

Released under the Official Information Act 1982

NZTA Contract 2018235 - F2Q SSBC & QTC DBC

Technical Note # 42

6 October 2020

SH6A (Frankton Road) Bus Signal and Virtual Priority

Corollary Report: SH6A/Marina Drive/Sugar Lane intersection layout improvements and assessment of operational performance

Executive Summary

This short report sets out the results of traffic modelling and analysis of the Frankton Road/Marina Drive/Sugar Lane intersection, as part of both the short-term improvement of the intersection (related to the development of Frankton Marina) and the longer-term aspirations as under consideration within the Frankton to Queenstown Single Stage Business Case (F2Q SSBC). The work investigates the scope for improving of pedestrian facilities (and general operation) of the intersection, both as an isolated site and within the wider SH6A corridor.

The operational performance of two concept layouts has been investigated:

- Option 1 – Short-term improvement at the site, minor changes to kerblines and lane markings, with fully protected crossings on all four arms
- Option 2 – Longer-term improvements at the intersection, with an additional access to Frankton Marina provided to the west of the existing intersection, close to the Perkins Road intersection. This allows the banning of the eastbound right turn into Sugar Lane, and the crossing on the west side amended to a staggered facility (the refuge being located in the removed right turn lane), with the crossing on the east side of the intersection removed

Traffic modelling analysis using SIDRA for both current (2018) and forecast (2028) traffic demand in the critical PM peak hour period was undertaken. The results demonstrate that:

- The signalisation of the SH6A/Marina Drive/Sugar Lane intersection will result in near-capacity operation of the site at current (2018) traffic levels in both layout options, assuming only nominal pedestrian crossing volumes (around less than 10 pedestrians/hour),
- As pedestrian crossing volumes increase, to above around a 25% call rate of the SH6A crossing, the option 1 layout is predicted to result in over-capacity operation at both 2018 and 2028 demand sets
- The Option 2 layout provides some nominal benefits over Option 1 at low pedestrian volumes (around 5% improvement in capacity), but benefits increase significantly at higher pedestrian volumes (above around a 25% call rate of the SH6A crossing) – and would result in double-digit reductions in the level of operation in terms of v/c

In conclusion, it is recommended that Option 1 can be implemented at the location, but only on a relatively short-term basis – with the operation monitored in terms of pedestrian crossing volumes.

In the longer term, the F2Q SSBC is likely to recommend the installation of a number of signalised intersections along Frankton Road, to improve local access, road safety (including protected pedestrian crossing provision) and dedicated public transport lanes and signal priority, which will set a cap on the traffic volumes that can be accommodated on SH6A, to a volume level around the existing (2018) demand. As total demand increases towards 2028, Option 1 is unlikely to provide sufficient capacity to accommodate these conflicting demands – at which point Option 2 provides a more suitable layout at this location, together with the installation of an additional Frankton Marina access intersection to the west. The Option 2 layout therefore provides an improved level of service on the corridor, that will be more compatible with the other (proposed) signalised intersections.

Introduction

This short report sets out the results of traffic modelling and analysis of the Frankton Road/Marina Drive/Sugar Lane intersection, as part of both the short-term improvement of the intersection (related to the development of Frankton Marina) and the longer-term aspirations as under consideration within the Frankton to Queenstown Single Stage Business Case (F2Q SSBC). The work investigates the scope for improving of pedestrian facilities (and general operation) of the intersection, both as an isolated site and within the wider SH6A corridor.

Input Data

SIDRA models have been developed to investigate operation of the intersection, under two scenarios:

- 2018 – traffic counts as carried out by Matrix for the F2Q SSBC work on 28/08/18
- 2028 – forecast volumes obtained from the most recent version of the 2028 Paramics model, developed under the Queenstown Transport Modelling DBC workstream (which includes a significant shift of trips to the public transport mode)

The PM peak hour (1700-1800) period was critical in both the 2018 and 2028 scenarios, and therefore all assessments were undertaken on this period – Figure 1 shows the volumes for both scenarios.

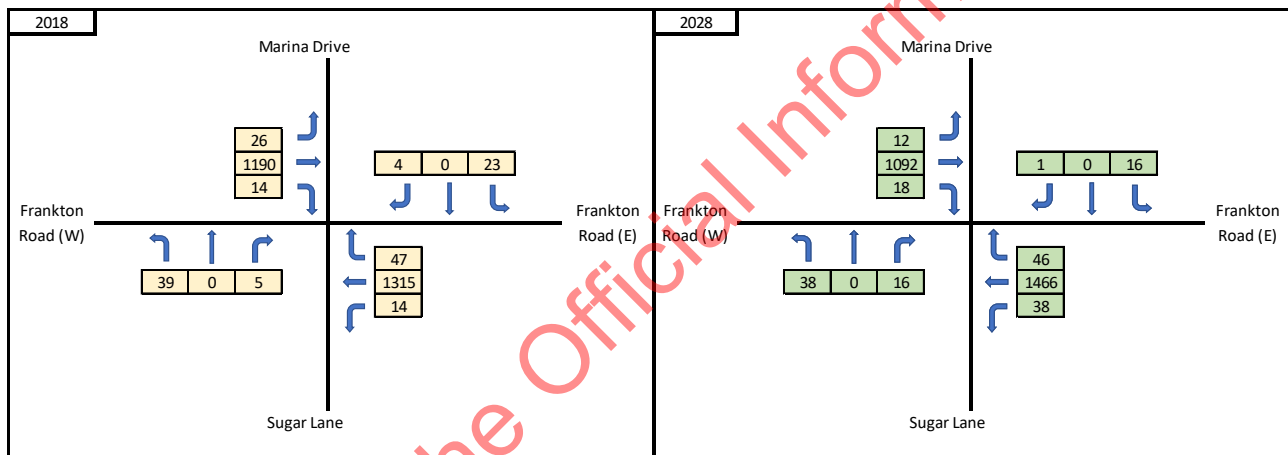


Figure 1: 2018 and 2028 Traffic flows (vehicles/hour)

Existing Operation

The existing intersection is priority controlled on the two side roads. Table 1 shows the performance of the intersection (in terms of lane v/c, and total intersection LOS and average delay/vehicle). The table has been colour coded for LOS, and any v/c results greater than 0.8, 0.9 and 1.0 (in bands).

Due to the poor performance predicted by the SIDRA model on the two side roads, the gap acceptance parameters have been reduced for movements out of the two side roads, until an acceptable (and realistic level of operation was reached.

The results show that even with gap acceptance parameters reduced significantly (in some cases both the critical gap and follow-up headway have been reduced by up to 50%), operation on the side road is still poor, with significant levels of delay (LOS F indicates a delay of 50 seconds or greater).

Table 1: Existing Operation of SH6A/Marina

Approach	Lane	Default Parameters		Calibrated Parameters	
		v/c	LOS	v/c	LOS
Sugar Lane (S)	All	2.38	F	0.69	F
Frankton Road (E)	LT	0.01	-	0.01	-
	A	0.69	-	0.69	-
	A/RT	0.24	C	0.24	C
Marina Drive (N)	All	2.16	F	0.67	F
Frankton Road (W)	LT	0.01	-	0.01	-
	A	0.63	-	0.63	-
	RT	0.12	E	0.12	E
Intersection	LOS	-		-	
	Delay (s)	38		4	

Consequently, operation of the existing intersection is poor, with the model showing that drivers are accepting very short gaps in conflicting traffic streams to exit the side roads. This suggests a road safety issue – and together with the lack of formal (controlled) pedestrian crossing facilities at the intersection, there is therefore a case for implementing a signalised solution to provide greater control and safety for all movements at the intersection.

Proposed Layouts

In terms of proposed signalised arrangements, a number of features of the operation have been assumed in discussion with the Transport Agency:

- All right turns from SH6A must be protected turns (i.e. no filtering is allowed)
- All pedestrian crossing facilities must be fully protected through both the walk and clearance periods

This places some constraints on the vehicular capacity at the intersection, particularly the installation of the crosswalks across the two SH6A legs, which add in a long period of non-green signal to traffic.

