Before the Queenstown Lakes District Council

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| In the matter of | The Resource Management Act 1991 (RMA) |
| And | The Queenstown Lakes Proposed District Plan Stage 3; Stream 18; Settlement Zone |

**Statement of evidence of Andy Carr for Universal Developments (Hawea) Limited #3248**

29 May 2020

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**Qualifications and experience**

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 30 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 six years ago. 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 involved assessing the traffic generation and effects of large residential developments (most of which include some element of ancillary development). Within this district, this includes the residences facilitated by Plan Changes 4 (North Three Parks, 600 residences), 39 (Arrowtown South, 215 residences), 41 (Shotover Country, 770 residences plus commercial development), and 45 (Northlake, 1,600 residences plus community and commercial development). Within Central Otago, my experience includes assessing the transportation effects of Plan Changes 12 (Wooing Tree) and 13 (River Terrace), as well as RC170378 which facilitated

residential development at the Cromwell Top Ten Holiday Park. I have also provided advice for Stonebrook (460 sections in Rolleston), Awatea (Christchurch, 139 residences) and numerous others.

8 I have carried out commissions in Queenstown Lakes district for more than 15 years. As a result of my experience, I consider that I am fully familiar with the environs of Hawea and the particular traffic-related issues associated with residential plan changes and resource consent applications.

**Code of Conduct for Expert Witnesses**

9 I confirm that I have read the Code of Conduct for expert witnesses contained in the Environment Court of New Zealand Practice Note 2014 and that I have complied with it when preparing my evidence. Other than when I state I am relying on the advice of another person, this evidence is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

**Scope of Evidence**

10 In this matter, I have been asked by the submitter, Universal Developments Limited, to provide an assessment of the transportation-related effects if its submission to rezone land towards the south of the existing urban development of Hawea was accepted. Based on the information provided to me by Mr Williams, this would facilitate:

a. 1,026 to 1,282 residential lots (plus 465 lots associated with the approved SHA);
b. 72 1,000sqm industrial lots; and
c. 16,800sqm GFA retail.

11 I have not been involved in the submission to date. However I was considerably involved in assessing the transportation effects of the submitter's proposal for the establishment of a Special Housing Area (**SHA**) at Hawea, which lies within the site that is the subject of the submission. The SHA was approved in April 2020.

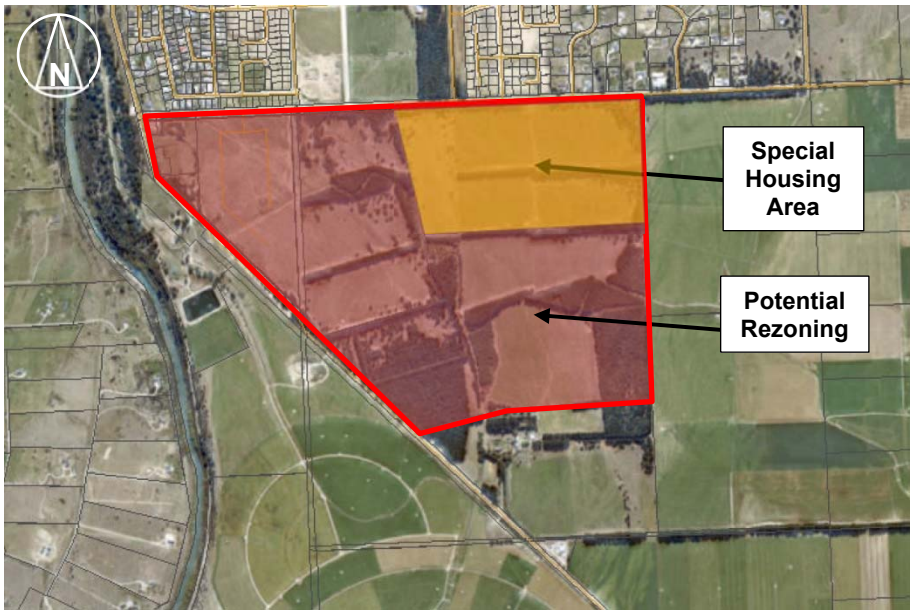



**Figure 1: Location of Submission Site and Special Housing Area (Extracted from Submission)**

12 Because the SHA is approved, I have included it within my analyses.

13 In order to assess the traffic-related effects of the rezoning sought by the submission, I initially report the outcomes of the analyses supporting the SHA, as this provides a recent (and tested/agreed) evaluation of the surrounding transportation networks. Consequently the first part of my evidence repeats the key aspects of the Transportation Assessment that accompanied the SHA request.

