



Proposed Development Woong Tree, Cromwell

Transportation Assessment

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CARRIAGEWAY
CONSULTING

traffic engineering | transport planning



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1. Introduction

- 1.1. Wooing Tree Development Partnership LP proposes to seeks consents for a proposal for the Wooing Tree vineyard, just north of State Highway 8B (**the site**) under the COVID-19 Recovery (Fast-track Consenting) Act 2020. The area was subject to a previous plan change (Plan Change 12) which was approved and enables the site to be used for commercial and residential purposes. The current proposal seeks to amend the existing provisions for the site by facilitating a different pattern of development and a greater number of residences than was previously assessed. However the general type of development and scale of non-residential development that would be permitted will be unchanged from the previous approved plan change (and now, current zoning).
- 1.2. This Transportation Assessment sets out a detailed analysis of the transportation issues associated with the proposal including changes in travel patterns that are likely to arise from development of the site. Where potential adverse effects are identified, ways in which these can be addressed are set out.
- 1.3. This report is cognisant of the guidance specified in the New Zealand Transport Agency's '*Integrated Transport Assessment Guidelines*' and although travel by private motor vehicle is addressed within this report, in accordance with best practice the importance of other transport modes is also recognised. Consequently, travel by walking, cycling and public transport is also considered.





2. Site Overview

2.1. Location

2.1.1. The site is located on the northern side of State Highway 8B, on the northern side of Cromwell town centre, and is bounded by State Highway 6 to the west, Shortcut Road to the east, and residential properties to the north. Under the previous plan change to the Central Otago District Plan (**District Plan**), the site was zoned as a mixture of Resource Area provisions. It is currently used for rural activities.

2.1.2. The location of the site in the context of the local area is shown in Figure 1 and in more detail in Figure 2.

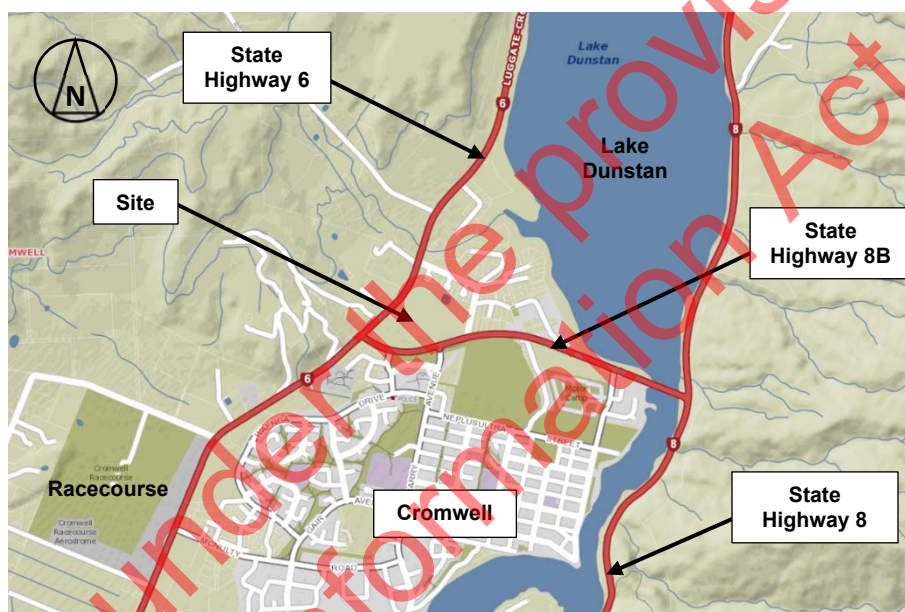


Figure 1: General Location of Site

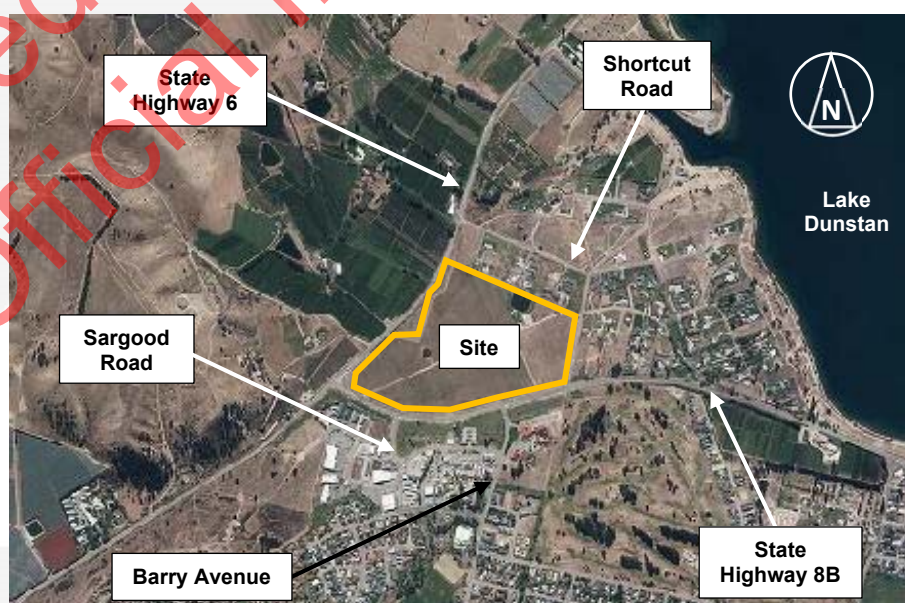


Figure 2: Aerial Photograph of Site and Environs



2.2. **Roading Classification**

- 2.2.1. The District Plan classifies State Highway 6 as a Rural State Highway with State Highway 8B being classified as an Urban State Highway. Barry Avenue is classified as an Urban Arterial Road with Sargood Road and Shortcut Road being classified as Urban Local Roads.
- 2.2.2. On this basis, it is reasonable to conclude that at a high level, the primary role of the highway is to carry through traffic, with through traffic also forming a high proportion of vehicles on Barry Avenue. Sargood Road and Shortcut Road provide for local journeys and property access.

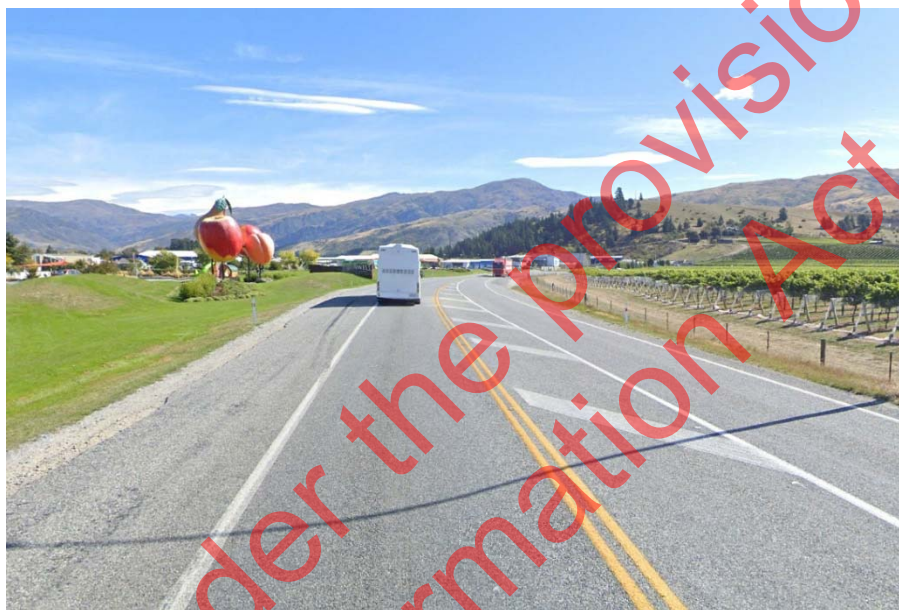
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3. Current Transportation Networks

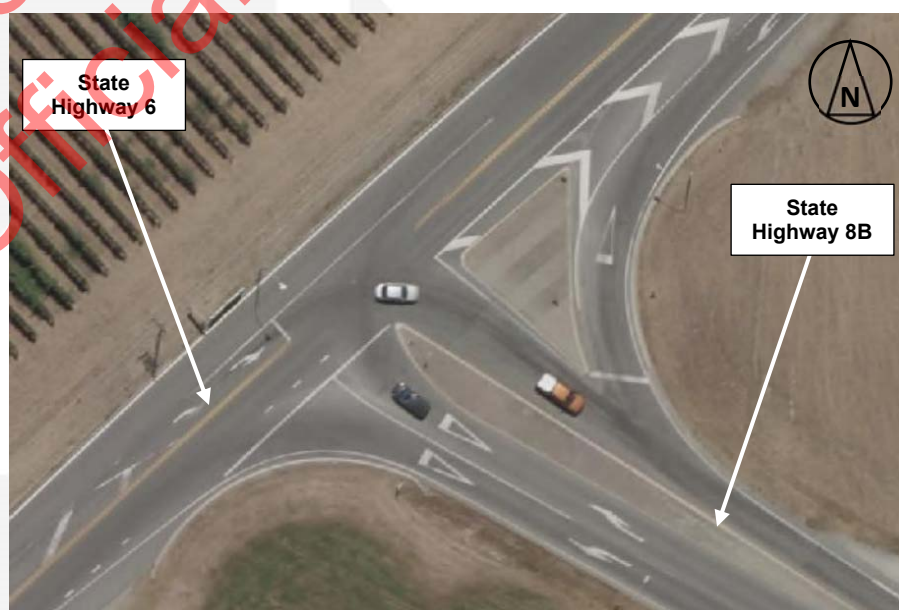
3.1. Roading Network

- 3.1.1. State highway 8B forms the southern boundary to the site. In this location it has a speed limit of 80km/h and provides one traffic lane in each direction of 3.5m width plus a sealed shoulder which varies up to 6m in width. There is an intermittent flush median along the highway which forms the taper to a number of right-turn auxiliary lanes at intersections between the highway and district roads.



Photograph 1: State Highway 8B, Looking West (Site on Right)

- 3.1.2. At its western end, State Highway 8B meets State Highway 6 at a priority ('give-way') controlled intersection. State Highway 8B flares as it approaches the intersection in order to provide two approach lanes over a distance of more than 100m. There are also auxiliary turning lanes for vehicles turning left and right from State Highway 6.



Photograph 2: Aerial Photograph of State Highway 6 / State Highway 8B Intersection

- 3.1.3. To the north of the intersection, State Highway 6 provides a connection towards Wanaka and the West Coast and to the south, the highway terminates at Invercargill.
- 3.1.4. Approximately 240m southeast of this intersection, Sargood Road meets State Highway 8B from the south at a priority ('give-way') controlled intersection. The intersection has auxiliary turning lanes for vehicles turning left and right from State Highway 8B, and a small amount of flaring on the Sargood Road approach.



Photograph 3: Aerial Photograph of State Highway 8B / Sargood Road Intersection

- 3.1.5. Sargood Road itself has a carriageway width of 11m and provides one traffic lane in each direction. It is subject to a 50km/h speed limit, and provides access to the western side of Cromwell town centre and to various other business activities further west.



Photograph 4: Sargood Road Looking South

- 3.1.6. Approximately 370m east of the State Highway 8B / Sargood Road intersection, Barry Avenue joins State Highway 8B from the south at a priority ('give-way') controlled intersection. This



intersection also has auxiliary turning lanes for vehicles turning left and right from State Highway 8B, and a small amount of flaring on the Barry Avenue approach. There is a landscaped central island on Barry Avenue.



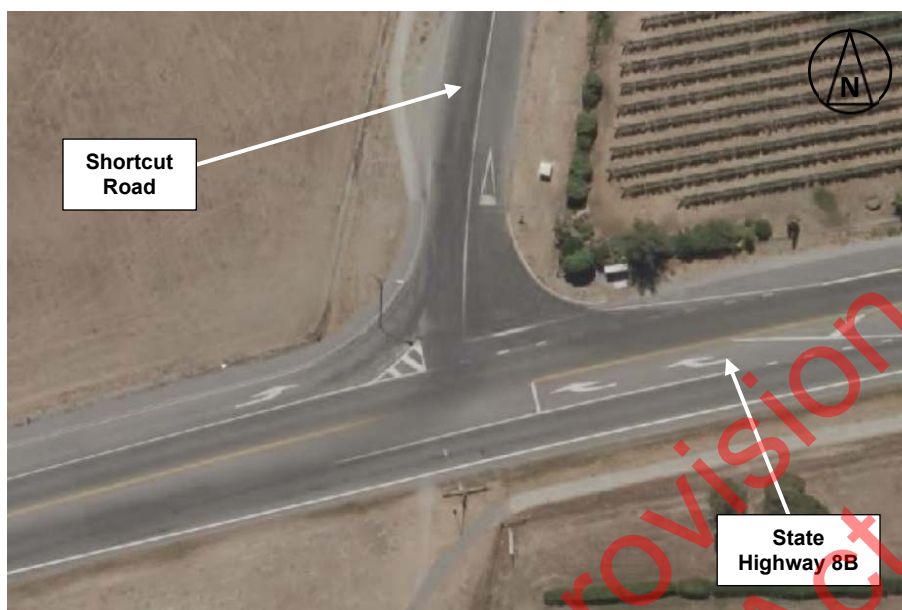
Photograph 5: Aerial Photograph of State Highway 8B / Barry Avenue Intersection

3.1.7. Barry Road has a carriageway width of 11m and provides one traffic lane in each direction. It is subject to a 50km/h speed limit, and provides access to the eastern side of Cromwell town centre.



