BEFORE CENTRAL OTAGO DISTRICT COUNCIL

UNDER the Resource Management Act 1991

IN THE MATTER of Proposed Plan Change 12

STATEMENT OF EVIDENCE OF ANDREW DAVID CARR

Dated 31 October 2017

INTRODUCTION

1. My full name is Andrew (Andy) David Carr.

2. I am a Chartered Professional Engineer and an International Professional Engineer (New Zealand section of the register). I hold a Masters degree in Transport Engineering and Operations and also a Masters degree in Business Administration.

3. I served on the national committee of the Resource Management Law Association between 2013-14 and 2015-17, and I am a past Chair of the Canterbury branch of the organisation. I am also a Chartered Member of Engineering New Zealand (formerly the Institution of Professional Engineers New Zealand), and an Associate Member of the New Zealand Planning Institute.

4. I have more than 28 years experience in traffic engineering, over which time I have been responsible for investigating and evaluating the traffic and transportation impacts of a wide range of land use developments, both in New Zealand and the United Kingdom.

5. I am presently a director of Carriageway Consulting Ltd, a specialist traffic engineering and transport planning consultancy which I founded in early 2014. My role primarily involves undertaking and reviewing traffic analyses for both resource consent applications and proposed plan changes for a variety of different development types, for both local authorities and private organisations. I am also a Hearings Commissioner and have acted in that role for Greater Wellington Regional Council, Ashburton District Council, Waimakariri District Council and Christchurch City Council.

6. Prior to forming Carriageway Consulting Ltd I was employed by traffic engineering consultancies where I had senior roles in developing the business, undertaking technical work and supervising project teams primarily within the South Island.

7. I have been involved in a number of proposals which have assessed the transportation-related outcomes of proposed plan changes. Within the Queenstown Lakes district, these have included the residences facilitated by Plan Changes 4 (North Three Parks, 600

residences), 25 (Kingston, 750 residences plus commercial development), 39 (Arrowtown South, 215 residences), and 41 (Shotover Country, 770 residences plus commercial development).

8. Further afield, my experience includes Stonebrook (460 sections in Rolleston), Perriam Cove (Cromwell, 48 units), Awatea (Christchurch, 139 residences) and numerous others.

9. I have carried out commissions in the Cromwell area for more than 12 years, including at the Highlands Motorsport Park. I am also presently engaged by Cromwell Holiday Park Limited as part of their proposal for up to 180 residential units at the campground. I am familiar with the wider Cromwell area and have visited the town centre and historic precinct on several occasions and I have also visited the area as part of preparing my evidence.

10. As a result of my experience, I consider that I am fully familiar with the environs of Cromwell and the particular traffic-related issues associated with plan changes of this nature.

11. I have read the Code of Conduct for Expert Witnesses in the Environment Court Practice Note 2014. This evidence has been prepared in accordance with it and I agree to comply with it. The matters addressed in this Statement of Evidence are within my area of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

SCOPE OF EVIDENCE

12. In this matter I have been asked by the plan change requestor, Wooing Tree Holdings Limited, to undertake a peer review of the Traffic Impact Assessment (**TIA**) prepared by Opus International Consultants (**Opus**) and particularly to comment on whether the conclusions drawn in that report are robust.

13. I have also been asked to review and provide comment on the submissions received on the plan change request (**PC12**) and the Council's s42A report where they relate to transportation matters.

14. By way of background, I was not involved in PC12 prior to the plan change request being made, and I therefore consider that I am able to provide a wholly independent peer review. I have however liaised with Opus where necessary to ensure that I have fully understood their analysis.

PEER REVIEW OF OPUS TRAFFIC IMPACT ASSESSMENT

15. In reviewing the Opus TIA, my comments are made in the same order and using the same headings as that report.

Opus TIA Section 1: Introduction

16. This section of the Opus report is factual, and therefore I have not made any further comment. I note though that the plan change area (**the site**) has frontage onto State Highway 6 (Luggate-Cromwell Road) (**SH6**) to the southwest, State Highway 8B (**SH8B**) to the south and Shortcut Road to the east. Shortcut Road also lies to the north of the site but the site does not have direct frontage onto it.

Opus TIA Section 2: Proposed Rezoning

17. This section sets out the expected sizes of the development in the area that would be facilitated through the plan change. I note that it is set out that the proposed residential zones have a combined area of 186,800sqm and the commercial zone has an area of 24,700sqm.

18. Also of importance is that the key transportation linkages are described. These are that the primary access would be via a new road constructed onto SH8B opposite Barry Avenue with the existing priority intersection being converted to a roundabout. A secondary access is provided onto Shortcut Road towards the east of the site, and there is a further access towards the northeastern corner of the site onto Shortcut Road. I understand that this is expected to be a service vehicle and cycling route only. I discuss this access in more detail subsequently.

Opus TIA Section 3: Existing Situation

19. I concur with the description of the transportation environment that is set out in the TIA. I note though that SH8B has very seasonal traffic flows. While the use of the Annual Average Daily Traffic (**AADT**) is reasonable, the summer flows are much higher than this. I have checked the NZTA traffic count database and note that for example, in 2016 the average daily flow during January/February 2016 was 7,933 vehicles (two-way) whereas in July/August 2016 it was 5,644 vehicles (two-way), some 30% lower.

20. Traffic volumes used for design are usually based on the 50th highest peak hour, meaning that values towards the upper end of the range are used, rather than the average volumes as Opus has used (described in their Section 3.5). I discuss this subsequently.