14 The second part of my evidence then builds on this to discuss the potential transportation effects of the submission. In undertaking this I have been mindful that the submission is at a high level. Accordingly my assessment focusses on identifying whether there are potential difficulties or constraints that would prevent the land from being rezoned, rather than proposing specific design solutions to any matters.

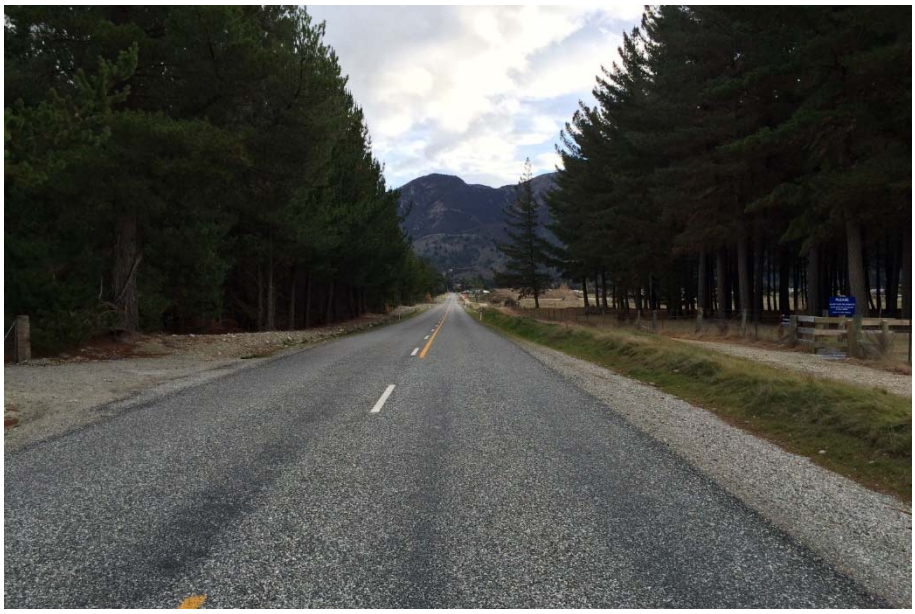
15 By way of example, I identify that a section of Domain Road would need to be improved and brought up to current standards. However I have not specified exactly what carriageway width is needed, but rather, simply noted that the legal width of the road is 20m and therefore there are no impediments to achieving a suitable cross-section.

16 I also note that subdivision of the site could not occur as of right but would require resource consents. Those consents afford the opportunity to evaluate the transportation effects arising from a specific proposed development at the time consents are sought.

17 For clarity, my assessment does not include for any up-zoning within Hawea as I understand is sought by the Council. This is because no traffic analysis has been produced by the Council to form a baseline which I can then assess.

**Transport Networks Adjacent to the Submission Site (Summary of Part of SHA Transportation Assessment)**

18 On the northern edge of the site lies Cemetery Road. This has a flat and straight alignment and is subject to an 80km/h speed limit. The carriageway is 7m wide with a centreline marking but no edgelines. There are swales of around 2.5m on each side, and metalled shoulders. The road has relatively recently been sealed over its full length.



**Photograph 1: Cemetery Road Looking West (Site on Left)**

19 At its western extremity, Cemetery Road meets Domain Road at a priority ('give-way') intersection. The intersection does not have any turning lanes nor sealed shoulders to enable one vehicle to pass another. The flat and straight alignment of Domain Road in this location means that sight distances for turning traffic are excellent.


**Photograph 2: Cemetery Road / Domain Road Intersection Looking West**

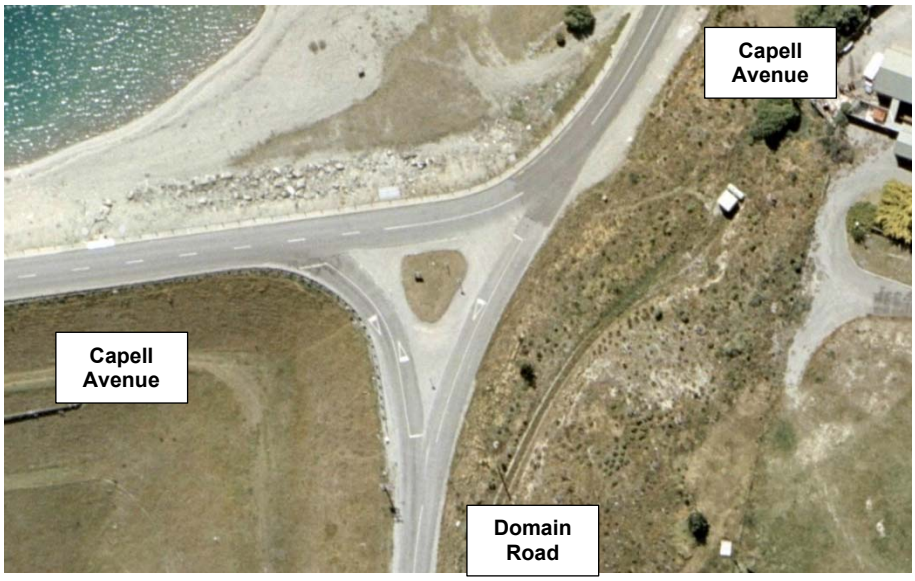
20 Domain Road forms the western edge of the submission site. The first 200m south of Cemetery Road is sealed but further south, the road is unsealed. The carriageway is typically in the order of 6m wide. The alignment is flat and straight, although there is a curve in the road approximately 200m south of Cemetery Road.

