

Queenstown Lakes
District Council

Plan Change 25, Kingston

TRANSPORTATION
ASSESSMENT FOR PLAN
CHANGE 25



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October 2008



TRAFFIC DESIGN GROUP

8788-4
24 October 2008

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Dear Jenny

TRANSPORT ASSESSMENT: PLAN CHANGE 25, KINGSTON

Following on from our investigations and analyses we are pleased to present our detailed assessment of the traffic effects of Plan Change 25 in Kingston on the southern shore of Lake Wakatipu, south of Queenstown.

Our report describes the traffic-related features of the site, its location within the surrounding network, and the details of existing traffic volumes and characteristics. Changes in traffic levels and patterns resulting from the potential Plan Change have been determined, and an assessment made of the resulting projected effects on the adjoining road network. Particular attention has been paid to the expected changes in travel patterns on State Highway 6 between Kingston and Queenstown.

Our report concludes that any wider area transportation related effects are minor, and localised transportation effects can be addressed during subdivision with the development of the transport network, suitably detailed intersection designs and a management plan for the rail corridor. Therefore the proposal can be supported from a transportation perspective.

Yours faithfully
TRAFFIC DESIGN GROUP LTD

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Status:

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Date:

24 October 2008

TABLE OF CONTENTS

1	INTRODUCTION	1
2	EXISTING TRANSPORT INFRASTRUCTURE	1
2.1	Location in the Transport Network.....	1
2.2	Site Description.....	3
2.3	Local Access.....	3
2.4	Unformed Legal Roads.....	8
2.5	Public Transport.....	9
2.6	Footpaths and Cycle Routes	9
2.7	Kingston Flyer	9
3	TRAVEL PATTERNS.....	11
3.1	Daily Traffic Volumes.....	11
3.2	Hourly Patterns	12
3.3	Traffic Growth and Seasonal Variation	15
3.4	Intersection Turning Movements	18
3.5	Speed Survey	20
4	ROAD SAFETY.....	20
5	FUTURE CHANGES TO INFRASTRUCTURE	22
5.1	Changes to Transport Networks.....	22
6	LEVELS OF SERVICE.....	22
6.1	Definitions	22
6.2	Existing Levels of Service on SH6.....	23
6.3	Existing Levels of Service at SH6 / Kent Street Intersection.....	24
7	STRATEGIC PLANNING ISSUES	25
7.1	Kingston 2020.....	25
7.2	Growth Management Strategy for Queenstown	25
7.3	Wakatipu Transport Strategy (WTS).....	25
7.4	Committed Development in Kingston	26
8	THE PROPOSAL.....	26
8.1	Masterplan Overview	26
8.2	Development Land Use	28
8.3	Travel Demand Management	28
8.4	Road Network Design.....	29
8.4.1	Road Hierarchy.....	29
8.4.2	Road Cross-sections.....	29
9	ACCESS TO KINGSTON FROM SH6.....	30
9.1	SH6/Kent Street.....	30

9.2	Secondary Access to SH6	30
9.2.1	<i>Benefits</i>	30
9.2.2	<i>Separation from Kent Street Intersection</i>	35
9.2.3	<i>Distance between SH6 and Kingston Flyer Railway Line and Railway Crossing</i>	35
9.2.4	<i>Available Sight Distance along SH6</i>	36
9.2.5	<i>Form</i>	37
9.2.6	<i>Other Opportunities</i>	39
10	TRIP GENERATION AND DISTRIBUTION	39
10.1	Existing Activity	39
10.2	Demographic Patterns	40
10.3	Expected External Traffic Generation of Kingston.....	40
10.3.1	<i>Residential Traffic Generation</i>	41
10.3.2	<i>Employment Land</i>	41
10.3.3	<i>Kingston School</i>	41
10.3.4	<i>Kingston Flyer</i>	41
10.3.5	<i>Kingston Golf Course</i>	42
10.3.6	<i>Kingston Acquisitions Limited (KAL) Proposal Traffic Generation</i>	42
10.3.7	<i>Other Commercially Available Beds</i>	42
10.3.8	<i>General Pass-By Movements</i>	42
10.3.9	<i>Total Generation</i>	42
10.4	Internal Traffic Generation	43
11	TRANSPORTATION EFFECTS	44
11.1.1	<i>Expected Future Patterns</i>	44
11.1.2	<i>SH6 LOS Assessment</i>	44
11.2	Access to State Highway 6	45
11.2.1	<i>Intersection Capacity</i>	45
11.3	Internal Road Layout	47
11.4	Effects on Existing Infrastructure	48
11.5	Network Design.....	48
11.6	Heavy Traffic Generation.....	49
12	RAILWAY LEVEL CROSSINGS	49
12.1	Requirements for Rail Crossing Facilities.....	49
12.1.1	<i>Need for Railway Level Crossings</i>	50
12.1.2	<i>View Distances</i>	51
12.1.3	<i>Crossing Design</i>	52
12.1.4	<i>Warning Device Warrants</i>	52
12.1.5	<i>Queuing Space</i>	53
13	DISTRICT PLAN PROVISIONS	54
13.1	Policies and Objectives.....	54
13.2	District Plan Rules.....	57
14	CONCLUSIONS	57

Queenstown Lakes District Council Plan Change 25, Kingston

1 INTRODUCTION

Traffic Design Group has been commissioned by the Queenstown Lakes District Council (“QLDC”) to undertake a transportation assessment of the proposed Plan Change 25, which relates to a site (“the Plan Change site”) immediately south west of the existing Kingston township zone (“the township”), located some 45km south of Queenstown.

This report identifies and assesses the transportation effects of the Plan Change and identifies key opportunities and constraints relevant to achieving these strategic objectives. This report will form part of the required QLDC analysis under Section 32 of the Resource Management Act.

The Plan Change site has an area of 88 hectares (ha) that is currently zoned Rural General. The Plan Change will enable residential, educational and some employment uses to occur within the site. The Plan Change site could accommodate up to 750 new households and 2.2ha of employment land, retaining the existing golf course and providing additional reserve land and public access, in addition to providing a suitable site for a future primary school.

2 EXISTING TRANSPORT INFRASTRUCTURE

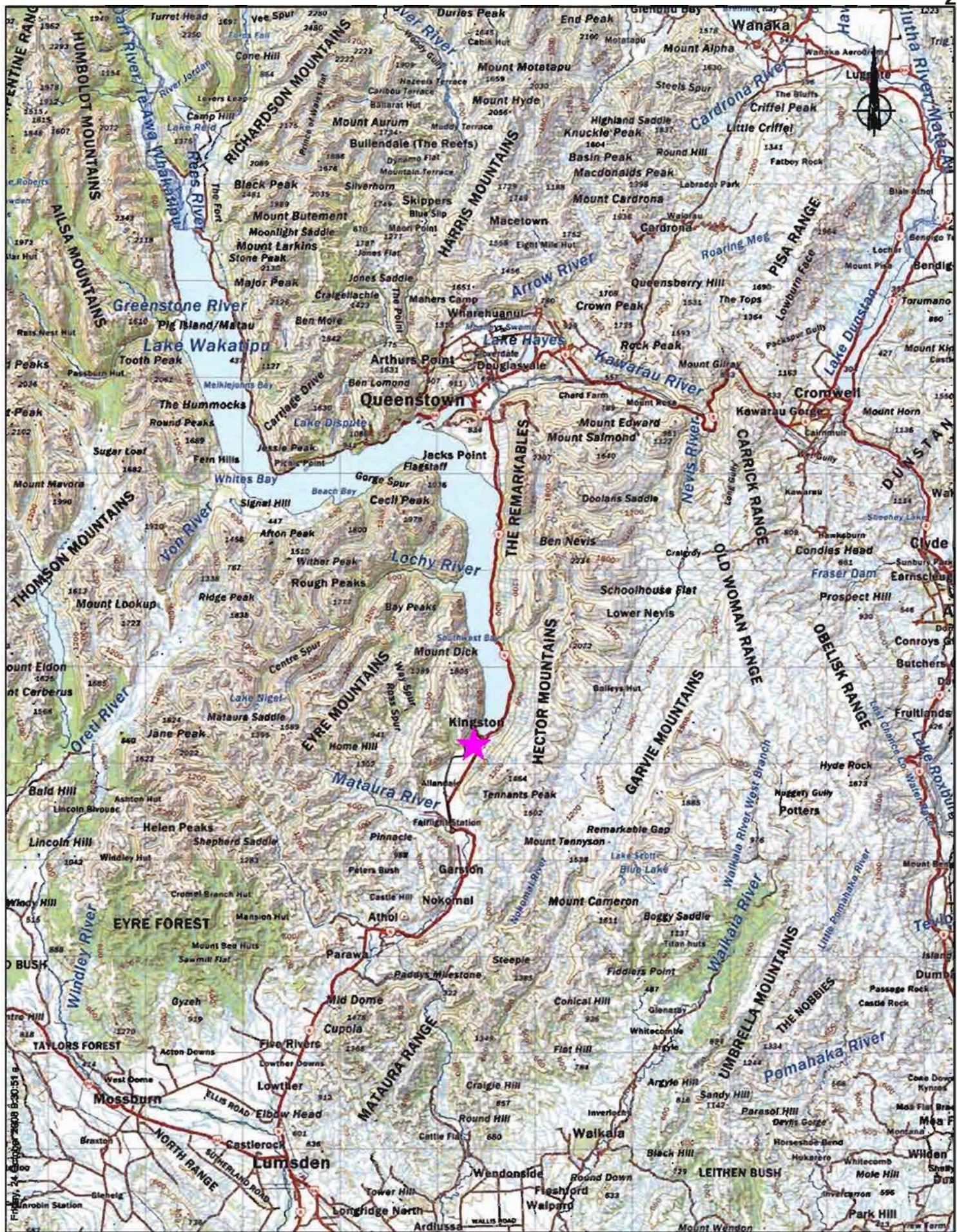
2.1 Location in the Transport Network

Figure 1 shows the location of the Plan Change site within a regional context. The Plan Change site is located on the southwest side of Kingston, a small township with a high proportion of holiday houses. Kingston itself is located 45km south of Queenstown on State Highway 6 (SH6).

SH6 forms part of the New Zealand Transport Agency (“NZTA”, formerly Transit New Zealand “Transit”) State Highway network. SH6 has a regional role of linking Queenstown with southern townships such as Invercargill and linking with SH94 giving access to the popular tourist region of Te Anau and Milford to the west.

The existing township is linked to SH6 by Kent Street, the main street of Kingston. From Kent Street there are a number of local streets providing access to predominantly residential areas.

A railway line servicing the Kingston Flyer, a historical steam engine passenger service and now tourist attraction, enters the township from the south east and travels through to the Kingston Railway Station located at the northwest end of Kent Street.



Kingston Plan Change
 Site Location

★ SITE

SCALE: NTB
 TRAFFIC DESIGN GROUP

1

2.2 Site Description

The Plan Change site has an area of approximately 88ha in total and lies to the immediate south of the township extent, and is currently zoned Rural General within the QLDC District Plan (“the District Plan”). Currently the site consists mostly of farmland, with the 9 hole Kingston Golf Course being located in the north western corner. Access to the site is available from various formed and unformed local roads extending from the township across the Kingston Flyer railway line.

Figure 2 shows the location of the site and some of the services and facilities in the township in the context of the existing local transport networks, as well as its location and scale relative to the existing township and road hierarchy as defined in the District Plan. Kingston itself is predominantly made up of residential dwellings with a small number of services and facilities available including a post office, tavern, tea-room/restaurant, 9 hole golf course, bowling green, tennis courts, petrol station, camping ground and a boat ramp. It is characterised by both permanent residents and holiday makers due to its mountain and lake views and is a popular summer destination. The Kingston Flyer vintage steam train is a popular tourist activity and as such generates tourist traffic through the township.

Statistics New Zealand data shows that Kingston had a “usually resident” population of approximately 150 residents at the 2006 census. Information in the Long Term Council Community Plan (“LTCCP”) shows the number of dwellings to be 208 including 144 unoccupied and 64 occupied which indicates a high proportion of holiday houses.

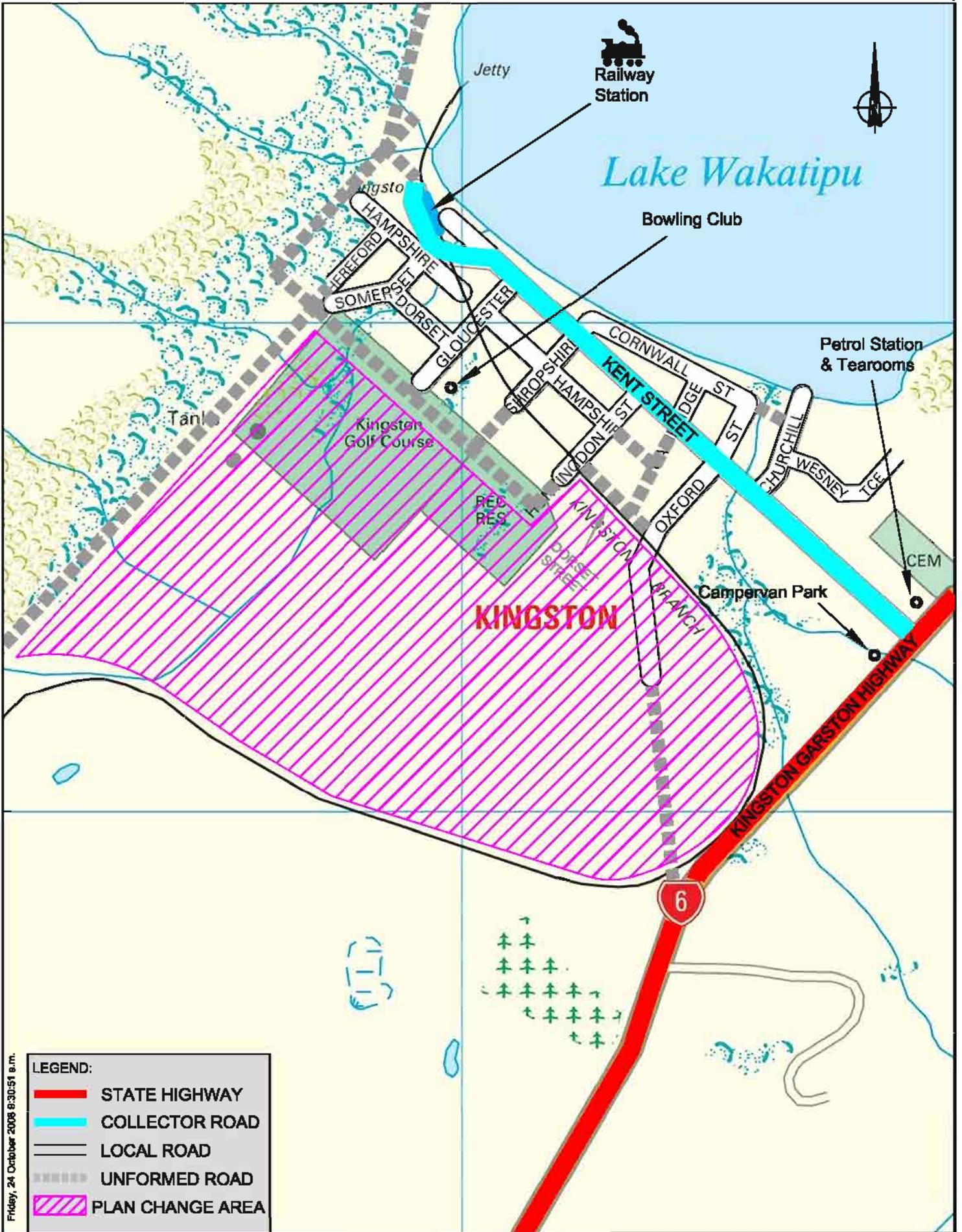
2.3 Local Access

SH6 runs approximately north/south to the east of the township and operates with an 80 km/h speed limit along the urban edge of the township. This speed restriction is in place from between approximately 400m to the south, and 350m to the north of Kent Street, where standard flush median thresholds have been provided.

The intersection of SH6 and Kent Street is give-way controlled and provides a flush median with a right turn bay. SH6 rises from both directions as it approaches the intersection with Kent Street, with the intersection located on a relatively flat section of road, approximately 450m long. Photograph 1 shows SH6 at the intersection with Kent Street, looking in a northeast direction. Photograph 2 looks southwest along SH6, looking away from the Kent Street intersection. The vertical curvature of the road can clearly be seen in the photograph.



Photograph 1 : Wide-angle view of SH6 / Kent Street intersection, looking northeast



Friday, 24 October 2008 8:30:51 a.m.

LEGEND:

- STATE HIGHWAY
- COLLECTOR ROAD
- LOCAL ROAD
- UNFORMED ROAD
- PLAN CHANGE AREA

**Kingston Plan Change
Road Network**

SCALE: 1:10,000@A4





Photograph 2 : View of SH6 / Kent Street intersection, looking southwest

The intersection is also characterised by the location of a tea-rooms and petrol station on its northern side. Visibility from the intersection to the north is restricted to approximately 180m by the presence of trees on the inside of a curve, and the visibility to the south is approximately 270m, being restricted by the vertical curvature of the road.

The following table shows sight distance measurements and requirements for traffic entering SH6 from Kent Street based on Table App 5B/1 – “Sight distance standards” of the Transit Planning Policy Manual.

DIRECTION	SURVEYED 85% SPEED (km/hr)	SIGHT DISTANCE STANDARD (m)	MEASURED SIGHT DISTANCE (m)
Northward	79 (southbound)	170	180
Southward	86 (northbound)	190	270

Table 1: Kent Street and SH6 Sight Distance Criteria

As indicated above, the sight distance standards included in the Transit Planning Policy Manual are met by the intersection of Kent Street and SH6 in both directions based on measured speeds.

Kent Street extends from SH6 through to the western end of the township with a straight alignment. As shown in Photograph 3, it descends a terrace between SH6 and Churchill Street and typically has a standard 7m road carriageway width between SH6 and Gloucester Street, narrowing down to approximately 6m west of Gloucester Street. Kent Street and all other roads in Kingston have a posted speed limit of 50 km/h.



Photograph 3 : View of Kent Street west of SH6, looking to the west

There are a number of short local residential streets intersecting along the length of Kent Street. Those formed streets that have the potential to provide direct access to the Plan Change site are Oxford Street, Huntingdon Street, Shropshire Street, Gloucester Street and Somerset Street. A brief description of the existing form of each of these streets follows and the location of each is provided in Figure 2.

Oxford Street extends southwards from Kent Street to the Kingston Flyer railway line, and has an unsealed carriageway width of approximately 4.5m. It forms a cross intersection with Kent Street and is controlled by give-way signs. On the southern intersection approach from Oxford Street the visibility to both the east and west is 40m being restricted by trees on the eastern side and an existing fence on the western side. A typical section of Oxford Street is shown in Photograph 4.