Photograph 6: Barry Avenue Looking South

3.1.8. Approximately 230m east of the State Highway 8B / Barry Avenue intersection, Shortcut Road joins State Highway 8B from the north at a priority ('give-way) controlled intersection. This intersection also has auxiliary turning lanes for vehicles turning left and right from State Highway 8B, and a small amount of flaring on the Shortcut Road approach.



Photograph 7: Aerial Photograph of State Highway 8B / Shortcut Road Intersection

- 3.1.9. Shortcut Road has a carriageway width of 8m and provides one traffic lane in each direction. It is subject to a 50km/h speed limit, and provides access to the rural residential properties towards the north of Cromwell.



Photograph 8: Shortcut Road Looking South

- 3.1.10. At its eastern extremity, State Highway 8B meets State Highway 8 at a priority intersection, with auxiliary turning lanes on each approach. In turn, State Highway 8 has a broadly curved route, from Milton in the south (where it meets State Highway 1) to Timaru to the north (where it also connects to State Highway 1).

- 3.1.11. From State Highway 8B, Shortcut Road has a north-south alignment with rural residential properties on the eastern side. The formation of the road continues northwards towards Lake Dunstan, but the named Shortcut Road turns towards the west where it meets State Highway 6 at a priority ('give-way') controlled intersection. This intersection has auxiliary turning lanes for vehicles turning left and right from State Highway 6 into Shortcut Road, and a small amount



of flaring on the Shortcut Road approach. This intersection also has an auxiliary right-turn lane provided for vehicles turning from the north into the Jackson Orchards roadside produce outlet



Photograph 9: Aerial Photograph of State Highway 8B / Shortcut Road Intersection

3.1.12. This section of Shortcut Road has a carriageway width of 8m and provides one traffic lane in each direction. It is subject to a 50km/h speed limit, and provides access to the rural residential properties towards the north of Cromwell.



Photograph 10: Shortcut Road Looking West



3.2. Non-Car Infrastructure

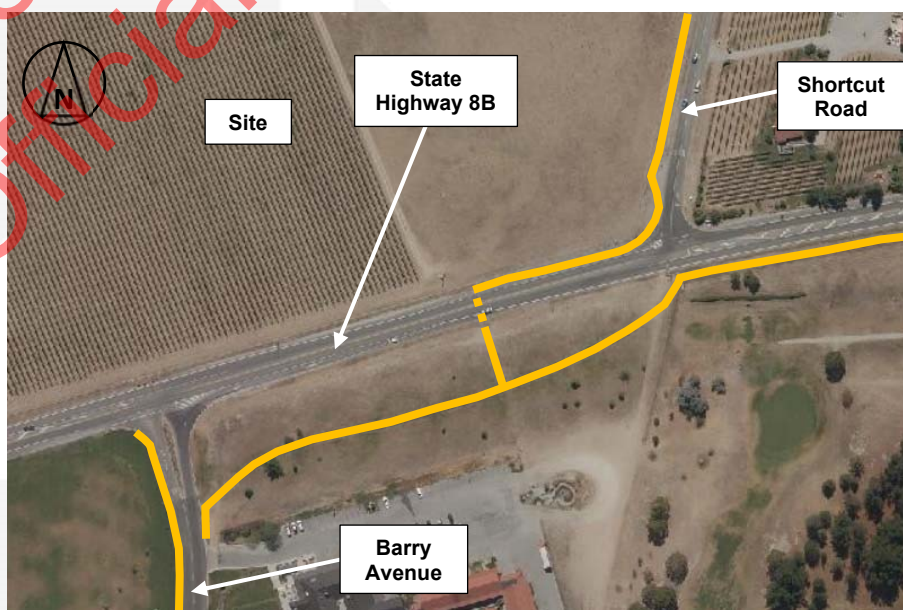
3.2.1. There is no specific infrastructure provided for cycling and public transport in the vicinity of the site. Cromwell does not have a regular scheduled bus service operating within the town, although there are services that connect Cromwell with Wanaka, Queenstown and Dunedin. The stops for these services are located just west of Barry Avenue, within the town centre.



Photograph 11: Bus Stops Within Cromwell

3.2.2. There is a network of footpaths around the site, with a footpath provided on the western side of Shortcut Road which extends over around 80m on the northern side of State Highway 8B. There is then a crossing point provided, and the footpath then connects to a route to Barry Avenue. Barry Avenue also has a footpath along the western side of the road.

3.2.3. There are no footpaths on State Highway 8B beyond 80m from Shortcut Road, nor on State Highway 6 or Sargood Road. East of Shortcut Road there is a footpath on the southern side of the highway nearly as far as Bell Avenue.



Photograph 12: Locations of Footpaths



3.3. *Future Changes*

- 3.3.1. Waka Kotahi NZ Transport Agency confirmed in February 2020 that it intends to construct a roundabout at the State Highway 6 / State Highway 8B intersection. Although no timeframes have been confirmed for this, it is typically that a large roundabout scheme would take around three years to design and construct, which suggests it could become operational in 2023.
- 3.3.2. In accordance with best practice, it can be expected that the current extent of development permitted within the Wooing Tree site will be taken into account in the roundabout design, as it forms part of the receiving environment.
- 3.3.3. It is also understood that when the roundabout is constructed, Waka Kotahi NZ Transport Agency intends to reduce the speed limit on State Highway 8B to 60km/h. As set out below, irrespective of any formal speed reduction, it will be difficult for a driver to exceed this speed regardless on the western section of the highway, and therefore this assessment allows for the lower speeds.

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4. Current and Future Transportation Patterns

4.1. Existing Traffic Flows

4.1.1. Waka Kotahi NZ Transport Agency carries out regular traffic counts on the state highway network. The closest traffic count on State Highway 8B is located just east of the intersection with State Highway 6 (counter 08B00002), and in 2018 (the most recent date for which data is available), the highway carried an Annual Average Daily Traffic volume of 7,780 vehicles.

4.1.2. This figure represents annual traffic growth of 6.0% (on a 2018 base) over the past four years, but when a longer timeframe of ten years is considered, the growth rate equates to 3.8% per annum (on a 2018 base). In other words, the rate of traffic growth has accelerated over the past five years compared to previous levels. For the purposes of this assessment, and taking into account the current economic outlook and COVID-19 matters, it is considered that the longer-term rate is the more appropriate to use and therefore a rate of 4% per annum has been applied.

4.1.3. Although the survey station does not count data continuously, sufficient information is recorded to enable a breakdown of the daily flows to be derived for the calendar year 2019:

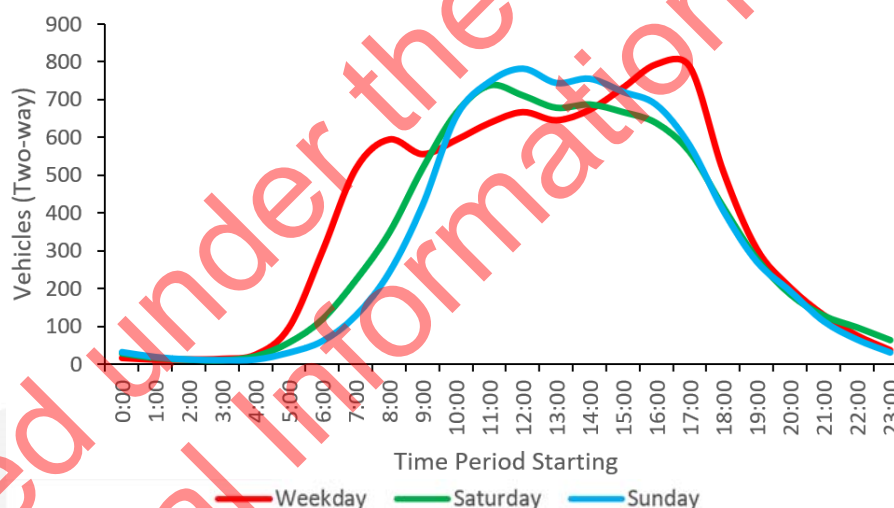


Figure 3: Traffic Flows on State Highway 8B, 2019

4.1.4. As shown above, the weekday traffic flows display a (small) morning and (larger) evening peak hour. The average recorded traffic flows were:

- Morning peak hour, 8am to 9am: 595 vehicles (two-way); and
- Evening peak hour, 4pm to 5pm: 794 vehicles (two-way)

4.1.5. During weekends, the peak traffic flows are broadly similar to those in the weekday evening peak hour with 738 vehicles (two-way) between 11am and 12pm on Saturday and 782 vehicles (two-way) on Sunday between 12pm to 1pm.

4.1.6. Previous plan changes in the Cromwell area have identified that traffic flows on the highways are seasonal. Comparing the average daily traffic flow in each month for the past two years shows the following:

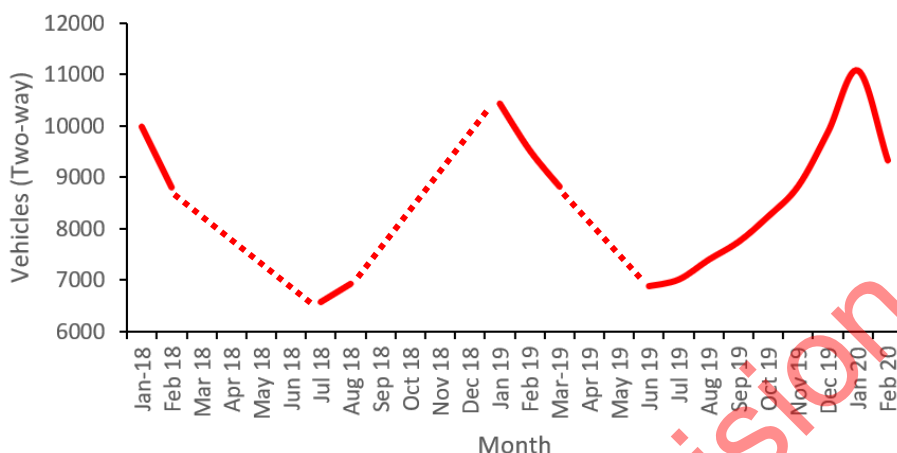


Figure 4: Average Daily Traffic Flows by Month on State Highway 8B

4.1.7. The graph is only partial because data is not collected continuously (missing data is shown as dashed in the graph above), but the counter shows a pattern of the summer months having greater traffic flows than the winter months.

4.1.8. The MobileRoad website shows the following daily traffic flows on the district roads in the area:

- Barry Avenue (near State Highway 8B): 3,100 vehicles (two-way);
- Shortcut Road (near State Highway 8B): 750 vehicles (two-way);
- Shortcut Road (near State Highway 6): 750 vehicles (two-way); and
- Sargood Road (near State Highway 8B): 4,500 vehicles (two-way).

4.1.9. The data recorded from counter on the highway shows that the morning peak hour volumes are 7.6% of the daily flow with the evening peak hour being 10.2% of the day flow. Applying these proportions to the district road suggests the peak hour volumes are:

- Barry Avenue (near State Highway 8B): 235-315 vehicles (two-way);
- Shortcut Road (near State Highway 8B): 60-80 vehicles (two-way);
- Shortcut Road (near State Highway 6): 60-80 vehicles (two-way); and
- Sargood Road (near State Highway 8B): 340-460 vehicles (two-way).

4.1.10. As part of Plan Change 12, turning surveys were carried out along State Highway 8B in the weekday peak hours in October 2016. These are shown below.

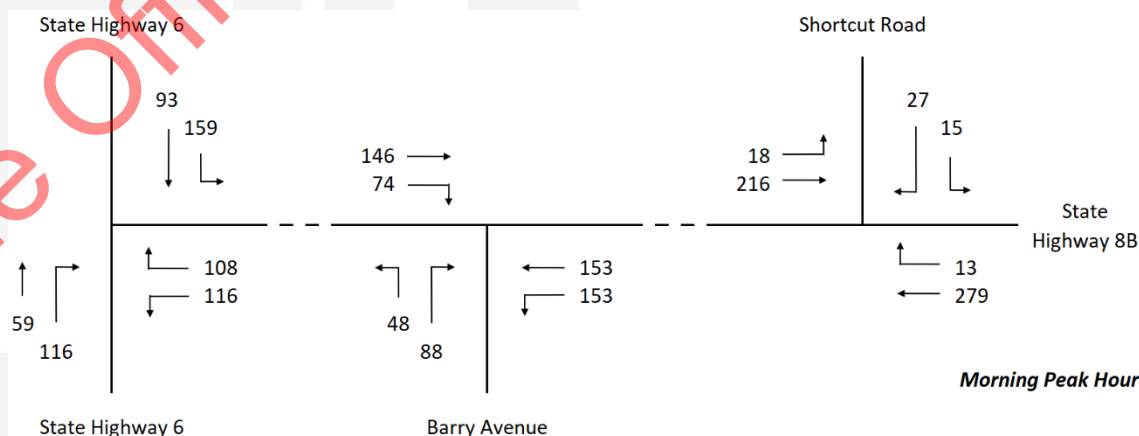


Figure 5: Observed Turning Volumes, Morning Peak Hour, 2016

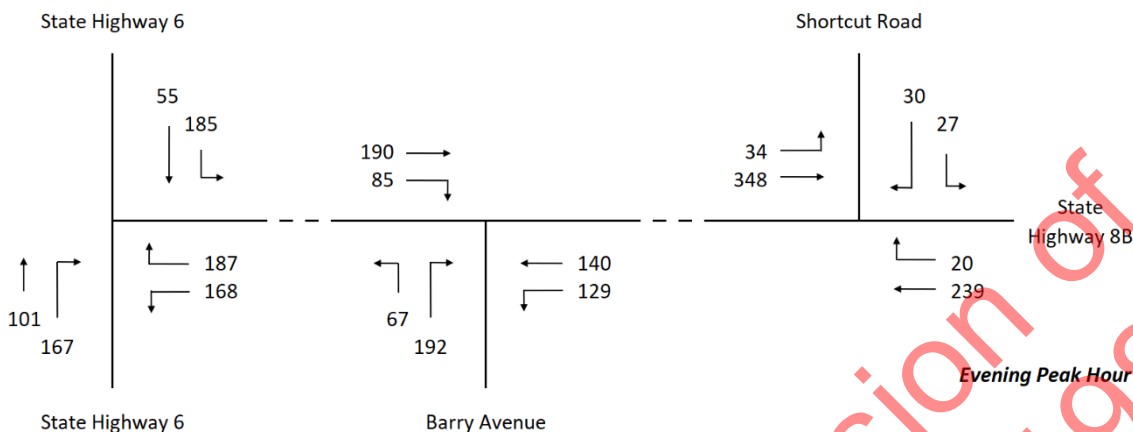


Figure 6: Observed Turning Volumes, Evening Peak Hour, 2016

4.1.11. No traffic volumes were observed at the State Highway 6 / Shortcut Road intersection. However it is reasonable to anticipate that the volumes on the highway at the same as observed at the State Highway 6 / State Highway 8B intersection. In respect of the turning volumes, the configuration of the road network means that the traffic flows turning to and from Shortcut Road will be similar to those at the State Highway 8B / Shortcut Road intersection. As can be seen above, this equates to around 20 turning vehicles on each movement in the morning peak hour, and 30 turning vehicles on each movement in the evening peak hour. Thus a synthesised turning volume has been adopted on each movement in these peak hours.

