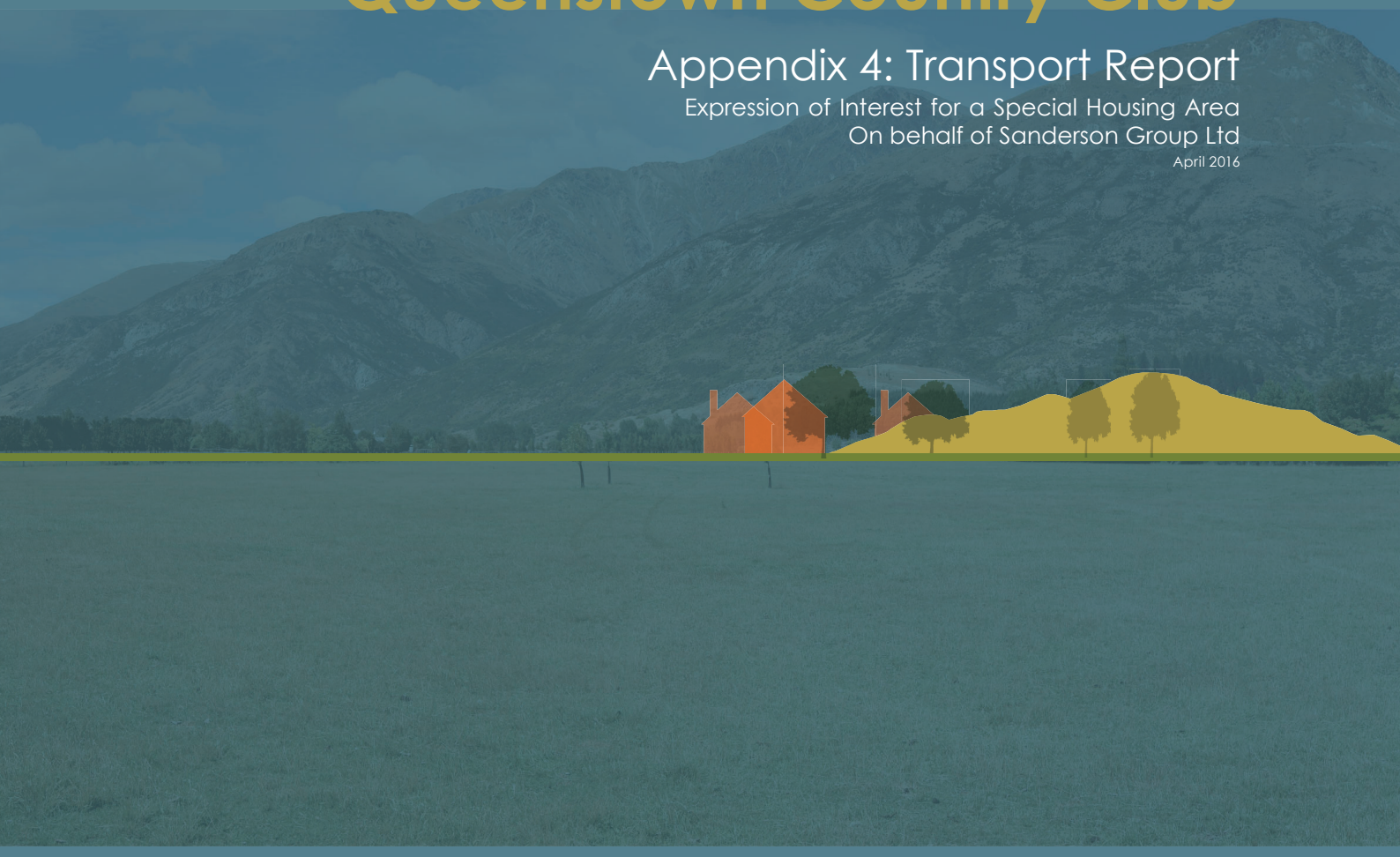
Queenstown Country Club

Appendix 4: Transport Report

Expression of Interest for a Special Housing Area
On behalf of Sanderson Group Ltd

April 2016



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Transport Assessment

April 2016

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Sanderson Group

Queenstown Country Club

Transport Assessment

Quality Assurance Statement

Prepared by:

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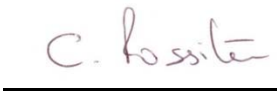
Principal Transportation Engineer



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1. Introduction

The Sanderson Group is proposing construction of a retirement village complex on a green-field site located between Lake Hayes Estate and Shotover Country about 12 km north of Queenstown. This report provides an assessment of the proposed access arrangements and expected traffic generation.