21 Towards the south of Cemetery Road, Domain Road turns to run in a northwest-southeast direction and connects to the district roading network further afield.

22 North of the intersection with Cemetery Road, Domain Road itself runs with a broadly north-south alignment. It is sealed with a 6m carriageway with 0.5m metalled shoulders, and has a centreline but no edgeline markings.

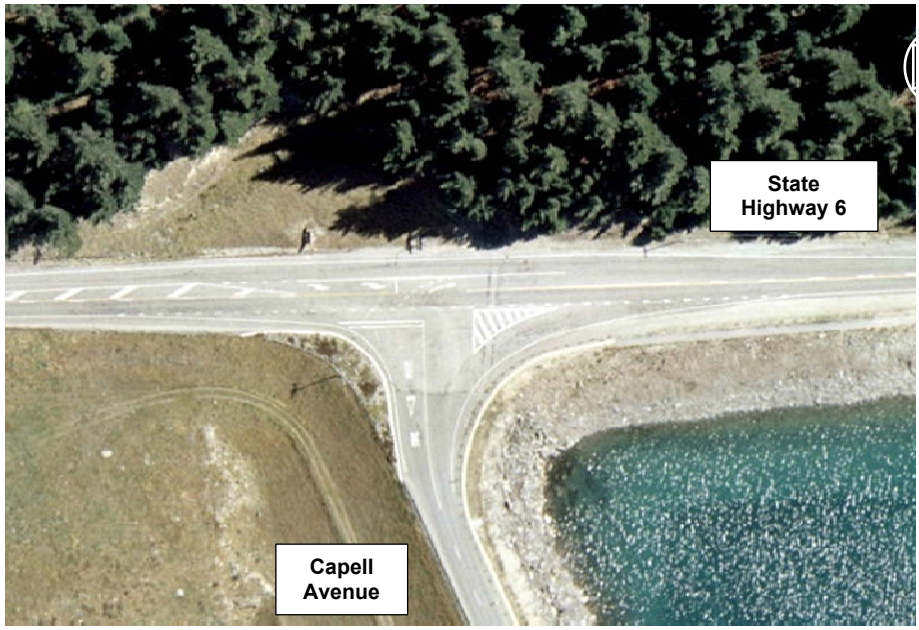
**Photograph 3: Domain Road (North of Cemetery Road) Looking North**

23 At its northern end, Domain Road meets Capell Avenue at a complex priority ('give-way') intersection. This has separate traffic lanes for each turning movement and is designed in a way that was common several decades ago where the potentially conflicting movements are separated from one another.




**Photograph 4: Capell Avenue / Domain Road Intersection**

24 Capell Avenue then crosses the dam and around 330m west of Domain Road, meets State Highway 6. The State Highway 6 / Capell Avenue intersection is formed as a high-capacity priority ('give-way') intersection with auxiliary turning lanes for the movements from State Highway 6 both left and right into Capell Avenue. There is a raised island at the end of Capell Avenue to separate eastbound and westbound traffic. The Capell Avenue approach is widened at the intersection to enable two vehicles to queue side-by-side.




**Photograph 5: State Highway 6 / Capell Avenue Intersection**

**Photograph 6: State Highway 6 / Capell Ave Intersection Looking North**

25 The speed limit on State Highway 6 in this location is 100km/h and thus sight distances of 285m are required for turning traffic. Towards the south, a sight distance in excess of 300m is available although ultimately it is limited by the horizontal curve of the highway. Towards the north, the sight distance is limited by the topography (as can be seen on Photograph 6) but 285m is achieved.

