Totara Street Modelling Report

Prepared for Tauranga City Council
Prepared by Beca Limited

26 August 2020

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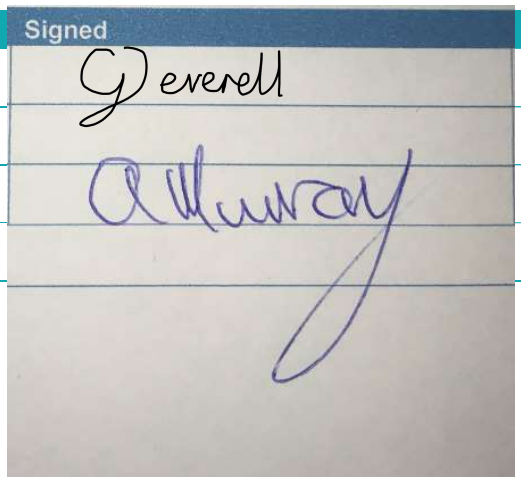
Revision History

Revision Nº	Prepared By	Description	Date
1.0	**Caleb Deverell**	DRAFT for Review	26/08/2020

Document Acceptance

Action	Name	Signed	Date
Prepared by	**Caleb Deverell**		26/08/2020
Reviewed by	**Andrew Murray**		26/08/2020
Approved by	**Andrew Murray**		26/08/2020
on behalf of	Beca Limited		

Executive Summary

Tauranga City Council (TCC) has engaged Beca to undertake Aimsun modelling to understand the effects of proposed pedestrian / cycle crossing along Totara Street, as well as an adjustment to the layout of the Rata Street and Totara Street intersection. This report assesses the traffic performance of the options and does not assess the feasibility, safety and design elements related to each option. The modelling investigated the following elements and sub-options:

- Pedestrian crossings of Totara Street, either;
  - Option 1: A midblock pedestrian crossing outside 202 Totara Street, or;
  - Option 2: At the Hewletts Road intersection, signalising the left turn slip lane from Hewletts Road into Totara Street
- A midblock pedestrian crossing on Totara Street just south of Kawaka Street
- Totara Street / Rata Street layout change, reducing the Totara Street northbound approach lanes from two to one

In the 2018 base year, both Totara Street / Hewletts Road crossing options are tested, however in the 2028 forecast year only the signalised left turn slip lane (Option 2) was tested.

This work builds on high-level, preliminary testing undertaken using SIDRA models in early August. That earlier work identified that both crossing options at Hewletts Road increased delays and queues for the eastbound traffic during the pm peak. A key difference to note is how the two models represent queues:

- SIDRA models indicate queue lengths (in vehicles and linear length) based on simple estimates of static queues from each signal
- AIMSUN simulation models include more precise representation of the interaction between queues in adjacent lanes and between intersections, based on their speed. However, the AIMSUN models also represent the dynamic 'concertina' effect of queueing, meaning that the measurements of the 'back of the queue' may differ from how many vehicles are deemed to be 'in a queue' (as some vehicles move forward may move above speeds considered to be 'queued').
- There are also other sources of queueing in the corridor, such as the Dive Crescent on-ramp merge, the traffic signals at the Marina entrance and the signals at Tasman Quay. As the queues interact it can be difficult to identify the true 'source' of the queueing. AIMSUN does consider these inter-connected corridor queues.

Given the uncertainties in predicting future traffic flows, cycle usage and traffic signal operation, this analysis should be focussed more on comparative analysis of options than absolute prediction of queue length. It is noted that the pedestrian crossings are called every signal cycle. Further, the modelling gives an estimation of delays and queueing, however in reality there will be daily and seasonal variability to this.

The main modelling was undertaken for a weekday PM peak. A Saturday model was also developed and tested; however, this was based on only limited calibration data so should be treated as more indicative. It is noted that outside of the peak hour, the impact on the delay and queueing is estimated to be lower due to lower traffic volumes through Hewletts Road and Totara Street.

The key findings of the modelling are discussed below.

Totara Street / Hewletts Road:

2018 Results:

The following table summarises the PM peak results for the Base, Option 1 and Option 2 scenarios. PM peak is shown here as there are more significant impacts than the Saturday peak.

Scenario	Hewletts EB Travel Time (min)	Hewletts EB Left Turn Travel Time (min)	Totara St SB Travel Time (min)	Hewletts Back of Queue Length (m)
Base	5.8	5.1	4.4	1,650m
Option 1	6.9	6.4	4.8	1,900m
Option 2	7.5	7.4	4.4	2,150m

- Providing a midblock crossing on Totara Street (Option 1), 100m north of Hewletts Road increases the travel time along Hewletts Road eastbound and on Totara Street southbound
  - In the PM peak, the Hewletts Road eastbound approach average travel time increases by approximately ~1.1 minutes, while the left turn into Totara Street increases by approximately ~1.3 minutes
  - The additional delay due to the crossing increases the estimated maximum back of queue length measured from Totara Street from 1,650m to 1,900m (+250m) in the PM peak
  - The Saturday peak sees limited increases in delay as a result of the midblock crossing due to lower demand for the critical movements. Travel time changes are within 0.5 minutes.
  - The Totara Street southbound movement sees an increase in travel time of approximately ~0.4 minutes.
- Signalising the left turn slip lane (Option 2) creates even more additional delay for the Hewletts Road eastbound approach:
  - In the PM peak, the Hewletts Road eastbound approach average travel time increases by approximately ~1.7 minutes, while the left turn into Totara Street increases by approximately ~2.3 minutes
  - The additional delay increases the estimate maximum back of queue length measured from Totara Street from 1,650m to 2,150m (+500m) in the PM peak
  - The Saturday peak sees limited increases in travel time as a result of the midblock crossing due to lower demand for the critical movement. Travel time changes are within 0.5 minutes.

2028 Results:

- The 2028 model does predict increased delay over the 2018 model. Signalising the left turn slip lane does not create significant additional delay in the PM peak due to capacity constraints in the northbound direction on Totara Street predicted by the model. That is, northbound queueing from the Totara/Waimarie intersection blocks back towards Hewletts Road, meaning the impact of the signalised crossing is minimal. It should be noted that no upgrades to Totara Street or Hewletts Road have been assumed in this modelling
- The Saturday peak sees some increase in travel time as a result of signalising the left turn slip lane. The Hewletts Road eastbound approach average travel time increases by approximately ~0.7 minutes, while the left turn into Totara Street increases by approximately ~0.9 minutes. The increase in delay is not estimated to significantly increase the maximum back of queue length on Hewletts Road eastbound.

Midblock Crossing South of Kawaka Street:

The addition of a midblock crossing approximately 45m south of Kawaka Street did not create any significant increase in average travel time at the approaches to the crossing. Queues can build up to ~100m when a crossing occurs, however these quickly dissipate once the pedestrian crossing phase is finished. Results will however depend on how often the crossing is called by cyclists or pedestrians.

It is noted that in the forecast years, capacity constraints at Rata Street (due to Maunganui Road) and the Hull Road roundabout cause some additional queueing along Totara Street through to the crossing. However, the addition of the crossing does not cause a significant impact.

Totara Street / Rata Street Intersection Layout Change

A survey of the Totara Street / Rata Street intersection identified that the Totara Street northbound left turn was only 3-5% of the northbound traffic. As a result, there is limited impact in travel time for the approach due to the removal of the dedicated left turn lane. The queue length can extend by up to ~150m, but this is dependent on the number of left turners and number of trucks at any one time. It is noted that the left turn movement will see a greater increase in travel time as they must wait with the right turners.

1 Introduction

Tauranga City Council (TCC) has engaged Beca to undertake traffic modelling to understand the effects of two proposed cycle crossings and an intersection layout change. The proposed elements and sub-options are as follows:

- Pedestrian crossings of Totara Street, either;
  - Option 1: A midblock pedestrian crossing outside 202 Totara Street, or;
  - Option 2: At the Hewletts Road intersection, signalising the left turn slip lane from Hewletts Road into Totara Street
- A midblock pedestrian crossing on Totara Street just south of Kawaka Street
- Totara Street / Rata Street layout change, reducing the Totara Street northbound approach lanes from two to one

This report summarises the key assumptions and outcomes of this modelling.

It is noted that this technical report assesses the traffic performance of the options and does not assess the feasibility, safety and design elements related to each option.

