14 December 2018

Laurel Hills Limited

C/- The Property Group
PO Box 104
Shortland Street
Auckland, 1140

Attention: Natasha Rivai

Dear Natasha,

Laurel Hills Special Housing Area
6 & 8 Layton Lane, Lower Shotover, Queenstown
Transport Assessment

The purpose of this letter is to provide a high level transport assessment for the proposed Laurel Hills, a Special Housing Area (SHA) subdivision at Lower Shotover.

It is noted that this assessment adopts the WSP Opus Integrated Transport Assessments provided as part of the Detailed Business Case to the Housing Infrastructure Fund which outlines transport initiatives to support the provision of 1,100 residential dwellings in the Ladies Mile area. This assessment therefore focuses on the local roading network and the ability to access this proposed residential development from Stalker Road.

1 Background

Laurel Hills is to be located at Lot 1 DP431492 and Lot 2 DP325561 being 6 & 8 Layton Lane. The site is to the south of Frankton-Ladies Mile Highway (SH6) and is currently accessed via Maxs Way / Layton Lane. Maxs Way is a private Right of Way (ROW) access over land owned by others which provides access to a total of 6 rural residential lots (including 6 & 8 Layton Lane). These existing rural residential lots including the site are within the Rural General Zone.

Laurel Hills is within the Indicative Master Plan area for the anticipated Ladies Mile residential development which has been added into the Council's Lead Policy for assessing Special Housing Area requests. Initially it is proposed to develop 1,100 residential dwellings in the Ladies Mile area which includes 225 dwellings in the vicinity of Stalker Road. WSP Opus have undertaken an Integrated Transport Assessment[1] (ITA), to identify and assess possible capacity improvements within the greater transport networks to accommodate the initial 1,100 dwellings. QLDC, ORC and NZTA have since agreed a programme (Programme 3) of improvements to the state highway network along with public transport initiatives. These improvements have approved funding through the Housing Infrastructure Fund. This programme of improvements is outlined within the ITA (refer Appendix A) and are expected to achieve transport improvements beyond the site that will support this proposed development.

[1] Refer WSP Opus Ladies Mile HIF, Integrated Transport Assessment (June 2018) and the subsequent Memorandum – Ladies Mile HIF Integrated Transport Assessment Amendment A, Detailed Analysis of Programme 3 (9 July 2018). These are provided in Appendix A.

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2 Existing Transport Network

The site has a road frontage onto Stalker Road. Stalker Road is a local road within the QLDC road hierarchy[2]. Stalker Road is the primary access to Shotover Country and performs the function of a collector road within the District's road network with the mixed function of providing access to properties within Shotover Country as well as providing a transport link between Shotover Country and Frankton-Ladies Mile Highway (SH6). The Proposed QLDC District Plan[3] proposes to reclassify Stalker Road (SH6 to Jones Road) as an arterial road.

Shotover Country is a suburb which when fully developed could contain approximately 970[4] residential lots. This suburb is also accessed from Jones Road which provides access via Howards Drive and links to Lake Hayes Estate. It is possible that at the site, Stalker Road would provide access to 1,000 dwelling equivalents suggesting that the future anticipated traffic flow on Stalker Road would be approximately 6,500 vehicle per day (vpd) or during the peak period approximately 660 vehicles per hour (vph)[5]. An assessment of future Stalker Road traffic flows is provided in Appendix B.

At the site, Stalker Road is formed as an arterial/collector road with an 8.4m carriageway which has been marked as two traffic lanes with a centreline only. The posted speed limit of Stalker Road at the site is 50km/hr and given the proximity to nearby roundabout intersections it is expected that the operating speed would be approximately 50km/hr at the site.

The nearest footpaths to the site, and cycle trails, are within the existing urban area of Shotover Country or at the Stalker Road roundabout. There is no footpath link adjacent to the site or linking the urban area of Shotover Country to the SH6 Roundabout. The nearest public transport route, Lake Hayes Estate to Frankton (and Jacks Point) passes the site with the nearest bus stops approximately 250m to the south of the proposed site access from Stalker Road. This bus service has a frequency of 30 minutes during the am and pm peak periods (06:00 to 09:00 and 15:00 to 18:00) with an hourly service throughout the remainder of the day (09:00 to 15:00 and 18:00 to 22:00).

3 Proposed Development

The proposed develop Laurel Hills a SHA subdivision which is expected to create up to 160 residential lots (dwellings). The proposed subdivision will develop a single access from Stalker Road. The development is likely to generate up to 1,200vpd or during the peak period approximately 130vph[6], a peak period traffic distribution is provided in Appendix B.

The layout of the proposed new access intersection with Stalker Road is provided in Appendix C. The new intersection includes footpath connections and identifies possible locations for new bus stops to serve the proposed subdivision.

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[2] Refer Operative QLDC District Plan, Appendix 6 Road Hierarchy.
[3] Refer Proposed QLDC District Plan notified 23 November 2017, Section 29.14 Schedule 1 – Road Classification.
[4] Based on consented subdivision as well as anticipated masterplans (future subdivision) facilitated by the Shotover Country Special Zone.
[5] Based on traffic flow data from Jacks Point which has an average daily traffic, per dwelling, of 6.5vpd or 0.66vph during the am peak period. Traffic data is collected over 305 days during the 12 months to the 31st July 2018.
[6] Based on traffic flow data from Jacks Point which has an 85th percentile daily traffic, per dwelling, of 7.4vpd or 0.81vph during the am peak period. Traffic data is collected over 305 days during the 12 months to the 31st July 2018.

4 Transport Effects

The proposed development is to be accessed from Stalker Road. This assessment of transport effects considered the ability to create an appropriate vehicle access from Stalker Road as well as connections to alternative transport networks such as public transport or walking/cycling infrastructure.

4.1 Road Networks

4.1.1 Stalker Road Roundabout and Frankton Ladies Mike Highway (SH6)

As noted in Section 1, Laurel Hills is part of the greater Ladies Mile SHA residential developments which includes 1,100 residential dwellings in the Ladies Mile area including 225 in the vicinity of Stalker Road. To support this future development a number of network improvements (road and public transport) have been identified as Programme 3[7] and have approved funding through the Detailed Business Case to the Housing Infrastructure Fund.

The findings of the WSP Opus ITA and the proposed programme of improvements (Programme 3) have been adopted as providing any necessary transport improvements to support this proposed development beyond from the site.

4.1.2 Local Road Network (connection to Stalker Road)

It is proposed to construct a new T-intersection from Stalker Road to serve the 160 residential dwellings. This intersection would be constructed approximately 90m to the north of the existing roundabout intersection of Stalker Road with Banbury Terrace and Oxfordshire Avenue, and approximately 250m south of the Stalker Road roundabout intersection with Frankton-Ladies Mile Highway (SH6).

Visibility sight distance to the north is restricted to approximately 125m as a result of a vertical (summit) curve in alignment of Stalker Road, this is in excess of recommended design minimum. To the south the visibility sight distance is significantly greater than 100m and allows for visibility through the existing roundabout and into the residential area of Shotover Country.

The design of a T-intersection to access the proposed SHA subdivision would be guided by current Austroads design guides, particularly Austroads Guide to Road Design, Part 4A: Unsignalised and Signalised Intersections (2010). This document would require that the proposed intersection meet the minimum Safe Intersection Sight Distance (SISD) requirements, for the anticipated operating speed, approximately 50km/hr, the SISD requirement can be met[8].

Based on the predicted future traffic flows the Austroads guidance[9] suggests that the proposed T-intersection will require:

- An urban basic left (BAL) turn treatment which is a simple left turn intersection treatment, and

[7] Refer WSP Opus Ladies Mile HIF, Integrated Transport Assessment (June 2018) and the subsequent Memorandum – Ladies Mile HIF Integrated Transport Assessment Amendment A, Detailed Analysis of Programme 3 (9 July 2018). These are provided in Appendix A.
[8] Refer Austroads Guide to Road Design, Part 4A: Unsignalised and Signalised Intersections (2010), Section 3.2.2, Tables 3.2: Safe Intersection Sight Distance & 3.3: Grade corrections.
[9] Austroads Guide to Road Design, Part 4A: Unsignalised and Signalised Intersections (2010), Section 4.8 Warrants for BA, AU and CH Turn Treatments.

- An urban channelised right (CHR) turn treatment which would include a right turn bay to be formed. The length of the right turn bay (queue length) can be confirmed through detailed intersection modelling.

The concept intersection design (refer Appendix C) allows for 3.5m through traffic lanes and a 3m flush median which would include the right turn bay. Traffic modelling based on this design has been undertaken using SIDRA traffic modelling software to understand the operational efficiency of the proposed intersection. The outcome of this traffic modelling is provided in Appendix D and is summarised based on the right turn manoeuvres in Table 1 below.

Table 2: Modelling Summary of Laurel Hills access intersection from Stalker Road

Period	Stalker Road			Laurel Hill Approach		
	Right Turn Delay seconds	Right Turn Queue vehicles/m	Right Turn LoS	Right Turn Delay seconds	Right Turn Queue vehicles/m	Right Turn LoS
am	7.0	0.1/0.6	A	12.1	0.1/0.4	B
pm	5.3	0.3/1.9	A	12.1	0.1/0.4	B

Based on this modelling the proposed intersection will operate with minimal delay and at a high level of efficiency. Based on this modelling there will typically be only one vehicle waiting on Stalker Road to turn right into the proposed development. This suggests that the proposed flush and right turn bay will be appropriate and that this intersection will have a minimal traffic effect on the operation of Stalker Road.

It is noted that this modelling is based on free flow traffic conditions on Stalker Road. Queuing is often observed on Stalker Road at the morning peak as a result of congestion on SH6. It is acknowledged that the identified transport improvements on SH6 may not fully remove this queuing. In this case the proposed intersection layout will continue to operate within a congested road environment.

The concept design for the intersection will be located approximately 40m to the north of the existing Maxs Way intersection. When the subdivision is undertaken Maxs Way will only serve four remaining rural residential lots. Maxs Way would be treated as a shared access ROW. It is noted that Maxs Way could be relocated to come directly from the new access road which will require approvals of the current owners/users. This is an opportunity which can be explored with the ROW users as the detailed design of the subdivision progresses. However, if Maxs Way can remain in its current location and this will not have an effect on the proposed intersection layout or the possible bus stop location.

4.1.3 Internal Transport Network

The conceptual site layout provides an internal road network based on the requirements of the current NZ Standard (NZS4404:2010) and the QLDC Land Development and Subdivision Code of Practice based on that standard. Based on the information provided it is expected that it will be possible to create an appropriate internal road network which will meet current guidance.

The proposed road network has been considered to allow for extensions to adjacent properties owned by others. Provision for these extensions will ensure that the internal road network may be extended to serve a greater number of dwellings in the future thus providing network resilience and facilitating the future development of adjacent properties as anticipated within the Ladies Mile Indicative Master Plan.

4.2 Public Transport Connectivity

The Lake Hayes Estate to Frankton (and Jacks Point) bus service passes the site on Stalker Road. The nearest current bus stops in each direction are located approximately 250m to the south of the proposed access intersection. It is possible to provide a new bus stops on Stalker Road near to the proposed access intersection, these are identified on the concept design provided in Appendix C. If these are installed the proposed residential lots would all be within approximately 700m of the bus service.

It is possible that future bus services/routes may pass through the subdivision improving bus links between the proposed development and the employment or commercial areas of Frankton and Queenstown. The proposed internal roads will allow for a future bus route/service to access the development and adjacent properties if necessary in the future.

4.3 Walking and Cycling

The Queenstown trails network provides opportunities for walking and cycling for leisure and commuting. The growth of e-bike sales will increase the use of this mode of transport for both leisure and commuting. The proposed subdivision would allow for these modes of transport in two ways: by providing appropriate provision within the road design (footpaths for pedestrians and low speed carriageways for cyclists), and through the provision of separate pedestrian and cycle trails. Initially, walking and cycling trails will link with Stalker Road to allow access to the Queenstown Trails network at the Stalker Road Roundabout with SH6 (to Spence Road) or via the Shotover Country trails. The concept design allow for a footpath connection between the urban area of Shotover country and the Stalker Road Roundabout with SH6 shown on the eastern side of Stalker Road.

The proposed internal road network allows for both footpaths adjacent to roads and as part of a separate trails network. Furthermore, these networks provide for the future extension through adjacent properties (to the east and west) to facilitate the overall provision of these transport modes in the future for the proposed site and to access possible future development on adjacent sites.

5 Summary

It is proposed to develop Laurel Hills as a Special Housing Area subdivision of Lot 1 DP431492 & Lot 2 DP325561 being 6 & 8 Layton Lane at Lower Shotover.

