controlled access points can effectively deter unauthorised individuals from entering the stations, thereby enhancing overall security. Entrances will be carefully designed to effectively manage passenger flows, mitigating the potential for overcrowding and minimising the risk of stampedes or other safety hazards, particularly during peak travel times. The impact is anticipated to be the same for both options.
Formal surveillance	High beneficial	High beneficial	CCTV monitoring will be installed in all internal station areas. Station external areas and other route locations (ancillary buildings, depot etc.) are also expected to be covered. The provision of surveillance cameras and monitoring systems is assumed to enable security personnel to detect and respond to potential threats in real time. The impact is anticipated to be the same for both options.
Informal surveillance	Moderate beneficial	Moderate beneficial	Informal surveillance measures are considered in the framework for the reference design of the scheme. The framework identifies several measures that will be incorporated to enhance informal surveillance along the corridor, including clear sightlines, minimal distance between ALR stations and existing bus stops and avoiding hidden access routes to stations along the motorway. These measures are expected to have a positive impact on security. The impact is anticipated to be the same for both options.
Landscaping	Not appraised	Not appraised	Opportunities for using landscaping features (hard/soft landscaping, street furniture, etc) to contribute to visibility and deter intruders are identified and discussed in the Journey quality section of this report.

Lighting and visibility	Neutral	Neutral	Details on lighting are not yet available in the Basis of Design. However, it is assumed that the design considers adequate lighting and clear sightlines at entrances to improve visibility and deter illicit activities, creating a safer environment for rail passengers. The impact is appraised as neutral for both options as specific scheme details are not available at this stage.
Emergency call	Moderate beneficial	Moderate beneficial	Emergency help points will be installed at each station, enabling an organised response in case of emergencies or incidents whilst creating a safer environment for passengers. As a result, the impact is appraised as positive at this stage. The impact is anticipated to be the same for both options.
Public transport journey between the boarding and alighting stops.	High beneficial	Moderate beneficial	The design and delivery of a secure transport scheme is expected to deliver significant safety improvements for passengers travelling between boarding and alighting stops. Improvements to personal safety and fear of crime are expected to be more significant under the separated option due to it having lower end-to-end and station-to-station journey times.

(b) Summary of findings

The overall assessment for security is expected to be **moderately beneficial** for both options, as the changes between the without-scheme and with-scheme cases indicates a positive impact on personal safety and fear of crime for individuals travelling via rail or within the areas which surround the scheme. Well-designed entrances and stations, efficient crowd management and enhanced emergency response capabilities are anticipated to significantly contribute to the creation of a safer and more secure environment for ALR passengers.

It is assumed there will be no variation between the two options for those security indicators relating to station design and facilities, given that the Basis of Design used to inform the assessment does not differentiate between options.

The separated light metro option is expected to perform slightly better in terms of journey improvements between boarding and alighting stops, given it has a shorter end-to-end travel time which may reduce passengers' exposure to safety risks and crime.

Journey Quality

The evaluation of journey quality examines the difference in key journey quality factor indicators between the without-scheme case and the two transport options. Three indicators are identified as relevant for the ALR scheme:

- **Traveller care:** aspects such as cleanliness, level of facilities, information and the general transport environment.
- **Traveller's views:** the view and pleasantness of the external surroundings in the duration of journeys.
- **Traveller stress**: frustration, fear of collisions and route uncertainty.

(a) Analysis of journey quality factors

The journey quality assessment for the separated and street running options is presented in the table below. Both options are assessed in relation to the three journey quality categories.

Table 12 Journey quality assessment

Journey Quality Category	Separated LM	Street-running LR	Comments
Traveller care	Moderate beneficial	Moderate beneficial	Several elements of the scheme design are expected to improve the general transport environment for passengers, pedestrians and cyclists, thus resulting in a better user experience. The proposed design provides sanitary facilities on the paid side of the station unless alternatives are already available. Access to sanitary facilities includes a baby changing table. The quantity of provision is subject to the peak passenger flow rate. Waste facilities will be provided at each station. At minimum, 2 bins will be provided per platform (one per level/entrance). Platform furniture and seating will be provided. Seating is to be evenly distributed along the platform length and will accommodate 5% of the normal maximum departing passenger volume during the average minute in the peak 15-minute period for each platform face. For staffed stations, fresh drinking water fountains will be provided within the paid concourse area. Passenger information displays will be located on the platform and bus interchanges. Bike and scooter hire facilities are to be provided at all stations. Secure bicycle parking will also be provided (approximately 20-60 spaces depending on station type). Kiss and ride stations will be provided at each station. 2-4 spaces are expected to be provided, as per station typology. Each of the aforementioned design elements are expected to have a favourable effect on passengers' satisfaction and enhance their overall journey experience. Given that the design scheme will be applied to both options, the impact is anticipated to be the same between the separated and street-running options.
Traveller views	Moderate beneficial	Moderate beneficial	Various landscape and visual mitigation measures have been integrated into the project for the purpose of minimising adverse environmental effects and preserving Te Taiao. Mana Whenua to have the ability to incorporate ngā kōrero tuku iho as cultural anchors including cultural design narratives and appropriate landscaping plans and design elements in each station. Te reo Māori integration as prescribed by Mana Whenua to be integrated into as prescribed by Mana Whenua into each station. Consideration will also be given to the inclusion of public art within each station environment. These cultural and social considerations are anticipated to improve the overall passenger experience. Opportunities for using landscaping features (hard/soft landscaping, street furniture, etc) to contribute to visibility and deter intruders are identified in the design schedule but have not yet been defined. Visual and landscape considerations will be applied to both options and thus the impact is anticipated to be the same for the separated and street-running options.

Traveller stress	High beneficial	Moderate beneficial	More reliable and quicker journey times are expected for travellers that shift their mode of travel from private vehicles and buses to rail. Improved journey time certainty and more efficient connections and transfers are expected to significantly reduce stress for new rail passengers. The improvement in journey time certainty is anticipated to be higher under the separated option, due to the option having a lower end-to-end journey time. A modal shift towards light rail is expected to reduce the volume of road traffic, resulting in more reliable journey times for road users which may positively impact on driver stress. A reduction in road accidents is also anticipated, which is likely to have a strong positive impact on driver perceptions. The scale of modal shift and subsequent improvements to traveller stress are expected to be greater under the separated option, given the shorter overall journey time and higher frequency. Enhanced walking and cycling facilities in and around stations are expected to provide more continuous, higher-quality active travel routes. This is expected to reduce route uncertainty and fear of collisions for cyclists and pedestrians. The scale of delivery of new walking and cycling facilities is expected to be the same for both options. As a result, the corresponding impact on traveller stress is expected to be similar. Customer information points will be required at each platform, ticket hall and concourse area. The extent of components are subject to station passenger capacity. These information points are expected to reduce fear of route uncertainty which may positively impact on passenger stress. The impact is expected to be the same under both options. Each of the previously mentioned factors is anticipated to positively influence passengers' stress levels while enhancing their overall journey experience.

(b) Summary of findings

The overall assessment for journey quality is expected to be **moderately beneficial** under both options due to anticipated improvements in traveller views, care and stress. Adequate design and the availability of amenities will enhance passenger comfort during the journey, thereby improving overall passenger satisfaction. Similarly, visual and landscaping considerations play a crucial role in maintaining a comfortable environment, thereby enhancing the overall journey experience and make it more enjoyable. Additionally, the provision of more reliable and quicker journey times is expected to reduce frustration and alleviate passenger's stress, ultimately resulting in a more positive travel experience.

The separated light metro option is expected to reduce traveller stress slightly more than the street-running option, given that the option provides a shorter end-to-end journey time than the street-running option. This in turn is expected to generate a higher modal shift from private vehicles, delivering additional stress reduction benefits by reducing the overall number of road accidents on the road network.

Accessibility outcomes

Introduction

Accessibility reflects the range of opportunities and choices available to individuals for connecting with employment, essential services, social networks and family. The extent of access is influenced by residential choices, the geographical distribution of services, and the availability and affordability of transportation alternatives. For transport interventions,

accessibility is used as a social metric, with the potential to reduce social exclusion and cater to the diverse transport requirements of different groups in society.

While the Project is expected to generate significant connectivity improvements, the scheme may also have localised accessibility impacts that will affect the social wellbeing of people in the area. One of the scheme objectives is to provide a desirable transport alternative that is cheaper, safer and more efficient than private vehicles. It is anticipated that the scheme will play a major role in redressing public transport 'inequity' in areas south of the Manukau Harbour, providing better access to jobs, education and amenities.

This analysis focuses on the operational impacts of the Project and assesses its impact on individual's access to essential destinations, excluding considerations of changes in accessibility resulting from construction.

Approach

A mixed quantitative and qualitative approach is undertaken to assess the accessibility impact of each option.

The qualitative assessment is conducted by analysing five key barriers impacting on accessibility[27]: the cost of transport, the availability and physical accessibility of transport, services and activities located in inaccessible places, safety and security and travel horizons (see Table 13). Improving accessibility can be achieved through one or a combination of these elements.

Table 13 Barriers to accessibility

Barrier to accessibility	Justification
The cost of transport	Individuals may find the costs of personal or public transport very high or unaffordable.
The availability and physical accessibility of transport	Individuals in isolated urban and rural areas may have limited, unreliable or no public transport services.
Services and activities located in inaccessible places	Infrastructure developments like hospitals, businesses, retail establishments, and culturally significant sites are frequently located in areas that may pose challenges for individuals without private vehicles.
Safety and security	Some individuals may choose not to utilise public transport or walk to essential services as a result of concerns regarding crime or anti-social behaviour.
Travel horizons	Certain individuals may exhibit reluctance to undertake lengthy journeys or cover substantial distances, or they may lack awareness of or confidence in using the available transportation services.

Source: Social Exclusion Unit (2003). Making Connections.

The quantitative approach to evaluating accessibility comprises two distinct components. Firstly, it establishes a catchment area within a 10-minute walking distance around key stations. An assessment of how walking isochrones for key stations are likely to change under each option (against the without scheme case) is undertaken.

Secondly, in alignment with the recent report commissioned by Waka Kotahi which investigates methods for identifying and assessing the distributional impacts that could result from transport interventions[28], accessibility is further analysed based on the number

[27] DfT (2022). TAG Unit A4.1 Social Impact Appraisal.
[28] Torshizian, E., Byett, A., Isack, E., Fehling, A., & Maralani, M. (2022). Incorporating distributional impacts (equity) in the cost–benefit appraisal framework.

of job opportunities reachable within 30 and 45-minute journey times using public transport.

Outcomes

(a) Analysis based on 10-minute Walkable Catchment Areas

This section compares population catchments between the Do Minimum and two transport options based on a 10-minute walkable catchment area. For the purpose of this analysis, 2051 population numbers have been used to compare each option.

The station locations under each proposed transport option are not identical. Therefore, a Do Minimum option has been generated for each proposed scenario to allow for the comparison of catchment areas between options. The analysis is based on distances of 800 metres, or approximately 10 minutes walking distance, from each proposed station.

For a number of stations, the resident population forecast is extremely low because these areas are currently industrial zones and will remain so into the future. These stations include:

- Landing Drive
- Discount Fashion Outlet
- Regional Airport
- International Airport.

Table 14 Population catchments between Do Min and Options

Separated LM Stations	Do Minimum (2051)	Separated LM (2051)	Street-running LR Stations	Do Minimum (2051)	Street-running LR (2051)	Difference (Separated – Street running)
Aotea	30,842	30,030	**Civic**	28,392	27,734	**8%**
University	20,039	20,514	No relevant stations			**-**
Dominion Junction	14,975	16,239	**Dominion Junction**	13,181	14,880	**8%**
Kingsland	8,090	9,263	**Eden Valley**	9,290	7,498	**19%**
No relevant stations			**Milton Rd**	8,858	7,612	**N/A**
Balmoral St Lukes	8,527	10,715	**Balmoral Rd**	5,611	6,646	**38%**
Sandringham	7,822	9,679	**Lambeth Road**	6,368	7,758	**20%**
Wesley	8,141	10,563	**Mt Roskill**	6,834	9,236	**13%**
Mount Roskill	5,215	6,160	**Puketepapa**	5,838	7,470	**-21%**
Hayr Road	5,573	6,172	**Hayr Road**	5,324	5,421	**12%**
Onehunga	5,251	5,777	**Onehunga**	5,174	5,239	**9%**
Māngere Bridge	374	2,192	**Māngere Bridge**	363	2,312	**-5%**
Te Ararata Creek	4,092	6,880	**Te Ararata**	5,822	7,686	**-12%**

Māngere Town Centre	4,663	5,976	**Māngere Town Centre**	5,129	6,423	**-7%**
Landing Drive	-	-	**Landing Drive**	-	-	**-**
Discount Fashion Outlet	-	-	**Discount Fashion Outlet**	-	-	**-**
Regional Airport	-	-	**Domestic Terminal**	-	-	**-**
International Airport	-	-	**International Terminal**	-	-	**-**

"-" Low resident population due to current and expected future zoning

The findings presented in Table 14 above suggest that the 10-minute population catchment is larger under the separated option. The analysis indicates that the separated option offers access to rail stations within a 10-minute walking distance to a larger share of the population. This implies that, compared to the street-running option, the separated option is likely to facilitate a greater increase in public transport ridership, lower dependence on private vehicles and enhanced connectivity to the transport network for residents and commuters within the catchment area.

The findings of the above analysis are to be interpreted with caution, given that they are derived from a high-level assessment with certain data limitations. Further investigation into the accessibility implications of each transport option will be required to reach a more robust and definitive conclusion.

(b) Job availability within 30 and 45 minutes of place of residence by public transport

Further analysis has undertaken to assess accessibility based on the number of job opportunities reachable within 30 and 45-minute journey times using public transport. The analysis utilises the outputs of the MSM model for the Do Minimum scenario and the two transport options. The population forecasts used to complete the job accessibility analysis are summarised in Table 15.

Table 15 Population forecast data source

Option scenarios	General population data source
Do Minimum	Do Min 2051 (AFC)
Street-running LR	LUTI IC 2051 (AFC)
Separated LM	LUTI IC 2051 (AFC)

To determine the number of jobs accessible by public transport within 30 and 45 minutes for ALR travellers, both options were evaluated in relation to the Do minimum case. This assessment aimed to identify the total increase in accessible job opportunities achieved under each option. The results of the analysis are presented in the tables below.

Table 16 Job Availability – No. of total jobs within 30 minutes of home by PT (AM)

	Do Minimum	Separated LM	Street-running LR
Jobs within 30 minutes of home by PT	47,865	55,923	53,052

Additional jobs compared to Do Min		8058 (+17%)	5187 (+11%)

Table 17 Job Availability – No. of total jobs within 45 minutes of home by PT (AM)

	Do Minimum	Separated LM	Street-running LR
Jobs within 45 minutes of home by PT	156,732	178,293	172,463
Additional jobs compared to Do Min		21,561 (+14%)	15,731 (+10%)

As suggested by the above results, both options are expected to increase the number of jobs that are available within 30 and 45 minutes of home by public transport. The scale of change is anticipated to be greater under the separated light metro option, suggesting that this option provides greater enhanced job accessibility than the street-running option.

(c) Qualitative Assessment

An additional qualitative analysis based on the 'key barriers impacting on accessibility' has been undertaken in accordance with requirements set out in the UK's Department for Transport (DfT) TAG unit A4.1 Social Impact Appraisal. The anticipated changes to key barriers to accessibility resulting from the ALR scheme are summarised in the table below.

Table 18 *Changes to key barries to accessibility*

Barrier to Accessibility	Separated LM	Street-running LR
Cost of Transport	This option is expected to deliver journey time and reliability benefits which will reduce the cost of transport for some users. The Distributional Impact Assessment (see Section 4) investigates the potential distribution of user benefits across different income groups.	This option is expected to deliver journey time and reliability benefits which will reduce the cost of transport for some users. Journey time benefits are expected to be lower under the street-running option, given it has a significantly longer end-to-end journey time than the separated option.
Availability and physical accessibility of transport	The option is expected to significantly improve the availability and physical accessibility of public transport by providing a new mode of travel through the delivery of a light metro system. The Basis of Design[29] states that the ALR system shall not result in service delivery degradation of existing transport infrastructure and systems. It is anticipated that some existing bus routes will be altered during the construction phase, but this impact falls outside the scope of the social impact appraisal. No other significant changes to bus infrastructure are expected.	The option is expected to significantly improve the availability and physical accessibility of public transport by providing a new mode of travel through the delivery of a light rail system. Benefits are anticipated to be slightly lower under the street-running option, given it has a lower frequency than the separated option. It is anticipated that some existing bus routes will be altered during the construction phase, but this impact falls outside the scope of the social impact appraisal. No other significant changes to bus infrastructure are expected.
Services and activities located in inaccessible places	The option will provide improved north-south connectivity for communities along the ALR corridor and the wider Auckland region.	This option will provide improved north-south connectivity for communities

[29] BoD

	An Accessibility and Equity Analysis[30] was undertaken by the transport workstream to assess changes in accessibility, measured in relation to jobs, education, social, cultural and recreational activities and healthcare. Based on the analysis, all areas of Auckland are expected to experience some level of improvement in accessibility.	along the ALR corridor and wider Tāmaki Makaurau Auckland region. Given that the Accessibility and Equity Analysis[31] did not differentiate between options, an assumption is made that the level of improvement in accessibility to currently inaccessible places will be the same under both options.
Safety and security	Providing a safe and attractive service is one of the core objectives of the ALR scheme. With the proposed changes, people are not expected to be deterred from walking or using public transport to access key services due to fear of crime or anti-social behaviour. However, to avoid potential double-counting, an analysis of these elements have been included only in the accident and security assessment.	Providing a safe and attractive service is one of the core objectives of the Project. With the proposed changes, people are not expected to be deterred from walking or using public transport to access key services due to fear of crime or anti-social behaviour. However, to avoid potential double-counting, an analysis on these elements have been included only in the accident and security assessment.
Travel horizons	The option will lead to wider travel horizons for individuals living along the CC2M corridor and across the wider Tāmaki Makaurau Auckland area. The separated light metro system will provide faster and more reliable journey times when accessing jobs, education, social, cultural and recreational activities and healthcare.	The option will lead to wider travel horizons for individuals living along the CC2M corridor and across the wider Tāmaki Makaurau Auckland area. Benefits under the street-running option will be slightly lower than the separated light-metro option, given it has a longer end-to-end journey time and lower frequency.

(d) Summary of findings

The appraisal of accessibility outcomes encompassed three aspects:

1. Accessibility to ALR stations by foot
2. ALR's role in facilitating access to employment
3. Key barriers impacting on accessibility

Based on the findings of the analysis, it can be concluded that the overall accessibility assessment is likely to be **moderately beneficial** for the separated light metro option, while the street-running light rail option is expected to bring **slight accessibility benefits.**

The station analysis indicates that separated light-metro offers greater accessibility by providing walkable station access to a higher proportion of the population. Likewise, the qualitative evaluation of job accessibility indicates that separated light metro offers greater employment accessibility benefits.

The analysis of key barriers impacting on accessibility indicated that the characteristics of separated light metro in terms of end-to-end journey time, average speed and frequency are best suited to significantly improve accessibility.

[30]Transport Accessibility and Equity Analysis Paper

[31] Transport Accessibility and Equity Analysis Paper

Health-related outcomes

Introduction

Health-related outcomes consider the impact of a transport intervention on active mobility, and any mental or physical health benefits that arise from changes in physical activity levels. Changes in the number of accidents and casualties are also considered as key health-related factors.

This analysis focuses on benefits to society arising from changes in individual health outcomes resulting from the introduction of the Project. Several health-related impacts are associated with ALR, including:

- Health benefits to PT users arising from changes in levels of physical activity.
- Health benefits to active travel users arising from changes in the physical environment.
- Prevention of road accidents and casualties.

The details of these impacts and their relevance to the ALR scheme are described below.

Health Benefits to Public Transport Users Arising from Changes in Physical Activity

Research from the World Health Organisation suggests that tangible alternatives to exercise, such as walking and cycling, represent practical opportunities for people to integrate physical activity into their daily lives. Physical activity reduces the risk of a broad range of chronic diseases including cardiovascular disease, diabetes and some cancers. It also plays an important role in preventing weight gain and improving mental health.

Compared to private vehicle users, public transport users typically engage more with active travel modes when travelling to and from PT stations. This generates mental and physical health benefits through an increase in the level of walking and cycling. As such, it is appropriate to assess changes in the levels of physical activity resulting from the introduction of the scheme, and how an increase in physical activity can contribute to improved health outcomes across Tāmaki Makaurau Auckland's population.

Health benefits to Active Travel Users Arising from Changes in the Physical Environment

Transport and the built environment can affect levels of physical activity that people engage with daily. Public transport schemes often comprise complementary walking and cycling measures which can improve the user experience for individuals that rely on active travel as their primary travel mode. It is therefore appropriate to consider the health benefits that are experienced by active travel users through the introduction of a transport scheme.

The ALR scheme is expected to generate physical and mental health benefits for existing active travel users by enhancing the conditions for active travel through interventions associated with the Project. The scheme comprises several complementary walking and cycling measures which are expected to improve active travel user experience along the corridor. This is anticipated to generate significant health benefits for individuals in Tāmaki Makaurau Auckland that rely on active methods as their primary mode of travel.

Prevention of Road Accidents

Transport interventions may alter the risk of individuals being killed or injured through accidents. Accidents can arise from all modes of transport and affects both users and non-users.

There are significant costs associated with accidents, for individuals, government, and private businesses. Individual costs are borne by the victims themselves, their friends and their relatives. Losses to society arise through medical and ambulance costs and from a

reduction in overall net economic output. As such, reducing the number of vehicle collisions generates benefits for society by reducing human and direct economic costs.

ALR is expected to decrease the overall number of road accidents that occur in Tāmaki Makaurau Auckland. The provision of an alternative public transport mode will generate a significant modal shift towards public transport, reducing the total number of private vehicle trips taken and therefore decreasing the total cost to society associated with road accidents.

Approach

As this category comprises several indicators, the following table summarises the approach taken for each one of the sub-categories.

Table 19 – Approach for the appraisal of health-related outcomes

Indicator	Proposed assessment
Health Benefits to Public Transport Users	A qualitative assessment of how the intervention affects the mental and physical health of public transport users through encouraging a higher level of physical activity.
Health Benefits to Active Travel Users	A qualitative assessment of how the intervention encourages wider uptake of active travel.
Prevention of Road Accidents	A qualitative assessment of the benefits to society arising from prevention of road accidents (quantitative estimate of the reduction in overall road accidents as a result of the proposed intervention).

Source: Author's elaboration.

Outcomes

(a) Analysis of Health Benefits to Public Transport Users Arising from Changes in Physical Activity

The World Health Organization (WHO 2000)[32] suggests that regular physical activity can result in the following health benefits:

- A 50% reduction in the risk of developing coronary heart disease (similar to not smoking).
- A 50% reduction in the risk of developing adult diabetes.
- A 50% reduction in the risk of becoming obese.
- A 30% reduction in the risk of developing hypertension.
- A 10/8-mmHg decline in blood pressure in people with hypertension (a similar effect to drugs).
- Reduced osteoporosis and falls in the elderly.
- Relief of symptoms of depression and anxiety.

The ALR scheme is expected to increase the overall level of active travel in the city by encouraging more people to walk and cycle to and from stations when accessing PT. The table below compares the projected total number of active kilometres walked to and from public transport under the Do Minimum scenario and two transport options.

[32] As recognised by Litman, T. (2012). Evaluating public transportation health benefits. Victoria, BC, Canada: Victoria Transport Policy Institute.

Table 20 Total active KM travelled, per day and across the population, when walking to and from PT (2051)

	Do Minimum	Separated LM	Street-running LR
Total active KM travelled to and from PT (walking, daily)	945,687	999,615	987,134

The results indicate that both transport options will generate an increase in the level of walking by encouraging individuals to engage with active modes when travelling to and from stations. An increase in the overall level of physical activity across the population is expected to generate numerous physical and mental health benefits for Aucklanders including:

- Enhanced physical fitness and reduced obesity rates within the city. This is particularly significant given that the rate of adult obesity has risen by 20% over the past decade, with a third of Tāmaki Makaurau Auckland adults currently classified as obese. Research suggests that obesity rates tend to be inversely related to use of alternative modes such as walking, cycling and public transit[33].
- Lower risk of cardiovascular diseases and strokes, diabetes, depression, anxiety and cancer across the population.

These benefits are anticipated to alleviate the burden on public health facilities and services attributed to a sedentary lifestyle. The promotion of physical activity and healthier living is expected to reduce the demand for healthcare resources related to sedentary behaviour.

The separated light metro option is expected to generate a marginally greater benefit than the street-running option in terms of health impacts. This is likely related to the fact that the separated light metro option presents a more efficient transport alternative which is expected to generate a more significant modal shift from vehicles to public transport. As such, it is anticipated that overall patronage will be higher under the separated light metro option and therefore more individuals are expected to engage with active travel to access the transport option.

However, since the differences in the total active distance travelled to and from public transportation among the options are only marginal, it is prudent to conclude that both options will result in a **slight positive health benefit**.

(b) Analysis of Health Benefits to Active Travel Users Arising from Changes in the Physical Environment

Complementary walking and cycling measures delivered in association with ALR are expected to encourage a higher number of people to engage with active travel as their primary form of travel. Table 21 below presents estimates of the change in total active kilometres travelled arising from changes in the physical environment. Estimates are presented for both the separated light metro and street running light rail schemes, in comparison to the Do Minimum scenario.

Table 21 Change in total active kilometres travelled under each transport option (2051)

	Separated LM	Street-running LR
Change in total active travel	27.19 km ('000,000s)	17.5 km ('000,000s)

[33] Litman, T. (2012). Evaluating public transportation health benefits. Victoria, BC, Canada: Victoria Transport Policy Institute

The above findings indicate that both options will promote an increase in the uptake of active travel methods through the delivery of complimentary walking and cycling measures. This, in turn, will generate significant health benefits among individuals that engage with active travel as a form of mobility. As demonstrated in the literature[34], an increase in neighbourhood walkability is associated with reduced symptoms of depression. Walking can alleviate emotional stress by enhancing individuals access to education and employment opportunities, fostering strong community bonds, and improving access to social and recreational activities.

Since complementary active travel interventions are only a sub-component of the scheme and are not expected to comprehensively alter Tāmaki Makaurau Auckland's existing active travel network, both options are expected to generate a **slight positive benefit.** The magnitude of impact is expected to be more significant under the separated light metro option due to anticipated land use changes enabling a denser urban form than the street-running scenario. A higher concentration of individuals, jobs and homes within the corridor will encourage higher overall active travel levels than under the street-running option.

(c) Analysis of the Prevention of Road Accidents and Casualties

The anticipated modal shift from private vehicles to public transport, as a result of the introduction of the scheme, is anticipated to decrease the total distance travelled by private vehicles annually, thus reducing the overall number of road crashes.

Table 22 presents estimates on the total annual number of road crash reductions that will occur under each transport option. The findings indicate that both options will lead to a reduction in the total annual road crash incidents in Tāmaki Makaurau Auckland. This is especially significant considering the recent decline in Tāmaki Makaurau Auckland's road safety record.

Table 22 Total annual road crash reductions under each transport option (2051)

	Separated LM	Street-running LR
Total Annual Road Crash Reductions	89	69

Based on these findings, both options will deliver similar social benefits through reducing the total overall costs of accidents for individuals, government and private businesses. Reducing the number of vehicle collisions will limit the individual costs borne by victims, friends and relatives, and will minimise losses to society by reducing overall medical and ambulance costs and impacts on net overall economic output.

The separated light metro option is expected to generate a slightly higher reduction in traffic crashes compared to the street-running option. The reduction in crashes is expected to be more significant because this option is anticipated to generate a larger modal shift from private vehicles to public transport than the street-running option, thus lowering the overall level of driving in a city.

However, since the differences in the total annual road crash reductions among the options are only marginal, it is prudent to conclude that both options will result in a **slight positive benefit** associated with crash rates.

[34] Berke, E. M., Gottlieb, L. M., Moudon, A. V., & Larson, E. B. (2007). Protective association between neighborhood walkability and depression in older men. Journal of the American geriatrics society, 55(4), 526-533.

(d) Summary of findings

The analysis of health-related outcomes entailed three components:

- Health benefits to PT users arising from changes in levels of physical activity.
- Health benefits to active travel users arising from changes in the physical environment.
- Prevention of road accidents and casualties.

At a scheme-wide level, the findings of the health-related outcomes analysis suggest that both transport options will deliver a **slight positive benefit**. Health benefits are expected to be realised by PT users through increasing levels of physical activity when travelling to and from stations. Benefits are also anticipated for active travel users through the delivery of complimentary walking and cycling measures in association with the Project. Finally, a modal shift from vehicles to public transport is expected to reduce the total annual number of road accidents.

While both options are expected to deliver similar benefits, the magnitude of impact is anticipated to be greater under the separated option. This option provides a more reliable, efficient transport service and is therefore expected to generate a more significant modal shift than the street running option. It also supports a denser urban form which will encourage a higher overall uptake in active travel. As such, the option is expected to perform slightly better in terms of delivering overall health benefits.

4. Distributional Impact Appraisal

4.1 Purpose

The World Health Organization (WHO) defines equity as: "the absence of avoidable or remediable differences among groups of people, whether those groups are defined socially, economically, demographically, or geographically".[35] Distributional and social equity considerations of the transport system refer to the distribution of impacts (benefits and costs) among members of the society and whether this distribution is appropriate[36].

The purpose of the Distributional Impact Appraisal (DIA) is to identify and evaluate groups that are expected to benefit and those that are likely to be burdened by the transport intervention. Particular attention is given to priority groups than may be disadvantaged socially or financially.

The DIA is complex because while there are several different types of equity and ways to characterise individuals, there lacks a standard methodology for their analysis. In addition, as recognised in the literature, equity is often not the core concern of mainstream transport project appraisals. Current understandings of equity impacts are fragmented across several disciplines, and relatively little work has been undertaken to define methods and techniques for assessing their effects in comparison with the so-called 'monetiseable impacts'.

Transport planning authorities and local governments are increasingly seeking to evaluate transport plans and policies from a distributional perspective. However, this process has proven to be difficult in practice. DIAs are usually over-simplified, and their evaluation is often limited by either the principle of proportionality[37] or by data availability. Furthermore, only a few countries, including the United Kingdom and Australia, have developed guidance frameworks for the inclusion of distributional impacts in transport policy appraisal.

According to Waka Kotahi guidance, equity impacts of transport service activities should be quantified wherever possible and reported as part of a transport evaluation. It is specifically recognised that "While an analysis of the distribution of benefits and costs among different groups of people is not required for economic efficiency analysis, evaluations of an activity should report the distribution of benefits and costs, particularly where they relate to the needs of transport disadvantaged populations. This reporting forms a part of the funding allocation process. When it is required, distributional effects should be reported separately from, but alongside, the Cost Benefit Analysis (CBA) results"[38]

Distributional impacts and implications are also recognised within the Land Transport Benefits Framework. However, no specific guidance relating to equity investigations is provided.

The Project is expected to generate a range of benefits and costs that will be disparately realised across different groups of individuals. The purpose of the DIA is to evaluate the distribution of benefits and burdens across key identified priority groups and communities in comparison to the rest of the population.

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[35] Davis, A., & Pilkington, P. (2019). A public health approach to assessing road safety equity—the RoSE cycle. *Measuring Transport Equity*, 159-170.

[36] Litman, T. (2017). *Evaluating transportation equity.* Victoria Transport Policy Institute.

[37] Relates to the effort that should be put into the analysis, which should be in proportion to the scale and importance of the proposal.

[38] Waka Kotahi NZ Transport Agency. (2023). *Monetised benefist ans costs manual.*

4.2 Methodology

The approach to the appraisal of distributional impacts of ALR is based on the UK Department for Transport (DfT) Transport Appraisal Guidance (TAG) unit A4.2 Distributional Impact Appraisal. This guidance represents best practice, providing expert advice for the equity assessment of transport projects. Experience has demonstrated that when this guidance is embedded in transport planning decisions, more effective and efficient appraisals are produced. The process has been developed over several years and has enabled the development of successful equity evaluations across a wide range of spending proposals.

Additional context and review have been taken from a recent report commissioned by Waka Kotahi investigating available methods for identifying and assessing the distributional impacts that may arise from transport interventions[39]. This research work aimed to identify a preferred method for use within the Waka Kotahi Monetised benefits and costs manual. It is worth noting that the recommended approach for the DIA relies extensively on the UK transport appraisal guidance.

Although UK guidance has been proven to represent good practice for the appraisal of equity impacts, it should be acknowledged that there is no widely universal standard methodology. Applying such guidance, this analysis has been supplemented with a more comprehensive baseline analysis developed to conduct an equity needs assessment for the Project.

In summary, the DIA is carried out in two phases. The **first phase** involves the completion of an equity baseline assessment for ALR (referred to as 'equity needs assessment'). It aims to identify the specific transportation needs of traditionally underserved communities and other important equity challenges in the area in relation to the nature of the Project.

The baseline equity analysis includes the following activities:

- **Identification of priority groups**: An analysis of the characteristics of people in the study area is undertaken through socio-demographic profiling at a disaggregated level (SA2 level). The proportion of people of low-income, different ethnic backgrounds and other protected characteristics is then evaluated for each small area in comparison to the national average to determine priority groups for inclusion in the DIA.
- **Description of existing structural inequalities to tackle in the area:** A high-level analysis of the urban challenges (e.g., risk of displacement, limited public transport, limited vehicle ownership) and historic inequalities (e.g., historic disinvestment, environmental justice concerns) is conducted for the area.
- **Analysis of the travel behaviours and preferences of different demographic groups:** Conducted using the Household Travel Survey[40]. This analysis also accounts for the travel patterns of different demographic groups in the project area.
- **Equity analysis of ALR:** Research is undertaken to generate an appropriate theoretical understanding of the equity impact of the project.

The **second phase** assesses the following eight distributional impacts using a three-step approach, as recommended in the UK Transport Appraisal Guidance:

[39] Torshizian, E., Byett, A., Isack, E., Fehling, A., & Maralani, M. (2022). Incorporating distributional impacts (equity) in the cost–benefit appraisal framework.
[40] New Zealand Household Travel Survey. 2022. https://www.transport.govt.nz/area-of-interest/public-transport/new-zealand-household-travel-survey/ (retrieved July 2023).

- **User benefits:** Including travel time savings for private vehicle and public transport users as well as vehicle operating costs and user charges where appropriate.
- **Noise impacts:** Defined as the effect of ALR on the acoustic environment (i.e. improvements or degradation in noise levels).
- **Air quality impacts:** Referring to changes in air pollution levels experienced by the local community. These impacts can either lead to a positive outcome, where pollution decreases and air quality improves, or a negative outcome, where pollution increases and air quality declines.
- **Safety impacts:** Defined as changes in transport-related accidents, serious injuries and deaths occurring as a result of the intervention.
- **Severance effects:** Covering the effects of ALR as a physical or psychological barrier separating communities of built-up areas.
- **Security impacts:** Related to the effects of ALR on overall safety and security levels for transport users.
- **Accessibility impacts:** Benefits or disbenefits associated with alterations in public transport accessibility to employment and other key destinations.
- **Personal affordability:** Defined as the impact on the cost of travel resulting from ALR.

Step 1 (Screening) is aimed at identifying the likely impacts for each indicator to determine which indicators will need further analysis through a full appraisal. Step 2 (Assessment) consists of a detailed spatial analysis to confirm the geographical area impacted by the intervention. In this step, priority groups and key amenities/trip attractors in the impact area are also identified. Finally, Step 3 (Appraisal) provides an assessment of the impact of the intervention on each social group. Further information about each step of the process is presented throughout the following chapters.

Step 1 – Screening Process

Each indicator is individually assessed using a screening proforma to determine if further appraisal is required. This step involves evaluating the potential impacts of the transport intervention on specific priority groups, with each indicator undergoing individual assessment.

The findings of the full screening proforma are presented in Appendix A. In summary, among the eight distributional impacts, the scheme is expected to influence every impact. This includes user benefits, noise, air quality, accidents, security, severance, accessibility, and personal affordability. These assessment categories have therefore been screened into the assessment.

Step 2a – Confirmation of areas impacted by the transport intervention

The initial screening provides a high-level overview of the broad areas that are likely to be impacted by the Project. In this step, an impact area is defined for each indicator to investigate the spatial effects in more detail. Robust evidence is provided to support the defined areas relevant to the DI appraisal.

Step 2b – Identification of priority groups in the impacted area

Analysis is undertaken to understand the characteristics of individuals living in the study area or travelling in identified impact areas. This analysis includes transport uses that are expected to undergo changes in generalised travel costs. It is conducted through a socio-

demographic profiling approach at a disaggregated level. Table 23 sets out the identification of priority groups across all indicators listed above.

Table 23 – Scope of socioeconomic analysis

Priority group	User benefits	Noise	Air quality	Safety	Security	Severance	Accessibility	Affordability
Household income	✓	✓	✓				✓	✓
Children (under 15)		✓	✓	✓	✓	✓	✓	
Young adults (15-24)				✓			✓	
Older people (70+)		✓		✓	✓	✓	✓	
Females					✓		✓	
People with a disability					✓	✓	✓	
Māori	✓			✓			✓	
Pacific peoples	✓			✓			✓	
Households without car access						✓	✓	
Households with dependent children							✓	

Source: Author's elaboration based on TAG Unit 4-2. Informed by discussions with Te Tiriti Partnerships

Step 2c – Identification of amenities in the impacted area

The concentration of social groups is based not only on resident population but also on the presence of amenities which may attract trips to the impact area. This may include schools, nurseries, parks and open spaces, health providers, care homes, marae, key employment sites, places of worship and places of gathering.

The local amenities which are likely to be used by priority groups have been identified through desktop analysis. The findings of this research are presented in Section 3.3. Key destinations of importance for Māori have validated by the Te Tiriti Partnerships Business Case Team.

Step 3 – Appraisal

An assessment score is presented for each relevant priority group under each indicator. The score is presented using a seven-point scale ranging from beneficial, through neutral, to adverse, as shown in Table 24.

Table 24 – General system for grading of DIs for each of the identified priority groups

Impact	Assessment
Beneficial and the population impacted is significantly greater than the proportion of the group in the total population	Large beneficial ✓✓✓
Beneficial and the population impacted is broadly in line with the proportion of the group in the total population	Moderate beneficial ✓✓
Beneficial and the population impacted is smaller than the proportion of the group in the total population	Slight beneficial ✓
There are no significant benefits or disbenefits experienced by the group for the specified impact	Neutral
Adverse and the population impacted is smaller than the proportion of the population of the group in the total population	Slight adverse ×
Adverse and the population impacted is broadly in line with the proportion of the population of the group in the total population	Moderate adverse ××
Adverse and the population impacted is significantly greater than the proportion of the group in the total population	Large adverse ×××

An assessment score is provided for each indicator and each associated priority group. In addition, a qualitative assessment is provided to describe the key impacts of each indicator. The analysis is summarised in the DI Appraisal Matrix presented in Section 7 of this report.

Key Assumptions and Limitations

There are a range of limitations associated with the DIA, including:

- Limited data availability for some DI indicators such as security poses challenges for conducting a detailed equity assessment. The security DI relies on several assumptions based on existing evidence of change and the importance of different elements of security to different priority groups.
- The DIA relies on assessments conducted by other workstreams (e.g. transport modelling, air quality specialists etc.). If the data is not available at a sufficiently disaggregated level, it may constrain the equity analysis.
- To ensure a proportionate approach, the DI assessment may at times evaluate a specific point in time (i.e. opening year). This provides a valuable snapshot of the equity impacts resulting from the project but may not capture the long-term or evolving nature of equity impacts.
- Evaluation methods often include quantitative and qualitative approaches which require expert judgement to complete. This could potentially result in a subjective interpretation of the results.

4.3 Equity baseline assessment

The purpose of the equity baseline analysis is to establish the baseline for understanding the existing equity conditions and challenges in Tāmaki Makaurau Auckland. It provides a comprehensive assessment of the current distribution of transport opportunities among different groups, including children, women, Māori and Pacific people and those with disabilites, among others.

The baseline assessment serves as a foundation for measuring the impacts and for setting mitigation strategies and other targeted interventions that will foster enhanced equity and fairness as a result of the project.

Identification of priority groups

Table 25 below summarises and compares socio-demographic information within the area[41] to the Tāmaki Makaurau Auckland region and the whole Aotearoa New Zealand.

Table 25 – Socio-demographic analysis

Priority Group	Data Source	Proportion in study areas	Proportion in Tāmaki Makaurau Auckland region	Proportion in Aotearoa New Zealand
Socio economic distribution (from lowest to highest income)	2018 New Zealand Index of Multiple Deprivation (IMD18)	18% (lowest)	20% (lowest)	20% (lowest)
		18%	17%	20%
		20%	20%	20%
		19%	20%	20%
		25% (highest)	22% (highest)	20% (highest)
Children (under 15)	2018 Census	17%	20%	20%
Young adults (15-24)	2018 Census	18%	14%	13%
Older people (70+)	2018 Census	5%	8%	10%
Females	2018 Census	49%	51%	51%
People with a disability	2018 Census	5%	5%	7%
Māori	2018 Census	7%	9%	13%
Pacific Peoples	2018 Census	16%	12%	6%
Households without car access	2018 Census	19%	7%	7%
Households with dependent children	2018 Census	39%	50%	42%

Overall, the proportions of potential priority groups in the scheme area are broadly similar to those at the national and regional levels. However, the following differences have been identified:

[41] Defined in the DIA as in the context analysis and the Social and Cultural Strategy. The study area made up of six geographical areas or community clusters (City Centre: Isthmus, Mt Roskill: Onehunga, Māngere and Auckland Airport) along the route.

- The proportions of children and older people are lower than the regional and national average. On the contrary, there is a higher-than-average proportion of young adults (15-24 years old) in the study area.
- The proportion of ethnic groups living in the study area differs from the national and regional data. In the study area, there are fewer people reported to be Māori (7%) and more reported Pacific peoples (16%).
- Census data suggests that the proportion of people with no-car living in the study area (19%) is significantly higher than regional (7%) and national levels (7%).
- The proportion of households with dependent children (39%) is similar to the national average (42%), but lower than regional levels (50%).
- There is a higher proportion of high-income individuals in the study area (25%) than the regional and national average (20% and 22%, respectively). Likewise, the representation of low-income individuals in the study area (18%) is slightly lower than than regional and national averages (both at 20%).

While the proportion of certain priority groups within the study area (women, households with dependent children and people with a disability) are mostly in-line with regional and national numbers, the findings of the baseline assessment do not imply that these groups should be excluded from the equity assessment. Rather, the findings suggest there are notable differences in terms of age, ethnicity and car availability which should be accounted for as additional considerations in the equity analysis.

A detailed analysis for each of the six identified geographic areas of importance is presented in Appendix B. The main conclusions of the spatial analysis are as follows:

- High-income earners are concentrated in the city centre (including along the city fringe) while the more socioeconomically challenged communities reside closer to the Airport.
- There is a low concentration of children in the city centre, and a higher concentration around Māngere and the Airport.
- Young adults are concentrated in the city centre.
- There is a relatively low proportion of elderly individuals within all areas.
- The city centre has a slightly lower relative concentration of females. All other areas have close to a 50% gender distribution.
- The concentration of individuals with disabilities is close to the national average in all areas.
- There is a relatively high concentration of Māori around Māngere but the proportion is still below the national average.
- The airport area has a very small population, with only 573 residents at Ihumatao. 38% (216) of those who live at Ihumatao identified themselves as Māori in the 2018 census. However, this accounts for only 0.2% of Māori population in Tāmaki Makaurau and does not suggest there is a high concentration of Māori in the area.
    - Looking at Māori by descent data from the census 2018, false representation of a large Māori community in the Airport area can also be seen due to its small population sample taken by the census 2018. In the Airport area, there are more people who identified themselves as Māori by Descent (51%| 321) than Non-Māori descent (48 %| 297). In Tāmaki Makaurau Auckland typically, Māori by descent represents 13% when non-Māori descendant accounts 85%. This overrepresentation of Māori in the airport area is due to small population in the Ihumatao and must be treated with caution.

- Pacific Peoples are more concentrated in Māngere and make up a sizable proportion of the population in Mt Roskill, Onehunga and airport.
- The city centre has a very high proportion of households without a car (over half). Car ownership levels are similar to the national average in all other areas.
- There is a higher concentration of households with dependent children in Mount Roskill and Māngere, and a lower concentration within the city centre. The proportion of households with dependent children is close to the national average in all other areas.

In addition to the socio-demographic profile, an equity index has been developed with the intention of providing an overall measure of potential cross-cutting disadvantages that are experienced by people. The equity index considers the intersectionality of the following socio-economic variables:

- Income
- Age
- Gender
- Physical and mental difficulties
- Ethnicity
- Availability of vehicles
- Dependent children.

These variables have been compared to the national average to identify areas (see Figure 3) with a concentration of people who experience multiple challenges.

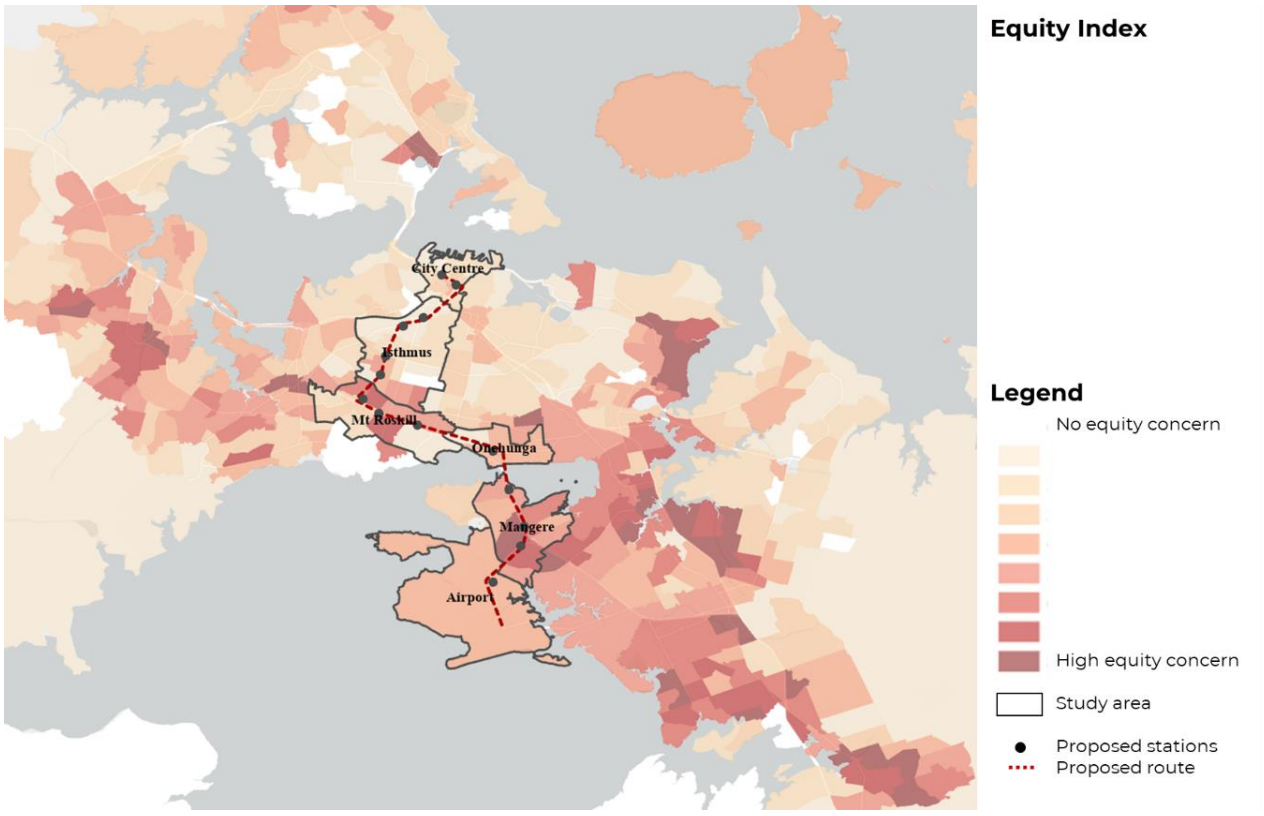


Figure 3 – Equity Index map

Figure 3 presents an unequal spatial distribution, highlighting certain pockets which experience multiple equity concerns. The areas along the proposed ALR corridor with the highest equity concerns include **Mt Roskill, Onehunga, Māngere and Airport**. The proposed stations located within these areas include Wesley, Puketāpapa, Onehunga, Māngere Bridge, Te Ararata, Māngere Town Centre and Landing Drive. The intersectionality

analysis suggests there are notable differences between geographical areas which should be accounted for in the equity analysis.

Transport equity and equity priority areas identified by Auckland Transport

The equity priority areas have been identified in Auckland Transport's Future Connect 2023 Main Report (2023). In line with previous analysis, Auckland Transport (2023) defines equity priority areas as areas "*where multiple overlapping, vulnerable populations experience poor outcomes across more than one domain*".

Auckland Transport acknowledges the following three domains of transport equity:

- **Local Access**: The ability to get to local destinations within a reasonable distance, using safe and appropriate infrastructure. For example, *"I can't easily get to my essential places in my neighbourhood"*.
- **Regional Access**: The ability to get to work and visit people from where you live, using various modes of transport. For example, *"I can't access people and jobs across the region using various modes"*.
- **Transport system disbenefits**: The negative impacts of the transport system that people experience, like noise, road safety hazards and severance. For example, *"The movement of others negatively impacts my community"*.

Table 26 indicates the areas along the proposed alignment that have been identified the priority areas by Auckland Transport.

Table 26 Equity priority areas (defined by AT) and the proposed stations

Proposed station	Option	Local access	Regional access	Transport system disbenefits
Karangahape	Street-running	-	-	Yes
Wesley	Both	-	-	Yes
Puketāpapa	Both	-	-	Yes
Hayr Road	Both	-	-	Yes
Onehunga	Both	Yes	-	Yes
Māngere Bridge	Both	Yes	-	Yes
Te Ararata	Both	Yes	-	Yes
Māngere town centre	Both	-	-	Yes

Auckland Transport's equity priority areas (shown in Table 26) are broadly in line with the equity index (shown in Figure 3) which highlights areas of intersectional disadvantage based on socio-economic status and personal identity. This confirms that priority groups typically reside within equity priority areas and are therefore faced with significant transport challenges and disadvantages as a consequence of decisions made in the past- what is commonly referred to as structural inequality.

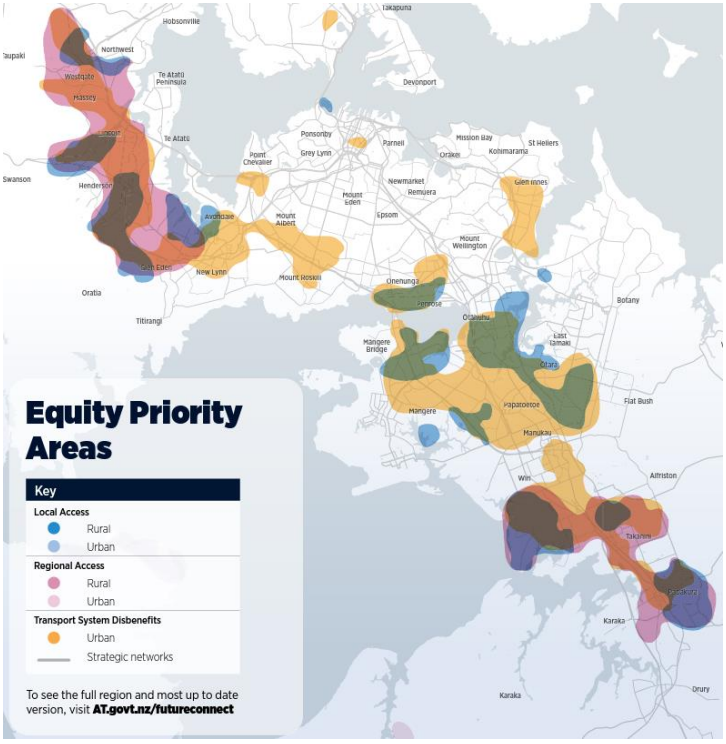


Figure 4 Equity Priority Areas identified by Auckland Transport

Description of the existing structural inequalities within the study area

Narratives behind selection of the priority group (ethnicity)

In the 18th and 19th centuries, European thinkers assumed the world's known diverse populations could be classified as 'races'. Marked by perceived physical differences, races were believed to have unalterable social and psychological characteristics. These ideas supported hierarchical notions of European (white Caucasian) superiority over other races[6].

Intolerance towards indigenous people

Intolerance towards indigenous people is typical of colonial societies. Māori were the subject of racism and discrimination as Europeans settled in Aotearoa New Zealand in the 19th century[6].

For example, from 1926 Māori typically received 25% less than the full rate for old-age and widows' pensions, which continued into the 1940s. There was also discrimination by hotel owners and landlords, and sometimes at swimming pools and cinemas[6].

Intolerance towards pacific peoples

The first significant wave of migrants from the Pacific Islands began in the late 1950s. As the Aotearoa New Zealand manufacturing sector expanded, employers turned to the Pacific. Migrants from Cook Islands, Niue and Tokelau arrived as Aotearoa New Zealand citizens. Technically, Samoans and Tongans needed approval to live and work in Aotearoa New Zealand[6].

The economic impact of the 1973 oil crisis and growing unemployment provoked a backlash against these recent arrivals. Pacific Islanders were blamed for the deterioration of inner-city suburbs, and for law-and-order problems. Under the 1972–75 Labour government, police and immigration officials sought to identify and deport those who had overstayed

their work permits. Raids on the homes of alleged overstayers – usually at dawn, to catch people before they woke – began in 1974[6].

Consequence of systematic injustice

Historic systematic injustice of the past and present has a significant consequence on the way we currently live. Systematic injustice is often reflected by socio-economic disparities. However, it is important to note that socio-economic status is also affected by age, gender, regional differences and disability. According to the 2018 Census, the median income of Māori and Pacific Peoples aged 15 and over is well below the national median income level.

Narratives behind the selection of priority group (ethnicity)

Acknowledging how historical injustice is significantly affecting their current socio-economic status, Māori and Pacific People have been included in the priority group in this assessment.

Analysis of the travel behaviours and preferences of different demographic groups

The Household Travel Survey (HTS) dataset offers valuable insights into the travel behaviour patterns of various demographic groups in the Tāmaki Makaurau Auckland Region, contributing to the equity analysis. In particular, the following data has been reviewed:

- Public transport usage by age group
- Average number of trips by gender
- Car availability, public transport frequency, trip duration and average distances by income level

The results of the HTS data set are presented for these figures in Figure 5.

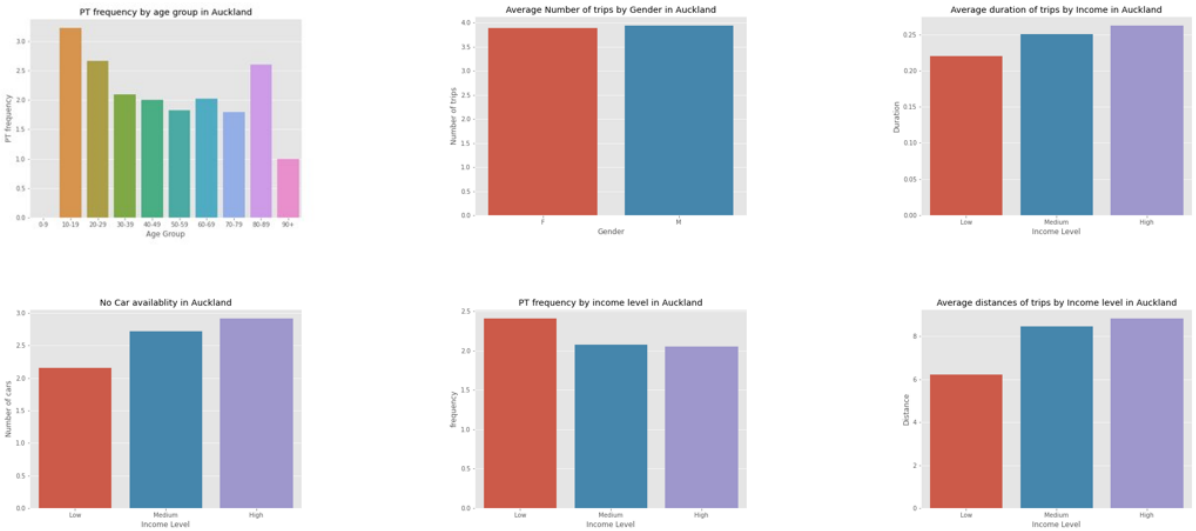


Figure 5– Indicators from the HTS

A summary of the conclusions derived from this analysis is as follows:

- Public transport usage appears to be more prevalent among individuals under the age of 19, while it is less significant for those over 90 years old. Education and the ability to travel with others seem to be major factors influencing PT usage.
- Higher income groups are more likely to own a car and are therefore less reliant on PT. Ton average, they tend to undertake longer trips in terms of distance and

duration. Conversely, low income households are more likely to be dependent on public transport.