2 Methodology

An Aimsun model has been developed in order to undertake the modelling of the proposed options. The Aimsun model is a cordon of the Tauranga Transport Hybrid Model (TTHM). The cordon covers Hewletts Road from Dive Crescent to Waimari Street and the Totara Street corridor from Hewletts Road to Rata Street and includes the Rata Street / Maunganui Road roundabout. The model extents are shown in **Figure 2-1**.

Figure 2-1: Model Extents

2.1 Model Years and Periods

The modelling was undertaken for a 2018 base year and the 2028 future year. The analysis was undertaken for a weekday (PM peak) and weekend midday (Saturday). No upgrades to the Hewletts Road or Totara Street corridors were assume din the 2028 models.

It is noted that with limited data available for the Saturday period, the model should be considered a representation and results should be treated as indicative only. There are two options for the Totara Street /

Hewletts Road crossing; at the intersection and a midblock crossing north of the intersection. Both these options will be tested in the 2018 base year scenario, however only the slip lane crossing will be modelled in the 2028 future year.

2.2 Intersection Layouts

2.2.1 Totara Street / Hewletts Road

Option 1: Midblock Crossing

Option 1 adds a signalised midblock crossing outside 202 Totara Street (or approximately 100m north of Hewletts Road). The crossing has been assumed to run every two minutes, with a crossing time of 18 seconds. This is based on an estimated demand of approximately 50 per hour in the peak period. The midblock signalised crossing is shown in **Figure 2-2**.

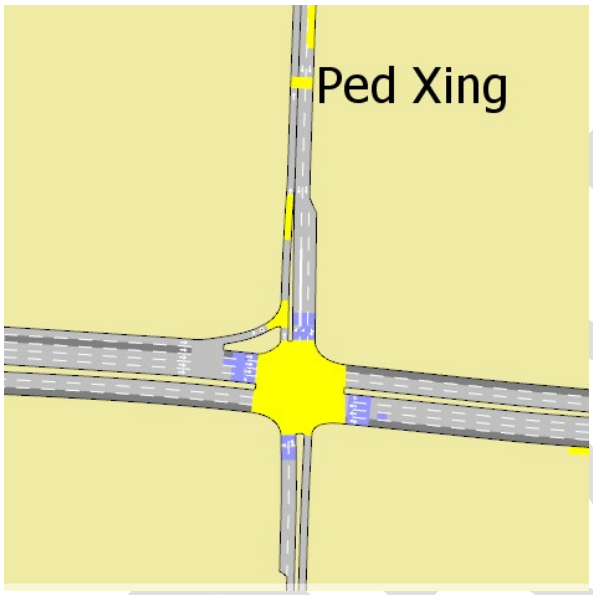


Figure 2-2: Option 1: Midblock Crossing

Option 2: At Intersection

Option 2 signalises the Hewletts Road to Totara Street left turn slip lane. This has been modelled as a staged crossing i.e. pedestrians / cyclists cross the slip lane and then wait in the island available to cross the remainder of Totara Street. The modelled layout is shown in **Figure 2-3**.

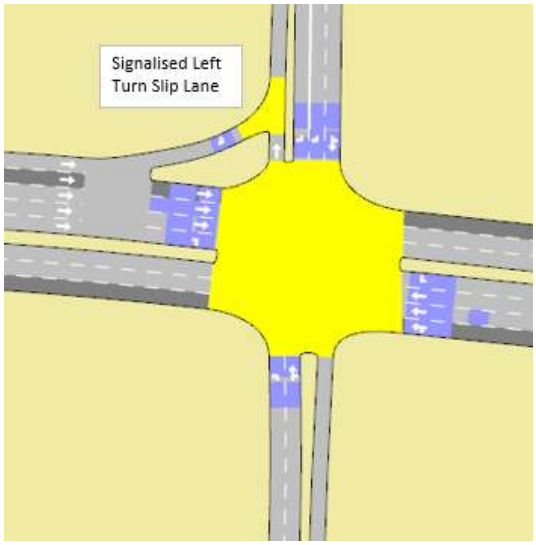


Figure 2-3: Option 2: At Intersection

2.2.2 Midblock Crossing at Kawaka Street

The midblock crossing crosses Totara Street at approximately 45m south of Kawaka Street. Again, the crossing has been assumed to run every two minutes, with a crossing time of 18 seconds. This is based on an estimated demand of approximately 50 per hour in the peak period. The midblock signalised crossing is shown in **Figure 2-4**.

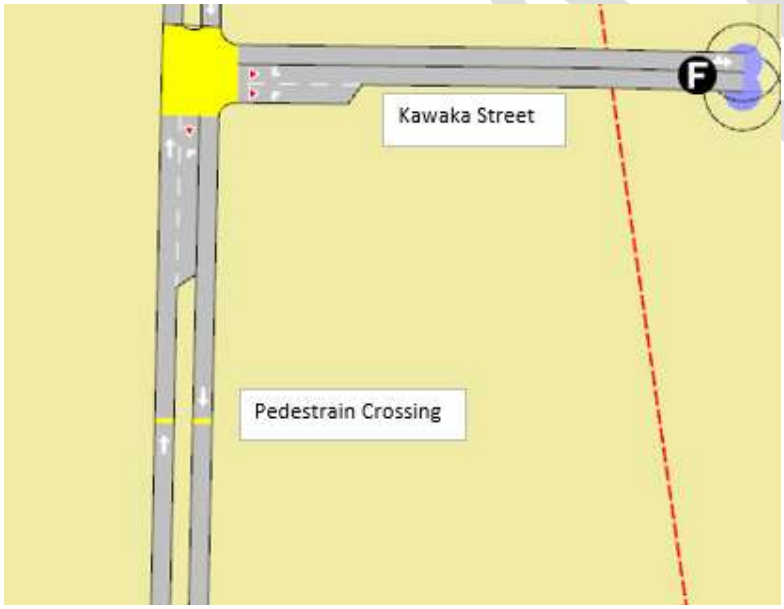


Figure 2-4: Midblock Crossing at Kawaka Street

2.2.3 Totara Street / Rata Street

The Totara Street / Rata Street intersection undergoes a layout change. The Totara Street northbound approach reduces from dedicated left and right turn lanes to a single shared left and right lane. The modelled layout is shown in **Figure 2-5**.

Figure 2-5: Totara Street / Rata Street

2.3 Demand Development

For the 2018 base model:

- Intersection, tube count and travel time data was used to refine the demand generated from the TTHM for the PM peak model
- SCATS count data and tube count data was used to estimate the Saturday midday model. The analysis shows that the Saturday midday flows are higher by 8% for the Hewletts Road movements when compared to Wednesday midday traffic
- The Saturday midday flows for the Totara Street movements south of Hull Road are 5% higher than the Wednesday midday traffic
- The Saturday midday flows for Totara Street between Hull Road and Kawaka Street are 50% higher than the Wednesday midday traffic
- The Saturday midday flows for Totara Street just south of Rata Street are 20% higher than the Wednesday midday traffic.
- The 2018 interpeak observed data was factored accordingly to generate the Saturday midday flows.

For the 2028 future year model:

- Traffic growth between 2018 and 2028 from TTSM (TSP Do Minimum scenario) was used to develop the 2028 flows
- For the PM peak model, the TTSM PM peak model growth was used
- For the Saturday midday model, the TTSM interpeak model growth was used

2.3.1 Cycle / Pedestrian Volumes

Analysis of cycle count data shows around 50 cyclists for the weekday PM peak and ~40 cyclists for the Saturday peak. Cycle volumes can be predicted to increase in the forecast year, however this is catered for by allowing a crossing phase every signal cycle. For the cycle crossing options, it was assumed that the crossing phase was called every signal cycle. Cyclists were not explicitly represented in the models – rather the impact of the signal crossings were included in the traffic models.

2.4 Base Year Model Check

A high-level model calibration / validation was undertaken to compare the Aimsun model flows and travel times to the available observed data.

The following tables summarise the validation results for the observed traffic counts and travel time in the PM peak.