Although a number of variations to the layout exist, the following two options have been looked at in more detail:

- Option 1 – Short-term improvement at the site, minor changes to kerblines and lane markings, with fully protected crossings on all four arms
- Option 2 – Longer-term improvements at the intersection, with an additional access to Frankton Marina provided to the west of the existing intersection, close to the Perkins Road intersection. This allows the banning of the eastbound right turn into Sugar Lane, and the crossing on the west side amended to a staggered facility (the refuge being located in the removed right turn lane), with the crossing on the east side of the intersection removed

Schematic arrangements of the two options are shown in Figure 2, Figure 3 and Figure 4. The bus lanes shown in Option 2 are still under investigation as part of the F2Q SSBC, but are not included in the SIDRA models of this option (and have little impact on overall intersection operation).



Figure 2: Option 1 - SH6A/Marina/Sugar

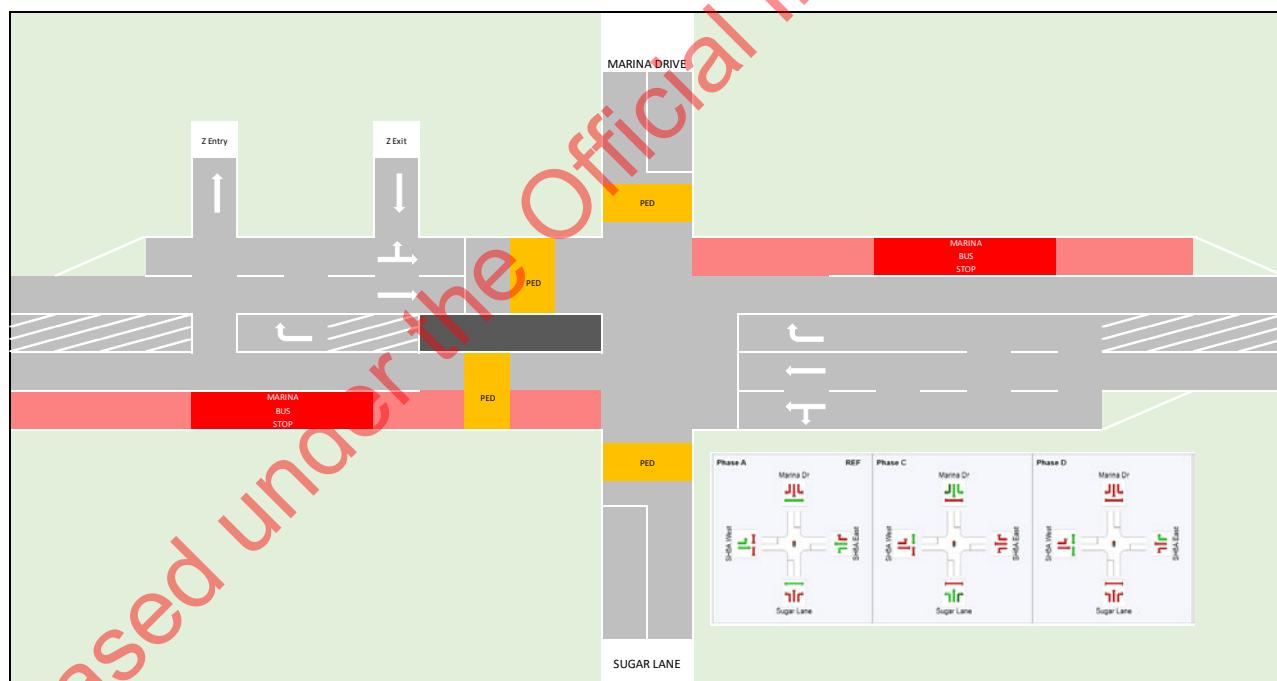


Figure 3: Option 2 - SH6A/Marina/Sugar

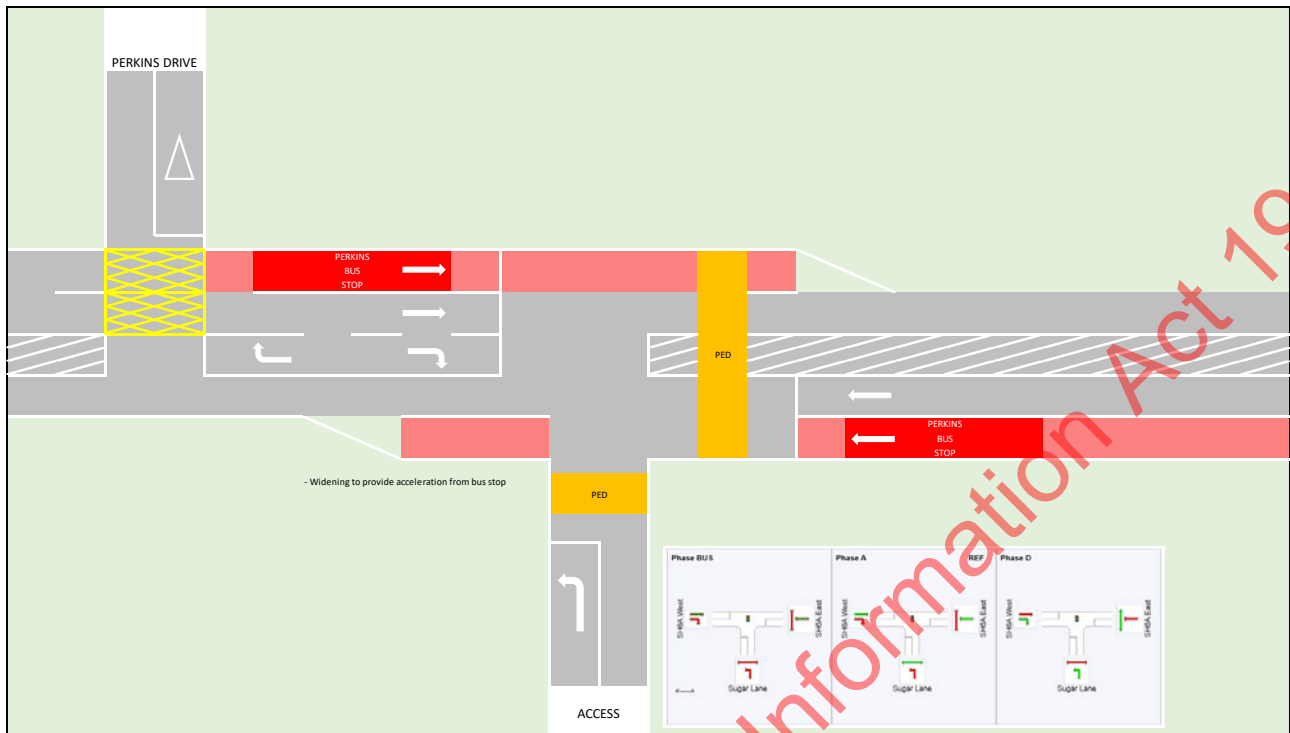


Figure 4: Option 2 - SH6A/New Marina Access

The two options represent the most realistic best and worst cases in terms of operational capacity for vehicles – Option 1 maximises the provision pedestrian movements at the existing intersection, with Option 2 creating more overall capacity by re-locating the eastbound right turn to the new access point, with some changes to pedestrian provision.

Option 1 – Signal Operation

Figure 5 shows the intended phase arrangement that would operate at the intersection, with a single-diamond overlap operation on the west-east direction.

