QTP
Quality Transport Planning

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Memorandum

To:	Gemma Dioni, CCC
From:	John Falconer, QTP
Subject:	Park Terrace TTMP – Analysis of Monitoring Data
Date:	Tuesday 27th June 2023
Copy:	

QTP have been asked by Christchurch City Council to provide an independent analysis of the data and monitoring being undertaken for the Park Terrace Temporary Traffic Management Plan (**TTMP**).

The following data has been provided to us to review and analyse:

- Travel time data for general traffic on routes potentially affected by the cycle way from Traffic Watcher.
- Traffic signal SCATS data for the Kilmore/Park intersection.
- Traffic counts undertaken at Armagh/Park, Kilmore/Park and Park/Salisbury intersection.
- Traffic queue counts for Kilmore Street approach to Park Terrace.
- Cycle tube counts on Park Terrace and in the cycleway.
- Bus boarding numbers and journey times between two bus stops to understand dwell times and associated impacts of bus boarders in the main traffic lane.

Each of the above data has been reviewed using combinations of the following checks on a case-by-case basis where appropriate:

- Sensibility checks to ensure data is within realistic bounds.
- Cross checks using manual calculations based on engineering first principles.
- Cross checks using traffic models and other traffic count data.
- Completeness and relevance of data.

In some cases, we have dropped some data sources or given it less weight, where potential deficiencies or limitations have been found.

The data has then been analysed to understand likely impacts associated with the construction of the Park Terrace cycle way and associated changes such as bus boarders in the main traffic lane.

Due to the narrow window between data being available and report submitting date, we have attempted to focus our time on what we think are the key pieces of information that help understand the effects of this project. Given more time, we acknowledge there are parts of this assessment that could be improved.

This memo summarises our review, analysis and conclusions. It is structured to report each data of the collected data types in turn.

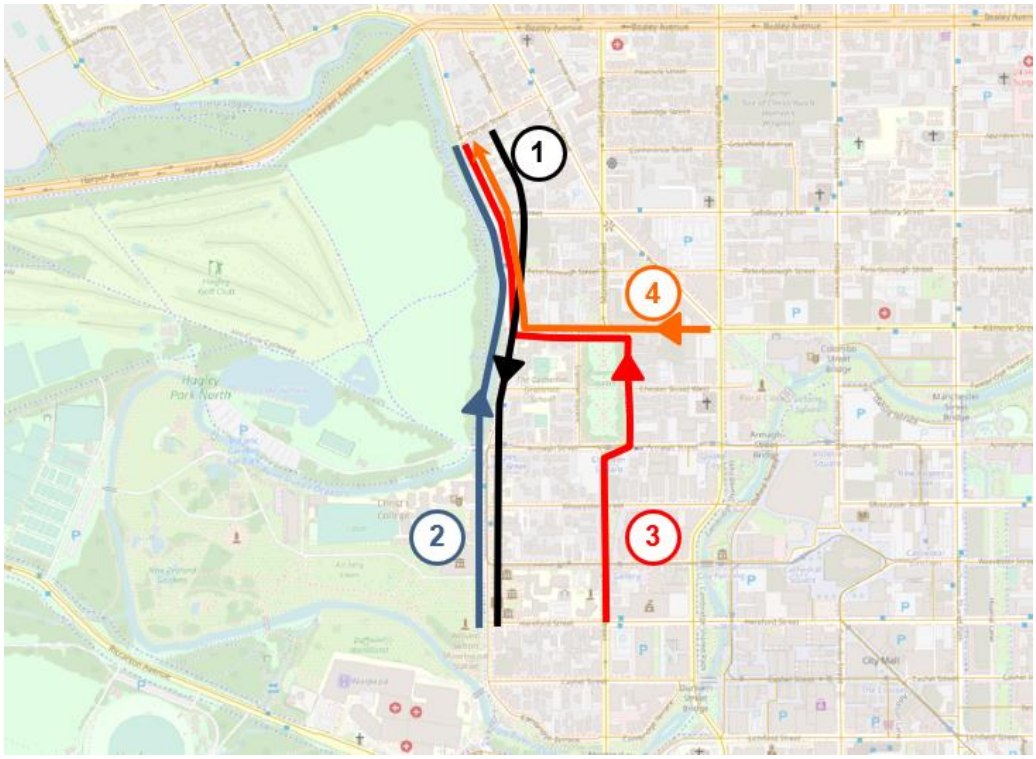
1. Travel Time Data

Travel time data for general traffic on routes potentially affected by the TTMP has been provided from 'Traffic Watcher'. This data was of limited value, mostly only showing average speeds over the whole day along the full length of selected routes.

We therefore utilised data from 'Tom Tom', which is obtained via GPS. The benefits of this data source are:

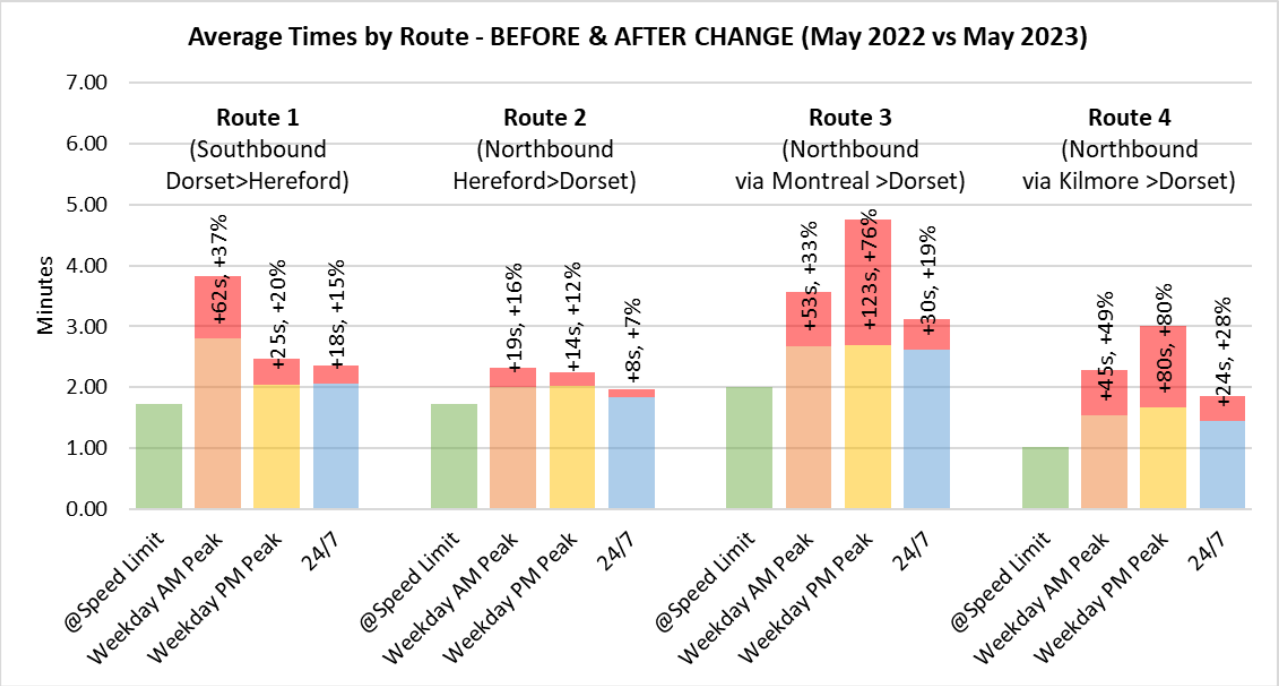
- Data represents approximately a 15% sample of all vehicles, so provides much more data than traditional method of conducting a limited number of floating-car surveys.
- Data provides for analysis over every link and for extensive time periods.
- When looking at travel times over these routes we only consider vehicles traversing the full route, not just part of it.

We have assessed four routes, shown below:



The chart below shows additional travel time delay by period (over travel at speed limit with no intersection delays), for each key route.

It shows May 2022 data selected for 'Pre-TTMP' comparison (12 months prior to 'Post-TTMP' adopted), to remove seasonal differences, along with changes in travel times by period for each key route between May 2022 and May 2023 (post-scheme).