21. Opus sets out the results of three traffic surveys carried out in the morning and evening peak hours at the SH8B / Barry Avenue, SH6 / SH8B, and SH8B / Shortcut Road intersections during October 2016. I agree that these intersections are likely to experience the greatest levels of change in traffic flows due to development of the site, with the majority of vehicles using the following routes:

    a. Eastbound (eg Alexandra): SH8B / Barry Avenue intersection then the SH8B / Shortcut Road intersection OR SH8B / Shortcut Road intersection;

    b. Southbound (eg town centre): SH8B / Barry Avenue OR SH8B / Shortcut Road intersection then SH8B / Barry Avenue;

    c. Southwestbound (eg Queenstown): SH8B / Barry Avenue intersection then SH6 / SH8B intersection OR SH8B / Shortcut Road intersection, through SH8B / Barry Avenue intersection and then SH6 / SH8B;

    d. Northbound (eg Wanaka): SH8B / Barry Avenue intersection then SH6 / SH8B intersection OR Shortcut Road and then SH6 / Shortcut Road intersection.

22. It can be seen though that northbound traffic would pass through the SH6 / Shortcut Road intersection and this has not been surveyed. Opus subsequently discusses in general terms the traffic flows through this intersection and in practice it is possible to derive estimated traffic flows from the data presented in the TIA. I have done this subsequently.

23. It is not possible to verify the results of the traffic surveys, but the peak hours are within the range that I would expect given the daily traffic flows, and the volumes exiting the SH8B / Barry Avenue intersection are the same as those entering the SH8B / Shortcut Road intersection, and vice versa. This is as would be expected.

24. Opus also observed traffic queues and used these observations to calibrate the traffic models used in the analysis. This is in accordance with best practice, although it is a technique most often used in congested situations rather than in this case where volumes are relatively low.

25. The NZTA Crash Analysis System (**CAS**) has been used to identify all reported crashes on the road network in the vicinity of the site between 2011 to 2015 plus the then-partial records for 2016. The TIA sets out that there were 22 crashes reported, but Figure 19 shows that in fact there were 25 crashes. There are minor discrepancies of this type throughout this section of the TIA (for example, four crashes are noted at the SH8B / Barry Avenue intersection but five are shown on the collision diagram).

26. In this section of the TIA, Opus does not comment on whether the crash records are as would be expected for the road network and whether there is any evidence of an underlying road safety issue. However they address the matter later, and thus I also discuss it subsequently.

27. I have taken the opportunity to examine the records from 2016 onwards to identify any matters of specific interest or concerns. This shows that a further five crashes have been recorded:

    a. Three crashes occurred at the SH6 / SH8B intersection. One of these involved a driver turning right from SH8B onto SH6 who was struck by a southbound vehicle on SH6. It resulted in serious injuries. Two crashes involved drivers turning right from SH6 onto SH8B that were struck by vehicles travelling south on SH6. Neither resulted in injuries.

    b. One crash occurred at the SH6 / Shortcut Road intersection, when a vehicle pulled out of Shortcut Road in front of a cyclist travelling southbound on the highway. It resulted in serious injuries to the cyclist;

    c. One crash occurred on SH6 mid-way between SH8B and Shortcut Road when a vehicle emerged from a fruit stall and was hit by a vehicle on the highway. It did not result in any injuries;

28. These additional crashes do not in my view materially change the road safety conclusions within the Opus report.

29. It is worth noting that one of the crashes at the SH6 / SH8B intersection involved two fatalities. Subsequent to this (in late 2012), NZTA permanently reduced the speed limit on SH6 to 80km/h (previously it was 100km/h) and installed a wider left-turn lane for the north-to-east movement. In the four years after this improvement scheme (2013 to 2016), there have been 3 crashes of which 2 resulted in injuries. In the previous four years of 2009 to 2012 there were 9 crashes of which 6 resulted in injuries. I therefore consider that the improvement scheme has significantly improved road safety in this location.

Opus TIA Section 4: Traffic Impacts

30. A plan change in and of itself does not give rise to any additional traffic, but rather it is the development that is enabled under the new zoning which generates traffic. Thus for any TIA supporting a plan

change request, the traffic generation is based on the extent and nature of activities which can be developed without the need to further consider any traffic matters.

31. In order to identify the extent of residential development, Opus has used the maximum permissible number of residences and floor areas for the commercial activities. In my experience, this is the appropriate approach.

32. The traffic generation rate used for the residential elements of the plan change are drawn from an Australian guide, whereas it is more common to use New Zealand data. The figure used by Opus (0.85 vehicle movements per residence in the peak hours) is slightly below that which is most commonly used (0.9 vehicle movements per residence in the peak hours) and this difference results in the expected traffic generation from the residential activity increasing from 179 to 189 vehicles (two-way). This is not sufficient to materially change any outcomes of the analysis.

