

Before Queenstown Lakes District Council

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In the matter of            The Resource Management Act 1991

And                            The Queenstown Lakes District proposed District Plan Topic 13  
Queenstown Mapping

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**EVIDENCE OF ANDY CARR FOR**

Universal Developments (177), Peter and Margaret Arnott (399), Hansen Family Partnership (751), FII Holdings Limited (847) and The Jandel Trust (717)

Dated 09 June 2017

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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 am a member of the national committee of the Resource Management Law Association and a past Chair of the Canterbury branch of the organisation. I am also a Member of the Institution of Professional Engineers New Zealand, and an Associate Member of the New Zealand Planning Institute.
- 4 I have more than 27 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 rezoning land, either through undertaking the supporting technical transportation work, or writing and presenting evidence to the relevant hearings panel, and in most cases, both. Within the Queenstown Lakes district, these have included District Plan Changes 4 (North Three Parks), 18 (Mount Cardrona), 25 (Kingston), 39 (Arrowtown South), 41 (Shotover Country), 45 (Northlake), and 46 (Ballantyne Road Industrial and Residential Extension). I have also been involved in plan change requests for a wide variety of activities elsewhere in the South Island.
- 8 With regard to my experience with mixed use zones, I have been involved in a 25ha site in Christchurch (at near the State Highway 1 / Memorial Avenue

intersection), with Queenstown Plan Change 43 (Frankton Mixed Use Zone), and sites in Invercargill, Belfast (Christchurch), and Ashburton, amongst others.

- 9 I have carried out transportation-related commissions for a variety of new developments in the Queenstown area for more than 12 years.
- 10 As a result of my experience, I consider that I am fully familiar with the particular traffic-related issues associated with the rezoning of areas of this nature.
- 11 I have read the Code of Conduct for Expert Witnesses in the Environment Court Practice Note. This evidence has been prepared in accordance with it and I agree to comply with it. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

### **Scope of Evidence**

- 12 I have been asked by counsel for the submitters to comment on the evidence of Ms Banks and in particular, her concerns that the development of the land as a Business Mixed Use Zone (“*BMUZ*”) would lead to adverse effects arising at the State Highway 6 / Hawthorne Drive roundabout.
- 13 By way of background, I have previously been engaged by the submitters to evaluate and assess the potential for a road which would connect Ferry Hill Drive to the west of Quail Rise, to a new fourth leg on the State Highway 6 / Hawthorne Drive roundabout.
- 14 My evidence addresses the following matters:
- (a) A brief description of the prevailing and future transportation networks in the area;
  - (b) The traffic likely to be generated by the provisions sought for the zone; and
  - (c) An assessment of the performance of the roundabout under an increased traffic loading.
- 15 In preparing this evidence I have reviewed the evidence of Ms Banks, and have relied on the model outputs previous provided to me.

### **Existing and Potential Future Transportation Networks and Volumes**

- 16 The State Highway 6 / Hawthorne Drive roundabout was constructed in 2014/15 and according to the NZTA website, was fully opened in December 2015. It has two circulating lanes with a total width of around 11m, and an overall diameter of 60m. As such, I consider it is designed to accommodate high traffic volumes.

- 17 In view of the recent construction date, in my view it meets current designs standards and codes for a roundabout.
- 18 The roundabout presently has three approaches, State Highway 6 (known in this location as the Frankton – Ladies Mile Highway) forms the eastern and western approaches, with Hawthorne Drive forming the southern approach. The submissions all anticipate that a fourth approach will be added, towards the north. I do not consider that this will present any significant design difficulties because the two state highway approaches are at 180-degrees to one another. In essence, providing a fourth approach would result in a four-leg roundabout where each approach is at 90-degrees to the ones on either side. This would continue to meet current guides and standards in respect of the geometry, and would present an easily legible environment to drivers.
- 19 On this basis, I do not consider that there is any impediment to providing the fourth roundabout approach as contemplated.
- 20 As part of my earlier work for the submitters, I obtained the traffic flows expected at the roundabout, and at the State Highway 6 / Tucker Beach Road intersection, from the Council's model holders Abley Transportation Consultants Limited (with the permission of the Council).
- 21 I have confirmed with Abley that these model outputs remain current. In comparing the results with those described by Ms Banks (her paragraph 5.37) there is a slight difference (in the order of less than 1%) but in my view this is not material. I have therefore relied upon these model outputs when assessing the submissions, but have used the forecast 2025 traffic flows, as these allow for growth of traffic on the highway.