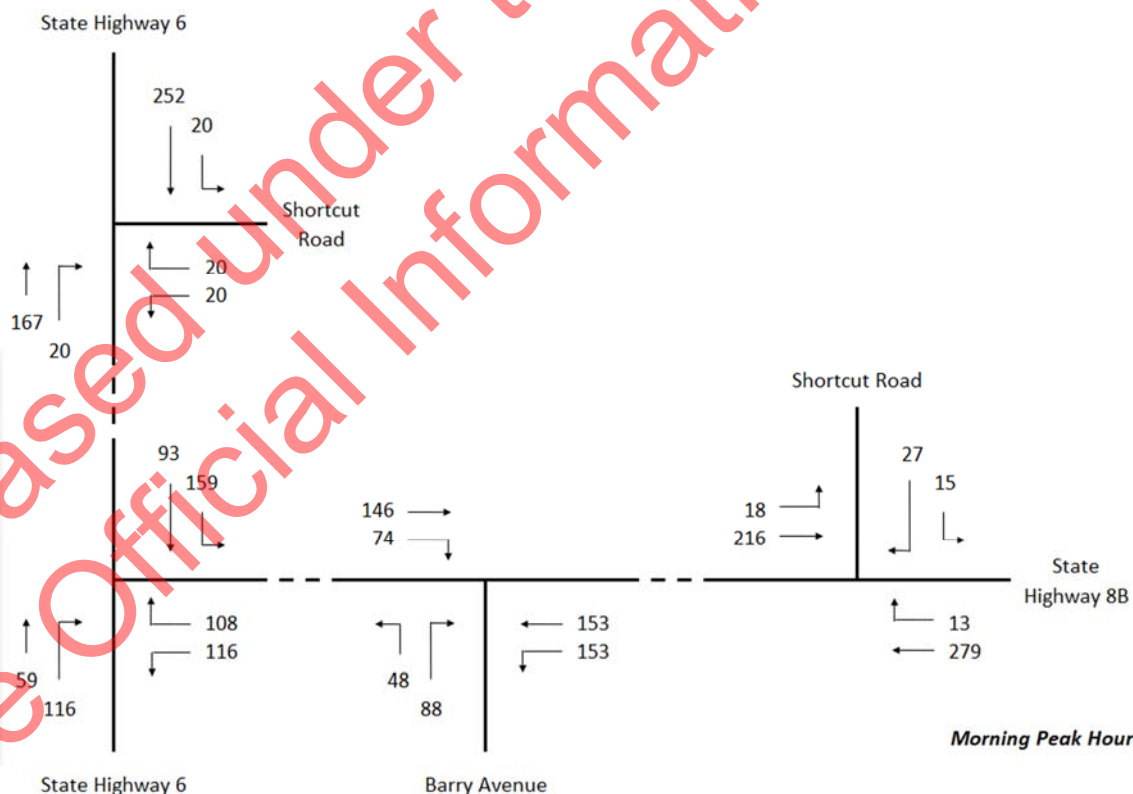


Figure 7: Observed and Synthesized Turning Volumes, Morning Peak Hour, 2016

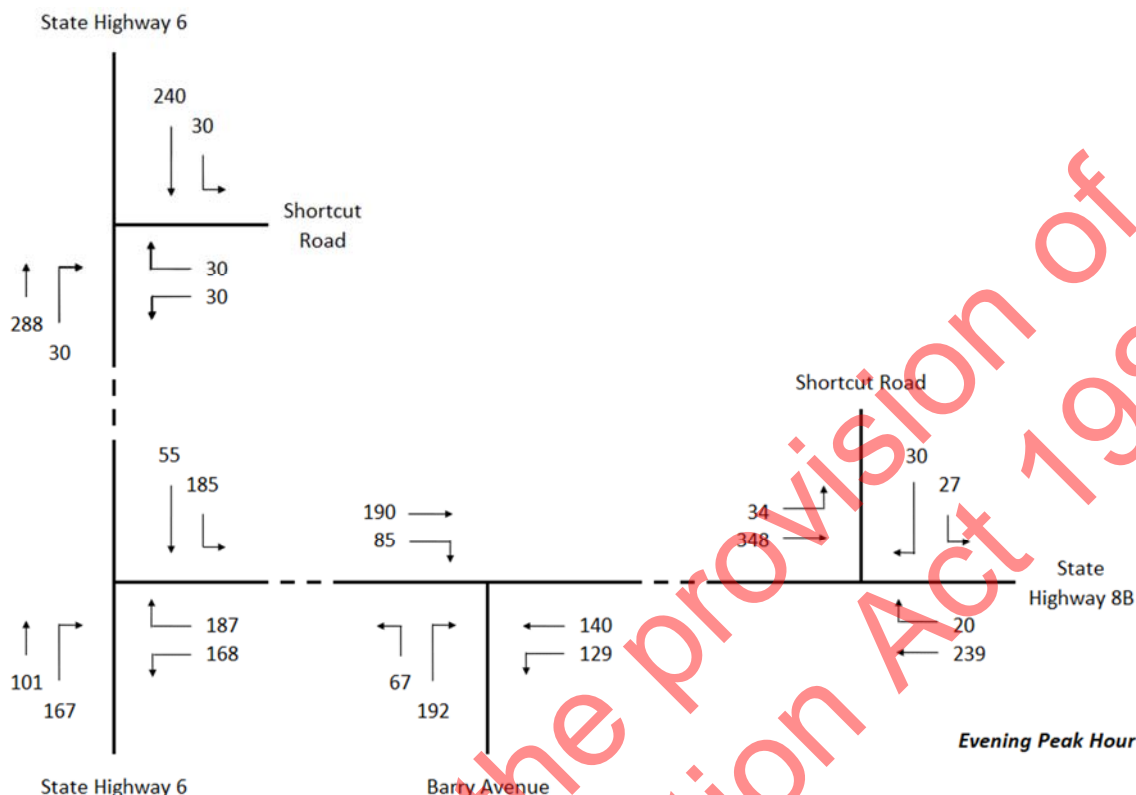


Figure 8: Observed and Synthesized Turning Volumes, Evening Peak Hour, 2016

4.1.12. As noted above, traffic flows on the highway are seasonal. Comparing October 2019 to the busiest month of January, traffic flows in the latter are around 30% greater. Previous plan changes within Cromwell have been requested by the Council to take this seasonality into account, and so for consistency the same approach has been used within this analysis.

4.2. Future Traffic Flows

4.2.1. The data shows that 431 vehicles were observed at the location of the automatic traffic counter in the morning peak hour, compared to 595 vehicles recorded in 2019 (27.5% less). Further, The data shows that 607 vehicles were observed at the location of the automatic traffic counter in the evening peak hour, compared to 794 vehicles recorded in 2019 (23.6% less). The difference is due to the ambient traffic growth in the area, and therefore the observed 2016 traffic flows on the highway have been increased by 28% and 24% respectively so that they reflect current conditions.

4.2.2. Furthermore, for plan change requests, it is best practice to evaluate the transportation effects ten years into the future. While this is a proposal progressed under the COVID-19 Recovery (Fast-track Consenting) Act 2020 and is not a plan change per se, the same approach has been taken within this report in order to provide a robust assessment. As set out above, the longer-term rate of 4% per annum has been applied and therefore the through traffic on the highway has been increased by 44%¹.

4.2.3. For clarity, no adjustments have been made to the turning volumes at the minor approaches to the intersections.

¹ 4% to bring the volumes to 2020, and then a further 10 years at 4% per annum



4.2.4. The traffic flows used as the receiving environment are shown below.

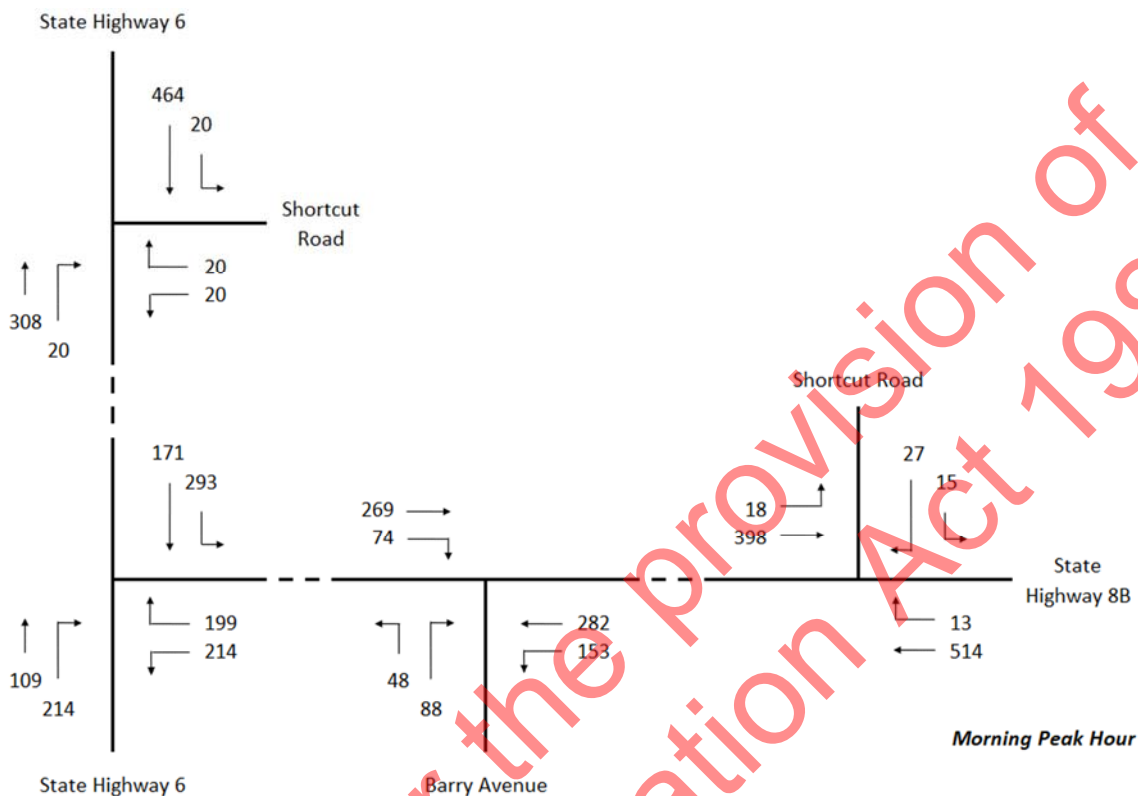


Figure 9: Turning Volumes, Morning Peak Hour, Design Year of 2030, No Development of Site

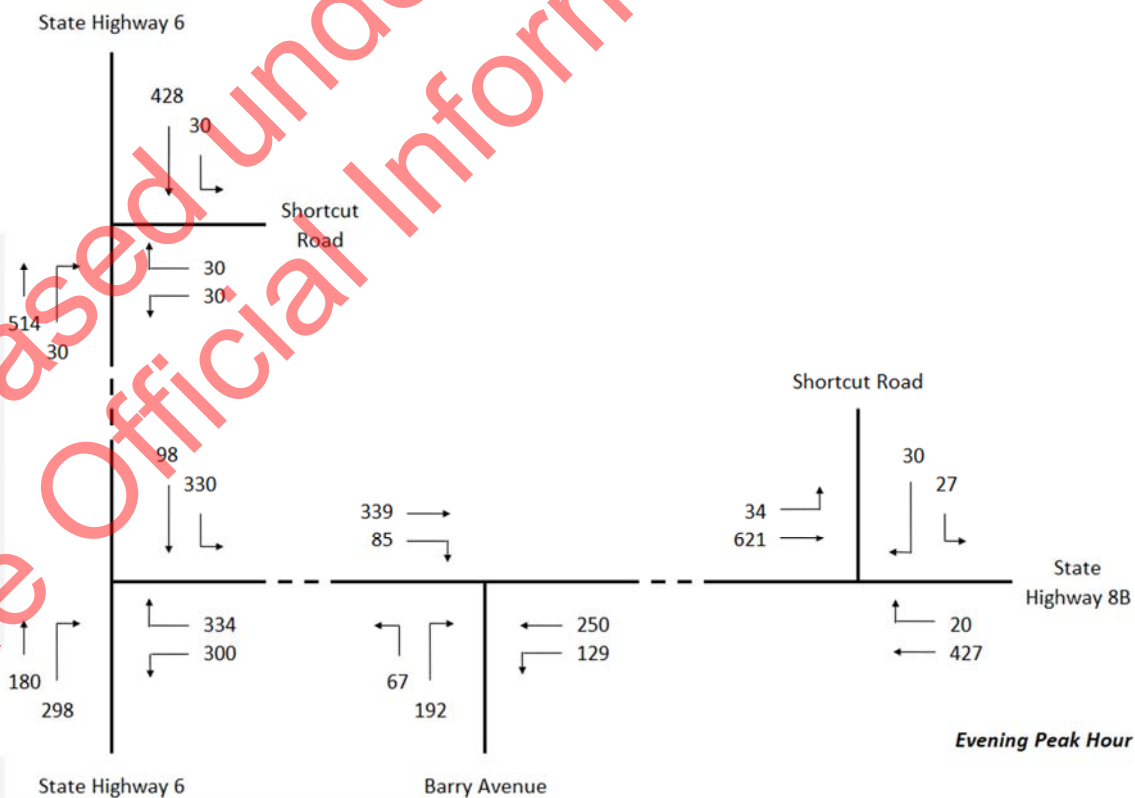


Figure 10: Turning Volumes, Evening Peak Hour, Design Year of 2030, No Development of Site



