Encouraging Active Transport use at Hillmorton High School

Olivia Archer, Tanya Smith, Julia Hopkins, Connor Wilson, Max Hamilton

GEOG309 – S2-23

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Executive Summary

Hillmorton High school is a co- educational high school located in the south-east of Christchurch, New Zealand. As of July 2022, the school had a roll of 1077 students (Ministry of Education, 2022), consisting of students between years 7 to 13. Within the next 10 years, the school is anticipating a roll growth to approximately 2000 students fuelled population growth of the surrounding suburbs of Wigram and Halswell. This means that the school would outgrow its current infrastructure, leading to a plethora of upgrades.

The school has already started planning major changes to the school's layout, with notable developments being the gym and 36 new learning spaces already in development. However, an area of concern that isn't often addressed – particularly within secondary education, is the methods and problems surrounding getting to and from school. To address this, the Christchurch City Council (CCC) and Hillmorton High School (HHS) are seeking data and associated analysis on how their students are travelling, why they use the modes that they do, and what the barriers and deterrents are to changing their transport behaviours to be synonymous with Active travel (AT), leading to the question of "how do we support active transport use at HHS based on their current travel behaviours."

To do this, we employed several spatial, quantitative, and qualitative techniques including a survey, GIS analysis and several site visits. Whilst our methods have their limitations due to the impact of ethical approval and time constraints, the results gave us sufficient insight to HHS's travel behaviours and allowed us to make some key conclusions.

Our key findings include:

- HHS already utilise active transport modes, with walking, cycling, and taking the bus being the main modes of transport.
- Private vehicles remained prominent within staff, mostly due to convenience, efficiency, and safety.
- Key issues and concerns throughout the whole school community were surrounding parking, congestion at the school gate and students showing a lack of knowledge about AT.
- The main locations of concern were the intersections on Halswell, Tankerville, and Mathers Roads. These are the intersections directly surrounding the school.

Building on projects already in progress from Waka Kotahi and the CCC, we recommend the inclusion of increased bike racks, increasing AT education, increasing bus accessibility, and improving the current pedestrian crossings in the immediate area. As there is a limited budget for infrastructure change, the most efficient solutions we found are social and educational changes and occur on the school's level.

Introduction

Hillmorton High School (HHS) is a Co-Educational High School with 1,077 students from years 7 to 13 as of July 2022. Over the next decade, the school expects a substantial increase to approximately 2000 students due to the population growth in nearby Wigram and Halswell suburbs, straining its existing infrastructure. However, transportation methods and challenges for students remain largely unexplored. To address this, the Christchurch City Council (CCC) and HHS are collaborating to gather data and conduct analyses on students' travel choices, motivations, and barriers to adopting Active Transport (AT) options, and we have been asked to analyse this and give recommendations.

Theory and Concepts

Definitions

Active transport – "Active transport or travel is any means of getting from A to B that involves being physically active" (Cambridgeshire Insight, 2017). This includes walking, scootering, cycling, or the first and last mile taking a bus.

Social Infrastructure - Term used to "encapsulate how society functions and defines people and their actions through culture, values, norms, sense of belonging, relationships and networks" (Beaton et al., 2020). This includes services in health, education, community support and development and emergency services (Davern et al., 2018).

Physical infrastructure – "fixed installations, structures, and networks that provide a framework for the movement of people and goods" (Biasotti, 2023). This includes buses, crossings, and cycle lanes, as well as roads and footpaths themselves.

Active Transport and Modes

The first idea that needs addressing is the current transport modes in use for schools, and the reasons for differences in use. All possible transport modes include private vehicles, motorcycles, buses, bicycles, walking, or small wheel modes (skateboard/scooter). Findings showed predominant use of cars/vans and low use of AT in the context of school travel (Dias et al., 2022, Simons et.al., 2017, Buehler et.al., 2011). Research also showed frequent use of surveys and analysis, and use of qualitative research designs (Simons et al., 2017; Dias et al., 2022) to collect this type of data.

Using AT provides several benefits, such as improved health and well-being, more frequent social interactions, and environmental benefits such as lowered carbon emissions. Saunders et al. (2013) found evidence that active travel can reduce the risk of diabetes, which is consistent with Martin et al. (2014) who also found that active travel can be highly beneficial for physical health and mental wellbeing.

There are numerous barriers to engaging in AT modes. Smith et al. (2020) and Wong et.al. (2011) found that distance and child safety are associated with children's AT. This was reinforced by Faulkner et al. (2010) who indicated that child safety was a consistent factor within parental influences. Another study from Mandic et al., (2018) found a negative association between children engaging in active travel due to their school bag weight and were instead opting for non-active modes such as private vehicle use.

Social Infrastructure

Social norms and group dynamics have a larger impact on students' choices regarding AT rather than individual perceptions (Fasan et al., 2021), leading to many mixed results within the literature. Students often feel social pressure to appear cool, leading to embarrassment when choosing AT modes from exposure to social media (Frater & Kingham, 2018), however a case study at Palmerston North Boys High School found there was no stigma around cycling due to social pressure. (Cheyne et al., 2017). Walking to school is also viewed as a valuable social time shared between friends therefore encouraging walking over cycling (Frater & Kingham, 2018).

Parents have a substantial influence on their children's choice of AT due to their perceived safety and convenience of car trip chaining (Mandic et al., 2015, Swain et.al.,2020). The absence of family encouragement and role modelling further reduces the likelihood of students adopting AT (Cheyne et al., 2017). Another study from Wilson et al., (2018) discovered that parent's socioeconomic status and their location from school played a role in whether students travelled actively. Engaging students and parents in education about AT modes has the potential to be beneficial for addressing this form of control. Having the peace of mind that their student has the capability to use AT modes safely can make AT more socially viable, with options for going about this including promotional strategies, incentives, emulation, and altering perceptions (Fasan et al., 2021; Cheyne et al., 2017).

Gender roles also showed varying effects and perception on AT modes. (Buehler et al., 2011). Girls often face challenges related to maintaining appearance, personal hygiene, and body image satisfaction, leading to concerns about physical activity and cycling in particular (Frater & Kingham, 2018; Fasan et al., 2021; Mandic et al., 2015).

Physical Infrastructure and Safety

Physical infrastructure plays a huge role in the perceptions of school travel safety (Smith et.al., 2020; Shaaban et.al.,2020). This includes end of route facilities, crossings, bus infrastructure and route quality.