### **Traffic Generation of the Proposed Provisions**

- 22 Ms Banks' evidence sets out a number of relevant matters in respect of the potential traffic generation of the site, and I have summarised these below:
- (a) The roundabout has been tested by the Council allowing for 1,150 residences within the submission sites. This showed a minimal difference in the performance of the roundabout as a whole, with increases of less than three seconds on the approaches (Banks evidence paragraph 5.21);
  - (b) If rezoned as BMUZ, a building height limit of 12m would be permitted, equating to three storeys (Banks evidence paragraph 5.21 and 5.52);
  - (c) A 32% reduction has been allowed in the site area for non-developable land (Banks evidence paragraph 5.30, 5.40, and others);

- (d) Under a BMUZ zoning, the maximum building coverage is 75% (Banks evidence paragraph 5.41); and
  - (e) A traffic generation rate of 2.5 vehicle movements per 100sqm GFA has been applied (Banks evidence paragraph 5.41 and others).
- 23 Having reviewed these issues, in my view they are reasonable assumptions to make in their own right.
- 24 However there are a number of relevant matters which are not specifically addressed by Ms Banks.
- 25 In the first instance a BMUZ could be expected to have a large number of residents (either within the site or within Quail Rise) who also work in the site. Any associated vehicle movements would not pass through the State Highway 6 / Ladies Mile Highway, although in practice these residents would also be likely to walk or cycle. Ms Banks does not appear to have allowed for this.
- 26 Ms Banks does not discuss the direction of traffic generated by the site. To some extent this is dependent on the mix of activities – a residential bias would mean that a greater proportion of traffic exits the site in the morning and enters in the evening, but a bias towards commercial uses would mean that the opposite was true.
- 27 A related matter is the direction of traffic approaching and departing the site. This is important because if, say, vehicles exit the site and turn towards the east then they do not pass the eastern or southern approaches and therefore do not reduce the capacity of those approaches. Conversely, vehicles exiting towards the west do have the effect of reducing the capacity on the eastern and southern approaches. Again it is not clear from her evidence what direction Ms Banks has allowed for.
- 28 For my analysis I have allowed for:
- (a) A 25% reduction in the traffic generation of the site arising from people living and working in the area, meaning that vehicles do not use the external network at in the peak times. This means that Ms Banks' generation rates of 2.5 vehicle movements per 100sqm reduce to 1.875 vehicle movements per 100sqm, and the residential rate reduces to 0.72 vehicle movements per residence;
  - (b) A 50/50 split between entering and exiting vehicles, to allow for some residents to leave the site for employment, while other who live elsewhere and are employed at the site, arrive; and

(c) In the peak hour, 45% of travel to be associated with the west, 30% to the south and 25% towards the east. The 2016 model shows that in the peak hours, 25% of traffic emerging / exiting from Quail Rise turns east, and I expect that the same will be the case for the submitters' sites. Of the 75% of traffic that turns to/from the west, some will then move onto Hawthorne Drive (south) due to the employment opportunities on Frankton Flats, Remarkables Park and the like, whereas other traffic will travel further west and into Queenstown itself. I have allowed for a slight bias towards Queenstown, but I also note that the extent of employment within Frankton Flats is substantial.

29 There is no guidance as to the point at which the level of efficiency at an intersection becomes unacceptable, but as a rule of thumb, it is commonly accepted that this is identified by the point where Level of Service D transitions to Level of Service E. The former represents a busy scenario but one where the road (or intersection) is operating in a stable manner, with the latter being a condition where the intersection is unstable and is close to capacity. In practical terms, this transition occurs when the delays per vehicle exceed 50 seconds.

30 Even allowing for this, there is no guidance as to whether this delay applies to individual turning movements, to the approach as a whole, or to the intersection as a whole. I note that Ms Banks describes the changes to the overall performance of the roundabout (Banks evidence paragraph 5.21). However in my analysis, I have identified the most conservative of these metrics (where any individual movement exceeds a 50-second delay per vehicle), in addition to the point where this delay is exceeded for the approach as a whole.

31 In order to identify these points, I have carried out a series of tests based upon different levels of development within the site.

**Model Results**

32 For my assessment, I have used the computer software package Sidra Intersection. For clarity, the default parameters have been used (that is, no adjustments have been made to the basic model).

33 Based on the Council's model 2025 flows, the roundabout would perform as set out below in the morning and evening peak hours.

