

5. Levels of Service

5.1 Intersections

5.1.1 Introduction

The SIDRA intersection analysis software has been used to determine the current level of service (LOS) provided at each of the key identified intersections on Ladies Mile. The analyses undertaken take into account both the existing traffic flows and those envisaged by 2021. As noted above, the latter scenario has been derived based upon traffic growth applied to the state highway at a rate of 450 vehicles per annum (being a continuation of the present traffic growth rate), and the traffic volume associated with Lake Hayes Estate being increased in accordance with the maximum permitted development within Lake Hayes Estate.

For clarity, this analysis does not take into account the proposed Plan Change, hence the future year (2021) analyses are what would be expected allowing for only currently-zoned land uses. The traffic volumes are shown on **Figure 10**.

5.1.2 Ladies Mile / Howards Drive

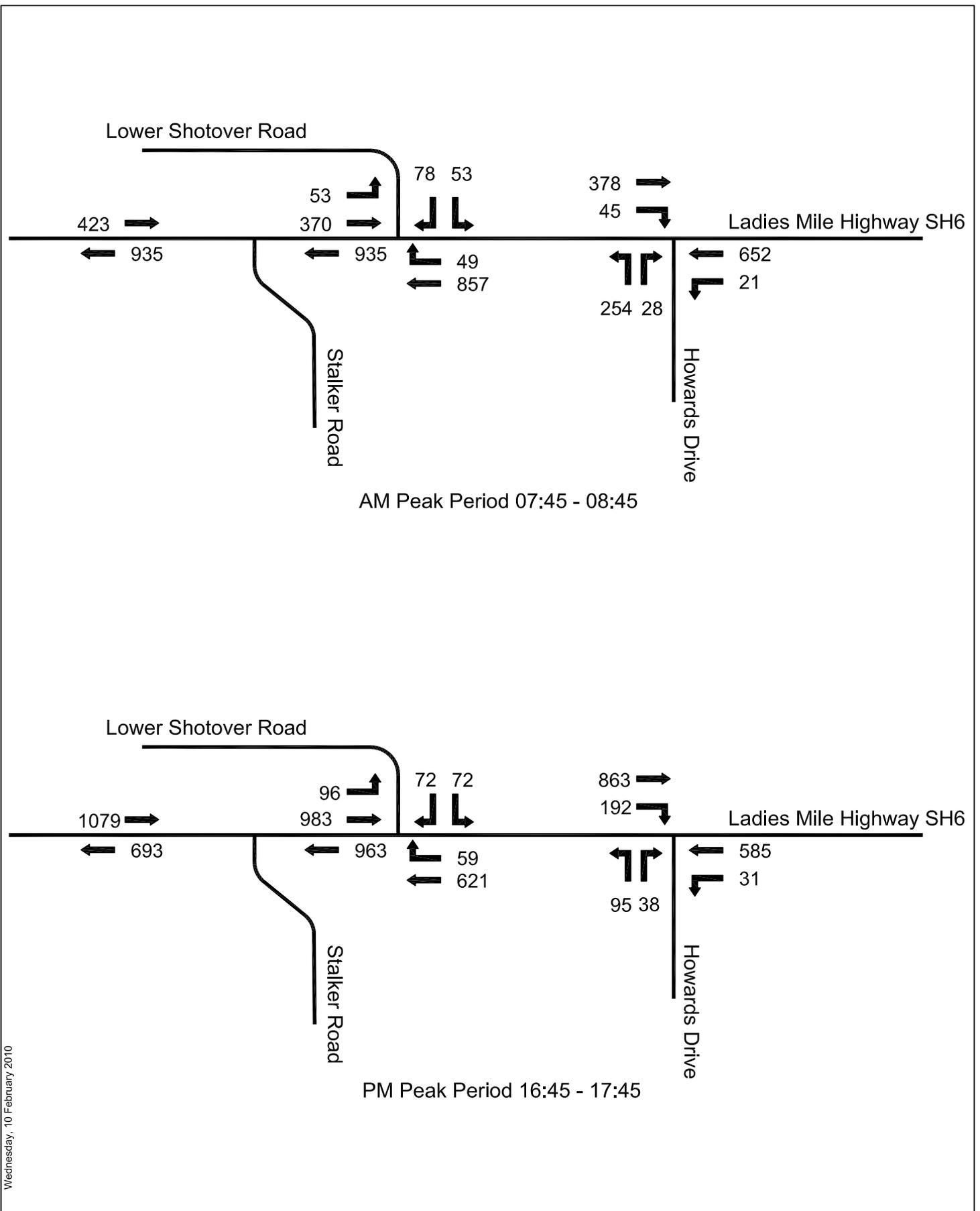
Approach	Movement	Average Control Delay (s/veh)	95th Percentile Queue (m)	LOS
SH6 Ladies Mile (East)	L	12.4	0	B
	T	0.0	0	A
Howards Drive	L	12.9	9	B
	R	16.4	2	C
SH6 Ladies Mile (West)	T	0.0	0	A
	R	13.9	1	B

Table 3: Ladies Mile / Howards Drive Intersection, 2008 AM Peak

Approach	Movement	Average Control Delay (s/veh)	95-th Percentile Queue (m)	LOS
SH6 Ladies Mile (East)	L	12.7	1	B
	T	0.0	0	A
Howards Drive	L	12.2	3	B
	R	23.5	4	C
SH6 Ladies Mile (West)	T	0.0	0	A
	R	13.8	5	B

Table 4: Ladies Mile / Howards Drive Intersection, 2008 PM Peak

It can be seen that at present the lowest level of service occurs for right-turning vehicles emerging from Howards Drive in the evening peak hour, but level of service LOS C still represents a good level of service.



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Approach	Movement	Average Control Delay (s/veh)	95th Percentile Queue (m)	LOS
SH6 Ladies Mile (East)	L	12.4	1	B
	T	0.0	0	A
Howards Drive	L	16.8	20	C
	R	24.8	4	C
SH6 Ladies Mile (West)	T	0.0	0	A
	R	15.6	2	C

Table 5: Ladies Mile / Howards Drive Intersection, 2021 AM Peak

Approach	Movement	Average Control Delay (s/veh)	95-th Percentile Queue (m)	LOS
SH6 Ladies Mile (East)	L	12.9	1	B
	T	0.0	0	A
Howards Drive	L	13.9	7	B
	R	76.3	34	F
SH6 Ladies Mile (West)	T	0.0	0	A
	R	15.4	13	C

Table 6: Ladies Mile / Howards Drive Intersection, 2021 PM Peak

It can be seen that in the morning peak hour, the queue of right turning vehicles is small and delays are moderate but in the evening peak hour, delays are more significant at more than a minute. This results in level of service LOS F for this movement.