Photograph 4 : View of Oxford Street south of Kent Street, looking to the south

Huntingdon Street is a sealed two-way 7m wide street extending from Kent Street to approximately 40m south of the railway crossing, which is controlled by standard railway give-way signs. It forms a T-intersection with Kent Street that is controlled by give-way signs and from the intersection good visibility is available in both directions along Kent Street. A typical section of Huntingdon Street is shown in Photograph 5.



Photograph 5 : View of Huntingdon Street south of Kent Street, looking to the south

Shropshire Street is a 7m wide sealed street extending to the railway line and forms a cross-intersection at Kent Street with give-way control. It provides good visibility in both directions.



Photograph 6 : View of Shropshire Street north of Railway, looking to the north

Photograph 7 shows Gloucester Street which extends south from Kent Street, and has a narrower carriageway width at approximately 3.5 to 4.0 metres wide. It crosses the Kingston Flyer railway to

provide access to the Kingston Golf Club, and forms a give-way controlled T-intersection with Kent Street. Good visibility is available looking to the east from the intersection and visibility of approximately 70m is available to the west.



Photograph 7 : View of Gloucester Street south of Railway, looking to the north

Somerset Street forms the minor arm of the T type intersection with Kent Street. It is presently formed with a gravelled surface approximately 3.2m wide up to a point around 180m to the southwest of its intersection with Kent Street.



Photograph 8 : View southwest along Somerset Street from its intersection with Hampshire Street

2.4 Unformed Legal Roads

Within Kingston there are several unformed legal roads, and some of these provide potential connections into the Plan Change site. The legal boundary of Oxford Street continues across the Kingston Flyer railway line into the site and then in a north-south direction to the south-eastern extent of the site adjacent to SH6. Devon Street is an unformed legal road running east-west on the northern

boundary of the Plan Change site between Huntingdon Street and Somerset Street, and this unformed road also forms the southern extent of Huntingdon Street and Gloucester Street. Shropshire Street extends south into the site through the golf course and beyond its southern boundary. The western boundary of the Plan Change site is formed by a further unformed legal road which is an extension of Somerset Street.

Between Oxford Street and Huntingdon Street is the unformed Cambridge Street, which extends from the Lake across Kent Street to the Kingston Flyer railway corridor, immediately to the north of the Plan Change site.

2.5 Public Transport

Currently there are no public transport facilities provided either within or to Kingston, although numerous tour coaches pass the township.

2.6 Footpaths and Cycle Routes

Kent Street provides a 1.2m wide footpath on the northern side along its length between SH6 and Shropshire Street. Footpaths are also provided along one side on both Shropshire Street and Huntingdon Street. All recent extensions to the road network have included the provision for footpaths.

No specific cycling facilities are available within the township, reflecting that with existing traffic volumes shared use of the road network by vehicles and cyclists is appropriate.

2.7 Kingston Flyer

The Kingston Flyer is a historic steam train that currently operates on a privately owned track extending between the railway station at the western end of the township through to Fairlight some 14 km south. The track currently forms the southern boundary of the township in most places. The train operates at relatively slow speeds of approximately 20-30 km/h. The Flyer currently operates on a timetable of two return trips per day, the first of which leaves Kingston at 10:00am and returns at 11:30am, the second trip leaves Kingston at 1:30pm and returns at 3:00pm between October and April inclusively.

Within the vicinity of the Plan Change site there are a number of rail crossings as detailed in Table 2 and shown in Figure 3.



1 KENT STREET



4 OXFORD STREET



2 GLOUCESTER STREET



5 PRIVATE CROSSING



3 HUNTINGDON STREET



6 PRIVATE CROSSING



Friday, 24 October 2008 9:30:51 a.m.

REVISION	DATE	DESCRIPTION

Kingston Plan Change
Kingston Flyer Level Crossing Locations

DRAWN BY
DATE: 24-10-08
CHECKED: RR
APPROVED: AAM

SCALE: As per 1:6000(3A)
DRAWING NO: 8788-4-03A



CROSSING REFERENCE	LOCATION	DESCRIPTION
1. Kent Street	Northeast of Somerset Street	Formed and sealed crossing, give way control
2. Gloucester Street	South of Hampshire Street	Formed and sealed crossing, give way control
3. Huntingdon Street	South of Hampshire Street	Formed and sealed crossing, give way control
4. Oxford Street	South of Kent Street (legal road)	Partially formed, uncontrolled
5. Private Crossing	Access from SH6, 420m south of Kent Street	Partially formed, uncontrolled
6. Private Crossing	Access from SH6, 700m south of Kent Street. Connects to the southern end of Oxford Street unformed legal road.	Partially formed, uncontrolled

Table 2: Kingston Flyer Existing Crossing Locations

There are a total of six crossings of the Kingston Flyer rail line in the vicinity of the Plan Change site. Three of the crossings are fully formed and sealed, with give way control. The remaining three are not fully formed or sealed and are presently used for farm access. The railway crosses Shropshire Street but no formed vehicle crossing point is provided because Shropshire Street is unformed south of the railway.

3 TRAVEL PATTERNS

3.1 Daily Traffic Volumes

NZTA and the QLDC undertake regular traffic counting programmes in the District, and the relevant recorded daily volumes are summarised in Table 3 below.

COUNT SITE	DAILY TRAFFIC VOLUME (Vehicles Per Day)	COUNT YEAR
SH6 South of Remarkables Skifield (40km north of Kingston)	2,970	2006
SH6 at Mid Dome (40km south of Kingston)	1,730	2006
Kent Street (Kingston Rd – Churchill St)	500	Oct 2005
Churchill St (Kent St – Wesley Tce)	250	Jun 2002
Oxford St (Kent St – railway track)	25	Oct 2005
Gloucester St (Kent St – end of seal)	150	Jan 2002
Somerset St (Kent St – Hampshire St)	110	Jan 2002
Cornwall St (Kent St – end of seal)	30	Oct 2005

Table 3: Daily Traffic Volumes

Traffic volumes shown in Table 3 highlight the dominance of SH6 in the vicinity of Kingston, with volumes in the order of 3,000 vehicles per day (vpd) recorded south of the Remarkables Skifield.

Within the township, Kent Street has a recorded volume of some 500vpd, which is a low volume reflective of the absence of strategic through traffic and the small resident population.

Other local roads within the township have daily traffic volumes that vary between 25vpd and 250vpd. These are also low volumes representing at most approximately one vehicle every minute during peak periods.

3.2 Hourly Patterns

Figure 4 shows the existing patterns of hourly movement on SH6 at Mid Dome south of Kingston.

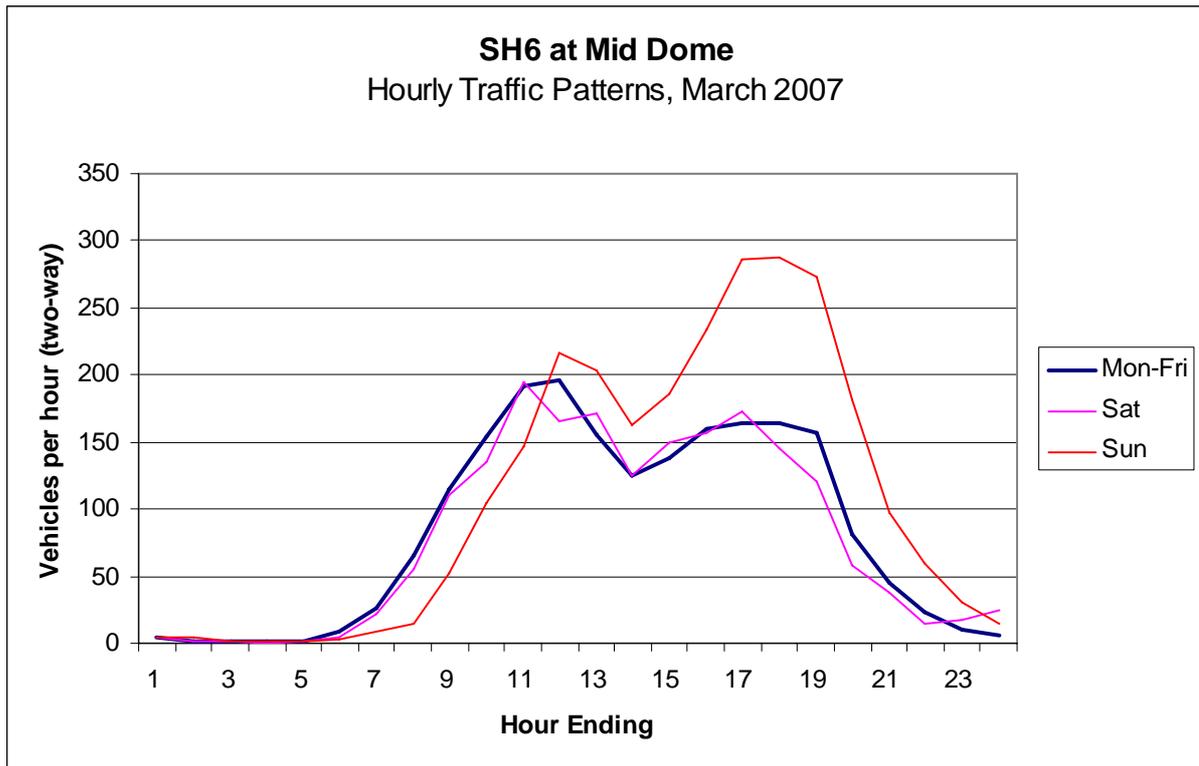


Figure 4 – Hourly Traffic Patterns SH6 (at Mid Dome)

The graph illustrates that SH6 in this location displays a pattern of hourly volumes that features a clear morning and evening peak hour with slightly different patterns occurring on the weekend than during the week. This reflects that in this location, the traffic pattern on SH6 is influenced somewhat by tourist travel.

Figure 5 shows the existing patterns of hourly movement on SH6 at the count site south of the Remarkables ski field access road, north of Kingston.

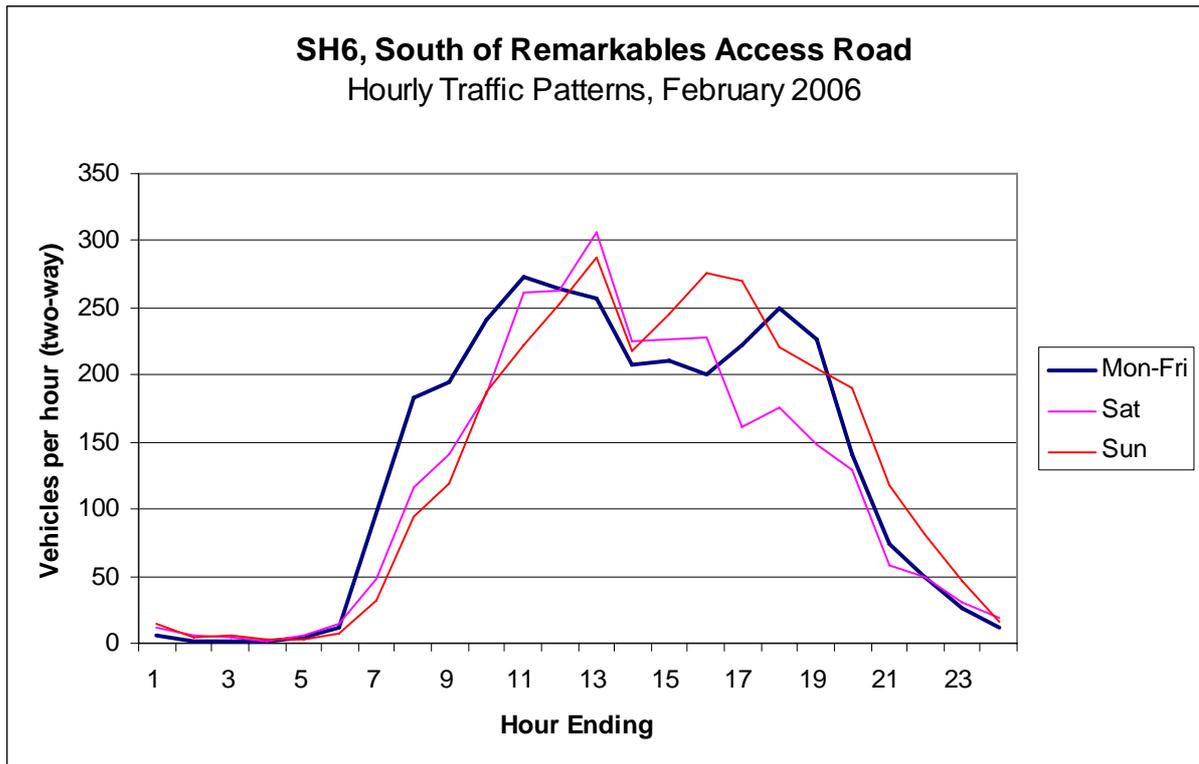


Figure 5 – Hourly Traffic Patterns SH6 (South of Remarkables)

Figure 5 illustrates that SH6 in this location displays a pattern of hourly volumes that also features weekday morning and evening peak hours. However the peak traffic volumes occur on Saturday and Sunday indicating some use by commuter traffic but a more dominant recreation pattern.

The following figure presents the patterns of hourly movement recorded on Kent Street in Kingston, which currently provides the only connection between Kingston and SH6.

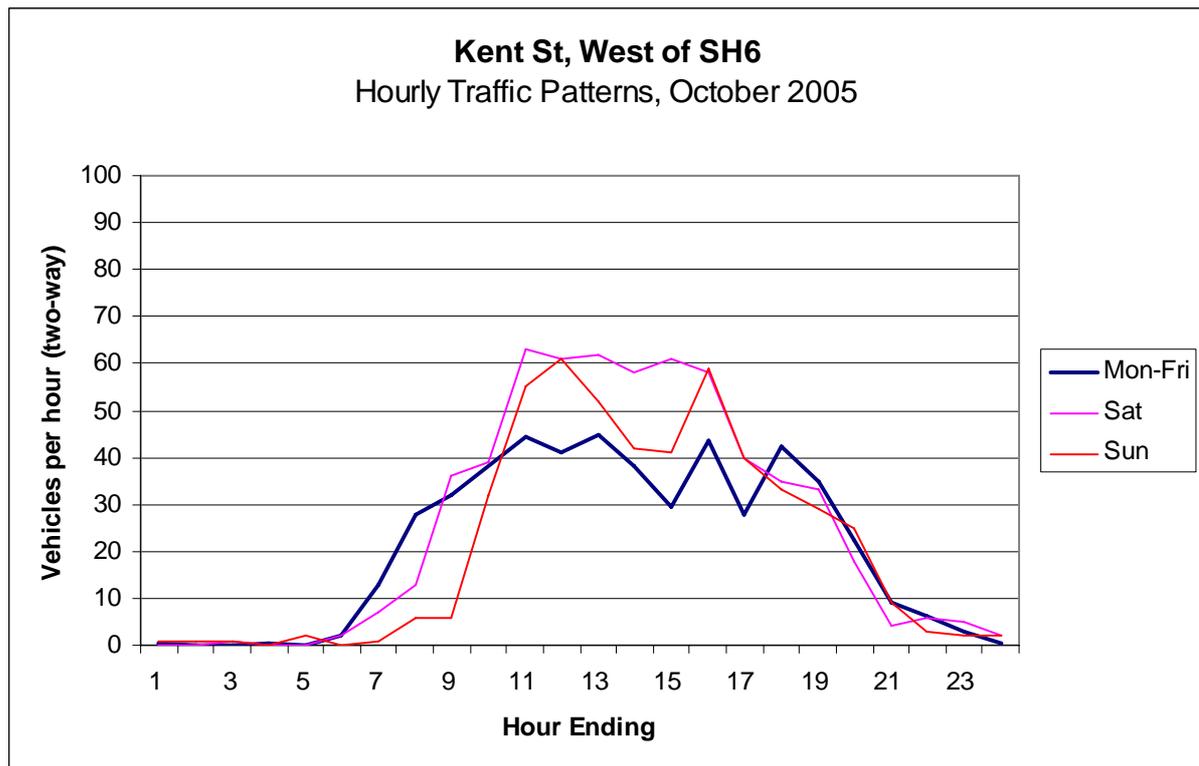


Figure 6 – Hourly Traffic Patterns Kent Street

As shown by the figure above, Kent Street does not include clear morning and evening peak hours, indicating that use by commuter traffic is not a feature. The pattern instead features a single broader weekday peak of up to 45 vehicles per hour (vph) during the middle part of the day. The weekend volumes are the highest, at approximately 60vph.

3.3 Traffic Growth and Seasonal Variation

Records of the historical annual average daily traffic volume (AADT) are maintained by NZTA. The last ten years of records have been analysed to determine the historical traffic growth patterns, and are shown in Figure 7.

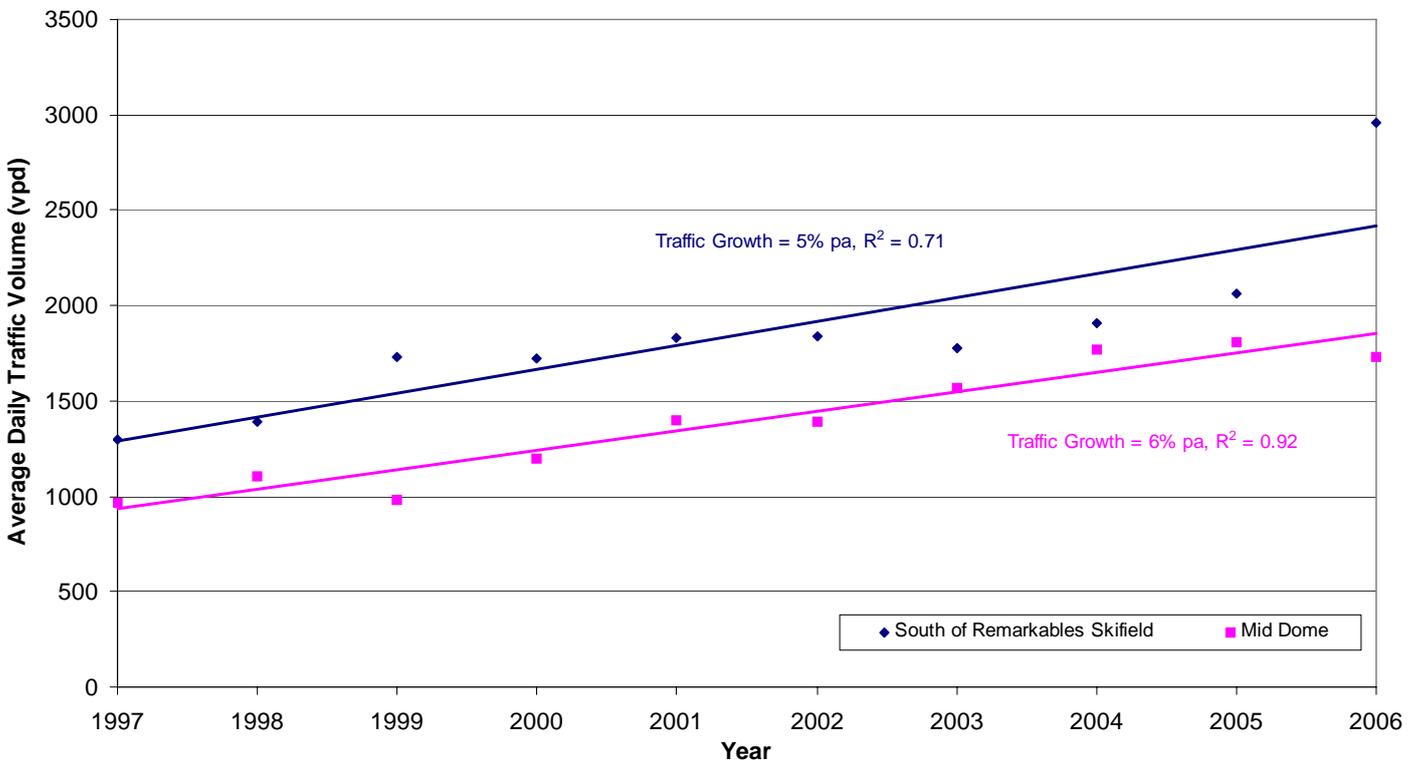
As can be seen, the annual traffic growth on SH6 is equivalent to a linear growth rate of 5-6% based on current traffic volumes. Whilst the absolute annual traffic growth volume is relatively low with increases in AADT of 100vpd each year, the percentage growth is high and is representative of the general growth in the Queenstown Lakes District.

