



TRAFFIC EFFECTS IN THE COMMUNITY

A Case Study of Tennyson Street and Beckenham,
New Zealand

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Executive Summary

- Tennyson Street is an arterial road connecting Colombo St and St Martins in Beckenham, southern Christchurch.
- The enrolment zone for Beckenham School Te Kura o Pūroto is dissected by Tennyson St.
- The community has become concerned over the safety and effectiveness of crossings along the street.
- This issue was elevated when there was a collision between a motor vehicle and a student from Beckenham School.
- Background findings helped form the research question of: *How do we best address the perceived issue of road safety of Tennyson Street and what measures can be taken if needed?*
- Project objectives were to gather opinions of Beckenham and Tennyson Street safety from the community and the Christchurch City Council (CCC), assess the number of students that need to cross Tennyson Street, explore possible safety improvement options and gather opinions of these options.
- Methods used included a previous course project and a community-initiated survey, interviewing council staff, using geographical information systems (GIS) to map the addresses of students, door to door street interviews, and online parent and community surveys.
- The results indicate that although Tennyson Street is not a priority for safety improvements from the council, the community feels improvements should be made.
- The community largely support all suggested safety improvement options but prefer infrastructure changes over community-based options.
- Limitations from this study include a bias sample in the parent's survey, mostly living to the north of Tennyson Street. Roadworks along Tennyson Street also limited primary speed data collection.
- Future research could focus on how changes directly affect residents of Tennyson Street and the surrounding area. A study of other schools and other potentially unsafe roads could be conducted for comparison purposes.

Introduction

This report highlights the effects of traffic of an arterial road through a residential suburb and analyses how the roads impacts safety of pedestrians from a local school and the wider community. Tennyson Street in Beckenham, in the south of Christchurch, runs through the enrolment zone for Beckenham School Te Kura o Pūroto, a state primary school. Members of the school community have been concerned for some time about the safety of pedestrians along Tennyson Street. This issue was elevated when a motor vehicle collided with a student. After initial background research the question: 'How do we best address the perceived issue of road safety of Tennyson Street and what measures can be taken if needed?' was constructed. This report follows a literature review, methods, a results and discussion section followed by a conclusion.

Literature Review

Prior research has assessed whether zebra crossings improve traffic safety. The New Zealand Transport Agency (NZTA, 2018a) states that low volume pedestrian crossings have greater potential danger as drivers become accustomed to not stopping. Easwarapadcham, Topp & Koorey (2013) found that the greater volume of pedestrians at a zebra crossing, the less waiting time they would experience. This reduces the risk of pedestrians and improves safety. Therefore, the article states that zebra crossings are unsuitable for low pedestrian volume streets or for crossings of infrequent use. Zebra crossings on Tennyson Street could be unsuitable due to crossing volume inconsistencies. Signalised crossings are viewed similarly to zebra crossings by the NZTA (NZTA, 2018b). Regular use is required to ensure drivers again, do not become accustomed to not stopping. Easwarapadcham et al (2013) suggest a signalised crossing is more applicable to high volume urban sites. They state that pedestrian crashes are twice as high at zebra crossings when compared to signalised. Therefore, neither of these potential safety improvement options would be applicable to Tennyson Street and should be excluded from our primary research as potential safety improvement options.

Variable speed limits have been implemented around New Zealand schools to reduce speeds to 40km/h. Ellison, Greaves & Daniels (2013) found mean speed was reduced through school zones but 29% was still above the 40km/h limit. This can create more potential risk as variation in speed is associated with reducing road safety (Dell'Acqua, 2011). Sun, El-Basyoung, Ibrahim & Kim (2018) found that school zones reduced fatal injury and collisions by 45% and found mean speed variation was also reduced. It is important to note this reduction was to 30km/h and in Canada as opposed to New Zealand where conditions are different. Even if school zones can be shown to significantly reduce speed, it is unlikely to be implemented on Tennyson Street as NZTA deems it too far from a school to be classified as a school zone (NZTA, 2011).

