How can the kerbside in Kilmore Street be better utilised to support economic activity, public amenity and sustainable transport?

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Abstract

The kerbside is an underutilised part of the urban environment, with the capacity to be repurposed for a wider range of uses. There is not, however, much data on how the kerbside is currently being used in Ōtautahi Christchurch. The aim of this report is to determine what the kerbside usage for our chosen survey site is, to trial out the use of traffic cameras for data collection, and to suggest better ways of using the kerbside, which could lead to further research for other parts of Christchurch. A section of Kilmore Street was chosen for the study site as the kerbside beyond the footpath is almost exclusively used for car parking. Data was collected both on-foot and using a traffic camera. Key results showed that parking occupancy was significantly lower on the east side of the street, and that the loading bay outside Wyndham Garden Hotel was busiest between 8am-12pm, with numerous vehicles parking for longer than the designated 10 minutes across the survey period. There is opportunity to more efficiently utilise the kerbside, including with greenspace, bike infrastructure and amenities, which can better serve the needs of the community, and support more sustainable modes of transport.

Introduction

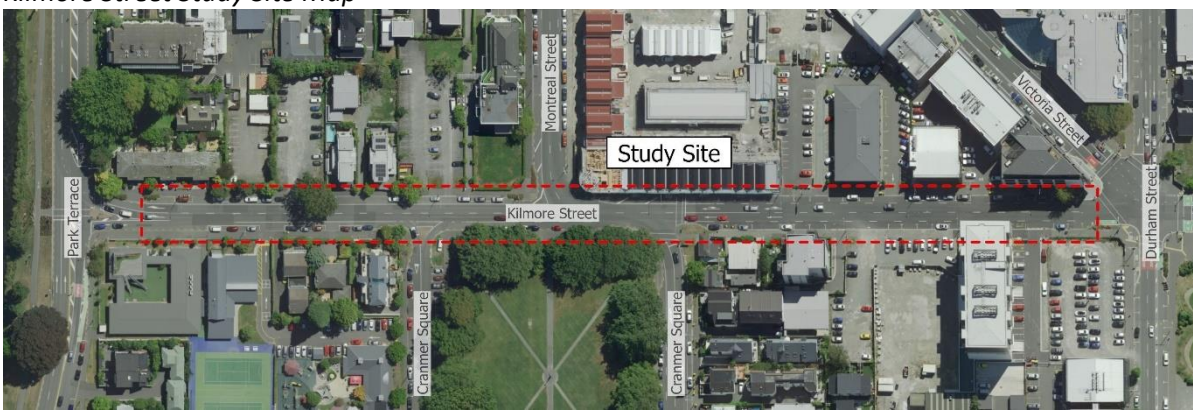
Often-forgotten about in the urban environment, the kerbside is primarily dedicated to parking. There are various definitions of “kerbside”, but for this paper it is defined as the area which “includes both the space between the property boundary and kerb (usually containing the berm and footpath) and also the lane adjacent to the kerb” (Auckland Transport, 2025). Increasing research is highlighting the opportunities and benefits of alternative uses which can better accommodate the needs and wants of everyone who uses the street, instead of only cars (Carmona et al., 2018; Eiseman et al., 2021). These uses include bike infrastructure, amenities such as seating or food trucks and greenspace.

For Ōtautahi Christchurch, there has been implementation of some of these alternative uses for several streets, primarily with bike infrastructure, wider footpaths and greenspace. However, kerbside usage is an area which Christchurch City Council (CCC) lacks research, so this study aims to draw attention to the benefits of alternative kerbside usage, while also comparing different data collection methods for parking occupancy, particularly with the CCC’s traffic cameras, for future studies. Kilmore Street between Durham Street and Park Terrace, in central Christchurch, was chosen for this study (shown in Figure 1) as, apart from the footpath, its kerbside is almost exclusively used for parking and a loading bay. In addition, there is a gap between two cycle paths at either end of this area which could be connected with a bike lane on the kerbside. Therefore, the research question for this study is “How can the kerbside in Kilmore Street be better utilised to support economic activity, public amenity and sustainable transport?”

Data collected for this study falls into the three categories of parking, movement, and loading bay. ‘Parking’ looked at the occupancy of all on-street parking spaces of the study area through a mix of on-street surveys and traffic camera data, both at 15-minute intervals. ‘Movement’ looked at pedestrians and cyclists going past Cathedral Grammer School, on Kilmore Street, as well as drop-offs and pick-ups around the start and end of the school day. ‘Loading bay’ looked at the loading bay usage outside Wyndham Garden Hotel through the traffic camera data.

Figure 1

Kilmore Street Study Site Map



Note. (Esri, 2024)

Literature Review

Kerbside, or curbside as referred to in different regions across the world, is used for various activities like pedestrian walkways, cycle tracks, parking areas, loading/unloading activities and is an area dedicated to economic developments, recreational activities, and various dynamic operations based on changing needs and demands. (Marsden et al., 2020; Gregg & Maisel, 2025; Cormack & Pointer, 2020) The understanding of the term kerbside, its use and purposes are varying from place to place in order to meet the need for sustainable developments, growing population, cultural factors and changes in transportation trends. (Jaller et al., 2021; Institute for Sensible Transport, 2016; Paganelli et al., 2019). For this paper, the definition of kerbside "includes both the space between the property boundary and kerb (usually containing the berm and footpath) and also the lane adjacent to the kerb" (Auckland Transport, 2025). This research explores diverse discipline of kerbside management across various regions using existing studies, understanding of transportation networks in selected study area and its land use patterns. It further delves into traditional uses, advanced techniques and analysis approaches to address current issues in the selected study region, Kilmore Street, Christchurch and suggest reallocation design to improvise economic activity, public amenities, and sustainable transport modes.

The modern kerbside is encountered with intense competition with growing needs. From the traditional use of on-street parking, the kerbside uses have developed to space for walking, cycling, pick-up and drop-off bays, loading and unloading activities, reserved bays for shared mobility services (e.g., car-share, bike-share, e-scooters) and place for outdoor dining, parklets, and green infrastructure (Jaller et al., 2021; Lloyd, 2023; Croeser et al., 2022; Gregg & Maisel, 2025). Further it is forced by expanding technologies, the rise of the sharing economy, and a cultural shift towards more people-focused urban planning (Institute for Sensible Transport, 2016; Paganelli et al., 2019; Hao et al., 2023). Planners are being challenged with the idea of "Movement and Place", where the kerbside has to be designed to serve dual purpose of facilitating movement and as a destination or "civic space" (Cormack & Pointer, 2020). These designs are highly influenced by factors like the place, changes in utilization over weeks, months, precise needs of the surrounding land uses and communities and differing by site (Marsden et al., 2020). Thus, the design must be developed in dynamically adaptive pattern rather than a fixed purpose use. (Jaller et al., 2021; Ward et al., 2024). The arrival of Connected and Autonomous Vehicles (CAVs) will only add further complexity, potentially reshaping kerbside demands for pick-up/drop-off and charging infrastructure (Sha et al., 2024).

Effective kerbside management is now focusing on a broader range of urban goals to accommodate varying needs. Kerbside redesigning can have great potential to support Subjective Well-being (SWB) by enhancing travel experiences, providing opportunities for recreation, forming social connections, and adding aesthetic and emotional value to the urban environment (Mouratidis, 2018; Mouratidis, 2021). In addition, integrating green infrastructure, seating, public art, and quality pedestrian environments most immediately supports this place-making role (Gregg & Maisel, 2025; Croeser et al., 2022). Well-designed kerbsides play a crucial role in upgrading local economy. Efficient delivery of goods, enhanced customer access and placing required amenities can facilitate space and attract more commercial activities. (Gregg & Maisel, 2025; Cormack & Pointer, 2020) Even though re-allocation of traditional parking to other activities like cycle lanes can sometimes be controversial, research in cities such as Toronto and San Francisco show neutral to positive business impacts, especially for businesses that serve locals (Arancibia et al., 2019; Poirier, 2018). All these developments can have a positive impact on both the economic aspect and property values in the locality (Maas & Watson, 2018).

Another major objective in recent research is the inclination towards sustainable development. Prioritizing pedestrians and cyclists are predominant, thus increasing their usage. This can be achieved through widening footpaths and separate, safe cycling facilities (Mouratidis, 2021; Cormack & Pointer, 2020). Studies shows a direct correlation between quality bikeway networks and bike uptake (Buehler & Dill, 2016). Having well interlinked and safe networks have shown increased trend in bike use (Koorey & Teather, 2016; Smith & Fu, 2025; TRA, 2023). Although, protected lanes have more positive impact than painted tracks when it comes to encouraging gender equity in cycling (Guo et al., 2023; Pellicer-Chenoll et al., 2025). "Safety in numbers" also implies that more cycling can provide safer conditions (Robinson, 2005). Additionally, safety of passengers using public transports must be ensured by providing safe and consistent kerbside access for buses, by eliminating unsafe gas between kerb and bus (Ward et al., 2024). These changes can promote increased use of public transport thereby improving public health through reduced pollution and rising active living (Mizdrak et al., 2023; Mouratidis, 2021).

Complex use of kerbside requires dynamic and responsive management. This includes the allocation of space according to temporal demands, application of latest technologies such as sensors and AI for real-time monitoring and adaptation to dynamic nature (Gregg & Maisel, 2025; Jaller et al., 2021; Hao et al., 2023; Institute for Sensible Transport, 2016). Dynamic parking pricing, such as SFpark, can manage demand and raise revenue (Maas & Watson, 2018). Before direct implementation of these designs, various combinations of setups can be done with the help of model simulations (SUMO, AIMSUN) and thus identify suitable plan (Jaller et al., 2021; Sha et al., 2024). Systematic option generation and constant evaluation like those put forward by Anciaes & Jones, 2022, can help make evidence-based decisions on street space re-allocation and improvise them on a regular basis. Pick-up/drop-off areas are crucial for managing ride-hailing and deliveries (Jaller et al., 2021; Cormack & Pointer, 2020). Parking policy needs to change for shared mobility, e.g., Free-Floating Car Sharing (Paganelli et al., 2019). On-street EV charging is feasible, but high-demand civic spaces can opt for off-street provision to ensure kerbside productivity is maintained (Cormack & Pointer, 2020). Green infrastructure such as kerbside infiltration systems for stormwater control is another innovative utilization of this space (Shahzad et al., 2022).