- 4.2.5. As noted above, the State Highway 6 / State Highway 8B intersection is due to be upgraded to a roundabout in the near future. It is therefore of little relevance to model the existing intersection, which Waka Kotahi NZ Transport Agency describes as experiencing pressure at peak times due to increased numbers of tourists. At the same time however, to date no roundabout layout has been devised for the intersection. For the purposes of analysis, a notional roundabout layout has been tested, which is simply a duplicate of the geometry of the State Highway 84 / Anderson Road roundabout further north (within Wanaka).
- 4.2.6. The geometry of the State Highway 8B / Barry Avenue and State Highway 8B / Shortcut Road intersections has been assumed to remain unaltered.
- 4.2.7. The existing intersections have been assessed with the traffic flows shown above using the computer software package Sidra Intersection, and the results are summarised below.

Road and Movement		Morning Peak Hour			Evening Peak Hour		
		Avg Delay (secs)	95 %ile Queue (veh)	Level of Service	Avg Delay (secs)	95 %ile Queue (veh)	Level of Service
State Highway 6 (south)	R	10.1	1	B	10.8	1	B
State Highway 8B	R	10.1	1	B	9.8	1	A
State Highway 6 (north)	T	4.3	1	A	5.0	2	A

Table 1: Performance of Notional State Highway 6 / State Highway 8B Roundabout in 2030, No Development of Site

Road and Movement		Morning Peak Hour			Evening Peak Hour		
		Avg Delay (secs)	95 %ile Queue (veh)	Level of Service	Avg Delay (secs)	95 %ile Queue (veh)	Level of Service
Barry Avenue	L	6.4	0	A	6.2	0	A
	R	12.3	1	B	17.2	3	C
State Highway 8B (east)	L	6.1	1	A	6.2	1	A
State Highway 8B (west)	R	5.7	0	A	5.6	0	A

Table 2: Performance of State Highway 8B / Barry Avenue Intersection in 2030, No Development of Site

Road and Movement		Morning Peak Hour			Evening Peak Hour		
		Avg Delay (secs)	95 %ile Queue (veh)	Level of Service	Avg Delay (secs)	95 %ile Queue (veh)	Level of Service
State Highway 8B (east)	R	8.5	0	A	10.2	0	B
Shortcut Road	L	7.4	0	A	10.6	0	B
	R	17.3	0	C	23.3	1	C
State Highway 8B (west)	L	7.5	0	A	7.5	0	A

Table 3: Performance of State Highway 8B / Shortcut Road Intersection in 2030, No Development of Site



Road and Movement		Morning Peak Hour			Evening Peak Hour		
		Avg Delay (secs)	95 %ile Queue (veh)	Level of Service	Avg Delay (secs)	95 %ile Queue (veh)	Level of Service
State Highway 6 (south)	R	9.0	0	A	8.8	0	A
Shortcut Road	L	8.2	0	A	6.8	0	A
	R	13.7	0	B	18.8	0	C
State Highway 6 (north)	L	7.5	0	A	7.6	0	A

Table 4: Performance of State Highway 6 / Shortcut Road Intersection in 2030, No Development of Site

4.2.8. The modelling shows that each of the intersections can accommodate the expected traffic volumes without significant queues or delays arising.

4.3. Non-Car Modes of Travel

4.3.1. Given that the area immediate adjacent to the site is predominantly rural and rural residential, it can reasonably be expected that it will be relatively lightly used by pedestrians and cyclists. During site visits, few pedestrians or cyclists were observed. It is considered that the walking routes provided for these road users are therefore reasonable.

4.3.2. As noted above, there are no regular bus services that pass the site. Although several longer-distance services pass nearby on the highway, there are no bus stops provided within walking distance other than those within the town centre.

4.4. Road Safety

4.4.1. The NZTA Crash Analysis System has been used to establish the location and nature of the recorded traffic crashes in the vicinity of the site. All reported crashes for the past five years (between 2015 and 2020) were identified along the boundary of the site:

- Shortcut Road, from State Highway 6 to State Highway 8B;
- State Highway 6, from Shortcut Road to State Highway 8B; and
- State Highway 8B, from State Highway 6 to Shortcut Road.

4.4.2. The assessment showed that 29 crashes had been recorded.

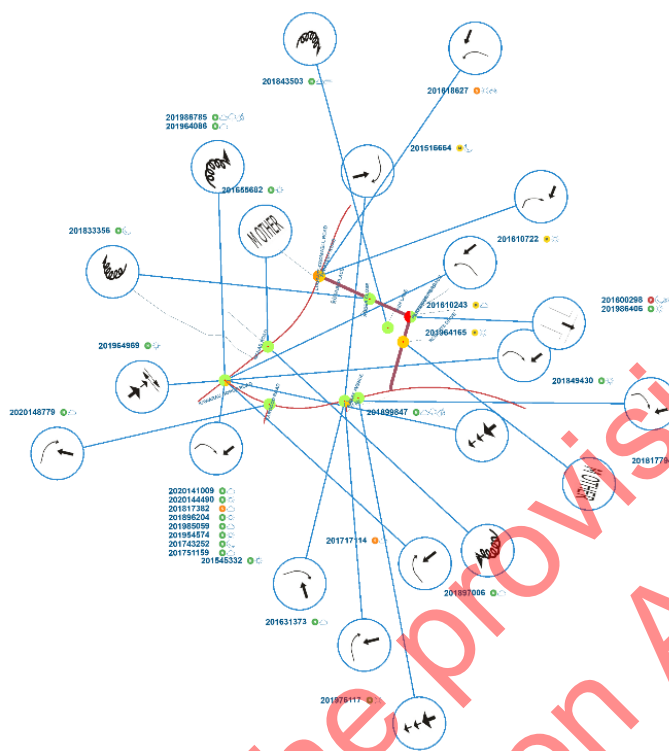


Figure 11: Crash Diagram, 2015-2020

4.4.3. The data shows that:

- Two crashes were reported at the State Highway 6 / Shortcut Road intersection
 - One crash occurred when a vehicle turned left out of Shortcut Road and struck a southbound cyclist on State Highway 6. This resulted in serious injuries
 - One crash occurred when a vehicle turned right into the fruit stall from State Highway 6 and struck a northbound vehicle on the highway. This resulted in minor injuries
- Two crashes were reported at the Shortcut Road / Partridge Road intersection (where Shortcut Road turns through 90-degrees)
 - One crash occurred when an intoxicated rider without a helmet, travelling eastbound on Shortcut Road failed to turn and left the road crashing into a fence. The rider suffered fatal injuries.
 - One crash occurred when an eastbound driver failed to notice the intersection, failed to turn and left the road. This did not result in any injuries.
- Four crashes were reported at the State Highway 8B / Barry Avenue intersection
 - Three crashes occurred when a vehicle turned right out of Barry Avenue and struck a westbound vehicle on State Highway 8B. One resulted in minor injuries and two did not result in any injuries.
 - One crash occurred when a vehicle turned right into Barry Avenue and was struck by a westbound vehicle on State Highway 8B. This did not result in any injuries.
- 15 crashes were reported at the State Highway 6 / State Highway 8B intersection
 - Nine crashes occurred when a vehicle turning right from State Highway 6 onto State Highway 8B failed to notice a southbound vehicle on State Highway 6 and turned directly in front. One crash resulted in serious injuries, one crash resulted in minor injuries and seven crashes did not result in any injuries.



- Two crashes occurred when a westbound vehicle on State Highway 8B ran into the rear of another vehicle waiting in the queue ahead. These did not result in any injuries.
 - Two crashes occurred when driver on State Highway 8B pulled out and was struck by a southbound vehicle on State Highway 6. One crash resulted in serious injuries and one crash resulted in minor injuries.
 - Two crashes occurred when a vehicle turning right from State Highway 6 onto State Highway 8B too quickly, skidded and left the road. These did not result in any injuries.
 - Two crashes were reported mid-block on State Highway 6 between State Highway 8B and Shortcut Road
 - One crash occurred when a vehicle exited a fruit stall and was struck by a northbound vehicle on the highway. This did not result in any injuries.
 - One crash occurred when a southbound driver on the highway drifted out of their lane, over-corrected, skidded and left the road. This did not result in any injuries.
 - One crash was reported south of the State Highway 8B / Sargood Road intersection
 - The crash occurred at a side road, when a vehicle emerged from the side road (Isles Street) and struck a northbound vehicle on Sargood Road. This did not result in any injuries.
 - One crash was reported mid-block on the northern section of Shortcut Road
 - The crash occurred when a driver swerved to avoid a cyclist and collided with mailboxes. This did not result in any injuries.
 - One crash was reported mid-block on the eastern section of Shortcut Road
 - The crash occurred when an intoxicated driver struck a fence while reversing from a driveway. This resulted in minor injuries.
 - One crash was reported mid-block on State Highway 8B between Shortcut Road and Barry Avenue
 - The crash occurred when a driver following a bus slowed to allow the bus to turn, and was struck from behind by another vehicle. This did not result in any injuries.
- 4.4.4. No crashes were reported at the State Highway 8B / Shortcut Road intersection or State Highway 8B / Sargood Road intersection.
- 4.4.5. The pattern of crashes does not indicate any particular safety-related deficiencies on this part of the roading network, other than at the State Highway 6 / State Highway 8B intersection. However as set out above, this intersection is due to be replaced by a roundabout in the near future.
- 4.4.6. To cross-check this, the Waka Kotahi Crash Estimation Compendium has been used to identify the expected crash rates at each location.

- State Highway 6 / State Highway 8B
 - Observed rate: 0.80 injury crashes per year
 - Calculated rate: 0.27 injury crashes per year
- State Highway 8B / Barry Avenue
 - Observed rate: 0.20 injury crashes per year
 - Calculated rate: 0.17 injury crashes per year
- State Highway 8B / Shortcut Road
 - Observed rate: 0.00 injury crashes per year
 - Calculated rate: 0.08 injury crashes per year
- State Highway 6 / Shortcut Road



- Observed rate: 0.40 injury crashes per year
- Calculated rate: 0.07 injury crashes per year

4.4.7. It can be seen that the observed rate is nearly three times higher than would be expected at the State Highway 6 / State Highway 8B intersection, and this is one reason cited for the forthcoming improvement scheme.

4.4.8. The rate is also higher at the State Highway 6 / Shortcut Road intersection. However both crashes had considerably different contributing factors and involved different turning movements and road users types. This does not suggest any particular roading-related concern.

4.4.9. The observed and expected rates are similar for the State Highway 8B / Barry Avenue and State Highway 8B / Shortcut Road intersections.

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5. Proposal

- 5.1. The type of development facilitated by the proposal is the same as proposed (and approved through Plan Change 12).
- 5.2. The documentation associated with the earlier plan change request set out that 186,800sqm of residential zoning was proposed, which would facilitate up to 210 residences. The current proposal is to allow for up to 350 residences.
- 5.3. Commercial use is also anticipated and within a total area of 24,700sqm, this would support a tourist-orientated 'vineyard village'. The types of activity are limited to avoid adverse retail effects on the existing Cromwell town centre, meaning that the shops typically include souvenir shops, cellar doors, fruit and vegetable sales, clothing, bike rental, ski and snowboard hire, jewellery, tourism-related booking services, and the like.
- 5.4. The provision made limits floor areas as follows:
 - Travellers accommodation of no more than 6,000sqm GFA
 - Shops of a total of no more than 3,000sqm GFA, with a convenience store being at most 100sqm GFA
 - A further 1,000sqm GFA of other activities
 - Subject to a total limit on building coverage of 7,500sqm GFA
- 5.5. The masterplan for the area shows two points of connection with the external network, onto State Highway 8B opposite Barry Avenue as a primary access, and onto Shortcut Road around 170m north of the highway as a secondary access. The connection onto State Highway 8B is made by a short link road which in turn connects to a network of internal routes within the site.