Interestingly, we found that most of these changes are most likely to be changes in demand between May 2022 and 2023, noting (from Tom Tom) the following changes in daily demands:

- Route 1 (Rolleston & Park southbound) No change
- Route 2 (Rolleston & Park northbound) -48%
- Route 3 (Montreal, Kilmore, Park northbound) +86%
- Route 4 Kilmore/Park northbound -3% (with a likely shift of balance to Victoria & Montreal)

Inspection of both TomTom link probe samples and SCATS loop counts confirms apparent substantial reassignment of Northbound traffic from Park Tce south of Kilmore St, both to Kilmore St (and thence Park Tce), but also to alternative routes (Victoria and Montreal).

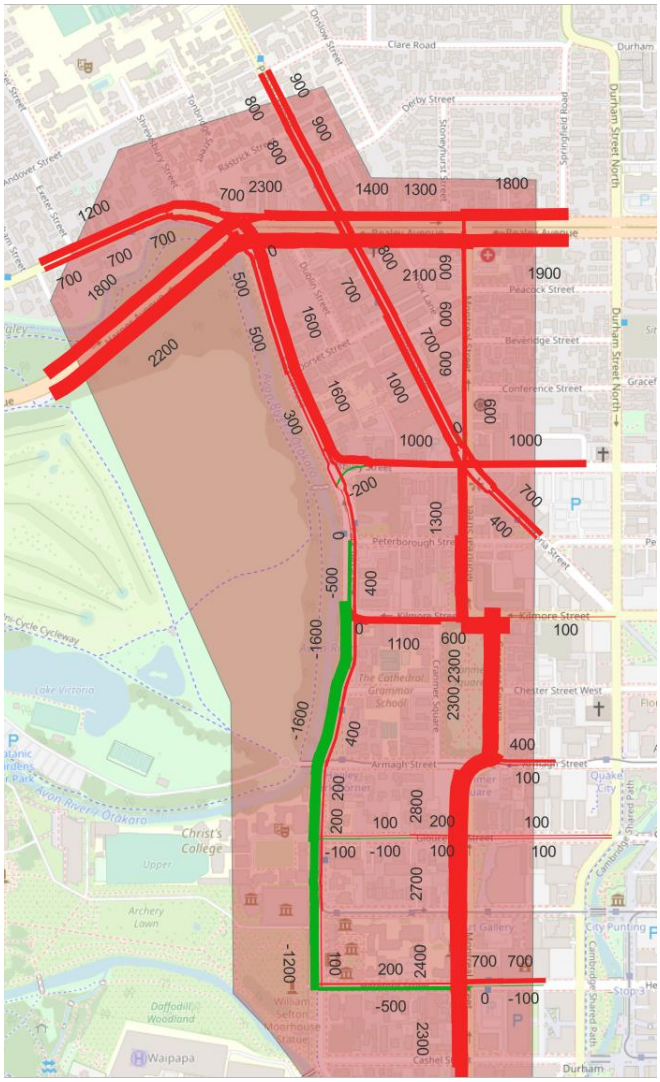
For motor-vehicle users of Park Tce (north of Kilmore) prior to the recent changes, the daily-average (24/7) TOTAL trip time (using TomTom data) is estimated to be 10.4mins (625 seconds), for their typical 5.6km journey.

Although higher during weekday peak hours, data suggests that the additional delay at Kilmore/Park only is estimated to average +9.8s (24/7) following the scheme implementation (when compared to the same period last year).

This equates to around +1.6% of the typical journey time for users of Park Terrace.

Furthermore, while the data suggests an increase in delays the month following implementation (compared to the previous year), it is very important to note that the bulk of the above changes clearly appear to result primarily from wider changes, given the net increase of traffic on the network, unlikely to have been brought about by the scheme.

The diagram below indicates the relative change in average daily traffic volumes (reflected by TomTom sampling), between May 2022 and May 2023.



While it appears that there has been a shift from Rolleston Ave onto Montreal St, clearly other unrelated net increases in traffic contribute to the overall change, with increased overall demand to the north of Salisbury also apparent.

It is therefore concluded that most of the change in delays in the vicinity of the cycleway are likely to be related to wider Central City changes rather than brought about by the scheme.

Further investigations could be made using data from earlier in 2023 prior to implementation of the TTMP but would be likely be affected by seasonal variation.

The Tom Tom data has also been used to estimate changes in delay at the Kilmore/Park intersection.

	Average Daily (24/7)					Weekday Morning Commuter Peak Hour					Weekday Evening Commuter Peak Hour				
Average Delay	Before (s)	Delay After (s)	Change (s, %)	LoS Before	LoS After	Before (s)	Delay After (s)	Change (s, %)	LoS Before	LoS After	Before (s)	Delay After (s)	Change (s, %)	LoS Before	LoS After
Park Sbnd Thru	12.3	13.6	1.3	B	B	21.5	30.6	9.1	C	C	11.9	14.8	3.0	B	B
Park Nbnd Thru	8.3	8.2	-0.1	A	A	8.2	14.4	6.2	A	B	9.6	13.0	3.4	A	B
Kilmore Left Turn	8.4	14.5	6.1	A	B	13.4	29.5	16.0	B	C	5.4	22.1	16.8	A	C
Kilmore R Turn	12.6	30.8	18.2	B	C	13.9	45.3	31.4	B	D	14.7	61.6	47.0	B	E
Intersection	11.1	20.9	9.8	B	C	15.7	35.7	20.0	B	D	12.0	34.6	22.6	B	C

	Average Daily (24/7)					Weekday Morning Commuter Peak Hour					Weekday Evening Commuter Peak Hour				
Worst 15% Delay	Before (s)	Delay After (s)	Change (s, %)	LoS Before	LoS After	Before (s)	Delay After (s)	Change (s, %)	LoS Before	LoS After	Before (s)	Delay After (s)	Change (s, %)	LoS Before	LoS After
Park Sbnd Thru	30.4	32.5	2.1	C	C	40.1	47.1	6.9	D	D	31.4	33.7	2.4	C	C
Park Nbnd Thru	22.6	23.3	0.7	C	C	26.6	32.8	6.3	C	C	26.7	32.3	5.6	C	C
Kilmore Left Turn	12.6	24.0	11.4	B	C	25.4	57.2	31.8	C	E	7.4	48.7	41.4	A	D
Kilmore R Turn	27.0	57.1	30.1	C	E	31.1	76.9	45.8	C	E	31.9	103.0	71.1	C	F
Intersection	26.2	42.3	16.1	C	D	33.5	59.2	25.8	C	E	29.4	63.5	34.1	C	E

As noted previously, it is therefore concluded that most of the change in delays in the vicinity of the TTMP are likely to be related to wider Central City changes rather than brought about by the scheme.

However, even with the increased traffic flows compared to the 'before' case, all movements are indicated to operate with a good Level of Service (LoS) in the range of A to D. Only the Kilmore Street right turn is indicated to operate at LoS E or F.

The queuing and delays on Kilmore Street are investigated and discussed further in section 4.

It should also be noted that the delay analysis above (using data throughout May 2023 and comparing this to May 2022) does not take into account traffic signal control changes introduced on June 8th 2023 to mitigate delays, as part of (on-going) operational optimisation. Therefore, the delays on Kilmore (using May 2023 analysis) are likely to be over-stated, compared to post-June 8 performance.

2. Traffic Signal Data (SCATS)

Traffic signal SCATS data was provided for the Kilmore/Park intersection (and has been also requested for other intersections).

After evaluating the data (primarily loop detections), it has not been used directly for any monitoring analysis, but rather as supplementary data to cross check traffic flows and to calculate movement capacities based on traffic signal timings (used to analyse queue lengths).