26 There are presently limited opportunities for vehicles to travel north-south from Cemetery Road. However, Sentinel Drive and Grandview Road both lie to the immediate north of the site, and have recently been extended to provide a connection into the centre of Lake Hawea township itself. Both roads have priority controlled ('stop') intersections with Cemetery Road but do not have auxiliary turning lanes.

**Photograph 7: Cemetery Road / Sentinel Drive Intersection**

27 As part of the SHA, there is an agreement in place to form Capell Avenue further north of Cemetery Road. This will have a broadly north-south alignment and will connect to the existing formation of the road, which turns towards the west and connects to Domain Road as discussed above. Thus any traffic generated by the SHA or submission site will not be required to use Domain Road to travel into the existing Hawea commercial area.

28 There is a well-developed network of walking and cycling routes in the area. This includes a 3m wide shared walking/cycling route over the full length of the northern side of Cemetery Road, which is mostly metalled but is sealed over its eastern extremity and close to the Sentinel Park subdivision.

**Photograph 8: Cemetery Road Footpath/Cyclepath, Looking West**

29 This route turns northwards at the Cemetery Road / Domain Road intersection, and runs along the eastern side of Domain Road but then diverts further east to run just within the Timsfield subdivision. It then re-emerges on the eastern side of Domain Road and is elevated around the eastern side of the Capell Avenue / Domain Road intersection.

**Photograph 9: Elevated Footpath/Cyclepath on Eastern Side of Domain Road (North of Cemetery Road)**

30 There are also north-south walking and cycling connections on Cemetery Road. This includes a 2m wide walking/cycling path which is located within the Capell Avenue road corridor and which connects to Cemetery Road opposite the SHA.


**Photograph 10: Capell Avenue Footpath/Cyclepath, At Cemetery Road**

31 There are also walking and cycling routes at the southern end of Isthmus Place (around 50m east of Capell Avenue) and opposite Swann Street, around 280m west of Capell Avenue. The latter is marked with 'cyclist crossing' signs on the Cemetery Road approaches, and is delineated by wooden fences on the approaches for pedestrians and cyclists.


**Photograph 11: Footpath/Cyclepath Crossing Cemetery Road Near Swann Street, Looking North**

32 No bus routes operate in the immediate area. However there is a school bus route which operates along Cemetery Road, and there is a school bus stop on the northern side of the road east of Domain Road.

**Traffic Flows (Summary of Part of SHA Transportation Assessment)**

33 The Transportation Assessment accompanying the SHA application noted that both the Timsfield and Sentinel Park subdivisions were being constructed, meaning that traffic flows in the immediate area of the submission site would increase in future. Similarly, development of the SHA will also result in increased volumes. The Transportation Assessment allowed for this increase, and reported the following traffic flows at full development of all three sites:

| Road | Existing Peak Hour Volume | Consented Future Peak Hour Volume |
|---|---|---|
| Cemetery Road | 30 | 370 |
| Domain Road (Capell Avenue to Cemetery Road) | 90-135 | 878-923 |
| Capell Avenue east of Domain Rd | 160-240 | 322-398 |
| Capell Avenue west of Domain Rd | 170-255 | 894-979 |

**Table 1: Traffic Flows on Roading Network with Full Development of SHA, Timsfield and Sentinel Park**

34 According to the MobileRoad website, Domain Road to the south of Cemetery Road carries around 150 vehicles each day. This indicates a peak hour flow in the order of 20 vehicles.

35 The Austroads Guide to Traffic Management Part 3 ('Traffic Studies and Analysis') was used in the Transportation Assessment to assess the level of service. These volumes meant that the roads would provide:

- Cemetery Road: Level of Service B;
- Domain Road (Capell Avenue to Cemetery Road): Level of Service D;
- Capell Avenue (east of Domain Road): Level of Service C; and
- Capell Avenue (west of Domain Road): Level of Service D.

36 The levels of service are all within the zone of stable flow.

37 I have calculated the Level of Service for Domain Road (south of Cemetery Road) and note that the low flows means that it provides Level of Service A, the best available.

38 The Capell Avenue / Domain Road and State Highway 6 / Capell Avenue intersections were modelled using the computer software program Sidra Intersection, using these traffic flows, and the results are summarised below.

| Road and Movement | | Morning Peak Hour | | | Evening Peak Hour | | |
|---|---|---|---|---|---|---|---|
| | | Avg Delay (s) | Queue (veh) | LoS | Avg Delay (s) | Queue (veh) | LoS |
| Domain Road (south) | L | 5.9 | 5 | A | 4.9 | 1 | A |
| | R | 6.2 | 1 | A | 12.0 | 1 | B |
| Capell Ave (east) | L | 4.6 | 0 | A | 4.6 | 0 | A |
| Capell Ave (west) | R | 5.1 | 0 | A | 5.5 | 3 | A |