- Aotearoa New Zealand ranks fourth in the world for per-capita car ownership. On average, low income households in Auckland still have access to a car.
- There appears to be no significant difference in the number of PT trips taken by men and women.

Based on the above, it can be concluded that **diverse travel patterns can be observed across different income groups**. These findings should be taken into account in the equity analysis.

Equity objectives of ALR

Equity is referenced twice within Investment Logic Map (ILM) for ALR:

Table 27 ILM Equity References

Section	Reference
Problem 1	Poor integration of urban and transit systems suppresses the supply of quality transit-supportive development, increasing **inequities** and reducing social cohesion.
Objective 3	A rapid transit service that: • Is attractive, reliable, affordable, frequent, safe and **equitable.** • Is integrated with the current and future public transport network. • Improves access to jobs, education and other opportunities.

Recent literature[42] suggests that investment in light-rail transit has become a key strategy for tackling environmental, economic and social issues in large metropolitan areas over the last decade. The equity goals of light-rail systems are typically focused on promoting accessibility and inclusivity for different social groups. These systems are also expected to contribute to the reduction of disparities by ensuring that benefits and costs are fairly distributed among protected populations. Some common equity goals of light rail schemes include:

- To positively affect mobility patterns by reducing car dependency and increasing public-transit ridership.
- To significantly improve local neighbourhoods and offer substantial economic benefits to residents by granting them increased access to various opportunities.
- To promote a fair public transport system, ensuring that benefits and disbenefits are distributed equitably across different segments of the population.
- Increasing employment and economic opportunities by facilitating access to key destinations, services and social networks such as healthcare, educational and recreational facilities and areas of employment opportunities.
- Addressing disparities in transport accessibility through the establishment of an affordable and inclusive transport system that prioritises areas with limited access to public transportation, especially benefiting low-income communities.

ALR represents a unique opportunity to reduce systematic discrimination and systemic differences in transport project outcomes among different groups with different capabilities and needs. A primary goal of the Project should be to address inequities resulting from the inadequate integration of transport interventions and land use outcomes. Simultaneously, it should strive to enhance social inclusion and enable people to actively participate in social and economic activities. Ensuring there is no discrimination against specific groups, particularly those that have been identified as priority groups, is

[42] Villafuerte-Diaz, J., Victoriano-Habit, R., Soliz, A., & El-Geneidy, A. (2023). Who Does Light Rail Serve? Examining Gendered Mobilities and Light-Rail Transit in Montreal, Canada. Transportation Research Record.

paramount. By achieving these objectives, ALR can significantly contribute towards creating a more equitable and accessible transportation experience for all individuals.

Equity Baseline

The baseline analysis presents a benchmark against which direct and indirect impacts of the transport intervention can be predicted and analysed. The primary findings of the detailed analysis are summarised below in connection with each of the predefined activities.

Table 28 Equity baseline

Activity	Baseline highlights
Identification of priority groups in the study area	Main findings from the socio-economic profile indicate that proportions of potential priority groups in the scheme area[43] are broadly similar to national and regional averages. However, on average, the following differences have been observed: • The proportions of children and older people are lower than the regional national average. On the contrary, there is a higher-than-average proportion of young adults (15-24 years old) in the study area. • The diversity of people living in the study area differs from the national and regional data. In the study area, less people reported to be Māori (7%) and more reported to be Pacific peoples (16%). • Census data showed that the proportion of people with no-car living in the study area (19%) is significantly higher than the regional (7%) and national average (7%). • The proportion of households with dependent children (39%) is similar to the national average (42%), but lower than the regional data (50%). • Individuals in the study area generally have a higher income compared to national and regional scales (25% of the population are high-income earners versus 20% and 22% respectively). Additionally, the representation of individuals with the lowest income in the study area (18%) is slightly lower than the corresponding figures from regional and national data (20%). In summary, the findings of the socio demographic profile do no suggest that women, households with dependent children and people with a disability should not be considered as a priority group given the concentration of these social groups based on resident population. In contrast, demographic results suggest notable differences in terms of age, ethnicity and car availability, which should be accounted for in the equity analysis. The equity index highlights certain geographic pockets with particularly pervasive equity concerns. These areas include Mt Roskill, Onehunga, Māngere and the Airport.
Description of existing structural inequalities to tackle in the area	Systemic historical injustices often manifest in socio-economic disparities relating to health, education, income, investment in communities, and access to jobs, housing, and basic needs. While race can certainly be correlated with socio-economic disparities through the denial of access to systems of power, it is important to note that age, gender, regional differences, and disability may

[43] Scheme area defined in the DIA as in the context analysis and the Social and Cultural Strategy. The study area made up of six geographical areas or community clusters (City Centre: Isthmus, Mt Roskill: Onehunga, Māngere and Auckland Airport) along the route.

Activity	Baseline highlights
	also be factors in unjust outcomes. The main findings of this analysis are summarised below: • The vulnerability index[44] (health, education and transport access) reveals that people living in the south of Tāmaki Makaurau Auckland have more difficulty when accessing key services. • The PTAL map[45] reveals poor public transport provision and more fatal crashes registered predominantly in the south of Tāmaki Makaurau Auckland. Similarly, most of the future corridor projects are not expected to be developed in South Tāmaki Makaurau Auckland. • Māori, as individuals and communities, were the subject of racism and discrimination as Europeans settled in Aotearoa New Zealand in the 19th century. This continued discrimination significantly impacts the economic opportunities for Māori to thrive. • It is recognised that Pacific people have experienced systematic discrimination throughout history. For example, in the past, pacific peoples have been accused of contributing to the decline of the inner-city suburbs as well as various law-and-order issues. The initial findings suggest that there are persistent inequalities in Tāmaki Makaurau Auckland which are of particular importance for Māori and Pacific population and those living in South Tāmaki Makaurau Auckland.
Travel behaviours and preferences of different demographic groups	The Household Travel Survey (HTS) dataset offers valuable insights into the travel behaviour patterns of various demographic groups in the Tāmaki Makaurau Auckland Region, contributing to the equity analysis. High level findings are as follows: • Public transport usage appears to be more prevalent among individuals under the age of 19, and less significant for those over 90 years old. Education and traveling with others seem to be major factors influencing PT usage. • Aotearoa Higher-income groups are more likely to own a car and are less reliant on PT. They tend to undertake longer trips in terms of distance and duration. Conversely, low-income households are more likely to depend on public transport. • New Zealand ranks fourth in the world for per-capita car ownership. On average, low-income households in Tāmaki Makaurau Auckland have access to a car. • There appears to be no significant difference in the number of trips taken between women and men. These findings suggest that the diverse travel patterns observed among different income level groups should be taken into account in the equity analysis.
Analysis if the equity goals associated with ALR	Some common equity goals of light rail schemes are: • To positively affect mobility patterns by reducing car dependency and increasing public-transit ridership. • To significantly improve local neighbourhoods and offer substantial economic benefits to residents by granting them increased access to various opportunities. • To promote a fair public transport system, ensuring that benefits and disbenefits are distributed equitably across different segments of the population.

[44] Gee and Nakamura (2023). "Equity in the built environment" – Arup
[45] Gee and Nakamura (2023). "Equity in the built environment" – Arup

Activity	Baseline highlights
	• Increasing employment and economic opportunities by facilitating access to key destinations, services and social networks such as healthcare, educational and recreational facilities and areas of employment opportunities. • Addressing disparities in transport accessibility through the establishment of an affordable and inclusive transport system that prioritises areas with limited access to public transportation, especially benefiting low-income communities. ALR represents a unique opportunity to reduce systematic discrimination and systemic differences in transport project outcomes among different groups with different capabilities and needs. Equity should be a primary goal of the Project and ensuring there is no discrimination against specific groups, especially those identified as priority groups, is paramount. By achieving these objectives, the system can contribute significantly to a more equitable and accessible transportation experience for all individuals.

4.4 Distributional Analysis

Safety

Introduction

Transport interventions have the potential to alter the risk of individuals, including non-users, being injured or killed in accident. The ALR will reduce the total distance travelled by vehicles (measured as volume of vehicle kilometres travelled or VKT) on the road network, consequently encouraging greater public transport usage. This shift is expected to yield a reduction in the number of accidents, as journeys taken on public transit generally exhibit lower overall safety risks compared to equivalent trips in private vehicles.

According to Vision Zero for Tāmaki Makaurau Auckland[46], the following communities and groups of people are more at risk on the Auckland transport network:

- People living in lower income areas

  People living in urban south, urban west and rural areas.
- Children living in the most socio-economically challenged areas, who have a three times higher injury rate than children living in the least deprived areas The injury rate is also higher for Māori and Pacific children in these communities.
- Senior citizens aged 70 years and over.
- Māori residents in Tāmaki Makaurau Auckland, who experience a significantly higher risk of road traffic injury than any other ethnicity group at all ages.

Other priority groups with higher accident risks include pedestrians, cyclists and young male drivers due to various factors including vulnerability, inexperience and risky behaviour.

Approach

The Project will reduce the total volume of vehicle kilometres travelled (VKT) on the road network, generating a range of substantial advantages beyond direct emissions reductions.

[46] Vision Zero for Tāmaki Makaurau. A Transport Safety Strategy and Action Plan 2030.

Most transport-related accidents, injuries and deaths occur on the road network and transport interventions which reduce VKT can reduce the risk of individuals, including non-users, being injured or killed in an accident.

In light of this, and due to the lack of modelling outputs which directly assess the scheme's impact on collisions on specific road links, distributional safety impacts will be assessed using VKT outputs which compare the Do Minimum scenario to the two transport options. This analysis is overlaid against the socioeconomic profile of each geographic area to provide a spatial description of the distribution of safety benefits across different priority groups.

The analysis also uses the Crash Analysis System (CAS), managed by the Waka Kotahi NZ Transport Agency, which captures information on where, when and how road crashes occur. The data has been analysed for the years spanning 2018 to 2022, focusing on the quantity and location of accidents which result in casualties, slight injuries, serious injuries, and fatal incidents.

Outcomes

Step 1 Screening

One of the objectives set out in the ALR Investment Logic Map (ILM) is to provide a rapid transit service that: is attractive, reliable, affordable, frequent, **safe**, and equitable.

Certain groups face higher accident risks due to various factors including vulnerability (e.g., pedestrians and cyclists are more susceptible due to their lack of protective barriers whilst older people may be physically vulnerable) or inexperience (e.g., young male drivers may have less driving experience and tend to engage in riskier driving behaviours).Therefore, it is appropriate to examine the affected area more closely to understand the changes in safety levels among priority groups following the introduction of the Project.

Step 2 Assessment

Step 2a: Confirmation of areas impacted by the transport intervention

The study area for safety is defined as areas which experience a significant change (>10%) in any of the following:

- Vehicle flow
- Speed
- Heavy goods vehicle flow
- Number of pedestrians, cyclists, or motorcyclists

Separated light metro

Applying these criteria, the study area for the separated light metro is defined in Figure 6. It includes links across the visualised area, with a notable focus on the city centre and proximity to stations. As shown, a majority of the affected links experience a decrease in traffic.

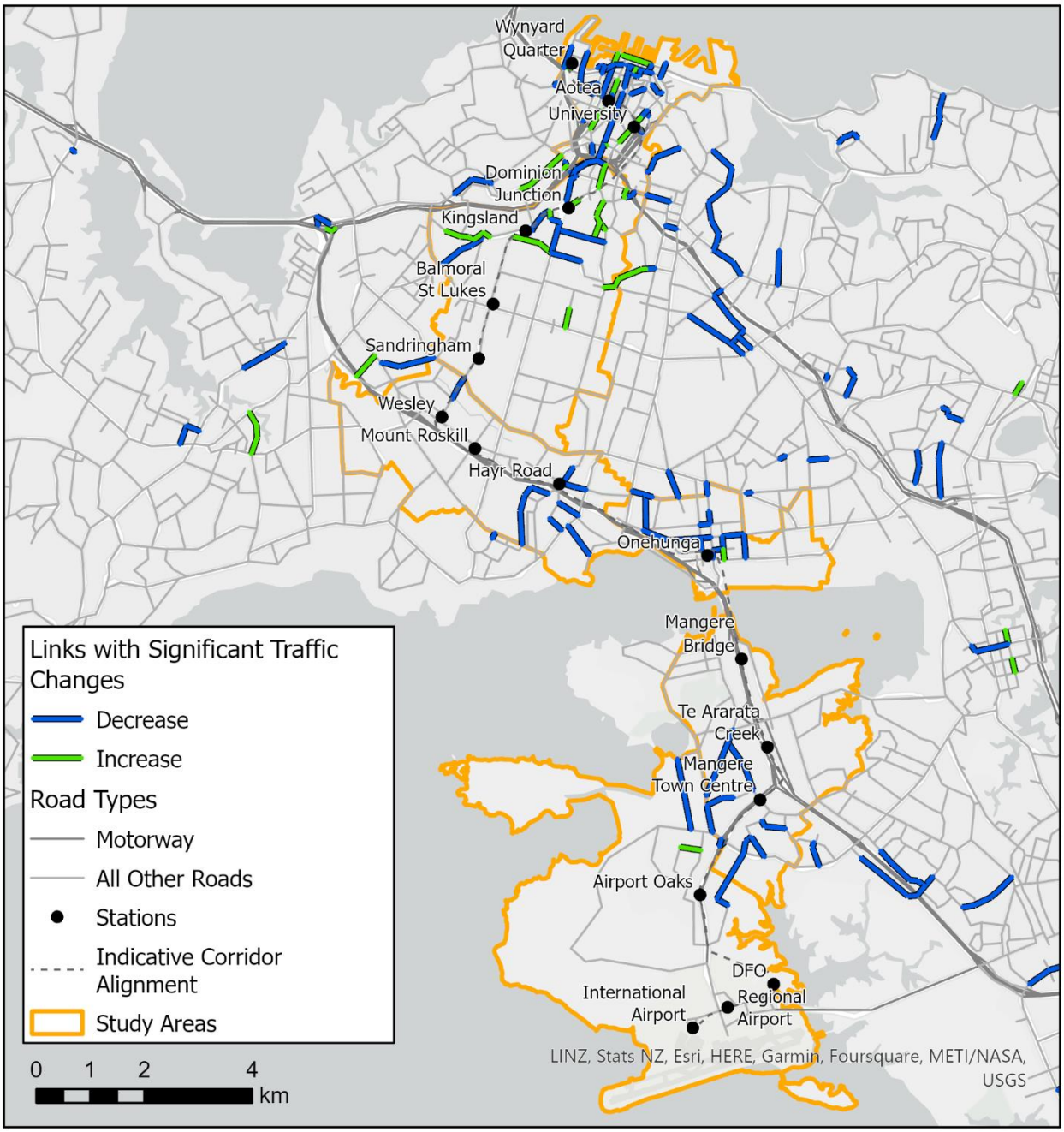


Figure 6 – Separated Light Metro safety study area

Street-running option

The safety impact area for the street-running option is presented in Figure 7. The impact area includes a greater number of links compared to the separated option. Significant traffic variations occur between the city centre and Hayr Road station, primarily because the option involves running the transit line along the street.

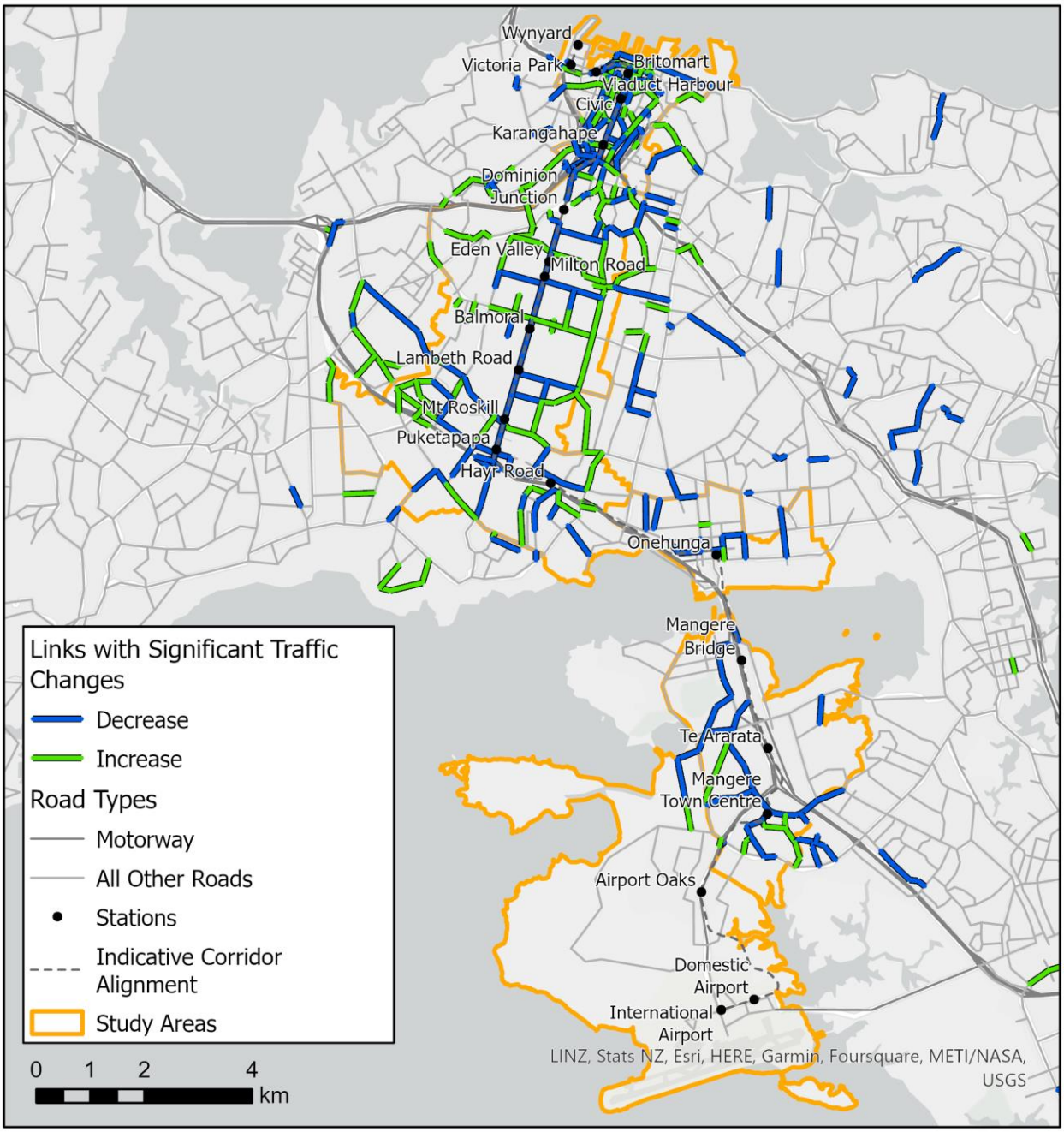


Figure 7 – Street-running metro safety impact area

Step 2b: Identification of social groups in the impact area

The identification of priority groups has been completed using the Crash Analysis System (CAS) database. Priority groups for the safety analysis include children, older people, and Māori. Considering their vulnerability in traffic, the following additional user groups have been included: pedestrians, cyclists, those with mobility impairments (including wheelchair and mobility scooter users), and male drivers.

Separated light metro

Tāmaki Makaurau Auckland, the most populous city in Aotearoa New Zealand, witnessed 31% of all minor, serious, and fatal crashes across the entire country between 2018 and 2022. The analysis of priority groups consists of comparing the proportion of crashes involving the potential priority groups in the safety impact area against the corresponding regional averages.

Table 29 shows the proportion of priority group populations within the defined safety impact area. The analysis suggests that pedestrians and cyclists are involved in a higher-than-average number of injury and fatal accidents, while all other priority groups closely align with the regional average.

Specific consideration should be given to the fact that significantly more crashes in the study area involve Pacific and Māori people than the regional average. As a result, these ethnicity groups have been also included in the analysis. For a more comprehensive examination of the safety risks linked to these communities, please refer to Step 2c.

Table 29 – Separated light metro priority group distribution in safety impact area (2018-2022)

Priority group	Proportion in safety impact area	Proportion in study areas	Proportion in Auckland Region
Children (under 15)	6%	5%	5%
Older people (70+)	5%	5%	5%
Māori	**10%**	9%	9%
Pacific peoples	**10%**	12%	7%
Pedestrians	**17%**	3%	7%
Cyclists	**9%**	6%	4%
Wheeled pedestrian (wheelchairs, mobility scooters)	1%	1%	0%
Young male drivers (16-24)	14%	15%	14%

Street-running option

Table 30 presents the proportion of priority groups in the safety impact area for the street-running option. Again, pedestrians and cyclists are more frequently injured or fatally harmed that compared to the regional average. While the variation in accident rates is not substantial for Māori , they have been included in the analysis alongside Pacific people to maintain consistency across both options.

Table 30 – Street-running metro priority group distribution in safety impact area (2018-2022)

Priority group	Proportion in safety impact area	Proportion in study areas	Proportion in Auckland Region
Children (under 15)	5%	5%	5%
Older people (70+)	5%	5%	5%
Māori	**8%**	9%	9%
Pacific peoples	**10%**	12%	7%
Pedestrians	**15%**	3%	7%
Cyclists	**10%**	6%	4%
Wheeled pedestrian (wheelchairs, mobility scooters)	1%	1%	0%
Young male drivers (16-24)	14%	15%	14%

Step 2c: Identification of amenities in the impact area

This section[47] provides a closer examination of the safety risks (frequency of severe and fatal crashes in the period of 2018-2022) linked to Māori and Pacific Peoples. Figure 8 and Figure 9 show the locations where crashes have frequently occurred in relation to relevant social facilities for Māori and Pacific Peoples' community and the proposed options.

(a) Analysis for Māori people

In total, 8% to 10% of serious and fatal crashes occurring in the impact area involve Māori people.

Separated light metro

There are two clusters along the separated option which experience a high proportion of serious and fatal crashes: the area around Wesley and Puketāpapa stations, and Māngere Bridge (between Māngere Bridge station and Te Ararata station). Most of these crashes occurred on the Southern Motorway. However, the crash cluster between Māngere Bridge and Te Ararata station is located along Walmsley Road and Favona Road.

Street-running option

There are small crash clusters along the street-running option alignment at the following locations: Lambeth Road station, Mt Roskill station, and Puketāpapa station. These crashes occur on Dominion Road, where light rail is proposed to operate as a street-running system.

Figure 8 illustrates the frequency of crashes involving Māori people and the location of relevant social facilities for the community.

[47] This analysis is based on Waka Kotahi Transport Agency's Crash Analysis System (CAS) data. CAS records all traffic crashes as reported to the Transport Agency by the NZ Police. It should be noted that not all crashes are reported to the NZ Police. Reporting rates tend to rise with the severity of the crash. For this reason, this analysis exclusively includes serious and fatal crashes, as they are more likely to be documented in the database compared to minor crashes.

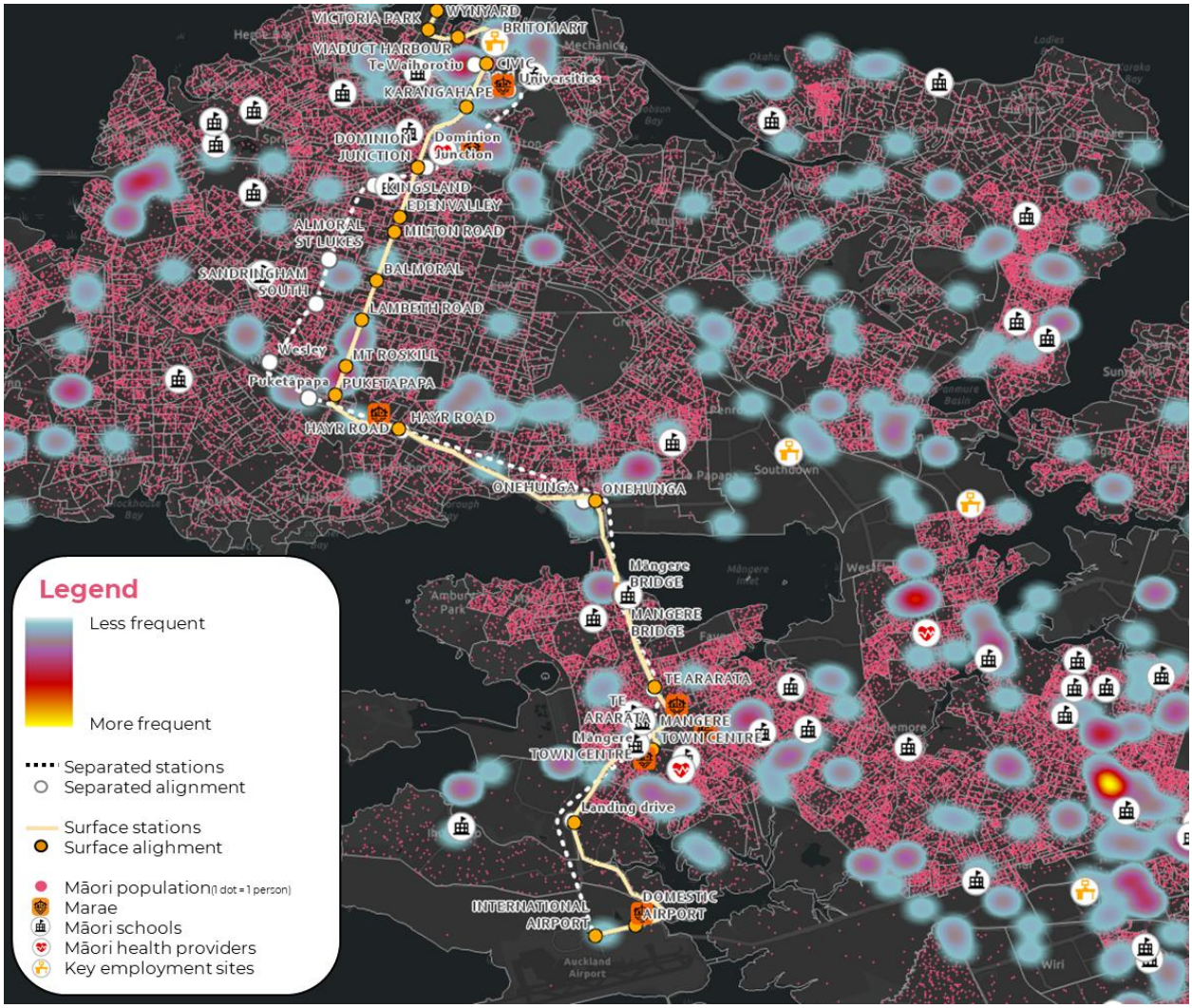


Figure 8 – Severe and fatal crashes involving Māori people and social facilities

(b) Analysis for Pacific Peoples

In total, 10% of serious and fatal crashes occurring in the impact area involve Pacific people.

Separated light metro

There are two clusters along the separated option which experience a high proportion of serious and fatal crashes: Wesley and Puketāpapa stations, and Māngere Bridge (located north of Māngere Bridge station.) Most of these crashes occur on the Southern Motorway.

Wesley station and Māngere Bridge station will be placed in areas where may residents identify as Pacific (32% and 21% respectively). As such, there are many social facilities for Pacific Peoples within these areas.

Street-running option

There are small crash clusters along the street-running alignment, specifically around Lambeth Road station, Mt Roskill station, and Puketāpapa station. Crashes have historically occurred along Dominion Road, where the street-running option is proposed to operate.

Figure 9 illustrates the frequency of crashes involving Pacific peoples and the relevant social facilities for their community. As shown by the map, the separated option serves

areas with a high number of social facilities for Pacific peoples.
Simultaneously, a high number of crashes involving Pacific peoples occurs in this area, especially around Puketāpapa station, with the majority of crashes occurring on the Southwestern Motorway.

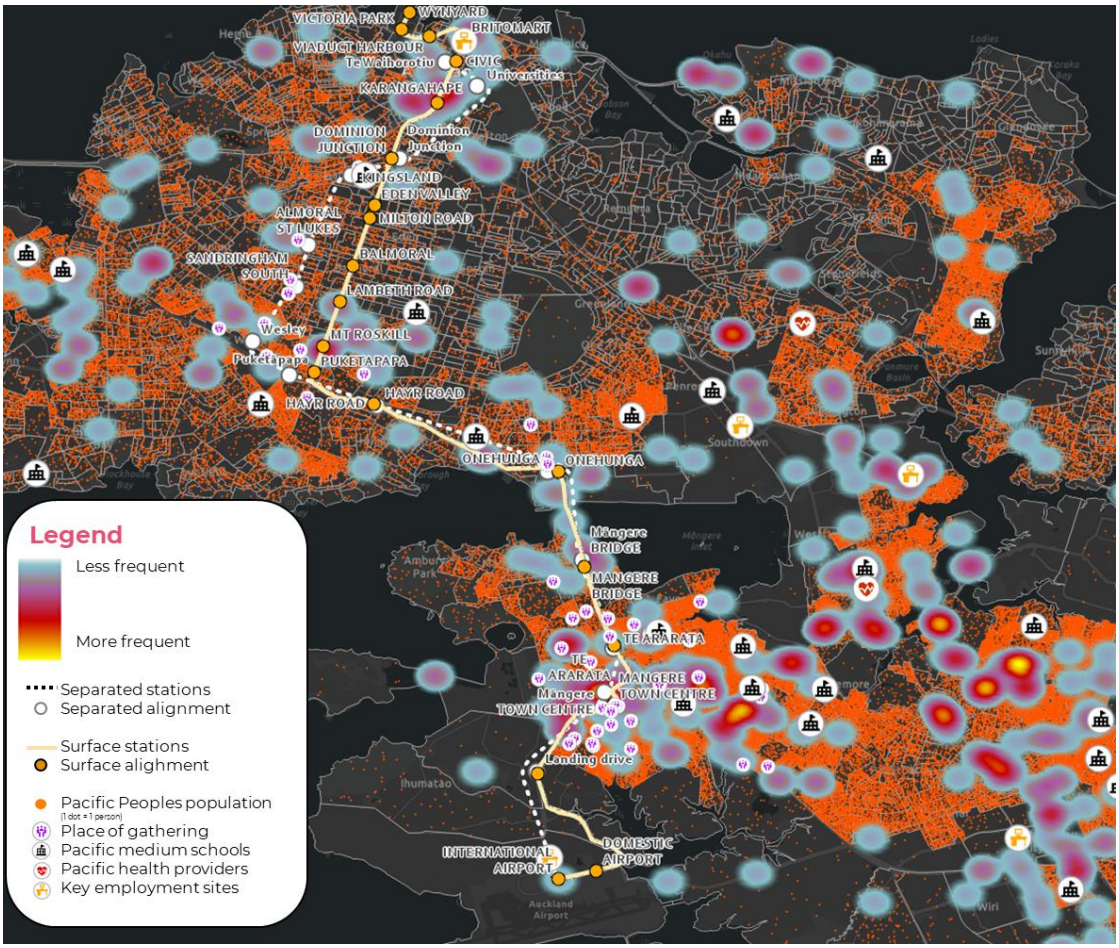


Figure 9 – Severe and fatal crashes involving Pacific people and social facilities

Step 3 Appraisal of impacts

Separated light metro

Table 31 presents the full appraisal of distributional safety impacts for the separated option. The table also profiles the CAS casualties by road user type as a means of identifying the baseline conditions in terms of typology for the assessment.

The findings suggest that more casualties occur on links that are expected to experience a reduction in traffic compared to those that are expected to experience an increase. This implies there is a higher likelihood of an overall reduction of casualties within the impact area, resulting in a moderately beneficial assessment for all priority groups.

Table 31 Estimated change in casualties between Existing and Separated option

Priority Group	Links with >10% Increase in Traffic		Links with >10% Decrease in Traffic		Net Difference		Total		Assessment
	Casualties	%	Casualties	%	Casual-ties	%	Casual-ties	%	
Children (under 15)	7	4%	31	6%	24	7%	38	6%	Moderate beneficial
Older people (70+)	4	3%	30	6%	26	7%	34	5%	Moderate beneficial
Māori	23	14%	43	8%	20	6%	66	10%	Moderate beneficial
Pacific peoples	14	9%	57	11%	43	12%	71	10%	Moderate beneficial
Pedestrians	28	18%	87	17%	59	16%	115	17%	Moderate beneficial
Cyclists	22	14%	41	8%	19	5%	63	9%	Moderate beneficial
Wheeled pedestrian*	1	1%	5	1%	4	1%	6	1%	Moderate beneficial
Young male drivers (16-24)	22	14%	72	14%	50	14%	94	14%	Moderate beneficial
Total	159	100%	521	100%	362	100%	680	100%	
All priority groups	*98*	*62%*	*289*	*55%*	*191*	*53%*	*387*	*57%*	

"" Wheeled pedestrian includes wheelchairs, mobility scooters.*

Street-running option

The safety assessment for the street-running option is presented

Table 32. Again, the net overall impact is positive for all priority groups and the overall

Priority Group	Links with >10% Increase in Traffic		Links with >10% Decrease in Traffic		Net Difference		Total		Assessment
	Casual-ties	**%**	**Casual-ties**	**%**	**Casualties**	**%**	**Casual-ties**	**%**	
Children (under 15)	32	6%	38	5%	6	3%	70	5%	Moderate beneficial
Older people (70+)	26	5%	46	6%	20	9%	72	5%	Moderate beneficial
Māori	40	7%	64	8%	24	11%	104	8%	Moderate beneficial
Pacific peoples	45	8%	88	11%	43	20%	133	10%	Large beneficial
Pedestrians	86	15%	118	15%	32	15%	204	15%	Moderate beneficial
Cyclists	61	11%	67	9%	6	3%	128	10%	Slight beneficial
Wheeled pedestrian*	3	1%	8	1%	5	2%	11	1%	Moderate beneficial
Young male drivers (16-24)	82	15%	111	14%	29	13%	193	14%	Moderate beneficial
Total	560	100%	780	100%	220	100%	1340	100%	
All priority groups	*290*	*52%*	*421*	*54%*	*131*	*60%*	*711*	*53%*	

assessment is concluded to be moderately beneficial. Compared to the CAS profile, Pacific peoples experience a larger proportional impact while cyclists experience a smaller proportional impact.

Table 32 – Street-running metro safety appraisal by priority group

Priority Group	Links with >10% Increase in Traffic		Links with >10% Decrease in Traffic		Net Difference		Total		Assessment
	Casual-ties	**%**	**Casual-ties**	**%**	**Casualties**	**%**	**Casual-ties**	**%**	
Children (under 15)	32	6%	38	5%	6	3%	70	5%	Moderate beneficial
Older people (70+)	26	5%	46	6%	20	9%	72	5%	Moderate beneficial
Māori	40	7%	64	8%	24	11%	104	8%	Moderate beneficial
Pacific peoples	45	8%	88	11%	43	20%	133	10%	Large beneficial
Pedestrians	86	15%	118	15%	32	15%	204	15%	Moderate beneficial
Cyclists	61	11%	67	9%	6	3%	128	10%	Slight beneficial
Wheeled pedestrian*	3	1%	8	1%	5	2%	11	1%	Moderate beneficial
Young male drivers (16-24)	82	15%	111	14%	29	13%	193	14%	Moderate beneficial
Total	560	100%	780	100%	220	100%	1340	100%	
All priority groups	*290*	*52%*	*421*	*54%*	*131*	*60%*	*711*	*53%*	

** Wheeled pedestrian includes wheelchairs, mobility scooters*

Summary

In summary, the analysis of road casualty and accident data reveals that a higher proportion of traffic links will experience a reduction in accidents than those forecasted to experience an increase in accidents. This outcome is true for the separated and street-running options, suggesting that both schemes will deliver **moderate safety benefits**.

Table 33 – Separated light metro outcome of safety assessment by priority group

Priority group	Assessment
Children (under 15)	Moderate beneficial
Older people (70+)	Moderate beneficial
Māori	Moderate beneficial
Pacific peoples	Moderate beneficial
Pedestrians	Moderate beneficial
Cyclists	Moderate beneficial
Wheeled pedestrian (wheelchairs, mobility scooters)	Moderate beneficial
Young male drivers (16-24)	Moderate beneficial

Table 34 – Street-running light rail outcome of safety assessment by priority group

Priority group	Assessment
Children (under 15)	Moderate beneficial
Older people (70+)	Moderate beneficial
Māori	Moderate beneficial

Pacific peoples	Large beneficial
Pedestrians	Moderate beneficial
Cyclists	Slight beneficial
Wheeled pedestrian (wheelchairs, mobility scooters)	Moderate beneficial
Young male drivers (16-24)	Moderate beneficial

Accessibility

Introduction

Accessibility reflects the range of opportunities and choices available to individuals in terms of employment, services, family, and friends. Accessibility is frequently used as a social indicator in the transport planning field. Recognising that social inequalities arise out of low density development and car-dependent urban design, accessibility is a specific concern for the following priority groups:

- **People with children, older people and people with a long-term illness** may rely more heavily on public transport for their mobility needs, as they may be less likely to drive.
- **People with disabilities and physical limitation**s are less likely to drive or have access to private vehicles and are more reliant on public and community transport or lifts from family and friends. They also may require regular access to healthcare facilities.
- **Women** are less likely to own a car and have a driving licence relative to their male counterparts, increasing their likelihood of using public transport. Even when a single vehicle is shared across a household, women are less likely to use it and are vehicle access disadvantaged.
- **People on low incomes** living in households with no access to a car are particularly vulnerable to social exclusion if public transport does not provide the accessibility required to reach key destinations.
- A commuting (travel to work and study) analysis has been conducted for **Māori and Pacific populations**. The analysis discovered a lack of public provision in the areas where large Māori and Pacific population live. A lack of high quality public transport provision creates a double burden for lower income households, as they often lack alternative transport modes such as private vehicles. Based on this, Māori and Pacific people are also identified as priority groups in the accessibility analysis.

Approach

Distributional accessibility impacts are be evaluated from a two-fold perspective:

- **Accessibility to job locations** using the outputs of the MSM model for the Do Minimum scenario and two transport options. The calculations are based on the number of jobs accessible by zone for ALR public transport travellers in 45 minutes. The outcome is presented by overlaying the spatial distribution of accessibility changes with the spatial distribution of priority groups (income, disabled people, young adults, female, etc) to identify which groups receive accessibility benefits from the project.

- **Accessibility to key destinations of importance for Māori and Pacific people**. The equity analysis identifies key destinations of significant importance for Māori, including Marae, schools, health providers and key employment sites. Using these results, the distributional analysis is conducted based on generating a catchment area at 30-and-45 minute distances from key amenities. An assessment of changes

in public transport isochrones[48] (against the Do Minimum scenario) is also undertaken. The same analysis is conducted for Pacific people.

A summary of the approach to the appraisal of distributional accessibility impacts is presented in the table below:

Table 35 – Approach to the appraisal of accessibility DIA

Indicator	Proposed assessment
Number of jobs than can be reached	A quantitative assessment of accessibility to jobs for priority groups by public transport.
Population that can access to key destinations	A quantitative assessment of accessibility to opportunities (proxied by key destinations) for Māori and Pacific people.

Outcome

Step 1 Screening

The Investment Logic Map sets out a strategic objective to 'provide a rapid transit service that improves access to jobs, education and other opportunities.' Transport interventions often have differentiated accessibility effects across the population, as experienced by various priority groups including young adults, disabled people and women, among others. Consequently, accessibility is frequently used as an indicator to differentiate the effects of transport schemes among priority groups and to determine the groups that are likely to benefit and the groups that are likely to lose out. A close examination of the affected project area is necessary to understand changes in accessibility among different priority groups following the introduction of ALR.

Step 2 Assessment

Step 2a: Confirmation of areas impacted by the transport intervention

The impact area for accessibility includes the six geographical areas or community clusters presented in Chapter 4.3: City Centre, Isthmus, Mount Roskill, Onehunga, Māngere and Auckland Airport. Given the transformative impacts of the scheme, consideration has also been made for the Tāmaki Makaurau Auckland Region as a whole.

Step 2b: Identification of social groups in the impact area

Certain groups are particularly vulnerable to the consequences of poor accessibility. These include people with children, older people, people with a long-term illness, people with disabilities, people on low incomes, women and Māori and Pacific people. As the Tāmaki Makaurau Auckland Region is considered part of the accessibility impact area, the income distribution and proportions of priority groups remain unchanged from those presented in the Safety analysis. A detailed distribution by study area is also presented in Appendix B.

Step 2c: Identification of amenities in the impact area

Consideration has been given to the following key destinations/amenities that fall within the impact area:

- Marae
- Health providers
- Schools
- Key employment sites
- Place of worship, and place of gathering.

[48] Public transport isochrones refer to the representation of areas or zones that can be reached within a designated travel time from a specific location.

Analysis in the following sections outline the changes in accessibility to destinations of significance for Māori and Pacific peoples. The analysis indicates the geographic location of identified key destinations.

Step 3 Appraisal of impacts

The core analysis of accessibility DIs consists of two assessments: (1) employing the most common accessibility metric, which is the number of jobs reachable within a specific time frame, and (2) evaluating the changes in accessibility to key destinations that are of significance for Māori and Pacific peoples.

(a) Job availability within 30 and 45 minutes of home by public transport

Analysis has been undertaken to assess the effect of the Project on the number of jobs accessible via public transport. The primary analysis involves estimating the number of jobs reachable by public transport within a 45-minute timeframe during the morning peak. This public transport journey time closely aligns with the forecasted average public transport journey time of 51 minutes for 2031. Recognising that minor variations in travel times around the 45-minute mark can sometimes lead to significant impacts, an analysis at the 30-minute threshold was also performed. However, no substantial differences were observed. Consequently, the analysis predominantly emphasizes the impacts at the 45-minute mark.

To evaluate the impacts, the following scoring criteria have been used:

Table 36 – Accessibility appraisal criteria

Proportionate Change in Jobs Reachable	Accessibility Analysis Score
Larger than +15%	Large beneficial
Larger than +5% to +15%[49]	Moderate beneficial
Larger than +1% to +5%	Slight beneficial
Larger than -1% to +1%	Neutral
Larger than -5% to -1%	Slight adverse
Larger than -15% to -5%	Moderate adverse
Less and including -15%	Large adverse

Source: Author's elaboration based on TAG Unit 4-2

Separated light metro

Figure 10 and Figure 11 present the job accessibility impact of the separated option, both inside and outside of the study area, for 45-minute and 30-minute public transport journeys. Significant benefits are observed within and near the study area, where the scheme has its most significant accessibility effects (expressed as the number of jobs reachable within the defined timeframes). Accessibility generally drops off with increasing distance from the ALR alignment, reflecting the benefits conveyed by the system.

In Figure 10, large adverse impacts can be observed in the area between Hayr Road and Onehunga. This is attributed to the area being on the edge of the 45-minute accessible zone, where minor variations in travel time can sometimes generate significant impacts. As shown in Figure 11, this accessibility impact for this area is slightly beneficial under the 30-minute scenario.

[49] This indicates that the value falls within this range and is greater than +5% but less than or equal to +15%.

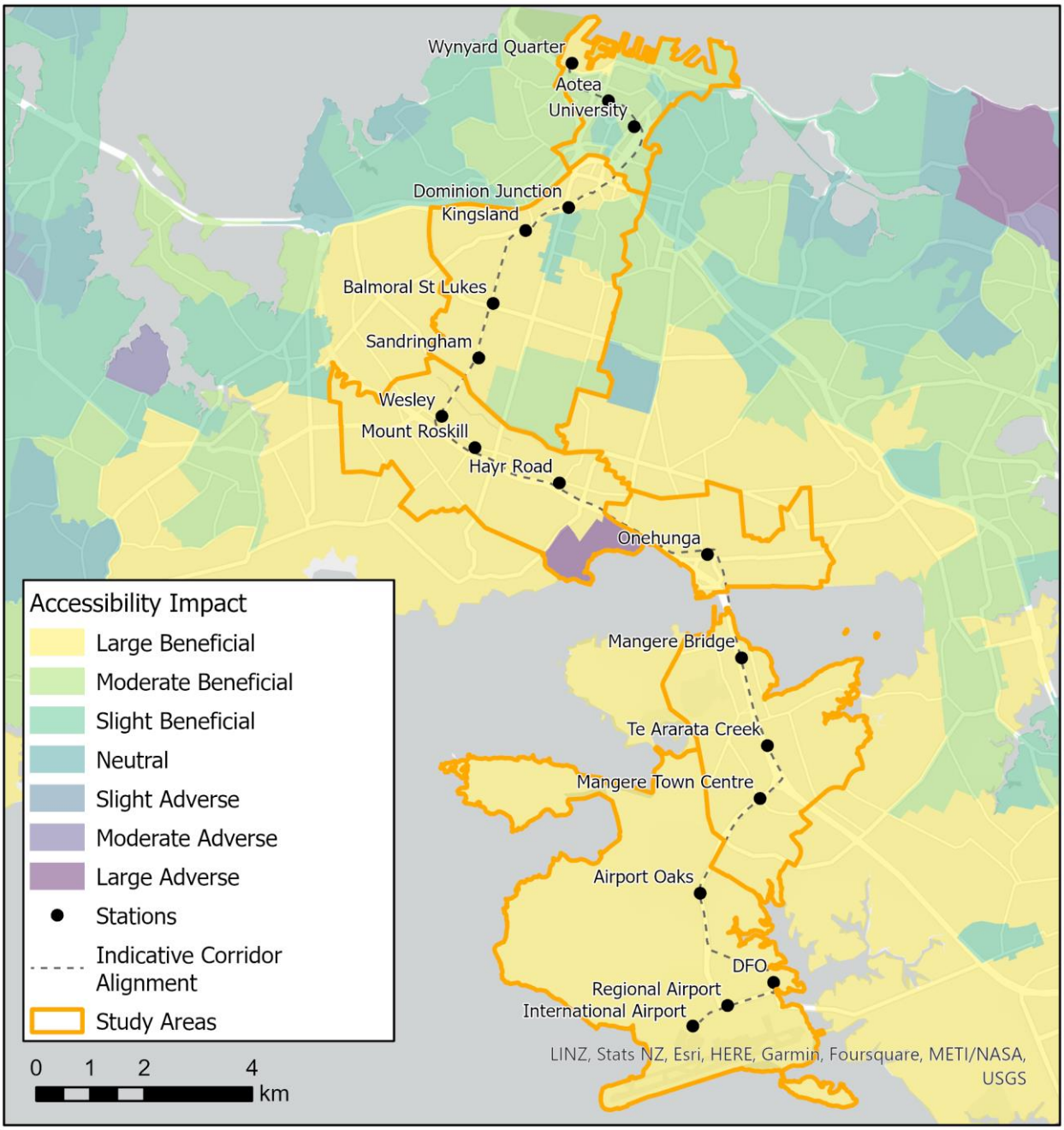


Figure 10 – Separated light metro accessibility impact – public transport 45min

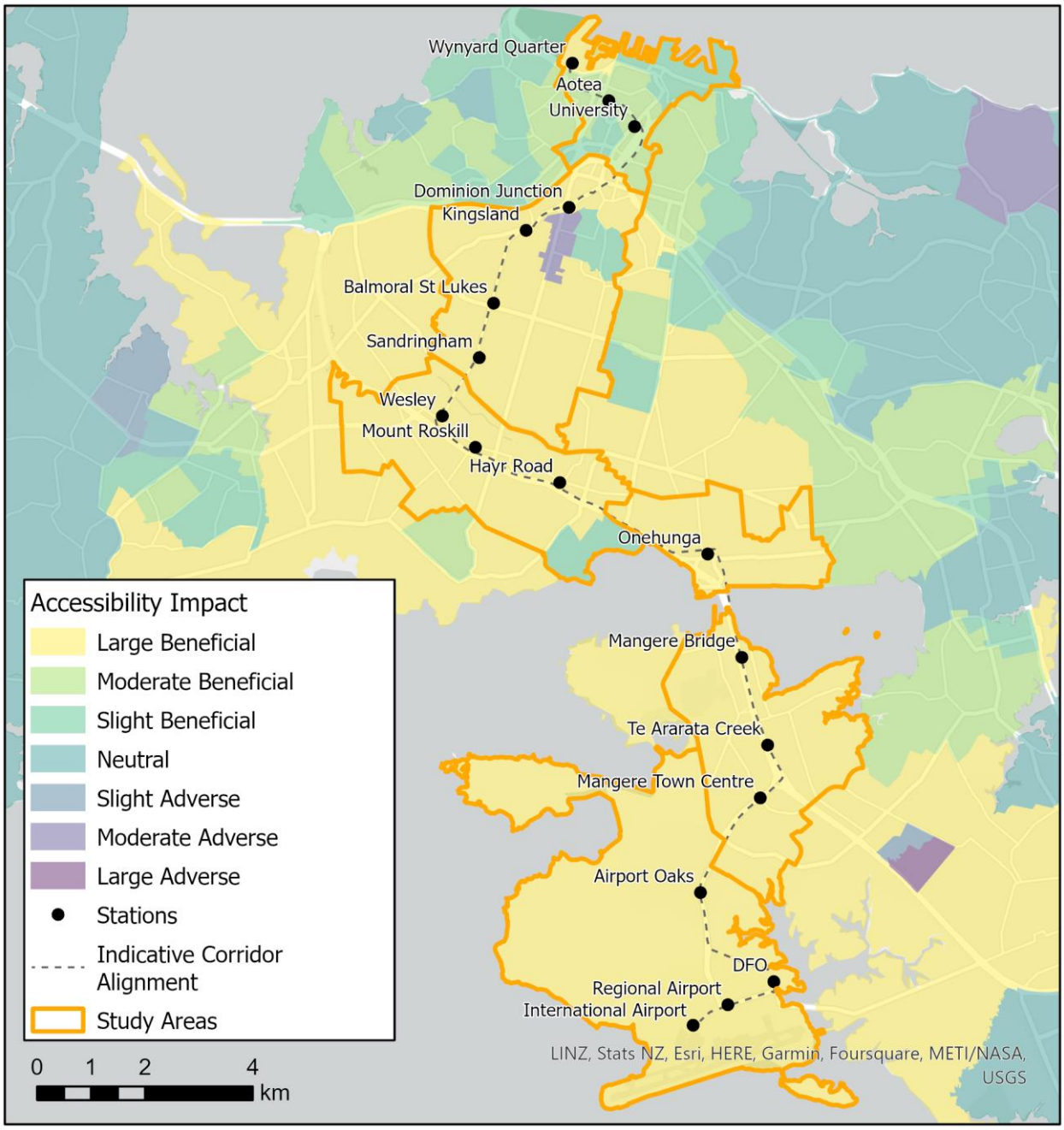


Figure 11 – Separated light metro accessibility impact – public transport 30min

The analysis of varying accessibility effects on priority groups is examined by allocating the benefits across socioeconomic and other relevant priority groups. It is important to note that children and older individuals have been excluded from this analysis as their travel patterns do not typically involve commuting to work. This analysis is limited to the AM peak period.

Table 37 presents accessibility to jobs by income distribution for the entire Tāmaki Makaurau Auckland Region, highlighting the total number of jobs for each income group that are expected to result from net changes in accessibility.

The analysis suggests that all income quintiles, except for the top 20%, experience significant large benefits from the scheme. The highest income quintile is positively impacted but to a lesser extent, primarily because they already possess favourable access to their desired job destinations.

Table 37 – Separated light metro assessment of accessibility impacts by income distribution.

	Income Quintiles					
	0 to 20% (Lowest 20% of income earners)	20% to 40%	40% to 60%	60% to 80%	80% to 100% (highest 20% of income earners)	Average
Jobs Reachable Do-Minimum	116,000	150,000	161,000	165,000	195,000	158,000
Jobs Reachable Separated light metro	150,000	194,000	202,000	191,000	209,000	189,000
Additional Jobs Reachable	33,000	44,000	41,000	25,000	14,000	31,000
Change in Jobs Reachable	28%	30%	25%	15%	7%	19%
Score	**Large Beneficial**	**Large Beneficial**	**Large Beneficial**	**Large Beneficial**	**Moderate Beneficial**	

Similarly, Table 38 presents the impact by priority group and study area, including a summary for the broader Tāmaki Makaurau Auckland Region beyond the defined study area. The data suggests that the separated option will generate large accessibility impacts in all areas, except for the city centre where public transport accessibility is already high. The results reveal that the four areas located north of the Māngere Bridge experience a balanced distribution in the number of reachable jobs due to the significant accessibility improvements outside the city centre. In contrast, the two areas situated south of the Māngere Bridge, Māngere and Airport, witness significant job accessibility improvements but remain less connected compared to the study areas further to the north.

The table reveals significant accessibility impacts are expected in Mount Roskill, indicating this area has a robust employment landscape. The Mount Roskill area contains a substantial concentration of households with dependent children, suggesting that targeted accessibility enhancements may have a particularly positive impact on this priority group. Onehunga also demonstrates notable accessibility improvements, but no specific priority group concentrations are identified in this zone.

The increase in job accessibility is also high near the airport and Māngere, primarily driven by the fact that the number of reachable jobs under the Do Minimum scenario is low. Given the concentrations of carers, Pacific people and Māori R in these areas, it is anticipated that these specific groups could stand to benefit from targeted accessibility improvements. However, it should be noted that Māori participation in the 2018 census was limited and impact on accessibility for this group should therefore be studied in further detail.

Finally, as the impact is the city centre is not significant, young adults and no-car households are expected to experience limited benefits in terms of employment accessibility. This conclusion is attributed to the concentrations of these groups in the area.

Table 38 – Separated light metro assessment of accessibility impacts by priority group.

	City Centre	Isthmus	Mt Roskill	Onehunga	Māngere	Airport	Outside Study Areas
Jobs Reachable Do-Minimum	401,000	324,000	239,000	245,000	68,000	66,000	116,000
Jobs Reachable Separated light metro	430,000	407,000	360,000	424,000	211,000	260,000	129,000
Additional Jobs Reachable	28,000	83,000	121,000	180,000	143,000	194,000	12,000
Change in Jobs Reachable	7%	26%	50%	74%	212%	292%	11%
Young Adults	28%	16%	16%	12%	18%	12%	14%
Females	47%	50%	49%	50%	51%	49%	51%
People with a Disability	3%	4%	6%	5%	8%	6%	6%
Māori	4%	6%	5%	9%	13%	38%	9%
Pacific Peoples	3%	7%	15%	13%	54%	14%	12%
Households without Car Access	51%	9%	7%	9%	7%	3%	14%
Households with Dependent Children	12%	41%	55%	40%	66%	45%	51%
Score	**Moderate Beneficial**	**Large Beneficial**	**Large Beneficial**	**Large Beneficial**	**Large Beneficial**	**Large Beneficial**	**Moderate Beneficial**

Street-running option

Figure 12 and Figure 13 present job accessibility impacts under the street-running option, both inside and outside of the study area, for 45-minute and 30-minute public transport journeys. As with the separated option, the analysis is similar for both 45 and 30 minute scenarios. Compared to the separated option, the areas that receive significant benefits are relatively smaller than under the street running optio and more focused to the areas whcih directly surround the scheme.

