

Emma Rose McCone

Student ID: 58325798

Department of Geography

University of Canterbury

**The importance of the local school environment in
encouraging active school travel**

A thesis

submitted in fulfilment

of the requirements for the degree of

Master of Science in Geography

Acknowledgements

This is in no shape or form an individual piece of work. I would like to acknowledge and thank each and every person who supported, influenced and assisted in any way with my research.

Firstly I would like to thank Haeata Community Campus. The students, principal Andy Kai Fong, and Jono Broom, a lead kaiārahi. Without the support of Andy and Jono, and the student participants who gave my questionnaire a go, I would not have been able to produce this research. I appreciate the willingness of the school community to welcome my research and I.

I'd like to thank my supervisors Dr. Angela Curl, and Professor Simon Kingham, who always trusted in me and gave me assurance when I was overwhelmed. Thank you Angela for giving thorough advice so promptly, even when across the other side of the world. Thank you to Simon for encouraging me to be confident in my ideas and ability.

Thank you to Seye Chan, an incredible mentor and inspiration when I was lost. I would not be here if he had not believed in me. The drive and passion I have for Geography is 100% the product of Mr Chan's incredible teaching and support.

Thank you to my whānau and friends, especially the ones who had no idea what a Masters thesis even was and still supported me. Thank you Rubie, who showed me how a dedicated work ethic can go a long way, and Stefanie, who proved that through adversity we find strength to just get on with it. Thanks Mum and Dad for sacrificing a lot to help me come to University. It is no cheap feat and I still owe you.

Thank you Hayden. Your unconditional love and support has given me confidence and optimism that at times was extremely hard to find.

Ngā mihi nui, arohanui.

Table of Contents

CHAPTER 1: INTRODUCTION.....	9
1.1 TRANSPORT PATTERNS AND BEHAVIOUR.....	11
1.2 URBAN PLANNING AND TRANSPORT	14
1.3 RATIONALE OF THESIS	15
1.4 HAEATA COMMUNITY CAMPUS.....	18
1.5 AIMS AND OBJECTIVES	21
1.6 OUTLINE OF THESIS	22
CHAPTER 2: LITERATURE REVIEW.....	24
2.1 PATTERNS OF SCHOOL TRANSPORT BEHAVIOUR	25
2.1.1 <i>Determinants of school travel mode choice</i>	25
2.1.2 <i>Temporal transport trends</i>	27
2.1.3 <i>Measuring school transport patterns</i>	29
2.2 YOUTH AND THE URBAN ENVIRONMENT.....	33
2.2.1 <i>Youth occupation of urban space</i>	33
2.2.2 <i>Recognition of youth in civic engagement</i>	35
2.3 POLICY AND INSTITUTIONAL FRAMEWORK.....	38
2.3.1 <i>National Transport Policy</i>	38
2.3.2 <i>Local Transport Policy</i>	40
2.3.3 <i>Education Policy</i>	41
2.4 SUMMARY	43
CHAPTER 3: METHODOLOGY.....	44
3.1 GEOSPATIAL ANALYSIS.....	47
3.1.1 <i>Rationale</i>	47
3.1.2 <i>Methodological approach</i>	48
3.2 TRANSPORT QUESTIONNAIRE.....	52
3.2.1 <i>Rationale</i>	52
3.2.2 <i>Methodological approach</i>	53
3.3 LOGISTIC REGRESSION MODEL OF ACTIVE SCHOOL TRAVEL DETERMINANTS	56
3.3.1 <i>Rationale</i>	56
3.3.2 <i>Methodological approach</i>	57
CHAPTER 4: RESULTS	60

4.1	GEOSPATIAL CONTEXT OF LOCAL ENVIRONMENT	61
4.1.1	<i>Concentration of students at pre-existing schools</i>	61
4.1.2	<i>Concentration of Haeata Community Campus students</i>	66
4.1.3	<i>Summary</i>	70
4.2	SCHOOL TRAVEL PATTERNS OF HAEATA COMMUNITY CAMPUS.....	72
4.2.1	<i>Demographic of participants</i>	73
4.2.2	<i>School transport patterns</i>	74
4.2.3	<i>Summary</i>	80
4.3	ASSESSMENT OF ENVIRONMENTAL DETERMINANTS OF SCHOOL TRAVEL PATTERNS	82
4.3.1	<i>Logistic regression models</i>	83
4.3.2	<i>Preferred mode</i>	85
4.3.3	<i>Local urban environment</i>	87
4.3.4	<i>Summary</i>	91
CHAPTER 5: DISCUSSION		92
5.1	ENABLERS AND BARRIERS TO ACTIVE SCHOOL TRAVEL AT HAEATA COMMUNITY CAMPUS..	93
5.2	THE IMPORTANCE OF UNDERSTANDING LOCAL CONTEXT	97
5.3	POTENTIAL RESPONSES TO ENCOURAGE ACTIVE SCHOOL TRAVEL.....	104
5.3.1	<i>Encouraging behaviour change</i>	104
5.3.2	<i>Land use planning</i>	109
5.3.3	<i>Built environment/infrastructure improvements</i>	111
5.4	OPPORTUNITY FOR FURTHER STUDY.....	114
5.4.1	<i>Strengths and limitations</i>	114
5.4.2	<i>Further research</i>	117
CHAPTER 6: CONCLUSION.....		119

Table of Figures

Figure 1: Map of Aranui showing the location of four pre-existing Aranui schools, which closed and were amalgamated into Haeata Community Campus.....	49
Figure 2: Images of local streets and roads used in Maptionnaire survey to understand participant’s perceptions of the local environment.....	58
Figure 3: Heat map showing the concentration of Wainoni School students’ residence in March 2016, n=80	63
Figure 4: Heat map showing concentration of Avondale School students’ residence in March 2016, n=218	64
Figure 5: Heat map showing concentration of Aranui Primary School students’ residence in March 2016, n=348.....	65
Figure 6: Heat map showing concentration of Aranui High School students’ residence in March 2016, n=401	66
Figure 7: Heat map showing concentration of Haeata Community Campus students’ residence in March 2018, n=749.....	67
Figure 8: Public transport routes accessible to Haeata Community Campus students overlaid on a heat map of concentrations of students' residence.	68
Figure 9: Christchurch cycle routes by type, overlaid on heat map of Haeata Community Campus concentration of students' residence.	70
Figure 10: Usual travel mode to and from school by frequency of use.....	75
Figure 11: Most recent travel mode used getting to school. Response to Maptionnaire survey question: Thinking about the last time you came to school, how did you get to school? n=74.	77

Figure 12: Heat map of the concentration of students' residence from Maptionnaire survey respondents, n=45. Smaller insert represents concentration of Haeata Community Campus (March 2018) population for comparison.78

Figure 13: Students response by transport mode for whether they would make any changes to their transport patterns n=7286

Figure 14: Map showing areas near Aranui identified as positive by Maptionnaire survey respondents, n=3187

Figure 15: Map showing areas near Aranui identified as negative by Maptionnaire survey respondents, n=1388

Figure 16: Theme of places identified by students as liked or disliked in Maptionnaire Survey89

Figure 17: Rating of safety for four local streets near Haeata Community Campus, from the Maptionnaire survey question: How safe do you feel walking or hanging out in these streets, where 1= very unsafe, and 10 = very safe91

Abstract

School travel is a major aspect of a young person's everyday activity. The relationship between the built environment that youth experience on their way to and from school, influences a number of factors including their development, health and wellbeing. This is especially important in low income areas where the built environment is often poorer, but the need for it to be high quality and accessible is greater.

This study focusses on the community of Aranui, a relatively low income suburb in Christchurch, New Zealand. It pays particular attention to Haeata Community Campus, a state school of just under 800 pupils from year one through to year thirteen (ages 5-18). The campus opened in 2017 following the closure of four local schools (three primary and one secondary), as part of the New Zealand Government's Education Renewal scheme following the Christchurch earthquakes of 2010/11. Dedicated effort toward understanding the local built environment, and subsequent travel patterns has been argued to be insufficiently considered.

The key focus of this research was to understand the importance of the local environment in encouraging active school travel. The present study combines geospatial analysis, quantitative survey software Maptionnaire, and statistical models to explore the features of the local environment that influence school travel behaviour.

Key findings suggest that distance to school and parental control are the most significant predictors of active transport in the study sample. Almost 75% of students live within two kilometres of the school, yet less than 40% utilise active transport. Parental control may be the key contributing factor to the disproportionate private vehicle use. However, active school travel is acknowledged as a complex process that is the product of many individual, household, and local environment factors.

To see increased active transport uptake, the local environment needs to be of greater quality. Meaning that the built environment should be improved to be youth friendly, with greater walkability and safe, accessible cycling infrastructure.

Abbreviations

GIS – Geographic Information Systems

CCC – Christchurch City Council

NZTA – New Zealand Transport Agency

URBAN – Understanding the Relationship between Activity and Neighbourhoods

KITC – Kids in the City

BEATS – Built Environment and Active Transport to School

ACTIS – Aranui Community Trust Incorporated Society

Chapter 1: Introduction

This chapter introduces the study, beginning with relevant background information of transport patterns and behaviour, and youth's interaction with the urban environment. The first section of the chapter outlines the problem which this study aims to provide some solutions to, being decreasing rates of active travel in youth. The cause of this problem is widely argued, with a number of studies attempting to identify the key enabler or barrier to active travel. This study argues for the importance of the local environment, both in its influence on school travel behaviour, and the way that specific local context should drive planning and policy responses.

The second section discusses youth and their engagement with the urban environment, stating the influence that exclusion of young people in urban decision making has on their mobility and activity. Thirdly, the rationale of the study is discussed, outlining the background to the study, and highlighting the research gap and contribution this study will make, which leads into the fourth section; a detailed description of Haeata Community Campus. The school community is described, as well as exploring some of the relevant background context to how the school came to replace four community schools after the Canterbury earthquakes. Lastly, the aim and objectives, followed by an outline of the entire thesis is provided.

As stated, this chapter of this thesis outlines the current problem faced with school travel behaviour. Namely, the increasing dependence on vehicle travel and its impact on young people, which is becoming a significant transport and public health problem. A secondary challenge to this is the lack of value given to young people and their perspectives of how their local environment should be and feel. Youth are, by and large, excluded from discussions

regarding the current state, and future of their neighbourhoods, despite being active inhabitants of them.

1.1 Transport Patterns and Behaviour

Since the introduction of motor vehicles, private vehicle use has fast become the most convenient and accessible mode of transport for many (Fishman, Böcker, & Helbich, 2015). Modern transport trends have become dominated by private vehicle use which has a range of impacts on society, households, and individuals (Litman, 2003). According to the most recent New Zealand census, with results available, over 70% of adults drove to work on census day, while only 10% walked or cycled (Statistics New Zealand, 2015), indicating high car dependence in New Zealand. This trend is similar across other developed countries, such as Australia and the UK (Cooper & Corcoran, 2018; Department for Transport, 2016). The high levels of car dependence and sedentary office working style that most people engage with has led to decreased physical activity in adults across the developed world, and subsequently poorer physical health (Hobbs, 2008). The prevalence of obesity in New Zealand has mirrored the trends of car dependence, increasing to be one of the highest of the developed world (Ministry of Health, 2018).

Active transport (usually encompassing cycling and walking as modes of transport) has a strong positive relationship with physical and mental health outcomes. People who walk or cycle to work are more likely to meet healthy physical activity guidelines than those who do not (Brown, Moodle, Coblac, Mantilla, & Carter, 2017; Fishman et al., 2015). Adults are recommended to engage in two and half hours of moderate physical activity weekly (Ministry of Health, 2017a). Young people should aim to spend an hour per day in moderate to vigorous physical activity (Ministry of Health, 2017c). When walking or cycling to work or school, a large portion of, if not all of the recommended healthy physical activity can be met without any other activities or sport (Fishman et al., 2015). Many argue for encouraging people to use active transport as a highly effective way to promote physical health (Brown et al., 2017; Stone

& Faulkner, 2014). While not commonly included in the definition of active transport, public transport is also known to be more beneficial in terms of physical activity due to the walking between stops required (Easton & Ferrari, 2015). Recognition of the physical health benefits of certain travel modes is important to consider for policy planners and urban designers, who have the potential to make positive impact on physical health outcomes.

Additional to the individual benefits of active transport, many wider impacts are acknowledged, such as reduced noise pollution, climate change mitigation, urban vitality, and reduced congestion in urban centres (New Zealand Institute of Economic Research, 2017). Active transport is more environmentally sustainable, especially compared to cars. Increased walking and cycling means less air pollution in cities, with an overall significantly smaller carbon footprint than motor vehicles (Ministry for the Environment, 2018). Therefore, it is desirable from both an individual and societal level to encourage active and public transport modes.

Similar to overall population trends, recent data shows that active transport to and from school in young people is also declining in the developed world, as car-centric lifestyles become more common (Bhosale, Duncan, & Schofield, 2017; Builing, Mitra, & Faulkner, 2009; McDonald, 2007). Local data from the most recent New Zealand Household Travel survey found young people between age 5 and 15 spent 70 per cent of their travel time as a private vehicle passenger (Ministry of Transport, 2019). In the URBAN study, 83% of the 213 recorded school trips in Christchurch were taken by private vehicle (Oliver et al., 2014). Given the adverse effects of physical inactivity, the lack of active travel is of particular concern for the public health sector, where one in eight children are already obese, a 4 per cent increase from 2006/7 to 2016/17 (Ministry of Health, 2017b). By utilising active school travel, students lessen their chances of

falling short of physical activity guidelines, and developing harmful health patterns (Carver, Timperio, Hesketh, & Crawford, 2010).

Active travel as a part of independent mobility is also important for young people developing essential social, cognitive and psychological skills (Ikeda, Hinckson, Witten, & Smith, 2018). Independent mobility gives young people confidence navigating their local neighbourhood, increases their connection to the natural and built environment, and encourages active travel as an adult (Fyhri, Hjorthol, Mackett, Fotel, & Kyttä, 2011). Children who are predominantly driven as their main mode of travel experience several negative implications such as decreased social opportunity, lose the opportunity to gain road-based skills and independence from their parents, and may grow up with minimal experience outside of private vehicle use (Mackett, 2002).

The adverse impacts of a car dominated society are becoming increasingly realised (Curtis, Babb, & Olaru, 2015). The impacts on physical and mental health, the environment and the ability to gain independence, especially for young people should not be overlooked when planners and policy advisors are making decisions regarding the way the transport network is designed (Veitch et al., 2017). In recognising the potential adverse impacts of sedentary lifestyles and low active travel, transport policy has become increasingly linked to urban planning and built environment design, with significant literature contributions attempting to determine aspects of the urban landscape that promote active travel (Bringolf-Isler et al., 2010; Buck et al., 2011; Curtis et al., 2015; Ikeda, Stewart, et al., 2018; Mandic, Williams, et al., 2016; Oliver et al., 2015). The following section highlights the influence of urban planning and the built environment on mobility and transport behaviour.

1.2 Urban Planning and Transport

The relationship between urban design and transport patterns, including mode choice, is well recognised (Tolley, 2003). Streets and urban areas can be intentionally designed to prioritise, encourage, or discourage any transport form, particularly when transport policy is integrated with urban planning policy (Suzuki, Cervero, & Iuchi, 2013). As discussed previously, transport trends show the dominance of private vehicle use, which many agree is an outcome of the common prioritisation of street space for cars in modern urban planning. A shift to value other modes of transport and urban space for uses other than the car is now being recognised (Curtis et al., 2015).

A range of studies have explored the relationship between urban design and transport mode choice and behaviour. A vast range of features of the urban environment have been suggested to be determinants of increased walking and cycling in cities, including; walkable infrastructure such as the provision of well-maintained and spacious footpaths; cycling infrastructure such as safe, separated cycleways; high number of pedestrian crossings; mixed land use; high residential density; street connectivity; traffic calming measures; and, proximity to green space and recreational facilities. Features that enable active school travel among young people are similar, yet some differing features unique to the experience of youth may also impact their behaviour. It is essential to acknowledge the way that different motivators exist for young people's choices and the urban environment is experienced in a vastly different way (Bridgman, 2004a). The design of space is a reflection of the community values and it is important that the reflection young people inhabit does not reject their unique experience and values (Masiulonis, 2017).

Safety of the built environment is often expected to have a strong correlation with active travel (Buliung & Mitra, 2015). People and particularly youth are less likely to walk or cycle if they feel unsafe (Ikeda, Stewart, et al., 2018). In the case of young people particularly, their parents' perceptions of safety is a major aspect. A parents concern regarding perceived risk of injury or harm from vehicles as well as stranger danger has a positive relationship with children's active travel and general independent mobility (Fyhri et al., 2011). While parents' concerns may be genuine, restriction of independent mobility has significant adverse implications. It can not only prohibit active school travel, but can also be associated with a lack of social, cognitive and wayfinding skills (Jones, Steinbach, Roberts, Goodman, & Green, 2012). It is evident there is a positive relationship between the urban environment and safety, where intentional design of inclusive, integrated, mixed use space has been shown to create safer communities (Naik, 2017).

1.3 Rationale of Thesis

From the background information discussed in Section 1.1 and 1.2, the challenge of promoting active travel in a car dominated society is evident. The complex nature of transport behaviour and its relationship with the urban environment shows the need for investigating the local environment in this study.

This study specifically aims to make significant contributions to the understanding of school travel behaviour by focussing on context specific aspects of the local environment. There is significant value in encouraging local context driven, evidence based policy and planning decisions. A number of strategic planning decisions could have given greater consideration to the local environment and community in this instance.

The present study uncovers some unique experiences of students in Christchurch, using one school, Haeata Community Campus, as the case study. A significant proportion of previous New Zealand studies of young people's mobility patterns and behaviour have been done in Auckland (Carroll, Witten, Kearns, & Donovan, 2015; Hinckson, 2016; Hinckson, Garrett, & Duncan, 2011; Oliver et al., 2015). Additionally, the BEATS study focussed on Dunedin students (Mandic, Williams, et al., 2016) and URBAN included a mix of Wellington, Auckland and Christchurch young people (Oliver et al., 2014). This will be the first comprehensive school travel study in Christchurch with a specific focus on the local context of the city. A key argument for the significance of this study is its highly context-specific objectives, arguing for more understanding of specific local communities, paired with strong empirical evidence for transport and education decision making. Some studies have acknowledged a contributing factor in transport mode choice can be based on the geographical context, such as topography and climate (Oliver et al., 2014; Pearce, Witten, Hiscock, & Blakely, 2007). These factors vary across countries and cities within them and particularly within New Zealand. For example, the extremely flat terrain of Christchurch compared to the steep coastal topography of Wellington makes it a significantly more cycle-friendly city. This only emphasises the need for this specific study, focussing on a community not previously engaged with.

The research adds to an existing limited set of literature on school transport patterns in New Zealand. Within this set of literature, there has not been any similar to this project, which focusses on unique aspects of the local environment. The focus is on a school community situated within one of New Zealand's most deprived suburbs, ranking in the highest measure of deprivation by New Zealand's index. Haeata Community Campus is unique in many ways: it is a brand new, independent learning-driven school; it amalgamates four schools that existed before the Canterbury Earthquakes; and the school population is over 50% Māori ethnicity,

which is uncommon in Christchurch and the South Island. Minority groups (including indigenous groups, deprived communities, and children) are frequently under-represented in research, particularly in urban planning and design, and transport studies (Chang, 2018; Hoang, 2013; James, 2013). The present study intentionally strives to understand a community typically excluded from decision-making and encourage positive change by understanding the transport environment. It highlights the importance of local context, as decision making cannot be based on the assumption that all communities have the same lived experience as the dominant majority voice that is emphasised in most engagement and studies.

Engaging with young people in this study is a priority. Research shows that young people are commonly excluded from urban planning decisions, which can adversely affect their experience of urban space (Bridgman, 2004b). Young people experience urban form different to adults in many ways. Masiulianis (2017) points out the way that urban space typically reflects adult ideals, incorporating a strong sense of formal order. This inherent value of adults and rejection of youth ideals in urban design implies spaces are not for young people to enjoy. Therefore, urban design planners need to improve their understanding of young people. Engagement with young people requires dedicated effort and consideration of different ways to involve and inspire young people within urban planning and engagement (Freeman & Tranter, 2011).

This study was influenced by the work done by Mackie Research Ltd. on the Future Streets-Māngere project, completed in 2016. The project was a collaboration also involving a number of New Zealand University and transport sector researchers, as well as community, Māori and Pacific advisors. Future Streets – Te Ara Mua, was a project that used community co-design principles, and urban space and safety improvements to increase the mode share of walking

and cycling in a suburb of Auckland. Safer crossings, improved pedestrian areas, and safety enhancements to a local park were some of the initiatives that were implemented with the community. The research team identified Aranui as a potential area for similar development and began to build relationships with local stakeholders, such as Haeata Community Campus, local researchers, the neighbourhood trust (ACTIS), NZTA, and CCC.

This study aims to encourage better collaboration and co-operation in strategic planning involving schools. There needs to be more recognition of the intrinsic link between school site planning, the local environment and transport.

1.4 Haeata Community Campus

This study explores one particular school as a case study. The school is located within Christchurch, New Zealand, in the suburb of Aranui. Haeata Community Campus is a composite school which educates year one through to year thirteen students. The campus opened in 2017 to bring together four closed community schools (Aranui High School, Aranui Primary School, Avondale School and Wainoni School), as part of the New Zealand Government's investment in greater Christchurch's education network. The Greater Christchurch Education Renewal scheme was a response to the Christchurch earthquakes of 2010 and 2011 (Ministry of Education, 2017). In its opening year (2017), the total roll at Haeata Community Campus was 908 students, and decreased to 744 in 2018 (Education Counts, 2018). The school is currently ranked at decile 1. New Zealand schools are ranked in the decile system (from 1 to 10) to allocate funding and resources that reduce barriers to learning faced by students from lower socio-economic communities. Decile 1 indicates the 10% of schools with the highest proportion of students from low socio-economic communities. Decile 10 includes the 10% of schools with the least proportion of these students (Ministry of Education, 2018).

The circumstances in which Haeata Community Campus and the four closed schools have come together are extremely unique. The impacts of the Canterbury Earthquake sequence in 2010 and 2011 damaged urban infrastructure extensively, with the effects on schools and the education system extending beyond the initial closures of September 2010 and February 2011 (Potter, Becker, Johnston, & Rossiter, 2015). Around 3,250 school students left the Greater Christchurch area to re-enrol elsewhere after the February 2011 earthquake (Newell, Beaven, & Johnston, 2012). Impacts of the school closures in Canterbury are discussed by Mutch (2017) who argues that the permanent closure of schools has a significant impact on community cohesion. The paper also discusses the unique role schools and teachers played in the immediate response, calming and caring for students, as well as fostering community resilience, in the aftermath of the February 2011 earthquake, which occurred during school hours.

The suburb in which Haeata Community Campus is located (Aranui) is a highly deprived area of Christchurch and New Zealand. Eastern areas of Christchurch tend to be home to lower socio-economic households. Compared to other areas in Christchurch, Aranui also has a higher proportion of Māori and Pasifika ethnicity, two minority groups in New Zealand shown to be over-represented in a number of different life outcome statistics (physical health, mental health, crime, life expectancy, income, and education) (Department of Corrections, 2008; Ministry of Education, 2013; Ministry of Health, 2016; Raerino, Macmillan, & Jones, 2013; Statistics New Zealand, 2013a). Since the signing of the Treaty of Waitangi in 1840, New Zealand is considered a bicultural nation, of Māori (the indigenous culture), and other non-indigenous cultures. Tensions exist within New Zealand regarding its identity as a bicultural nation, particularly how it plays out policy (Sibley & Liu, 2004). Contest and struggle between tāngata whenua (indigenous people and guardians of the land) and tauwiwi (people who came to New

Zealand after Māori) have existed from historic colonisation practices (Sibley & Liu, 2004). However, community development needs to view the Treaty of Waitangi as a living document, incorporating the principles agreed upon into modern daily practice (Munford & Walsh-Tapiata, 2006). Acknowledging biculturalism, Māori values and principles in future interventions is essential to meaningful outcomes in the Aranui community.

Haeata Community Campus follows a unique curriculum embedded with cultural significance. The school values are stated as “alofa (compassion, commitment and love ignite action) success, manaakitanga (every learner having a sense of belonging), service, and hanga whare (building the foundation for ALL learners to leave our school MORE curious than when they arrived)” (Haeata Community Campus, 2016). *Ākonga*, meaning students in Te Reo Māori, is the core focus, and encompasses the high standard of biculturalism and recognition of Māori culture within the school environment. The learning programme is non-traditional in the sense that collaborative teaching and flexible learning spaces are a significant feature of the new school, with individual interests and passions directing their learning (Haeata Community Campus, 2016). While press surrounding the opening of the new school in 2017 was doubtful of the new teaching and learning style (Long & Cann, 2017; Redmond, 2017a, 2017b), the school states that pushing the boundaries of traditional learning will enable students to engage and “be empowered to take control of their futures” (Haeata Community Campus, 2016). The intention of the study is to provide a summary of findings that is accessible for all staff and students, as well as supplying the data for teachers to use as an educational tool, giving students agency over their own information. An important aspect of research with young people is ensuring findings are effectively disseminated (Freeman & Tranter, 2011). The learning approach of Haeata Community Campus fits appropriately within the context of this study.

Haeata Community Campus' core ethos of empowering students lends itself well to participation in research that gives them a voice in their local community.

These circumstances and characteristics, namely the impacts of the Canterbury earthquake sequence, and socio-economic status and deprivation of the Aranui suburb, add complexities and uniqueness to the socio-demographic nature of the Haeata Community Campus. There are ongoing policy and planning implications of the Canterbury earthquakes on communities (Potter et al., 2015), and financial barriers to transport and accessibility affect low socio-economic groups the most (Raerino et al., 2013). Some studies suggest those in more deprived areas engage more in active travel, yet still have worse health outcomes (Ministry of Health, 2003; Turrell, Haynes, Wilson, & Giles-Corti, 2013). The Adolescent Health Research Group contrastingly found lower physical activity among females, older students, and students from the most deprived areas (Clark et al., 2013). This complex relationship challenges transport and health policy planning to understand more about what drives low socio-economic communities in their travel behaviour choices.

1.5 Aims and Objectives

The primary aim of this research is to investigate whether there is an association between the urban environment near Haeata Community Campus and transport patterns. This includes establishing what the transport trends are within the school, and assessing what potential reasons may be for these trends. The study will examine how the urban environment could result in more positive transport choices and trends for the school and its students. There may be certain spaces or aspects of the local environment that students identify to be a main determinant of active travel. Beyond this aim, the study intends to discuss and encourage a more collaborative approach to school planning, to include the transport sector, as well as education, health and others, for the purpose of the many benefits of active school transport.

To explore the relationship between youth friendly urban environments and school transport patterns, the following research questions have guided the chosen methodology and objective outcomes;

1. What are some aspects of the local context that may be important to understand for the Haeata Community Campus community?
2. What does current school travel patterns and behaviour look like at Haeata Community Campus?
3. What aspects of the local environment influence active travel at Haeata Community Campus?

1.6 Outline of Thesis

The structure of this thesis is divided into six chapters. The first chapter gives context, rationale, and the aims of the study, as well as introducing key concepts and relevant background information.

Chapter Two contains a review of literature regarding transport, specifically; patterns of school transport behaviour, and youth engagement with the built environment. The review critically examines the existing knowledge in this field, methods used, and how the present study fits within current literature. The chapter concludes by reviewing the policy and institutional framework that this research is situated within, including relevant transport, education and local policy.

Chapter Three is the methodology chapter which outlines the two-part process used to determine and understand the relationship between the local environment and transport patterns, specifically for students of Haeata Community Campus in Aranui, Christchurch. The chapter will detail the two methodological approaches, which was geospatial analysis of school roll data, followed by a Maptionnaire survey for students focussed on travel behaviour and perceptions of the local environment. Chapter Three will outline the processes of the

methodology as well as discussing existing literature, studies, and research context that have influenced the research design.

Subsequent results are presented and described in Chapter Four. Results are separated into three distinct sections; geospatial context of the local environment, school travel patterns of Haeata Community Campus students, and assessment of environmental determinants of school travel behaviour. The results show how this study has explored the local environment and its relationship with school travel.

Chapter Five critically discusses the results to give understanding of the relationship in question. The discussion has three key points; the enablers and barriers to active travel at Haeata Community Campus, the importance of understanding local context, and potential responses to encourage active travel. These points of discussion critically review how the findings from this study fit in the wider context, and what they suggest for future school travel behaviour and planning. The chapter concludes by examining the limitations and future research opportunities.