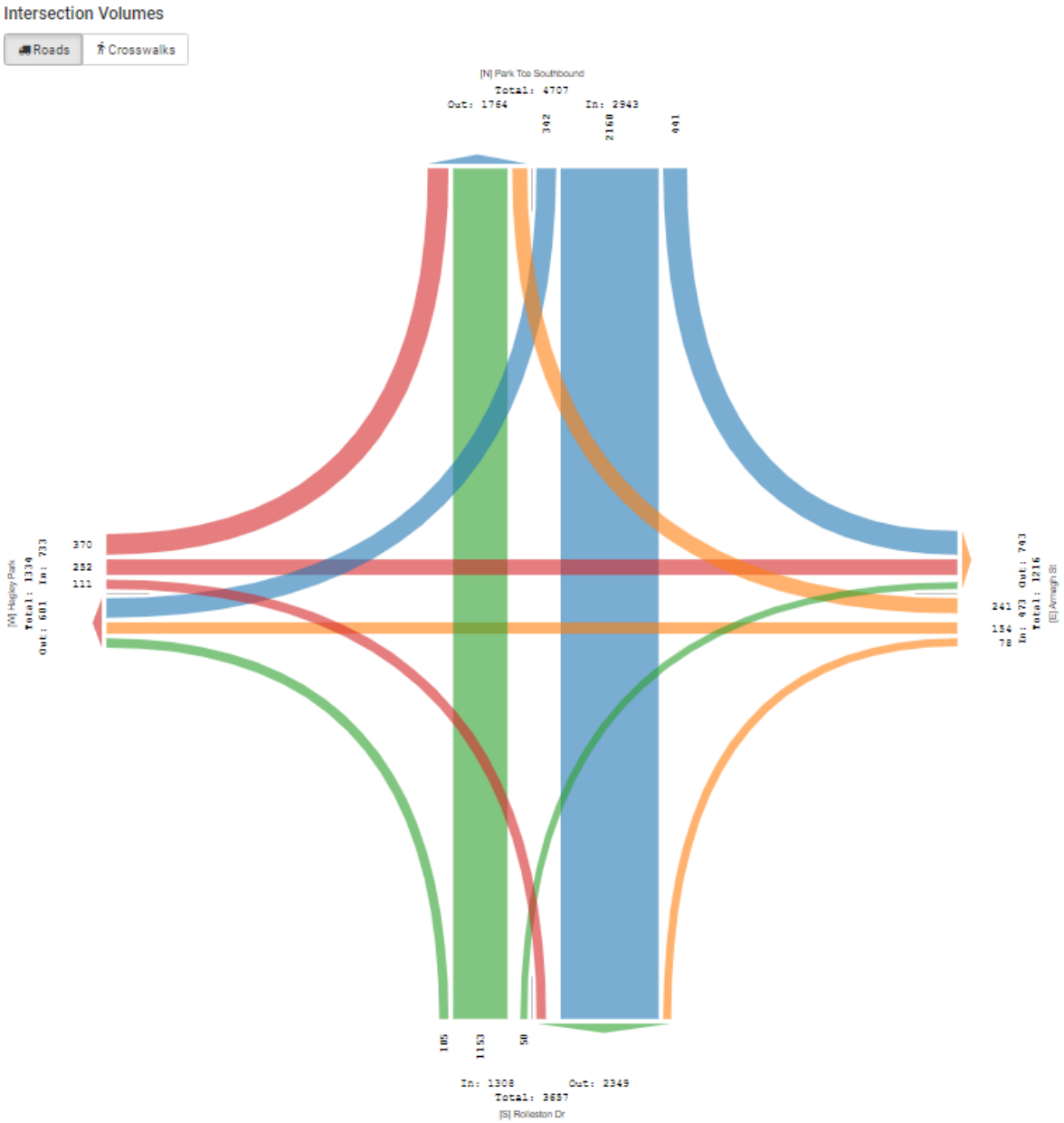
Limitations with the SCATS data for monitoring purposes include loops not being provided on all movements (e.g. slip lanes), not being able to determine through or turning movements for shared lanes (e.g. where two lanes have been combined as one), and redundant loops still active still detecting vehicles (or cycles in the new cycleway).

3. Intersection Traffic Counts

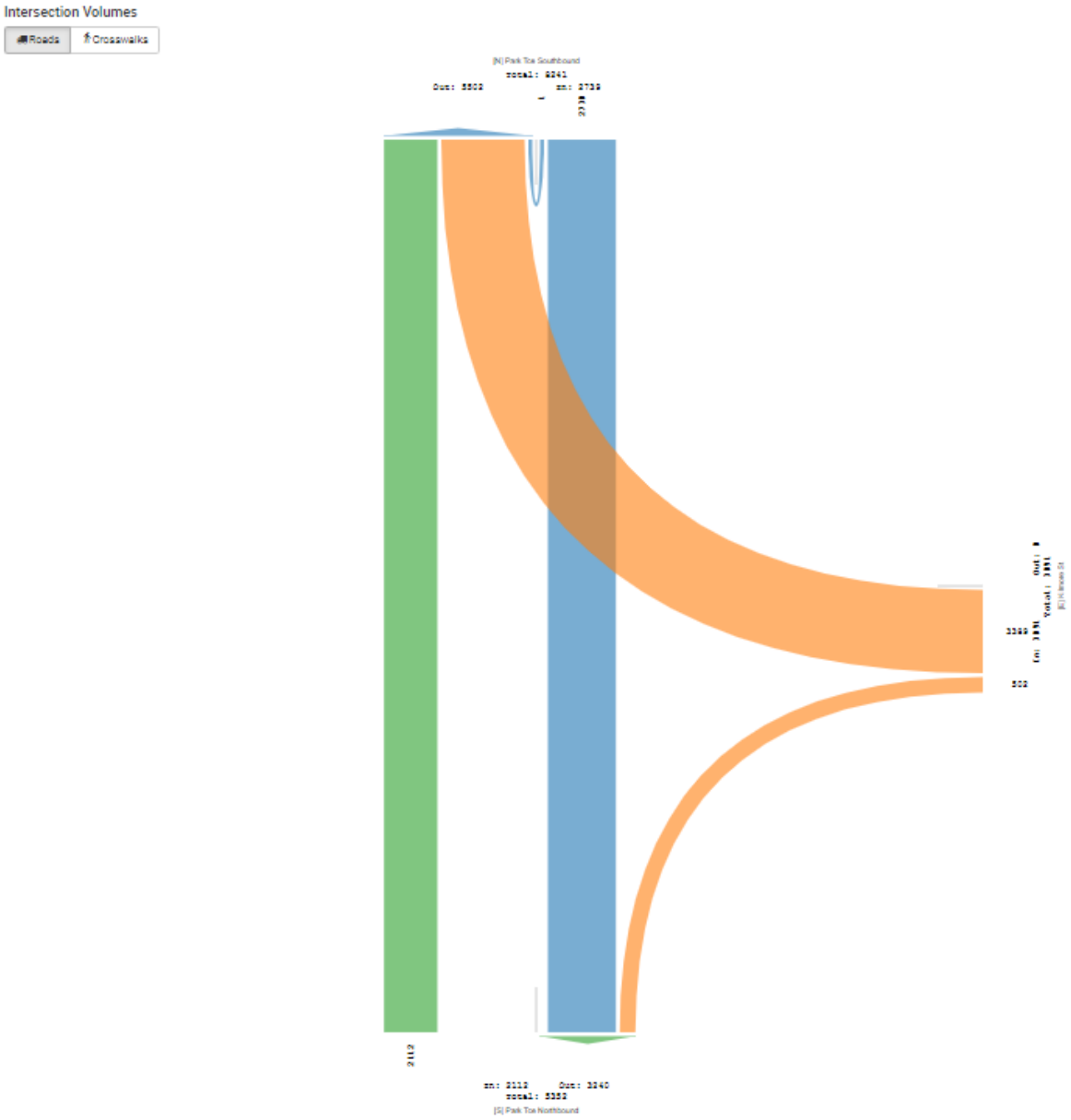
Traffic count data has been provided for Armagh/Park and Kilmore/Park intersections for Tuesday 30th May 2023.

Weekday 7 hour (0700-0900 + 1100-1300 + 1500-1800) summaries of turning movements (for all vehicles and any cyclists using the road) are provided below:

Armagh/Park - Intersection Daily (7hr) Movements Tuesday 30th May 2023



Kilmore/Park - Intersection Daily (7hr) Movements Tuesday 30th May 2023



At this stage, there is no suitable pre-implementation data from which to compare any changes in traffic flows due the introduction of the TTMP.

These diagrams do however provide an overview of the relative scale of movements at each of the intersections.

The diagrams also confirm that there are much more southbound trips on Rolleston Ave (south of Armagh) than northbound trips. The most likely reason for this is that Montreal Street, a one-way street parallel to Rolleston Ave 250m to the east, is significantly more attractive for north bound trips originating in the Rolleston Ave area.