Table 2-1: PM Peak GEH Statistics

	4:00pm – 5:00pm	5:00pm – 6:00pm	Target
GEH<5.0	85%	89%	85%
GEH<7.5	98%	98%	90%
GEH<10	100%	100%	95%

Table 2-2: 4:00pm - 5:00pm Travel Time

Route Name	From	To	Median	15th %ile	85th %ile	Modelled	Check
Totara St	Hewletts Rd	Maunganui Rd	216	207	256	224	Pass
Totara St	Maunganui Rd	Hewletts Rd	437	324	630	326	Outside criteria
SH2	Chapel St	Tasman Quay	172	136	281	235	Outside criteria

Table 2-3: 5:00pm - 6:00pm Travel Time

Route Name	From	To	Median	15th %ile	85th %ile	Modelled	Check
Totara St	Hewletts Rd	Maunganui Rd	237	203	298	284	Pass
Totara St	Maunganui Rd	Hewletts Rd	311	247	668	329	Pass
SH2	Chapel St	Tasman Quay	213	134	503	207	Pass

It is noted that for the 4:00pm – 5:00pm travel time, not all the routes meet the travel time criteria of modelled travel time being within 15% or one minute of the observed travel time. However, both of these routes are within the 15th percentile and 85th percentile observed travel time range.

Limited count data was available for Saturday. Therefore, a high-level check of the travel time was undertaken. The following tables demonstrate the Saturday travel time validation.

Table 2-4: 10:00am - 11:00am

Route Name	From	To	Median	15th %ile	85th %ile	Modelled	Check
Totara St	Hewletts Rd	Maunganui Rd	309	264	404	306	Pass
Totara St	Maunganui Rd	Hewletts Rd	312	235	421	253	Pass
SH2	Chapel St	Tasman Quay	149	126	193	116	Pass

Table 2-5: 11:00am - 12:00pm

Route Name	From	To	Median	15th %ile	85th %ile	Modelled	Check
Totara St	Hewletts Rd	Maunganui Rd	229	193	260	246	Pass
Totara St	Maunganui Rd	Hewletts Rd	279	234	401	271	Pass
SH2	Chapel St	Tasman Quay	156	129	274	115	Pass

The tables demonstrate that all the travel time routes measured meet the travel time criteria of modelled travel time being within 15% or one minute of the observed travel time.

3 Modelling Results

3.1 Base Year Results

3.1.1 Totara Street / Hewletts Road

In the base year model (2018), an analysis was done on the performance of the Totara Street / Hewletts Road crossing options 1 and 2. Option 1 is a midblock crossing on Totara Street approximately 100m north of the Hewletts Road. Option 2 signalises the left turn slip lane from Hewletts Road into Totara Street to provide a signalised, staged crossing across Totara Street.

The peak hour travel time along Hewletts Road eastbound (Chapel Street to Totara Street) and Totara Street southbound (from Hull Street to Hewletts Road) is shown in **Figure 3-1** for the PM peak.

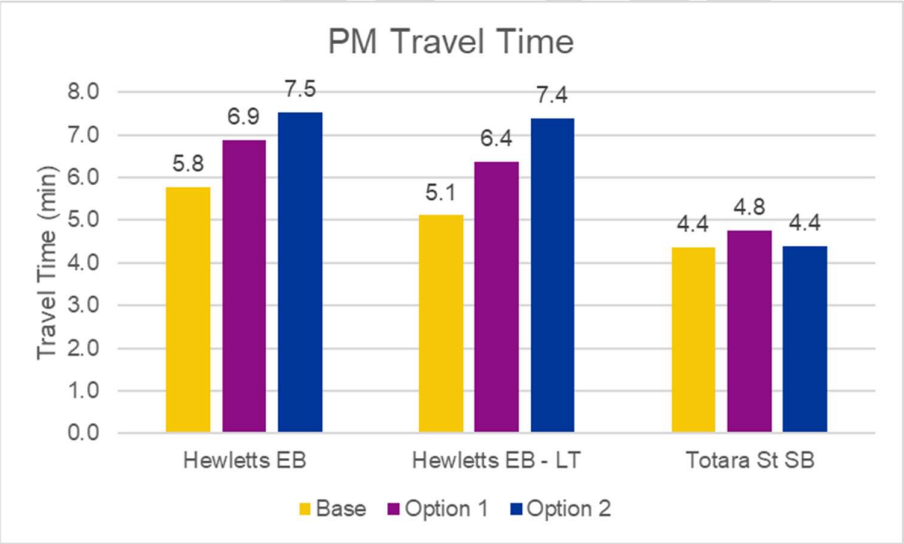


Figure 3-1: PM Peak Hour Travel Time

The figure demonstrates that Option 1 and Option 2 both have an impact on the Hewletts Road corridor due to the crossing. Signalising the left turn slip lane has a greater impact on the travel time, with an increase of ~1.7 minutes over the existing layout, compared to ~1.1 minutes for the midblock crossing for the overall approach. An increase in the left turn travel time from Chapel Street of ~1.3 minutes and ~2.3 minutes for Option 1 and Option 2 respectively is predicted by the model.

Signalising the left turn slip lane doesn't have any impact on the Totara Street southbound travel time. The midblock crossing causes an increase in the Totara Street southbound travel time of ~0.4 minutes. The model has assumed signal coordination between the midblock crossing and the Totara Street / Hewletts Road crossing. Without coordination the midblock crossing will have a greater impact on the Totara Street Corridor.

The travel time along Hewletts Road eastbound and Totara Street northbound and southbound is shown in **Figure 3-2** for the Saturday peak.

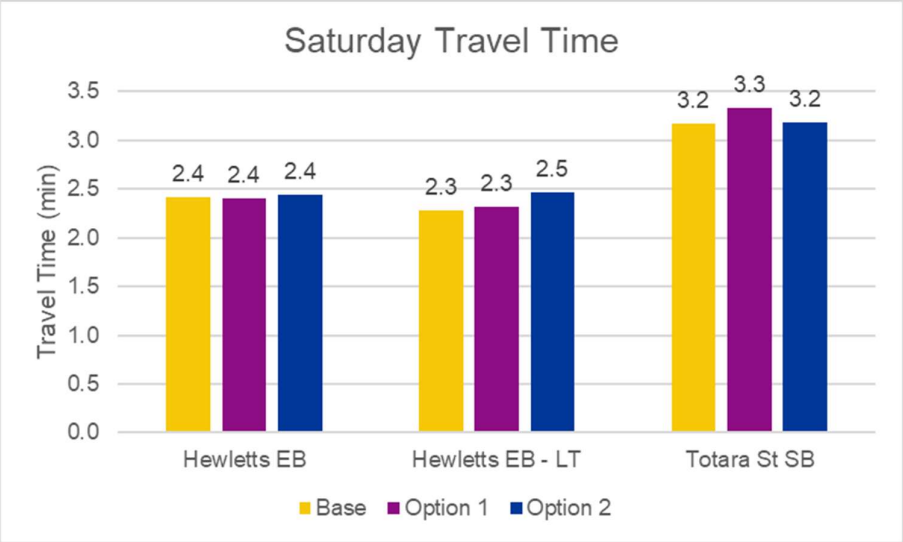


Figure 3-2: Saturday Travel Time

The figure demonstrates that there is limited impact on the intersection / corridor as a result of either option in the Saturday model, with slight increases in travel time along Hewletts Road for those travelling to Totara Street in Option 2 and a slight increase in travel time for the southbound Totara Street movement in Option 1.

Table 3-1 summarises the vehicle flow (veh/h) for the existing layout and the options tested at the Totara Street / Hewletts Road intersection:

Table 3-1: Key Movement Vehicle Flow

Flow (veh/h)	PM Peak			Saturday		
	Base	**Option 1**	**Option 2**	**Base**	**Option 1**	**Option 2**
Hewletts	2,680	2,610	2,560	1,970	1,970	1,970
Hewletts LT	1,180	1,140	1,120	820	820	820
Totara St SB	990	1000	990	970	970	970

The table demonstrates that the throughput vehicle flow generally reduces, in particular for Option 2, which also sees the greater impact on travel time in the PM peak. The Saturday peak shows very limited change in vehicle throughput.