Chapter Six will conclude the thesis, summarising the study, including its approach, findings and implications for the local community, and future travel planning interventions.

Chapter 2: Literature Review

This chapter reviews existing literature to signpost the position of the present study within existing bodies of work. Within the field of Transport Geography, a significant body of research exists seeking to understand the links between transport modal choice and health, social, and environmental outcomes. A significant mix of methods has been used to measure and understand transport patterns, utilising qualitative and quantitative approaches, as well as more recently, a significant interest in incorporating Geographic Information Systems (GIS) capabilities into transport research.

This review covers two key areas of literature; patterns of school transport behaviour, and youth engagement with the built environment. The first section regarding patterns of school transport behaviour examines the prevailing trends in previous studies, followed by a discussion of the determinants of transport behaviour, which has been the subject of significantly more mixed results and relationships. Secondly, a body of unique and limited literature on youth engagement with the built environment is discussed, highlighting the gap in research, being exclusion of young people's perspective on urban form. The two bodies of literature are linked in the way that creating a local environment to support active travel in youth, should appropriately engage with the community of youth that any planning interventions would affect. As a historically under-valued group in planning, it is important to acknowledge the discourse that exists regarding engagement with young people.

The final section of this review outlines the policy and institutional framework that this study sits within. In relatively recent times, New Zealand and Christchurch has been subject to new and changing transport landscapes, promoting more alternative modes of transport.

2.1 Patterns of School Transport Behaviour

2.1.1 Determinants of school travel mode choice

Previous studies have focussed on the various determinants of active school travel, seeking to uncover potential strategies to encourage more young people to develop active travel habits, for improved developmental, environmental, and physical health outcomes.

Across a wide range of literature, the prevailing factor determining active transport is shown to be distance. In a vast majority of studies, the most significant correlate of the likelihood of active travel to school is distance from home to school (Buliung & Mitra, 2015; Curtis et al., 2015; Easton & Ferrari, 2015; Ikeda, Stewart, et al., 2018; Mandic et al., 2015; Millward, Spinney, & Scott, 2013; Oliver et al., 2014). There does not appear to be any consensus on what distance threshold individual students will deem too far to engage in active school travel. In regards to walking, distances close to one kilometre and no further than two kilometres, approximately a 15-20 minute walk, are suggested across many studies (Fishman et al., 2015; Millward et al., 2013; Rabl & de Nazelle, 2012). However some studies suggest 800 metres is a more accurate standard walking distance, using it as a buffer distance for walking in geospatial studies (Curtis et al., 2015; Veitch et al., 2017). A cycling threshold is undoubtedly going to be higher than walking. Some studies have assumed this distance to be around 4-6 kilometres (Fishman et al., 2015; Ikeda, Stewart, et al., 2018). The most recent household travel survey is consistent with this suggesting an ‘average trip’ cycling is four kilometres (Ministry of Transport, 2019). Little research has been done on this concept specifically. Young people especially will likely have different thresholds than adults, given age is correlated with walking and cycling, with younger children less likely to travel as far by foot or cycle as youth (Buliung & Mitra, 2015; Easton & Ferrari, 2015).

Considering a socio-ecological model of active transport, many confounding factors can influence behavioural choice by individuals. Similar to ecological models of health behaviour discussed by Sallis, Owen, and Fisher (2008), personal, social, and environmental aspects of an individual's lifestyle can interact and determine the likelihood of walking or cycling as a primary mode of transport. Theorising active transport within a socio-ecological model indicates someone will not change their behaviour if the environment discourages or permits that behaviour (Sallis et al., 2008). Beyond personal characteristics such as income, employment, education and demographics, intrapersonal factors such as family, social and cultural norms may also influence behaviour (Curtis et al., 2015). One particular review of the most commonly associated factors to active school travel found that beyond distance from home to school, a positive correlation between active school travel and densely populated areas, urbanised areas, mixed land use, and high street connectivity were consistently found (Stewart, 2011). Environmental factors can be significant in the case of active travel, and many argue that the built environment and urban form needs to be carefully designed in a way that encourages and promotes the desired behaviour (Ikeda et al., 2018).

Features such as safe crossings, cycle-paths, traffic volumes, road layout, residential density, land use, and presence of greenery were identified by a number of studies as factors that may influence transport mode choice and patterns (Buliung & Mitra, 2015; Easton & Ferrari, 2015; Oliver et al., 2016). In regards to children's school transport patterns, the safety of the built environment is often associated with the likelihood of a child walking to school (Buliung & Mitra, 2015). For younger children especially, parental perceptions of safety often dictate whether or not the child will participate in active transport in their journey to school (Buliung & Mitra, 2015). There has been a number of studies on parental perceptions of safety, exploring the level of control parents have over their children's independent mobility and school travel.

Studies have had mixed findings, with some suggesting parents control of their children's travel behaviour is for convenience (Curtis et al., 2015). In Fyhri et al.'s (2011) study, convenience was a significant factor for young people over 11, while for younger children, concern for safety was more significant. As previously mentioned, safety is a considerable concern for many parents. Typically, the general safety of the neighbourhood, as well as traffic safety are considered a risk. A number of studies exploring parental perceptions of neighbourhood safety found this to be a key barrier of active school travel (Bringolf-Isler et al., 2010; Buliung & Mitra, 2015; Carver et al., 2010; Oliver et al., 2014; Veitch et al., 2017). Parents tend to impose restrictive or avoidance strategies against active travel when they feel the environment is too unsafe (Carver et al., 2010). A specific study of cycle skills programmes found parents thought cycle skills programmes would make their children safer in traffic and improved their overall perceptions of cycling as a school travel mode (Mandic et al., 2017).

To summarise, a number of complex factors and relationships have been found to interact with school travel behaviour. While distance to school is the most consistently recurring significant factor, there is certainly little doubt that other socio-demographic, environmental and political influences have a role in determining travel outcomes.

2.1.2 Temporal transport trends

It is widely accepted that school travel trends have shifted significantly in the last two decades to favour private vehicle travel. This trend has been attributed to a number of factors associated with modern lifestyles. Over time, a number of household and family characteristics have changed. Firstly, a number of studies argue shifts in the working situation of many households with more women in paid full or part time employment places increasing time pressure on parents (Mackett, 2002). This often leads to families resorting to what seems to be the fastest and most convenient mode of transport, chauffeuring young people using a private vehicle to

school (Carver et al., 2010; Collins & Kearns, 2010). In some cases, children are travelling in the car as a form of mobile day care, accompanying parents along busy schedules and tasks (Mackett, 2013). In cases where neither parent is available at school travel time, an association with active school travel has been discovered, providing further evidence for the negative relationship between parental vehicle journeys and active school transport (Buliung & Mitra, 2015). One particular study exploring the intergenerational differences in school travel in New Zealand found significant decline in active transport between children and their parents school travel behaviour (Bhosale et al., 2017). The strong shift in perceptions and behaviour between generations indicates a rapid and recent change.

Developments in transport over time have not mitigated the distances barrier between home and school. Easton and Ferrari (2015) found that between the mid-1980's and 2013, average distance to school increased from 2 miles (3.22 kilometres) to 3.7 miles (5.95 kilometres) for 11-16 year olds in the UK. Studies have explored this trend, with many agreeing that the freedom of choice for school, as well as the increasing dispersal of larger, and less schools in New Zealand could be a key reason for increasing average distances to school (Easton & Ferrari, 2015; Mackett, 2013). Generally, school enrolment policy in New Zealand allows students within a designated catchment area to attend, while also giving students outside the catchment opportunity to apply for any remaining spaces within capacity (Mandic et al., 2015). This trend is also more pronounced for older students in high schools than for younger children. Buliung and Mitra (2015) found from their sample of over 2,000 Toronto school students living within 3.2km of their school, that 42% of high school students lived between 1.6km and 3.2km away, while only 13% of the younger, elementary school students lived within that distance range.

In summary, literature on school travel is predominantly modern and focussed on the shift to private vehicle dominated travel patterns. Active school travel studies are relatively common, exploring the reasons why young people no longer seem to engage in walking or cycling for school travel or general mobility. Parental influence, household characteristics, and school enrolment policy changes are some of the key theories explored in this literature, which arguably have some or a combined level of influence on travel behaviour.

2.1.3 Measuring school transport patterns

The field of transport geography employs a range of methodological approaches. Of the studies considered within this review, a variety of approaches were used, including quantitative, qualitative and GIS techniques. All methods yield insightful findings and contribute to the limited but growing body of literature on school transport patterns and active school travel.

Travel surveys and diaries have been a common measurement approach for geographers attempting to understand mobility patterns, involving the use of a questionnaire or other written record of transport journey details. Across the studies in this review, a number employed travel surveys, with similar benefits and limitations (Badland et al., 2015; Christiansen et al., 2014; Fishman et al., 2015). Travel diaries can be a relatively effective method of collecting accurate trip and mode data from large samples (Christiansen et al., 2014). They also provide essential insight to individual travel characteristics, specifically highlighting day-to-day similarity and variance as a result of trip purpose or destination (Prelicean, Gidófalvi, & Susilo, 2015). However, bias exists particularly in how participants recall their travel patterns. Response bias can arise as the result of retrospective participation and inability to recall activities accurately enough, or as a result of social desirability from participants. As acknowledged by Schlich and Axhausen (2003), participants who engage in travel diaries over an extended period of time may have a significant number of trips and forget to record all daily trips accurately if

completing at the end of each day. When used in the instance of school travel young people may sometimes also require a parent to help or complete their travel diary for them which may result in selection bias when students of families who are time poor do not complete the task, as well as reliance of parents to accurately report behaviour or patterns of their child (Kurka et al., 2015). Recall bias caused by social desirability can easily occur in transport research if participants feel some sort of social status indication attached to any particular mode, pattern or other aspect of the study (Furnham, 1986). These limitations to travel surveys or diaries are important to acknowledge and consider pairing with other quantitative or GIS methods.

Quantitative measures of mobility including accelerometers are commonly used in active transport studies. Within this review, a number of studies used accelerometer data, typically in combination with surveys, travel diaries, or GIS analysis (Carroll, Calder-Dawe, Witten, & Asiasiga, 2018; Carver et al., 2010; Kurka et al., 2015; Oliver et al., 2015; Stone & Faulkner, 2014). They are particularly effective for understanding the contribution of daily travel patterns to healthy physical activity recommendations. As agreed by the majority of transport studies, active transport is deemed to be a highly effective way for individuals to engage with a healthy level of daily physical activity (Fishman et al., 2015). This has been a key focus of the existing literature on young people's transport, given the current state of obesity and increasing sedentary lifestyles of children in the developed world, including New Zealand (Brown et al., 2017; Mackett, 2013; Ministry of Health, 2017b).

Data from three key studies in New Zealand is commonly used for active school travel or youth mobility research. URBAN (Understanding the Relationship between Activity and Neighbourhoods) (Oliver et al., 2014), KITC (Kids in the City) (Oliver et al., 2011), and BEATS (Built Environment and Active Transport to School) (Mandic et al., 2016) are three

recent large scale studies of young people in New Zealand cities. The studies explore active travel and the urban environment in Dunedin (BEATS), Auckland (URBAN and KITC), and Wellington and Christchurch (URBAN). The KITC study studies a group of children aged 9-11 years, as well as their parents/caregivers. The study sample size was 160 children. Measures of the children's independent mobility and physical activity incorporated global positioning systems, accelerometers, GIS, and observational audits. Qualitative measures of perceptions and experiences were also included (Carroll et al., 2015). The URBAN study covers three cities including 217 children aged 6.5-15 years. Parents completed travel diaries, and interviews, and GIS derived-variables were used to analyse distance and neighbourhood walkability (Oliver et al., 2014). Finally, the BEATS study used a mixed-method approach of surveys, accelerometers, GIS, focus groups, and interviews to gather information from parents, teachers, school principals and students. The study includes students age 19-13 and recruited from 12 secondary schools, gaining 1,181 participants (Mandic et al., 2016). These studies offer significant contributions in this field, particularly in New Zealand. The approaches used are relatively similar, incorporating various objective and derived measures of the urban environment and physical activity. The inclusion of qualitative measures to understand perceptions and experiences on a deeper level is also a significant strength, as well as the utilisation of GIS.

The contribution of Geographic Information Systems (GIS) to this body of literature is important to acknowledge. A number of studies use GIS to measure routes, create objective and derived measures of street connectivity, land use and other built environment features, and locate popular destinations within the neighbourhood. In particular, Badland et al. (2015) developed the NDAI-C (Neighbourhood Destination Accessibility Index for Children) measurement tool incorporating several datasets of geocoded locations as well as destinations

captured in a travel diary. The index, adapted from NDAI (the adult equivalent index) effectively captured areas that enabled children's mobility and offers considerable geospatial information to urban planners. A number of other studies have complemented their study of school transport and young people's transport patterns using various map layers, variables and analysis tools included in GIS (Bringolf-Isler et al., 2010; Buck et al., 2011; Millward et al., 2013; Veitch et al., 2017). A key strength of GIS is the ability to load, compare and integrate datasets of multiple variables, as in Mavoa, Witten, McCreanor, and O'Sullivan's (2012) study, which is an effective analysis of Auckland's public transit system. While GIS provides a number of powerful tools for understanding transport patterns and spatial information relating to transport, the main criticism is its inability to include human perspective or lived experience of young people in their transport environment (Oliver et al., 2016).

A noteworthy observation from the literature is the balance of obtaining valuable insight from the transport user themselves, while navigating the uncertainty of young people to participate with full comprehension in research within the field of school transport studies. The importance of including young people in the dialogue of how their urban environment is designed is discussed further in the following section, with particular regard to how minority groups (including young people, but also low socio-economic, indigenous groups and ethnically diverse communities) are given disproportionately less voice in urban design matters.

2.2 Youth and the Urban Environment

2.2.1 Youth occupation of urban space

Studies have explored the relationship between the built environment and human mobility within the neighbourhood, in the interests of making urban spaces accessible for people. Research is increasingly becoming concerned with what the enablers and barriers to high utilisation of public spaces, and high mobility may be (Knowles, 2009). Within this domain, less research has been centred on how young people specifically interact with their local built environment. Some studies acknowledged this lack of understanding and have made efforts to better understand youth and their engagement with the built environment around them (Kurka et al., 2015; Stone & Faulkner, 2014). One particular example in New Zealand, the KITC study, has made significant contributions to understanding young people's occupation of the urban environment, through understanding Auckland youth and their experience (Badland et al., 2015; Carroll et al., 2015; Oliver et al., 2015; Witten, Kearns, Carroll, & Asiasiga, 2017).

Independent mobility is considered a significant aspect of young people's interaction with their local neighbourhood, providing valuable social and developmental life skills. Young people are increasingly being exposed to less opportunities for independent mobility (including and additional to active school travel) for numerous reasons. A key aspect of independent mobility is the young person's ability to navigate streets and their neighbourhood without any supervision. A number of key development opportunities (cognitive, physical health, and social skills) are lost when young people's independent mobility is restricted (Veitch et al., 2017). One key predictor of independent mobility is parental control. A study of the perceived risk of parents and its impact on independent mobility found significant worries from parents were associated with more restricted independent mobility (Carver et al., 2010). Young people whose parents perceive the urban environment to be unsafe may constrain their child's

behaviour through either avoidance or defensive mechanisms. An avoidance approach may see parents minimising children's engagement with perceivably risky urban environments, while defensive approaches may mean parents accompany their children more often, or drive them in a vehicle rather than letting them walk or cycle. Parents' perceived risk may also be associated with the restriction of young people who would otherwise prefer to utilise active transport, which may result in establishing sedentary travel patterns from an early age (Collins & Kearns, 2001).

The social opportunity of using specific modes of transport such as public transit has also been noted by some studies such as Jones et al. (2012). Highlighting the importance of understanding young people, especially where they may not choose the most logical or efficient mode. Frater and Kingham (2018) found young girls mobility behaviour can be entirely based on who they are 'hanging out' with and what their social pressures encourage them to do. Other studies have also found social factors such as societal norms and peer pressure to act as an enabler or barrier to how young people engage with the urban environment (Badland et al., 2015; Ergler, Kearns, & Witten, 2016; Veitch et al., 2017).

A significant body of research investigating young people's occupation of space, have determined a negative relationship between car dependence, prioritisation of vehicles in urban design, and space in local neighbourhoods that is friendly for youth (Barker, 2003). Since young people are generally unlicensed (until age 16 in New Zealand), they are unable to access vehicles independently, and therefore significantly restricted in their ability to utilise road space. As a result, young people are often dependent on active or public transport to navigate urban centres. Where poor urban infrastructure exists for these modes, youth are essentially excluded from their public realm (Carroll et al., 2015). An urban design approach that

acknowledges alternative transport modes and gives space to pedestrians, cyclists and other various non-vehicle users is increasingly discussed in literature. Studies mostly attempt to quantify the benefits of this planning approach as well as determining the best ways to promote non-vehicle transport. This not only makes streets accessible and safer for young people who do not use private vehicles, but also benefits for other groups in society. Elderly who are restricted in their private vehicle access or dependent on a mobility scooter also benefit from this planning approach, where more space for pedestrians gives them more space and freedom for mobility, whether by foot or scooter. It is also cost and environmentally friendly to prioritise active and public transport and promote the use of non-vehicle modes. Walking is free as a transport mode and cycling has been proven to be cost effective as a one-off significant cost compared to the ongoing expenses of car ownership (Brown et al., 2017). Walking and cycling are emission free, while motor vehicles contribute 17.3 per cent of New Zealand's gross annual carbon emissions (Ministry for the Environment, 2018). This combined with generally poor engagement and consideration of young people's voices in planning and decision making, can lead to a number of adverse outcomes.

In summary, acknowledging the different way that young people engage with the urban environment is important when designing space and infrastructure that supports young people. Encouraging active travel and independent mobility of youth needs to have a dedicated and different approach to how planners approach transport challenges in adults.

2.2.2 Recognition of youth in civic engagement

Additional to the common exclusion experienced by young people in their built environment, youth are also less likely to be included in discussions or engagement regarding what they want to see in their cities.

A Radio New Zealand journalist, Kate Newtown (2018), recently investigated the inequality of voice in Auckland Council submissions. This study found the loudest voice in shaping the cities future is older, wealthier Pākēha people. While Auckland is more ethnically diverse than Christchurch, studies support the fact that indigenous, minority and poorer groups of society do not contribute to consultation or engagement processes as much as their white, richer counterparts (Chang, 2018). Research regarding urban planning and the ways society wants to design cities is shaped to make majority groups voices heard more easily (George, Duran, & Norris, 2014). There are some studies of marginalised youth and their participation in civics. However, it is worth noting that engaging minority groups in research is similarly rare, with one study finding mistrust of researchers is a key barrier for participation (George et al., 2014). One study of civic engagement for low-income minority youth in Los Angeles suggests young people require more exposure and education of what their role could be in civic participation, and how the system works, in order to enable them to participate (Hoang, 2013). The argument for specialised attention when engaging minority and marginalised groups is argued for by a number of studies, suggesting extra resources, policy, programs and services are essential to ensuring equitable representation of voice within urban decision making (Flanagan, Cumsille, Gill, & Gallay, 2007; Hoang, 2013).

Many have argued for the significant difference in quality of engagement when adults act in a tokenistic manner allowing youth to share thoughts and opinions versus self-driven shared decision making with adults (Bridgman, 2004a). The way that adults treat young people in engagement exercises, and the value they overtly give to their opinion effects how playful or serious the subsequent feedback may be (Bosco & Joassart-Marcelli, 2015). Engaging with younger children in particular can be difficult and deter decision makers and leaders from attempting. However, it is important to value their voice and ensure they do not become

marginalised in the city. Marginalisation of young people can also make accessing public spaces difficult to access for parents. The argument for not only more inclusion of young people in decision making, but also for value and respect of their opinion, giving them more power and influence with decision making is becoming evident (Bridgman, 2004b).

The idea of a youth friendly environment suggests urban environments could do more to be inclusive of young people. The concept is not specifically defined, however Freeman and Tranter (2011), suggest it to be a combination of two key elements; a good social environment and a good physical environment. It should feel safe and supportive, with a strong sense of community, and urban form should discourage isolation of families, incorporate safe street initiatives, and encourage mixed-use development. However, the most important aspect may just be the inclusion of young people and valuing their input. A number of studies support the claim that planners do not adequately value youth participation (Bridgman, 2004b; Carroll et al., 2015). Young people need to be involved more in a self-driven manner where they know they are being heard and their voice will influence decision making (Barker, 2003; Bosco & Joassart-Marcelli, 2015)

Therefore, not only are young people in general not widely understood or listened to in decision making, the specific study population in Aranui, Christchurch is likely to be significantly more excluded from discussion. For students of Haeata Community Campus, members of their family and community are likely to not have a significant voice either.

2.3 Policy and Institutional Framework

2.3.1 National Transport Policy

As previously mentioned, New Zealand active transport rates are declining in most cities as car dependence rapidly increases. In the most recent census for which results are available, over 70% of people drove a car to work, on the day of census (Statistics New Zealand, 2015). As more research emerges on the public health, and environmental benefits of alternative transport modes, local and national government is diverting effort and resources into active and public transport.

The 2018 National Policy Statement on Land Transport (Ministry of Transport, 2018b) set out four key objectives for creating liveable cities, including safety, accessibility, environmentally friendly and high value for money. The recent policy statement gives significant recognition toward alternative modes of transport, including cycling, walking and public transport. Reference to the encouragement of walking and cycling in three of the four aspects of the strategic direction shows the increasing focus New Zealand government is putting on active transport. Increased investment in safer walking and cycling infrastructure, encouragement of active transport for increased health and reduced emission benefits, and accessible urban areas with accessible modal options were some of the specific ways the policy aims to create an effective transport network.

Aside from the recent Government Policy Statement on Land Transport, a number of other key strategies and plans are implemented by New Zealand's Ministry of Transport. Some of the relevant frameworks to this study include the road safety strategy known as Safer Journeys 2010-2020, and the 3-year National Land Transport Programme released in 2018.

Of the existing strategies and plans, New Zealand's Safer Journeys (Ministry of Transport, 2010) is perhaps the most influential to young people. Youth are some of the most vulnerable road users, especially as pedestrians. Young people between the ages of 5 and 24 had the highest average number of deaths and injuries as pedestrians with motor vehicles, as well as the most common time of day for incidents involving children occurring during school pick-up time (2-4pm) (Ministry of Transport, 2017b). The strategy focussed on improving safety for young drivers, who were identified as high risk. In regards to school travel behaviour, the plan acknowledges the need to improve streets for young people and ensure areas near schools are particularly safe zones. Specific actions included low speed zones near schools and cycling, walking and road safety programmes in schools (Ministry of Transport, 2010). Since the Safer Journeys strategy expires in 2020, the Ministry of Transport is already considering how the future road safety strategy will be framed. In a 2018 Cabinet Paper (Ministry of Transport, 2018a), the Associate Transport Minister proposed a 'vision zero' focus, encouraging a goal of zero road deaths. Particular attention to young people as vulnerable transport users was mentioned, encouraging better accessibility for all transport modes.

The National Land Transport Programme (New Zealand Transport Agency, 2018) is a three year plan that focusses on how New Zealand will develop a transport network that the 2018 Government Policy Statement sets out. Just under 17 billion dollars of total funding is to be invested in a number of projects over the time period. Some investment into active transport is highlighted: \$390 million towards walking and cycling improvements; \$3.1 billion towards public transport infrastructure; and, \$4.3 billion to reduce death and serious injury on New Zealand roads. The programme consistently cites schools as benefiting from enhanced cycling and walking as well as safety improvements nationwide. Specific initiatives include supporting

future cycling skills programmes in schools and general safety promotion programmes in schools and communities.

In summary, national transport policy is leaning further towards incorporating more alternative transport modes, investing more in cycling, walking and public transport. Acknowledgement of the benefits to young people and schools are often given when discussing active transport or road safety improvements. However, there could be potential for further multi-sector collaboration ensuring school travel behaviour yields the best personal, community, and environmental outcomes.

2.3.2 Local Transport Policy

Local transport policy has shifted recently to give significantly more priority to alternative transport modes. The most significant movement towards active transport prioritisation was the Christchurch Major Cycle Routes which was announced in the Christchurch Transport Strategic Plan in 2012. The thirteen cycle routes intend to connect popular destinations across Christchurch and encourage higher cycle uptake for transport (Christchurch City Council, n.d.). A large share of Government funding from the Urban Cycleways Programme in 2014 helped to kick-start the construction of 13 major cycle routes. The Urban Cycleways Programme was announced by the government in 2014, stating \$100 million investment from the government for cycleways across the country (New Zealand Government, 2014). Three of the thirteen Christchurch Cycle Routes have been fully completed, with many others partially constructed.

Specifically for young people, school travel plans are commonly implemented by city councils across New Zealand, with Christchurch City Council in particular, providing professional advisors to work with schools to provide guidance, information and associated resources (Christchurch City Council, n.d). The New Zealand Transport Agency also encourages

practical responses to safety concerns that affect schools uniquely, with both a set of guidelines for schools and a technical guidebook for road safety professionals such as traffic engineers (New Zealand Transport Agency, 2014). These resources, when utilised by local government bodies can effectively encourage healthy behaviours.

Local and national transport policy appears to be focussing on active transport modes more than in the past, reflecting positive potential developments for alternative transport modes. The way in which this study contributes to this already positive direction, is that it encourages evidence based, local context driven policy. This study gives insight to how a community and its community, cultural, and socio-demographic characteristics can play a role in shaping transport behaviour. Recognition of local context is important when moving forward with these local and national transport policies aiming to promote active travel.

2.3.3 Education Policy

In studies where distance has been the most significant predictor of active travel or general transport behaviour, a number mentioned the impact of school zoning and allocation policies (Badland et al., 2016; Frater & Kingham, 2018; Mandic et al., 2015). The impact of increasing choice policy in education may be the cause of increasing distance from school, particularly for secondary school students.

Over time, education policy has shifted to a choice-based model, giving parents and students more freedom to decide what school they believe will provide the best education (Mandic et al., 2015). This model gives individuals more power to pursue schools that suit their needs. Tomorrow's Schools strategy, implemented almost 30 years ago, reformed New Zealand's education system with the aim of restructuring administration of schools and their resources to be more local and focussed on the improved learning opportunities for children (Ministry of

Education, 1988). Part of the Tomorrow's Schools reform included the concept of 'Enrolment Schemes', where the purpose was described as ensuring students can attend a state school reasonably convenient to their home. A maximum roll is set and all pupils within the zone are guaranteed enrolment. Students out of zone could apply for any places remaining if the maximum roll is not met by local students. This policy allow parents to enrol away from their local school if successful in application, giving them power to choose 'better' schools, as opposed to the closest school (Badland et al., 2016). One particular study of school enrolment zones in Christchurch using GIS found significant distance savings could be made if all students attended their nearest school, as opposed to enrolling out of zone (Devonport, 2017). This highlights the transport implications of education policy.

Very recently, the entire New Zealand education system has come under review with a large public consultation project occurring in early 2018. The project, Education Conversation | Kōrero Mātauranga, is an Education Work Programme designed to endure a long term vision for New Zealand education (New Zealand Government, n.d.). Ensuring all students, no matter where they are from, are supported and receive quality education is central to the review. A key aspect of the project was to review the 1989 Tomorrow's Schools reform. Arguments have suggested that the key changes in Tomorrow's Schools reform are no longer relevant and providing the best education for New Zealand students.

It is important to acknowledge national level education policy and the way it can influence other factors of communities' lived experience, including transport. As suggested, the shift away from localised schools has been a contributor to greater average distance between home and school, which subsequently is a significant barrier to active school travel.

2.4 Summary

In reviewing existing studies that cover active transport patterns, school travel, and the interaction between youth and their urban environment, a key gap is identified. While many studies have attempted to understand common factors of the urban environment that may predict transport behaviour, there has yet to be a study that uncovers the local context of a specific community. This study acknowledges the unique social, economic, and environmental context of Haeata Community Campus to emphasise the importance of evidence based transport policy and planning. The strategic planning decisions made regarding Haeata Community Campus suggest transport and health implications of low active travel was not carefully considered with the decision to amalgamate schools.