5.1.3 Ladies Mile / Lower Shotover Road

Approach	Movement	Average Control Delay (s/veh)	95th Percentile Queue (m)	LOS
SH6 Ladies Mile (West)	L	12.7	1	B
	T	0.0	0	A
Lower Shotover Road	L	7.5	1	A
	R	16.1	5	C
SH6 Ladies Mile (East)	T	0.0	0	A
	R	13.3	1	B

Table 7: Ladies Mile / Lower Shotover Road Intersection, 2008 AM Peak

Approach	Movement	Average Control Delay (s/veh)	95-th Percentile Queue (m)	LOS
SH6 Ladies Mile (West)	L	12.8	1	B
	T	0.0	0	A
Lower Shotover Road	L	10.2	2	B
	R	22.7	6	C
SH6 Ladies Mile (East)	T	0.0	0	A
	R	15.5	2	C

Table 8: Ladies Mile / Lower Shotover Road Intersection, 2008 PM Peak

It can be seen that at present the lowest level of service occurs for right-turning vehicles emerging from Lower Shotover Road, although level of service LOS C still represents a good level of service.

Approach	Movement	Average Control Delay (s/veh)	95th Percentile Queue (m)	LOS
SH6 Ladies Mile (West)	L	12.8	1	B
	T	0.0	0	A
Lower Shotover Road	L	8.3	2	A
	R	40.8	18	E
SH6 Ladies Mile (East)	T	0.0	0	A
	R	13.9	1	B

Table 9: Ladies Mile / Lower Shotover Road Intersection, 2021 AM Peak

Approach	Movement	Average Control Delay (s/veh)	95th Percentile Queue (m)	LOS
SH6 Ladies Mile (West)	L	12.8	3	B
	T	0.0	0	A
Lower Shotover Road	L	16.1	8	C
	R	325.5	139	F
SH6 Ladies Mile (East)	T	0.0	0	A
	R	20.9	6	C

Table 10: Ladies Mile / Lower Shotover Road Intersection, 2021 PM Peak

By the morning peak hour of 2021, the queue of right turning vehicles from Lower Shotover Road experiences level of service LOS F, with delays for vehicles of around one minute. In the evening peak hour, the delay increases to nearly 5.5 minutes. In practice, these potential delays are likely to be reduced by changes in driver behaviour, such as changing the time of travel or selecting an alternative route (if available). However, even with such changes in behaviour, delays are likely to be significant.

5.1.4 Ladies Mile / Stalker Road

Approach	Movement	Average Control Delay (s/veh)	95th Percentile Queue (m)	LOS
SH6 Ladies Mile (East)	L	12.2	0	B
	T	0.0	0	A
Stalker Road	L	13.6	0	B
	R	19.4	0	C
SH6 Ladies Mile (West)	T	0.0	0	A
	R	15.0	0	C

Table 11: Ladies Mile / Stalker Road Intersection, 2008 AM Peak

Approach	Movement	Average Control Delay (s/veh)	95-th Percentile Queue (m)	LOS
SH6 Ladies Mile (East)	L	12.2	0	B
	T	0.0	0	A
Stalker Road	L	12.3	0	B
	R	25.2	1	D
SH6 Ladies Mile (West)	T	0.0	0	A
	R	13.9	0	B

Table 12: Ladies Mile / Stalker Road Intersection, 2008 PM Peak

It can be seen that at present the lowest level of service occurs for right-turning vehicles emerging from Stalker Road in the evening peak hour, when level of service LOS D arises.

Approach	Movement	Average Control Delay (s/veh)	95th Percentile Queue (m)	LOS
SH6 Ladies Mile (East)	L	12.2	0	B
	T	0.0	0	A
Stalker Road	L	17.0	0	C
	R	34.5	1	D
SH6 Ladies Mile (West)	T	0.0	0	A
	R	18.8	0	C

Table 13: Ladies Mile / Stalker Road Intersection, 2021 AM Peak

Approach	Movement	Average Control Delay (s/veh)	95-th Percentile Queue (m)	LOS
SH6 Ladies Mile (East)	L	12.2	0	B
	T	0.0	0	A
Stalker Road	L	14.2	0	B
	R	68.2	2	F
SH6 Ladies Mile (West)	T	0.0	0	A
	R	15.7	0	C

Table 14: Ladies Mile / Stalker Road Intersection, 2021 PM Peak

As with the performance of the Howards Drive intersection, in the morning peak hour the queue of right turning vehicles is small and delays are moderate, but in the evening peak hour delays are more significant which results in level of service LOS F for this movement.

5.1.5 Summary

Overall, the analyses show that at the present time there is a good level of service provided at each of the three intersections assessed. However, allowing for growth on the highway and for full development of Lake Hayes Estate, difficulties arise for right-turning vehicles emerging from the minor approaches. The modelled delays are more significant in the evening peak hour than in the morning. It is considered that the delays for traffic emerging from Lower Shotover Road and potentially Howards Drive are such that in practice changes in driver behaviour will occur.

In respect of Lower Shotover Road, it is likely that most drivers will use an alternative route. However for Howards Drive (and possibly also some drivers Lower Shotover Road) there are few alternatives available. Consequently either drivers will firstly turn left and then 'u-turn' on the highway, or will accept smaller gaps in the traffic streams before turning right onto the highway. Both of these are likely to have consequential adverse effects upon road safety. Thus it is likely that prior to 2021, NZTA will have to undertake some form of improved traffic management or intersection improvement scheme at one of these locations (most likely Lower Shotover Road). This may involve prohibiting the right-turn movement completely, but at this stage it is considered more likely that all turning movements will be retained and a roundabout constructed in this location, which provides greater capacity.

5.2 Public Transport

There are a variety of measures to describe the level of service provided by a public transport system. Appendix A includes level of service descriptions for public transport service headway and for service operating hours. These are taken from the Highway Capacity Manual 2000 (HCM), given there is no equivalent for the New Zealand context.