4. Traffic Queues – Kilmore Street / Park Terrace

The video and traffic count data indicates that traffic queues at intersections have not changed much due to the TTMP related changes, except for the Kilmore St approach to Park Tce, where previously there were two right turn lanes into Park Tce, there is now a single lane.

While the Park Tce northbound approach has also dropped from two approach lanes to a single lane, maximum queue lengths are typically 10 vehicles (50m) or less and always clear within a single traffic signal cycle.

The southbound approach on Park Tce has not changed as a result of the TTMP and therefore is expected to continue to operate similarly as it did previously.

This section therefore focuses on this right turn movement, where queues that were previously spread over two traffic lanes are now stacked into a single lane. Additionally, the loss of a lane has reduced capacity for this movement from 1,230 to 640 veh per hour.

However, prior to the changes, peak vehicle demand for this movement was 693[1] (during the evening peak hour) which equates to only 56% of the available capacity available at the time (so any excess capacity was not being utilised).

With the changes, the amount of traffic making the right turn has changed only slightly (to 606, a reduction of 87 or 12%). So, the movement is now operating close to its theoretical capacity during the busiest parts of the day (peaks of the peak periods), but well within capacity at other times.

The maximum theoretical capacity equates to (up to) 14 vehicles able to make the right turn every signal cycle.

The post implementation queuing data shows that average queues lengths are:

- 5 vehicles during the morning peak period
- 3 vehicles during the inter-peak period
- 8 vehicles during the evening peak period

The absolute maximum observed queue length was 16 vehicles, and were observed to occur only very occasionally as follows:

- 3 instances (between 7:50 and 7:55am) and 5 instances (between 8:10 and 8:20am) during the morning peak
- 11 instances (between 3:45 and 4:00pm) during the mid afternoon
- 7 instances (between 5:10 and 5:20pm) during the evening peak

In these instances where the queue length exceeds the maximum throughput of 14 vehicles per green, then the remaining 1 or 2 vehicles had to wait for the next green (and this was also confirmed by watching the video footage).

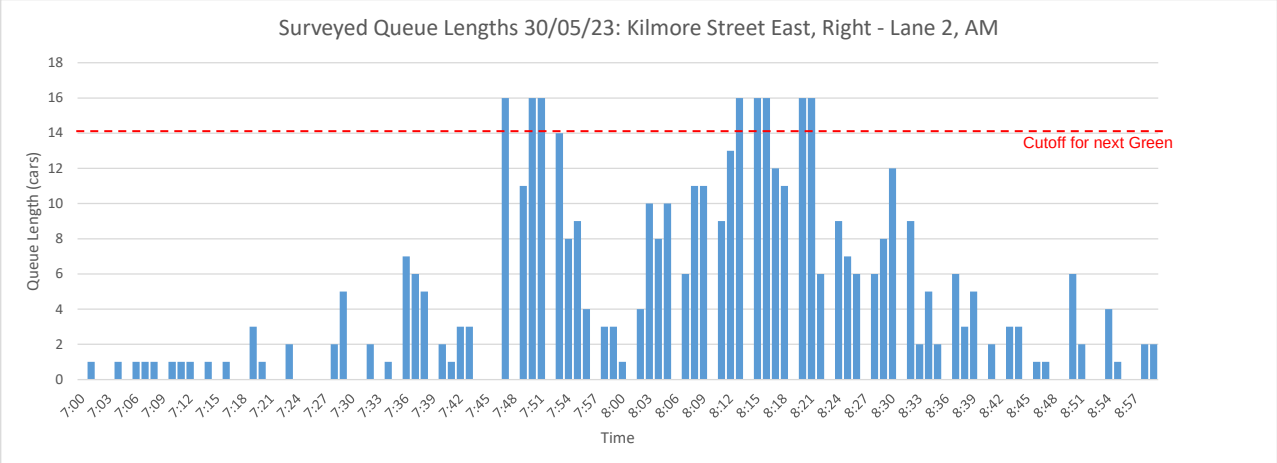
This means that out of the 3,389 vehicles that made the right turn per day[2], only around 50 (or 1.5%) did not get through in a single green phase and therefore experienced additional delay (typically around 30 seconds).

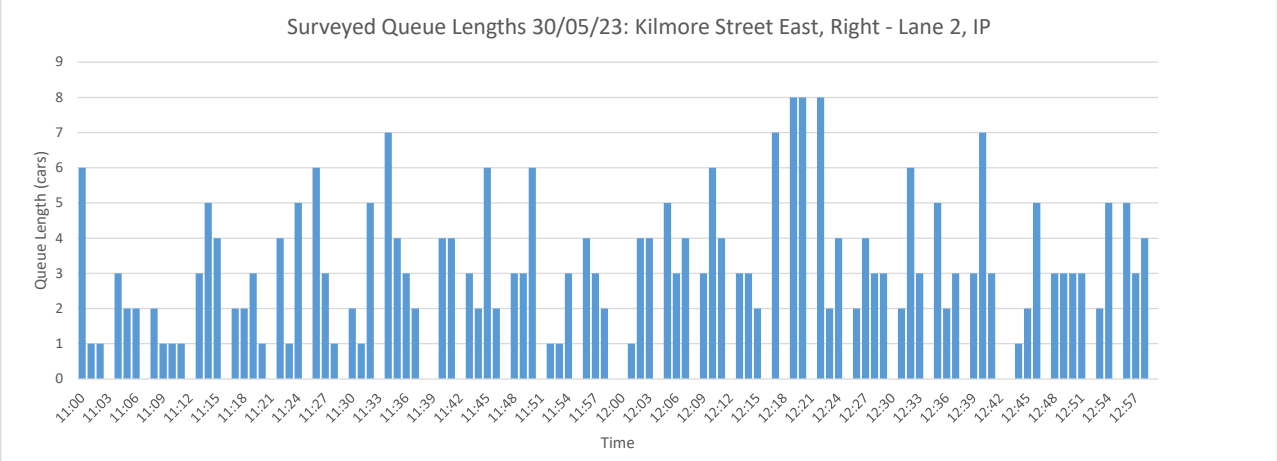
[1] SCATs Loop Data Wed 5th April 2023

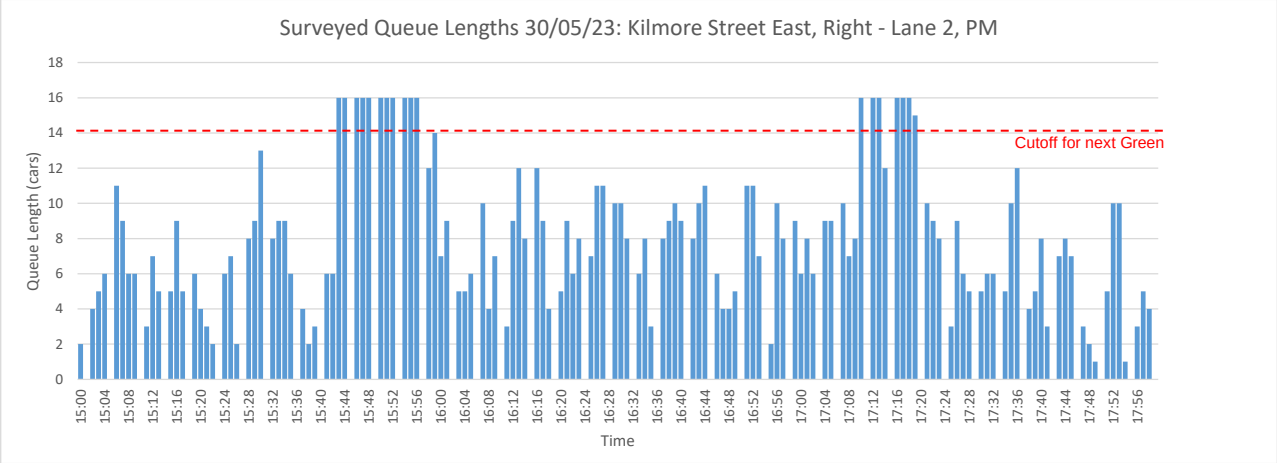
[2] On the surveyed date of Tue 30 May 2023 (CCC I7015 Kilmore St - Park Tce)

As noted above, the traffic signal timings at this intersection were altered on June 8th to provide more green time to Kilmore Street during the PM peak period. Hence, for this period, the observed Kilmore Street queues on the survey date of 30th May shown below are likely to over-state the current (post 8th June) queues (although the change will also have slightly increased queues and delays for the southbound movement on Park Terrace).