33. In respect of the commercial activity, I reviewed the TIA submitted with the plan change request and identified concerns with the trip rates that had been used. Accordingly, I contacted Opus who identified that there had been a typographical error in their Table 7, although they also confirmed that their calculations had used the correct values. The comparison of the values is set out below:

Activity	**Peak Trip Rate (vehicles per hour per 100sqm GFA)**	
	AM	**PM**
Bar	2.0 (unchanged)	Was 9.6, now 10.3
Motel	0.8 (unchanged)	Was 0.7, now 0.6
Restaurant	No data	Was 12.6, now 11.7
Shop	Was 7.9, now 4.5	Was 11.7, now 5.6

Table 1: Comparison of Opus 'Adjusted Trip Generation Rates

34. I have reviewed these rates against those set out in NZTA Research Report 453 ('Trips and Parking Related to Land Use') as shown below:

Activity	Peak Trip Rate (vehicles per hour per 100sqm GFA)	
	AM	PM
Bar	No data	10.3
Motel	0.8 per room	0.8 per room
Restaurant	No data	0.6 per seat
Shop	No data	14.6

Table 2: Published Trip Generation Rates

35. The rate for the bar is the same as Opus has used. However it appears that the rate for the motel has been applied to the floor area rather than per unit. The Opus calculation results in peak hour flows of 48 vehicle movements, which equates to a 60-unit facility.

36. The data for the restaurant is based on a rate per seat rather than per 100sqm as Opus has used. However the resultant traffic generation is 116 vehicles in the peak hours (58 vehicles entering and 58 vehicle exiting) which will be far higher than a traditional restaurant (volumes of this size are typically associated with fast-food outlets). This means that this calculation is robust in my view.

37. In respect of the shop though, the published rates are considerably greater than Opus has used. Their rate of 5.6 vehicles movements per 100sqm GFA is what would be expected at a specialist shop rather than a general retailer. In this regard I note from Ms Hampson's evidence that the retail activities are not intended to compete with those in the existing town centre, but activities such as grocery stores / food retailers (which I understand would be allowed) have a higher traffic generation rate. To ensure a robust assessment, I have used the higher traffic generation rate shown in Table 2 above. Clearly in the event that there is a greater bias towards specialist retail, then the traffic generation would lower.

38. Taking these matters into account, I consider that the traffic generation of the business-related elements of the plan change will be greater than Opus has calculated. Using the higher, and in my view more appropriate, generation rates the basic traffic generation will in my view be in the order of 350 vehicles (two-way) in the morning peak hour. This is slightly lower than Opus shows on their Table 8 and as such I consider that there is a numerical error in their calculation (albeit one that presents a 'worst case' outcome). In the evening peak hour, I consider that the commercial activities could generate up to 850 vehicles (two-way), which is 75% more than Opus calculates.

39. However, there are further matters that should be assessed in my view:

    a. 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 state highway or Shortcut Road;

    b. Activities aimed at tourists will attract a higher proportion of minibuses and coaches than usual, which will diminish the traffic generation;

    c. 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.

40. Taking these into account, in my view it is appropriate to reduce the traffic flows generated by the commercial activities on the external roading network by 20%. Thus in the morning and evening peak hours, the traffic flows would be 280 and 680 vehicles respectively.

41. To summarise this:

Scenario	Traffic Generation	
	AM	PM
Residential	Opus: 179 Me: 189	Opus: 179 Me: 189
Commercial	Opus: 369 Me: 280	Opus: 479 Me: 680
Total	Opus: 548 Me: 469	Opus: 658 Me: 869

Table 3: Comparison of Opus and My Traffic Generation

42. This shows that Opus has overestimated the traffic generation in the morning peak hour, but underestimated by 32% in the evening peak hour.

43. There is one further matter with regard to the traffic generation of the site. I understand that the plan change provisions have been revised such that the 4,000sqm GFA of retail that Opus assessed has now been reduced to 3,000sqm GFA. In practice terms, this will immediately reduce the traffic generation of this element of the plan change by a quarter. In practice, it means that the expected traffic flows of 280 and 680 vehicles (two-way) in the morning and evening peak hours for the commercial activities reduce by 60 and 120 vehicles (two-way) respectively.

44. To maintain consistency with the Opus work, I have not allowed for this reduction in my analysis. However this approach again means that the analysis is highly robust.

45. In respect of the distribution of these vehicles, Opus does not describe how the proportions of traffic using each route have been selected, but this is not unusual in the context of transport planning where there are a myriad of possible solutions and approaches. Intuitively, in my view the proportions are reasonable and ultimately I note that Opus has not identified any intersections where capacity is constrained, meaning that even if the proportions were to be slightly

different then the intersections have the ability to accommodate higher flows.

46. I agree with the assessment that has been carried out showing that the route via Shortcut Road will be more attractive to drivers who are travelling northwards than the route using SH8B and SH6.

47. In broad terms I agree with the directional split of traffic entering and exiting the development, but the adoption of a 80-20 split for the residential activity is unusual. It is more common to use a split of 90% of traffic exiting and 10% entering in the morning peak hour, with 65% entering and 35% exiting in the evening peak hour.

48. I agree that the morning and evening peak periods are the ones that need to be assessed, and that the inter-peak periods are less relevant.

49. The TIA then includes details of the modelling of the intersections of interest. The software package that has been used is Sidra Intersection, which I consider is appropriate. Opus has provided their model runs to me in electronic format.

50. I noted above that Opus calibrate the traffic models to match observed queues. Having reviewed the models, this has resulted in the gap acceptance values being increased – that is, drivers in Cromwell appear to wait for longer gaps in the traffic stream before turning than the 'average' driver. In my experience this can occur in situations where queues and delays are low because drivers tend to 'take their time' without any peer pressure from other drivers. As traffic flows increase, drivers' gap acceptance usually reduces.