With a daytime headway of 60 minutes, the public transport service on Ladies Mile has a service frequency LOS E. The service from Queenstown to Arrowtown operates between 6:30am and 12:30am which corresponds with level of service LOS B for hours of service. The service to Queenstown does not provide a late evening service with the last scheduled departure from Arrowtown at 7pm. The reduced operating hours corresponds with a level of service LOS D. It is considered therefore, that overall, the public transport system does not provide a high level of service in terms of service provision.

5.3 Walking and Cycling

Given the general lack of walking and cycling in the immediate vicinity (as a result of the present land uses) it is considered that the level of provision for these road users is appropriate and adequate.

6. Description of Private Plan Change

6.1 Proposed Development

The proposed plan change will enable development of a new residential area situated between Lake Hayes Estate and the Shotover River that will provide for a range of housing types and densities around a small, central community precinct. The site would be divided into a number of activity areas as indicated in the structure plan illustrated in **Figure 11**.

Activity Area 1 (AA1) would form the largest part of the site and would be used for low density permanent living accommodation. AA1 is located predominantly around the periphery of the area where the edges are defined by natural features such as terrace escarpments.

Activity Area 2 (AA2) includes the land located around both sides of the central access road. Together with Activity Area 3, it will form the core of the site and provide for a higher density of housing than AA1. It will also allow for some small scale retail facilities to service the immediate needs of the community. Activity Area 3 (AA3) includes 3ha of land that has been set aside for educational and community facilities.

The remainder of the site will largely comprise open space areas or reserves and will include a heritage precinct area to provide protection of the early settler's cottage and surrounding area.

6.2 Road Network

The proposed vehicle access connections for the site and the proposed alignments of the primary and secondary roads for the site are shown in **Figure 12**. The primary access will be from the Ladies Mile / Stalker Road intersection with a further access from the Ladies Mile / Howards Drive intersection, facilitated via an internal roading link between the two areas. The structure plan shows a primary road extending south from the existing section of Stalker Road to a cross-roads intersection, J1. From this intersection, Road 1 and Road 2 forms a loop to the west and south. Another primary road, Road 3, connects Road 1 with Howards Drive to the east. The structure also shows two secondary roads, Road 4 and Road 5, to the north and south of this connection that will provide access to the eastern sections of AA1.

A parcel of land to the west of Howards Drive has been reserved for potential construction of a Park and Ride facility that would serve residents of both the plan change site and Lake Hayes Estate, as well as traffic presently utilising the state highway.



**FIGURE 25:
SHOTOVER COUNTRY STRUCTURE PLAN**

Drawn	Checked	Approved	Date	Scale	Sheet No.	Total Sheets
LADIES MILE PARTNERSHIP			10/27/20	1:375	25	
			10/27/20	1:750		

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LEGEND

Activity Areas:

- 1 Low Density Living
- 2a Medium Density Living
- 2b Medium Density Living
- 3 Education & Community Precinct
- 4 Historic Precinct
- 5a Open Space - State Highway
- 5b Open Space - Escarpments
- 5c Open Space - Riverside Protection Area
- 5d Open Space - Wetland/Recreation
- 5e Open Space - Transmission Corridor

Other Features:

- Intersection Points (max 20m variation from centre line)
- ▬ Primary Road (max 30m variation from centre line)
- ▬ Secondary Road (max 20m variation from centre line)
- ▬ 30m Wetland Setback
- ▬ Indicative Trails
- ▬ Alternative Connection to SH6
- ▬ Riverside Protection Areas
- ▬ Terrace Buffer Area (6m from terrace edge)
- ▬ Zone Boundary



KEY

- Primary Road
- Secondary Road
- Central Node
- Park & Ride Area

Item	Quantity	Unit	MSL
10270	23		
1:3750			
1:7500			

FIGURE 23:
VEHICLE ACCESS CONNECTIONS
AND PARK & RIDE

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DRAWN: CKC
 DATE: 10.02.2010
 SCALE: —
 DWG NO: 9489-3C-12A

Shotover Country Proposed Plan Change
 Proposed Vehicle Access Connections and Park & Ride

REVISION	DATE	DESCRIPTION

7. Traffic Generation and Distribution

7.1 Traffic Generation

The predicted traffic generation for each of these activities has been based on the trip generation rates published by the New Zealand Trips and Parking Database. However, since the non-residential activities are primarily intended to serve the local community (including the Lake Hayes Estate) it is not expected that these will attract significant numbers of trips from outside the site. Similarly, the presence of these non-residential land uses will also mean that some trips made from the residential land uses will not be required to be made externally. This will potentially also affect the trip generation from Lake Hayes Estate.

7.1.1 Residential

Under the Council's Development Standards, each residential property is required to be assessed as generating 8 vehicle movements per day (two-way). Previous analyses undertaken in the area have allowed for between 0.8 and 1.0 vehicle movements per dwelling occurring in the 'typical' commuter peak hours. Of the peak hour movements, 30% enter the development and 70% exit in the morning peak hour, with 60% entering and 40% exiting in the evening peak hour.

In this regard, the traffic survey on Howards Drive is of particular note, since this road serves a large residential area in very close proximity to the proposed site. While the trip generation per household cannot be determined with accuracy, the figure calculated above of 7.6 trips per household per day is close to Council's 'design' figure of 8 such trips per day. Consequently, some confidence can be placed that the daily patterns of traffic flow are also reliable. In terms of the morning and evening peak hours the data shows that of the 'design' 8 vehicle movements per day, 0.61 vehicle movements (two-way) occurred between 7am to 8am and 0.87 vehicle movements (two-way) occurred between 8am to 9am, suggesting that the morning peak period occurs over an extended period. This is commensurate with anecdotal evidence. Conversely, the evening peak period occurred over a much shorter period with 0.94 vehicle movements (two-way) made between 5pm and 6pm.

For the purposes of this analysis, an upper limit of 773 residences has been adopted.

Activity	Quantity	Peak Hour	TRIP GENERATION		
			In	Out	Total
Residential	773 units	07:00-08:00	141	330	471
		08:00-09:00	202	470	672
		17:00-18:00	436	291	727

Table 15: Base (Internal) Trip Generation of Residential Land Use

It is considered that in the peak hours, around 90% of these trips will be made on the external road network with the remainder being made to internal locations, notably the pre-school and school.