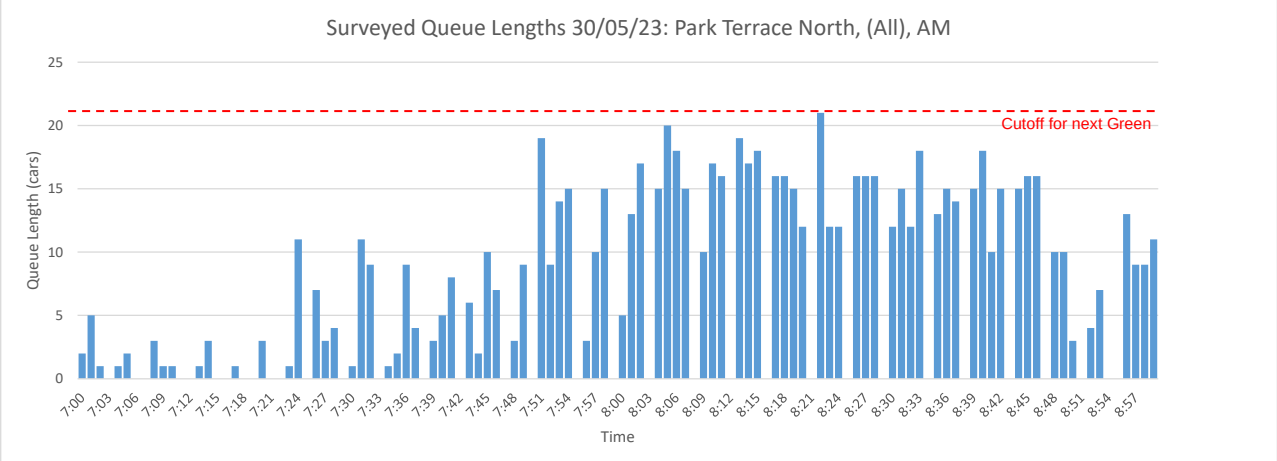
Kilmore Steet Queues – Right Turn into Park Terrace

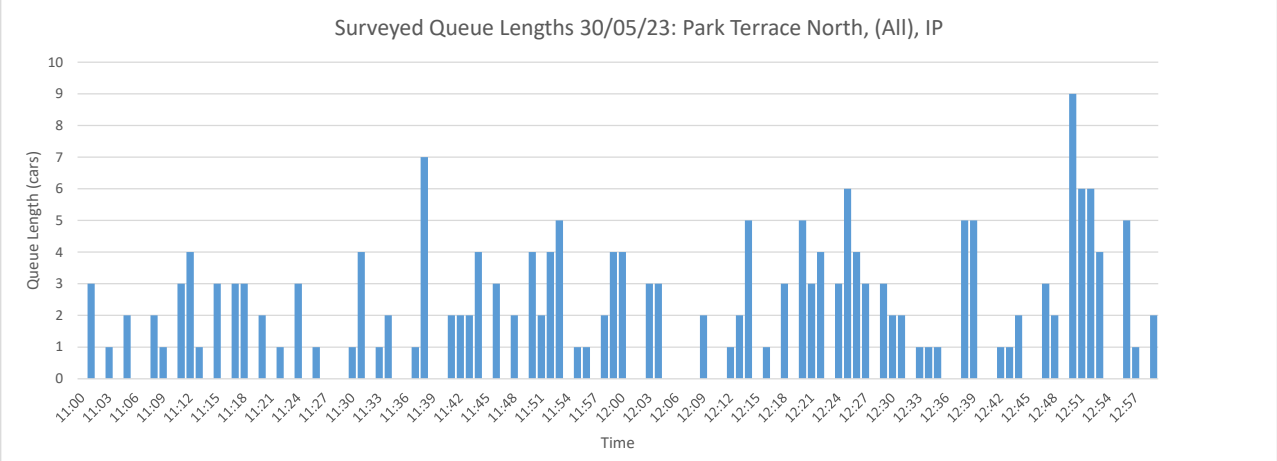


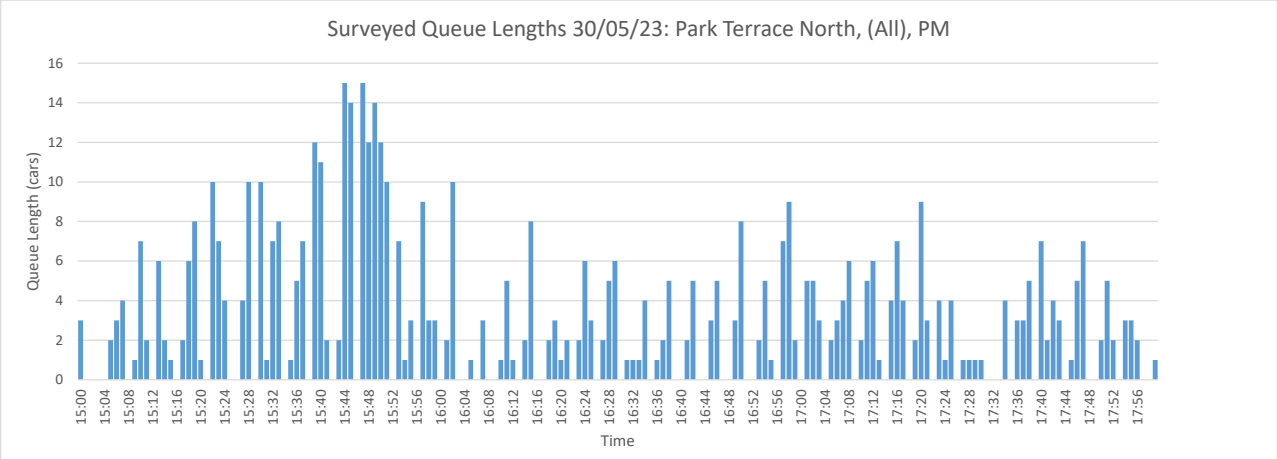




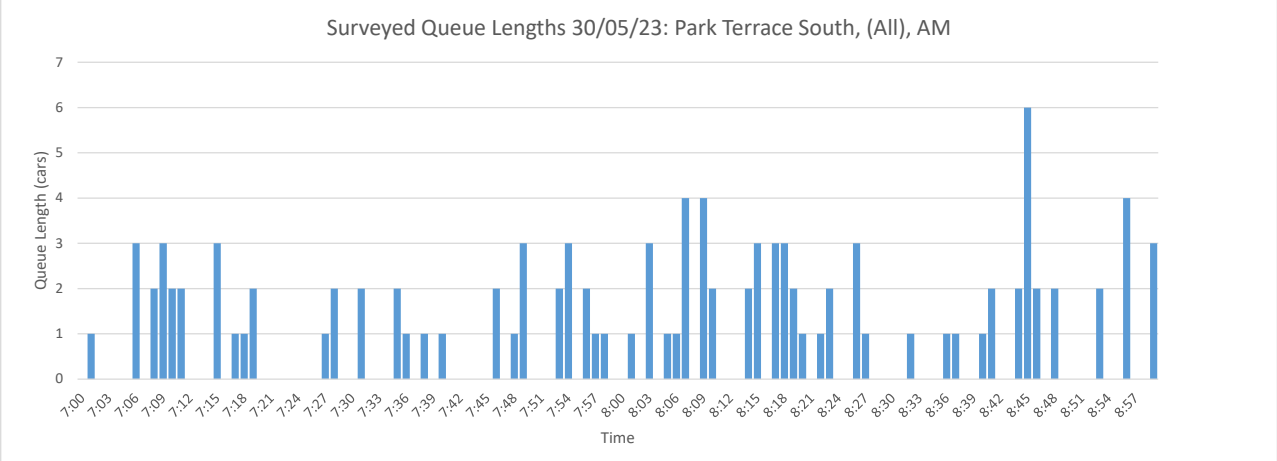
Park Terrace Southbound Queues – Approaching Kilmore Street