Some other features of the operation, as included in the modelling runs, are:

- The eastbound and westbound left turns from SH6A are held back at the start of the main road phase for the period of the pedestrian walk and clearance time on the south and north crosswalks respectively. In reality, these crossings may not be called in every signal cycle, but as left turn volumes are small and in dedicated left turn lanes (except through buses), the impact of this on operation is minor and not critical
- In addition, the pedestrian crosswalks on the north and south legs are also set to run in phase D, the all-round pedestrian phase. On site, demand for these movements would only activate a call for phases A/B/C, and the pedestrian call for phase D would only be activated on demand for the west or east crosswalks
- Phase alternatives B, C, F1 and F2 allow the two right turns from SH6A to operate independently, and their appearance is subject to demand. In the models, the westbound right turn volume is sufficiently high for the signal group to be called in most cycles – for the eastbound direction, demand is sufficient for the signal group to be called in around 50%, and this has been coded in the model

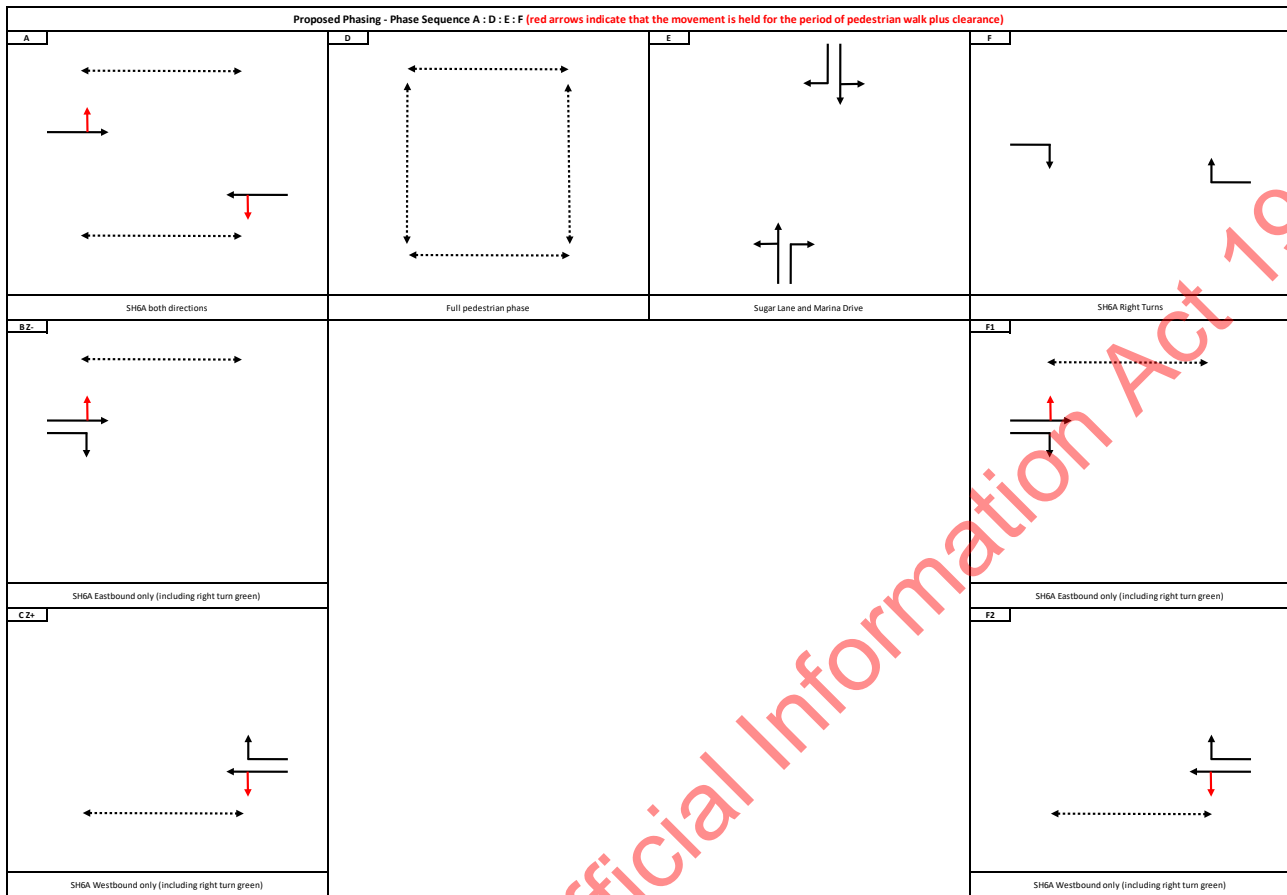


Figure 5: Option 1 - Intersection Phase Arrangement

Option 2 – Signal Operation

Figure 6 shows the intended phase arrangement that would operate at the existing intersection.

Some other features of the operation, as included in the modelling runs, are:

- The eastbound and westbound left turns from SH6A are held back at the start of the main road phase for the period of the pedestrian walk and clearance time on the south and north crosswalks respectively. In reality, these crossings may not be called in every signal cycle, but as left turn volumes are small and in dedicated left turn lanes (except through buses), the impact of this on operation is minor and not critical
- The staggered crossing on the west leg would be demanded in phase C and/or C1, with C1 representing the alternative phase to allow the critical through westbound movement to operate if the southern half of the pedestrian crossing is not demanded
- It is possible that both phases C and C1 could operate so as to ensure a northbound pedestrian has sufficient time to negotiate the full movement through the central refuge. In the southbound direction, this is not required as phase B also caters for the northern half of the crossing

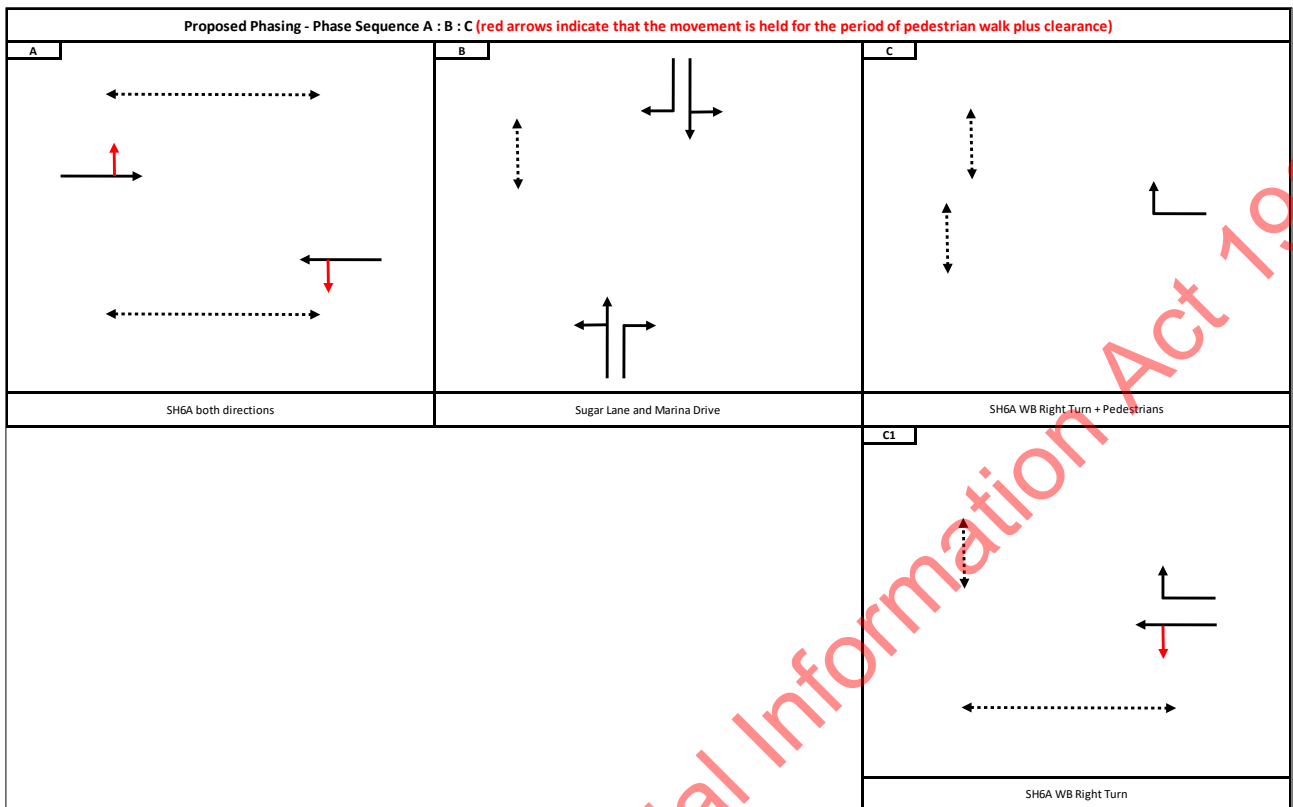


Figure 6: Option 2 - Intersection Phase Arrangement

Operational Results

In terms of assumptions, the main impact on the operation of the intersection is the level of pedestrian activity. Whilst movements on the south and north crosswalks have negligible impact on vehicular performance, the demand for the west and east crosswalks does have a significant effect.