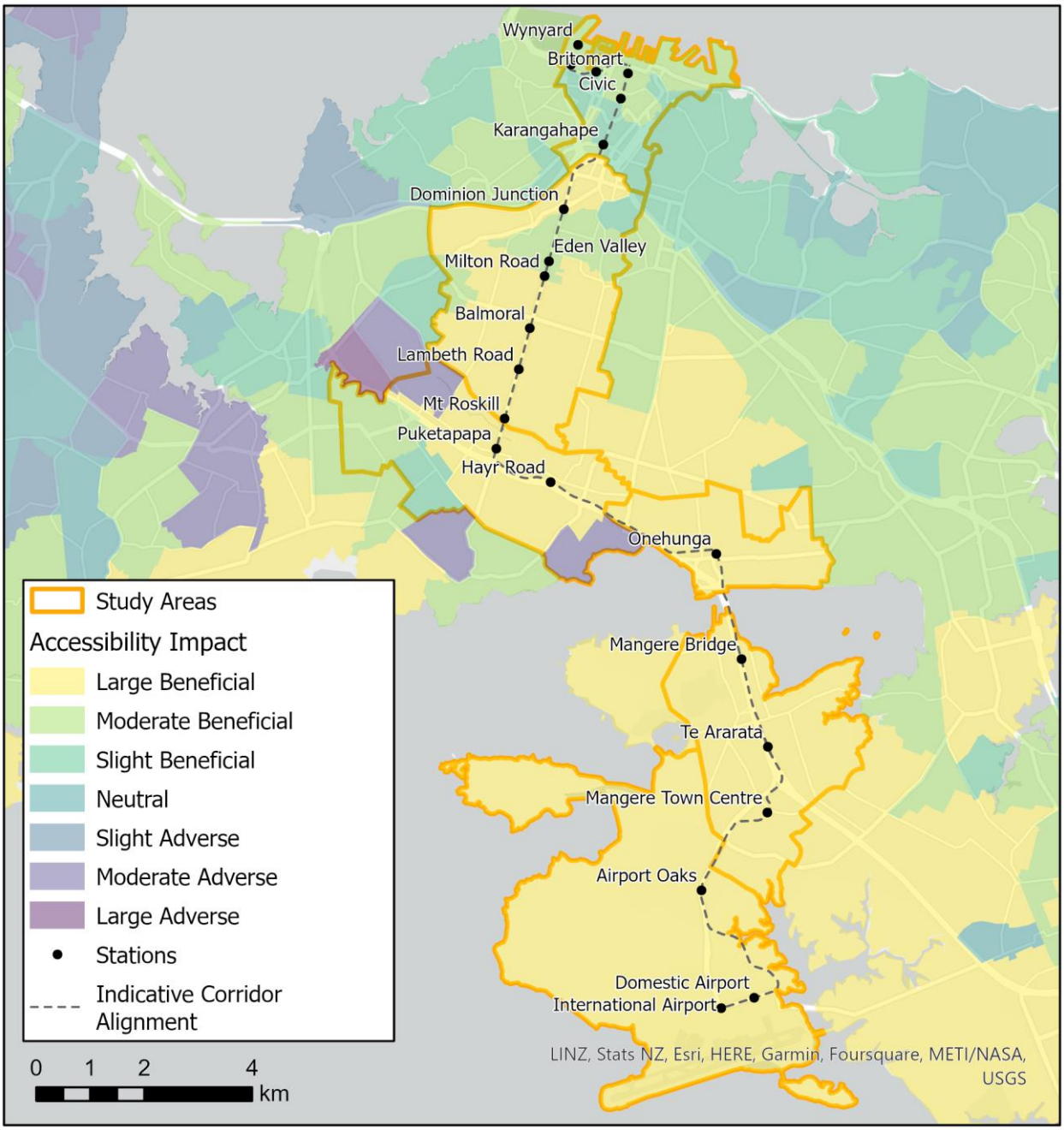


Figure 12 – Street-running light rail accessibility impact – public transport 45min

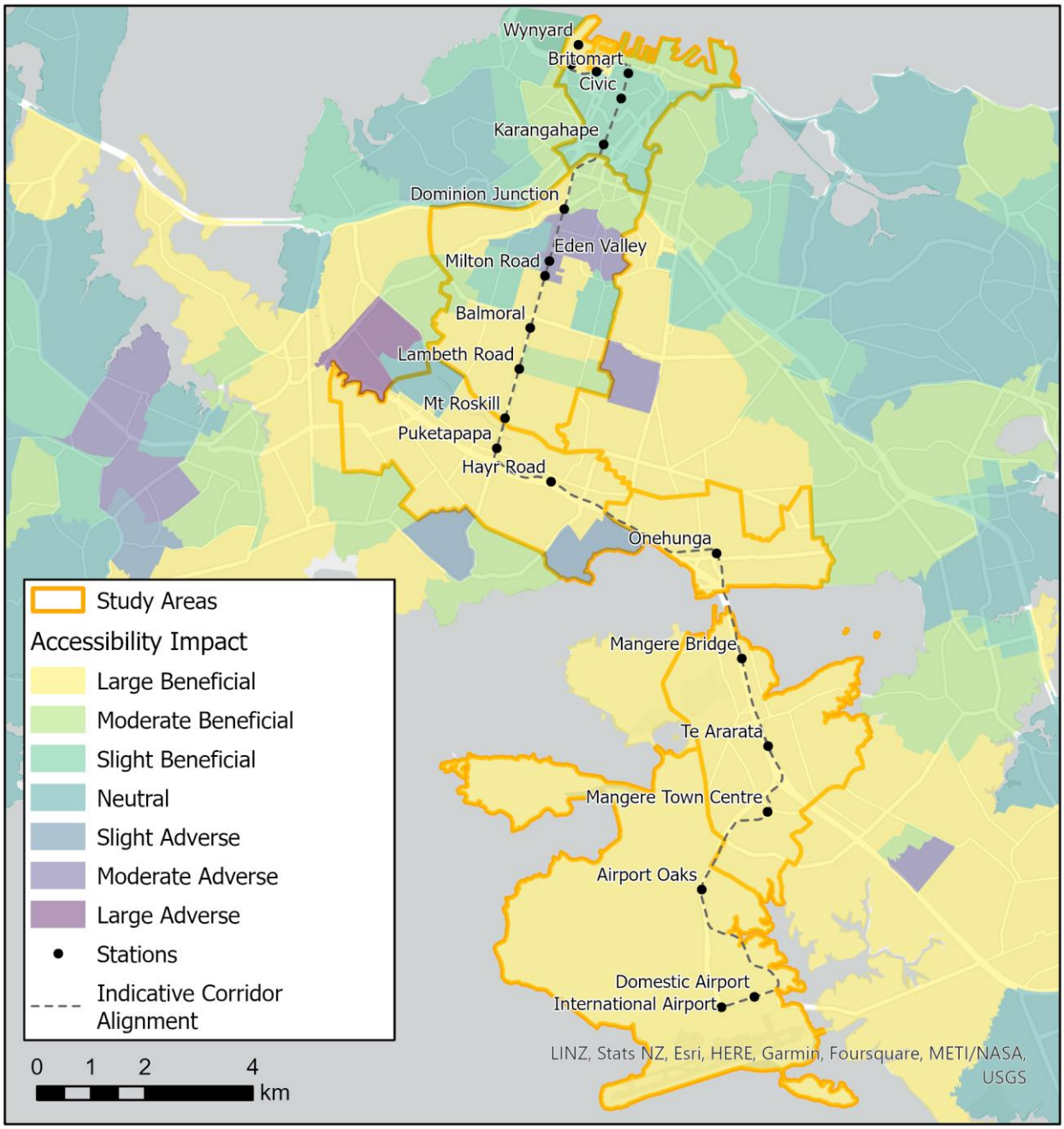


Figure 13 – Street-running light rail accessibility impact – public transport 30min

Table 39 presents accessibility to jobs by income distribution for the entire Tāmaki Makaurau Auckland Region. According to the analysis, the greatest benefits will be realised by individuals with the lowest incomes. Other income groups will experience moderate benefits. In comparison to the separated option, the overall benefit is smaller, with the three middle quintiles experiencing the most significant reduction in benefits.

Table 39 Street-running light rail assessment of accessibility impacts by income distribution

	Income Quintiles					
	0 to 20% (Lowest 20% of income earners)	**20% to 40%**	**40% to 60%**	**60% to 80%**	**80% to 100% (highest 20% of income earners)**	**Average**
Jobs Reachable Do-Minimum	116,000	150,000	161,000	165,000	195,000	158,000
Jobs Reachable street running light metro	142,000	176,000	185,000	183,000	207,000	179,000
Additional Jobs Reachable	26,000	22,000	20,000	16,000	12,000	19,000
Change in Jobs Reachable	22%	15%	12%	9%	6%	12%
Score	**Large Beneficial**	**Moderate Beneficial**	**Moderate Beneficial**	**Moderate Beneficial**	**Moderate Beneficial**	

Table 40 shows the impact by priority group and study area, including a summary for the broader Tāmaki Makaurau Auckland Region beyond the defined study area. As with the separated option, all areas are anticipated to experience large impacts. The largest impacts are expected in Māngere and near the airport, areas which contain a high concentration of Māori, Pacific people and households with dependent children.

The city centre, which contains high concentrations of young adults and households without car access, are experiencing the smallest impact given that this area is already well connected by public transport.

Table 40 – Street-running metro assessment of accessibility impacts by priority group.

	City Centre	Isthmus	Mt Roskill	Onehunga	Māngere	Airport	Outside Study Areas
Jobs Reachable Do-Minimum	401,000	324,000	239,000	245,000	68,000	66,000	116,000
Jobs Reachable street running light metro	422,000	387,000	307,000	366,000	181,000	218,000	124,000
Additional Jobs Reachable	21,000	63,000	50,000	114,000	113,000	152,000	7,000
Change in Jobs Reachable	5%	20%	19%	45%	168%	228%	6%
Score	**Moderate Beneficial**	**Large Beneficial**	**Large Beneficial**	**Large Beneficial**	**Large Beneficial**	**Large Beneficial**	**Moderate Beneficial**
Young Adults	28%	16%	16%	12%	18%	12%	14%
Females	47%	50%	49%	50%	51%	49%	51%
People with a Disability	3%	4%	6%	5%	8%	6%	6%
Māori	4%	6%	5%	9%	13%	38%	9%
Pacific Peoples	3%	7%	15%	13%	54%	14%	12%
Households without Car Access	51%	9%	7%	9%	7%	3%	14%
Households with Dependent Children	12%	41%	55%	40%	66%	45%	51%

(b) Accessibility to key destinations for Māori

Further analysis has been undertaken to highlight areas which enable access to and from Māori social facilities by public transport within 30 minutes. Relevant Māori social facilities include:

- Schools (full immersion learning schools, Kōhanga Reo, Kura Reo, mainstream schools offering Māori courses/ classes, mainstream schools with Māori immersion units, and Whare Wānanga)
- Māori health providers
- Marae
- Key employment sites (selected by travel patterns from the census 2018's travel to work by Māori).

Traditionally, in transport planning, benefits are measured by travel time savings and/or accessibility. These measures are often tested during peak time periods, which typically occur between 7am and 9am and 5pm and 7pm. Transport infrastructure and systems are often designed to favour those who travel towards central business districts (CBDs) during the peak periods. These approaches disproportionally disbenefit those who do not travel towards CBDs during peak hours as many public transport operators reduce service frequency during off-peak periods.

Off-peak public transport users often include indigenous people, people of colour, low-income household members, people with child/ren, female, workers outside CBDs, young adults, elderly, and people with disabilities.

In this analysis, travel arrival time is set for a range of hours that are reflective of trip purposes, rather than conforming with traditional peak hours, to consider diverse needs of communities.

Table 41 – Trip arrival times used in the analysis.

Trip purpose	Trip arrival time
School	9 a.m. weekday (Peak hour)
Health providers	12 p.m. weekday (off peak)
Marae	12 p.m. weekday (off peak)
Key employment sites	9 a.m. weekday (peak hour) 8 a.m. weekend (off peak)

Population numbers used in this analysis include the general population and Māori. The data source is indicated in Table 42.

Table 42 Population forecast data source

	General population data source / scenario	Māori population data source
Existing	Do min 2018 (ACF)	Stats NZ Population forecast by ethinicty (Local board area level)
RLTP	Do min 2051 (AFC)	
Street-running option	LUTI IC 2051 (AFC)	
Separated option	LUTI EP 2051 (AFC)	

Access to schools

There are 92 schools designated as destinations within the catchment area. The analysis suggests that both transport options will improve accessbility in East Tāmaki Makaurau Auckland around Howick area, with the separated option capturing a higher proportion of the population than the street-running option. It is important to note that the improvements in accessibility in the East Tāmaki Makaurau Auckland area are likely brought on in-part by other schemes such as Eastern Busway, and Airport to Botany.

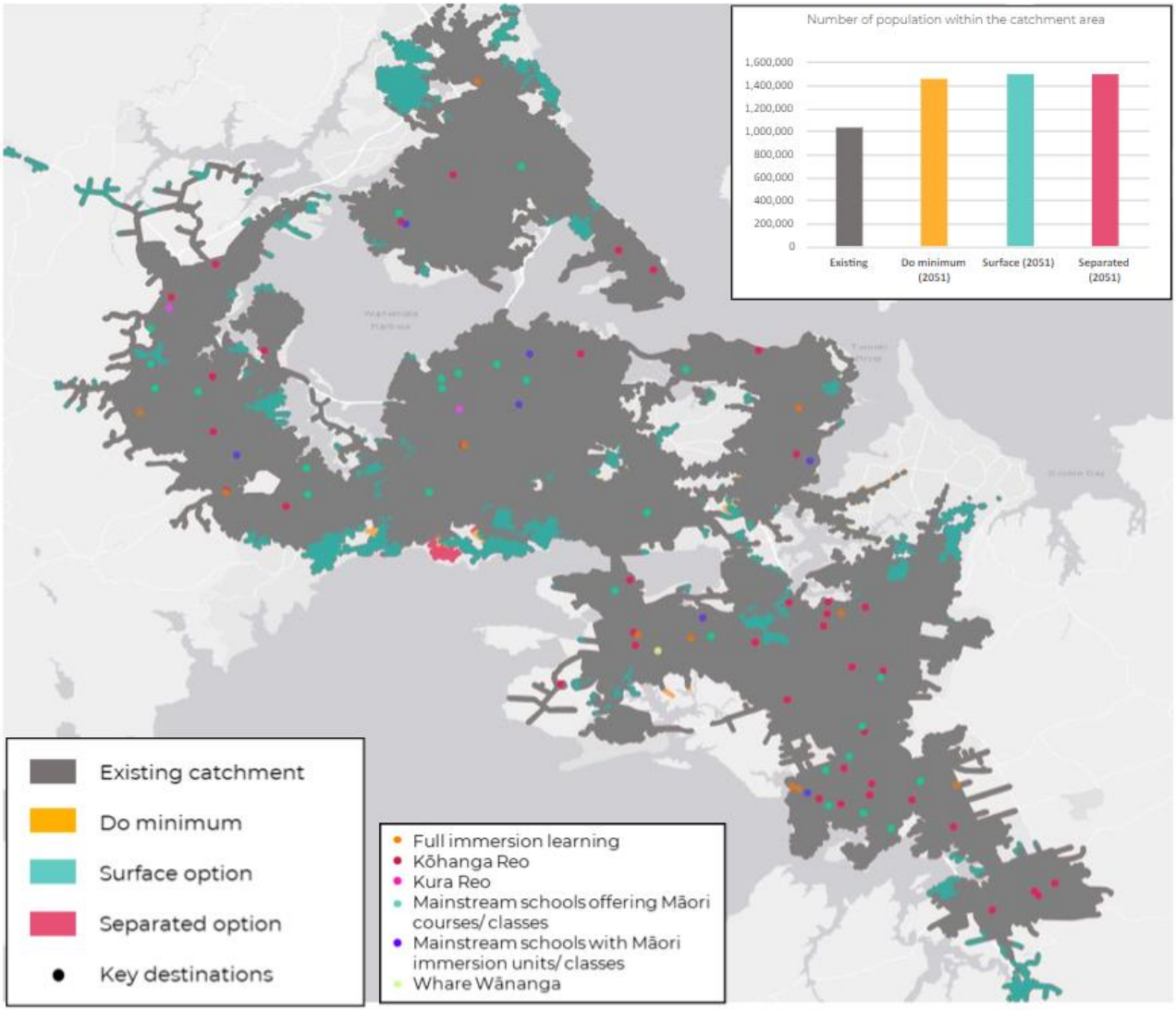


Figure 14 – Access to schools (Arriving at 9AM)

Table 43 – Population within the catchment (access to schools)

	Population within the catchment area	Māori population 2018 | 2043
Existing (2018)	1,029,853	112,810 | 155,336
RLTP (2051)	1,449,827	114,138 | 157,545
Street-running (2051)	1,489,908	115,898 | 159,983
Separated (2051)	1,493,520	116,091 | 160,239

Access to health providers

There is only one Māori health provider within Isthmus, which is in Eden Terrace. Two other Health providers are located in South Tāmaki Makaurau Auckland, one in Māngere town centre and the other in Ōtāhuhu.

Most improvements are expected in Isthmus, which contains the longest section of the proposed route under both separated and street-running options. Under both options, the 30-minute catchment area expands towards Mouth Eden to the south and towards Western Springs to the west. It also expands to Mouth Roskill to the south and Point Chevalier to the west. Significant accessibility improvements are also expected in Onehunga. In South Tāmaki Makaurau Auckland, the catchment area increases from

Māngere to the airport in the south. The population catchment is larger under the separated option relative to the street-running option.

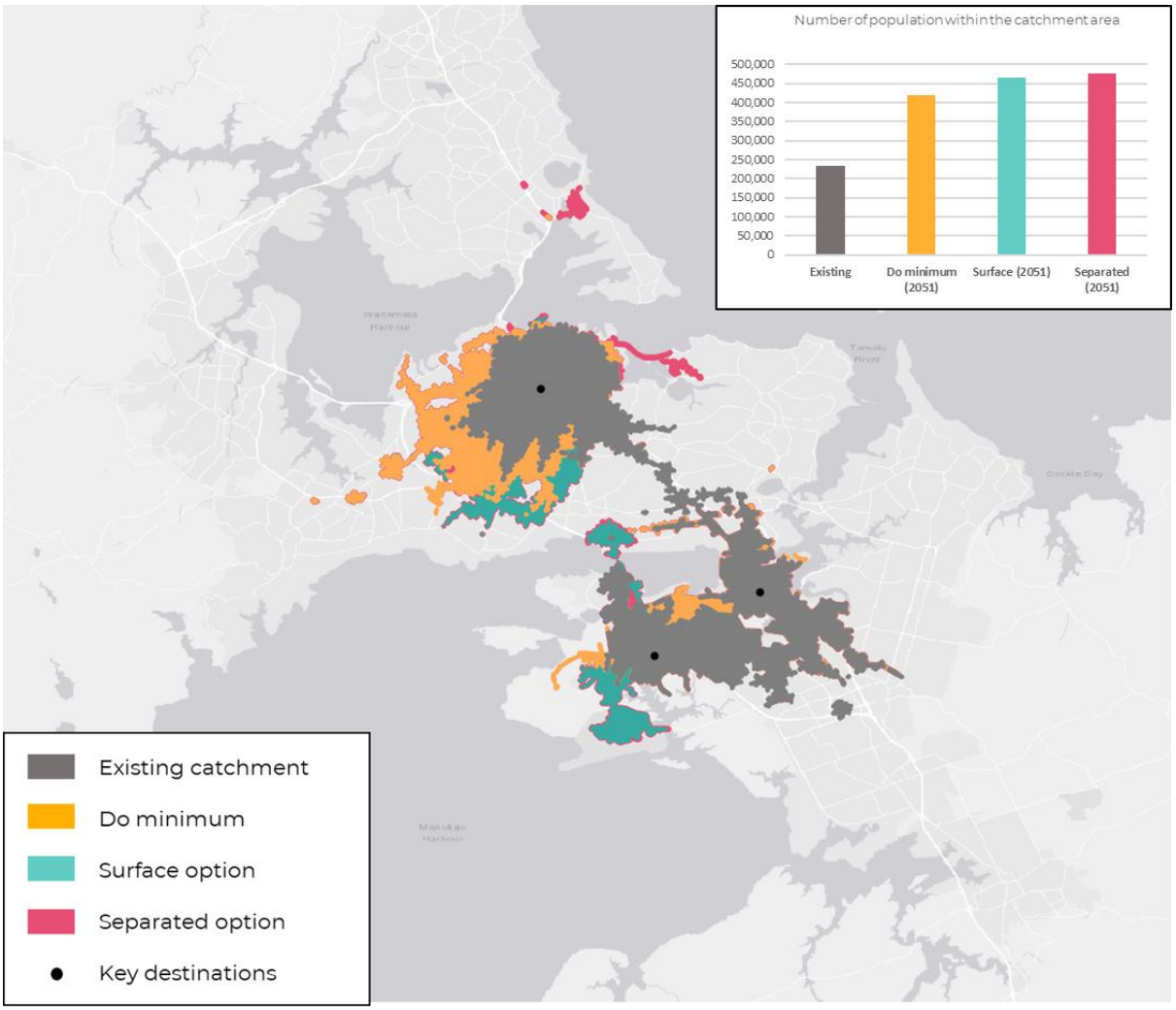


Figure 15 Access to health provider (Arriving at 12PM)

Table 44 Population within the catchment (access to health providers)

	Number of population within the catchment area	Number of Māori population 2018 | 2043
Existing (2018)	232,851	19,413 | 24,564
RLTP (2051)	419,991	21,948 | 28,747
Street-running (2051)	466,408	24,075 | 31,687
Separated (2051)	475,803	24,540 | 32,304

Access to hospitals

Auckland hospital

The diagram below compares the catchment area for Auckland hospital access between the two transport options. The catchment is slightly larger under the the street-running option, which has a wider catchment area around Mt. Eden and Mt. Roskill.

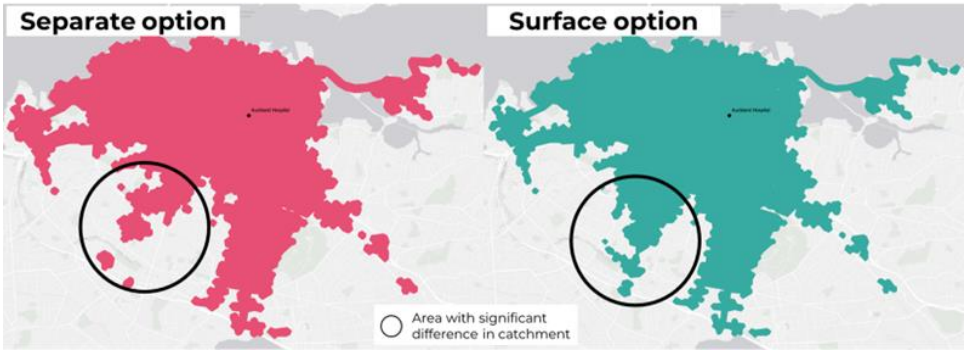


Figure 16 Auckland hospital catchment areas

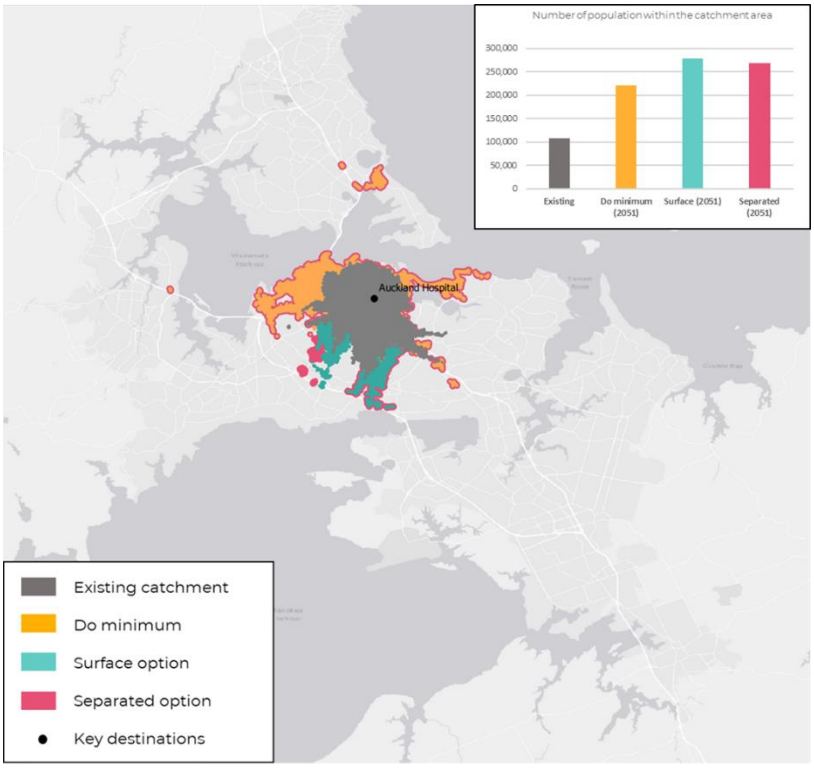


Figure 17 Access to Auckland hospital (Arriving at 12pm)

	Number of population within the catchment area	Number of Māori population 2018 | 2043
Existing (2018)	108,430	6,587 | 9,203
RLTP (2051)	221,449	8,424 | 11,593
Street-running (2051)	277,707	10,766 | 15,001
Separated (2051)	267,793	10,315 | 14,348

Table 45 Population within the catchment (access to Auckland hospital)

Middlemore hospital

The catchment to and from Middlemore Hospital is slightly larger under the separated option, but the difference in the population within the catchment area is minimal. Compared to the population catchment for Auckland Hospital, there are far more Māori within the catchment given that there is a larger Māori population around Middlemore Hospital.

As ALR options do not directly serve Middlemore Hospital, the impact is of the Project limited. The difference in population number is largely due to population growth over time rather than accessibility improvements resulting from the scheme.

Figure 18 Access to Middlemore hospital (Arriving at 12PM)

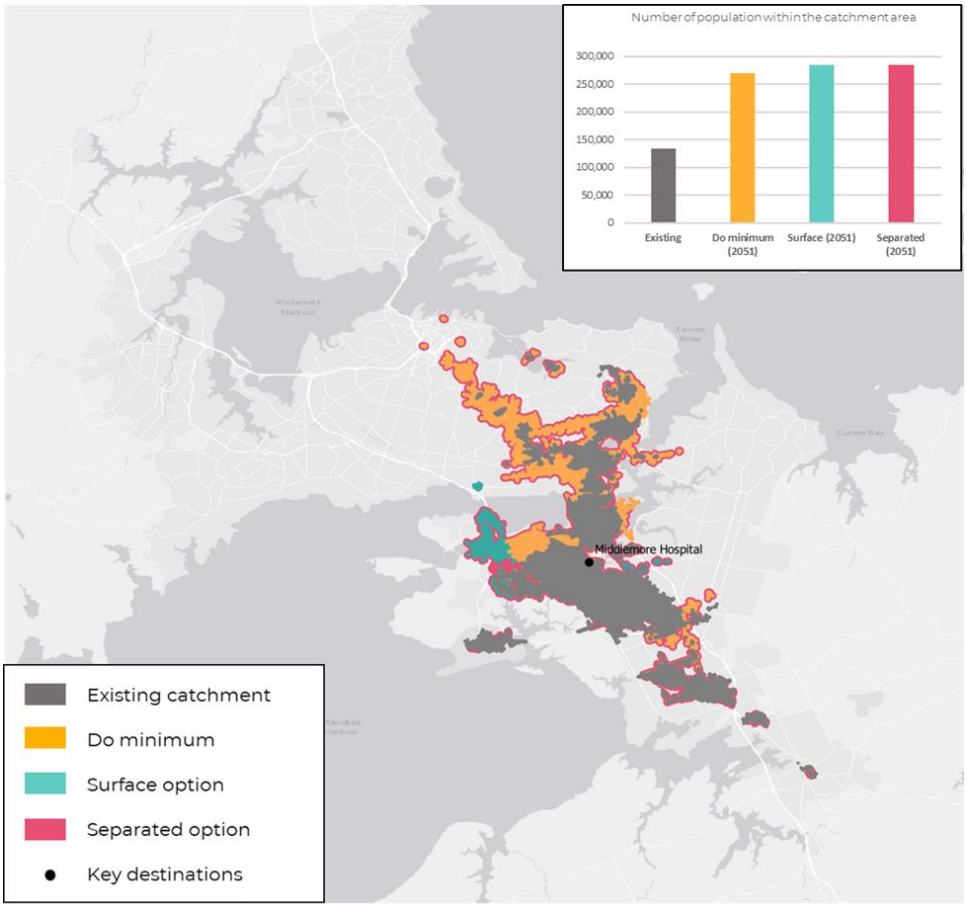


Table 46 Population within the catchment (access to Middlemore hospital)

	Number of population within the catchment area	Number of Māori population 2018 | 2043
Existing (2018)	108,430	6,587 | 9,203
RLTP (2051)	221,449	8,424 | 11,593
Street-running (2051)	277,707	10,766 | 15,001
Separated (2051)	267,793	10,315 | 14,348

Middlemore hospital and Auckland hospital (combined)

The catchment for combined accessibility to Auckland hospital and Middlemore Hospital is slightly larger under the street-running option, with the street-running option serving a wider catchment around Mt. Eden and Mt. Roskill.

Figure 19 Access to Middlemore and Auckland hospital (Arriving at 12PM)

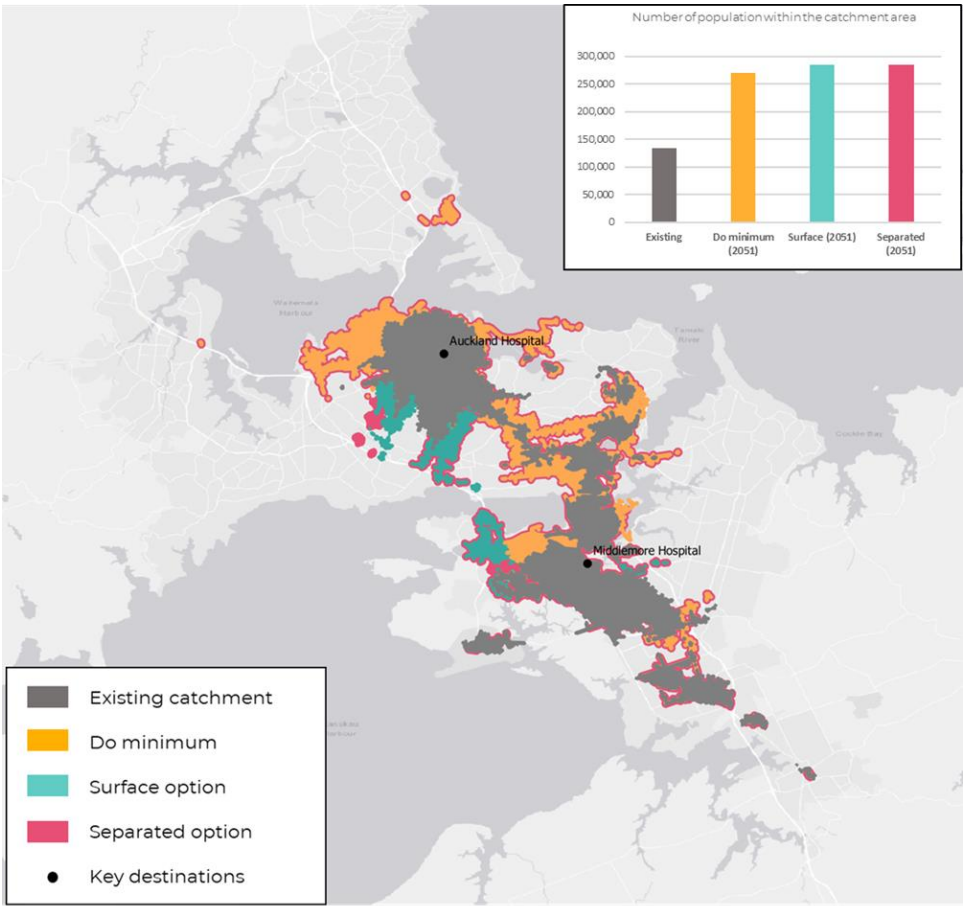


Table 47 Population within the catchment (access to Middlemore and Auckland hospital)

	Number of population within the catchment area	Number of Māori population 2018 | 2043
Existing (2018)	242,109	24,122 | 31,459
RLTP (2051)	462,983	27,716 | 36,925
Street-running (2051)	534,293	31,237 | 41,724
Separated (2051)	524,392	30,882 | 41,180

Access to Marae

There are four Marae in the Isthmus, two in the City Centre, one at Dominion Road junction and one in Mt. Roskill. There an additional six south of Māngere Bridge, including four in Māngere and two near the airport.

Most accessibiliity improvements are observed in the Isthmus, especially around Point Chevalier. Under both options, the catchment extends from west of Ponsonby Road to Point Chevalier. The catchment area recedes slightly within Mt. Roskill, likely due to anticipated changes in the local bus network.

There is a slight accessibility improvement south of Māngere Bridge around Papatoetoe. While the magnitude of change is relatively small, it has the potential to benefit a large number of Māori who reside in the area, as confirmed by Census 2018.

The total population catchment is larger under the separated option, while the street running option captures slightly more Māori.

Figure 20 Access to Marae (Arriving at 12PM)

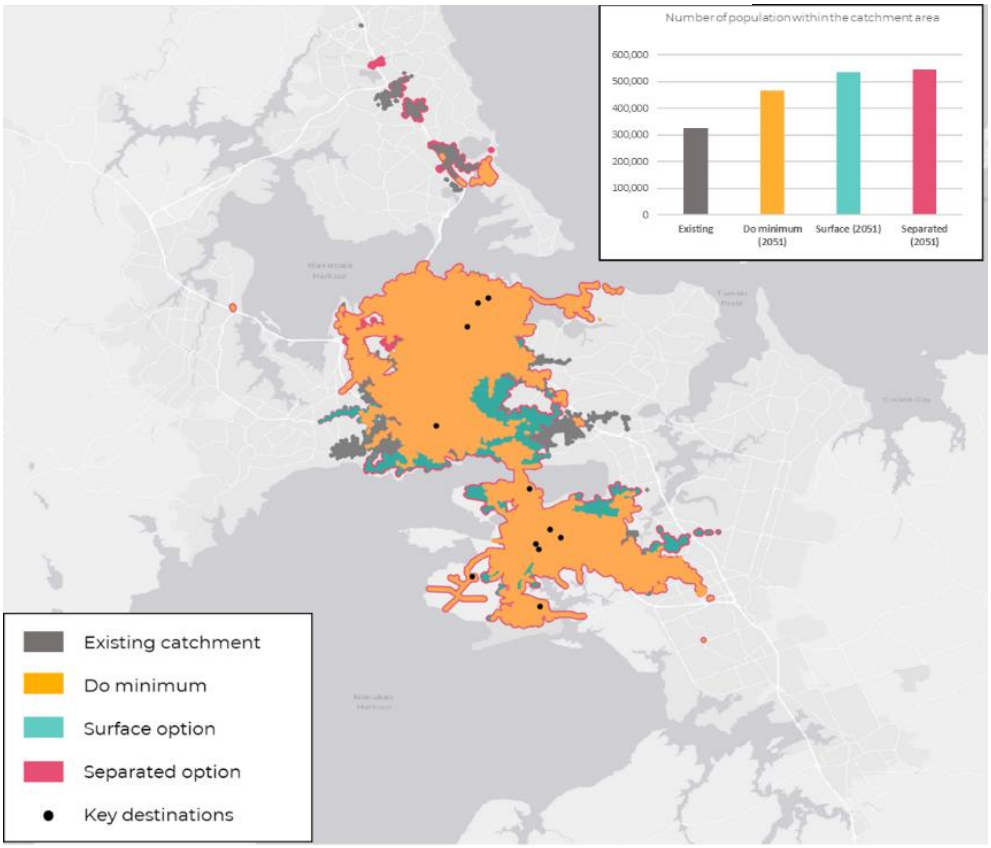


Table 48 Population within the catchment (access to Marae)

	Number of population within the catchment area	Number of Māori population 2018 | 2043
Existing (2018)	323,748	26,493 | 35,473
RLTP (2051)	465,884	24,644 | 32,518
Street-running (2051)	535,957	28,143 | 37,316
Separated (2051)	542,820	28,055 | 37,092

Access to key employment sites

Arriving over weekends (8AM)

This analysis examines the accessibility for workers traveling during off-peak hours, such as weekends, when public transport services are typically reduced. Key employment sites include the CBD, Penrose, Mt. Wellington, East Tāmaki, and Manukau City Centre. These key employment sites have been identified by the census 2018 data Māori Travel to Work data.

The general population catchment is larger under the street-running option. Both options result in a reduction in the catchment for Māori, likely due to the fact that accessibility improvements are observed in areas for which future Māori population increases are not expected.

While both transport options improve accessibility around Mt. Roskill, the proposed options reduce accessibility in Epson and Mt. Eden.

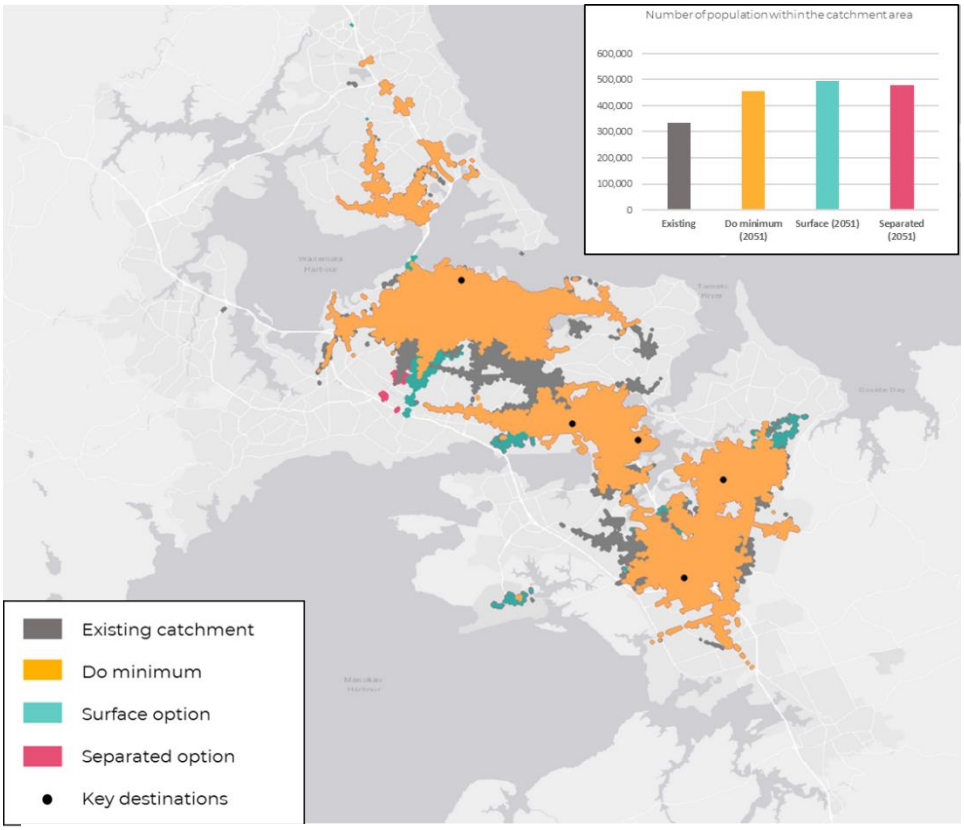


Figure 22 Population within the catchment (access to key employment sites - weekends)

Table 49 Population within the catchment (access to key employment sites - weekends)

	Number of population within the catchment area	Number of Māori population 2018 | 2043
Existing (2018)	335,071	33,259 | 42,918
RLTP (2051)	455,819	29,315 | 37,609
Street-running (2051)	493,386	31,555 | 40,500
Separated (2051)	479,075	30,764 | 39,340

Arriving over weekdays (9AM)

For workers that follow traditional weekday working patterns, most accessibility improvements are observed in the Isthmus. Under both options, significant improvements are expected in Point Chevalier, Sandringham, and Epsom. Improvements are also expected in East Tāmaki Makaurau Auckland (Howick, Botany, and East Tāmaki.), but these changes are likely caused by other programmes such as the Eastern Busway and the Airport to Botany.

A larger population catchment is generated under the separated option. For both transport options, twice as many people can access the selected employment sites by public transport within 30 minutes.

Māori residents are expected to experience the most direct transport benefits, particularly among those workers that live in the Isthmus but work in the CBD.

Figure 24 Population within the catchment (access to key employment sites - weekdays)

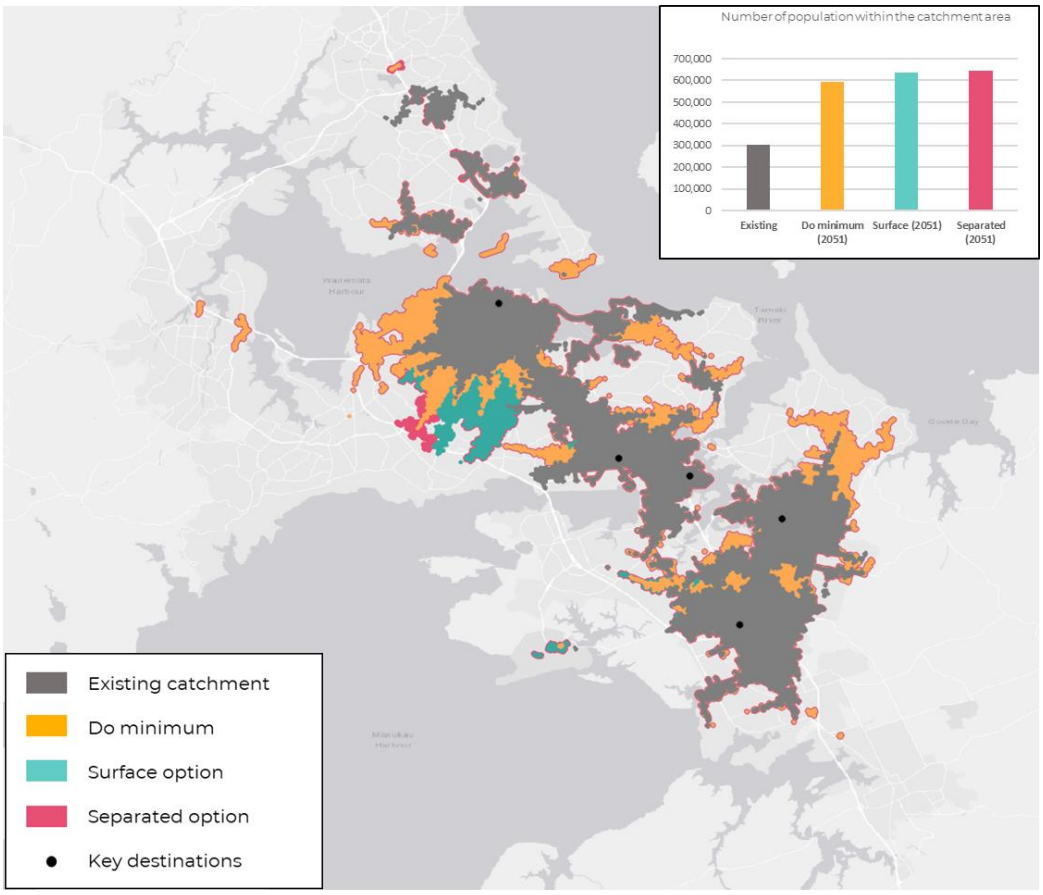


Table 50 Population within the catchment (access to key employment sites - weekdays)

	Number of population within the catchment area	Number of Māori population 2018 | 2043
Existing (2018)	301,779	32,218 | 42,076
RLTP (2051)	591,809	38,837 | 51,192
Street-running (2051)	637,203	40,807 | 53,949
Separated (2051)	645,544	41,010 | 54,223

Summary of key Māori destination accessibility

Across the general population, the street-running option improves accessibility to Māori social facilities more effectively than the street-running option. The same results apply for Māori, except in the case of access to Marae and key employment sites during off-peak hours. A more detailed summary of the accessibility analysis for Māori access to these key destinations is provided below:

Access to Marae: The street-running option captures a slighty larger Māori population (+224). Given than this analysis relies on population forecast by ethnicity from the 2018 Census data at local board area, which covers a significant area, the level of difference (+/-200) is considered negligible.

Key employment sites (off peak): The proposed transport options have smaller accessibility catchment areas compared to the existing situation around Green Lane, Ellerslie, and Glen Innes, as illustrated in Figure 25. This is due to changes in the future public transport network, including routes and frequency, which fall outside the scope of this project but have been considered in this analysis. This outcome highlights the importance of establishing frequent feeder services to maximise the benefits of ALR in the future.

These areas, including the Albert-Eden local board area (Green Lane) and the Maungakiekie-Tāmaki local board area (Ellerslie and Glen Innes), also fall within local board areas which are anticipated to experience a 30% increase in Māori population by 2043, as per the 2018 Census data.

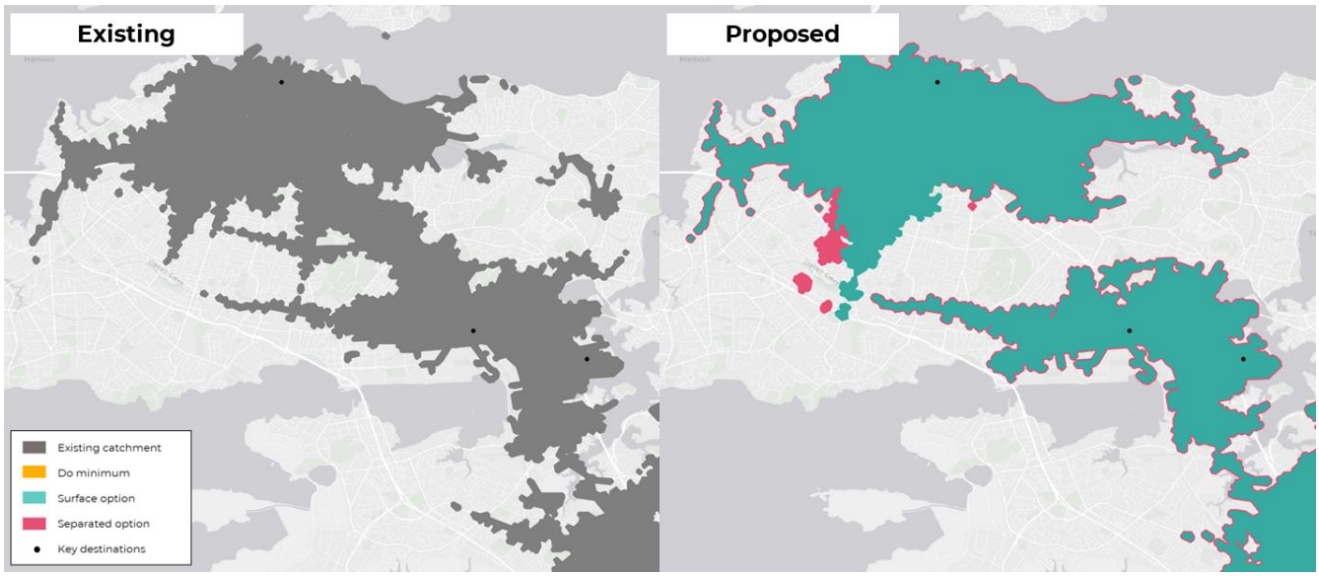


Figure 25 Existing vs proposed option comparison (key employment sites during off peak-hours)

(C) Accessibility to key destinations for Pacific Peoples' community

This analysis illustrates the accessibility of social facilities for Pacific peoples' communities via public transport within a 30-minute travel time. These facilities are deemed relevant to the Pacific Peoples' community, having been identified through a literature review and validated by a colleague with a Pacific background and familiarity with Tāmaki Makaurau Auckland. The included facilities are as follows:

- Pacific medium schools.
- Pacific Peoples' health providers.
- Place of gathering.
- Place of worship.
- Key employment sites (selected by travel patterns from the census 2018's travel to work by Pacific Peoples).

In this analysis, travel arrival time is set for a range of hours depending on trip purposes, rather than traditional peak hours, in order to consider diverse needs of different communities. The table below indicates the travel arrival time used for each component of this analysis.

Table 51 Trip arrival times used in the analysis.

Trip purpose	Trip arrival time
School	9 a.m. weekday (peak hour)
Health providers	12 p.m. weekday (off peak)
Place of gathering **Place of worship**	12 p.m. weekend (off peak)
Key employment sites	9 a.m. weekday (peak hour) 8 a.m. weekend (off peak)

Access to schools

In total, 33 Pacific medium schools are included in this analysis. Both transport options improve accessbility in East Tāmaki Makaurau Auckland around Howick area. However, these improvements are unlikely to be a result of the ALR options, given that the analysis includes other transport schemes such as Eastern Busway and Airport to Botnay which are located in the East Tāmaki Makaurau Auckland.

The results suggest that the separated option captures a larger proportion of the population than the street-running option.

Table 52 Access to schools (Arriving at 9AM)

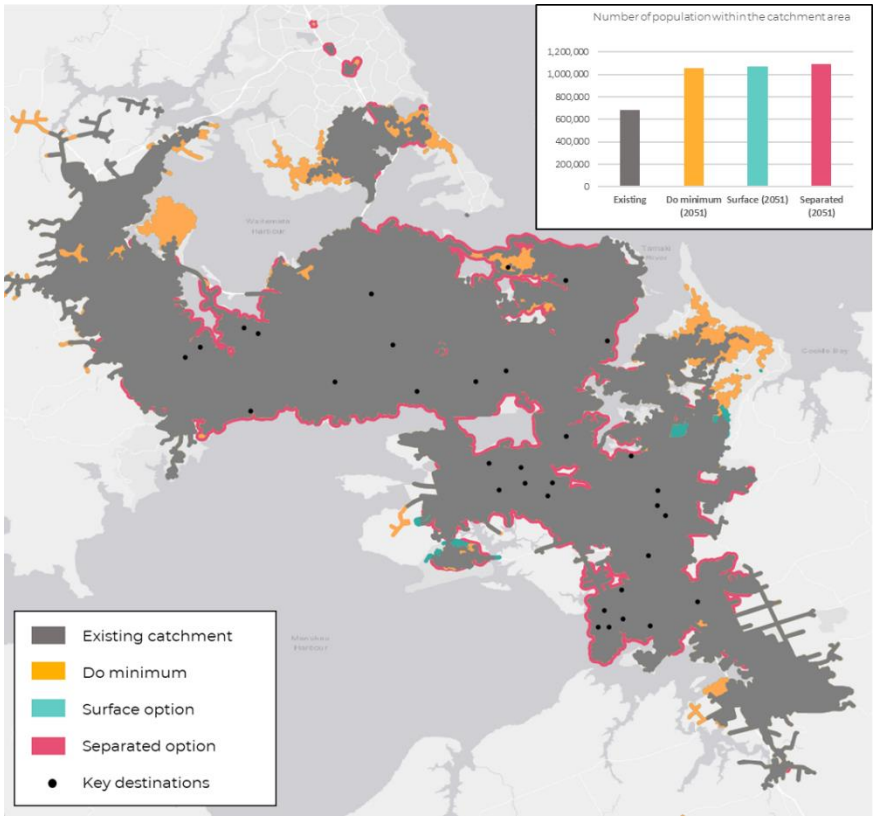


Table 53 Population within the catchment (schools - arriving at 9am)

	Number of population within the catchment area	Number of Pacific Peoples population 2018 | 2043
Existing (2018)	683,946	133,999 | 194,697
RLTP (2051)	1,053,663	140,232 | 203,661
Street-running (2051)	1,068,574	140,170 | 203,289
Separated (2051)	1,096,653	141,540 | 204,934

Access to health providers

There are three pacific health providers, located in Ellerslie, Ōtāhuhu, and Manurewa. The health providers are not located closely along the proposed alignment for either transport option. The most significant accessibility improvements are expected around Māngere town centre, which is home to a significant concentration of Pacific people (Census 2018) – over half of the population living in Māngere identify as Pacific.

Compared to the street-running option, the separated option captures the highest proportion of the general population. However, the catchment for Pacific people reduces under both options, likely due to the fact that the population of Pacific peoples is low in areas where the accessibility changes are expected to occur.

Figure 27 Access to health providers (Arriving at 12PM)

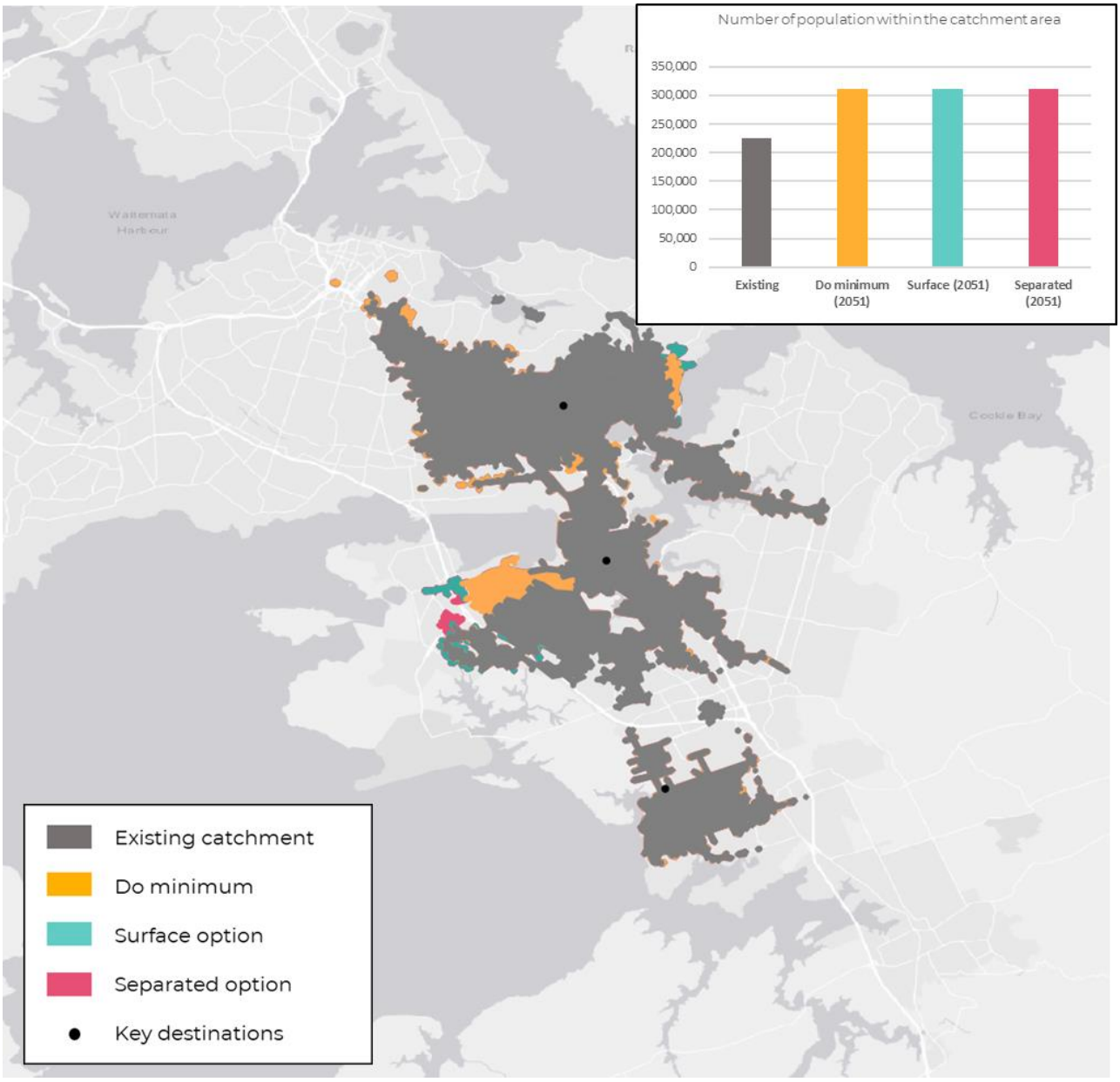


Table 54 Population within the catchment (access to health providers)

	Number of population within the catchment area	Number of Pacific Peoples population 2018 | 2043
Existing (2018)	225,930	52,048 | 76,710
RLTP (2051)	310,588	48,360 | 71,294
Street-running (2051)	310,579	48,402 | 71,310
Separated (2051)	311,408	48,783 | 71,878

Access to place of gathering

Places of gathering includes churches, community centres, and public spaces that are often used by Pacific peoples. Places of gathering have significant cultural significance because they provide space for Pacific peoples to practice their language and traditions.