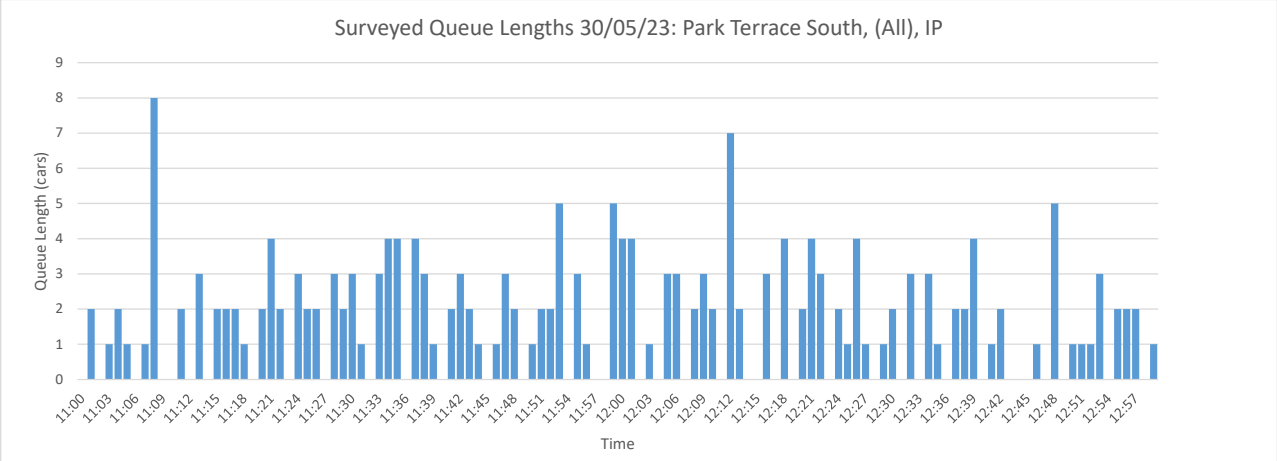


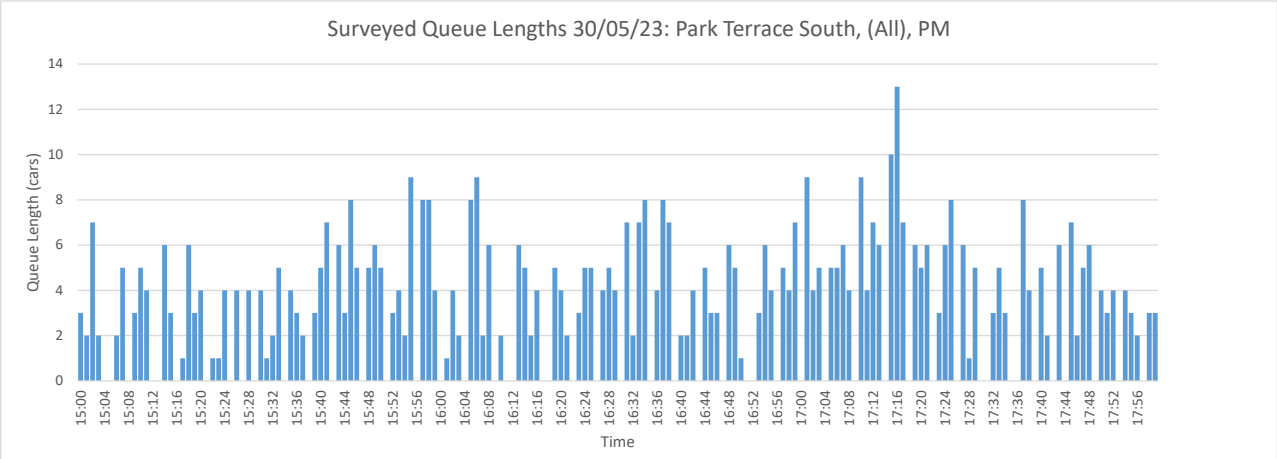




Park Terrace Northbound Queues – Approaching Kilmore Street







Maximum Queue Length Summary

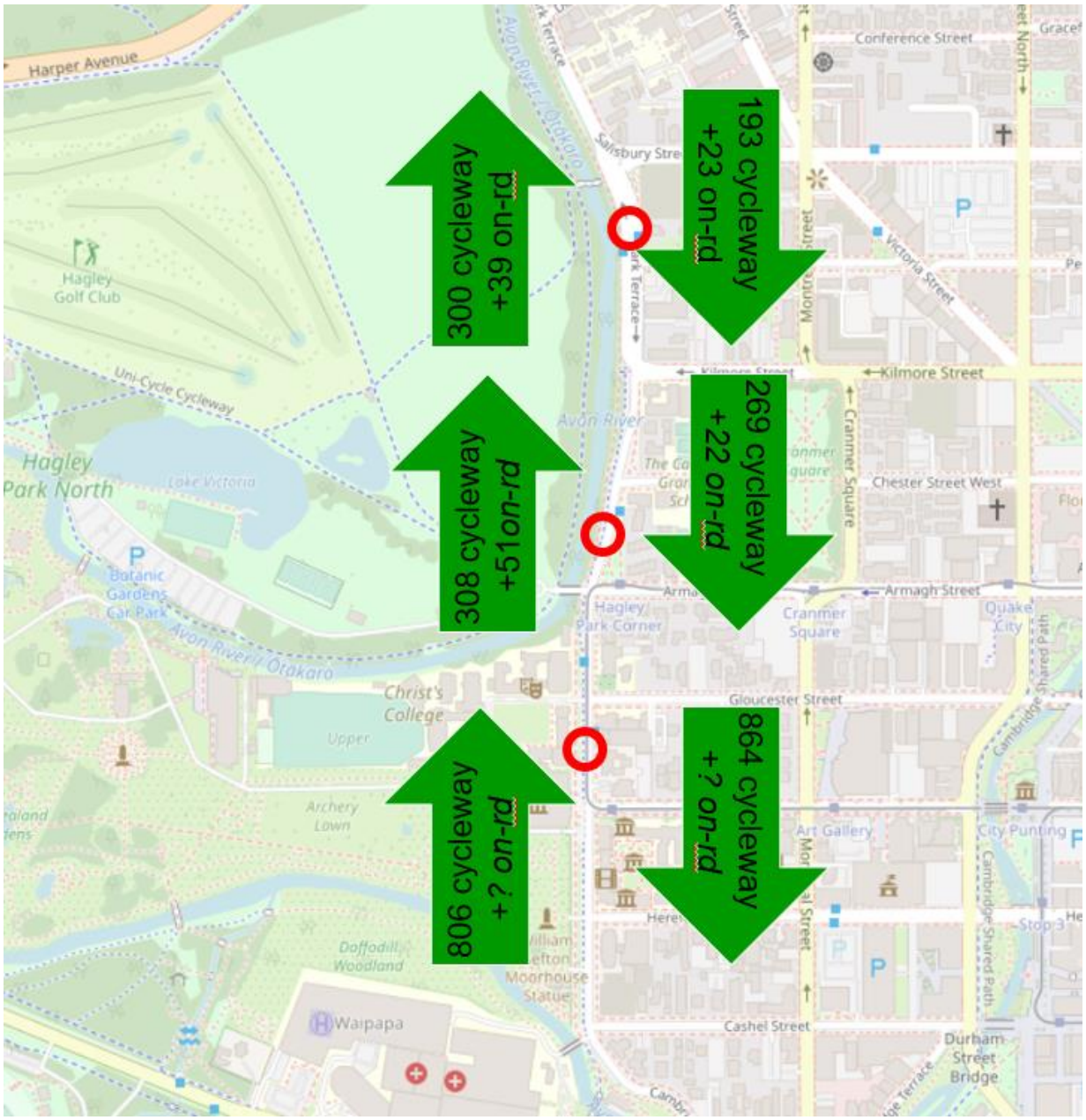
The extent of maximum observed queue lengths (assuming 5m per vehicle and verified from video footage[3]) for each period (morning, inter-peak and evening) are shown spatially above, to confirm that these do not interfere with any adjacent intersections.