51. The TIA reports the delays for each turning movement at each of the three intersections assessed (SH8B / Barry Avenue, SH8B / Shortcut Road and SH6 / SH8B).

52. The analysis set out in the TIA shows that the location with the greatest delays in the immediate area is at the SH8B / Barry Avenue intersection. This is also the location through which the vast majority of traffic generated by development in the plan change area will pass. It therefore follows that if this location will operate satisfactorily with

the expected traffic flows, then all other intersections will similarly operate efficiently. I have therefore re-assessed this intersection using the traffic flows that I have calculated above. Within this assessment, I have also assumed that this intersection would be retained as a priority intersection, so that there can be a direct 'like-for-like' comparison with the existing volumes. I have also allowed for the default gap acceptance parameters, to take account of the higher prevailing volumes and likelihood of drivers accepting lesser gaps than they do at present.

53. A summary of the analysis is set out below.

Road / Movement	Average Delay per Vehicle (Secs)	
	AM	PM
Barry Ave (Right)	14.0	21.1
Barry Ave (Left)	6.6	6.4
SH8B (Right)	7.5	7.4

Table 4: SH8B / Barry Avenue, Existing Delays

Road / Movement	Average Delay per Vehicle (Secs)	
	AM	PM
Barry Ave (Right)	10.9	17.4
Barry Ave (Thru)	7.7	16.2
Barry Ave (Left)	5.5	10.2
SH8B (Right)	7.5	7.4
Site (Right)	10.8	23.5
Site (Thru)	8.2	14.4
Site (Left)	5.4	5.7

Table 5: SH8B / Barry Avenue, Delays with Full Development of Plan Change Area

54. My analysis shows that a priority intersection would operate satisfactorily in both peak hours. While there would be increases in delays on Barry Avenue, these are not significant (around four

seconds per vehicle). Delays at the proposed site access for right-turning vehicles would be very similar to those currently seen for right-turning vehicles at Barry Avenue.

55. From this analysis, I conclude that because a priority intersection would operate satisfactorily in the location through which the bulk of the generated traffic flows will pass, priority intersections will also operate satisfactorily elsewhere (that is, at the SH8B / Shortcut Road and SH6 / SH8B intersections).

56. I also conclude that although the SH6 / Shortcut Road has not been modelled, because there are fewer vehicles passing through this intersection, it too will operate efficiently.

57. I highlight that these conclusions are based on traffic flows that use a high proportion of general retail (rather than specialist stores). They also do not take account of the reduced floor area for shops (4,000sqm GFA reducing to 3,000sqm GFA) which is now proposed. If these matters had been considered, then the same conclusions would be drawn but the delays per vehicle set out above would be even lower than shown.

58. Finally, I note that the plan change proponents have agreed to restrict development within the site until a roundabout is constructed at the SH8B / Barry Avenue intersection. As a generic form of intersection, roundabouts have much more capacity than priority intersections. Since a priority intersection would operate satisfactorily, it therefore follows that a roundabout would also work well.

59. In respect of the roundabout, Opus shows two potential variants – one with a single circulating lane and one with two circulating lanes. The difference in performance between the two is negligible and in practice only affects the Barry Avenue approach where the average delay differs by 6 seconds. In my view this is an unsurprising result. In effect, a single-lane roundabout has significantly more capacity than the demands placed on it by the existing traffic flows and those from the proposed plan change. This means that it almost operates under free-flow conditions. The addition of the second circulating

lane adds more capacity, but since the capacity of the single-lane is greatly under-utilised, the second lane has little effect.

60. Overall then, I therefore agree with Opus' conclusions, that the traffic generated by development of the site can be accommodated by the existing roading network.

61. In view of the extent of available capacity on the roading network shown by my analysis (which allows for a robust calculation of the traffic generation), I do not consider that any further sensitivity tests are necessary to evaluate the performance of the roading network under different assumptions for traffic generation or the distribution of vehicles.

62. Finally, a sketch layout for a roundabout is shown on the masterplan for the development (Opus TA Appendix A). I note that this makes use of land on the southern side of SH8B which is outside the legal highway boundary and which appears to be a Council reserve. In the event that this land was not to be made available, I consider that the roundabout could still be constructed, but that it would need to be located further towards the north and thus some realignment of the highway would be needed (which can take place within the site and/or the legal highway).

Opus TIA Section 5: Crash Assessment

63. In this section of the TIA, Opus evaluates the road safety performance of the road network that would be affected by traffic generated by the proposed plan change. Opus identifies that there are two intersections of concern in this regard, the SH8B / Barry Avenue intersection and the SH6 / SH8B intersection.

64. I have taken the opportunity to update this for the most recent five years period (2012 to 2016).

65. With regard to the SH8B / Barry Avenue intersection, Opus calculates that one injury crash would be expected over a five years period whereas two have been recorded (between 2011 and 2015). Between 2012 and 2016 however, only one injury crash has been

recorded, meaning that the intersection performs as would be expected.

66. I noted above that in late 2012 NZTA introduced safety-related improvement measures at the SH6 / SH8B intersection. However these, and the consequent improvement in safety, have not been taken into account by Opus and this results in them presenting an overly-pessimistic view of the safety performance of the intersection.

67. Between 2013 and 2016 there have been two injury crashes at this intersection, whereas Opus calculates that just one should have been recorded if the intersection was to have a typical safety performance.