The provision of infrastructure that supports different methods both during and at the end of route contributes to the overall accessibility of an area (Shaaban et.al., 2020). Crossings were the main source of increased safety perception, with signalized crossings being perceived as the safest and unmarked and refuge crossings being the most dangerous (Swain et.al., 2020). This was also reflected in Smith et.al. (2020) and Painter et.al (2018) where the addition of infrastructure such as tactile paving, cycle paths, larger footpath coverage and relocating crossings to better locations showed an increase in perceived safety on a long-term scale. Some of the studies also found that the presence of smaller scale infrastructure such as safe bike parking and the formalization of bus stops made students want to bike more often (Painter et.al., 2008, Smith et.al., 2020).

HHS has many bus networks connecting the school to its surrounding suburbs. The most frequently reported barriers across students, parents and staff in Mindell et.al (2021) were being alone/stranger danger on buses, infrequent bus services and unsuitable timetables. These issues can all be mitigated by infrastructural and logistical changes such as better facilitating bus stops, changing bus routes and increasing frequency (Mindell et.al., 2021).

It is important to note that changing infrastructure can initially have the reverse impact on safety because when large adjustments occur in communities, it may take a while for the community to adjust to change due to the group's joint mentality. (Smith et.al., 2020). However, in the long term, the impacts of the infrastructure changes around schools can be observed as being positive. This was seen in McDonald et.al (2013) where walking and biking in Auckland schools increased over the course of three years following major infrastructure changes.

Methods

Survey

The main method of sourcing data was an anonymous online survey which was provided for our project by the CCC following their School Travel Safety planning processes, however, the council welcomed our additions and input to the survey. The survey was sent to the school's students, staff, and parents and was available to be completed for approximately 2.5 weeks, with the distribution of these results indicated in Table 1. Quantitative analysis tools such as the use of Power Query and pivot tables were used to analyse multichoice and closed-answer survey questions, whilst short answer qualitative responses were sorted through manually into categories.

Site visits

Our group visited the site on two separate occasions to become familiar with the school and to confirm and investigate any points of concern. The findings from these can be found in Appendix A.

Geographic Information System (GIS)

GIS was used primarily as a visual aid to give spatial context to some of the responses in the survey, as well as being able to identify gaps within existing infrastructure.

There were 3 main data sources used: bus routes, school zones, and the locations of concern. We also made attempts to visualize the students' addresses (Figure 1). This entailed using anonymized student addresses to create heatmaps of where the students were coming from and their potential routes to school but because of issues surrounding ethical consent, the data we had was too anonymous and didn't give us the data we needed. The data for a single street was often reduced to a single high-density point, making the distributions not representative.

Figure 1: School addresses as a heatmap showing high-density areas at the intersection of Hoon hay, Curletts, Halswell and Lincoln roads. Areas such as Oaklands (bottom left) may be more accurate due to the streets being shorter.

Bus routes

The bus routes were difficult to access due to having to use an API to access the files. Metro Canterbury stores bus routes in their system as General Transit Feed Specification (GFTS) files which are available to use on a commercial level.

The GFTS files were extracted using python, using an API request system, producing files that contain coordinates, point ID's and route identifiers. This meant that the routes appeared as thousands of points as opposed to recognisable routes. Using the route identifiers and the point to line feature on QGIS, the routes were then visualised to be recognisable.

Locations of Concern

The locations of concern were collated from the survey questions into a shared list of locations with values indicating how many times they were mentioned. These were imported into QGIS by adding points and attributes to a shapefile. As there were roads mentioned without exact locations, the whole road was highlighted to avoid bias.

School Zones

The school zones were scraped from a leaflet from the Education Counts website. Education Counts holds the Ministry of Educations publicly available data, including school zones, roll counts and demographic

information. The extraction involved using python code to extract a JSON file from the leaflet, and then converting that raw data into a Geo JSON file that could be imported into QGIS.

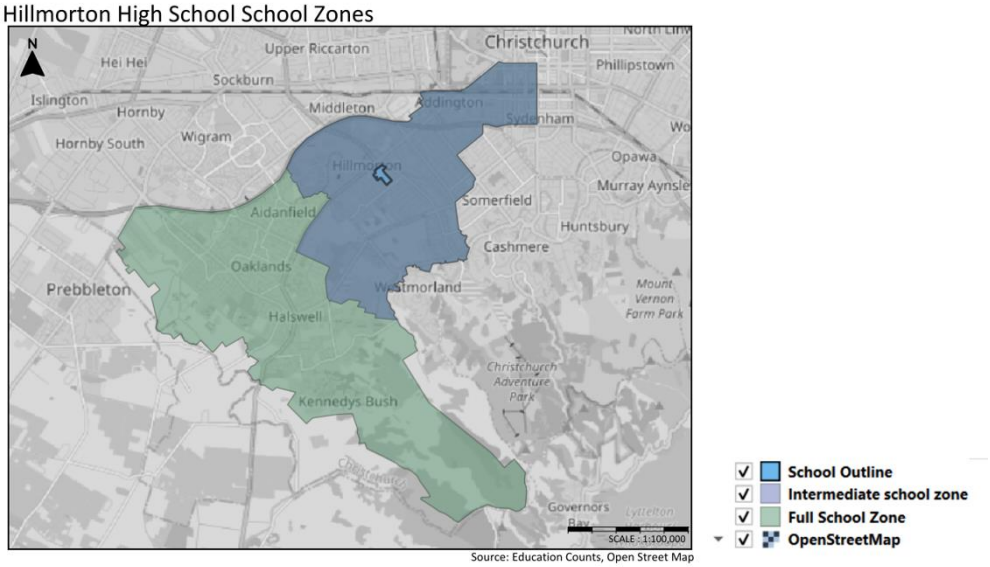

Figure 2: School zones for HHS, blue shows intermediate zone (Year 7-8), green shows full school zone (Year 7-13).

Results

Survey data

Data breakdown

Data Source	Date(s) collected	Method	Sample size	Total in roll	Percentage completed
Years 7-13 Student survey	August	Online	379	1077	35.2%
Parent survey	August	Online	124	N/A	N/A
Staff survey	August	Online	54	137	39.4%
		Total	557		

Modes of Transport

How do you usually travel to work?