Figure 8 shows the seasonal daily traffic pattern over the 12 month period ending October 2006 at the Mid Dome site to the south of Kingston. This pattern shows that SH6 is subject to seasonal traffic patterns, with the typical traffic volumes through the summer period being over twice as high as the volume of the quieter winter period.

Figure 8 also presents the seasonal peak hourly traffic pattern over the same period showing that the peak hour of the day displays a similar pattern to the daily volume.

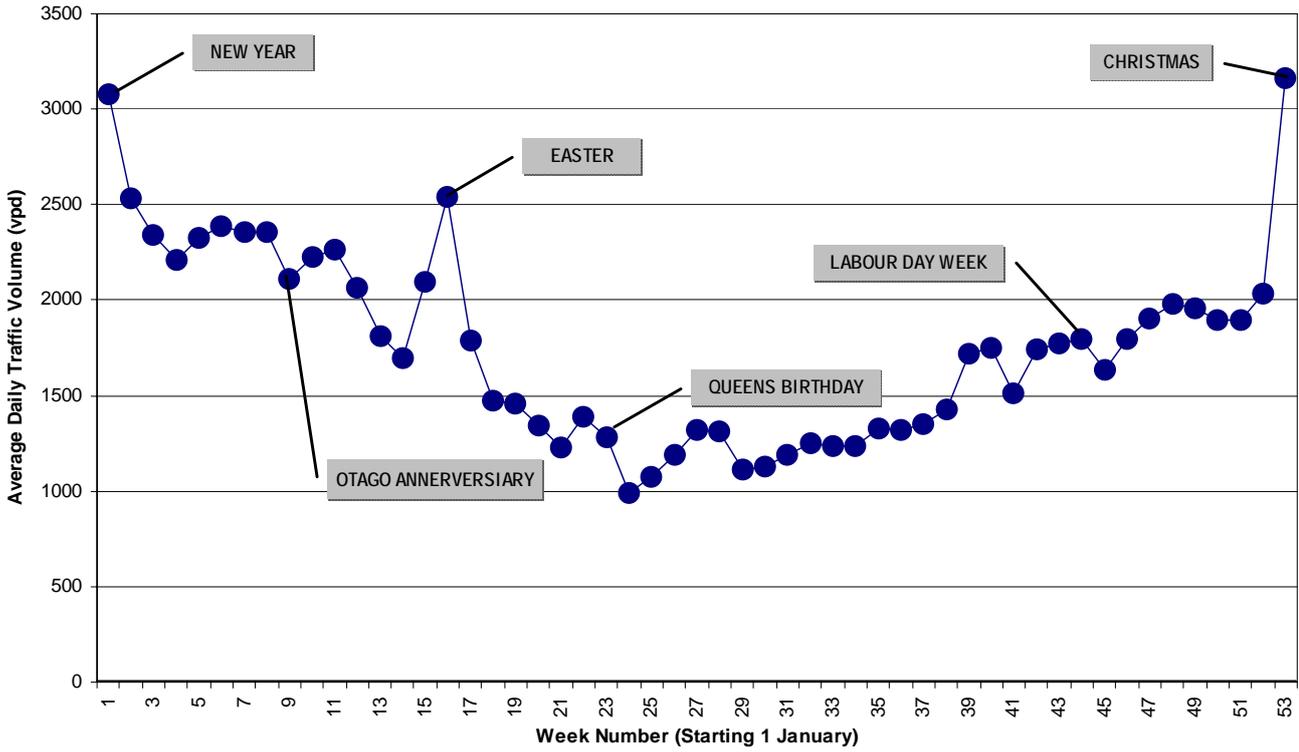
There are several proposals to create more direct transport links to Milford from Queenstown. These may have a reducing effect on the future growth of traffic on this section of SH6.

State Highway 6 Traffic Growth 1997-2006

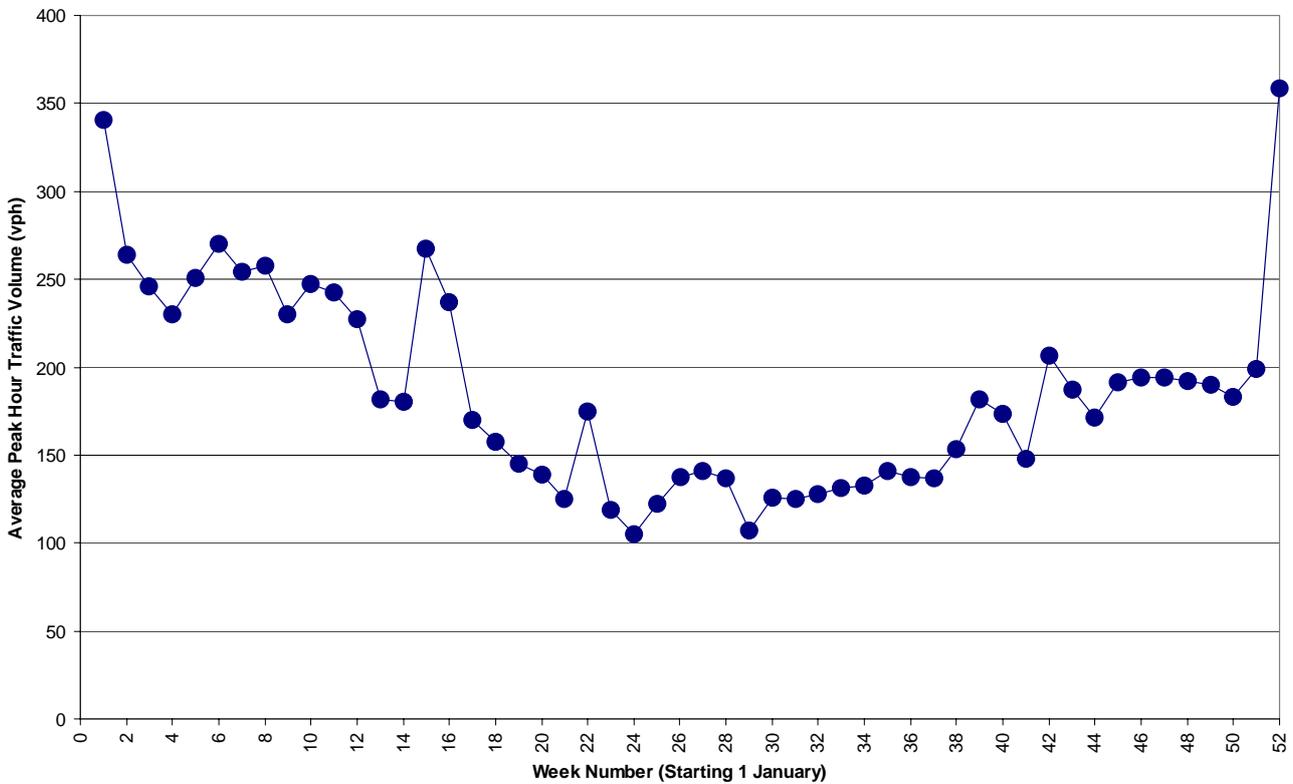


Friday, 24 October 2008 9:30:52 a.m.

State Highway 6, Mid Dome, 2005 - 2006
Seasonal Variation of Daily Traffic



State Highway 6, Mid Dome, 2005-2006
Seasonal Variation of Peak Hour Traffic



Friday, 24 October 2008 9:30:52 a.m.

3.4 Intersection Turning Movements

Manual traffic surveys were carried out at the intersection of Kent Street and Kingston Road (SH6) on Wednesday 8 November 2006 between 7:30am-10:30am and again between 4:00pm-6:00pm, and then on Sunday 11 November 2006 between 1:00pm-3:00pm. Based on analysis of the seasonal patterns this week has traffic volumes 10% higher than the annual average week. The surveys included movements to and from the tea rooms and service station located on the northern side of the intersection. A summary of the peak hourly movements during the surveyed periods is shown in Figure 9.

Sunday traffic volumes were found to peak between 2:00pm and 3:00pm. At this time SH6 carried a flow some 170 vehicles per hour (vph), which was split relatively evenly by direction. The service station and café driveways carried 36vph (IN+OUT), while the volume on Kent Street was some 50vph, and also distributed evenly by direction.

Volumes on SH6 peaked between 9:30am-10:30am during the Wednesday morning survey and between 4:30pm-5:30pm during the Wednesday afternoon survey. In each of these periods SH6 carried some 120vph. The Wednesday periods showed a degree of variation in directional split. During the morning period 55% of SH6 traffic was southbound, while during the afternoon period some 60% of SH6 traffic was northbound. The service station and café carried some 25vph (IN+OUT) during each of these periods. Kent Street carried 45vph during the morning peak period, but only 26vph during the afternoon period.

The surveys of the Kent Street/SH6 intersection showed that the peak hour of activity on Kent Street occurred between 2:00pm and 3:00pm on Sunday (weekend peak hour) when some 52vph (two-way) were observed. This is generally consistent with the October 2005 pattern shown earlier in Figure 6.

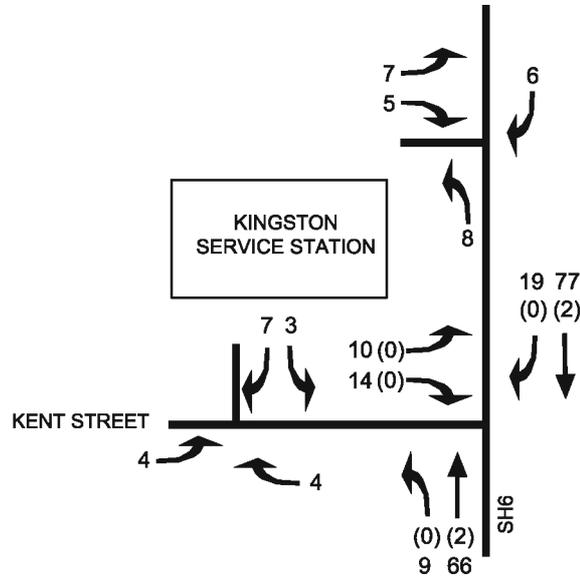
The following table indicates the existing distribution of traffic entering and leaving Kingston and the directional split on SH6 (either north or south).

		NORTH	SOUTH	TOTAL
AM	IN	0.20	0.31	0.51
	OUT	0.31	0.18	0.49
	TOTAL	0.51	0.49	1.00
PM	IN	0.54	0.19	0.73
	OUT	0.15	0.12	0.27
	TOTAL	0.69	0.31	1.00
WEEKEND	IN	0.37	0.17	0.54
	OUT	0.19	0.27	0.46
	TOTAL	0.56	0.44	1.00

Table 4: Kingston Peak Hour Traffic Distribution

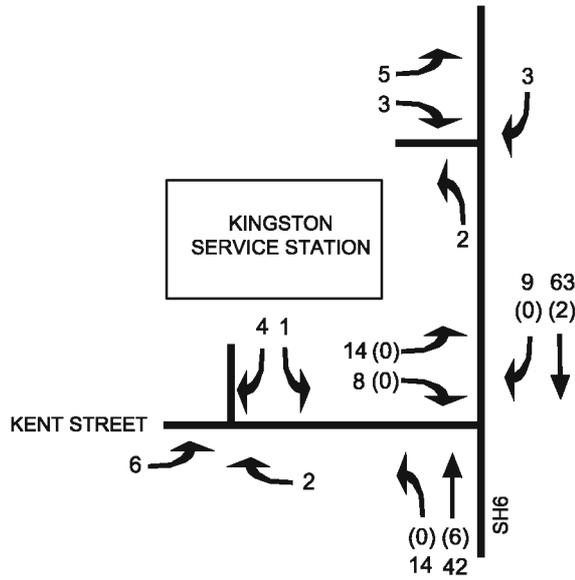
The existing distribution of traffic, as indicated by the table above, shows that during the morning and weekend peak hours the traffic is relatively equal in terms of the distribution of movements to and from Kingston (in and out), as well as the distribution of traffic between Kingston and north and south. During the evening peak hour however, some 75% of Kent Street traffic was directed into the township and 75% of traffic on Kent Street occurred either to or from SH6 to the north.

Sunday 12-11-2006
2:00pm - 3:00pm



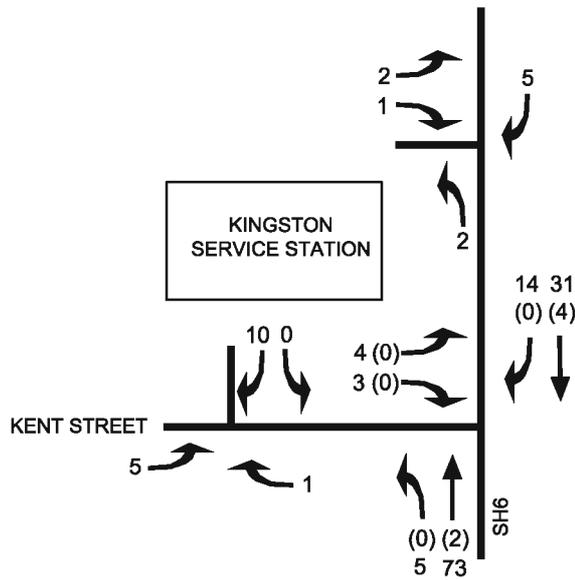
XX Light Vehicles
(XX) Heavy Vehicles

Wednesday 8-11-2006
9:30am - 10:30am



XX Light Vehicles
(XX) Heavy Vehicles

Wednesday 8-11-2006
4:30pm - 5:30pm



XX Light Vehicles
(XX) Heavy Vehicles

Friday, 24 October 2008 9:30:54 a.m.

3.5 Speed Survey

A speed survey was undertaken for through traffic on SH6 past Kent Street over the period 11:45am to 12:45pm on Thursday 16 November 2006. The 85th percentile operating speed in the northbound direction was 86km/h, and in the southbound direction it was 79km/h.

A second survey was undertaken on Wednesday 7 May 2008 between 12:15pm and 12:45pm further to the south at the speed limit signs (close to the proposed new SH6 access). This survey indicated 85th percentile operating speeds of 90km/h in the northbound direction and 94km/h in the southbound direction.

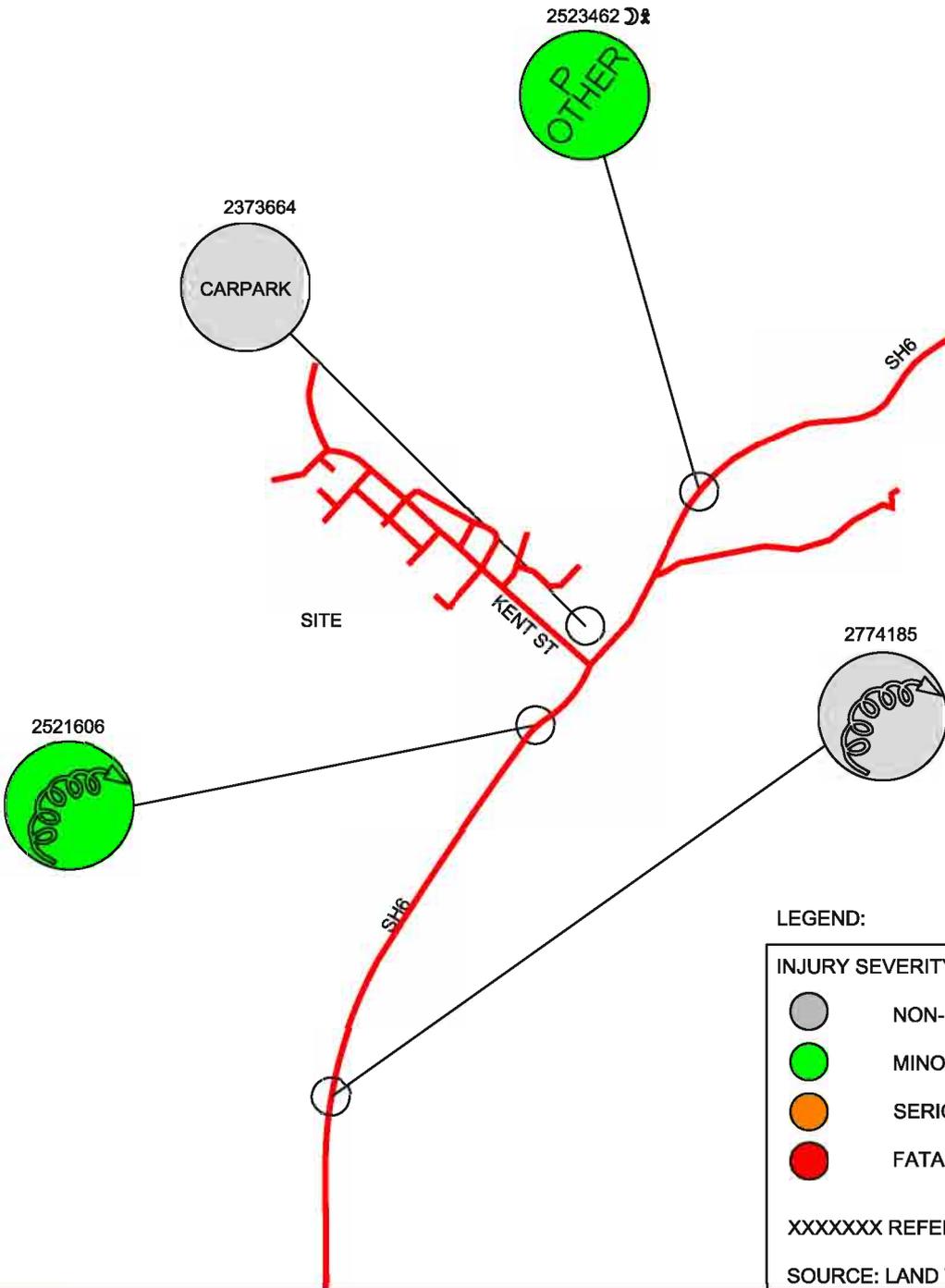
4 ROAD SAFETY

A search of NZTA's accident records for the township and SH6 within 1km of the Kent Street intersection has been undertaken for the most recent five year period between 2003 and 2007. The crash search has identified four crashes, as summarised below and shown on Figure 10:

- No accidents have been reported on any of the local roads within Kingston, or on Kent Street beyond the SH6 intersection
- One minor injury accident at a rest area on SH6 some 800m north of Kingston involving an intoxicated driver who collided with another vehicle within the rest area (2006)
- One minor reversing accident within the parking area at the intersection of Kent Street and SH6, which did not result in injury (2003)
- Two loss of control accidents on SH6, one 300m south of Kent Street (2005) and one 550m south of Kent Street (2007). The 2005 accident resulted in minor injuries, while the 2007 accident did not involve injuries.