2. Existing Transportation Infrastructure

Lake Hayes Estate is located approximately 12km northeast of Queenstown along State Highway 6 (SH6). **Figure 1** shows that Howards Drive forms the main access route to Lake Hayes Estate from SH6.

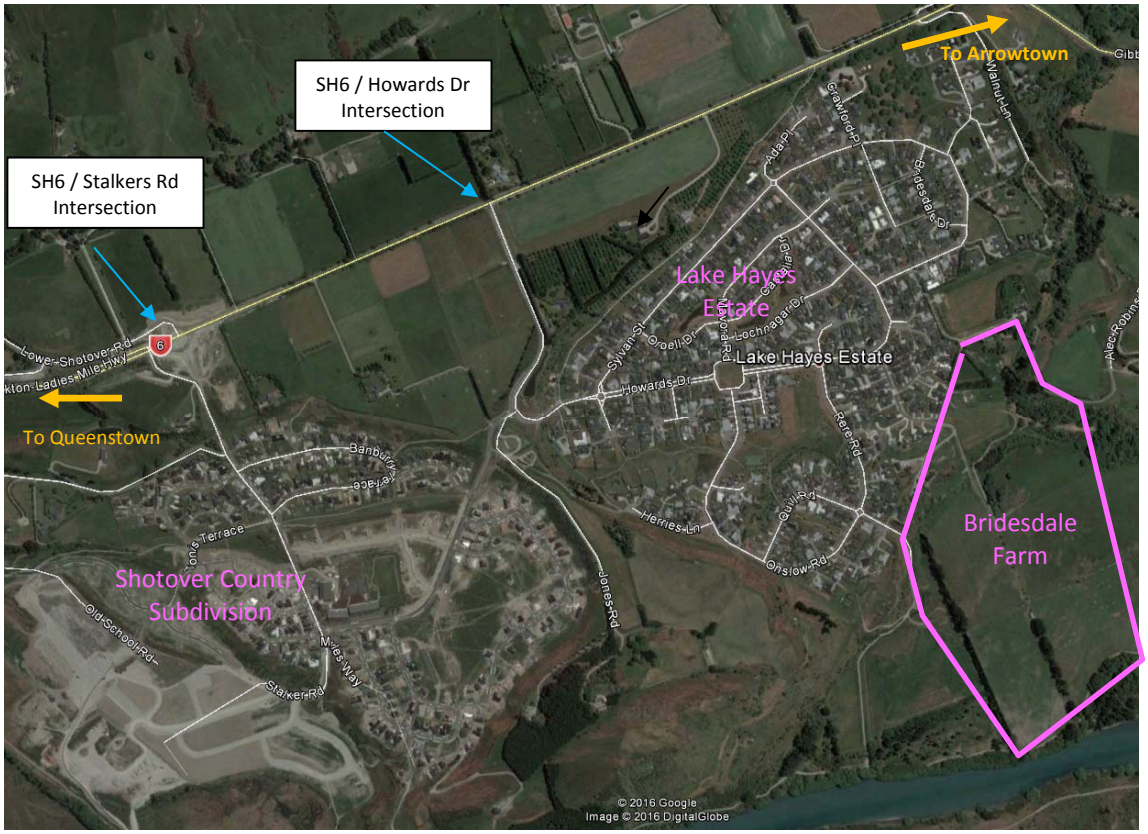

Figure 1: SH6 / Howards Drive Intersection Location

The SH6 / Howards Drive intersection is a three-arm give-way controlled intersection with Howards Drive being the minor road. The intersection has a 20m long right turn bay and a left turn lane on SH6. The speed limit on SH6 is 100km/h, and the speed limit on Howards Drive is 50km/h.