Re-allocation and redesigning kerbside have several hurdles. One such hurdle will be the opposition from private car owners as conventional car-centric design is remodified (Cormack & Pointer, 2020). Management is also obstructed by limited existing data and limitations in current collection practices to develop an understanding of complex kerbside activity (Ward et al., 2024; Jaller et al., 2021). Safety is also a concern, with on-street parking, for instance, accounting for a large proportion of collisions between vulnerable road users and vehicles in New Zealand (Ward et al., 2024). Introduction of new micro-mobility forms such as e-scooters also brings about novel safety and conflict dynamics in pavements and shared paths (Lloyd, 2023). Additionally, uncompromising rules and policies, inter-departmental coordination, and collaboration with private operators (particularly data sharing) are required for effective management (Gregg & Maisel, 2025; Paganelli et al., 2019; Institute for Sensible Transport, 2016). Equity between all users group is also of high importance, in a manner that redesigns are equitable for all users, including vulnerable groups (Mizdrak et al., 2023; Mouratidis, 2021). Lastly, environmental factors like weather may affect the use of some kerbside facilities and alter overall traffic flow pattern (Keay & Simmonds, 2005).

Based on the reviewed literature, a global shift towards redesigning the urban kerbside as a multi-functional, dynamic, and people-oriented space was observed. Leaving behind a conventional emphasis on car movement and parking, and adopting principles of dynamic allocation, sustainable mode prioritisation (walking, public transport, cycling), strategic connectivity of new mobility

services, and extension of place-making roles through amenities, Kilmore Street can be activated into more vibrant kerbside facilitating multi-functioning. Addressing current limitations in data and collection methods, application of dynamic designs, advanced technologies, revised policies and collaboration with all stakeholders can help in achieving the objectives successfully. The findings of international research and practice point to the potential for kerbside interventions to play a positive role in Christchurch's wider objectives of urban sustainability, economic success, and a better quality of life for its citizens.

Methods

The movement surveys and parking surveys were carried out on the 4th of April, 2025. The weather was bright and clear, and the temperature was 18°C (am) and 25°C (pm). It was a regular working and school day, and no major roadworks impacted the survey area, although there was a construction site on the street that had three/four vehicles parked along the street all day.

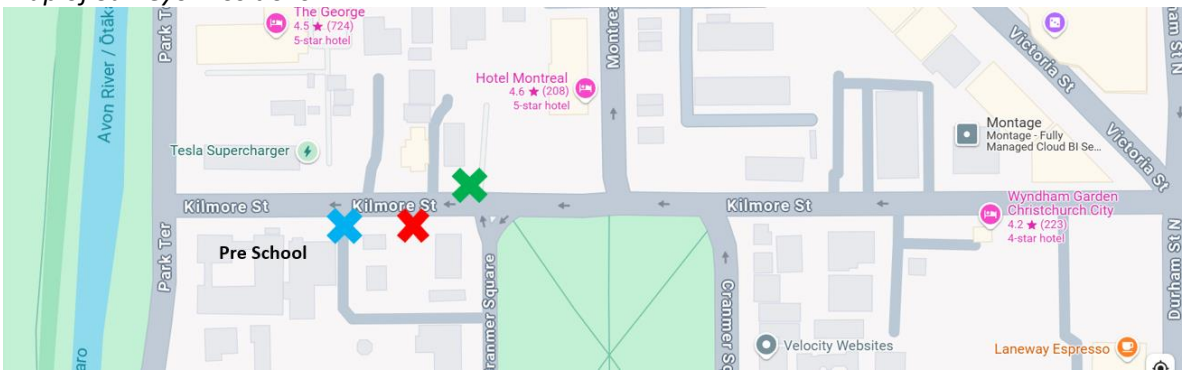
Movement Survey

The movement surveys ran from 08:00 to 09:15 (am), and 14:30-15:45 (pm), to capture the drop-off and pick-up movements for Cathedral Grammar Pre School. From 08:00-09:15, the surveyor was positioned on the pavement at 20 Kilmore Street (marked with a red X on Figure 2) and had a clear view of the Pre School. From 14:30-15:45 the surveyor was positioned on the north side of Kilmore Street (marked with a green X on Figure 2)

Pedestrians were counted, and their direction of travel noted. They were categorised as ‘adult’, ‘child’, ‘baby’ and ‘dog’. Vehicle movements were counted as they exited the school (marked with a blue X on Figure 2), and all cyclists were counted as they passed the surveyor, travelling west along Kilmore Street, which is a one-way street. Vehicle movements (excluding cyclists) on Kilmore Street were not counted. Any unusual or unlawful vehicle movements were noted. All counts were consolidated every fifteen minutes. The data was imported to Excel and then extracted to form the graphs in Figures 7 and 8.

Figure 2

Map of Surveyor Positions



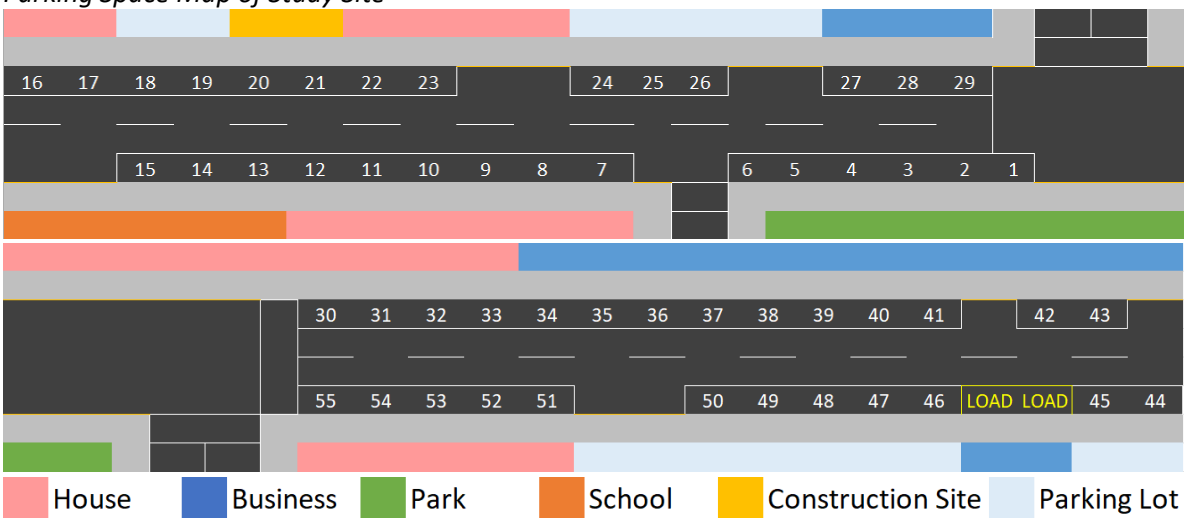
Note. Site map showing the Pre School and position of the surveyor. Adapted from (Google Maps, n.d.)

Parking Survey

The parking surveys were conducted at the same time as the movement surveys. The surveyor designated a number to each legal parking space, with 55 spaces in total, as seen in Figure 3. The surveyor walked a beat along the entire survey area at fifteen-minute intervals, noting the first three letters of the vehicle's numberplate in the designated parking space. Using only the first three letters for the vehicle registration provides sufficient anonymity, as the vehicle type etc was not collected data. The occupancy data was collated into a table in Excel and extracted in fifteen-minute intervals to create Figure 5.

Figure 3

Parking Space Map of Study Site



Note. Western half of study site (top), eastern half (bottom)

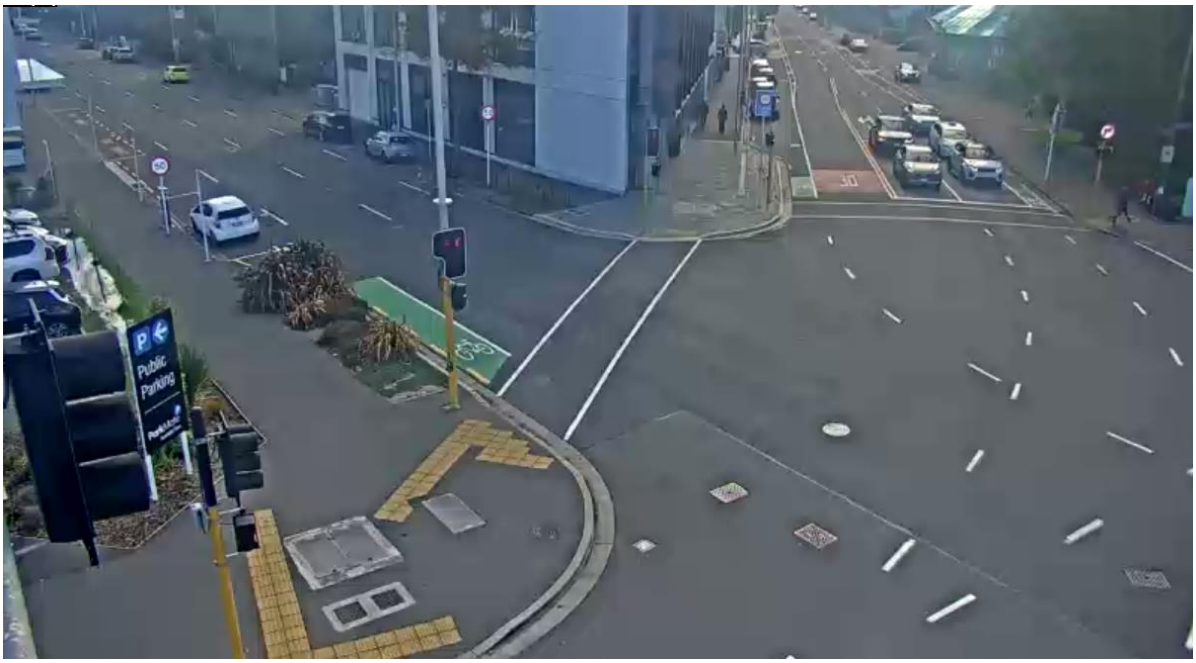
Parking was also surveyed using one of the CCC's traffic cameras, at the intersection of Durham Street and Kilmore Street, as shown in Figure 4 below. The CCC had not used their traffic cameras for this purpose before, so this was more-so about trialling them for their potential use in monitoring parking occupancy in future, rather than just getting data for the survey period. From this, nine parking spaces were able to be accurately identified and monitored from pre-recorded footage of the day, with each vehicle's arrival and departure noted, allowing for the occupancy of all the spaces to be congregated into fifteen-minute intervals from 00:00-20:00 on 4 April.