Queuing

This work builds on some recent, high-level SIDRA analysis undertaken prior to this modelling. It is important to note that there are differences in how SIDRA and Aimsun represent queues:

- SIDRA models indicate queue lengths (in vehicles and linear length) based on simple estimates of static queues from each signal

- AIMSUN simulation models include more precise representation of the interaction between queues in adjacent lanes and between intersections, based on their speed. However, the AIMSUN models also represent the dynamic 'concertina' effect of queueing, meaning that the measurements of the 'back of the queue' may differ from how many vehicles are deemed to be 'in a queue' (as some vehicles move forward may move above speeds considered to be 'queued').
- There are also other sources of queueing in the corridor, such as the Dive Crescent on-ramp merge, the traffic signals at the Marina entrance and the signals at Tasman Quay. As the queues interact it can be difficult to identify the true 'source' of the queueing. AIMSUN does consider these inter-connected corridor queues.

The following figures demonstrate a snapshot of the simulation that is representative of the level of queueing on Hewletts Road and Totara Street between the existing layout and the options tested for the PM peak:

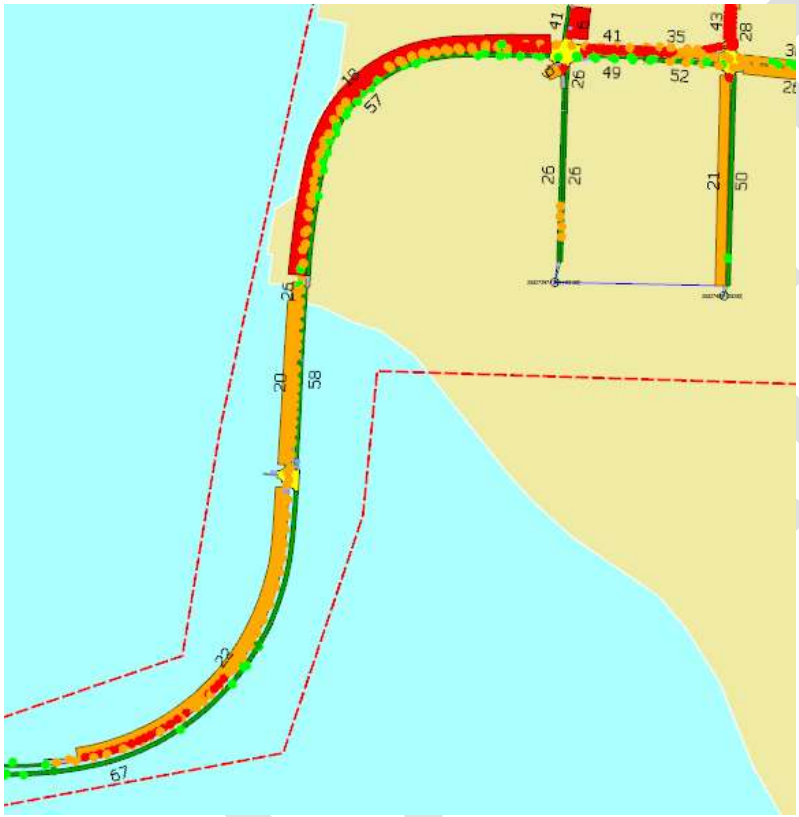


Figure 3-3: 2018 PM Base – Snapshot of Indicative queuing

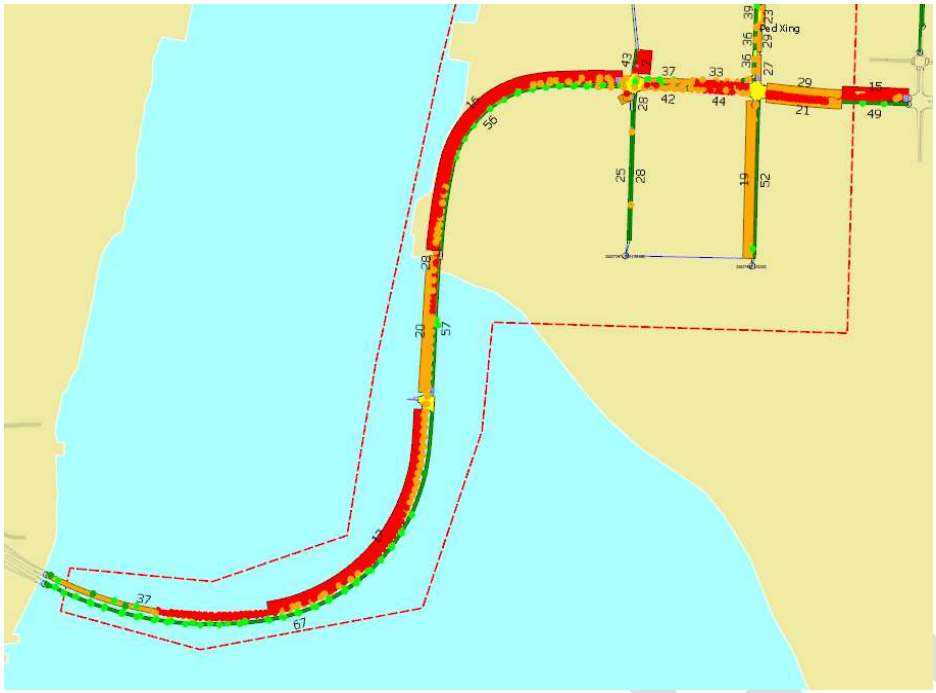


Figure 3-4: 2018 PM Option 1 – Snapshot of Indicative queuing

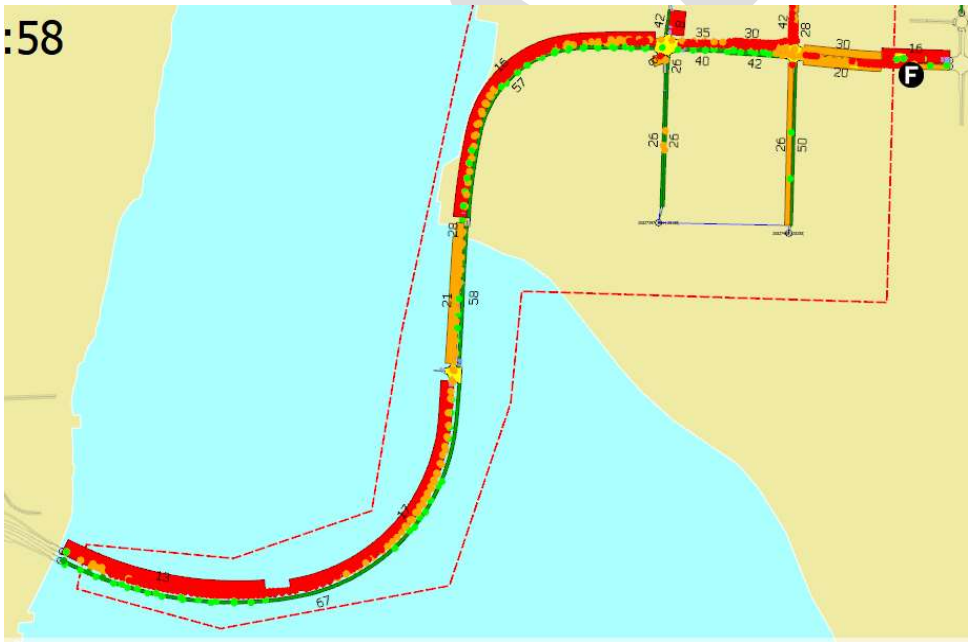


Figure 3-5: Option 2 – Snapshot of Indicative queuing

The figures demonstrate the PM peak indicative maximum back of queue length from Totara Street for each option tested. This can be summarised with the following illustration:

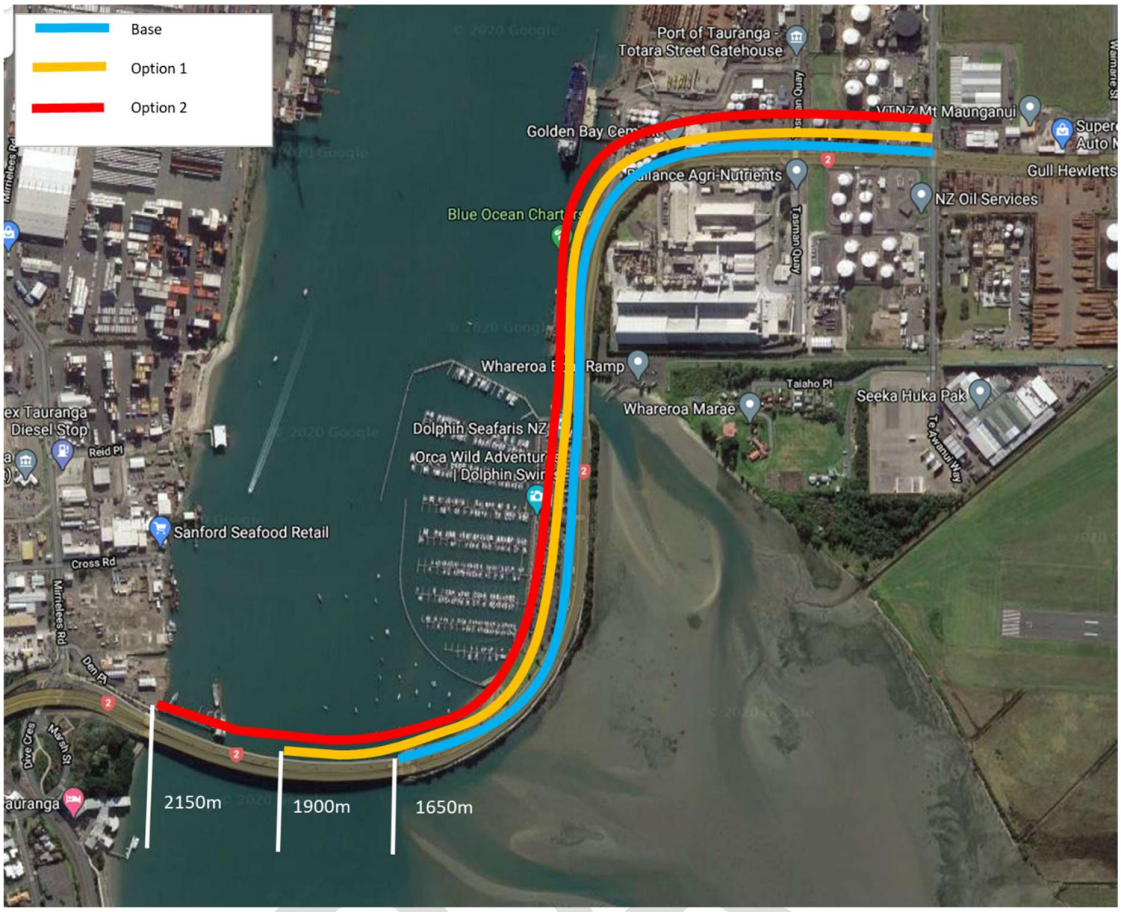


Figure 3-6: Indicative Corridor Queue Length

The figure shows an indicative 'back of queue' length of 1650m for the 2018 base scenario, 1900m (+250m) for Option 1 and 2150m (+500m) for Option 2. This indicative corridor queue length quoted is from a single model run[1]. In reality there will be daily and seasonal variations to both the queue length and the impact of providing a signalised pedestrian crossing.

As can be seen in the figures, there is a dynamic 'concertina' effect of the queueing, with faster moving vehicles within the 'queue'. the measurements of the 'back of the queue' may differ from how many vehicles are deemed to be 'in a queue' (as some vehicles move forward may move above speeds considered to be 'queued'). Therefore, this diagram attempts to indicate the point where the queuing in the corridor may be first experienced and is focussed on the relative performance of each option.

The length of vehicles 'in a queue' is reported in the table below:

Table 3-2: 2018 PM – Quantitative Aimsun 'Length of Queued Vehicles'

Length of Queued Vehicles (m)	Base	Option 1	Option 2	Option 1 Change	Option 2 Change
Maximum	640	810	900	170	260
Average	190	270	300	80	110

The table shows a quantitative measure used in Aimsun to define how many vehicles are considered queueing (and therefore the length of that queue) based on their speed and acceleration. This measure is an

[1] The visual assessment was from a representative single model run, while quantitative statistics are an average from multiple model runs

aggregation queue length from multiple Aimsun 'sections'. Some early or intermediate sections may no longer be considered 'queueing' (due to speed being above the queueing speed threshold). However, the back of the queue can still be extending. Therefore, we have extracted the queue length based on a visual assessment.

Given the uncertainties in predicting future traffic flows, cycle usage and traffic signal operation, this analysis should be focussed more on comparative analysis of options than absolute prediction of queue length.

3.1.2 Midblock Crossing South of Kawaka Street

The midblock crossing south of Kawaka Street was set to be called every two minutes in both the PM peak and Saturday peak models.

The peak hour travel time in the PM peak and Saturday peak for Totara Street northbound and southbound at the approach to the crossing is shown in **Figure 3-7** and **Figure 3-8** respectively.

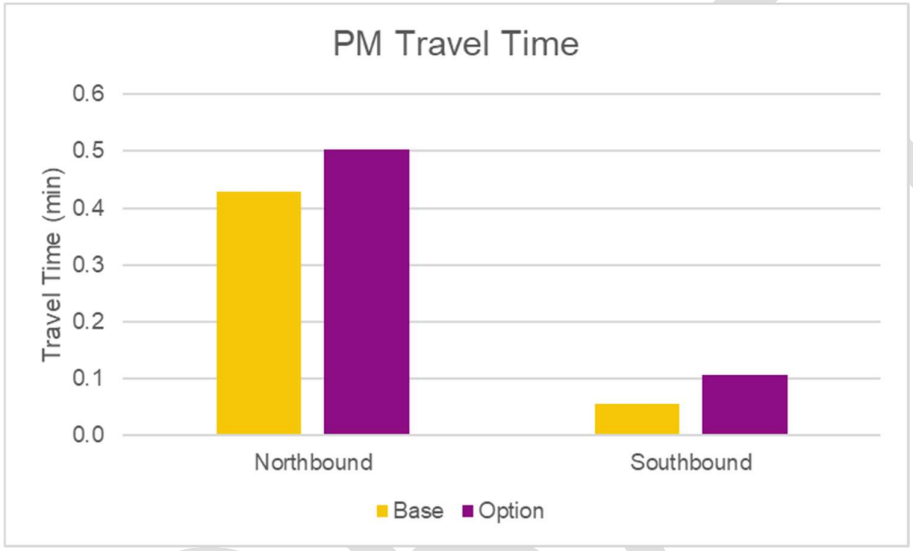


Figure 3-7: PM Peak Hour Travel Time – Kawaka

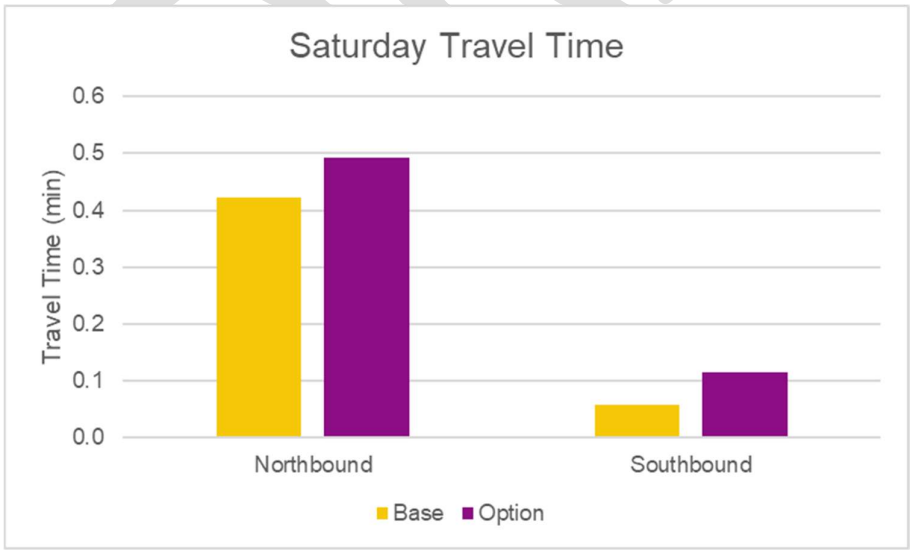


Figure 3-8: Saturday Travel Time - Kawaka

The figures demonstrate that there is a negligible impact on the average travel time in both the northbound and southbound direction with the introduction of the midblock crossing.

Table 3-3 shows the vehicle flow on Totara Street at the proposed midblock crossing location for the existing layout and the option. Differences in flow are related to the variation experienced in simulation modelling, rather than any capacity changes at this location.