The current (2018) pedestrian volumes are practically zero on these two movements (as surveyed in August 2018). However, there are a number of factors which would increase pedestrian activity into the future:

- Increased congestion in the network is forecast to lead to a greater share of PT trips. Consequently, there is predicted to be a greater number of trips from properties on Marina Drive using PT, and therefore needing to cross SH6A for at least one half of a return journey
- The Frankton Marina is currently being developed to include a number of retail units which could act as an attractor and generator of trips, again some of which would choose a PT mode
- The current crossing provision at the location is relatively minor, which an uncontrolled staggered crossing point between the intersection and the petrol filling station. An enhancement in facilities would also be likely to induce movements across SH6A at this location, that may currently be deemed as less accessible

Consequently, rather than calculate likely pedestrian volumes based on uncertain forecasts, we have undertaken sensitivity tests with the following levels of operation of the crosswalks on the west and east legs of the intersection, in both Options:

- 0%
- 10%
- 25%
- 50%
- 75%
- 100%

It is likely that, certainly in the short term, pedestrian volumes are likely to result in operation of the crossing within the 0-25% activation range.

In all tests, a cycle time of 100 seconds has been utilised. A higher cycle time could be used, but is to the detriment to side road, right turn and pedestrian movements in terms of delay, and is considered a reasonable compromise – an increased cycle time has only marginal impact on the operation at the intersection, as the frequency of appearance of side road, right turn and pedestrian signal groups would also increase (i.e. a greater proportion of calls per hour).

Table 2 shows the results of the SIDRA analysis at 2028. In all cases, sufficient green time was allocated to the movements from the side roads and right turn movements off SH6A so as to maintain under capacity operation – in most cases a minimum green time of 5-6 seconds was sufficient. Consequently, the results shown are solely for the two critical through movements along SH6A.

Table 2: Proposed Operation of SH6A/Marina at 2028 under Options 1 and 2

Approach	Ped Activation Rate	Number of Ped Calls	Option 1		Option 2	
			v/c	LOS	v/c	LOS
SH6A Westbound Through	0%	0	0.99	E	0.95	C
	10%	4	1.03	F	0.96	C
	25%	9	1.09	F	0.98	D
	50%	18	1.19	F	1.03	F
	75%	27	1.31	F	1.11	F
	100%	36	1.46	F	1.17	F
SH6A Eastbound Through	0%	0	0.79	A	0.79	A
	10%	4	0.82	B	0.79	A
	25%	9	0.87	B	0.79	A
	50%	18	0.96	D	0.79	A
	75%	27	1.06	F	0.82	A
	100%	36	1.19	F	0.87	A

The table shows that at very low pedestrian volumes (0-10% call rate), operation is similar for both options, albeit Option 2 has around a 4% improvement in overall capacity for eastbound movements – this is due to the lower clearance period required for the pedestrian crossing across SH6A compared to Option 1.

As pedestrian activity increases beyond a 25% call rate (which is equivalent to a two-way pedestrian crossing volume of around 10-15 pedestrians per hour), the difference between the two options diverges significantly for both through movements on SH6A due to the equivalent increase in lost time to vehicles.

In terms of the eastbound movement, Option 2 provides a constant LOS across all pedestrian volumes up to a 50% call rate, at which point phase C is elongated beyond the green time required for the westbound right turn. For the westbound movement, Option 2 provides increasingly significant benefits over Option 1 as pedestrian volumes increase, due to the shorter pedestrian clearance period, and the operation of the pedestrian movement concurrently with the westbound right turn (therefore reducing the number of phases in operating per signal cycle).

Table 3 shows the similar analysis for the 2018 demand set.

Table 3: Proposed Operation of SH6A/Marina at 2018 under Options 1 and 2

Approach	Ped Activation Rate	Number of Ped Calls	Option 1		Option 2	
			v/c	LOS	v/c	LOS
SH6A Westbound Through	0%	0	0.88	B	0.84	A
	10%	4	0.92	C	0.87	B
	25%	9	0.97	D	0.91	B
	50%	18	1.06	F	0.94	C
	75%	27	1.17	F	0.98	D
	100%	36	1.30	F	1.04	F
SH6A Eastbound Through	0%	0	0.87	B	0.87	B
	10%	4	0.90	C	0.87	B
	25%	9	0.96	D	0.87	C
	50%	18	1.05	F	0.87	B
	75%	27	1.17	F	0.90	C
	100%	36	1.31	F	0.96	D

The results show a similar picture to 2028, but with a reduction in criticality on the westbound approach. However, overall, the results show that near-capacity operation is predicted with the installation of either layout option – and the differential in performance between the two options increases with growth in pedestrian crossing volumes.

It should be noted that the longer-term strategic operation of the network (as is being developed as part of the F2Q SSBC) is that the through traffic volumes on SH6A will be capped at a level that can be accommodated by each signalised intersection on the corridor. In the westbound direction, this will involve gating traffic at the Frankton Flats end of the corridor (with bus lanes added for public transport priority) – consequently, the level of this capping of eastbound volumes will need to be significantly more aggressive within layout Option 1, particularly as pedestrian crossing volumes increase.

For example, in order to maintain a v/c ratio of 85% on the westbound movements at 2028 at a 50% pedestrian call rate:

- Option 1 – would need to reduce the demand flow by 419v/h
- Option 2 – would need to reduce the demand flow by 256v/h

In the westbound direction, the capping of traffic volumes is achieved more “organically” through capacity restrictions within Queensdown Town Centre and the limiting of parking spaces for commuter trips (i.e. there is expected to be a higher PT mode share in this direction in the PM peak period).

Conclusions

The SIDRA analysis has shown that:

- The signalisation of the SH6A/Marina Drive/Sugar Lane intersection will result in near-capacity operation of the site at current (2018) traffic levels, assuming only nominal pedestrian crossing volumes
- As pedestrian crossing volumes increase, to above around a 25% call rate of the SH6A crossing, the option 1 layout is predicted to result in over-capacity operation in both demand sets
- The Option 2 layout provides some nominal benefits over Option 1 at low pedestrian volumes (around 5% improvement in capacity), but benefits increase significantly at higher pedestrian volumes (above around a 25% call rate of the SH6A crossing) – and would result in double-digit reductions in the level of operation in terms of v/c

In conclusion, it is recommended that Option 1 can be implemented at the location, but only on a relatively short-term basis – with the operation monitored in terms of pedestrian crossing volumes.

In the longer term, the F2Q SSBC is likely to recommend the installation of a number of signalised intersections along Frankton Road, to improve local access and road safety (including protected pedestrian crossing provision), which will set a cap on the traffic volumes that can be accommodated on SH6A, to a volume level

around the existing (2018) demand. Consequently, the public transport mode share is expected to increase significantly to accommodate the increase in trips, resulting in a growth in pedestrian movements across the corridor. Therefore, towards 2028, the Option 1 is unlikely to provide sufficient capacity to accommodate these conflicting demands – at which point Option 2 provides a more suitable layout at this location, together with the installation of an additional Frankton Marina access intersection to the west. The Option 2 layout therefore provides an improved level of service on the corridor, that will be more compatible with the other (proposed) signalised intersections.