For both transport options, accessibility improvements are expected in Isthmus, particularly around St Mary's bay and Point Chevalier. Some improvements are also anticipated around Papatoetoe, an area where 14% of resident identify themselves as Pacific peoples (Census 2018).

The separated option captures a slightly higher overall population than the separated option. However, the number of Pacific people within catchment area decreases under both options, likely due to the fact that accessibility improvements are predominantly observed in areas where the population of Pacific Peoples is not expected to grow.

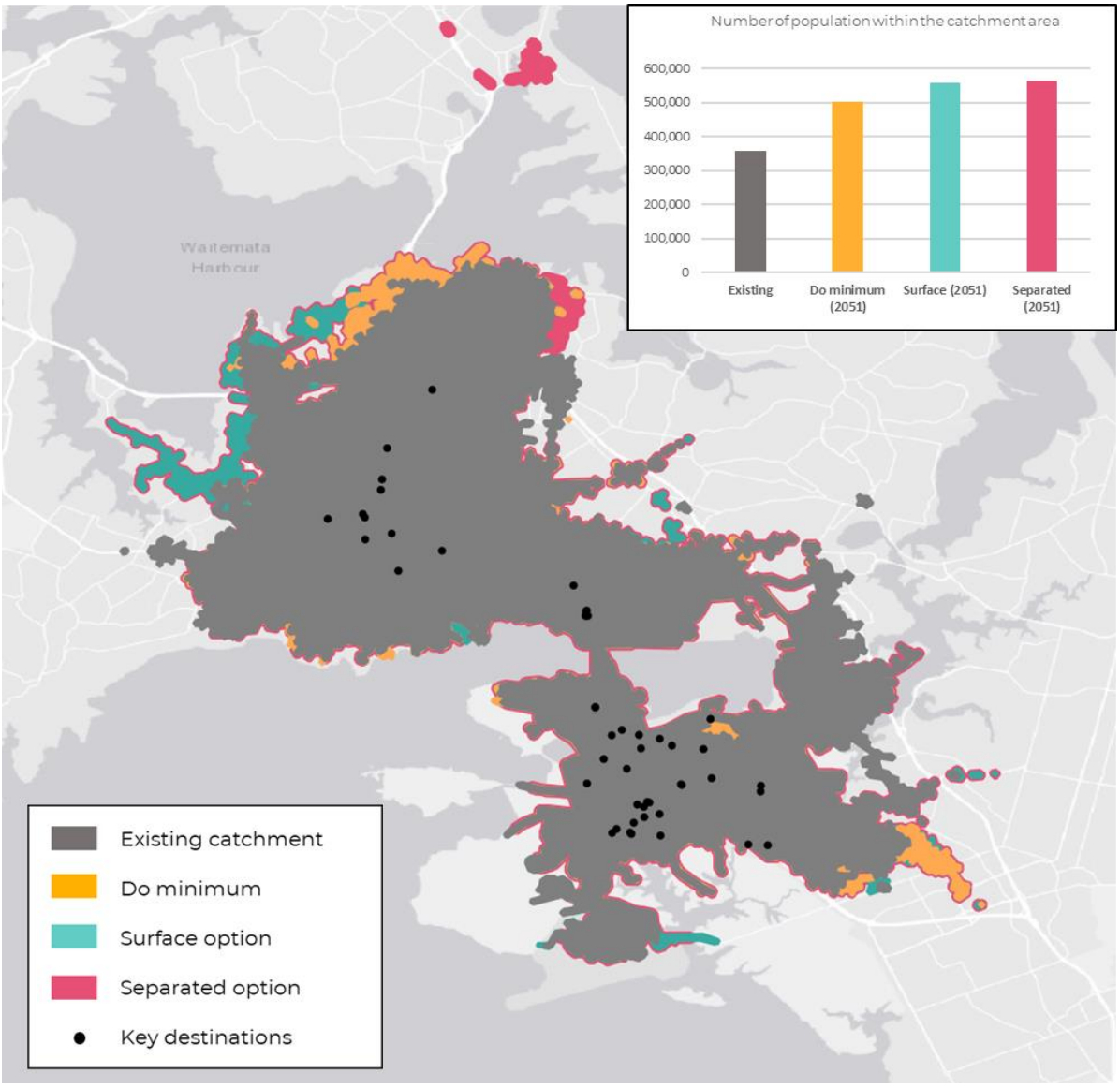


Figure 28 Place of gathering (Arriving at 12PM)

Table 55 Population within the catchment (access to places of gathering)

	Number of population within the catchment area	Number of Pacific Peoples population 2018 | 2043
Existing (2018)	356,336	70,650 | 98,664
RLTP (2051)	500,349	64,034 | 88,932
Street-running (2051)	556,172	71,430 | 99,580
Separated (2051)	564,452	70,296 | 97,769

Access to key employment sites

Arriving at weekends 8AM

This analysis examines the accessibility for workers traveling during off-peak hours, such as weekends, when public transport services are typically reduced . Key employment sites have been identified using travel patterns from the Census 2018 Travel to Work and School by Pacific Peoples. Key employment sites include CBD, Onehunga, Mt Wellington/ Penrose, East Tāmaki, and Manakau.

The accessibility catchment for the general population is larger under the separated option. The street-running option has a slightly larger catchment area around Mount Eden, which tends to capture more population during the weekend.

The number of Pacific people in the catchment area decreases under both options, likely due to the fact accessibility improvements are expected in areas for the population of Pacific Peoples is not expected to grow.

Figure 29 Key employment sites (Arriving weekends 8AM)

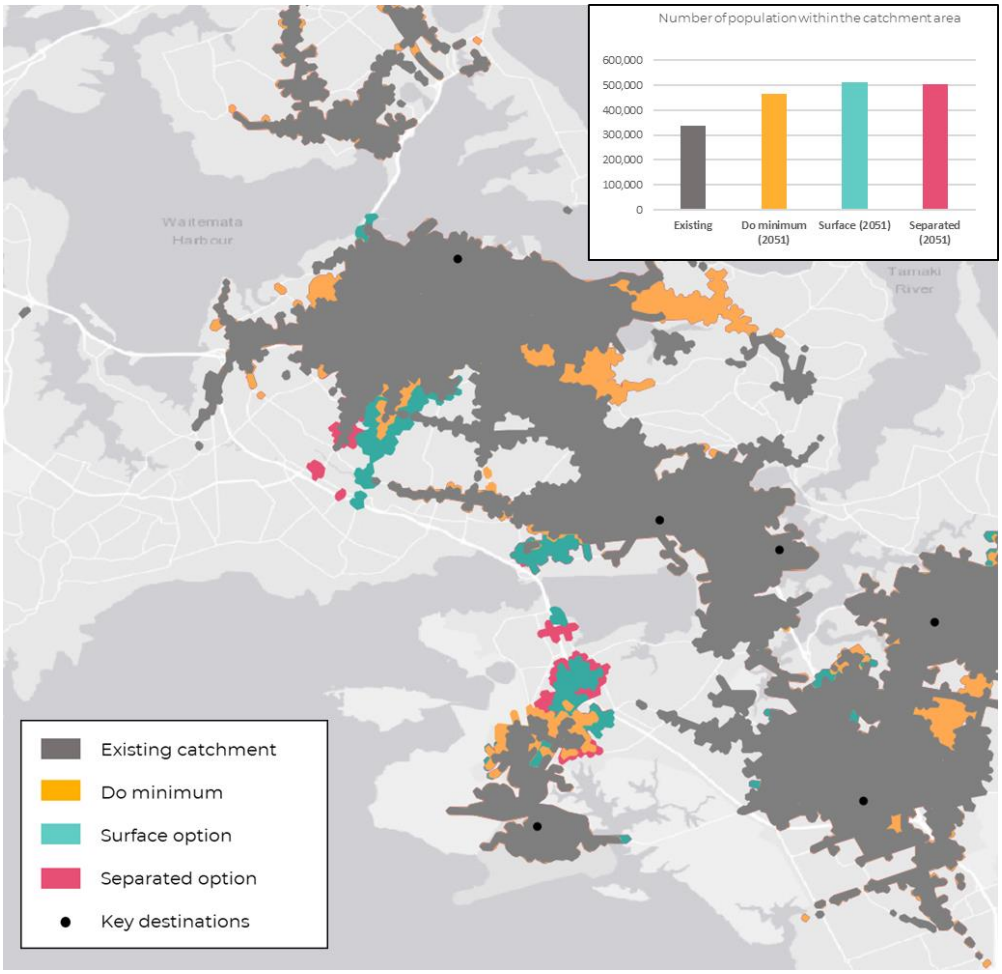


Table 56 Population within the catchment (access to key employment sites - weekends)

	Number of population within the catchment area	Number of Pacific Peoples population 2018 | 2043
Existing (2018)	337,719	64,546 | 91,427
RLTP (2051)	464,774	57,915 | 82,257
Street-running(2051)	512,905	62,926 | 89,382
Separated (2051)	503,380	63,071 | 89,872

Arriving at weekdays 9AM

This analysis investigates accessibility for workers travelling during weekday peak hours. As suggested by the figure below, the separated option captures the largest overall population catchment.

The analysis reveals that both transport options improve accessibility to the west of Isthmus, particularly around Point Chevalier. The street-running option improves accessibility around Mt Eden and Epsom, while the separated option increases accessibility in Mt Roskill.

Both street-running and separated options increase accessibility around Māngere, where over 50% of residents identify themselves as Pacific Peoples.

Figure 30 Access to key employment sites (Arriving weekdays at 9 AM)

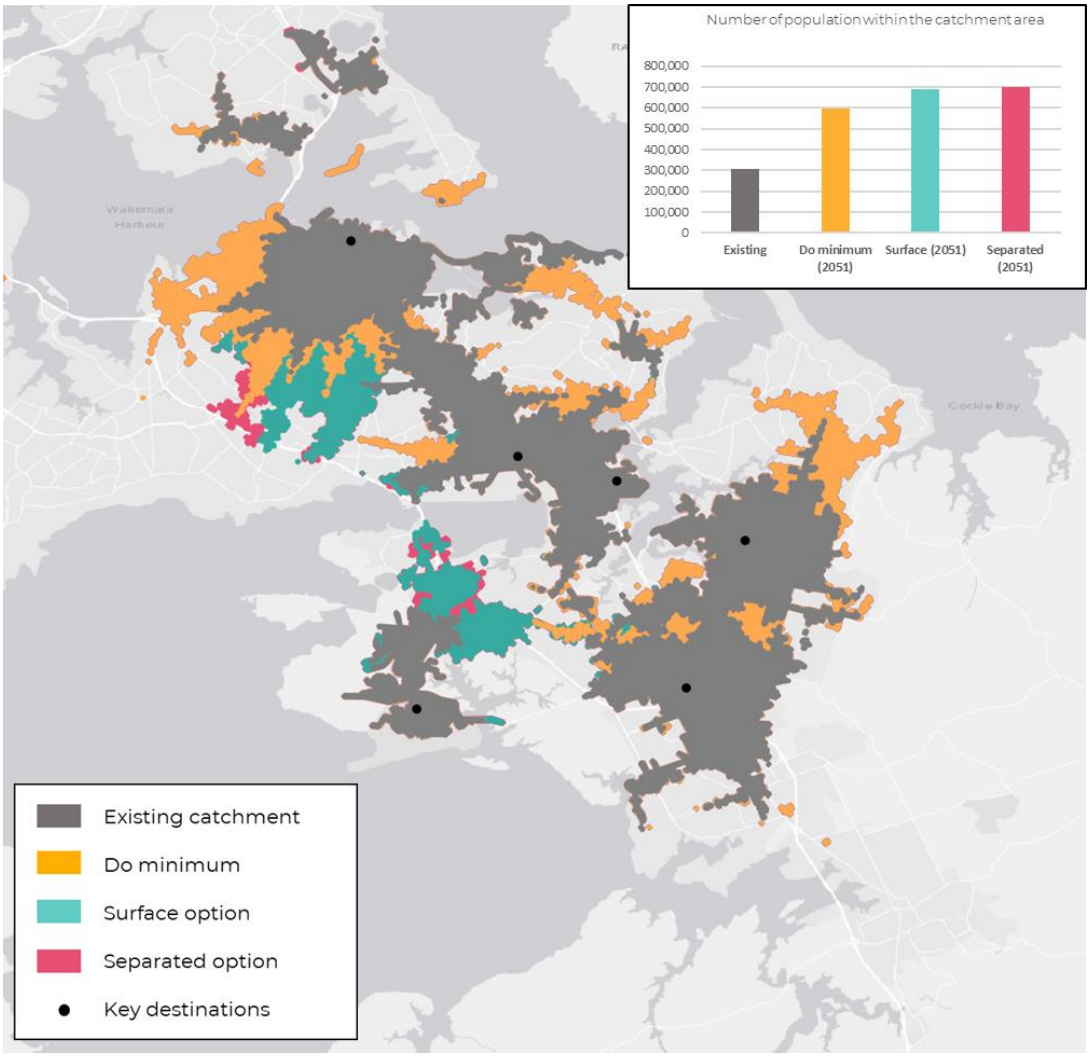


Table 57 Population within the catchment (access to key employment sites - weekdays)

	Number of population within the catchment area	Number of Pacific Peoples population 2018 | 2043
Existing (2018)	307,064	63,125 | 91,061
RLTP (2051)	594,725	70,796 | 101,142
Street-running(2051)	689,193	83,014 | 118,650
Separated (2051)	701,565	84,268 | 120,447

Summary

General Summary

In summary, the DI analysis for accessibility combines data on job accessibility and the concentration of priority residents in various zones. This analysis has yielded valuable insights into the distribution of employment opportunities areas with a higher concentration of priority populations, including women, young adults, individuals with mobility challenges, households without cars, and caregivers. In addition, a supplementary analysis has been conducted to closely examine changes in key destinations that are of significance to Māori and Pacific people.

The results of these findings are summarised in the table below:

Table 58 – Outcome of accessibility assessment by priority group

Priority group	Assessment Separated LM	Assessment Street- running LR
Māori community	Moderate beneficial	Slight beneficial
Pacific community	Neutral	Neutral
Female	Moderate beneficial	Moderate beneficial
Young adults	Slight beneficial	Slight beneficial
People with a disability	Large beneficial	Large beneficial
Households without car access	Slight beneficial	Slight beneficial
Carers	Large beneficial	Large beneficial
Lowest 20% of income earners	Large beneficial	Large beneficial
Highest 20% of income earners	Moderate beneficial	Moderate beneficial

In summary, the analysis suggests that both options are expected to result in improved accessibility. The separated light metro option is anticipated to perform slightly better, as the street-running option may not provide the same level of benefits in terms of reaching jobs and accessing key destinations.

A **moderate beneficial impact** is anticipated for the separated light metro option, while a **slight benefit** is foreseen for the street-running option. However, it's important to note that the difference between the options is not substantial.

Māori

Overall, the analysis suggests that a higher number of Māori people will experience accessibility benefits under the separated option. However, the differences between street-running and separated options are very marginal. The analysis suggests that both proposed options will enhance accessibility for the Māori community compared to the existing situation. This implies that more Māori communities will have the ability to access social facilities by public transport in the future.

Given that the results indicate a comparatively larger Māori population presence within the catchment area for social facilities under the separated option, **moderate accessibility benefits** are anticipated for this choice. The street-running option is assessed as **slight beneficial** due to its smaller population catchment impact. However, caution should be exercised in interpreting these results, given that accessibility is influenced by multiple factors including the availability and quality of transport infrastructure, and the efficiency of the transportation system.

Pacific Peoples

The analysis indicates that the separated option generates better accessibility using public transport for most social facilities. However, as the growth of Pacific Peoples' population is projected to occur outside the ALR corridor area, the direct benefits on the Pacific population catchment are limited. As a result, the overall impact of both options is appraised as neutral. Therefore, feeder services from future ALR stations will become very important to enabling Pacific peoples to realise more direct transport benefits from the Project.

User benefits

Introduction

Transport schemes typically generate user benefits (or user disbenefits) which are often concentrated in specific areas or among particular demographic groups. User benefits include travel time savings for both private vehicles and public transport, in addition to reduced vehicle operating costs. Examining the distributional effects of user benefits can reveal whether an intervention generates disproportionate benefits or disbenefits among certain income groups.

ALR is expected to facilitate a modal shift to public transport, reducing travel time, perceived congestion and perceived vehicle operating costs for road users. As a consequence, a full distributional impacts assessment is undertaken to understand how user benefits from ALR are likely to be realised across identified priority groups.

Approach

The analysis uses disaggregated appraisal outputs by zone from the MSM model. User benefits for car trips (excluding Heavy Commercial Vehicles), including congested travel time and public transport as well as vehicle operating costs, are analysed at an origin-destination level.

This analysis focuses on home-based travel, while trips related to employers' business, non-home-based travel and airport trips are excluded. For the purpose of assigning trips to model zones, AM trips are assumed to start at home, PM trips are assumed to end at home and IP trip benefits are split equally by origin and destination.

Outcomes

Step 1 Screening

While user benefits are associated with most transport schemes, benefits are typically accounted for as net outcomes which may hide the presence of disproportional effects. A full DIA is completed to analyse the distribution of user benefits across user benefits and priority groups including Māori and Pacific people.

Step 2 Assessment

Step 2a: Confirmation of areas impacted by the transport intervention

The impact area for the appraisal of user benefits is defined as the area in which the transport intervention is expected to generate changes to the cost of travel for users of the transport intervention. For ALR, the model covers the Auckland region as well as the suburbs of Pokeno and Tuakau in Waikato.

Step 2b: Identification of social groups in the impact area

Table 59 – Priority group distribution in user benefit impact areapresents the distribution of households by income for the impact area relative to the regional average. The data suggests there are minor differences in the impact group distribution which can be attributed in part to the fact that one-third of the population reside in the Auckland region. No significant concentrations of priority groups are identified in the user benefits impact area.

Table 59 – Priority group distribution in user benefit impact area

Priority group	Proportion in user benefit impact area	Proportion in study areas	Proportion in Auckland region
Lowest 20% of income earners	20%	18%	20%
Income Quintile 4	17%	18%	17%
Income Quintile 3	20%	20%	20%
Income Quintile 2	20%	19%	20%
Highest 20% of income earners	22%	25%	22%
Māori	9%	7%	9%
Pacific Peoples	12%	16%	12%

Step 2c: Identification of amenities in the impact area

Amenity identification is not required for user benefits, given that the appraisal focuses on the impact of user benefits across income groups meaning the impact area is too large to identify local attractions. It is worth noting that this analysis will be supplemented by a study of the distribution of benefits on Māori and Pacific peoples.

Step 3 Appraisal of impacts

Separated light metro

Figure 31 presents the distribution of the public transport user time benefits for the separated option, demonstrating that the greatest benefits are realised in an wide area centred around the scheme.

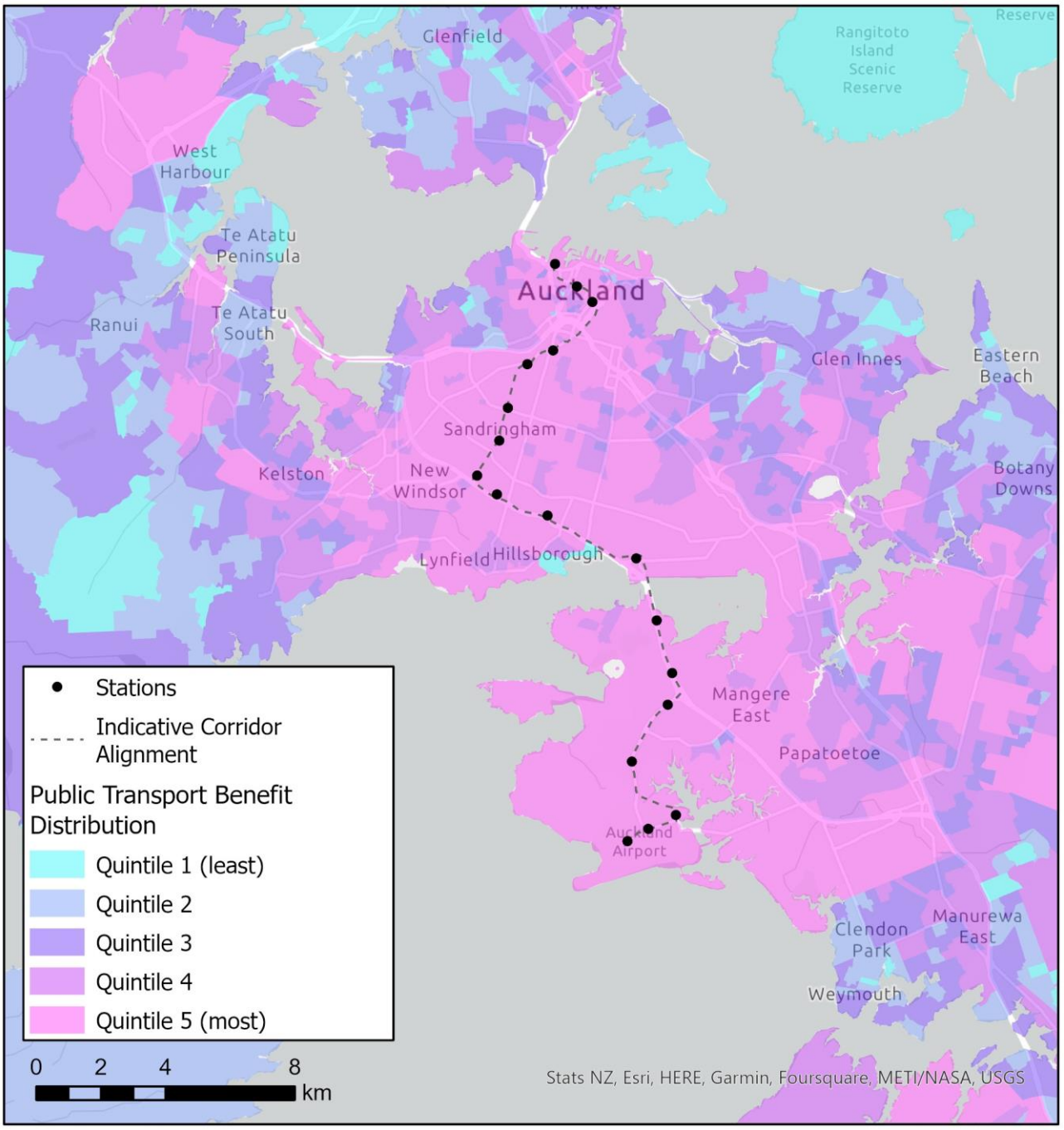


Figure 31 – Separated light metro public transport user benefits by quintile

Figure 32 presents the distribution of car benefits. It can be observed that the distribution of car benefits is more even throughout the impact area. However, there is still a notable concentration around the scheme, there are a few pockets of low benefits and disbenefits which are potentially attributable to improvements in pedestrian station access in these particular areas.

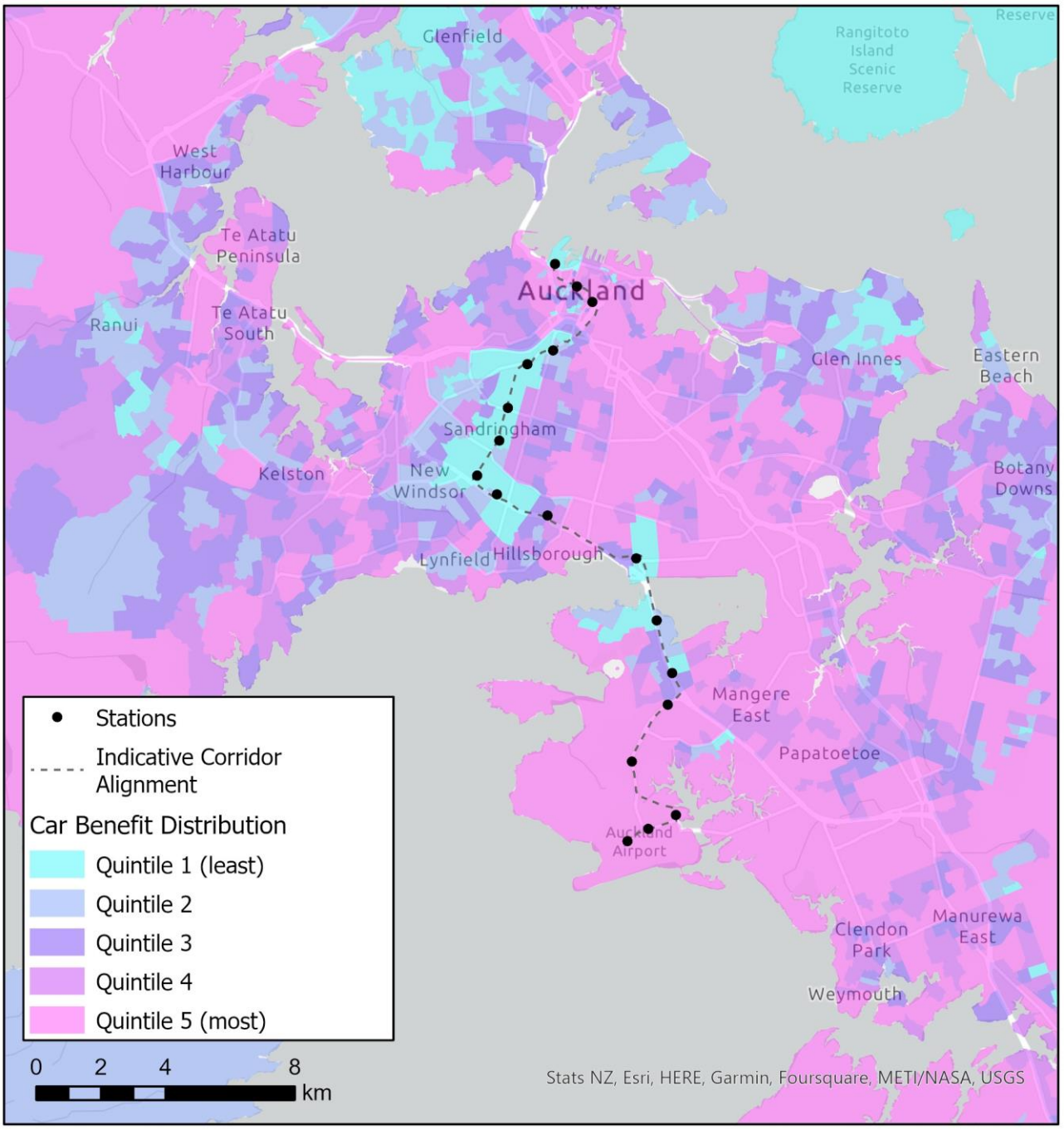


Figure 32 – Separated light metro car user benefits by quintile

Table 60 presents the distribution of benefits by income quintile. The data suggests that most benefits are derived from public transport (public transport users time savings) which are distributed less equally than car benefits. Overall, the second-lowest income quintile receives a disproportionately large share of the benefits, while all other income quintiles receive benefits in proportion to their share of the population.

Table 60 – Separated light metro user benefit appraisal by income

	Income Quintile 5 0% to 20% (lowest 20% of income earners)	Income Quintile 4 20% to 40%	Income Quintile 3 40% to 60%	Income Quintile 2 60% to 80%	Income Quintile 1 80% to 100% (highest 20% of income earners)	Total
PT benefits ($m)	427	556	294	264	370	1,911
PT disbenefits ($m)	-	-	-	-	-	-
Car benefits ($m)	140	132	131	135	123	661
Car disbenefits ($m)	-	-	-	-	-	-
Total benefits ($m)	567	688	425	399	493	2,572
Total disbenefits ($m)	-	-	-	-	-	-
Share of benefits	22%	27%	17%	16%	19%	100%
Share of disbenefits	-	-	-	-	-	-
Share of total population in the impact area	20%	17%	20%	20%	22%	100%
Assessment	Moderate beneficial	Large beneficial	Moderate beneficial	Moderate beneficial	Moderate beneficial	

Table 61 presents the distribution of user benefits for Māori and Pacific Peoples. The data suggests that Māori experience benefits in line with their share of the population, whilst Pacific peoples experience a disproportionately large share of benefits.

Care should be taken when interpreting these results, given the limited participation of Māori in the 2018 census which may lead to potential inaccuracies in the final assessment. The findings may be subject to change due to potentially false representation of the Māori community in this study area.

Table 61 – Separated light metro user benefit appraisal for Māori and Pacific Peoples

	Māori	Pacific Peoples
PT benefits ($m)	241	406
PT disbenefits ($m)	-	-
Car benefits ($m)	80	106
Car disbenefits ($m)	-	-
Total benefits ($m)	320	512
Total disbenefits ($m)	-	-
Share of benefits	12%	20%
Share of disbenefits	-	-

Share of total population in the impact area	10%	13%
Assessment	Moderate beneficial	Large beneficial

Street-running option

The distribution of the public transport benefits for the street-running option is presented in Figure 33. Similarly to the separated option, the greatest benefits are distributed across a broad geographic area but are primarily centred around the scheme.

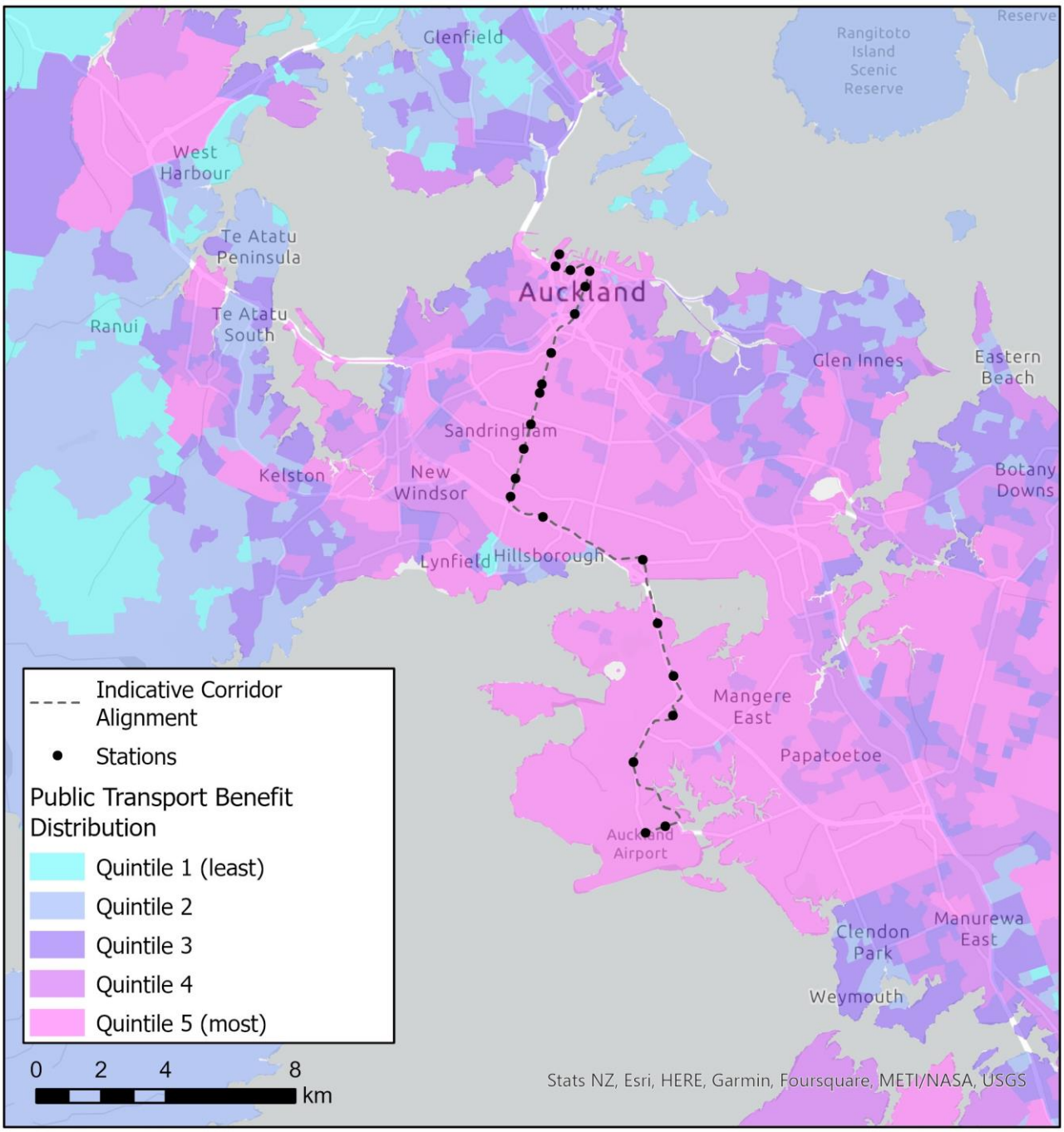


Figure 33 – Street-running light metro public transport user benefits by quintile

As demonstrated in Figure 34, the car benefits are realised across a more extensive area, with a lower concentration of benefits directly surrounding the scheme. This is primarily

attributable to the influence of the street-running section, which has a more significant impact on highway infrastructure.

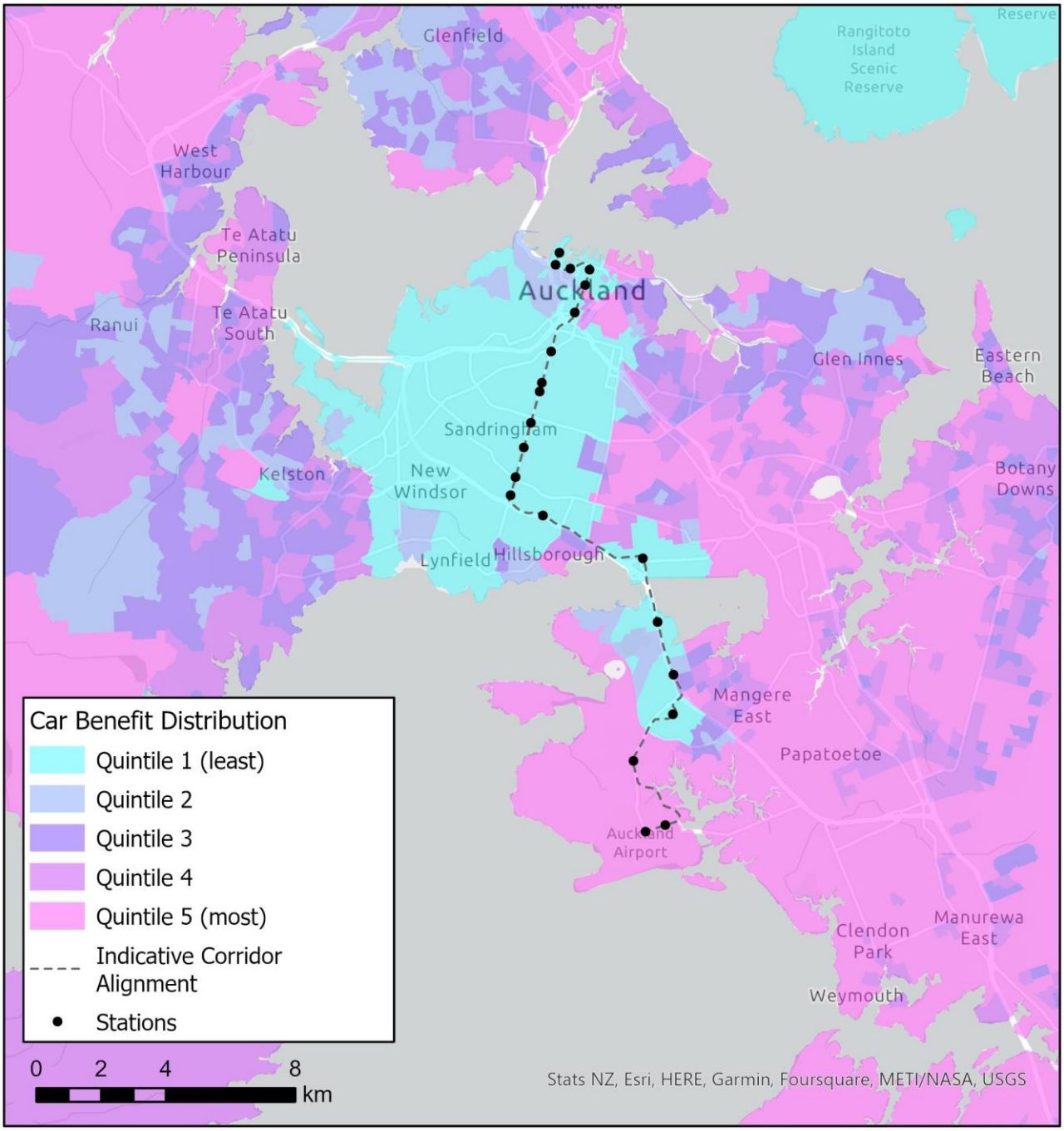


Figure 34 – Street-running light metro car user benefits by quintile

Table 62 presents the distribution of benefits by income quintile. As demonstrated by the data, public transport benefits account for over 90% of the total benefits. Both public transport and car benefits exhibit unequal distribution among the income quintiles. Income quintile five (lowest income group) is the only group that receives benefits in proportion to its share of the population. Income quintile four (second lowest income group) receives a disproportionately large share of the benefits, while all other income groups receive a disproportionately lower share of the benefits.

Table 62 – Street-running light metro user benefit appraisal by income

	Income Quintile 5 0% to 20% (lowest 20% of income earners)	Income Quintile 4 20% to 40%	Income Quintile 3 40% to 60%	Income Quintile 2 60% to 80%	Income Quintile 1 80% to 100% (highest 20% of income earners)	Total
PT benefits ($m)	481	595	299	269	351	1,995
PT disbenefits ($m)	-	-	-	-	-	-
Car benefits ($m)	72	48	33	32	3	188
Car disbenefits ($m)	-	-	-	-	-	-
Total benefits ($m)	553	643	332	301	354	2,183
Total disbenefits ($m)	-	-	-	-	-	-
Share of benefits	25%	29%	15%	14%	16%	100%
Share of disbenefits	-	-	-	-	-	-
Share of total population in the impact area	20%	17%	20%	20%	22%	100%
Assessment	Moderate beneficial	Large beneficial	Slight beneficial	Slight beneficial	Slight beneficial	

Table 63 presents the results of the user benefits assessment for Māori and Pacific Peoples. The analysis suggests that Māori experience benefits in line with their share of the population whilst Pacific Peoples experience a disproportionately large share of the benefits.

Table 63 – Street-running light metro user benefit appraisal for Māori and Pacific Peoples

	Māori	Pacific Peoples
PT benefits ($m)	271	447
PT disbenefits ($m)	-	-
Car benefits ($m)	37	44
Car disbenefits ($m)	-	-
Total benefits ($m)	309	490
Total disbenefits ($m)	-	-
Share of benefits	14%	22%
Share of disbenefits	-	-
Share of total population in the impact area	10%	13%
Assessment	Moderate beneficial	Large beneficial

Summary

In summary, the results of the distributional analysis that suggest both the separated light metro option and street-running alternative will deliver net user benefits across all income quintiles, but the benefits will not be distributed evenly.

Separated light metro

The overall impact of user benefits for the separated option is assessed as **moderately to largely beneficial**. A summary of the overall assessment by priority group is summarised in Table 64. Moderate benefits are anticipated for all income quintiles, except for income quintile 4 (the second-lowest income group) who are expected to realise a proportionally greater share of the total population benefit. A moderate positive effect is anticipated for Māori people, while a large benefit is foreseen for the Pacific community.

Table 64 – Separated light metro outcome of user benefit assessment by priority group

Priority group	Assessment
Lowest 20% of income earners	Moderate beneficial
Income quintile 4	Large beneficial
Income quintile 3	Moderate beneficial
Income quintile 2	Moderate beneficial
Highest 20% of income earners	Moderate beneficial
Māori	Moderate beneficial
Pacific Peoples	Large beneficial

Street-running option

The overall assessment of user benefits for the street-running option is appraised as **slightly to moderately beneficial**. A summary of the overall assessment by priority group is summarised in Table 65. Overall, moderate benefits are expected for Māori individuals and the lowest 20% of income earners, as the share of benefits aligns with their representation in the impact area. The distribution of benefits appears to favour the 20-40% income quintile (income quintile 4) and Pacific peoples. In contrast, income quintiles 3, 2, and 1 (the highest income earners) are projected to receive only slight user benefits.

Table 65 – Street-running light metro outcome of user benefit assessment by priority group

Priority group	Assessment
Lowest 20% of income earners	Moderate beneficial
Income quintile 4	Large beneficial
Income quintile 3	Slight beneficial
Income quintile 2	Slight beneficial
Highest 20% of income earners	Slight beneficial
Māori	Moderate beneficial
Pacific Peoples	Large beneficial

Affordability

Introduction

The average annual cost of public transport in Tāmaki Makaurau Auckland is approximately NZD$1472.00. This is slightly lower than the national annual average of $1,659.50. Recognising this challenge and aiming to restore public transport services to pre-pandemic levels, the Government has recently announced significant support for young public transport users. Starting from July 2023, this initiative includes free public transport for children under 13 and half-price discounts for people under 25[50].

There is plenty of research showing that the monetary costs of travel can be a major barrier to mobility for certain groups of people, thus affecting their ability to reach key destinations. Therefore, affordability is of key significance for the operation of ALR. Affordability is also a distributional issue and has hence been included in the distributional impacts analysis. Changes in transport costs may have disproportionate effects in cases where there are few or no transport alternatives, particularly in situations where financial constraints limit access to cars and their use. In such cases and where budgets are constrained, a step change in public transport costs might affect individuals ability to travel to work, attend school or access fresh, affordable food.

The appraisal of affordability mirrors the analysis for user benefits but focuses on the monetary cost of travel.

Approach

The monetary cost of travel can be a major barrier to mobility. This impact is particularly important for low-income groups and typically has a significant effect on their ability to access key destinations. As such, personal affordability impacts are a key distributional consideration for appraising a transport intervention. This section considers changes in the monetary cost of travel for travellers, excluding travel time savings resulting from the introduction of the ALR scheme.

Affordability impacts typically arise as indirect consequences of an intervention, which are usually conceived to improve transport efficiency, accessibility and/or safety. The Project is expected to have tangible impacts on the affordability of residual car users.

The approach to affordability aligns with the methodology outlined in the user benefits section. However, the affordability analysis concentrates on the changes in monetary costs of travel, considering only vehicle operating costs. Other monetary expenditures, such as public transport fares and tolls, are not individually evaluated and therefore are not incorporated into this analysis.

Outcomes

Step 1 Screening

As ALR will enable a shift to public transport, it will reduce travel time, perceived congestion, and perceived vehicle operating costs for residual road users. An analysis of DIs is needed to assess how the latter element (comprising car fuel and non-fuel operating costs) is distributed among income quintiles.

[50] Budget 2023 Highlights - Greater Auckland. Accessed August 2023.

Step 2 Assessment

Step 2a: Confirmation of areas impacted by the transport intervention

The impact area for assessing affordability remains consistent with that of user benefits, as previously described in the earlier chapter of this report.

Step 2b: Identification of social groups in the impact area

As the personal affordability assessment mirrors the user benefit appraisal component, the impact area and the identification of social groups remains unchanged with no significant concentrations or priority groups found in the impact area.

Step 2c: Identification of amenities in the impact area

Identification of amenities within the impact area for the affordability distributional impact appraisal is not required. This is because the appraisal focuses on the impact across income groups, and the impact area is too large to identify local attractions.

Step 3 Appraisal of impacts

Separated light metro

Table 66 presents the distribution of affordability benefits from vehicle operating costs by income quintile. Generally, there are overall benefits resulting from a reduction in vehicle operating costs due to a reduction in congestion; however, these benefits are not evenly distributed across the income quintiles. The lowest income quintile (income quintile 5) receives disproportionately substantial benefits, while income quintiles 4 and 1 (comprising the highest income earners) receive comparatively modest benefits (slight benefits). All other income quintiles receive benefits in proportion to their share of the population (moderate benefits).

Table 66 – Separated light metro affordability appraisal by income

	Income Quintile 5 **0% to 20% (lowest 20% of income earners)**	**Income Quintile 4** **20% to 40%**	**Income Quintile 3** **40% to 60%**	**Income Quintile 2** **60% to 80%**	**Income Quintile 1** **80% to 100% (highest 20% of income earners)**	**Total**
Benefits ($m)	4.9	1.6	4.6	4.7	3.1	19.0
Disbenefits ($m)	-	-	-	-	-	-
Share of benefits	26%	8%	24%	25%	16%	100%
Share of disbenefits	-	-	-	-	-	-
Share of total population in the impact area	20%	17%	20%	20%	22%	100%
Assessment	Large beneficial	Slight beneficial	Moderate beneficial	Moderate beneficial	Slight beneficial	

Street-running option

Table 67 presents the distribution of vehicle operating cost benefits by income quintile. Overall, there are disbenefits caused by an increase in congestion around areas where the scheme will operate on-street. These disbenefits are not distributed proportionally among income quintiles. Income quintile four (second lowest income group) and income quintile

one (highest income earners) experience a disproportionately large share of disbenefits. Income quintile five (lowest income earners) is anticipated to experience the lowest share of disbenefits (slight adverse). The remaining income quintiles are expected to experience disbenefits in line with their share of the population and thus their impact has been appraised as moderate adverse.

Table 67 – Street-running light metro affordability appraisal by income

	Income Quintile 5 0% to 20% (lowest 20% of income earners)	Income Quintile 4 20% to 40%	Income Quintile 3 40% to 60%	Income Quintile 2 60% to 80%	Income Quintile 1 80% to 100% (highest 20% of income earners)	Total
Benefits ($m)	-	-	-	-	-	-
Disbenefits ($m)	-0.5	-3.4	-2.3	-3.1	-5.7	-15.0
Share of benefits	-	-	-	-	-	-
Share of disbenefits	3%	22%	16%	21%	38%	100%
Share of total population in the impact area	20%	17%	20%	20%	22%	100%
Assessment	Slight adverse	Large adverse	Moderate adverse	Moderate adverse	Large adverse	

Summary

In summary, the results of the distributional analysis suggest that the separated light metro option will deliver net affordability benefits while the street-running alternative will deliver net disbenefits across all income quintiles. The benefits and disbenefits resulting from each option are not evenly distributed across income quintiles.

Separated light metro

The overall impact of affordability for the separated option is assessed as **slightly beneficial**. A summary of the overall assessment by priority group is summarised in Table 68.

Table 68 – Separated light metro outcome of affordability assessment by priority group

Priority group	Assessment
Lowest 20% of income earners	Large beneficial
Income quintile 4	Slight beneficial
Income quintile 3	Moderate beneficial
Income quintile 2	Moderate beneficial
Highest 20% of income earners	Slight beneficial

Street-running option

The overall assessment of user benefits for the street-running option is appraised as **slightly adverse**. A summary of the overall assessment by priority group is summarised in Table 69.

Table 69 – Street-running light metro outcome of affordability assessment by priority group

Priority group	Assessment
Lowest 20% of income earners	Slight adverse
Income quintile 4	Large adverse
Income quintile 3	Moderate adverse
Income quintile 2	Moderate adverse
Highest 20% of income earners	Large adverse

Security

Introduction

Studies exploring travel safety perceptions indicate that certain groups of users adjust their travel behaviour to avoid incidents that are perceived as risky and that present a threat to personal safety[51]. Priority groups such as women, younger people, older people and people with disabilities tend to perceive their risks as higher when using public transport. These users might feel more anxious when using public transport, which could discourage them from traveling. This, in turn, could make the transport system less accessible for them.

Different aspects of public transport service quality can influence traveller's safety, including: the behaviour and professionalism of drivers, the overall condition of vehicles, security measures such as surveillance cameras, emergency communication systems, the condition of infrastructure, and adequate lighting.

ALR has the potential to affect people's personal safety, especially women, young individuals, seniors and those with disabilities. It is essential to take into account the unique concerns of these groups when making changes to the transport system.

Approach

The distributional impact analysis of security builds on the personal safety analysis undertaken as part of the Social Impact Appraisal (SIA) in Chapter 3. It includes consideration of the following:

- Changes in public transport waiting facilities / interchange facilities.
- Changes to pedestrian access.
- Changes to provision of lighting and visibility.
- Changes to landscaping.
- Changes to formal or informal surveillance.

[51] Loukaitou-Sideris, A. (2014). Fear and safety in transit environments from the women's perspective. Security journal, 27, 242-256.

To conduct the analysis of distributional impacts on personal security, changes to individual security indicators resulting from ALR, as identified in the SIA, are utilised as inputs. Subsequently, a comprehensive assessment of the impact of the project on potential priority groups is conducted, considering the performance and relative importance of each indicator. The overall security improvement is then calculated. A scoring system is then developed, taking into account the weightings applied to different priority groups, to calculate an overall assessment of the security impact of ALR.

Outcomes

Step 1 Screening

Transport interventions may affect the level of security experienced by those using the transport system. In particular, public transport users face specific security challenges when stopping and passing through stations. The characteristics of these stations are crucial in terms of security and are especially relevant to the ALR scheme.

The introduction of ALR has the potential to significantly impact the safety and security of public transport users. This impact will depend on various factors, including the design of the system, operational practices, and the existing urban environment. Furthermore, the presence of this new system may also have implications for crime rates in the surrounding areas.

Hence, it is deemed necessary to conduct a security assessment for the Project. Additionally, an analysis of distributional impacts should be performed, particularly for priority groups that tend to perceive risk more acutely when using public transport. Research has indicated that demographic groups with specific concerns regarding personal security include women, teenagers, older individuals, and people with disabilities.[52]

Step 2 Assessment

Step 2a: Confirmation of areas impacted by the transport intervention

As indicated in TAG Unit A4.2, the impact area will include the specific locations where improvements are being made to personal security, together with the catchment area for walking to the facility.

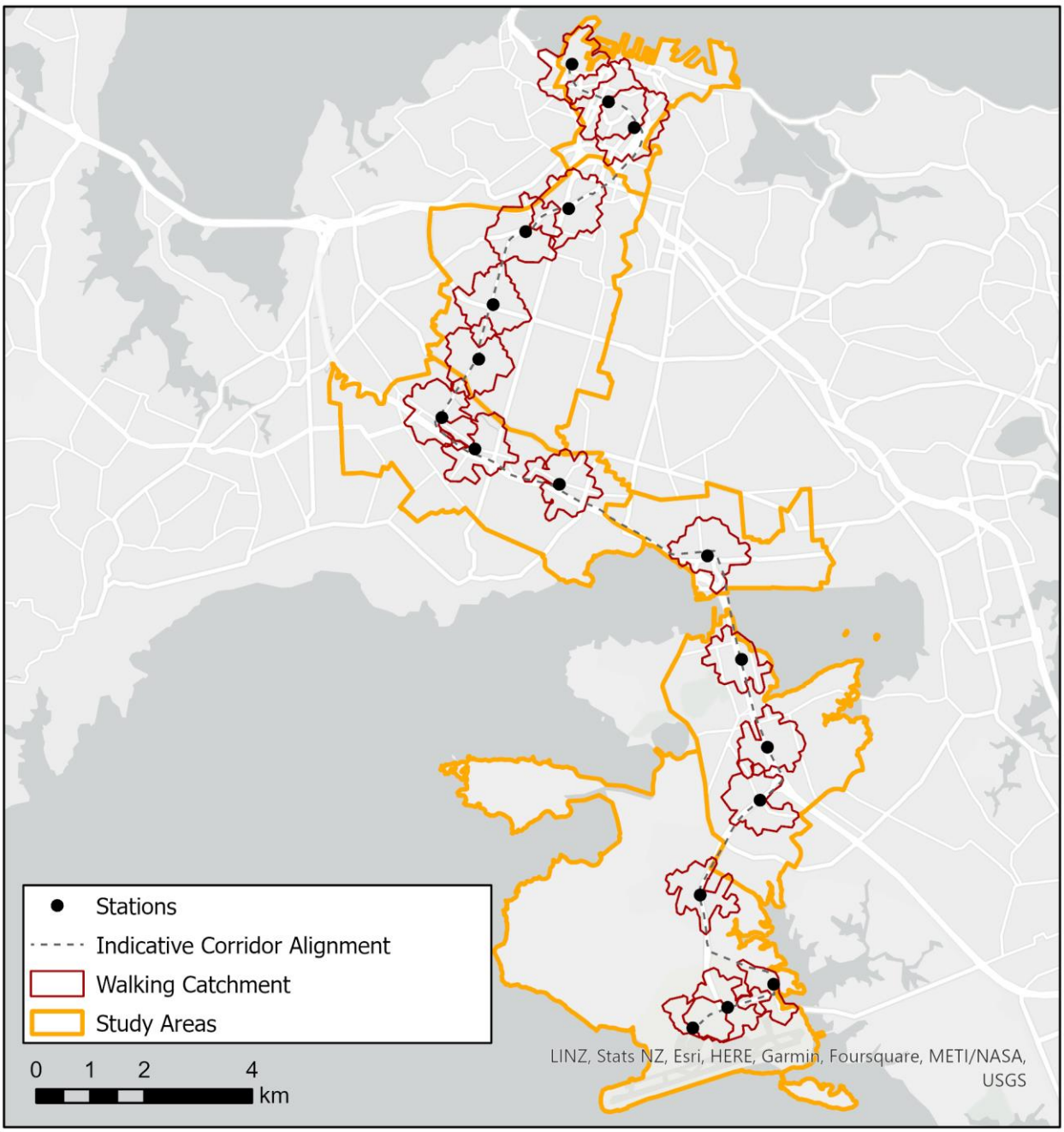
Since the primary focus of security enhancements pertains to stations within ALR, this security analysis defines the impact area as the walking catchment around each station.

Separated light metro

A 10-minute walking catchment from stations is defined in Figure 35 as the impact area for the separated light metro option. It is considered that the area reachable by walking to the facilities encompass specific locations where enhancements to personal security are being implemented.

[52] DfT (2023). TAG Unit A4.2 Distributional Impact Appraisal.

Figure 35 Security impact area – Separated light metro



Street-running option

Similarly, a 10-minute walking catchment from stations is defined in Figure 36 as the impact area for the street-running option. It is considered that the area reachable by walking to the facilities encompass specific locations where enhancements to personal security are being implemented.