Within the current policy situation of New Zealand, this study can encourage localised and evidence driven action. In a climate where the New Zealand government is investing more in active and public transport, highlighting the particular need of young people, low income communities and generally marginalised groups, this study encourages decision makers to consider some of the most vulnerable transport users, and how their local environment impacts their behaviour.

Chapter 3: Methodology

This chapter introduces and explains the chosen methodology used to answer the key research objective: what is the importance of local environmental factors on school transport patterns and behaviour?

The two key aspects are geospatial analysis of school roll data, and a Maptionnaire survey of Haeata Community Campus students transport patterns and perceptions of the local environment.

A range of methods have been previously used to assess transport trends and behaviour. Transport geography is a field that brings extremely useful insight to the spatial patterns of mobility in a given area (Knowles, 2009). A combination of geospatial analysis and quantitative surveying was determined to be the most comprehensive methodology for this study due to the benefits in transport geography of mixing Geographic Information Systems (GIS) and traditional qualitative and quantitative methods (Oliver et al., 2016). The key strengths of this approach are the ability to situate information within a geospatial database, giving analysis geographical meaning. The capability of GIS in particular has been argued to give geographers significantly better understanding of the connections between society, environment and place (Yeager & Stieger, 2013). Where Geography was once a field of strict separation of either quantitative or qualitative measurement, researchers now realise the value of combining various types of measures to understand patterns, particularly in human geography (Visser & Jones, 2010). Previous transport studies have similarly combined the capabilities of GIS with other qualitative and quantitative measures (Ikeda, Stewart, et al., 2018; Mandic et al., 2015)

This choice of methodological approach addresses the research questions of this study most effectively. The first aspect of this study is exploring the local context relevant to school transport. GIS offers effective understanding of the available data geographically. Using a questionnaire to then understand students transport patterns and behaviour, as well as perceptions of the local urban environment is most effective for understanding the subject population and their lived experience. As suggested by Oliver et al. (2016), information about the built environment can be collected and used effectively in conjunction with self-reported mobility patterns. Given the existing literature emphasising the importance of including the voice of young people (Bridgman, 2004a; Carroll et al., 2018), the participation of students themselves was deemed paramount. In addition to choosing a questionnaire as the best approach for understanding young people's transport patterns and perceptions of their local environment, the use of Maptionnaire, a web based survey tool, means the present study has the ability to incorporate participatory mapping exercises. The use of this particular survey platform ensures the exercise is engaging for young people as well as having the ability to evaluate any various locations(Oliver et al., 2016). Using data and key findings from both the geospatial analysis and Maptionnaire survey, the present study then models active school travel to understand what some of the key drivers or barriers may be. Statistical analysis is first and foremost important as a way of understanding data and determining the most significant findings (Rogerson, 2010).

The methodology comprises of three key aspects, discussed in greater detail further on. The first being geospatial analysis of the local environment and school roll data. This first aspect gives some background knowledge to the study area, as well as key travel distance statistics for the school population. The second aspect is a Maptionnaire survey of year 7-13 students at Haeata Community Campus that seeks understanding of transport patterns and basic

perceptions of the local neighbourhood. Finally, the logistic regression model attempts to model enablers and barriers of active travel within the local environment.

The geospatial aspect of the methodology was carried out early in the study and was designed to inform and influence the subsequent phase (i.e. the Maptionnaire). The separate phases of methodology answer various aspects of the research sub-questions to a varying degree for each.

These sub-questions are:

1. What are some aspects of the local context that may be important to understand for the Haeata Community Campus community?
2. What does current school travel patterns and behaviour look like at Haeata Community Campus?
3. What aspects of the local environment influence active travel at Haeata Community Campus?

The following sections of this chapter outlines the methodological approaches of this study.

3.1 Geospatial analysis

3.1.1 Rationale

The use of GIS in transport research, as well as more broadly within the transport industry is acknowledged as being particularly effective in understanding information and patterns (Shaw, 2010). While spatial analysis in transport has always existed as an appropriate way to investigate travel patterns and inform transport policy, the introduction and development of GIS software and constant innovative geo-computation opportunities has accelerated spatial analysis for transport (Shaw, 2010). GIS-T, a term representing GIS in Transport, now widely used and recognised, has influenced transport policy and planning significantly. A number of studies have noted the advancement and use of GIS in transport, stating its significant role in the area (Mavoa et al., 2012; Miller, 1999; Shaw, 2010). GIS analysis enables studies to easily calculate distance, analyse networks and visualise spatial patterns. Analysing density of certain features can also be insightful, such as measuring dwelling, or green space density to determine potential physical activity levels (Oliver et al., 2016). These significant contributions offer plentiful opportunities for the present study and the overall objective of assessing the importance of the local environment in determining school travel patterns.

In the instance of this study, geospatial analysis of school roll data with GIS was performed for the purpose of understanding current context and likely transport trends for students. Data from the four pre-existing schools also gives important historical context to the situation of Haeata Community Campus. Some students would be ex-students of one of these pre-existing schools, meaning their transport route and patterns could vary from years prior, as a result of the amalgamation of schools. Evaluating the change in average distance from 2016 to 2017/2018 as the new school opened provides insight for education and transport professionals to encourage more collaborative design and planning when master planning future schools.

Examining the current roll data gives some preliminary understanding of what transport patterns could look like. Knowing that students are more likely to walk or cycle to school given the distance is around one kilometre, and not usually further than two kilometres, uncovering the average distance to school for students would indicate whether active school travel could be effectively encouraged. GIS also provides the opportunity to understand local transport context, such as the spatial concentration of cycle and public transport infrastructure. A selection of contextual transport data is investigated to understand the level of accessibility for students of Haeata Community Campus. Namely, public transport routes and cycle route layers are added to the analysis to visually represent the provision of infrastructure of alternative transport modes including active and public transport.

The spatial analysis capability of GIS programmes offers strong reason for this approach as the most effective way to preliminarily understand the context of the transport landscape for Haeata Community Campus.

3.1.2 Methodological approach

3.1.2.1 Data

The main data source is school roll data collected by the Ministry of Education and is obtained with permission from the school (Haeata Community Campus). The data set includes geocoded addresses of all enrolled students at various time-points. The full data set includes data from: Haeata Community Campus, in March 2017 and 2018; as well as March 2016 data from Avondale Primary School, Wainoni Primary School, Aranui Primary School, and Aranui High School. The data for Haeata Community Campus in 2017 had 897 unique points, and 749 unique points in the 2018 dataset, which represents about 97.6% (2017) and 98.5% (2018) of the actual roll at each point, respectively. For the 2016 data, there were the following number of unique points for each school, including geocode rates representing the proportion of total

students enrolled at the time of the dataset who were able to be geocoded into the database: 335 (98.8% geocode rate) for Aranui High School; 194 (99.5% geocode rate) for Aranui Primary School; 80 (100% geocode rate) for Wainoni Primary School; and 218 (98.6% geocode rate) for Avondale Primary School. Figure 1 shows the location of each of the pre-existing schools in Aranui. It is important to note that the Haeata Community Campus was built on the old Aranui High School site.

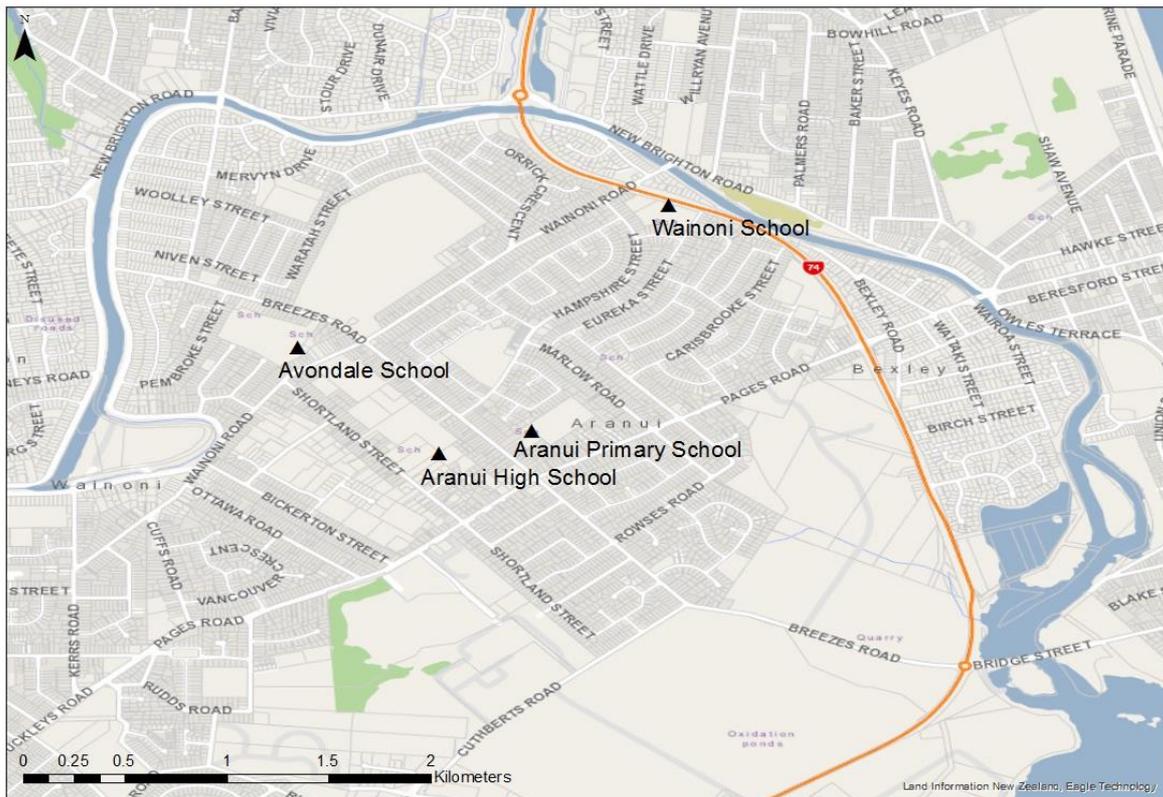


Figure 1: Map of Aranui showing the location of four pre-existing Aranui schools, which closed and were amalgamated into Haeata Community Campus.

Data from the University of Canterbury including citywide cycle lanes and public transport routes and bus stops were overlaid on the student density maps. All cycling infrastructure and routes are broken into one of three categories; cycleways, cycle lanes and shared paths. As defined by the Christchurch City Council (2018b), a cycleway is defined as infrastructure mainly separated from the roadway, with a range of safety and accessibility features to make cycling easier. A cycle lane is generally a designated strip of roadway for cyclists to use, and

a shared path refers to paths separated from the roadway, designed to be shared by pedestrians and cyclists.

The public transport layer has been manipulated to only include two bus routes that pass closest to, and best service Haeata Community Campus. The Yellow Line – Rolleston to New Brighton, and 80 – Lincoln to Parklands were the two public transport routes chosen. The data set included point data of the bus stops as well as line layers with the bus routes.

3.1.2.2 Analysis

For each school and time point, nearest facility network analyst tool was utilised to determine the distance between each incident (student address) and facility (Haeata Community Campus, or appropriate previous school). In the instance of Haeata Community Campus, three facility points were used to ensure more accurate distance, incorporating the multiple school entrances that students could use. The network analyst tool then provided distance based on nearest school entrance. Distance was calculated using a road network database. Therefore, a key assumption is that students follow roads on their journey to school, even when walking. A more detailed analysis of distance could be presented using a pedestrian network that includes any alley-ways or other footpaths that cut through roads and therefore shorten the trip. An anonymous spreadsheet of each student's individual distance from their home address to school was extracted and provided key summary statistics of distance for each population and time-point. The point data was aggregated then extrapolated into a kernel density layer, in the interest of confidentiality, to show the general areas and concentrations of where students live.

Additional to the spatial analysis, a number of map layers were overlaid to understand more about the local transport environment. Distance buffers based on the road network were created in regard to Haeata Community Campus. This creates a polygon for each area around the school

presenting addresses that are 1km, 2km, 3km and 4km distance from school, using the road network. Public transport and cycling infrastructure layers were also overlaid on the data.

3.2 Transport questionnaire

3.2.1 Rationale

Given all of the benefits of GIS-T, particularly in this study, there is still no understanding of why people behave in the patterns that can be visualised through GIS. Therefore, the use of GIS in this study, investigating the geospatial context and access by proximity to alternative modes is most effective when combined with another approach such as a quantitative survey. Understanding of modal preferences and effect of the built environment is best understood through the use of a questionnaire, complemented by geospatial context, computed using GIS-T methods. Questionnaires have been the most common way for collecting transport data. The majority of information already gathered regarding transport behaviour is obtained through surveys or travel diaries (Oliver et al., 2016). Minimal surveys of young people and their transport patterns have been completed, relative to the number of adult travel surveys (Oliver et al., 2016). One review of youth questionnaires pointed out that a key strength of surveys is the understanding that individual behaviour may be more directly influenced by their personal perceptions of the local environment as opposed to objectively measured environmental attributes (Reimers, Mess, Bucksch, Jekauc, & Woll, 2013). The use of qualitative measures to understand perceptions of the built environment was considered. However, while interviews or focus groups may yield deeper understanding, it is often compromised by less coverage. Interviews or focus groups would also be less comparable to the geospatial data. Therefore, in this study, a questionnaire is deemed most effective to understand Haeata Community Campus students' behaviour and perceptions.

The questionnaire was designed to meet the research objective of understanding the transport patterns of Haeata Community Campus students. Knowing the results of the GIS mapping element, the questionnaire was designed to link the two aspects of methodology and give some

human understanding to the concentrations of students living in certain geographic areas, and trends of proximity to alternative transport infrastructure and services. The most significant limitation of the geospatial analysis was that transport mode was unknown for the dataset. The key objective of the questionnaire was to understand the dominant transport patterns and modal preferences of students, as well as some potential reasoning behind these transport choices. It was important to understand how students travel to and from school and what their key motivators may be for these decisions.

3.2.2 Methodological approach

3.2.2.1 Sample

Haeata Community Campus students were asked to participate in the Maptionnaire survey. Students under year 7 (equivalent to approximately age 11) were excluded from the survey. The decision to focus on older youth was largely the result of ensuring participants were relatively capable of independently consenting to participate, and also comprehend the questions included. The participation of young people in research and planning needs to be considerate of what engages them best and how they can best get across their point (Freeman & Tranter, 2011). Haeata Community Campus also primarily divides students from year 0-6 and year 7-13 for a majority of learning. Therefore, the exclusion of younger children was logistically most effective. After excluding the students under year 7, approximately 450 students (the total year 7-13 population) were given the opportunity to participate. A total of 79 students participated in the Maptionnaire survey, a response rate of approximately 17%.

3.2.2.1 Survey design

The questionnaire was hosted on the web-based mapping questionnaire tool Maptionnaire. Maptionnaire is a tool designed to assist planners in making evidence-based decisions with the inclusion of spatial evidence. The ability for participants to locate specific points, lines and polygons on a map gives geographical meaning to typical questionnaire responses. Aside from

the ability to ask geographical questions, Maptionnaire has traditional survey mechanisms incorporated such as multiple-choice, range, and open-text questions.

The Haeata Community Campus transport questionnaire has two key parts. The first section of questions covers transport patterns, including: general transport mode choice, most recent recall of mode choice, transport companionship, parental control and influence; and preferred mode of travel. The second part concentrates on perspectives on local streets and the neighbourhood urban environment, to begin to understand how young people view their local environment, and the aspects of local environment that young people notice. The questions in the survey were determined by the research objective, meaning questions needed to give a measure of students travel mode and patterns, as well as perceptions of the local environment.

It is important to note that no question within the survey was mandatory to answer, giving participants freedom of participation. Therefore, some measures obtained from the Maptionnaire are based on fewer responses than the overall response rate.

3.2.2.2 Procedure

Ethical approval from the University of Canterbury Educational Research Human Ethics Committee was received for this study. Ethical approval was granted on the basis that the survey was emphasised to be voluntary, that parents were well informed and had the opportunity to suggest their child opt-out, and support from the school was not assertive in its encouragement for students to participate.

Organisation of the questionnaire heavily involved the principal and other staff of Haeata Community Campus who were willing to use school facilities and resources to assist the success and encourage participation in the questionnaire. Every student has access to laptops

and tablets at school meaning access to a device to complete the Maptionnaire survey on was not an issue.

The survey was hosted for two weeks at Haeata Community Campus beginning the week of November 5th 2018 and allowed students to voluntarily participate during their Puna Ako time. Puna Ako time at Haeata Community Campus involves vertical grouping across years 7-13 where students plan their timetables, reflect on plans, and do social emotional learning as a group.

3.2.2.3 Analysis

Data from the Maptionnaire was then organised into descriptive tables, including a number of cross-tabulations, specifically to compare active and non-active travel participants. Comments made by participants regarding places they identified as positive or negative are discussed and presented in analysis of participant's perceptions of their local environment. Further inferential statistical analysis of the Maptionnaire data is used to model key determinants of active school travel.

3.3 Logistic Regression model of active school travel determinants

3.3.1 Rationale

Testing for statistical significance is an important aspect of understanding quantitative data in geography (Rogerson, 2010). Statistical significance of data, relationships, and models infer how much attention to give to particular results. In the description of results from the Maptionnaire, a number of interesting findings could be observed. However, this model using logistic regression, gives more detail about how much various factors influence the likelihood of active school travel in students of Haeata Community Campus.

Logistic regression was chosen to analyse these variables because it has the ability to use categorical variables in analysis including categorical outcome variables. Logistic regression predicts the likelihood of a categorical outcome occurring with information from other variables (both numerical and categorical). The regression was used to test whether socio-demographic and local built environment measures influence a student's likelihood of engaging in active travel. The measure of active travel used in this analysis was participant's response to the question, "thinking about the last time you came to school, how did you travel to school?" Responses for walking were categorised as active, and responses for car were categorised as non-active. Other transport modes were excluded due to minimal responses and the risk of them skewing results significantly. A range of literature studying the relationship between urban environment and active travel has found mixed results. As outlined in the literature review, there has not been significant consensus on the socio-demographic or built environment factors that encourage active school transport.

This study does not intend to uncover the key attributes of a local environment that enables active travel. Moreover, the key objective of this model is to determine the specific local influences, recognising the importance of context and the way that communities are unique in their behaviour. This approach also has some key limitations such as the coarseness of measure of active travel. Behaviour may be much more varied in reality. Given the relevant measures obtained in the Maptionnaire survey, this model is the most effective for establishing relationships.

3.3.2 Methodological approach

3.3.2.1 Data

Data used in the model was predominantly from the Maptionnaire dataset. GIS was used to derive distance from school for the Maptionnaire sample, based on where participants located their home on a map.

A number of variables were selected to test against the active school travel outcome. Age, gender, distance to school, parental control and built environment measures were included. Measures of age and gender are taken as indicated by participants in Maptionnaire. Distance from school was computed using nearest facility network analyst tool in ArcGIS. Students indicated the location of their house within Maptionnaire which was anonymised, analysed in GIS and then reattached to an individual ID number for each respondent's dataset. The parental control variables are taken from the outcome of an agree/disagree statement being, "My parent(s) or caregiver(s) choose how I get to and from school", "My parent(s) or caregiver(s) choose what I do before and after school", and "It is easiest for me to travel with my parent(s) or caregiver(s)". The measure for perceptions of the built environment were measured as a 10-point Likert scale of perceived safety from four key streets either near or bordering Haeata Community Campus (Pages Road, Breezes Road, Hampshire Street and Shortland Street).

Photographs of each streetscape were used in Maptionnaire to familiarise students with the area they were being questioned on (Figure 2).



Figure 2: Images of local streets and roads used in Maptionnaire survey to understand participant’s perceptions of the local environment

3.3.2.2 Analysis

A model of active school travel determinants used data obtained from the student questionnaire as well as distances derived from GIS analysis. All regression was run using SPSS 25. Initially, binary logistic regression models were run for each variable independently to examine the influence of each factor individually on active transport, determining the most influential determinants within this sample. After initial analysis, distance, parental control and built environment measures were the variables determined to be used in the final regression model. Two of the parental control measures (“My parent(s) or caregiver(s) choose how I get to and from school” and “It is easiest for me to travel with my parent(s) or caregiver(s)”) and one built

environment measure (Shortland Street) were determined to be most effective and other parental control or built environment measures were excluded.

Chapter 4: Results

This chapter presents the results of the study. Results are separated into three sections:

1. Geospatial context of local environment
2. School transport patterns of Haeata Community Campus
3. Assessment of environmental determinants of active school travel

The chapter begins with results of geospatial analysis, completed with ArcGIS capabilities. The results present current Haeata Community Campus roll data as well as the four pre-existing schools data. Results are primarily shown visually with heat maps of the density of student residence. Distance to school is also presented and compared across schools and time-points. Accessibility of public transport and cycling infrastructure is presented in this section as overlays on heat maps of Haeata Community Campus population.

Secondly, school transport patterns, determined by a Maptionnaire survey completed with student's year seven and above is discussed. These results expand on what was already determined by the geospatial analysis, providing information on travel mode and behaviour.

Finally, an assessment of environmental determinants of active school travel is presented from logistic regression models of a number of predictor variables. Comments from the questionnaire are also further discussed where participants had opportunity to comment on aspects of the local urban environment and their perceptions.

4.1 Geospatial context of local environment

The first section of results includes summary statistic tables from the network analyst results and visual map representation of the concentrations of student residence from Haeata Community Campus in March 2017 and 2018, as well as the four pre-existing schools in the area (now closed Wainoni School, Avondale School, Aranui Primary School and Aranui High School).

Additional map layers including public transport routes and cycle infrastructure were combined with school roll data to show current proximity and access to active school transport modes.

4.1.1 Concentration of students at pre-existing schools

The concentration of student's residence at pre-existing schools show some similar and contrasting trends to the current situation at Haeata Community Campus. Spatial distribution of student's residence varies, particularly when comparing the three now closed primary schools to the new Haeata Community Campus, where previously primary school students typically lived closer to their school. This indicates a potentially significant change in transport behaviour as a result of the school closures and opening of Haeata Community Campus. The most similar concentration pattern to Haeata Community Campus would be Aranui High School, which as expected for high schools, is more dispersed and far reaching than the three smaller primary schools. There is a trend of heightened concentration for the smallest school, compared to the highest dispersion at Aranui High School, the largest of the pre-existing schools in the suburb of Aranui.

Comparing key distances of pre-existing schools (Table 1) to current Haeata Community Campus distance to school (Table 2), there are some key similarities as well as contrasting findings. The average distance for pre-existing primary schools was between 1 and 1.7 kilometres, while Aranui High School was over 2.5 kilometres. When comparing Haeata

Community Campus students' average distance of approximately two kilometres, it is relatively further than pre-existing primary schools. However, Aranui High School students had a slightly higher average distance and also included the highest proportion of students living 3-4 or over 4 kilometres from school. It would be expected that students who shifted from a primary school to Haeata Community Campus as a result of the amalgamation are more likely to experience greater increase of distance barrier to school. Primary schools are typically more localised than high schools, which is consistent with the patterns observed of pre-existing primary schools compared to Aranui High School.

Table 1: Key summary statistics from Nearest Facility Analysis determining distance each student lives from their school in March 2016.

Averages distance between home and school								
School	Distance (average, m)				Minimum (m)		Maximum (m)	
<i>Wainoni School</i>	1,144.98				151.72		4,683.22	
<i>Avondale School</i>	1,690.49				362.00		8,691.66	
<i>Aranui Primary School</i>	1,640.97				7.37		16,612.82	
<i>Aranui High School</i>	2,557.22				25.80		20,312.94	
Distance buffer measurement between home and school								
	<i>Wainoni School</i>		<i>Avondale School</i>		<i>Aranui Primary School</i>		<i>Aranui High School</i>	
	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>
<1km	47	58.8	60	27.5	59	30.4	136	37.6
1-2km	22	27.5	99	45.4	97	50.0	80	23.9
2-3km	6	7.5	40	18.3	11	5.7	29	8.7
3-4km	3	3.8	5	2.3	19	9.8	40	11.9
>4km	2	2.5	14	6.4	8	4.1	60	17.9
Total (n)	80		218		194		335	

Table 2: Key summary statistics from Nearest Facility Analysis determining distance each student lives from Haeata Community Campus in March 2017 (n=897) and March 2018 (n=749).

Averages distance between home and school								
School	Distance (average, m)		Minimum (m)		Maximum (m)			
<i>Haeata (March 2017)</i>	2,021.54		1.74		20,327.84			
<i>Haeata (March 2018)</i>	1,823.17		24.32		19,169.33			
<i>Year 0-6*</i>	1,488.51		24.32		15,274.75			
<i>Year 7-13*</i>	2,113.59		24.32		19,169.33			
Distance buffer measurement between home and school								
	<i>Haeata (2017)</i>		<i>Haeata (2018)</i>		<i>Year 0-6*</i>		<i>Year 7-13*</i>	
	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>
<1km	335	37.4	305	40.7	155	44.5	150	37.4
1-2km	317	35.3	264	32.3	142	40.8	122	30.4
2-3km	54	6.0	44	5.9	16	4.6	28	7.0
3-4km	100	11.2	62	8.3	16	4.6	46	11.5
>4km	91	10.1	74	9.9	19	5.5	55	13.7
Total (n)	897		218		348		401	

* Analysed by splitting March 2018 Haeata Community Campus data

4.1.1.1 Wainoni School 2016

Wainoni School was the smallest of the four pre-existing schools. It was a full primary (year 1-8) school of decile 1. Key observations include a significant concentration of students residing close to school.

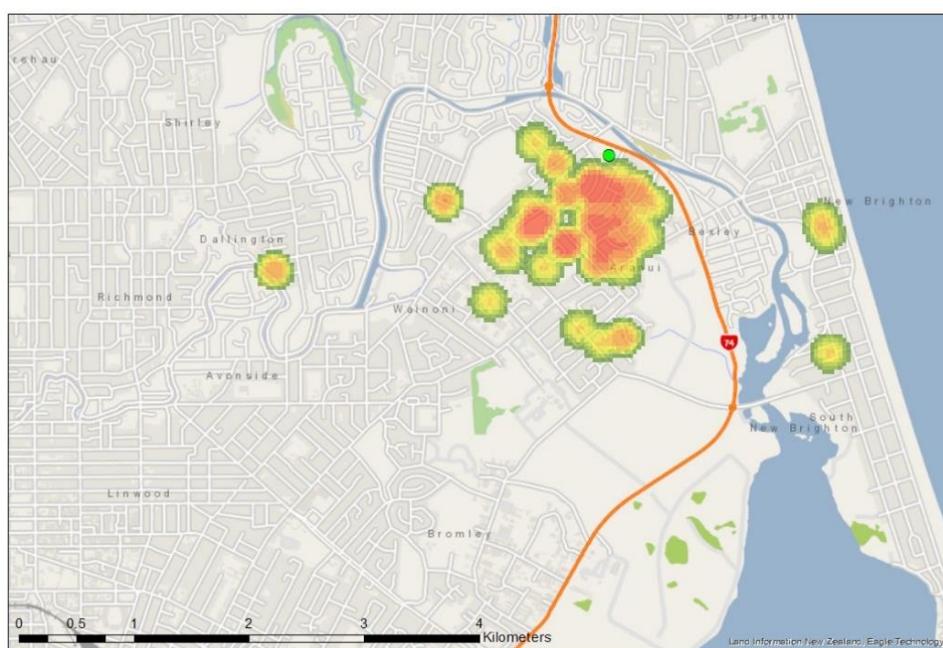


Figure 3: Heat map showing the concentration of Wainoni School students' residence in March 2016, n=80

As in Table 1, 59% of students were within one kilometre of the school. Less than 15% live further than two kilometres, which represents 11 of the 80 student addresses in the dataset. The geographic distribution of these students can be observed in Figure 3, where smaller concentrations are observed further south-west, beyond the key cluster directly south of Wainoni School.

4.1.1.2 Avondale School 2016

Avondale School is another relatively small primary school. Avondale School is defined as a contributing primary school, meaning it catered to year 1-6 students. It had a decile rating of 3. The highest proportion (45.4%) of students reside within the 1-2-kilometre bracket. A very small number of students (19 of 218 students within the dataset) live either 3-4 kilometres, or greater than four kilometres from school. A visual representation of Avondale School student's residence is shown in Figure 4. Key clusters can be observed directly to the north of the school, as well as south-west in the Avondale suburb, and further east in the suburb of Aranui. Student's residence also stretches further south.