Howard Drive has a relatively straight and level alignment for about 250m south of SH6 but then descends about 20m in elevation over a distance of 400m via a series of curves in the road. Jones Avenue which provides secondary access to the Shotover Country subdivision to the west meets Howards Drive at a priority intersection in the middle of the second curve about 500m south of SH6. Howards Drive has been widened around the curve to include a right turn bay.

The Bridesdale Farm area represents a recent extension to Lake Hayes Estate that will ultimately provide about 150 residential units. Access to this area from SH6 is via Howards Drive.

Stalker Road provides the primary access to the Shotover Country subdivision. The SH6 / Stalker Road intersection has recently been converted to a four-arm roundabout with Lower Shotover Road. Howards Drive provides a secondary access route to the subdivision.

3. Traffic Patterns

3.1 SH6 Daily Traffic Volumes

The latest NZTA traffic volume data recorded on SH6 east of Lower Shotover Road for a week long period in September 2015 indicates the following:

- An average daily weekday (Monday to Thursday) traffic volume of 12,000 vehicles per day (vpd);
- Friday has a higher volume of 12,700vpd; and
- A Saturday traffic volume of 11,000vpd and Sunday traffic volume of 10,500vpd.

3.2 SH6 Hourly Movement Patterns

Figure 2 shows the hourly traffic volume counts on SH6 in September 2015. The main features of this traffic pattern include:

- There were two peak periods from Monday to Thursday. A morning peak volume of 1,100 vehicles per hour (vph) occurred between 8am and 9am, and the evening peak 1,200vph occurred between 5pm and 6pm;
- Saturday and Sunday have a single broad peak period during the day which extends from midday through to about 6pm. The traffic volumes during this period were in the range 900-1,000vph.

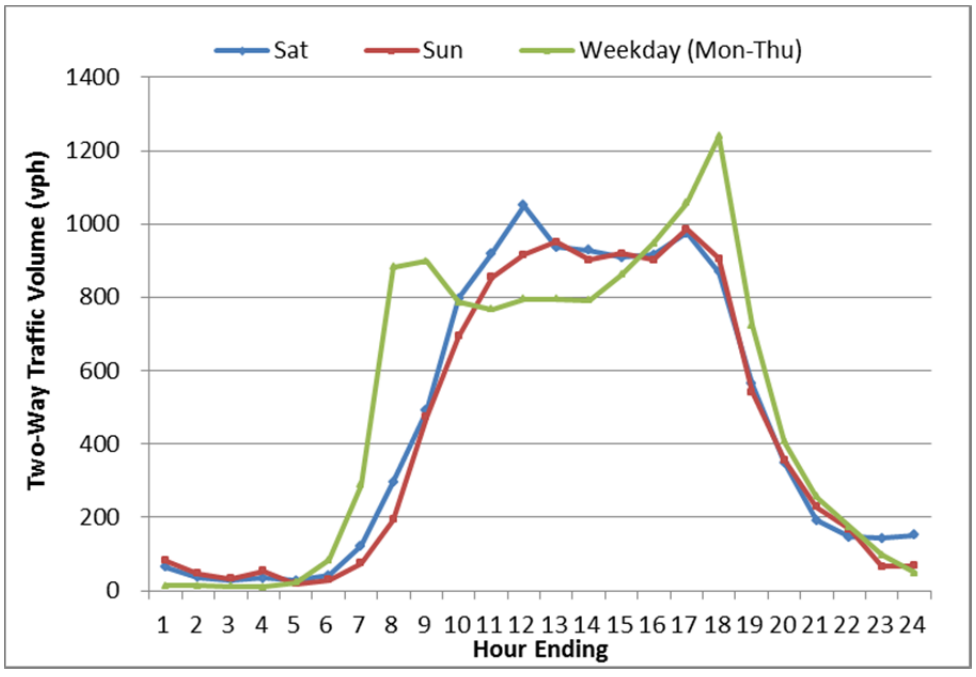

Figure 2: SH6 East of Lower Shotover Road (Week Beginning 14 September 2015) – Hourly Traffic Volumes

3.3 SH6 / Howards Drive Intersection Movement Patterns

Vehicle turning movements at the SH6 / Howards Drive intersection were observed during the evening peak hour (5pm to 6pm) on 24 September 2014 and morning peak hour (8am to 9am) on 25 September 2014.