68. While the proportional difference between the two figures is large (that is, the actual rate is double that which is forecast), in practice it relates to just one additional injury crash being recorded in a four-year period. Such 'noise' is to be expected because crashes tend to have a random pattern both by time and location. On this basis, I do not consider that the crash rate at this location is of concern.

69. A similar scenario arises on the section of SH8B between Sargood Road and Barry Avenue, where Opus has identified an existing safety issue. However, just one crash has been recorded compared to an expectation of zero crashes, which again can be contributed to 'noise'. For completeness, this crash involved a driver who drifted off the road while looking at the giant fruit sculpture and struck a pedestrian.

70. I agree with Opus that there is likely to be a rise in crashes that is in proportion to the volume of traffic that is generated. However this is common to every development of every type in every location, because the number of crashes is proportional to the traffic flow (meaning that as traffic volumes increase, so do traffic crashes). Importantly though, the risk *per driver* remains constant or decreases.

71. Opus has helpfully calculated that the additional traffic would result in an increase of 1 additional injury crash every 50 to 100 years. I

confirm that this calculation is correct, and I therefore agree that the road safety effects of the plan change will be negligible.

Opus TIA Section 6: Pedestrian Facilities

72. Opus recommends that a pedestrian underpass is provided to serve the site, but does not set out any reasoning behind this.

73. The NZTA Pedestrian Planning and Design Guide sets out a way by which the Level of Service provided for pedestrians can be calculated. Based on this, I find that under the existing geometry of the highway, Level of Service F is provided which is noted as being unsatisfactory in all circumstances.

74. However the provision of a central refuge and kerb build-outs to reduce the width of carriageway that a pedestrian needs to cross would mean that Level of Service A was provided which is noted to be “excellent”.

75. The provisions of the plan change do not preclude the ability to implement a pedestrian underpass, but rather, they restrict development within the site until such time as an underpass is provided.

76. No details have been provided as to where the underpass would be sited in the TIA but the plan change request shows that it is located to the east of the SH8B / Barry Avenue roundabout. In general terms the underpass needs to be located on the pedestrian desire line since pedestrians generally attempt to walk in a straight line between their origin and destination. With this in mind, all things being equal then in my view the underpass would be better located on the western side of the roundabout since this would provide a shorter route between the site and Cromwell town centre.

77. I am not aware that any site investigations have been carried out regarding the ability to construct the underpass. It is therefore possible that there may be some impediment to constructing it on one side of the roundabout or the other. With that in mind, in my view the *preferred* location of the underpass could be determined but this should not be *fixed* at this early stage. Flexibility should be retained

until sufficient work has been carried out to ensure that the preferred location is feasible.

78. It is also known that pedestrians generally try to stay at the same grade, and thus I consider that it may be necessary to implement measures within the carriageway to prevent at-grade crossing movements. However these are matters of detail for which NZTA has responsibility as the road controlling authority.

79. One final matter in respect of the underpass is that sufficient area must be provided at either end to accommodate the steps and ramps for users (the latter being particular relevant for the mobility impaired). This will require land at the southern end which appears to be outside the highway reserve.

80. Opus does not discuss any pedestrian or cyclist facilities within the site or on the northern side of the underpass. I consider that at least a suitable connection is required towards the north, and this would fall within the site itself. I discuss this in more detail when responding to submissions.

Opus TIA Section 7: Parking Assessment

81. I agree with Opus that since the application is for a plan change, it is appropriate for matters of detail such as specific parking numbers to be left until details of the development have been finalised.

Opus TIA Section 8: Conclusions and Recommendations

82. Overall, although I have different views to Opus in respect of traffic generation and the form of intersections, I am of the view that the traffic-related effects of the plan change requests will be benign and the generated vehicles can be accommodated by the transportation networks without adverse safety or efficiency matters arising.

83. The one exception to this is that both Opus and myself consider some form of formal crossing provision should be provided on SH8B for pedestrians. In this regard, the plan change provisions restrict the extent of development that can take place within the site until such time as an underpass is provided.

Additional Matters

84. Although the masterplan shows a transportation connection towards the northeast of the site, this is not mentioned by Opus. I understand from the proponents that this is intended to function as a service access and to also provide for a potential cycle linkage.

85. In practice, in my view it will be very difficult to ensure that this access is used only by service vehicles because it will be a public road and therefore open for use by all. However the extent of vehicle usage of the main access onto Shortcut Road will be very low, and so even if a proportion of this was to move onto the link towards the north, no capacity issues would arise. However if the link is expected to be used by both cyclists and vehicular traffic, it will be necessary to ensure that the carriageway width provided is adequate (or the cycle lane is separated from the traffic lane).

SUBMISSIONS

86. I have read the submissions that address transportation-related matters, and comment on these below. For clarity, they are not set out in any particular order. I have referenced the submission number(s) which raise the issue(s).

87. There are a number of submissions that have raised traffic or road safety matters in a general sense with no particular issues being noted. However in responding to the submissions that do include specific matters, I trust that I have addressed the concerns of the general submissions too.

Submitter Concern: The plan change will lead to an increase in traffic flows (#1, #5)

88. The assessment of Opus and my own assessment show that the traffic flows that would be generated by development of the site can be accommodated on the roading network without significant delays arising. This is the case even when making highly robust assumptions about the traffic flows.

Submitter Concern: The roundabout / additional traffic will delay all traffic (#1, #13, #14, #15, #20)

89. I acknowledge that a roundabout means that all drivers must slow down in order to negotiate it, and that this will introduce a small delay for every vehicle at all times of day. This includes east-west traffic that is presently using SH8B unimpeded. However the delay is in the order of a few seconds which is not significant when considered in the context of the whole journey.