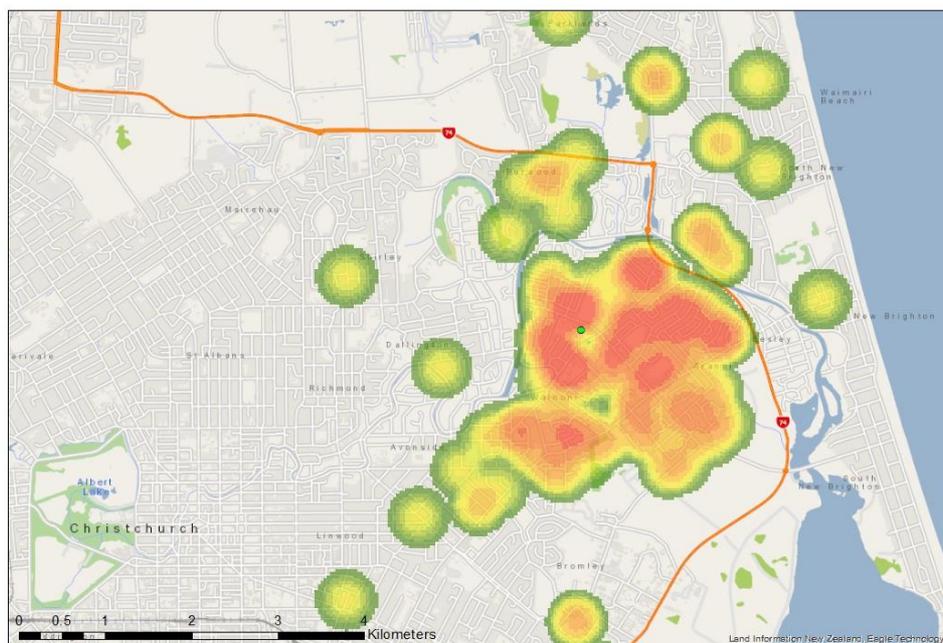


Figure 4: Heat map showing concentration of Avondale School students' residence in March 2016, n=218

4.1.1.3 Aranui Primary School 2016

Aranui Primary School is a full primary school with a decile rating of 1. Similar to the other primary schools in the area in 2016, a large proportion (50%) of Aranui Primary School students live within the 1-2-kilometre distance bracket. Around 15%, a total of 36 students within the dataset, lived further than three kilometres from the school.

Figure 5 represents the geographic distribution of student's residence. Students are predominantly dispersed to the east and south. The key concentration of students is in the area directly surrounding the school.

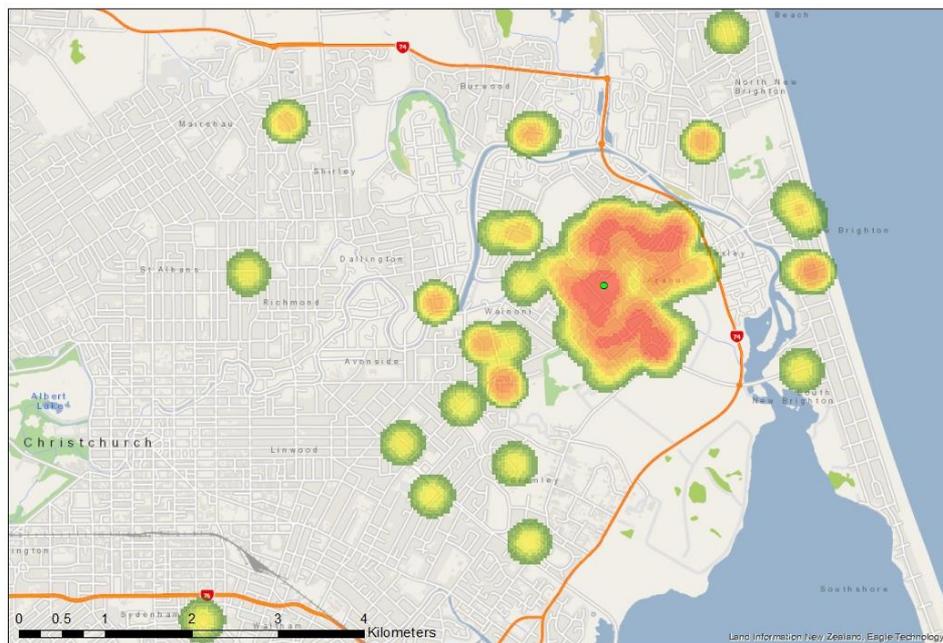


Figure 5: Heat map showing concentration of Aranui Primary School students' residence in March 2016, n=348

4.1.1.4 Aranui High School

Aranui High School is the largest of the four pre-existing schools studied. With a total of 335 points. The students of Aranui High School were relatively more dispersed than the other pre-existing schools, which were all primary schools. While a significant proportion and number of students did reside within one kilometre of Aranui High School, the proportions within the 3-4 kilometre, and over four-kilometre bands are relatively high compared to the old primary schools. The proportion of students residing more than three kilometres from the Aranui High School campus was 29.8%.

A visual representation of these students is shown in Figure 6, where the most significant concentration of student residence can be observed in the area surrounding Aranui High School and to the north. Students are also relatively concentrated in areas further south such as Avonside and Linwood, as well as along the coast in New Brighton. In contrast to the pre-existing primary school student's residence, Aranui High School has some students residing in significantly distant suburbs of Christchurch, shown by some of the smaller pockets of concentration to the west of Aranui High School in Figure 6.

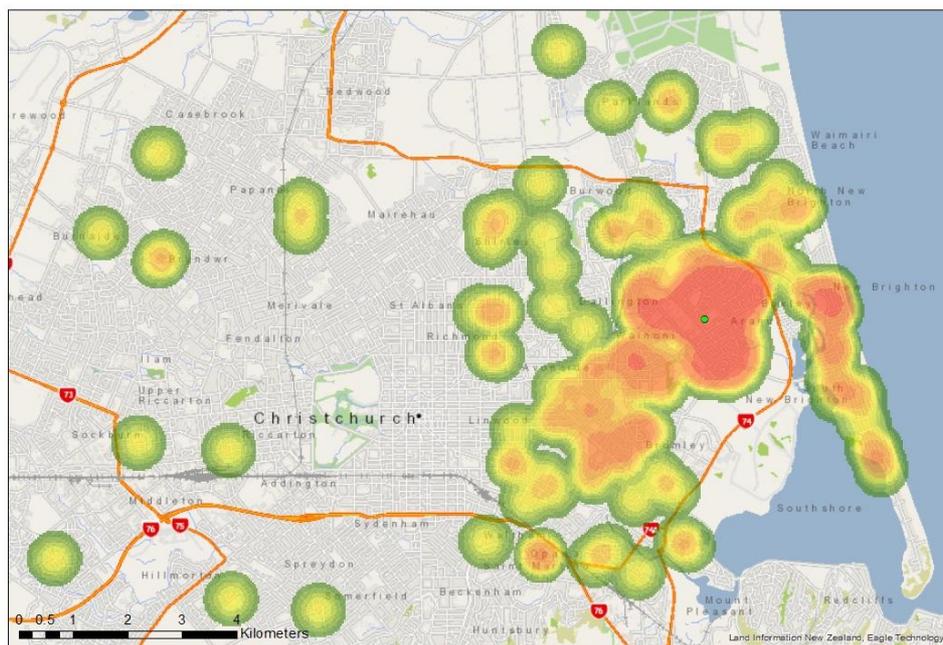


Figure 6: Heat map showing concentration of Aranui High School students' residence in March 2016, n=401

4.1.2 Concentration of Haeta Community Campus students

4.1.2.1 Distance to school

The concentration of Haeta Community Campus students in March 2017 and March 2018 were discussed in Section 4.1.1, and Table 2. Results are relatively similar between March 2017 and March 2018. A key difference is the reduction in total student roll of Haeta Community Campus between the two data time-points. The absolute loss of students between 2017 and 2018 was around 150, which is reflected in the dataset, having similarly less data points in March 2018 than March 2017.

From the most recent data (March 2018, included in Table 2) the highest proportion of students live within one kilometre of Haeata Community Campus (40.72%), with a slightly lower proportion living between one and two kilometres (35.25%). The proportion of students residing over two-kilometres from school reduced between 2017 and 2018. The number of students changed from 245 to 180 students living more than two-kilometres (27.31% and 24.03% respectively).

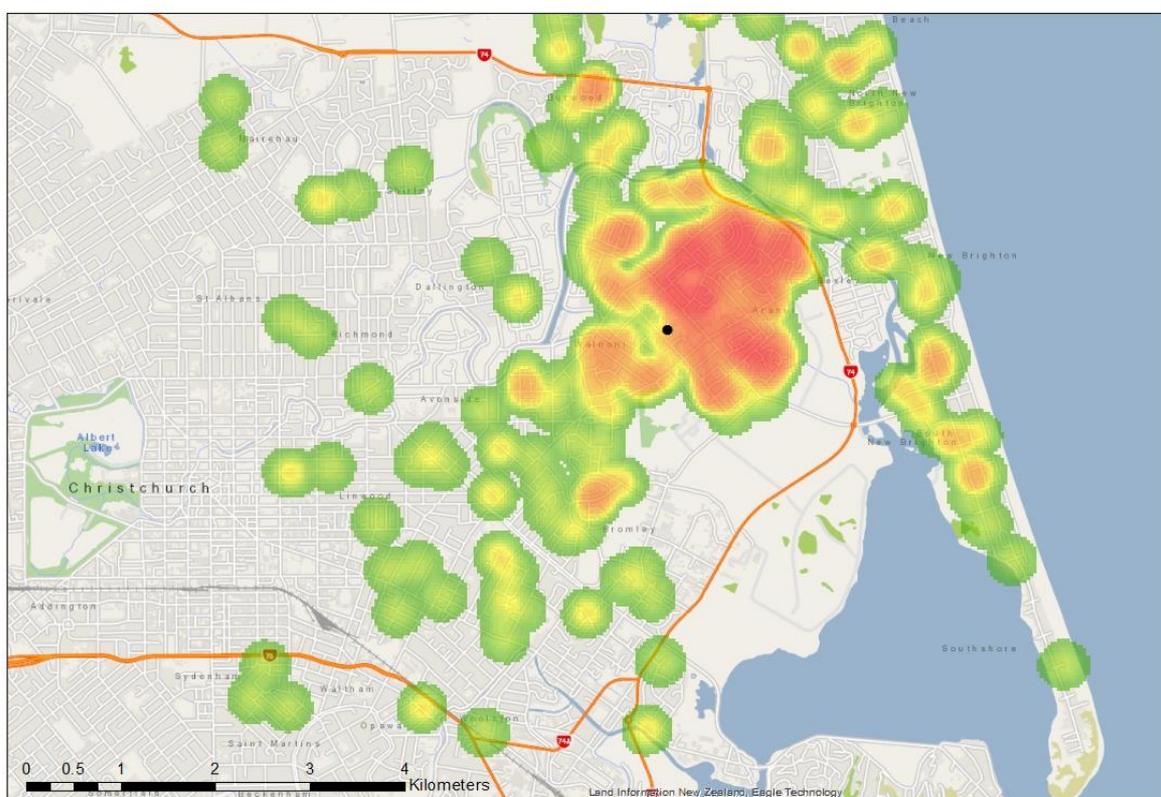


Figure 7: Heat map showing concentration of Haeata Community Campus students' residence in March 2018, n=749

As per Figure 7, key concentrations are located to the north-east of Haeata Community Campus, in the area bordered by Pages Road, Breezes Road, Wainoni Road, and New Brighton Road. Another concentrated group of students can be observed to the south-east of Haeata Community Campus. Less concentrated groups of students are located south-west towards Avonside and Linwood, along the coast of New Brighton, and north towards Burwood and Parklands.

4.1.2.2 Accessibility of public transport and cycling infrastructure

Figure 8 shows the two public transport routes which best service Haeata Community Campus, overlaid on the concentration of Haeata Community Campus students in 2018. The two routes travel between the eastern and western suburbs of Christchurch via the Central City. Table 3 represents the proximity and access to key public transport routes that service Haeata Community Campus from student's home addresses. There are a number of students who live a significant distance from a bus stop on the two chosen routes, with majority living within 500m -1 kilometre of either the 80 or Yellow Line bus. The closest stops to the school are on parallel major roads to the north-west and south-east of Haeata Community Campus. Neither of the bus routes travel down the roads perpendicular which pass by the main entrance ways to the school.

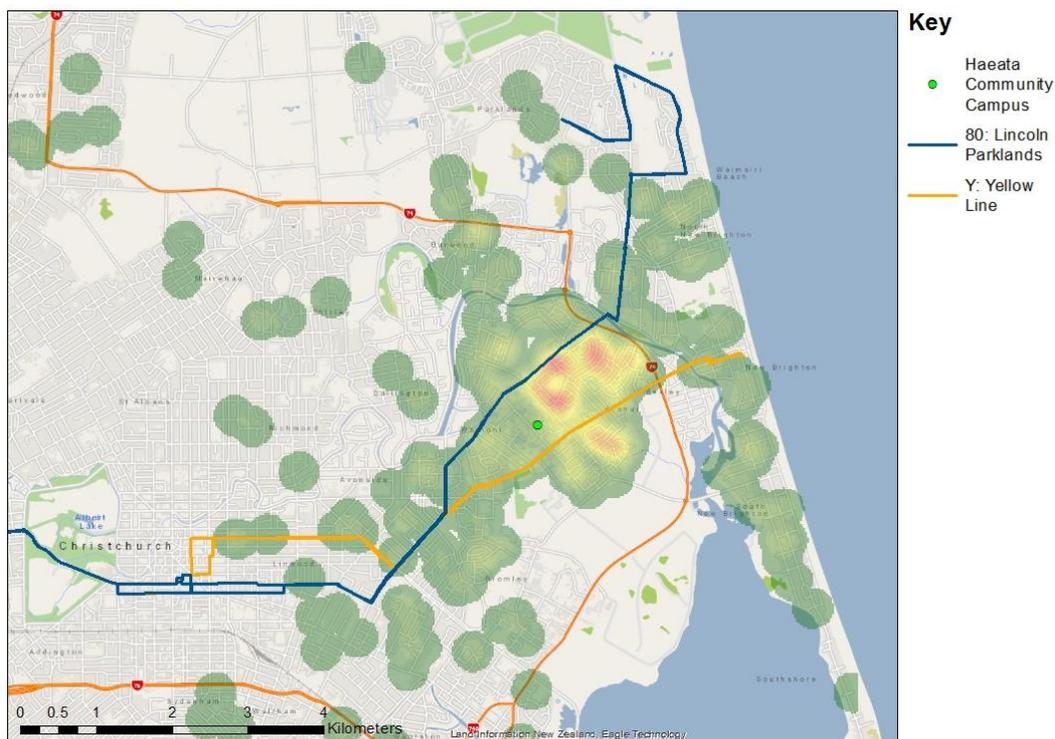


Figure 8: Public transport routes accessible to Haeata Community Campus students overlaid on a heat map of concentrations of students' residence.

Given the nature of the data, it cannot be determined whether the bus stop that students are nearest to is running in the direction towards Haeata Community Campus, however, bus stops going either way are usually within close proximity in Christchurch. From these results, it could

be possible that access to relevant bus stops and services is less than optimal for some students, specifically due to distance barriers. However, without knowledge of usage patterns, it is difficult to conclude that public transport is not utilised by Haeata Community Campus students.

Table 3: Proximity by distance to bus stops on two key public transport lines near Haeata Community Campus

Distance		80: Lincoln – Parklands	Y: Yellow Line
<500m			
	%	21.9%	27.37%
	n	164	205
500m-1km			
	%	30.84%	43.39%
	n	231	325
1km-1.5km			
	%	19.89%	8.81%
	n	149	66
1.5km-2km			
	%	13.22%	6.81%
	n	99	51
>2km			
	%	14.15%	13.62%
	n	106	102

Cycling infrastructure is shown in Figure 9 which depicts the proximity and level of safe accessible cycling near Haeata Community campus. The cycleways are colour-coded to represent one of three types of infrastructure; cycleways, shared paths and cycle lanes. The first two are separated from the roadway, with shared paths being designed to be used by pedestrians and cyclists. Cycle lanes are generally a designated strip of roadway, typically the least safe of all three types of infrastructure.

Key observations from Figure 9 is the lack of cycling infrastructure compared to most other parts of Christchurch. The grey routes shown in Figure 9 indicate that of the minimal cycling infrastructure in Aranui and near Haeata Community Campus, there are only cycle lane options, with no shared paths or cycleways creating a safer and more accessible cycling route nearby.

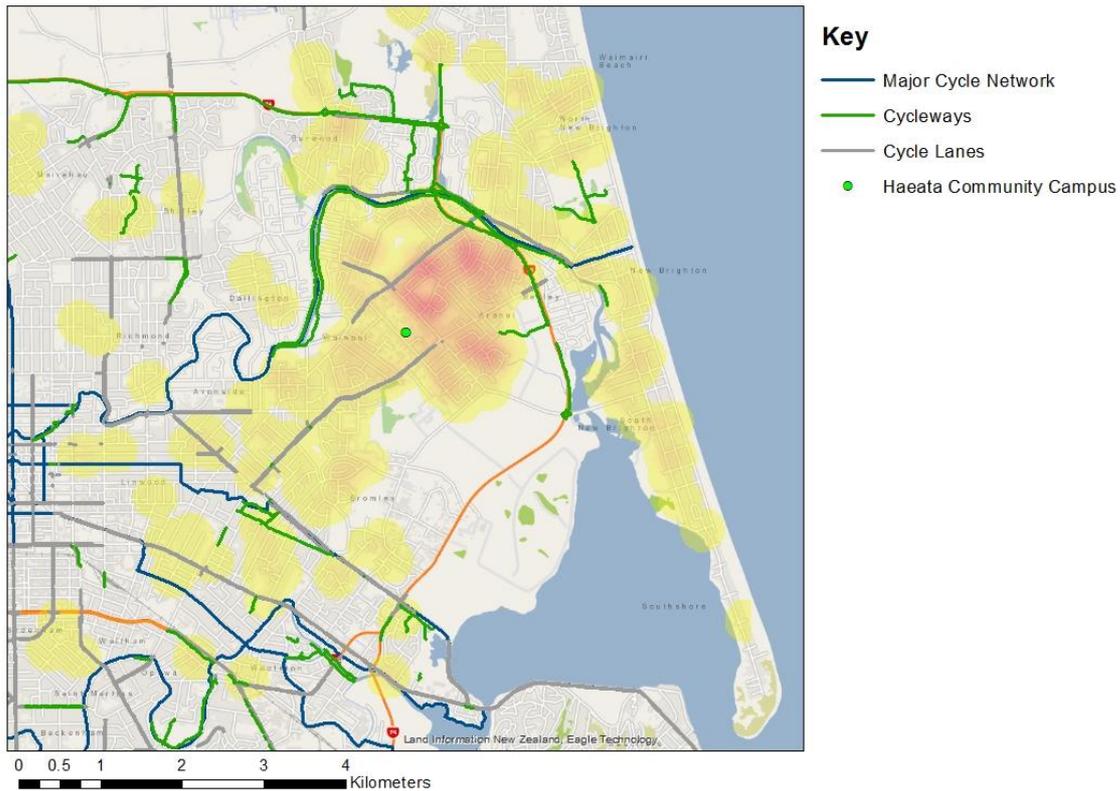


Figure 9: Christchurch cycle routes by type, overlaid on heat map of Haeata Community Campus concentration of students' residence.

4.1.3 Summary

Results of the geospatial analysis raise some intriguing questions regarding transport to and from Haeata Community Campus. Compared to pre-existing primary schools, Haeata students are more dispersed, however there is still a significant proportion of students (75%) residing within two kilometres of the school. A previous study within Christchurch found distance to school for high school students is typically higher on average, compared to these findings (Devonport, 2017) offering significant opportunity for active travel. Younger students on average, are located closer to Haeata Community campus than older students, similar to circumstances pre-amalgamation. Pre-existing primary schools were significantly more localised than Aranui High School. The overlay of alternative transport patterns including public transport and cycling infrastructure indicates relatively less access to safe active transport, particularly compared to other areas in Christchurch. These findings have given

significant insight to key stakeholders including local council and transport authority, emphasising the power of geospatial analysis, particularly for understanding school roll data. The significant proportion of students found to live within two kilometres of school has been particularly significant for these stakeholders. The next section of results explore school travel patterns, using knowledge of the average distance to school to understand what barriers and enabler may exist to incentivise active school travel.

4.2 School travel patterns of Haeata Community Campus

Building on the results of the geospatial analysis, the questionnaire seeks understanding of transport patterns from students themselves. As a key limitation of GIS is the lack of human perspective and lived experience. This questionnaire effectively complements the results in Section 4.1. The questionnaire gives meaning to the concentrations observed for Haeata Community Campus students.

The response rate was a total of 79 responses, representing around 17% of Haeata Community Campus year 7-13 students. This was a lower than expected response rate. However, it reflects the challenges of engaging in such a community and only further exemplifies the need to understand communities that differ from predominant New Zealand Pākeha culture. As highlighted previously, the bicultural nature of New Zealand creates a unique societal context to work within. The challenges of this survey highlights a key challenge of the entire research process, being the need for research design that suits the culture of the population. The Maptionnaire survey could certainly have been worked into the school, community and culture in a number of different ways to the present study's approach.

This section begins by highlighting the demographic characteristics of the sample, with comparison to the school population. Following this, the transport patterns of respondents, including modal share and companionship are described and trends discussed. Finally, the results of network analysis from recorded Maptionnaire data determines the distance from school for the sample compared to the population school roll data. This reflects how representative the Maptionnaire sample may be of the total population, and how it could predict mode choice using known distance data.

4.2.1 Demographic of participants

The socio-demographic characteristics of the Maptionnaire survey respondents is shown in Table 4. Response data is displayed next to data of the total population to give a basic indication of the characteristics of the population that this sample was taken from. It is important to note that the questionnaire results are not directly comparable to the total population as their method of selection for ethnicity in particular was likely different to the survey. Students below year 7 (usually age 11 years) were intentionally excluded from the questionnaire, to focus on older youth and ensure a reasonable level of reading comprehension for the questionnaire. A total of 25 (31.6%) females, and 36 (51.4%) males completed the questionnaire, with nine participants selecting either *other*, or *I don't want to say*.

In regard to some differences between the sample and population, the age of the sample over-represents the 14-17 year old age group. Most participants were in their early teens (i.e. 13-15 years old). Also, a relatively high number of participants selected European as their ethnicity. Given that there are 16 people of European ethnicity at the school, and 11 completed the survey, it is likely that some students confused NZ Pākehā with European. While still acknowledging that the selection method of ethnicity in the sample and population dataset may have been different, there are still low absolute numbers of NZ Māori and Pasifika participants. This reflects the trend of ethnicities aside from NZ Pākehā being under-represented in many studies and engagement opportunities in New Zealand. Interestingly, the gender split of participants does not reflect the typical outcome of questionnaires, where female participants usually make up a slightly larger proportion. There are more male students in the population which could be the explanation for this finding, however it is not certain.

Table 4: Summary of demographic characteristics of Maptionnaire survey sample, n=79

	Participants (n)	Participants (%)	Total population (n)	Total population (%)
<i>Age (excluding all under 11yrs/year 7)</i>				
18 and over	2	3.85	8	2.09
14-17	35	67.31	203	53.00
11-13	15	28.85	172	44.91
Total*	52	100	383	100
<i>Ethnicity</i>				
NZ Pākehā	32	35.56	225	30.08
NZ Māori	26	28.89	355	47.46
Pasifika	5	5.56	122	16.31
Asian	4	4.44	29	3.88
European	16	17.78	11	1.47
Other	7	7.78	6	0.80
<i>Gender</i>				
Male	36	51.43	401	53.90
Female	25	35.71	343	46.10
I don't want to say	6	8.57	-	-
Other	3	4.29	-	-

*Note: Questions were not compulsory to answer, therefore not all participants gave demographic information

4.2.2 School transport patterns

4.2.2.1 Usual travel behaviour recall

This section describes participant's responses when asked to recall their usual school transport mode and their travel companions. The question included a scale of 'almost every day' to 'never' for each mode of transport in order to encompass travel behaviour that were non-exclusive to one particular mode. Questions of before and after school behaviour were asked separately, acknowledging young people's tendency to have various after school activities, commitments and independence. From the results, most participants will exclusively almost always walk or travel by car to and from school (Figure 10). Indications of occasional use for transport modes ('sometimes' or 'rarely' responses) was relatively consistent across all, with the highest proportions of occasional use recorded for car and walking. A small proportion of participants indicated occasional bike and public transport use. However, responses showed a high number of students stating they never travel using bus, scooter/skateboard, or cycle.

Overall, typical school travel seems to involve walking or transport by car, some using public transport, and very few utilising bikes, scooters or skateboards.

The split of mode share for walking is higher than previously recorded rates in New Zealand (Ministry of Transport, 2017a), and Christchurch specifically (Oliver et al., 2014), where walking has recently been estimated closer to 15% of trips (compared to 37% of the present sample). Possible explanation for this difference could be attributed to a number of factors. For example, individuals from low socio-economic areas typically have higher walking uptake than those in the least deprived areas (Turrell et al., 2013). The high proportion of students living less than two kilometres of school may also be the reason for higher than usual walking rates. Determinants of active travel are explored further on in Section 4.3.

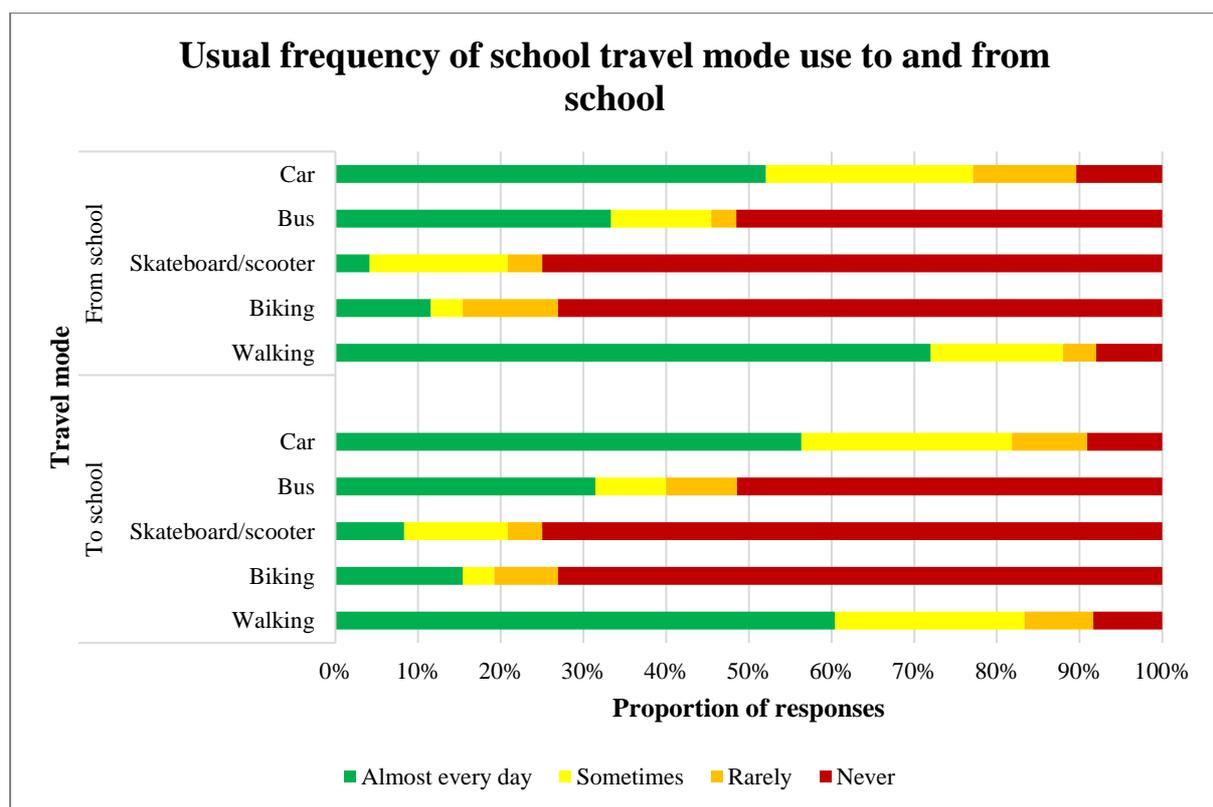


Figure 10: Usual travel mode to and from school by frequency of use

In regards to school travel companionship, most students travelled alone or with family members, compared to with friends. Results also suggest that some respondents travel with family to school, but alone on the journey home (Table 5). Trends in journey companionship

from this sample is a potentially interesting contrast to some literature which suggests school travel (particularly active and public transport) can be a significant social opportunity for young people. Youth may choose their travel mode based on a number of social factors, including how their friends get to school and how they could hang out with their friends on the way to and from school (Frater & Kingham, 2018; Jones et al., 2012; Mandic et al., 2015).