The observed traffic volumes at the intersection are summarised below.

Approach	Movement	Traffic Volume (vph)
SH6 (West)	Through	236
	Right In	62
Howards Drive	Left Out	340
	Right Out	56
SH6 (East)	Left In	33
	Through	406
Total		**1,133**

Table 1: AM Peak - SH6 / Howards Drive Intersection Peak Hour Traffic Volumes (vph)

Approach	Movement	Traffic Volume (vph)
SH6 (West)	Through	454
	Right In	291
Howards Drive	Left Out	124
	Right Out	27
SH6 (East)	Left In	42
	Through	456
Total		**1,394**

Table 2: PM Peak - SH6 / Howards Drive Intersection Peak Hour Traffic Volumes (vph)

As can be seen from the tables above, approximately 80% to 85% of the traffic entering or exiting Howards Drive is coming from or heading towards the west. The other 15% to 20% is coming from or heading towards the east.

The surveys recorded peak hour traffic volumes on Howards Drive of about 500 vehicles per hour (vph). Based on the peak hour factors from SH6 traffic volumes, this suggests that the average daily traffic volume was about 5,000 vehicles per day (vpd) in 2014. With the ongoing development in the Shotover Country subdivision and also at Lake Hayes Estate (Bridesdale Farm), it is likely that current traffic volumes on Howards Drive could be about 10% higher than those recorded in 2014.

3.4 Existing Intersection Performance

Analysis of the SH6 / Howards Drive intersection has been undertaken using the intersection analysis software package SIDRA Intersection for the morning and evening peak hour using the observed traffic volumes reported in **Table 1**.

Level of service[1] is reported based on the Highway Capacity Manual (HCM) 2010, as shown in **Table 3**.

LOS	Average Delay (sec/veh)
A	<10
B	10-15
C	15-25
D	25-35
E	35-50
F	50

Table 3: HCM 2010 LOS Criteria for Priority Intersections

The peak hour assessment shows that the intersection worst movement (right turn from Howards Drive) operates at level of service (LOS) C during the AM peak hour and LOS D during the evening peak hour.

LOS C marks the beginning of a range of flow in which the operation of individual users becomes significantly affected by interactions with others in the traffic stream, and the general level of comfort and convenience declines noticeably at and below this point. LOS D represents high density stable flow, and the driver generally experiences poor level of comfort and convenience. At intersections, this typically represents a situation where there are high opposing flows for turning movements which increases the delay for drivers waiting for a suitable gap. As opposing flows increase, drivers will tend to take smaller gaps, which in turn increases the risk of crashes.

3.5 State Highway Traffic Growth

Figure 3 shows the annual average daily traffic volumes recorded on SH6 east of Lower Shotover Road from 2000 to 2014. It shows a period of rapid growth from 2000 to 2007 and slower growth from 2007 to 2014. Figure 3 also shows the effect of removing traffic generated by the Lake Hayes Estate. This suggests that the underlying growth from the wider area accounts for about 2% growth per annum in the traffic volumes.

[1] Level of service is a qualitative measure of intersection performance. A range from LOS A to LOS F is applied, representing free flow through to congested forced flow conditions.