The proposed subdivision is to be accessed from Stalker Road a new intersection can be constructed to the north of the existing Maxs Way which would remain in its current position as a shared access serving four rural residential lots. The shared access will not affect the operation or safety of proposed access intersection. It is possible, although not necessary, that Maxs Way can be realigned and accommodated within the subdivision's internal road network.

An initial engineering assessment show that an appropriate access intersection can be provided and would include a simple left turn and a right turn bay within a flush median. This assessment demonstrates, through traffic modelling, that the proposed subdivision can be adequately accessed from Stalker Road and can comply with current traffic guidance to create an efficient access intersection. I consider that the design of an access intersection can be provided which will minimise any potential effects on the operation and safety of the local road network. It is acknowledged that transport improvement works may not completely remove existing congestion on Stalker Road, I consider that the proposed intersection layout will also operate within a congested road environment.

The proposed subdivision access will also include appropriate pedestrian and cycle links and can, if necessary, provide bus stops on Stalker Road near to the access intersection. I consider that the proposed development can link to, and enhance, existing alternative transport links including bus, pedestrian and cycle networks.

Within the internal development there are appropriate links that may serve adjacent undeveloped lots. These links may, if future development proceeds, allow for the extension of the proposed transport infrastructure to accommodate vehicular access, from Stalker Road, as well as alternative transport modes such as bus, walking and cycling. I consider that the internal road layout has allowed for possible future expansion with appropriate connectivity to surrounding properties should these be developed. The proposed development allows for the future network resilience and development of all transport networks including bus, walking and cycling.

This assessment does not specifically consider transport effect beyond the site and have adopted the findings and recommended outcomes from the WSP Opus Integrated Transport Assessments. The Laurel Hills subdivision is part of an overall approved development of 1,100 residential dwellings anticipated by the Indicative Master Plan for the Ladies Mile area. The potential effects of this overall development have been considered within the separate WSP Opus Integrated Transport Assessments which identifies a programme of transport improvements. These identified transport improvements have approved funding through a Detailed Business Case to the Housing Infrastructure Fund. These improvements to the state highway network and to public transport infrastructure will minimise any potential effects beyond the site.

I consider that the propose Laurel Hills subdivision can be appropriately accessed and that the proposed access intersection in conjunction with the other proposed transport links outlined in this report will minimise any potential transport effects to a point which is acceptable.

Should you require any further information please contact me.

Yours sincerely,

Jason Bartlett

CEng MICE, G.IPENZ
Traffic Engineer

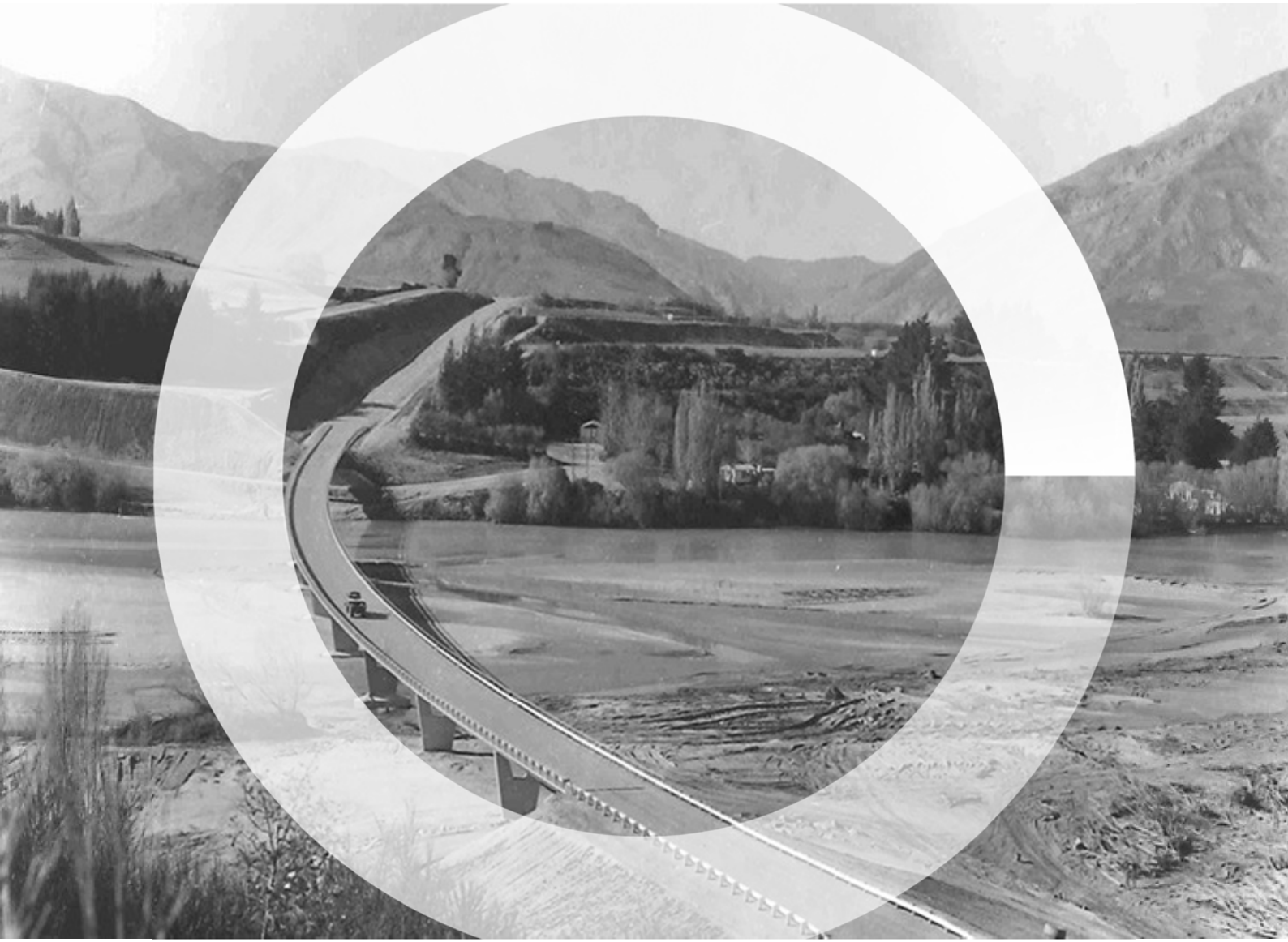
Appendix A WSP Opus Integrated Transport Assessment

The following WSP Opus Integrated Transport Assessments are attached.

- Ladies Mile HIF, Integrated Transport Assessment (June 2018), and
- Memorandum – Ladies Mile HIF Integrated Transport Assessment Amendment A, Detailed Analysis of Programme 3 (9 July 2018).

Ladies Mile HIF

Integrated Transport Assessment



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Executive Summary

This report has been prepared with the intention of supporting QLDC's business case for HIF funding towards lead transport infrastructure to enable housing development at the Ladies Mile site. The traffic impact of proposed development programmes has been assessed against the capacity of the SH6 corridor. Traffic modelling of existing and forecast conditions has informed a required package of integrated transport solutions, designed to encourage a sufficient uptake of alternative transport modes and supress traffic demand to below the corridor's capacity. The findings of the assessment can be summarised as follows.

Traffic growth on SH6 is placing a significant strain on the already-busy corridor, with 2-year growth rates at 9.0%. With considerable development continuing in Frankton and the wider Queenstown area, growth rates are not expected to decrease significantly, other than in the event of economic downturn.

The Ladies Mile site has significant accessibility challenges due to its' location, surrounding topography and limited connections to active modes and public transport. Car dependent development has prevailed in the past, as exemplified by Shotover County and Lake Hayes Estate; this is not sustainable into the future as there is very limited opportunity to increase highway capacity in an affordable way.

Primary access is proposed to be directly onto SH6, which is the only regional highway to the east and north. The route is a lifeline for the Queenstown economy. As such, key stakeholders (such as NZ Transport Agency) require a level of operational efficiency and a safe environment to be maintained for all customers using the road.

Recent surveys confirm that the pinch point in the network is in the vicinity of Shotover Bridge where the maximum traffic flow that can be accommodated in one hour is approximately 1,600 vehicles. The Transport Agency is not supportive of any scenarios that (in combination with background growth) result in peak traffic flows of more than 1,600 vehicles at this location.

For each programme, a package of transport improvement measures have been identified with the intention of enabling the development to take place without breaching the capacity of the Shotover Bridge. These include concept designs for the immediate access points onto SH6, a range of Public Transport, walking and cycling and TDM improvements to encourage mode shift away from single occupancy car trips. Options for a Park and Ride site to capture westbound regional trips with associated bus priority measures on SH6, and the potential for re-routing some SH6 traffic via Arthurs Point have also been investigated.

It is important to capitalise on the change opportunity when new residents first move into an area and establish their travel behaviour. Alternative travel choices should be available from the outset of the development.

Junction analysis confirms that either roundabout or traffic signals would have capacity to cater for traffic demands at immediate access points for all proposed programmes. Therefore, it can be concluded that the highway capacity is the constraint, rather than the intersections. Traffic signals allow for more efficient pedestrian crossings, provide more control over traffic flow and allow priority to be maintained for SH6 traffic, while enabling bus priority measures at intersections to compliment the bus lanes. However, given the 80km/h speed environment, roundabouts provide higher capacity and offer a safer solution. For these reasons, NZ Transport Agency have indicated that they would not support traffic signals at the site.

Based on a set of key assumptions, which have been sensitivity tested, traffic modelling indicates the following:

- Programme 1 is forecast to generate 285 vehicles above capacity at completion. To keep peak hour flows at the bridge below 1,600 vehicles a mode shift of 15% and 25% is required at Ladies Mile and Lake Hayes/Shotover Country respectively.
- Programme 2 is forecast to generate 508 vehicles above capacity at completion. To keep peak hour flows at the bridge below 1,600 vehicles a mode shift of 15% and 25% is required at Ladies Mile and Lake Hayes/Shotover Country respectively, in addition to a Park and Ride on SH6 with a turn in rate of 20%.
- Programme 3 is forecast to generate 770 vehicles above capacity at completion. To keep peak hour flows at the bridge below 1,600 vehicles a mode shift of 40% and 40% is required at Ladies Mile and Lake Hayes/Shotover Country respectively, in addition to a Park and Ride on SH6 with a turn in rate of 20%. This would require a step change in transport infrastructure, including mass transit, an increase in highway capacity or a combination of the two.
- Programme 4 is forecast to generate 1,570 vehicles above capacity at completion. To keep peak hour flows at the bridge below 1,600 vehicles a mode shift of 50% and 50% is required at Ladies Mile and Lake Hayes/Shotover Country respectively, in addition to a Park and Ride on SH6 with a turn in rate of 40%. This would require a step change in transport infrastructure, including mass transit, an increase in highway capacity or a combination of the two.

Economic analysis of the transport infrastructure indicates that a BCR of 2.17 can be achieved for Programme 1 and BCR of 2.75 can be achieved for Programme 2.

Population density is considered to be too low to make MRT commercially viable at Ladies Mile. A single terminal would not provide for a sufficient catchment, while multiple terminals would further increase cost. Rough order costing, provided by Doppelmayr, for an MRT solution (gondola from Ladies Mile to Frankton) put the costs in the region of $80m to $95m. Programmes 1 and 2 produce less than $15m in transport benefits, indicating that the additional cost of an MRT solution would far outweigh the benefits provided.

Contents

1 Introduction

This report presents an assessment of traffic issues and integrated transport planning opportunities associated with the planned Ladies Mile housing development site(s) situated alongside the Ladies Mile section of State Highway 6 in Queenstown.

The intention of the assessment is to support the Queenstown Lakes District Council (QLDC) business case for HIF funding towards the lead transport infrastructure necessary to enable the housing development.

The assessment considers the transport impacts of proposed development programmes and presents a transport strategy that mitigates the potential for traffic volumes to exceed peak hour capacity on SH6.

1.1 Ladies Mile Development Proposals

The Ladies Mile area was identified as a potential site that could increase the housing supply in the Queenstown area and therefore attract HIF funding. Queenstown Lakes District Council submitted an Indicative Business Case (IBC) proposal to the Ministry of Business Innovation and Employment (MBIE) in March 2017 requesting funding for further development of this proposal. Funding was granted in July 2017 upon which commenced the detailed business case (DBC) stage. A key component of the DBC is to develop the programme options to identify the preferred programme of works which includes the development size (number of lots) and lead infrastructure requirements. From the IBC, the preferred option brought forward was for a development of 1,100 lots.