Activity	Quantity	Peak Hour	TRIP GENERATION		
			In	Out	Total
Residential	773 units	07:00-08:00	127	297	424
		08:00-09:00	182	423	605
		17:00-18:00	392	262	654

Table 16: External Trip Generation of Residential Land Use

It is also considered that the presence of the pre-school and school within the proposed Shotover Country site will prove attractive to residents of Lake Hayes Estate and since there is to be a direct link between the two areas, this will reduce the traffic volumes on Howards Drive. An allowance of a 5% reduction has been adopted in this analysis.

7.1.2 Retail

At this stage, the composition of the retail land use is not determined although it is understood that it will comprise small shops appropriate to serve the site and Lake Hayes Estate only. Therefore a generic rate appropriate for a small shopping centre has been adopted (35.7 trips per 100sqm GFA in the peak hour).

Retail land uses generally generate minimal traffic levels in the morning peak hour, and it is considered that even those traffic movements are likely to be wholly internal to the site. In the evening peak hour, many trips will either be made internally to the site (such as from residences) or will be 'pass by' trips which already have been calculated as part of the residential land use. Equally, the size of retail offer is not considered sufficient to attract large proportions of external trips into the site. Thus the overall external trip generation of the retail development has been reduced by 90%.

Activity	Quantity	Peak Hour	TRIP GENERATION		
			In	Out	Total
Retail	1000sqm GFA	08:00-09:00	0	0	0
		17:00-18:00	179	179	358

Table 17: Base Trip Generation of Retail Land Use

Activity	Quantity	Peak Hour	TRIP GENERATION		
			In	Out	Total
Retail	1000sqm GFA	08:00-09:00	0	0	0
		17:00-18:00	18	18	36

Table 18: External Trip Generation of Retail Land Use

7.1.3 Community Facilities

Again the composition of the community facilities has not been determined and different types of facility have different trip generation rates and different likelihoods of generating traffic in the morning and evening peak hours. A generalised rate for a medical centre has been adopted, of a peak hour rate of 14.6 trips per 100sqm GFA.

In common with the retail aspect of the development however, it is understood that these facilities are intended to primarily provide for residents of the site rather than those living externally. Thus the overall external trip generation of the community facilities has been reduced by 90%.

Activity	Quantity	Peak Hour	TRIP GENERATION		
			In	Out	Total
Community	1000sqm GFA	08:00-09:00	73	73	146
		17:00-18:00	73	73	146

Table 19: Base Trip Generation of Community Land Use

Activity	Quantity	Peak Hour	TRIP GENERATION		
			In	Out	Total
Community	1000sqm GFA	08:00-09:00	7	7	14
		17:00-18:00	7	7	14

Table 20: External Trip Generation of Community Land Use

7.1.4 Pre-School

The surrounding area is primarily residential, and work recently undertaken by Traffic Design Group for a pre-school facility in Lake Hayes Estate highlighted that there is latent demand for such a development in the immediate area. Thus it is anticipated that all trips associated with a pre-school would be internal to the site.

7.1.5 Primary School

As with the pre-school, it is anticipated that the bulk of trips to the school will be made wholly internal to the site. At this stage though the school zone cannot be confirmed and thus it is possible that a proportion of movements would be external to the site. An allowance has been made of 20% of trips to be external.

The trip generation of a school depends upon the number of pupils rather than floor area, but from information in the Trips and Parking Database, a Gross Floor Area of 1,500sqm would suggest around 400 students could be accommodated. The database also suggests a rate of 0.6 trips per pupil in the peak hours.

Activity	Quantity	Peak Hour	TRIP GENERATION		
			In	Out	Total
Primary School	1500sqm GFA (400 pupils)	08:00-09:00	120	120	240
		17:00-18:00	0	0	0

Table 21: Base Trip Generation of Primary School Land Use

Activity	Quantity	Peak Hour	TRIP GENERATION		
			In	Out	Total
Primary School	1500sqm GFA (400 pupils)	08:00-09:00	24	24	48
		17:00-18:00	0	0	0

Table 22: External Trip Generation of Primary School Land Use

7.2 Park and Ride

One option allowed for within the proposed plan change is for the creation of a Park and Ride site. This will affect the modal split for journeys made to and from the site, Lake Hayes Estate and also potentially on the state highway.

2006 census data for journey to work has been examined to determine the amount of commuter traffic passing the site on the state highway. This data suggests that between 15% and 25% of traffic passing the proposed site could be intercepted by a park and ride scheme, depending on the level of parking reduction in the town centre. This is broadly in line with the Wakatipu Transportation Strategy which suggests that more frequent public transport services, parking restraint in Queenstown and Park and Ride facilities could translate to approximately a 20% transfer of car trips to public transport by 2026.

Within this analysis a more conservative approach has been taken of a 10% reduction in car-borne travel associated with the proposed plan change site, with these movements being made by bus instead. A further (and again conservative) allowance has been made of 10% of trips associated with Lake Hayes Estate and on the state highway also transferring to bus.

Because the Park and Ride is an optional, rather than certain, outcome of the proposed Plan Change the following assessment includes scenarios with and without the Park and Ride operating.

7.3 Overall Traffic Generation

The overall traffic generation of the site, when fully developed is follows:

Activity	Quantity	Peak Hour	TRIP GENERATION		
			In	Out	Total
All land uses	-	07:00-08:00	114	267	381
		08:00-09:00	192	409	601
		17:00-18:00	375	258	633

Table 23: External Trip Generation of Overall Land Uses with Park and Ride

Activity	Quantity	Peak Hour	TRIP GENERATION		
			In	Out	Total
All land uses	-	07:00-08:00	127	297	424
		08:00-09:00	213	454	667
		17:00-18:00	417	287	704