The accident search was extended to include the part of 2008 up to April, and no further accidents have been reported in that time. Reviewing earlier crashes, there was a fatal accident in 2001 involving a driver entering the service station at the intersection of SH6 and Kent Street. At the time of the accident the speed limit past the Kent Street and SH6 junction was 100km/h, and the intersection was constructed to a lower geometric standard. As a result of the accident improvements have been made in the vicinity of the Kent Street and SH6 intersection including reducing the speed limit in the area to 80km/h and creating the central median and associated right turn bay into Kent Street. No accidents have occurred at the intersection since the improvements have been made. Hence, presently there is safe connectivity between the township and the State Highway network from the Kent Street and SH6 intersection and also an excellent record of safety within the township.

NZTA engineers have advised that NZTA are considering constructing a left turn lane from the southern SH6 approach of the intersection with Kent Street, which will further assist in separating potential conflicts between through and turning traffic.



LEGEND:

INJURY SEVERITY

- NON-INJURY
- MINOR INJURY
- SERIOUS INJURY
- FATAL

XXXXXXXX REFERENCE NUMBER

SOURCE: LAND TRANSPORT NZ CAS DATABASE

Friday, 24 October 2008 9:30:50 a.m.

5 FUTURE CHANGES TO INFRASTRUCTURE

5.1 Changes to Transport Networks

A search through the NZTA State Highway Land Transport Programme and the QLDC plans shows that no future upgrades are planned for the road network in the vicinity of Kingston. However, the NZTA programme does identify a strategic study to investigate passing opportunities on SH6.

6 LEVELS OF SERVICE

6.1 Definitions

Service flow rate is defined as the maximum hourly flow at which a designated Level of Service (LOS) can be maintained under known traffic conditions, such as road carriageway standard, the level of heavy vehicles and the directional split of traffic over a given time period. The following LOS definitions are given in “Basic Level of Service Criteria for Two-Lane Two-Way Rural Roads” of Austroads Guide to Traffic Engineering Practice Part 2: Roadway Capacity:

LOS A is a condition of free flow in which individual drivers 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, and the general level of comfort and convenience provided is excellent

LOS B is in the zone of stable flow and drivers still have reasonable freedom to select their desired speed and to manoeuvre within the traffic stream, although the general level of comfort and convenience is a little less than with level of service A (excellent).

LOSC is also in the zone of stable flow, but most drivers are restricted to some extent in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience declines noticeably at this level.

LOS D is close to the limit of stable flow and is approaching unstable flow. All drivers are severely restricted in their freedom to select their desired speeds or to manoeuvre within the traffic stream. The general level of comfort and convenience is poor, and small increases in traffic flow will generally cause operational problems

LOS E occurs when traffic volumes are at or close to capacity, and there is virtually no freedom to select desired speeds or to manoeuvre within the traffic stream. Flow is unstable and minor disturbances within the traffic stream will cause breakdown

The following table shows LOS thresholds for various peak hour traffic volumes on SH6, using the above criteria and considering the current geometric standard of SH6. It also shows the LOS at various intersection average delays.

LEVEL OF SERVICE	TWO-WAY SERVICE FLOW RATE (vph)	INTERSECTION DELAY (sec/veh including geometric delay)
A	240	10
B	475	15
C	770	25
D	1,240	35
E	2,000	50

Table 5: Level of Service Thresholds

The following table, from the Otago Regional Land Transport Strategy 2005, provides guidelines on acceptable LOS levels.

ROAD TYPE	PEAK TIMES*	OTHER TIMES
Strategic urban road network outside urban areas	Only accept LOS A,B,C or D	Only accept LOS A,B, or C
Remaining classified** road network (except as stated below)	Only accept LOS A,B, or C	Only accept LOS A or B
Dunedin and Queenstown CBDs	Only accept LOS A,B,C,D or E	Only accept LOS A,B, or C
Other local roads	Specific criteria***	Specific criteria***

* Peak times are between 7-9am and 4-6pm weekdays but may vary depending upon the demands of different areas.

** The classified road network includes arterial and collector/distributor roads as defined in city and district plans.

*** The specific criteria needs to be identified by each road controlling authority (RCA) based upon social, environmental, safety and economic factors appropriate for each location.

Table 6: Otago Regional Land Transport Strategy (2005) - Recommended Minimum Levels of Service

The Otago Regional Land Transport Strategy recommends that on SH6 a minimum LOS C is achieved throughout the day, while during peak times a LOS D is acceptable.

6.2 Existing Levels of Service on SH6

As there is a high level of seasonal variation in hourly traffic volumes, a level of service assessment has been made over a full year using the average peak hour volume in each week of the year. The peak hour traffic volume of around 300vph recorded at both Mid Dome and Remarkables has been applied as representing the eighth week of the year, the week during which it was counted, in the seasonal pattern indicated in Figure 8. As Kingston is expected to generate more movements on the section of SH6 north of Kingston than the section to the south, the northern section is considered in the analysis.

Figure 11 below presents the estimated existing seasonal peak hour traffic volumes on SH6 north of Kingston shown as a cumulative total including the contribution from Kingston. The contribution from Kingston is based on the November 2006 survey of the Kent Street/SH6 intersection. The LOS thresholds presented in Table 5 are also shown in Figure 11.

Estimated Existing Peak Hour Traffic Volumes and Level of Service, SH6 North of Kingston
Average Peak Hour Volume by Week of Year

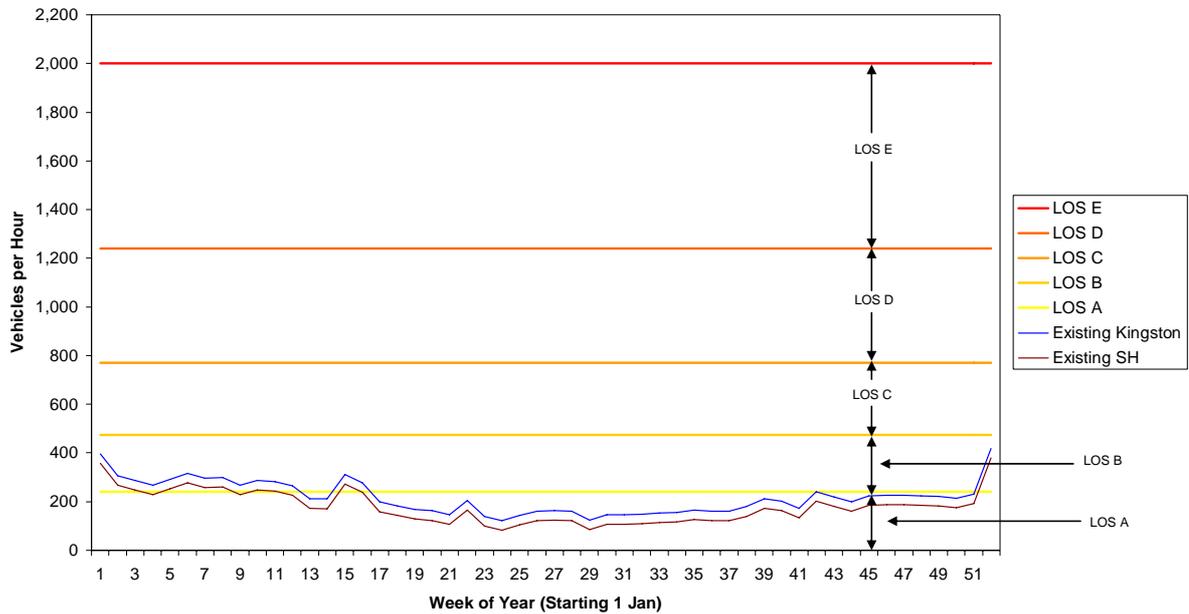


Figure 11 – Estimated Existing State Highway Level of Service

Figure 11 illustrates that SH6 is estimated to currently operate with LOS B at the busiest periods of the year and LOS A at other times. It is noted that this LOS assessment applies to the busiest hour of the day only. When the peak hour is operating with LOS B the remainder of the day will typically be operating at a better level of service.

6.3 Existing Levels of Service at SH6 / Kent Street Intersection

The performance of the SH6 / Kent Street intersection has been assessed with the Sidra Intersection 3.2 software package using the observed 2006 traffic volumes.

MOVEMENT		VOLUME (VPD)			AVERAGE STOP-LINE DELAY (S/VEH)			MAX QUEUE LENGTH (VEH)			LOS		
		AM	PM	Sunday	AM	PM	Sunday	AM	PM	Sunday	AM	PM	Sunday
SH6 North	Through	65	35	79	0	0	0	0	0	0	A	A	A
	Right	9	14	19	0.1	0.2	0.2	0	0.1	0.1	A	B	A
Kent Street	Left	14	4	10	0.2	0.3	0.2	0.1	0	0	A	B	B
	Right	8	3	14	0.7	0.7	1	0	0	0.1	B	B	B
SH6 South	Left	14	3	14	0	0	0	0	0	0	A	A	A
	Through	48	75	68	0	0	0	0	0	0	A	A	A
Intersection		158	134	204	0.1	0	0						

Table 7: SH6 / Kent Street intersection, 2006 (Morning, Evening & Sunday Peaks)

It can be seen that the intersection operates well within its maximum capacity. The queues and delays are very small, and the maximum saturation is less than 5%. The calculated average delays translate to LOS B or better.

7 STRATEGIC PLANNING ISSUES

7.1 Kingston 2020

Kingston 2020, prepared in November 2003 sets out the Kingston community's vision, strategic goals and priorities for the next 20 years. The key community outcomes that are identified in this document that are related to transportation and this assessment are:

- To maintain a strong urban boundary by confining future expansion to the north western side of the highway
- To grow the economy of Kingston through enabling two distinctly different commercial precincts to evolve, and for families to live and work within the settlement
- To enhance the existing trails and foreshore through improved maintenance, expansion, signage and design for multiple users where possible
- To enhance the amenity and streetscape through well-designed and landscaped entranceways, lighting and landscaping

7.2 Growth Management Strategy for Queenstown

The Growth Management Strategy for Queenstown which was adopted by the QLDC in May 2007 recommends that settlements such as Kingston should be compact with distinct edges and defined urban growth boundaries. It also sets out that such settlements should accommodate around 800 to 1,000 dwellings to reach a critical mass for affordable servicing, and an appropriate range of local services and employment can be supported.

7.3 Wakatipu Transport Strategy (WTS)

QLDC and NZTA commissioned a transportation study of the Wakatipu Basin to investigate both short and long term proposals to improve the transportation network to accommodate existing traffic volumes and the growth in traffic anticipated with the development proposed within the basin. Whilst the WTS study area did not include Kingston, it is still of relevance to this Plan Change as there is the potential for development in Kingston to generate traffic that contributes to the transportation needs in the Wakatipu Basin, particularly during the commuter periods.

The WTS has produced a strategy and an implementation plan for future development of the Wakatipu transportation system. As part of travel demand management measures, the WTS has proposed management of parking availability, particularly in central Queenstown, as a way to discourage commuter parking and as an incentive to use the new public transport systems. Park and Ride facilities are also proposed within the northern sector of the Frankton Flats so that motorists can interchange to buses for the journey along SH6A. It is estimated by the WTS study team that a 20% transfer of car trips to public transport could be achieved by 2026 for this corridor.

In summary, the planning for the future of strategic travel in the Wakatipu Basin has been substantially addressed by the WTS. Kingston will have a relatively small contribution to the overall travel demand in the Wakatipu Basin and consequently the scope and timing of projects is not expected to change as a

result of the Plan Change. Therefore, it is considered that the wider transportation effects of the proposed Plan Change on the Wakatipu Basin do not need to be considered further.

7.4 Committed Development in Kingston

Council identified in the LTCCP that there is capacity for around 100 households in Kingston in addition to the existing 208. The level of additional development adopted for the Plan Change assessments has been calculated by GHD Ltd to be higher at some 171 additional households. This gives a total of 379 in the existing Kingston township zone.

Kingston Acquisitions Limited (KAL) propose to develop a mixed use development in the vicinity of Devon Street and Hereford Street in Kingston. This proposal includes a mixture of visitor accommodation, residential, commercial, social and recreational activities and is to be heard at a Council hearing in 2008. Although this development is not committed and no indication is available at the time of writing of this report on the likelihood of the application being granted consent, it has also been included in the analysis. Again this is to represent a worst case scenario. Should the KAL proposal not be granted consent the findings of this report would remain relevant and robust.

It is also expected that other visitor accommodation will become available within Kingston, and an allowance has been made for 100 commercially available beds.

The total ultimate land use scenario that will be assessed in this report is set out in the following section.

8 THE PROPOSAL

8.1 Masterplan Overview

Figure 12 shows the Masterplan layout for the Plan Change site. As can be seen, the Plan Change site will provide primarily for residential development, with a higher concentration housing tending to occur within the central area of the site. A 2.2ha employment area will be provided at the western end of the site and a new primary school site will be provided near the south-eastern corner of the golf course. Community facilities can be accommodated within the south-eastern corner of the golf course. The Plan Change includes a structure plan that locates the various landuse into Activity Areas as follows:

- Activity Area 1 – Residential
 - Within Activity Area 1a sections are between 350m² and 500m² and there is opportunity to provide comprehensive housing and visitor accommodation;
 - Within Activity Area 1b sections are between 450m² and 700m²;
 - Within Activity Area 1c sections are between 700m² and 900m².
- Activity Area 2 – Employment
- Activity Area 3 – Educational facilities
- Activity Area 4 – Open Space
 - Activity Area 4a provides for the golf club house
 - Activity Area 4b provides for open space and recreation.

Master Plan showing detailed road layout

- Activity Area 1A (Higher Density Residential)
- Activity Area 1B (Medium Density Residential)
- Activity Area 1C (Lower Density Residential)
- Activity Area 2 (Employment)
- Activity Area 3 (Education Precinct)
- Activity Area 4 (Open Space)
- Activity Area 4A (Village Clubhouse Precinct)
- Visitor Accommodation Precinct
- Road



Friday, 24 October 2008 8:30:50 a.m.

REVISION	DATE	DESCRIPTION

Kingston Plan Change
Proposed Site Layout

DRAWN: rlt
 DATE: 8-8-08
 CHECKED: RR
 APPROVED: AAM

SCALE: 1:5000 @ A3
 DRAWING NO: 8788-4-C12C

12

Roads within the site will be laid out in a grid type network with an east-west 'Greenway' road connecting from SH6 to the employment area supported by north-south primary residential local roads that also link to the existing township. A lower order network of secondary local streets will support the Greenway and primary residential roads. Activity Area 1a, which provides the highest level of density will also be serviced by rear access lanes that provide rear access to the sections and rear garages. Each of the internal roads will be provided with pedestrian paths on both sides of the road providing a high level of connectivity for all transport modes.

The proposed connections to the surrounding road network will require the private railway crossing (labelled as crossing 6 on Figure 3) to be removed, as will the existing Oxford Street crossing (4), although the latter will be replaced with a new crossing some 60m north via Cambridge Street. The option of a road link across vacant land south of Oxford Street would require a new rail crossing.

A pedestrian link is proposed across the railway from the eastern end of the Plan Change site to connect with an unformed legal road that leads to Kent Street about 200m from its intersection with SH6.

8.2 Development Land Use

The development scenario that has been considered in this report for the Plan Change site is 750 households, 2.2ha of employment land and in addition a potential primary school catering for 150 pupils. These activities have been assessed in combination with:

- The fully developed KAL proposal
- A total of 379 residential lots in Kingston, outside the Plan Change site, and in addition to the KAL proposal
- 100 commercially available beds elsewhere in Kingston

8.3 Travel Demand Management

Kingston is a compact township, and the proposed Plan Change will retain this compact nature by consolidating development to the immediate south of the existing township. The extent of the settlement including the Plan Change site is approximately 1.5km distance from corner to corner, and the southern extent of the Plan Change site is only 1.1km from the lake. At a typical walk speed, this enables all parts of the township to be accessible within a 20 minute walk. As the topography is flat to gently sloping, walking and cycling will be viable options for practically all internal movements providing that the transport networks are designed in such a way to enable and encourage these modes.

Kingston also has the advantage of not having any through traffic, so traffic volumes and vehicle speeds can be kept low. Therefore walking and cycling access can be a primary consideration when designing the transportation network for the Plan Change site.

The structure plan for the Plan Change includes a network of streets generally based on a grid layout that will be highly permeable for pedestrians and cyclists. Footpaths are to be provided on all streets and these are supported by green corridors that include provisions for pedestrian paths. There will be low traffic volumes on all of the streets so that walking and cycling amenity is not compromised, and

design elements such as defined crossing points of the main spine road can be included to further assist the encouragement of walking as a viable mode of travel.

The school is located centrally within the site so that walking distance is minimised, and whilst the employment area is located at the south western end of the township, it is still within viable commuter walking distance for the whole township.

8.4 Road Network Design

8.4.1 Road Hierarchy

Figure 13 shows the proposed road hierarchy for the Plan Change site that will be included in the subdivision guidelines for the Kingston Village Special Zone. As can be seen, a strong hierarchy is provided, with a 'Greenway' being the main east-west link, connected by a network of primary residential streets, which in turn are linked together by a network of secondary residential streets.

The Greenway running through the Plan Change site from SH6 to the employment area is considered to be consistent with the collector road status given by the District Plan, for which the definition includes the following:

"Collector Roads provide for the distribution and circulation of traffic between or within local areas and to and from the arterial network. Collector roads also provide access to private properties fronting the road, however, the main function is to provide access to local roads."

The Greenway will support the parallel Collector function of Kent Street and provide a direct connection to SH6 minimising the increase in traffic on streets in the existing township, and providing a direct route for commercial traffic from the employment area to access SH6. However, the retention of Kent Street as the primary visitor access to Kingston can be retained through appropriate guide signage on SH6.

A network of local roads (residential-primary) are provided on a southwest to northeast orientation, providing for movement and integration between the existing township and the Plan Change site. Connecting between these local roads and forming the lower level of the grid layout will be secondary residential streets. The employment area will also be served by a local road, albeit with a different carriageway provision than the residential local roads. Rear access lanes will be provided within Activity Area 1a, which provides the highest level of residential density.