Loading Bay

CCC collected traffic camera footage from a camera located near the intersection of Kilmore Street and Durham Street North, facing west, from 4 April 2025 06:00-20:00. The camera footage captured vehicle movements and parking activity on the Loading Bay to the front of the Wyndham Hotel, as shown in Figure 4. The loading bay has a P10 'at any time' restriction. The team members reviewed the footage from 06:00-20:00 and captured this data, noting the length of time the vehicles were parked.

Figure 4

CCC Intersection Camera View



Note. Loading bay in top left corner

Results

Parking Survey

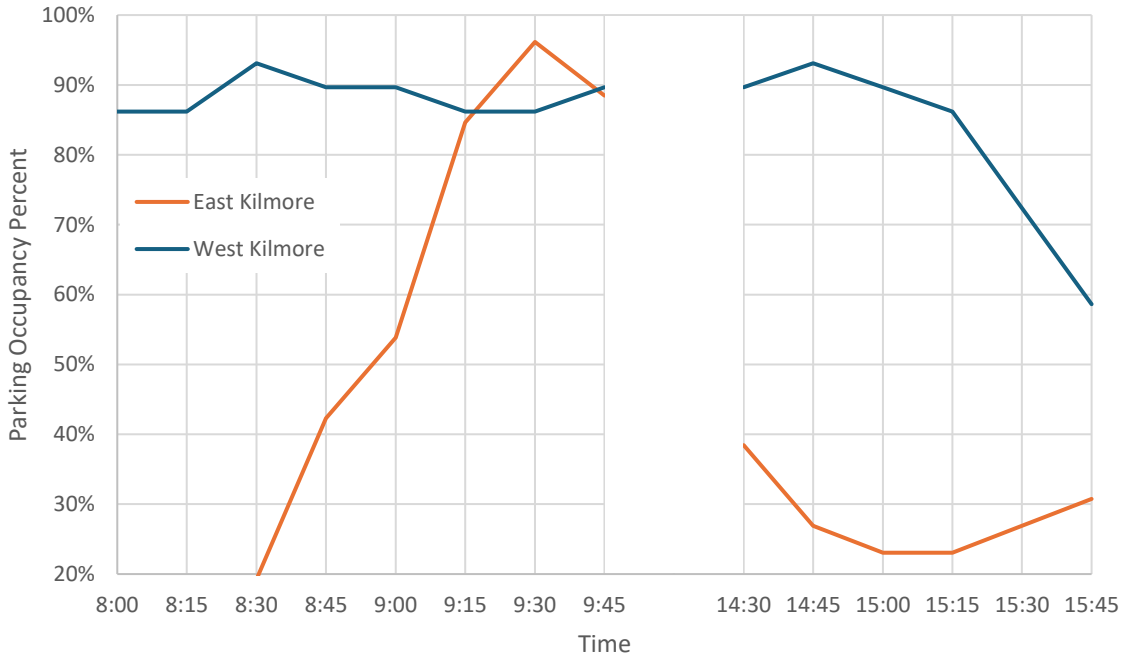
Results from the on-the-ground survey was split into two zones on either side of Montreal Street, east and west Kilmore, as they have significantly different surrounding uses, shown in Figure 5. The east side, designated an activity street, has paid two-hour parking, while the west side, designated a local street, has free parking with no time limit for most spaces. The east side had 26 parking spaces at the time of data collection, while the west had 29 spaces. This data was collected from 08:00 to 09:45 for the morning period and 14:30 to 15:45 for the afternoon period. Results from the CCC traffic camera were only able to accurately capture parking for 9 parking spaces on Kilmore Street, near Durham Street, but data was able to be collected from midnight to 20:00.

For East Kilmore Street, in Figure 5, parking occupancy in the morning started at 19% at 08:30, steadily increased to 96% at 09:30, and decreased slightly to 88% by 09:45. In the afternoon, occupancy was significantly lower, started at 38% at 14:30, decreased to a low of 23% between 15:00-15:15, and increased back up to 31% by 15:45.

For West Kilmore Street, in Figure 5, parking occupancy never dropped below 86% in the morning and peaked at 08:30 at 93%. In the afternoon, occupancy remained above 86% until sharply declined to 72% at 15:30 and to 59% at 15:45.

Figure 5

Kilmore Street Parking Survey on Foot

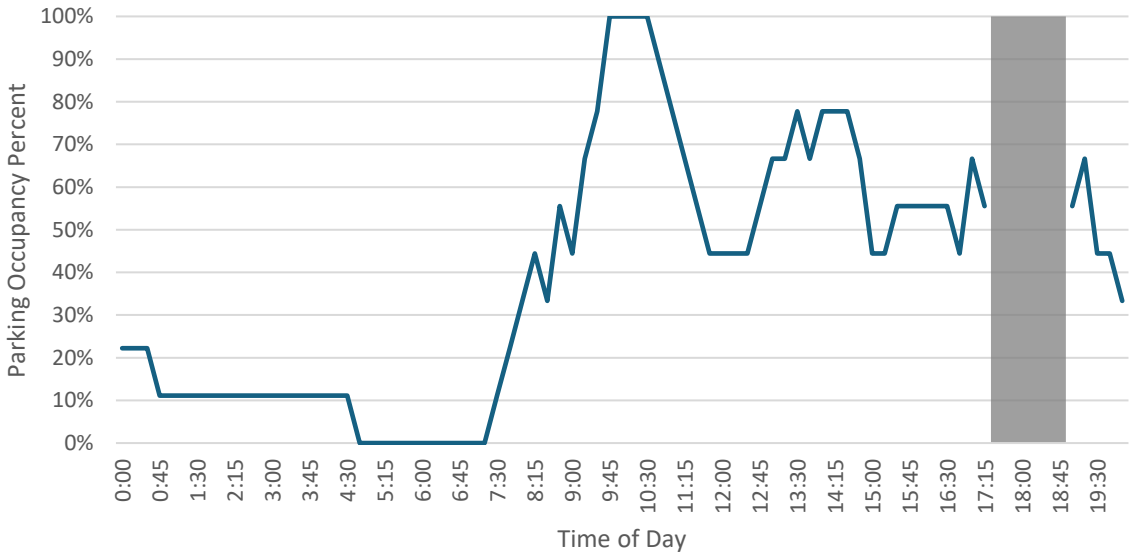


Note. Morning period from 08:00-09:45 (left), afternoon period from 14:30-15:45 (right).

For the CCC traffic camera, in Figure 6, parking occupancy was at 22% at midnight, however that dropped to 0% by 04:45. It quickly increased from 07:30, peaking at 100% occupancy by 10:00, until 10:30, and dropped to 44% by 11:45. Another, smaller, peak occurred between 12:30 and 15:00, with a high of 78%. There is a gap in the data from 17:20 to 19:00 as this was when sun glare blinded the camera, making it too difficult to see any vehicles parked.

Figure 6

East Kilmore Street Parking Survey from Camera

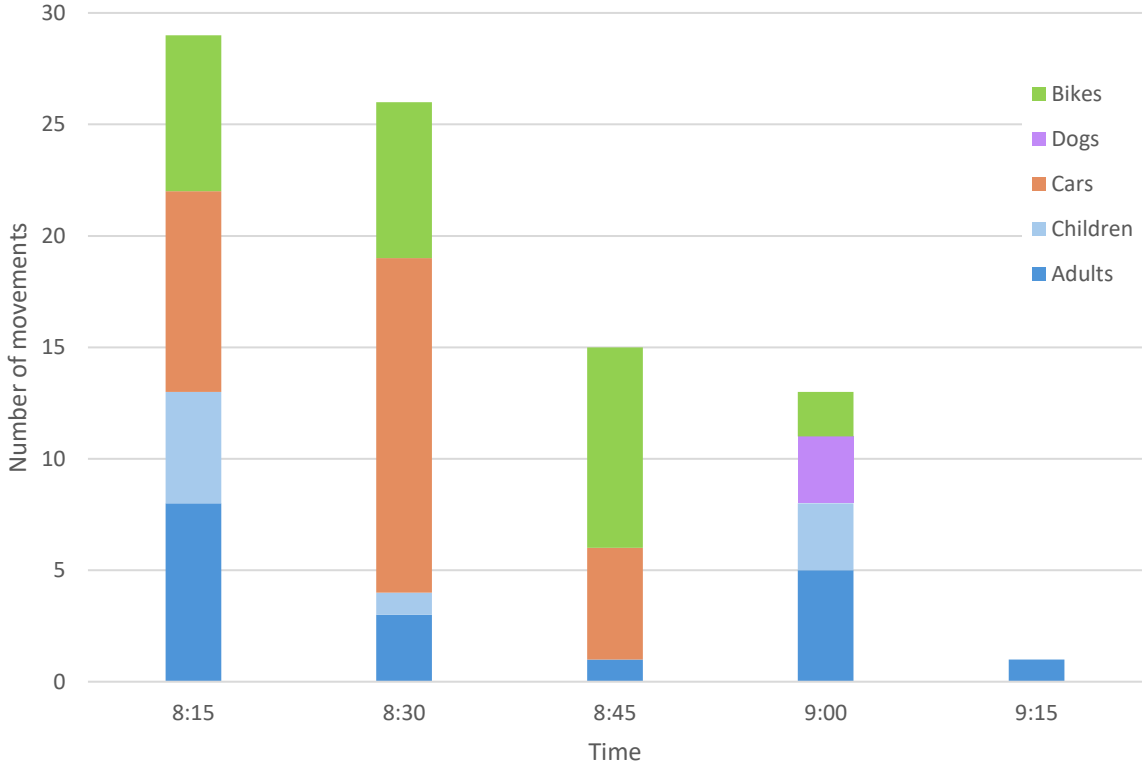


Note. Does not include parking for all of East Kilmore Street.