The development of the programme options has been through an iterative multi criteria analysis (MCA) process. At the current time, there are four programme options ranging from the smallest, least ambitious option of 450 lots through to a maximised development potential or most ambitious option of 2,185 lots.

The latest MCA has been informed by the previous work undertaken by WSP Opus. A high-level transport model of the Ladies Mile area was undertaken by WSP Opus in February 2018 which identified that preferred option of 1,100 lots was unsustainable and would ultimately lead to significant congestion on SH6 in the AM peak on the westbound link (Shotover Bridge) unless a high degree of modal shift was achieved. Further iterations of the model determined that a development of 750 lots was the maximum size of development under a reasonably expected mode shift scenario, this was presented at a workshop held on 15 June 2018 upon which the latest MCA was developed.

The diagram below summarizes the development proposals (programme options):

Programme	Description
1 – Do Minimum (450 lots) 	Area to the North of SH6 between Howards Drive and Stalker Road. Access via new intersection at the Howards Drive junction

Programme	Description
2 – Intermediate (750 lots) 	Area to the North of SH6 between Howards Drive and Stalker Road plus area to east of Howards Drive and West of Stalker Road. Access via new intersection at Howards Drive plus existing Stalker Road roundabout.
3 – Preferred (1100 lots) 	More intense development of Area to the North of SH6 between Howards Drive and Stalker Road plus area to east of Howards Drive and West of Stalker Road. Access via new intersection at Howards Drive plus existing Stalker Road roundabout.
4 – Full Master Plan Area (2,185 lots) 	Full development of Ladies Mile Master Plan area with access via new intersections at Howards Drive, McDowell Road and Lower Shotover Road. Plus use existing intersection at Stalker Road and Howards Drive.

1.2 Assessment Approach

The assessment approach has been iterative in that the work undertaken for the assessment is informed by, but also informs the programme options. Through this iterative process it has been possible to develop transport solutions that would enable development on Ladies Mile in a sustainable manner whereby lead infrastructure can be implemented ahead of potential traffic congestion issues arising. Therefore, understanding the site and its limitations as well as the development potential has been key to providing a robust analysis.

This assessment has included:

- Further development of the existing transport models
- Identifying potential development rates
- Understanding background traffic growth and its drivers
- Understanding current site conditions, constraints and transport options
- Using industry knowledge and expertise to identify potential modal shift opportunities and uptake.
- Consideration of various transportation options and their suitability to Ladies Mile
- Consideration of planning and policy constraints
- Collaboratively working with key stakeholders

1.3 Working Collaboratively with Key Stakeholders

To ensure that the project achieves its objectives, four key stakeholders were engaged in the process, as summarised in Table 1. Each stakeholder had a different area of interest but each were critical to ensure the ongoing viability of the project.

Table 1 Key Stakeholders

Stakeholder	Role	Interest
QLDC	Client and HIF funding applicant, Planning and policy regulator	Maximise the potential development to increase housing supply in the district and ease housing affordability.
NZ Transport Agency	Affected party	The HIF development will be accessed directly from SH6. The Transport Agency has an obligation to protect the State Highway and want to understand the mitigation measures put in place to allay any potential adverse effects. Engagement in this process will allow them to ensure that their planning is aligned with impacts the development will have on SH6
MBIE	Funding partner	MBIE will ultimately approve funding and need assurance that the funds will be appropriately spent and deliver on the objectives of the HIF.
ORC	Affected Party	ORC are the public transport providers for the Queenstown area. Therefore, they need to be consulted on all public transport matters to ensure they are viable and achievable within the time frames.

In addition to the above, the developers and landowners directly affected by the HIF development could also provide valuable input to the project. However, QLDC has previously consulted with the community on the development of Ladies Mile and at this time only one developer has a planned development on the site (Glenpanel). The Glenpanel development in its current form will be considered through the transport planning process.

2 Ladies Mile in Context

This section sets out the context within which the project is being undertaken. It includes policy and strategy at national, regional and local levels, as well as future projects that have been committed, planned or proposed in the vicinity of the Ladies Mile site.

2.1 Policy and Strategy documents

2.1.1 Government Policy Statement 2018

The Government Policy Statement (GPS) 2018 is focused on four key priorities; safety, access, environment, and value for money. The four categories have been developed to reduce DSIs, deliver the best infrastructure for the right cost, provide increased access for people and reduce adverse effects on the climate.

To reduce deaths and serious injuries, governing bodies will need to have a greater focus on safety improvements on high risk state highways, such SH6 in Queenstown, as well as local roads.

The second priority of the GPS is access, with increased investment in footpaths and cycleways to encourage uptake of active travel modes. The strategic vision looks at an increased focus in urban centres and development in thriving regions, such as Queenstown. There is a direction to support national freight and tourism connections, as well as integrating transport and land use planning, which increases access to employment, education and recreation.

The policy statement also seeks to protect the environment in relation to land transport, with mode shift to help aid in lowering emissions to facilitate the wider commitments of the Government such as achieving the Paris Agreement target. It notes the importance of creating liveable cities through enhanced public spaces and improved accessibility.

The final priority is around investing in value for money projects which consider the full range of costs and benefits over the whole life of the investment

2.1.2 Safer Journeys

Safer Journeys is New Zealand's road safety strategy for 2010 to 2020 and has been developed to reduce deaths and serious injuries. Priorities have been established to make New Zealand's roads safer, through short and term measures for all transport modes. Safer Journeys supports safer walking and cycling through the provision of appropriate infrastructure. Short term this involves delivering safer roads with space for active modes, better enforcement and more urban speed management. Longer term, land use planning should support public transport and active modes and plans should actively incorporate road safety into designs.

2.1.3 Regional Policy Statement for Otago (1998)

Otago's Regional Policy Statement for transport promotes and encourages the sustainable management of Otago's transport network through:

- Promoting the use of fuel efficient modes of transport
- Encouraging a reduction in the use of fuels which produce emissions harmful to the environment
- Promoting a safer transport system
- Promoting the protection of transport infrastructure from the adverse effects of land use activities and natural hazards.

As of late 2017, the Policy Statement is under review. However, Otago Regional Council will continue to provide social, cultural and environmental wellbeing, community and safety for future generations.

2.1.4 Otago Southland Regional Land Transport Plan 2015-2021

The Otago Southland RLTP was produced jointly between Otago and Southland Regional Transport Committees to help acknowledge shared challenges and opportunities within the regions. The plan focuses on delivering a transport system that is safe, delivers an appropriate level of service, supports economic activity and productivity and provides transport choices.

For urban areas, including Queenstown, the RLTP seeks to reduce reliance on the private motor vehicle, especially for shorter trips. It supports integrated transport planning and providing transport for future requirements in addition to present. The plan encourages future development and subdivisions, such as Ladies Mile, to be effectively served by public transport and active modes, reducing the demand on the road network. Public transport should run on a regular basis and connect nodes to a centre with essential services. It should

also be accessible with adequate bus stops, shelters and footpaths for people to access the services. Provision for active modes must be incorporated into new designs and major improvements. This can be by reallocating road space, delivering separated paths and priority for pedestrians and people on bikes.

2.1.5 Queenstown District Lakes Operative District Plan 2013

The Operative District Plan recognises the need for a sustainable, safe transport system that provides maximum choice between modes. The unique nature of transport demands and constraints in Queenstown mean that land use and access need to be controlled efficiently. Objectives 6 and 7 within the District Plan refer to recognising and meeting the needs of people who travel by active modes and public transport.

2.2 Other Local Projects

Transport issues facing the Ladies Mile corridor are not isolated to that area of the network. A host of studies across Queenstown have been identified to understand transport issues in Frankton and the town centre. Table 2 summarises the studies undertaken to date most relevant to the Ladies Mile site. The studies show an acknowledgement of a need to reduce reliance on private vehicles and set out strategies for reducing demand from background traffic growth and local residential developments.

Table 2 Queenstown Transport Studies Undertaken and Planned

Queenstown Integrated Transport PBC	Queenstown Town Centre DBC	Frankton to Queenstown SSBC	Grant Road to Kawarau Falls DBC	Public Transport Demand Capacity Analysis	Wakatipu Active Travel Network DBC
Addresses issues through making public transport and active modes attractive alternatives and managing parking to reduce use of private vehicles	Proposes a raft of improvement measures for the town centre, including new road links, pedestrianisation, bus priority and hub improvements and improved parking management	Proposes increasing capacity on SH6A with priority for public transport and intersection improvements	Currently underway, seeks to improve capacity of the SH6 link and intersections, increasing prioritisation of public transport (including a PT hub) and integrating with active modes	Required to understand the demand for public transport across Queenstown and capacity of proposed solutions	Sets out strategic active mode links to be integrated with other planned transport improvements and studies

Figure 1 summarises potential, planned and committed physical works in the vicinity of the Ladies Mile site.

Committed projects include:

- Link, intersection, public transport and active mode improvements around Frankton, maintaining the movement function of SH6 while providing access to the commercial area
- Westbound slip lane at Tucker Beach Road to remove the conflict between SH6 through traffic and turning local traffic. This will directly impact the Ladies Mile

development by increasing the capacity of the Shotover Bridge, though the overall effect is expected to be minor for traffic on SH6

Planned projects include:

- A new link to the Quail Rise residential area, reducing demand at the Tucker Beach Road intersection
- A privately funded and operated gondola connecting Remarkables Park in Frankton with the Remarkables ski field via Lake Hayes estate. This is expected to be used by students travelling to school, thus reducing traffic volumes
- Upgrading the Howards Drive intersection on SH6 to a roundabout. The Ladies Mile site is planned to access SH6 via the northern approach of this intersection

Potential projects include:

- A Mass Rapid Transit link between Frankton and the town centre (currently anticipated to be a gondola)
- Ferry services on the Kawarau River to Lake Hayes estate and between Frankton and the town centre
- Bus priority at the SH6/6A intersection
- Park and Ride facilities at Jacks Point, Frankton and/or Lake Hayes

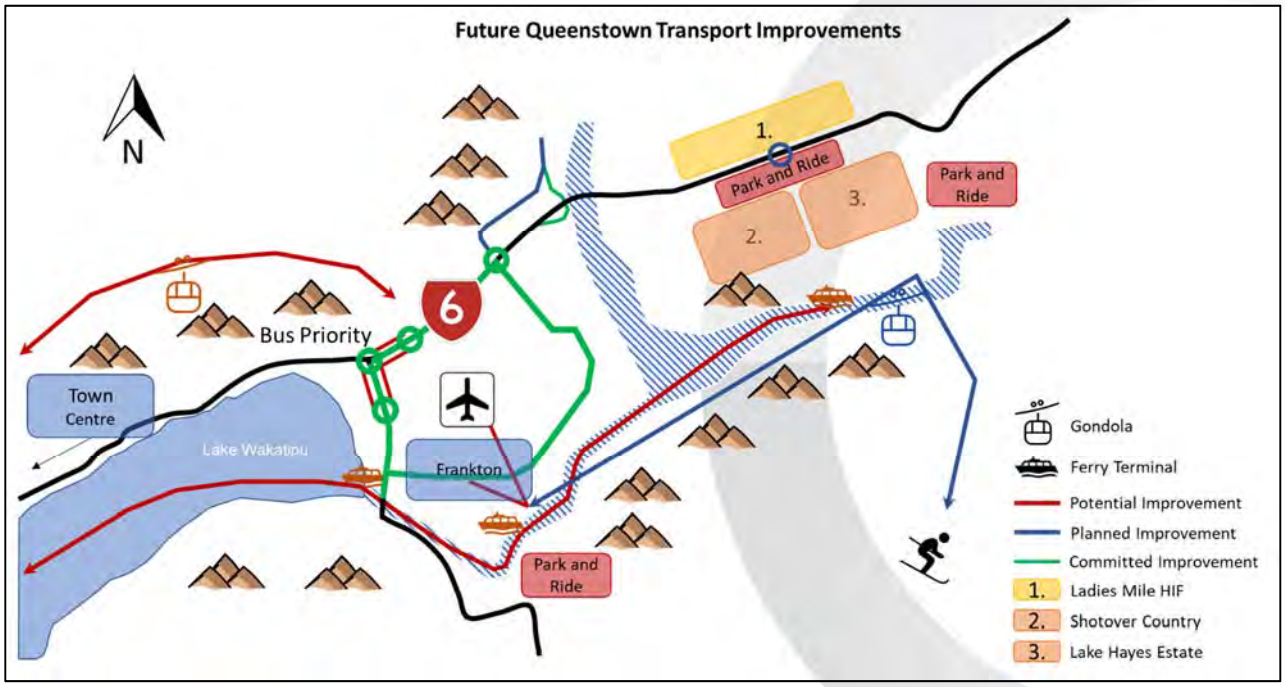


Figure 1 Potential, Planned and Committed Future Queenstown Transport Improvements

3 Baseline Conditions

3.1 Site Analysis

Figure 2 summarises an access and movement analysis of current morning peak hour conditions at the Ladies Mile site. Access to the site is proposed to be via SH6, which is the only regional highway in the area and provides a lifeline for the local economy. In recent years, the function of the highway has evolved from purely providing movement for regional traffic to providing access to the local residential areas. NZ Transport Agency, as a key stakeholder, require that the movement function of the highway is not jeopardised by favouring local access. The corridor is

geographically constrained by the Shotover and Kawarau rivers, and mountainous terrain on all sides, restricting possible solutions for capacity upgrades.