The principal disadvantage of the Option 2 layout is the need to remove the crossing of SH6A on the east leg of the intersection. However, it is considered that, on balance, the advantages of the layout in respect of public transport delay and synchronised SH6A corridor operation will outweigh the removal of this crossing.

Prepared by:

s 9(2)(a)

Principal Transportation Engineer (Project Team Member)

Reviewed By:

s 9(2)(a)

Project Design/Integration Manager

Released under the Official Information Act 1982

Appendix B28 Queenstown Arterial Stages 1 and 2 – Intersection Optioneering

Released under the Official Information Act 1982

NZTA Contract 2018235 - F2Q SSBC & QTC DBC

Technical Note # 44

27 October 2020

Queenstown Arterial Stages 1 and 2 – Intersection Optioneering at Shotover Street/Gorge Road and Henry Street

Introduction

This short note sets out the optioneering that was carried out to ascertain the optimal arrangement of the layout and operation of the key Shotover Street/Gorge Road/Henry Street intersection that forms part of the Stage 1 and Stage 2 Arterial scheme.

This optioneering was undertaken in November 2019, and therefore precedes the announcement of “shovel ready” funding on 26 June 2020 to proceed with Stage 1 only of the Arterial – however comment is made on the retrospective impact of this within the note.

- Frankton Road/Melbourne Street/Dublin Street.
- Melbourne Street/Sydney Street.
- Gorge Road/Shotover Street/Henry Street.
- Stanley Street/Shotover Street.

Intersection Options

The Queenstown Town Centre Masterplan (and Arterial assessment at IBC level) identified 3 shortlisted options for the re-design of this key intersection:

- “Option 4” – 4-arm intersection with Memorial Hall retained.
- “Option 4.1” – 4-arm intersection with Memorial Hall removed.
- “Option 5” – 2 x 3-arm intersections.

The layout of these options is as set out in Figure 1 to Figure 3 below, as set out in the Arterials IBC report.