8.4.2 Road Cross-sections

Figures 14 to 16 show the indicative cross-sections proposed for the various road types, which are designed to reinforce the road hierarchy. The Greenway collector route, being the new main access road leading to the site from SH6 will consist of a 7m wide carriageway with informal car parking bays provided amongst landscaping on the edge of the carriageway. Shared cycle and pedestrian paths will be provided on both sides of the carriageway. A similar cross-section is proposed for the road servicing the employment area.

The local roads will be provided at two levels to reflect the function and traffic volumes within the network. The higher level primary residential streets will provide connections from Kent Street and the Greenway, linking to the secondary residential streets. They will therefore include some short distance through traffic. The streets will consist of a 7m wide carriageway, which will provide for parking on the carriageway. It is expected that parking demand on these streets will be relatively low as the orientation of the grid layout minimises the number of properties with direct frontage to the streets. The streets also

typically have a wide storm water corridor adjacent to them which further minimises the direct property frontage. The 7m dimension provides flexibility in terms of traffic movement and car parking under these conditions. The street will typically operate with two-way traffic with unrestricted parking on one side of the carriageway, or more occasionally with parking on both sides of the carriageway with slow one-lane movement of traffic between parked vehicles. The width is consistent with existing streets in Kingston such as Huntingdon Street, and as discussed further in Section 11.4 of this report will readily accommodate the expected traffic volumes.

The secondary residential streets will have a primary function of providing for property access, with each street being short and connecting to the primary residential network. Minimal provision for through movement will be made, thereby encouraging alternative transport modes for short local trips within the Plan Change site. The 5.7m width of the carriageway will create a slow street environment conducive to shared use by non-vehicular traffic, and enables staggered parking on one side of the street, whilst providing sufficient width for a heavy vehicle to pass. The 5.7m width is adopted as the most practical width as 6.0m can give the perception that two vehicles can park opposite each other whilst still retaining a through lane, whereas it is actually insufficient. With a 5.7m wide road, it is clearer to drivers that parking opposite another parked car will block the road.

Footpaths will be predominantly informal, being along tracks on at least one side of each road with a preference for porous materials that still provide for the range of users of the footpaths (eg wheelchairs and prams). Footpaths will also be utilised within the open swale areas where practical.

9 ACCESS TO KINGSTON FROM SH6

9.1 SH6/Kent Street

The existing intersection of SH6/Kent Street provides the only formed road access to Kingston. This intersection was described previously in Section 2.3 of this report and meets minimum requirements in terms of sight distance and operates with a high level of service.

9.2 Secondary Access to SH6

9.2.1 *Benefits*

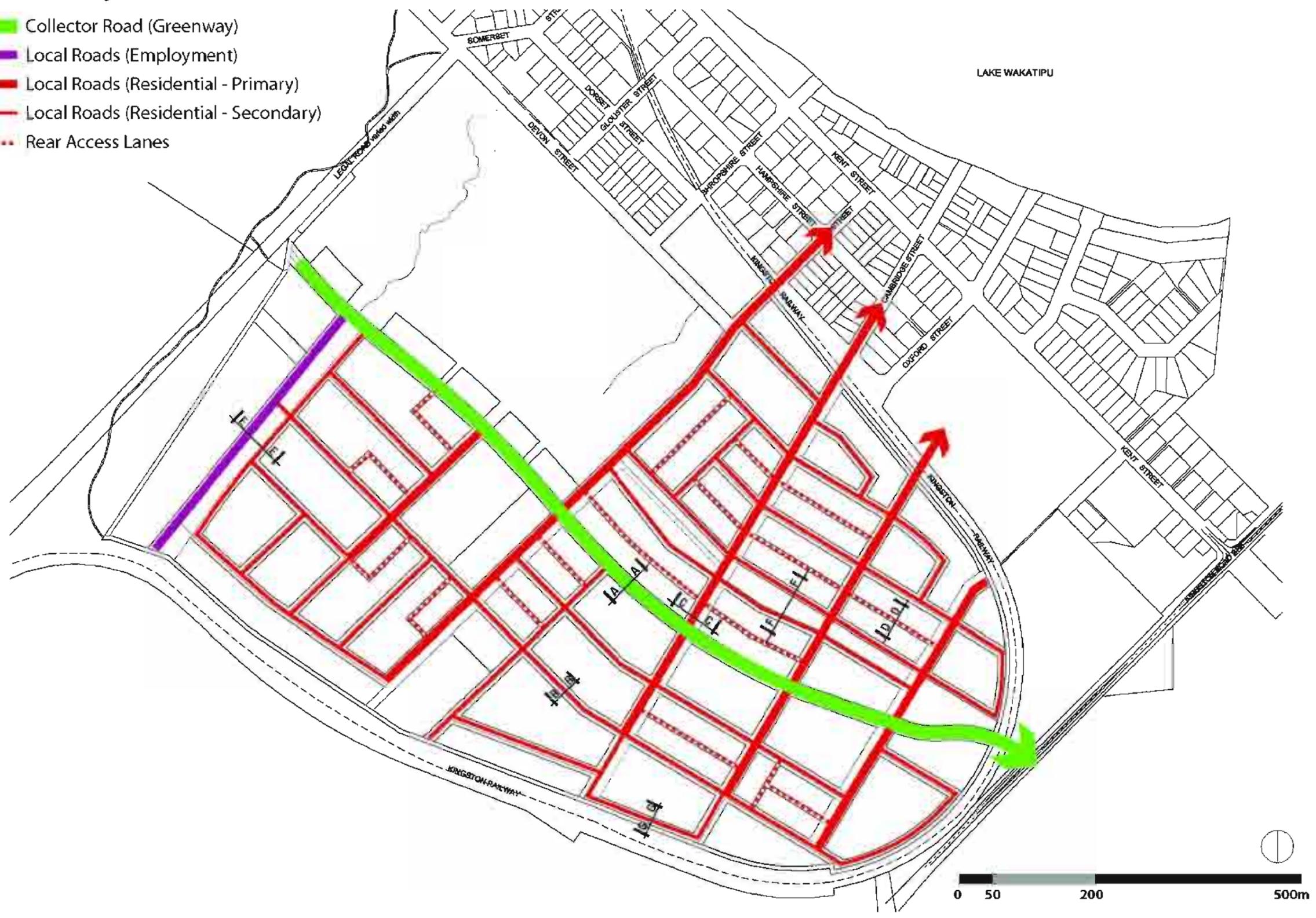
The benefits of providing a secondary access to Kingston associated with the Plan Change development include greater network reliability and shorter travel times and distances for a large proportion of those travelling both to the north and south from the Plan Change area.

Based on distance considerations, it is expected that all drivers travelling to the south from the Plan Change site will utilise the secondary access, and those generally south of the linear park (approximately 80% of the residential development) will use the access for travel to and from the north. This will minimise the additional through traffic resulting from the Plan Change on existing local roads within the township due to more direct routes being available to the external network. The provision of the secondary access direct to SH6 also provides for the avoidance of commercial traffic associated with the proposed employment area being required to utilise the existing local road network through the township.



Road Hierarchy Plan

-  Collector Road (Greenway)
-  Local Roads (Employment)
-  Local Roads (Residential - Primary)
-  Local Roads (Residential - Secondary)
-  Rear Access Lanes



Friday, 24 October 2008 8:30:50 a.m.

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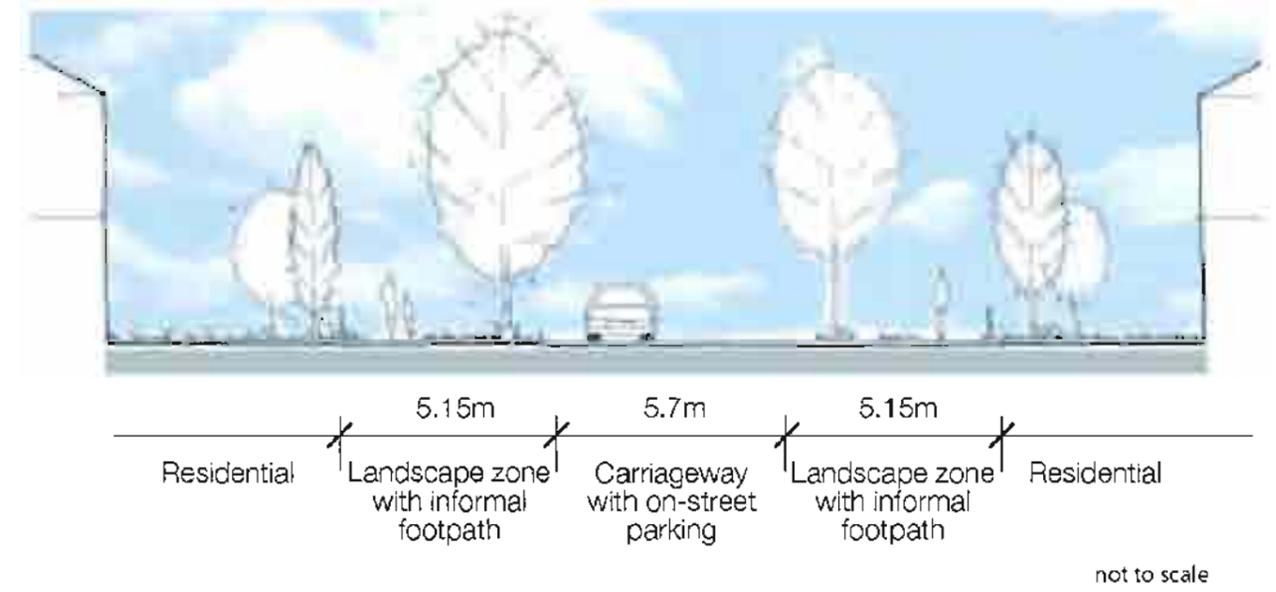
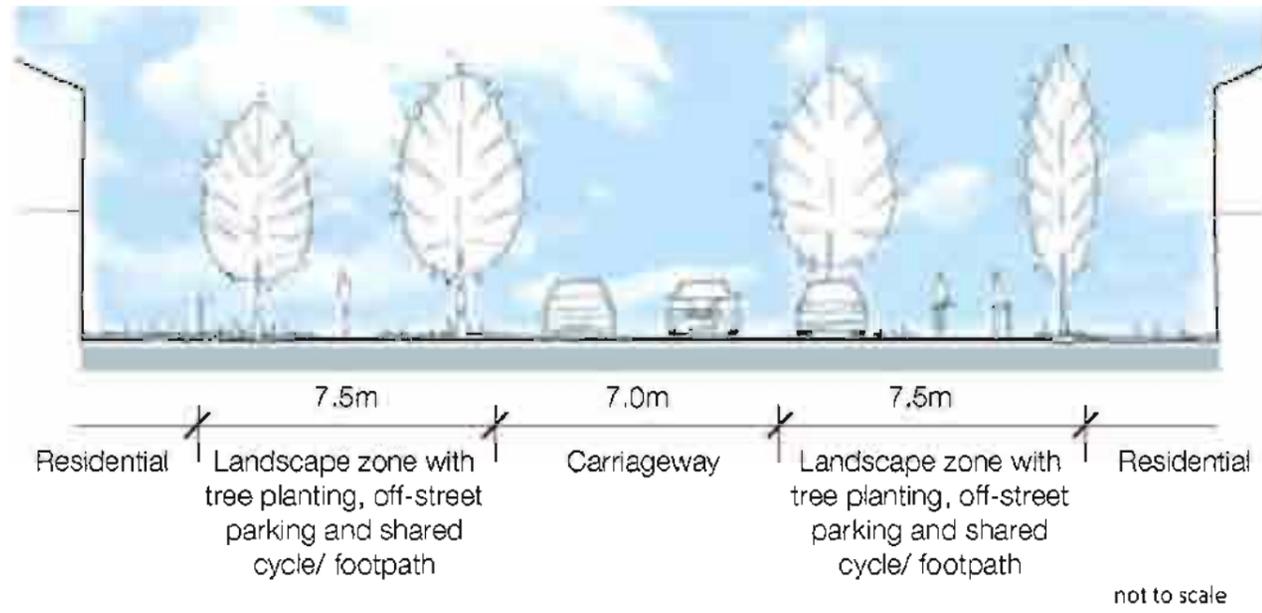
Kingston Plan Change
Road Hierarchy

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 DATE: 24-10-08
 CHECKED: RR
 APPROVED: AMM

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 DRAWING NO: 8788-4-C13C

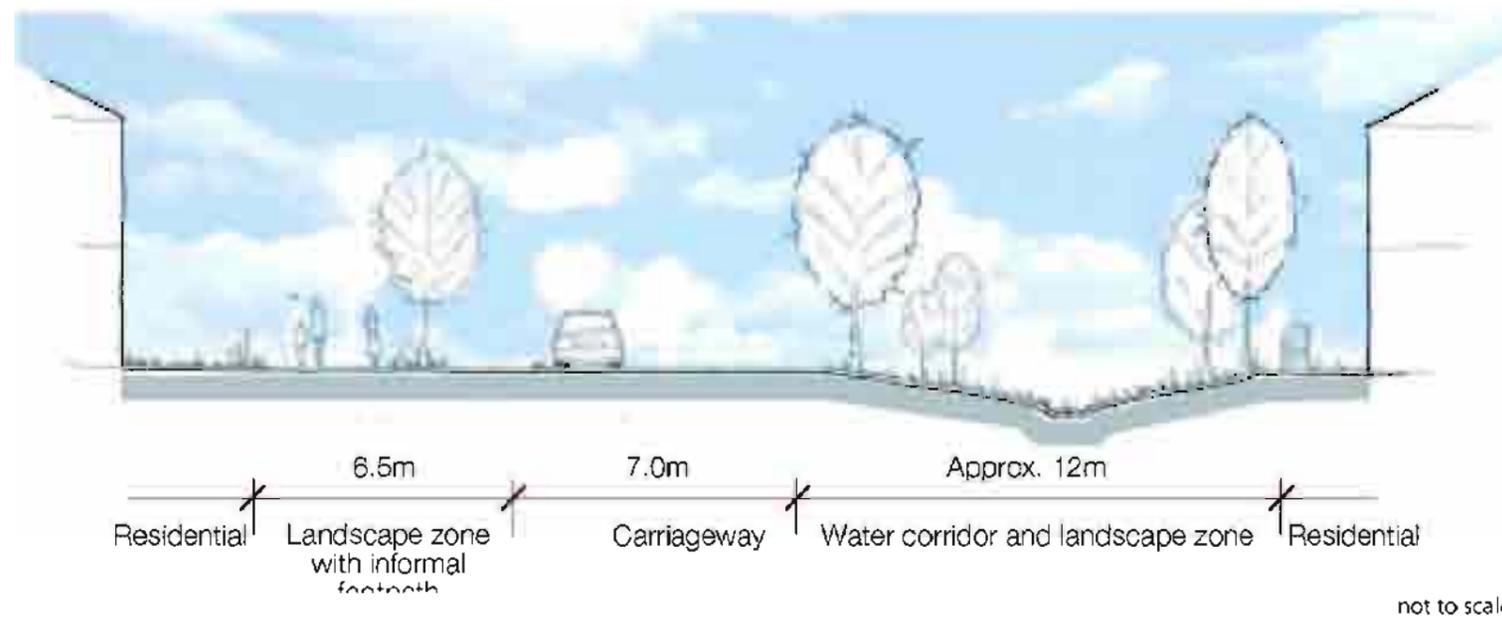


Road Section A & B & C



Typical Section A - Kingston Greenway (22m)

Typical Section B - Local Road - Residential Secondary (16m)



Typical Section C - Local Road - Residential Primary (20m) and Swale (width varies)

Friday, 24 October 2008 9:30:50 a.m.

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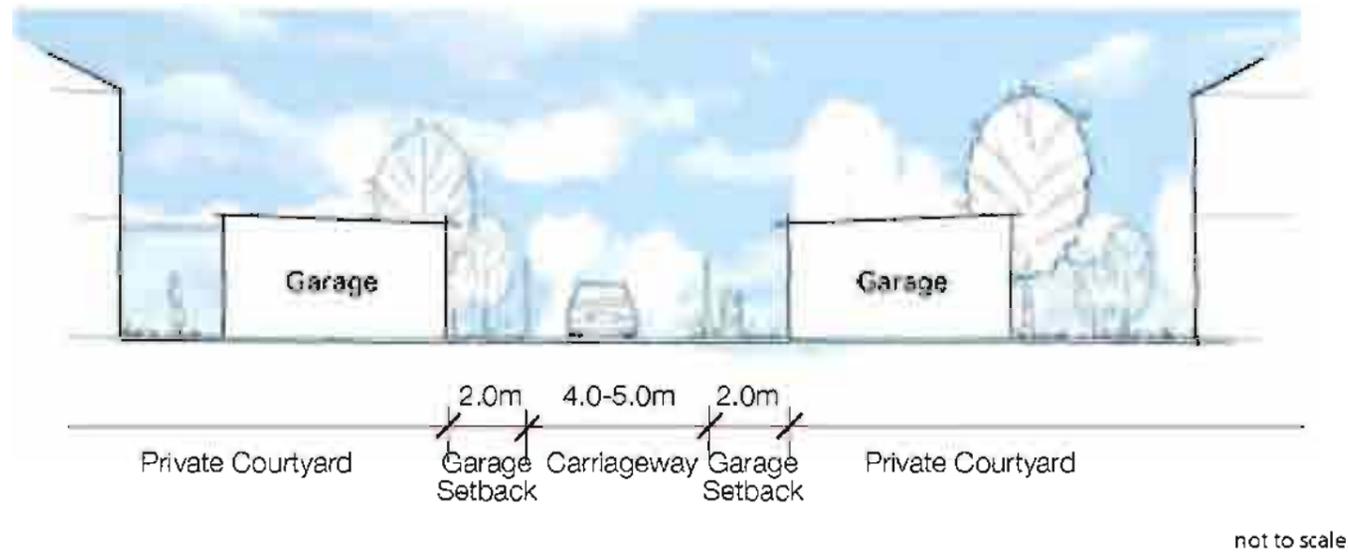
Kingston Plan Change
Cross Sections

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DATE: 24-10-08
CHECKED: RR
APPROVED: AAM

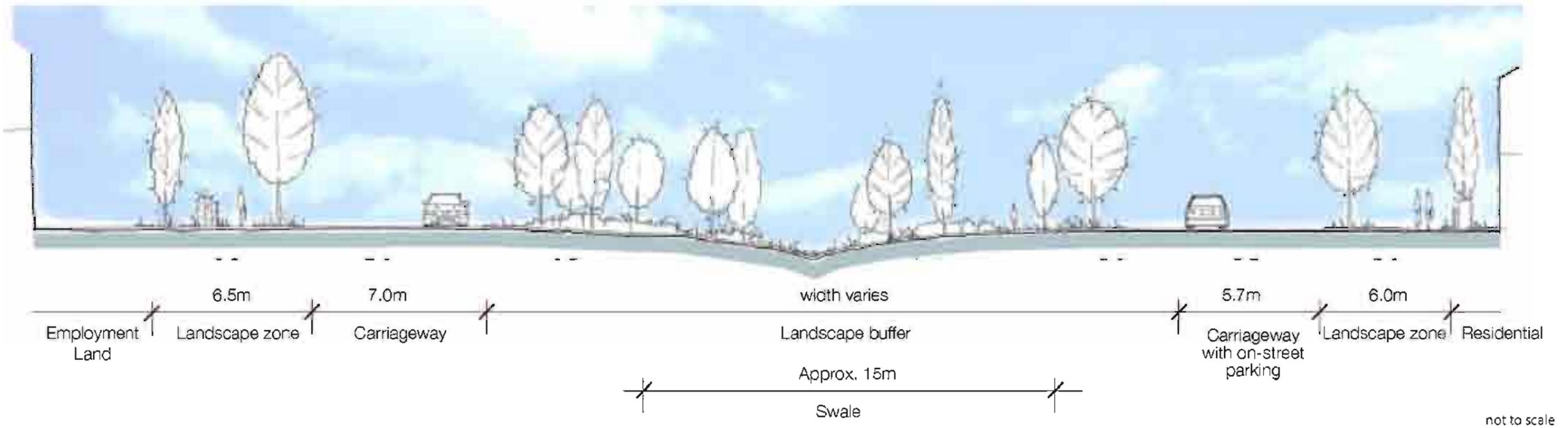
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14

Road Section D & E



Typical Section D - Rear Access lane (4-5m)



Typical Section E - Water Corridor and Landscape Buffer to Employment Land (width varies)

Friday, 24 October 2008 9:30:50 a.m.