Traditionally, car-dependent development has prevailed in Queenstown, as evidenced by the Lake Hayes and Shotover Country estates. Given the topographical constraints described above, there is limited opportunity to increase highway capacity. Queueing currently occurs at the Stalker Road roundabout, the Shotover Bridge and the SH6/6A roundabout.

State Highway 6 has a severing effect on movement north and south of the highway. Land use is mainly residential to the south of SH6 (other than Shotover Primary School) but mixed-use areas are proposed for Ladies Mile, which are likely to generate demand for crossing. As discussed in later Section 3.9, traffic volumes are growing rapidly on SH6, which is becoming increasingly difficult for pedestrians and cyclists to cross, particularly in peak times.

A cycle trail runs parallel to SH6 from Lake Hayes to Frankton along the northern bank of the Kawarau River, but there are no crossing points on the river. The existing Shotover Bridge on SH6 has no facilities for pedestrians or cyclists, creating an indirect route into Frankton including a 1.5km detour to the north across the old Shotover Bridge. The river is up to 400m wide in places, which is likely to prove cost-prohibitive for a future bridge.

Recent improvements to the public transport system, including a $2 flat fare and increased frequency, have led to increased patronage. However, the network is set up for operator efficiency, rather than passenger efficiency, and frequency remains low. As such, the level of service for outbound and return journeys can inconsistent; some services require an hour wait at the Frankton interchange.

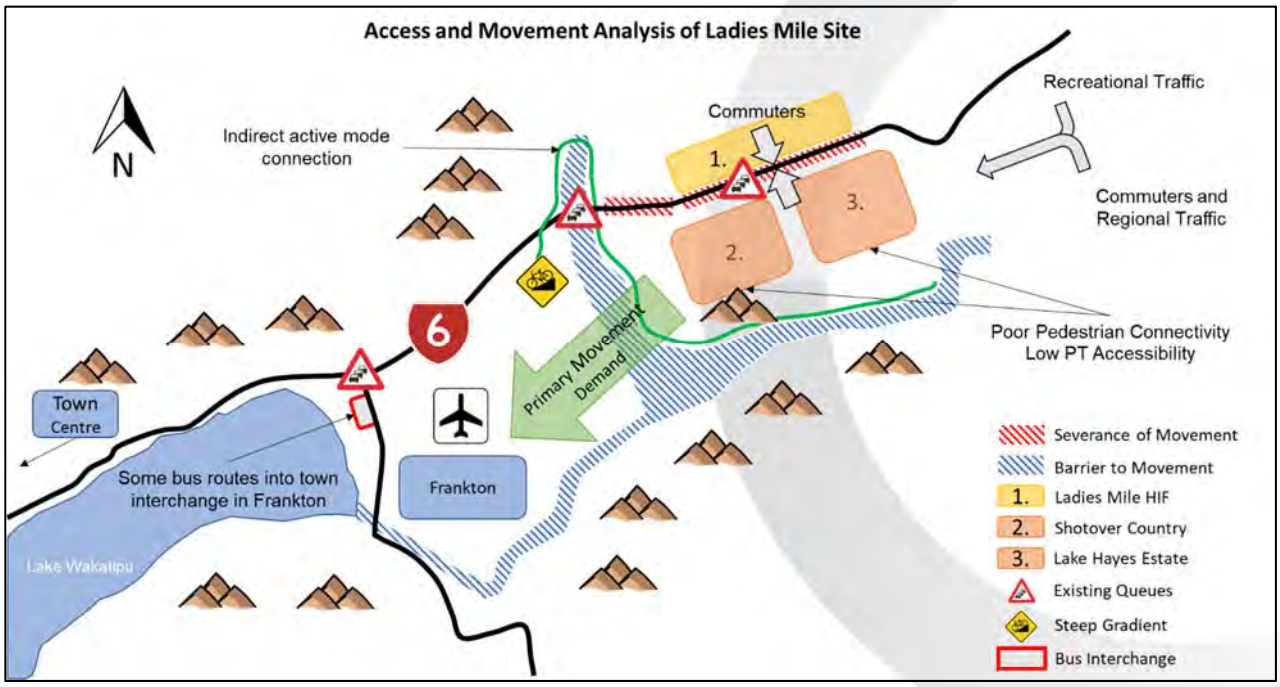


Figure 2 Access and Movement Analysis of Ladies Mile Site

Figure 3 provides travel time isochrones for various modes of transport.

A lack of pedestrian infrastructure along SH6 restricts the walkable distance (30-minute walk) from the site to the Shotover Country and Lake Hayes Estate developments. The lighter green isochrone shows the walkable distance with pedestrians using roads as well as footpaths. Residents are likely to walk only to destinations within the residential developments on Ladies Mile or public transport terminals for destinations further afield. Most destinations are accessible within a 30-minute bike ride of the site (at 20km/h), including Frankton, the base of the ski field access roads and the outskirts of the CBD. The site's proximity to SH6 enables private vehicle access to all of Queenstown within 30 minutes, as far west as Closeburn and far south as Wye Creek.

Residents of Ladies Mile are likely to have similar travel patterns to those in the recently-completed residential developments at Lake Hayes Estate and Shotover Country. Employment in Queenstown has historically been focussed in the central business district, though Frankton is increasingly becoming a significant employment centre. The site lies east of both areas, approximately 11km from the town centre and 5km from Frankton.

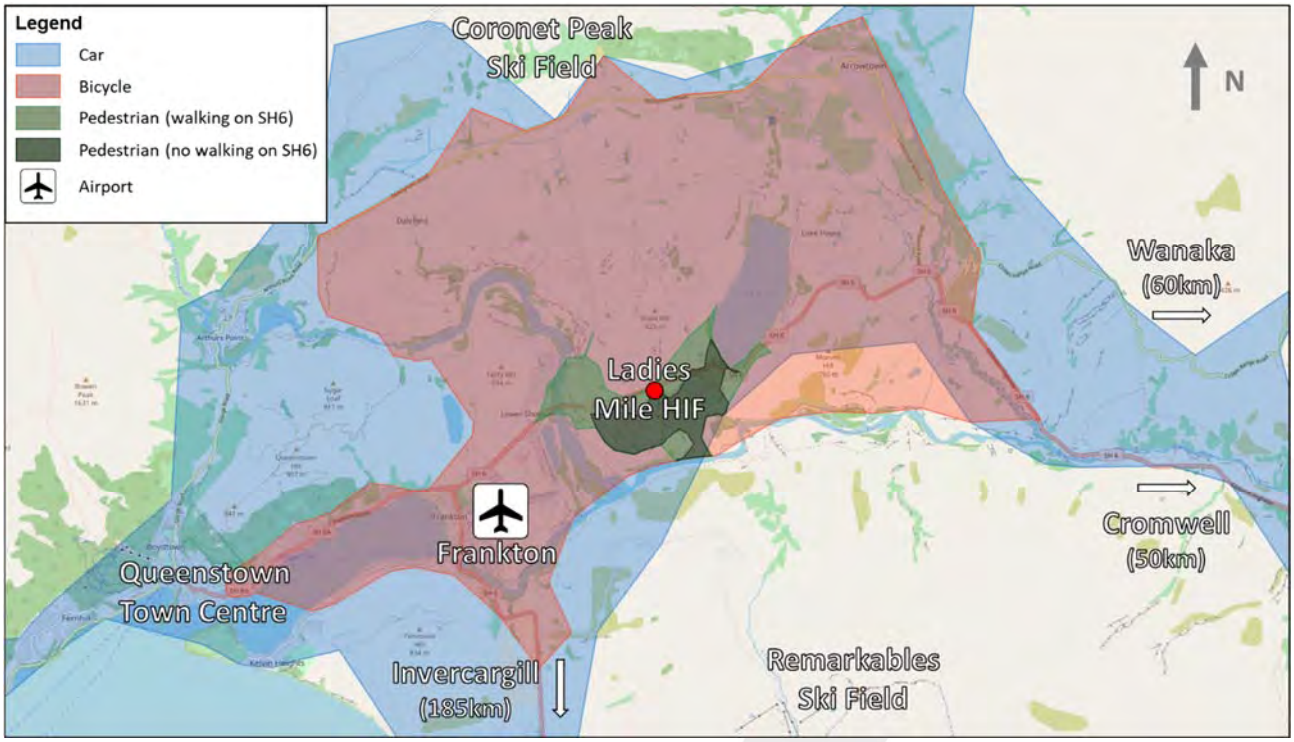


Figure 3 Travel Time Isochrones from Ladies Mile HIF Site (30min travel time). Source: Openstreetmap.org and Iso4app

3.2 Highway Access

The regional context of SH6 is shown on Figure 4, which also illustrates the existing road hierarchy within the Queenstown lakes District as defined by the NZ Transport Agency One Network Road Classification (ONRC).

Figure 4: Road Hierarchy Queenstown Lakes District

The existing road hierarchy as defined by NZ Transport Agency Once Network Road Classification (ONRC) the immediate vicinity of Ladies Mile is shown in Figure 5.

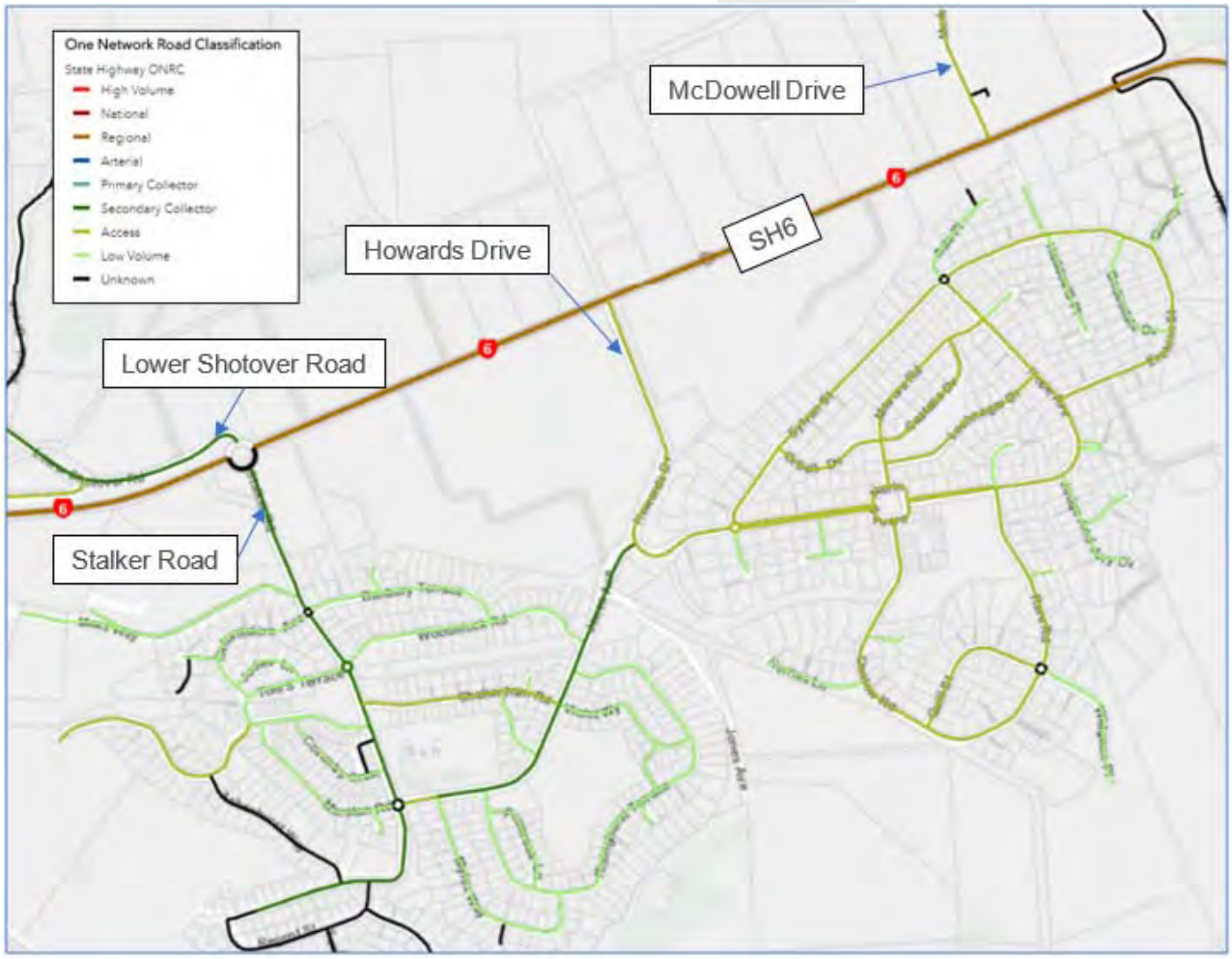


Figure 5: Road Hierarchy Ladies Mile

In the immediate vicinity of the site, SH6 consists of a two-way, two-lane road with a sign posted speed limit of 100km/h. The road width varies from approximately 13.0m to 16.0m in width, sealed with road marking along its length and edge post markers on both sides. There is a shoulder on either side with an approximate width of 2.0m.