Movement Survey

During the morning movement survey, shown in Figure 7, a total of 18 adults, 6 children, 3 dogs and 25 cyclists were observed. Of the pedestrians, 2 were joggers. 29 cars were observed leaving the school, and one near miss was noted between a car leaving the school and a cyclist at 08:37, when sunstrike was present.

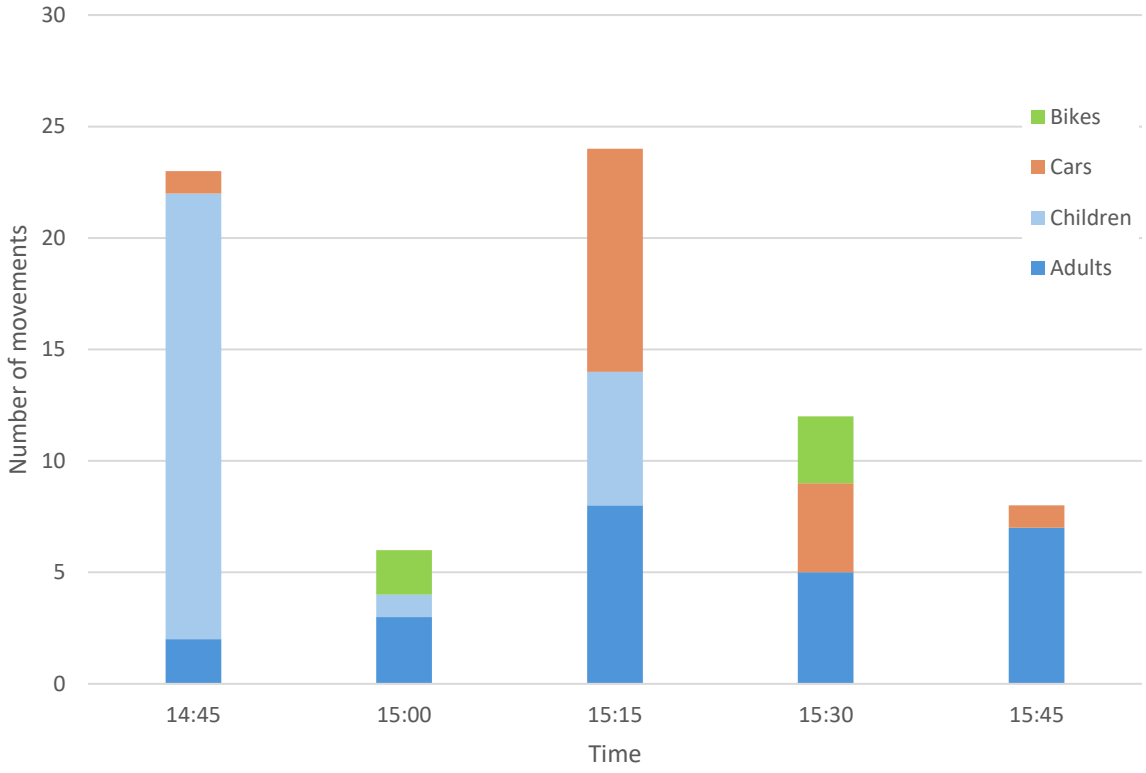
Figure 7
Morning Movement Survey



During the afternoon survey, shown in Figure 8, a total of 26 adults, 27 children and a baby in a stroller were noted. The large number of children was the result of a school bus drop off from a school trip or similar. 15 cars were observed leaving the school, with 1 car going in the 'no entry' to the school. 5 cyclists were observed. One car was noted to park illegally for 20 minutes. 3 Lime scooters (1 at 14:42 and 2 at 15:18) and 1 DHL delivery scooter (the same vehicle, in two directions, at 14:39 and 14:42) travelled on the footpath.

Figure 8

Afternoon Movement Survey



Loading Bay

Table 1, and Figures 9 - 11 represents various analysis outputs of usage patterns for the loading bay on Kilmore Street based on a single day observation. These analyses give information on parking duration, vehicle types, peak occupancy periods, and overall demand distribution during the day in the loading bay, with implications for improved management of the loading bay.

Table 1 indicates the average number of vehicles in the loading bay for each hour of the day. Darker red colour indicates higher average occupancy (busy hours), and light blue shades indicate lower average occupancy (less busy hours). Hours between 08:00 am -12:00 noon shows highest average use. Early morning, noon and late evening hours demonstrate moderate to low average usage. The heatmap visually confirms that the late morning (8 AM - 12 PM) is the average peak demand period for this loading bay. As already mentioned, the lower occupancy hours can be used for alternative purposes, and the peak hour uses can be enforced with some restrictions or imposition of time-of-day price for efficient management of the zone.

Table 1

Average Hourly Occupancy Rate of Vehicles in Loading Bay

Time (hr)	Average Hourly Occupancy
6	2
7	2
8	15
9	11
10	14
11	12
12	8
13	1
14	7
15	10
16	7
17	6
18	6
19	8
20	0

Figure 9 shows the distribution of parking durations for vehicles using the loading bay. The x-axis is the parking duration intervals (upper limits of the interval in minutes), and the y-axis is the count of vehicles in each interval. Most of the vehicles (around 70%) used the loading bay for a short period, 5 minutes or less. There were only few vehicles which stayed for longer period, indicating that it is an essential stop for short-term parking. The very few extremely long stays (e.g., >2 hours) are outliers.

But the data also reveals cases where vehicles using the bay beyond the P10 time limit, with some vehicle stays extending beyond 2 hours which is against the P10 rule. As mentioned by Ezquerro, Moura, & Alonso (2020), such unauthorized usage can lead to reduced vehicle rotation and availability to permitted users. Even though the reasons for these uses are not evident, studies suggests that an extremely small percentage of such overstays are typically caused by extensive loading/unloading activities (Ezquerro et al., 2020). The need for further analysis of the regions kerbside usage is noticeable from the data. Future research could focus on exploring whether these overstays are associated with particular times of day or vehicle type.

Figure 9

Frequency of Parking Durations in Loading Bay

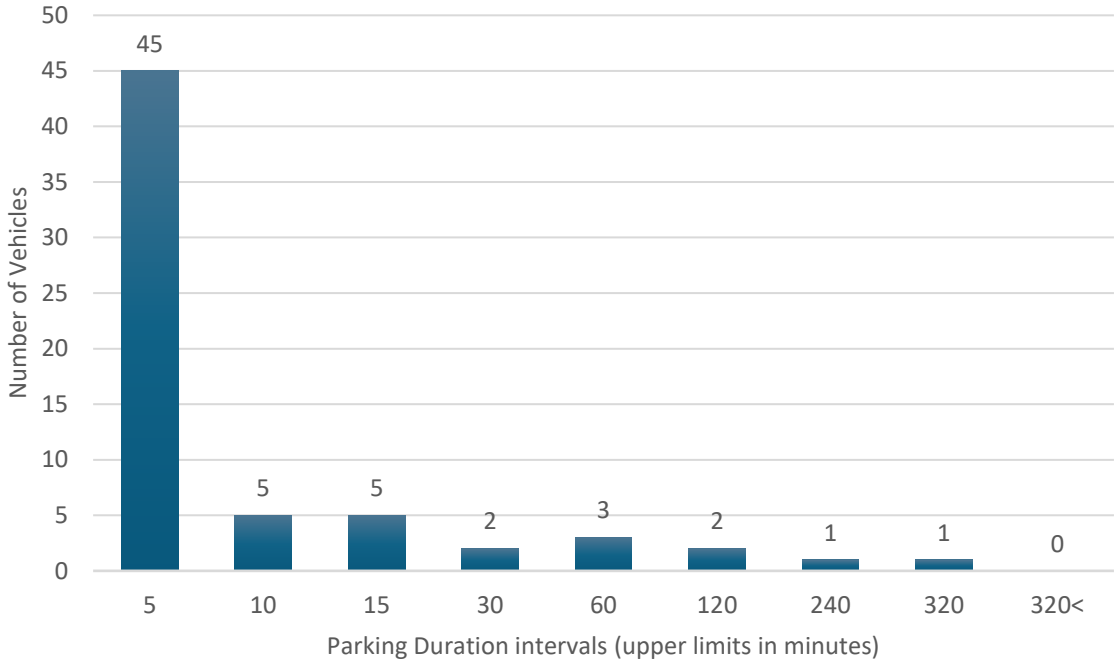


Figure 10 depicts the number of vehicles occupying the loading bay based on the vehicle type (Car, bus, truck, taxi and van) at each 10 minutes interval throughout the observation period. Each line represents a different vehicle type. Cars were the most frequent users of the loading bay, showing consistent presence throughout the day with several peaks where 2-3 cars were present simultaneously. All other vehicle types were present only for short span of time. Based on the observations, the loading bay is predominantly utilized by private cars. Even though it is designed as a loading bay, its use for the purpose is limited during the observation. This put forwards the need for redesigning or converting the existing use to multi-functional space. If the goal is to prioritize commercial vehicles, current usage patterns suggest this is not being achieved. Only one delivery vehicle was recorded (11:00-11:30) and one coach (07:45-08:30).