**Table 2: Peak Hour Levels of Service at the Capell Avenue / Domain Road Intersection with Full Development of SHA, Timsfield and Sentinel Park**

| Road and Movement | | Morning Peak Hour | | | Evening Peak Hour | | |
|---|---|---|---|---|---|---|---|
| | | Avg Delay (s) | Queue (veh) | LoS | Avg Delay (s) | Queue (veh) | LoS |
| SH6 (south) | R | 7.7 | 0 | A | 8.1 | 2 | A |
| Capell Ave | L | 4.7 | 4 | A | 5.2 | 1 | A |
| | R | 5.8 | 1 | A | 10.7 | 1 | A |
| SH6 (north) | L | 8.8 | 0 | A | 12.5 | 1 | B |

**Table 3: Peak Hour Levels of Service at the State Highway 6 / Capell Avenue Intersection with Full Development of SHA, Timsfield and Sentinel Park**

39 The analysis shows that queues and delays at the intersections remain low.

40 In addition to these key intersections, the Transportation Assessment noted that it was possible that the existing formation of a number of intersections within the township might need to be upgraded to accommodate the increased traffic flows. The timing of any such schemes will depend on the staging/timing of development within each subdivision, which can be expected to vary in response to market demands and other factors. Moreover each subdivision will contribute only in part to the need for any intersection improvements. However, the legal road widths available within Hawea mean that there are no reasons why layouts which will meet current design guides could not be achieved. As such, it was set out that the potential for future intersection upgrades is not considered to represent a constraint to development.

41 No road safety concerns were identified with regard to the increased traffic flows arising on the roading network, and it was also noted that there were good levels of infrastructure for walking and cycling along Cemetery Road which would accommodate any increase in the use of these modes.

**Key Transportation Aspects of the Submission**

42 I have been provided with an estimated yield for the rezoning of:

a. 1,026 to 1,282 residential lots (plus 465 lots associated with the approved SHA);
b. 72 1,000sqm industrial lots; and
c. 16,800sqm GFA retail.

43 I note that under the District Plan, a residential lot could have an auxiliary unit. However this is only possible at the larger lots. To accommodate this, and in line with the analyses undertaken for other residential developments in the district, I have allowed for 50% of the larger low density lots to have such a unit. Thus the residential yield for the purposes of the traffic assessment is 1,407 units.

44 Under the District Plan, industrial lots are only permitted to have 75% coverage. Thus the 72 lots proposed would have a total of 54,000sqm GFA, and this is the figure used within my assessment.

45 I understand that the extent of industrial and retail development is proposed to make the township less reliant on employment and retail opportunities elsewhere. In practice thought, there will inevitably be some level of external traffic generation, as some residents will choose to shop elsewhere and some people that do not live in Hawea may be employed within the township.

46 The ‘future development plan’ shows points of access onto Domain Road (south of Cemetery Road) and also onto Cemetery Road. My analysis therefore allows for roading connections onto both of these roads.

47 Traffic generation occurs as a result of changes land use activity. Consequently, I rely on the yield and development plan for the remainder of my assessment.

**Traffic Generation of the Submission Site**

48 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.

49 In this case, it is understood that employment opportunities within Lake Hawea township are relatively limited, although it is reasonable to anticipate that the proposed industrial and local shopping centre zonings will provide significantly increased employment opportunities for local residents.

50 Typical residential dwellings each generate 0.9 vehicle movement in the peak hours. In the morning peak hour, 90% of the traffic generated by the proposal is likely to be exiting the subdivision, with 65% of the generated vehicle movements entering the area in the evening peak hour.

| Period | In | Out | Total |
|---|---|---|---|
| Morning Peak Hour | 126 | 1,137 | 1,264 |
| Evening Peak Hour | 821 | 442 | 1,264 |

**Table 4: Peak Hour Traffic Generation of Residential Development**

51 The traffic generation of industrial development depends on the nature of the activities, with heavy industrial generating a different amount of traffic to light industrial uses. Applying a generic peak hour rate towards the upper end of the range (which allows for a mix of activities but a bias towards manufacturing and contracting rather than warehousing) of 2.0 vehicle movements per 100sqm GFA, yields a traffic volume of 1,080 vehicle movements. Since these movements relate to employment, the bulk will enter the industrial areas in the morning and depart in the evenings as people arrive at their workplace and depart. I have allowed for 85% directional flow.

| Period | In | Out | Total |
|---|---|---|---|
| Morning Peak Hour | 918 | 162 | 1,080 |
| Evening Peak Hour | 162 | 918 | 1,080 |