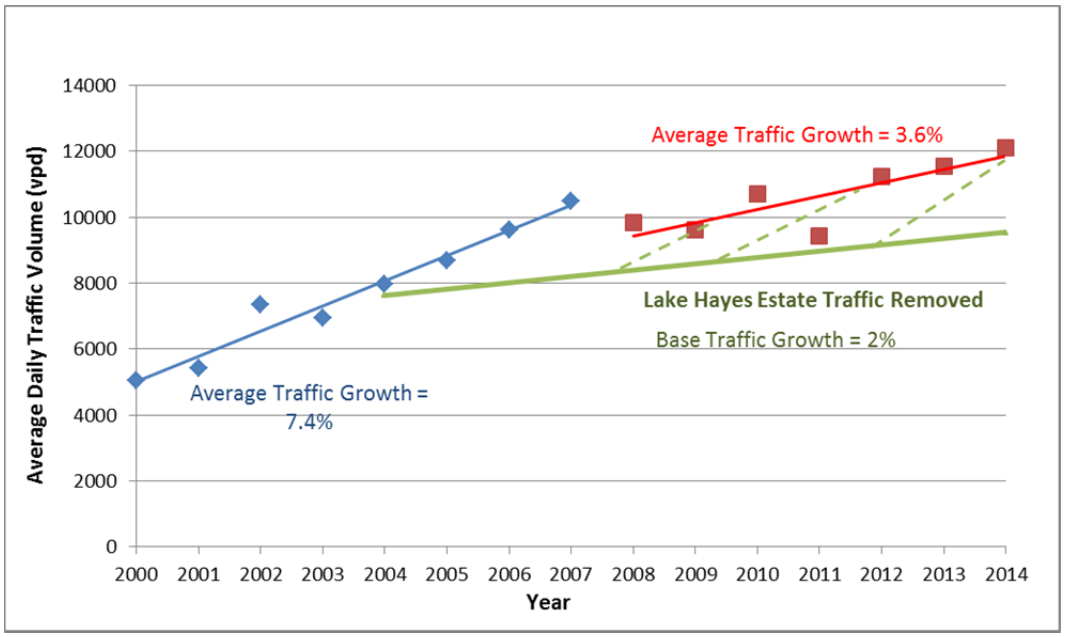

Figure 3: State Highway Traffic Volumes East of Lower Shotover Road

4. Development Proposal

The Queenstown Country Club development proposal involves the creation of a retirement village. The plans show a northern part to the village with one access to Howards Drive and one access onto Jones Avenue. The northern intersection on Howards Drive leads to an avenue through the village about 150m south of SH6. The southern access is proposed onto Jones Avenue about 60m west of Howards Drive.

The southern part of the village would have a single access to Jones Avenue also to the north of the escarpment. Ten separate residential lots are also proposed at the western end of the southern village with access provided by a new road leading to Onslow Road within Lake Hayes Estate.

Table 4 shows the proposed composition of the overall village. The northern part of the village will include community facilities such as a small medical centre providing specialist services (e.g. physiotherapy, optometrist, dentist, orthopaedic), childcare and small scale retail. The northern village will also include a clubhouse that is intended primarily for use by local residents.

Facility	North	South
Villas	153	74
Apartments	36	36
Rest-home Beds	72	
Worker Accommodation Units	7	
Clubhouse (m^2)	300	
Community Facilities (m^2)	2,000	
Private Sections		10

Table 4: Proposed Composition of Each Village

5. Traffic Generation and Distribution

5.1 Expected Traffic Generation

The NZTA Research Report 453 "Trips and Parking related to Land Use" contains traffic generation rates for a range of activities including retirement accommodation. This has been used as the basis for calculating the expected level of traffic generation of the proposed developments. The following tables provide a breakdown of the expected traffic generation during the morning and evening peak periods as well as at a daily level. For the purposes of this assessment, an indicative composition for the community facilities has been adopted. Since the peak traffic generation period for retirement villages typically occurs during the middle of the day rather than during the commuter peak periods, a traffic generation rate of 0.2vph per unit has been adopted. This represents about 50% of the peak hour rate and is consistent with the hourly traffic generation profile observed by TDG at a semi-rural retirement village.

Facility	Traffic Generation Rate	North	South
Villas	0.2vph / unit	31	15
Apartments	0.2vph / unit	7	7
Rest-home Beds	0.2vph / bed	14	
Worker Accommodation Units	0.0vph / unit	0	
Private Sections	0.8vph / lot		8
Clubhouse[2]	0.8vph / 100m^2 PFA	2	
Community Facilities:			
Medical (4 Professionals)	11.6vph / professional	46	
Childcare (50 Children)	1.1vph / child	55	
Retail[3] (200m^2 GFA)	13.0vph / 100m^2 GFA	26	
Café[4] (100m^2 PFA)	3.2vph / 100m^2 PFA	3	
Total		**185**	**30**