The Frankton Ladies Mile Highway (SH6) has one roundabout intersection with four legs, namely SH6, Lower Shotover Road and Stalker Road. The Stalker Road roundabout has been operational since December 2015, when it was installed to help alleviate traffic congestion on the state highway. The roundabout is approximately 35m in diameter, and has a pedestrian island with pram crossings for adjacent footpaths. The roundabout has two lanes for the through movements along SH6 and one lane for the Stalker Road and Lower Shotover Road approaches. There are also two give-way T-intersections with Howards Drive and McDowell Drive. These roads are described below:

3.2.1 Stalker Road

Stalker Road connects to the roundabout with SH6 and is described as a local road in the QLDC District Plan. It is a two-lane, two-way road approximately 6.1m in width and is chip sealed and unmarked along its length except for roadmaking at the intersection with SH6. The signposted speed on the road is 50km/h. Stalker Road provides access to the Lower Shotover area.

3.2.2 Lower Shotover Road

Lower Shotover Road is a collector road as described by the District Plan, it is a two-way two-lane road 6.3m in width. It is sealed and marked with shoulders on either side of the road with edge-marker posts. The sign-posted speed is 80km/h. This road would function as an alternative route to Arrowtown in the case of an incident on SH6.

3.2.3 Howards Drive

Howards Drive is a local road with in accordance with the District Plan, it is a 7.2m chip sealed road with road marking for a two-way road with shoulders either side. The posted speed limit is 50km/h. Howards Drive connects SH6 to Lake Hayes Estate directly south of the State highway.

3.2.4 McDowell Drive

McDowell Drive is a local road in Queenstown Lakes District, it is 6.3m in width and it services residential dwellings north of SH6 in Ladies Mile. The road is sealed and is only marked at the intersection with SH6.

3.3 Walking and Cycling

The Queenstown area has a cycle trail that consists of eight sections. These trails traverse the area between Lake Wakatipu, Arrowtown, and Gibbston Valley. The trails are summarised in Figure 6 below.

Figure 6: Queenstown Trail Map

Generally, the walking and cycling provision in and around the Ladies Mile area is limited. The main provision is the Twin Rivers Trail and the commuter trail which connects Twin Rivers and the Lake Hayes Circuit.

The Twin Rivers Trail which starts in Frankton and crosses the Shotover Bridge north of SH6. This is a wooden pedestrian and cyclist bridge that is part of the Queenstown Trail, large enough for two-way movement. The trail follows Shotover River south to an underpass under the SH6 bridge on the Ladies Mile side.

The trail then follows the coast along Shotover River and Kawarau River, around Ladies Mile. It joins with the Commuter Trail which goes through Lake Hayes Estate and goes under SH6 via an underpass and joins along the north side of SH6, then joining on to the Lake Hayes Circuit.

Cyclists along SH6 would use the shoulders to cycle in as there is no other provision, and there is no extra provision for cyclists to cross the SH6 bridge so cyclists would use the Shotover Bridge to cross the river. There is a turnoff from the shoulder before the eastern end of the SH6 bridge provided for cyclists to use the underpass that leads to the Shotover Bridge. There is also a footpath with pram crossings for cyclists and pedestrians at the Stalker Road roundabout on all approaches to the intersection.

3.4 Public Transport

Public Transport in Queenstown consists of a bus network connecting Central Queenstown, Arthurs Point, Frankton, Arrowtown and Lake Hayes Estate.

The bus network has been recently improved by providing new consistent services supported by an improved fare and ticketing system. The changes were implemented in November 2017, as a jointly funded project by Otago Regional Council, NZTA and Queenstown Lakes District Council.

The bus network is shown in Figure 7. It comprises four routes which run at either 15 minute, 30 minute or hourly frequencies from 6am to 10pm, 7 days a week. The routes extend from Arrowtown to Sunshine Bay, and from Arthurs Point, north of Queenstown Town Centre, to Jacks Point, south of Frankton. The new services are run with accessible buses with Wi-Fi and bike racks.

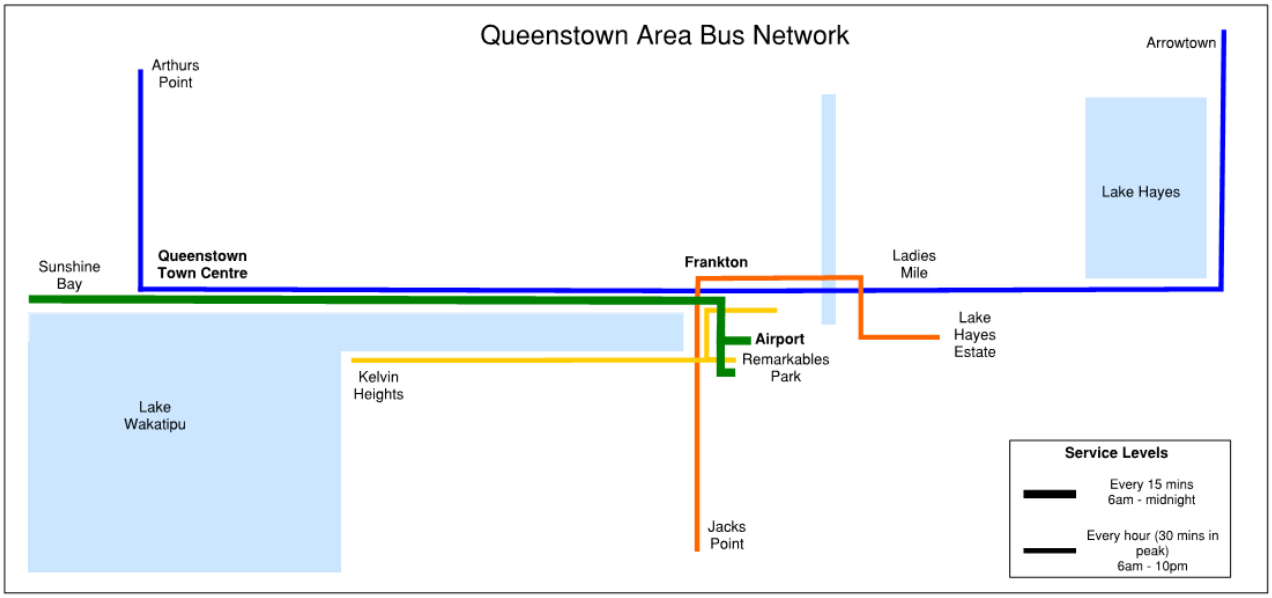


Figure 7 Queenstown Area Bus Network (November 2017)

As part of the project, Queenstown introduced the GoCard, a smart card allowing people to travel on all of Queenstown's bus services for a flat fee of $2, including transferring within 30 minutes. Without a GoCard, travel is $5 per trip, with an increased fare to travel to and from the airport. The GoCard is planned to be upgraded during 2018 to allow online top ups.

The simplicity of the routes and timetables, combined with the new fare system has resulted in large patronage increases. The monthly patronage for bus use in Queenstown has more than doubled from 41,000 in February 2017 to 100,000 in February 2018, as shown in Figure 8.

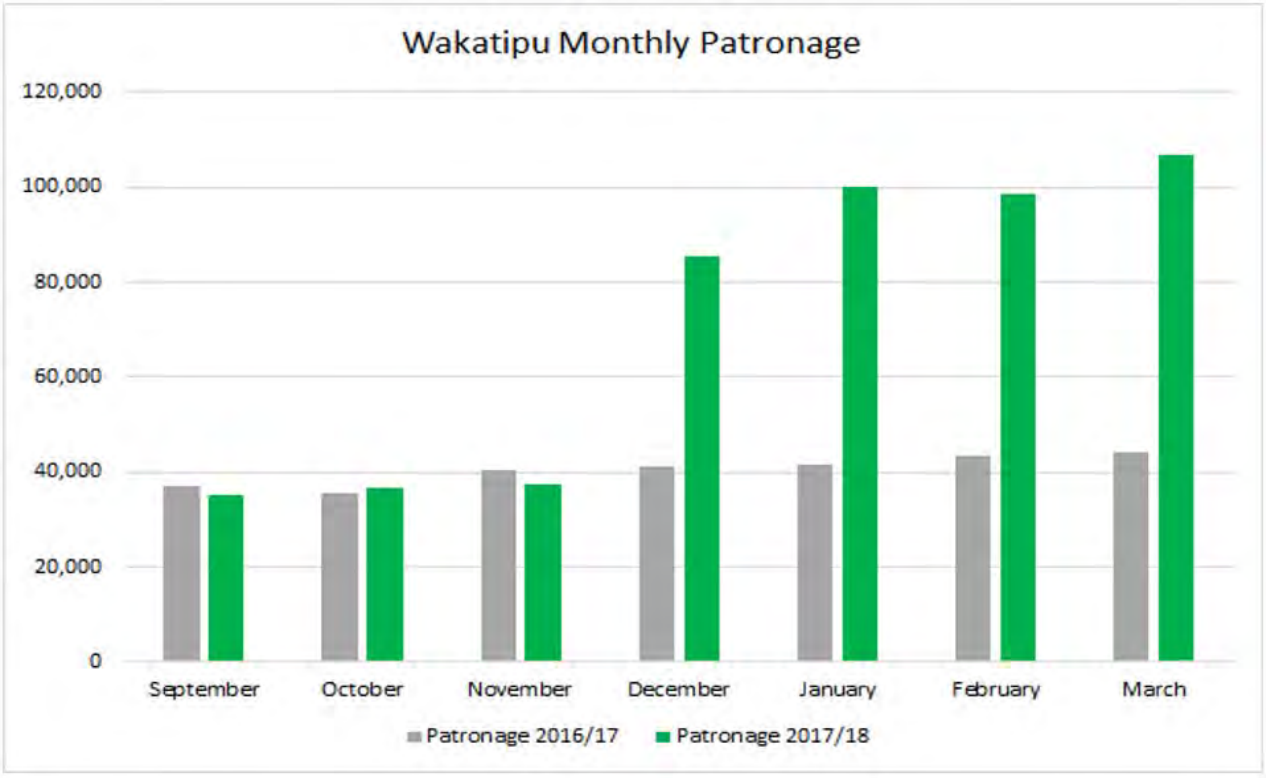


Figure 8 Wakatipu Monthly Patronage – Orbus (https://crux.org.nz/community/time-to-ban-cars-from-our-town-centres/)

The introduction coincided with car park fee rises within Queenstown Central to encourage further bus usage.

Savvy, a ride sharing service also operates in Queenstown and provides an on-demand transport service to a slightly wider area than public transport. Services are booked by an app on the user's phone, which provides a time and price for the journey.

3.5 Ladies Mile

The Ladies Mile development is currently served by two bus routes, as shown in Figure 9. They both operate hourly throughout the day and half hourly during peak to provide additional services towards Frankton and Queenstown during the morning and in reverse in the afternoon peak.

Figure 9 Bus Routes around Ladies Mile

Route 2 originates in Arrowtown, travels along SH6, through the Ladies Mile development, over the Shotover Bridge, through the Frankton Hub, along Frankton Road to Queenstown Town Centre before terminating at Arthurs Point. Route 4 starts within the Lake Hayes Estate, bordering Ladies Mile, travels through Shotover Country, over the Shotover Bridge, through the Frankton Hub and terminates at Jacks Point.