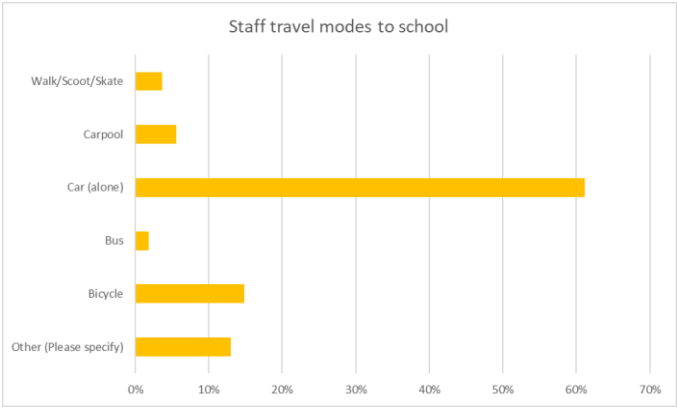

Figure 3: Main modes of travel used by staff members.

Travelling alone by car is the highest reported mode of getting to work by staff, and travelling by bus is the lowest reported mode.

How do you usually travel to school?

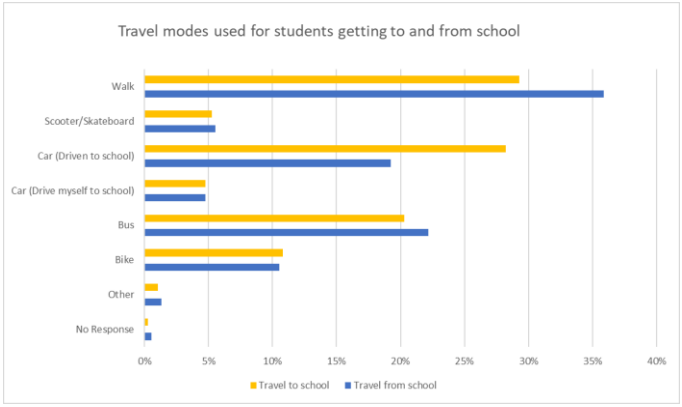

Figure 4: Main travel modes used by students getting to/from school, as reported by the Parent/Caregiver

Walking, family car, and taking the bus are the main modes of transportation for students travelling to and from school, however the distribution of them changes before and after school.

How does your child usually travel to school?

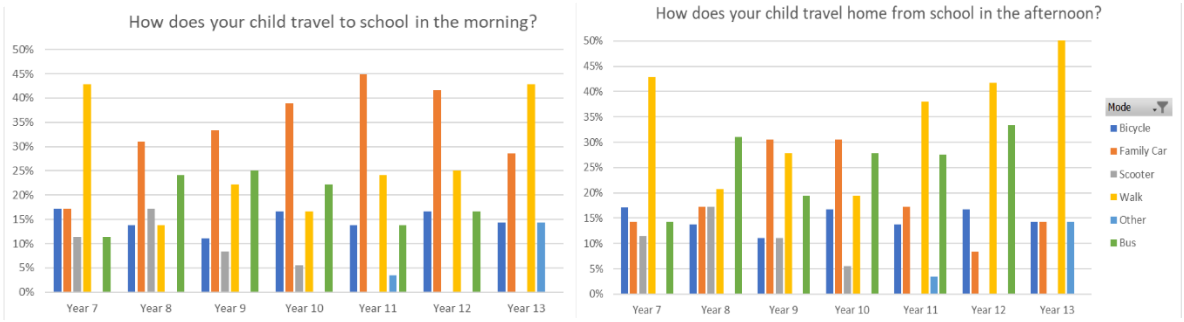

Figure 5: Main modes of transport used by children travelling to school by year group, as reported by the Parent/Caregiver.

The most common modes used are family cars, walking and bussing. When getting to school the Year 7's and Year 13's walks the most, and there is a decrease in active modes from Year 8-12, Only students Year 10 and below scooter to school, and cycling remains consistent throughout all year levels.

When leaving school, walking is the most common mode, followed by bus then car. There is a decrease in the use of family car in comparison to arriving to school. This is met with an increase in the use of buses and walkers after school. Cycling percentage remains consistent with before-school travel.

Distance of travel

How far do you have to travel to get to school?

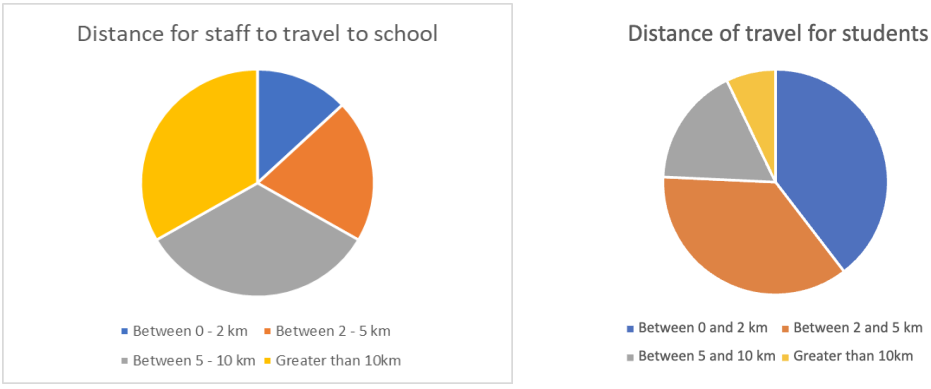

Figure 6: Distance travelled to school for staff and students.

The majority (66.67%) of staff travel more than 5km to get to work. In contrast, most students (76%) travel between 0km and 5km to get to school, with the majority of those being less than 2km.

Table 2: Distance to school by year level.

Distance	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Grand Total
Between 0 and 2 km	4.22%	3.69%	6.60%	6.60%	8.71%	5.80%	3.96%	39.58%
Between 2 and 5 km	1.58%	2.11%	7.39%	5.01%	9.76%	7.65%	2.64%	36.15%
Between 5 and 10 km	0.53%	0.79%	2.90%	3.17%	3.69%	3.96%	2.11%	17.15%
Greater than 10km	0.26%	0.26%	1.06%	1.58%	2.11%	0.53%	1.32%	7.12%
Grand Total	**6.60%**	**6.86%**	**17.94%**	**16.36%**	**24.27%**	**17.94%**	**10.03%**	**100.00%**

For distance between 0 and 5km, Year 9s and Year 11s were the most common year, and for distance between 5 and 10km, Year 10s and Year 11s were the most common. Those in the senior school are likely to live further away, and this is likely because of the school's zonation.