Table 24: External Trip Generation of Overall Land Uses without Park and Ride

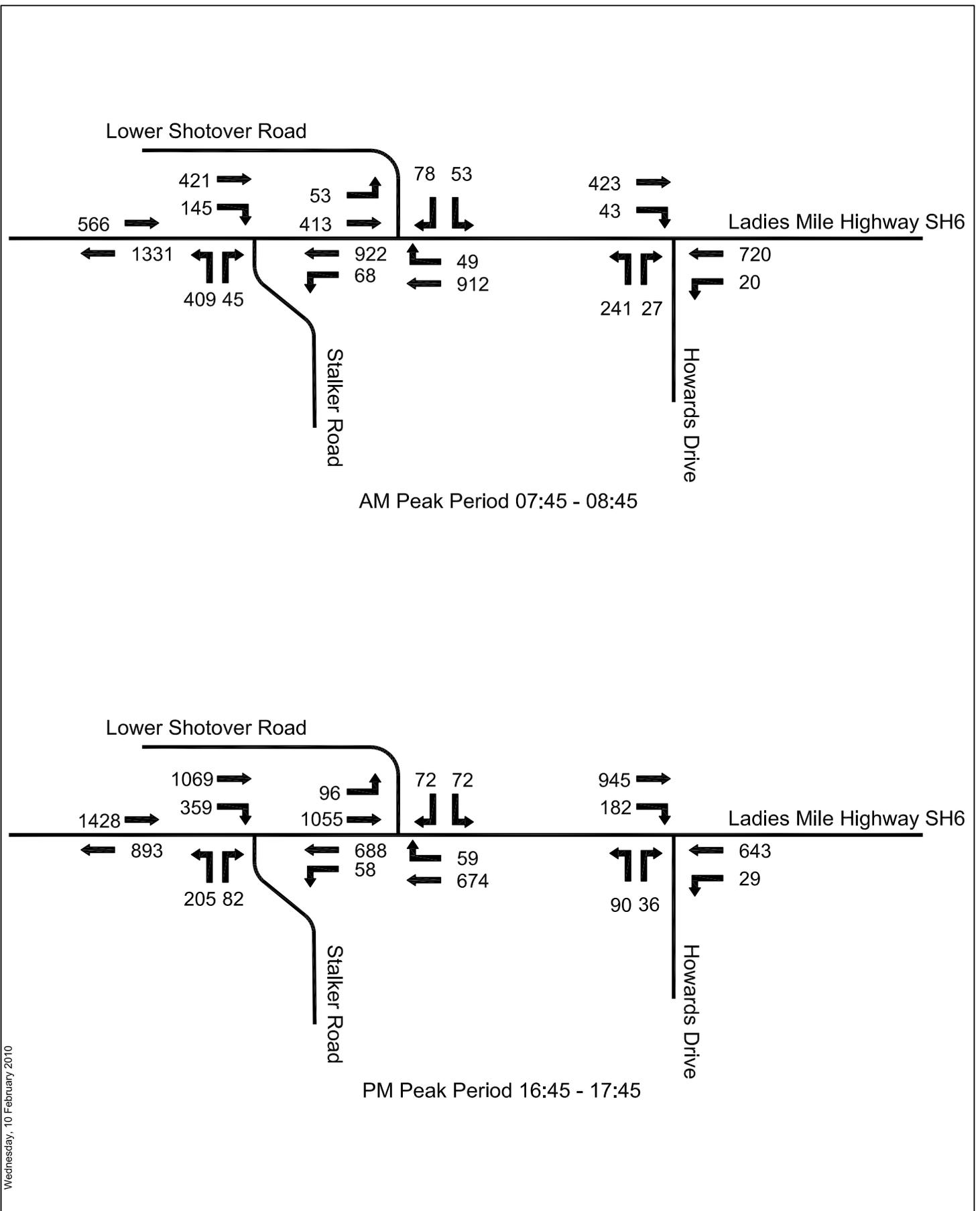
7.4 Traffic Distribution

With its location being immediately to the west of Lake Hayes Estate and a similar proposed primary point of access to the State Highway, it is considered that the distribution of trips will be very similar to that of Lake Hayes Estate, as described above, with the majority of trips being made to and from the west.

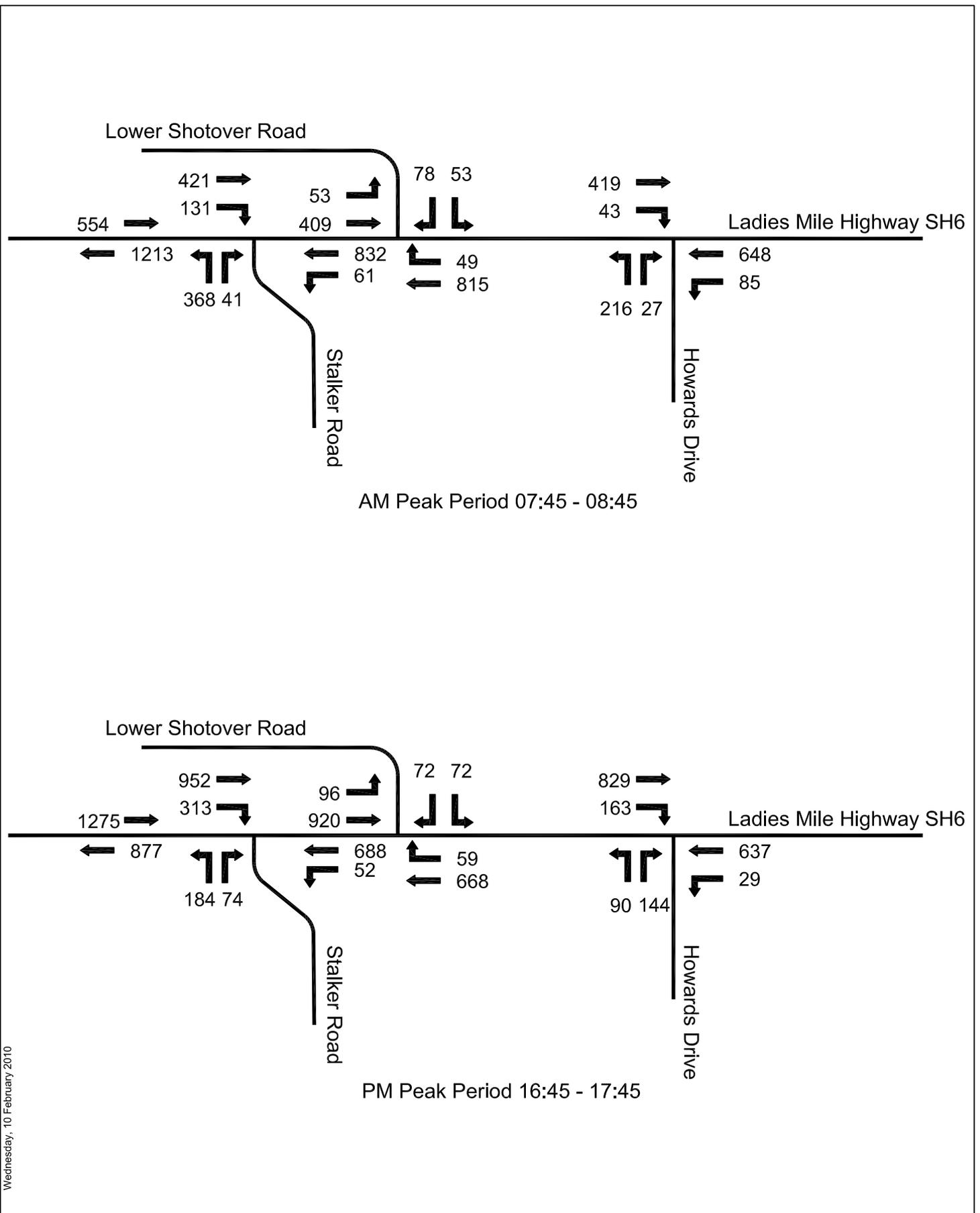
Given the proximity of the park and ride site to Howards Drive, it is considered that all vehicles associated with this land use will use Howards Drive rather than Stalker Road.