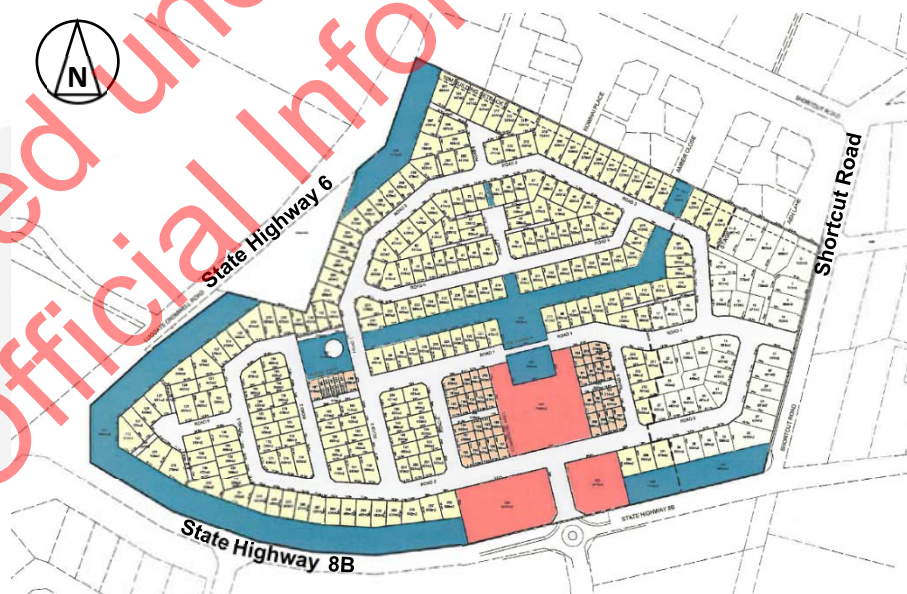


Figure 12: Indicative Masterplan (Extract from Adapt Studio Limited Drawing 'Masterplan Concept' Rev E)



6. Traffic Generation and Distribution

6.1. Traffic Generation

6.1.1. Traffic generated by residential developments is known to vary for a variety of reasons, with one such reason being the proximity (or otherwise) to employment and community facilities. Where a dwelling is some distance from these types of facilities, the traffic generation rates tend to be lower than for residences that are closer due to 'trip chaining', that is, the tendency of a resident to carry out multiple visits to different destinations during the same trip away from the dwelling. Conversely, trip rates are higher where residences are closer to such facilities.

6.1.2. Accordingly, for this analysis a rate of 8 vehicle movements per day per residence has been used, with 0.9 vehicle movements per residence occurring in each of the peak hours. Of these, recent plan changes in Cromwell have adopted 80% of these vehicles exiting a residential area in the morning peak hour (with 20% entering). In the evening, 65% of vehicles are anticipated to enter with 35% exiting.

6.1.3. This gives rise to the following traffic generation for the approved plan change and the current proposal:

- Approved plan change / current zoning
 - Morning peak hour: 151 vehicles exit and 38 vehicles enter; and
 - Evening peak hour: 66 vehicles exit and 123 vehicles enter
- Proposed development:
 - Morning peak hour: 252 vehicles exit and 63 vehicles enter; and
 - Evening peak hour: 110 vehicles exit and 205 vehicles enter

6.1.4. The retail element of the proposal is limited to specialist activities and therefore a lower traffic generation rate is appropriate rather than a higher rate (which would typically be biased towards retail activities that attract a greater number of customers, such as supermarkets). A rate of 5.6 vehicle movements per 100sqm GFA has been used in the evening peak hour, with a notional allowance of 20% of this in the morning peak hour (as most shops will not be open and/or attract many customers at this time). However the convenience store has been anticipated to generate a higher rate of 12 vehicle movements per 100sqm GFA in the evening peak hour, with the same ratio of 20% applied to the morning peak hour.

6.1.5. This gives rise to the following traffic generation, for both the approved plan change and the current proposal:

- Morning peak hour: 17 vehicles exit and 17 vehicles enter; and
- Evening peak hour: 87 vehicles exit and 87 vehicles enter

6.1.6. For the travellers accommodation, the traffic generation depends on the number of rooms provided and as such, it is necessary to convert from a floor area to a number of rooms. However the layout of the building is not currently known. The previous plan change proposal made an allowance for the maximum number of rooms to equate to 100sqm, taking account of back-of-house, communal areas, staff-only areas and the like, meaning that up to 60 rooms could be constructed. These would generate 0.8 vehicle movements per room in the peak hours and for this assessment, it has been assumed that all vehicles would exit in the morning (as guests check out or travel to other attractions) and in the evening peak hour, an allowance has been made for 75% of vehicles to enter (as guests arrive) and 25% of vehicles to exit (as guests travel for evening activities and meals)



6.1.7. This gives rise to the following traffic generation for both the approved plan change and the current proposal:

- Morning peak hour: 48 vehicles exit and 0 vehicles enter; and
- Evening peak hour: 12 vehicles exit and 36 vehicles enter

6.1.8. With regard to the remaining activities, Plan Change 12 allowed for a bar/restaurant. As this activity could be expected to have a relatively high traffic generation it is appropriate to adopt the same approach and a rate of 10.3 vehicle movements per 100sqm GFA has been used for the evening peak hour. Such activities tend not to be well-used in the morning peak hour and therefore a notional allowance has been made of 20% of the evening peak hour.

6.1.9. This gives rise to the following traffic generation for both the approved plan change and the current proposal:

- Morning peak hour: 5 vehicles exit and 5 vehicles enter; and
- Evening peak hour: 50 vehicles exit and 50 vehicles enter

6.1.10. However, there are three further matters that should be considered:

- Customers of the commercial activities that live outside the site will travel once but will visit multiple destinations within the site. Therefore there will be travel that is wholly internal to the site and will not appear on the external roads;
- Activities aimed at tourists will attract a higher proportion of minibuses and coaches than usual, which will diminish the traffic generation;
- Because of the proximity of the residential and commercial activities (both within the site and in the town centre), people will be more likely to walk than at other locations.

6.1.11. To reflect this, the external traffic generation of the commercial activities has been reduced by 10%. This gives rise to the following traffic generation:

Activity		Traffic Volumes			
		Morning Peak Hour		Evening Peak Hour	
		In	Out	In	Out
Approved Plan Change / Current Zoning	Residential	38	151	123	66
	Retail	17	17	87	87
	Travellers accommodation	0	48	36	12
	Bar/restaurant	5	5	50	50
	Internal travel @ 10%	-2	-7	-17	-15
	Total external trips	58	214	279	200
Current Proposal	Residential	63	252	205	110
	Retail	17	17	87	87
	Travellers accommodation	0	48	36	12
	Bar/restaurant	5	5	50	50
	Internal travel @ 10%	-2	-7	-17	-15
	Total external trips	83	315	361	244
Difference (proposed minus approved)		+25	+101	+82	+44

Table 5: Traffic Generation Arising from Approved Plan Change and Current Proposal



6.2. Trip Distribution

6.2.1. With regard to the distribution of these vehicles, the same approach has been adopted for the current proposal as was set out within the approved plan change:

Route	Via Primary Access onto State Highway 8B	Via Secondary Access onto Shortcut Road
To Cromwell town centre via Barry Ave	65%	0%
To Cromwell town centre via Sargood Rd	5%	0%
To eastern parts of Cromwell via Alpha St	4.5%	0.5%
Towards Queenstown	10%	0%
Towards Wanaka	1.5%	3.5%
Towards Omarama	4.5%	0.5%
Towards Alexandra	4.5%	0.5%

Table 6: Trip Distribution

6.2.2. This gives the following distribution of vehicles for the approved plan change / current zoning:

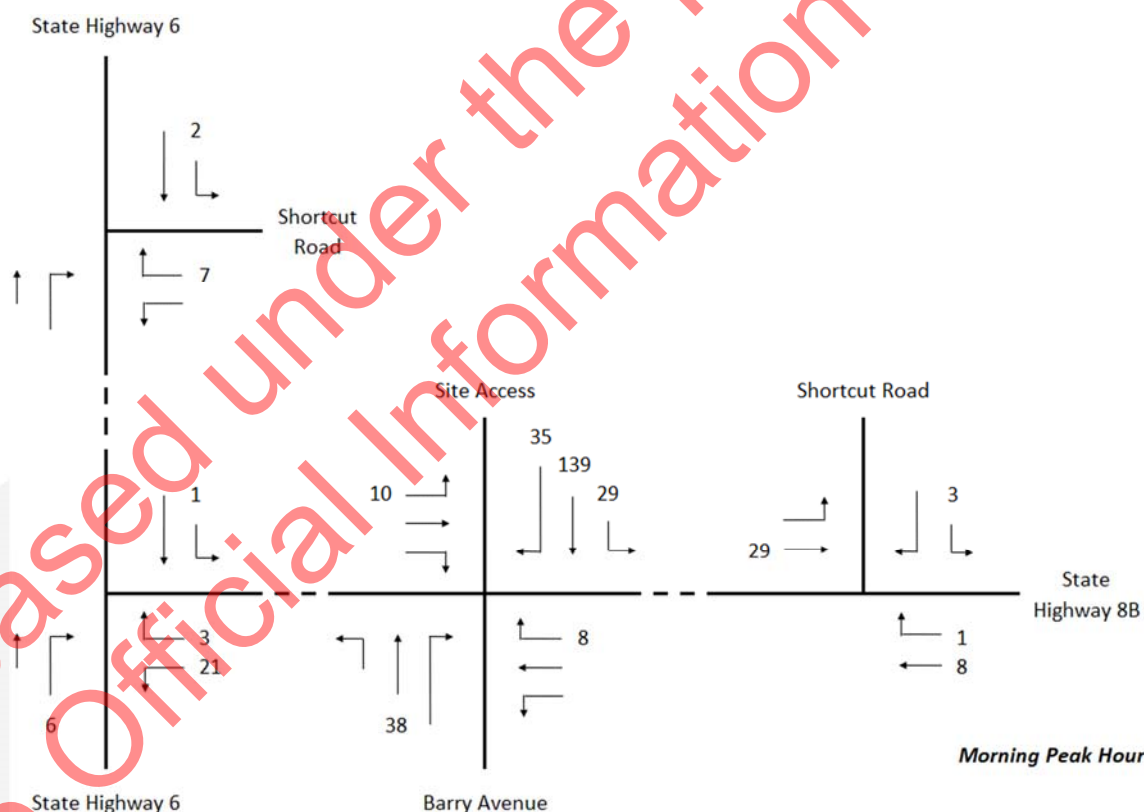


Figure 13: Turning Volumes for Approved Plan Change / Current Zoning, Morning Peak Hour

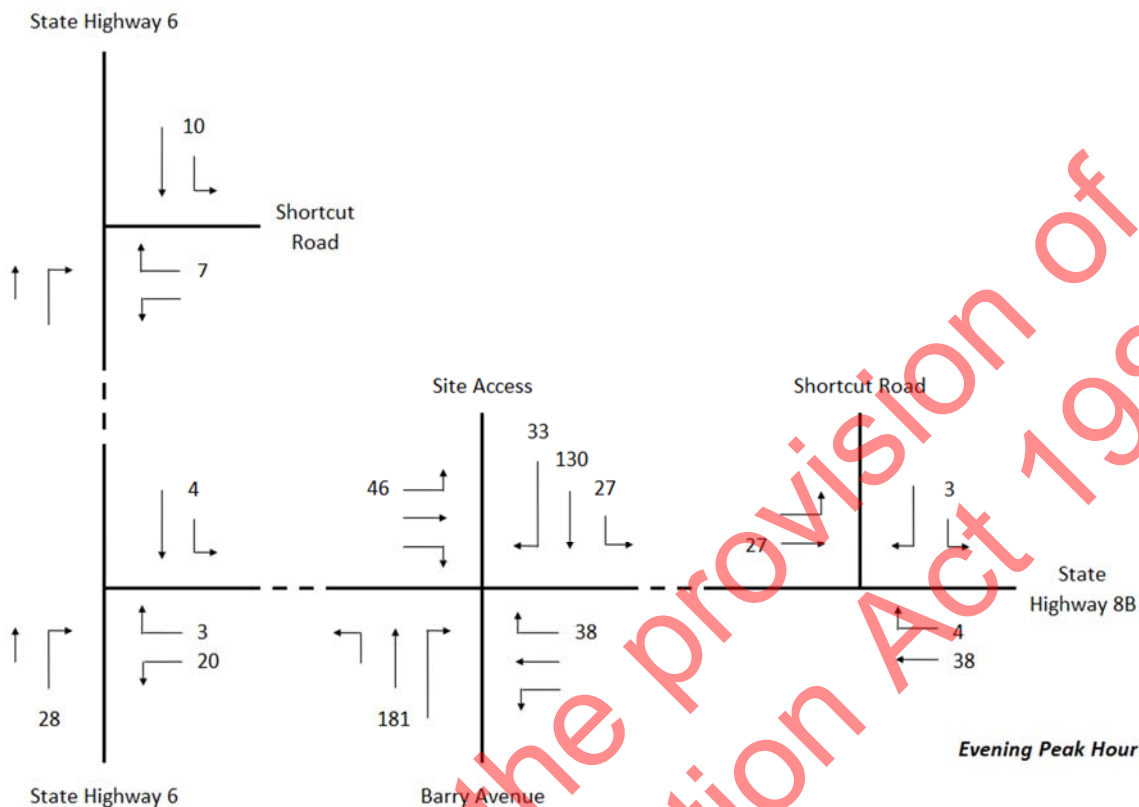


Figure 14: Turning Volumes for Approved Plan Change / Current Zoning, Evening Peak Hour

6.2.3. The following Figures shows the increase in traffic arising from the current proposal over and above the approved plan change:

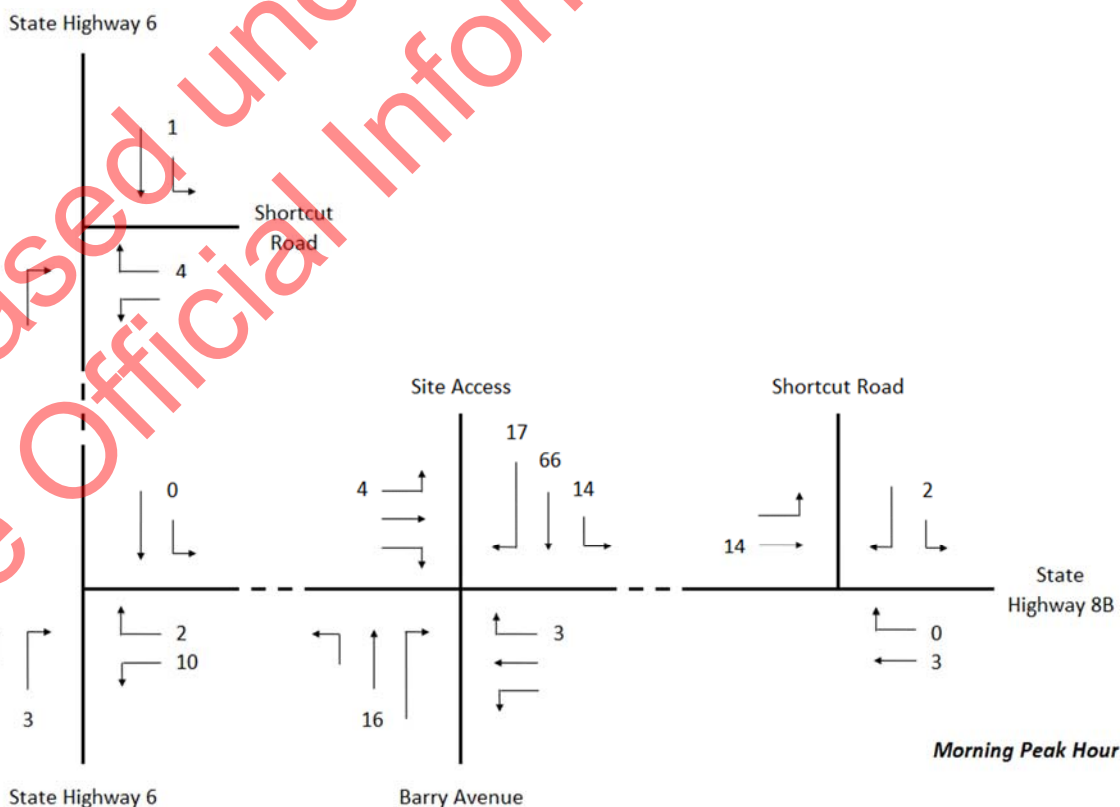


Figure 15: Increase in Turning Volumes for Current Proposal, Morning Peak Hour

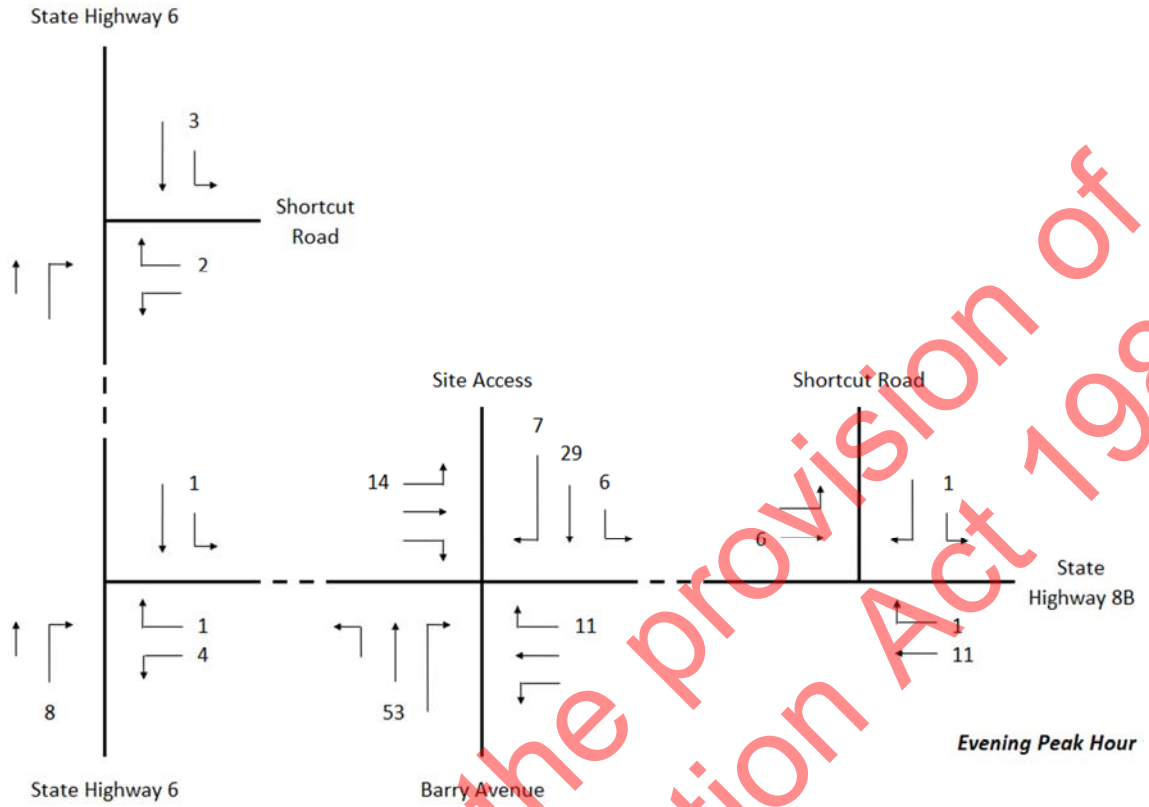


Figure 16: Increase in Turning Volumes for Current Proposal, Evening Hour Peak Hour

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7. Effects on the Transportation Networks

7.1. Intersection Capacity

7.1.1. The intersections affected by the traffic generated by full development of the site under both the current land use zoning and the proposed development have been reassessed using the computer software package Sidra Intersection, and the results are summarised below.

Road and Movement		Morning Peak Hour			Evening Peak Hour		
		Avg Delay (secs)	95 %ile Queue (veh)	Level of Service	Avg Delay (secs)	95 %ile Queue (veh)	Level of Service
Approved Plan Change / Current Zoning							
State Highway 6 (south)	R	10.1	1	B	10.9	2	B
State Highway 8B	R	10.1	1	B	9.8	1	A
State Highway 6 (north)	T	4.3	1	A	5.2	2	A
Proposed Development							
State Highway 6 (south)	R	10.1	1	B	10.9	2	B
State Highway 8B	R	10.1	1	B	9.8	1	A
State Highway 6 (north)	T	4.3	1	A	5.3	2	A

Table 7: Performance of Notional State Highway 6 / State Highway 8B Roundabout in 2030, Plus Development of Site

Road and Movement		Morning Peak Hour			Evening Peak Hour		
		Avg Delay (secs)	95 %ile Queue (veh)	Level of Service	Avg Delay (secs)	95 %ile Queue (veh)	Level of Service
Approved Plan Change / Current Zoning							
State Highway 8B (east)	R	8.7	0	A	10.5	0	B
Shortcut Road	L	7.7	0	A	11.2	0	B
	R	18.4	0	C	27.2	1	D
State Highway 8B (west)	L	7.5	0	A	7.5	0	A
Proposed Development							
State Highway 8B (east)	R	8.8	0	A	10.6	0	B
Shortcut Road	L	7.9	0	A	11.3	0	B
	R	18.9	0	C	28.3	1	D
State Highway 8B (west)	L	7.5	0	A	7.5	0	A

Table 8: Performance of State Highway 8B / Shortcut Road Intersection in 2030, Plus Development of Site



Road and Movement	Morning Peak Hour			Evening Peak Hour			
	Avg Delay (secs)	95 %ile Queue (veh)	Level of Service	Avg Delay (secs)	95 %ile Queue (veh)	Level of Service	
Approved Plan Change / Current Zoning							
State Highway 6 (south)	R	9.0	0	A	8.8	0	A
Shortcut Road	L	8.2	0	A	7.8	0	A
	R	13.9	0	B	19.1	1	C
State Highway 6 (north)	L	7.5	0	A	7.6	0	A
Proposed Development							
State Highway 6 (south)	R	9.0	0	A	8.8	0	A
Shortcut Road	L	8.2	0	A	7.8	0	A
	R	14.0	0	B	19.2	1	C
State Highway 6 (north)	L	7.5	0	A	7.6	0	A

Table 9: Performance of State Highway 6 / Shortcut Road Intersection in 2030, Plus Development of Site

- 7.1.2. It can be seen that all of these intersections provide an excellent level of service, and that the differences in queues and delays between the approved plan change / current zoning and the proposed development are negligible.
- 7.1.3. With regard to the site access at full development of the area, for the purposes of assessing intersection capacity, initially this was modelled with a notional crossroads layout at the State Highway 8B / Barry Avenue intersection with a right-turn auxiliary lane on the highway. The results of this showed that a crossroads would not have sufficient capacity for full development of the site, because although the Barry Avenue approach functioned satisfactorily in the morning peak hour, in the evening peak hour it was forecast to have large queues and delays.
- 7.1.4. Under Plan Change 12, a roundabout was anticipated to be constructed at this intersection. Although no detailed design was produced, a notional layout has been tested with one circulating lane and one lane on each approach. The results are summarised below for full development of the site:

Road and Movement	Morning Peak Hour			Evening Peak Hour			
	Avg Delay (secs)	95 %ile Queue (veh)	Level of Service	Avg Delay (secs)	95 %ile Queue (veh)	Level of Service	
Approved Plan Change / Current Zoning							
Barry Avenue (south)	R	10.8	1	B	11.3	3	B
State Highway 8B (east)	R	10.7	3	B	10.6	3	B
Site Access	R	11.6	1	B	13.2	2	B
State Highway 8B (west)	R	9.7	2	A	13.2	5	B
Proposed Development							
Barry Avenue (south)	R	11.0	1	B	12.0	4	B
State Highway 8B (east)	R	11.5	4	B	11.0	3	B
Site Access	R	11.9	2	B	13.4	2	B
State Highway 8B (west)	R	9.9	2	A	15.1	6	B

Table 10: Performance of Notional State Highway 8B / Barry Avenue Roundabout in 2030, Plus Development of Site



- 7.1.5. The modelling shows that a single lane roundabout with one lane on each approach would function with an excellent level of service.
- 7.1.6. Finally, the intersections have been reassessed to allow for seasonal traffic flows (as required by the Council on other recent plan changes) though increasing traffic on the state highway by 30%, and the results are summarised below.

Road and Movement		Morning Peak Hour			Evening Peak Hour		
		Avg Delay (secs)	95 %ile Queue (veh)	Level of Service	Avg Delay (secs)	95 %ile Queue (veh)	Level of Service
Approved Plan Change / Current Zoning							
State Highway 6 (south)	R	10.5	1	B	11.6	3	B
State Highway 8B	R	10.4	1	B	9.9	2	A
State Highway 6 (north)	T	4.7	2	A	6.0	3	A
Proposed Development							
State Highway 6 (south)	R	10.5	1	B	11.6	3	B
State Highway 8B	R	10.5	1	B	9.9	2	A
State Highway 6 (north)	T	4.7	2	A	6.1	3	A

Table 11: Performance of Notional State Highway 6 / State Highway 8B Roundabout in 2030, Plus Development of Site Plus 30% Additional Traffic on Highway

Road and Movement		Morning Peak Hour			Evening Peak Hour		
		Avg Delay (secs)	95 %ile Queue (veh)	Level of Service	Avg Delay (secs)	95 %ile Queue (veh)	Level of Service
Approved Plan Change / Current Zoning							
State Highway 8B (east)	R	9.6	0	A	13.1	0	A
Shortcut Road	L	9.4	0	A	16.9	0	C
	R	33.8	1	D	75.0	1	F
State Highway 8B (west)	L	7.5	0	A	7.5	0	A
Proposed Development							
State Highway 8B (east)	R	9.6	0	A	13.1	0	B
Shortcut Road	L	9.4	0	A	16.9	0	C
	R	34.2	1	D	78.6	2	F
State Highway 8B (west)	L	7.5	0	A	7.5	0	A

Table 12: Performance of State Highway 8B / Shortcut Road Intersection in 2030, Plus Development of Site Plus 30% Additional Traffic on Highway



Road and Movement		Morning Peak Hour			Evening Peak Hour		
		Avg Delay (secs)	95 %ile Queue (veh)	Level of Service	Avg Delay (secs)	95 %ile Queue (veh)	Level of Service
Approved Plan Change / Current Zoning							
State Highway 6 (south)	R	10.0	0	B	9.7	0	A
Shortcut Road	L	10.2	0	B	9.5	0	A
	R	21.0	0	C	37.4	1	E
State Highway 6 (north)	L	7.5	0	A	7.6	0	A
Proposed Development							
State Highway 6 (south)	R	10.0	0	B	9.7	0	A
Shortcut Road	L	10.2	0	B	9.5	0	A
	R	21.1	1	C	37.7	1	E
State Highway 6 (north)	L	7.5	0	A	7.6	0	A

Table 13: Performance of State Highway 6 / Shortcut Road Intersection in 2030, Plus Development of Site Plus 30% Additional Traffic on Highway

Road and Movement		Morning Peak Hour			Evening Peak Hour		
		Avg Delay (secs)	95 %ile Queue (veh)	Level of Service	Avg Delay (secs)	95 %ile Queue (veh)	Level of Service
Approved Plan Change / Current Zoning							
Barry Avenue (south)	R	11.4	1	B	12.5	4	B
State Highway 8B (east)	R	10.9	4	B	10.8	4	B
Site Access	R	12.3	2	B	14.4	2	B
State Highway 8B (west)	R	9.8	3	A	15.2	8	B
Proposed Development							
Barry Avenue (south)	R	11.6	2	B	13.7	5	B
State Highway 8B (east)	R	12.4	5	B	11.1	4	B
Site Access	R	12.6	3	B	14.9	3	B
State Highway 8B (west)	R	10.0	3	A	18.5	10	B

Table 14: Performance of Notional State Highway 8B / Barry Avenue Roundabout in 2030, Plus Development of Site Plus 30% Additional Traffic on Highway

7.1.7. It can be seen that all of these intersections continue to provide an excellent level of service even under this increased traffic loading. The greatest different between the approved plan change and the proposed development occurs at the State Highway 8B / Barry Avenue roundabout, where in the evening peak hour delays increase by around 3 seconds for eastbound traffic on the highway. However Level of Service B continues to be provided, the same as for the approved zoning.