Entrances used to enter/exit the school

What entrance do you use to enter and exit the school?

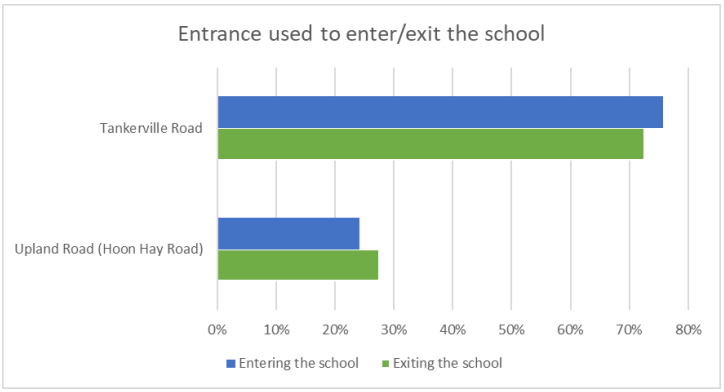

Figure 7: Most used entrance entering/exiting school for Parent/Caregiver

Most parents/caregivers report using the Tankerville road entrances to enter and exit the school. This is more than double the back entrance on Upland Road for both entering and exiting the school.

Factors Influencing Travel

Why is driving in the family car or carpooling your preferred means of travel for taking your child to school?

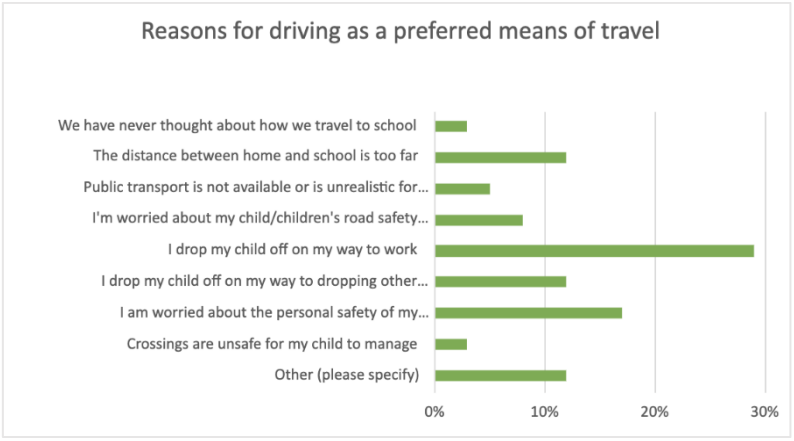

Figure 8: Reasons for driving as the Preferred means of travel for Parent/Caregiver

The most common reason for driving as a preferred method of travel is due to dropping off a child on the way to work. This is followed by concerns about the personal safety of my child/children and the distance between home and school being too far.

What are the main reasons you have for driving currently? (Select all that apply)

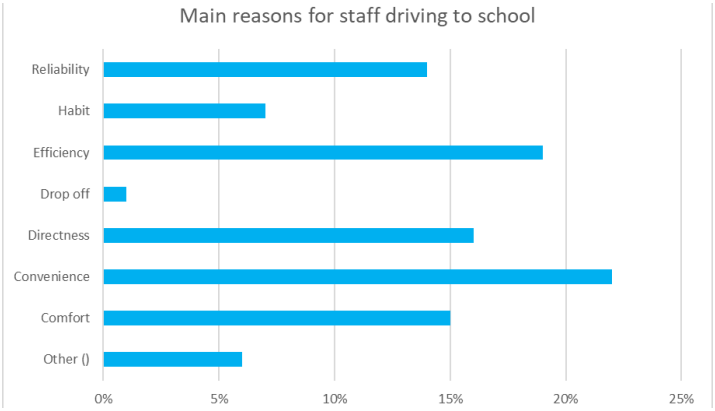

Figure 9: Main reason travelling by car to school for staff members.

Convenience, efficiency and directness are the 3 most common reasons for staff driving to school, with reliability and comfort also being key factors. Dropping kids off on the way to work is the least common reason.

It is likely that my child would walk, cycle or scoot to school more often if... (Select all the apply)

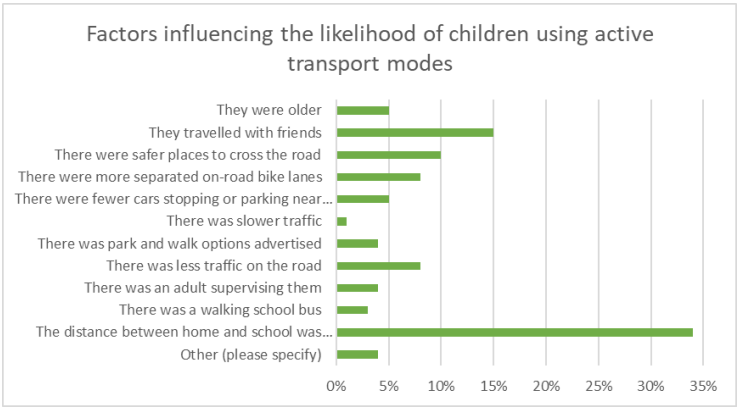

Figure 10: Barriers that limit their child engaging with AT for Parent/Caregiver

Distance is the main factor determining the likelihood of children using active modes. This is followed by travelling with friends, safer crossing points and less traffic.

What are the main deterrents to you travelling to work by bicycle?

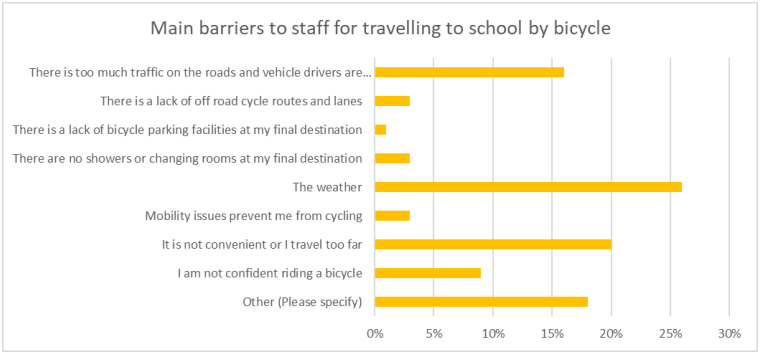

Figure 11: Barriers associated biking to school for staff members.