The pattern of vehicle movements at Ladies Mile / Howards Drive intersection is likely to change as a result of the linkage between the proposed site and Lake Hayes Estate. For example, vehicles associated with the easternmost residential areas within the plan change site travelling towards the east may use Howards Drive as the more direct route. Similarly, vehicles associated with Lake Hayes Estate which presently turn west from Howards Drive could use Stalker Road instead, particularly if dropping children off at school. At this stage, given the inherent uncertainties in determining the proportions of vehicles which would do this, no revisions have been made to the traffic patterns in this regard.

The traffic volumes and distribution are illustrated on **Figures 13 and 14**.



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8. Effects on the Transportation Network

8.1 Traffic Volumes

Stalker Road is currently classified as a Local Road by the District Plan. With full development of the site (with or without the Park and Ride in place), the road would carry a significant traffic volume (in excess of 5,000 vehicles per day) and several sections of the road would carry a high proportion of through traffic. Thus the plan change would justify Stalker Road being reclassified as a Collector Road with the plan change in place, being a road that “provides the distribution and circulation of traffic between or within local areas and to and from the arterial road network”. This situation is also evident at present with Howards Drive.

8.2 Intersection Performance

The SIDRA intersection analysis software has been used to predict the operational performance of the intersections on Ladies Mile near to the plan change site based on the forecast traffic generation and distribution described earlier.

8.2.1 Ladies Mile / Howards Drive

Approach	Movement	WITH PARK AND RIDE			WITHOUT PARK AND RIDE		
		Average Control Delay (s/veh)	95th Percentile Queue (m)	LOS	Average Control Delay (s/veh)	95th Percentile Queue (m)	LOS
SH6 Ladies Mile (East)	L	12.4	2	B	12.4	0	B
	T	0.0	0	A	0.0	0	A
Howards Drive	L	16.5	16	C	17.7	20	C
	R	26.9	4	D	28.5	4	D
SH6 Ladies Mile (West)	T	0.0	0	A	0.0	0	A
	R	15.5	2	C	16.2	2	C

Table 25: Ladies Mile / Howards Drive Intersection, with development, 2021 AM Peak

Approach	Movement	WITH PARK AND RIDE			WITHOUT PARK AND RIDE		
		Average Control Delay (s/veh)	95th Percentile Queue (m)	LOS	Average Control Delay (s/veh)	95th Percentile Queue (m)	LOS
SH6 Ladies Mile (East)	L	12.8	1	B	12.8	1	B
	T	0.0	0	A	0.0	0	A
Howards Drive	L	14.3	5	B	14.4	5	B
	R	346.2	196	F	114.6	19	F
SH6 Ladies Mile (West)	T	0.0	0	A	0.0	0	A
	R	15.8	7	C	15.9	9	C

Table 26: Ladies Mile / Howards Drive Intersection, with development, 2021 PM Peak

It can be seen that in the morning peak hour, there is very little effect on this intersection with the development in place compared to the situation without the development, irrespective of whether the development includes a Park and Ride site. The levels of service on each turning movement are the same under each of the three scenarios considered (without development and with development, with or without the Park and Ride site).

In the evening peak hour, there is also little change on all turning movements under each scenario, other than for the right-turn movement from Howards Drive where the delays increase significantly. The greatest delays occur with the Park and Ride in place because of those drivers who have used the park and ride facility seeking to emerge back onto the highway having switched mode from bus back to their car. Without the Park and Ride site however, delays still increase due to the increased traffic volumes on the state highway associated with the plan change site. It should be noted however that level of service LOS F occurs on this turning movement under each scenario (with or without the plan change) as can be seen from Table 6 above.

8.2.2 Ladies Mile / Lower Shotover Road

Approach	Movement	WITH PARK AND RIDE			WITHOUT PARK AND RIDE		
		Average Control Delay (s/veh)	95th Percentile Queue (m)	LOS	Average Control Delay (s/veh)	95th Percentile Queue (m)	LOS
SH6 Ladies Mile (West)	L	12.8	1	B	12.8	1	B
	T	0.0	0	A	0.0	0	A
Lower Shotover Road	L	8.6	2	A	8.6	2	A
	R	40.5	18	E	55.2	22	F
SH6 Ladies Mile (East)	T	0.0	0	A	0.0	0	A
	R	14.1	2	B	14.1	2	B

Table 27: Ladies Mile / Lower Shotover Road Intersection, with development, 2021 AM Peak

Approach	Movement	WITH PARK AND RIDE			WITHOUT PARK AND RIDE		
		Average Control Delay (s/veh)	95th Percentile Queue (m)	LOS	Average Control Delay (s/veh)	95th Percentile Queue (m)	LOS
SH6 Ladies Mile (West)	L	12.8	2	B	12.8	2	B
	T	0.0	0	A	0.0	0	A
Lower Shotover Road	L	14.7	6	B	18.0	7	C
	R	290.9	94	F	388.4	114	F
SH6 Ladies Mile (East)	T	0.0	0	A	0.0	0	A
	R	19.5	4	C	23.2	5	C

Table 28: Ladies Mile / Lower Shotover Road Intersection, with development, 2021 PM Peak

Overall, there is a negligible difference in the performance of this intersection with or without the traffic associated with the plan change if the Park and Ride site is operating. The increased traffic volumes are offset by the reduction in traffic occurring through the implementation of the park and ride scheme and changes in delays are slight. Without the Park and Ride however, delays for right-turning movements out of Lower Shotover Road increase by over a minute compared to the scenario with the Park and Ride. This is due to the effect of the Park and Ride diminishing the traffic volumes on the state highway at this location.