Table 3-3: Totara Street (at Kawaka St) Vehicle Flow (veh/h)

	PM Peak		Saturday	
	Northbound	**Southbound**	**Northbound**	**Southbound**
Base	820	460	620	690
Option	820	460	620	690

The following figures demonstrate a snapshot of the simulation that is representative of the maximum queuing on Totara Street at the midblock crossing location.

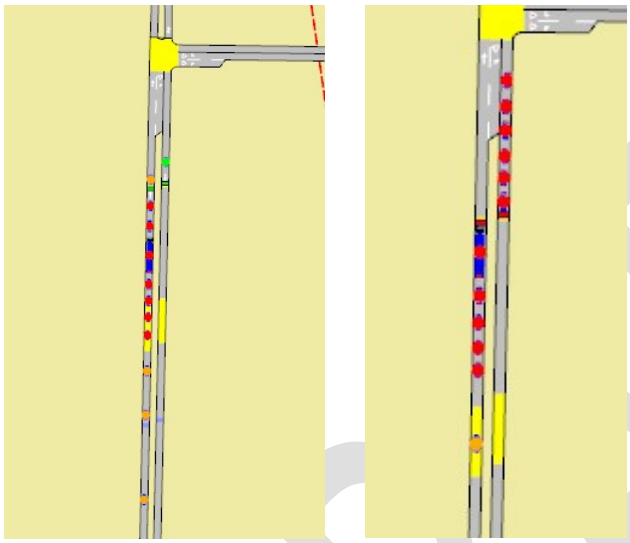


Figure 3-9: Kawaka Crossing Queueing

The figures demonstrate that the crossing creates a maximum queue of approximately 60 - 70m in the northbound direction and 40 - 50m in the southbound direction for the PM peak. The Saturday peak sees similar levels of maximum queue length. The average queue length is much lower for both peaks as the queue dissipates every signal cycle.

3.1.3 Totara Street / Rata Street Intersection

The Totara Street dedicated left turn lane is removed and becomes shared with the right turn. Survey data indicates that the left turn is only 3% of the Totara Street northbound traffic arriving at the intersection in the PM peak. This survey data was based on a single day and therefore, in the model the percentage of left turners was conservatively set at 5%. Saturday data was unavailable and therefore the same percentage split was used.

The northbound travel time has a negligible change in travel time in both the PM and Saturday model. However, the maximum queueing experienced has increased in the Saturday model by up to ~125m. In the Saturday model there is a greater constraint on the northbound movement on Maunganui Road, and therefore interrupts the flow on Totara Street northbound due to queue blocking back. Increases in queue length are related to vehicles that would have used the left turn lane. With a lower percentage of left turners, the additional queueing would decrease.

The flow through the intersection has remained consistent between the base model and the option at approximately 330 vehicles per hour in the PM peak and 420 vehicles per hour in the Saturday peak.

3.2 Forecast Year Results

3.2.1 Totara Street / Hewletts Road

For the forecast year, only a single option for the Totara Street / Hewletts Road crossing has been modelled. As advised by TCC, Option 2 has been modelled as it is likely that a safe crossing would be required at this location, regardless of the traffic performance. Option 2 provides a staged crossing at Hewletts Road by signalising the left turn slip lane.

In the do minimum (or existing layout) Totara Street northbound is capacity constrained by Hull Road roundabout and the Waimarie St / Totara Street intersection. Queueing blocks back from these locations to Hewletts Road. As a result, signalising the left turn slip lane is not expected to have a significant impact on the travel time through Hewletts Road.

The peak hour travel time along Hewletts Road eastbound (Chapel Street to Totara Street) and Totara Street southbound (from Hull Street to Hewletts Road) is shown in **Figure 3-10** for the PM peak.

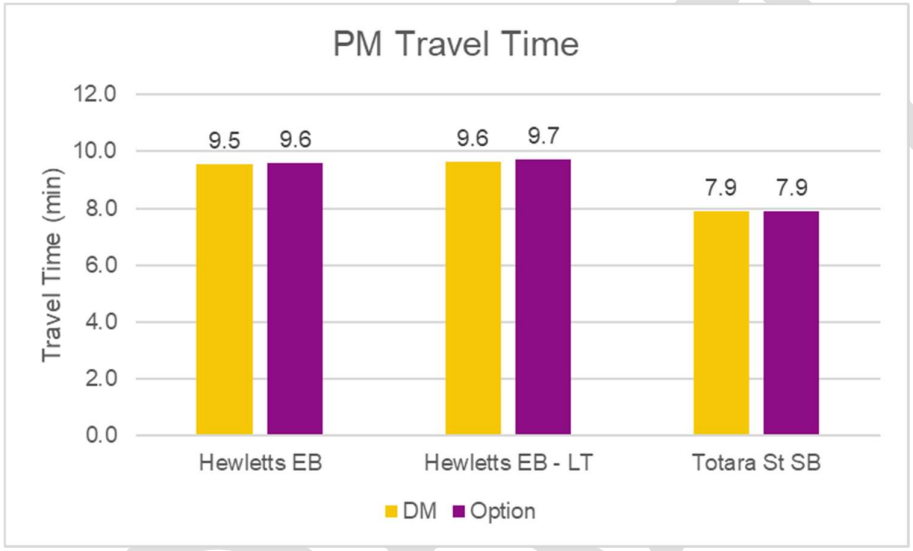


Figure 3-10: PM Peak Hour Travel Time

The travel time in 2028 for the PM peak shows limited change between the option and the do minimum (DM). As mentioned above, this is due to the capacity constraints on Totara Street northbound.

The travel time along Hewletts Road eastbound and Totara Street northbound and southbound is shown in **Figure 3-11** for the Saturday peak.

Due to lower demand than the PM peak, the model is not capacity constrained at Hull Road and Waimarie Street in the northbound direction. As a result, there is slightly greater impact on the Hewletts Road travel time. The left turn vehicle flow is still lower than the PM 2018 peak hour flow, and so has a lower impact than in 2018.

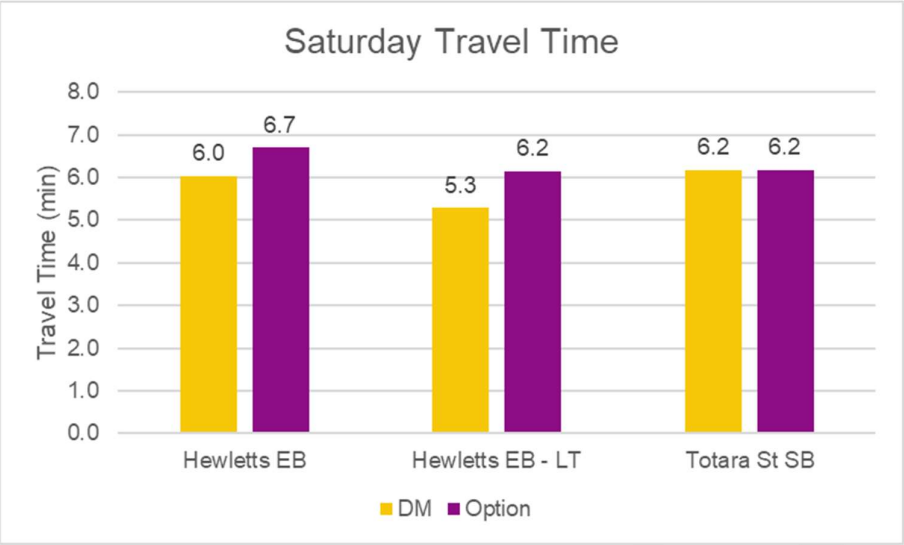


Figure 3-11: Saturday Travel Time

There is an increase in the Hewletts Road travel time of approximately ~0.7 min and an increase in the travel time specifically for left turners of approximately ~0.9 minutes. The Totara Street southbound movement travel time remains consistent.

Table 3-1 summarises the vehicle flow (veh/h) for the existing layout and the options tested at the Totara Street / Hewletts Road intersection:

Table 3-4: 2028 Hewletts / Totara Flow

Vehicle Flow (veh/h)	PM		Saturday	
	DM	Option	DM	Option
Hewletts	2,540	2,530	2,380	2,360
Hewletts LT	1,100	1,100	950	940
Totara St SB	1,030	1,030	1,040	1,050

The table demonstrates that the throughput vehicle flow has limited change between the do minimum and option.