REVISION	DATE	DESCRIPTION

Kingston Plan Change
Cross Sections

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DATE: 24-10-08
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APPROVED: AAM

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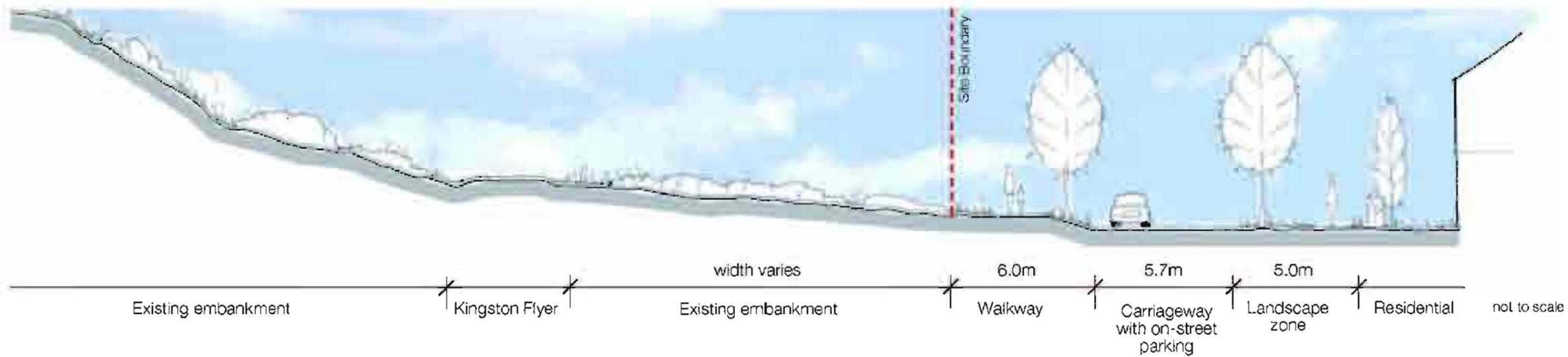
TRAFFIC DESIGN GROUP

15

Street Section F & G



Typical Section F - Linear Park (width varies)



Typical Section G - Kingston Flyer Embankment and Walking Trail (width varies)

Friday, 24 October 2008 9:30:50 a.m.

REVISION	DATE	DESCRIPTION

Kingston Plan Change
 Cross Sections

DRAWN: rtd
 DATE: 11-06-08
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 APPROVED: AAM

SCALE: NTS
 DRAWING NO: 8788-4-C18C

TRAFFIC DESIGN GROUP

16

At present the only accesses to SH6 other than Kent Street are small farm tracks. An important advantage of a secondary access is that it provides network reliability during emergency situations. An accident occurring at the Kent Street/SH6 intersection or road works could force the closure of Kent Street and restrict access to the settlement and without the secondary access there is no option for alternative access.

NZTA have indicated that they do not support provision of footpaths on SH6 and the development pattern proposed for the Plan Change maintains a buffer to SH6 so that all property access and pedestrian and parking activities are accommodated within Kingston.

The access location has been selected considering three main factors:

- Separation from Kent Street Intersection
- Distance between SH6 and the Kingston Flyer Railway Line and the crossing over the railway line
- Available sight distance along SH6

Each of these factors is discussed in the following sections.

9.2.2 Separation from Kent Street Intersection

SH6 from 835m south of Kent Street to 300m north of Kent Street is defined as a Limited Access Road (LAR) in the District Plan. The objective of LAR designation is to protect and maintain the safety and high level of traffic service on such routes that could be adversely affected by new access points.

For the purposes of safety, efficiency and sustainability NZTA has a policy of minimising access directly to and from the State Highway network. In relation to intersection spacing the latest revision of the Transit Policy Manual has moved away from being prescriptive and specifying minimum separation distances in favour of a case by case approach. The criteria to be considered when determining spacing includes outcomes of growth strategies and NZTA's strategic studies, category of state highway, safety issues, and project affordability. The greatest possible separation from Kent Street is desirable however this has to be considered in the context of the other factors, such as available sight distance, separation from the railway line, and effect on the highway speed limits. These matters are discussed further as follows.

9.2.3 Distance between SH6 and Kingston Flyer Railway Line and Railway Crossing

As shown in Figure 3, the Kingston Flyer Railway Line follows an alignment that comes within approximately 15m of SH6 at a point approximately 550m south of Kent Street. Where an intersection is located close to a railway crossing space is required between the railway line and the intersection so that a long vehicle queued at the intersection, in this case one waiting to enter SH6 can do so safely clear of the railway lines.

The minimum separation of an intersection from the railway required under OnTrack standards (whilst OnTrack is not the operator in this case, these standards are relevant) is 30m. There is a zone of SH6 where this separation is not available. This zone starts approximately 450m south of Kent Street and is approximately 200m long. The access cannot be located in this area. All other locations can provide sufficient separation between the railway line and SH6.

The topography of the land between the highway and the railway crossing is also an important consideration as this will affect approach grades to both the highway intersection and the railway level crossing. The elevation of the highway relative to the railway increases further to the north, and therefore this has a bearing on the preferred intersection location.

9.2.4 Available Sight Distance along SH6

The Transit Policy Planning Manual Appendix 5B sets out minimum sight distance standards based on the 85th percentile operating speed.

At the surveyed southbound operating speed of 94km/h the minimum sight distance standard is 225m based on the NZTA requirements. The minimum sight distance standard to the south is 203m based on the surveyed operating speed of 90km/hr. Features of SH6 in the vicinity of Kingston that affect sight distance are the vertical curvature near the SH6/Kent Street intersection and the horizontal curvature to the south of the Plan Change site.

Considering the separation distances from Kent Street and the railway line, the access location could be at one of the two existing railway crossing locations identified in Figure 3. The location approximately 420m south of Kent Street is located on a straight section of SH6 and would encourage greater use for the predominant movement to the north from the Plan Change site and is located very close to the existing 80km/h speed limit signs. If the intersection was moved further to the north, the available sight distance is not able to satisfy the minimum requirements for the operating speed, and to the south it is not able to satisfy the requirements for separation between the highway and railway line.

On the basis of the above assessment of the various elements, the intersection location adopted is some 420m south of Kent Street. Sight distance measurements at this location show that some 275m of sight distance is available to the north, thus satisfying the NZTA requirements. The 310m of available sight distance to the south also readily meets the NZTA sight distance requirements.

The proposed location will provide 45m of separation from the railway, readily meeting the standard outlined in the previous section and providing sufficient queuing space as described later in Section 12.1.5.

The views to the north and south from the proposed intersection are shown below in Photographs 9 and 10.



Photograph 9 - View from Proposed Access to the North



Photograph 10 - View from Proposed Access to the South

9.2.5 Form

A conceptual design of the proposed secondary SH6 access intersection 420m to the south of Kent Street is shown as Figure 17.

NZTA has indicated that the intersection of the new access road and SH6 will require left and right turn bays on SH6. The road reserve of SH6 in this area is between 20 and 23m wide. Sufficient width is therefore available to widen the carriageway to provide these lanes. Some localised earthworks will be required on either side of SH6 as the existing highway carriageway on the Plan Change site side is slightly elevated from the surrounding land, and this will require filling. It is noted that the proposed access road will travel through land that is not within the road or railway reserves.



SCALE 1:1000

SCALE 1:1000

SCALE 1:2000

REVISION	DATE	DESCRIPTION

Kingston Plan Change
Conceptual Intersection Design

DRAWN: /BI
 DATE: 9-8-08
 CHECKED: /RR
 APPROVED: /AAM

SCALE: as above
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9.2.6 Other Opportunities

Creating a strong urban boundary using SH6 is a strategic objective of Kingston 2020 and also consistent with the objectives NZTA have outlined in preliminary consultation for this project. At present the service station and tea rooms on the corner of Kent Street and SH6 have direct access to SH6, as shown in Photograph 10 below.



Photograph 11 – Kent Street/SH6 Service Station

Whilst outside the scope of this Plan Change, an opportunity exists during upgrade of the intersection by NZTA to formalise access to these activities either to SH6 directly or by designing access from Kent Street. Figure 17 includes a conceptual option of extending the existing island to provide an access from Kent Street, which provides greater separation from the SH6 intersection and a formalised and narrower access to SH6 directly from the service station forecourt. This is presented as a conceptual design for discussion purposes only.

10 TRIP GENERATION AND DISTRIBUTION

10.1 Existing Activity

The Plan Change site is currently zoned Rural General and has a negligible traffic generation.

The existing township currently generates approximately 500vpd externally, based on the Kent Street traffic data. This traffic is generated by a total of 208 dwellings, (of which 64 households (31%) are usually occupied), together with the Kingston Flyer, and recreational and scenic opportunities such as the Kingston Golf Course and lakeshore. Allowance has been made for an additional 26 households to be occupied on a temporary basis, giving an average of 90 occupied households, although this is expected to fluctuate seasonally.

Attributing 450vpd of the 500vpd volume of Kent Street to local households indicates a current external generation rate of 2.2 trips per day per household, or 5.0 trips per day per occupied household.

10.2 Demographic Patterns

The Statistics NZ Census allows consideration of patterns in employment with changes in population, housing occupancy, and travel to work data. To assist with determining patterns of development for assessment of travel patterns, data from within the surrounding area has been reviewed.

Seasonal variation in occupancy may have a significant effect on traffic generated within the Plan Change site, depending on the future demographic details of the household owners and operation of households within Kingston including new and existing households. Higher household occupancy would be encouraged for both the existing Kingston households and the houses enabled by the Plan Change should significant employment opportunities be available locally. Low seasonal variation of household occupancy would also be a result of greater employment opportunities being created within the township and Plan Change site as more permanent residents are provided for in the settlement. Should employment opportunities be limited it is likely that more houses will be purchased or developed as holiday homes, and that the occupied household rate will generally be similar to the 2006 Census levels, with high seasonal variation in holiday periods.

A review of the Census data from 1996, 2001 and 2006 for various locations within the Queenstown Lakes District shows that within each area there is a general trend for the percentage of occupied dwellings to increase as the number of total dwellings increases. This reflects the greater degree of self sufficiency that develops as populations expand. Based on locations (excluding Queenstown) of a similar size to what Kingston would be following the development of the Plan Change site, the percentage of occupied dwellings adopted for the traffic generation analysis is 75%. This is somewhat higher than the 59% occupancy recorded for 2006 in the Glenorchy area unit which includes Kingston.

The future population of Kingston can be estimated by applying the standard 2.5 people per household occupancy rate. This would result in an additional population of approximately 1,400 people associated with the Plan Change, and a total population in Kingston of approximately 2,100 people.

Another key consideration is the number of jobs that could be supported by the future population of Kingston. Having adopted a high percentage of occupied dwellings, the expectation is that this will in turn provide opportunities for employment. A review of the 2006 Census data within the District indicates that the ratio of jobs to population is between 25% and 55%. To provide a worst case scenario in terms of the traffic generation onto SH6, the lower figure of 25% has been adopted, indicating that the Kingston township will support approximately 525 jobs.

With approximately 70% of the potential Kingston workforce employed, it is estimated that approximately 1,220 residents within Kingston will be employed. Given that some jobs in Kingston will be taken by those from outside the township, estimated at 10%, up to 750 residents will be employed outside the township. This proportion of people working outside of the township is consistent with the Census data for locations such as Hawea, Arrowtown, and the wider Wakatipu area.

10.3 Expected External Traffic Generation of Kingston

The Kingston township is not expected to be fully self sufficient, resulting in traffic movements external to the township for work, shopping, social and recreational purposes. However as the township grows, the level of commercial development may grow increasing the level of self sufficiency. As there is expected to be some traffic generation associated with internal destinations, this will result in combined external traffic generation rates that are lower than the rates applied to individual sites. Further, given

the distance of Kingston from the main supporting service area around Queenstown, there will be a high level of trip linking. For example, shopping trips will be combined with employment trips whereas in Queenstown there is a higher likelihood that these will be undertaken as separate trips. As the level of traffic generation is somewhat dependant on the level of other development within Kingston, the following traffic generation analysis is for Kingston as a whole.

10.3.1 Residential Traffic Generation

Under the assessed development scenario Kingston will have up to 1,130 households – including the 380 permitted within the existing township, and 750 proposed as part of the Plan Change. As discussed in the previous section, it is expected that some 750 Kingston residents will be employed outside of Kingston. The traffic generation associated with the journey to/from work is expected to make up approximately 50% of all external home based traffic movements, with the remainder being associated with other trip purposes. On this basis, the expected external traffic generation rate is some 3.0vpd/hh, equating to approximately 2,500vpd.

By adopting the typical percentage of 10% of residential traffic generation occurring within the busiest hour of the day, a total of 250vph will occur during the peak hour.

There is the potential for this traffic generation to be reduced through the provision of public transport services, particularly at peak times when there would be steady demand for commuter transport to Queenstown.

10.3.2 Employment Land

The 2.2ha of employment land has been assessed to generate traffic at a rate of 375vpd/ha, of which approximately 45% are expected to occur externally (or 170vpd/ha). This has been determined by reference to data from other mixed use employment areas, and by considering the traffic generation associated with the expected number of workers as described earlier.

At the above traffic generation rate, the resulting external traffic generation is expected to be some 375vpd, of which some 15% are expected to occur in the peak hour, resulting in approximately 55vph.

The employment area has the potential to generate heavy vehicle traffic, which will largely be dependant on the type of activities proposed. Typically, approximately 10% of the total traffic generation of an industrial type development will be heavy vehicles. The 2.2ha employment area could therefore generate approximately 80 heavy vehicle movements per day based on typical commercial/industrial landuse.

10.3.3 Kingston School

Included within the Plan Change structure plan is provision for a primary school. Based on a resident population of 2,100 people, it is expected that the school may have a roll in the order of 150 children, some of whom will travel from outside of Kingston. These external movements associated with school bus, staff and other service trips to the school are expected to generate approximately 30vpd, of which approximately 10vph could be expected in the peak periods.

10.3.4 Kingston Flyer

The Kingston Flyer currently has an associated traffic generation estimated at some 60vpd. This is based on two timetabled services per day, each generating some 15 vehicle trips, or 30 vehicle

movements. It is expected that this operation will be unaffected by implementing the Plan Change. All movements associated with the Kingston Flyer have been applied as being external as most are expected to be made by visitors to Kingston. None of these movements are expected to occur within the peak hour associated with the residential traffic generation.

10.3.5 Kingston Golf Course

It is considered that the majority of traffic generated by the golf course, at full development of the Plan Change site, will be internal to the town. To allow for some use of the golf course by outside users a daily external traffic generation of 20vpd has been adopted, with 5vph occurring within the peak hour.

10.3.6 Kingston Acquisitions Limited (KAL) Proposal Traffic Generation

The assessment of the external traffic generation associated with the KAL proposal concluded that on a typical weekday the proposal could generate up to 1,494vpd with a peak hour of 128vph externally to the township. However, that assessment recognised that the assessment was very conservative in order to present a worst case scenario. In particular the worst case traffic generation scenario did not allow for increasing self sufficiency as Kingston grows, use of alternative travel modes, or traffic generation rates adjusted for the distant location of the development from Queenstown.

For this Plan Change assessment which assesses the fully developed settlement, it is more appropriate to consider an alternative traffic scenario in which the traffic generation rate external to Kingston will reduce because of increased self-sufficiency within the settlement and a typical occupancy rate. For this assessment, it is predicted that the KAL site will generate external traffic generation at the same rate as the houses in Kingston, being 3vpd per occupied unit (both visitor accommodation and residential units), with 75% occupancy. Other trips associated with the development are expected to be internal to Kingston. This results in an external traffic generation of some 390vpd, with some 40vph expected in the peak hours.

10.3.7 Other Commercially Available Beds

Allowance has been made for up to 100 other commercially available beds in Kingston. As some of these have already been considered in terms of the overall household traffic generation, the additional traffic generation applied for this assessment is some 2vpd/bed external to Kingston. Therefore, on a typical weekday with 75% occupancy they are expected to generate up to 150vpd daily with a peak hour of up to 15vph.

10.3.8 General Pass-By Movements

Pass-by trips are those where vehicles make an intermediate stop part way through a planned journey, predominantly for scenic reasons and rest stops. They can generally be considered as a function of the passing traffic and the size of Kingston. It is estimated that pass-by trips will equate to some 200vpd and 20vph, representing approximately 10% of passing traffic. Whilst the movements are additional at the intersections accessing Kingston, they are not additional to the wider transport network.

10.3.9 Total Generation

Consideration has been given to the above trip generation to distribute trips internally between households and the golf course and school, with remaining trips allocated to SH6 to give an indication of traffic movements to and from SH6 (external movement). Table 8 below shows the traffic generation of

Kingston with the implementation of the Plan Change and development of the existing township to its full potential including the KAL mixed use development (the ultimate development scenario).

ACTIVITIES	SIZE	DAILY EXTERNAL TRAFFIC GENERATION RATE	DAILY EXTERNAL TRAFFIC GENERATION (vpd)	PEAK EXTERNAL TRAFFIC GENERATION (vph)
Existing (permitted) residential	380hh (75% occ)	3.0vpd/occupied hh	840	85
Plan Change residential	750hh (75% occ)	3.0vpd/occupied hh	1,660	165
Kingston Flier	n/a	60vpd	60	-
Golf course	n/a	20vpd	20	5
School	n/a	30vpd	30	10
Employment area	2.2ha	170vpd/ha	375	55
KAL Development	174unit/beds (75% occ)	3.0vpd/occupied unit	390	40
Commercially Available Beds	100 beds (75% occ)	2.0vpd/occupied bed	150	15
Pass-by traffic	n/a	200vpd	200	20
TOTAL			3,725vpd	395vph

Table 8: Traffic Generation

As identified by the above analysis, the settlement is expected to generate a total of 3,725vpd external traffic movements at full development of the existing township, Plan Change activities, and other developments within the township. During the peak hour, the external traffic generation will be approximately 395vph.