Weather, inconvenience and traffic are the main reasons for staff not using a bicycle. This is reinforced by personal hygiene and geographical limitations.

What are the main barriers that prevent your child/ren travelling to school by bus?

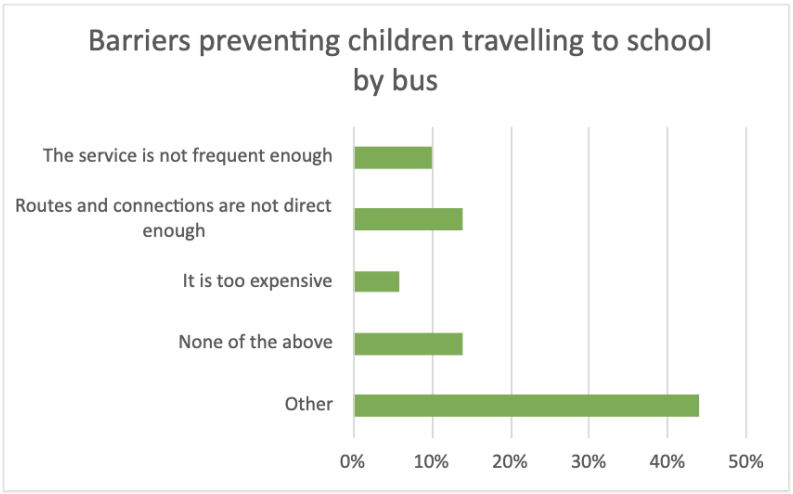

Figure 12: Barriers associated with busing that limit children engaging with buses, as reported by the Parent/Caregiver

Other barriers to children travelling to school by bus were more prevalent than the suggested barriers presented in the survey. These other barriers consisted of the buses being too over crowed, too much of a hassle and timing of the buses.

What would motivate you or make you feel safe to use active modes to get to school?

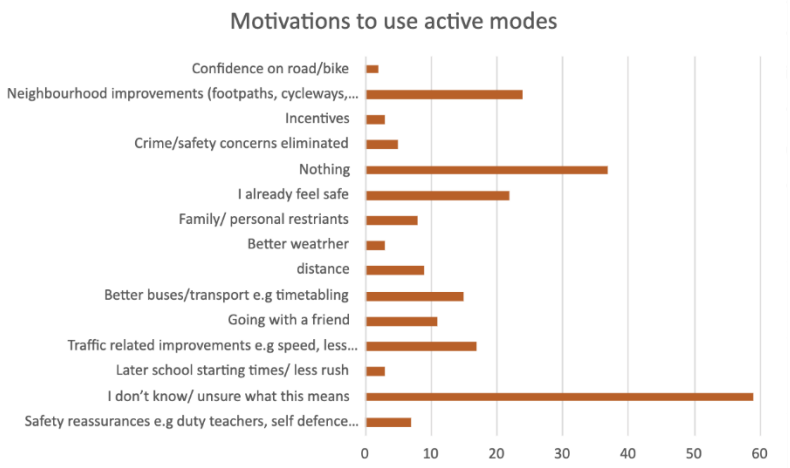

Figure 13: Motivations that could encourage students to engage with active modes.

Most students stated they didn't know what active travel means/ didn't know what would motivate them or had nothing that would motivate them.

Parking

What parking issues if any do you see at your school gate? (Select all that apply)

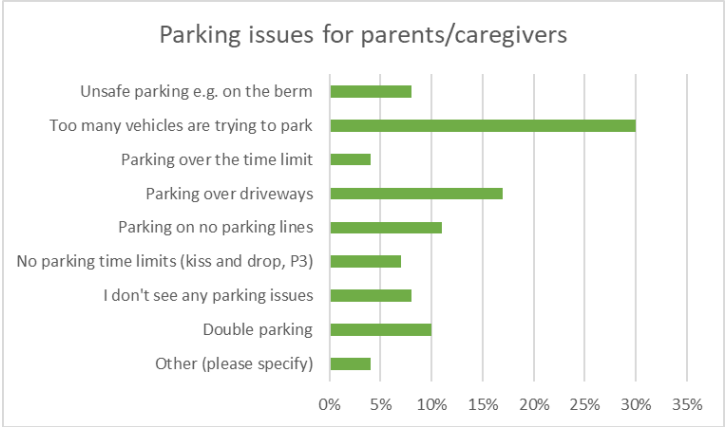

Figure 14: Parking issues associated at the school gate for Parent/Caregivers

Congestion around the school gates and drop off points are the main issues for parents/caregivers parking. This is reinforced by people parking over driveways, on no parking lines and parking on the berm.

What parking issues if any do you see at your school gate?

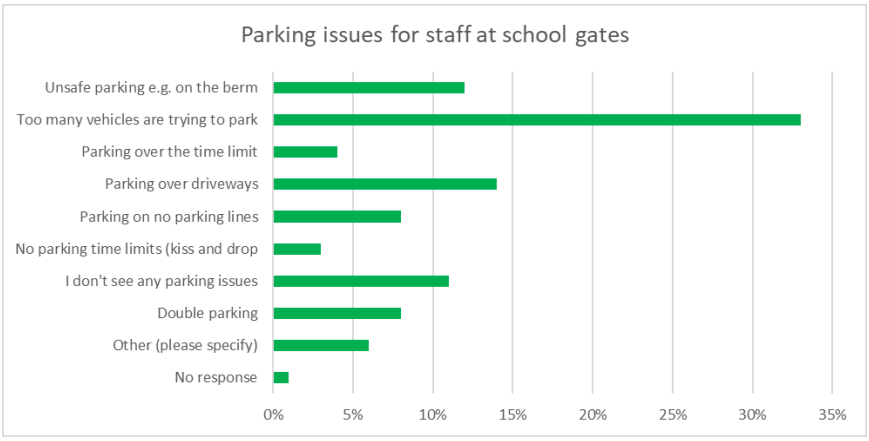

Figure 15: Parking issues at the school gate for staff members

Too many vehicles and unsafe parking are the most reported issues for staff parking.

Locations of Concern/safety

Thinking about children's safety when travelling to school... What are the reasons why children feel unsafe?