The two routes create two buses an hour in either direction using the western end of the Frankton – Ladies Mile Highway and the Shotover Bridge for most of the day. At peak times, there are an additional two services per hour.

Travel time surveys taken from TomTom data between 2014 and 2016 show there are delays from Stalker Road (east of the Shotover bridge) towards Frankton during the morning peak. For this section, buses use the same lanes as the general traffic, therefore vehicle speeds would be similar. During peak, the speeds are approximately 40km/hr, whereas during other times of the day, they are 67 km/hr.

Current bus stops are located approximately 500m apart through the residential streets. There are few bus stops on the Ladies Mile Highway and SH6 between the Shotover Bridge and Arrowtown. There are existing issues with some journeys requiring transfers, such as Lake Hayes to Queenstown, and service frequency resulting in hour-long layovers.

3.6 Mode Share

Traffic count surveys have been carried out annually on the three major routes into Queenstown town centre, however the results only include vehicle mode share rather than vehicle occupancy. The three routes that were analysed were Gorge Road, Lake Esplanade and Frankton Road, shown in Figure 10.

Figure 10 Queenstown Modal Split Survey – Map of Survey Locations (From Stantec Report)

Over the past 10 years, the mode split has varied minimally, with cars making up about 85% of the travel into Queenstown. Pedestrian and cyclist traffic has remained around 10% and 1% respectively. 2018 had a similar number of buses, but greater number of coaches than previous years, however the report suggests it was due to counting error rather than a large increase. The overall number of cars entering Queenstown town centre has reduced from 5,958 in 2017 to 5,571 in 2018. This, combined with the increase in bus patronage suggest there are more people travelling by bus into the town centre.

On 17th May 2018, WSP Opus carried out a vehicle occupancy survey on the Shotover Bridge, westbound during the AM and eastbound during the PM peak. During the morning peak, there were approximately 1750 people travelling westbound in 1300 vehicles. About 25% of vehicles had two people and a further 6% had three or more. The overall numbers are slightly higher during the afternoon peak travelling eastbound over the bridge, and 35% of vehicles carrying two or more people.

3.7 Road Safety

The crash history of the Ladies Mile region using NZ Transport Agency's Crash Analysis System (CAS) revealed a total of 198 crashes between 2007-2017. This crash analysis was conducted for a 3.0km range from the intersection of SH6 and Howards Drive and the results are shown in Figure 11.

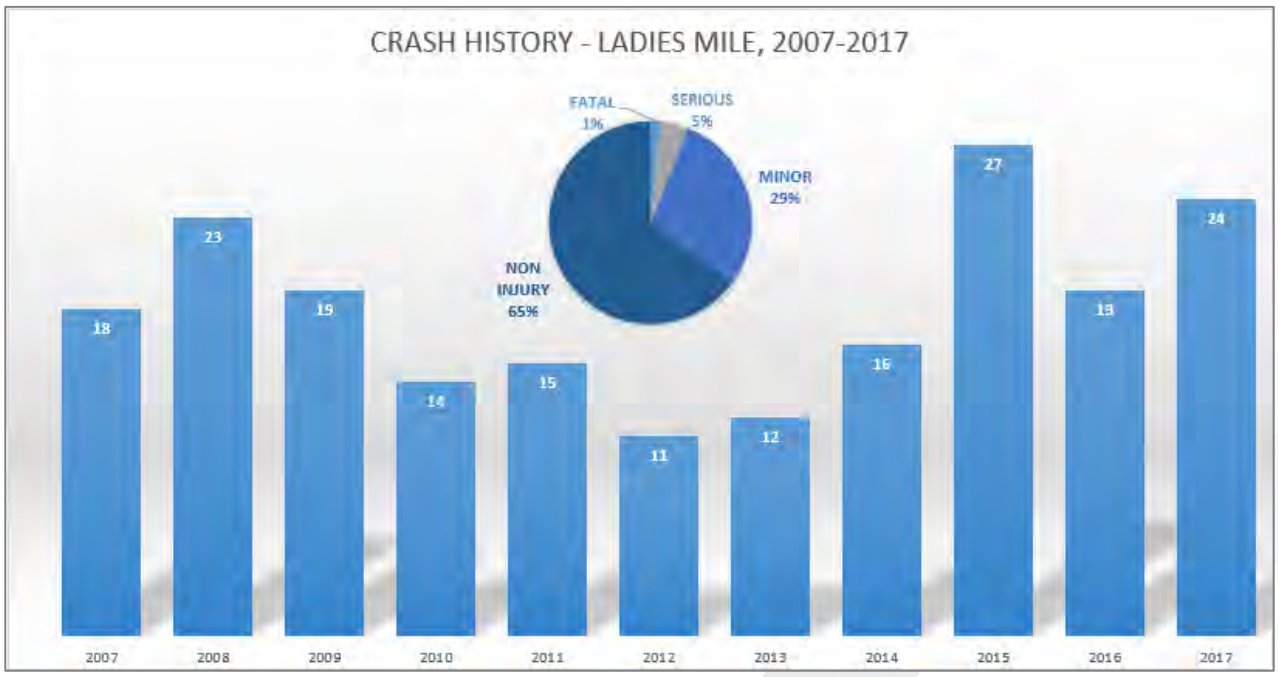


Figure 11: Crashes in Ladies Mile over the last 10 years, CAS 2007-2017

The graph above shows that the majority (94%) of total crashes between 2007 and 2017 were either minor or non-injury crashes. There were three fatal crashes and nine serious injury crashes. On the whole, it appears that the traffic safety of Ladies Mile has worsened in recent years. The first fatal crash occurred in 2009 on Lower Shotover Road and involved a tree falling on a car causing fatality. The second fatal crash also occurred in 2009 in Frankton just west of Shotover River, it involved a head-on collision on SH6. The final fatal crash occurred in 2015 just west of Howards Drive and involved another head-on collision on SH6. The majority of the severe crashes were clustered around SH6 and had six instances where the driver lost control, two instances of head-on collisions, and two instances of turning crashes.

It is evident from the crash history above that along this section of SH6 there is a crash record of vehicles colliding head-on or losing control resulting in fatalities and serious injuries. The crash location by severity of crash sites are shown in *Figure 12* below.

Figure 12: Crashes over the last 10 years in Ladies Mile

From the figure above, the biggest clustering of crashes (all severity) is west of the Shotover River on SH6 with the intersection of SH6 and Hardware Lane (previously Glenda Drive). Glenda Drive was previously a T-intersection and had two exit lanes and one entering lane at the intersection. This was converted to Hardware Lane, a one-way road with an exit only for pedestrians and cyclists, no crashes have been recorded since.

The other location with a historic clustering of crashes has been the Lower Shotover Road and SH6 intersection. This intersection has also been converted to a roundabout and no crashes have been recorded since.

There has only been one pedestrian crash in the past 10 years which occurred in 2007 and resulted in minor injuries. There have been four crashes involving cyclists which were minor and non-injury crashes, one on the intersection of Domain Road and Lower Shotover Road, two on Tucker Beach Road, and the last one on Glenda Drive.

3.8 Existing Traffic Conditions

3.8.1 Daily Traffic Volumes

The section of SH6 between Stalker Road and Howards Drive had an average daily traffic two-way volume of 15,777 in 2017, according to Traffic Monitoring System data. Figure 13 highlights the seasonal variability on the road. A lull in demand is apparent in April and May when tourist numbers typically decline. There now appears to be only one 'shoulder season' with October and November volumes now mostly above the yearly average.

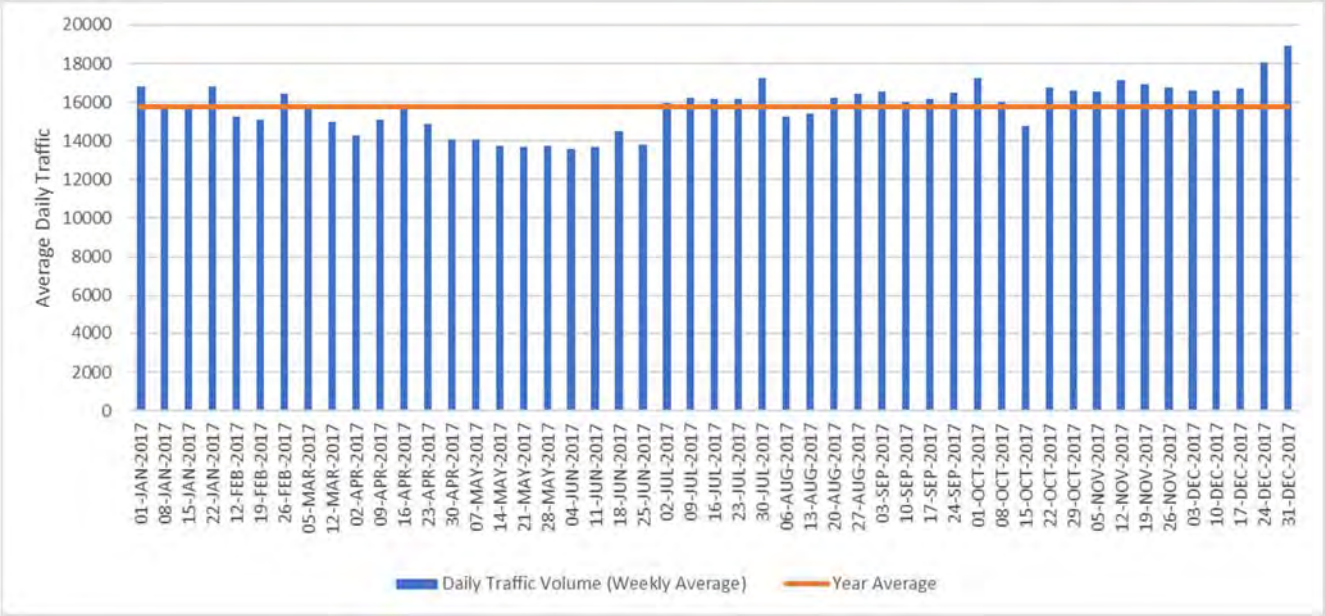


Figure 13 2017 Annual Variability in Daily Traffic Volumes East of Shotover Bridge

3.8.2 Peak Hour Traffic Volumes

Traffic volumes on Ladies Mile are tidal due to the large residential developments to the east and employment centres to the west. Previous analysis of traffic data found that the morning peak hour (07:30-08:30) is critical with a westbound volume of 1,451 measured in the last week of January 2018[1]. Table 3 summarises the peak hour traffic volumes on Ladies Mile.

Table 3 Peak Hour Traffic Volumes on Ladies Mile East of Shotover Bridge

	AM	PM
Eastbound	706	1,255
Westbound	1,451	998

As can also be seen in Figure 13, the last week of January 2018 count is fairly representative of average conditions throughout the year, particularly considering that the rolling average through the year is actually increasing at a significant rate (see later section on background traffic growth).

Turning counts were undertaken at the Ladies Mile intersections with Howards Drive and Stalker Road on Wednesday 24th January 2018, summarised in figures Figure 14 and Figure 15. These intersections are the sole accesses to the Lake Hayes Estate and Shotover Country developments. A new access road on the northern approach to the Howards Drive roundabout is proposed under all Ladies Mile programmes. It should be noted that volumes shown at McDowell Drive were summed from volumes observed at the other intersections.