Notwithstanding this, it is still considered that this increase is somewhat academic in that the extent of delays for right-turning vehicles from Lower Shotover Road with or without the Plan Change site are such that improvements to this intersection will be required before 2021 regardless of whether the plan change is approved or not. It should also be noted that the level of service of this turning movement does not change under any of the three scenarios (being level of service LOS F in the evening peak hour).

8.2.3 Ladies Mile / Stalker Road

Approach	Movement	WITH PARK AND RIDE			WITHOUT PARK AND RIDE		
		Average Control Delay (s/veh)	95th Percentile Queue (m)	LOS	Average Control Delay (s/veh)	95th Percentile Queue (m)	LOS
SH6 Ladies Mile (East)	L	12.6	2	B	12.7	2	B
	T	0.0	0	A	0.0	0	A
Stalker Road	L	22.8	42	C	22.5	13	C
	R	43.9	10	E	57.3	42	F
SH6 Ladies Mile (West)	T	0.0	0	A	0.0	0	A
	R	18.2	8	C	20.7	11	C

Table 29: Ladies Mile / Stalker Road Intersection, with development, 2021 AM Peak

Approach	Movement	WITH PARK AND RIDE			WITHOUT PARK AND RIDE		
		Average Control Delay (s/veh)	95th Percentile Queue (m)	LOS	Average Control Delay (s/veh)	95th Percentile Queue (m)	LOS
SH6 Ladies Mile (East)	L	13.3	2	B	13.5	2	B
	T	0.0	0	A	0.0	0	A
Stalker Road	L	16.2	13	C	16.7	15	C
	R	267.2	61	F	342.0	72	F
SH6 Ladies Mile (West)	T	0.0	0	A	0.0	0	A
	R	17.9	21	C	18.4	26	C

Table 30: Ladies Mile / Stalker Road Intersection, with development, 2021 PM Peak

Again, the performance of the intersection with and without the development in place is comparable in both the morning and evening peak hours, other than for the right-turn movement out of the site. In the morning peak hour and with the Park and Ride scheme in place, the increase is low (around 10 seconds). Even if the Park and Ride scheme is not taken forwards, the increase is only around 20 seconds.

In the evening peak hour, the delays for right turning vehicles increase from just over one minute (without the plan change) to 4.5 minutes or 5.7 minutes (with and without the Park and Ride respectively). Under either of the latter two scenarios, the extent of delay is considered to be significant.

8.3 Road Safety

As noted above, the extent of delays for right-turning movements are considered to be large. Some drivers will be able to re-time their trips and will select not to travel in the busiest periods. Others may be able to avoid the intersection completely and will divert to an alternative route. However these options will not be open to all drivers (for example visitors unfamiliar with the area), and it is considered that two changes in behaviour are likely to arise.

Some drivers will continue to attempt to turn right but will select gaps of reduced duration in the opposing traffic streams. This gives a reduced margin for error, and for other drivers to take action to avoid a conflict (if necessary) when a vehicle emerges. Other drivers will turn left rather than right, and then u-turn elsewhere on the highway. Both of these options increase the potential for accidents to occur.

It is considered that these types of behaviour will arise at Lower Shotover Road and potentially Howards Drive irrespective of whether the Plan Change proceeds. Consequently, with or without the Plan Change development, it is considered that some form of intersection improvement scheme is required in this location to avoid road safety problems.

8.4 Mitigation of Effects

The greatest increase in delays for right-turning vehicles emerging from Howards Drive in the evening peak hour are primarily due to the proposed Park and Ride site, a scheme which will by its nature serve to support sustainable transport and to reduce traffic volumes on the state highway to the west of the intersection. Moreover, the concept of implementing a system of Park and Ride sites is fully supported by the Wakatipu Transportation Strategy, and the extent of increase in delay for right-turning vehicles will be common to any Park and Ride site on the south side of the highway (in fact such delays increase the further west that the Park and Ride site is located since state highway traffic volumes increase further west). Removing the Park and Ride site from the Plan Change results in lower delays, yet also diminishes the potential contribution of the Plan Change to sustainable travel at the site, at Lake Hayes Estate and on State Highway 6.

Given the delays expected under prevailing traffic growth conditions at the Ladies Mile / Lower Shotover Road intersection, it is not considered that a 'do nothing' scenario would be acceptable to the road controlling authorities. Of the potential measures which could be implemented, traffic signals and the prohibition of right-turn movements are considered unlikely to be implemented. Thus at this stage an assessment has been undertaken of constructing a roundabout at this location. The layout tested is shown in **Figure 15** but at this stage it is a generic layout comprising two lanes on each approach and two circulating lanes. It is envisaged that Stalker Road (and potentially also Lower Shotover Road to a lesser extent) would be realigned, such that the roundabout would have four approaches (the other two being Ladies Mile east and west). A preliminary assessment of this layout indicates Level of Service LOS C or better for each turning movement would occur in 2021 (including the right-turn movements) with the plan change approved but without the Park and Ride operating.