Table 5: Usual travel companion to and from school, as indicated by participants of Maptionnaire survey.

Usual travel companion	To school		From school	
	n	%	n	%
Alone	24	25.81	33	33.67
With parent(s)/caregiver(s)	27	29.03	22	22.45
With siblings	32	34.41	30	30.61
With friends	10	10.75	13	13.27
Total	93	100	98	100

4.2.2.2 Most recent travel behaviour recall

Participants were asked to state which mode of transport they used when they last came to school, and from school. Often in surveys, bias can occur when asking participants of their usual actions, where they may answer according to how they think will reflect best on them. In the instance of this survey, there was very little difference between how students said they usually travel, and their recall of most recent travel mode. Results of to school travel mode is presented in Figure 11. Car (44.59%) and walking (37.84%) were the most common responses from participants for travel mode to school. There were some slight differences in pre and post-school travel patterns, potentially suggesting some students are dropped off in a car before school, and walk home after school, matching literature on parental working schedules (Builing et al., 2009). Biking and scooter/skateboard use makes up the smallest mode share of this sample. A potential contributing factor of this trend could be the economic cost of owning a bike/scooter/skateboard.

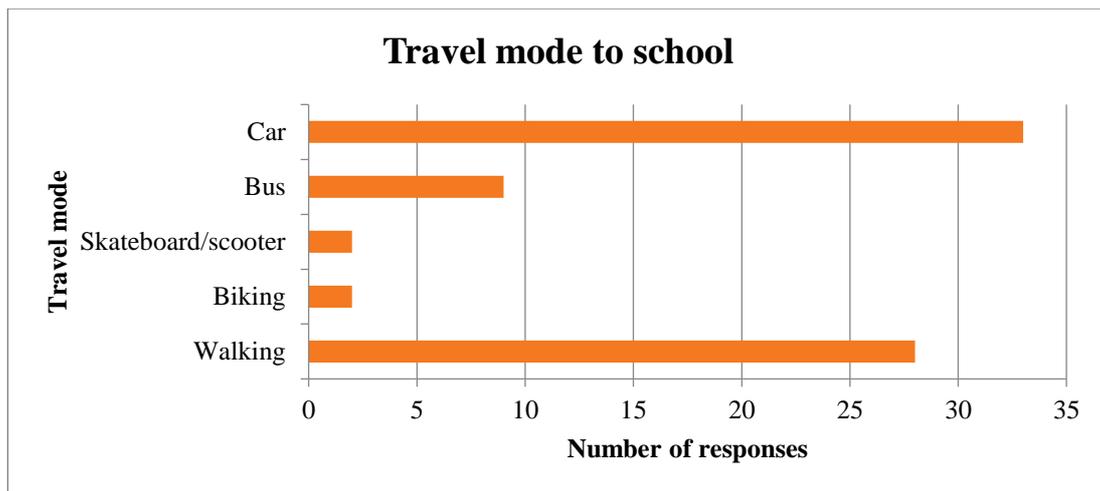


Figure 11: Most recent travel mode used getting to school. Response to Maptionnaire survey question: Thinking about the last time you came to school, how did you get to school? n=74.

4.2.2.3 Distance from school

Students were asked to locate their home on a map embedded into the Maptionnaire survey. A total of 45 respondents chose to do so. The relatively low number of participants completing this aspect of the survey limits the strength of analysis to look at distance by mode, but provides insight not gained in the initial geospatial analysis. These responses were analysed the same as the school roll data using ArcMap Network Analysis functions. Figure 12 is a heat map showing the distribution of respondents, next to a smaller version of roll map data of the entire school population. The spatial representation of students in the sample is relatively accurate with similarly located concentrations of the population, despite the small sample size.

Summary statistics of the network analysis are included in Table 6, including comparison of average distance measures to the entire population, as well as separation of the roll map data by age (Primary aged versus Secondary School age) to make the data from the sample more comparable. Students aged 10 years and younger were excluded from participating in the Maptionnaire survey to ensure participants fully comprehend questions.

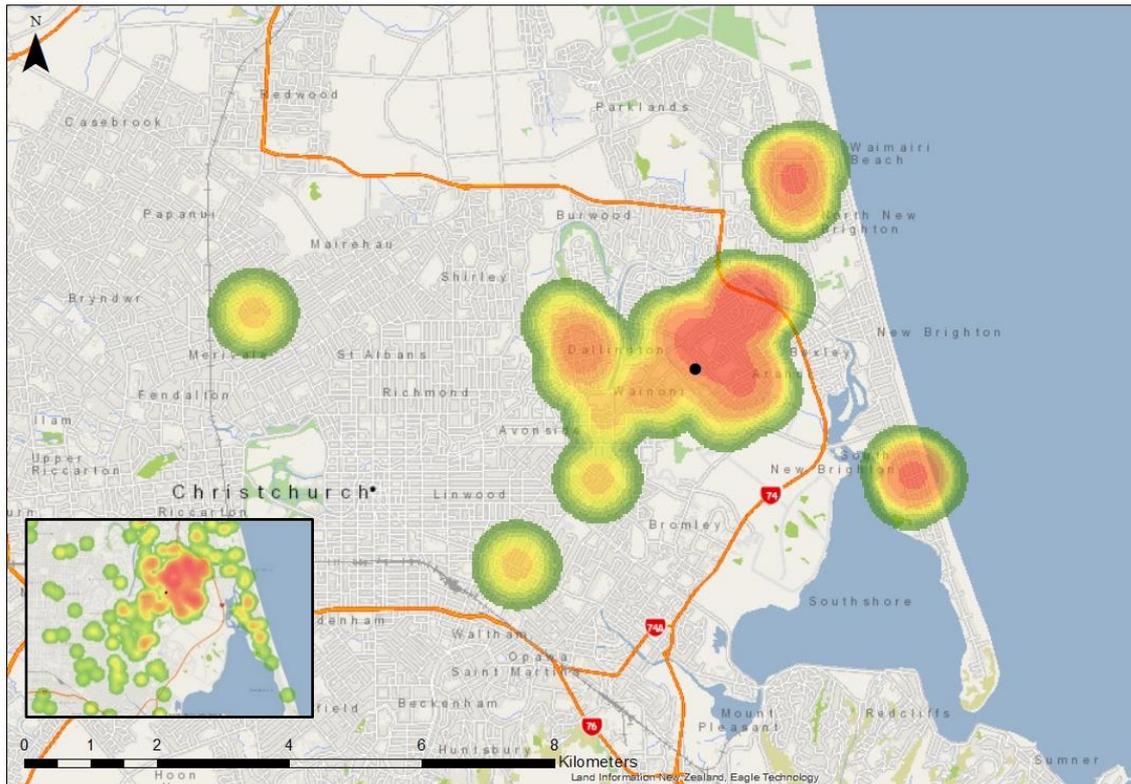


Figure 12: Heat map of the concentration of students' residence from Maptionnaire survey respondents, n=45. Smaller insert represents concentration of Haeata Community Campus (March 2018) population for comparison.

The average distance of the sample is slightly higher than the findings from the population roll data. This suggests there may be an underrepresentation within the sample of students who live particularly close to school. However, the sample averages are by and large quite similar, suggesting relatively good representation. This can also be observed in Figure 12.

It was hypothesised that younger primary aged students typically live closer to their school than secondary aged students, who are the population this sample is taken from. This may be the key explanation of the higher averages found in the sample. When year 0-6 and 7-13 students were separated in the roll data, lower average distance was found for younger students (mean distance of 1.49km compared to 2.11km year 7-13), supporting this hypothesis.

Distance between home and school was separated by transport mode since this was known for the sample. A considerable absolute difference in mean distance (3.27 kilometres) for those

travelling by car versus those walking was found. Another finding worth noting is the minimum and maximum distance recorded for active and non-active travellers. An individual walking to school lives as far away as 3.77 kilometres away, which is a considerable distance to walk. Also, a student living less than 800 metres from school is travelling by car. For the majority of individuals, this distance should be easily walkable. This indicates factors aside from distance are a significant determinant in this case.

Table 6: Summary statistics of network analysis results for Maptionnaire survey sample compared to population, and population separated by age.

Averages distance between home address and school						
School		Distance (mean, km)	Minimum (km)	Maximum (km)		
<i>Maptionnaire sample*</i>		2.69	0.12	15.24		
<i>Haeata (all students)</i>		1.83	0.02	19.17		
<i>Haeata (year 7-13)</i>		2.11	0.02	19.17		
<i>Haeata (year 0-6)</i>		1.49	0.02	15.27		
Distance buffer measurement between home and school						
		< 1km	1-2km	2-3km	3-4km	>4km
<i>Maptionnaire sample*</i>						
	%	31.11%	28.89%	2.22%	15.56%	22.22%
	<i>n</i>	14	13	1	7	10
<i>Haeata (all students)</i>						
	%	40.72%	35.25%	5.87%	8.28%	9.88%
	<i>n</i>	305	264	44	62	74
<i>Haeata (year 7-13)</i>						
	%	37.4	30.4	7.0	11.5	13.7
	<i>n</i>	150	122	28	46	55
<i>Haeata (year 0-6)</i>						
	%	44.5	40.8	4.6	4.6	5.5
	<i>n</i>	155	142	16	16	19

Note: All Haeata Community Campus data taken from March 2018 roll dataset
 * Maptionnaire Sample inclusive of year 7-13 only

Table 7: Average distances to school for Maptionnaire survey sample, separated by active (walking) and non-active (car) mode.

Average distance from home to school for active vs non-active school travellers				
	<i>Mean (km)</i>	<i>Median (km)</i>	<i>Maximum (km)</i>	<i>Minimum (km)</i>
Active	1.07	0.96	3.77	0.32
Non-Active	4.34	3.50	15.3	0.73

4.2.2.4 Modelling active transport with known distance data

The distance between home and school, as well as mode choice is known for 38 participants. Using this knowledge, the mode share of the Haeata Community Campus population is predicted by distance bands (i.e. how many students within one kilometre would use active transport given the sample is 100% representative?). The purpose of this basic model of school travel patterns is to determine the likely patterns of travel across the population. As per Table 8, a significant distance decay is observed, where the proportion of students travelling by car increases substantially as soon as the distance is above one kilometre, and becomes a vast majority beyond two kilometres. From these results, it highlights the opportunity to encourage and promote active travel up to two kilometres, for the 80 students who are predicted to use a private vehicle for school travel within this distance band.

Table 8: Prediction of population travelling by active or non-active travel in a range of distance bands, as suggested by Maptionnaire survey sample findings.

Modelling active transport of Haeata Community Campus population (year 7-13)						
	< 1km		1-2 km		> 2km	
	<i>AT</i>	<i>Car</i>	<i>AT</i>	<i>Car</i>	<i>AT</i>	<i>Car</i>
Sample (%)	90.91%	9.09%	46.15%	54.85%	7.15%	92.85%
Sample (n)	10	1	6	7	1	13
Predicted (n)	136	14	56	66	9	120

4.2.3 Summary

The results in this section predominantly focus on the data recorded by the Maptionnaire survey completed by students. The current modal share as indicated by the sample includes relatively similar share between walking and cycling (approximately 35% each) and very little utilisation of any alternatives (i.e. cycling, scooter/skateboard or public transport). Comparison of average distances shows the sample is reasonably representative of the population of year 7-13 students at Haeata Community Campus. Once the population data is separated by year level, a relatively strong difference in primary-aged versus secondary-aged students is observed, where younger students appear to be a smaller distance from school than older students.

Using spatial data from Maptionnaire, a clear difference in distance between active and non-active travel users is apparent. Active travel users from the sample live on average, 3.27 kilometres closer to school than non-active travellers. Modelling the statistics to the entire population, shows a strong distance decay, where the proportion of active travel substantially declines beyond a distance of one-kilometre from school.

4.3 Assessment of environmental determinants of school travel patterns

A number of factors interact and correlate with the likelihood of active school travel, with many studies in agreement that school travel behaviour is a complex issue with social, economic, and environmental impacts of various scales (personal, local, national) contributing to overall patterns and trends (Curtis et al., 2015). According to relevant existing literature, one of the most significant predictors of active travel is distance, with a sharp distance decay gradient found in Millward et al.'s (2013) study. This is consistent with findings of the basic distance model discussed in Section 4.2. In acknowledging that active travel is usually the result of many factors confounding to create an encouraging environment, the following results delve into personal socio-demographics, local characteristics and environmental features that may determine active travel as the dominant outcome for the sample of Haeata Community Campus students.

This section firstly describes findings from analysing measures derived from the questionnaire to understand active travel. Using logistic regression, variables were tested for relationship with the likelihood of active travel as the outcome. Following discussion of the model, some additional Maptionnaire survey data is discussed including students open-ended question responses which suggest a number of factors affecting their personal school travel behaviour. The final part of this section presents the spatial data recorded by the Maptionnaire survey of spaces and places that participants 'like' or 'dislike' in Aranui and their reasons for respective indications.

4.3.1 Logistic regression models

Logistic regression was used to determine the strongest correlates of active school travel from the Haeata Community Campus sample. The variables chosen to test against active travel were distance, age, gender, ethnicity, parental control, perceptions of the local environment, described by Table 9. All variables were collected in the student questionnaire.

Initial logistic regression of each variable determined any variables that had minimal influence on active travel, therefore excluding them from the multi-variable logistic regression. The variables deemed to have no influence on the likelihood of active travel in this sample were age, gender, and measure two of parental control ('My parent(s) or caregiver choose what I do before and after school'). The descriptive statistics in Table 9 reflect the minimal difference between these variables for active or non-active travel. Ethnicity was also excluded because the participant responses are not exclusive to one single ethnicity making it difficult to include accurately in the model. There are also very few respondents representing Pasifika, Asian and other ethnicities, making it difficult to assume any differences in those groups is significant. Similarly with age, very few respondents from each age category may be a contributor to the poor fit of logistic regression with active travel, making it an unlikely predictor.

The variables used in multivariate analysis were determined by their individual fit with active travel in logistic regression. Distance from school, measure one and three of parental control ('Parent(s) or caregiver choose how I get to and from school' and 'Easiest to travel with my parent(s) or caregiver'), and measure four of the built environment (Shortland Street) were used in the final multivariate model. While averages in the built environment measures were not significantly different, the variable was included as it is deemed a significant aspect of the study.

Table 9: Summary statistics of potential determinants of active travel to be used in logistic regression model

Summary of variables used for determinants of active transport model									
		NZ							
		Pākehā	NZ Māori	Pasifika	Asian	European	Other		
Ethnicity	Active Travel (%)	50.00	50.00	0.00	33.33	60.00	25.00		
	Non-Active Travel (%)	50.00	50.00	100.00	66.67	40.00	75.00		
	Total (n)	22	24	4	3	15	4		
						Male	Female		
Gender	Active (%)					45.45	50.00		
	Non-Active (%)					54.55	50.00		
	Total (n)					22	28		
		11yrs	12yrs	13yrs	14yrs	15yrs	16yrs	17yrs	18 and over
Age	Active (%)	20.00	66.67	50.00	66.67	33.33	50.00	66.67	0.00
	Non-Active (%)	80.00	33.33	50.00	33.33	66.67	50.00	33.33	100.00
	Total (n)	5	3	6	6	6	12	6	2
		Measure 1*		Measure 2**		Measure 3***			
		Agree	Disagree	Agree	Disagree	Agree	Disagree		
Parental Control	Active (%)	29.03	63.33	46.34	50.00	20.00	80.00		
	Non-Active (%)	70.97	36.67	53.66	50.00	80.00	20.00		
	Total (n)	31	30	41	18	35	25		
		* My parent(s) or caregiver choose how I get to and from school							
		** My parent(s) or caregiver choose what I do before and after school							
		*** It is easiest for me to travel with my parent(s) or caregiver							
		Measure 1*	Measure 2**	Measure 3***	Measure 4****				
Local built environment	Active	6.36	7.00	6.40	6.88				
	Non-Active	7.03	6.97	6.36	7.41				
	Total (n)	62	62	62	62				
Distance	Note: Built environment measures based off responses to “How safe do you feel walking or hanging out in these streets?” in a scale of 1-10 (1=least safe, 10=most safe). Average (mean) score reported in this table.								
	* Pages Road								
	** Breezes Road								
	*** Hampshire St								
	**** Shortland Street								
		Mean* (km)	Median (km)	Minimum (km)	Maximum (km)				
Distance	Active	1.074	0.96	0.32	3.77				
	Non-Active	4.342	3.50	0.73	15.30				
		*Note: difference of mean distance to school for active and non-active travel (3267.81 metres) was significant t (29) = 2.995, p<.05.							

Table 10 shows the results of multivariate regression for three variables (distance, parental control, and perception of the local environment). The only variables that had a significant correlation to active travel were distance and parental control.

Table 10: Logistic regression model results, testing the relationship between local environment variables and the likelihood of active travel

		95% CI for Odds Ratio			
		B(SE)	Lower	Odds Ratio	Upper
Included					
	Constant	4.266 (3.078)			
Model 1	Distance	-0.001 (0.00)	0.998	0.999	1.000
	Parental control (Measure 1)	-3.658 (1.573)*	0.001	0.026	0.562
	Parental control (measure 2)	-1.772 (1.369)	0.170	0.170	2.488
	Built environment	0.020 (0.271)	0.599	1.020	1.736

Note: $R^2 = .04$ (Homer and Lemeshow), $.55$ (Cox & Snell), $.74$ (Nagelkerke). Model $\chi^2(1) = 23.489$, $p = 0.000$.
* $p < 0.05$

4.3.2 Preferred mode

In the Maptionnaire survey, participants were asked; if they could change how they get to and from school, whether they would want to travel by a different mode than their current usual mode. From Figure 13, there is a clear indication of very little desire to switch to active school transport or sustainable modes of transport (i.e. public transport). Of those who selected car as their preferred choice of school travel mode, five indicated their usual travel mode was walking, and four indicated their usual mode was bus. Respondents who indicated they would not change anything about their transport mode were 45% (20 respondents) car users and 39% (17 respondents) walkers.

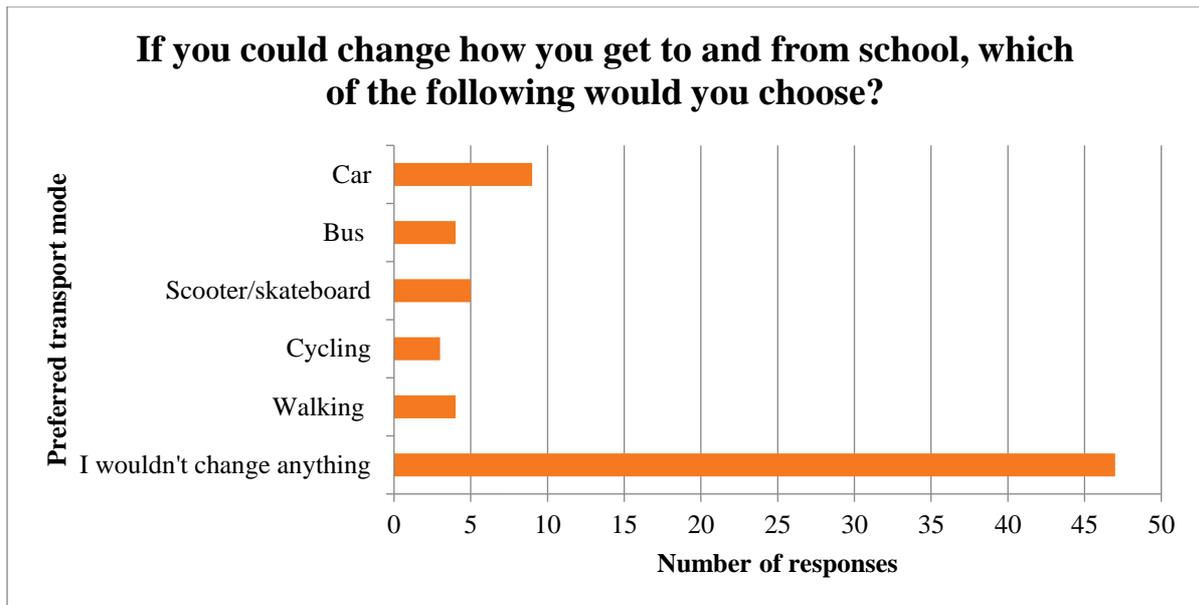


Figure 13: Students response by transport mode for whether they would make any changes to their transport patterns n=72

A total of 22 respondents answered a follow up question of why they would prefer their selected mode. Responses varied considerably, with participants commenting on a range of preferred travel modes. A couple of respondents indicated a desire to drive, with the main barrier being unable to access a vehicle, and/or lack of licence.

“I don't own my own car or have a license” – Car preferred mode

Time and distance constraints were mentioned as a key motivator for choosing one mode over another for several participants.

“I feel lazy getting driven but my house is far so thats why i wouldn't mind busing so i could take my time” – Bus preferred mode [sic]

“busing takes to [sic] long compared to going home in a car” – Car preferred mode

“busy parents and they leave either before or after us” – Car preferred mode

Some participants who indicated preference for cycling or scooter/ skateboard suggested a number of reasons for this choice, including perceived greater enjoyment, lack of actual bike/scooter/skateboard, and faster than walking.

4.3.3 Local urban environment

This section presents responses to aspects of the Maptionnaire survey that asked participants to consider the level of safety on key streets surrounding Haeata Community Campus, and positive and negative aspects of their local neighbourhood. Respondents were asked to use the mapping tools embedded in Maptionnaire to identify places they do or do not like to travel to or hang out in. These places are mapped in Figure 14 and Figure 15.

In Figure 14, clusters exist around the school and to the north around Hampshire Street where a group of shops and park are located. One further group of points are located at the northern end of Hampshire Street. Another concentration of points further south of Haeata Community Campus relates to Eastgate Shopping Centre which is a moderately sized mall with the Linwood Library and Service Centre included. Other points are randomly located across the suburb. Some were clarified in comments to be houses of participants, relatives and friends.

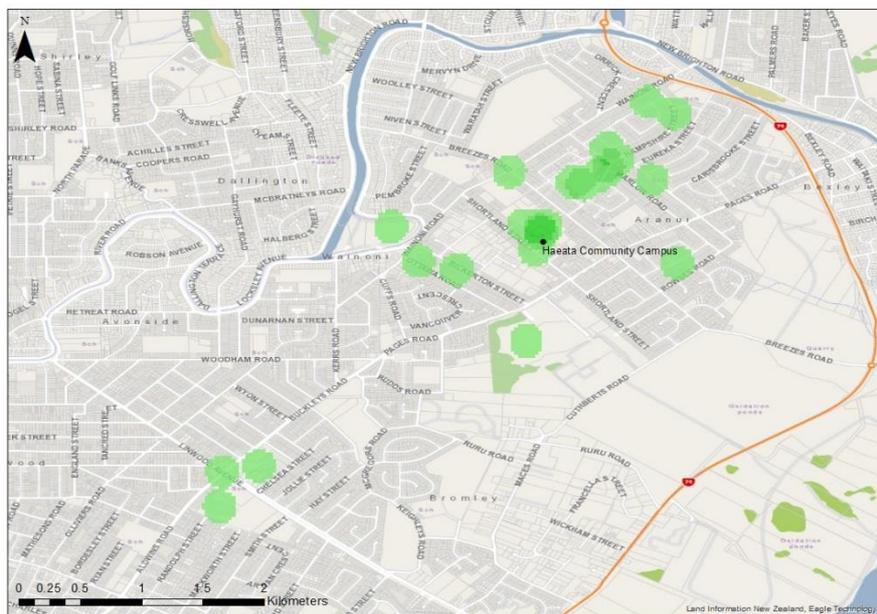


Figure 14: Map showing areas near Aranui identified as positive by Maptionnaire survey respondents, n=31

In Figure 15, one cluster is located at Haeta Community Campus. Other key points located on the map include Hampshire Street near the shops and park, as well as the northern end of Hampshire Street and some other random locations around Aranui.

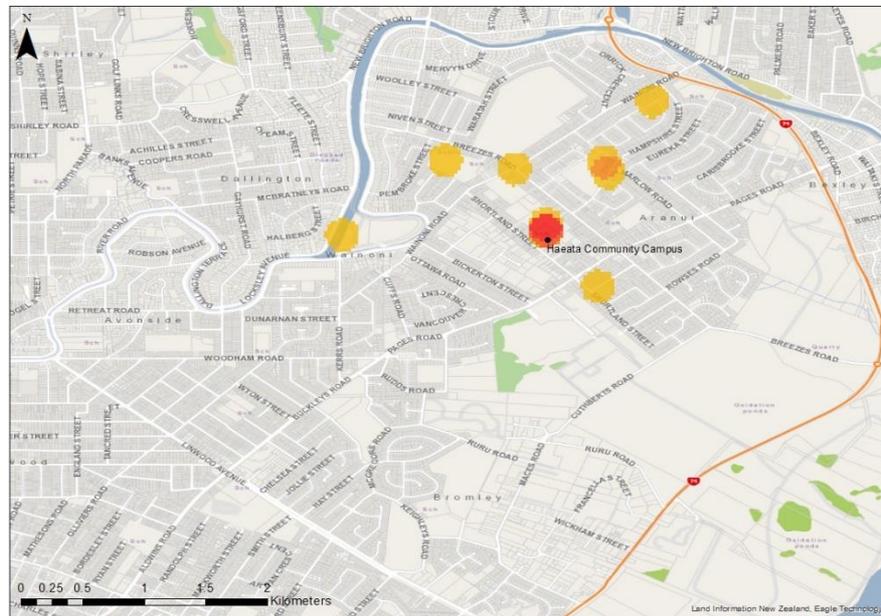


Figure 15: Map showing areas near Aranui identified as negative by Maptionnaire survey respondents, n=13

There was some diversity in how participants felt of certain spaces in Aranui. Firstly, some young people identified the school as a positive place, while other suggested it as negative. From follow-up comments, most who liked school felt this way because it was a safe and friendly space. Those who disliked school didn't provide reasoning except for one student who felt bullied. Another space which was both favoured and perceived negatively by different participants was the Hampshire Street area near the park and shops. Of those who responded to the follow up question, most reasons for or against this space were consistent. Participants who liked the space enjoyed hanging out with friends or exercising in the park. Those who don't like the area found it intimidating or unpleasant. A noteworthy observation of these findings is the diversity of perceptions and experiences among the respondents. While some spaces are favoured by a few individuals, the same space has been identified by others as being disliked. Diversity of perceptions within this small sample emphasises the need to understand

young people and recognise that spaces are perceived differently across what many planners assume to be one homogenous group.

The type of places identified are represented in Figure 16. As shown, the most common type of place identified positively was parks and recreational areas. The most common type of space regarded as negative by respondents was a school, including both Haeata Community Campus and other local schools.