Not that average queue lengths during each period are less than half the maximum values displayed above.

[3] Collected during the survey period.

5. Cycle Counts

A summary of daily cycle tube counts on Park Tce and in the cycleway is provided below:

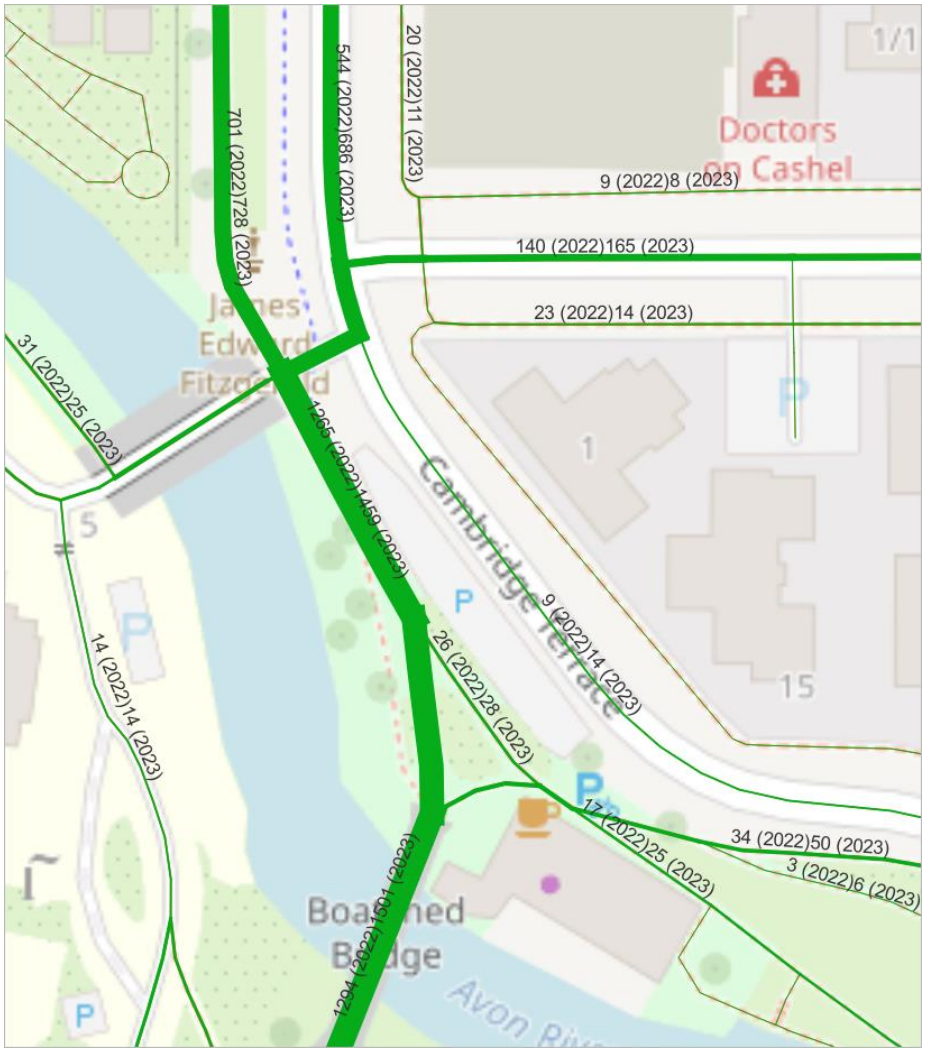


We have also analysed Strava data to understand potential changes in cyclist numbers as a result of the TTMP.

Stava only measures the routes of users of the application (who tend to be the keener cyclists). Comparing to Smart Counters (which count 100% of trips), typical sample rates from Strava are currently around 5.8% of all cyclists in this area.

But if we expand this sample, it can provide an estimate of the (changes) in daily cycle demand, on a link-by-link basis.

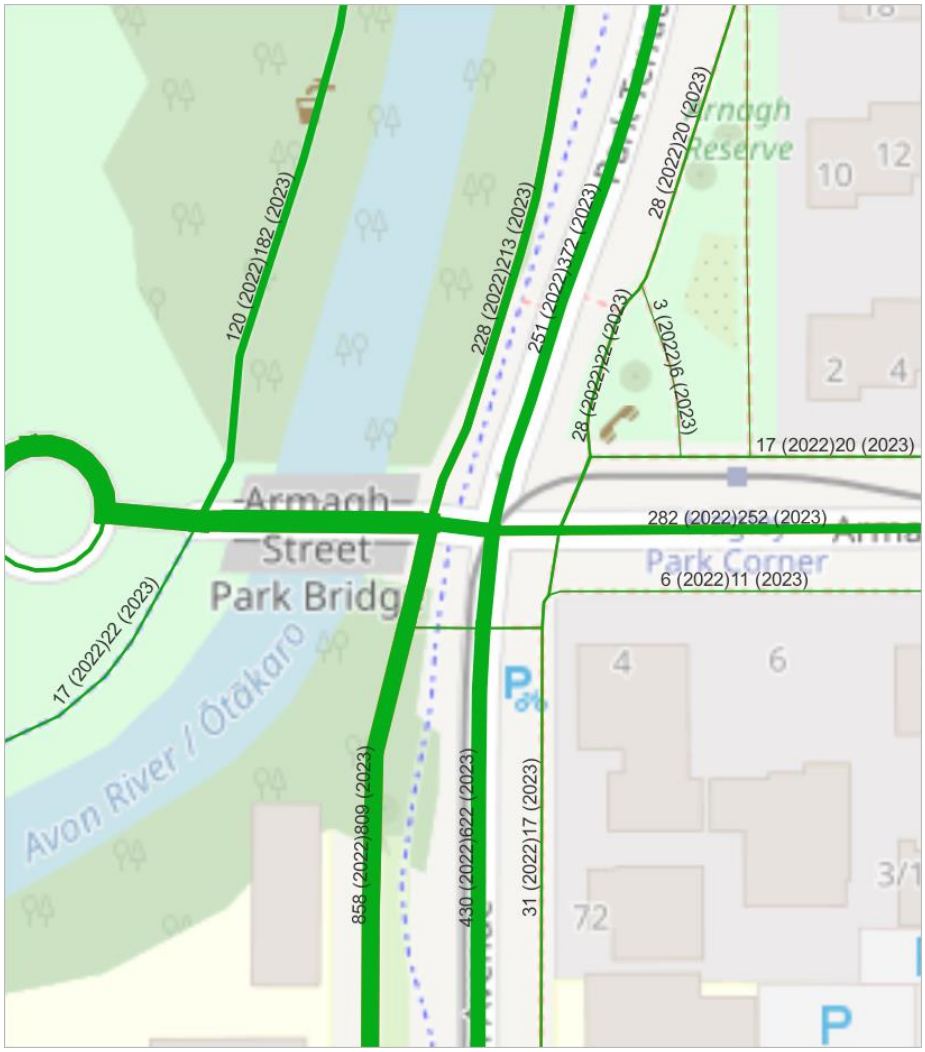
For example, we can see that north of the Antigua Bridge, daily cycle use rose from around 1,300/day (May 2022) to around 1,450/day in May 2023.


Doctors on Cashel
9 (2022)8 (2023)
140 (2022)165 (2023)
23 (2022)14 (2023)
20 (2022)11 (2023)
544 (2022)686 (2023)
701 (2022)728 (2023)
31 (2022)25 (2023)
14 (2022)14 (2023)
9 (2022)14 (2023)
26 (2022)28 (2023)
17 (2022)25 (2023)
34 (2022)50 (2023)
3 (2022)6 (2023)
Cambridge Terrace
Avon

Over the Armagh Bridge, daily cycle use remained broadly static, at around 1,250/day between May 2022 and May 2023.

South of Armagh St however, total cycle use is estimated to have risen from 1,320 to 1,450/day, or +10%.