Figure 10

Occupancy Count of Vehicle Types in Loading Bay

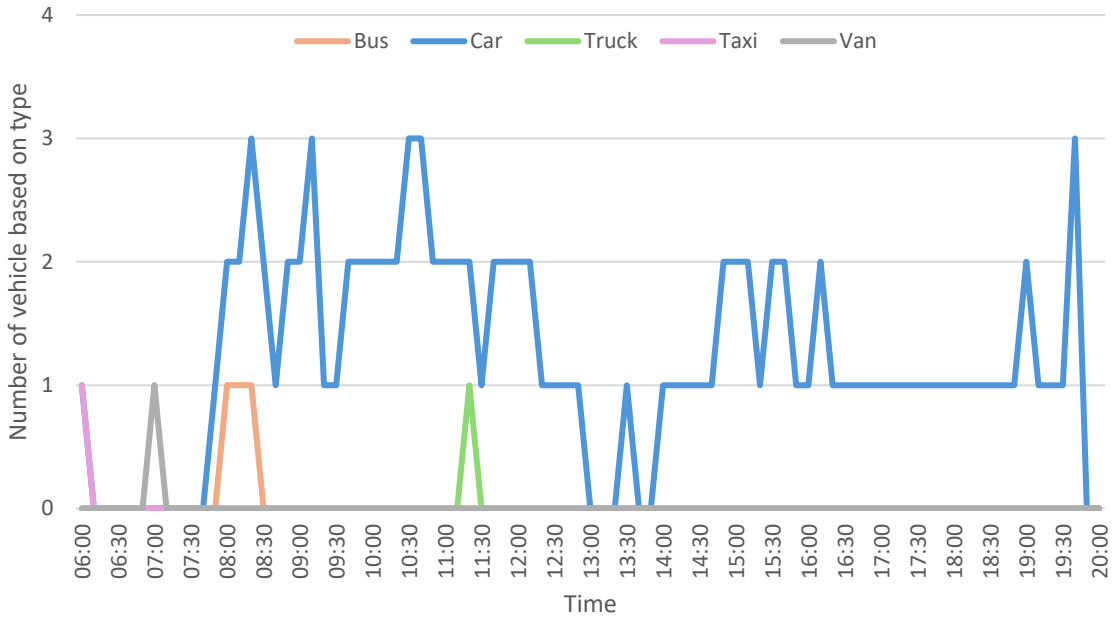
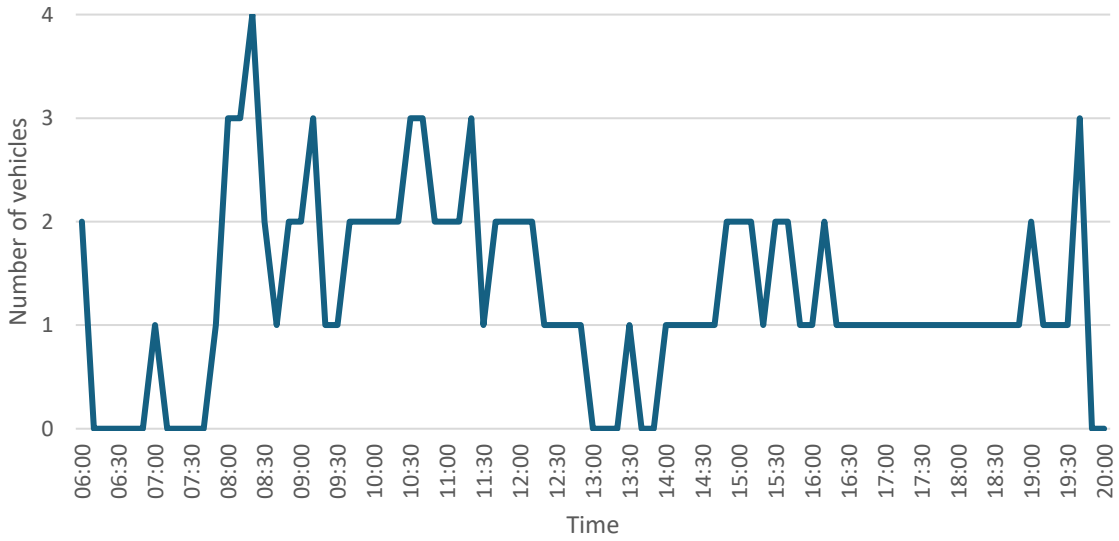


Figure 11 shows the total of all vehicle types combined taking up the loading bay at each 10-minute interval. The loading bay was on high demand throughout the day. Most of the peak occupancy time was during the morning hours. There were also low occupancy periods, most notably during early morning. Based on this fluctuating use, there could be room for dynamic management or accommodating other short-term kerbside uses such as pick-up/drop-off during low times.

Figure 11

Total Occupancy Count in Loading Bay



Discussion

Suggested Uses

The kerbside was split into 5 zones, shown in Figure 12, so that suggested uses were based on the surrounding property usage. Zone 1 is next to Cathedral Grammer School, so play elements were included, with minimal loss of parking. Zone 2 includes several amenities as it is next to Cranmer Square, Zone 3 is a mix of residential, off-street parking, and the Wyndham Garden Hotel (with a café), so the loading bay, a parklet and some greenspace, were all included. Zone 4 is a mix of business and residential, and zone 5 is mostly residential, so there were minimal changes to parking other than the addition of greenspace.

Figure 12

Different Zones on Kilmore Street

Note. (Esri, 2024)

Figure 13 goes into more detail about what the street could look like, however this is merely a concept, which does not consider any planning regulations or other practicalities.

Figure 13

Proposed Suggestions for Kilmore Street

Note. (Esri, 2024)

Amenities

The kerbside of Kilmore Street offers numerous chances to activate public space, enhance user satisfaction, and provide a more vibrant street environment. Except for some specific operating zones like parking, pick-up/drop-off and loading bay, the general kerbside, such as footpaths and other potential areas, may be activated using well-designed amenities. Based on various analysis, the following recommendations were formulated for developing a more people friendly, accessible, and engaging space for pedestrians, local businesses, and the community.

Cafe seating/ benches: Kilmore Street is a mixture of different zones which includes school, cafes, residential buildings, park, and others. For that reason, placing seating arrangements/benches alongside cafes or by broad sidewalks can significantly enhance street attractiveness and economic vibrancy. Even redesigning few parking space for this purpose can have positive impact on the street

users if done without encroaching on required access. It will also act as a relief for pedestrians (Anciaes, 2022).

Play Area / Hopscotch etc. on Pavement: Incorporation of larger play equipment's can be an issue on street with limited space, but this can be resolved by placing smaller, fundamental play items. This can attract the school students from the nearby school into engaging with some physical activities and can bring a sense of play particularly in areas of expected family passerby or proximity to community facilities like schools (Stevens et al.,2024). Painted games like hopscotch or mazes on wider sections of the footpath can be utilised for this. Artworks and incorporation of Māori cultures can attract tourists and other international residents, and it also helps in better understanding of traditional culture.

Fitness Machine / Water Fountain (with dog bowl): As health consciousness is increasing among all age groups, allocating space for some fitness activities can be useful for an active community like in New Zealand. A public water fountain, available for all, with a dog bowl, is a valuable addition for pedestrians and dog owners.

Food / Coffee Truck (with Wastebins): Locations for licensed mobile traders could be established, particularly where pedestrian flow is strong but perhaps fewer fixed food outlets (example shown in Figure 14). This offers dynamism and diversity to street-level provision, supplying needs in the moment and perhaps creating more foot traffic (Rui & Jones, 2021). It should also involve clear regulations regarding opening hours, waste disposal and the prevention of obstruction to pedestrian or required vehicle access.

Vending Machines: Increased use of pedestrians will require sufficient supplies to meet their basic needs. Vending machines can be a suitable choice for this. It can be placed in well-lit, safe location without interrupting other activities and pedestrians. It also offers 24/7 access to necessities.

Toilet: It is a necessary public health facility, improving comfort and accessibility for everyone using the street.

All these amenities require regular maintenance, safety and security, good design and should be a placed such that it doesn't interrupt the pedestrians and other users.