**Table 5: Peak Hour Traffic Generation of Industrial Development**

52 With regard to the retail, a typical traffic generation rate for a 'shopping centre' is 12 vehicle movements per 100sqm GFA in the peak hour. Consequently the 16,800sqm indicated would generate 2,050 vehicle movements (two-way) at peak times. The most significant peak time in respect of an assessment of the roading network is on a weekday evening, as the shopping centre would generate traffic at the same time as the residential element of the proposal (and many people do not shop in the morning commuter peak hour).

| Period | In | Out | Total |
|---|---|---|---|
| Morning Peak Hour | 101 | 101 | 202 |
| Evening Peak Hour | 1,008 | 1,008 | 2,016 |

**Table 6: Peak Hour Traffic Generation of Retail Development**

53 The figures above represent the traffic generation of the individual activities but do not allow for movements wholly within the submission site. That is, at present a work trip, shopping trip and residential trip are counted separately but in practice, a person will often call in to the shops on their way home from work. Thus simply adding the numbers above will represent a significant overestimation of the traffic effects on the external road network. In this example, a journey home from work via the shops would be one trip and not three trips. These journeys between home, work and retail will not take place on the external network at all for residents of the submission site.

54 As the focus of the requested rezoning is to promote more 'live work play' opportunities within the Hawea township, I have allowed for 45% of the total generated trips of the industrial and retail activities to be wholly within the submission site, 45% to be associated with current residential areas of Hawea, and 10% to be trips that take place on the external roading network (that is, Capell Avenue (west) and the state highway).

| Period | Movements within Site | | Movements between Site and Hawea | | External Movements | | Total | |
|---|---|---|---|---|---|---|---|---|
| | In | Out | In | Out | In | Out | In | Out |
| Morning Peak Hour | 118 | 458 | - | - | 8 | 679 | 126 | 1,173 |
| Evening Peak Hour | 821 | 442 | - | - | - | - | 821 | 442 |

**Table 7: Refined Peak Hour Traffic Generation of Residential Development**

| Period | Movements within Site | | Movements between Site and Hawea | | External Movements | | Total | |
|---|---|---|---|---|---|---|---|---|
| | In | Out | In | Out | In | Out | In | Out |
| Morning Peak Hour | 413 | 73 | 413 | 73 | 92 | 16 | 918 | 162 |
| Evening Peak Hour | 73 | 413 | 73 | 413 | 16 | 92 | 162 | 918 |

**Table 8: Refined Peak Hour Traffic Generation of Industrial Development**

| Period | Movements within Site | | Movements between Site and Hawea | | External Movements | | Total | |
|---|---|---|---|---|---|---|---|---|
| | In | Out | In | Out | In | Out | In | Out |
| Morning Peak Hour | 45 | 45 | 45 | 45 | 10 | 10 | 101 | 101 |
| Evening Peak Hour | 453 | 453 | 453 | 453 | 101 | 101 | 1,008 | 1,008 |

**Table 9: Refined Peak Hour Traffic Generation of Retail Development**

55 I highlight that the zero figures for the external residential development in the evening peak hours do not reflect that there will be no such trips – just that the movements are included within the trips associated with the industrial and retail figures.

56 Taking into account the proposed accesses onto the external network and respective locations of activity zones, I initially assigned these external vehicle movements as follows:

a. Residential traffic
    a. 65% onto Cemetery Road, Domain Road and Capell Avenue (west)
    b. 25% via Domain Road (south) and Capell Avenue (west)
    c. 10% via the new Capell Road link

b. Industrial
    a. All external movements via Domain Road and Capell Avenue (west)
    b. Movements within Hawea via the new Capell Road link
c. Retail
    a. All external movements via Domain Road and Capell Avenue (west)
    b. Movements within Hawea via the new Capell Road link

57 The outcome of this trip distribution is that the bulk of the generated traffic will pass through the Domain Road / Cemetery Road and Capell Avenue / Cemetery Road intersections. Thus if these intersections operate satisfactorily under these traffic loadings, different trip distribution assumptions which reduce in lower traffic flows will also show that the intersections operate satisfactorily.