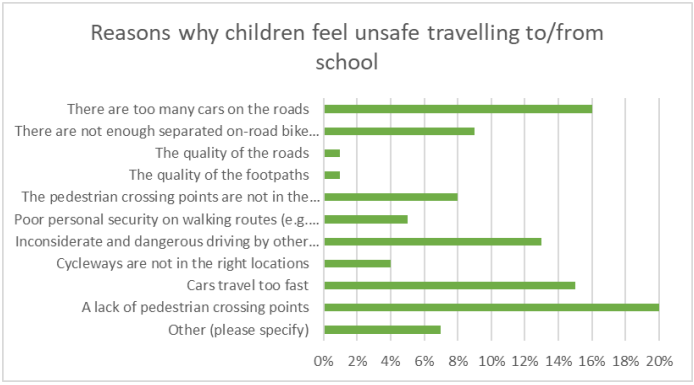

Figure 16: Reasons for children feeling unsafe when travelling to/from school, as reported by the Parent/Caregiver

Crossing points and car congestion were the main reported reasons for children feeling unsafe, followed by speed of traffic and dangerous driving.

Why do you feel that children are not safe in these locations while travelling to or from school? (Select all that apply)

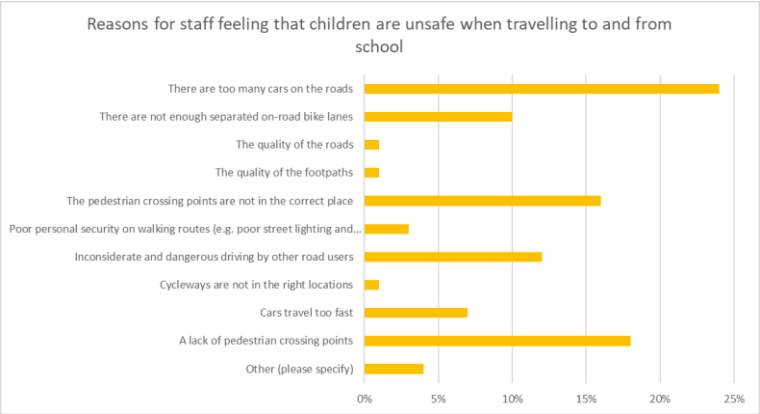

Figure 17: Reasons to believe children are not safe when travelling, as reported by staff members.

Too many cars were the main reasons for concerns in terms of children's safety, followed by lack of pedestrian crossing.

Thinking about children's safety when travelling to school... Are there any locations where you feel that children could be safer when travelling to or from school?

Figure 19: Percentage of staff who think there are locations where children could be safer when travelling to school.

54% of staff members reported that they had locations of concern for the safety of children travelling to and from school.

What happened or what made you feel unsafe on your travel? (optional question)

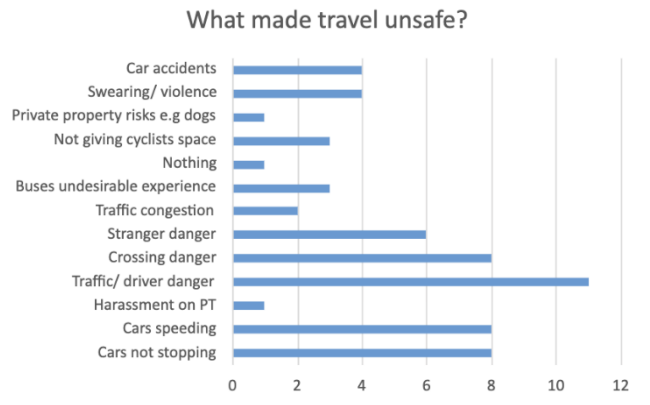

Figure 20: Main reasons that made travel journeys unsafe for students.

Traffic/driver danger was the most common response, followed by cars speeding, cars not stopping, crossing danger and stranger danger.

Please tell us more about the location of most concern (street names, intersections, etc)

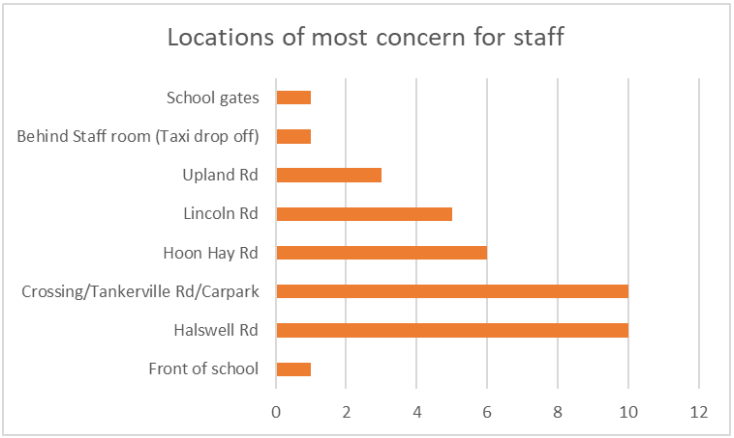

Figure 21: Locations of concern for staff members

Halswell Road and Tankerville Road (main entrance) were the highest reported locations of concern.

Where do you feel unsafe when travelling to or from school? (Optional question)

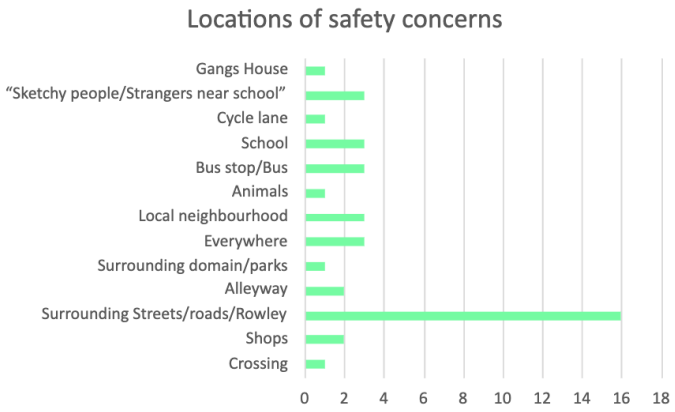

Figure 22: Location of concerns for students

Most of the students who responded felt unsafe when travelling to/from school in surrounding streets.