The queue length between the do minimum and the option are very similar for the PM peak. In both scenarios the queue length extends well beyond the extents of the model by approximately ~500 vehicles.

The following figures show the queue length along Hewletts Road in the Saturday peak for the do minimum and the option.

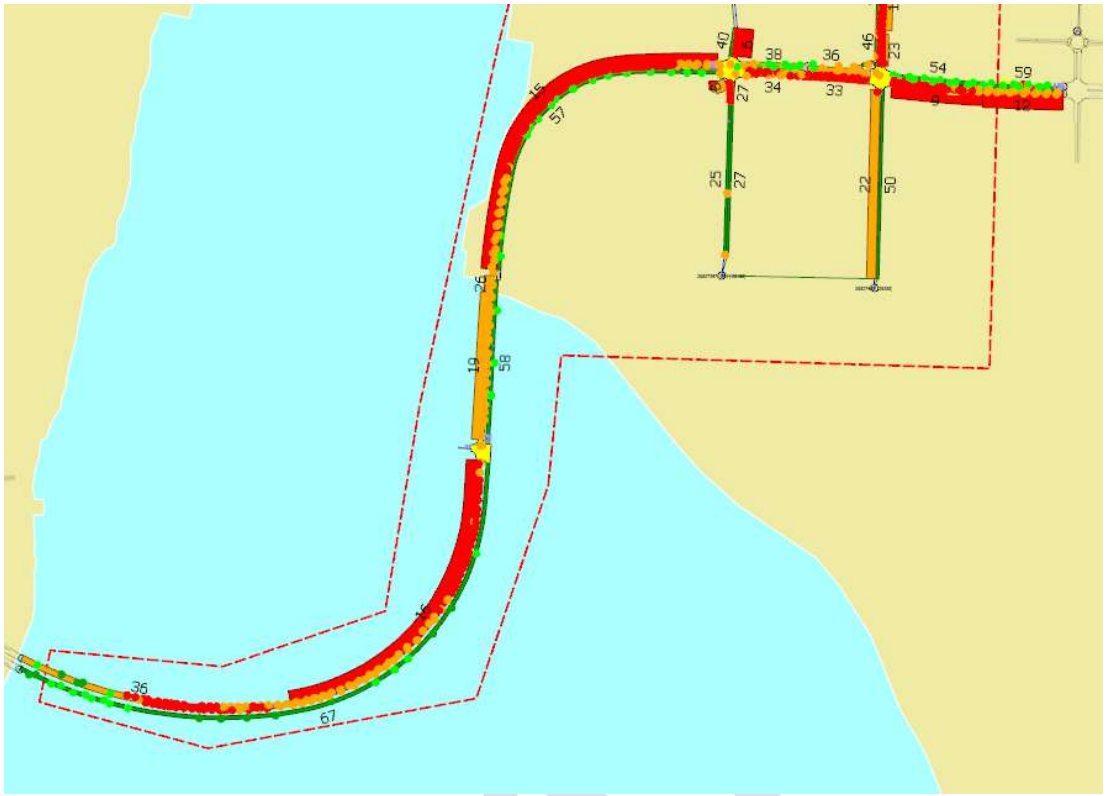


Figure 3-12: 2028 Saturday Do Minimum

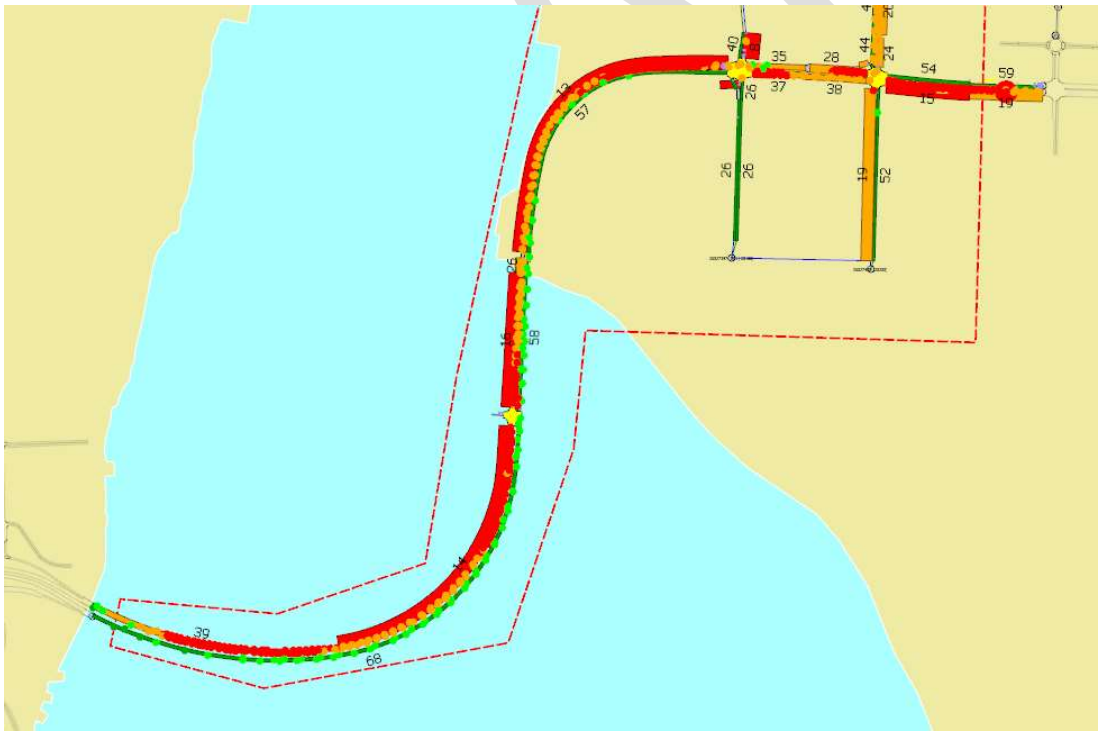


Figure 3-13: 2028 Saturday Option

The figures demonstrate that additional back of queue length does not change significantly between the do minimum and option.

3.2.2 Midblock Crossing South of Kawaka Street

The introduction of the mid-block crossing on Totara Street 45m south of Kawaka Street has limited impact on the travel time and queuing in the forecast year models for PM and Saturday peaks. It is however noted that capacity constraints in the Saturday model at both Rata Street (due to Maunganui Road) and at the Hull Road roundabout southbound approach cause queueing through the crossing location. Regardless of this, the crossing itself has limited impact on the corridor.

Travel time results are presented for PM peak and Saturday peak for the approach to the crossing in **Figure 3-14** and **Figure 3-15**.