7.2. Timing of Proposed State Highway 8B / Barry Avenue Roundabout

7.2.1. The development of the site is expected to occur from east to west. This means that initially the site will be served from Shortcut Road only. However in practice it will be impractical (and unattractive from a commercial perspective) to serve the non-residential development from Shortcut Road because customers will need to drive past the site before then doubling-back on themselves.



7.2.2. Consequently, the staging sequence will be:

- A proportion of the residential lots will be developed, starting from the east side of the site, and all being served from Shortcut Road;
- The non-residential activities will be constructed, at the same time as a roundabout at the State Highway 8B / Barry Avenue intersection; and
- The remainder of the site will be developed.

7.2.3. An assessment has been carried out to determine the maximum extent of residential traffic that could be served by Shortcut Road. Given the trip distribution, this potentially affects both the State Highway 8B / Shortcut Road and State Highway 6 / Shortcut Road intersections. However routes between the site and destinations to the southeast, south and southwest are considerably shorter via State Highway 8B than via State Highway 6, meaning that there will be little difference in the traffic volumes at the State Highway 6 / Shortcut Road intersection. As a result, this assessment is focussed on the changes at the State Highway 8B / Shortcut Road intersection.

7.2.4. An assessment has also been carried out of the point at which queues and delays at a priority intersection increase to the point at which capacity is exhausted (that is, Level of Service D changes to Level of Service E). The following intersection performance is identified for 55% development of the residential area (that is, 190 of the maximum 350 residences):

Road and Movement		Morning Peak Hour			Evening Peak Hour		
		Avg Delay (secs)	95 %ile Queue (veh)	Level of Service	Avg Delay (secs)	95 %ile Queue (veh)	Level of Service
State Highway 8B (east)	R	8.6	0	A	10.3	0	B
Shortcut Road	L	7.5	0	A	10.7	0	B
	R	26.0	3	D	34.2	2	D
State Highway 8B (west)	R	7.5	0	A	7.6	1	A

Table 15: Performance of State Highway 8B / Shortcut Road Intersection in 2030, Plus 55% Residential Development

7.2.5. It can be seen that under this traffic loading, the intersection continues to have acceptable queues and delays. Level of Service D is maintained on all approaches (as it transitions to Level of Service E once delays reach 35 seconds).

7.2.6. By way of a further assessment, the State Highway 8B / Barry Avenue priority intersection has also been re-evaluated under the traffic loadings arising from 55% of residential development being served from Shortcut Road and the results are summarised below.

Road and Movement		Morning Peak Hour			Evening Peak Hour		
		Avg Delay (secs)	95 %ile Queue (veh)	Level of Service	Avg Delay (secs)	95 %ile Queue (veh)	Level of Service
Barry Avenue	L	6.6	0	A	6.3	0	A
	R	14.8	1	B	26.2	6	D
State Highway 8B (east)	L	6.2	1	A	6.2	1	A
State Highway 8B (west)	R	5.8	0	A	5.6	0	A

Table 16: Performance of State Highway 8B / Barry Avenue Intersection in 2030, Plus 55% Residential Development



7.2.7. It can be seen that under this traffic loading, the intersection continues to have acceptable queues and delays, and Level of Service D is maintained on all approaches (again, this transitions to Level of Service E once delays reach 35 seconds).

7.2.8. Based on this analysis, it is considered that a maximum of 192 residences could be developed within the site before a roundabout is required at the State Highway 8B / Barry Avenue intersection.

7.3. Layout of Proposed State Highway 8B / Barry Avenue Roundabout

7.3.1. As set out above, the design of this roundabout has not been progressed thus far and for the purposes of this analysis, an existing roundabout nearby (in Wanaka) has been adopted to evaluate capacity.

7.3.2. The current design approach for roundabout is set out within the Austroads Guide to Road Design Part 4B (Roundabouts). A detailed design is beyond the scope of this report but it is possible to establish a number of key parameters:

- The design of the roundabout will be dependent on the speed limit on the highway.
- Assuming a 60km/h speed limit, then the central island of the roundabout must be at least 20m and desirably 24m
- Given that this is a state highway, it can be expected that semitrailers and B-trains will need to negotiate the roundabout
- With this size of central island, a minimum circulating carriageway of 8.5m to 8.9m would be required
- Consequently the minimum outer diameter of the formed roundabout will be between 28.9m and 32.5m
- Additional area is needed around the roundabout for services, verges and the like. There is no guidance in respect of this but at this stage it would be reasonable to allow for an additional 5m. This will also give additional options for adjustment of the geometry as the detailed design progresses
- The flat and straight nature of the approaches is unlikely to give rise to any issues around sightlines

7.3.3. The Figure below shows a 32.5m diameter circle, representing the outer edges of formed roundabout, plus a 42.5m diameter circle, representing the roundabout plus verges.

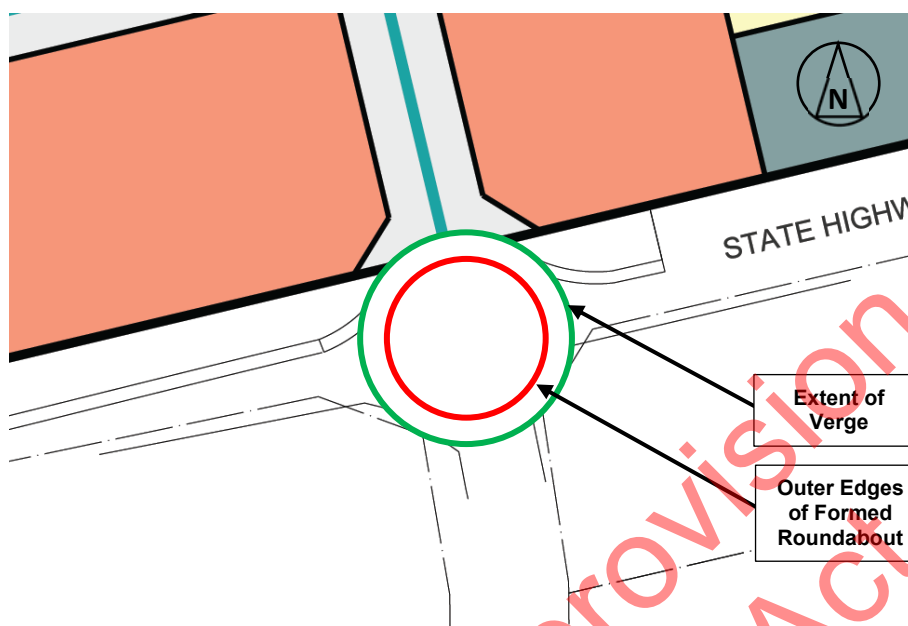


Figure 17: Indicative Masterplan With Roundabout Dimensions Overlaid

7.3.4. It can be seen that the indicative extent of required land on the masterplan aligns well with the key design parameters set out above. However roundabout design is influenced by a range of factors and ultimately the final layout will be subject to a more rigorous approach than set out above. As such, allowing for the practical maximum amount of land in this area would be prudent.

7.4. **Non-Car Modes of Travel**

7.4.1. The development of the site is likely to result in increased levels of walking and cycling in the immediate area. Within the site itself, the roading network will have footpaths and be designed in a manner that meets best practice in respect of providing for those walking such as through the provision of kerb cut-downs at intersections.

7.4.2. The Waka Kotahi NZ Transport Agency 'Cycle Network and Route Planning Guide' sets out criteria for when a dedicated on-street cycle lane is justified. For roads subject to a 50km/h operating speed, a marked lane is justified when traffic flows are in excess of 3,000 vehicles per day. This equates to a greater level of development than is proposed within the residential areas of the site, and it is therefore not expected that on-road marked cycle lanes will be required.

7.4.3. Within those roads that also serve the non-residential development, it is reasonable to anticipate that specific infrastructure will be made for cyclists. This could be either through on-road routes, or an off-road shared cycleway. In either case, the legal widths of the roads are sufficient for such provision can be made.

7.4.4. There are no scheduled bus services within Cromwell, and the site lies 200m to 600m from the current bus stops within the town centre. It is more likely that a bus service (if introduced in future), will serve the residential and commercial/industrial areas of Cromwell towards the south of the town centre as this is location of the greatest number of potential passengers. However there are no reasons why the key roads within the site could not be constructed to allow for buses.



- 7.4.5. Given that the proximity of the existing town centre, there will be a strong north-south desire line across State Highway 8B for those walking and cycling. The ease with which people can cross the highway is, in part, affected by the speed limit. In view of the proposed roundabout at the State Highway 6 / State Highway 8B intersection, and the ultimate requirement for a roundabout at the State Highway 8B / Barry Avenue intersection, traffic speeds between the two roundabouts will naturally be restricted by the need for drivers to negotiate the roundabout geometries. This therefore creates the opportunity for a reduction in the speed limit on the highway.
- 7.4.6. Furthermore, although there will be a focus for pedestrian and cyclist movements around the commercial aspect of the site, pedestrians typically walk as close to their desire line as possible and usually do not deviate for extended periods in order to utilise a formal crossing place. Consequently, it can be expected that the development of the site will result in pedestrians crossing the highway in several locations rather than making a detour to use one particular crossing point.
- 7.4.7. According to the Austroads Guide to Road Design Part 3 ('Geometric Design'), a car can accelerate by 1km/h for every 5m of travel (paragraph 3.5.6). Therefore to reach the current speed limit of 80km/h, if the vehicle has negotiated one of the roundabouts at a speed of (say) 35km/h, would take 225m. It would take a further 165m to slow down from this speed before reaching the next roundabout where the driver may need to stop. However the distance between the two roundabouts is only around 525m. That is, a driver would only be able to travel at the maximum speed for a distance of 135m.
- 7.4.8. Taking these two factors into account, it is considered that the speed limit on the highway between the two roundabouts could reasonably be reduced to 60km/h, and potentially lower. It is understood that a reduction to 60km/h is being considered by the Waka Kotahi NZ Transport Agency.
- 7.4.9. Anticipating that 60km/h is the prevailing speed limit, then the Waka Kotahi NZ Transport Agency 'Pedestrian Planning and Design Guide' sets out that pedestrians would have Level of Service E when crossing the highway (described as "*major concern*"). However the introduction of a pedestrian refuge (or potentially several refuges to give pedestrians choice in where they cross) would give rise to Level of Service A ("*excellent*"). These can easily be constructed / retrofitted within the highway, and are a suitable measure for a 60km/h speed environment.
- 7.4.10. The current plan change provisions require an underpass to be provided beneath State Highway 8B prior to any development of the site. This provision was put in place at a time when there had been no discussion of a reduced speed limit.
- 7.4.11. However based on the analysis above, it is considered that the underpass does not need to be constructed immediately. Rather, initial pedestrian crossing provision could be made through refuges for the limited amount of development initially permitted within the site (192 residences, as noted above). The construction of the underpass could then be concurrent with the construction of the roundabout and the non-residential development.
- 7.4.12. It is understood that the matter of whether an underpass is required, and if so at what stage, is presently being discussed between Waka Kotahi NZ Transport Agency, Central Otago District Council and Wooing Tree Development Partnership LP. This discussion is in the context of devising an optimal solution for pedestrian connections to and through the site.



7.5. Road Safety

7.5.1. The Waka Kotahi Crash Estimation Compendium has again been used to identify the expected crash rates at each location with full development of the site under the current proposal.

- State Highway 6 / State Highway 8B (roundabout)
 - Expected rate without any development of the site: 0.46 injury crashes per year
 - Expected rate with full development of the site: 0.48 injury crashes per year
- State Highway 8B / Barry Avenue
 - Expected rate without any development of the site: 0.18 injury crashes per year
 - Expected rate with full development of the site and reduced speed limit: 0.27 injury crashes per year (for crossroads)
 - Expected rate with full development of the site and reduced speed limit: 0.34 injury crashes per year (for roundabout)
- State Highway 8B / Shortcut Road
 - Expected rate without any development of the site: 0.08 injury crashes per year
 - Expected rate with full development of the site: 0.09 injury crashes per year
- State Highway 6 / Shortcut Road
 - Expected rate without any development of the site: 0.08 injury crashes per year
 - Expected rate with full development of the site: 0.09 injury crashes per year

7.5.2. It can be seen that the expected crash rate differs little at the State Highway 6 / State Highway 8B roundabout, State Highway 6 / Shortcut Road intersection and State Highway 8B / Shortcut Road intersection even when the site is fully developed.

7.5.3. The expected rate increases at the State Highway 8B / Barry Avenue but this is not unexpected given that the bulk of the generated traffic passes through this intersection.