Submitter Concern: The increased traffic flows will result in adverse road safety issues (#1, #5, #7, #11, #20, #24)

90. While an increase in traffic means that there will be an increase in crashes, this occurs as a result of all developments (and also arises as a result of people choosing to travel more irrespective of any development). The effects on road safety have been considered and show that the increase in injury crashes will be extremely low.

Submitter Concern: Shortcut Road should not be closed as a result of the plan change (#3, #4, #5, #9, #10, #11, #13, #14, #15, #20, #21, #22, #23, #39, #40)

91. Having reviewed the relevant documentation, I am unable to identify any provision that means that Shortcut Road at SH8B would be required to be closed if the plan change request was accepted. I note though that there is wording to ensure that the closure of Shortcut Road at SH8B is not precluded.

92. The closure of a road is a statutory process that is outside the Resource Management Act – in essence, a road closure cannot be progressed through this or any other plan change request but it requires a separate process.

Submitter Concern: The main access road should be designed to cope with large traffic volumes (#3)

93. I anticipate that the roads within the site will be designed to meet the Council's roading standards, and will therefore be suitable for the expected type and volume of traffic.

Submitter Concern: The location of the pedestrian underpass has not been shown (#5, #11) / the underpass should be located to the west of the proposed roundabout and not the east (#26, #41)

94. I acknowledge that the precise location has not been shown on the masterplan within the TIA but it is shown on the masterplan accompanying the plan change request.

95. In my view, all things being equal then the underpass would be better located on the western side of the roundabout since this would provide a shorter route between the site and Cromwell town centre. However there may be some technical impediment to locating it in this position and so until further site work has been carried out to show that it is feasible in this position, I consider that the location should remain flexible.

Submitter Concern: No indication has been given of the vehicular and pedestrian flow within the development (#5, #11)

96. The traffic generation at the boundaries of the site has been assessed by Opus, and I have reviewed this within my evidence. Within the site itself, it is uncommon within a plan change to assess the volumes on each road since no fixed development is yet proposed. However the carriageway widths and footpath provision will meet the Council's standards.

Submitter Concern: Suitable provision for walking and cycling should be made within the site (#26)

97. The internal roads will meet the Council's standards which also mean that they will be suitable for walking and cycling. I expect that the underpass will be designed with the needs of cyclists in mind. However the provision of connections to the south of the underpass is not a matter which the proponents can address.

98. The plan change request as lodged did not make any provision for walking and cycling linkages between the northern end of the underpass and through the site. However I am aware that Mr Vivian has recommended an addition to the matters of discretion for the Wooing Tree Overlay Area, to enable an assessment of the extent to

which provision is made for pedestrian and cyclist movement, including the provision of footpaths and cycling infrastructure. I understand that subdivision of land is a Restricted Discretionary Activity, and so the outcome will be that the walking and cycling links will be assessed when an application for subdivision is made.

99. I consider that this is an appropriate addition, and addresses the issue raised in the submission.

Submitter Concern: The speed limit on SH8B should be reconsidered (#32)

100. The setting of speed limits is not a matter than can be considered within the context of a plan change request as it is carried out under a separate statutory process. The plan change request does not preclude the speed limit being changes by NZTA in future, if the Agency so desires.

Submitter Concern: There should be consideration of the ways in which pedestrians and cyclists will cross SH8B (#32, #39)

101. I agree that the plan change is likely to increase the extent of pedestrian and cyclist crossing activity at SH8B, and therefore that some type of formal crossing provision should be made. This could be by way of the underpass, or through infrastructure provided at-grade, which would also result in an excellent level of service being provided.

Submitter Concern: The roundabout and underpass need to be in place before any development occurs (#7)

102. In my analysis above, I set out that the proposed roundabout at Barry Avenue would provide considerable capacity and that in practice, it would be possible to serve the whole of the development using a priority intersection instead. I also set out that a combination of a pedestrian refuge and build-outs would provide an excellent level of service if pedestrians crossed the road at-grade.

103. Accordingly, from a solely transportation perspective, there is no reason why the roundabout or underpass should be provided at the

outset. Rather, it would be possible to construct these part-way through the development of the site without the transportation networks being adversely affected by development-related traffic. This is the approach that is proposed through the plan change provisions.

Submitter Concern: There is insufficient distance between the roundabout and the SH6 / SH8B intersection (#7)

104. The separation distance is in the order of 500m, which is appropriate. I note that NZTA has a statutory duty to operate the highway in a safe and efficient manner, and has not commented adversely on the separation distance.

Submitter Concern: A roundabout with two circulating lanes should be provided rather than just one circulating lane (#23, #35)

105. Opus modelled both of these scenarios and identified that the difference in delays between them was negligible. In my view this is because the single-lane roundabout already provides excess capacity, and thus the provision of a second lane does not provide any capacity that is needed for the traffic volumes.

106. Irrespective of the option selected, the diameter of the inner island of the roundabout will be the same because of the need to accommodate the turning circles of large vehicles. This means that providing a second lane necessarily increases the physical size of the intersection. As such, it would be more costly to construct but would not provide any benefits in terms of reduced delays for traffic.