Road and Movement		Average Delay Per Vehicle (secs)	
		AM Peak	PM Peak
Hawthorne Drive (south)	L	5.5	5.3
	T	-	-
	R	9.6	10.5
State Highway 6	L	5.4	5.4

(east)	T	5.8	5.8
	R	-	-
Hawthorne Drive (north)	L	-	-
	T	-	-
State Highway 6 (west)	R	-	-
	L	-	-
	T	5.7	10.1
	R	12.9	17.4

**Table 1: Delays at the State Highway 6 / Hawthorne Drive Roundabout, 2025, No Development**

- 34 I have then carried out a series of tests on the roundabout to determine the point at which efficiency would reduce, that is, the transition between Level of Service D and Level of Service E (that is, where delays of 50 seconds are reached).
- 35 The following results are achieved when the site generates a total of 1,310 vehicle movements (two-way) are generated in the peak hours:

Road and Movement		Average Delay Per Vehicle (secs)	
		AM Peak	PM Peak
Hawthorne Drive (south)	L	6.1	8.8
	T	5.7	8.2
	R	13.2	15.0
State Highway 6 (east)	L	8.4	7.7
	T	9.2	8.4
	R	16.5	15.6
Hawthorne Drive (north)	L	4.2	19.6
	T	3.6	19.0
	R	10.3	<b>50.0</b>
State Highway 6 (west)	L	7.1	30.4
	T	7.9	33.6
	R	14.7	42.6

**Table 2: Delays at the State Highway 6 / Hawthorne Drive Roundabout, 2025, Site Traffic Volume of 1,310 Vehicles in the Peak Hours**

- 36 It can be seen that at this level of traffic generation, the delays in the morning peak hour remain very low, but in the evening the threshold of Level of Service D to E is reached on one turning movement (the right-turn movement out of Hawthorne Drive (north) as highlighted). By way of example, using the trip generation rates set out above, the scale of development which would generate this level of traffic is:

- (a) 52,400sqm GFA of commercial use plus 455 residences; or

- (b) 34,900sqm GFA of commercial use plus 910 residences; or
- (c) 17,470sqm GFA of commercial use plus 1,365 residences.

37 The following results are achieved when the site generates a total of 1,430 vehicle movements (two-way) in the peak hours:

Road and Movement		Average Delay Per Vehicle (secs)	
		AM Peak	PM Peak
Hawthorne Drive (south)	Average of all approaches	8.5	13.6
State Highway 6 (east)	Average of all approaches	10.9	16.1
Hawthorne Drive (north)	Average of all approaches	6.9	<b>49.4</b>
State Highway 6 (west)	Average of all approaches	7.9	<b>49.4</b>

**Table 3: Delays at the State Highway 6 / Hawthorne Drive Roundabout, 2025, Site Traffic Volume of 1,430 Vehicles in the Peak Hours**

38 Again, at this level of traffic generation, the delays in the morning peak hour remain very low, but in the evening the threshold of Level of Service D to E is reached on two approaches (Hawthorne Drive (north) and State Highway 6 (west) as highlighted). Using the trip generation rates set out above, examples of the scale of development which would generate this level of traffic are:

- (a) 57,200sqm GFA of commercial use plus 495 residences; or
- (b) 38,130sqm GFA of commercial use plus 995 residences; or
- (c) 19,070sqm GFA of commercial use plus 1,490 residences.

39 The difference between the two scenarios is just 120 vehicle movements (two-way) in the peak hours, which equates to an average of one vehicle entering the site and one vehicle exiting the site in the peak hours. In practice then, the difference between the two figures is minimal.

40 From the information provided to me, I understand that the submitters sites are a total of 26.0992ha:

- (a) Margaret and Peter Arnott: 4.0468ha;
- (b) Hansen Family Partnership: 8.0936ha;
- (c) Fii Holdings Limited: 4.0469ha;
- (d) Universal Developments Limited: 8.9964ha; and

(e) Jandel Trust: 0.9155ha.