Table 5: Expected Traffic Generation of Each Village (AM Peak)

[2] Not open during the morning peak period
[3] Morning peak rate is about 30% of evening peak
[4] Rate is 4% of average daily based on ITE hourly variation data

Facility	Traffic Generation Rate	North	South
Villas	0.2vph / unit	31	15
Apartments	0.2vph / unit	7	7
Rest-home Beds	0.2vph / bed	14	
Worker Accommodation Units	0.0vph / unit	0	
Private Sections	0.8vph / lot		8
Clubhouse	7.5vph / 100m^2 PFA	23	
Community Facilities:			
Medical (4 Professionals)	11.6vph / professional	46	
Childcare (50 Children)	0.5vph / child	25	
Retail (200m^2 GFA)	42.5vph / 100m^2 GFA	86	
Café (100m^2 PFA)	10.0vph / 100m^2 PFA	10	
Total		**242**	**30**

Table 6: Expected Traffic Generation of Each Village (PM Peak)

Facility	Traffic Generation Rate	North	South
Villas	2.6vpd / unit	398	192
Apartments	2.6vpd / unit	94	94
Rest-home Beds	2.5vpd / bed	180	
Worker Accommodation Units	6.0vpd / unit	42	
Private Sections	8vpd/unit		80
Clubhouse	90vpd / 100m^2 PFA	270	
Community Facilities:			
Medical (4 Professionals)	79.4vpd / professional	320	
Childcare (50 Children)	4.1vpd / child	200	
Retail (200m^2 GFA)	129vpd / 100m^2 GFA	260	
Café (100m^2 PFA)	135vpd / 100m^2 PFA	135	
Total		**1,899**	**366**

Table 7: Expected Traffic Generation of Each Village (Daily)

The difference in the traffic generation of the two village areas arises from the proposed care home and community facilities that form part of the northern part of the village. The clubhouse will also contribute to higher traffic generation in the northern part of the village but it is understood that this is intended primarily for residents' use rather than the general public. On this basis, the average daily traffic generation of the club house would be expected to be less than 270vpd and therefore, the tabulated traffic generation levels represent upper limits.

5.2 Expected Distribution

With the proposed site layout for the northern part of the village, it is expected that the majority of vehicle movements associated with the villas and clubhouse will be via the northern access to Howards Drive and all other movements would be via the other accesses. On this basis, there would be about 700vpd using the Howards Drive access and about 1,200vpd on the Jones Avenue driveway. During the peak commuter periods, it is expected that there would be about 70 two-way vehicle movements per hour at the Howards Drive access and about 200 vehicle movements at the Jones Avenue access.

All access to the southern part of the retirement village is proposed via a single driveway to Jones Avenue with the individual residential lots having access to Onslow Road. On this basis, the retirement village access would be expected to carry about 290 vehicle movements per day and about 20 vehicle movements per hour during the morning and evening commuter periods.

The ten individual lots would generate about 80 additional vehicle movements per day on the Lake Hayes Estate road network with about ten vehicle movements in the morning and evening peak hours.

It is anticipated that Howards Drive will be the primary access route to SH6 with only a small percentage choosing to travel through the Shotover Country subdivision via Jones Avenue and Stalker Road. However, this pattern of movements will be influenced by the level of delay experienced by drivers at the SH6 / Howards Drive intersection.

The community facilities proposed in the northern part of the village are intended primarily to serve the residents within the new villages and also local residents from the Shotover Country subdivision and from Lake Hayes Estate. On this basis, it is considered likely that the northern part of the village area would only generate about 1,100 additional vehicle movements per day on Howards Drive south of SH6.

6. Access Review

6.1 Howards Drive Access (Northern Village)

Although the peak hour of traffic generation for the retirement villages will not coincide with the peak commuter periods on Howards Drive, the volume of right turning movements at peak commuter times at the northern access will exceed the warrants set out in the Austroads Guide to Road Design Part 4A for a basic right turn treatment but will not meet the warrant for a full channelized right turn treatment. However, given the slower reaction times of older drivers and a desire to maximise safety at the entrance, we recommend that Howards Drive is widened to provide a full right turn bay at this entrance.