Figure 14

Food / Coffee Truck Examples

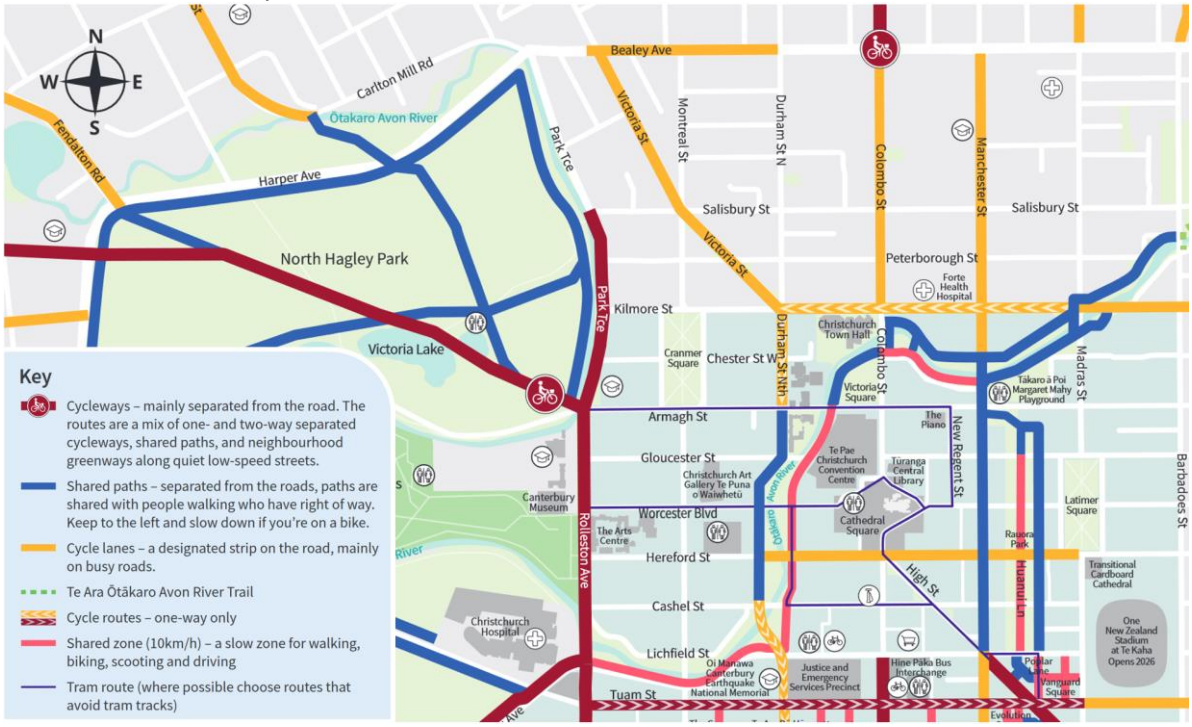
Note. (left) An example of a coffee truck which can be parked in a single car parking space. Image credit: Kayaba Coffee Truck by Marco Verch under Creative Commons 2.0)right) An example of a food truck on a trailer, which utilises a single car parking space. Image credit: image from tacosnsalsav.com

Bike Infrastructure

While there were already several cyclists using this street, better bike infrastructure would encourage more cyclists to use it. Hence, there are a couple of recommendations for better infrastructure. Primarily, this would be a protected bike lane on the south side of Kilmore Street as it increases separation between bikes and vehicles. This improves the perceived safety from cyclists, and in turn encourages more people to bike (Smith & Fu, 2025; TRA, 2023). By having the lane on the south side of Kilmore, it would provide cyclists safe and direct access to both Cranmer Square and Cathedral Grammer School. When looking at the wider cycle network in Christchurch Central, in Figure 15, there is a clear gap in the network between Rolleston Ave / Park Terrace and Durham St. This means that cyclists traveling between North Hagley Park and the central city can only travel along Rolleston Ave if they want to stay on the network, potentially adding a significant distance to their commute. An increased travel distance is a problem for cycling as the longer a commute is, in terms of time or distance, the less likely people are to cycle (Koorey & Teather, 2016; Smith & Fu, 2025; TRA, 2023). The suggested bike lane in Figure 13, would shorten travel times, though with it only being a one-way, along with other parts of Kilmore and Durham Streets, there would need to be another cycle path going in the opposite direction nearby to shorten commute times for both directions.

Figure 15

Christchurch Central Cycle Paths



Note. From *Te mahere paihikara o Ōtautahi - Christchurch bike map*, by Christchurch City Council, 2025 (https://ccc.govt.nz/assets/Documents/Transport/Cycling/map/Christchurch-Bike-Map-2025.pdf).

Other additions include cycle parking (with e-bike charging stations), and water fountains, in Zone 2. At the time, there were several e-scooters parked in the north-west corner of Cranmer Square, partially blocking the footpath, suggesting that there is a need for micromobility parking there.

These improvements all help support bike-centric developments, such as one already planned for 52 Kilmore Street by Williams Corporation (Williams Corporation, n.d.). This is a mix of apartments and townhouses that have no car parking, instead having cycle parking.

Greenspace

Apart from Cranmer Square, there are few trees along Kilmore Street. In fact, there is only one tree on the whole east side of the study area. Greenspace is known to promote both physical and mental health benefits (Browning et al., 2022). These benefits include supporting physical activity and community wellbeing. This is because greenspace helps reduce negative environmental impacts such as the urban heat island effect, air pollution, and noise (Browning et al., 2022). By incorporating pockets of greenspace throughout Kilmore Street, it helps distribute these benefits to all residents and pedestrians using the street.

This also helps the CCC's urban forest plan, which is a plan to increase tree canopy cover in the urban environment over the next 50 years (Christchurch City Council, 2023). The central city in general has around 20% canopy cover, which is on the higher end of coverage, however this includes Hagley Park, which has far more tree coverage than the rest of the central city, meaning that coverage is probably significantly lower for the rest of the area (Christchurch City Council, 2023). In addition, the central city is planned to become far denser than the rest of the city, under plan change 14, meaning that kerbside greening projects like this are more important for the central city to help provide enough greenspace that is publicly accessible (Newsline, 2024).

There are some sections of the kerbside that are completely unused, where no cars, pedestrians, or cyclists can go, providing a great opportunity to add greenspace with no push back from the community for removing any car parks. One section is shown in Figure 16, with the unused area not currently being able to be used for anything due to it being a part of the Kilmore-Montreal Street intersection. Not much else can be done for that area, and it would provide a barrier from the road, for both the footpath and townhouses there.

Figure 16

Unused Kerbside in Kilmore-Montreal Intersection

Note. Intersection of Kilmore-Montreal Street were most of the kerbside is unused (Google Maps, n.d.).

Parking

Parking can be viewed as a service for car owning residents, and having a roadside parking space has been shown to increase property values (Maas & Watson, 2018), especially where homes are close to a ‘destination location’. Our project area would fall into this category as it is very close to Hagley Park. Residents may be understandably resistant to losing car parking spaces near their property as they fear devaluation of their property. That said, while residents may express a sense of ‘ownership’ felt over the kerbside near their home, the kerb is, in fact a community asset, owned and managed by Christchurch City council (Local Government Act 1974, s.316).

In Zone 1 (Figure 12), near the school, and closest to Hagley Park, the free parking is well utilised, and the 120 min restriction reasonably well observed, with the occupancy rate consistently at or above 86% in the morning. We considered adding a 'kiss and go’ parking zone close to the school (with a 5 min parking restriction) however pre-schools require a caregiver to personally hand over the child to their care, so this would not be practical.

Zone 3, from Durham Street N to Cranmer Square is less well utilised. This could be because there is a charge for parking here and a P120 restriction, however the lower usage does indicate a lower need for car parks. There are also numerous off-street parking facilities for both business and residential use in this area.

Zone 3 also passes the Wyndham Hotel’s frontage and includes the loading bay. The loading bay is used only infrequently for loading goods into and out of the hotel, but frequently to drop off/pick up clients and staff. During the survey period only one truck and one coach were noted. The section of the loading bay directly outside the cafe at the hotel would lend itself well to an outdoor seating ‘parklet’ (example in Figure 17), which have been extremely successfully utilised in Wellington, bringing ‘life and creativity’ as well as increased business to the areas they are used (Wellington

Businesses Keen to Get More Parklets in CBD, 2022). The loading bay itself would not be compromised, however the temporary parklet could easily be relocated if necessary.

Figure 17
Parklet Example

Note. Example of a temporary parklet, providing outdoor seating for a cafe (*How to Build a Parklet DIY | Happy Eco News*, 2023)

Zone 4, to the north, in part currently put to paid P120, could be used for dedicated carshare parks (example shown in Figure 18). Car sharing is relatively new in Aotearoa NZ, with companies like MEVO and Cityhop having vehicles to hire in Christchurch, Wellington, Hamilton and Auckland (Go with Mevo - New Zealand's Favourite Car Share, 2024, *NZ's Leading Van & Car Sharing Service | Cityhop*, n.d.). The concept is simple, with customers using an app to hire a car or van by the minute (MEVO) or hour (Cityhop). Data from 2019/2020, provided by MEVO and Cityhop, showed that one car share vehicle replaces 11 private vehicles (Car Share Schemes Driving Force for Eco-City Status, 2020). Wellington City Council supports car sharing by both offering dedicated free car share parks and allowing users to park at no cost anywhere in the city in metered or coupon parking, and P120 and above.

The project area does not have any dedicated mobility spaces, and adding one, or two, mobility parks near the Cranmer Square 'amenity zone' in either Zone 1, 2, or 5 (Figure 12) would ensure a greater degree of inclusivity for disabled people.

Figure 18

Dedicated Car Share Parking in Wellington

Note. Dedicated car parking for car share companies such as MEVO and Cityhop, on Bolton Street, Wellington *(Google Maps, n.d)*

Research Methods Critique

As detailed in the methods section, a traffic camera at the intersection of Kilmore Street and Durham Street was used to look at parking occupancy for the visible parts of Kilmore Street. This is not something that the CCC currently uses its cameras for, but it was used here to test the viability of using them in future to more efficiently survey parking.

There were a few key benefits to this method, compared to on-the-ground surveying. Primarily, it was a much faster way of surveying, after some practice, with it taking less than an hour to collect 20 hours of data. This saved so much time not having to wait around for each 15-minute interval to collect data. It was also very useful for looking at loading bay use as it provided clear usage throughout the day, and night, and showed a lot of usage that was not captured in the 15-minute survey. Finally, it was far more safer having someone sit in front of a computer looking back through the camera recording, than having to walk along the footpath and cross the street countless times in a day.

There were however several problems with this method, most notably the software used to analyse the camera footage was unstable, constantly freezing, which meant that the footage had to be reset each time. This significantly increased the amount of time to collect the data, as it took a while to Figure out how to work around some of these quirks. It would be significantly more convenient for the parking occupancy survey if the traffic camera was able to take a photo of the area every 15 minutes, so that the same results could be achieved at a faster rate, without having to use the unstable software and fast forward to each 15-minute interval.