A coarse check on the calculated traffic generation of the township can be undertaken by considering the traffic generation of the existing township. The projected traffic generation equates to an overall traffic generation of approximately 3.3vpd per private dwelling. The existing traffic generation of Kingston at 500vpd for 208 dwellings is an overall township traffic generation rate of approximately 2.4vpd/private dwelling. Based on this comparison, the order of magnitude of the townships external traffic generation calculated for the future is considered to be consistent after allowance for the increased employment activity and proportion of occupied dwellings following implementation of the Plan Change.

10.4 Internal Traffic Generation

Following development of the Plan Change, Kingston will have approximately 1,130 households, and with the associated school, employment area, and other commercial, recreational and community facilities there will be demand for trip making within Kingston itself. The compact nature of the township indicates that alternative transport modes such as walking and cycling will be viable modes of transport for the expanded settlement, thereby reducing vehicle based trip rates. Having considered the internal trip making potential of the village, it is expected that approximately 1,000vpd of the internal traffic generation will cross the railway line between the existing township and the proposed Plan Change site. This will particularly include trips associated with travelling to the school and employment area, and other trips associated with social and recreational trip purposes.

11 TRANSPORTATION EFFECTS

11.1.1 *Expected Future Patterns*

It is likely that as Kingston expands the pattern of external traffic generation over the course of the day and the directional distribution will change. Whilst the traffic volume on Kent Street does not currently have clear AM and PM peaks typically associated with commuter traffic it may do so in the future as the population and range of land use activities in the area expand.

Kingston is a 45km drive from Queenstown and whilst it may develop some commuter patterns it is not expected to exhibit the pronounced AM and PM peak patterns that are commonly observed in urban areas and fringes. Under the ultimate development scenario the pattern of external traffic generation is expected to be a mixture of commuting and those patterns more typical of a recreational/tourist route.

For the purpose of a robust and worst case assessment of the impacts of the potential Plan Change in combination with the ultimate development scenario for the settlement all the peak hours of the various activities considered have been assessed as occurring during the same hour. This is considered unlikely in practice, however, it gives an absolute worst case analysis.

To assess the worst case impacts on the section of SH6 north of Kingston, a distribution of 80%/20% North/South has been assessed, with 55% of traffic entering the settlement during the peak hour of SH6. This assesses a significant change in pattern as the current directional split is 55%/45% North/South.

Approximately 90% of vehicles exiting from the Plan Change site are expected to utilise the new SH6 access, reducing the potential effects of change in amenity to the existing township.

11.1.2 *SH6 LOS Assessment*

Specific analysis has been undertaken regarding the traffic generation of the potential Plan Change on SH6, in particular the section between Kingston and Queenstown which is expected to accommodate the majority of the external traffic generation described in the above section.

Figure 18 below presents the estimated future seasonal peak hour traffic volumes on SH6 north of Kingston shown as a cumulative total. The projection includes the following elements:

- The existing contribution of Kingston
- The existing 'other' traffic volume, not associated with Kingston
- 15 years (2006 to 2021) of linear growth in this 'other' traffic volume at 5% per annum
- The expected future traffic generation of developments in Kingston other than that associated with the Plan Change
- The expected future traffic generation of the Plan Change

The LOS thresholds presented in Table 5 are also shown on the graph.

Forecast Future Peak Hour Traffic Volumes and Level of Service, SH6 North of Kingston
Average Peak Hour Volume by Week of Year

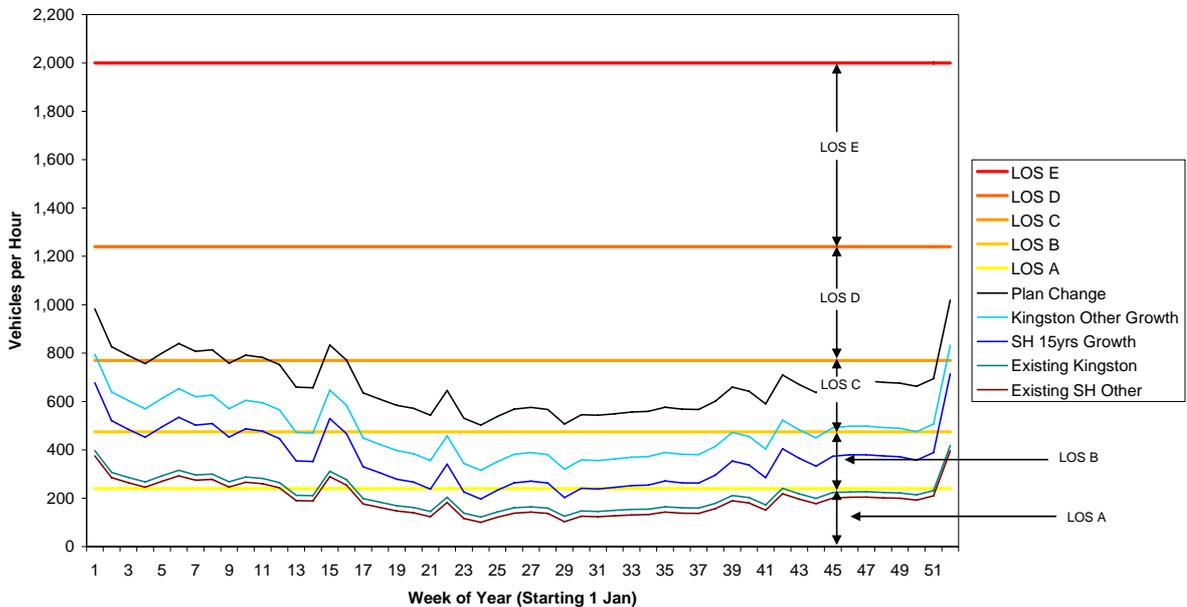


Figure 18 – Forecast Future State Highway Level of Service

As indicated by the figure above, the peak hour volume on SH6 at the year 2021 (15 years growth) is predicted to increase an average of some 550vph (two-way) by making allowance for traffic growth on SH6, full development of the Plan Change activities and higher density development of the existing township. Over the course of the year the level of service varies from LOS C to D.

The Otago Regional Land Transport Strategy sets out that on the strategic urban network outside urban areas LOS D or better is acceptable during peak times. Figure 18 illustrates that this is achieved even with an assessment based on a combination of worst-case inputs.

Once again this analysis considers the peak hour of any given day and the level of service afforded to road users during other parts of the day would be the same or better, being LOS C most of the time.

Overall the conclusion of the analysis of external traffic volumes generated by the potential Plan Change can be accommodated by the existing form of SH6 in the vicinity of Kingston whilst retaining the envisaged level of service for this type of strategic road.

11.2 Access to State Highway 6

11.2.1 Intersection Capacity

Intersection analysis software Sidra Intersection 3.2 has been used to assess the performance of the upgraded intersection of Kent Street and SH6 as well as the proposed new intersection with SH6 with the traffic flows that could be generated following full development of the Plan Change site, predicted to be year 2021 at the earliest.

The distribution of traffic within the settlement road network has been assessed by considering the shortest distance route between elements of the settlement and the access points to SH6. Externally,

the distribution of traffic has been assessed by adopting the wider area distribution outlined within Section 11.1.1. The results are shown in the following tables.

APPROACH	MOVEMENT	VOLUME (VPH)	AVERAGE STOP-LINE DELAY (SEC/VEH)	95-PERCENTILE QUEUE LENGTH (VEH)	LOS
SH6 (North)	Through	307	0.0	0.0	A
	Right	104	1.1	0.5	B
Kent Street	Left	85	1.4	0.5	B
	Right	10	7.0	0.1	C
SH6 (South)	Left	13	0.3	0.0	B
	Through	261	0.0	0.0	A
Intersection		780	0.4	-	-

Table 9: Kent Street - SH6 Sidra Intersection Analysis Results 2021

APPROACH	MOVEMENT	VOLUME (VPH)	AVERAGE STOP-LINE DELAY (SEC/VEH)	95-PERCENTILE QUEUE LENGTH (VEH)	LOS
SH6 (North)	Through	247	0.0	0.0	A
	Right	70	0.8	0.3	B
New Access Road	Left	57	1.1	0.3	B
	Right	25	5.3	0.3	C
SH6 (South)	Left	31	0.2	0.1	B
	Through	217	0.0	0.0	A
Intersection		647	0.4	-	-

Table 10: New Access Road - SH6 Sidra Intersection Analysis Results 2021

The results of the analysis indicate that the operation of the intersections will be very good during peak traffic flows following full development of the Plan Change site and a high level of service will be maintained for all road users.

The low traffic volumes in comparison to capacity are evident in delay and queue performance measures. The highest movement average delay is expected for right turning vehicles exiting Kent Street onto SH6 with an average delay of 7.0 seconds. The maximum 95% queue length (that which is exceeded on only 5% of occasions) is expected to reach a maximum of 0.5 vehicle lengths for left turns from the new access road. Such delays and queues are very minor, and indicate a high level of efficiency will be maintained at the intersection.

From this analysis it is recognised that the left turn lane likely to be constructed on the southern SH6 approach to the Kent Street intersection with SH6 is justified for driver amenity and potentially safety reasons rather than being a capacity requirement.

A sensitivity test was also undertaken with traffic volumes on SH6 increased to 200% of their predicted 2021 levels at the intersection of Kent Street and SH6. Even at this unlikely high level of demand the

maximum delay for any movement was 25 seconds, for the right turn out of Kent Street and the maximum 95% queue length was less than 1 vehicle length.

The analysis confirms that both the Kent Street and SH6 intersection, and the secondary access intersection with SH6 will operate with an excellent level of service.

11.3 Internal Road Layout

Table 3.1 of the QLDC Development and Subdivision Engineering Standards Amendments and Modifications to NZS4404:2004 indicates the current road reserve standards based on road classification which also take account of traffic volume. The minimum road reserve standards that are relevant to the types of road proposed for the Plan Change as compared to the proposed roading standards to be included in the subdivision guidelines for Kingston Village are shown in the following table.

ROAD HIERARCHY		MINIMUM ROAD RESERVE WIDTH (m)		CARRIAGEWAY WIDTH (m)	
QLDC	KINGSTON VILLAGE	QLDC	KINGSTON VILLAGE	QLDC	KINGSTON VILLAGE
Local – Residential through road	Local, Residential Secondary	18.0	16.0	6.0m (including parking)	5.7m (including parking)
Local – Residential through road	Local, Residential Primary	18.0	20.0	2 x 3.0m lanes, plus additional width for parking bays	7.0m (including parking)
Collector - Residential road	Collector, Residential	20.0	22.0	2 x 3.5m lanes, plus 2 x 2.5m parking	3.5m lanes, plus additional width for parking in landscaping
Local - Business	Local, Business	20.0	Varies (greater than 20m)	2 x 3.5m lanes, plus 2 x 2.5m parking	3.5m lanes, plus additional width for parking in landscaping

Table 11: QLDC Road Standards Compared to Proposed Cross-Section Designs

As indicated above, the proposed Kingston Village cross-sections have some differences when compared with the district standards. The reasoning for the proposed cross sections for Kingston Village was outlined earlier in Section 8.4 of this report.

The differences in the local road cross sections represent the high overall provision of road reserve within the Kingston Village which provides a highly permeable network enabling it to operate with low traffic volumes. The parking demands on the local residential primary on-street are expected to be relatively low, and therefore the narrower carriageway width will encourage lower speeds, which is considered appropriate for the intended function of this type of road.

The Collector Road and Industrial Local Road will have indented parking within the landscaping, rather than forming part of the fully formed carriageway. Again, this will assist in the control of speeds along the route, as well as better achieving the urban design amenity objectives.

Overall, it is considered that the proposed Kingston Village cross-sections will contribute to the provision of an efficient transport network that is consistent with the urban design outcomes sought for the zone.

11.4 Effects on Existing Infrastructure

The volume of Kent Street at its eastern end is likely to increase from its present 600vpd to a daily volume of some 2,000vpd under the ultimate development scenario (that includes both the full development of the Plan Change site and the existing township zone). Although classified as a collector road, the width of the road is only some 6.0m to 7.0m, which is generally consistent with QLDC Local Road standards. Given the increases in traffic it is expected that Kent Street will need to be upgraded to the standard of a residential collector road, which involves the addition of formed parking adjacent to the carriageway.

The traffic volumes across the railway between the existing township and the Plan Change site are expected to be up to approximately 1,500vpd (of which approximately 1,000vpd are local movements internal to the settlement), which will be split across up to three rail crossing points. With the grid layout and associated road hierarchy proposed, it is expected that volumes will be distributed over the available crossings such that the existing section of Huntingdon Street is expected to carry approximately 500vpd. At this volume, the existing 7m carriageway width will continue to operate efficiently, and no upgrades are considered necessary.

Cambridge Street and the other eastern connection between Kent Street and the railway are currently unformed and will need to be formed to provide connection to the Plan Change site. The traffic volumes are also expected to be in the order of 500vpd. The carriageway formation of these new link roads is expected to be consistent with the formation of the Cambridge Street extension within the Plan Change site, being 7m width.

11.5 Network Design

The creation of a residential grid network based on new urbanist principals and providing linkage to the existing established area of Kingston will offer a high level of connectivity. Well connected road networks improve traffic safety and reduce travel. They have also been shown to promote good urban health and reduce crime.

The proposed secondary access to Kingston will provide greater network reliability and shorter travel times and distances for drivers, and avoid the need for commercial traffic associated with the employment area to utilise local residential streets for access. The secondary access will also enable traffic volumes to be spread across the local network thereby retaining a high level of amenity within the settlement. A further important advantage of the secondary access is that it provides network reliability during emergency situations. An accident occurring at the Kent Street/SH6 intersection could force the closure of Kent Street and restrict access to the settlement and without the secondary access there is no option for alternative access.

The retention of Kent Street as the primary visitor access to Kingston can be provided for by maintaining the existing guide signage at the SH6 intersection that highlights the tourist attractions and services available. From the south, additional guide signage could be installed in advance of the Greenway intersection that identifies Kent Street as the primary visitor access to the settlement.

11.6 Heavy Traffic Generation

As discussed earlier, the employment area (Activity Area 2) may contain landuse activities that generate heavy vehicles. The predicted level of heavy traffic is some 10% of the total traffic generation of activity area 2 if it is predominantly developed as industrial landuse, resulting in approximately 80 heavy vehicle movements per day. This would reduce if the landuse is more commercial in nature. The network form is such that any heavy vehicles will choose to adopt the Greenway for access to SH6 due to its wider carriageway formation and the through priority afforded to it over side road intersections.

The contribution of heavy traffic to the total volume on the Greenway will typically be less than 10%, with it being as low as 5% at its eastern end. Both the absolute number of heavy vehicles and the proportional composition of heavy traffic on the Greenway will be within normal expectations for a road of this type, and the layout of the road will not provide any particular transportation related constraints.

Assessment matters are proposed as part of the Plan Change to require assessment of industrial and service activities with respect to the effects on amenity of the landuses adjoining the Greenway. Providing that activities are proposed that generate typical levels of heavy traffic, it is not envisaged that these amenity effects will be any more than minor. If an activity that generates a higher level of heavy traffic than expected seeks resource consent, then it will be possible to consider additional controls to protect the amenity of adjacent landuses, such as controlling the hours of operation or placing a limit on daily heavy vehicle traffic generation.

12 RAILWAY LEVEL CROSSINGS

12.1 Requirements for Rail Crossing Facilities

As described previously, the Plan Change site is bounded on three sides by the Kingston Flyer railway line, with existing crossing points located as previously described in Section 2.7 of this report. Whilst the railway is in private ownership, it is subject to the requirements of the Railways Act 2005 and the railway operator operates with a safety management plan. For the purpose of this Plan Change, this is important because it is necessary to assess the ability of the railway operator to provide safe locations for crossing the railway for access to the Plan Change site with the increased level of traffic activity generated, and to incorporate this into their safety management plan.

The total traffic generation to/from the Plan Change site across the railway line is likely to be in the order of 3,200vpd at full development. Allowing for external traffic distributions and the location of activity centres in the settlement, it has been assessed that of the total volume crossing the railway, some 1,700vpd will utilise the crossing point on the new access road to SH6, with the remainder (being 1,500vpd) being spread over the Cambridge Street, Huntingdon Street and potential link south of Oxford Street. During the peak hour a volume of 195vph has been assessed to occur via the southern SH6 crossing point, which will be the crossing carrying the highest volume.

Level crossings on publicly owned railway tracks are subject to the requirements of OnTrack, who have standards for the need and design of new level crossings, and assessment criteria for upgrading existing crossings. These take account of the following key matters:

- Proximity to other level crossings along the railway line;

- The availability of alternative routes;
- Available sight distance for drivers approaching the level crossing;
- Design matters such as the separation from other road intersections and approach grades;
- Warrants for the provision of active traffic control such as flashing lights and warning bells.

No standard guidelines for the design or location of railway crossings are included in the District Plan, and it is considered most appropriate to have regard to the OnTrack requirements on the above matters which are included in the document by Tranz Rail (whose functions have since been incorporated into OnTrack), Infrastructure Code Supplement (G417) – Level Crossings. However, the low frequency of the scheduled train movements (four per day for seven months of the year) and low speed (estimated at 25-30km/h) of the train movements on this railway line need to be taken into account when assessing against the OnTrack requirements.

12.1.1 Need for Railway Level Crossings

The criteria when considering the need for a new public level crossing are:

- The nearest public/private level crossing shall be 1km in urban areas, and 2km in rural areas;
- Where reasonable alternative access exists, estimated annual vehicle kilometers (veh-km) saved shall exceed 50,000 for a public level crossing.

The separation between proposed level crossing locations (both formed and unformed) is (from southeast to northwest):

- New access road to SH6 (existing private crossing) to access through vacant land south of Oxford Street (new crossing) = 650m
- Access through vacant land south of Oxford Street to Cambridge Street crossing (new crossing) = 170m
- Cambridge Street to Huntingdon Street (existing crossing) = 160m
- Huntingdon Street to Gloucester Street (existing Crossing = 350m
- Gloucester Street to Kent Street (existing crossing) = 160m

The proposed railway crossing locations are considerably closer to each other than recommended by the OnTrack standards. A critical element of the crossing separation relates to the ability of a train to stop between crossings, which on a main trunk line that carries very long trains lead to the 1km requirement. Typically pulling in the order of four carriages, the Kingston Flyer is considerably shorter at just over 80m long, and will therefore have plenty of scope to stop at an intermediate location on the tracks without crossing any of the new roads. The overall desire to minimise crossing locations is also associated with minimising the potential need for providing numerous sets of active warning devices at the level crossings. In this case, if the desirable view distance provisions are met, then the need for active warning devices will be limited.