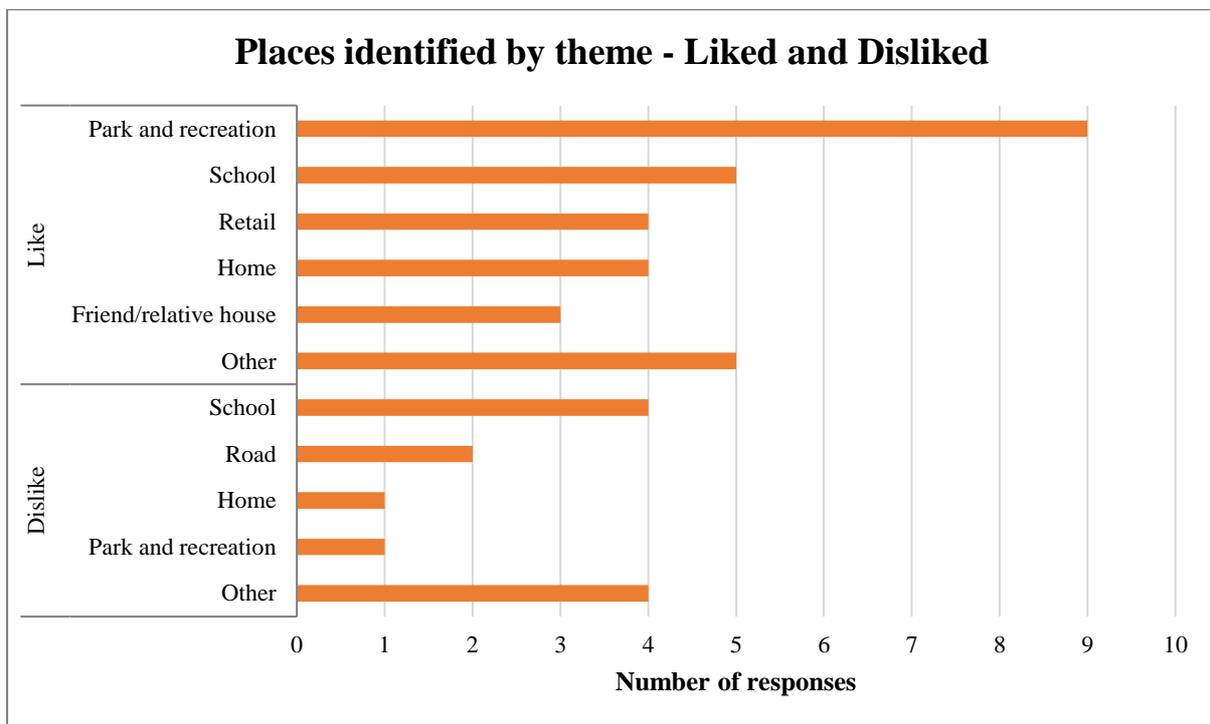


Figure 16: Theme of places identified by students as liked or disliked in Maptionnaire Survey

Following the identification of a space using a point marker, respondents were prompted to answer why they did/did not like the space they had identified. Positive comments about places are represented by a selection of quotes from respondents below:

“cause it has a library and food” – Like, Eastgate Shopping Centre

“There's a park and a dairy. Not bad. 5/7 ” – Like, Hampshire Street shops

“Because I like to hangout and play basketball with my friends” – Like, Linwood Park

Some respondents suggested reasons why they do or do not like the places that they identified in this exercise. A number of respondents suggested safety was a key factor. Students stated their like of places was because it was somewhere they felt safe, in contrast to other areas in the neighbourhood. Respondents also suggested places they disliked were due to the perceived lack of safety in those spaces. The following quotes were taken from questionnaire respondents who indicated that Haeata Community Campus was a place they liked. However, their comments indicated this was because they felt like their school was a place of safety, compared to the lack thereof in other areas of the local neighbourhood.

“because this is my school and I feel safe and don’t have to keep looking back every 5 minutes” – Like, Haeata Community Campus

“cause I don't hang out anywhere because everywhere in aranui is dangerous. This is just the place I got to the most outside of my house” – Like, Haeata Community Campus

Of those who pointed out areas they disliked, reasons why were varied. Most referred to the perceived safety or comfort of the space they selected. One participant indicated dislike for the whole area.

“its dirty and horrid” – Dislike, Hampshire Street

“I don't feel safe enough” – Dislike, Lenton Street

“cause kids always get smart” – Dislike, Chisnallwood Intermediate

Respondents were asked to comment on the perceived safety of four specific local streets surrounding Haeata Community Campus. They ranked the streets from 1-10, with 1 being very unsafe, and 10 being very safe. Images of the streets were used to prompt students. The results are shown in Figure 17. Hampshire Street was regarded as very unsafe by 23% of participants, which is consistent with the comments from participants already discussed regarding the same area. Around half of the participants indicated moderate to high safety rating of all streets.

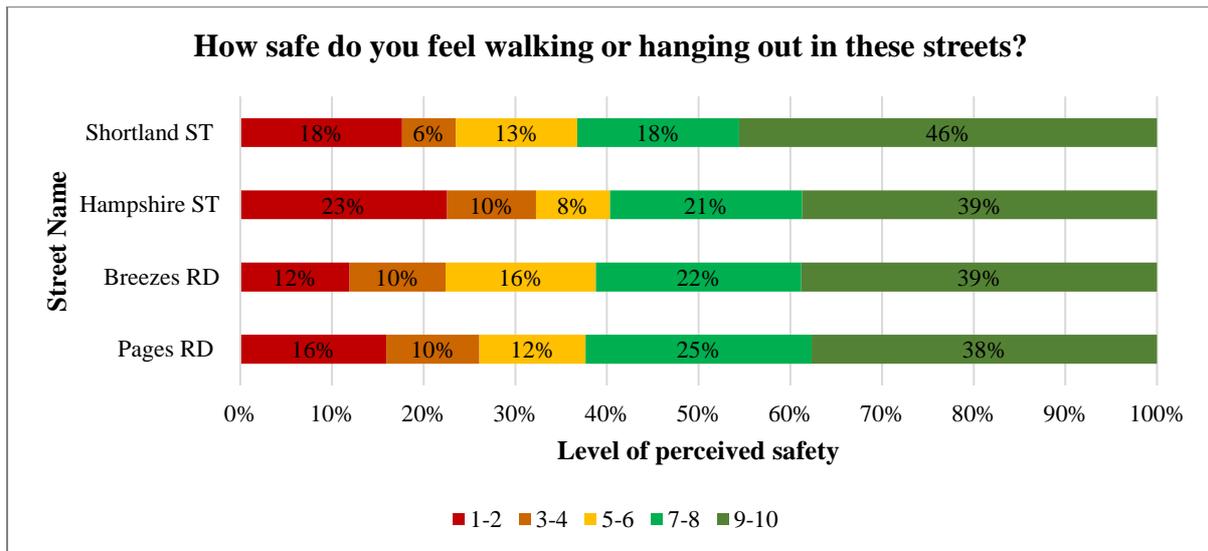


Figure 17: Rating of safety for four local streets near Haeata Community Campus, from the Maptionnaire survey question: How safe do you feel walking or hanging out in these streets, where 1= very unsafe, and 10 = very safe

4.3.4 Summary

Distance and parental control prevail as the most significant factors of active school travel in the present study. Both variables have a statistically significant relationship with the likelihood of active school travel. However, other data including qualitative responses to open-ended Maptionnaire survey questions suggest many other factors also have a role in determining school travel mode. While distance and parental control may be significant, students own perceptions of desirable travel mode and the safety of the local neighbourhood suggest that social factors, in particular perceived risk of crime, lack of safety, and lack of pleasant public spaces for some students are relevant.

Chapter 5: Discussion

This study examines the relationship between aspects of the local neighbourhood and school travel behaviours of Haeata Community Campus students, in Christchurch, New Zealand. Key findings of the present study are: 1) distance and parental control are two factors with a significant relationship with active travel, where parental control could be driven by perceived lack of safety or convenience of driving children to destinations as opposed to youth independent mobility; and, 2) students express concerns regarding their local neighbourhood and its lack of safety, indicating that the built environment does not promote active travel.

This chapter will discuss the research findings and their implications in broader context. The key focus is the relevant contribution of key findings to the existing body of academic work, as well as the practical outcomes for the local study context, and broader stakeholders in school transport and youth friendly urban design.

The results of the study in relation to the research objectives are presented. The significance of key findings relative to the existing body of literature is critically assessed, with notable similarities and differences to previous findings highlighted. The situation of this study within the existing knowledge of this discipline is determined.

Following this, consideration of broader research implications such as encouraging physical built environment measures, outlining potential policy approaches and behavioural change action for young people and their families.

A critical reflection of the strengths and limitations of the study, including opportunities of further study to compliment the current findings will conclude the chapter.

5.1 Enablers and barriers to active school travel at Haeata

Community Campus

A key objective of this study was to understand transport patterns of Haeata Community Campus students. This includes: determining the modal share statistics; any patterns across demographic factors such as age, gender or ethnicity; and, perceptions of the built environment near school. In discovering the modal trends, behaviour and perceptions of students, promotion of active travel can be more targeted, and evidence driven. The benefits of active travel are widely acknowledged, particularly for young people, who are increasingly leading sedentary lifestyles, and subsequently not meeting healthy physical health outcomes. Therefore, stakeholders of the school community are interested in how school travel patterns and behaviour can be changed to increase walking, cycling and other active modes of transport.

The results of this study, consistent with findings from similar research, suggest that one of the most significant predictors of active travel is distance between home and school (Buliung & Mitra, 2015; Curtis et al., 2015; Easton & Ferrari, 2015; Ikeda, Stewart, et al., 2018; Mandic et al., 2015; Millward et al., 2013; Oliver et al., 2014). The difference in mean distance for students who walk versus those who travel by car in this study is statistically significant, indicating a strong distance decay for the likelihood of active travel, specifically walking. This key finding is consistent with literature which suggests distances of around one kilometre and up to two kilometres is considered walkable (Millward et al., 2013).

Results show approximately 38% of students travel by foot to school. Initial geospatial analysis found almost 75% of students live less than two kilometres of school. A significant question arising from this finding being, if a majority of students live within walking distance of school, what is the reason for half of them not utilising active transport? Additionally, only 5% of

students travel by cycle, scooter or skateboard, therefore students living in the upper end of the two-kilometre threshold are unlikely to be using “wheeled” transport options instead of walking. Using a bicycle, scooter or skateboard typically increases an individual’s active transport distance threshold (Rabl & de Nazelle, 2012). The most recent household travel survey results suggest an average cycle trip is just over four kilometres (Ministry of Transport, 2019). Some literature has found slightly lower thresholds for young people (Wati & Tranter, 2015), while others are relatively consistent with adult thresholds (Frater, 2015). Cycle ability may also contribute to lack of cycle uptake at Haeata Community Campus. Young people have stated they would be more likely to cycle after being included in a cycle skills training programme (Mandic, Flaherty, et al., 2016). Additionally, affordability of cycles may be a contributing factor, especially in a low-socio economic area such as Aranui. As acknowledged by Raerino et al. (2013), a key factor in transport disadvantage is the economic cost of owning and maintaining a vehicle, which is likely to be similar for young people wanting to cycle.

A number of different factors could explain the disproportional ratio of active transport to the proportion of students living within threshold distance of school. Existing literature puts forward a number of potential determining factors (aside from distance) such as adequate pedestrian infrastructure, safety, street connectivity, land use, residential density, social influences, socio-economic status, parental control, weather, topography and more. Most literature also agrees that active travel behaviour is situated within a socio-ecological model of determinants, meaning many complex relationships influence behaviour. Numerous factors occurring on various scales (e.g. individual, family, community, regional, and national) are argued to simultaneously promote or discourage people from using active travel. Specifically for school travel, factors such as age, school policy and social characteristics and national education policy can play a significant role in young people’s transport patterns.

Measures of parental control reported by young people in the study suggested significant concerns and perceived risk from parents of students. A correlation between high parental control and non-active travel is evident. This finding has a number of implications for young people of Haeata Community Campus. High measures of parental concern could be the result of two circumstances; parents control their child's school travel because it is more convenient for them; or, parents concern for the safety of the built environment is deemed too risky for them to allow their child to utilise active transport. Literature supports both of these possible factors, with Badland et al. (2016) study finding an increase of school car travel as result of changing household characteristics, such as the increase of women in the workforce, and convenience of combining school drop-off and work travel. Evidence of parental safety concerns influencing increased car travel is found in Carver et al. (2010) and Buliung and Mitra (2015) studies. These two studies found parental perceptions of the built environment, particularly safety, could determine young people's active travel patterns. The relationship has been found to be stronger for younger children than older youth, indicating the effect of growing independence as children become teenagers (Curtis et al., 2015). Younger children were intentionally excluded from this study to simplify the Maptionnaire approach, so it is unclear whether a strong correlation exists between age and independent mobility. No relationship was found with the present studies sample which included 11-18-year old students. The lack of association between active transport and age within this study may be consistent with Curtis et al. (2015) finding that 10-11 years old is when young people gain more licence to navigate neighbourhoods independently.

Safety concerns in Aranui are historically embedded, with the suburb being known anecdotally across Christchurch as a dangerous area (Montgomery, 2013). While measures of safety in Hampshire Street, Shortland Street, Breezes Road and Pages Road were not significantly

correlated with active travel, some participants indicated concern and a few participants made comment regarding how unsafe they feel in Aranui. The emotiveness of some of these comments suggested major issues with the local environment and how young people feel in it. It is highly likely that given the reputation of Aranui, the perceived lack of safety that has been described by some students is felt more broadly across the school, and may act as a key barrier to active travel and independent mobility. Negative perceptions caused by fear of potential crime and danger within the local environment can be detrimental to the development of young people when it restricts their ability to travel independently and navigate their own community (Badland et al., 2016). Fear of crime can be a strong behavioural adjusting factor in some people's lives. One New Zealand study found access to green space and subsequent quality of life was hindered by any fear of crime in the neighbourhood (Fleming, Manning, & Ambrey, 2016). The issue of safety in the community requires a collective approach from many stakeholders. Studies argue the nature of crime in communities is not just a justice system issue, but an issue of public health, deprivation, education and unemployment (Kawachi, Kennedy, & Wilkinson, 1999). This again highlights the need for an approach to transport challenges that acknowledges the social, environmental, economic and political context that Haeata Community Campus and Aranui is situated within, in order to make significant changes.

5.2 The importance of understanding local context

A key research objective was to highlight the importance of understanding the local environment, especially for the future consideration of responses that encourage transport behaviour change. In this study, the local environment encompasses: the physical built environment including all infrastructure and streetscapes; the social environment including socio-demographic characteristics, shared and individual perceptions of the local environment and norms influenced by culture and society; and, the political environment such as policies, interventions and decisions made that have affected the transport environment.

Specific elements of local context are discussed in this section, arguing their significance in any future intervention or transport policy. This study shows that the local context of the Haeata Community Campus community is important to understand when investigating transport patterns and the urban environment. The key findings of this research are in some ways consistent with the existing body of literature, and in others a complete contrast. For example, many studies have also found distance to be an important contributing factor of active school travel. The high level of significance indicated in the relationship between parental control and student's ability to engage with active travel was a less expected finding. While literature has commonly found some degree of influence of parents on children's travel to school, most have found this to be more prominent in young children as opposed to the age of the sample in the present study (youth over age 11) (Buliung & Mitra, 2015). The variety of findings is different to what has been reported elsewhere and is likely the result of unique community characteristics such as the social, environmental, political and economic context. This leads to the argument for more evidence driven local understanding for policy that impacts specific communities. Transport planning, education policy, and urban design specifically should be mindful of the unique local aspects.

One of the key questions arising from this study relates to the impact of amalgamating the four pre-existing schools. This hyper-local decision could be a contributing factor to the patterns of active school travel of Haeata Community Campus. The decision to close the four schools and open one new large school was not a positive decision for young people's transport and independent mobility. The results of the present study determine that the amalgamation was not appropriately considered because: (a) an increase in average distance from the three primary schools was observed, and (b) there is a significant relationship between distance and mode of travel. A number of studies that have found significant relationships between active school travel and distance suggest that modern education policy that encourages less localised schools may have a negative impact on the likelihood of active travel (Frater & Kingham, 2018; Ikeda, Stewart, et al., 2018; Mandic et al., 2015). In particular, for the students who may experience a greater distance barrier as a result of the move, it is clear that the amalgamation of schools had a significant effect on the distance decay effect on active transport. Students who chose to attend Haeata Community Campus after previously attending Aranui High School would not experience any affect since Haeata was constructed on the old Aranui High School site. Aranui Primary School was close to the Haeata site. However, students who previously attended Avondale and Wainoni (two of the most localised pre-existing schools) were located further from the new site. Another important consideration is those who chose to leave the area and attend a school outside of Aranui after Haeata Community Campus opened. It is highly likely that those students would now live a reasonable distance from their new school, if they remained living in the Aranui area. While the distance effect of these students is not analysed in this study, it is worth noting that the decision to amalgamate schools could have had significant impact on their school travel behaviour. The analysis of previous school roll data for comparison of current data was a significant strength of this study. Recognising the historic context of the school closures and establishing the likely transport patterns helps to

understand the current transport environment. Despite these considerations, the present study found a relatively high proportion of students currently living within two kilometres of Haeata Community Campus which suggest the school is still relatively localised. Some students do choose to attend Haeata from distances as far away as Hornby (approximately 18 kilometres), which may be attributed to the attraction of a different learning style that Haeata Community Campus offers. The unique student-driven learning experience of Haeata Community Campus is appealing to many families, which could be the key reason some students outside of the Aranui area attend Haeata Community Campus. However, one media article published in 2018 quoted the school Principal stating that Haeata attracts a number of out of school enrolments, many who have been excluded from previous schools (Palmer, 2018). While it is evident that many aspects of the decision to amalgamate four pre-existing schools and open Haeata Community Campus could have impacted some students travel behaviour, it is not clear to what extent. The true effect of school amalgamations and education planning policy could be further uncovered, providing significant insight in future research.

One aspect of local context that is essential to discuss is the strong cultural influence. The culture within Aranui is important to acknowledge in any relevant policy or intervention. An intervention could target young people and their parents by promoting the health benefits of active travel in an education campaign, or it could be a more hard engineering approach that builds higher quality footpaths and cycleways. Whether the approach is an educational, engineered, or other solution, the cultural and social context of the community is important to recognise and engage with. As previously recognised, the population of Haeata Community Campus has a significant proportion of NZ Māori and Pacific peoples relative to the rest of Christchurch. The suburb of Aranui is similar, with 23.9% of the population identifying as Māori, and 16.8% identified as Pacific peoples, compared to 8.5% and 3.1% respectively across

the whole Christchurch City population (Statistics New Zealand, 2013b). Māori and Pacific peoples in New Zealand are subject to many poorer life outcomes when compared with NZ Pākeha. Life expectancy, average education level, and median income are all lower for Māori and Pacific peoples (Ministry of Education, 2013; Ministry of Health, 2016; Statistics New Zealand, 2013a). Additional to this, transport disadvantage has been studied in New Zealand Māori, suggesting that a mismatch of transport services and location of services contributes to social exclusion, adversely affecting Māori in particular (Raerino et al., 2013). The inequality of transport systems in New Zealand towards Māori is a factor worth recognising within the present study. While there was no focus on ethnicity in the results, largely due to low response rates, school travel behaviour may vary significantly for the community of Aranui, compared to an area such as Cashmere, where 93% of residents identify as European (Christchurch City Council, 2013). Māori tend to have vastly different transport needs and values to other ethnic groups of New Zealand, where the lived experience of being Māori and accessing Marae, cultural sites and whanau are central to their needs (Raerino et al., 2013). Private vehicles are therefore often considered the only feasible transport mode that works for the wider needs of this group. In promoting active travel to young people of Aranui, it is essential to gain a deeper understanding about what underpins the community and the motivators of current behaviour.

Economic disadvantage in access to transport may be a factor for the students of Haeata Community Campus. The school itself is Decile 1, where deciles represent the proportion of students from the most deprived areas in New Zealand schools, indicating Haeata Community Campus includes students from some of the most deprived neighbourhoods of New Zealand. Aranui as a community also has a considerably lower median household income than Christchurch City as a whole (\$19,800 and \$29,800 respectively) (Statistics New Zealand, 2013b). Income and transport patterns are intrinsically linked, considering private vehicles, the

dominant mode in Christchurch and New Zealand, come at a relatively high cost. Car ownership in Aranui compared to Christchurch City as a whole is relatively lower, with over 15% having access to no car, compared to under 10% for the city (Statistics New Zealand, 2013b). The burden of cost to access transport is a key reason why many people in low socio-economic areas continue to have high unemployment, because the cost of travelling to interviews and work is unaffordable (Currie & Delbosc, 2010). In New Zealand specifically, young Māori men are consistently entering the justice system as a result of the cost burden associated with vehicle licensing and ownership. Two significant negative cycles exist, where (a) the cost of getting a drivers licence restricts individuals ability to get work, and (b) persistent illegal driving due to the cost of having a safe, warranted and registered car leads to consistent traffic stops, fines and convictions, increasing the likelihood of a criminal record for Māori men (Raerino et al., 2013). This only further amplifies any existing economic disadvantage, with the challenges of accessing key destinations having different and more intense barriers than for some other groups. It is not understood to what extent students or families of Haeata Community Campus may be caught in this negative cycle caused by the cost burden of private vehicle transport. However, it is important to acknowledge the existing inequity in New Zealand's broader society and the impacts this may have on transport behaviour.

The exclusion of minority groups in decision making processes only exaggerates existing inequality (Wood, 2017). Youth, indigenous people, low socio-economic communities, and other minority groups are some of the most commonly excluded from urban planning narratives (Wood, 2017). It is for this reason in particular that Haeata Community Campus needs to be understood within its local context and with respect to the local community. Students of Haeata Community Campus and the youth of Aranui are likely to not have had many opportunities to share their ideas of what the city of Christchurch needs to be for them. Engaging young people

in civics is challenging for many authorities. However, the benefits of giving young people a voice within their city are worth noting. Recognising the contributions that youth can give to social, cultural, political and environmental sustainability can enhance the quality of life for the entire city population (Bridgman, 2004b). Early work by Hart (1979) began to argue for inclusion of young people in urban planning and decision making. In particular, recognising youth as more than just those who inherit the consequences of adult's decisions, but active participators in the present society. The present study includes student participants to highlight their importance in urban design. It is recognised by a significant bulk of literature that the built environment has a significant effect on young people's transport behaviour. Yet, there is a major disconnect between recognising this fact and allowing young people to decide how their neighbourhood should be and feel. A number of recommended principles for including young people have been discussed. In 1992, Hart made significant early contributions by theorising a ladder of youth participation, establishing a scale from tokenistic adult interpretation of young people's ideas to fully participatory and self-led engagement from youth. Since then, Bridgman (2004b) as one example, has created criteria for child friendly cities in Canada. Essentially, the key argument is for active involvement of young people, in a way that is self-led and gives young people power and influence within the realm of urbanism. These models are the optimal situation, not considering for limitations such as those encountered in this study with time constraints, ethics committee restrictions and limited resources. This does not mean that recommendations from studies such as Hart (1992) and Bridgman (2004b) can be ignored. More so, studies and engagement should strive for the most inclusive approach possible, viewing youth engagement as an important part of civic life, not just a tokenistic exercise. Aside from the young students of Haeata Community Campus, their families and other community members are also not likely to be heard equally. For a number of reasons, wealthier, Pākeha voices are overrepresented in many council submission processes, the main process for

delivering feedback on decisions within cities (Newtown, 2018). In understanding the local context, acknowledging and engaging meaningfully with the community is an essential aspect.

In summary, a number of hyper-local factors may be central to transport patterns and behaviour for Haeata Community Campus, highlighting the need to understand local communities and encourage evidence driven local policy responses. The cultural, economic, social, environmental, and geographic attributes of Aranui should be considered in any policy or intervention that directly impacts the community. As acknowledged by many studies, a solution for one school may not change the behaviour of another because of the specific local context.

5.3 Potential responses to encourage active school travel

As identified by the present study, there is opportunity to encourage more Haeata Community Campus students to engage in active school travel. The benefits of active school travel such as increased physical activity and health, lower overall carbon and greenhouse gas emissions, and increased social and cognitive development justify a response that promotes active travel behaviour.

Some key reasons from this study specifically that may indicate why more students do not walk, cycle, scooter or skateboard to school can be best summarised as:

- The distance between school and home is too far to walk.
- Parents are concerned about the safety of the local urban environment.
- It is convenient for students to travel with their parents in a vehicle on their way to work or other errands.
- Students are concerned about the safety and feel of the local urban environment.

A response to the findings of this study to promote active school travel and independent mobility within Aranui should focus on the aforementioned factors. While the focus of data collected in this study is of young people over the age of ten years old, Haeata Community Campus is a full year 0-13 school and any interventions to improve active school travel would also need to understand younger children's transport behaviours.

5.3.1 Encouraging behaviour change

Firstly, one key approach to encouraging active school travel is behavioural change schemes. Education and promotional campaigns could be utilised to shift students perspectives on active travel and increase uptake. Changing transport behaviour can be challenging, particularly when the choice to utilise active transport modes is part of a wider socio-ecological system of personal, household, community and wider societal influences (Badland et al., 2016). As

indicated in the results of the present study, very few students indicated a desire to change their usual mode of school transport. Therefore, students would need a particularly engaging incentive or change in influencing factors to consider active travel. As previously acknowledged, active travel is a complex phenomenon that is the result of many confounding factors.

5.3.1.1 Changing behaviour through promotional and educational campaigns

Campaigns such as cycle skills programmes for students, walking school buses, and campaigns promoting cyclist visibility and road safety have been implemented in various urban settings with mixed results. Cycle skills programmes have been proven to give young people more confidence cycling as a mode of transport. Programmes that target schools are promoted nationwide in New Zealand and most councils, including Christchurch City Council offers the opportunity for schools to book in-school training programmes. Given that in the present study, very few participants indicated the utilisation of cycling as a school travel mode, a potential response could be to provide cycle skills training to students. Research shows that young people agree that cycle skills programmes would likely increase their confidence cycling (Mandic, Flaherty, et al., 2016). However, the translation of increased confidence cycling to using cycling as a primary mode of transport has a number of other barriers. Young people from Dunedin schools found after engaging with a cycle skills programme, they felt more comfortable cycling in parks and around playgrounds but few felt competent to cycle on roads or to school (Mandic et al., 2018). Despite concern from young people about cycling, parental perceptions of cycle skills programmes are relatively positive (Mandic et al., 2017). While cycle training programmes have been shown to have positive impacts on the confidence of young people in Dunedin, a number of key assumptions may restrict its impact on Haeta Community Campus students. First and foremost, access to a cycle may hinder students' ability to change their perceptions of cycling as an accessible transport mode. The lack of safe and

separated cycleways, as highlighted in Section 4.1.2.2, may also be a key barrier, that even with a change of perception through skill development, will continue to restrict students cycling.

Walking school buses have been popularised since the early 2000's. The initiative begun in Canada around 1996, spreading to countries such as Denmark, USA and New Zealand shortly after (Kingham & Ussher, 2007). Specifically in New Zealand, walking school buses have proved both popular and effective. A wide range of benefits including; increased independence for young children, positive relationships with students of various ages, stronger community and family connections, greater visibility of pedestrians around school hours by vehicle users and increased fitness and physical activity (Kingham & Ussher, 2007). With a majority of students living within a short distance of school, a walking school bus could be an effective initiative to implement, particularly for younger children as walking school buses typically engage young children of primary school age. One key shortcoming is that there is no existing evidence for whether walking school buses assist young people to transition to long term independent active travel for the rest of their life (Collins & Kearns, 2010). Another key limitation of walking school buses is the time and effort resource required. The commitment needs to come from parents who are willing to dedicate time in the morning and afternoons walking with students. There also needs to a key person organising and driving the initiative within the parent group or school. While the benefits are evident, implementing a walking school bus in Aranui may come with other challenges.

Campaigns to promote cycle and road safety in New Zealand have focussed on encouraging vehicle users to give enough road space to cyclists, and promoting cycling as a safe and attractive mode choice (New Zealand Transport Agency, 2019). The role of personal protective

equipment when cycling was found to be significant for those who perceived high vehicle danger, and use of gear tended to drop for those who had lower perceived risk (Aldred & Woodcock, 2015). An opposing study found that the impact of promoting cycle safety had less impact on non-cycling participants, when compared to the promotion of health benefits (Gamble, Walker, & Laketa, 2015). A continuous argument in New Zealand also exists regarding the compulsory helmet law. One evaluation of the compulsory helmet law discussed the costs and benefits concluding that since its inception in 1994, the legislation has failed in regard to promoting cycling, health, safety, environmental issues and civil liberties (Clarke, 2012). The law has been discussed in relation to young people's active travel behaviour, with perceptions of helmet use negative for most, particularly females (Frater & Kingham, 2018; Molina-García, Queralt, Bengoechea, Moore, & Mandic, 2018). With New Zealand Transport Agency already focussing on road safety and encouraging cycling as a transport mode, there may be little promotional or educational responses in the local area that could encourage significant behaviour change. From the studies discussed here, it is evident that individual perceptions of safety will play a large part in the uptake of cycling.

Potential implementation of any of these campaigns could work to varying degrees at Haeata Community Campus. Considering safety is a likely concern for students and parents, acting as a barrier to active travel, the promotion of road safety could reap high benefits. However, the lack of high quality infrastructure may hinder efforts to change behaviour and perceptions of students. The success of any campaigns is likely to be majorly influenced by the neighbourhood characteristics.

5.3.1.2 Behaviour influenced by modal perceptions and social norms

The perceptions of various transport modes from young people can be influential to their use. Societal expectations and norms commonly impact travel mode choice, and what youth think is cool or uncool can be a major determinant of travel mode (Frater & Kingham, 2018).