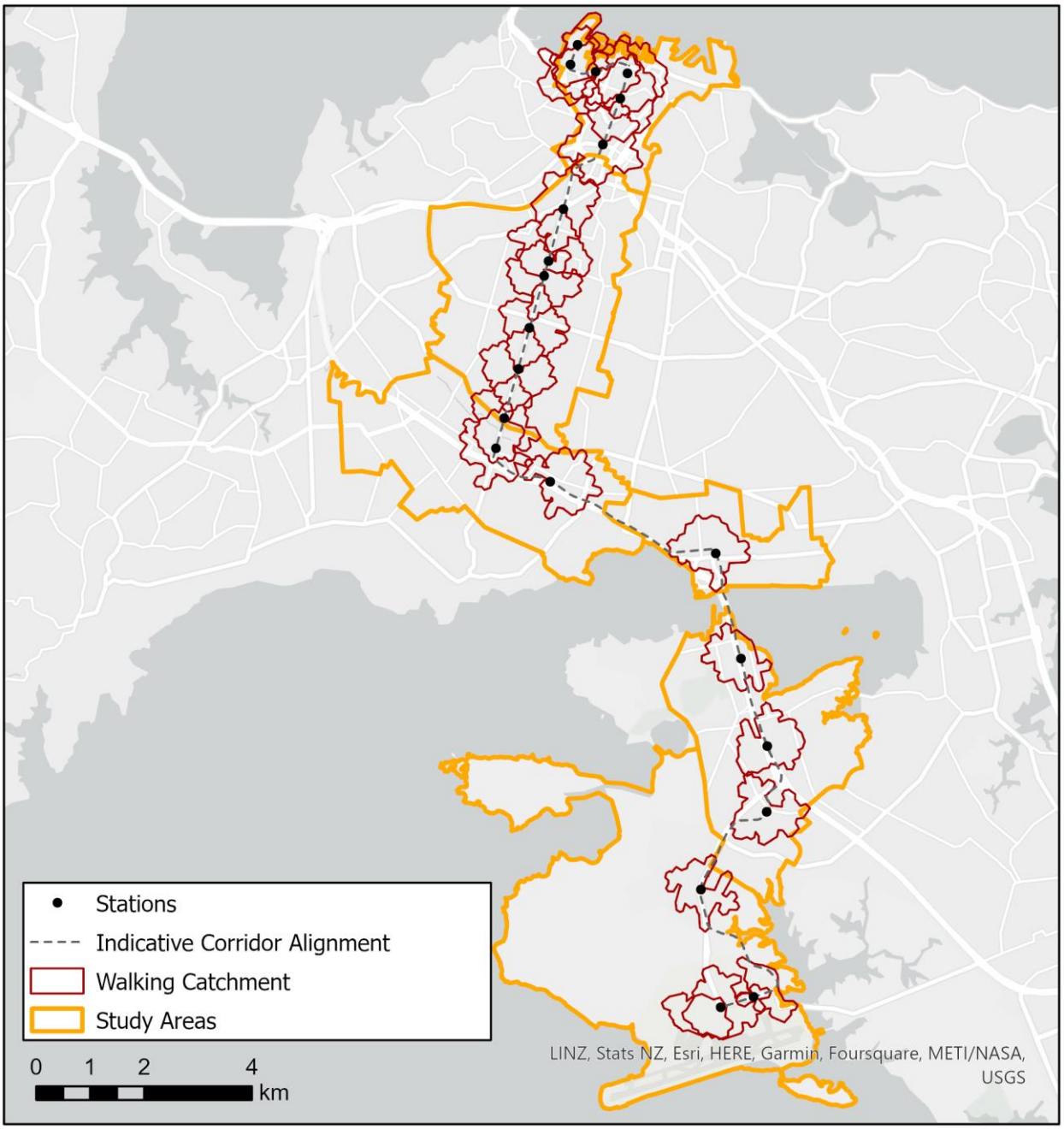


Figure 36 – Security impact area – Street-running option

Step 2b: Identification of social groups in the impact area

Certain priority groups have particular concerns about their personal safety or tend to be more susceptible to crime. The priority groups of relevance to security include women, teenagers, older people, and people with disabilities.

Separated light metro

Table 70 presents the proportion of priority groups within the security impact area for the separated light metro option in comparison to the overall study area and the Tāmaki Makaurau Auckland region. The data suggests that representation of females and people with disabilities are relatively in line with the regional data. Young adults are overrepresented in the impact area (23%) compared to regional rates (14%). In contrast, the proportion of older people is significantly lower in the security study area.

Table 70 – Priority group distribution in security impact area

Priority group	Proportion in security impact area	Proportion in study areas	Proportion in Auckland Region
Young adults (15-24)	23%	18%	14%
Older people (70+)	4%	5%	8%
Females	49%	49%	51%
People with difficulties	4%	5%	5%

Street-running option

Table 71 presents the distribution of priority groups in the security impact area compared to the overall study area and the Tāmaki Makaurau Auckland region. As with the separated light metro option, representation of females and people with difficulties is relatively in line with the regional data. Young adults are overrepresented in the impact area (22%) compared to regional rates (14%). In contrast, the security study area for the street-running option has a notably lower proportion of older individuals compared to the regional level.

Table 71 – Priority group distribution in security impact area

Priority group	Proportion in severance impact area	Proportion in study areas	Proportion in Auckland Region
Young adults (15-24)	22%	18%	14%
Older people (70+)	4%	5%	8%
Females	49%	49%	51%
People with difficulties	4%	5%	5%

Step 2c: Identification of amenities in the impact area

For the purposes of this high-level assessment, the analysis has been narrowed to focus solely on stations within the CC2M. Consequently, the analysis of other community facilities such as health centres, community centres, schools, local shops, places of worship and playgrounds has been excluded from consideration.

This deliberate scoping is intended to serve the immediate purpose of the security DI analysis. A more comprehensive identification of amenities within the impact area will be conducted when sufficient quantitative data becomes available to facilitate a thorough appraisal of security.

Step 3 Appraisal of impacts

The approach to the DI appraisal is based on the existing results for the assessment of security indicators (see SIA) but has been enhanced to describe the impacts on specific potential priority groups. The performance for each security indicator has been taken from the analysis conducted in the SIA. For the no-scheme scenario, a neutral impact has been assumed for all indicators as no stations are present under this case. The relative importance of each indicator has been defined for each priority group based on the typical journeys made by the various groups and their likely time of travel. This component relies on assumptions based on existing evidence describing the importance of different

elements of security that affect different potentially vulnerable groups using the transport system.

Separated light metro

The following table presents the analysis of the personal security DI for the separated light metro option.

Table 72 – Assessment of personal security DIs – Separated light metro

Security indicator	Performance for each security indicator			Relative importance of each indicator [B] (High / Medium / Low) (=3/2/1)				Weighted score for each indicator [C] = [A] * [B]				Qualitative comment
	Without scheme	With scheme	Change (0/+1/+2) [A]	All users	Older people	Women	Young adults	All users	Older people	Women	Young adults	
Site perimeters, entrances and exits	Neutral	High beneficial	+2	Medium	Medium	Medium	Medium	4	4	4	4	The introduction of site perimeters, entrances and exits will have a high beneficial impact on security. The relative importance of this indicator is medium for each priority group.
Formal surveillance	Neutral	High Beneficial	+2	Medium	Medium	High	Medium	4	4	6	4	Formal surveillance measures will have a high beneficial impact on security. The relative importance of this indicator is high for women and medium for other priority groups.
Informal surveillance	Neutral	Moderate Beneficial	+1	Medium	Medium	Medium	Medium	2	2	2	2	Informal surveillance measures will have a moderately beneficial impact on security. The relative importance of this indicator is medium for all priority groups.
Landscaping	Neutral	Not appraised	-	Medium	Medium	Medium	Medium	0	0	0	0	Landscaping was not appraised under the security assessment as it has been discussed in the journey quality section of the SDI report.
Lighting and visibility	Neutral	Neutral	0	Medium	Medium	High	Medium	0	0	0	0	Lighting and visibility will have a neutral effect on security. The relative importance of this indicator is high for women and medium for other priority groups.
Emergency call	Neutral	Moderate Beneficial	+1	Medium	Medium	High	Medium	2	2	4	2	Emergency call facilities will have a moderately beneficial impact on security. The relative importance of this indicator is high for women and medium for other priority groups.
Public transport journey between boarding and alighting stops	Neutral	High beneficial	+2	Medium	Medium	Medium	Medium	4	4	4	4	Any improvements to the PT journey between boarding and alighting stops is expected to have a high beneficial impact on security. The relative importance of this indicator is medium for all groups
Total security improvement score [D] = [C]								16	16	20	16	
No of users affected (>10,000 is high) [E]								77.500	3.300	37,900	17,700	
Overall assessment of security impacts								Moderate beneficial	Slight beneficial	Moderate beneficial	Moderate beneficial	

Street-running option

Table 73 – Assessment of personal security DIs – Street-running option

Security indicator	Performance for each security indicator			Relative importance of each indicator [B] (High / Medium / Low) (=3/2/1)				Weighted score for each indicator [C] = [A] * [B]				Qualitative comment
	Without scheme	With scheme	Change (0/+1/+2)	All users	Older people	Women	Young adults	All users	Older people	Women	Young adults	
Site perimeters, entrances and exits	Neutral	High beneficial	+2	Medium	Medium	Medium	Medium	4	4	4	4	The introduction of site perimeters, entrances and exits will have a high beneficial impact on security. The relative importance of this indicator is medium for each priority group.
Formal surveillance	Neutral	High Beneficial	+2	Medium	Medium	High	Medium	4	4	6	4	Formal surveillance measures will have a high beneficial impact on security. The relative importance of this indicator is high for women and medium for other priority groups.
Informal surveillance	Neutral	Moderate Beneficial	+1	Medium	Medium	Medium	Medium	2	2	2	2	Informal surveillance measures will have a moderately beneficial impact on security. The relative importance of this indicator is medium for all priority groups.
Landscaping	Neutral	Not appraised	0	Medium	Medium	Medium	Medium	0	0	0	0	Landscaping was not appraised under the security assessment as it has been discussed in the journey quality section of the SDI report.
Lighting and visibility	Neutral	Neutral	0	Medium	Medium	High	Medium	0	0	0	0	Lighting and visibility will have a neutral effect on security. The relative importance of this indicator is high for women and medium for other priority groups.
Emergency call	Neutral	Moderate Beneficial	+1	Medium	Medium	High	Medium	2	2	4	2	Emergency call facilities will have a moderately beneficial impact on security. The relative importance of this indicator is high for women and medium for other priority groups.
Public transport journey between boarding and alighting stops	Neutral	Moderate Beneficial	+1	Medium	Medium	Medium	Medium	2	2	2	2	Improvements to the PT journey between boarding and alighting stops is expected to have a moderate beneficial impact on security. The relative importance of this indicator is medium for all groups.
Total security improvement score [D] = [C]								14	14	18	14	
No of users affected (10,000 is high) [E]								107,700	4,400	52,300	24,100	
Overall assessment of security impacts								Moderate beneficial	Slight beneficial	Moderate beneficial	Moderate beneficial	

Summary

In summary, the distributional analysis of key security indicators assesses various changes to individual security resulting from ALR, with particular consideration given to the performance and relative importance of each security indicator on identified priority groups.

After confirming the security impact area for each transport option and identifying the proportion of priority group members that fall within the security impact area, a security impact appraisal was carried out to assess the performance and relative importance of each indicator with respect to each priority group, based on their typical journeys and likely time of travel.

The findings of the distributional analysis indicate that **moderately positive benefits** will be achieved under both transport options. The benefits are expected to be most acute for women, who make up the largest proportion of the study area and who are affected by the highest number of security indicators.

The effect on young adults is also expected to be moderately beneficial, as the proportion of young people within the study area is high. While older people are expected to benefit from the scheme, the impact is only anticipated to be slightly beneficial given a relatively low proportion of elderly people fall within the security impact area.

Beyond the relative proportion of priority groups that are affected, the assessment of security impacts is not highly beneficial in any case because the improvement in security indicators is not substantial (i.e., changing from poor to high). While the relative performance of each security indicator is nearly identical under each transport option for all priority groups, the magnitude of benefit is expected to be slightly larger under the separated option. This is because a higher proportion of priority individuals fall within the security impact area, and because the separated option generates a slightly superior overall security benefit through larger anticipated improvements for the 'public transport journey between the boarding and alighting stops' aspect.

Air quality

Introduction

Air quality impacts are likely to occur whenever a transport intervention results in changes to vehicle traffic flows or speeds or where the physical gap between traffic and people is altered.

The ALR scheme is expected to result in changes to traffic flows around stations and on adjacent roads. Additionally, the introduction of a new transport option through the delivery of a light rail system is expected to generate a modal shift from vehicles to public transport and active forms of travel. The change in concentration of air pollutants resulting from the redistribution of traffic in the study area requires further analysis to deduce how changes in air quality will differentially impact households and individuals living around stations and along the ALR corridor.

Air quality has significant distributional impacts. Negative air quality impacts are frequently prevalent in low-income areas, where residents experience the negative impacts of car use despite often lacking access to a car themselves. Individuals in low-income communities typically already suffer from relatively poor health, and air quality impacts can exacerbate these health problems. As such, it is necessary to concentrate the analysis of changes in air quality on the impacts on low-income individuals and households.

In addition, evidence suggests that children and young people are more at risk from air pollution due to spending more time outside and suffering greater exposure to harmful

pollutants. Consideration should therefore be given to the analysis of air quality impacts experienced by these demographic groups.

Approach

The air quality DI assessment relies on the results generated by the Vehicle Emissions Prediction Model (VEPM), jointly developed by the Waka Kotahi NZ Transport Agency and Auckland Council to project vehicle emissions within the Auckland region. This model is categorised as an average-speed model since it incorporates changes in speed, which are calculated using the transportation model, as one of its primary inputs.

The "Guide to Assessing Air Quality Impacts from State Highway Projects"[53] acknowledged that despite the variety of pollutants emitted, nitrous oxides (NOx) and particulate matter ($PM_{2.5}$) pose the greatest concern for human health. Consequently, this DI analysis exclusively concentrates on assessing changes in NOx and $PM_{2.5}$ levels on each link across the model. The comparison between Do Minimum and the transport intervention options in the opening year are the basis for the analysis of the air quality distributional impact for this Project.

The road network assessment facilitates the quantification of changes in air pollutant concentrations in areas that are proximate to the transportation network following the implementation of the scheme. By considering the scale and direction of changes in NOx and PM2.5 concentrations[54], specific air quality impacts are associated with particular areas using GIS. This approach enables the overlay of demographic profile data to better understand the demographic distribution of these impacts.

Outcomes

Step 1 Screening

The delivery of ALR is expected to result in significant changes in traffic emissions. A change in the level of emissions is primarily attributed to traffic flow changes resulting from various factors including a modal shift from private vehicles to public transport, increased PT capacity and the implementation of dedicated infrastructure for active travel modes. These changes are expected to have a substantial impact on traffic patterns and congestion levels, directly affecting the levels of air quality experienced in the areas which surround the scheme. Therefore, it is appropriate to closely examine the affected area to understand how changes in traffic emissions will impact priority groups following the introduction of the scheme.

Step 2 Assessment

Step 2a: Confirmation of areas impacted by the transport intervention

In the absence of a full air quality model, the affected road network for the purposes of the air quality assessment has been defined as roads that meet any of the following traffic change criteria:

- Annual average daily traffic (AADT) change greater than 1000
- A change in Heavy duty vehicle (HDV) AADT greater than 200
- A change in modelled speed by 5km/h in the opening year.

[53] New Zealand Transport Agency (2019). Guide to assessing air quality impacts from state highway projects. Reference 14-265. Version 2.2.

[54] In this instance, a change in traffic emissions of at least 1% is defined as a significant change.

Based on general recommendations described in the "State Highway Environmental and Social Responsibility Screen: Explanation Guide"[55], the air quality DI analysis is conducted for areas that fall within a 200-metre radius of any impacted link.

Separated light metro

The air quality impact area for the separated light rail option is presented in Figure 37. The figure highlights links that are expected to be impacted by changes in motorised traffic flow, subsequently resulting in air quality impacts. Traffic flow changes are most pronounced along the motorway, where significant reductions are expected to occur because of a modal shift from vehicles to public transport. Changes are also expected in the city centre, where significant traffic rerouting is anticipated to be required as a result of the scheme.

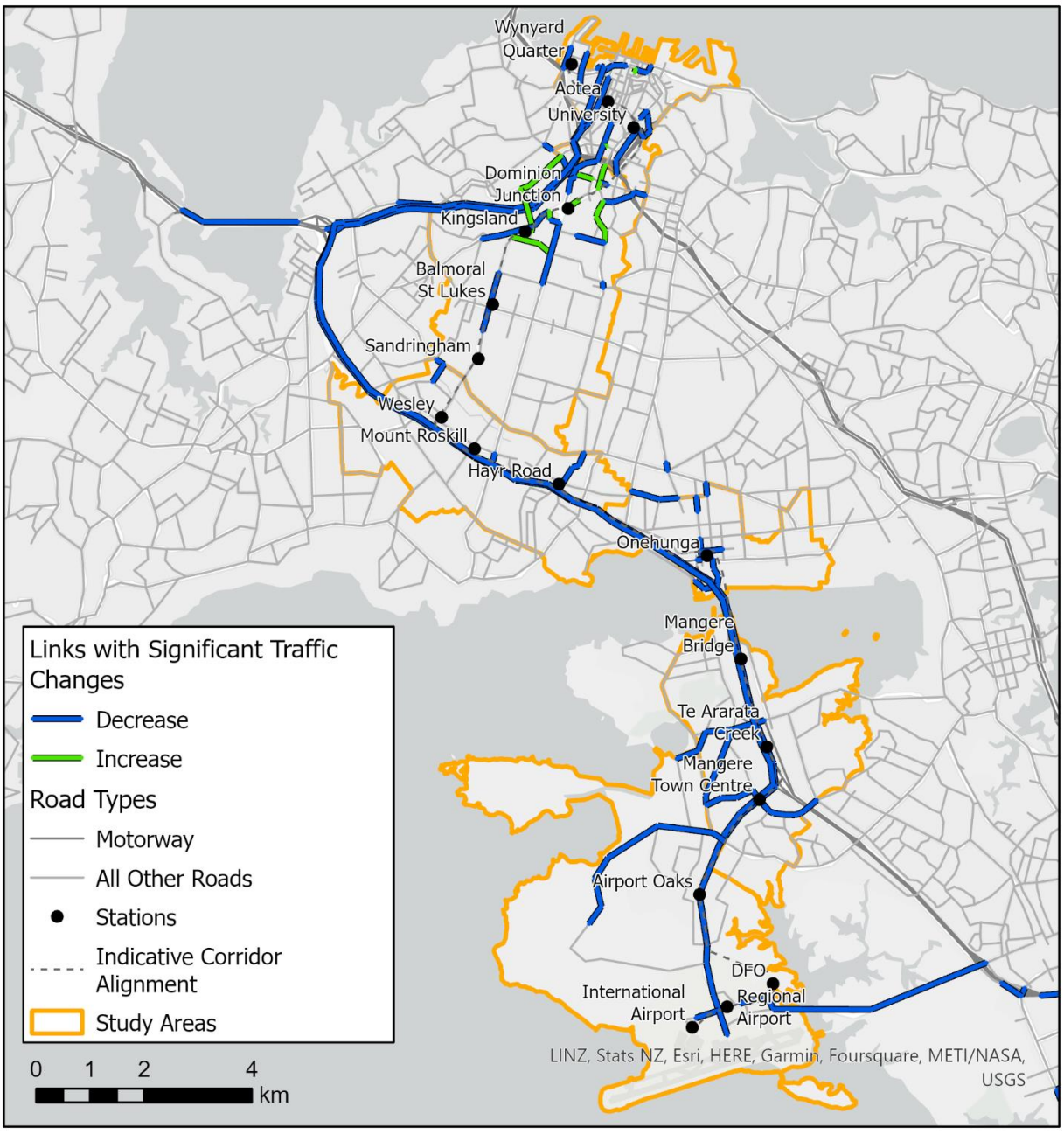


Figure 37 – Separated light metro traffic flow-based air quality impact area

Street-running option

[55] New Zealand Transport Agency (2015). State highway environmental and social responsibility screen: explanation guide. hip.nzta.govt.nzVersion 2.2.

The air quality impact area for the street-running option is presented in Figure 38. The figure reveals that the street-running option is expected to create more significant traffic changes compared to the separated option. Notable traffic reductions are anticipated along the street-running corridor running north from Puketāpapa, while many parallel roads experience an increase in traffic due to diversions from this corridor. As with the separated option, there is a significant reduction in traffic along the motorways that fall within and near the study areas.

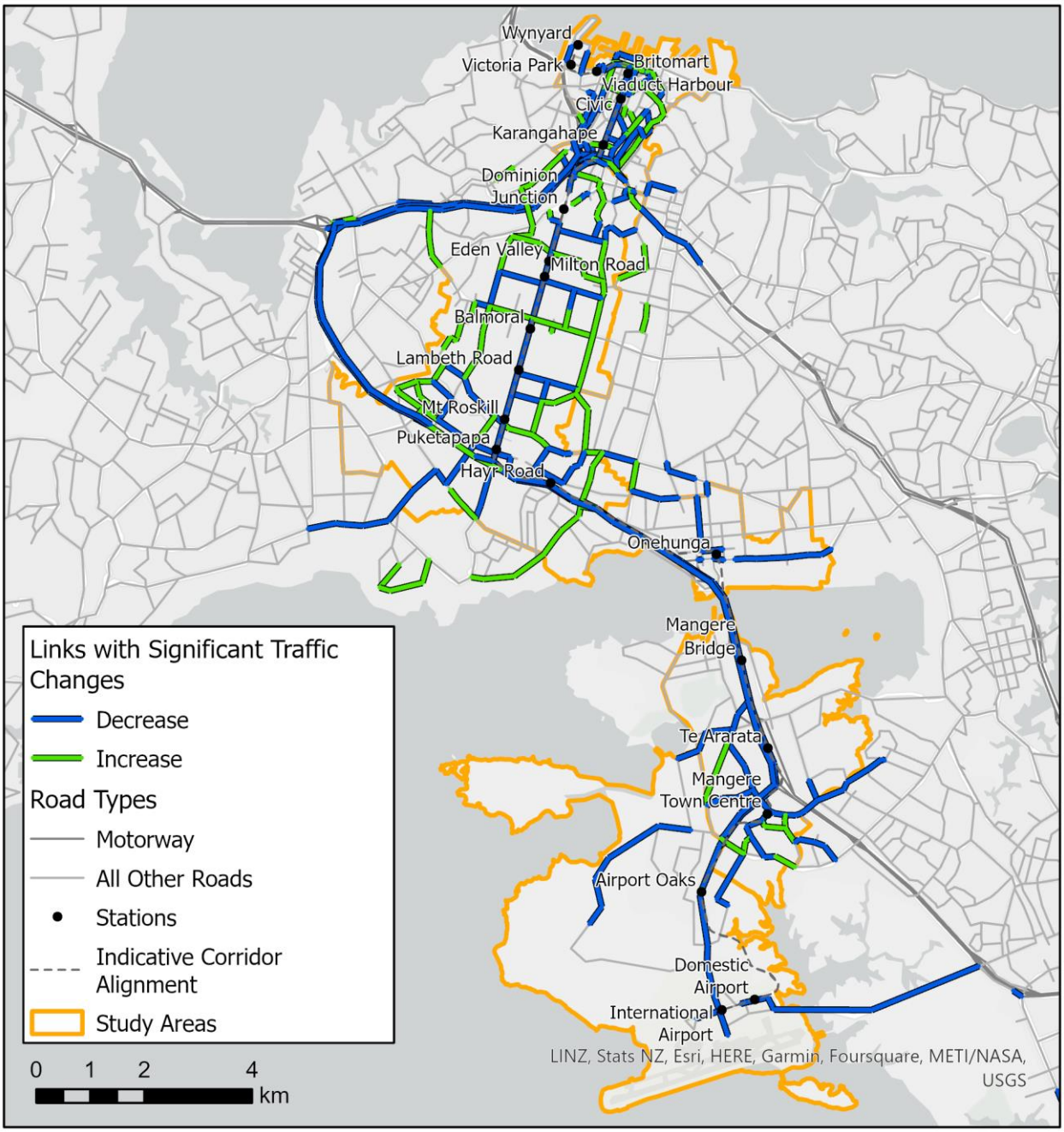


Figure 38 – Street-running metro traffic flow-based air quality impact area

Step 2b: Identification of social groups in the impact area

Priority groups in terms of air quality include children, young adults and low-income individuals.

Separated light metro

Table 74 shows the proportion of children, young adults, high income and low-income earners within the defined air quality impact area. The analysis suggests that the

proportion of low-income earners and young adults is higher than the regional average. Meanwhile, the proportion of children and high-income earners is below the regional average.

Table 74 Separated light metro priority group distribution in traffic flow-based air quality impact area

Priority group	Proportion in air quality impact area	Proportion in study areas	Proportion in Auckland Region
Children (under 15)	17%	17%	20%
Young adults (15 to 24)	18%	18%	14%
Lowest 20% of income earners	28%	18%	20%
Highest 20% of income earners	18%	25%	22%

Street-running option

Table 75 presents the proportion of priority groups in the air quality impact area for the street-running option. Under this option, young adults are overrepresented while children are underrepresented compared to the regional average. High- and low-income earners are both slightly overrepresented in the impact area.

Table 75 – Street-running metro priority group distribution in traffic flow-based air quality impact area

Priority group	Proportion in air quality impact area	Proportion in study areas	Proportion in Auckland Region
Children (under 15)	17%	17%	20%
Young adults (15 to 24)	19%	18%	14%
Lowest 20% of income earners	21%	18%	20%
Highest 20% of income earners	24%	25%	22%

Step 2c: Identification of amenities in the impact area

For a full understanding of changes in ambient air quality, it is essential to analyse changes at specific receptors. In the absence of a comprehensive air quality model, this DI analysis applies a simple approach focused on assessing changes in emissions from vehicles by link. Consequently, the analysis narrows its focus exclusively to links with significant changes in NOx and $PM_{2.5}$ levels. The evaluation of other community facilities, such as schools, nurseries, and playgrounds, has been intentionally omitted from consideration.

This deliberate scoping is intended to serve the immediate purpose of the air quality DI analysis. A more exhaustive identification of amenities within the impact area will be conducted when sufficient quantitative data becomes available to facilitate a thorough assessment of air quality changes experienced by sensitive receptors.

Step 3 Appraisal of impacts

The DI appraisal considers the likely population affected by significant changes in concentrations of air pollutants as a result of the introduction of ALR. The evaluation of impacts has specifically focused on two key air pollutants associated with transportation

(NOx and $PM_{2.5}$) due to their recognised significance in terms of potential human health concerns.

NO_x Emissions

Separated light metro

Table 76 presents the NO_x air quality appraisal by income quintile for the separated option. The analysis suggests that all income groups will experience a net improvement in air quality, with only a small proportion of the population experiencing a deterioration in air quality levels. Income quintile 1 (the lowest 20% of income earners) will experience disproportionately smaller benefits than expected for its population distribution, while income quintile 3 will experience disproportionately large benefits. All other income groups will receive benefits in line with their share of population in the impact area.

Table 76 – Separated light metro NO_x air quality appraisal by income

	Income Quintile 1 (lowest Income)	Income Quintile 2	Income Quintile 3	Income Quintile 4	Income Quintile 5 (highest income)	Total
Population in each group with improved air quality [A]	7,000	5,000	7,000	6,000	6,000	31,000
Population in each group with no change in air quality [B]	3,000	1,000	1,000	2,000	1,000	8,000
Population in each group with deteriorating air quality [C]	2,000	1,000	0	1,000	1,000	6,000
Net no of Winners / Losers in each group [D] = [A] - [C]	4,000	4,000	7,000	4,000	5,000	-
Total population in each group [E] = [A] + [B] + [C]	-	-	-	-	-	24,000
Proportion of net Winners / Losers [F] = [D] / [E]	18%	17%	27%	18%	20%	
Share of total population in the impact area	28%	16%	19%	19%	18%	
Assessment	Slight beneficial	Moderate beneficial	Large beneficial	Moderate beneficial	Moderate beneficial	

Table 77 presents the impact for children and young adults. The analysis indicates that both age groups will experience overall net benefits that align with their respective shares of the child and young adult population within the impact area assessment.

Table 77 – Separated light metro NO_x air quality appraisal for children and young adults

	Children	Young Adults
Population in each group with improved air quality [A]	5,000	5,000
Population in each group with no change in air quality [B]	2,000	1,000
Population in each group with deteriorating air quality [C]	1,000	1,000

Net no of Winners / Losers in each group [D] = [A] - [C]	3,000	4,000
Total population in each group [E] = [A] + [B] + [C]	11,000	11,000
Proportion of net Winners / Losers [F] = [D] / [E]	15%	18%
Share of total population in the impact area	17%	18%
Assessment	Moderate beneficial	Moderate beneficial

Street-running option

The NO_x assessment for the street-running option is presented by income group in Table 78. Again, the net overall impact is positive but the net number of winners is lower compared to the separated option. Benefits are also spread out less equally – income quintile one (the lowest 20% of income earners) and income quintile 3 receive a disproportionately large share of the benefits, while income quintile 5 (highest 20% of income earners) receives a disproportionately small share of the benefits for its population distribution.

Table 78 – Street-running light metro NO_x air quality appraisal by income

	Income Quintile 1 (lowest Income)	Income Quintile 2	Income Quintile 3	Income Quintile 4	Income Quintile 5 (highest income)	Total
Population in each group with improved air quality [A]	11,000	9,000	10,000	11,000	13,000	54,000
Population in each group with no change in air quality [B]	4,000	2,000	4,000	2,000	1,000	12,000
Population in each group with deteriorating air quality [C]	7,000	7,000	6,000	8,000	12,000	39,000
Net no of Winners / Losers in each group [D] = [A] - [C]	4,000	3,000	4,000	3,000	1,000	-
Total population in each group [E] = [A] + [B] + [C]	-	-	-	-	-	15,000
Proportion of net Winners / Losers [F] = [D] / [E]	28%	18%	28%	19%	6%	
Share of total population in the impact area	21%	17%	19%	19%	24%	
Assessment	Large beneficial	Moderate beneficial	Large beneficial	Moderate beneficial	Slight beneficial	

Table 79 presents the results for children and young adults. The results suggest that the net overall impact is positive, and the share of benefits is in-line with the share of population of each priority group within the impact area.

Table 79 – Street-running light metro NO_x air quality appraisal for children and young adults

	Children	Young Adults
Population in each group with improved air quality [A]	9,000	10,000
Population in each group with no change in air quality [B]	2,000	2,000
Population in each group with deteriorating air quality [C]	6,000	7,000
Net no of Winners / Losers in each group [D] = [A] - [C]	2,000	3,000
Total population in each group [E] = [A] + [B] + [C]	20,000	22,000
Proportion of net Winners / Losers [F] = [D] / [E]	15%	23%
Share of total population in the impact area	17%	19%
Assessment	Moderate beneficial	Moderate beneficial

$PM_{2.5}$ Emissions

Separated light metro

The $PM_{2.5}$ emissions assessment is presented by income quintile in Table 80. The results of this assessment are in line with the NOx assessment, suggesting a net positive overall air quality impact, with a disproportionately large share of benefits being realised by income quintile 3 and income quintile 5 (the highest 20% of income earners). Conversely, a disproportionately small share of benefits will be realised by income quintile 1 (the lowest 20% of income earners).

Table 80 – Separated light metro $PM_{2.5}$ air quality appraisal by income

	Income Quintile 1 (lowest Income)	Income Quintile 2	Income Quintile 3	Income Quintile 4	Income Quintile 5 (highest income)	Total
Population in each group with improved air quality [A]	5,000	5,000	6,000	6,000	6,000	28,000
Population in each group with no change in air quality [B]	4,000	1,000	1,000	1,000	1,000	8,000
Population in each group with deteriorating air quality [C]	3,000	1,000	1,000	2,000	1,000	9,000

Net no of Winners / Losers in each group [D] = [A] – [C]	2,000	4,000	5,000	4,000	4,000	-
Total population in each group [E] = [A] + [B] + [C]	-	-	-	-	-	19,000
Proportion of net Winners / Losers [F] = [D] / [E]	11%	19%	27%	20%	23%	-
Share of total population in the impact area	28%	16%	19%	19%	18%	-
Assessment	Slight beneficial	Moderate beneficial	Large beneficial	Moderate beneficial	Large beneficial	-

Table 81 shows the PM2.5 assessment for children and young adults. The results indicate that both age groups will experience net benefits that are proportionate to their share of the population.

Table 81 – Separated light metro $PM_{2.5}$ air quality appraisal for children and young adults

	Children	Young Adults
Population in each group with improved air quality [A]	4,000	5,000
Population in each group with no change in air quality [B]	2,000	1,000
Population in each group with deteriorating air quality [C]	2,000	1,000
Net no of Winners / Losers in each group [D] = [A] - [C]	2,000	3,000
Total population in each group [E] = [A] + [B] + [C]	10,000	11,000
Proportion of net Winners / Losers [F] = [D] / [E]	14%	19%
Share of total population in the impact area	17%	18%
Assessment	Moderate beneficial	Moderate beneficial

Street-running option

For the street-running option, the $PM_{2.5}$ results are more varied that the NO_x results when comparing to the separated option. Table 82 presents the assessment by income quintile. Income quintile four receives a disproportionately large share of the benefits, while income quintiles three and five (highest 20% of income earners) are expected to receive a disproportionately small share of the benefits.

Table 82 – Street-running light metro $PM_{2.5}$ air quality appraisal by income

	Income Quintile 1 (lowest Income)	Income Quintile 2	Income Quintile 3	Income Quintile 4	Income Quintile 5 (highest income)	Total
Population in each group with improved air quality [A]	10,000	9,000	8,000	10,000	12,000	49,000
Population in each group with no change in air quality [B]	4,000	2,000	4,000	2,000	1,000	13,000
Population in each group with deteriorating air quality [C]	8,000	7,000	8,000	8,000	12,000	43,000
Net no of Winners / Losers in each group [D] = [A] - [C]	1,000	1,000	0	2,000	0	-
Total population in each group [E] = [A] + [B] + [C]	-	-	-	-	-	6,000
Proportion of net Winners / Losers [F] = [D] / [E]	25%	22%	6%	41%	7%	
Share of total population in the impact area	21%	17%	19%	19%	24%	
Assessment	Moderate beneficial	Moderate beneficial	Slight beneficial	Large beneficial	Slight beneficial	

Table 83 presents the $PM_{2.5}$ analysis for young adults and children. The results suggest that young adults receive a disproportionately large share of the benefits, while children receive a disproportionately small share of the benefits in relation to their proportion of the population.

Table 83 – Street-running light metro $PM_{2.5}$ air quality appraisal for children and young adults

	Children	Young Adults
Population in each group with improved air quality [A]	8,000	9,000
Population in each group with no change in air quality [B]	2,000	2,000
Population in each group with deteriorating air quality [C]	7,000	8,000
Net no of Winners / Losers in each group [D] = [A] - [C]	0	2,000
Total population in each group [E] = [A] + [B] + [C]	18,000	21,000
Proportion of net Winners / Losers [F] = [D] / [E]	6%	41%

Share of total population in the impact area	16%	19%
Assessment	Slight beneficial	Large beneficial

Summary

In summary, the distributional analysis of air quality impacts has been developed based on link estimates of vehicle emissions from The Vehicle Emissions Prediction Model (VEPM). The approach is designed to provide a conservative assessment of air quality risk for two key transport-related air pollutants – particulate matter ($PM2_{.5}$) and nitrous oxides (NOx).

An analysis in GIS was undertaken to estimate in detail the changes experienced by households that belong to different priority groups. The same process was applied to analyse the proportion of the population in priority groups forecast to experience increases and/or decreases in air quality.

The results of the distributional analysis suggest that the separated light metro option is likely to bring **moderately positive** air quality benefits, while the street-running alternative is expected to bring about **slightly positive** benefits.

Separated light metro

Combining the results of the NO_x and $PM_{2.5}$ assessments, the overall impact of emissions for the separated option is assessed as **moderately beneficial**. A summary of the overall assessment by priority group is summarised in Table 84.

Table 84 – Separated light metro outcome of air quality assessment by priority group

Priority group	Assessment
Children (under 15)	Moderate beneficial
Young adults (15-24)	Moderate beneficial
Lowest 20% of income earners	Slight beneficial
Highest 20% of income earners	Moderate beneficial

Street-running option

The overall assessment of emissions for the street-running option is appraised **as slightly beneficial**, primarily because there are fewer net winners in the impact area. A summary of the overall assessment by priority group is summarised in Table 85.

Table 85 – Street-running light metro outcome of air quality assessment by priority group

Priority group	Assessment
Children (under 15)	Slight beneficial
Young adults (15-24)	Moderate beneficial
Lowest 20% of income earners	Moderate beneficial
Highest 20% of income earners	Slight beneficial

Noise

Introduction

Noise impacts are defined as the effects that the ALR can have on the acoustic environment. Noise impacts can be positive or negative and are likely to occur where a transport intervention results in changes to traffic flows or speeds, or where there is an alteration in the physical gap between people and traffic.

Noise impacts affect various social groups differently. Children and elderly individuals are particularly susceptible to the effects of noise, and people residing in economically disadvantaged areas often face increased exposure to adverse noise effects.

ALR is expected to generate changes in traffic flows, generating noise impacts on residents along the corridor, especially children, elderly people and low-income individuals. It is essential to take these groups into account when evaluating the scheme's noise DI impact.

Approach

In the absence of a full noise modelling, the distributional appraisal of noise impacts involves a high-level qualitative approach to assess the impact of each option on the acoustic environment. The qualitative assessment is conducted by analysing the links on the road network which experience significant change (+25% or -20%)[56] in traffic flows.

The changes in traffic are calculated directly from the MSM which compares each option against the Do Minimum scenario. The analysis considers the proportion of each identified priority group that reside in or utilise the area, to illustrate the perceived noise benefits or disbenefits specific to these groups.

Outcomes

Step 1 Screening

There will be a potentially significant change in noise levels as a result of the Project, primarily attributed to changes in traffic flows resulting from various factors including a modal shift from private vehicles to public transport, increased capacity and the implementation of dedicated infrastructure for active travel modes. These changes are likely to have a substantial impact on traffic patterns and congestion levels, directly affecting the levels of noise experienced in the surrounding area.

Therefore, it is appropriate to closely examine the affected area to understand how changes in noise will impact priority groups following the introduction of ALR.

Step 2 Assessment

Step 2a: Confirmation of areas impacted by the transport intervention

The area impacted by noise includes any link on the road network experiencing significant changes (+25% or -20%) in vehicle flow, speed or proportion of heavy vehicles compared to the Do Minimum scenario for the opening year. From the identified roads, the impact area has been assessed with a 600-metre buffer to consider the effects on neighbouring roads, surrounding neighbourhoods, businesses and amenities[57]. This area extends beyond the Environmental and Social Responsibility Screen's recommendation of 200m from the proposed alignment. This extension is necessary because the appraisal method lacks precision and relies on traffic data rather than a comprehensive noise model.

[56] As defined in the UK TAG, links with an increase of 25% or more or a decrease of 20% or more in vehicle flow are expected to result in noise impacts. The approach taken in this section utilises these thresholds, which are commonly employed as criteria to pinpoint areas where noise levels could be influenced by changes in traffic patterns.

Separated light metro

The roads affected by the noise analysis due to changes in motorised traffic for the separated light metro are displayed in Figure 39. The figure illustrates the distribution of impacts across study areas. Traffic flow changes (+25% or -20%) are most pronounced in the city centre, where significant rerouting is expected to be required as a result of the introduction of the scheme.

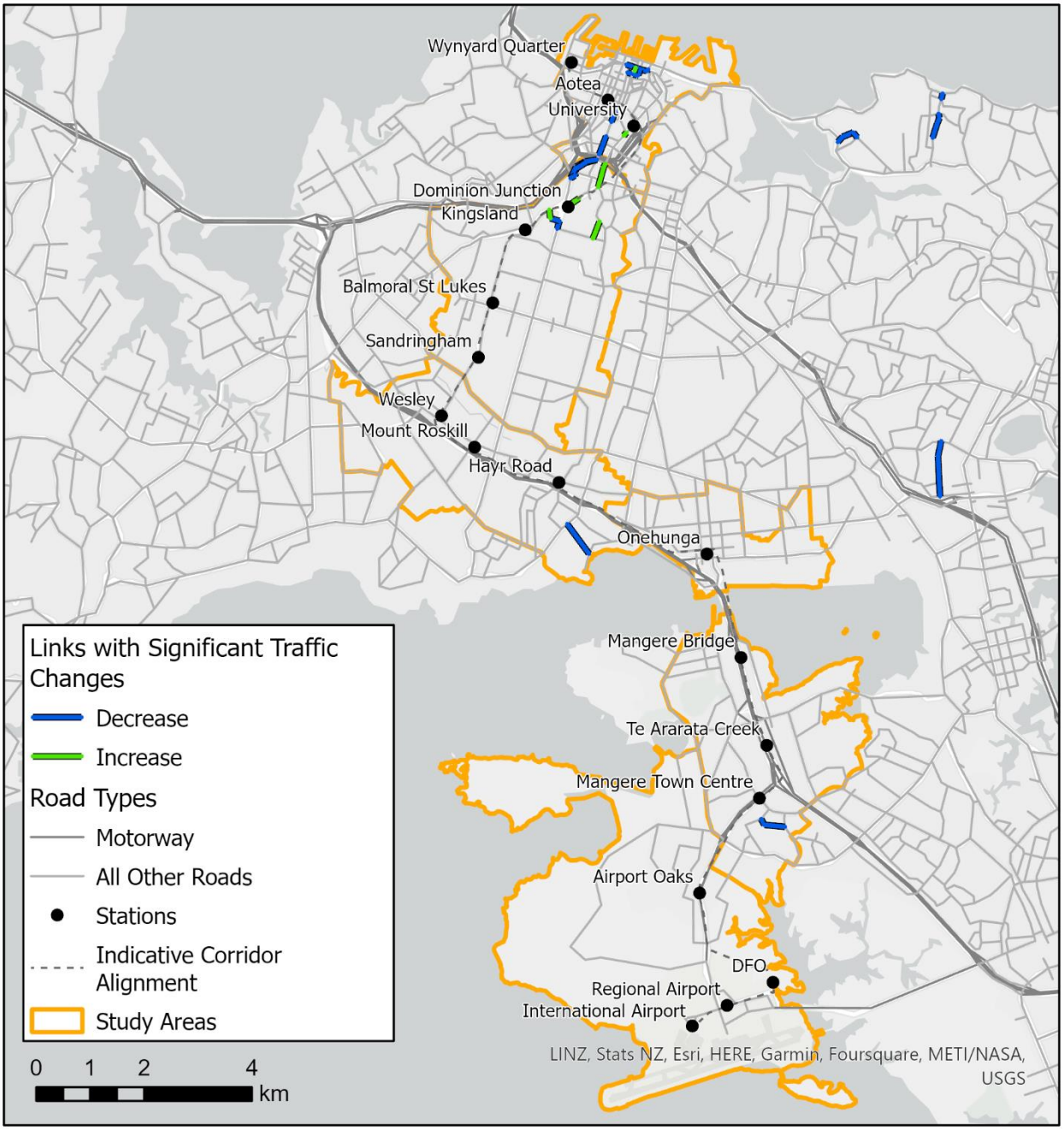


Figure 39 – Separated light metro traffic flow-based noise impact area

Street-running option

The impact area for the street-running option is illustrated in Figure 40. The street-running option leads to substantial changes in traffic flow when compared to the separated option. Notably, there are significant reductions in traffic along the street-running corridor north of Puketāpapa. Conversely, several parallel roads experience increased traffic due to diversions from this corridor.

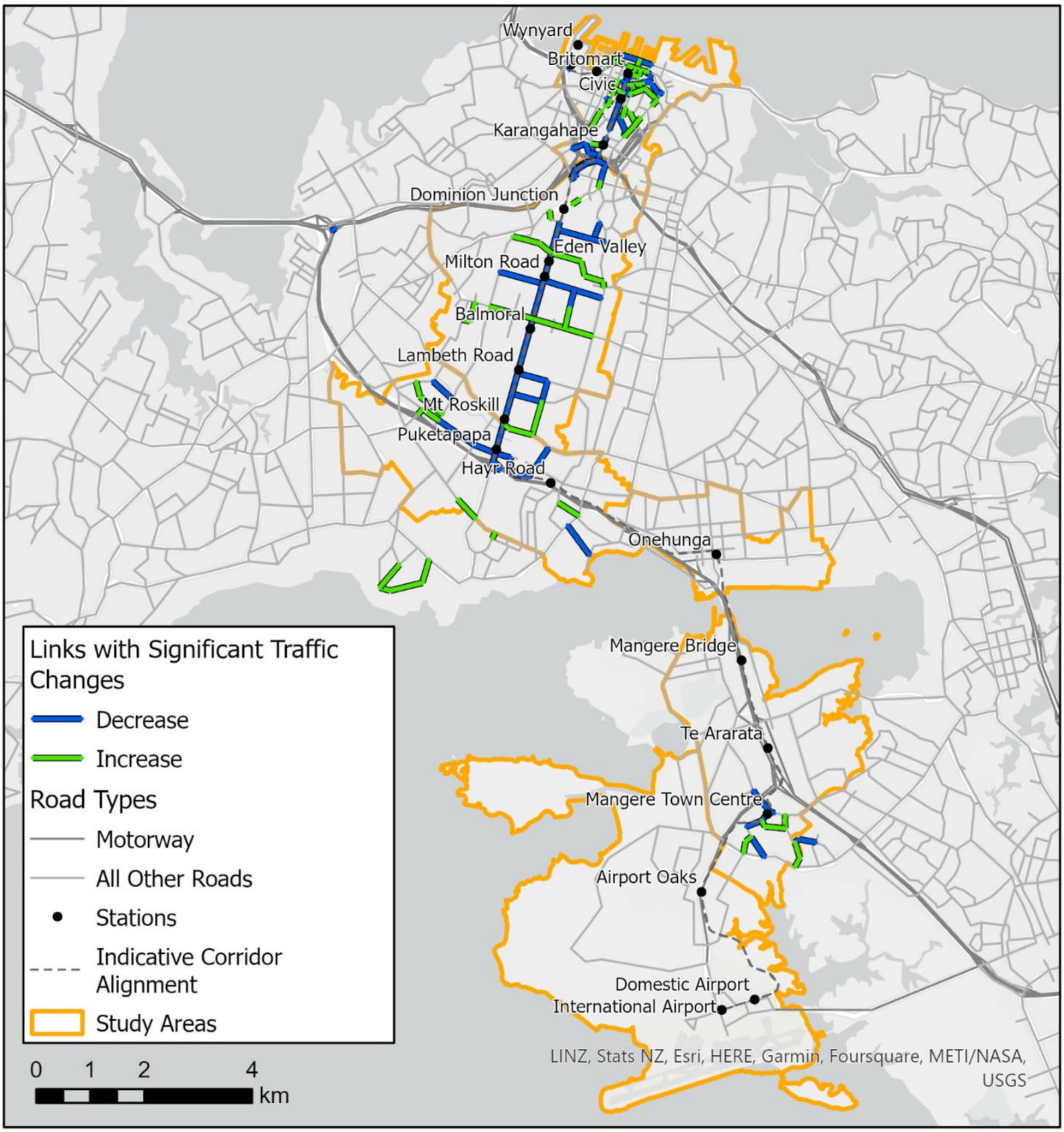


Figure 40 – Street-running metro traffic flow-based noise impact area

Step 2b: Identification of social groups in the impact area

Particular priority groups in terms of noise include children, older people and low-income individuals.

Separated light metro

Table 86 shows the proportion of priority groups for the impact area, in comparison with proportions in the region. The analysis determined that the proportion of children (15%) and older people (4%) is below the regional average for these groups (20% and 8% respectively). The lowest 20% of income earners and highest 20% of income earners were significantly overrepresented compared to regional levels.

Table 86 – Separated light metro priority group distribution in traffic flow-based noise impact area

Priority group	Proportion in noise impact area	Proportion in study areas	Proportion in Auckland Region
Children (under 15)	15%	17%	20%
Older people (70+)	4%	5%	8%
Lowest 20% of income earners	26%	18%	20%
Highest 20% of income earners	35%	25%	22%

Street-running option

Table 87 presents the priority groups in the impact area for the street-running option. As with the separated option, there is a lower proportion of children (16%) and older people (5%) compared to the regional averages (20% and 8%). The lowest 20% of income earners are slightly overrepresented compared to the regional average, while the proportion of the highest 20% of income earners is significantly above the regional average.

Table 87 – Street-running metro priority group distribution in traffic flow-based air quality impact area

Priority group	Proportion in noise impact area	Proportion in study areas	Proportion in Auckland Region
Children (under 15)	16%	17%	20%
Older people (70+)	5%	5%	8%
Lowest 20% of income earners	21%	18%	20%
Highest 20% of income earners	29%	25%	22%

Step 2c: Identification of amenities in the impact area

A thorough examination of noise and vibration should analyse changes at specific sensitive receptors. In the absence of a comprehensive noise model, this DI analysis applies a simplified approach focused on evaluating changes in traffic flows as a proxy for noise levels. The evaluation of other community facilities that attract large numbers of people from different income groups or that are of importance for children and the elderly has been intentionally omitted from consideration.

This deliberate scoping is intended to serve the immediate purpose of the noise DI analysis. A more exhaustive identification of amenities within the impact area will be conducted when sufficient quantitative data becomes available to facilitate a thorough assessment of noise changes experienced by sensitive receptors.

Step 3 Appraisal of impacts

The DI assessment presents a qualitative analysis which includes links on the road network which experience significant change (+25% or -20%) in traffic flows. The changes in traffic are calculated directly from the MSM which compares each option (separated light metro and street-running light rail) against the Do Minimum scenario. The analysis considers only links with an annual average daily traffic (AADT) flow above 8000 vehicles. For these links, the following classifications have been used:

- Decrease: links with an AADT flow change below 20%

- Increase: links with an AADT flow change above 25%

Separated light metro

Figure 41, Figure 42, and Figure 43 depict the noise evaluation by link assessment along with the concentration of the various priority groups. Links are categorised as beneficial when traffic decreases and adverse when traffic increases, as indicated above.

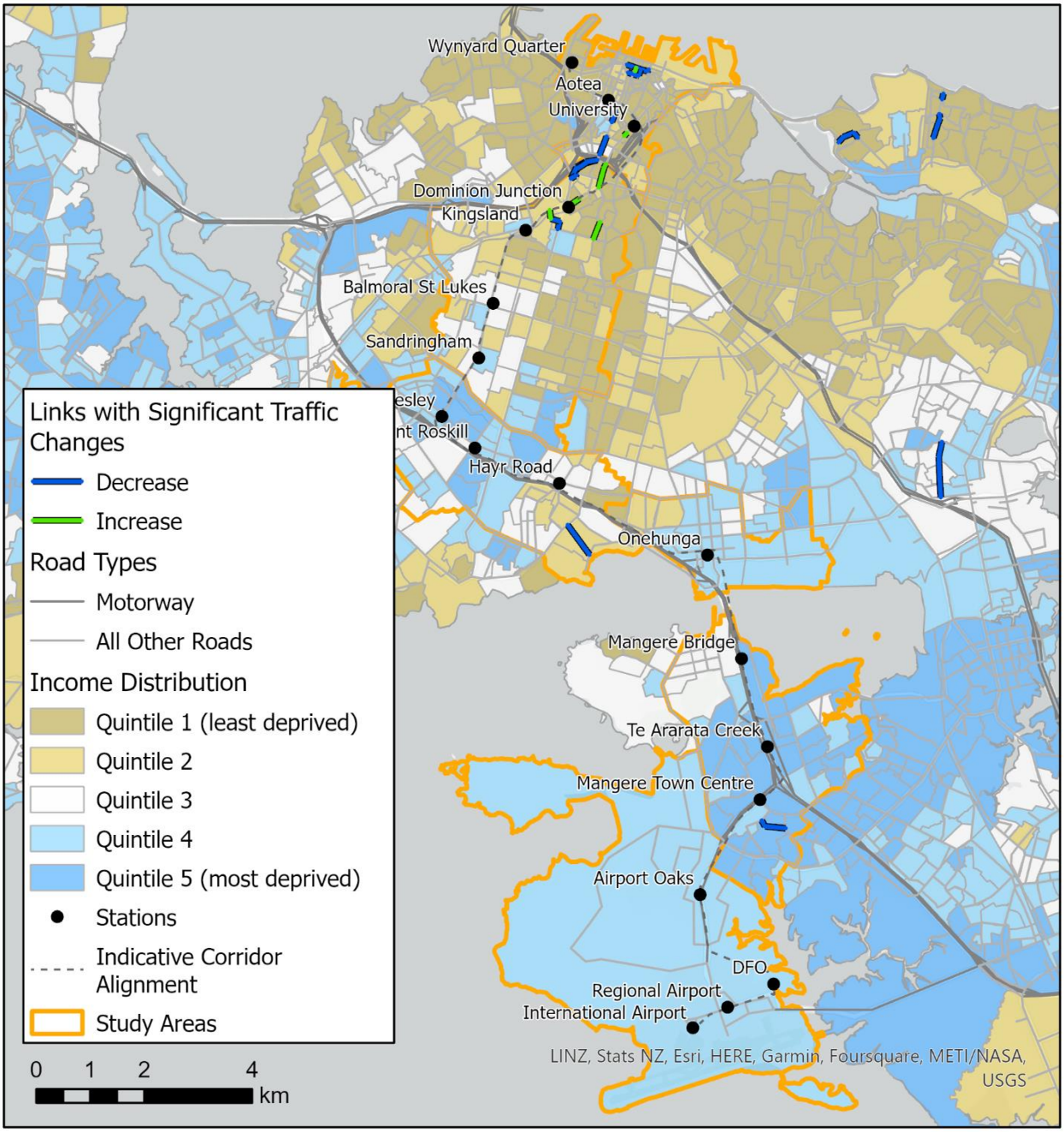


Figure 41 – Separated light metro traffic flow-based noise impact – income

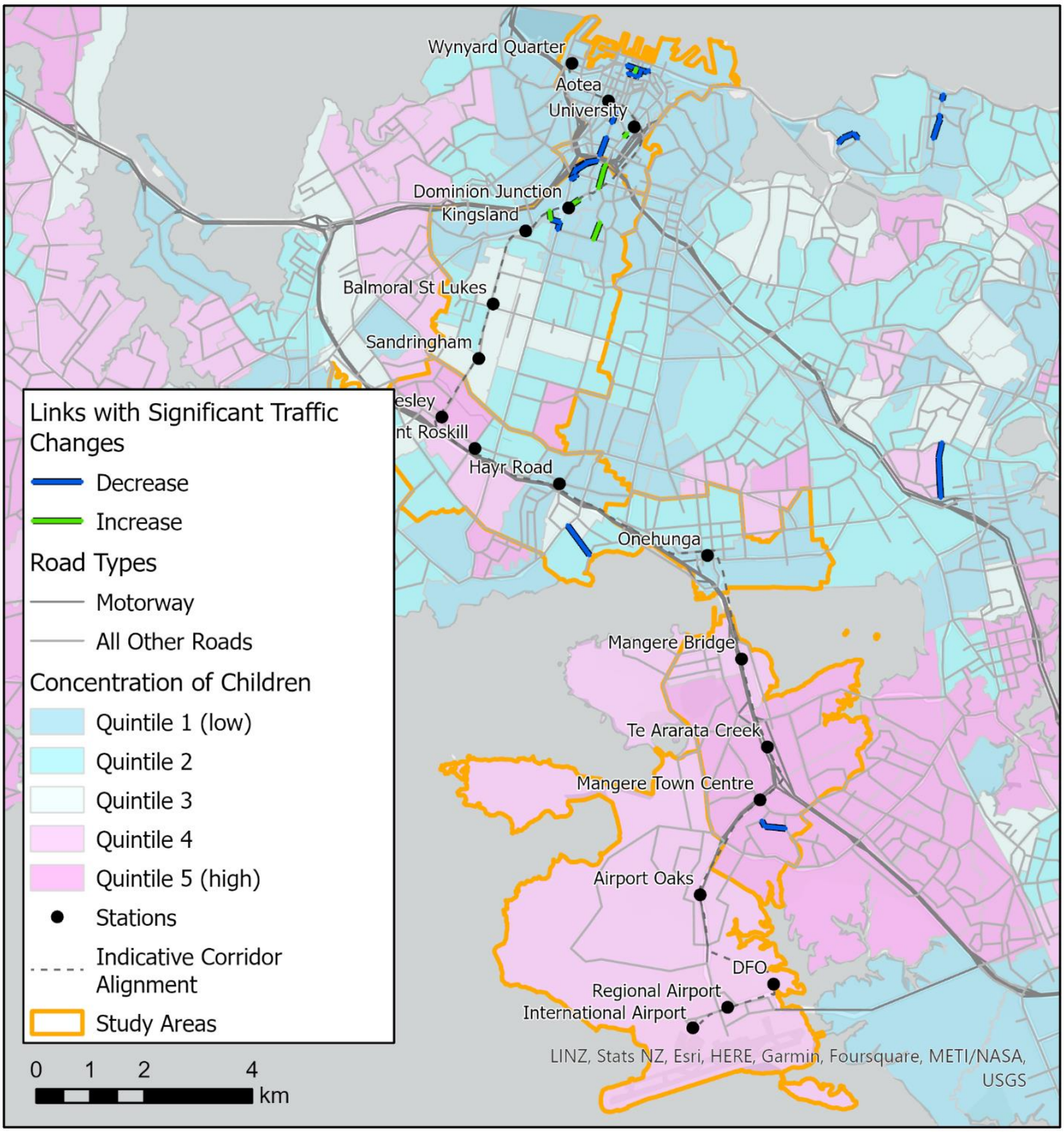


Figure 42 – Separated light metro traffic flow-based noise impact – children

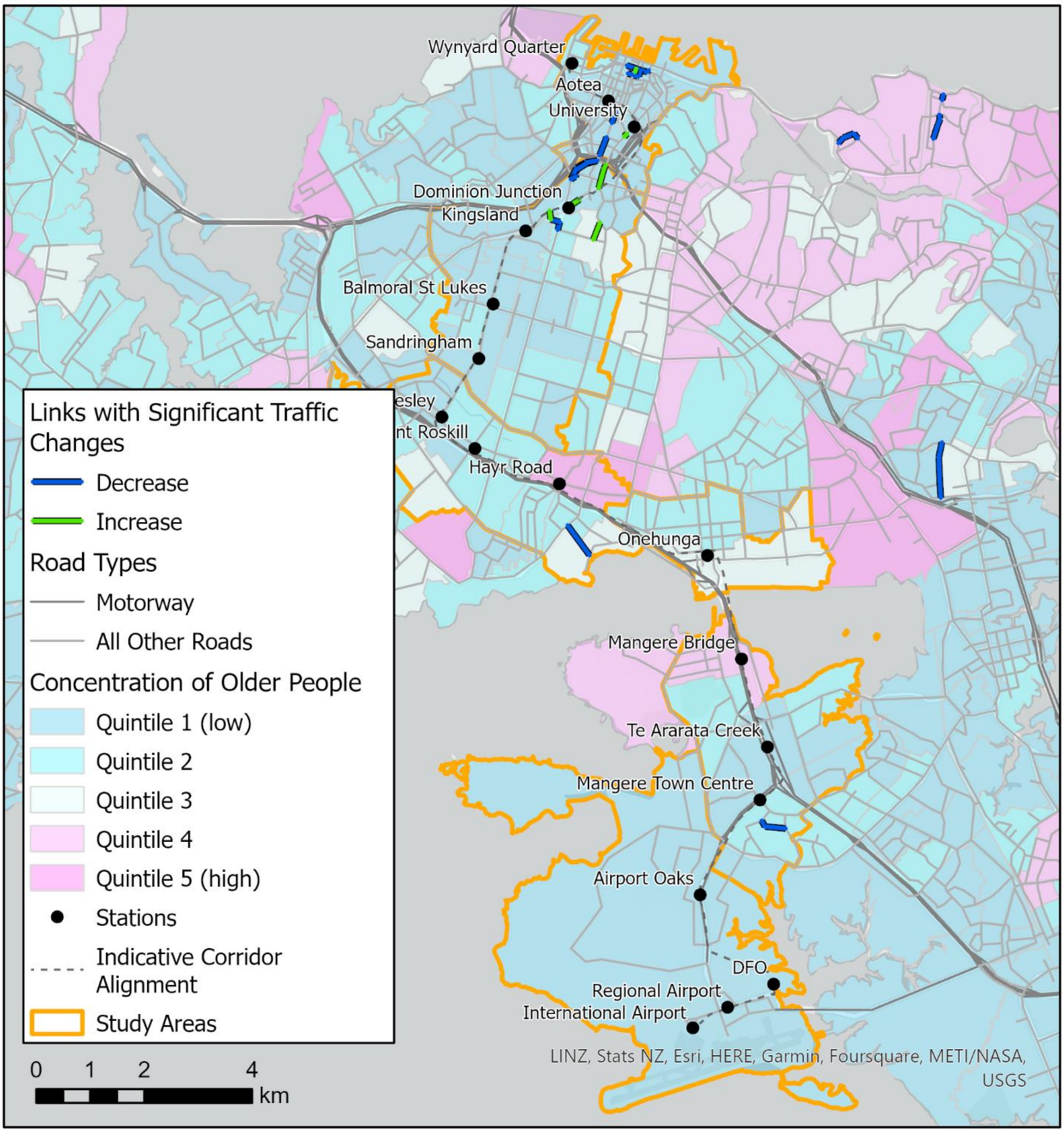


Figure 43 – Separated light metro traffic flow-based noise impact – older people

The maps above indicate that highway impacts are not in direct proximity to the scheme. Furthermore, there are very few segments of the road network where traffic flows undergo a substantial change (>25% or <-20%) , particularly in areas where priority groups reside. Therefore, it appears that the noise impact of the separated light metro option does not significantly affect the identified priority groups.