- 41 In my view, based on my analysis it is appropriate to allow development to occur within the submitters' combined sites up to a threshold of 1,430 vehicle movements (two-way) in the peak hours as a permitted development. Adopting this threshold means that only one approach, in only one peak hour (the evening), would move from Level of Service D to Level of Service E. Moreover, the traffic flows that I have used are based on those expected in 2025, and so they include for growth on the highway and therefore include a further element of conservatism. I therefore consider that there is negligible risk to the efficiency of the roading network under this scenario.
- 42 One difficulty with adopting a single threshold figure over the whole of the submitters' sites is that one landowner could develop more quickly and/or more intensively than the others, disproportionately 'using up' the capacity on the network. To avoid this happening, in my view it would be reasonable to allow for each hectare of land to generate 55 vehicle movements (two-way) in the peak hours (that is, 1,430 vehicle movements divided by 26.1ha), meaning that the available roading capacity would be distributed more equitably between the landowners.
- 43 For illustration, using Ms Banks' unadjusted trip rates, this would equate to 69 residences or 2,200sqm of commercial development, per hectare.
- 44 Beyond the threshold of 55 vehicle movements per hectare (two-way), I consider that it would be reasonable to allow for controls on the extent of further development. For example, development above the threshold could be a Restricted Discretionary Activity with the effects on the efficiency of the State Highway 6 / Hawthorne Drive roundabout being a transportation-related matter of discretion.
- 45 My views on this matter are influenced by the fact that there are a number of uncertainties in the nature of the road network in future. In the first instance, there are several potential future roading schemes which may change the traffic patterns at the roundabout if they were to be progressed. One of these is the possibility of a road link from the roundabout to Ferry Hill Drive in Quail Rise. Such a link would be an attractive route for a number of residents of Quail Rise meaning that traffic flows using Hawthorne Drive (north) would increase. Conversely the road link means that vehicles associated with the submitters sites could access the highway via Tucker Beach Road rather than having to use Hawthorne Drive which would reduce traffic volumes.
- 46 NZTA has stated that it is considering revisions to the State Highway 6 / Tucker Beach Road intersection. The full nature of these has not yet been fully determined, but changes in capacity would change the relative attractiveness of

this intersection and of the State Highway 6 / Hawthorne Drive roundabout as a route to reach the site.

- 47 It is also plausible that a third lane could be added to the circulating carriageway of the State Highway 6 / Hawthorne Drive roundabout. This could easily be done and would significantly increase the capacity of the roundabout.
- 48 The extent to which the site will be fully developed is not known. It is plausible that there will be some land parcels which will not be developed to their maximum extent and therefore do not require their full allocation of capacity at the State Highway 6 / Hawthorne Drive roundabout. As a result, other land parcels could exceed the 55-vehicle threshold, but this would need to be assessed at the time. Related to this, the mix of activities within the site is not known at this stage meaning that the traffic generation characteristics might be slightly different to what has been allowed for in the calculation.
- 49 Given these uncertainties, I consider that the appropriate approach is to assess the traffic-related effects of development of more than 55 vehicle movements (two-way) per hectare at the time that such a development is proposed.
- 50 In this regard I note that the notified version of the District Plan, Rule 8.5.3.2 requires a Traffic Impact Assessment to be undertaken for *any* development on the submitters' sites. In my view, based on my analysis, such an assessment is unnecessary for developments generating less than 55 vehicle movements per hectare (two-way) in the peak hours because, as I have shown above, this level of traffic can be accommodated by the State Highway 6 / Hawthorne Drive roundabout. Beyond this threshold however, I consider that the technical matters addressed by this rule are sufficient to ensure that the efficiency of the roundabout will be properly assessed and the functioning of the state highway network will be protected.

### **Conclusion**

- 51 Having reviewed the submission made by Margaret and Peter Arnott (#399), Hansen Family Partnership (#751), Fii Holdings Limited (#847), Universal Developments Limited (#43) and Jandel Trust (#717), I am able to support the rezoning of their respective sites, provided that there is a limitation on the extent of traffic generation in relation to permitted development.
- 52 Based on my analyses, I consider that each hectare of the submitters' sites could generate a maximum of 55 vehicle movements (two-way) in the peak hours without adverse potentially causing efficiency issues at the State Highway 6 / Hawthorne Drive roundabout. This figure has been derived from conservative assumptions and therefore in my view, from a transportation perspective, this level of development should be a permitted activity. Expressing

the threshold based on units of one hectare results in an equitable outcome for the different landowners involved.

- 53 There are a number of unquantifiable matters that mean that any effects beyond this threshold cannot be assessed at this stage, including whether a link road will be provided between Quail Rise and the State Highway 6 / Hawthorne Drive roundabout, any changes to the State Highway 6 / Tucker Beach Road intersection proposed by NZTA, any potential future upgrade of the State Highway 6 / Hawthorne Drive roundabout, whether all areas within the site are developed to their maximum potential, and the mix of activities within the site that will occur.
- 54 However these matters do not necessarily mean that the capacity of the road network will be exceeded, merely that conditions will be different. Accordingly, I consider that development in excess of 55 vehicle movements (two-way) per hectare in the peak hours should be controlled in some way, such as through being a Restricted Discretionary Activity. I consider that the matters set out in Rule 8.5.3.2 of the notified District Plan are appropriate for an assessment of the traffic-related effects for such development.

**Dated this 9 day of June 2017**



**Andy Carr**