Approach	Movement	MORNING PEAK HOUR			EVENING PEAK HOUR		
		Average Control Delay (s/veh)	95th Percentile Queue (m)	LOS	Average Control Delay (s/veh)	95th Percentile Queue (m)	LOS
SH6 Ladies Mile (East)	L	13.7	26	B	14.8	25	B
	T	13.8	26	B	15.1	25	B
	R	17.9	25	B	19.4	25	B
Stalker Road	L	17.5	61	B	10.5	23	B
	T	16.6	61	B	9.6	23	B
	R	22.8	61	C	15.8	23	A
SH6 Ladies Mile (West)	L	12.2	13	B	12.7	46	B
	T	13.0	13	B	13.6	46	B
	R	17.0	13	B	17.7	46	B
Lower Shotover Road	L	13.2	7	B	17.2	16	B
	T	10.1	7	B	14.1	16	B
	R	18.2	7	B	22.3	16	C

Table 31: Potential Ladies Mile / Lower Shotover Road / Stalker Road Roundabout, with development, 2021



Thursday, 11 February 2010

REVISION	DATE	DESCRIPTION

**Shoatover Country Proposed Plan Change
Nominal Roundabout Layout - Ladies Mile (SH16)**

DRAWN: rdt
DATE: 11.02.2010
SCALE: 1:1000@A3
DWG NO:9489-3C-15A



9. District Plan Rules

It is considered that the District Plan Rules set out in Appendix 7 and Council's Development and Subdivision Engineering Standards (Amendments and Modifications to NZS4404:2004) will form an appropriate basis for the proposed Plan Change.

However it is envisaged that there may be occasional departures from these since, to achieve the optimum urban design outcome, non-compliances may arise. For example, intersection spacing may need to be reduced to create a network that is highly permeable for pedestrians, or carriageway widths may be reduced to support a low-speed environment (which in turn is more attractive for walking and cycling). Such departures would be consistent with Council strategies, but will be discussed with Council at subdivision design stage.

Other strategic planning matters are considered within the report of Mr Ferguson.

Appendix A

Level of Service Definitions

Level of Service Definitions

The quality of service provided by a road network requires quantitative measures to characterise operational conditions within a traffic stream. The level of service (LOS) is a quality measure that describes the operational conditions generally in terms of measures such as speed and travel time, freedom to manoeuvre, traffic interruptions, comfort and convenience.

In general, six levels of service are defined with letters from A to F used to designate each level. A level of service A represents the best operating conditions while LOS F represents the worst conditions. Each level of service represents a range of operating conditions and the driver's perception of those conditions. Safety does not form part of the measures used to assign a level of service.

The following descriptions for individual levels of service have been taken from the Austroads Guides to Traffic Engineering Practice:

- **Level of Service A** – represents free flow. Individual users are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to manoeuvre within the traffic stream is extremely high. The general level of comfort and convenience provided to the motorist or passenger is excellent.
- **Level of Service B** – is in the range of stable flow, but the presence of other users in the traffic stream begins to be noticeable. Freedom to select desired speeds is relatively unaffected, but there is a slight decline in the freedom to manoeuvre within the traffic stream from level of service A. The level of comfort and convenience provided is somewhat less than at level of service A, because the presence of others in the traffic stream begins to affect individual behaviour.
- **Level of Service C** – is the range of stable flow, but 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. The selection of speed is now affected by the presence of others, and manoeuvring within the traffic stream requires substantial vigilance on the part of the user. The general level of comfort and convenience declines noticeably at this level.
- **Level of Service D** – represents high-density, but stable-flow. Speed and freedom to manoeuvre are severely restricted, and the driver experiences a generally poor level of comfort and convenience. Small increases in traffic flow will generally cause operational problems at this level.
- **Level of Service E** – represents operating conditions at or near the capacity level. All speeds are reduced to a low, but relatively uniform value. Freedom to manoeuvre within the traffic stream is extremely restricted, and is generally accomplished by forcing a vehicle to “give way” to accommodate such manoeuvres. Comfort and convenience levels are extremely poor, and driver frustration is generally high. Operations at this level are usually unstable, because small increases in flow or minor perturbations within the traffic stream will cause breakdowns.
- **Level of Service F** – is used to define a forced or breakdown flow. The condition exists wherever the amount of traffic approaching a point exceeds the amount that can traverse the point. Queues form behind such locations. Operations within the queue are characterised by stop-and-go waves, and they are extremely unstable.

Highway Capacity Manual 2000

The US Highway Capacity Manual 2000 (HCM2000) describes methods for determining the levels of service for roads and intersections. For urban roads, a level of service can be allocated by measuring the average vehicle speed on the road. At intersections, the level of service is determined by the average control delay for each vehicle travelling through the intersection.

Average Control Delay (s/veh)	Level of Service
≤ 10	A
11 – 20	B
21 – 35	C
36 – 55	D
56 – 80	E
> 80	F

Table 32: Level of Service Definitions - Signalised Intersections (HCM 2000)

Average Control Delay (s/veh)	Level of Service
≤ 10	A
11 – 20	B
21 – 35	C
36 – 55	D
56 – 80	E
> 80	F

Table 33: Level of Service Definitions - Roundabouts

Average Control Delay (s/veh)	Level of Service
≤ 10	A
11 – 15	B
16 – 25	C
26 – 35	D
36 – 50	E
> 50	F

Table 34: Level of Service Definitions – Priority Controlled Intersections (HCM 2000)

Average Vehicle Speed (km/h)	Level of Service
> 50	A
40 – 50	B
29 – 39	C
23 – 28	D
18 – 22	E
≤ 17	F

Table 35: Level of Service Definition – Urban Roads with 55km/h Typical Free-flow Speed

Public Transport

There are a variety of measures to describe the level of service provided by a public transport system. Table 36 and Table 37 show level of service descriptions for the service headway and for the service operating hours. These are taken from the Highway Capacity Manual 2000 (HCM), given there is no equivalent for the New Zealand context.

LOS	Headway (min)	Comments
A	< 10	Passengers do not need schedules
B	10 – 15	Frequent Service; passengers consult schedules
C	16 – 20	Maximum desirable time to wait if bus is missed
D	21 – 30	Service is unattractive to passengers
E	31 – 60	Service available during the hour
F	> 60	Service unattractive to all riders

Table 36: Service Frequency LOS for Urban Transit Service (HCM 2000)

LOS	Hours per day	Comments
A	> 18	Night service provided
B	17 – 18	Late evening service provided
C	14 – 16	Early evening service provided
D	12 – 13	Day time service provided
E	3 - 11	Peak hour service / limited interpeak service
F	< 3	Very limited or no service

Table 37: Hours of Service LOS for Urban Transit Service (HCM 2000)