Visibility was a major problem as well. The camera was only able to accurately capture 9 parking spaces, out of the 26 spaces for the whole eastern side of Kilmore Street. This has implied that occupancy for the street was far higher than what it was. When looking at the on-the-ground survey data for all east Kilmore Street in Figure 6 at 09:45 for example, the 100% occupancy rate from the camera is only 88% for all the East side, this is worse at 15:45 where the camera's 56% occupancy is

only 31% overall. It probably would be able to capture the whole east side if the camera was placed somewhere between Cranmer Square and Durham Street, instead of at the intersection. However, even for the parking spaces that were visible, they were not clearly distinguishable from the camera, making it difficult at times to Figure out which space a car is parked in. This was not relevant for getting the occupancy rate of the whole area, but it would be an issue for trying to get the parking turnover. There was also sun glare in the evening from around 5:20pm to 7pm, which blinded the camera, and obstructed the view of all but two of the parking spaces as shown in Figure 19. This left a gap in the data, which according to CCC parking payment data for a part of Kilmore Street not in this survey, (B. Jassin, personal communication, March 21, 2025) may have shown the lowest parking occupancy for the whole day payment is enforced, at 6pm.

Figure 19

Sun Glare on Camera

Looking at other studies that use cameras to monitor parking, they have a stationary camera, which is often used alongside a machine learning model to detect real time parking occupancy (Khoshelham, 2021). Presumably, this model would be able to track occupancy rates over time, however this would require the installation of new cameras solely for monitoring parking and potentially raise privacy concerns (Chen et al., 2023).

There are numerous other ways of surveying parking occupancy, including roadside LiDAR, as well as wireless and fixed sensors, other than cameras (New South Wales Government, n.d.; Zhihui et al., 2023). These methods would be far more expensive than just using the traffic cameras, but they provide several benefits. For roadside LiDAR, these benefits include 24-hour data collection as it is unaffected by any lighting issues, and privacy as it does not capture imagery that could identify license plates or people, while still being relatively cheap compared to sensors or contracting out manual surveying (Chen et al., 2023). For sensors, these include a flexibility in the type of sensor able to be used, based on accuracy, reliability, cost and the environment it would be installed in, with wireless sensors having the added benefit of minimal installation requirements (Ball et al., 2016; Khoshelham, 2021)

Alternatively, data similar to that collected in this study, just over a longer data collection period, could be used to model current and future parking demand for the kerbside (Samaranayake et al., 2023).

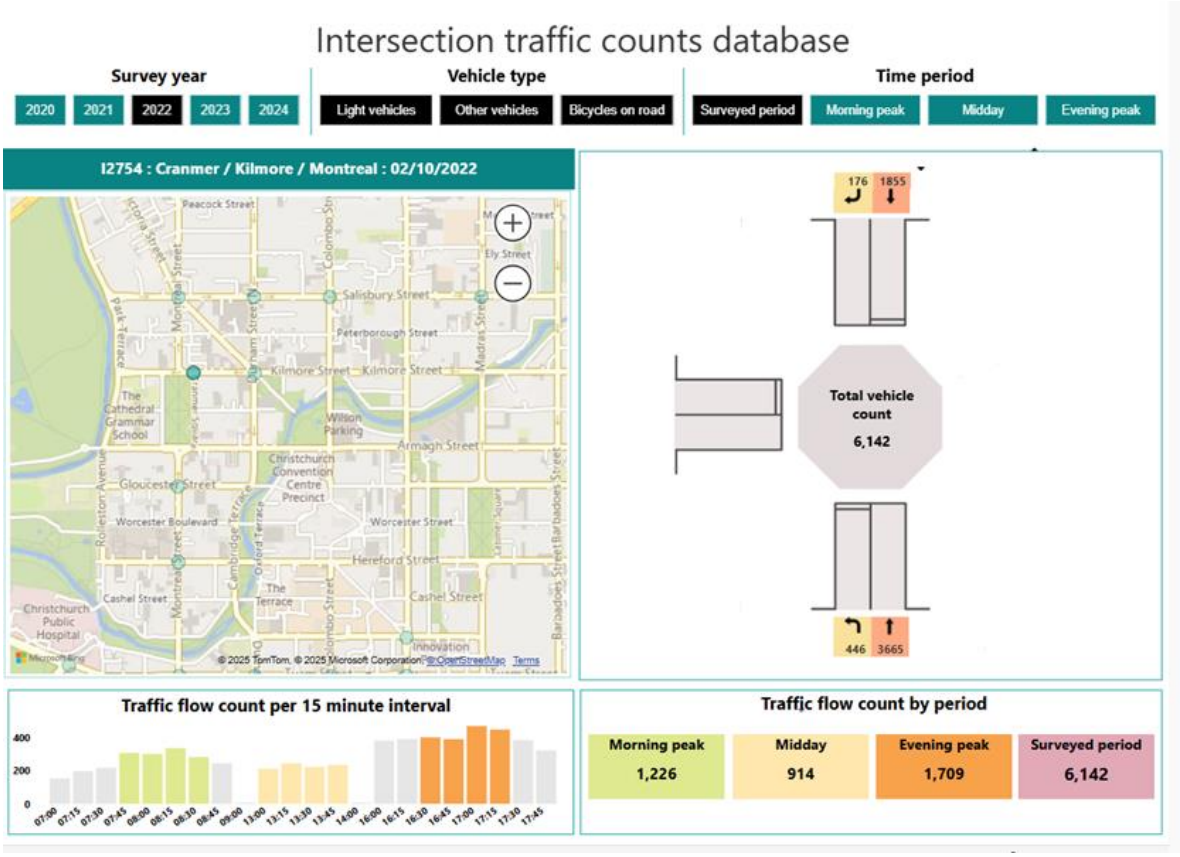
Limitations

Inaccurate Data

One of the databases that has been used to assess vehicle movements is Christchurch City Council's (CCC) Intersection Traffic counts Dashboard, as shown in Figure 20 (Christchurch City Council, n.d.). It is an interactive website which shows the vehicle count by type and movement direction at intersections over five hours on a single day. These traffic counts are undertaken every three years and are collected in person at the relevant intersection, before being uploaded and coded (personal communication, 29 March, 2025). The collectors have, anecdotally, used both paper records and iPads, but the method used in this instance is not recorded. The five-hour total survey period consists of 7am to 9am, 1pm to 2pm and 4pm to 6pm on a single ordinary weekday (not on school or public holidays).

Figure 20

Intersection Traffic Counts Database



Note. (Christchurch City Council, n.d.)

The Intersection Traffic Counts Dashboard shows that the last survey in the project area took place in 2022. The data is therefore less current than it might be, ideally, however it is still relied upon by traffic professionals (personal communication, 29 March, 2025). The weather at the time of the

intersection survey (2 October 2022) is not recorded, but traffic volume has been shown to change according to weather conditions (Keay & Simmonds, 2005). Road works in the immediate area or connecting roads are not noted. Road works will affect traffic flow, and not knowing if they were present is also a limitation of the database. Traffic counts were made in June 2020 (Intersection Traffic Counts Dashboard, n.d., survey 13200), when Ōtautahi Christchurch was in Alert Level 3 ('COVID-19 Alert Levels in New Zealand', 2025) which was a time when travel was significantly restricted (essential personal movement only, working from home as much as possible), but this is not noted on the database despite it being a significant factor affecting traffic movements.

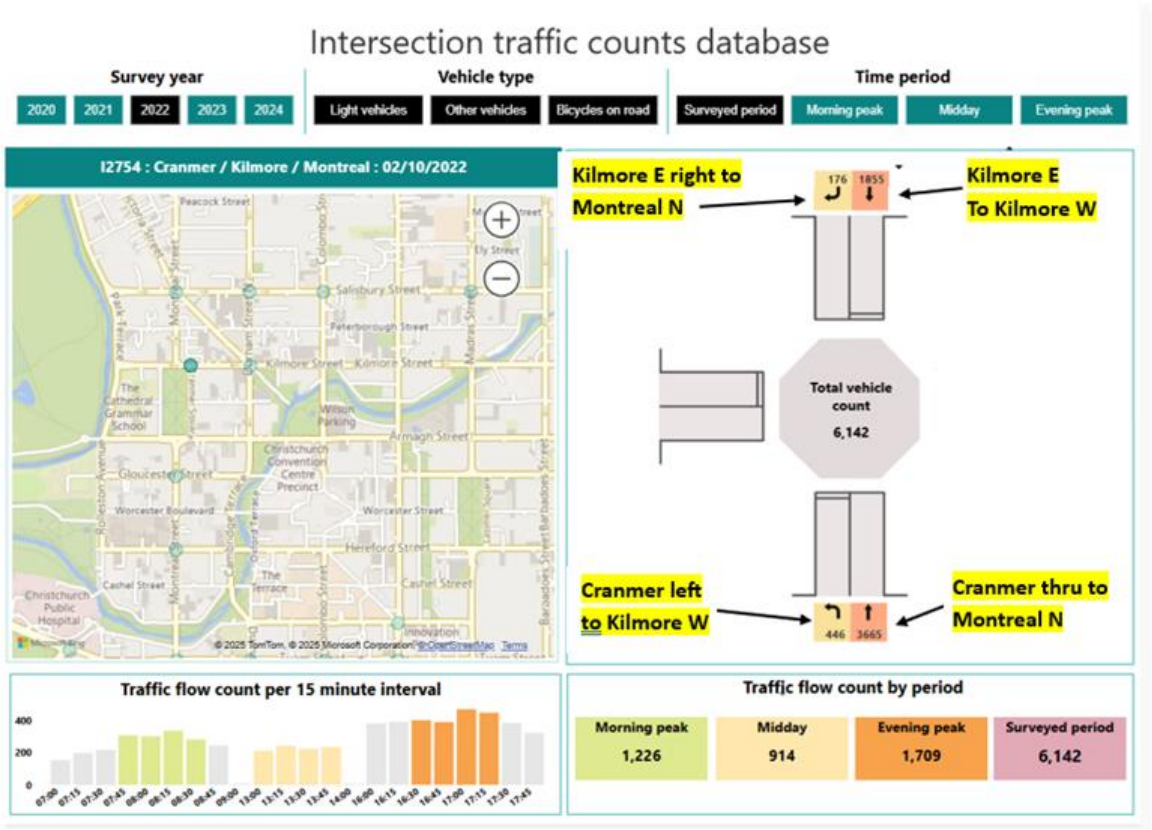
A more significant limitation to this database can be seen when examining the dashboard entry for Cranmer /Kilmore/Montreal Streets on 02/10/22 (Figure 20).