7.5.4. Roads within the site can be constructed to meet appropriate guides and standards, and there is therefore no reason why any safety-related issues should be introduced.

7.5.5. Initial discussions with Waka Kotahi NZ Transport Agency identified that they wished to see a 'Safe System' assessment of the differences between the proposal and the approved plan change.

7.5.6. The Safe System Assessment is a structured way in which the safety of an intersection, section of road or other such piece of transportation infrastructure can be assessed. Where changes to the roading environment are proposed (such as in this case, where traffic flows increase due to the development of the PC14 site), the Safe System Assessment can be used to show changes in level of risk.

7.5.7. The process is one whereby 'safety' is disaggregated into 7 different categories:

- Potential for a vehicle to leave the road;
- Potential for a head-on crash;
- Potential for a crash at an intersection;
- Potential for other types of crash (such as nose-to-tail, overtaking, manoeuvring);
- Potential for a pedestrian to be involved in a crash;
- Potential for a cyclist to be involved in a crash; and
- Potential for a motorcyclist to be involved in a crash



7.5.8. For each of these 7 categories, an assessment is made of three matters, on a scale of 0 to 4:

- The exposure of the road user to risk:
 - 0: No exposure, meaning that road users are not present or cannot encounter one another
 - 1: low exposure: where traffic flow is less than 1,000 vehicles per day, and/or pedestrian/cyclist/motorcyclist volumes are less than 10 per day
 - 2: moderate exposure: where traffic flow is 1,000 to 5,000 vehicles per day, and/or pedestrian/cyclist/motorcyclist volumes are 10 to 50 per day
 - 3: high exposure: where traffic flow is 5,000 to 10,000 vehicles per day, and/or pedestrian/cyclist/motorcyclist volumes are 50 to 100 per day
 - 4: very high exposure: where traffic flow is more than 10,000 vehicles per day, and/or pedestrian/cyclist/motorcyclist volumes are more than 100 per day
- The likelihood of a crash:
 - 0: Minimal chance that a crash will occur
 - 1: Highly unlikely that a crash will occur
 - 2: Unlikely that a crash will occur
 - 3: Likely that a crash will occur
 - 4: Highly likely that a crash will occur
- The severity of a crash:
 - 0: Minimal chance that it will result in a fatality or serious injury
 - 1: Highly unlikely that it will result in a fatality or serious injury
 - 2: Unlikely that it will result in a fatality or serious injury
 - 3: Likely that it will result in a fatality or serious injury
 - 4: Highly likely that it will result in a fatality or serious injury

7.5.9. The scores are devised based on quantitative data (such as traffic flows, the road geometry, crash history, speed limit) and also qualitative assessment (such as the likelihood of a crash, and its severity). As such, the assessment is recommended in the literature to be undertaken by experienced engineers.

7.5.10. Finally, the scores are assembled into a table, and are then multiplied and added together to give an overall score out of 448. As can be seen from the scoring criteria, a lower score represents a better outcome. The literature identifies that “*the closer the score is to zero, the more the project in question aligns with Safe System principles*”. However it is important to note that the assessment does not have any trigger thresholds or similar, so a score is not classified as being ‘good’ or ‘bad’, and nor does the assessment indicate a particular point where some form of intervention is required, justified or recommended. Rather, it is simply a numerical calculation which shows how well a location aligns with Safe System principles, and the only outcome is a numerical value. It is not possible to compare scores from different sites. Engineering judgement is then required to be applied.

7.5.11. The Safe System Assessment for the current zoning of the site (through Plan Change 12) is shown below. This assumes no reduction in the speed limit on State Highway 8B, since such a reduction was not considered at the time of the plan change request. However an underpass and roundabout is proposed to serve the site through the existing provisions.



Criteria	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
	Run-Off Road	Head-On	Inter-section	Other	Pedestrian	Cyclist	Motor-cyclist	
(a) Exposure	4	4	4	4	0	3	3	
(b) Likelihood	1	1	1	1	0	1	1	
(c) Severity	2	3	2	3	0	3	3	
Product (a x b x c)	8	12	8	12	0	9	9	
Total (sum of all products)							58	

Table 17: Safe System Assessment of Current Site Zoning at Full Development

7.5.12. The Safe System Assessment for the proposed development of the site is shown below, for the interim step of 192 residences being served through Shortcut Road, plus the reduced speed limit, plus the provision of pedestrian refuges.

Criteria	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
	Run-Off Road	Head-On	Inter-section	Other	Pedestrian	Cyclist	Motor-cyclist	
(a) Exposure	3	3	3	3	4	2	3	
(b) Likelihood	1	1	2	1	1	1	1	
(c) Severity	1	2	1	2	3	3	3	
Product (a x b x c)	3	6	6	6	12	6	9	
Total (sum of all products)							48	

Table 18: Safe System Assessment of Proposed Development (55% Residential Only)

7.5.13. The Safe System Assessment for the proposed development of the site is shown below, at full development. This allows for the underpass and the roundabout.

Criteria	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
	Run-Off Road	Head-On	Inter-section	Other	Pedestrian	Cyclist	Motor-cyclist	
(a) Exposure	4	4	4	4	0	3	3	
(b) Likelihood	1	1	1	1	0	1	1	
(c) Severity	1	2	1	2	0	3	3	
Product (a x b x c)	4	8	4	8	0	9	9	
Total (sum of all products)							42	

Table 19: Safe System Assessment of Full Proposed Development

7.5.14. The assessment indicates that at full site development, the proposal has a better score than the current provisions. This is largely because the current proposals allow for the reduced speed limit which will diminish the potential for crashes (as road users have more time to react to the situation) and also the severity.

7.5.15. The interim stage of allowing for 192 residences to be served by Shortcut Road has a higher score for pedestrians (as they cross the road at-grade) and also for the potential for crashes at intersections (as the traffic passes through a priority intersection). However overall it



remains better than the score associated with the previous plan change at the time the plan change was considered.

7.5.16. On this basis it is not considered that the Safe System assessment has identified any particular safety concerns arising from the proposal.

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8. Statutory Framework

8.1. Introduction

8.1.1. There are a number of statutory documents that are relevant to the proposal. These are discussed in detail below, together with an assessment of whether the proposed development aligns with the strategic guidance given.

8.2. Otago Regional Land Transport Plans 2015-2021

8.2.1. The purpose of the RLTP is to “*set our vision of transport in the future and how intend to achieve this by funding and providing transport services and infrastructure*”. The June 2018 update of the document also adds “*...and by concentrating over the next few years on achieving a safer and more sustainable transport system that supports and enhances regional development*”.

8.2.2. The key long-term strategic objectives are:

- A transport system that is safe;
- A transport system that delivers appropriate levels of service;
- A transport system that supports economic activity and productivity;
- A transport system that provides appropriate transport choices;
- A transport system based on effective coordination; and.
- Mitigating the effects of the transport system on the environment

8.2.3. The traffic generated by development of the site can be accommodated on the roading network with appropriate levels of service, and there are no reasons to anticipate that adverse road safety effects would arise. The site is located just north of Cromwell town centre and is therefore within a viable walking and cycling distance of existing development.

8.3. Otago Regional Public Transport Plan 2014

8.3.1. This Plan focusses on areas with higher numbers of residents, specifically the Wakatipu Basin and Dunedin. As such, there is little mention made of Cromwell or surrounding areas. However the site layout does not preclude the ability to implement public transport in future. Moreover, as noted above, the site is located proximate to Cromwell town centre and within a relatively short distance of the existing bus stop within the town.

8.4. Central Otago District Plan

8.4.1. The District Plan sets out a number of transportation-related rules with which any development is expected to comply. Consideration of these rules is important at this stage in order to identify whether the proposal requires any exemption from any rules. Consequently an assessment of the proposed development against these rules has been undertaken and the results are summarised below.

8.4.2. District Plan Part 12.7.1: Access Standards from Roads: Part (ii): Sight Distances

8.4.2.1. Under the District Plan, assuming that roads within the site are subject to a speed limit of 50km/h then each lot requires a sight distance of 40m at its access. This can be achieved through appropriate site layout design.



8.4.2.2. However it is likely that there will be a number of lots which do not achieve the appropriate sight distance because the lot is adjacent to an intersection and the intersection geometry means that the sightline passes across land outside the lots and the road reserve, or because the access is on the inside of a curve and the curve restricts the sight distance.

8.4.2.3. The sight distance of 40m is based upon a vehicle speed of 50km/h. However as a vehicle approaches an intersection it must slow down in order to be able to give-way to other vehicles and/or to negotiate the intersection geometry. Since there is a direct relationship between vehicle speeds and sight distances, it follows that where speeds are physically reduced, sight distances can also be reduced while still allowing a driver to see and react to a potential hazard ahead. Taking this into account, it is considered that the sightlines at each lot access will be appropriate for the prevailing speeds.

8.4.3. *District Plan Part 12.7.1: Access Standards from Roads: Part (vii): Access to Urban Local Roads*

8.4.3.1. The accesses can be sealed as appropriate, and it is not expected that any will be located within 15m of the highway.

8.4.4. *District Plan Part 12.7.2: Parking: Part (i): Number of Spaces*

8.4.4.1. At this stage, no detailed layout has been produced for the individual lots. However their size means that each will be able to provide several car parking spaces, meeting Plan requirements.

8.4.5. *District Plan Part 12.7.2: Parking: Part (ii): Parking in Excess of Three Spaces*

8.4.5.1. It is not expected that any lots will provide more than three parking spaces.

8.4.6. *District Plan Part 12.7.3: Loading and Manoeuvring: Part (i): Servicing Activities*

8.4.6.1. Part of the proposal is for residential activities and therefore the loading and unloading of goods is not expected to occur frequently. However the commercial aspect of the development will mean that loading occurs often and thus loading areas will be required. These can be constructed outside the legal road, and in a manner that does not require reversing to or from the adjacent roading network.

8.5. ***Council's Engineering Code of Practice***

8.5.1. The Council has a Code of Practice which sets out appropriate widths for the internal roads within site. It is not considered that there are any reasons why these could not be met.

8.5.2. In passing, the Code of Practice sets out different road widths to those that are contained in the overarching Standard NZS4004:2010 ('Land Development and Subdivision Infrastructure'). Rather, the Code is based on the 2004 version of the Standard, which has been superseded for more than 10 years. Irrespective, the internal layout of the site can be designed in a manner to adhere to either the Code of Practice or to the more recent design Standard.

8.6. ***Summary***

8.6.1. It is considered that the proposal is aligned with the strategic objectives of the Otago Regional Land Transport Plans 2015-2021, as relevant to this particular area. The Otago Regional



Public Transport Plan is not particularly relevant due to the focus on other areas, but the proposal is not contrary to it.

- 8.6.2. The site layout is likely to be able to comply with all the transportation requirements of the District Plan, other than potentially in respect of Part 12.7.1(ii) Sight Distances. However any non-compliances with the sight distances are likely to arise due to the proximity of the lot access to curves or intersections, with those geometric features also meaning that vehicle speeds will be reduced in the immediate area, which in turn means that shorter sight distances will be adequate.
- 8.6.3. Overall, it is not considered that the proposal gives rise to any adverse transportation effects that are more than minor.

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9. Conclusions

- 9.1. This report has identified, evaluated and assessed the various transport and access elements of a proposal for a residential and commercial development on the northern side of State Highway 8B, Cromwell.
- 9.2. Overall, the transportation modelling shows that the effects of the development differ very little from the approved plan change (Plan Change 12) which resulted in the rezoning of the area several years ago. This conclusion remains valid, even when the seasonality of the highway is taken into account.
- 9.3. It is understood that development of the site will take place from east to west with residential development being served from Shortcut Road. Assessment shows that up to 192 residences could be served from Shortcut Road without an inappropriate level of service being provided. At development levels beyond this, improved access to the site is required.
- 9.4. The earlier plan change required the provision of a roundabout at the State Highway 8B / Barry Avenue intersection. Analysis shows that a single-lane roundabout with a single lane on each approach would have ample capacity for the traffic generated at full development (again this conclusion remains valid allowing for the seasonality of the highway).
- 9.5. The crash history in the vicinity of the site does not indicate that there would be any adverse safety effects from the proposal. A Safe System assessment has also been undertaken for the proposal. This does not identify any particular change in road safety arising from the proposal or the interim step of serving up to 192 residences from Shortcut Road.
 - 9.5.1. There will be an increase in pedestrians crossing the highway due to development of the site. Without some form of formal crossing aid, it is likely that a poor level of service would be provided. The provisions of the District Plan require the construction of an underpass prior to any development of the site, but the likely reduction in the speed limit means that measures such as pedestrian refuges are also viable. It is understood that the matter of whether an underpass is still required, and if so at what stage, as well as alternative options to provide pedestrian crossing movements, is being discussed between Waka Kotahi NZ Transport Agency, Central Otago District Council and Wooing Tree Development Partnership LP.
- 9.6. There will be a high degree of compliance with the transportation requirements of the District Plan and the internal roads within the site will be able to comply with the Council's standards. The most likely source of any non-compliance with the District Plan will be due to restricted sightlines where lots gain access close to curves or intersections but these features also mean that vehicle speeds will be reduced in the immediate area, which in turn means that shorter sight distances will be adequate. Consequently, any such non-compliances are likely to be supportable.
- 9.7. The proposal is also aligned with overarching strategic planning documents, as relevant to the area.
- 9.8. Overall, and subject to the preceding comments, the proposal can be supported from a traffic and transportation perspective and it is considered that there are no traffic and transportation reasons why the proposal could not be approved.

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CARRIAGEWAY
CONSULTING

traffic engineering | transport planning

A. PO Box 29623, Christchurch, 8540 P. 03 377 7010 E. office@carriageway.co.nz