The overall assessment of the traffic-flow based noise assessment is neutral, and this is summarised in Table 88.

Table 88 – Separated light metro outcome of traffic flow-based noise assessment by priority group

Priority group	Assessment
Children (under 15)	Neutral
Older people (70+)	Neutral

Lowest 20% of income earners	Neutral
Highest 20% of income earners	Neutral

Street-running option

Figure 44, Figure 45, and Figure 46 depict the noise evaluation by link assessment along with the concentration of the various priority groups. Links are categorised as beneficial when traffic decreases and adverse when traffic increases, as indicated above.

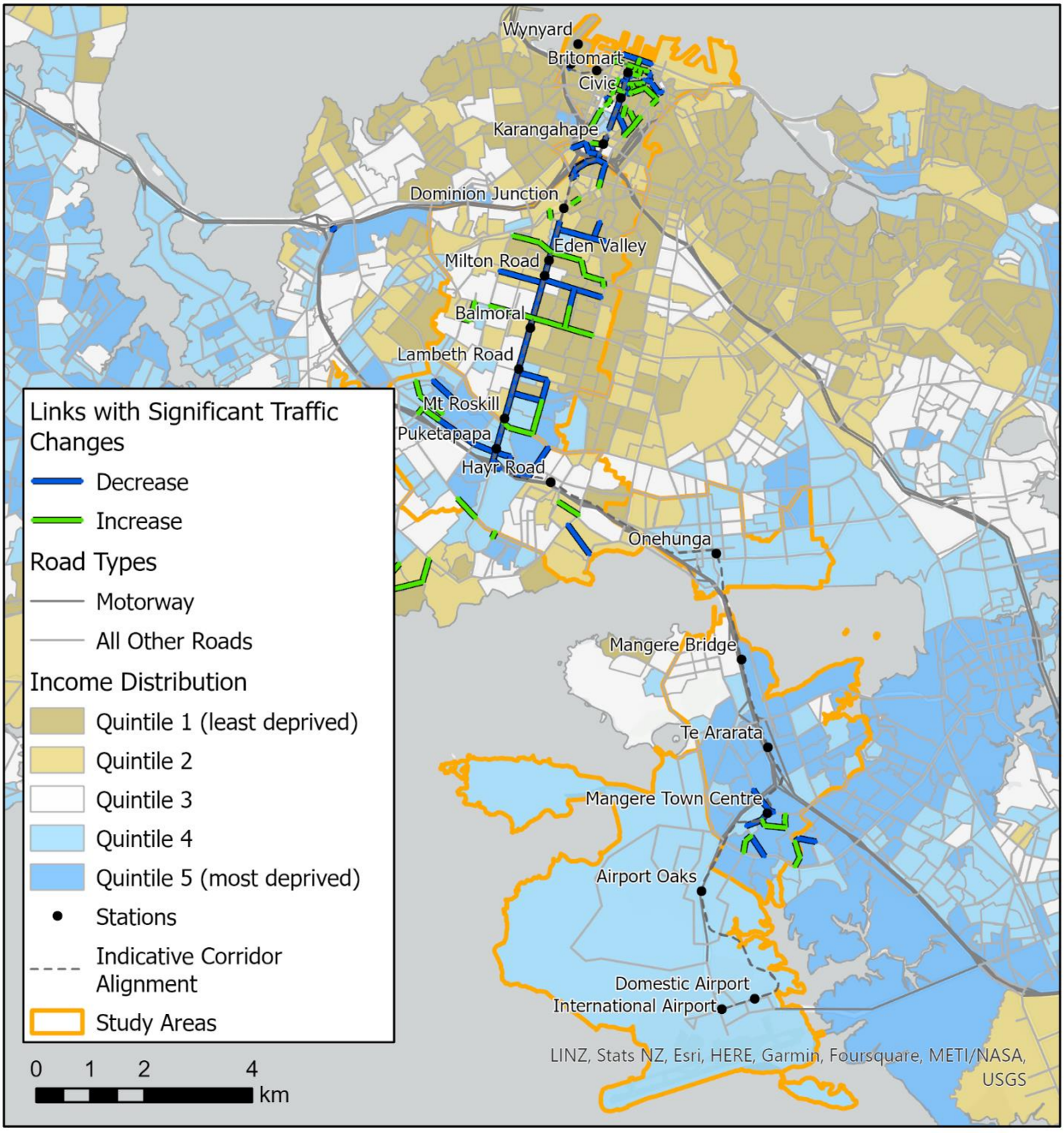


Figure 44 – Street-running metro traffic flow-based noise impact – income

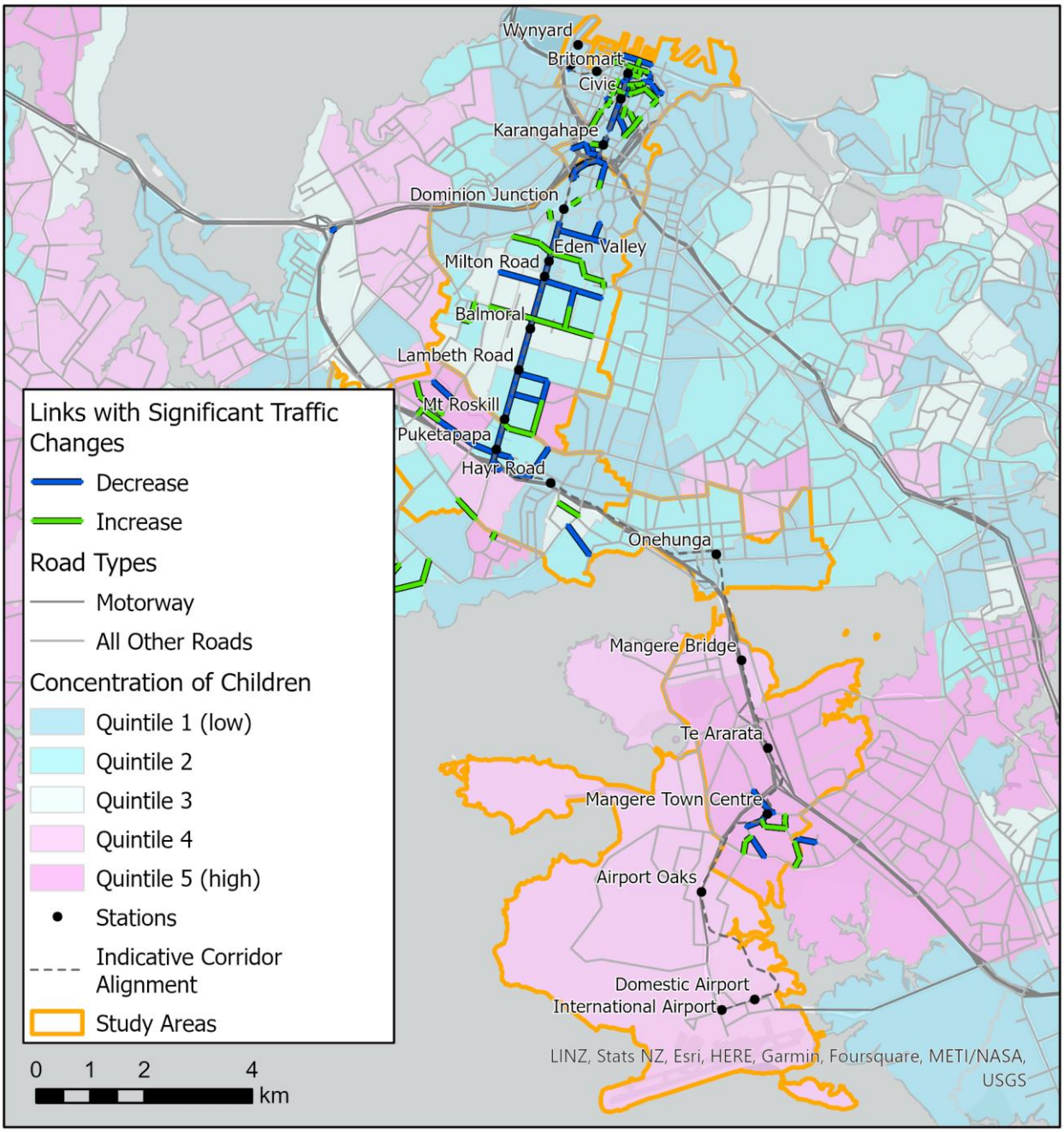


Figure 45 – Street-running metro traffic flow-based noise impact – children

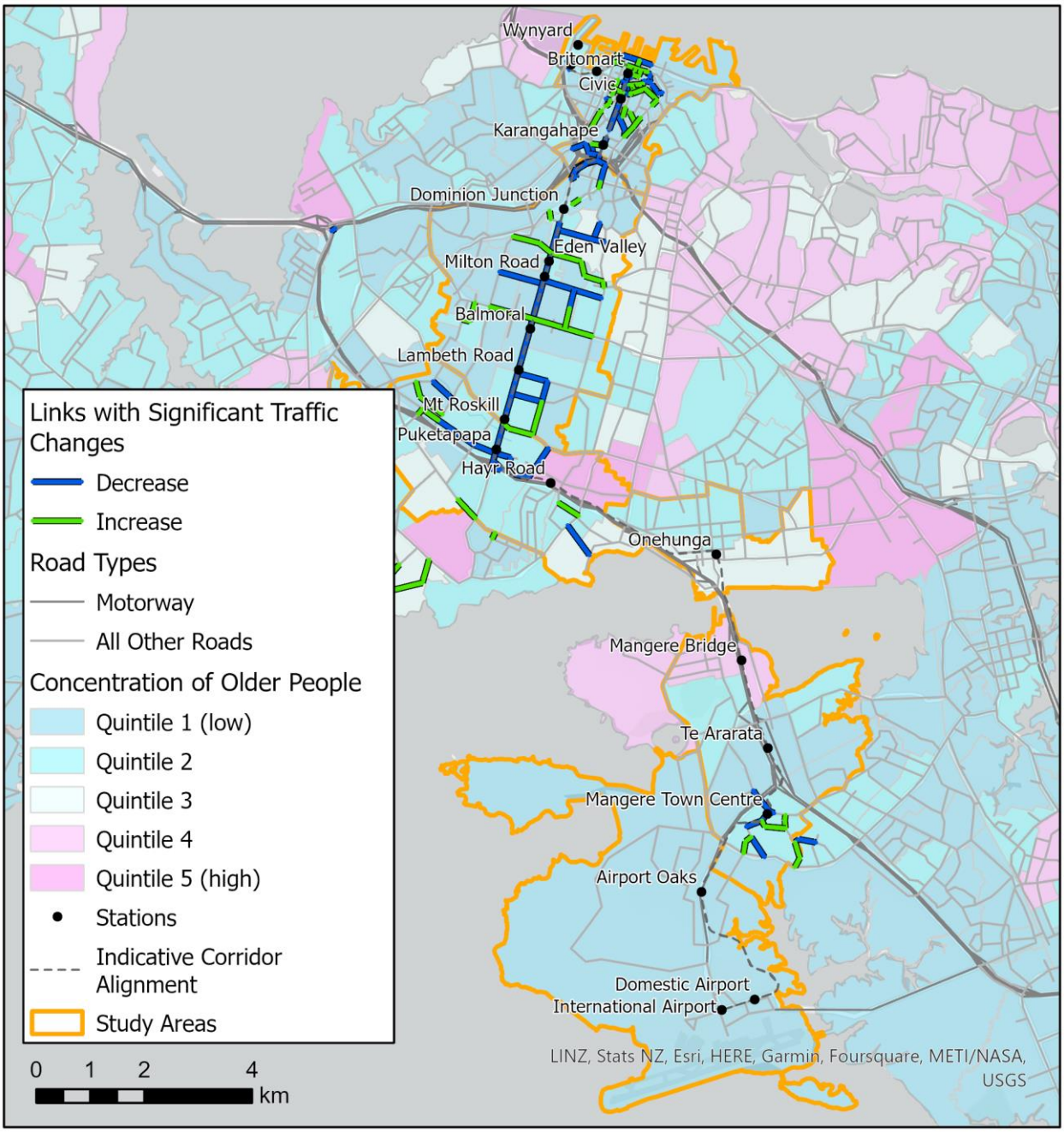


Figure 46 – Street-running metro traffic flow-based noise impact – older people

As mentioned previously, the impacts are expected to be more significant under the street-running option and various groups may be affected through both increases and decreases in traffic flow. However, based on the maps above, it is not straight-forward to definitively conclude whether the street-running option leads to significant noise benefits or disbenefits for various priority groups.

When overlaying the traffic flow maps with the concentrations of priority groups, it is not evident that these groups are affected differentially by the scheme in terms of noise. Areas with a high proportion of low-income individuals experience a decrease in traffic flows in some areas, and an increase in others. Similarly, areas with a high concentration of children experience fluctuations in traffic flows, including both decreases and increases. The noise impact for these priority groups is therefore appraised as neutral. Very few changes in traffic flows occur in areas that hold a high concentration of elderly people. As such, the impact of noise is also appraised as neutral.

The overall assessment of the traffic flow-based assessment is neutral, and this is summarised in Table 89.

Table 89 – Street-running option outcome of traffic flow-based noise assessment by priority group

Priority group	Assessment
Children (under 15)	Neutral
Older people (70+)	Neutral
Lowest 20% of income earners	Neutral
Highest 20% of income earners	Neutral

Summary

In summary, due to the lack of quantitative data, the distributional analysis of noise impacts relies on traffic flow changes as a proxy to identify noise impacts for priority groups that are particularly sensitive to noise. An analysis in GIS was undertaken to estimate if these changes where in close proximity to areas with significant concentrations of priority groups.

The results of the distributional analysis suggest that the scheme is likely to bring **neutral impacts**, in particular for the separated light metro option. However, the results obtained from overlaying the maps do not provide a definitive conclusion, and as a result, the appraisal remains neutral for both options.

A comprehensive noise and vibration assessment should be conducted in a subsequent stage of the Project's development. Generally, it is anticipated that noise impacts from the street-level option will be more significant compared to a tunnelled option. However, this assessment needs to be confirmed by a thorough noise model, which will accurately quantify noise emissions and their effects on the surrounding environment and on sensitive receptors.

Severance

Introduction

The term 'community severance' describes the effects of transport infrastructure or motorised traffic as a physical or psychological barrier separating one built-up area from another built-up area or open space[58]. Severance can be attributed to two primary factors:

- High vehicle flows that substantially hinder pedestrian movements.
- Physical infrastructure that acts as a barrier to free movement

It mainly affects non-motorised modes, particularly pedestrians. Groups such as children, older people, people with disabilities, and people without access to a car are potentially vulnerable to the effects of severance. Children are particularly vulnerable as they tend to cross the road at dangerous crossing points and may struggle to accurately assess the speed of traffic, putting them at higher risk of accidents. Additionally, these groups often

[58] Anciaes, P. R., Jones, P., & Mindell, J. S. (2016). Community severance: where is it found and at what cost?. Transport Reviews, 36(3), 293-317.

face longer journey times or are often required to use pedestrian routes that are unsuitable and difficult to use.

Approach

A high-level mixed quantitative and qualitative approach is undertaken to assess the severance impact of each option. The qualitative assessment is conducted by analysing the links on the road network which experience significant change (>10%) in traffic flows. The changes in traffic are calculated directly from the MSM which compares each option against the Do Minimum scenario. The analysis will consider the percentage of individuals within potential priority groups who reside in or utilise the area, to illustrate the identified benefits or disadvantages specific to these groups.

The quantitative approach for assessing severance is based on establishing a 10-minutes catchment originating from key stations[59]. This method incorporates insights from the SIA, which analyses the severance consequences arising from proposed changes to areas around station vicinities, including modifications in infrastructure and supplementary measures. The final phase of this analytical segment encompasses the calculation of the individuals within predefined potential priority groups who could encounter positive or negative impacts, both with and without the scheme (i.e., the proportion of priority group members residing around the stations). Subsequently, an overall assessment of the effect on each of the priority groups is determined.

A summary of the approach to the appraisal of severance DI impacts is provided in the table below:

Table 90 – Approach for the appraisal of severance DI

Indicator	Proposed assessment
Changes in traffic flows	A quantitative assessment of severance based on changes in the traffic flows caused by the intervention.
Changes in infrastructure and complementary measures	A quantitative assessment of severance based on changes in severance from pedestrian infrastructure changes, as well as assessing the potential impact on priority groups.

Outcomes

(a) Analysis based on changes in traffic flows

Step 1 Screening

Potentially significant changes in vehicle flows are expected to occur as a result of the Project. This change is primarily attributed to an overall improvement in the efficiency of the transport system resulting from factors such as modal shift from private vehicles to public transport, increased capacity, and the implementation of dedicated infrastructure. These combined changes are likely to have a substantial impact on traffic patterns and congestion levels, directly impacting the levels of severance experienced in the area.

It is therefore appropriate to examine the affected area more closely to understand the changes in severance to priority groups following the introduction of ALR.

Step 2 Assessment

Step 2a: Confirmation of areas impacted by the transport intervention

[59] It means that key stations can be reached within a 10-minute travel time.

The area impacted by severance includes any links on the road network that are anticipated to experience significant changes (+/- 10%) in vehicle flow, speed, or the proportion of heavy duty vehicles (HDV) on the road compared to the do-minimum scenario for the opening year. From the identified roads, the impact been identified for a 400m buffer which surrounds the scheme to account for effects on neighbouring roads and surrounding neighbourhoods, businesses and amenities.

Separated light metro

The roads affected by the severance analysis due to changes in motorised traffic for the separated light metro are displayed in Figure 47. The figure illustrates the distribution of impacts across study areas. Notably, in the city centre, there are more pronounced impacts resulting from rerouting.

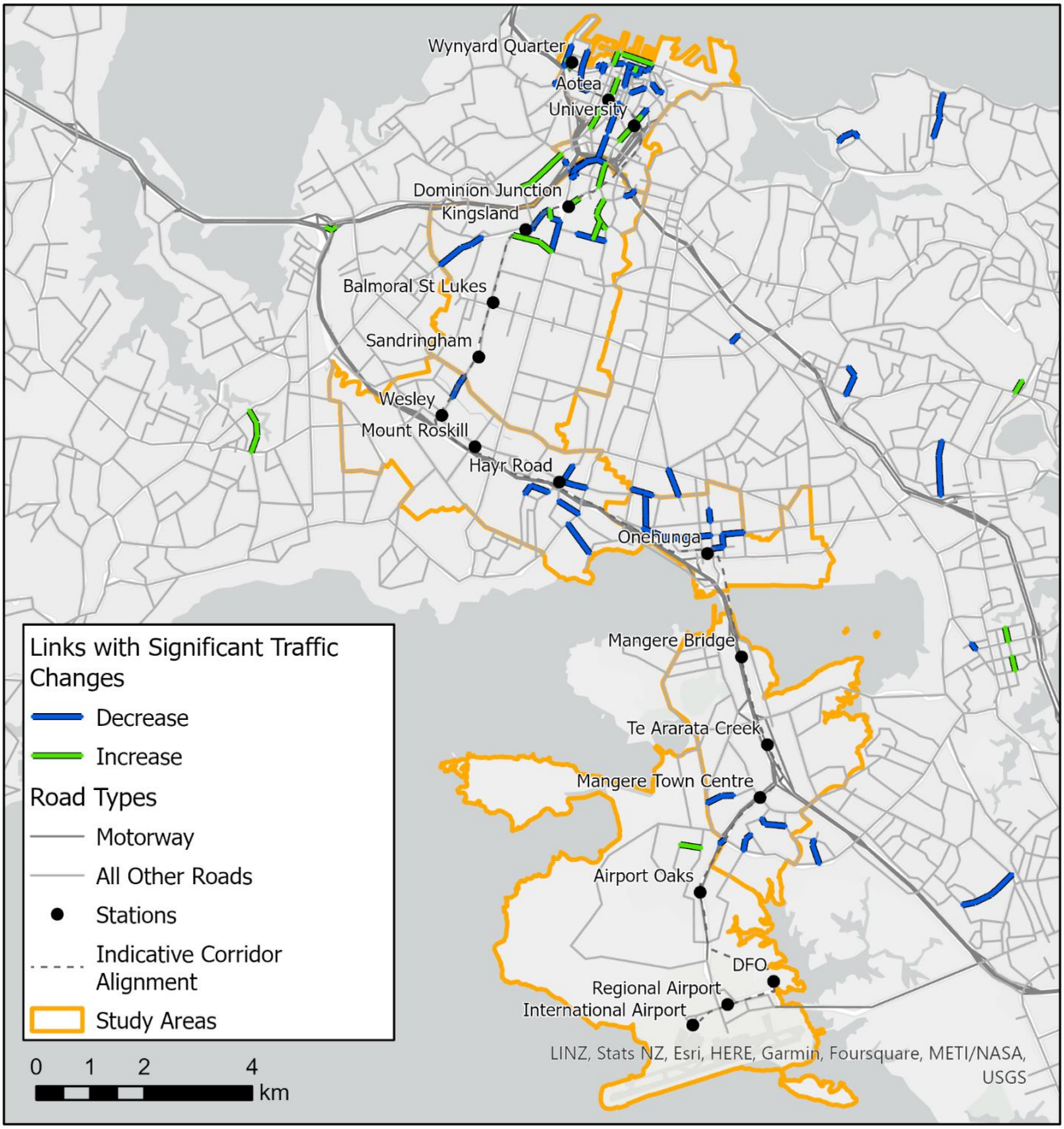


Figure 47 – Separated light metro traffic flow-based severance impact area

Street-running option

The impact area for the street-running option is presented in Figure 48. The findings suggest there will be significant impacts compared to the separated option. There are

notable reductions in traffic along the street-running corridor running north from Puketāpapa. Many parallel roads experience a traffic increase as a result of traffic diversion.

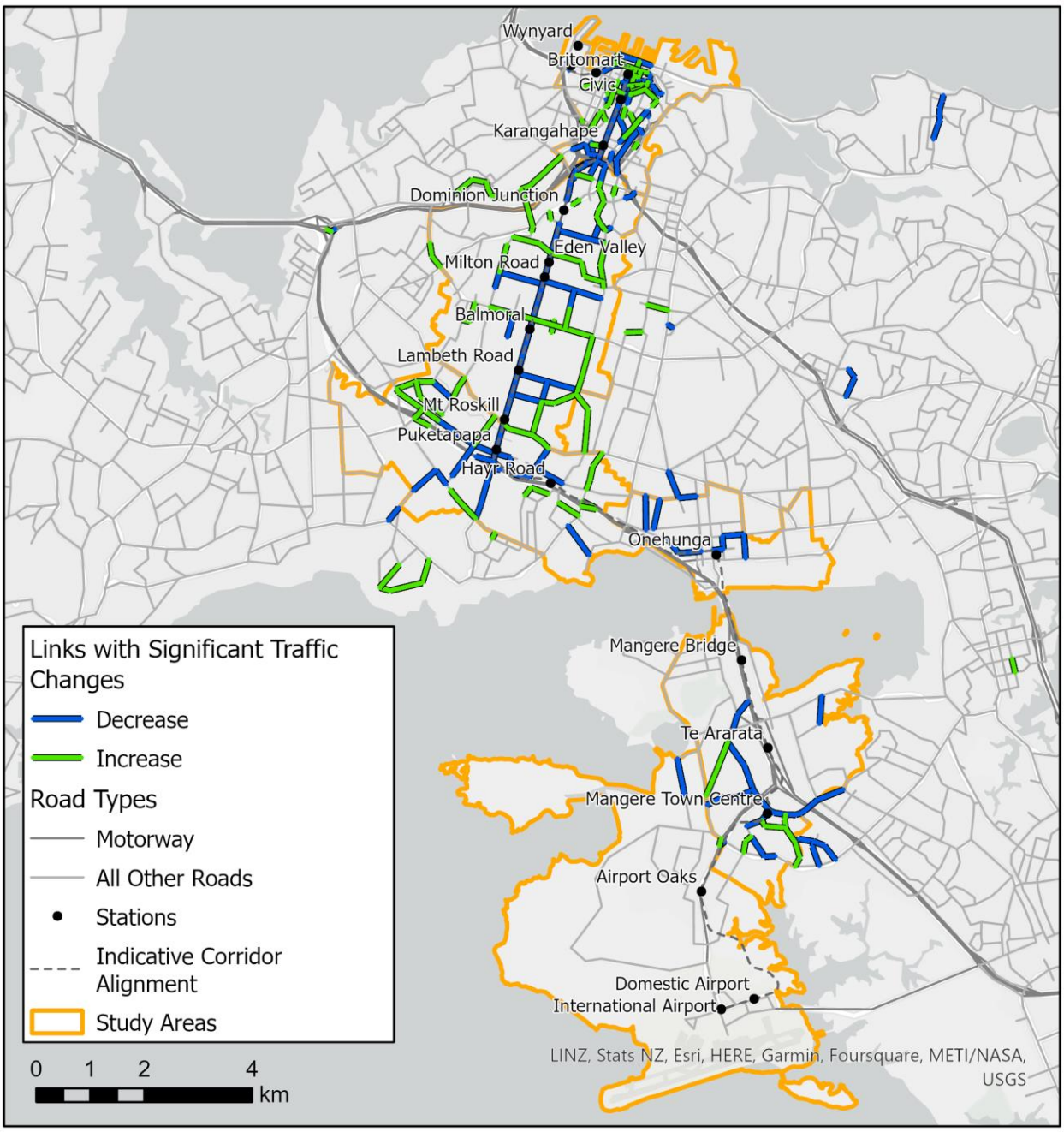


Figure 48 – Street-running metro traffic flow-based severance impact area

Step 2b: Identification of social groups in the impact area

Relevant priority groups in terms of severance include no-car households, older people, children, and people with disabilities.

Separated light metro

Table 91 shows the proportion of priority groups within the impact area, in comparison to the overall proportions in the region. The data indicates that the representation of older people and people with a disability is in line with regional data. Households with no access to a car are overrepresented in the impact area (27%) compared to regional rate (7%). In contrast, the proportion of children in the severance study area is slightly lower than the regional average.

Table 91 – Separated light metro priority group distribution in traffic flow-based severance impact area

Priority group	Proportion in severance impact area	Proportion in study areas	Proportion in Auckland Region
Children (under 15)	14%	17%	20%
Older people (70+)	5%	5%	8%
People with a disability	5%	5%	7%
Households without car access	**27%**	7%	7%

Street-running option

Table 92 presents the priority groups in the impact area for the street-running option. There is a slightly larger proportion of children and a lower proportion of households without car access when compared to the separated light metro study area. This variation can be attributed to the option having a more extensive impact area outside the city centre, which results in a lower proportion of children and a higher proportion of households without car access.

Table 92 – Street-running metro priority group distribution in traffic flow-based severance impact area

Priority group	Proportion in severance impact area	Proportion in study areas	Proportion in Auckland Region
Children (under 15)	16%	17%	20%
Older people (70+)	5%	5%	8%
People with a disability	5%	5%	7%
Households without car access	**21%**	7%	7%

Step 2c: Identification of amenities in the impact area

Priority group concentration is not only based on resident population, but also on the trip amenities that exist within the impact area. For the purposes of this high-level assessment, the analysis has been narrowed to focus solely on significant transportation hubs intended for use by the identified priority groups. As such, the analysis will centre on the key stations proposed by the scheme. The analysis of other community facilities such as health centres, community centres, schools, local shops, places of worship and playgrounds has been excluded from consideration.

This deliberate scoping is intended to serve the immediate purpose of the severance DI analysis. A more comprehensive identification of amenities within the impact area will be conducted when sufficient quantitative data becomes available to facilitate a thorough appraisal of severance.

Step 3 Appraisal of impacts

This DI assessment presents a quantitative analysis which includes links on the road network which experience significant change (+/- 10%) in traffic flows. The changes in traffic are calculated directly from the MSM which compares each option (separated light metro

and street-running light rail) against the Do Minimum scenario. The analysis considers only links with an annual average daily traffic (AADT) flow above 8,000 vehicles. For these links, the following categorisation has been used:

- Slight impact: Links with a AADT flow change between 10% and 30%.
- Moderate impact: Links with a AADT flow change between 30% and 60%.
- Large impact: Links with a AADT flow change above 60%.

Separated light metro

Figure 49 illustrates the evaluation by link, categorised as beneficial when traffic decreases and adverse when traffic increases, as indicated above. Figure 50, Figure 51, Figure 52, and Figure 53 depict the assessment along with the concentration of the various priority groups.

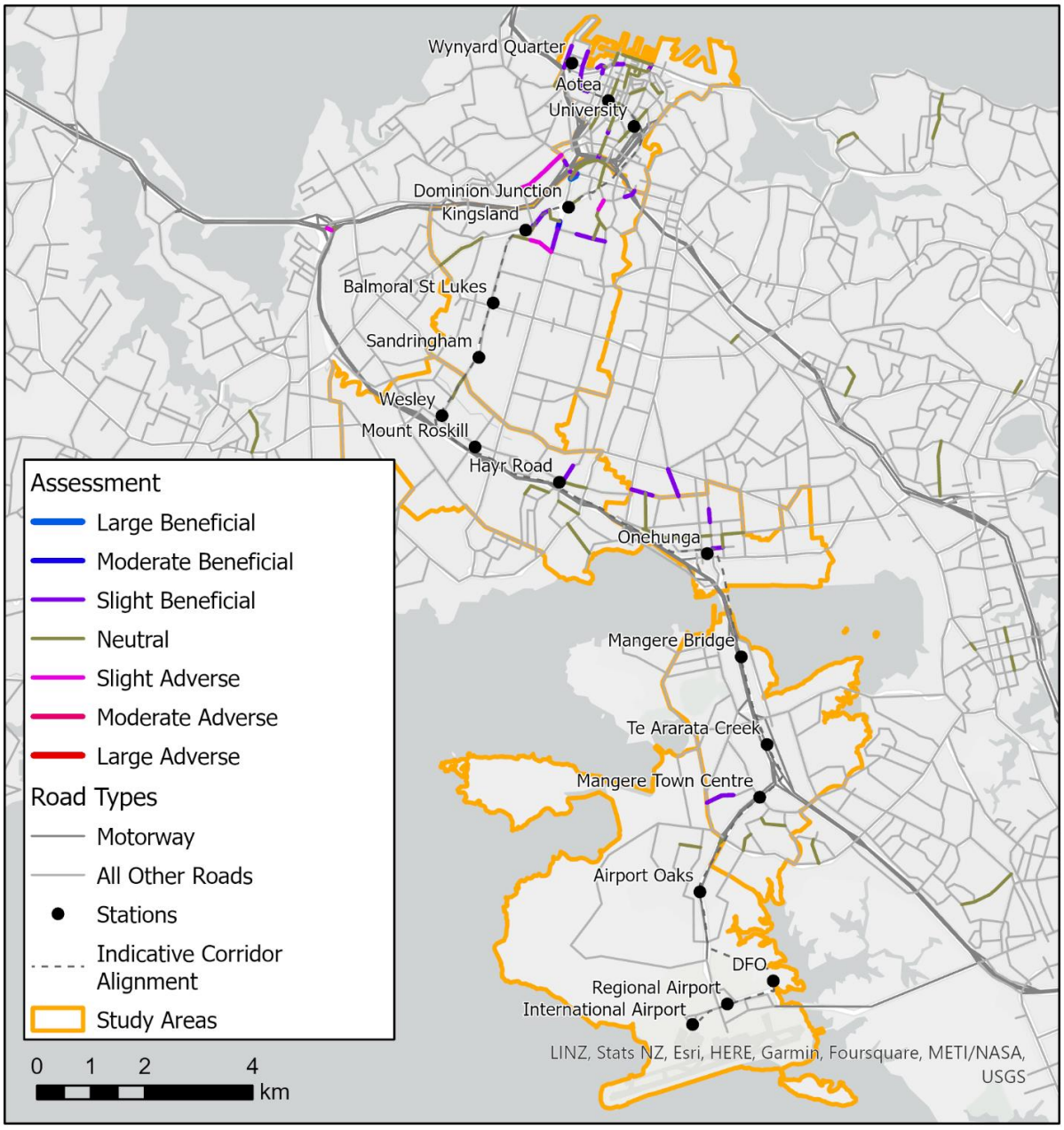


Figure 49 – Separated light metro traffic flow-based severance assessment

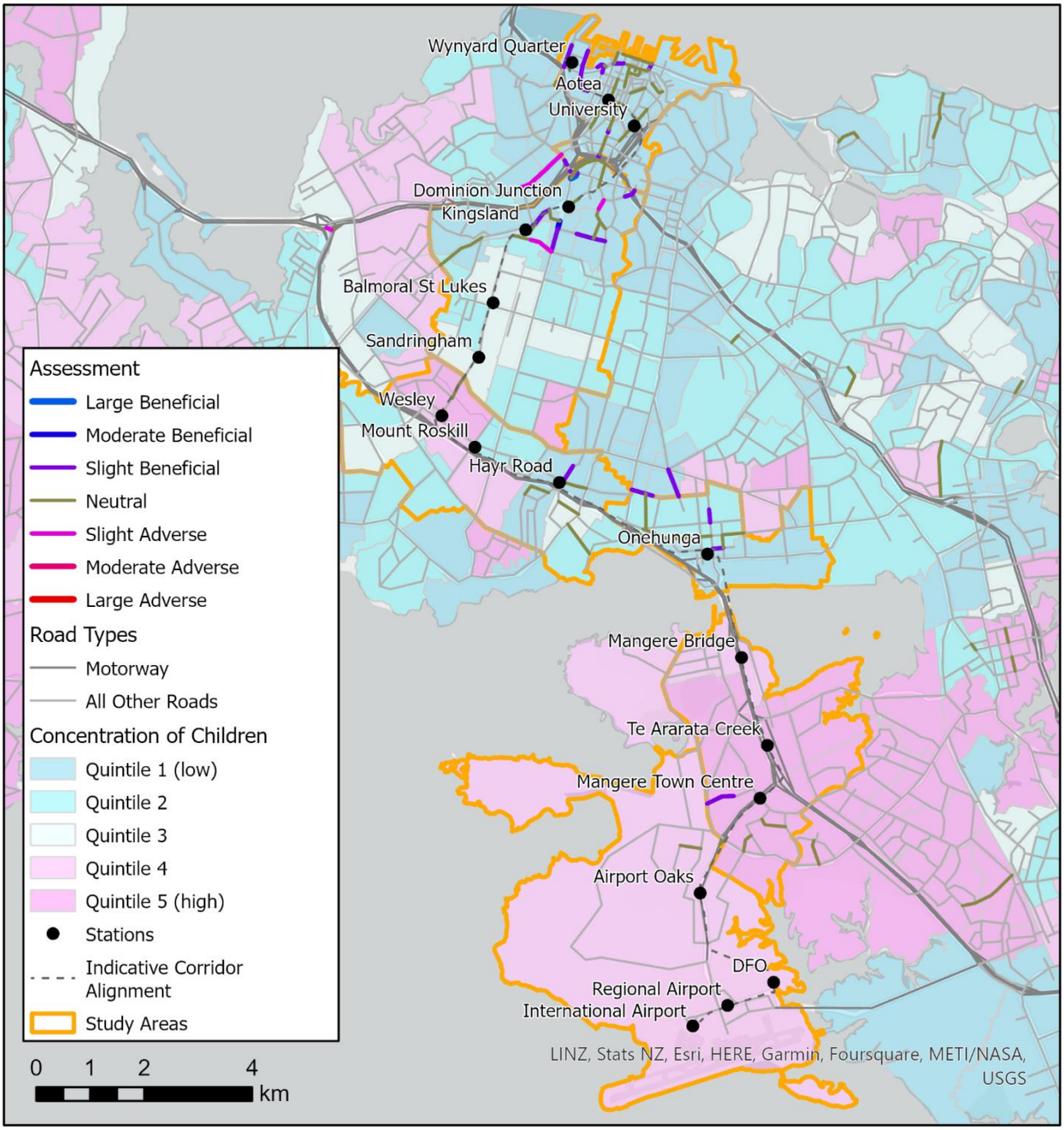


Figure 50 – Separated light metro traffic flow-based severance assessment – children

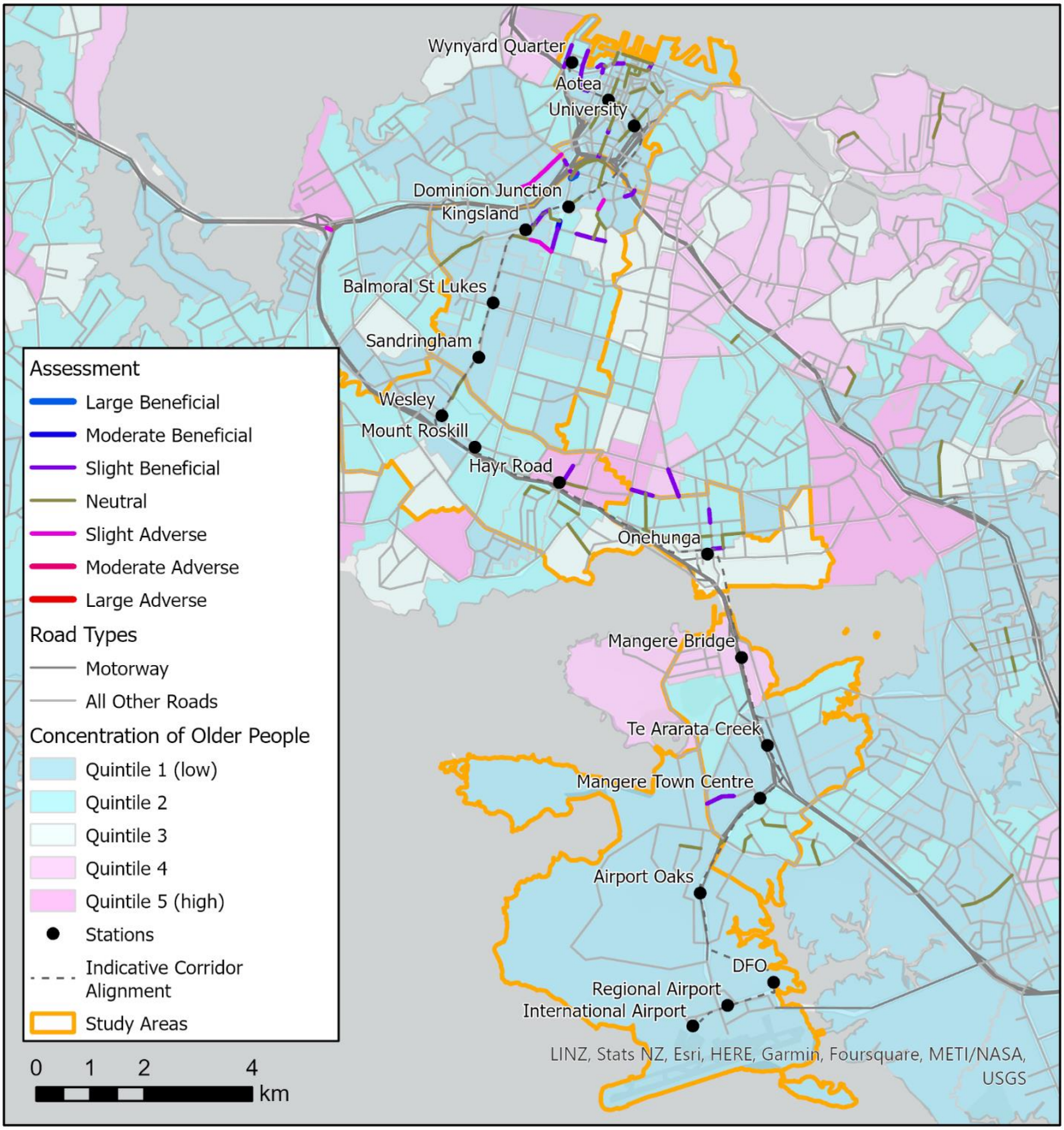


Figure 51 – Separated light metro traffic flow-based severance assessment – older people

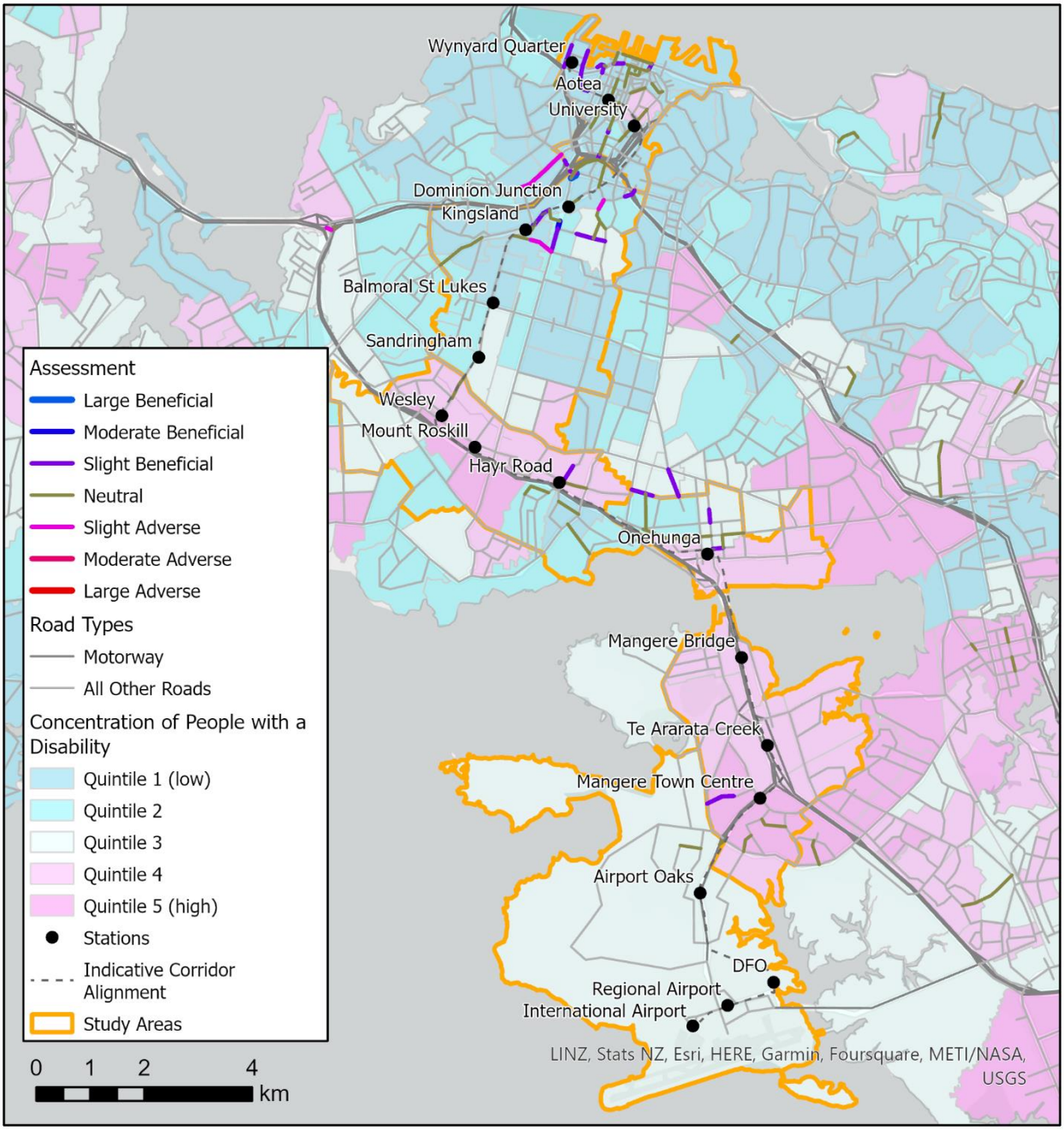


Figure 52 – Separated light metro traffic flow-based severance assessment – people with a disability

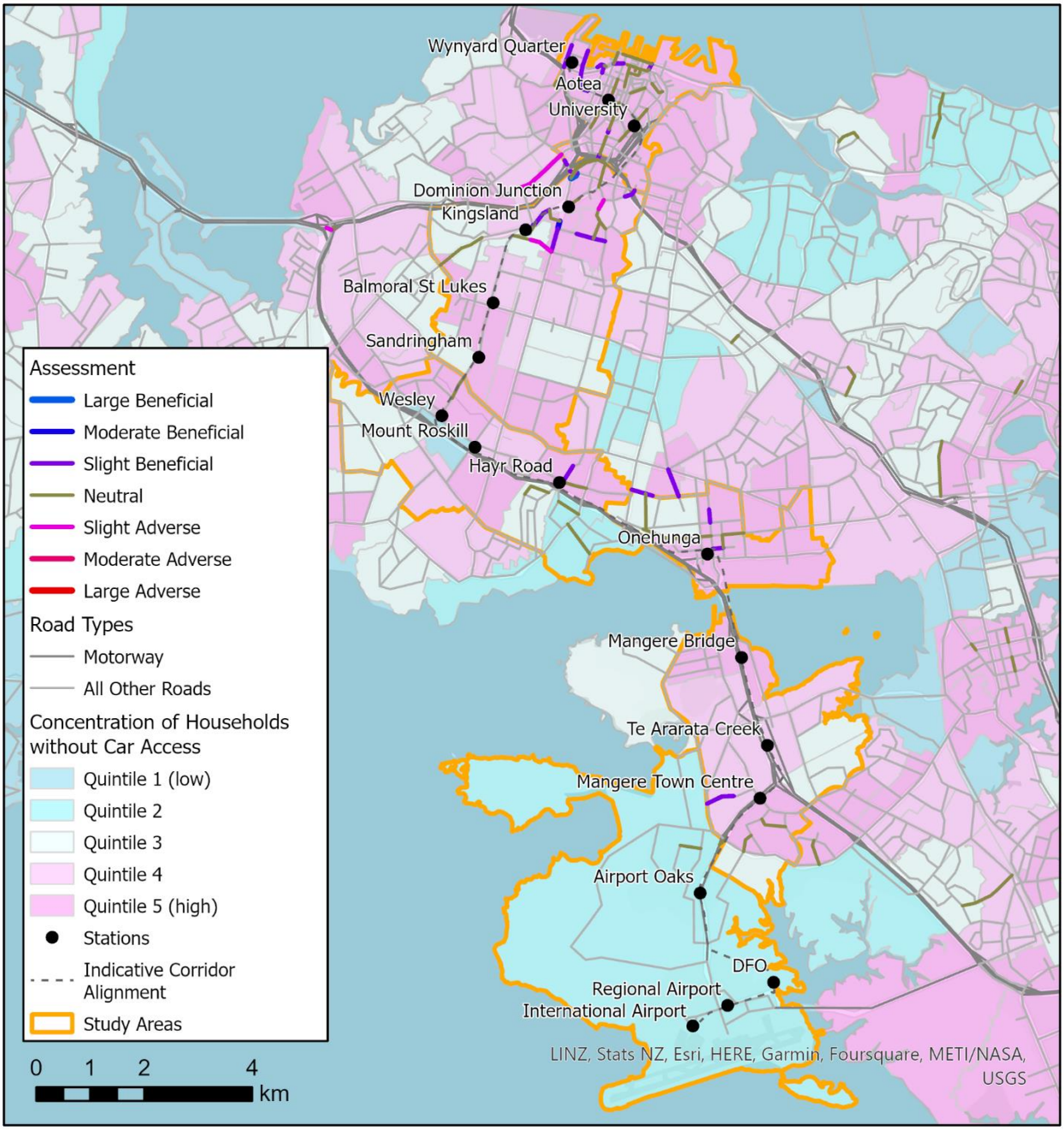


Figure 53 – *Separated light metro traffic flow-based severance* assessment – households without car access

Based on the above maps, it can be observed that many of the highway impacts do not directly border the scheme. Furthermore, none of the areas reflect substantial increases in traffic flow, which would indicate significant adverse impacts (moderate or large), particularly in areas where priority groups reside. Consequently, it appears there could be a neutral impact on priority groups' ability to access essential amenities and services in the area.

A more thorough analysis aimed at determining the proportion of individuals in priority groups that might be affected by an increase in traffic flows is provided below.

Table 93 presents the assessment of severance. The number of people (and households) impacted has been approximated by considering the population residing within an estimated 500 meters[60] from the scheme. The assessment score has been defined using a 7-point scale. Slight beneficial/adverse impacts are represented as (+1/-1), moderate beneficial/adverse impacts as (+2/-2), and large beneficial/adverse impacts as (+3/-3). Neutral impacts are defined as (0). Finally, the table provides a summary of the severance assessment for priority groups within the impact area.

The analysis indicates that most priority groups reside near links classified as having a neutral impact in the severance assessment. Additionally, a substantial number of individuals live near links expected to experience slight beneficial impacts. There is a limited number of links where a slight increase in traffic flows is anticipated to generate adverse effects for specific priority groups. For all other link assessments, only a small number of people reside in the vicinity.

The overall DI assessment on severance is neutral due to the negligible impact on the affected factors.

[60] In this case, a catchment area defined by a physical distance in meters (500m) was applied to capture the proportion of priority groups living within a reasonable walking distance in order to assess the potential impact of severance directly caused by increased traffic flows.

Table 93 – Separated light metro assessment of traffic flow-based severance assessment by priority group

Link Assessment	All relevant priority groups			Children			Older People			People with a Disability			Households without Car Access		
	Change in Severance [A]	No of People affected [B]	Overall Effect [A] * [B]	Change in Severance [A]	No of People affected [B]	Overall Effect [A] * [B]	Change in Severance [A]	No of People affected [B]	Overall Effect [A] * [B]	Change in Severance [A]	No of People affected [B]	Overall Effect [A] * [B]	Change in Severance [A]	No of People affected [B]	Overall Effect [A] * [B]
Large Beneficial	3	200	500	3	100	200	3	0	100	3	0	100	3	100	200
Moderate Beneficial	2	200	500	2	100	200	2	100	100	2	0	100	2	0	100
Slight Beneficial	1	10,900	10,900	1	4,600	4,600	1	2,300	2,300	1	1,300	1,300	1	2,800	2,800
Neutral	0	60,700	0	0	23,800	0	0	8,300	0	0	6,200	0	0	22,400	0
Slight Adverse	-1	2,000	-2,000	-1	1,200	-1,200	-1	300	-300	-1	200	-200	-1	300	-300
Moderate Adverse	-2	0	0	-2	0	0	-2	0	0	-2	0	0	-2	0	0
Large Adverse	-3	0	0	-3	0	0	-3	0	0	-3	0	0	-3	0	0

The overall assessment of the traffic flow-based assessment is neutral, and this is summarised in the table below.

Table 94 – Separated light metro outcome of traffic flow-based severance assessment by priority group

Priority group	Assessment
Children (under 15)	Neutral
Older people (70+)	Neutral
People with a disability	Neutral
Households without car access	Neutral

Street-running option

Figure 54 presents the assessment by link for the street-running option, categorised as beneficial when traffic decreases and adverse when traffic increases. The assessment indicates there will be large positive impacts in the street-running section of the route. Conversely, there will be large adverse impacts on some the parallel routes. In this option, the traffic impacts predominantly occur in parts of the alignment with street-running operation and parallel roads.