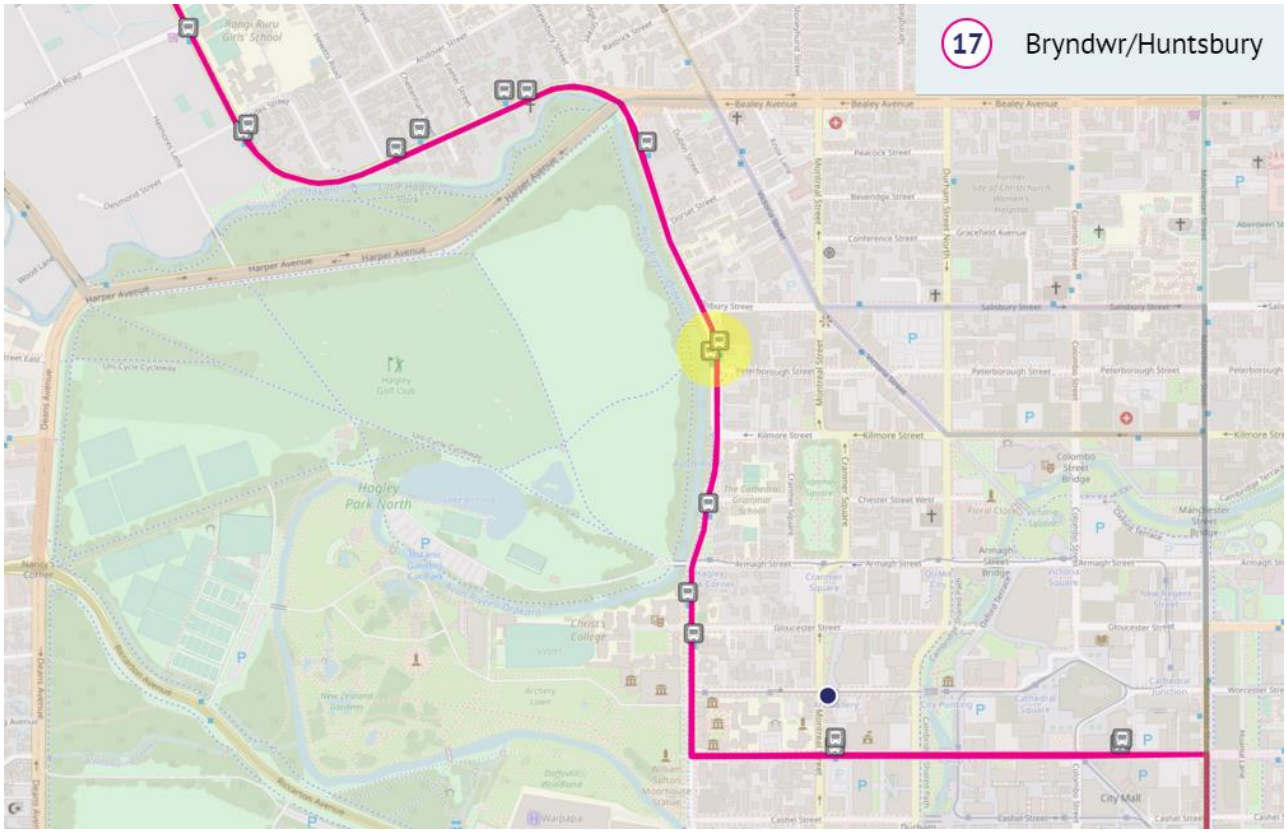
And North of Armagh Street, total cycle use (including via the parallel path inside Hagley Park) is estimated to have risen from 640 to 810/day, or +26% in the year between May 2022 and May 2023 (the month after the scheme was implemented).



6. Bus Dwell Time

Bus boarding numbers and journey times between two bus stops to understand dwell times and associated impacts of bus boarders in the main traffic lane.

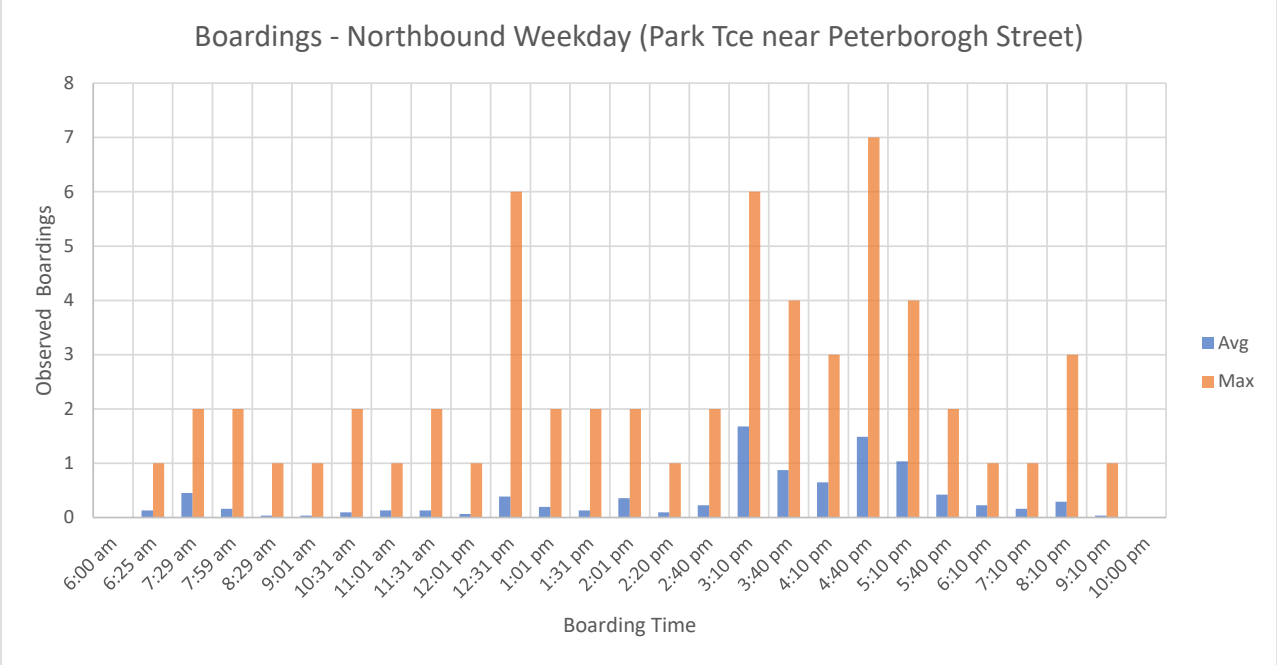
There is only a single bus service (17 Bryndwr/Huntsbury) that uses Park Terrace. It runs every 30 minutes. The route and stops within the area of interest are shown below:



Due to the space taken to accommodate the cycle way, the bus stops for the north bound services along Rolleston Drive and Park Terrace are incorporated within the general traffic lane. This requires any vehicles following a northbound bus to wait behind it whenever people board or alight from the bus.

Data relating to northbound weekday observed bus boardings between 1st May and 13th June at the stop near Peterborough Street (highlighted in yellow on the map above) are summarised below by period:

- During the morning peak period (0700-0900), the average number of boardings is 0.6 per day and the maximum number observed was 2.
- During the inter-peak period (0900-1600), the average number of boardings is 4.4 per day and the maximum number observed was 6.
- During the evening peak period (1600-1800), the average number of boardings is 3.6 per day and the maximum number observed was 7.



Based on the time[4] it takes these passengers to board, then the duration the bus is stopped is summarised below:

- During the morning peak period (0700-0900), the average stopping time is 6 seconds the maximum is 13 seconds. This results in the bus being stopped for an average total of 18 seconds out of 7,200 seconds. Therefore, the probability of a motorist being delayed by a bus stopping is 0.2%.
- During the inter-peak period (0900-1600), the average stopping time is 6 seconds the maximum is 29 seconds. This results in the bus being stopped for an average total of 83 seconds out of 25,200 seconds. Therefore, the probability of a motorist being delayed by a bus stopping is 0.3%.
- During the evening peak period (1600-1800), the average stopping time is 9 seconds the maximum is 33 seconds. This results in the bus being stopped for an average total of 34 seconds out of 7,200 seconds. Therefore, the overall probability of a motorist being delayed by a bus stopping is 0.5%.

It is apparent that the very low probability and relatively small effect of motorists being delayed by bus boardings occurring in the traffic lane results in an impact that is less than that of a typical pedestrian crossing or signalised intersection.

[4] Based on both first principle calculations and Ecan data 'Rolleston Ave to Carlton Mill travel times.xlsx' that isolates dwell times.