Initiatives from the community could help improve traffic safety. Traffic wardens have been shown to improve traffic safety by helping people cross the road at predetermined crossing points. Although there have been concerns in the past that they add to collision rates, this has proven to not be the case (Gutierrez et al. 2014 Rothman et al. 2015). Furthermore, it has been shown that it is important to have appropriate patrol times (Forbes 2016) and as Tennyson Street is not directly outside of the school, this would need to be addressed.

Wang et al. (2018) showed that of those students who had access to safer crossing methods, primary aged children were more likely to act dangerously when crossing roads. They concluded that the younger groups were at higher risk due to their inability to perceive the dangers and consequences of crossing dangerously due to ongoing brain growth.

From this background research, several project objectives were formed:

1. What is the community's opinion on traffic safety in Beckenham and on Tennyson Street?

2. What are the council's views on traffic safety?

3. How many students are required to cross Tennyson Street?

4. What are the potential safety improvement options?

5. What are the community's views on potential safety improvement options?

Methods

Previous 2017 GEOG309 Project and Community Survey

A previous GEOG309 project looked at reviewing traffic speeds in Beckenham that included a survey with community opinions. Another previous survey from the community was conducted in early 2018 regarding Tennyson St traffic safety. These surveys were used to help answer objective 1.

Christchurch City Council Traffic Engineer Interview

Talking to a traffic engineer gave an expert opinion on the traffic safety of Tennyson Street from a professional perspective. The engineer was aware of the concern around Tennyson Street and had been in contact with the community prior to the project. As the engineer is a representative of local government, the organisation likely to perform any road changes, he would be aware of their restrictions, which helped include only realistic potential options to be included when gathering opinions. This was to help answer objectives 2 and 5.

GIS to map school addresses

In order to assess how many students attending Beckenham School needed to cross Tennyson Street, a list of student addresses was acquired from the school. This consisted of only addresses and no other identifiable data. The school also removed entries of students who did not live near the Beckenham area for privacy reasons which brought the total number of entries to near 400 compared to the school role of about 480 (the addresses included instances of 2 or more students living at the same location). The list was geocoded using ArcGIS. Points were then selected and counted. This was to help answer objective 3.

Online Parents and Community Survey

Online survey tool Maptionnaire (2018) was used to create a survey to gauge community opinions on the safety on Tennyson Street and potential options for safety improvements. Maptionnaire has a geospatial mapping element where respondents can add points and lines to a base map which can then be exported for analysis later.

A survey aimed at gauging parents' opinions of traffic safety of primary school aged children was made and distributed in the weekly newsletter at Beckenham School and again advertised on school social media accounts after an initially poor response rate.

A second survey was created to gauge the opinions of Tennyson Street safety from the wider community. This survey started with a branching question which asked if the person answering has primary school aged children to which answering yes then asks questions from the parents' survey. Answering no, leads to questions regarding opinions of traffic from the respondent. In total, 148 individuals responded to the surveys. These surveys were used to help answer objectives 1, 3 and 5.

Street Interviews

Door to door street interviews along Tennyson St were conducted. Interviews were semi-structured based on questions used in the online wider community survey. Every 5th house was approached for interview, of all the houses that were approached only 1 was used to go towards the community based Maptionnaire survey. A flyer promoting the online survey was left at those houses in between. Houses unable or unwilling to be interviewed were also provided this flyer. This was to help answer objective 1.

Results & Discussion

1. What are the community's opinions on traffic safety in Beckenham and on Tennyson Street?

From the combined survey of Beckenham School and the wider community, when asked about their child's safety in Beckenham, the survey found 55% view traffic speed as a major issue, 41% view traffic volume as a major issue and 61% view the number of suitable crossing points as a major issue. This is reflected with the combined results of 72% in support of a reduced speed limit in the Beckenham loop (an area of Beckenham within a curve of the Heathcote River). This coincides with a previous survey conducted in Beckenham where 66% of respondents believed there should be greater traffic speed restrictions (Jones et al. 2017).