Locations of Concern – GIS

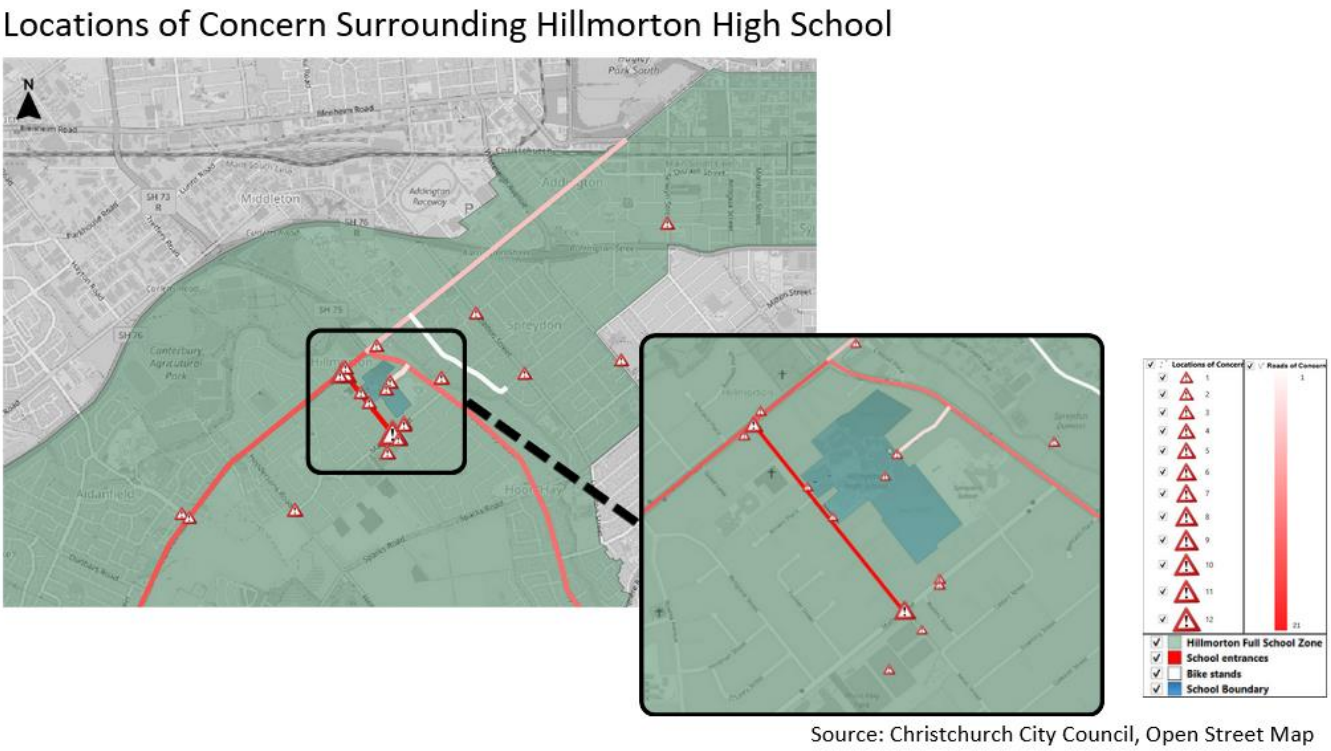

Figure 23: Locations of concern for students as shown in a GIS visualisation.

The main areas of concern expressed directly surround the school grounds, with all the points being within the school zone. Tankerville Road (where the school's main entrance is) is the road with the largest amount of concern, but Halswell has the most identifiable locations of concern.

Other Comments

Is there anything else you would like to tell us about your travel to/from school?

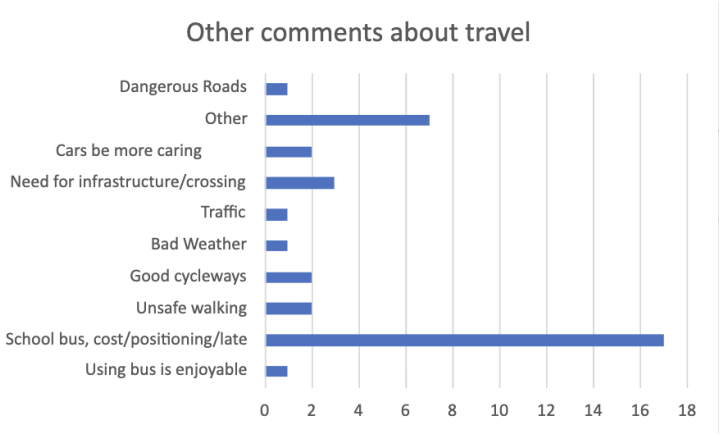

Figure 24: Additional comments about travel from students

Further comments from students involved issues with school busses in terms of costs/ bus stop positioning/ arrival time and lateness.

Discussion

When looking at the distribution of mode use at HHS, there are several key points to be considered.

- HHS already has a higher amount of AT use compared to what has been reported within literature, however the prominence of cars and their associated danger is still a major issue.
- The students' year level showed differences between the different modes of transport chosen due to potential social shifts in group dynamics. As year 9 and 10 students still participate in driving from school this is contrasted with older cohorts where walking is prominent (Figures 5). Older students tend to enjoy social interactions with friends and therefore are found walking in groups from school, that comes with less social embarrassment, which was anticipated from the literature. Younger cohorts (years 7-8) also participated in walking to and from school, but the use of scooters was also seen unlike the older cohorts. Between the different cohorts it is clear that their different social behaviours influence their mode use.
- There are differences between staff and student modal use, with staff being less likely to use active modes overall. The perspectives from these two groups have shown differences in terms of what issues are important (Figure 9), with issues such as convenience and personal hygiene appearing within the staff data, and distance and safety being the prominent issues for students (Figure 10).
- There are significant shifts in modes depending on whether students are coming to or leaving school. The survey data indicates that more students travel actively after school (Figure 5). But this occurs due to not being dropped off to school on the way to the parent or caregivers work, as reinforced within previous literature.
- Distance was shown as a major issue. Students overall tend to be in a closer radius of the school (Figure 8), and are thus more likely to use active modes, but the distribution between AT uses versus the distance lived away did not align with literature. The younger cohorts (year 7-9) live closer due to the school zoning but drive to and from school more. This could be due to students not feeling independent enough/ parents not allowing them to travel alone, or due to having younger siblings that need to be dropped somewhere else therefore participating in car trip chaining.
- Safety concerns were prevalent within all groups surveyed, with all groups identifying the same locations around the school (Appendix A) that deter them from using active modes. Students generally travel the same way to get to school every day, therefore, might be comfortable with their route and don’t have any reservations about the trip. Issues that did make students feel unsafe were congestion, driver danger, and traffic speed (Figure 22). Unsafe driving was also expressed by parents/caregivers and staff due to the hazardous parking around the school with parking on driveways, on berms, and on no parking lines being prominent. Crossing danger and lack of and location of pedestrian crossings were brought up across all the targeted groups (Figure 18, 22, 25) as another issue surrounding the school.