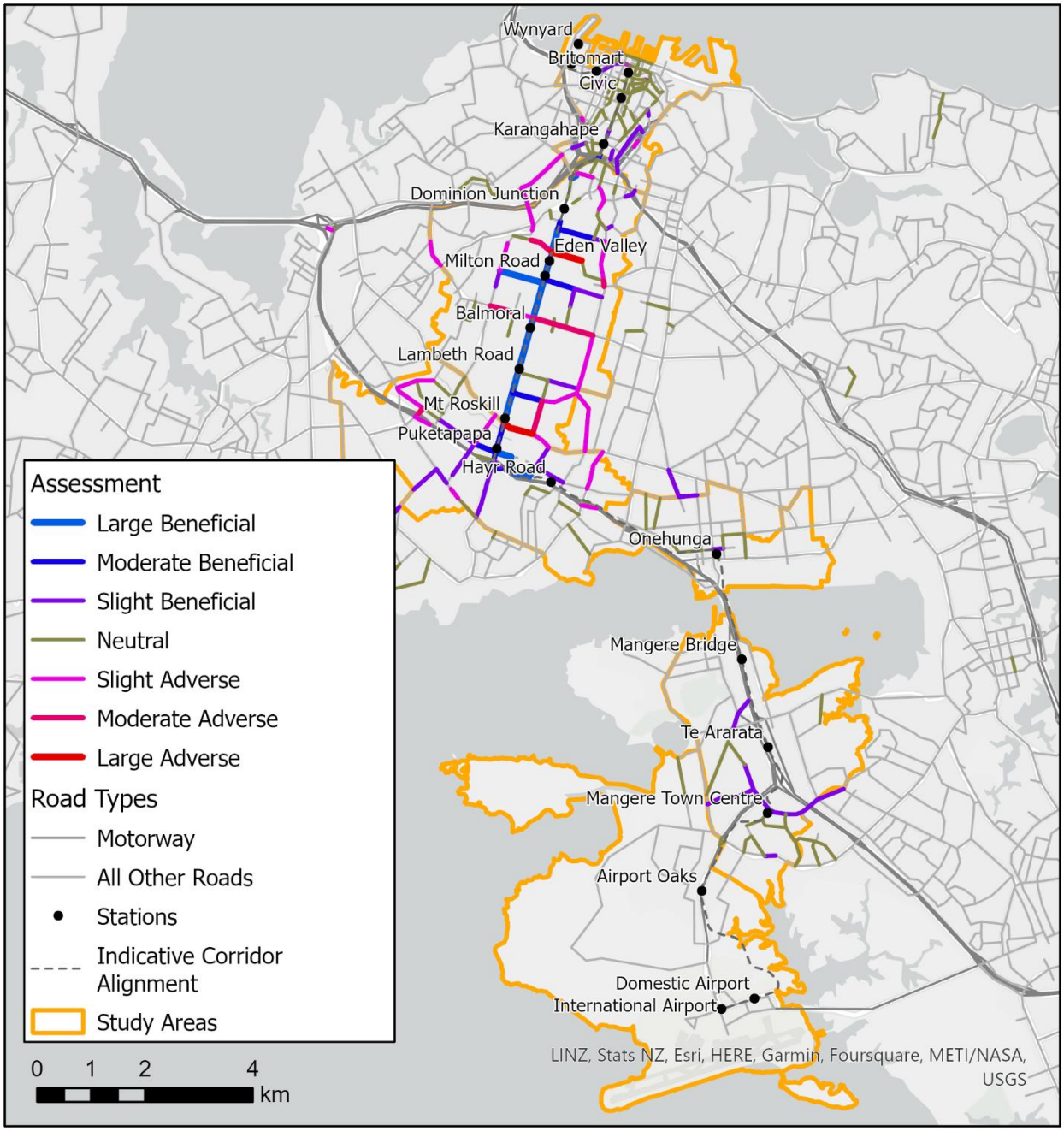


Figure 54 – Street-running metro traffic flow-based severance assessment

Based on the previous map, it is not straight forward to definitively conclude whether the option results in benefits or disbenefits in terms of substantial increases in traffic flow. Numerous areas exhibit significant adverse impacts, while others exhibit significant benefits. Consequently, the traffic flow mapping has not been overlaid with concentrations of priority groups. Instead, a more comprehensive analysis, aimed at determining the proportion of individuals in priority groups that may be affected by increased traffic flows, is provided in the following section.

As mentioned, impacts are more significant under the street-running option and affect various priority groups through simultaneous increases and decreases in traffic. Across all identified priority groups, there are notably large beneficial impacts compared to large adverse impacts. About half of children, older individuals, and people with disabilities experience no significant impact. In contrast, for households without car access, over 80% of them are not significantly affected by these traffic changes.

Table 95 – Street-running metro assessment of traffic flow-based severance assessment by priority group

Link Assessment	All relevant priority groups			Children			Older People			People with a Disability			Households without Car Access		
	Change in Severance [A]	No of People affected [B]	Overall Effect [A] * [B]	Change in Severance [A]	No of People affected [B]	Overall Effect [A] * [B]	Change in Severance [A]	No of People affected [B]	Overall Effect [A] * [B]	Change in Severance [A]	No of People affected [B]	Overall Effect [A] * [B]	Change in Severance [A]	No of People affected [B]	Overall Effect [A] * [B]
Large Beneficial	3	9,900	29,700	3	5,900	17,600	3	2,000	5,900	3	1,200	3,600	3	900	2,600
Moderate Beneficial	2	6,200	12,400	2	3,200	6,500	2	1,400	2,800	2	900	1,800	2	700	1,300
Slight Beneficial	1	29,000	29,000	1	15,200	15,200	1	5,000	5,000	1	3,500	3,500	1	5,200	5,200
Neutral	0	104,100	0	0	36,300	0	0	13,600	0	0	10,000	0	0	44,300	0
Slight Adverse	-1	20,700	-20,700	-1	11,100	-11,100	-1	4,000	-4,000	-1	2,500	-2,500	-1	3,200	-3,200
Moderate Adverse	-2	5,200	-10,400	-2	3,300	-6,600	-2	900	-1,800	-2	500	-1,100	-2	400	-900
Large Adverse	-3	2,100	-6,200	-3	1,100	-3,300	-3	500	-1,400	-3	300	-900	-3	200	-600

The overall assessment of the traffic flow-based assessment is slightly beneficial for all priority groups, except for households without car access which is assessed as neutral. This is summarised in Table 96*Table 96*.

Table 96 – Street-running light rail outcome of traffic flow-based severance assessment by priority group

Priority group	Assessment
Children (under 15)	Slight beneficial
Older people (70+)	Slight beneficial
People with a disability	Slight beneficial
Households without car access	Neutral

(b) Analysis from the station-based assessment

Step 1 Screening

Further quantitative assessment has been undertaken to assess the impact of the infrastructure improvements around new stations. For this assessment, only significant improvements have been considered. The planned infrastructure measures are listed in Table 97.

Table 97 – Significant station-based infrastructure improvements

Station	Key Infrastructure Improvement
University	A new pedestrian-cycle bridge across SH16 to the Domain and Hospital.
Dominion Junction	A new at grade junction at Dominion Junction with pedestrian crossing.
Kingsland	Several minor improvements, including proposals for cycle lanes, bus stops and pedestrian crossings.
Māngere Bridge	A new 5m wide pedestrian-cycle bridge over the Southwestern Motorway to replace an existing bridge across the SH-20.
Te Ararata	A new 5m wide pedestrian-cycle bridge over the Southwestern Motorway to replace an existing bridge across the SH-20.
Māngere Town Centre	A new station plaza bridge intended to replace the existing facilities on Bader Drive, including pedestrian, cycling and traffic infrastructure.
Airport Oaks	A new 5m wide pedestrian-cycle bridge over George Bolt Memorial Drive.

Step 2 Assessment

Step 2a: Confirmation of areas impacted by the transport intervention

In this detailed station analysis, the catchment area is defined by travel time to represent the fact that stations cater to individuals within a 10-minute walking distance. Therefore,

the impact area (refer to Figure 57) is delineated as the area accessible within a 10-minute walk from the stations.

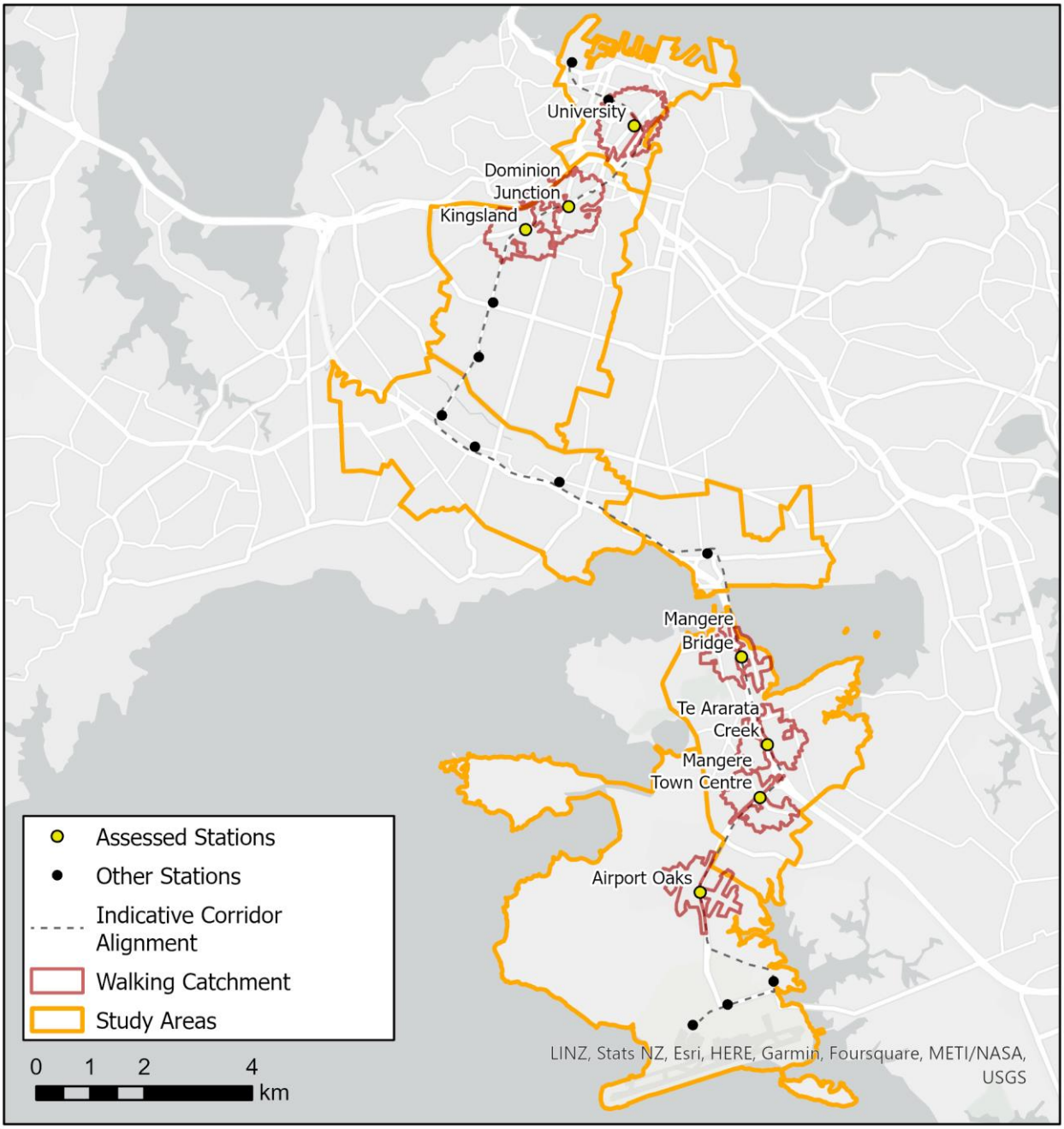


Figure 55 – Station-based severance impact area

Step 2b: Identification of social groups in the impact area

Table 98Table 98 below shows the proportion of priority groups for the impact area, in comparison with proportions in Tāmaki Makaurau Auckland Region. The proportion of priority groups are overall in line with the Tāmaki Makaurau Auckland Region, except for no-car households which are overrepresented in the impact area (29%) when compared to regional rates (7%).

Table 98 – Priority group distribution in station-based severance impact area

Priority group	Proportion in severance impact area	Proportion in study areas	Proportion in Auckland Region
Children (under 15)	14%	17%	20%
Older people (70+)	4%	5%	8%
People with a disability	4%	5%	7%
Households without car access	**29%**	7%	7%

Step 2c: Identification of amenities in the impact area

A desktop study was conducted to identify the amenities within the impact area. Findings are summarized in Table 99. The study reveals several parks in proximity to the university and a few additional amenities. Dominion Junction boasts several amenities, while Kingsland offers limited amenities in the vicinity. Moving further south, areas such as Māngere Bridge, Te Ararata, and Māngere Town Centre contain numerous schools and pre-schools near the stations. These areas feature several other amenities in their vicinity. There are no amenities available within the immediate vicinity of the Airport.

Table 99 – Amenities in station-based severance impact area

Station	Schools and Pre-schools	Play-grounds, parks and sport centres	Medical Facilities	Places of Worship	Commu-nity Centres
University	2	6	0	2	0
Dominion Junction	2	2	1	3	0
Kingsland	1	1	0	0	0
Māngere Bridge	5	1	0	0	1
Te Ararata Creek	5	0	0	3	1
Māngere Town Centre	5	2	2	2	0
Airport Oaks	0	0	0	0	0

Step 3 Appraisal of impacts

An evaluation of the alteration in severance caused by the proposed new infrastructure around the station has been conducted in the Social Impact Appraisal chapter (see section 3.4). The results of the SIA analysis will be used in this section, with the assessment of severance distributional impacts focused on the following priority groups: children, older people, people with a disability and households without access to a car.

The overall severance evaluation of infrastructure improvements at the station level is presented in Table 9. Building on these findings, Table 101 provides an assessment of these infrastructure improvements tailored to priority groups. The estimation of the number of

affected individuals (and households) within each priority group is based on the population residing within the defined walking distance of each station.

The overall impact is determined by multiplying the change in severance score, as detailed in Table 9, by the number of affected individuals. An overall assessment is then made based on the assessment for each station.

The severance worksheet details the number of people in each priority group that are likely to be affected by severance around the main ALR stations. This information is subsequently used to evaluate the distributional impacts of severance.

The assessment reveals that the most significant effects are expected at University and Māngere Town Centre. This is primarily attributed to both a substantial change in the severance score and the high number of affected individuals. The impact at Dominion Junction is also expected to be significant, primarily driven by the alteration in the severance score. A significant impact is also observed at Te Ararata, primarily due to the presence of a substantial number of priority groups residing in the vicinity.

The overall assessment of the station-based assessment is moderately positive, as summarised in Table 100.

Table 100 – Outcome of station-based *severance assessment by priority group*

Priority group	Assessment
Children (under 15)	Moderate beneficial
Older people (70+)	Moderate beneficial
People with a disability	Moderate beneficial
Households without car access	Moderate beneficial

Summary

In summary, the influence on severance is expected to stem from both additional infrastructure and changes in motorised traffic. Changes in traffic patterns can impact how residents access various services, while new infrastructure such as pedestrian bridges and underpasses can enhance safety and reduce severance through providing dedicated crossing points.

Key findings of the traffic flow-based assessment are as follows:

- For the street-running option: a slight beneficial impact is anticipated for all priority groups with the exception of households without car access which is assessed as neutral.
- For the separated option: a neutral impact is expected, applicable across priority groups.

The severance analysis based on additional infrastructure (station-based assessment) determined that both options are projected to yield a moderately beneficial outcome in terms of severance reduction. The separated light metro option is anticipated to perform slightly better, as the street-running option is not expected to deliver the same level of benefits, particularly in the University area.

Considering the performance of both options under these assessment scenarios (traffic flow-based and station-based), a **moderate overall positive severance effect** is anticipated for both the separated light metro option and for the street-running option.

Table 101 – Assessment of station-based severance assessment by priority group

Station	All relevant priority groups			Children			Older People			People with a Disability			Households without Access to a Car		
	Change in Severance [A]*	No of People affected [B]	Overall Effect [A] * [B]	Change in Severance [A]	No of People affected [B]	Overall Effect [A] * [B]	Change in Severance [A]	No of People affected [B]	Overall Effect [A] * [B]	Change in Severance [A]	No of People affected [B]	Overall Effect [A] * [B]	Change in Severance [A]	No of People affected [B]	Overall Effect [A] * [B]
University**	2	2,100	4,200	2	300	500	2	100	300	2	200	400	2	1,550	3,110
Dominion Junction	2	900	1,800	2	400	800	2	200	300	2	100	200	2	180	360
Kingsland	1	800	800	1	600	600	1	100	100	1	100	100	1	70	70
Māngere Bridge	1	500	500	1	300	300	1	100	100	1	100	100	1	40	40
Te Ararata Creek	1	1,200	1,200	1	900	900	1	100	100	1	200	200	1	30	30
Māngere Town Centre	3	1,200	3,600	3	800	2,500	3	200	500	3	100	400	3	30	100
Airport Oaks	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0

(*) The assessment score has been defined using a 7-point scale. Slight beneficial/adverse impacts are represented as (+1/-1), moderate beneficial/adverse impacts as (+2/-2), and large beneficial/adverse impacts as (+3/-3). Neutral impacts are defined as (0).

(**) The street-running option does not stop at the University area so the new pedestrian bridge is not expected to be delivered. As such, improvements to severance are anticipated to be lower under the street-running option in comparison to the separated light metro.

5.Urban investment option assessment

Summary of urban options

ALR is a combined Transport and Urban investment intended to address an interlinked set of transport, urban and carbon problems. Therefore, in addition to the transport intervention, the full scope of the ALR investment considered a series of urban investment options that would improve urban outcomes. Urban investment interventions are inherently different to transport investment interventions, and are focused on realising transport benefits sooner.

Taking the separated light rail option as the starting point, the urban response identified two shortlisted options for urban intervention that were then inputted into the economic assessment of the corridor business case. The options present two different urban scenarios based on **population, employment and household growth** assumptions and spatial distributions within the ALR corridor. A range of enabing infrastructure category investments were subsequently developed for each option to enhance outcomes from the transport investment. A summary of the two shortlisted urban options is presented in the table below.

Table 102 – Shortlisted urban options

	ALR + Incremental Investment	ALR + Active Investment
Summary Description	This option assumes that the Do Minimum component of future growth resulting from an increase in accessibility brought on by ALR is brought forward to occur before 2051. This acceleration of growth is achieved through a moderate level of additional urban interventions, policy changes and/or land acquisition.	This option assumes that the Do Minimum components of growth resulting from an increase in accessibility brought on by ALR is brought forward to occur before 2051. It also assumes that the baseline population change that occurs between 2051-2065 is brought forward to before 2051.

Following confirmation of the shortlisted options, a review of possible urban interventions were explored to understand the extent of intervention that would be required to realise each urban outcome. A summary of urban interventions is presented in the table below.

Table 103 – Urban interventions

Intervention	Description
Catalyst development	*Measures which catalyse the market to deliver market interventions at scale in locations otherwise not currently conducive for development*
Improved environment	*Measures which make places more attractive and increase their usability, in order to create conditions to catalyse development in locations where it might otherwise be less attractive or be undertaken in a less desirable manner.*
Enabling infrastructure investment	*The direct provision of (and payment for) enabling infrastructure within the corridor by the public sector, to help direct development towards it and allow developers to undertake different forms of development to what would otherwise be viable.*
De-risking development	*Measures which de-risk development using financial tools, in order to encourage greater development supply*
Direct funding	*Measures which provide direct funding at public cost, to bring down the cost to developers and incentivise development.*
Urban delivery agency	*Measures which would provide new powers to coordinate development, potentially through a new urban delivery entity, supporting development within the ALR corridor and directly intervening to achieve desirable outcomes.*
Strategy and System	*Measures which would alter the mechanics of the planning system to bring about wider strategic policy changes, which help to encourage development in the ALR corridor.*

Development and zoning	*Measures which would change local development and zoning rules within the context of the existing planning system and framework, to facilitate greater levels of development within the ALR corridor.*

After confirming the extent of intervention that would be required to achieve each option, the two shortlisted urban options proceeded to the economic assessment. In the following section, our primarily focus will be on the ALR + Active Investment option as it represents the most significant and transformative change.

Urban interventions and the SDI

While the transport investment alone is expected to generate a range of social and distributional benefits, the urban interventions listed above have the potential to create additional social and distributional impacts based on their ability to enhance urban uplift beyond the level achieved by the transport intervention. As such, consideration must be given as to how urban interventions may have altered the findings of the SDI that are presented in section 3 and section 4 of this report.

To account for any changes resulting from the urban intervention, the findings of the SIA and DIA were individually reviewed to identify impact categories where the urban intervention is anticipated to have altered the assessment outcomes. The anticipated change resulting from the urban intervention is described for each affected impact category, alongside a summary of the consequence for the overall assessment (i.e. the extent to which the urban intervention is expected to alter the findings of the original SDI assessment).

The following tables summarise the results for the SIA and the DIA respectively.

Table 104 Summary of expected impacts or urban options on the SIA

Impact category	Impact	Anticipated change	Consequence for the assessment
Community-related outcomes	Community severance	Additional investments in transport infrastructure and network upgrades, and particularly improvements to walking and cycling infrastructure, are anticipated to deliver additional community severance benefits by facilitating better movement within and across communities.	The community severance assessment is expected to change from slightly-moderately positive to **moderately beneficial.** Walking and cycling improvements are expected to enhance pedestrian connectivity and facilitate better social interactions and gatherings along the corridor and within key station areas.
	Social connectedness	Plans to enhance the environment in areas along the corridor, including placemaking pop-ups, meanwhile uses, place branding and place marketing are anticipated to enrich the character of areas and neighbourhoods along the corridor. This enhancement will provide a better sense of place and will facilitate social connectedness by providing better spaces for individuals to connect.	At the scheme-wide level, the assessment for social connectedness is expected to remain **moderately beneficial** However, the anticipated place-making enhancements are expected to provide significant additional improvements in areas along the corridor which currently provide limited opportunity for social connection, such as the airport, Mount Roskill, Onehunga and Māngere.
	Personal safety and fear of crime	Overall, the improvement in quality of facility and services associated with ALR remains almost similar. As a result, impact on personal safety and fear of	At the scheme-wide level, the assessment for security is expected to remain **moderately beneficial.**

		crime for individuals travelling via rail or within the areas which surround the scheme is not anticipated to change significantly.	
	Journey quality	Plans to improve the environment and additional investments in transport infrastructure may improve overall passenger satisfaction, reduce frustration and alleviate passenger's stress.	At the scheme-wide level, the overall assessment for journey quality is likely to remain **moderately beneficial**.
	Health benefits arising from changes in levels of physical activity	Green infrastructure investments are anticipated to increase the overall health benefits arising from changes in levels of physical activity by incentivising more people to engage with active travel as a means of travelling to and from ALR stations. In addition, investments in transport infrastructure and active travel networks are expected to contribute to increased uptake of active travel modes.	The assessment for health benefits arising in changes in levels of physical activity when travelling to and from stations is expected to increase from slightly beneficial to **moderately beneficial.** Investments that encourage higher engagement with active modes of travel will increase the overall level of physical activity in the population, thus alleviating the burden on public health facilities and services associated with a sedentary lifestyle.
Health related outcomes	Health benefits to active travel users arising from changes in the physical environment	Improvements to green and open spaces in areas along the corridor are expected to increase the attractiveness of active travel as a form of transport. This change will deliver additional health benefits by enabling a higher overall uptake of cycling and walking in areas along the corridor. An increase in active travel will be further facilitated by investments into transport-related infrastructure which will provide improved walking and cycling infrastructure along the corridor and around stations.	The assessment of health benefits to active travel users arising from changes in the physical environment is expected to increase from slightly beneficial to **moderately beneficial** While complementary active travel interventions were only a sub-component of the ALR scheme, the delivery of additional active travel investments through the urban intervention is expected to significantly increase the overall mode share of active travel, thus generating significant additional health benefits through promoting an increase in the adoption of active travel methods.
	Prevention of road accidents and casualties	General network improvements and investment in transport-related infrastructure will improve safety on roads along the corridor and around stations. This may in turn contribute to the prevention of road accidents and casualties.	Benefits arising from the prevention of road accidents and casualties are expected to remain **slightly beneficial.** While general network improvements are likely to improve road safety to some extent, the urban transport intervention is not directly aimed at preventing road accidents and casualties. As such, the impact is only expected to be marginal and the overall health impact is not expected to change.
Accessibility outcomes	Changes in accessibility	The urban intervention is expected to deliver new social and enabling infrastructure which	The appraisal of benefits arising from changes in accessibility is expected to remain as

		will provide new access to schools, places of leisure, community centres and employment opportunities. The supply of social infrastructure will be delivered to meet the expected increase in demand due to population growth. Therefore, the net impact on accessibility to schools, places of leisure and key services is expected to be negligible. However, direct funding mechanisms will also be utilised to create an enterprise zone that will deliver employment incentives and create additional jobs within the corridor. This intervention is expected to improve employment accessibility outcomes by providing additional access to jobs within the corridor, beyond that which is required to satisfy demand from future population growth.	**moderately beneficial.** While significant employment growth is forecast for both urban options, the urban intervention is not expected to significantly alter accessibility to essential services, social networks or family because interventions will be delivered to satisfy future demand.

Table 105 Summary of expected impacts or urban options on the DIA

Impact	Anticipated change	Consequence for the assessment
User benefits	An increase in transit ridership resulting from the overall population increase could potentially generate additional public transport benefits. Benefits for private vehicles may also increase as more drivers and passengers are expected to benefit from the potential reduction in traffic congestion.	The overall assessment will remain **moderate to large beneficial**. While the distribution of the benefits may shift slightly, it is not expected to be significant.
Affordability	Despite general network improvements and investments in transport-related infrastructure, certain areas may still witness an increase in traffic due to an increase in demand. A surge in traffic is likely to reduce cost-saving improvements, as congestion might not alleviate significantly.	The increased traffic is expected to bring fewer benefits, potentially leading to disbenefits. Consequently, the assessment may shift to **neutral or slightly adverse**. The distribution of benefits may also change, but it remains unclear which priority groups will benefit.
Noise	General network improvements and investment in transport-related infrastructure will improve overall traffic flow around stations and in key development areas. This may in turn generate noise reduction benefits through improving traffic conditions along the corridor. On the other hand, in a context with increased population, there may be less reduction in traffic congestion, resulting in an overall decrease in noise levels.	Benefits arising from changes in noise levels are expected to remain **neutral.** While general network improvements are likely to improve traffic flow to some extent, the urban transport intervention is not directly aimed at improving noise. As such, the impact is only expected to be marginal and overall noise levels are not expected to change significantly. There is also a potential for reduced traffic congestion benefits (linked to noise benefits) due to the population increase.

Air quality	In a scenario with increased population growth, there may be less reduction in traffic congestion, resulting in an overall decrease in air quality improvement in the areas where air quality improves the most.	The assessment of air quality is expected to change from moderately beneficial to **slight beneficial**. The distribution of impacts is likely to change, with priority groups in the city core receiving fewer benefits, especially the highest 20% of income earners. In contrasts, priority groups less concentrated in the city core (such as children) are anticipated to receive a larger share of the benefits.
Safety	While a significant proportion of the separated option will be underground, it is expected that public realm enhancements will be concentrated around the proposed stations. These enhancements are likely to contribute to improved safety for road users. Nevertheless, there could be a potential increase in traffic as a result of a growing population, which may partially counterbalance the safety improvements.	Benefits arising from the prevention of road accidents and casualties are expected to remain **moderately beneficial.** The distribution among the priorty groups wil change as the links in the impact area changes.
Severance	The increased population may lead to less reduction in traffic and thereby severance improvements. Additional investments in transport infrastructure and network upgrades, and particularly improvements to walking and cycling infrastructure, are anticipated to deliver additional community severance benefits by facilitating better movement within and across communities.	The traffic based severance was assessed as neutral and will remained classified as neutral. The community severance assessment based on additional infrastructure (station-based assessment) may change from moderately positive to largely positive. The combined evaluation of severance is likely to remain **moderately beneficial**.
Security	Signficant public realm improvements are expected to be delivered under the urban intervention, particularly around stations and in key urban oppotunity areas. These include meanwhile use spaces and other placemaking interventions. Investments aimed at improving the environment around stations are expected to deliver additional security benefits for priority groups by creating informal surveillence mechanisms and enhancing lighting and landscaping features.	Security benefits are expected to remain **moderately beneficial** under the urban intervention. While security improvements are likely in areas that are expected to undergo significant public realm improvements, the urban intervention is not explicitly aimed at improving security. As such, any changes in the overall levels of security across the corridor will be marginal.
Accessibility	Urban interventions will include better access to the proposed stations. These interventions will likely include well connected and safer pedestrian and cycling facilities. These will ultimately improve last mile connectivity between the proposed stations and final destinations. The feeder services also need to be improved to maximise the benefits of the proposed ALR option. This is especially relevant for some of the priority groups (Māori and Pacific peoples' communities) who are less likely to experience direct benefits of the proposed alignments.	The benefits from the urban interventions for the changes in accessibility is expected to remain as **moderately beneficial.** While the overall accessibility catchment is expected to improve, the urban intervention may not bring a substantial alteration in accessibility to essential services, social networks or family connections. However, it is possible with increased density that more essential services may become available around the proposed stations. Consequently, this could enhance accessibility to essential services and

		social networks in the vicinity of the proposed stations.

6. Summary of findings

6.1 Social Impact appraisal

The findings of the SIA suggest that the delivery of ALR will have significant social impacts for individuals and groups living along the corridor and across the wider Auckland region. The baseline study highlighted existing conditions and characteristics of the social locality, from which several social outcome categories were identified and defined for further analysis.

The community-related outcomes section analysed conditions of severance, social connectedness, personal safety and fear of crime. Overall, the findings of the analysis suggest that both options will have a **slightly to moderately beneficial** impact on community-related conditions. The analysis suggested that both options would have a severance impact resulting in slight to moderately positive benefits for users. However, the benefit was expected to be slightly lower for the street-running option, as the route does not pass through the university area. The impact on social connectedness was appraised as moderately beneficial for both options, and it was assumed there was no variation in benefits between options given that both schemes run through all corridor sections. For both options, improvements to personal safety, fear of crime and journey quality were determined to have a moderate beneficial impact. For these factors, the magnitude of impact is expected to be slightly greater under the separated option given the lower overall journey time contributing to a reduction in passengers exposure to risks and a reduction in traveller stress.

For the accessibility outcomes section, the ability for people to travel and access the services they require was appraised. The assessment indicated that both options will have a positive net impact on accessibility, primarily through improved travel time reliability and time savings. The impact is expected to be **moderately beneficial** under the separated option, and **slightly beneficial** under the street-running option. The magnitude of impact is expected to be slightly greater under the separated option due to the option providing a greater net increase in job accessibility by public transport.

The health-related outcome appraisal considered health benefits to PT and active travel users, as well as benefits to society arising from the prevention of road accidents and casualties. Overall, both options are expected to generate **slightly beneficial** health impacts**.** Under both options, an increase in the total active distance travelled to and from public transportation is expected to generate slightly positive health benefits arising from changes in levels of physical activity. Health benefits arising from changes in the physical environment are also expected for both options, through promoting an increase in the uptake of active travel. The anticipated prevention of road accidents and casualties under is expected to produce slightly positive health benefits under each option. This impact is expected to be of slightly greater magnitude under the separated option, because the modal shift from private vehicles is expected to be slightly more significant.

6.2 Distributional impact appraisal

The following tables present the distributional impacts appraisal matrix by income distribution as well as social and user groups (Distributional Appraisal Matrix).

Table 106 DI Appraisal Matrix (Separated Light Metro)

	IoD Income Domain					Are impacts distributed evenly?	Qualitative statement
	Lowest				Highest		
	0-20%	20-40%	40-60%	60-80%	80-100%		
Accessibility	Large beneficial	Not assessed	Not assessed	Not assessed	Moderate beneficial	No	Accessibility benefits are identified as largely beneficial for low income individuals and moderately beneficial for high income individuals. The impact is not distributed evenly across groups.
User benefits	Moderate beneficial	Large beneficial	Moderate beneficial	Moderate beneficial	Moderate beneficial	No	Moderate benefits are anticipated for all income quintiles, except for the second-lowest income group. This group appears to be most favoured as they are experiencing a proportionally greater share of the total population benefit.
Affordability	Large beneficial	Slight beneficial	Moderate beneficial	Moderate beneficial	Slight beneficial	No	The lowest income quintile receives disproportionately substantial benefits, while income quintiles 4 and 1 receive comparatively modest benefits. All other income quintiles receive benefits in proportion to their share of the population.
Air quality	Slight beneficial	Not assessed	Not assessed	Not assessed	Moderate beneficial	No	Air quality impacts are expected to be slightly beneficial for low income individuals and moderately beneficial for high income individuals. As such, the impact is not distributed evenly between income groups.
Noise	Neutral	Not assessed	Not assessed	Not assessed	Neutral	Yes	The impact is neutral for high and low income individuals and distributed evenly across these groups.

	AST Entry									Qualitative statement
	Priority groups									
	Children	Young adults	Older people	People with disabilities	Māori communities	Pacific communities	Households with no car	Females	Households with	

									dependent children	
Safety	Moderate beneficial		Moderate beneficial		Moderate beneficial	Moderate beneficial				This option is likely to bring moderate safety benefits for all the priority groups. Vulnerable users such as pedestrians, cyclists and wheeled pedestrians are also expected to experience moderate benefits.
Accessibility		Slightly beneficial		Large beneficial	Moderately beneficial	Neutral	Slight beneficial	Moderately beneficial	Large beneficial	Accessibility impacts range from neutral to largely beneficial across priority groups. Households with dependent children and people with disabilities receive the greatest benefit, while the impact on pacific communities is neutral.
Security		Moderately beneficial	Slightly beneficial					Moderately beneficial		All priority groups impacted by security experience positive benefits. The impact is moderate for young adults and females, and slight for older people.
Air quality	Moderate beneficial	Moderate beneficial								Children and young adults are expected to experience air quality impacts. The impact is expected to be moderatelyly beneficial for children and for young adults.
Noise	Neutral		Neutral							The results of the distributional analysis suggest that the scheme is likely to bring neutral impacts for all priority groups.
Severance	Neutral		Neutral	Neutral			Neutral			An overall assessment of neutral is applicable across all priority groups.
User benefits					Moderate beneficial	Large beneficial				A moderate positive user benefit effect is anticipated for Māori people, while a large benefit is foreseen for the Pacific community.

Note: Grey cells indicate that the appraisal is not applicable to those categories. 'Not assessed' indicates an appraisal that was not completed at this stage.

Table 107 DI Appraisal Matrix (Street-running Light Rail)

	IoD Income Domain					Are impacts distributed evenly?	Qualitative statement
	Lowest				Highest		
	0-20%	20-40%	40-60%	60-80%	80-100%		
Accessibility	Large beneficial	Not assessed	Not assessed	Not assessed	Moderate beneficial	No	Accessibility benefits are identified as largely beneficial for low-income individuals and moderately beneficial for high income individuals. Given this, the impact is not distributed evenly across income groups.
User benefits	Moderate beneficial	Large beneficial	Slight beneficial	Slight beneficial	Slight beneficial	No	Overall, moderate benefits are expected the lowest 20% of income earners. The distribution of benefits appears to favour those in income quintile 4. In contrast, income quintiles 3, 2, and 1 (the highest income earners) are projected to receive only slight user benefits.
Affordability	Slight adverse	Large adverse	Moderate adverse	Moderate adverse	Large adverse	No	Income quintile 4 and 1 (highest income earners) experience disproportionately large share of disbenefits. Income quintile five (lowest income earners) are anticipated to experience the lowest share of disbenefits (slight adverse). The remaining income quintiles experience disbenefits in line with their share of the population.
Air quality	Moderate beneficial	Not assessed	Not assessed	Not assessed	Slight beneficial		Air quality impacts are expected to be moderately beneficial for low income individuals and slightly beneficial for high income individuals. As such, the impact is not distributed evenly between income groups.
Noise	Neutral	Not assessed	Not assessed	Not assessed	Neutral	Yes	The impact is neutral for high- and low-income individuals and distributed evenly across these groups.

	AST Entry								Qualitative statement
	Priority groups								
	Children	Young adults	Older people	People with disabilities	Maori communities	Pacific communities	Households with no car	Females	Households with dependent children
Safety	Moderate beneficial		Moderate beneficial		Moderate beneficial	Large beneficial				This option is likely to bring moderate safety benefits for most of the priority groups. For Pacific peoples, there is larger proportional impact (large beneficial) and for cyclists there is a smaller proportional impact (slight beneficial). Other vulnerable users such as pedestrians and wheeled pedestrians are also expected to experience moderate benefits.
Accessibility		Slightly beneficial		Large beneficial	Slightly beneficial	Neutral	Slight beneficial	Moderately beneficial	Large beneficial	Accessibility impacts range from neutral to largely beneficial across priority groups. Households with dependent children and people with disabilities receive the greatest benefit, while the impact on pacific communities is neutral.
Security		Moderately beneficial	Slight beneficial					Moderately beneficial		All priority groups impacted by security experience positive benefits. The impact is moderate for young adults and females, and slight for older people.
Air quality	Slight beneficial	Moderate beneficial								Children and young adults are expected to experience air quality impacts. The impact is expected to be slightly beneficial for children and moderately beneficial for young adults.
Noise	Neutral		Neutral							The results of the distributional analysis suggest that the scheme is likely to bring neutral impacts for all priority groups.
Severance	Slight beneficial		Slight beneficial	Slight beneficial			Neutral			Several priority groups are expected to be impacted by severance. The benefit is appraised as neutral for households without a car and slightly beneficial for children, older people and people with disabilities.

User benefits					Moderate beneficial	Large beneficial				A moderate positive user benefit effect is anticipated for Māori people, while a large benefit is foreseen for the Pacific community.

Note: Grey cells indicate that the appraisal is not applicable to those categories. 'Not assessed' indicates an appraisal that was not completed at this stage.

Appendix A –Screening proforma

Each indicator should be assessed individually using a screening proforma (Step 1) to determine whether it requires to be appraised further (Steps 2 and 3). A summary of the screening process undertaken is presented in the table below in Table 108.

For each indicator, it includes a suggested appraisal output criterion. The potential impact is assessed with qualitative comment. The final shows whether the indicator should be assessed further in distributional analysis.

Table 108 – Indicator screening

Indicator	Appraisal output criteria	Potential impact (yes/no, positive/ negative if known)	Qualitative comments	Proceed to step 2
User benefits	The user benefit analysis has been used in the appraisal.	Yes, positive	As ALR will enable a shift to public transport, it will reduce travel time, perceived congestion, and perceived vehicle operating costs for road users. As a consequence, a full distributional impacts assessment should be undertaken to evaluate the distribution of these benefits among income quintiles is required.	Yes
Air quality	Any change in alignment of transport corridor or links with significant changes in vehicle flow, speed, or percentage of heavy-duty vehicles (HDVs) content: • Change in 24-hour annual average daily traffic (AADT) of 1,000 vehicles or more • Change in 24-hour AADT of HDVs of 200 HDVs vehicles or more • Change in daily average speed of 10 kilometres per hour or more • Change in peak hour speed • Change in road alignment of 5 metres or more.	Yes, positive	ALR is expected to result in changes to traffic flows around stations and on adjacent roads. Additionally, the introduction of a new transport option through the delivery of a light rail system is expected to generate a modal shift from vehicles to public transport and active forms of travel. The change in concentration of air pollutants resulting from the redistribution of traffic in the study area requires further analysis to deduce how changes in air quality will differentially impact households and individuals living around stations and along the corridor.	Yes
Safety	Any change in alignment of transport corridor (or road layout) that may have positive or negative safety impacts, or any links with significant	Yes, positive	ALR will reduce the total distance travelled by vehicles (measured as volume of vehicle kilometres travelled VKT) on the road network, consequently encouraging	Yes

Indicator	Appraisal output criteria	Potential impact (yes/no, positive/ negative if known)	Qualitative comments	Proceed to step 2
	changes in vehicle flow, speed, %heavy goods vehicle (HGV) content or any significant change (more than 10%) in the number of pedestrians, cyclists or motorcyclists using road network.		greater public transport usage. This shift is expected to yield a reduction in the number of accidents, as journeys taken on public transit generally exhibit lower overall safety risks compared to equivalent trips in private vehicles.	
Security	Any change in public transport waiting and/or interchange facilities, including pedestrian access, is expected to affect user perceptions of personal security.	Yes, positive	ALR has the potential to affect people's personal safety, especially women, young individuals, seniors and those with disabilities. It is essential to take into account the unique concerns of these groups when making changes to the transport system.	Yes
Severance	Introduction or removal of barriers to pedestrian movement, either through changes to road crossing provision or the introduction of new public transport or road corridors. Any areas with significant changes (more than 10%) in vehicle flow, speed, %HGV content.	Yes, mixed	The inclusion of better integrated cycling and pedestrian facilities along the ALR route and around stations is anticipated to reduce severance by facilitating better movement with and across communities. On the contrary, the infrastructure required to deliver ALR may generate barriers that reduces the ability for individuals to access services and facilities.	Yes
Accessibility	Changes in routings or timings of current public transport services, any changes to public transport provision, including routing, frequencies, waiting facilities (bus stops and rail stations) and rolling stock, or any indirect effects on accessibility to services (eg demolition and relocation of a school).	Yes, positive	ALR should integrate seamlessly with the existing and future public transport network while improving access to employment, education, and other opportunities. As a result, assessing accessibility changes for these priority groups in the affected area is crucial after the implementation of ALR.	Yes
Affordability	In cases where the following costs would occur: parking charges (including where changes in the allocation of free or reduced-fee spaces may occur); car fuel and non-fuel operating costs (where,	Yes, positive	As ALR will enable a shift to public transport, it will reduce travel time, perceived congestion, and perceived vehicle operating costs for residual road users. An analysis of DIs is needed to assess how the latter element (comprising car fuel and non-	Yes

Indicator	Appraisal output criteria	Potential impact (yes/no, positive/ negative if known)	Qualitative comments	Proceed to step 2
	for example, rerouting or changes in journey speeds and congestion occur resulting in changes in costs); road user charges (including discounts and exemptions for different groups of travellers); public transport fare changes (where, for example, premium fares are set on new or existing modes or where multi-modal discounted travel tickets		fuel operating costs) is distributed among income quintiles.	

Appendix B – Socio-demographic analysis

The analysis presented in this appendix forms the basis for the completion of Step 2b, which involves identifying social groups within the impact area. Its primary objective is to illustrate the proportions of people belonging to various social groups across both the impact area as a whole and for each of the six geographic regions. This assessment aims to highlight any notable differences. The results are provided in Table 10 below.

Table 109 – Socio-demographic analysis by study area

Priority group	All study areas	City centre	Isthmus	Mt Roskill	Onehunga	Māngere	Airport
Population	171,000	35,000	57,000	36,000	8,000	34,000	1,000
Income distribution (from low to high)	18%	0%	2%	17%	9%	58%	100%
	18%	2%	12%	28%	64%	26%	0%
	20%	9%	21%	37%	12%	16%	0%
	19%	21%	33%	16%	14%	0%	0%
	25%	68%	33%	3%	0%	0%	0%
Children (≤15)	17%	5%	16%	18%	17%	28%	21%
Young adults (15-24)	18%	28%	16%	16%	12%	18%	12%
Older people (≥70)	5%	2%	5%	8%	7%	5%	3%
Females	49%	47%	50%	49%	50%	51%	49%
People with difficulties	5%	3%	4%	6%	5%	8%	6%
Māori	7%	4%	6%	5%	9%	13%	38%
Pacific peoples	16%	3%	7%	15%	13%	54%	14%
No car households	19%	51%	9%	7%	9%	7%	3%
Household with dependent children (carers)	39%	12%	41%	55%	40%	66%	45%

Below, we will explore the significant variations observed among the different geographic areas:

- The highest incomes are found around the city centre, including city fringes, while more socioeconomically challenged communities reside closer to the Airport.
- There is a low concentration of children in the city centre but a higher concentration around Māngere and Airport.
- Young adults are more concentrated in the city centre.

- There is a low proportion of elderly individuals in all areas.
- The city centre has a relatively slightly low concentration of females, while all other areas are close to a 50% gender distribution.
- The concentration of people with difficulties is close to the national average in all areas.
- There is a relatively high concentration of the Māori community around Māngere but below the national average. Airport has a small total population, but it has the largest proportion of Māori of any of the geographies.
- Pacific Peoples are more concentrated in Māngere. Pacific peoples make up a sizable proportion of the population in Mt Roskill, Onehunga and Airport.
- The city centre has a very high proportion of households without a car, with more than half of the households not owning a car. All other areas are close to the national average.
- There is a higher concentration of households with dependent children in Mt Roskill and Māngere, while the city centre has fewer households with dependent children. All other areas are close to the national average.

The following figures illustrate the socio-demographic characteristics of the population, categorized by statistical area 2 (SA2). These figures specifically emphasize the notably high proportions of social groups within the area, and they are also compared to national rates. This analysis aims to provide a more detailed examination compared to the equity baseline assessment. Its purpose is to visually identify areas where significant differences exist.