The northern site access is located on a straight and generally level section of Howards Drive. Although Howards Drive slopes down towards the south, it is considered that the District Plan sight distance requirement of 80m can be achieved.

6.2 Jones Avenue Access (Northern Village)

The proposed site layout includes a new priority intersection on Jones Avenue about 60m west of Howards at the crest of the road. **Photograph 1** and **Photograph 2** provide indicative sight lines from the proposed intersection.

Photograph 1: Northern Village Access to Jones Road – View North

Photograph 2: Northern Village Access to Jones Road – View South

The Austroads Guide to Road Design Part 4A sets out minimum sight distance requirements for a new intersection. The desirable Safe Intersection Sight Distance (SISD) is 97m on roads with an operating speed of 50km/h. This reduces to 70m under the Extended Design Domain (EDD) criteria on low volume urban roads where drivers would be expect to be more alert to intersections.

The available sight distance requirement to the north of the intersection is constrained by the separation from the Howards Drive intersection. While this results in a sight distance that is below the desirable SISD, this is not considered to be a safety concern in this location because the proximity of the Howards Drive intersection means that vehicles will be approaching at less than 50km/h. The separation exceeds the EDD SISD for 40km/h of 53m.

Jones Avenue rises through a cutting from Shotover Country towards the proposed new intersection over a crest curve. The crest reduces the available sight distance to the south and as a consequence, the available sight distance will be sensitive to the final location of the intersection. At this preliminary design stage, it is considered that a minimum sight distance of 60-70m could be achieved without major earthworks. This is sufficient to exceed the EDD SISD criteria but does not meet the desirable SISD criteria. On this basis, we would recommend that an advance warning sign for the side road is installed.

6.3 Jones Avenue Access (Southern Village)

The access to the southern part of the village is proposed along the alignment of a legal road to the east of Jones Avenue. The legal road meets Jones Avenue above the cutting through the escarpment above Shotover Country. **Photograph 3** and **Photograph 4** show the sight lines from the legal road at its proposed intersection with Jones Avenue.

Photograph 3: Village Access to Jones Avenue – View South

Photograph 4: Village Access to Jones Avenue – View North

The available sight distance to the south easily exceeds the Austroads desirable SISD requirements for a road with an operating speed of 50km/h. However, the crest curve to the north of the legal road constrains the available sight to about 60-70m. Again, this is considered sufficient to exceed the EDD SISD criteria but does not meet the desirable SISD criteria. **Photograph 4** shows that there is an earth embankment on the inside of the curve to the north. It is considered a reduction in the height of this would increase the sight distance to an acceptable level.

6.4 SH6 / Howards Drive

The following tables show the expected levels of service at the SH6 / Howards Drive intersection as the Bridesdale Farm and the retirement villages are developed. Three growth scenarios for SH6 have been investigated to represent the expected changes in state highway traffic volumes over the next five to ten years.

Development	2014	SH6 5% Growth	SH6 10% growth	SH6 15% Growth
Lake Hayes Estate (LHE)	13(B)	14(B)	(15)B	16(C)
LHE + Bridesdale	14(C)	15(C)	16(C)	17(C)
LHE + Bridesdale + Villages	15(C)	17(C)	18(C)	19(C)

Table 8: Expected Intersection Delays(s) and Levels of Service - SH6 / Howards Drive (AM)

Development	2014	SH6 5% Growth	SH6 10% growth	SH6 15% Growth
Lake Hayes Estate (LHE)	24(C)	26(D)	(28)D	32(D)
LHE + Bridesdale	28(D)	31(D)	35(D)	39(E)
LHE + Bridesdale + Villages	33(D)	37(E)	41(E)	46(E)

Table 9: Expected Intersection Delays(s) and Levels of Service - SH6 / Howards Drive (PM)

The analysis indicates that with the Bridesdale Farm subdivision, the SH6 / Howards Drive intersection will operate with a level of service C in the morning peak and LOS D in the evening peak with about 10% overall growth in the SH6 traffic volumes. This represents about five years of growth based on the current average growth rate. In the evening peak, the level of service is expected to fall to LOS E in five to ten years. The 95 percentile queue length for the right turn movement from SH6 into Howards Drive is forecast to be about 20m which will fill the available storage space of the right turn bay. This suggests that intersection improvements are likely to be required in a five to ten year time frame.