Parents of Beckenham Primary School were surveyed on how their child/children commuted to and from school each day. 32% commute by car, 16% on bike, 32% by foot and the remaining 19% were by other means such as scooter/skateboard. This means 68% of the school roll choose active transport to commute. When asked as to why their children are sometimes driven to school, 17% stated that is was due to the route not being safe enough. The main reason for vehicle use was due to convenience on the way to work with 39%. Parents were also surveyed about the supervision of their children while they walk and bike to school. 57% are supervised by an adult while they walk to school and 16% are supervised by an older child. When biking to school, adult supervision increases to 83% and 17% are unsupervised. Overall, 52% of parents stated that they feel their child is unsafe while traveling around Beckenham. While only 24% stated that they feel their child is safe.

Figure 1 shows the most used routes to Beckenham School by active transport users. Norwood Street shows the highest concentration of commuters and is used more so than the Eastern Terrace route. The Norwood island crossing on Tennyson Street is likely the most used crossing point has it connects the northern part of the school zone to the access way of Norwood Street.

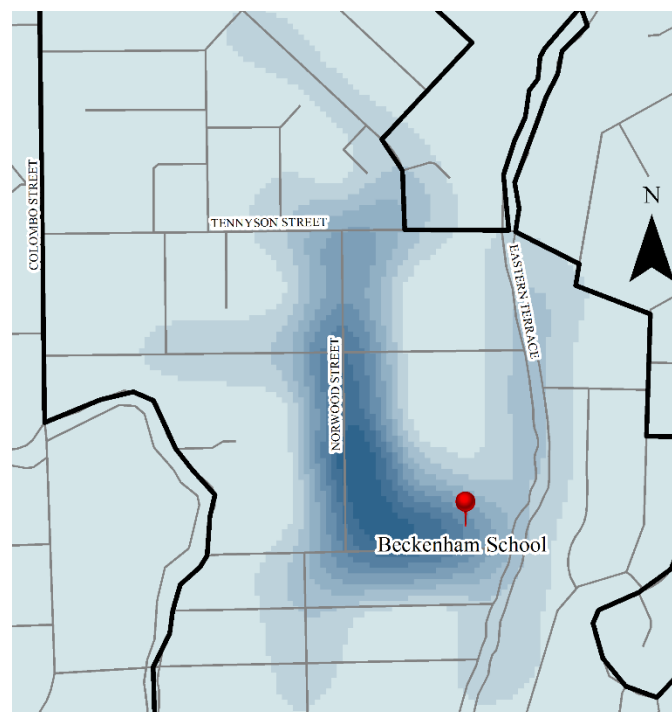


Figure 1. Heatmap image highlighting the most common route to Beckenham School by active transport users.

Within the survey, there were many opportunities for respondents to express their opinion in comment sections. Common themes of respondents when asked about traffic safety in Beckenham were feeling that excessive speed was an issue and that there is a lack of appropriate crossing points. Most of the respondents failed to mention if they view the current speed limit as excessive or if they are witnessing drivers breaking the speed limit. Common comments about speed include: *“Some cars drive too fast. The speed limit should be reduced considering the vast majority of drivers are residents”*; *“Traffic speed is an issue”*; and *“The traffic along Norwood and Birdwood can be high volume and fast during peak hours. This is a challenge for any young pedestrians to cross alone....”*

The other common theme of insufficient crossing points included comments about implementing traffic lights and zebra crossings. These ideas weren't just limited to Tennyson Street, but it was mentioned far more than other streets. Some comments included: *“Tennyson St needs a set of traffic lights at Norwood St to allow children to cross safely”*; and *“Centaurus Rd, Tennyson St, are both very busy roads and there are limited or NO crossing, just small island, so very difficult for a child to make judgements and stay in a safe place. Complex decision making required.”*

When asked specifically about traffic safety on Tennyson Street, 73% said the current infrastructure in place failed to make crossing the street easy. Slightly more, 75% said it was unsafe for their child to cross Tennyson Street. Parents were specifically asked to map locations along Tennyson Street they believed were unsafe for their child. Figure 2 shows parents particularly find the pedestrian islands as unsafe. Norwood, Southampton and Eastern Terrace are particularly highlighted by the parents. It is important to note that this could be due to the islands attracting the most pedestrian volume. Norwood Street is of importance as it provides a crossing to one of the main access routes to the primary school. The Eastern Terrace island, another important access route to the school, has a dairy located nearby, attracting further pedestrian volume.