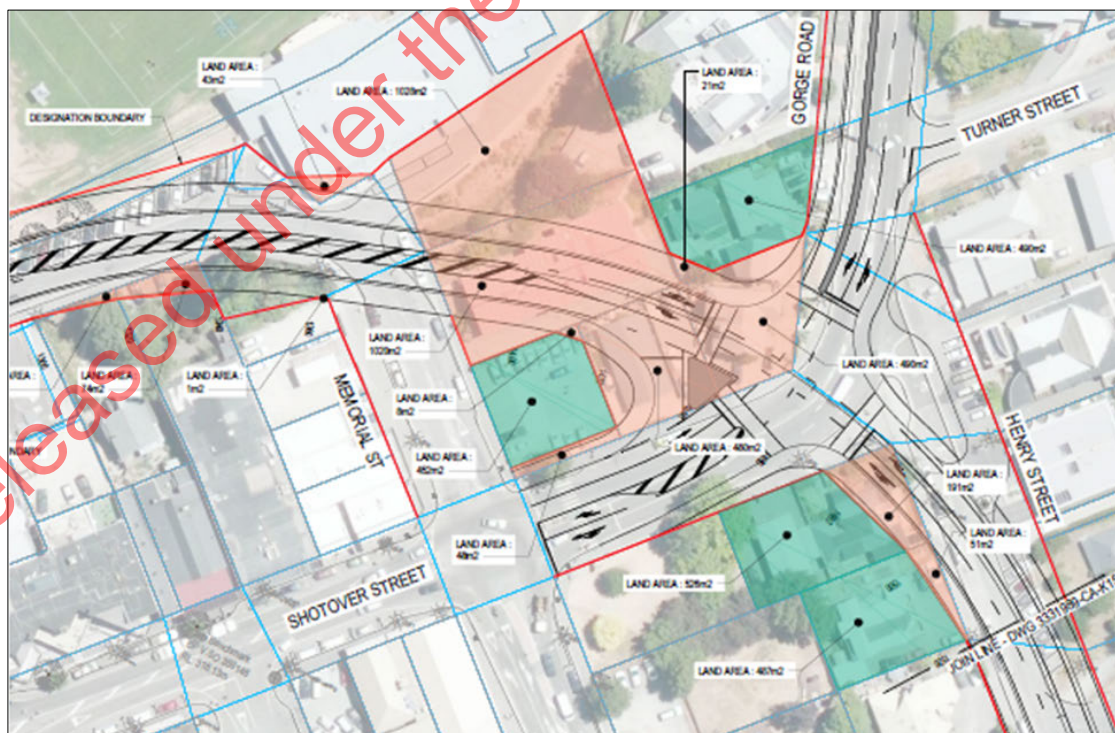


Figure 1: Layout at Shotover Street/Gorge Road/Henry Street - Option 4

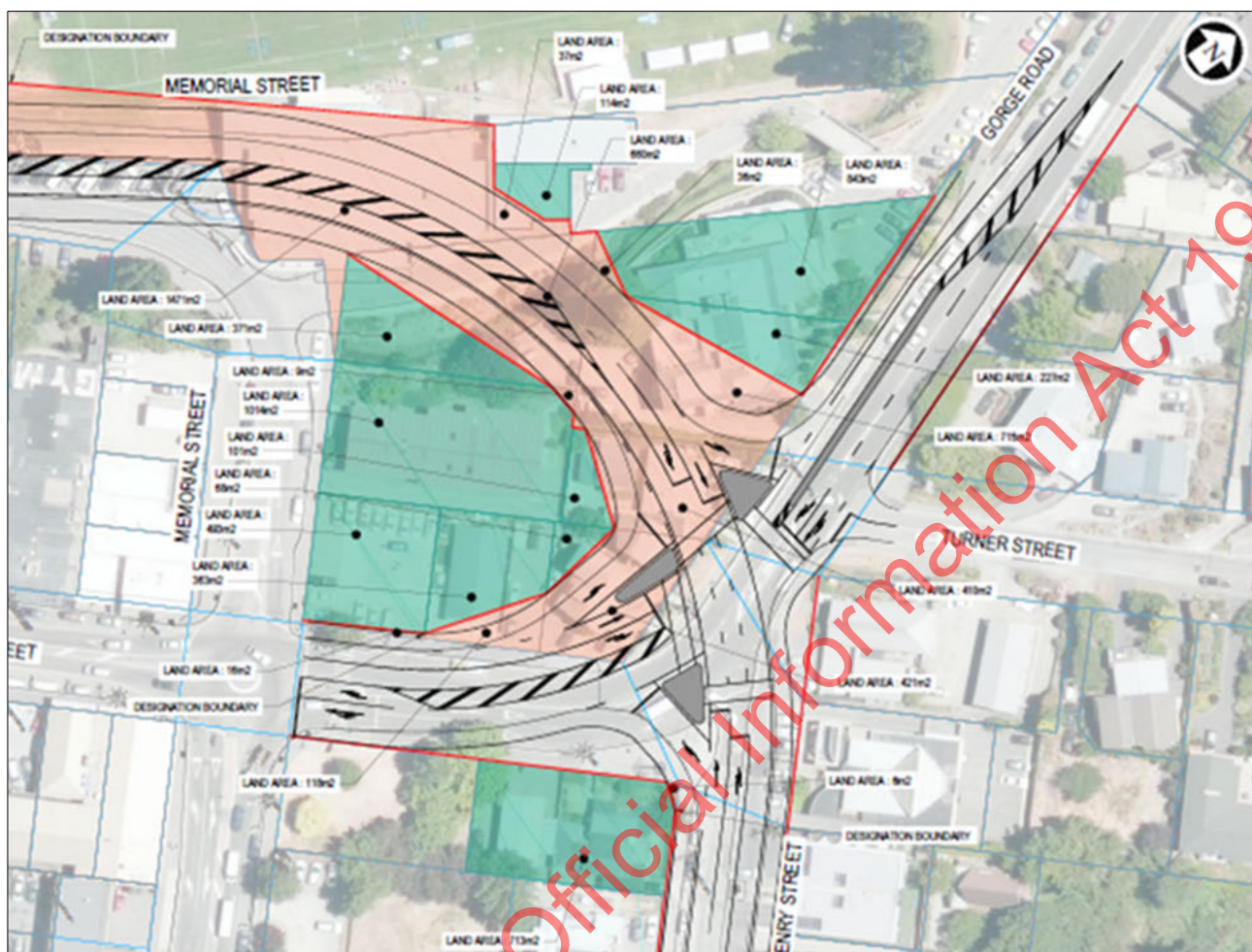


Figure 2: Layout at Shotover Street/Gorge Road/Henry Street – Option 4.1

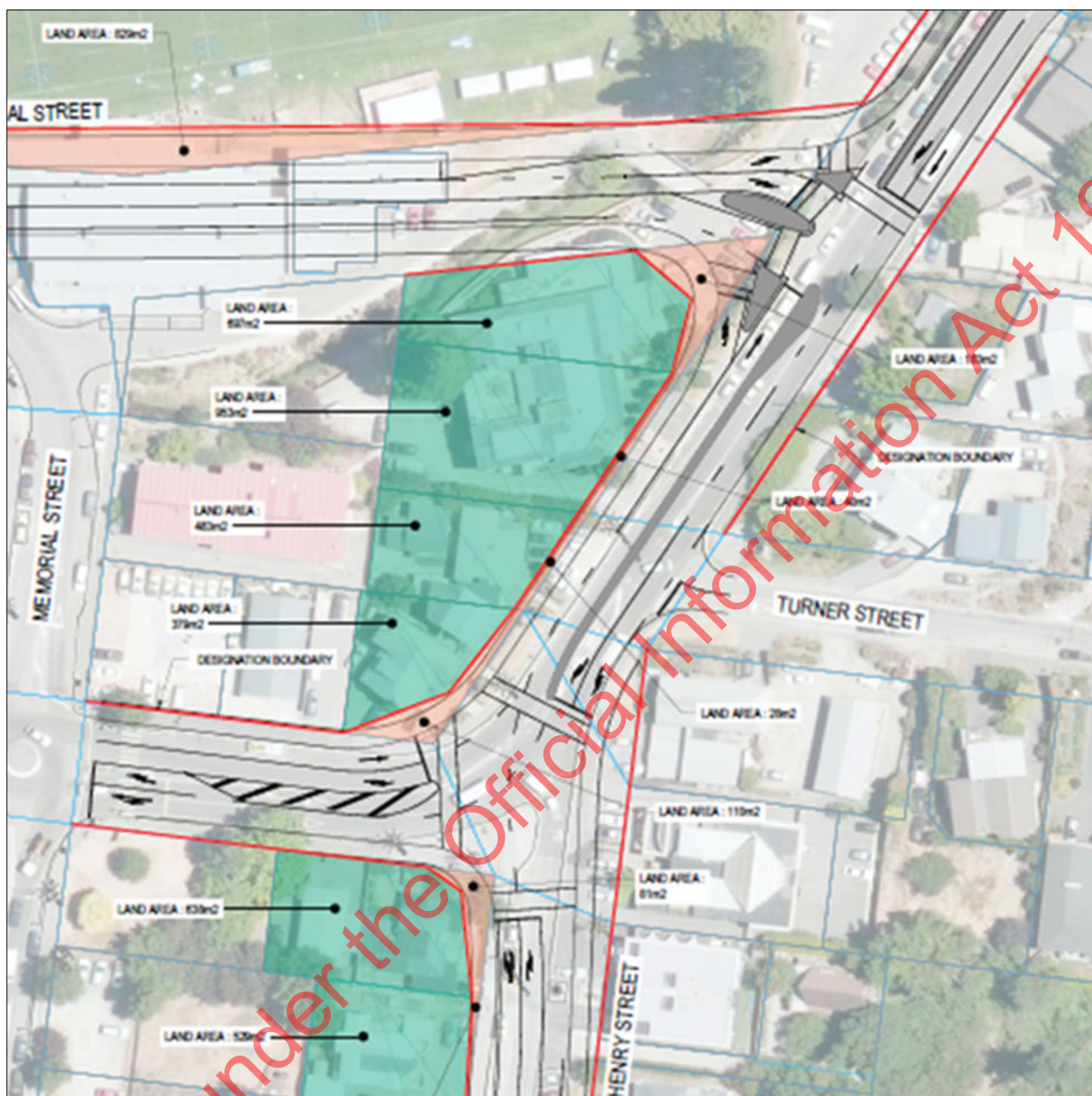


Figure 3: Layout at Sholover Street/Gorge Road/Henry Street – Option 5

Intersection Operation

As part of the QTC DBC, the above intersection options were re-visited. Key principles were established to incorporate into the assessment in terms of pedestrian crossing provision:

- Pedestrian crossing facilities would be provided across all arms of the intersection(s), and all would be fully protected (no turning vehicles able to turn in parallel with conflicting pedestrians) in line with Safe System objectives.
- Also, all pedestrian crossings would be single-phase (kerb to kerb in one movement) so as to remove triangular islands (or other central refuges) from all options.
- Right turn movements would operate as protected only (no filtering).

4-Arm Option

The layouts shown in Figure 1 and Figure 2 are essentially the same in terms of layout at the key intersection – the differences are mainly the alignment of the new 4th arm (Memorial Street extension) which has little impact on intersection operation.

As indicated in the previous section, the layouts have been amended to remove triangular islands and minimise the footprint of the intersection.

The assumed signal phasing structure is as below (Figure 4).

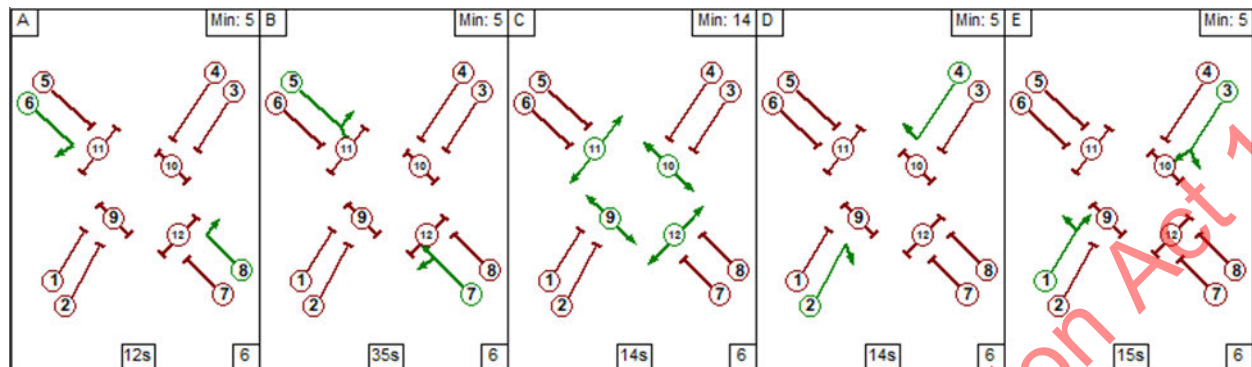


Figure 4: Phase Arrangement at Henry Street/Gorge Road

This operation provides an all-red pedestrian phase (but not including diagonal pedestrian movements). In addition, all right turn movements are fully protected (no turning vehicles able to turn across conflicting through movements) in line with Safe System objectives.

Table 1 shows the results of this assessment, using the 2028 Interpeak volumes (which are predicted to be slightly higher than AM and PM peak hour flows in 2028) for the scenario with Arterial Stages 1 and 2 with the western end of Stanley Street closed to general traffic. A maximum cycle time of 120 seconds has been used – in a town centre environment a lower cycle time of 90 seconds (or lower) is preferred to minimise pedestrian wait times.