Studies have investigated the social perceptions of various transport modes. Recent findings from Christchurch show young girls in particular are against cycling as a mode of transport because of how it is perceived to undermine femininity and be viewed negatively by their peers. Young women in Christchurch perceive cycling to not be for them for a number of reasons. They may feel peer pressure from other girls encouraging them to not cycle, they feel like cycling is not feminine and that their physical appearance is compromised by cycling, and that groups of young girls would prefer to walk and socialise with each other on their way to and from school (Frater & Kingham, 2018). Societal barriers such as peer pressure between students could be a major challenge in changing Haeta Community Campus travel behaviour. It may be worth spending effort encouraging young girls to walk by making walking safer and easier, as opposed to encouraging cycling, which has been found in many studies to be less popular among females than males, particularly teenage girls compared to young children (Carver et al., 2010; Easton & Ferrari, 2015). It is worth noting that some young people also see public transport as more than just a travel mode from one destination to another. One particular UK study discovered many young people perceived time spent on local busses as important 'hanging out' time with their peers (Jones et al., 2012).

The societal norms specific to young people are worth acknowledging in initiatives and campaigns to promote active travel. The power of student's peers in encouraging one mode or another is relatively powerful.

5.3.2 Land use planning

Land use planning can impact how communities use space. The pretext to the current study involves the decision to close four schools in a community and amalgamate students into one large central Aranui school. In regards to the rest of the surrounding local land use near Haeata Community Campus, majority is residential suburban, with some industrial to the south, a few commercial and three open space community parks areas (Christchurch City Council, 2017). Studies have shown that high density residential urban areas with good street connectivity and mixed use buildings (i.e. commercial with ground floor retail) effectively promote active travel, while significant sprawl and low residential density can contribute to low neighbourhood walkability (Frank et al., 2006). Detailed land use analysis has not been undertaken in this study, but footpaths in Aranui are relatively conventional with minimal safety, accessibility or aesthetic features. The residential density of Aranui is relatively low, consisting of single detached homes on moderately sized sections, consistent with other suburban areas in Christchurch. The style of housing is a key aspect of youth friendly urban environments, where medium density is likely the most family and child friendly. Low density increases the risk of isolation and decreases the sense of community which supports young people (Freeman & Tranter, 2011). Therefore, it is likely that walkability and level of youth friendliness in Aranui would be considerably low relative to other places with higher residential density, street connectivity and pedestrian friendly footpaths.

Given the assumption that the local environment is likely to not be rated with high walkability, increased collaboration between urban planning and education policy planners would benefit students. Ensuring that schools are located in highly walkable neighbourhoods has a number of positive impacts. Walkable areas not only promote active transport, but also increase public

presence, therefore making neighbourhoods safer. Studies have found densely populated and busier streets tend to have less crime than quiet streets (Fleming et al., 2016; Irving, 2015).

The role of strategic planning spans across many scales, from how schools are located across a city, how many, and who they service, to hyper-local urban design planning that takes careful consideration of pedestrian friendly infrastructure near schools and designing safe crossing points. Planning and its impact on active transport is widely acknowledged (Badland et al., 2015; Curtis et al., 2015; Wood, 2017). The role of planners means that some responsibility lies with these decision makers regarding Haeata Community Campus and the local environment that prevents some students from engaging in active transport or any independent mobility. Better strategic planning for the school and its local built environment is necessary. The Ministry of Education (2015) *Designing Schools in New Zealand: Guidelines and Principles* document clearly outlines the need to assess potential transport circulation routes, of vehicles and pedestrians. However, there is likely key differences between assessing routes of movement and ensuring the local neighbourhood is walkable. This raises a key question for this study is whether land use was appropriately considered when master planning for the amalgamation of the four previous schools into Haeata Community Campus before it was constructed in 2017. The findings of the present study suggest that there was insufficient consideration of the local neighbourhood, its land use and walkability, providing a strong argument for better consideration of the local environment in not only the location of schools, but any decisions to close and amalgamate.

As a response to the current study's findings, land use planning could be better managed, ensuring that education planning is better integrated with land use so that neighbourhoods surrounding schools are considered highly walkable. Strategic urban planning across all scales

needs to carefully consider the level of mobility that the local environment promotes. There would be numerous positive impacts for considerate land use planning when choosing locations and designing neighbourhoods with schools.

5.3.3 Built environment/infrastructure improvements

The best response to Haeata Community Campus transport challenges could be to engineer solutions within the local built environment. Improvements to the built environment, making it safer, more aesthetic and youth friendly could be a way to increase current rates of cycling and walking to school. Separated cycleways, wider pedestrian friendly footpaths, traffic calming measures and improvements to public spaces are some examples of ways the built environment could change to promote active travel.

Participants of the present study acknowledged the unsafe feeling of streets in Aranui. Students described feeling anxious about what potential dangers could arise and described streets as unappealing. To change these perceptions of the local environment, more inclusive urban design, and youth friendly design aspects should be used (Carroll et al., 2015). Youth friendly urban environments are defined as those where young people feel safe, with high quality social and physical environments (Freeman & Tranter, 2011). If youth in Aranui feel like there are no safe places in their local environment aside from Haeata Community Campus (which two participants specifically stated), then the suburb is, by Freeman and Tranter's (2011) definition, not youth friendly. There is likely more to be understood regarding the lack of perceived safety among some students. However, comments from participants suggest the feel of the built environment is a contributing factor to their travel behaviour. Independent mobility within ones neighbourhood is important, especially for young people developing essential health, social, and cognitive behaviours. Areas of the local environment such as Hampshire Street, which for some was flagged as a negative space, could be an area of focus for built environment

improvements. Through infrastructure improvements such as traffic calming measures, and improvements to the streetscape, particularly footpaths, the areas identified as being unsafe by students could foster more positive experiences and lead to Aranui becoming an increasingly youth friendly area (Mackett, 2013). It is worth noting that any planners hoping to achieve a more youth friendly Aranui should engage the youth community in more depth to understand what their specific perception of a youth friendly local environment is.

A common solution to low active travel uptake is to build or improve pedestrian and cycling infrastructure as a way of encouraging people to use it. The phrase “build it and they will come” is commonly used as justification of transport decisions that involve large infrastructure projects. The argument for active transport, specifically cycling suggests that strategies for cycling need be accompanied by safe routes that encourage would-be cyclists to change their travel patterns (Koorey, 2003). Induced demand is a transport theory best defined by the way that the construction of more roads and highways to ease congestion, causes increased demand for vehicle travel that simply fills the new infrastructure (Díez-Gutiérrez, Andersen, & Nilsen, 2018). One example of this occurring for active transport is the upgrade of cycle infrastructure in Norway to a cycle highway leading to increased bicycle use over two years, including those who were not regular cyclists (Skov-Petersen, Jacobsen, Vedel, Thomas, & Rask, 2017). Locally, the number of cyclists in Christchurch has recently increased as the results of the construction of the first routes of the 13 major cycleways (Christchurch City Council, 2018a). Therefore, safer cycling infrastructure in Aranui could induce higher demand for cycling as a mode of active school travel. Funding towards Christchurch’s major cycle routes has been effective in proving this applies in the local context. However, safe and accessible cycling infrastructure has not yet been implemented in Aranui or near Haeata Community Campus. The existing infrastructure includes only painted strips on the side of the road. Future

developments could occur given the interest in this study from stakeholders such as the Christchurch City Council. High quality pedestrian and cycling infrastructure is lacking in Aranui currently and could be a positive step towards higher active travel rates for Haeata Community Campus. Additionally, restriction of motor vehicles in the local environment is another effective approach. In order to promote active travel and independent mobility for young people, measures that restrict vehicles (i.e. speed bumps, reduced speeds and cul-de-sacs) are most effective (Bartlett, Hart, Satterthwaite, de la Barra, & Missair, 1999).

A local environment that is youth friendly incorporates values and features that may contrast to what adults consider a good neighbourhood to be. Youth friendly environments help young people to feel, safe and valued, with a strong sense of community and social resources (Freeman & Tranter, 2011). Given what is known about aspects of the built environment that encourage active travel and independent mobility (i.e. high residential density, traffic calming measures, and walkable streets), Aranui fails to make a strong case for being a youth friendly local environment. While some aspects of the built environment are difficult to change (i.e. housing density), improving the walkability by redesigning footpaths, and implementing safe separated cycleways could be an effective approach to improving mobility, particularly for alternative modes.

5.4 Opportunity for further study

5.4.1 Strengths and limitations

5.4.1.1 Strengths

This study has provided significant findings for both local stakeholders and the broader body of literature. The study shows the importance of uncovering specific context of the local environment when understanding transport patterns and recommending possible interventions.

A key strength lies wherein the combination of geospatial analysis and quantitative individual participant data. The use of school roll data gave significant meaning and insight to the geographic distribution of students, that with some level of basic GIS skills could be replicated and provide useful information for other schools. Current local council school travel plans do not engage with significant GIS mapping and analysis. Therefore, this type of strategy could be beneficial. Beyond the contribution of maps and spatial data, the Maptionnaire exercise combined with GIS provided significant extra insight to the travel patterns and behaviours of Haeata Community Campus students. As acknowledged by several other researchers in this field, an approach that mixes GIS with other quantitative and/or qualitative methods is an effective way to understand phenomena across space, especially transport.

Including school students in the study was a purposeful decision to ensure the study is youth focussed. While it may have been more effective to survey parents on their child's travel patterns, this study has addressed the issues of youth exclusion within the public realm and it is important for young people to shift away from being passive receptors of decisions made by adults in power. There would be less risk of error and the process to gain consent would be simpler in adult participants but the voice of young people would be missed and likely diluted by their parents. In future studies, more collective study design, participation, and decision

making with the young people of the study would be a positive step towards better engagement with, and understanding of youth.

This is the first study to comprehensively investigate school travel patterns and potential determinants within Christchurch in recent times. Only a select few studies have been undertaken in New Zealand as a whole but have generally been focussed on Auckland and Dunedin, two geographically different cities. The existing BEATS, URBAN and KITC studies are the largest and most insightful studies existing at present. As extensively noted by the present study, local context is of high importance so this data is not likely to have compatibility with other Christchurch schools. The value of this research contrasts the more generalised conclusions made by other research in active school travel, and youth engagement with urban environments.

The significant contribution of this research to the field of school travel geography is how it emphasises and discusses the importance of understanding local environments. The instrumental part of this research was the focus on understanding the local neighbourhood and assigning high value to local context. Specific studies offer important contributions different than those that attempt to generalise determinants across schools. This research has highlighted the context of the local environment to accentuate its unique characteristics and understand how these various factors contribute to active school travel.

5.4.1.2 Limitations

A number of limitations need to be acknowledged of this research. In future research, these limitations could be mitigated or eliminated and provide further significant developments in the findings. Some of the key challenges included; lower than expected response rate, time and

resource constraints, and a gap in further measurement and understanding of school travel patterns.

Effective engagement with young people and children was difficult to plan in a way that made the study interesting for participants while also providing insightful data. A significant number of trade-offs had to be made in the design of the Maptionnaire survey to be open and inclusive, ensuring that participants didn't find the survey boring, hard to understand, too time consuming, or invasive of their privacy. A balance of engaging participants and making them feel comfortable versus yielding a significant quality and quantity of data can be challenging. Difficulty in the ethical approval process meant that the survey was also not as far reaching as it initially aimed to be.

Time and resource constraints were unavoidable in the way that this project was limited by the characteristics of Masters Research. There were also some unexpected time delays in the ethical research approval process and through collaboration with other stakeholders that placed further pressure on the study. Collaboration with numerous stakeholders can take time and easily place pressure on research to make sure all parties agree and are accepting of the approach. Ensuring the Maptionnaire survey fit within time constraints of the school also caused some delays and time pressure. The Maptionnaire needed to be hosted at school to ensure students were not unfairly excluded from participation. However, timing the questionnaire around the school terms proved challenging.

The Maptionnaire yielded a less than expected response rate. A number of mitigating measures were in place to reduce the risk of low participation, including hosting the survey within the school, and implementing an opt-out consent process. Measures were purposefully considerate

of the local community, ensuring access to the survey did not disadvantage students without access to internet at home, or students who may find it difficult to get parental permission in an opt-in survey approach. A total of 79 responses was a satisfactory rate and was still sufficient to analyse and gather some key findings from. However, the fact that none of the Maptionnaire fields were mandatory complicated cross-tabulations and regression models in the way that these analyses exclude any participants who did not answer both or all of a selection of questions. Some comparisons were difficult to make with limited participants completing both fields. Responses to questionnaires completed by young people cannot always be guaranteed to be accurate. Even though self-reported data has reliability issues, especially with young people, respecting their ability to speak on behalf of themselves is important to value.

5.4.2 Further research

There are a number of opportunities arising from the findings of this study. While this research makes significant contributions to the understanding of active school travel, the complex nature of this field lends itself to a number of future research trajectories.

Interest from stakeholders of this research such as NZTA and CCC suggests future research could lead to investment towards improvement of the built environment. This could end up being similar to the Te Ara Mua project in Māngere. The key opportunity if any changes to the built environment occurs would be to monitor the impact of said improvements over a period time following. Even if no changes occur to the built environment, longitudinal studies of active school travel patterns are rare, and non-existent within Christchurch. This could be the opportunity to monitor the school over a period of time. Insight to behaviour and patterns of the community gathered over an extended period could make significant contributions to both the transport and education sector.

A key opportunity that was not able to be actioned by this study was in-depth discussion with students of Haeata Community Campus to further understand their perceptions of the local urban environment and active travel. A focus group or participatory exercise with a group of diverse students could offer significantly better discernment of influencing factors of active travel. Initially, an accompanied built environment audit with students was planned for this study. Time and resource constraints meant the study was limited to just the geospatial analysis and the Maptionnaire survey. A participatory and youth driven exercise such as a built environment audit could be a significant addition to this study, providing key qualitative information about the local environment.

Some findings of the present study raise questions that could not be answered with the data gathered. Firstly, the number of students who mentioned safety in Aranui was an issue could be further investigated. Testing for crime, perceived danger of crime and its impact on mobility, particularly for young people could yield intriguing results. Given that parental control has a significant relationship with active travel at Haeata Community Campus, parents may be able to give insight to the reason some students feel unsafe in Aranui.

Generally, more could be understood about Haeata Community Campus and the factors contributing to school travel patterns. This research has only begun to uncover the travel behaviour patterns and underlying perceptions and choices that influence them. In any future research, it is important to engage and include the local community, including Haeata Community Campus students, and Aranui residents. As emphasised throughout, the voice of young people needs to be valued and allowed to drive decision making.

Chapter 6: Conclusion

The present study's main objective was to determine the level of influence that Aranui's local environment has with Haeata Community Campus students' school travel patterns. The unique context of a recent amalgamation of four local schools into this one composite school was an important consideration. Through understanding the context of the local built environment as well as students transport patterns, the present study assessed the characteristics of Aranui and Haeata Community Campus that promote active travel.

The combination of geospatial analysis and Maptionnaire survey data gave significant insight to the community and their travel patterns. Maptionnaire provides an innovative approach to community engagement that combines geospatial, quantitative and qualitative data. Maptionnaire incorporates traditional survey mechanisms such as multi-choice questions and Likert-scales. Additionally, the attachment of comments to point, lines and polygons that participants can geographically locate themselves gives significantly more value and understanding of the lived experience to spatial data. This study used geospatial analysis of school roll data initially, but the addition of insight from students who participated in the Maptionnaire survey gave significant value to the findings.

Key findings of the present study include the fact that approximately 75% of Haeata Community Campus students live within two kilometres of their school. This distance is considered walkable and towards the upper limit cycling, scootering or skateboarding could be substituted to make the journey more accessible and less time consuming, while still remaining active. A majority of participants indicated they either travel by car or walk to and from school. Very few utilise alternative transport modes such as cycling, scooter/skateboard or public

transport. Key stakeholders such as the school Principal recognise that a higher proportion of active travel is beneficial to the community for a number of reasons; reduced congestion at before and after school times, reduced vehicle emissions, and physical, cognitive and social benefits of increased physical activity in young people. The present study aimed to uncover the current context of the local environment, transport patterns, and enablers and barriers to active travel in order to provide insight for community leaders, planners, and decision makers.

Distance has a strong relationship with active travel in the present study, where a significant difference in mean distance was found between active and non-active transport users. The median recorded distance for active transport users was just under one kilometre, consistent with literature that suggests distances similar, and up to approximately two kilometres are considered walkable. Despite this, the proportion of students who live less than two kilometres of school is inconsistent with active travel mode share. Approximately 75% of students are located within two kilometres of school via road network. The mode share of walking from the study sample is only around 35%. From the initial phase of the study (i.e. geospatial and initial questionnaire results), it was intriguing to consider what the determining factors of active travel may be for the proportion of students who live closer than two kilometres from school, but travel by car. Beyond the impact of distance, a relationship between parental control and active travel was significant in this study. This may indicate that either parents of Haecata students perceive the local environment to be unsafe and therefore control their child's transport behaviour, or parents find it more convenient to drive their children to school because of their routine and household work schedule. A mix of findings regarding parental control of children's mobility have agreed that parents have increased concern over their children walking or cycling alone, primarily for safety reasons. Parents also often have more demanding working

lifestyles involving both parents which make school travel by car the most convenient option. These changes in modern lifestyle have influenced trends of young people's mobility over time.

While distance and parental control were the only statistically significant variables in predicting active travel, it is worth noting that other aspects of the local environment may still be influential. Some students commented on places in Aranui suggesting they are unsafe and they do not feel comfortable walking or hanging out in their neighbourhood. These comments raise concern for the safety of Aranui as a suburb. The area is anecdotally known to be unsafe and subject to high crime rates relative to the rest of Christchurch. The safety of young people and their ability to navigate their neighbourhood and local streets independently is an important aspect of growing up and learning important cognitive and social skills. The risk of crime and danger creates a complex transport landscape that requires more collaborative planning beyond just the transport and education sector to encourage active school travel. Fortunately, Aranui Police is involved with the school, through this transport study and generally as a means of supporting the community. This kind of cross collaboration and understanding of shared problems among different community stakeholders could help create more robust solutions to Haeata Community Campus transport challenges.

In regard to acknowledging the importance of the local environment, it is worth noting the significant findings that were established by investigating the school's own roll data. The fact that approximately 75% of students live within two kilometres of Haeata Community Campus, is a key finding that has been given particular interest by the Christchurch City Council and the National Transport Agency, following a presentation of preliminary findings. The power of geospatial analysis, particularly the way results can be presented visually, is quite a powerful tool for sending strong messages to decision makers. However, the findings from the present

study also emphasises the need for further work in the area. Future research needs to understand fully what the driving factors of active and non-active travel for Haeata Community Campus students. Qualitative data from interviews or focus groups may help to recommend future intervention or policy that could be implemented to encourage active travel, and independent mobility in Aranui. In any future infrastructure or transport interventions for Aranui, transport planning and policy should recognise the local context and importance of the local environment. As suggested, some improvements to the built environment, such as safer cycleways, more pedestrian friendly areas, and youth friendly public space could be implemented. However, it is essential to acknowledge the unique characteristics of the Haeata Community Campus and Aranui community and the way they are part of a larger socio-ecological system of students travel behaviour and subsequent mode choice.

Overall, this study has made a significant contribution towards understanding youth travel patterns to and from school. This study adds further support to existing literature that states distance is the most significant and accurate predictor of active travel. While this is arguably the most consistent finding within the school transport literature, there is widespread acknowledgement that young people's mobility and school travel especially, is a result of many complex relationships and confounding factors. This study also found parental control to have a significant relationship with active travel, where students who perceived their parents to have more influence on their school travel and mobility were less likely to engage in active travel. While it is yet to be determined the reason for the relationship found in the present study, opportunities for further study arise to investigate the perceptions of active travel from parents. Additional to this opportunity, a number of future trajectories of study in this field have been identified, particularly for this community and within Christchurch, where limited studies have been done to date.

Given the number of gaps for future research, it is worth noting that as the first study of Aranui's amalgamated "mega-school" and its students' travel behaviour, the present study has set a clear pathway for future understanding of this community and the impacts of school closures. Greater consideration of the local environment was neglected at the time of Haeata Community Campus opening and this could be a barrier for active travel. Careful master planning that ensures high walkability, with policy and infrastructure that is evidence-driven by local context is essential. This study effectively highlights how the local environment and decisions effecting the local community are intrinsically linked to transport and can promote healthy school travel.

Reference List

- Aldred, R., & Woodcock, J. (2015). Reframing safety: An analysis of perceptions of cycle safety clothing. *Transport Policy*, 42, 103-112.
<https://doi.org/doi:10.1016/j.tranpol.2015.05.001>
- Badland, H., Donovan, P., Mavoa, S., Oliver, M., Chaudhury, M., & Witten, K. (2015). Assessing neighbourhood destination access for children: development of the NDAI-C audit tool. *Environment and Planning B: Planning and Design*, 42(6), 1148-1160.
<https://doi.org/doi:10.1068/b140009p>
- Badland, H., Kearns, R., Carroll, P., Oliver, M., Mavoa, S., Donovan, P., . . . Witten, K. (2016). Development of a systems model to visualise the complexity of Children's independent mobility. *Children's Geographies*, 14(1), 91-100.
<https://doi.org/http://dx.doi.org/10.1080/14733285.2015.1021240>
- Barker, J. (2003). Passengers or political actors? Children's participation in transport policy and the micro political geographies of the family. *Space and Polity*, 7(2), 135-151.
<https://doi.org/doi:10.1080/1356257032000133900>
- Bartlett, S., Hart, R., Satterthwaite, D., de la Barra, X., & Missair, A. (1999). *Cities for Children: Children's Rights, Poverty and Urban Management*. New York, NY: Earthscan Publications Ltd.
- Bhosale, J., Duncan, S., & Schofield, G. (2017). Intergenerational change in children's independent mobility and active transport in New Zealand children and parents. *Journal of Transport & Health*, 7, 247-255.
<https://doi.org/doi:10.1016/j.jth.2017.09.004>
- Bosco, F. J., & Joassart-Marcelli, P. (2015). Participatory planning and children's emotional labor in the production of urban nature. *Emotion, Space and Society*, 16, 30-40.
<https://doi.org/https://doi.org/10.1016/j.emospa.2015.07.003>
- Bridgman, R. (2004a). Child-Friendly Cities: Canadian Perspective. *Children, Youth, and Environments*, 14(12), 178-200.
- Bridgman, R. (2004b). Criteria for best practices in building child-friendly cities: involving young people in urban planning and design. *Canadian Journal of Urban Research*, 13(2), 337-346. <https://doi.org/132.181.233.182>
- Bringolf-Isler, B., Grize, L., Mäder, U., Ruch, N., Sennhauser, F. H., Braun-Fahrlander, & team, S. (2010). Built environment, parents' perception, and children's vigorous outdoor play. *Preventive Medicine*, 50(5), 251-256.
<https://doi.org/doi:10.1016/j.ypmed.2010.03.008>
- Brown, V., Moodle, M., Coblac, L., Mantilla, H., & Carter, R. (2017). Obesity-related health impacts of active transport policies in Australia - a policy review and health impact modelling study. *Sport and Physical Activity*, 41(6), 611-616. <https://doi.org/doi-org.ezproxy.canterbury.ac.nz/10.1111/1753-6405.12726>
- Buck, C., Pohlabein, H., Huybrechts, I., Bourdeaudhuij, D., Pitsiladis, Y., Reisch, L., & Pigeot, I. (2011). Development and application of a moveability index to quantify possibilities for physical activity in the built environment of children. *Health & Place*, 17(6), 1191-1201. <https://doi.org/doi:10.1016/j.healthplace.2011.08.011>
- Building, R., Mitra, R., & Faulkner, G. (2009). Active school transportation in the Greater Toronto Area, Canada: An exploration of trends in space and time (1986-2006). *Preventive Medicine*, 48(6), 507-512.
<https://doi.org/https://doi.org/10.1016/j.ypmed.2009.03.001>

- Buliung, R., & Mitra, R. (2015). Exploring differences in school travel mode choice behaviour between children and youth. *Transport Policy*, 42, 4-11.
<https://doi.org/http://dx.doi.org/10.1016/j.tranpol.2015.04.005>
- Carroll, P., Calder-Dawe, O., Witten, K., & Asiasiga, L. (2018). A prefigurative politics of play in public places: Children claim their democratic right to the city through play. *Space and Culture*, 1-14. <https://doi.org/doi:10.1177/1206331218797546>
- Carroll, P., Witten, K., Kearns, R., & Donovan, P. (2015). Kids in the city: Children's use and experiences of urban neighbourhoods in Auckland, New Zealand. *Journal of Urban Design*, 20(4), 417-436.
<https://doi.org/http://dx.doi.org/10.1080/13574809.2015.1044504>
- Carver, A., Timperio, A., Hesketh, K., & Crawford, D. (2010). Are children and adolescents less active if parents restrict their physical activity and active transport due to perceived risk? *Social Science & Medicine*, 70(11), 1799-1805.
<https://doi.org/https://doi.org/10.1016/j.socscimed.2010.02.010>
- Chang, E. (2018). Bridging an engagement gap: Towards equitable community-based technology leadership practice. *International Journal of Leadership in Education*, 1-19. <https://doi.org/doi:10.1080/13603124.2018.1492504>
- Christchurch City Council. (2013). Community board and ward profiles: Cashmere Ward. Retrieved 7 February, 2019, from <https://ccc.govt.nz/culture-and-community/christchurch/statistics-and-facts/community-profiles/spreydon-cashmere/cashmere-ward/>
- Christchurch City Council. (2017). *Planning Map 33A: Zones, Other Notations, Designations and Heritage Orders*. Retrieved from https://districtplan.ccc.govt.nz/linkedcontent/planningmaps/PlanningMaps_33.pdf
- Christchurch City Council. (2018a). Cyclist numbers step up a gear. Retrieved from <https://www.ccc.govt.nz/news-and-events/newsline/show/2916>
- Christchurch City Council. (2018b, September 2018). Explore By Bike: Christchurch Bike Guide and Map
- Christchurch City Council. (n.d.). About the Major Cycle routes. Retrieved 8 February, 2019, from <https://www.ccc.govt.nz/transport/cycling/major-cycle-routes/about-cycle-routes/>
- Christiansen, L. B., Toftager, M., Schipperijn, J., Ersbøll, A. K., Giles-Corti, B., & Troelsen, J. (2014). School site walkability and active school transport - association, mediation and moderation. *Journal of Transport Geography*, 34, 7-15.
<https://doi.org/doi:10.1016/j.jtrangeo.2013.10.012>
- Clark, T. C., Fleming, T., Bullen, P., Denny, S., Crengle, S., Dyson, B., . . . Utter, J. (2013). *Youth'12 Overview: The health and wellbeing of New Zealand secondary schools students in 2012*. Auckland, New Zealand: The University of Auckland.
- Clarke, C. (2012). Evaluation of New Zealand's bicycle helmet law. *New Zealand Medical Journal*, 125(1349), 1-10.
- Collins, D., & Kearns, R. (2001). The safe journeys of an enterprising school: Negotiating landscapes of opportunity and risk. *Health & Place*, 7(4), 293-306.
[https://doi.org/doi:10.1016/S1353-8292\(01\)00021-1](https://doi.org/doi:10.1016/S1353-8292(01)00021-1)
- Collins, D., & Kearns, R. (2010). Walking school buses in the Auckland region: A longitudinal assessment. *Transport Policy*, 17(1), 1-8.
<https://doi.org/doi:10.1016/j.tranpol.2009.06.003>
- Cooper, J., & Corcoran, J. (2018). Journey to work in Australia. Retrieved 10 January, 2019, from <http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/2071.0.55.001~2016>

- Currie, G., & Delbosc, A. (2010). Modelling the social and psychological impacts of transport disadvantage. *Transportation*, 37(6), 953-966.
<https://doi.org/doi:10.1007/s11116-010-9280-2>
- Curtis, C., Babb, C., & Olaru, D. (2015). Built environment and children's travel to school. *Transport Policy*, 42, 21-33.
<https://doi.org/http://dx.doi.org/10.1016/j.tranpol.2015.04.003>
- Department for Transport. (2016). *National Travel Survey: England 2015*.
- Department of Corrections. (2008). *Over-representation of Māori in the criminal justice system*. Retrieved from
https://www.corrections.govt.nz/resources/research_and_statistics/over-representation-of-maori-in-the-criminal-justice-system.html
- Devonport, A. (2017). *The impact of secondary school enrolment schemes on school desirability, academic achievement and transport*, University of Canterbury).
- Díez-Gutiérrez, M., Andersen, S., & Nilsen, Ø. (2018). Generated and induced traffic demand: Empirical evidence from a fixed link toll in Norway. *Case Studies of Transport Policy*. <https://doi.org/doi:10.1016/j.cstp.2018.11.007>
- Easton, S., & Ferrari, E. (2015). Children's travel to school - the interaction of individual, neighbourhood and school factors. *Transport Policy*, 44, 9-18.
<https://doi.org/http://dx.doi.org/10.1016/j.tranpol.2015.05.023>
- Education Counts. (2018). School Rolls. Retrieved 3 April, 2018, from
<https://www.educationcounts.govt.nz/statistics/schooling/student-numbers/6028>
- Ergler, C. M., Kearns, R., & Witten, K. (2016). Exploring children's seasonal play to promote active lifestyles in Auckland, New Zealand. *Health & Place*, 41, 67-77.
<https://doi.org/doi:10.1016/j.healthplace.2016.07.001>
- Fishman, E., Böcker, L., & Helbich, M. (2015). Adult Active Transport in the Netherlands: An analysis of its contribution to physical activity requirements. *Plos One*, 10(4), 1-14. <https://doi.org/doi:10.1371/journal.pone.0121871>
- Flanagan, C., Cumsille, P., Gill, S., & Gallay, L. (2007). School and community climates and civic commitments: Patterns for ethnic minority and majority students. *Journal of Educational Psychology*, 99(2), 421-432. <https://doi.org/doi:10.1037/0022-0663.99.2.421>
- Fleming, C., Manning, M., & Ambrey, C. (2016). Crime, greenspace and life satisfaction: An evaluation of the New Zealand experience. *Landscape and Urban Planning*, 149, 1-10. <https://doi.org/doi:10.1016/j.landurbplan.2015.12.014>
- Frank, L. D., Sallis, J. F., Conway, T., Chapman, J., Saelens, B. E., & Bachman, W. (2006). Many pathways from land use to health: Associations between neighbourhood walkability and active transportation, Body Mass Index and air quality. *Journal of the American Planning Association*, 72(1), 75-87.
<https://doi.org/DOI:10.1080/01944360608976725>
- Frater, J. (2015). *Influences on cycling to school among teenagers: An investigation using the theory of planned behaviour and the prototype willingness model in Christchurch, New Zealand*, University of Canterbury, Christchurch).
- Frater, J., & Kingham, S. (2018). Gender equity in health and the influence of intrapersonal factors on adolescent girls' decision to bicycle to school. *Journal of Transport Geography*, 71, 130-138. <https://doi.org/doi:10.1016/j.jtrangeo.2018.07.011>
- Freeman, C., & Tranter, P. (2011). *Children and their urban environment*. London; Washington DC: Earthscan.