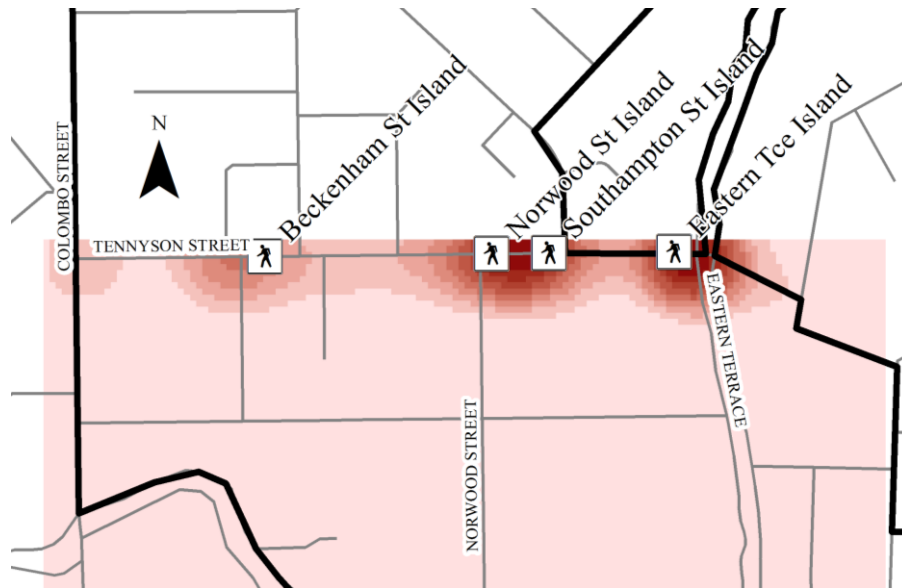


Figure 2. Heat map showing areas where parents feel their child is unsafe specifically traveling along Tennyson Street.

During the survey, respondents were able to make comments specifically about traffic on Tennyson Street. Again, the common theme was that crossing the street is unsafe. Many commented that the islands are in locations too close to intersections and are too narrow. One comment included: *“The ‘safe crossing’ areas are confusing. No one knows what the rules are, they’re not big enough to hold kids, bikes, adults, scooters and buggies (which they often need to accommodate), they’re in awkward spots too close to intersections....”*

These statistics show parents are more apprehensive with their child traveling around Tennyson Street than the other surrounding streets. In the parents’ survey, respondents were asked to locate areas where they feel their child is unsafe. Figure 3 shows Tennyson Street, particularly the Norwood Street island crossing is an area of high concern for parents. The Eastern Terrace island and Sandwich road/ Norwood Street intersection is also an area of concern.