Limitations

The main limitation throughout our project was we couldn't seek ethical approval for our project. Our project involved the analysis of children and teenagers, which comes with many hurdles due to the sensitivity of identities and consent. This was especially relevant to names and addresses, but also gender, year level and race. The survey, conducted by the CCC, was ethical as it followed their ethical procedures. This meant we were unable to speak to students (in focus groups), acquire street address data, collect gender and ethnicity information, and make connections between these variables. This would’ve been helpful, as literature has found links between gender and mode use. This meant that our research was somewhat shallow in its findings, particularly when we consider social norms and the demographic of the school.

Another limitation was the school and university terms did not line up. This meant there were periods of time where we were unable to conduct the survey, complete site visits and have meetings with our staff connections. This caused delays in the time it took to collect our findings and data. We also identified that the timing of the survey was a limitation due to the time of year and the time of the week the participants filled out the survey. Having done the survey in winter, some survey responses might have been different as they could have changed their travels modes due to weather. Another aspect is that some people tend to have multiple methods of travel to school, and the survey only allowed the participants to select one method of travel. This is a phenomenon known to school travel planners as "which way today?" and may have skewed our results.

Proposals

As a result of our research from literature reviews and survey data, we recommend several initiatives that aid in alleviating the key barriers to AT.

Bike Parking

Our initial proposal is to increase the bike parking on the school site. During our site visits we identified heavy congestion at current bike racks, meaning there is a demand to use bikes, but insufficient bike storage to facilitate this demand. It was also clear that the bike and scooter stands located at the front of the school were far more popular than those at the back. This may be due to the classroom locations of students that use biking/scootering more (Year 7-9). Therefore, we recommend that the school invests in more sufficient quality bike parking and places them in ideal locations, such as at the front of the school near the Akonga Ako building and alongside the new gym.

Active Transport Education

Our second recommendation is to increase the education about AT characteristics such as cycle and bus education. Our survey found that there we're students who did not know or understand what 'active transport' meant. Whilst this could be attributed to factors such as the terminology being jargonistic, providing these students with knowledge surrounding the traits of AT is still key when deciding if AT is a viable option for students to get to and from school. We suggest doing this in two ways: through cycling education and bus information.

Education regarding cycling can be acquired through a hands-on approach with the CCC cycle safe program, which teaches skills for safely manoeuvring a bicycle on busy roads. This could also be incorporated into outdoor education classes to provide a consistent platform for developing confidence and encouraging new behaviours. For the bus system, children may not know how to hail a bus, understand the stops, or know what a Metro-Card is and how to use it. Bus education could be facilitated in a similar style to the CCC cycle safe program, where educators come in and teach these critical skills. Bus information, such as routes and timetables could also be given to parents and be available at the office, which removes that first step of having to find information.

Increasing Public Transport Accessibility

The current bus system needs to better facilitate the school area to accommodate for the number of students that are traveling via bus. Improving the bus stops where there is no seating or physical shelter (Mathers Road) as well as timing the buses and altering some of the bus routes for more coverage would benefit the overall accessibility for the school. Appendix B shows the current bus network, but there are evident gaps especially to the southwest of the school and into Wigram.

Crossing Improvements

Currently, road and infrastructure upgrades are only being planned on Tankerville/Halswell road, however the intersection at Mathers and Tankerville road lack pedestrian crossings, therefore implementing them in these areas should be considered. Including tactile paving at these crossings should be incorporated to account for those who have site loss or are partially impaired.

Conclusion

Our research question was ‘How do we support active transport use at Hillmorton High School based on their current travel behaviours’. After investigating the existing transport modes at HHS, it is evident that a range of factors are limiting the school community from opting for AT modes, but with careful consideration and prioritisation there are potential remedies to the issues mentioned. After analysing the survey, it was apparent that the key issues of concern throughout the school community were surrounding parking, congestion at the school gate, and safety issues present at the main intersections surrounding the school. With the expected growth of the school, it is our recommendation that the school considers these barriers and conducts further consultation with the CCC and other relevant entities to enact support for active transport into the future.

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Appendix A: Site visit findings

Upland Road

While observing Upland Road, we noticed a considerable number of students engaging with bikes, this is probably due to the bike stand being closely located to the Upland Road entrance/exit. Additionally, there were taxis providing transport for students with disabilities and other students opting for scooters, both of which significantly added to the issue of congestion at the gate. The primary modes of transport observed on Upland Road were, biking, scootering and private vehicle use.

Halswell Road

At 3 pm, Halswell Road experienced substantial traffic congestion, likely due to parents picking up/leaving with kids, and the wider public finishing work. The bus stops were very overcrowded and there was a noticeable absence of safe pedestrian crossing in the vicinity. The primary modes of transport observed on Halswell Road were, walking, bussing and private vehicle use.

Tankerville Road

At 3 pm, Tankerville Road was heavily congested predominantly due to cars parked along the roadside and students exiting the main gate. It became clear that every Thursday three buses pick up students from surrounding schools that visit HHS for technology, creating a substantial amount of congestion. On Tankerville Road the primary modes of transport seen were walking, private vehicle use and biking.

Mathers/Tankerville Road

The survey concluded that the Mathers Road intersection was the greatest area of concern. This is due to the lack of designated pedestrian crossings, instead, students are crossing on the corner where most cars are turning left from Tankerville Road. Most students were travelling by foot, as the intersection provides a shortcut through Hoon Hay Park. Interestingly, congestion came in a huge wave around 3.15pm, further dissipating to nothing. Walking and private vehicle use were the primary modes of transport used on Mathers Road/Tankerville Road.

Appendix B: Bus routes surrounding Hillmorton High School