Table 1: Operational performance for 4-arm intersection

Approach	Movement	Volume (v/h)	V/C*	LoS*
Henry Street	L+A	475	88%	E
	R	211	100%	F
Shotover Street	L+A	215	95%	F
	R	227	108%	F
Memorial Street	L+A	468	88%	E
	R	23	88%	E
Gorge Road	L+A	272	111%	F
	R	134	64%	E
Intersection				F

*V/C = Volume/Capacity; LOS = Level of Service

The results show poor operation of the intersection is predicted, with poor levels of service on all approaches and several movements operating above capacity – meaning that queue lengths would progressively increase through the peak period.

We have undertaken a further assessment to establish how the layout could be changes to provide more capacity for vehicular movements. This layout is shown in Figure 5, which includes the following additional lanes:

- Additional left turn lane on Henry Street approach.
- Additional left turn lane on Memorial Street.
- Additional left turn lane on Gorge Road.

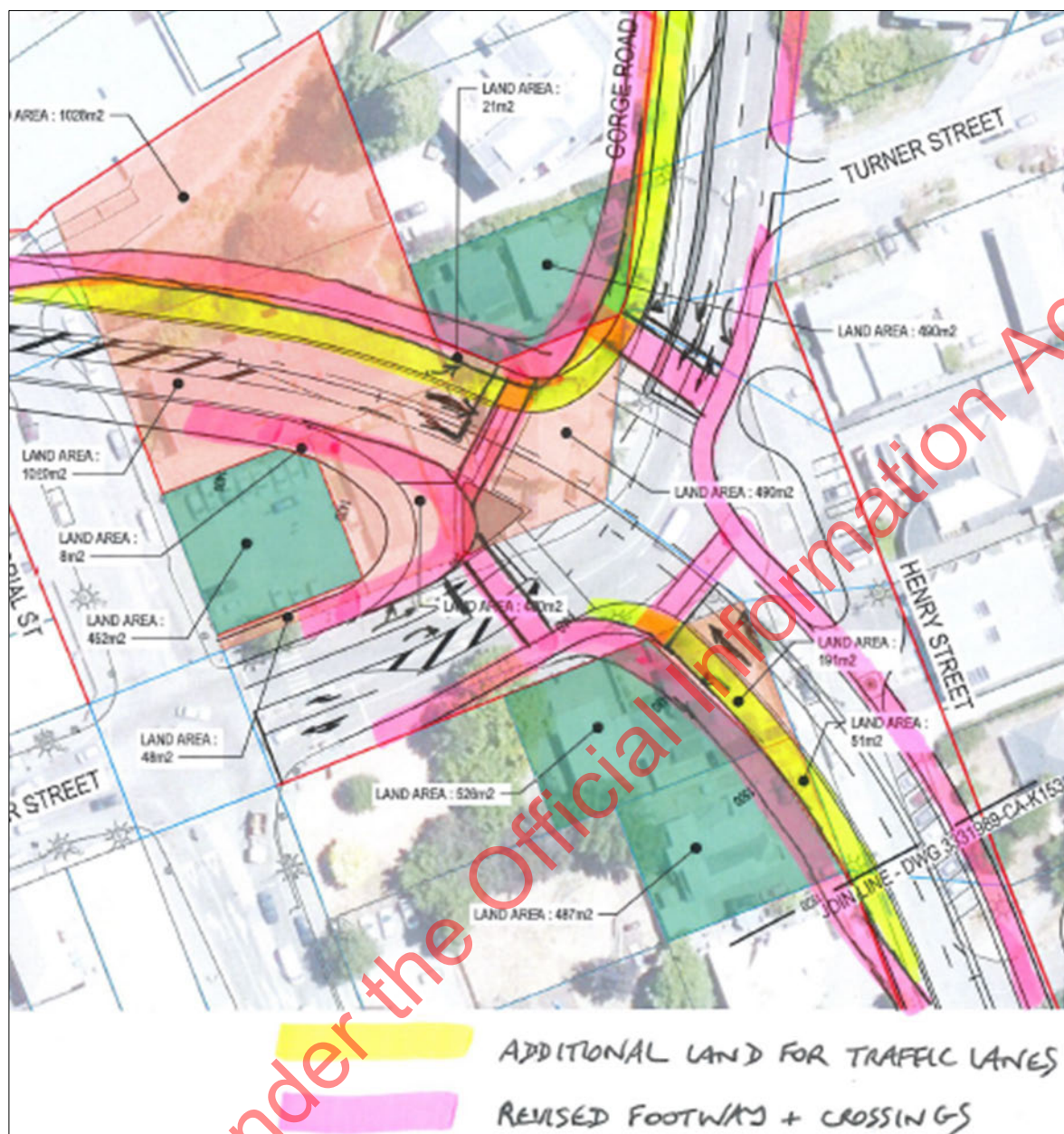


Figure 5: Expanded 4-arm intersection layout

These improvements clearly have a significant impact on the land take requirements to achieve this expanded intersection footprint. The Queenstown Town Centre Masterplan Advisory Group expressed concern with the size of the intersections for the town centre as proposed.¹ The revised results are shown in Table 2.

The results show improved operation with the forecast traffic levels being able to be served (i.e. all movements are operating in an undersaturated condition), albeit most movements are still operating at LOS E. This is primarily due to the relatively high cycle time operating at the intersection of 120 seconds (in order to provide sufficient vehicular capacity).

¹ QLDC Town Centre Masterplan, Recommendations from Advisory Group Presentation No. 4 held 26 September 2017

Table 2: Operational performance for expanded 4-arm intersection

Approach	Movement	Volume	V/C	LoS
Henry Street	L+A	475	76%	E
	R	211	82%	F
Shotover Street	L+A	215	80%	E
	R	227	81%	E
Memorial Street	L+A	468	48%	E
	R	23	55%	E
Gorge Road	L+A	272	82%	E
	R	134	82%	E
Intersection				E

2 x 3-Arm Option ("Double-T")

As for the 4-arm arrangements, the layouts have been amended to remove triangular islands and minimise the footprint of the intersection. The resultant intersection of the double-T arrangements is shown in (Figure 6).



Figure 6: Layout at Shotover Street/Gorge Road/Henry Street in Double-T arrangement

In terms of signal phasing structure, two options are available (at both halves of the Double-T):

- Pedestrians run separately in parallel with non-conflicting traffic movements (see Figure 7)
- All-red pedestrian phase (see Figure 8).

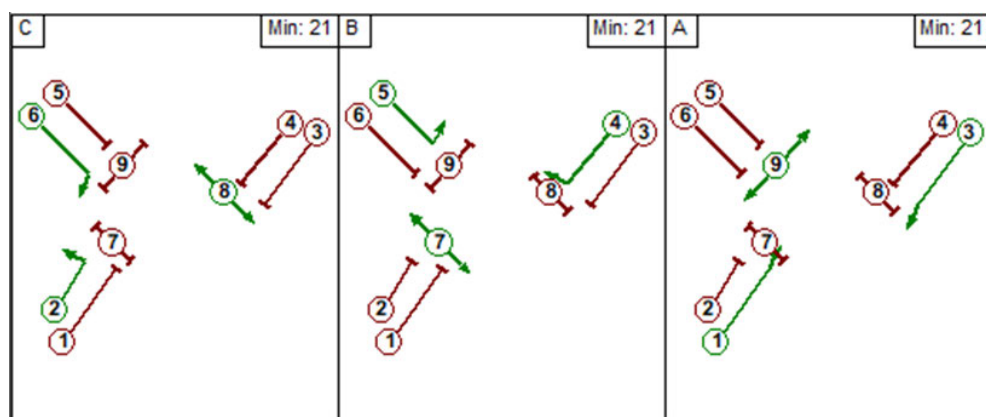


Figure 7: Phase Arrangement at Henry Street/Gorge Road with pedestrians running with non-conflicting traffic movements