**Effects of Traffic Flows with Submission Site Rezoning on Road Capacity**

58 Based on the anticipated traffic flows, the increase in traffic on the roads set out above will be as follows:

| Road | Peak Hour Volume with SHA | Peak Hour Volume with Submission Site Rezoning |
|---|---|---|
| Cemetery Road | 370 | 837-1,113 |
| Domain Rd south of Cemetery Rd | 20 | 300 |
| Domain Rd (Capell Avenue to Cemetery Road) | 878-923 | 1,624-1,774 |
| Capell Avenue west of Domain Rd | 894-979 | 1,204-1,725 |

**Table 10: Traffic Flows on Roading Network with Full Development of SHA, Timsfield and Sentinel Park Plus Site Rezoning**

59 I have again used the Austroads Guide to Traffic Management Part 3 ('Traffic Studies and Analysis') to assess the level of service under these volumes as showed that the roads would provide:

- Cemetery Road: Level of Service C;
- Domain Road (south of Cemetery Road): Level of Service B;
- Domain Road (Capell Avenue to Cemetery Road): Level of Service E; and
- Capell Avenue (west of Domain Road): Level of Service E.

60 The levels of service on Cemetery Road and Domain Road (south of Cemetery Road) are all within the zone of stable flow.

61 The level of service on Domain Road (Capell Avenue to Cemetery Road) and Capell Avenue (west of Domain Road) and is not within the zone of stable flow and the point of this transition from stable to unstable flow is around 1,500 vehicles per hour.

62 That said, as I noted above, these are the 'worst case' flows, for the reasons set out above and in practice, I expect that the generated volumes will be less. I consider it is important to note that traffic generation can only arise as a result of changes in land use, and the changes in land use which I have assessed can only arise if the site is subdivided. Subdivision requires resource consents and cannot take place as of right. This therefore affords the opportunity to the Council to consider whether any improvement measures are needed to any of the roads in order to accommodate the traffic flows with an improved level of service.

63 Given that the legal road widths are some 20m, I consider that the extent of land available is sufficient to construct any appropriate roading improvement schemes. I also note that Domain Road (south of Cemetery Road) would need to be upgraded as a matter of course due to the current unsealed nature of the carriageway. Accordingly, I do not consider that this is a constraint to the requested rezoning.

**Effects of Traffic Flows with Submission Site Rezoning on Intersection Capacity**

64 With regard to the effects on the intersections, I have firstly modelled the Domain Road / Cemetery Road intersection using the computer software program Sidra Intersection. At any priority intersection, the greatest delays occur for the vehicles turning right from the minor approach. In this case however, this is also expected to be the highest movement at the intersection. Accordingly, I have tested a revised intersection geometry whereby the movements between Domain Road (north) and Cemetery Road has the priority, and vehicles on Domain Road (south) must give-way. The results are summarised below.

| Road and Movement | | Morning Peak Hour | | | Evening Peak Hour | | |
|---|---|---|---|---|---|---|---|
| | | Avg Delay (s) | Queue (veh) | LoS | Avg Delay (s) | Queue (veh) | LoS |
| Domain Road (south) | L | 17.8 | 2 | C | 6.7 | 0 | A |
| | R | 29.3 | 0 | D | 14.2 | 0 | B |
| Cemetery Road | L | 5.6 | 0 | A | 5.6 | 0 | A |
| Domain Road (north) | R | 15.3 | 1 | C | 6.6 | 0 | A |

**Table 11: Peak Hour Levels of Service at the Domain Road / Cemetery Road Intersection with Full Development of SHA, Timsfield and Sentinel Park Plus Site Rezoning**

65 The modelling shows that the intersection would work satisfactorily, with a good level of service and low queues and delays arising in both peak hours.

66 I have then modelled the Capell Avenue / Domain Road intersection using the computer software program Sidra Intersection, using these traffic flows, and the results are summarised below.

| Road and Movement | | Morning Peak Hour | | | Evening Peak Hour | | |
|---|---|---|---|---|---|---|---|
| | | Avg Delay (s) | Queue (veh) | LoS | Avg Delay (s) | Queue (veh) | LoS |
| Domain Road (south) | L | 92 | 121 | F | 5.0 | 2 | A |
| | R | 7.0 | 1 | A | 12.6 | 1 | B |
| Capell Ave (east) | L | 4.6 | 0 | A | 4.6 | 0 | A |
| Capell Ave (west) | R | 5.1 | 1 | A | 5.4 | 3 | A |

**Table 12: Peak Hour Levels of Service at the Capell Avenue / Domain Road Intersection with Full Development of SHA, Timsfield and Sentinel Park Plus Site Rezoning**

67 It can be seen that the current form of the intersection offers poor level of service with high queues and delays in the morning peak hour. In my view this is not surprising, as the present layout does not meet current codes, and the proposal leads to a large increase in the flow turning to and from the minor approach. Best practice is that the minor approach of any intersection carries the lower flows, and therefore this would indicate that Capell Avenue (east) should be the minor approach and therefore a change in priority is justified.