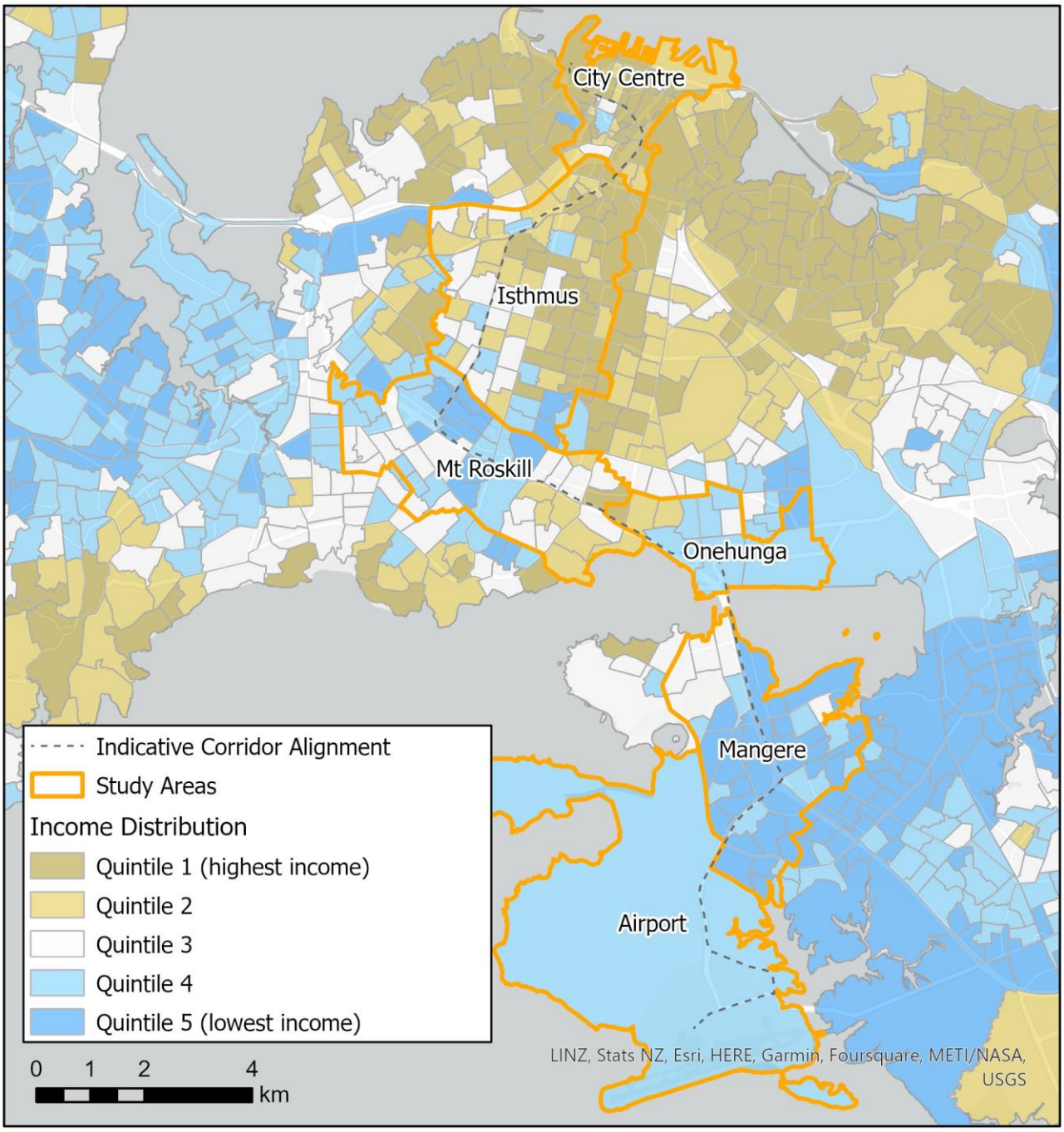


Figure 56 – Income distribution

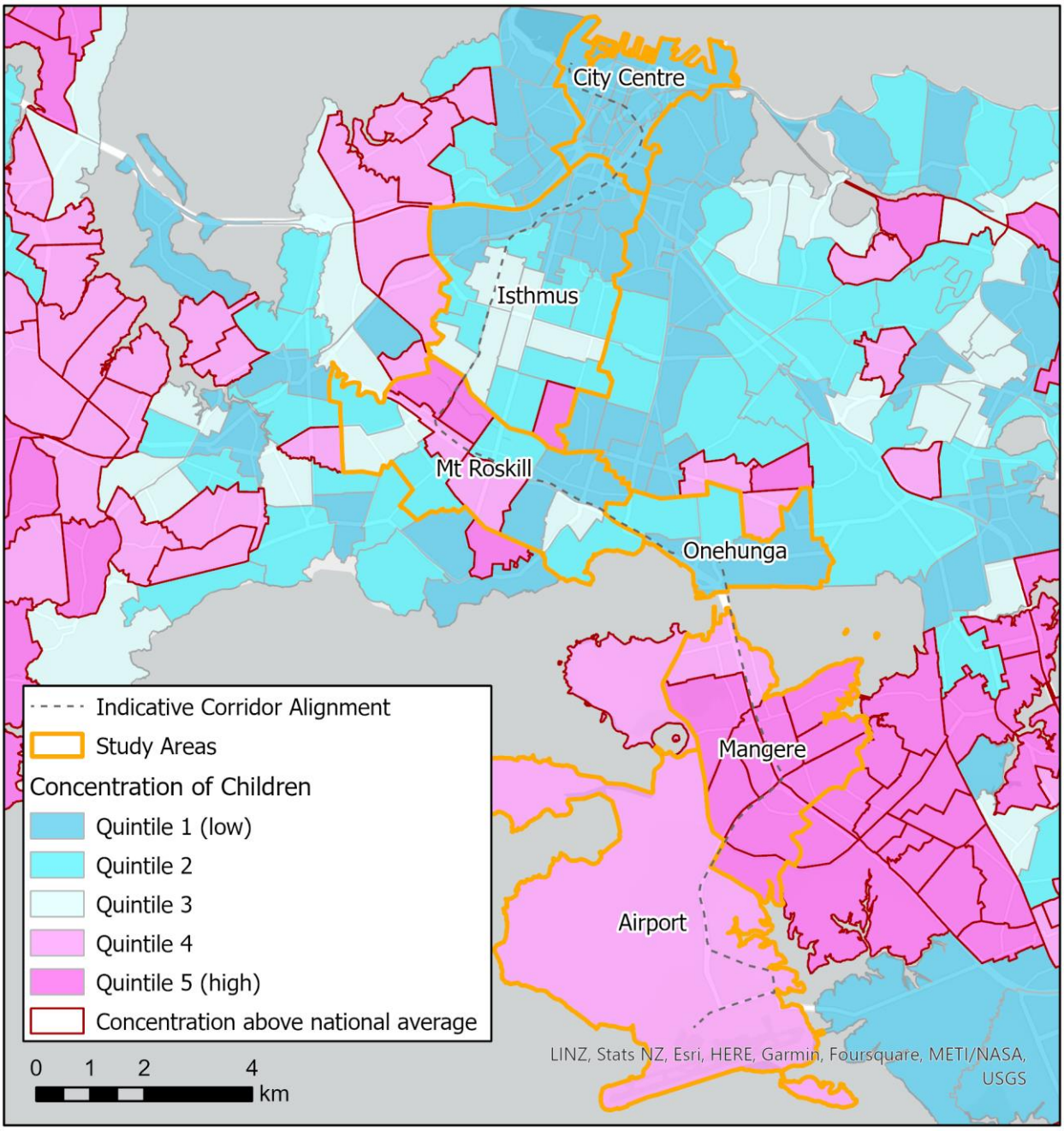


Figure 57 – Concentration of children

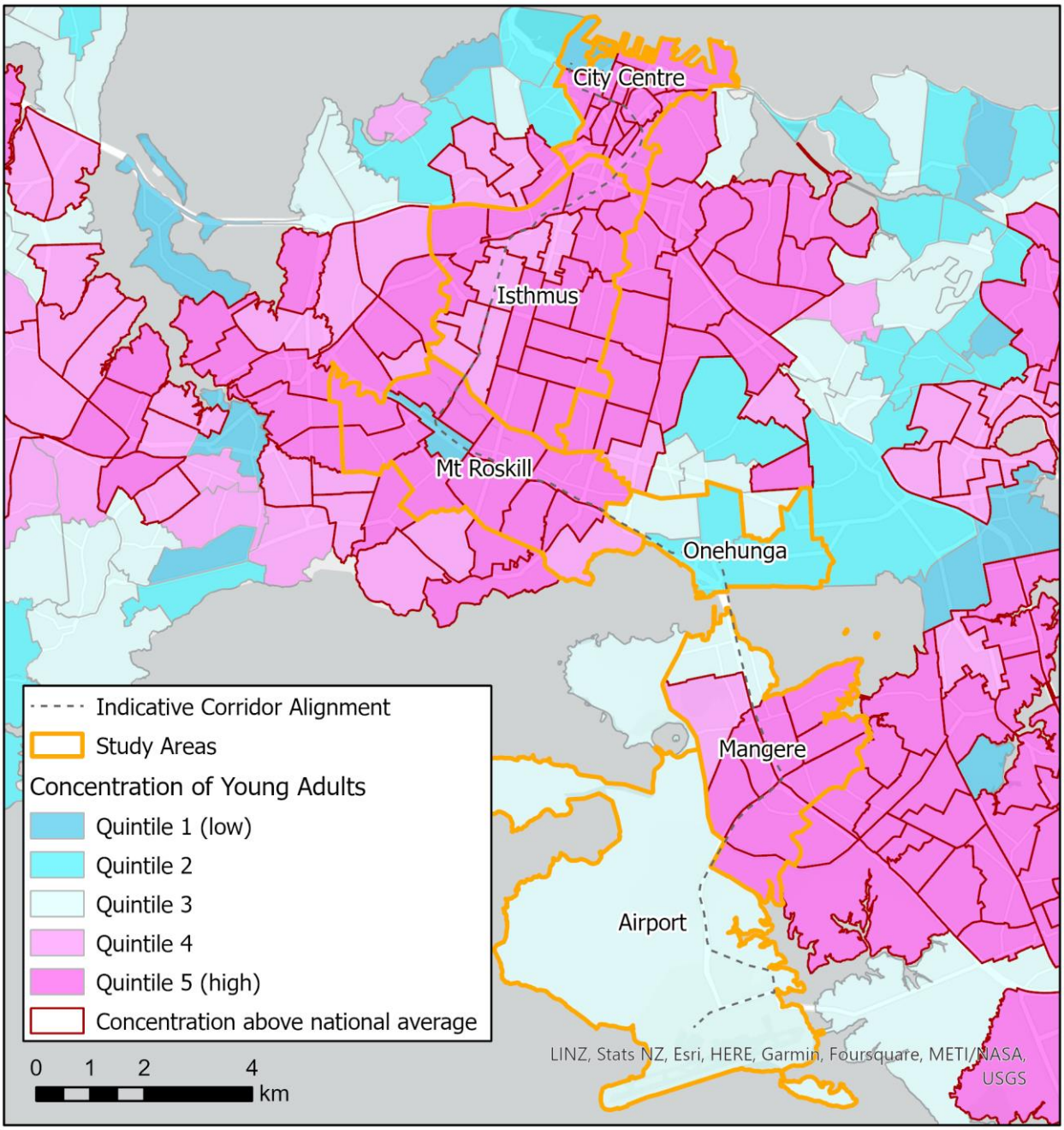


Figure 58 – Concentration of young adults

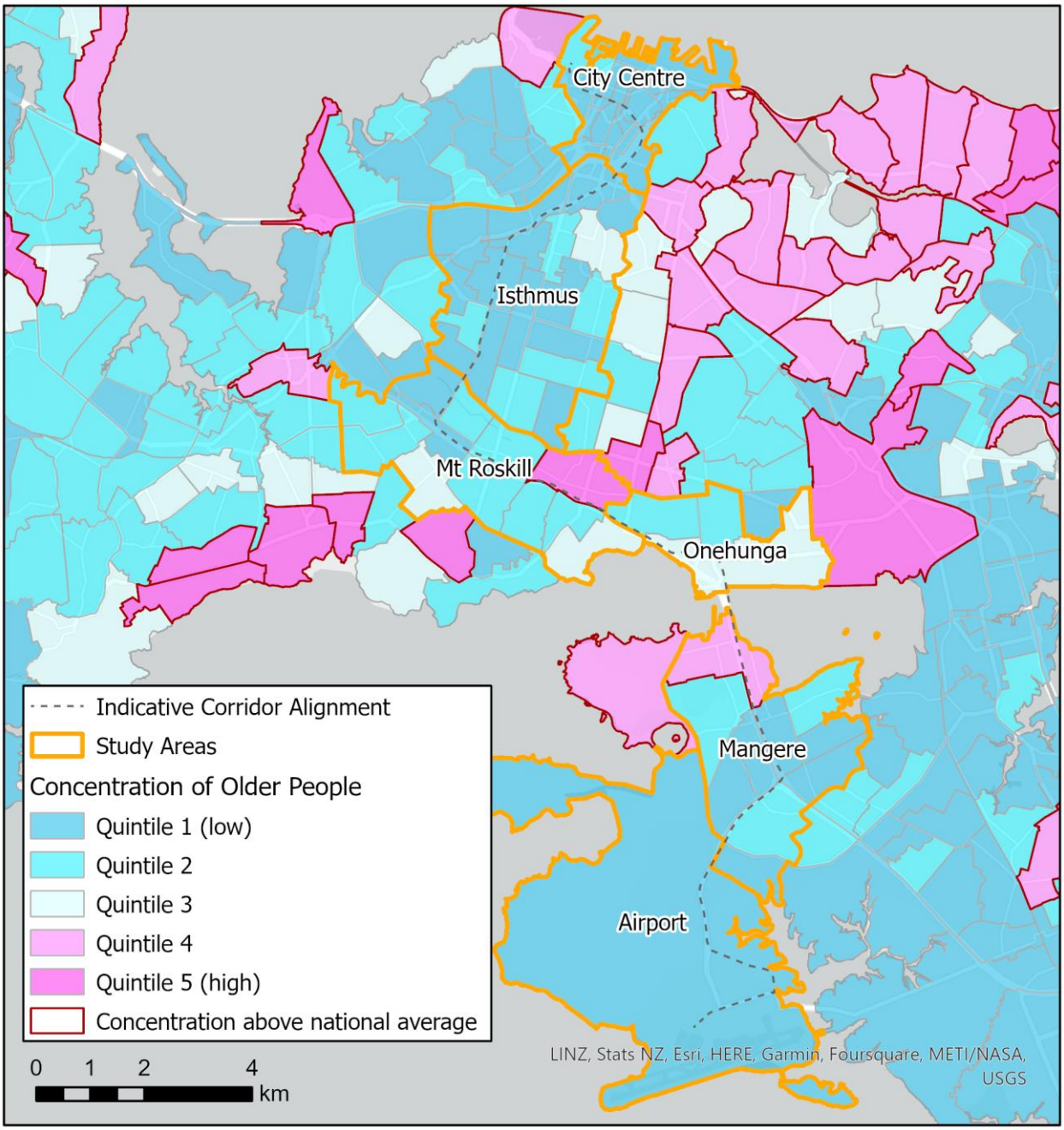


Figure 59 – Concentration of older people

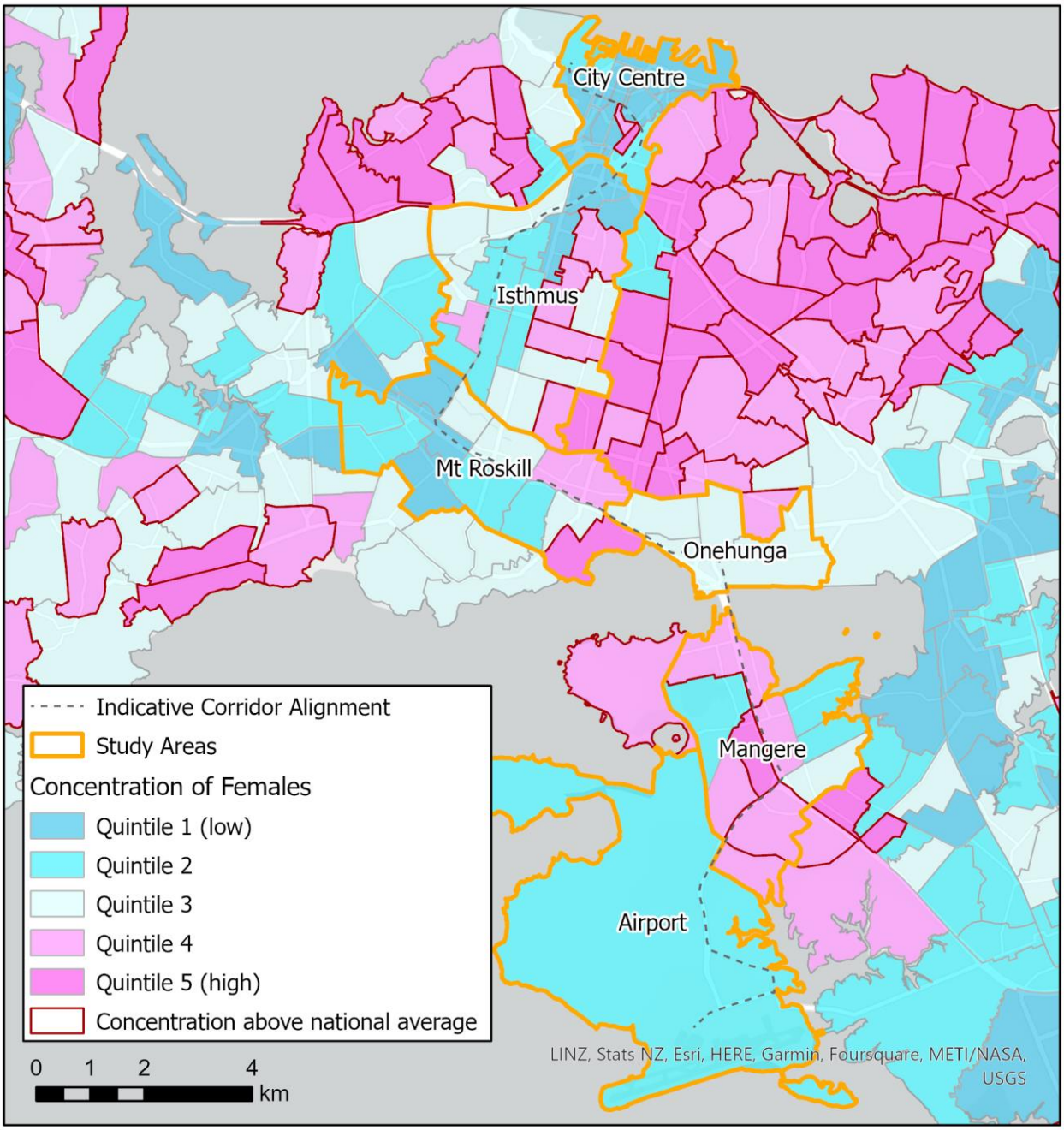


Figure 60 – Concentration of females

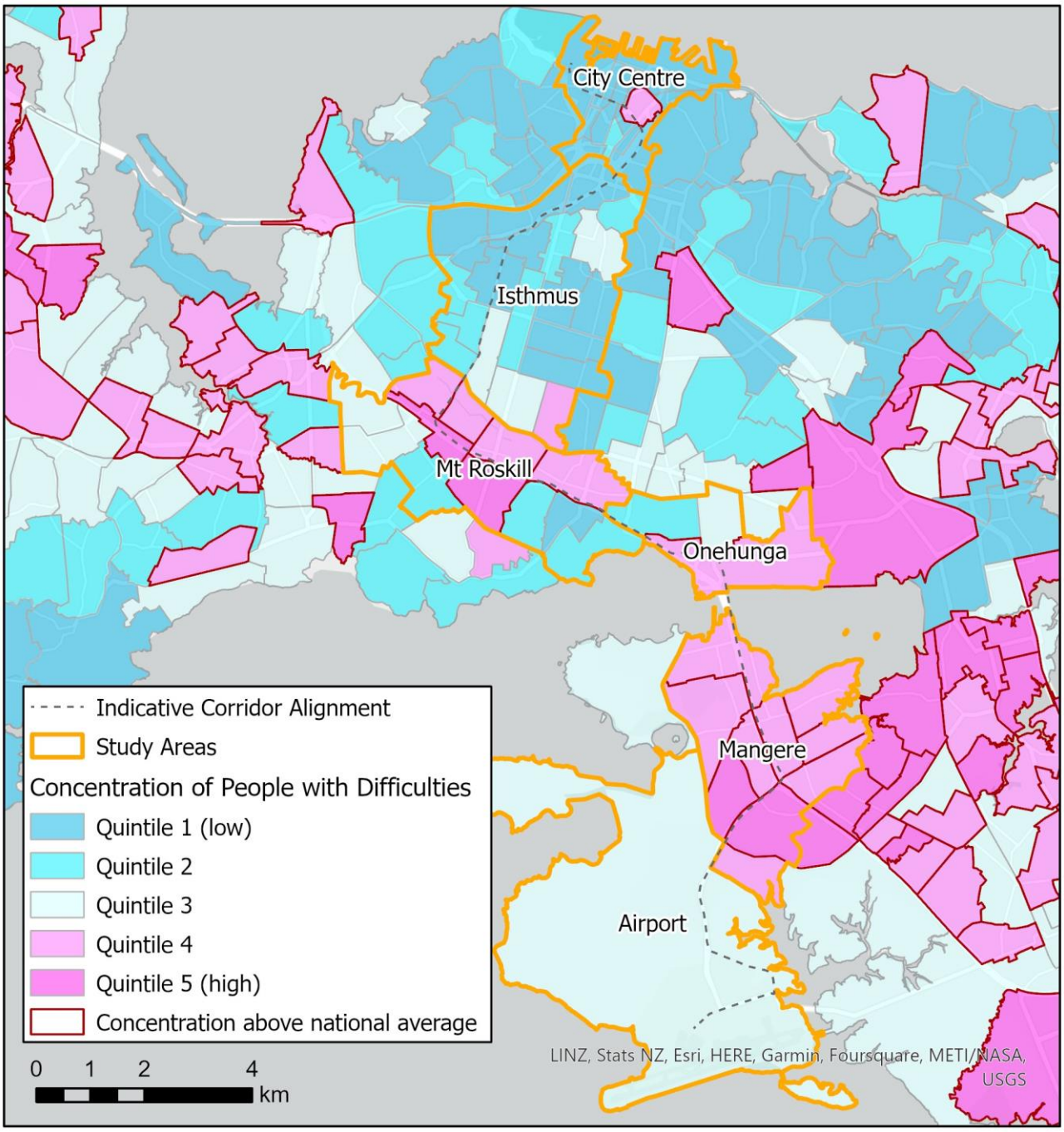


Figure 61 – Concentration of people with difficulties

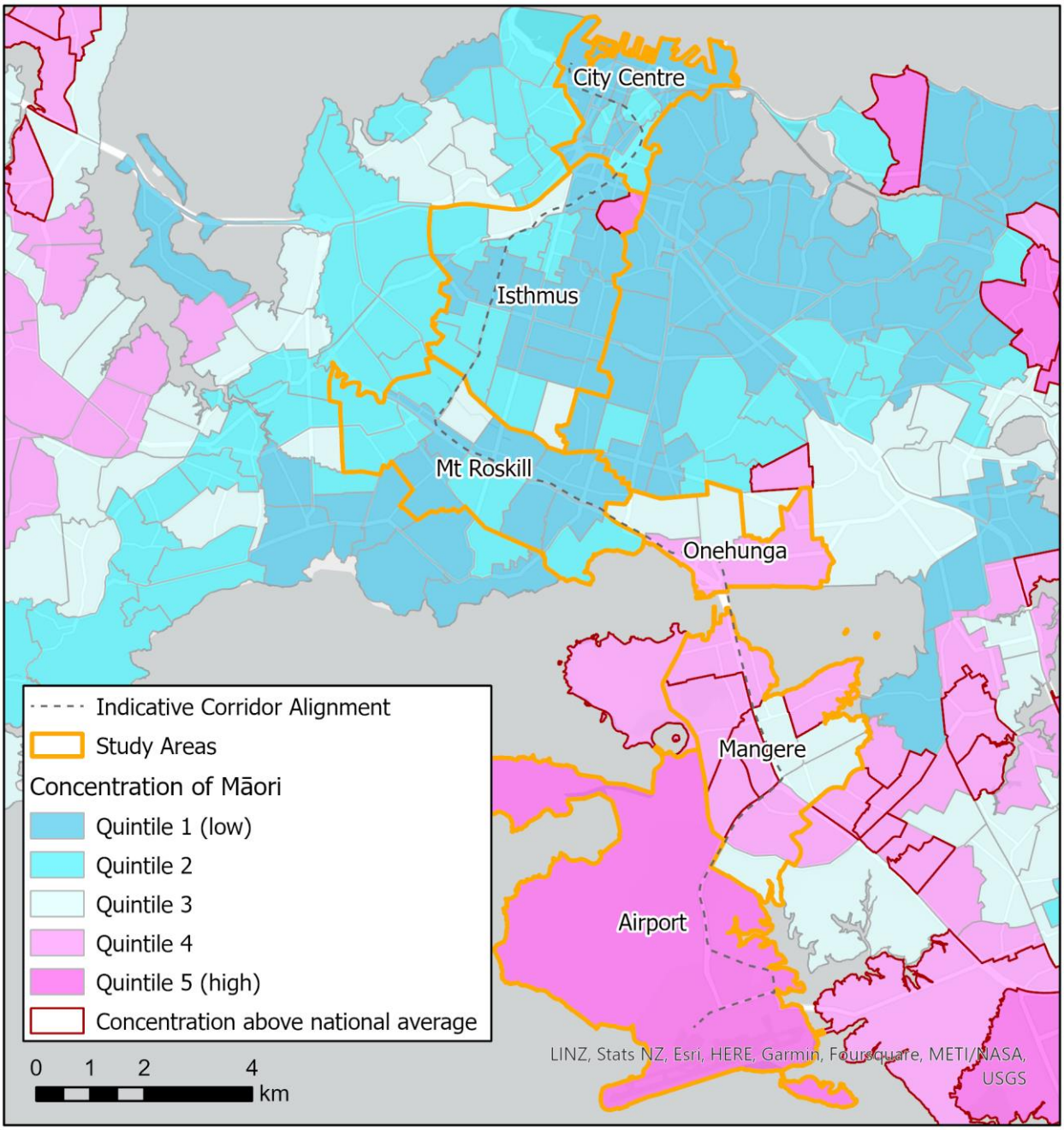


Figure 62 – Concentration of Māori

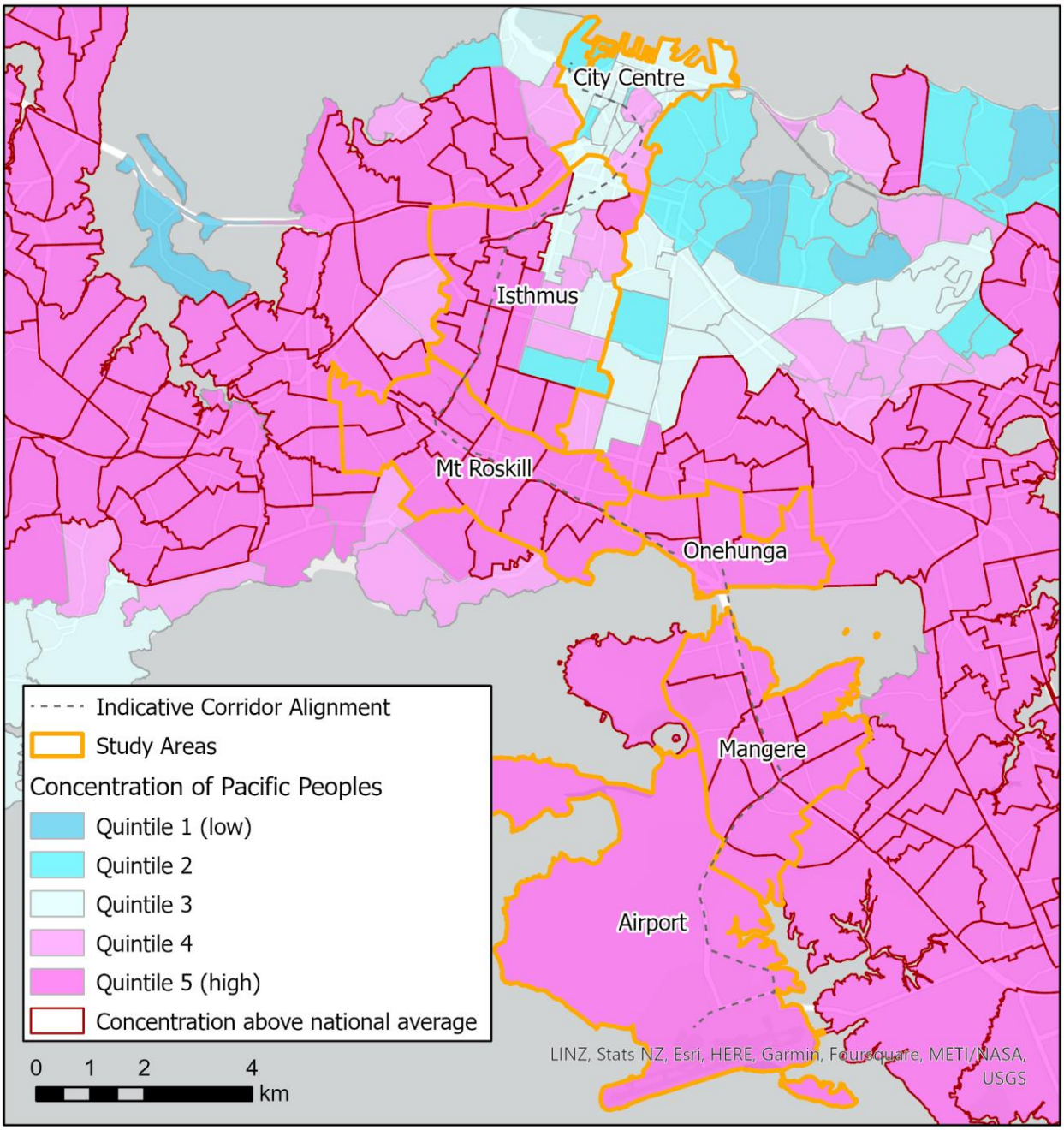


Figure 63 – Concentration of Pacific peoples

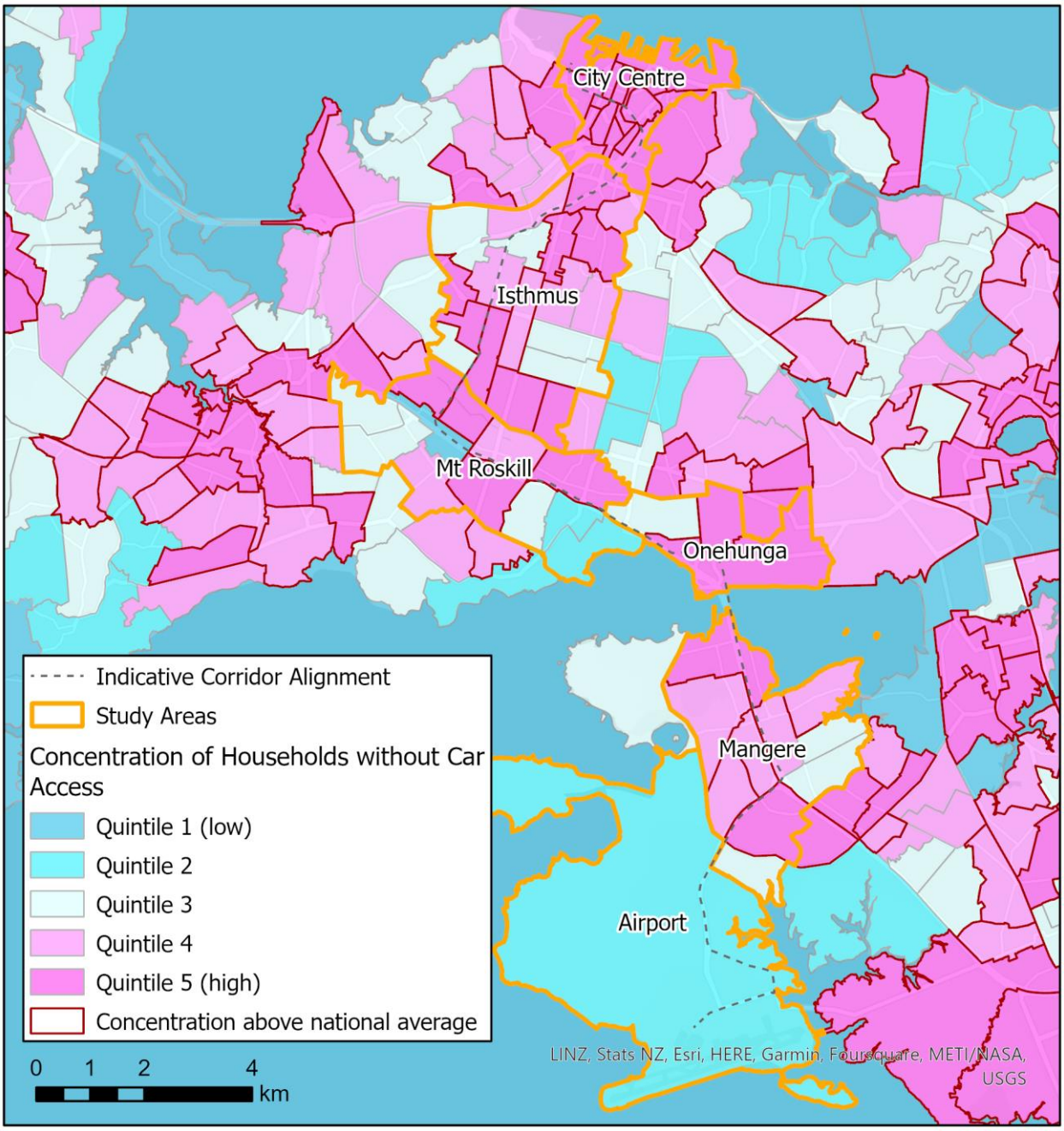


Figure 64 – Concentration of households without car access

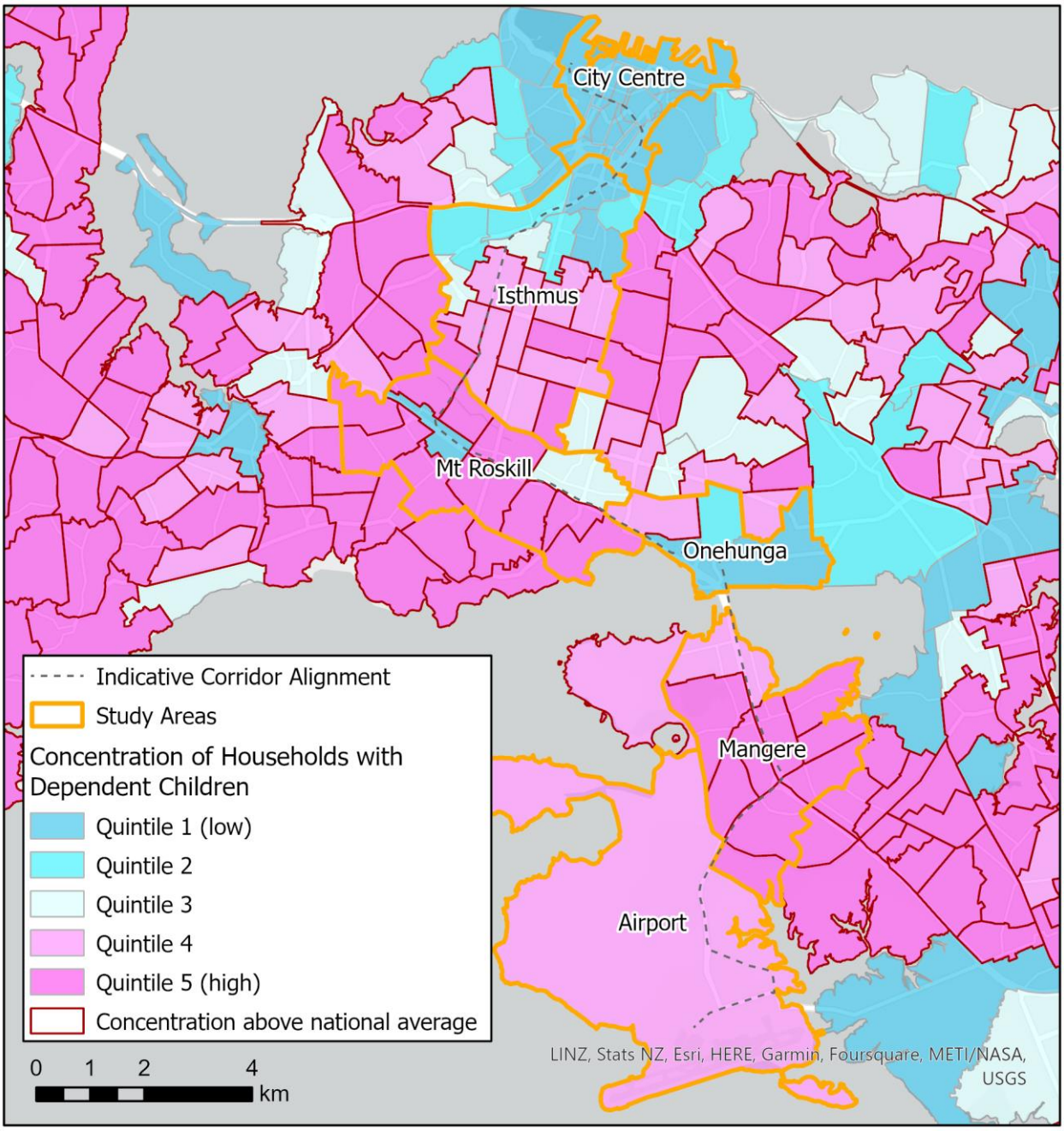


Figure 65 – Concentration of household with dependent children (carers)

To supplement the more general socio demographic profile discussed above, we conduct an additional examination using spatial analysis to further identify specific target populations. This analysis aims to compare the baseline demographic distributions within the impact area to country-wide averages at the SA2 level. The goal is to further identify communities of concern by focusing on the differences (delta) between these two thresholds. Results are presented below for the following demographic categories: income, age, ethnicity, vehicle ownership, people with difficulties, single parents with children, gender, and people on support payment.

Income

Median personal income of the study area is $4000 higher than the national median. It is very close to the Auckland regional average ($36,237: Auckland region/ $35,992: Study area).

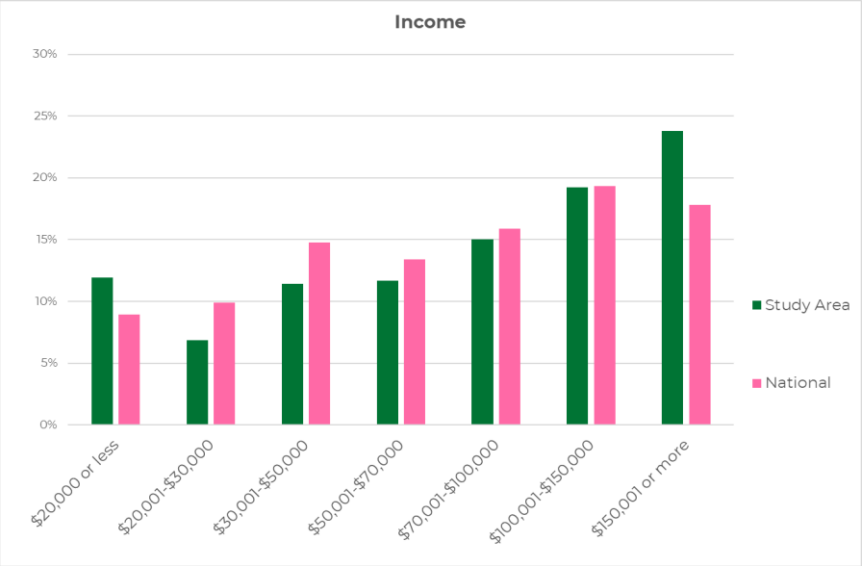


Figure 66 Comparison of personal income (Study area – national average)

Table 110 Personal income comparison

Study area	Auckland region	National
$35,992	$36,237	$31,800

Figure 67 shows the areas below the national household income of $75,500. Along the proposed ALR route, more households earning below the national average income can be seen in:

- City centre
- Wesley
- Puketāpapa
- Hayr Road
- Māngere town centre stations.

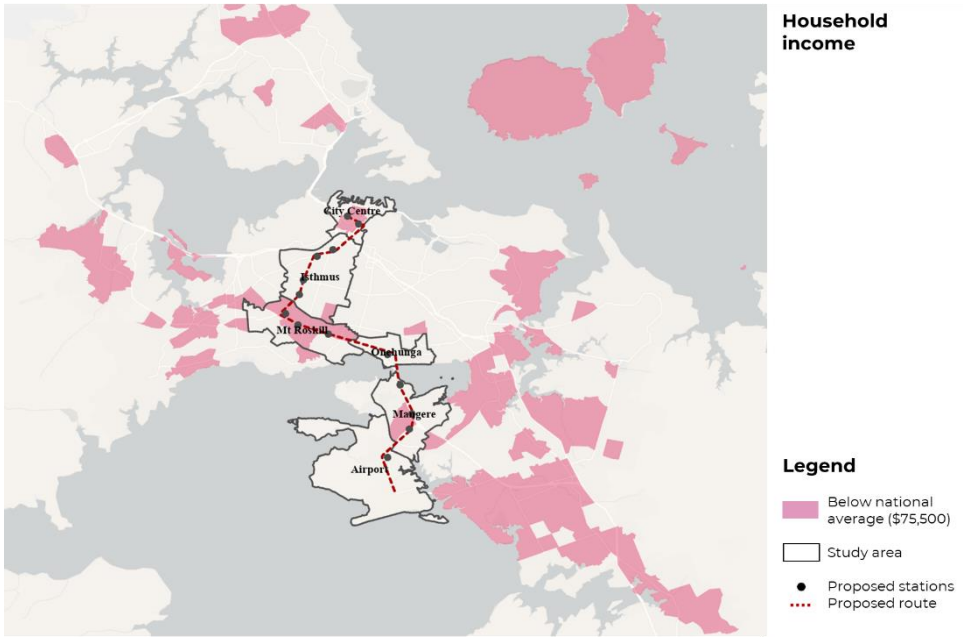


Figure 67 Household income by areas

Age

In comparison to the national average, there are fewer children and elderly people in the study area. By comparison, there are more people aged between 17 and 69 than the rest of New Zealand.

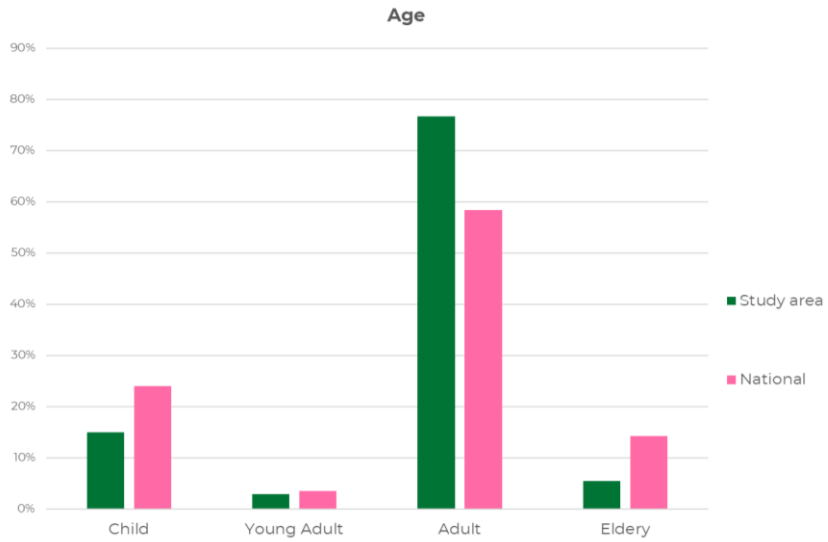


Figure 68 Comparison of age composition (Study area – national average)

As the previous figure shows, along the proposed route, the concentration of children, young adults, and elderly people can be found in:

- Wesley
- Puketāpapa
- Hayr Road
- Te Ararata
- Māngere town centre stations.

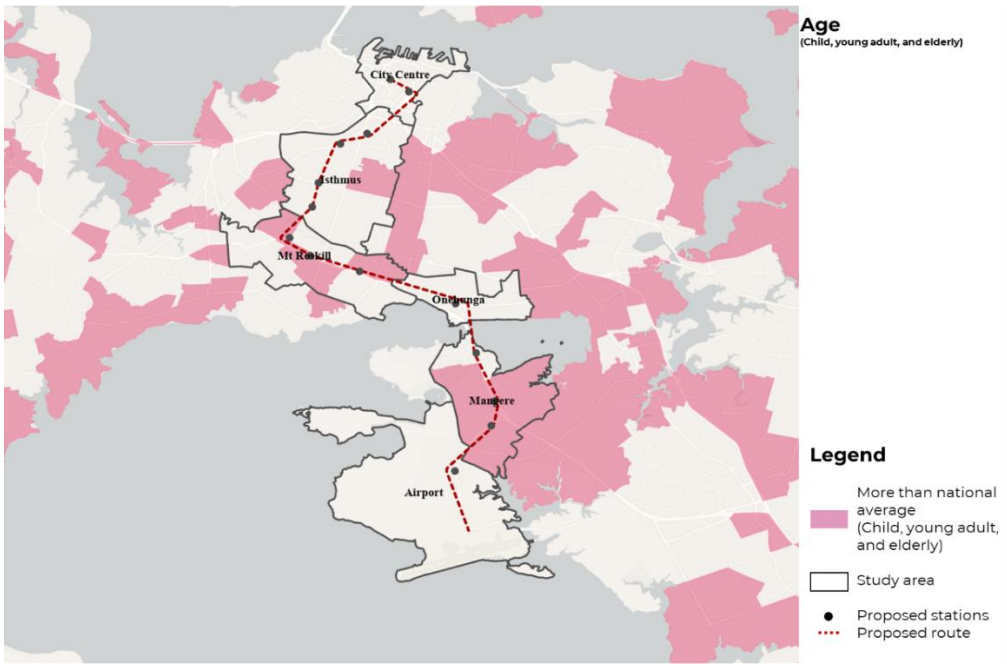


Figure 69 Age composition by areas

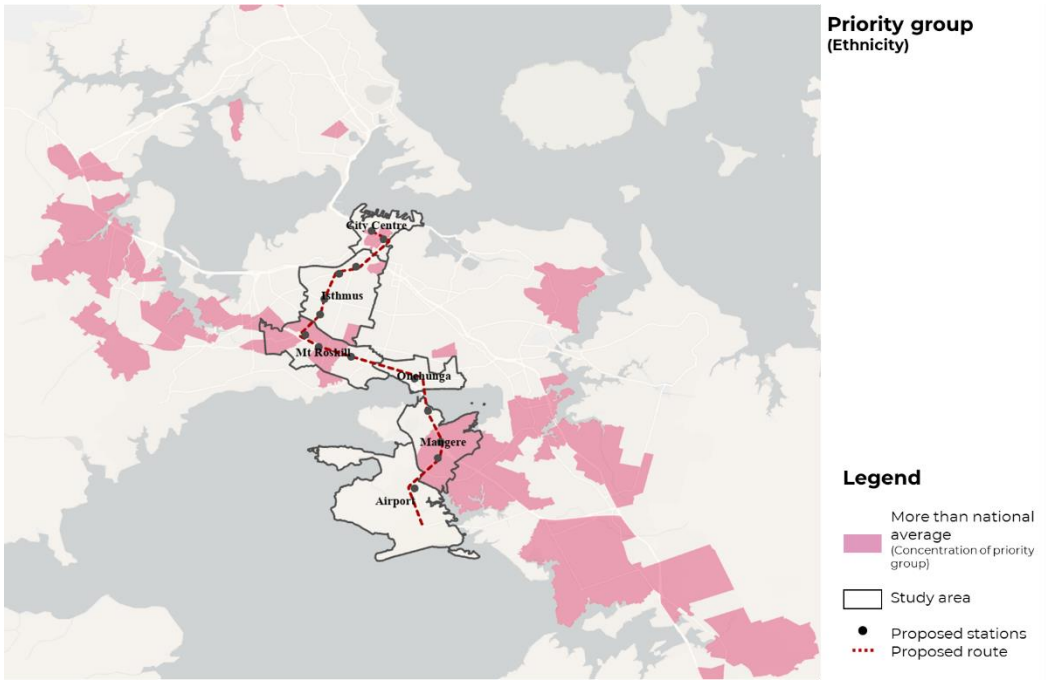
Ethnicity

As shown in the figure below, the study area has more diverse communities. There are fewer people with European descendant and Māori background than the average in the study area. By contrast, there are more Pacific peoples, Asian, and MELAA people than the average.

Figure 70 Comparison of ethnic demographics (Study area – national average)

Along the ALR route, the areas where there is the concentration of the priority group (ethnicity) includes:

- Te Waihorotiu
- Wesley
- Puketāpapa
- Te Ararata
- Māngere town centre stations.



Vehicle ownership

Vehicle ownership is lower than the national average in the study area. 19% of the household within the study area do not own a vehicle. Fewer household own more than two vehicles compared to the national average.

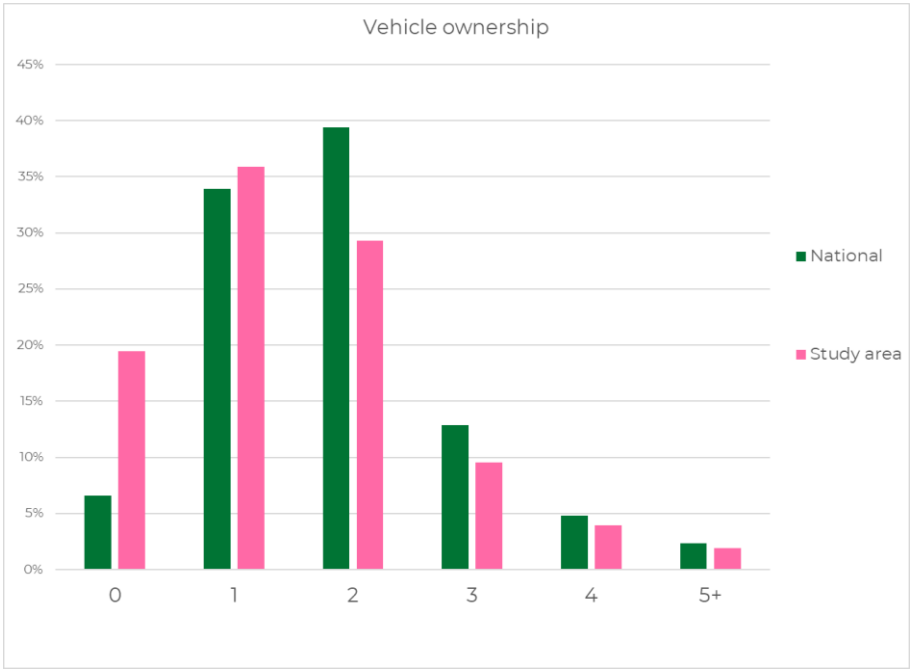


Figure 71 Comparison of car ownership (Study area – national average)

Along the proposed ALR route, relatively many stations are located within the areas where many household currently do not have access to vehicles. These include:

- Te Waihorotiu
- Universities
- Dominion junction
- Balmoral St Lukes
- Sandringham South
- Wesley
- Puketāpapa
- Hayr Road
- Onehunga
- Māngere Bridge
- Māngere town centre.

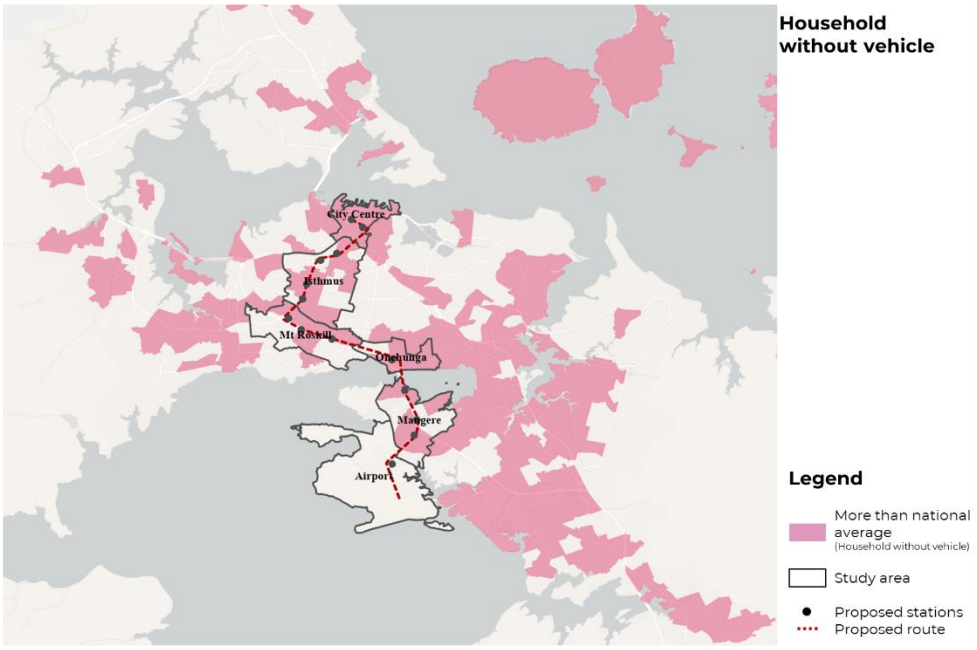


Figure 72 Households without a car by areas

People with difficulties

The following difficulties were considered in the census 2018:

- Remembering or concentrating
- Washing all over or dressing
- Communicating using your usual language
- Visual
- Hearing
- Walking.

As the below figure shows, within the study area the proportion of people with difficulties are very similar to the national average with 62% people indicating people do not have difficulties.

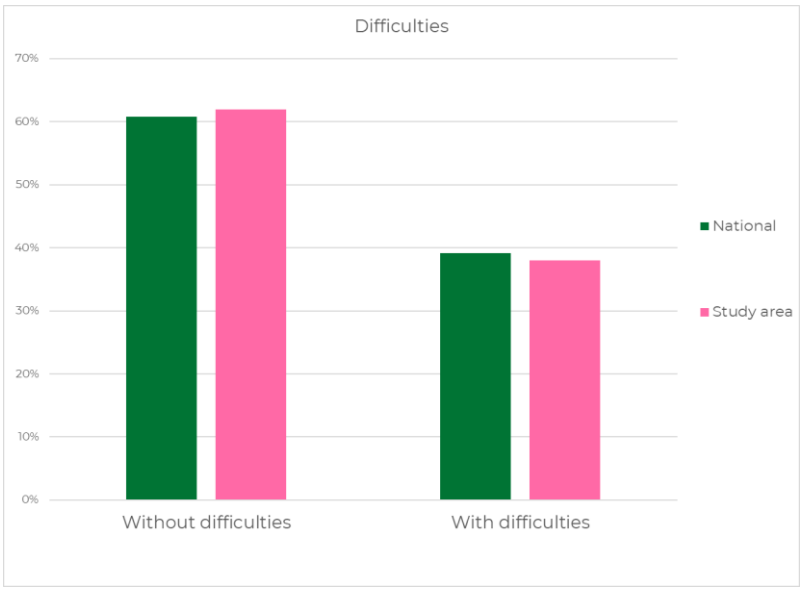


Figure 73 Comparison proportion of people with difficulties (Study area – national average)

Along the proposed ALR route, the concentration of people with difficulties is seen:

- Wesley
- Puketāpapa
- Hayr Road
- Onehunga
- Māngere bridge
- Te ararata
- Māngere town centre
- Landing drive stations.

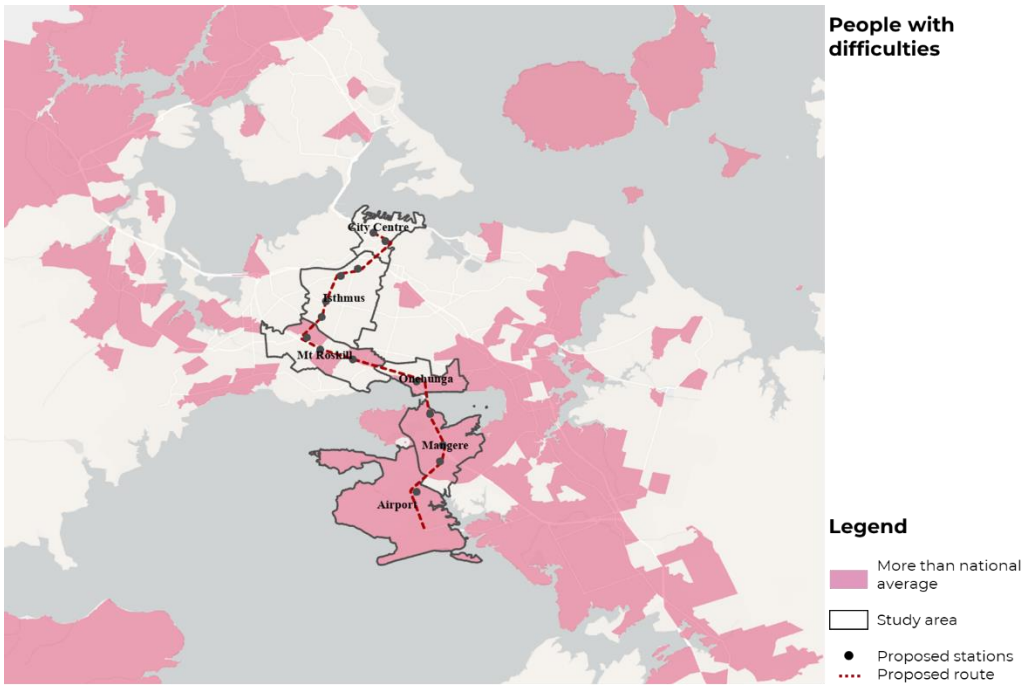


Figure 74 People with difficulties by areas

Gender

As shown in the below figure, there are fewer female in the study area than the national average.

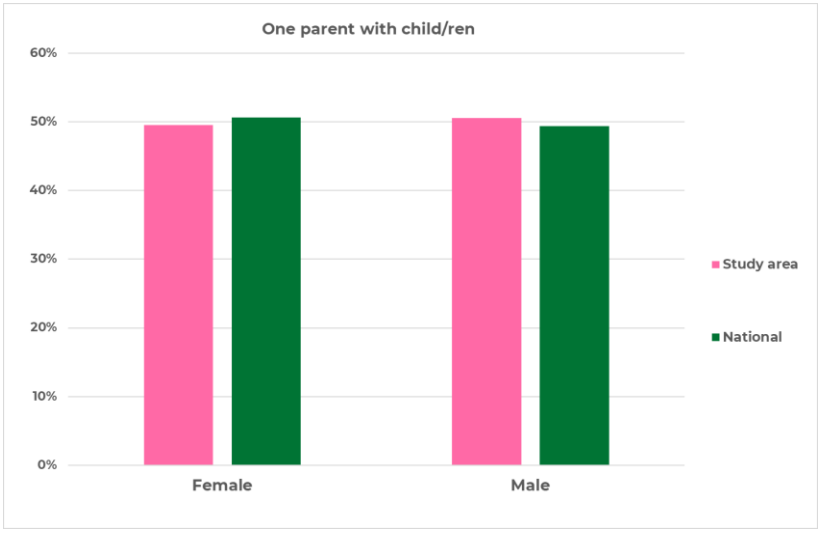


Figure 75 Comparison of females (Study area – national average)

Along the proposed ALR route, the concentration of gender priority group is seen in :

- Balmoral St Lukes
- Sandringham South
- Hayr Road
- Onehunga
- Māngere bridge
- Te ararata
- Māngere town centre stations.

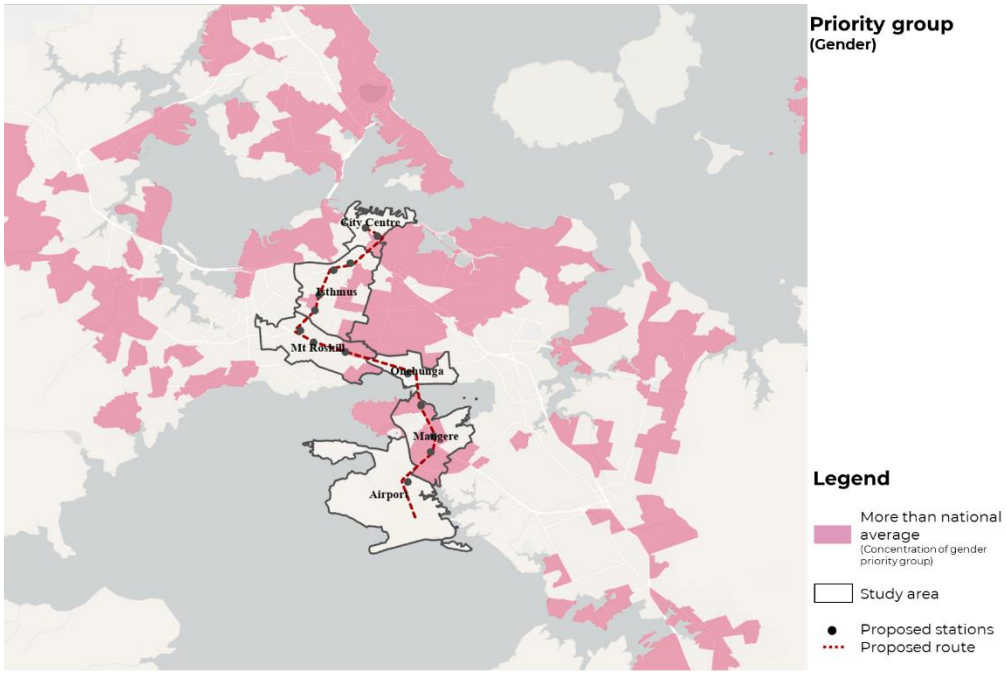


Figure 76 Gender by areas

People on support payment

There are more people on support payment within the study area than the national average. 20% of people in the study area are on support payment, while 17% of whole New Zealanders are on the support payment.

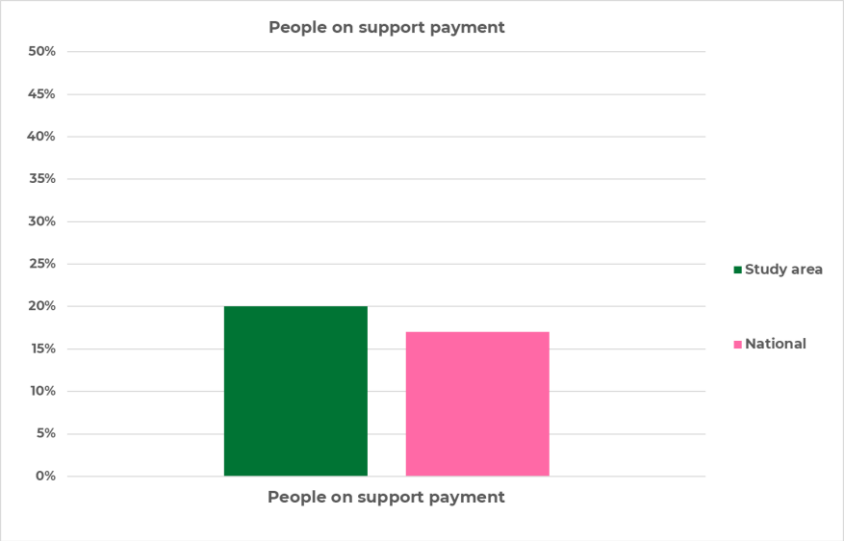


Figure 77 Comparison of people on support payment (Study area – national average)

Along the proposed ALR route, the concentration of gender priority group is seen in:

- Te waihorotiu
- Univerisities
- Balmoral St Lukes
- Sandringham South
- Onehunga
- Te ararata
- Māngere town centre
- Landing drive stations.

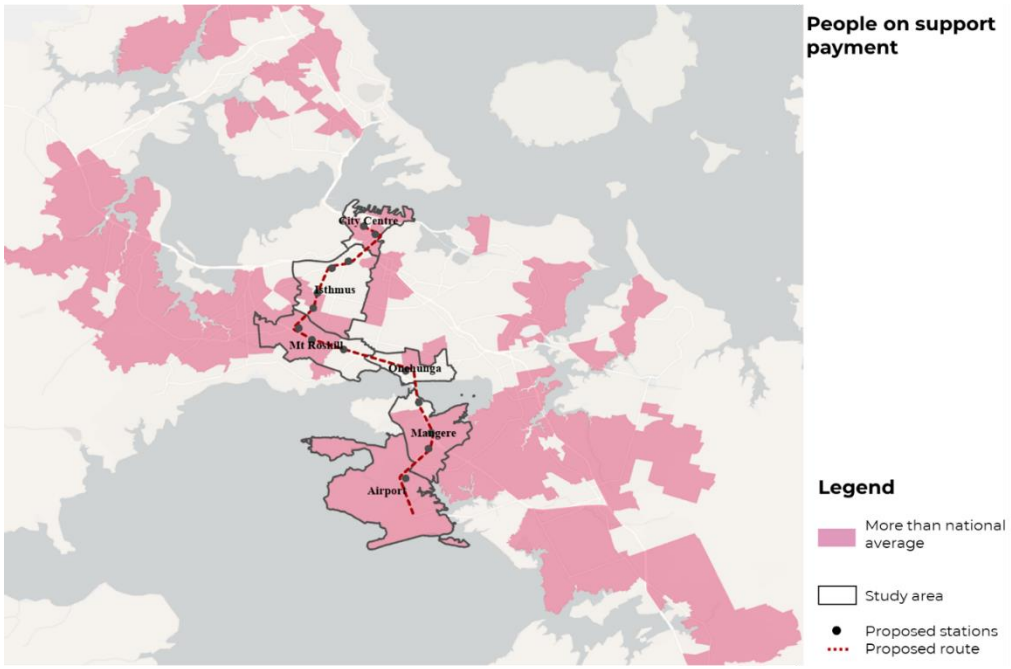


Figure 78 People on support payment by areas

Conclusions

Along the proposed CC2M options, the concentration of communities who face multiple challenges live in:

- Mt Roskill
- Onehunga
- Māngere Bridge
- Māngere town centre.

Comparing the alignments of separated and street-running options, separated option serves closer to the areas where faces the concentration of multiple challenges. This is because more areas located at the west of street-running option experience the challenges. These include Avondale, New Lynn, and Owairaka.

By contrast, people who live the areas near the street-running option are less likely to experience the multiple challenges. These include Epsom, One Tree Hill, and Remuera.