[1] Ladies Miles HIF Development Traffic Modelling Memo (WSP Opus, Feb 2018)

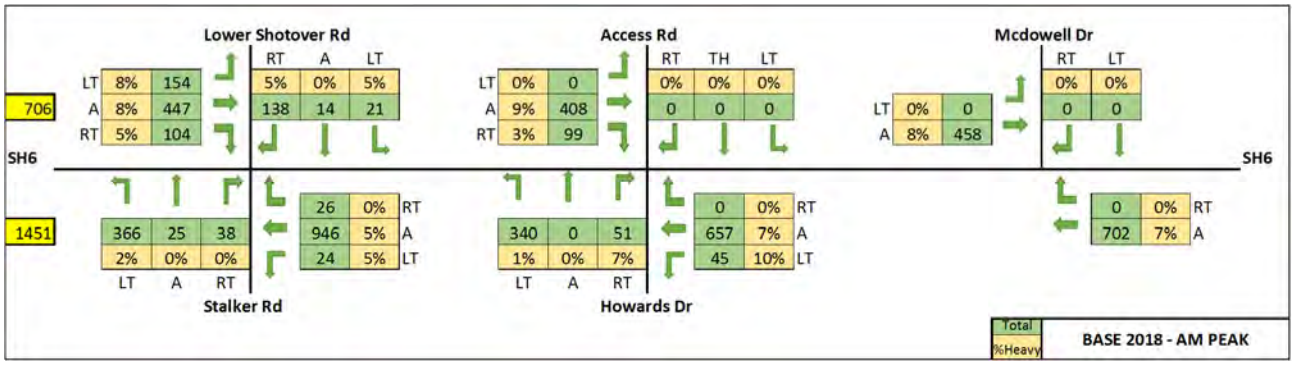


Figure 14 AM Ladies Mile Turning Count Summary (24th Jan 2018)

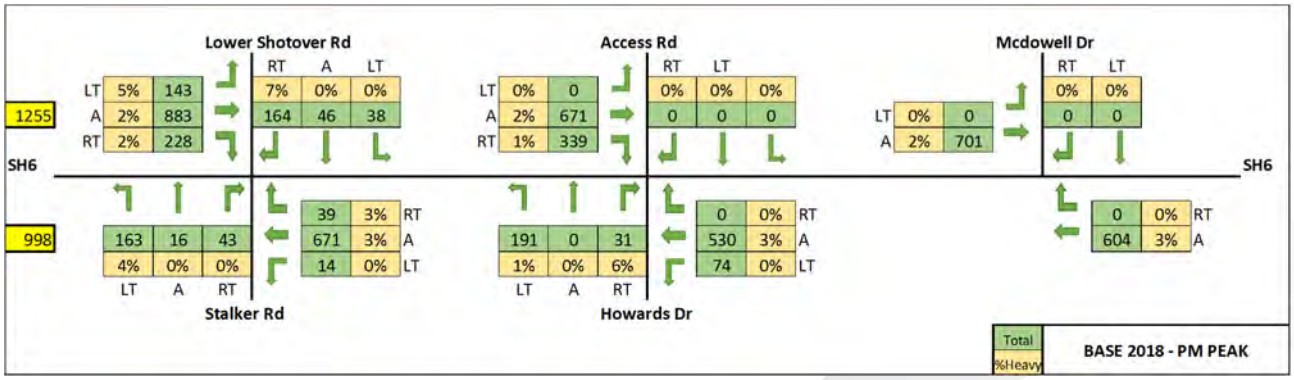


Figure 15 PM Ladies Mile Turning Count Summary (24th Jan 2018)

3.9 Traffic Growth

It is well established that traffic volumes across the Queenstown district have been increasing rapidly over the past 5-10 years. The highest volumes are present around Frankton and on SH6A into the town centre, but as shown in Figure 16, volumes have recently increased at a high rate across the network. The green line with red markers shows average daily traffic on SH6 at the western end of Ladies Mile, where the average annual 10-year growth rate is 3.0% and 5-year growth rate is 8.5%. Annual traffic growth at the site has been close to 12% for 2016 and 2017.

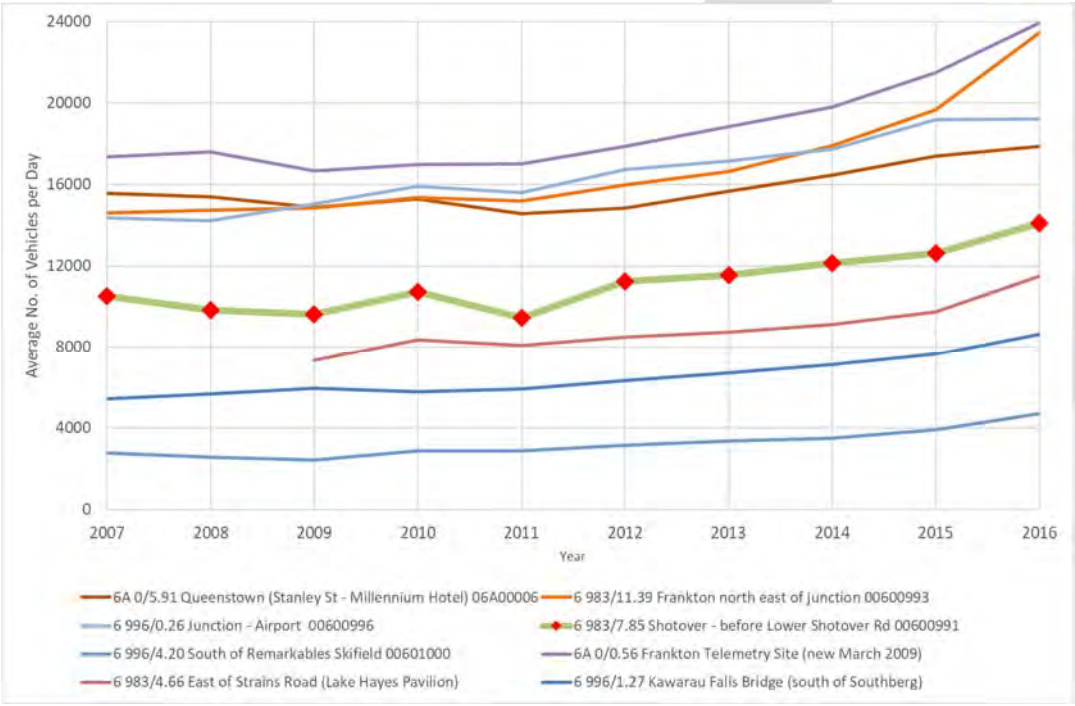


Figure 16 Wakatipu Basin Annual Average Daily Traffic (2007-2016)

4 Transport Analysis

This section presents the methodology, inputs and results of the transport modelling undertaken for the project.

4.1 Transport Modelling Overview

A spreadsheet model was developed using measured traffic volumes and trip generation rates to determine existing and anticipated traffic demands on the SH6 corridor. Traffic generated by the development was then distributed around a simplified Ladies Mile network based on existing travel patterns. Different mode shares were then tested for each of development, local residential and regional traffic. Resulting volumes were compared against the known capacity of the corridor to gauge the scale of intervention required to keep the highway operating below capacity in the future. Turning volumes were then extracted from the model to assess future intersection performance.

Traffic volume models were developed for both morning and evening peaks but the assessment focussed on the morning peak, which was found to be critical in terms of total traffic volume. The morning peak also directly affects Ladies Mile, with congestion and queueing extending eastwards from the Shotover Bridge. Evening peak demands on Ladies Mile are restricted by the Shotover Bridge and travel patterns are assumed to be approximately the reverse of the AM peak.

4.1.1 Data Sources

Table 4 summarises the data used to develop the Ladies Mile transport model.

Table 4 Data Sources for Ladies Mile Transport Model

Turning Counts	Queenstown TRACKS Model	Ladies Mile Housing Infrastructure Fund Business Case	NZTA Traffic Monitoring System (TMS)	Occupancy Surveys
Undertaken 23/1/2018 at Howards Drive and Stalker Road. Factored for seasonality using TMS data. Informed 'local' traffic demand in the model	Select Link analyses informed trip distribution of regional traffic (from SH6 east)	Model scenarios were developed (Section 4.3) based on number of dwellings, network loading and building rates proposed in the business case	Extracted at Strains Road and Shotover Bridge, informed current SH6 traffic demand and growth rates	Undertaken 17/5/2018, informed the potential number of cars taken off the road by PT interventions

4.1.2 Assumptions

The following assumptions were used to build the model:

- Trip generation and distribution at Ladies Mile will be the same as at the Lake Hayes and Shotover Country developments. This was measured in manual turning counts surveys
- Traffic flows calculated by the model are demand flows rather than actual flows; the model does not consider network capacity constraints
- Growth from Lake Hayes and Shotover Country is capped to reflect the planned total number of houses at the estates

- Existing public transport share and the proportion of regional traffic using Arthur's Point to access Queenstown are implicit in the base traffic counts; any changes to these figures in the model is relative to existing conditions
- Interpeak volumes are the average of AM and PM peak volumes, reduced by 10%. This reduction is based on data from the Strains Road TMS site
- All growth rates are linear

4.1.3 Traffic Growth Rates

Background growth in the model was applied for regional (originating east of Ladies Mile) and local traffic (originating in Lake Hayes and Shotover Country estates) separately.

Growth on SH6 was based on historic growth at NZTA TMS sites 00600991 (SH6 near Lower Shotover Road) and 00600988 (SH6 near Strains Road). Figure 17 highlights the trend seen in traffic growth around Queenstown, whereby volumes have been increasing at a faster rate in recent years. The rate at which traffic grows in the future is dependent on several unpredictable factors. The following growth scenarios were therefore adopted in the transport model:

- Low growth (3.07%): 10-year (2007-2017) growth rate on SH6
- Medium growth (5.69%): 5-year (2012-2017) growth rate on SH6
- High growth (9.00%): 2-year (2015-2017) growth rate on SH6
- Medium to low growth (5.69% flattening by 0.1% per year): 5-year (2012-2017) growth rate on SH6 reducing each year

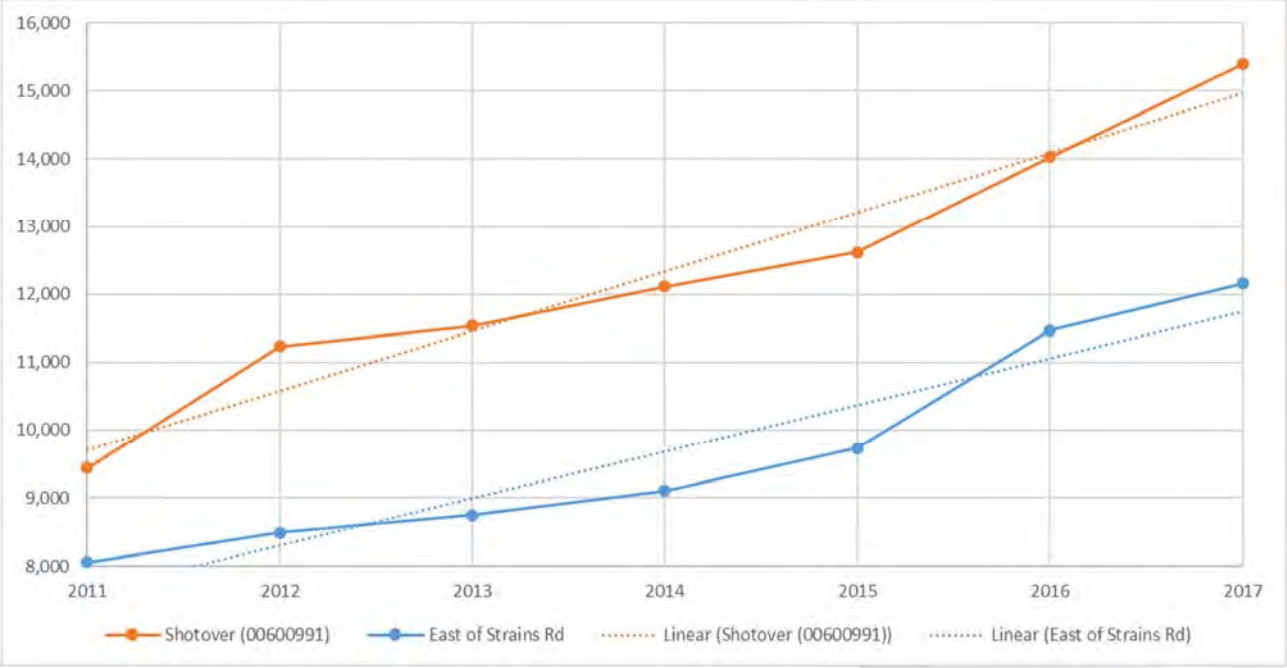


Figure 17 SH6 Annual Average Daily Traffic Volumes on SH6 (NZTA Traffic Monitoring Sites)

Growth from the Lake Hayes and Shotover Country estates was based on the number of houses and jobs in place at 2016 (1,102) and planned final households and jobs (1,330). Growth was capped at the expected final build. The following growth scenarios were therefore adopted in the transport model:

- Low growth (1.15%): 50% expected completion rate at Lake Hayes Shotover Country
- Medium growth (1.72%): 75% expected completion rate at Lake Hayes Shotover Country
- High growth (2.30%): 100% expected completion rate at Lake Hayes Shotover Country
- Medium to low growth (1.72% flattening by 0.05% per year): 75% expected completion rate at Lake Hayes Shotover Country

There is likely to be to be a change in commuter patterns following the development of the site, in that the availability of local housing may reduce the number of regional commuters travelling to Queenstown. However, measured data suggests that background growth has continued despite construction of various residential developments around Queenstown. Additionally, recreational traffic makes up a significant amount of the volume observed on SH6, and is not expected to change as a result of the Ladies Mile development.