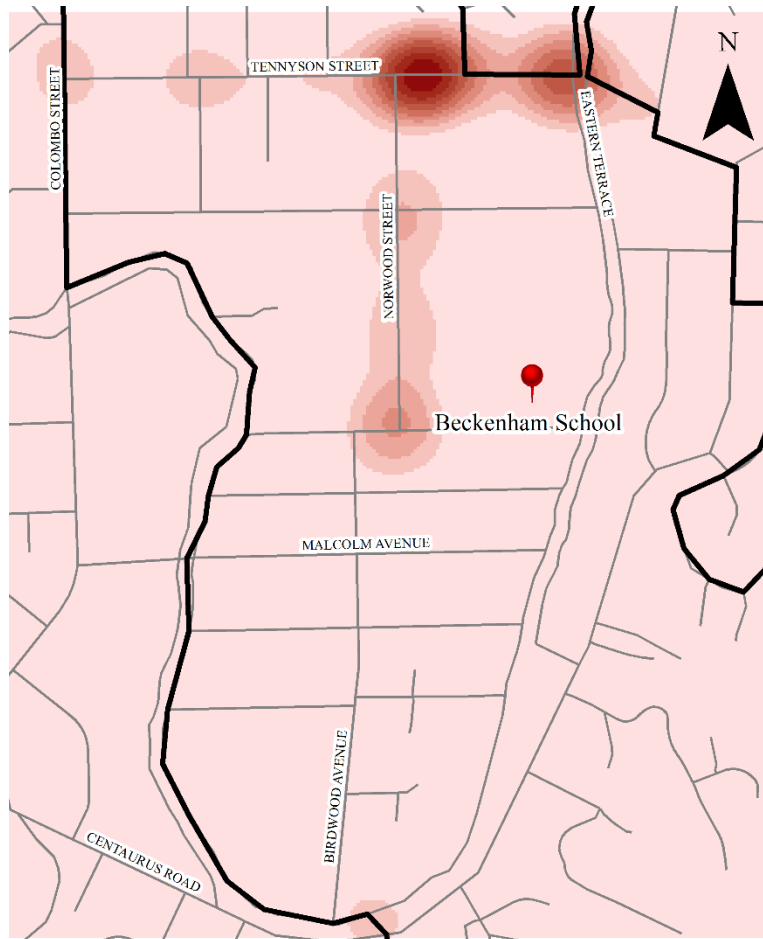


Figure 3: Heat map image showing results from the Parent's Survey when asked to locate unsafe areas for their child to travel in the Beckenham area.

2. What are the council's views on traffic safety?

Talking with the traffic engineer, in the wider context of Christchurch, Tennyson Street is not a major issue. It was noted that the crossing islands meet minimum width requirements when built but are still quite narrow. It was also noted that Tennyson Street is quite unique where there are cycle lanes built on the kerb and swap to the road. There is a possibility of widening some of the islands that are most used to allow more space on the islands, however this is restricted to the council road safety improvement budgets, when funds become available as there are other areas in Christchurch which have a higher safety priority. Another issue with widening the islands is that of placement, the islands must not interfere or block driveways, this is to prevent any instances of pedestrian-car collisions or near misses.

CCC island crossing data for Tennyson Street showed before school there were 44 people who used the four island crossings and 30 people after school on an overcast Friday in June 2017. This can be compared to crossing data for the island crossing at 122 Centaurus Road, where 16 people used the crossing before school and 14 people after school on a fine Thursday August 2018 (CCC, 2018a).

CCC traffic speed and count data from September 2017 along Tennyson Street between the Southampton Street and Eastern Terrace intersections was provided. Mean traffic speeds on Monday to Friday during School travel times (8-9am and 3-4pm) never exceeded 50km/h with averaging 47km/h heading west on Tennyson Street between Southampton Street and Eastern Terrace. Traffic heading east for the same survey area had a slightly higher mean of 48km/h. 32% of vehicles heading west exceeded the 50km/h speed limit, with a mean exceeding limit of 53km/h. 38% of east bound traffic exceeded 50km/h also with a mean exceeding speed of 53 km/h (CCC, 2018a). Average daily traffic for Tennyson Street is 9,397 while for Centaurus Road it is 10,816 (CCC 2018b).

3. How many students are required to cross Tennyson Street?

Of the 400 students from the provided dataset, 110 (28%) students need to cross Tennyson St to get to Beckenham school. 50 students (13%) need to cross Centaurus Rd. 10 (3%) students cross Colombo St, 110 (28%) students cross Norwood St / Birdwood Ave and 230 (58%) live outside of the Beckenham Loop. The large number of students clustered in the northern end of the Beckenham Loop is likely due to Thorrington Primary School at the southern end of Colombo Street also being zoned for the Beckenham loop (southern end).