- Furnham, A. (1986). Response bias, social desirability and dissimulation. *Personality and Individual Differences*, 7(3), 385-400. [https://doi.org/doi:10.1016/0191-8869\(86\)90014-0](https://doi.org/doi:10.1016/0191-8869(86)90014-0)
- Fyhri, A., Hjorthol, R., Mackett, R. L., Fotel, T. N., & Kyttä, M. (2011). Children's active transport and independent mobility in four countries: Development, social contributing trends and measures. *Transport Policy*, 18(5), 703-710. <https://doi.org/doi:10.1016/j.tranpol.2011.01.005>
- Gamble, T., Walker, I., & Laketa, A. (2015). Bicycling campaigns promoting health versus campaigns promoting safety: A randomized controlled online study of 'dangerization'. *Journal of Transport & Health*(3), 369-378. <https://doi.org/doi:10.1016/j.jth.2015.05.007>
- George, S., Duran, N., & Norris, K. (2014). A systematic review of barriers and facilitators to minority research participation among African Americans, Latinos, Asian Americans, and Pacific Islanders. *American Journal of Public Health*, 104(2), e16-e31. <https://doi.org/doi:10.2105/AJPH.2013.301706>
- Haeata Community Campus. (2016). Our Curriculum Retrieved 18 March, 2018, from <https://www.haeata.school.nz/our-curriculum>
- Hart, R. (1979). *Children's Experience of Place*. New York: Irvington.
- Hart, R. (1992). *Children's Experience of Place: From tokenism to citizenship*. Florence, Italy: UNICEF International Child Development Centre.
- Hinckson, E. (2016). Perceived challenges and facilitators of active travel following implementation of the School Travel-Plan programme in New Zealand children and adolescents. *Journal of Transport & Health*, 3, 321-325. <https://doi.org/doi:10.1016/j.jth.2016.05.126>
- Hinckson, E., Garrett, N., & Duncan, S. (2011). Active commuting to school in New Zealand children (2004-2008): A quantitative analysis. *Preventive Medicine*, 52(5), 332-336. <https://doi.org/doi:10.1016/j.ypmed.2011.02.010>
- Hoang, H. (2013). Mitigating barriers to civic engagement for low-income, minority youth ages 13-18: Best practices from environmental youth conferences. *Journal of Youth Development*, 8(3), 95-105. <https://doi.org/doi:10.5195/jyd.2013.87>
- Hobbs, S. H. (2008). Getting from fat to fit: The role of policy in the obesity disaster. *HealthcarePapers*, 9(1), 8-21.
- Ikeda, E., Hinckson, E., Witten, K., & Smith, M. (2018). Associations of children's active school travel with perceptions of the physical environment and characteristics of the social environment: A systematic review. *Health & Place*, 54, 118-131. <https://doi.org/doi:10.1016/j.healthplace.2018.09.009>
- Ikeda, E., Stewart, T., Garrett, N., Egli, V., Mandic, S., Hosking, J., . . . Smith, M. (2018). Built environment associates of active school travel in New Zealand children and youth: A systematic meta-analysis using individual participant data. *Journal of Transport & Health*, 9, 117-131. <https://doi.org/doi:10.1016/j.jth.2018.04.007>
- Irving, C. (2015). Crime prevention through environmental design: Application to Christchurch City planning practices. *Lincoln Planning Review*, 7(1-2), 44-47.
- James, S. W. (2013). Rights to the diverse city: Challenges to indigenous participation in urban planning and heritage preservation in Sydney, Australia. *Space and Culture*, 16(3), 274-287. <https://doi.org/doi:10.1177/1206331213487052>
- Jones, A., Steinbach, R., Roberts, H., Goodman, A., & Green, J. (2012). Rethinking passive transport: Bus fare exemptions and young people's wellbeing. *Health & Place*, 18(3), 605-612. <https://doi.org/https://doi.org/10.1016/j.healthplace.2012.01.003>

- Kawachi, I., Kennedy, B. P., & Wilkinson, R. G. (1999). Crime: Social disorganization and relative deprivation. *Social Science & Medicine*, 48(6), 719-731.
[https://doi.org/doi:10.1016/S0277-9536\(98\)00400-6](https://doi.org/doi:10.1016/S0277-9536(98)00400-6)
- Kingham, S., & Ussher, S. (2007). An assessment of the benefits of the walking school bus in Christchurch, New Zealand. *Transportation research Part A: Policy and Practice*, 41(6), 502-510. <https://doi.org/doi:10.1016/j.tra.2006.11.008>
- Knowles, R. D. (2009). Transport Geography. *International Encyclopedia of Human Geography*, 441-451.
- Koorey, G. (2003). *Why a cycling strategy on its own will NOT increase cycling*. presented at the New Zealand Cycling Conference,
- Kurka, J. M., Adams, M. A., Todd, M., Colburn, T., Sallis, J. F., Cain, K. L., . . . Saelens, B. E. (2015). Patterns of neighbourhood environment attributes in relation to children's physical activity. *Health & Place*, 34, 164-170.
<https://doi.org/doi:10.1016/j.healthplace.2015.05.006>
- Litman, T. (2003). Integrating public health objectives in transportation decision-making. *American Journal of Health Promotion*, 18(1), 103-108.
<https://doi.org/doi:10.4278/0890-1171-18.1.103>
- Long, J., & Cann, G. (2017, October 13, 2017). 'Flexible learning': an education fad, or a positive move for kids? Retrieved from
<https://www.stuff.co.nz/national/education/97739748/Flexible-learning-an-education-fad-or-a-positive-move-for-kids>
- Mackett, R. L. (2002). Increasing car dependency of children. Should we be worried? *Proceedings of the Institution of Civil Engineers: Municipal Engineer*, 151(1), 29-38.
<https://doi.org/doi:10.1680/muen.2002.151.1.29>
- Mackett, R. L. (2013). Children's travel behaviour and its health implications. *Transport Policy*, 26, 66-72.
- Mandic, S., de la Barra, S. L., Bengoechea, E. G., Stevens, E., Flaherty, C., Moore, A., . . . Skidmore, P. (2015). Personal, social and environmental correlates of active transport to school among adolescents in Otago, New Zealand. *Journal of Science and Medicine in Sport*, 18(4), 432-437. <https://doi.org/doi:10.1016/j.jsams.2014.06.012>
- Mandic, S., Flaherty, C., Pocock, T., Kek, C. C., Chillón, P., Ergler, C. M., & Bengoechea, E. G. (2017). Parental perceptions of cycle training for adolescents. *Journal of Transport & Health*, 6, 411-419. <https://doi.org/10.1016/j.jth.2017.03.009>
- Mandic, S., Flaherty, C., Pocock, T., Kek, C. C., McArthur, S., Chillón, P., & Bengoechea, E. G. (2018). Effects of cycle skills training on children's cycling-related knowledge, confidence and behaviours. *Journal of Transport & Health*, 8, 271-282.
<https://doi.org/doi:10.1016/j.jth.2017.12.010>
- Mandic, S., Flaherty, C., Pocock, T., Mintoft-Jones, A., Frater, J., Chillón, P., & Bengoechea, E. G. (2016). Attitudes towards cycle skills training in New Zealand adolescents. *Transportation Research Part F: Psychology and Behaviour*, 42, 217-226.
<https://doi.org/doi:10.1016/j.trf.2016.08.002>
- Mandic, S., Williams, J., Moore, A., Hopkins, D., Flaherty, C., Wilson, G., . . . Spence, J. C. (2016). Built environment and active transport to school (BEATS) study: Protocol for a cross-sectional study. *BMJ Open*, 6(5), 1-11. <https://doi.org/doi:10.1136/bmjopen-2016-011196>
- Masiulanic, K. (2017). Chaos and Confusion: The clash between adults' and children's spaces. In K. Masiulanic & E. Cummins (Eds.), *How to Grow a Playspace: Development and Design* (pp. 49-64). New York: Routledge.
- Mavoia, S., Witten, K., McCreanor, T., & O'Sullivan, D. (2012). GIS based destination accessibility via public transit and walking in Auckland, New Zealand. *Journal of*

- Transport Geography*, 20(1), 15-22.
<https://doi.org/doi:10.1016/j.jtrangeo.2011.10.001>
- McDonald, N. (2007). Active transportation to school: Trends among U.S. school children. *American Journal of Preventive Medicine*, 32(6), 509-516.
<https://doi.org/doi.org/10.1016/j.amepre.2007.02.022>
- Miller, H. J. (1999). Potential contributions of spatial analysis to geographic information systems for transportation (GIS-T). *Geographical Analysis*, 31(4), 373-399.
<https://doi.org/doi.org/10.1111/j.1538-4632.1999.tb00991.x>
- Millward, H., Spinney, J., & Scott, D. (2013). Active-transport walking behavior: destinations, durations, distances. *Journal of Transport Geography*, 28, 101-110.
<https://doi.org/doi.org/10.1016/j.jtrangeo.2012.11.012>
- Ministry for the Environment. (2018). *New Zealand's Greenhouse Gas Inventory 1960-2016*.
- Ministry of Education. (1988). *Tomorrow's Schools: The Reform of Education Administration in New Zealand*.
- Ministry of Education. (2013). Quick Stats about Māori Education. Retrieved 30 January, 2019, from <https://www.educationcounts.govt.nz/topics/31351/nga-haeata-matauranga-annual-report-on-maori-education/7.-quick-stats-about-maori-education>
- Ministry of Education. (2015). *Designing Schools in New Zealand: Requirements and Guidelines*.
- Ministry of Education. (2017). Haeata Community Campus. Retrieved 18 March, 2018, from <https://www.education.govt.nz/ministry-of-education/specific-initiatives/christchurch-schools-rebuild-programme-2013-2022/haeata-community-campus/>
- Ministry of Education. (2018). School deciles. Retrieved 18 January, 2019, from <https://www.education.govt.nz/school/running-a-school/resourcing/operational-funding/school-decile-ratings/>
- Ministry of Health. (2003). *NZ Food, NZ Children: Key Results of the 2002 National Children's Nutrition Survey*. Wellington, New Zealand:
- Ministry of Health. (2016). *Annual Update of Key Results 2015/16: New Zealand Health Survey*. Wellington:
- Ministry of Health. (2017a). How much activity is recommended? Retrieved from <https://www.health.govt.nz/your-health/healthy-living/food-activity-and-sleep/physical-activity/how-much-activity-recommended>
- Ministry of Health. (2017b). Obesity statistics. Retrieved April 8, 2018, from <https://www.health.govt.nz/nz-health-statistics/health-statistics-and-data-sets/obesity-statistics>
- Ministry of Health. (2017c). *Sit Less, Move More, Sleep Well: Physical Activity Guidelines for Children and Young People*. Retrieved from <https://www.health.govt.nz/system/files/documents/pages/physical-activity-guidelines-for-children-and-young-people-may17.pdf>
- Ministry of Health. (2018). Obesity. Retrieved 10 January, 2019, from <https://www.health.govt.nz/our-work/diseases-and-conditions/obesity>
- Ministry of Transport. (2010). *Safer Journeys: New Zealand's Road Safety Strategy 2010-2020*.
- Ministry of Transport. (2017a). *New Zealand Household Travel Survey 2015-2017*. Retrieved from <https://www.transport.govt.nz/assets/Uploads/Research/Documents/18b14beb02/Houshold-Travel-Survey-intro-Dec2017.pdf>
- Ministry of Transport. (2017b). *Pedestrian Crash Facts*.
- Ministry of Transport. (2018a). *Cabinet Paper Improving Road Safety in New Zealand*.

- Ministry of Transport. (2018b). *Government Policy Statement on Land Transport*. Retrieved from <https://www.transport.govt.nz/multi-modal/keystrategiesandplans/gpsonlandtransportfunding/>
- Ministry of Transport. (2019). New results from Household Travel Survey: Overview. Retrieved from <https://www.transport.govt.nz/mot-resources/household-travel-survey/new-results/overview/>
- Molina-García, J., Queralt, A., Bengoechea, E. G., Moore, A., & Mandic, S. (2018). Would New Zealand adolescents cycle to school more if allowed to cycle without a helmet? *Journal of Transport & Health*, *11*, 64-72. <https://doi.org/doi:10.1016/j.jth.2018.10.001>
- Montgomery, R. (2013). The Aranui/Hampshire Paradox: Planning and the politics of street naming in Christchurch, New Zealand. *Lincoln Planning Review*, *5*(1-2), 27-34.
- Munford, R., & Walsh-Tapiata, W. (2006). Community development: working in the bicultural context of Aotearoa New Zealand. *Community Development Journal*, *41*(4), 426-442. <https://doi.org/doi:10.1093/cdj/bsl025>
- Mutch, C. (2017). Winners and losers: School closures in post-earthquake Canterbury and the dissolution of community. *Waikato Journal of Education*, *22*(1), 73-95. <https://doi.org/doi:10.15663/wje.v22i1.543>
- Naik, M. (2017). Of agency, participation and design: Two contrasting play scenarios in Indian cities. In K. Masiulani & E. Cummins (Eds.), *How to Grow a Playspace: Development and Design* (pp. 65-71). New York: Routledge.
- New Zealand Government. (2014). *\$100 million for urban cycleways* [Press release]. Retrieved from <https://www.beehive.govt.nz/release/govt-delivers-333-million-urban-cycleways>
- New Zealand Government. (n.d.). Kōrero Mātauranga | Education Conversation. Retrieved from <https://conversation.education.govt.nz/>
- New Zealand Institute of Economic Research. (2017). *Benefits from Auckland road decongestion*. Retrieved from https://nzier.org.nz/static/media/filer_public/6f/df/6fdfdada-923e-4199-8da9-cc940ae25bc1/nzier_report_on_auckland_benefits_of_decongestion.pdf
- New Zealand Transport Agency. (2018). *National Land Transport Programme 2018-21*.
- New Zealand Transport Agency. (2019). Our current advertising: Cycling advertising. Retrieved from <https://www.nzta.govt.nz/safety/our-advertising/our-current-advertising/cycling-advertising/>
- Newell, J., Beaven, S., & Johnston, D. M. (2012). *Population movements following the 2010-2011 Canterbury Earthquakes: Summary of research workshops November 2011 and current evidence*. Lower Hutt, NZ: GNS Science. Retrieved from http://www.massey.ac.nz/massey/fms/Colleges/College%20of%20Humanities%20and%20Social%20Sciences/Psychology/Disasters/pubs/GNS/2012/Misc_Series_44.pdf
- Newtown, K. (2018). White Noise: Some Aucklanders have more say in their city's future than others. *Radio New Zealand*. Retrieved from <http://shorthand.radionz.co.nz/white-noise/>
- Oliver, M., Badland, H., Mavoa, S., Witten, K., Kearns, R., Ellaway, A., . . . Schuller, P. J. (2014). Environmental and socio-demographic associates of children's active transport to school: a cross-sectional investigation from the URBAN Study. *international Journal of Behavioral Nutrition and Physical Activity*, *11*(1), 70-82. <https://doi.org/doi:10.1186/1479-5868-11-70>
- Oliver, M., Mavoa, S., Badland, H., Parker, K., Donovan, P., Kearns, R., . . . Witten, K. (2015). Associations between the neighbourhood built environment and out of school

- physical activity and active travel: An examination from the Kids in the City Study. *Health & Place*, 36, 57-64. <https://doi.org/doi:10.1016/j.healthplace.2015.09.005>
- Oliver, M., Schoeppe, S., Mavoa, S., Duncan, S., Donovan, P., & Kytta, M. (2016). Children's geographies for activity and play: an overview of measurement approaches. *Play and Recreation, Health and Wellbeing*, 67-86. https://doi.org/10.1007/978-981-4585-96-5_16-1
- Oliver, M., Witten, K., Kearns, R., Mavoa, S., Badland, H., Carroll, P., . . . Ergler, C. M. (2011). Kids in the City study: Research design and methodology. *BMC Public Health*, 11(1-12). <https://doi.org/doi:10.1186/1471-2458-11-587>
- Palmer, S. (2018). The New Zealand schools with the highest expulsion rates. *Newshub*. Retrieved from <https://www.newshub.co.nz/home/new-zealand/2018/04/the-new-zealand-schools-with-the-highest-expulsion-rates.html>
- Pearce, J., Witten, K., Hiscock, R., & Blakely, T. (2007). Are socially disadvantaged neighbourhoods deprived of health-related community resources? *International Journal of Epidemiology*, 36, 348-355. <https://doi.org/doi:10.1093/ije/dy1267>
- Potter, S. H., Becker, J. S., Johnston, D. M., & Rossiter, K. P. (2015). An overview of the impacts of the 2010-11 Canterbury earthquakes. *International Journal of Disaster Risk Reduction*, 14(1), 6-14. <https://doi.org/doi.org/10.1016/j.ijdrr.2015.01.014>
- Prelipcean, A., Gidófalvi, G., & Susilo, Y. (2015, 3-5 June 2015). *Comparative framework for activity-travel diary collection systems*. presented at the Models and Technologies for Intelligent Transport Systems (MT-ITS), Budapest, Hungary. <https://doi.org/doi:10.1109/MTITS.2015.7223264>
- Rabl, A., & de Nazelle, A. (2012). Benefits of shift from car to active transport. *Transport Policy*, 19(1), 121-131. <https://doi.org/doi:10.1016/j.tranpol.2011.09.008>
- Raerino, K., Macmillan, A. K., & Jones, R. G. (2013). Indigenous Māori perspectives on urban transport patterns linked to health and wellbeing. *Health & Place*, 23, 54-62. <https://doi.org/doi.org/10.1016/j.healthplace.2013.04.007>
- Redmond, A. (2017a, September 1, 2017). Aranui community concerned by modern learning environments, fighting at Haeata Community Campus. Retrieved from <https://www.stuff.co.nz/national/education/96372363/aranui-community-concerned-by-modern-learning-environments-fighting-at-haeata-community-campus>
- Redmond, A. (2017b, September 6, 2017). Haeata Community College hell or a haven? Retrieved from <https://www.stuff.co.nz/national/education/96506320/haeata-community-college-hell-or-a-haven>
- Reimers, A., Mess, F., Bucksch, J., Jekauc, D., & Woll, A. (2013). Systematic review on measurement properties of questionnaires assessing the neighbourhood environment in the context of youth physical activity behaviour. *BMC Public Health*, 13(1), 1-15. <https://doi.org/doi:10.1186/1471-2458-13-461>
- Rogerson, P. (2010). *Statistical methods for geography: A student's guide* (3rd ed.). Los Angeles: Sage.
- Sallis, J. F., Owen, N., & Fisher, E. B. (2008). Ecological Models of Health Behaviour. In K. Glanz, B. K. Rimer, & K. Viswanath (Eds.), *Health Behaviour and Health Education: Theory, Research and Practice* (4th Edition ed., pp. 465-485). San Francisco, CA: Wiley.
- Schlich, R., & Axhausen, K. (2003). Habitual travel behaviour: Evidence from a six-week travel diary. *Transportation*, 30(1), 13-36. <https://doi.org/doi:10.1023/A:1021230507071>
- Shaw, S.-L. (2010). Geographic information systems for transportation: from a static past to a dynamic future. *Annals of GIS*, 16(3), 129-140. <https://doi.org/10.1080/19475683.2010.513155>

- Sibley, C. G., & Liu, J. H. (2004). Attitudes towards biculturalism in New Zealand: Social dominance and Pākehā attitudes towards the general principles and resource-specific aspects of bicultural policy. *New Zealand Journal of Psychology*, 33(2), 88-99.
- Skov-Petersen, H., Jacobsen, J. B., Vedel, S. E., Thomas, A. S. N., & Rask, S. (2017). Effects of upgrading to cycle highways - An analysis of demand induction, use patterns and satisfaction before and after. *Journal of Transport Geography*, 64, 203-210.
<https://doi.org/doi:10.1016/j.jtrangeo.2017.09.011>
- Statistics New Zealand. (2013a). 2013 QuickStats about income. Retrieved from <http://archive.stats.govt.nz/Census/2013-census/profile-and-summary-reports/quickstats-income.aspx>
- Statistics New Zealand. (2013b). *QuickStats about Aranui*. Retrieved from http://archive.stats.govt.nz/Census/2013-census/profile-and-summary-reports/quickstats-about-a-place.aspx?request_value=14841&parent_id=14758&tabname=&sc_device=pdf
- Statistics New Zealand. (2015). 2013 Census QuickStats about transportation and communications. Retrieved 10 January, 2019, from <http://archive.stats.govt.nz/Census/2013-census/profile-and-summary-reports/quickstats-transport-comms/travel-to-work.aspx>
- Stone, M. R., & Faulkner, G. (2014). Outdoor play in children: Associations with objectively-measured physical activity, sedentary behaviour and weight status. *Preventive Medicine*, 65, 122-127. <https://doi.org/doi:10.1016/j.ypmed.2014.05.008>
- Suzuki, H., Cervero, R., & Iuchi, K. (2013). *Transforming cities with transit: Transit and land-use integration for sustainable urban environment*. Washington, D.C.: The World Bank.
- Turrell, G., Haynes, M., Wilson, L., & Giles-Corti, B. (2013). Can the built environment reduce health inequalities? A study of neighbourhood socioeconomic disadvantage and walking for transport. *Health & Place*, 19(1), 89-98.
<https://doi.org/doi:10.1016/j.healthplace.2012.10.008>
- Veitch, J., Carver, A., Salmon, J., Abbott, G., Ball, K., Crawford, D., . . . Timperio, A. (2017). What predicts children's active transport and independent mobility in disadvantaged neighbourhoods? . *Health & Place*, 44, 103-109.
<https://doi.org/https://doi.org/10.1016/j.healthplace.2017.02.003>
- Visser, S., & Jones, J. P. I. (2010). Measurement and Interpretation. In B. Gomez & J. P. I. Jones (Eds.), *Research Methods in Geography: A Critical Introduction* (pp. 41-59). West Sussex, UK: Wiley-Blackwell.
- Wati, K., & Tranter, P. (2015). Spatial and socio-demographic determinants of South East Queensland students' school cycling. *Journal of Transport Geography*, 47, 23-26.
<https://doi.org/doi:10.1016/j.jtrangeo.2015.07.005>
- Witten, K., Kearns, R., Carroll, P., & Asiasiga, L. (2017). Children's everyday encounters and affective relations with place: experiences of hyperdiversity in Auckland neighbourhoods. *Social & Cultural Geography*, 1-18.
<https://doi.org/doi:10.1080/14649365.2017.1347700>
- Wood, J. (2017). Planning for children's play: Exploring the 'forgotten' right in Welsh and Scottish policy. *Town Planning Review*, 88(5), 579-602.
<https://doi.org/doi:10.3828/tpr.2017.35>
- Yeager, C., & Stieger, T. (2013). Applied geography in a digital age: The case for mixed methods. *Applied Geography*, 39, 1-4.
<https://doi.org/doi:10.1016/j.apgeog.2012.12.001>

Appendices

Appendix 1: Maptionnaire Survey Questions

Transport Patterns

1. How do you usually get to school? (Almost every day, Sometimes, Rarely, Never)
 - a. Walking
 - b. Biking
 - c. Skateboard/Scooter
 - d. Bus
 - e. Car
2. Who would you usually travel to school with?
 - a. Alone
 - b. With siblings
 - c. With friends
 - d. With my parent(s) or caregiver
 - e. Other? Specify
3. How do you usually get home from school? (Almost every day, Sometimes, Rarely, Never)
 - a. Walking
 - b. Biking
 - c. Skateboard/Scooter
 - d. Bus
 - e. Car
4. Who would you usually travel home from school with?
 - a. Alone
 - b. With siblings
 - c. With friends
 - d. With my parent(s) or caregiver
 - e. Other? Specify

Thinking about the last time you came to school

5. How did you get to school?
 - a. Walking
 - b. Biking
 - c. Skateboard/scooter
 - d. Bus
 - e. Car
 - f. Other? Specify
6. How did you get home from school?
 - a. Walking

- b. Biking
- c. Skateboard/scooter
- d. Bus
- e. Car
- f. Other? Specify

Preferred mode

7. If you could change how you get to and from school, which of the following would you choose?
- a. I wouldn't change anything
 - b. Walking
 - c. Cycling
 - d. Scooter/skateboard
 - e. Bus
 - f. Car
8. Why would you prefer this mode?

How much does your whanau influence your travel?

9. My parent(s) or caregiver choose how I get to and from school
- a. Agree
 - b. Disagree
 - c. Other
10. My parent(s) or caregiver let me choose what I do before and after school
- a. Agree
 - b. Disagree
 - c. Other
11. It is easiest for me to travel with my parent(s) or caregiver
- a. Agree
 - b. Disagree
 - c. Other

Local streets:

12. How safe would you feel walking or hanging out in these streets? (1=not safe, 10=very safe)
- a. Pages Road
 - b. Breezes Road
 - c. Hampshire Street
 - d. Shortland Street
13. Do you know where your house is on this map? If yes, please click on the nearest road or street to your house, then click next
14. Which places around Haeta do you like to travel to or hang out in? You can repeat as many times as you like before moving onto the next question.

- a. Can you describe why you like this space?
- 15. Which places around Haeata do you dislike travelling or hanging out in? You can repeat as many times as you like before moving onto the next question.
 - a. Can you describe why you dislike this space?

About you

- 16. How old are you?
- 17. What is your ethnicity?
 - a. NZ Māori
 - b. NZ Pākehā
 - c. Pasifika
 - d. Asian
 - e. European
 - f. Other, specify
- 18. What gender are you?
 - a. Male
 - b. Female
 - c. I don't want to say
 - d. Other, specify

Final thoughts

- 19. Is there anything else you'd like to tell us about your journey to and from school?