68 Producing a detailed design for an intersection improvement scheme is not appropriate at this time. However as shown on Photograph 4 above, there is a significant amount of land at the intersection (the current carriageway location will accommodate a circle with a 30m radius), and so I have tested a notional roundabout layout since this form of intersection has the highest capacity. The layout allows for just one traffic lane on each approach other than on Domain Road (south) where I have allowed for one additional (but very short) approach lane such that two vehicles can queue side by side. Testing this layout shows the following outcomes:

| Road and Movement | Morning Peak Hour | | | Evening Peak Hour | | |
|---|---|---|---|---|---|---|
| | Avg Delay (s) | Queue (veh) | LoS | Avg Delay (s) | Queue (veh) | LoS |
| Domain Road (south) | 7.0 | 17 | A | 4.5 | 2 | A |
| Capell Ave (east) | 6.9 | 1 | A | 7.8 | 1 | A |
| Capell Ave (west) | 7.7 | 1 | A | 7.0 | 5 | A |

**Table 13: Peak Hour Levels of Service at a Notional Capell Avenue / Domain Road Roundabout with Full Development of SHA, Timsfield and Sentinel Park Plus Site Rezoning**

69 The analysis shows that queues and delays at the roundabout will generally be low. The exception to this is in the morning peak hour when the queue length on Domain Road is forecast to increase to 17 vehicles, but the delay of around 7 seconds indicates that this is a rolling queue and is therefore primarily due to drivers slowing down to negotiate the intersection geometry.

70 Finally, I have carried out an assessment of the State Highway 6 / Capell Avenue intersection:

| Road and Movement | | Morning Peak Hour | | | Evening Peak Hour | | |
|---|---|---|---|---|---|---|---|
| | | Avg Delay (s) | Queue (veh) | LoS | Avg Delay (s) | Queue (veh) | LoS |
| SH6 (south) | R | 7.8 | 0 | A | 9.9 | 7 | A |
| Capell Ave | L | 4.8 | 15 | A | 5.3 | 2 | A |
| | R | 6.2 | 1 | A | 20.7 | 1 | C |
| SH6 (north) | L | 7.9 | 0 | A | 7.9 | 0 | A |

**Table 14: Peak Hour Levels of Service at the State Highway 6 / Capell Avenue Intersection with Full Development of SHA, Timsfield and Sentinel Park Plus Site Rezoning**

71 The modelling shows that queues and delays at the intersection remain low.

72 Given that the legal road widths are some 20m, I consider that the extent of land available within the legal road is sufficient to construct any appropriate intersection improvement schemes, should any be required. Accordingly, I do not consider that this is a constraint to the requested rezoning.

**Effects of Traffic Flows with Submission Site Rezoning on Road Safety**

73 The earlier review of road safety within the Transportation Assessment did not identify any road safety concerns in the immediate area. I have taken the opportunity to review the crash records within Hawea, and note that between 2015 to the current time, in the whole of Hawea (and including the State Highway 6 / Capell Avenue intersection) there were just six crashes reported. Five of the six crashes occurred towards the west of Hawea, with two crashes on Domain Road (between Timsfield Drive and Capell Avenue), one crash on Capell Avenue (between Domain Road and Perry Crescent) and 2 crashes on Capell Avenue (between Domain Road and the state highway).

74 I consider that in part, the low crash rate reflects the low traffic flows within Hawea. If accepted, the submission will result in increased traffic flows and thus there is an increased potential for a higher number of crashes (since crash numbers are proportional to traffic flows). At the same time however, the improvement schemes described above will accommodate the increased traffic flows and as those improvements will be designed to meet current standards. They can therefore be expected to operate safely under the increased traffic loadings

75 Overall then, I do not consider that the rezoning sought by the submission will result in adverse road safety effects arising.

**Internal Layout of Submission Site**

76 The ‘future development plan’ of Mr Williams shows an indicative primary roading layout for the site. From a transportation perspective, the indicative layout does not present any difficulties in achieving the Council’s Code of Practice for Subdivision in full. If there are any deviations from the Code, these can be assessed when subdivision consents are applied for. However at this stage I do not consider that there are any reasons why any variations to the Code of Practice would preclude the requested site rezoning.

**Conclusions**

77 Having assessed the expected yield of the site provided to me, and taking account of the expected traffic generation and internal movements, I consider that there are no traffic and transportation reasons why the submission could not be approved, and the site rezoned.

78 As the extent of development within the site increases, it is likely that there will be a need for intersection and roading improvements, This is not unusual in the context of a large development. Such improvements can be accommodated within the existing legal roads, which are 20m wide.

**Andy Carr**

Dated this 29 May 2020