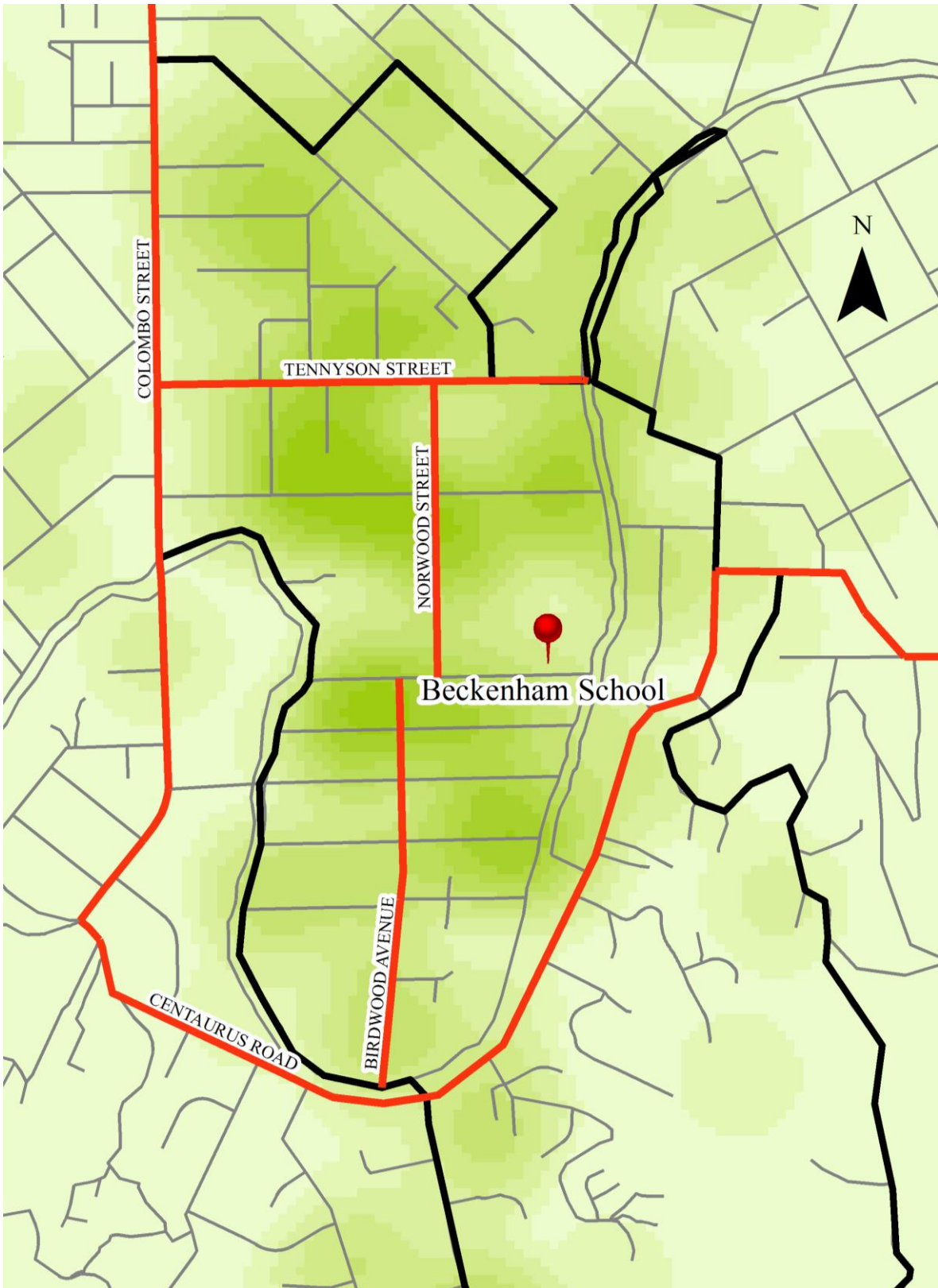


Figure 4. Kernel density heat map of Beckenham School provided local student address data with major streets in red and Beckenham School enrolment zone in black.

4. What are the potential safety improvement options?

Six potential options to improve traffic safety along Tennyson Street were identified, including a mix of infrastructure improvements and community-based options.



Figure 5: Recommended speed signs on Tennyson Street

Recommended speed signs (Figure 5) are yellow speed signs that are not legally enforceable, however they give motorists a warning that it is recommended to alter their speed. These signs had been identified as an option by the council prior to the study and were made and installed during the study period. Widening the crossing islands along Tennyson Street was also identified as an option by the council, depending on future funding availability. The three most commonly used crossing islands are straight islands, where pedestrian's cross straight across

the road; diagonal islands, where pedestrians are directed to look towards oncoming traffic; and chicane islands where pedestrians are forced to turn to oncoming traffic before crossing the roads (Figure 6). The current islands on Tennyson Street are diagonal islands. Land narrowing is an option which can naturally reduce traffic speed without limits or road infrastructure. Reduced parking is also an option which can improve motorist and pedestrian visibility at crossings.