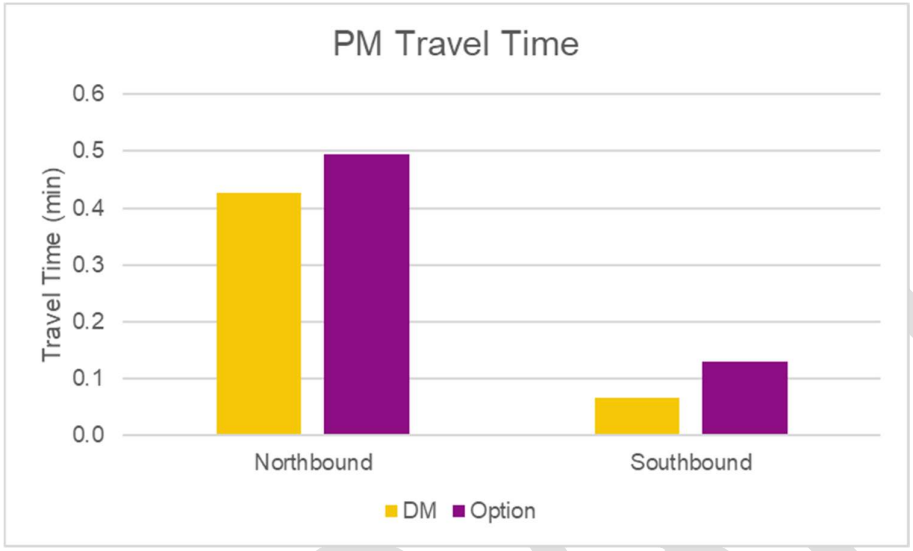


Figure 3-14: 2028 PM Peak Travel Time – Kawaka

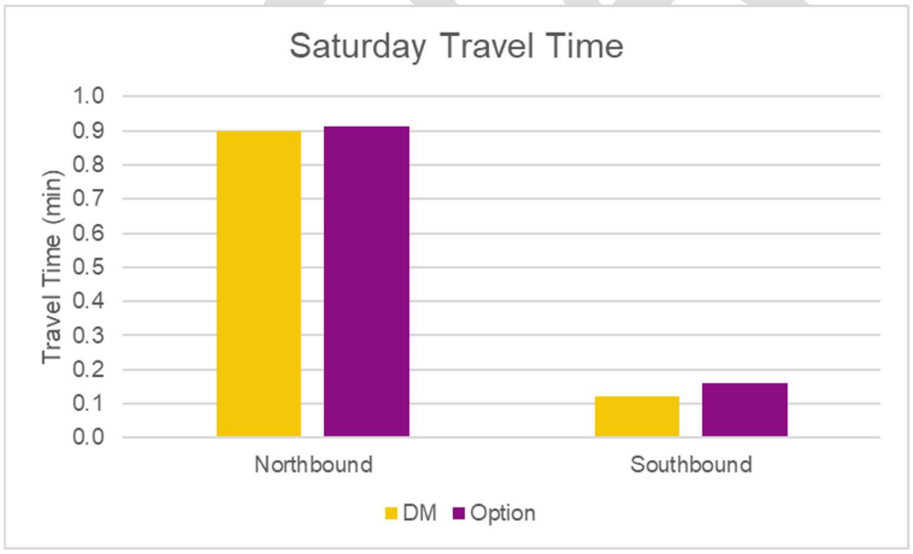


Figure 3-15: 2028 Saturday Travel Time – Kawaka

3.2.3 Totara Street / Rata Street Intersection

The Totara Street dedicated left turn lane is removed and becomes shared with the right turn.

The northbound travel time has a negligible change in travel time in both the PM and Saturday model. However, the maximum queueing experienced has increased in the Saturday model by up to ~140m. In the Saturday model there is a greater constraint on the northbound movement on Maunganui Road, and

therefore interrupts the flow on Totara Street northbound due to queue blocking back. Increases in queue length are related to vehicles that would have used the left turn lane. With a lower percentage of left turners, the additional queueing would decrease.

The flow through the intersection has remained consistent between the do minimum and the option at approximately 320 vehicles per hour in the PM peak and 480 vehicles per hour in the Saturday peak.

4 Conclusions

Tauranga City Council (TCC) has engaged Beca to undertake Aimsun modelling to understand the effects of proposed pedestrian / cycle crossing along Totara Street, as well as an adjustment to the layout of the Rata Street and Totara Street intersection. The modelling investigated the following elements and sub-options:

- Pedestrian crossings of Totara Street, either;
  - Option 1: A midblock pedestrian crossing outside 202 Totara Street, or;
  - Option 2: At the Hewletts Road intersection, signalising the left turn slip lane from Hewletts Road into Totara Street
- A midblock pedestrian crossing on Totara Street just south of Kawaka Street
- Totara Street / Rata Street layout change, reducing the Totara Street northbound approach lanes from two to one

In the 2018 base year, both Totara Street / Hewletts Road crossing options are tested, however in the 2028 forecast year only the signalised left turn slip lane (Option 2) was tested.

This work builds on high-level, preliminary testing undertaken using SIDRA models in early August. That earlier work identified that both crossing options at Hewletts Road increased delays and queues for the eastbound traffic during the pm peak. A key difference to note is how the two models represent queues:

- SIDRA models indicate queue lengths (in vehicles and linear length) based on simple estimates of static queues from each signal
- AIMSUN simulation models include more precise representation of the interaction between queues in adjacent lanes and between intersections, based on their speed. However, the AIMSUN models also represent the dynamic ‘concertina’ effect of queueing, meaning that the measurements of the ‘back of the queue’ may differ from how many vehicles are deemed to be ‘in a queue’ (as some vehicles move forward may move above speeds considered to be ‘queued’).
- There are also other sources of queueing in the corridor, such as the Dive Crescent on-ramp merge, the traffic signals at the Marina entrance and the signals at Tasman Quay. As the queues interact it can be difficult to identify the true ‘source’ of the queueing. AIMSUN does consider these inter-connected corridor queues.

Given the uncertainties in predicting future traffic flows, cycle usage and traffic signal operation, this analysis should be focussed more on comparative analysis of options than absolute prediction of queue length.

The main modelling was undertaken for a weekday PM peak. A Saturday model was also developed and tested; however, this was based on only limited calibration data so should be treated as more indicative.

The key findings of the modelling are discussed below.

Totara Street / Hewletts Road:

2018 Results:

The following table summarises the PM peak results for the Base, Option 1 and Option 2 scenarios. PM peak is shown here as there are more significant impacts than the Saturday peak.

Scenario	Hewletts EB Travel Time (min)	Hewletts EB Left Turn Travel Time (min)	Totara St SB Travel Time (min)	Hewletts Back of Queue Length (m)
Base	5.8	5.1	4.4	1,650m
Option 1	6.9	6.4	4.8	1,900m
Option 2	7.5	7.4	4.4	2,150m

- Providing a midblock crossing on Totara Street (Option 1), 100m north of Hewletts Road increases the travel time along Hewletts Road eastbound and on Totara Street southbound
  - In the PM peak, the Hewletts Road eastbound approach average travel time increases by approximately ~1.1 minutes, while the left turn into Totara Street increases by approximately ~1.3 minutes
  - The additional delay due to the crossing increases the estimated maximum back of queue length measured from Totara Street from 1,650m to 1,900m (+250m) in the PM peak
  - The Saturday peak sees limited increases in delay as a result of the midblock crossing due to lower demand for the critical movements. Travel time changes are within 0.5 minutes.
  - The Totara Street southbound movement sees an increase in travel time of approximately ~0.4 minutes.
- Signalising the left turn slip lane (Option 2) creates even more additional delay for the Hewletts Road eastbound approach:
  - In the PM peak, the Hewletts Road eastbound approach average travel time increases by approximately ~1.7 minutes, while the left turn into Totara Street increases by approximately ~2.3 minutes
  - The additional delay increases the estimate maximum back of queue length measured from Totara Street from 1,650m to 2,150m (+500m) in the PM peak
  - The Saturday peak sees limited increases in travel time as a result of the midblock crossing due to lower demand for the critical movement. Travel time changes are within 0.5 minutes.

2028 Results:

- The 2028 model does predict increased delay over the 2018 model. Signalising the left turn slip lane does not create significant additional delay in the PM peak due to capacity constraints in the northbound direction on Totara Street predicted by the model. That is, northbound queueing from the Totara/Waimarie intersection blocks back towards Hewletts Road, meaning the impact of the signalised crossing is minimal. It should be noted that no upgrades to Totara Street or Hewletts Road have been assumed in this modelling
- The Saturday peak sees some increase in travel time as a result of signalising the left turn slip lane. The Hewletts Road eastbound approach average travel time increases by approximately ~0.7 minutes, while the left turn into Totara Street increases by approximately ~0.9 minutes. The increase in delay is not estimated to significantly increase the maximum back of queue length on Hewletts Road eastbound.

Midblock Crossing South of Kawaka Street:

The addition of a midblock crossing approximately 45m south of Kawaka Street did not create any significant increase in average travel time at the approaches to the crossing. Queues can build up to ~100m when a crossing occurs, however these quickly dissipate once the pedestrian crossing phase is finished. Results will however depend on how often the crossing is called by cyclists or pedestrians.

It is noted that in the forecast years, capacity constraints at Rata Street (due to Maunganui Road) and the Hull Road roundabout cause some additional queueing along Totara Street through to the crossing. However, the addition of the crossing does not cause a significant impact.

Totara Street / Rata Street Intersection Layout Change

A survey of the Totara Street / Rata Street intersection identified that the Totara Street northbound left turn was only 3-5% of the northbound traffic. As a result, there is limited impact in travel time for the approach due to the removal of the dedicated left turn lane. The queue length can extend by up to ~150m, but this is dependent on the number of left turners and number of trucks at any one time. It is noted that the left turn movement will see a greater increase in travel time as they must wait with the right turners.