It is expected that the target travel distance saving of 50,000veh-km/year will be readily met with the provision of a new crossing point between Huntingdon Street and the proposed crossing adjacent to SH6 crossing. The addition of a second intermediate crossing is more marginal based on the veh-km savings. However, it will provide an important function in providing a highly permeable network and the inclusion in the Masterplan retains flexibility for the future.

As a result of the lack of development to the south of the railway line and low train volumes the lack of separation has not resulted in a safety issue in the past. Consequently, the provision for up to three new crossing points is considered appropriate and can be considered further during subdivision together with the detailed crossing design and revisions to the railway operator's safety plan.

12.1.2 View Distances

Minimum view distances are specified within the Tranz Rail code of practice. The "view distance" is the visibility distance available from the road along the railway track clear of obstructions. The view distance is measured at a number of points back from the railway centerline, with each point back contributing to different requirements for control.

The minimum view distance for a track with a 40km/h authorized train speed is 89m, measured 5m back from the track centerline. Whilst the authorized train speed on this track is unknown, based on estimated speeds of the Kingston Flyer, 40km/h has been adopted for assessment purposes.

The minimum approach view if automatic warning devices or stop signs are not provided is 65m along the track from a point 30m back from the track centre line. This is the desirable provision as a give way type crossing is permitted and with good visibility it is generally considered to be safer than a stop controlled crossing with lesser visibility provisions.

A summary of the ability to meet minimum view distances at the various existing and potential rail crossing locations is provided in Table 12.

LOCATION	MINIMUM VIEW DISTANCE 5m back (89m required)	POTENTIAL IMPROVEMENTS
SH6 Access, 400m south of Kent Street	Does not comply	Potential vegetation clearance and increase cutting within the Railway reserve
New Access 120m south of Oxford Street	Can comply	Potential vegetation clearance within the railway reserve
Cambridge Street	Complies	NA
Huntingdon Street	Complies	NA

Table 12: Rail Crossing Distances

In summary, two of the four crossing points currently meet the OnTrack view distance requirements. Some vegetation control within the railway reserve land will be required to meet the view distance requirements for the new access to the Plan Change site from SH6 with the potential for some earthworks to also be required, while some vegetation control could be required within the railway reserve for the new access south of Oxford Street to meet the view distance requirement. At the time of subdivision it would be desirable to restrict the construction of buildings or other constraints to sight distance within the approach view triangle to provide greater flexibility in the control of the crossings.

12.1.3 Crossing Design

The criteria identify that the crossing road is generally square to the track, with at least 30m separation between the railway tracks and adjacent intersections and 30m of straight road on either side. Where the approach angle is not square, the angle must not be less than 60°. The level crossings proposed with intended road layout for the Plan Change can satisfy these various requirements.

A separation distance of 45m is available between SH6 and the proposed Greenway level crossing, and separation to intersections at other crossings will exceed 30m. A high radius curve is provided on the approach to the level crossing adjacent to SH6 to enable the crossing point of the railway and the approach to the road intersection to be square.

To provide a continuous straight road reserve corridor from the lake to the southern extent of the Plan Change site, the angle between the railway track and new crossing between the site and Cambridge Street will be at an angle of 70° rather than being square to the track. Road intersection design adopts 70° as an acceptable minimum angle to ensure that drivers have a clear view of approaching vehicles, and on this basis it is considered that the effects of the off-set will be minor.

12.1.4 Warning Device Warrants

Warning devices are required on the basis of a warrant formulae taking account of traffic volumes, train volumes, and available view distance. During subdivision of the Plan Change site, an analysis of the need for active controls will need to be undertaken based on the latest scheduling of train movements and proposed provision of view distances at the crossings. Based on the current train schedules, a preliminary analysis of the warrants for the provision of warning devices is provided below.

VIEW DISTANCE PROVISIONS	VIEW DISTANCE CALC (BASED ON 40KM/H TRAIN SPEED)	VOLUME THRESHOLDS FOR WARNING DEVICES (VPD)	
		FLASHING LIGHTS AND BELLS	HALF BARRIER ARMS
Full approach visibility on each quadrant	55m back from centreline 65m visibility along track	1,250vpd	6,250vpd
Partial Approach Visibility	30m back from centreline 65m visibility along track	420vpd	2,100vpd
Stop Line Visibility Only	5m back from centreline 89m visibility along track	250vpd	1,250vpd

Table 13: Warning Device Volume Thresholds

As can be seen, if the full approach view distances are provided, there will be a higher traffic volume threshold at which the warning devices are required, which will reduce the engineering systems upgrades required to the track to accommodate the warning devices.

Under the case that full visibility provisions can be achieved through design at the time of subdivision, then volumes of over 1,250vpd would be required to warrant flashing lights and bells. The analysis indicates that this volume would be realised by the SH6 access point toward full development of the site, with 1,750vpd forecast at full development. The 1,250vpd threshold would not be exceeded for over 10 years based on consistent development on the Plan Change site following approval. With the provision of full visibility, there would be no need for half barrier arms. If full visibility can be provided at the other

crossing points, then the expected volumes of approximately 500vpd would not warrant flashing lights and bells, and a standard Give Way treatment could be provided.

If a lower level of approach visibility was provided at the crossings, then the traffic volume thresholds will substantially reduce, such that each of the crossings would require flashing lights and bells, and barrier arms would need to be considered at the southern crossing point adjacent to SH6.

Given the additional cost associated with installation and operation of active warning devices, overall ease of management of having a give way sign controlled crossing, and potential noise related effects of bells, it is expected that efforts will be made at the time of subdivision to maximise visibility of approaches. However, it is noted that the needs of the railway crossings can also be altered by amending the railway operator's safety plan to restrict the train speed over the crossings to a speed appropriate to the available view distance. This alternative approach reflects the comparatively low use of the railway.

12.1.5 Queuing Space

The Kingston Flyer currently has a schedule that results in it using the railway four times daily from October to April. Its timetable does not coincide with the expected time of peak directional traffic generation of Kingston Village, which would be related to potential commuter traffic earlier and later than the Kingston Flyer. Analysis has been undertaken to consider how the available queue storage compares with the expected traffic volumes across the Greenway railway line level crossing to ensure that queues will not form to an extent where there are effects on the State Highway.

The Greenway access road to SH6 will provide 45m of storage space between the rail line and SH6, which has been assessed as being equivalent to 6 vehicles. The time that barriers are down (or lights are operating) is approximately 35 seconds including advanced warning and train clearance times. The volume capacity on the level crossing is then calculated by considering at what volume the queue exceeds the storage.

Utilising Sidra Intersection 3.2 software, the 95th percentile back of queue exceeds 6 vehicles when the hourly flow rate is greater than 220vph. That is, in five times out of 100 that a train crosses the access road the queue could exceed the available storage capacity between the railway line and the highway at that volume.

The peak hour traffic generation analysis indicates that the peak traffic generation across the southern level crossing in the peak direction could be approximately 130vph. Therefore, even if the Kingston Flyer schedule changed so that it operated at the time of peak traffic generation, the available storage is expected to accommodate almost all of the queuing events. In practice, the peak movements do not coincide with the Kingston Flyer operating times, and therefore the likelihood of the railway resulting in queuing on the highway is very low.

If queuing does occasionally extend back onto the highway, it will be momentary and the proposed provision of left and right turn lanes on SH6 allow storage clear of the through lanes.

On the basis of this analysis, it is considered that there will be no adverse effects on the operation of the highway with the proposed 45m separation between the carriageway and railway centreline.

13 DISTRICT PLAN PROVISIONS

13.1 Policies and Objectives

The District Plan includes several relevant policies and objectives relating to transportation that need to be considered during the consideration of the Plan Change. The Transport Objectives and Policies are provided within Section 14.1.3 of the District Plan. The relevant objectives relate to efficiency, safety and accessibility, the environmental effects of transportation, pedestrian and cycle transport, and to public and visitor transport. The following is a summary:

Efficiency:

- To encourage efficiency in the use of motor vehicles.
- To promote the efficient use of all roads by adopting and applying a road hierarchy with associated access standards based on intended function.
- To promote the efficient use of roads by ensuring that the nature of activities alongside roads are compatible with road capacity and function.
- To protect the safety and efficiency of traffic on State Highways and arterial roads, particularly State Highway 6A, by restricting opportunities for additional access points off these roads and by ensuring access to high traffic generating activities is adequately designed and located.
- To promote the efficient use of fuel for transport purposes, by providing or a District wide policy of consolidated urban areas, settlements, retail centres and residential environments.
- To promote and provide for the consolidation of new areas of residential development and for higher density development within identified areas.
- To consider options for encouraging and developing greater use of public transportation facilities and in particular to continue to investigate the options for alternative transport means.
- To require access to property to be of a size, location and type to ensure safety and efficiency of road functioning.

The proposed Plan Change will support the efficiency objectives outlined above in a number of ways. The proposed boundary of the Plan Change site will ensure that the Settlement is contained within a well defined boundary, in accordance with the Growth Management Strategy for Queenstown. This encourages efficient use of motor vehicles by providing opportunities for alternative modes of transport such as walking and cycling internally to the town. Such alternative modes of transport are also encouraged by the proposed grid network of roads that creates high permeability for pedestrians.

A single new high standard access is proposed providing direct access from the Plan Change site to SH6 that will have ample capacity to accommodate the traffic volumes anticipated at full development. SH6 itself will continue to operate at acceptable levels of service.

Safety and Accessibility

- To maintain and improve safety and accessibility by adopting and applying a road hierarchy with associated design, parking and access standards based on the intended function.
- To ensure the intensity and nature of activities along particular roads is compatible with road capacity and function, to ensure both vehicle and pedestrian safety.
- To encourage the development of pedestrian and cycle accessways, within the main settlements.
- To maintain and upgrade, where appropriate, the existing roads and provide for new roads and related facilities where these are important for providing access
- To ensure intersections and accessways are designed and located so:
 - good visibility is provided.

- they can accommodate vehicle manoeuvres.
- they prevent reverse manoeuvring onto arterial roads; and
- are separated so as not to adversely affect the free flow of traffic on arterial roads.

It is proposed to design roads for the Plan Change to relevant standards. Access to SH6 will be provided to NZTA specifications and provide adequate sight distance. The pattern of accidents in the vicinity of the site has shown that there are no particular issues with the existing road network that would be affected by the proposal.

Environmental Effects of Transportation

- To protect the amenities of specified areas, particularly residential and pedestrian orientated town centres from the adverse effects of transportation activities.
- To discourage traffic in areas where it would have adverse environmental effects.
- To support the development of pedestrian and similar links within and between settlements and the surrounding rural areas, in order to improve the amenity of the settlements and their rural environs.
- To ensure new roads and vehicle accessways are designed to visually complement the surrounding area and to mitigate visual impact on the landscape.
- To maintain and enhance the visual appearance and safety of arterial roads which are gateways to the main urban centres.
- To implement appropriate procedures, in conjunction with the takata whenua and Historic Places Trust, should any waahi tapu or waahi taonga be unearthed during roading construction. (see Section Objective 1 Policy 1 for consultation procedures with takata whenua).

The Plan Change is consistent with the Growth Management Strategy for Queenstown, which sets out that such settlements should accommodate around 800-1,000 dwellings to reach an ideal critical mass where affordable servicing, a range of local services and employment can be supported. The Plan Change will enable some 1,130 households to be developed within the settlement, and set aside an area for employment to ensure that the Township can grow in a self sufficient fashion, minimising the level of traffic generated externally.

Town Centre Accessibility and Car Parking

- To achieve a general reduction in the dominance of vehicles and heavy commercial vehicles within each town centre through the on-going establishment of off-street car parks.
- To manage vehicle movement within the town centres to provide for appropriate levels of accessibility, minimise congestion and promote personal safety.
- To provide an integrated and well located off-street car parking resource around the periphery of the town centres.
- To provide off-street parking within particular areas of the town centres in order to limit and reduce traffic flowing into and through those areas and thereby retain the character of the centres.

The provision of an employment area within the Settlement will increase the self-sufficiency, minimising the need for work related travel for residents. Internally, the need for travel will be minimised by the settlement's compact size and provisions for alternative modes of travel.

Pedestrian and Cycle Transport

- To develop and support the development of pedestrian and cycling links in both urban and rural areas.
- To require the inclusion of safe pedestrian and cycle links where appropriate in new subdivisions and developments.
- To provide convenient and safe cycle parking in public areas.

The compact nature of the settlement creates an ideal environment for internal cycling and walking trips. The extent of the township including the Plan Change site is approximately 1.5km distance from corner to corner, and the southern extent of the Plan Change site is only 1.1km from the lake. At a typical walk speed, this enables all parts of the township to be accessible within a 20 minute walk. As the topography is flat to gently sloping, walking and cycling will be viable options for practically all internal movements providing that the transport networks are designed in such a way to enable and encourage these modes.

The structure plan for the Plan Change includes a network of streets generally based on a grid layout that will be highly permeable for pedestrians and cyclists. Footpaths are proposed on all streets and these are supported by green corridors that include provisions for pedestrian paths. There will be low traffic volumes on all of the streets so that walking and cycling amenity is not compromised, and design elements such as defined crossing points of the main spine road can be included to further assist the encouragement of walking as a viable mode of travel.

The school is located centrally within the site so that walking distance is minimised, and whilst the employment area is located at the south western end of the township, it is still within viable commuter cycling and walking distance for the whole township.

Public and Visitor Transport

- To plan and encourage an efficient pattern of public transport.
- To investigate opportunities for public transport as an alternative to, or in association with, changes or extensions to the major road network.
- To support the development and operation of various types of tourist transport.
- To liaise with the Otago Regional Council and public transport operators to ensure the public transport needs of the District are met.

The provision of public transport is outside of the scope of the Plan Change, and the Wakatipu Transport Strategy did not identify any future services to the south of the Queenstown area. However, with a potential future size of approximately 1,130 households the demand generated by commuting workers and high school students may be sufficient in itself to warrant the provision of a bus service during peak periods. Outside of peak periods general tourist activity and the demands for shopping and personal trips into Queenstown may warrant a regular service between the peak periods.

Typical accessibility standards are for a bus service to be within 500m of 90% of the population. Kingston could be served at this standard if a bus service followed the length of Kent Street to the Kingston Flyer station, before travelling up Somerset Street past the golf course club house and employment area before travelling down the main spine road to the new SH6 access and back to Queenstown. Cambridge Street between Kent Street and the main spine road is a possible alternative to the use of Somerset Street although it would necessitate doubling back by the bus service.

Kent Street and the main east-west spine roads will be well placed to accommodate the design requirements of buses. Similarly, access to SH6 will be of a high geometric standard readily able to accommodate heavy vehicles. Somerset Street and its extension would require improvement to accommodate a bus service, and the intersections with the spine road and Kent Street would need to provide for the turning requirements of a bus. Such provisions can be readily made at the time of detailed subdivision design.

13.2 District Plan Rules

While the MasterPlan layout enables a realistic estimate of traffic generation and distribution and has sufficient detail to allow a compliance check of the layout against the rules of the District Plan and the QLDC subdivision standards (adopted from NZS4404:2004), it is not appropriate or necessary to consider such aspects in detail as part of the Plan Change as these are addressed as part of subdivision applications. However, there are a number of specific aspects of the District Plan Rules that can be considered as part of the Plan Change in terms of identifying matters that will be raised during subdivision.

Any subdivision following the adoption of the Plan Change will have an activity status of a Controlled Subdivision Activity under Rule 15.8.2.1, for which the Council reserves control over the following main transportation matters:

- The location, alignment, gradients and pattern of roading, service lanes, pedestrian accessways and cycle ways, their safety and efficiency.
- The standards of construction and formation of roads, private access, service lanes, pedestrian access, accessways and cycleways.
- Any requirements for widening, formation or upgrading of existing roads.

Table 11 (Section 11.3) compares the proposed road cross sections to those of the QLDC subdivision standards. The comparison between the road standards indicates that the 16m road reserve width proposed for Local Roads would not meet the required 18m minimum requirement of the QLDC standards which is considered excessive for the narrow carriageway roads proposed. While it is considered that the road cross section proposed for the roads within the 16m road reserve adequately provides for road users, services and landscaping, specific approval would be required from the QLDC at the time of subdivision and the proposed Kingston Village subdivision guidelines are intended to guide this process.

Clause 3.3.7 Intersection Design of NZS4404 states that the distance between intersections on a local distributor road or higher classification road shall be 150m or greater and a separation distance of at least 40m shall be provided between intersections on local roads. There are several instances where the separation distances would not be met with the road layout indicated by the Master Plan, although in general the Master Plan network is consistent with the intersection separation specifications. At the low traffic volumes expected on the network, the expected non-compliances will have a negligible effect.

14 CONCLUSIONS

This report has considered the transportation issues for a Plan Change to rezone an area of approximately 88ha immediately south of the existing Kingston township. Based on the master plan it is estimated that the Plan Change site could provide for an additional 750 households. The analysis contained in this report has been based on an ultimate development scenario that includes these 750 households, 2.2ha of employment, 379 residential lots elsewhere in Kingston, the fully developed Kingston Acquisitions Limited proposal and 100 other commercially available beds.

Detailed analysis has been undertaken of the expected traffic volumes generated by Kingston on SH6 between Kingston and Queenstown. Analysis of the levels of service in the year 2021 show that SH6 still provides a level of service that is within the appropriate range as recommended by the Otago Regional Land Transport Strategy.

It has been found that the intersection of Kent Street and SH6 has sufficient capacity to provide for the potential traffic resulting from the Plan Change in combination with the further zoned development potential of the Kingston township with no more than minor effects on safety and efficiency. However, it is desirable to provide some formalisation of access to activities (petrol station and tea rooms) at the intersection to retain its safe and efficient operation.

An additional access to the Plan Change site from SH6 420m south of Kent Street is proposed. The access will have benefits in regard to minimising additional traffic movement through the existing Kingston township. This will maintain high levels of amenity within the existing township. The second SH6 access will also provide travel time savings and an alternative for access in emergency situations.

A standard grid based road hierarchy is proposed for the Plan Change that will distribute traffic through a highly permeable transport network, and provide an appropriate level of roading infrastructure relative to the function of each street.

It is likely that the Plan Change will increase traffic volumes on roads crossing the rail line to a level where some form of warning device may be warranted at the SH6 access crossing. Requirements for active warning devices can be minimised by providing clear view lines on the approaches to the level crossings at the time of subdivision. Any changes will result in a consequential alteration to the railway operator's safety plan, which can also be addressed in detail at the time of subdivision in consultation with the railway operator.

In conclusion, it is considered that the wider area transportation related effects of the proposed Plan Change are minor, and the site specific subdivision guidelines proposed for the Plan Change will ensure that detailed transportation design matters are addressed during subdivision design. Therefore the Plan Change can be supported from a transportation perspective.

Traffic Design Group Ltd
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