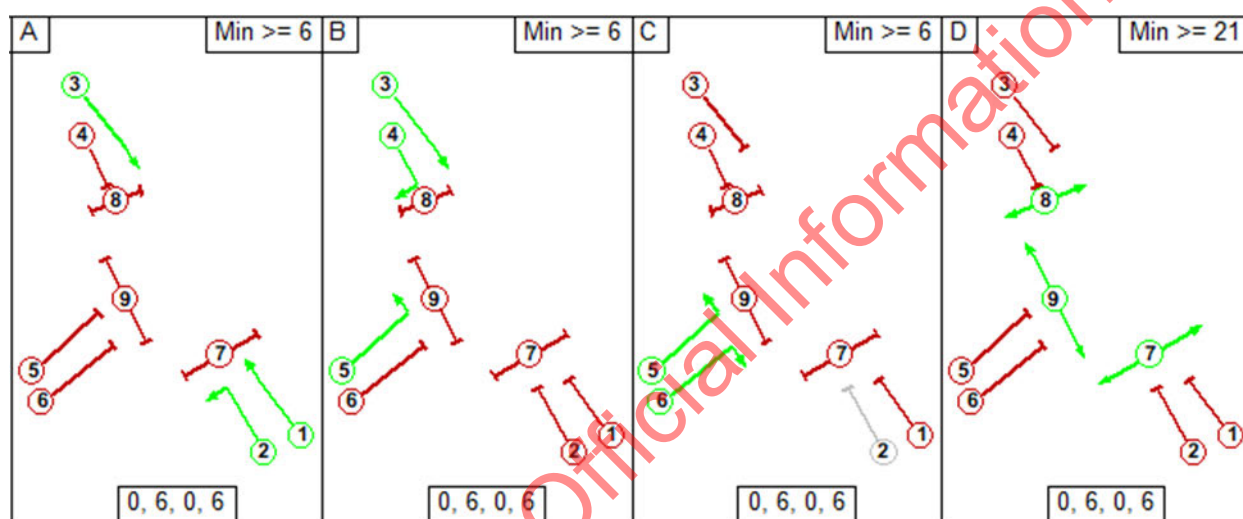


Figure 8: Phase Arrangement at Henry Street/Gorge Road with all-red pedestrian phase

In terms of signal cycle time:

- For the separately phased pedestrian phase alternative, a 100 second cycle time has been used.
- For the all-red pedestrian phase alternative, a 120 second cycle time has been used.

The difference is due to the additional lost time from operating an all-red pedestrian phase, which consequently requires a higher cycle time.

Table 3 shows the results of this assessment, using the 2028 Interpeak volumes (which are predicted to be slightly higher than AM and PM peak hour flows in 2028).

The results show satisfactory operation of the intersection is predicted for both options, although with little spare capacity in the all-red pedestrian phase alternative. It should be noted that the two internal approaches on Gorge Road to both intersections have lower V/C levels than other movements – this is an intended feature of the operation and is used to ensure that queue lengths in both directions of this internal section are minimised (or at least kept below the stacking area).

In both cases, the operation is an improvement on the 4-arm option – and the alternative with separate pedestrian movements also operates better than the enhanced 4-arm option.

The flexibility in signal phase structure is also important given the potential changes at adjacent intersections as stages of the Arterial are constructed, and changes are also made on Stanley Street around the improved PT hub, and associated signal operation changes at the Stanley Street/Shotover Street intersection. In terms of the latter, the internal link of Shotover Street between this intersection and the south half of the double-T (at Shotover/Henry) has limited stacking space, and therefore there will need to be careful consideration of any alterations to phase arrangement at the former intersection to optimise the co-ordination between the two intersections (and limit queuing in the internal section).

Table 3: Operational performance for double-T intersections

Approach	Movement	Volume (v/h)	Pedestrians with traffic		All-red pedestrian	
			V/C	LoS	V/C	LoS
Henry Street/Gorge Road/Shotover Street (South Intersection)						
Henry Street	L	251	84%	D	89%	D
	A	435	84%	D	89%	D
Shotover Street	L	215	58%	D	36%	D
	R	227	52%	D	90%	F
Gorge Road	A	424	59%	B	40%	A
	R	188	51%	C	79%	E
Intersection			D		D	
Memorial Street/Gorge Road/Shotover Street (North Intersection)						
Gorge Road (South)	L	236	45%	B	44%	C
	A	414	57%	D	67%	C
Memorial Street	L	151	71%	D	90%	E
	R	340	71%	D	90%	E
Gorge Road (North)	A	172	52%	C	87%	E
	R	134	52%	C	87%	E
Intersection			C		D	

August 2020 Update

As noted above, the original assessment was undertaken in November 2019 using the predicted flow volumes at the time.

The latest set of wider modelling work was completed in August 2020 to include the Arterial Stage 1 only, with models coded with various Arterial options. To provide an update, Table 4 shows the updated traffic flows from the associated scenario as compared to the existing assessment (2028 NZUP + Art12 + Stanley Closed) – the movements are shown for the 4-arm option format for simplicity, but the volumes can be simply re-assigned to the Double-T option.

The latest results show a relatively modest increase in total volumes of around 7.5%, but particularly on a number of critical movements such as 3 of the 4 right turns, and the Henry Street approach.

An assessment of the various layout options presented previously has been undertaken using the latest flow volumes. Table 5 shows a summary of the results – for brevity and ease of comparison, only the intersection LOS and worst performing movement in each scenario is shown.

Table 4: Comparison of Predicted 2028 Flow volumes (Interpeak hour)

Approach	Movement	Previous Volume	Latest Volume	Difference
Henry Street	L	251	305	+54
	A	224	224	=
	R	211	275	+64
Shofover Street	L	203	119	-84
	A	12	1	-9
	R	227	260	+33
Memorial Street	L	151	163	+12
	A	317	354	+37
	R	23	3	-20
Gorge Road	L	107	173	+66
	A	165	156	-9
	R	134	142	+8
Intersection		2025	2175	+150

Table 5: Updated intersection performance results

Layout Option	Demand Set	Worst Lane/Movement	V/C	Intersection LOS
4-arm (not enhanced)	Previous	Gorge Road L+A	111%	F
	Latest	Henry Street RT	142%	F
Double-T with individual pedestrian phases	Previous	Gorge Road LT	84%	C/D
	Latest	Gorge Road LT	97%	D
Double-T with pedestrian all-red	Previous	Memorial Street RT	90%	D
	Latest	Memorial Street RT	97%	E

Table 5 shows that:

- All scenarios show a deterioration in performance due to the increase in volumes, as would be expected.
- The 4-arm option shows a significant deterioration in performance (of around 25 percentage points). Operation is very poor with movements from all 4 arms predicting to operate at around 135-140% saturation.
- Both double-T options see a lesser deterioration, with operation very close to the capacity of the intersection.

The updated results are consistent with the previous conclusion that the double-T arrangement is predicted to perform better in terms of traffic efficiency than the 4-arm alternative.

Summary

In conclusion, it is recommended that the double-T arrangement is taken forward as the preferred option:

- The predicted operational performance is an improvement on the 4-arm option.
- The flexibility of operation (phase structure) provides the opportunity to operate a lower cycle time in the network, and therefore reduce pedestrian wait times, and vehicular queues on short internal sections between intersections.
- The arrangement is generally also more compatible with the change in network between Stage 1 and Stage 2 of the Arterial being constructed. The layout and operation of the Gorge/Shotover/Henry intersection is largely unchanged between these two scenarios.

Prepared by:

s 9(2)(a)

Principal Engineer Transportation (Project Team)

Reviewed By:

s 9(2)(a)

Project Design / Integration Manager

s 9(2)(a)

Project Team Leader

Released under the Official Information Act 1982