The development of the retirement village will increase traffic volumes at the intersection. While there will be some increase in delays for right turning vehicles in the morning peak, these will be small and are unlikely to be noticeable to drivers. In the evening peak however, the delays for vehicles turning right from Howards Drive will start to increase more rapidly and represent LOS E. At these volumes, drivers will be tempted to take smaller gaps and there will be a greater risk of crashes occurring. The 95 percentile queue lengths on SH6 are expected to increase to about 25m which exceeds the available storage space which also increases the potential for crashes.

The overall effect is that the development of the retirement villages is likely to bring forward the need for intersection improvements. Any change in timing though will be dependent upon the rate at which the retirement villages are developed and occupied.

Preliminary discussion with NZTA has been held to determine their long terms plans for SH6 Ladies Mile Highway. NZTA do not currently have any current plans to upgrade the intersection to a roundabout but have indicated that this may occur in the long term as part of a safety improvement programme for the SH6 Ladies Mile Highway. In the shorter term,

they have indicated that increased traffic volumes on Howards Drive above those currently consented is likely to require widening of the western approach so that the right turn bay can be extended.

7. Summary and Conclusions

The investigation of expected traffic generation of the two retirement villages suggests that the northern part of the village could generate about 1,900vpd and the southern part of the village could generate about 290vpd. About 900vpd would be generated by the community facilities proposed. In practice, this is likely to represent an upper limit for the traffic generation because the proximity of the facilities to both Shotover Country and Lakes Hayes Estate, as well as the two proposed retirement villages, will make walking and cycling a realistic travel mode option.

With the forecast traffic volumes, it is considered that the northern entrance to the northern village from Howards Drive will require a right turn bay to be constructed to ensure that it operates safely and efficiently.

Two new intersections are proposed on Jones Avenue, one at the existing intersection with a legal road that will provide access to the southern village and one about 60m west of Howards Drive. The existing vertical and horizontal alignment of Jones Avenue constrains the available sight distances that can be achieved to less than the desirable minimum SISD set out in the Austroads Design standards for a road with a 50km/h operating speed. However, it is considered that a SISD of 60-70m can be achieved at both intersections without major reconstruction of Jones Avenue which is sufficient to meet the EDD SISD criteria. On this basis, the proposed access locations are considered acceptable but recommend that advance warning signage for the new side roads is installed on Jones Avenue to alert drivers to the new roads.

The analysis of the SH6 / Howards Drive intersection suggest that intersection improvements will be required in the five to ten year time frame even without any development of the retirement village living. Preliminary discussion with NZTA indicates that the preferred short term improvements would involve lengthening of the right turn bay rather than a change of intersection configuration to a roundabout. It is considered likely that the proposed retirement villages will bring forward the need for these intersection improvements.

Overall, it has been concluded that the proposed development does not generate any traffic effects that would not be expected if the land was developed for residential housing. The retirement villages will generate only low levels of traffic during peak commuter periods compared with typical residential development. Further, since the proposed community facilities are intended to serve local residents, the associated traffic generation on the wider road network will also be low. On this basis, it has been concluded that the proposal can be supported from a transport perspective.

8. Recommendations

Following this preliminary investigation of the expected traffic generation of the proposed village, it is recommended that the following road network improvements are considered.

(i) Form a priority intersection on Howards Drive controlled by give way signs. It is recommended that a right turn bay is formed on Howards Drive.

(ii) Form a new intersection on the west side of Jones Road at least 60m west of Howards Drive. The final location of the intersection will need to be confirmed as part of the detailed design to ensure that it maximises the sight distance to the south.

(iii) Form a priority intersection on Jones Avenue generally along the alignment of the existing paper road. Sight distances will be improved by aligning the intersection as far to the north as practical and by reducing the height of the earth bank to the north of the intersection.

(iv) Investigate public transport requirements and likely requirement for new bus stops on Howards Drive and Jones Avenue to service the village residents.

TDG