107. One submitter highlights that the traffic flows used may not be representative of the volume at the busiest times of the year. I noted previously that during summer, the traffic flows on the highway differ from those during the off-peak period by around 30%. I have therefore doubled the traffic flows on SH8B (which allows for significant future traffic growth) and have re-run the Opus models. The results are summarised below.

Road / Movement	Average Delay per Vehicle (Secs)			
	AM		PM	
	Single Lane	Dual Lane	Single Lane	Dual Lane
Barry Ave (South)	5	4	6	5
SH8B (East)	8	7	8	7
Site (North)	5	3	6	4
SH8B (West)	8	8	10	8

Table 6: Forecast Delays at the SH8B / Barry Avenue Roundabout, 100% Increase in SH8B Traffic

108. This shows that even when allowing for significantly greater traffic flows on the highway (and retaining the robust calculation of the traffic flows generated by the site), the single lane roundabout performs well, and the difference between the single circulating lane and dual circulating lane is minimal. On this basis, I consider that the single circulating lane option will continue to provide an excellent level of service with low delays. A roundabout with two circulating lanes is simply not required as a result of the plan change.

Submitter concern: Rules 7.3.6(vi)(d) to (f) and 8.3.6(i), (xii) and (xiii) should be amended such that a non-compliance becomes a Prohibited Activity rather than a Non-Complying Activity (#29)

109. These rules relate to the way in which access will be gained between the site and the roading network. In essence, they are the rules which mean that no access is to be provided to the state highway except via the single lane roundabout, and which restrict development within the site until such time as the roundabout and/or pedestrian underpass are constructed and operational.

110. Based on the analysis set out above, I am of the view that full development of the site could take place without the need for a roundabout or underpass, even when the traffic flows on SH8B are doubled. While I agree with the submitter that there is a need to ensure that the efficiency and safety of the state highway is not

compromised, I consider that sufficient analysis has been undertaken to show that the risk of this is extremely low.

111. Furthermore, because the roading network that would be affected is part of the state highway network, I expect that NZTA will be considered as an Affected Party and would be able to set out its technical case if such an application for access minus the roundabout was to be made.

112. Overall then, in my view there is therefore no need for the change of status that the submitter proposes.

Submitter Concern: A roundabout and/or pedestrian underpass should be provided (#4, #6, #8, #33, #34, #39, #41)

113. There are provisions made within the plan change request that limit the extent of development that can take place until such time as a roundabout and pedestrian underpass are provided.

114. The plan change provisions mean that some development can occur without the two facilities being provided. In my experience it is very common for a 'staging' rule to be put in place in this way as it means that infrastructure is provided as and when required by the development rather than there being a period when there is a large over-provision.

Submitter concern: The rules should be amended to remove references to specifics of the roundabout design (#29)

115. These rules relate to the specification of the roundabout as having a single circulating lane. I have set out elsewhere in my evidence that a roundabout with a single lane will have ample capacity to accommodate the traffic flows, even if the volumes on the state highway were to double and the site was developed to the maximum extent possible (and tested using robust flows). I therefore disagree that this part of the rule should be removed because it means that the proponents may be required to construct a two-lane roundabout when one-lane is ample (and in fact a priority intersection would also provide a good level of service).

116. Most other aspects of the roundabout layout, such as the physical size, are not stipulated in the rules. I consider that this provides sufficient ability to ensure that the roundabout will be able to meet appropriate guides and standards, if these were to change in future.

117. I note though that the roundabout diameter is specified, and it is possible that this may change under different iterations of guides/standards. I therefore agree that this particular element of the provisions should be removed.

Submitter concern: Rules 7.3.6(vi)(e) and 8.3.6(xii)(b) should be amended to recognise that cyclists will also utilise the underpass (#6, #29, #33, #39)

118. In practice there is relatively little difference between an underpass designed for pedestrians and one that is designed for cyclists also, but I agree that an amendment to the rules as suggested would ensure that the design is suitable for both types of road user.

Submitter concern: Rules 7.3.6(vi)(e) and 8.3.6(xii)(b) are supported as they limit development within the site until the proposed roundabout and pedestrian underpass have been completed and are operational #29)

119. I have set out above that in practice, the whole of the site could be developed without providing either a roundabout or an underpass, and an appropriate level of service would be provided for all road users. I understand that the proponent is willing to offer a limitation on development, but from a solely transportation perspective, I do not consider that this provision is required as such.

Submitter concern: Rule 7.3.6(vi)(f) should be amended so that the road through the subdivision connecting to Shortcut Road should be designed and constructed to the same standard as Shortcut Road (#29)

120. I anticipate that the road connecting to Shortcut Road will be vested with the Council and as such it will be required to meet the appropriate Council standards. Part of this relates to the traffic flows that are to be carried by the road. In my view, it is therefore

unnecessary to provide any further definition or specification for the road.

COUNCIL OFFICERS REPORTS

121. I have read the s42A report prepared by Mr David Whitney in respect of the plan change request. He highlights a number of transportation matters.

122. Mr Whitney does not consider that the plan change request includes provision for the closure of the SH8B / Shortcut Road intersection. If this was progressed then it would be carried out through a different statutory process. I agree with his views.

123. He also considers that a roundabout and underpass are an integral part of the plan change request and that both are needed to mitigate the traffic effects associated with the plan change request. I do not agree that they are required for the purposes of mitigation, and as set out previously, the traffic flows can be accommodated via a priority intersection.

124. One particular matter raised by Mr Whitney is that of a restricted amount of development being permitted prior to the roundabout being constructed. He highlights that no analysis is included within the Opus TIA, which instead focusses on the full development of the site with the roundabout rather than on the partial site development.