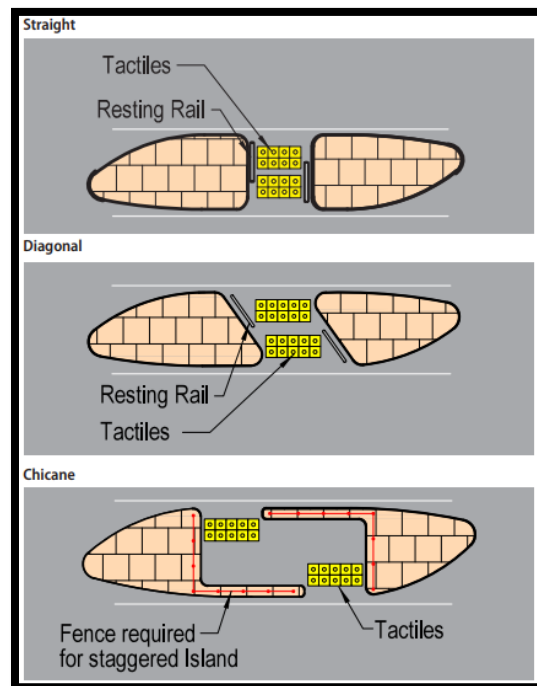


Figure 6: Island Crossing Design Types.

As previously noted, traffic crossing wardens have been shown to help improve traffic safety. Having dedicated wardens can give unsupervised children a safe place to cross the road, as well as being a supervisor for large groups. A walking school bus is another option from the community that is also supported by the New Zealand Transport Agency (2018c). A walking school bus allows parents and children to walk to school together and meet others along the way.

Other infrastructure improvements have been shown through previous research to be unsuitable for Tennyson Street. Zebra and signalised crossings could potentially reduce safety on the street (Easwarapadcham, Topp & Koorey 2013) while installing variable speed limits is

unlikely due to the school's distance from Tennyson Street (NZTA 2011). Speed bumps are also unsuitable due to the arterial nature of the street and would create noise pollution issues with breaking and accelerating of vehicles. Many of these options also require substantial funding from the council which has a limited budget.

5. What are the community's views on potential safety improvement options?

Infrastructure Safety Improvement Options

Recommended Speed Signs

Combined survey data from the parents' and wider community survey show 53% of respondents believe the speed signs will improve safety of Tennyson Street and 79% of respondents support their implementation.

Traffic Island Improvements

Overall the wider community were neutral in supporting traffic island improvements and their improved safety capabilities. Parents like the idea of improving the island crossings specifically upgrading them to chicane islands. Parents preferred islands mostly on Tennyson Street to be upgraded, particularly the Norwood Street and Eastern Terrace islands. The wider community also favoured islands along Tennyson Street to be upgraded, but also down Norwood Street.

Lane Narrowing

Combined survey data from the parents' and wider community survey show 50% support the implementation of lane narrowing along Tennyson Street. 19% were neutral to the idea and 24% were against this safety improvement option. 45% of respondents believe this safety improvement option will improve safety on Tennyson Street while 26% disagree. 20% were neutral and 9% unsure. These statistics may differ to the views of those who reside on Tennyson Street. In one street interview conducted, a respondent mentioned how they had witnessed car mirrors being clipped due to the narrow nature of the street. Therefore, the statistics may be more biased toward lane narrowing than if only Tennyson Street residents were surveyed.

Reduced Parking

Combined survey results show 77% of respondents support reduced car parking around the crossing islands on Tennyson Street. Furthermore, 70% agree that these will improve traffic safety on the street. Again, this survey may have bias toward reduced parking if results were compared to those who live on Tennyson Street. In street interviews of Tennyson Street residents, respondents were less supportive of reduced parking.

Community-Based Safety improvement options

School Wardens & Walking School Bus

Results from the parents' survey showed 70% support the implementation of school wardens and 68% believe they will improve safety on Tennyson Street. 59% of parents support implementing the walking school bus and 61% believe it will improve safety on Tennyson Street. The wider community were not surveyed about these community-based safety improvement options as they are more relevant to improving safety of school children.