When examining Figure 20, the image shows the total number of vehicle movements for 'light vehicles', 'other vehicles' and 'bicycles on road' for the entire surveyed period (five hours). Looking more closely, however, and taking into account knowledge of the one-way system at that intersection (Google Maps, n.d.), it is clear that the direction of flow shown in Figure 20 is incorrect, as the traffic is shown to be travelling in directions which are impossible, or at least illegal, as they are travelling the wrong way up one way streets – from North to South on Montreal Street, for example. After noticing this error, the Excel spreadsheet was downloaded for this traffic count (2022 Intersection, n.d.) and the data was found to be correct, but the flow directions were not. This is likely a simple coding error; however, it is extremely unhelpful for anyone attempting to use the dashboard. Had this error occurred on a crossroad intersection, there is no way that the error would have been detected. This is a good example of technology only being as effective as the human inputting or coding the data. There are two points where human error can be limitation to this database, in collecting the data, which we cannot review, and in coding the data. That this error has not been corrected since the survey in 2022 would lead to the assumption that it has not been noticed.

Assuming that the count itself was correct, the Excel Spreadsheet described above was used to edit the dashboard for the purpose of the project (Figure 21).

Figure 21

Edited Intersection Traffic Counts Database

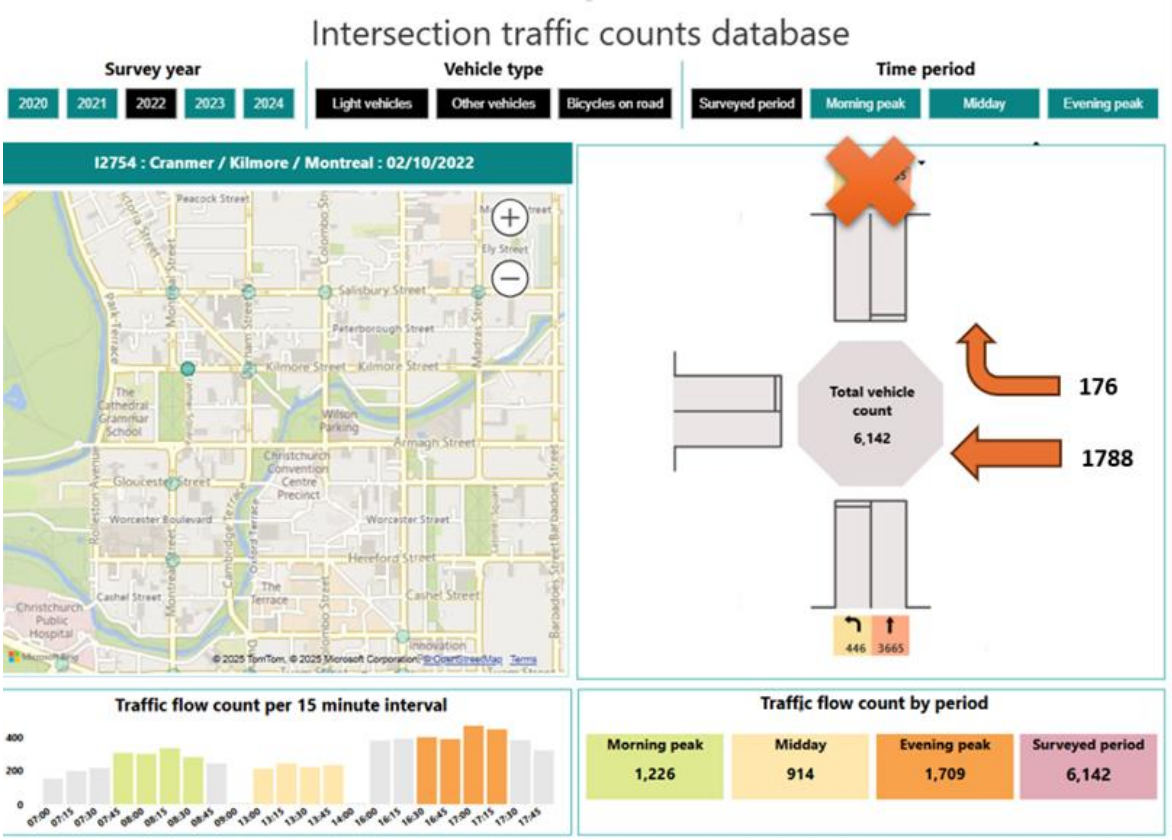


Note. Edited intersection traffic counts database to show areas of concern, S Pallett

In Figure 21 the correct direction which should have originally been applied to the number count in the dashboard has been highlighted. Figure 22 shows the data as it should have been presented. The database is useful as a crude counting tool, however, and is of use when assessing significant changes in the (three or more) years between the surveys.

Figure 22

Corrected Intersection Traffic Counts Database



Note. Corrected intersection data, S Pallett

Missing data

These surveys only took place on Friday 4th April 2025, with the on-the-ground parking and movement surveying taking place during two periods in the morning and afternoon, and traffic camera surveying from midnight to 20:00. Based on the CCC parking payment data for a part of Kilmore Street not in this survey, (B. Jassin, personal communication, March 21, 2025), It would have also been of benefit to collect data on Monday as well, as that has the lowest average parking occupancy during the week, at least for that part of Kilmore Street.

Figures 7 and 8 show that there are several cyclists already using this street, predominantly in the morning. This discrepancy could be attributed to the street being a one way, meaning that cyclists can only travel westwards, unless (illegally) on the footpath. However, this data only captures the end of the school day, and not the workday, so there may be more cyclists at that time, who have to bike in from another street in the morning. A survey from around 16:00-18:00 would have been of benefit here.

Māori Consultation

A further limitation to this project was that there was little consideration for incorporating mātauranga Māori. Consultation and engagement with Ngāi Tahu would help address this gap in our research, and influence the design of any future project, making it important before progressing this

project. For example, Kaitiakitanga, the protection of the natural environment, could be incorporated into future kerbside projects, through native plantings, to help connect people back to the natural environment, but consultation would be needed to find out how best to incorporate it. We consulted the Kā Huru Manu atlas and note that the intersection of Durham St N and Kilmore St (the eastern boundary of the project area) is part of Kā Ara Tūpuna, or the way of the ancestors (see Figure 23).

Figure 23

Site shown on the Ngāi Tahu atlas Kā Huru Manu

Note. Map generated from the cultural mapping project which shows Ngāi Tahu place names, cultural sites and values (Kā Huru Manu, n.d.)

Survey Critique

A chartered professional engineer (name withheld) specialising in traffic engineering (personal communication, 19 May, 2025) was generous enough to share their thoughts on the 'ideal' survey strategy for projects of this nature.

Parking Survey

A parking survey series at 08:00 (one beat) to capture the morning commute, 14:00 (one beat, to capture adherence to the P120), 30 mins prior to school ending time, 5 mins before the school ending time, 30 mins after school end time (one beat each, to capture school pick up behaviour), and 20:00(one beat, to capture overnight parking behaviour). This survey would be done on a normal work day, during the school term. One survey would be done initially, and this series would be repeated if the data presented a need for further information.

Our parking survey, with beats every 15 minutes represented a 'gold standard' of parking survey (personal communication, 19 May, 2025). A limitation to our survey was that we did not do a survey which captured the overnight parking data.

Movement survey

The engineer described the ideal movement survey to be performed as we did it. The told us that they would have added a movement survey from 17:00 to 18:00 to capture pedestrians, e-scooters and cyclists at the end of the normal work day, and highlighted the need to capture the pedestrian data (age, clusters) more completely. The ideal movement survey would have taken place on the same day/s as the parking survey, which we did.

Future Research

For this study site, more data needs to be collected for every weekday, from at least a 08:00 to 20:00 period, to capture a better picture of kerbside usage, the effects of the start and end of the school and work days, and overnight parking, where there is no payment or time limit.

Conclusion

The kerbside in the Kilmore Street study area is used almost exclusively for car parking, which is consistent with globally reported kerbside use. It is not, however, the most efficient or effective use of the space, which could be better used to serve the whole community rather than just the private car owner.

A detailed series of surveys of the project area indicates that there is less need for private car parking than is currently provided for, and that the large loading area outside the Wyndham Hotel could be more effectively used without losing the loading capacity of the hotel.

Suggestions for the project area include connecting existing cycles paths in the surrounding area, constructing a parklet outside the Wyndham Garden Hotel cafe with outdoor seating, adding several amenities such as micromobility parking, and space for food/coffee trucks, dedicated car share parking and a significant increase in greenspace. We intentionally focussed on creating a sense of community and joy in the area, with small features such as hopscotch, a dog fountain and dwarf fruit trees in planters utilised, as well as increasing the capacity for active transport.

The kerbside can be a hugely valuable resource for the entire community, and this project has shown that there are a multitude of alternatives to car parking which could be employed to benefit everyone.

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