125. I agree that this scenario has not been considered and accordingly, I have modelled the SH8B / Shortcut Road intersection using the computer software program Sidra Intersection. For this analysis, I have allowed for a highly extreme scenario of 50% of all development-related traffic using the intersection, plus a 50% increase in the amount of traffic using the state highway. The results are summarised below.

Road / Movement	Average Delay per Vehicle (Secs)	
	AM	PM
Shortcut Rd (Right)	14.2	29.4
Shortcut Rd (Left)	6.5	8.5
SH8B (Right)	7.4	9.1

Table 6: SH8B / Shortcut Road, 50% Development Traffic Plus 50% Increase in SH8B Traffic

126. The modelling shows that even under this scenario, delays are very low in the morning peak hour. In the evening peak hour, the delays per vehicle for vehicles turning right out of Shortcut Road reach 30 seconds. This equates to Level of Service D which is typically not considered by road controlling authorities to be unreasonable for a right-turn movement at a priority intersection in an urban area.

127. As I noted above, this is very much an extreme scenario and in practice is unlikely to arise because the traffic generated by the site and the volume using the state highway will be lower than this. That said, in my view this analysis shows that there is sufficient capacity at the SH8B / Shortcut Road intersection to accommodate a large increase in traffic flows without difficulty. This is perhaps unsurprising because the intersection has only low turning flows yet already has auxiliary left-turn and right-turn lanes and thus a high capacity.

128. Mr Whitney discusses the submission of NZTA, and concurs that the reference to a single-lane roundabout should be removed. I do not agree with this. While I acknowledge that there is a need to ensure that the roundabout is designed to meet the standards and guides that apply at the time the roundabout is designed, this is not precluded by the specification of a single circulating lane. My analysis has shown that a single lane has significant (and arguably excessive) capacity for the expected traffic flows and so limiting it to a single lane has little detrimental effect. I agree though that the reference to the roundabout diameter should be removed.

129. Mr Whitney considers that the reference to the pedestrian underpass should be amended to include cyclists also. There is little difference in practice between designs that allow for only pedestrians and those that include for cyclists also, but I am not opposed to this amendment.

130. In Mr Whitney's view, the underpass should be located to the west of the SH8B / Barry Avenue intersection, I set out above that I agree that a location on the western side is preferable from a connectivity viewpoint, but in my view the location should remain flexible until the location of the underpass has been shown to be feasible.

131. Finally in respect of the underpass, Mr Whitney considers that provision should be made for connectivity towards the north (that is, through the site). Mr Vivian has recommended an addition to the Assessment Matters when an application for subdivision is lodged which will require the assessment of walking and cycling links. I support this recommendation and consider that it will address Mr Whitney's concerns.

132. Mr Whitney discusses NZTA's submission to make activities which do not comply with new Rules 7.3.6(vi)(d)–(f) and Rules 8.3.6(xii)(a) and (b) to prohibited activities rather than non-complying activities. He considers that the submission is "*excessive*" and having evaluated the effects on highway capacity and road safety, I agree.

133. In conclusion, Mr Whitney recommends that the plan change is approved, subject to amendments. The changes that he recommends that relate to transportation issues are:

a. the removal of the reference to a single circulating traffic lane at the SH8B / Barry Avenue roundabout. I do not agree with this amendment;

b. the specific reference to a 'pedestrian / cyclist' underpass. I do not object to this amendment, but in my view it is not necessary;

c. that the underpass should be located to the west of the SH8B / Barry Avenue roundabout. I do not agree that this amendment should be made until it has been shown that the underpass could

feasibly be constructed in this location, but I would support an amendment showing that this is the preferred location;

d. requiring connectivity for pedestrians and cyclists from the northern end of the underpass to Shortcut Road and McNulty Inlet beyond. I agree that provision should be made to connect the underpass to and through the site, and support Mr Vivian's recommendation in this regard. However in my view it is not appropriate to impose a requirement on the proponents to form routes on land that it outside the plan change area (that is, the requirements for walking and cycling routes should be limited to the southern and western sides of Shortcut Road only).

134. Mr Whitney does not mention one design element of the roundabout, which is the diameter. I recommend that this is removed from the provisions, as indicated by NZTA.

CONCLUSION

135. Having carried out a peer review of the Opus TIA, and supplemented this with my own analysis, I consider that there are no transportation reasons why the plan change request could not be recommended for approval subject to modifications. I have formed this view based on a robust assessment of the expected traffic generation of the site.

136. The modifications that I consider are required are:

a. the removal of the specified roundabout diameter, since in my view (and that of NZTA as a submitter) there is a need to ensure that there is flexibility in the provisions so that the roundabout can be designed to meet appropriate standards and guides; and

b. the inclusion of rules to require pedestrian and cycling connections between the northern side of the underpass and to/through the site, as recommended by Mr Vivian.

137. While I agree with Mr Whitney's overall assessment of the transportation matters, we differ in respect of the changes that should be made to the plan change provisions. In particular, I consider that

the roundabout should continue to be specified to have a single circulating lane, and that there should be flexibility retained in the location of the underpass (albeit with a preference to locate this to the west of the roundabout).

138. Overall, and subject to the above comments, I consider that there are no transportation-related reasons that would preclude this plan change request from being recommended for approval.

Andrew David Carr

31 October 2017