Both safety improvement options would require volunteers. In the parents' survey, respondents were asked of their willingness to volunteer. 2% were willing to volunteer as a school warden, 15% for the walking school bus and 4% were willing to volunteer for both. The majority of 51% said they were unwilling and the remaining 29% responded with 'maybe'. Respondents of the community survey were also asked about their willingness to volunteer as a school warden. The theory was that perhaps some retirees or other residents with some spare time who live on or near Tennyson Street could volunteer. 88% of respondents were unwilling to volunteer and the remaining 12% responded with 'maybe'.

Respondents were able to place comments on the community options within the survey. Many stated that because of work commitments they were unable to volunteer, others stated Tennyson Street is too far from Beckenham School for school wardens to work, and others mentioned the current island infrastructure will prevent walking buses from working. This is due to the islands being too small to accommodate a larger volume of children crossing at one time.

Limitations

For the month of August, a large section of Tennyson Street underwent roadworks. This reduced part of the street to one lane and reduced the speed limit. This prevented any gathering of speed or crossing data for the research period. Fortunately, much of the street data was provided by the Christchurch City Council from prior research.

Further data was to be gained through street interviews along Tennyson Street. This would provide more detailed information and comparisons could be made of those who live on the street versus other respondents. Unfortunately, response rates for the street interviews were low and the use of this data is limited. This was due possibly to the time and day of the street interviews being carried out (Sunday, 1-3 o'clock), the survey was time and weather conditions on the day might have proven to be good for leaving the house to do other activities.

The parents' survey was to be distributed to another school in the Beckenham area to allow further comparisons of results. However, no reply was received from this school.

The surveys were in some instances sent out also to people outside of the areas that were covered by the community and school social media pages.

Bias of the survey results is also a potential limitation of this report. As mentioned above, those who live on Tennyson Street may have differing opinions to most of the survey respondents. Also, it appears that parents who live north of Tennyson Street are more likely to respond to the survey than those who live within the loop. Figure 7 shows parents surveyed consisted more of people who live north of Tennyson Street. This is most likely due to parents in the north having to cross Tennyson Street more often than those who live within the Beckenham loop.



Figure 7. Beckenham School Roll addresses are shown in the left image and the addresses of respondents to our parent's survey are shown in the right image. Tennyson Street is highlighted by the red line and The Beckenham School zone is shown with the black outline. The right image shows a higher concentration of respondents to the north of Tennyson Street when compared to the Beckenham loop.

Further Research

Further street interviews of Tennyson Street residents would provide more information for how those most affected by the street feel about its traffic safety. It would also remove some of the potential bias of our surveys. Further street data could be gathered for the number of pedestrian crossings and for speed measurements. Speed data would be of interest, since the installation of the recommended speed signs. This may have altered driver's behaviour while children are present. A broader survey population could also be gained by surveying more of the surrounding schools. Other streets and schools of different areas could also be studied with similar methods to better compare results.

Conclusion

This research paper shows the Beckenham community view traffic speed and suitable crossing points as an issue in their suburb. Much of this concern is specifically directed at Tennyson Street with many parents expressing their apprehension with their children travelling around this street.

Solutions for this street are limited by council funds and the potential infrequent use of crossings. Traditional crossings such as zebra and signalised have been deemed inappropriate. All infrastructure solutions proposed in this report were met with favour by the community. This involved recommended speed signs, island improvements, lane narrowing and reduced parking. Community-based solutions were also met with positivity by the community. School traffic wardens were slightly preferred by parents compared to walking school buses however volunteer willingness was higher for the walking school bus.

Due to the community feedback, this report finds the best solutions would combine infrastructure upgrades with community-based solutions. The Norwood Street island appeared as the most used and was highlighted as the most unsafe crossing point. This island should be upgraded (when funds are available) to a chicane island. To provide the best safety improvements, parking should be reduced around the island along with lane narrowing. The improved island should also enable walking school buses to operate more efficiently, with more space for a larger volume of children. The community solution appears to be the most viable due to higher volunteering willingness.

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The Beckenham community

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