4.1.4 Corridor Capacity

The capacity constraint nearest to the development is the section of SH6 either side and including the Shotover Bridge, which is restricted to one lane in each direction and necessitates a merge from 2 lanes on the approach from either side. Traffic flow on the section is further reduced by steep gradients on both sides of the bridge and interactions with traffic exiting Tucker Beach Road. The capacity of the bridge has been assessed previously[2] at 1,590v/h using calculation methodologies in NZ Transport Agency Economic Evaluation Manual and Austroads Guide to Traffic Management Part 3.

In order to provide more certainty in the operation and capacity of the bridge, on-site surveys and observations were carried out on 19th, 20th and 21st June 2018. This showed:

- The constraint to westbound operation of the section is the interaction between the Tucker Beach Road intersection and the uphill gradient towards Frankton, both on the west side of the bridge
- Due to the heavy westbound flow over the bridge in the morning peak, vehicles turning right out of Tucker Beach Road towards Frankton frequently accepted short gaps in the westbound traffic stream, or turn across the eastbound lane into the right turn pocket to wait for gaps. This subsequently causes westbound trough vehicles to brake, resulting in slow subsequent acceleration on the downstream uphill section
- This behaviour then causes queue shockwaves to develop back to the Stalker Road roundabout, and specifically the two to one lane merge on the exit. Once the merge behaviour is at slow speed, it does not recover until the demand falls significantly

On 21st June, the slow merging behaviour was observed over a full hour period, with throughput of 1515 vehicles in the hour

As noted in the previous section, the Tucker Beach Road intersection improvements are due to be implemented by April 2019. This will re-assign the right turn movement out of the side road to move under the SH6 carriageway, and join a westbound ramp, merging with the SH6 westbound lane on the uphill section prior to Hardware Lane. It is expected that this will provide a small degree of additional capacity (by replacing the existing right turn movement, with a downstream merge), but due to the merge being on the uphill gradient and the presence of a significant level of heavy vehicles, the impact will be relatively minor.

Consequently, the observed 1,515v/h maximum throughput has been set to 1,600v/h to represent this improvement, and has been adopted as the nominal capacity of the bridge.

Consequently, should the demand on this westbound link be over 1600v/h, additional vehicles will be served outside of the hour, and a residual queue will build up – this is what is currently being observed in the morning peak period. This therefore has an impact on the operation of the Ladies Mile section of SH6, with queues in the morning peak stretching back beyond the Stalker Road roundabout and, on occasions, Howards Drive. Due to the unpredictable nature of the pinch point downstream (individual vehicle incidents at the Tucker Beach intersection, and on the downstream uphill second), the variability in operation, and resultant queue lengths, within this section can be significant from day to day, even with similar levels of demand.

[2] Ladies Mile HIF – Update to Previous Traffic Assessment Memo (WSP Opus, 19 March 2018)

In the eastbound direction, the pinch point in the network is the two to one lane merge between the Hawthorne Drive roundabout and the Tucker Beach Road intersection, which is critical in the PM Peak period. On occasions, queues in this period can stretch back into Hawthorne Drive and Grant Road. However, the effect of this is to provide an eastbound gate to traffic passing over the bridge, and therefore traffic generally flows in a free-flow state in the Ladies Mile section – and consequently our analysis has centred on the AM peak period operation. However, it is noted that any additional traffic due to the Ladies Mile development, is likely to increase operational issues in the eastbound direction in the PM peak period.

While the bridge has been identified as the immediate constraint on capacity for the Ladies Mile site, the wider corridor is geographically constrained by the Shotover and Kawarau rivers, Lake Wakatipu and Queenstown Hill. Increasing general capacity on the Shotover Bridge will migrate congestion downstream without a significant level of other further network interventions along SH6 and SH6A, and within Frankton and Queenstown.

4.1.5 Arthur's Point Diversion

Rerouting a proportion of regional traffic through Arthur's Point was examined as a way of reducing demand on the Shotover Bridge. A Select Link Analysis of the Queenstown TRACKS model revealed that there are approximately 155 regional peak-hour trips into Queenstown that could feasibly be rerouted. However, the route into Queenstown is approximately 40% longer than SH6 from Arrow Junction, and is constrained by a one-way bridge at Arthur's Point. It is therefore anticipated that no more than 20% of regional trips would use the route. The resulting reduction in demand (i.e. around 30 vehicles per hour) at Shotover Bridge would have minimal effect on capacity of the corridor.

Malaghans Road is also of lower standard than the State Highway, and as such presents a less safe route.

4.2 Future Baseline Conditions

Figure 18 shows the forecast westbound demand at the Shotover Bridge from local (bars) and regional (lines) traffic, without the Ladies Mile development.

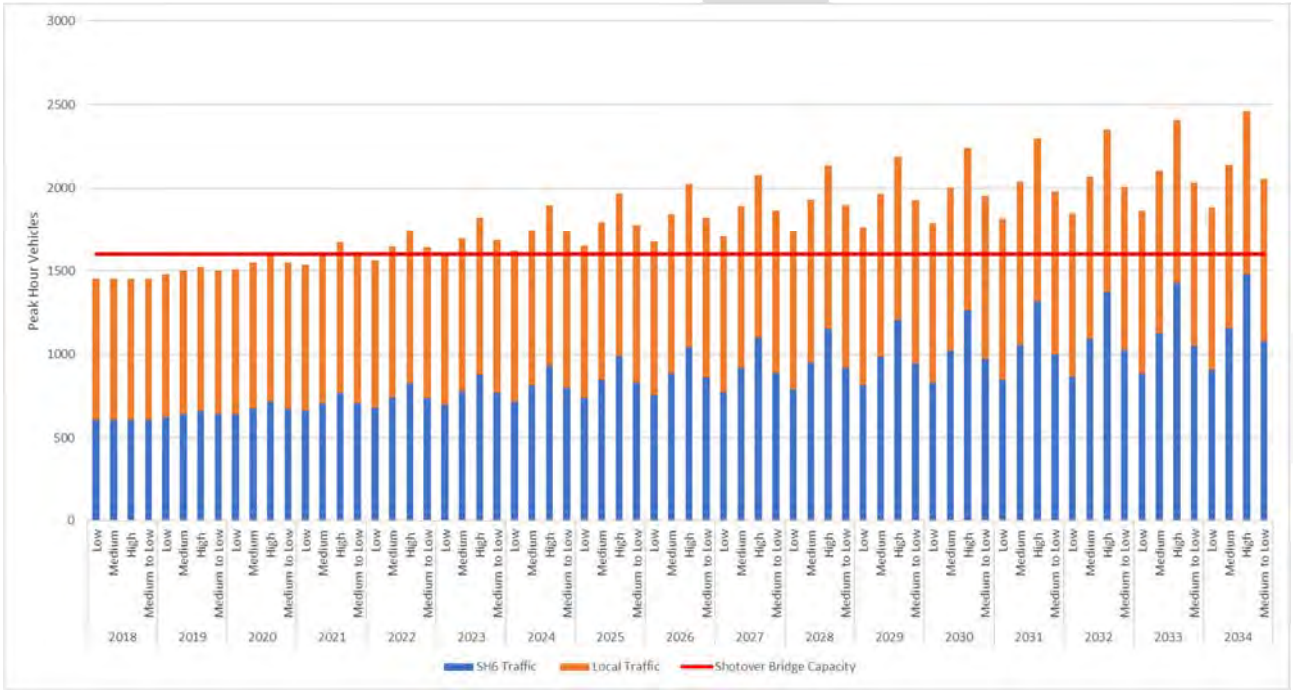


Figure 18 Forecast Traffic Demand at Shotover Bridge (SH6 and Local)

At existing levels, a slight majority of westbound traffic is generated locally. Regional traffic is expected to make up the majority by 2028 (medium and high growth scenarios). As described in Section 4.1.4, the capacity of the Shotover Bridge is approximately 1,600 veh/h, a value which background traffic alone is forecast to reach between 2020 and 2024 for the average demand, assuming no additional development over that already consented, and based on the January 2018 demand of 1451v/h. Note, that demand fluctuates on a day to day level, and this level will likely to be reached prior to 2020 in some high-demand days.

4.3 Future Reference Case

Due to uncertainty in the various parameters generating future traffic demands, several scenarios were developed for each of 6 variables for years 2018-2048. Traffic demands were calculated for all combinations of scenario inputs.

A reference case comprising the expected level for each parameter was chosen to base the overall assessment on. Sensitivity testing was then carried out from the reference case. Table 5 summarises the reference case (highlighted) and possible combination of scenarios.

Table 5 Summary of Transport Model Variables

Growth Rate	Low – SH6: 3.07%; Local: 1.15% Medium – SH6: 5.69%; Local: 1.72% High – SH6: 9.00%; Local: 2.30% Medium to Low – As Medium with SH6 growth tapering by 0.1% per year and local growth tapering by 0.05% per year	Growth rates for SH6 traffic were determined using data from counters on SH6. Growth rates for local traffic were determined from the 2018 build-out of Lake Hayes and Shotover Country and expected completion date.
Number of Dwellings	Programme 1: 450 lots Programme 2: 750 lots Programme 3: 1,100 lots Programme 4: 2,185 lots	Various proposals were put forward for different development sizes as part of the HIF DBC, ranging from realistic to more aspirational dwelling numbers. Road access to the site differs depending on the scale of development.
Construction Start	2020 2022 2024	Year in which construction begins – effect of background traffic by time of completion
Build Rate (dwellings/y)	75 100 125	Build rates were adopted based on observed rates at other local developments, cognisant that there is a finite supply of labour available locally.
Arthurs Point Diversion	0 – 20%	The effect of increasing the attractiveness of the route into Queenstown through Arthurs Point was examined as a way of reducing regional trips along Ladies Mile.

Trip Reduction Factor	0 – 20%	A trip reduction factor was used for a general sensitivity test of demands on the corridor.

The medium growth rate scenario (5-year rate) was adopted for the reference case due to recent sustained growth in commercial and residential developments around Queenstown. Traffic growth continuing at the 2-year rate is considered possible but unsustainable, while it is expected that only a downturn in the economy would cause a return to the 10-year rate, despite the increase in local housing availability. Growth rates are discussed in more detail in Section 4.1.3.

The preferred Programme for the Ladies Mile site is 1,100 houses. However, preliminary model testing showed that the highway is unlikely to have capacity to support development of that scale. Therefore, the more achievable Programme 2, with 750 houses, was adopted for the reference case.

Given the urgent need for housing in Queenstown, the highest feasible build rate of 125 houses/year was adopted for the reference case. Tests also revealed that slower build rates would result in highway capacity being reached by the time of development completion due to background growth. Similarly, it is assumed that building would commence as soon as possible, so 2020 was chosen for construction to start.

The Arthur's Point diversion (discussed in Section 4.1.5) and trip reduction factor parameters were set at zero for the reference case.

In addition to the demand scenarios, the level of public transport mode shift and Park and Ride uptake could be altered to determine the scale of intervention required for volumes to remain below capacity (discussed in Section 4.5).

4.4 Trip Generation

Traffic generated from the Ladies Mile site is assumed to have the same characteristics as that from the Lake Hayes and Shotover Country estates. Trip generation rates were calculated from turning counts undertaken on 24th Jan 2018 and the known build-out of the housing developments. These were foud to be consistent with empirical data from the Trips Database Bureau, as shown in Table 6, and were therefore used in the modelling.

Table 6 Ladies Mile Trip Generation Rates

	AM PEAK		PM PEAK	
	OUT	IN	OUT	IN
Shotover Country/Lake Hayes	0.55	0.19	0.30	0.47
TDB Database	0.49	0.26	0.40	0.58

4.5 Modelling Results

This section presents results from the traffic volume modelling, a spreadsheet developed from first principles, and intersection modelling, undertaken in SIDRA intersection 7.

4.5.1 Corridor Modelling Results

The corridor model tested highway loading from the 4 proposed development programmes, under a range of scenarios, described in Section 4.3. Results presented here are based on the reference case assumptions for the different programmes (total number of dwellings and completion year).

ld be prohibitively expensive.

Table 7 shows that, without interventions to reduce demand, capacity is expected to be reached before the Ladies Mile development is complete under all programme scenarios. Demand can be limited in Programme 1 without a park and ride on SH6, subject to the alternative mode shares shown being achieved. Programme 2 is anticipated to require a park and ride on SH6 with a capture rate of 20% by completion. Programmes beyond a yield of 750 houses would require step-change interventions to provide the capacity to allow the required mode shifts. However, this would require higher levels of mode shift than could be reasonably be expected and any off-highway solutions, such as mass rapid transit would be prohibitively expensive.

Table 7 Traffic Demand Analysis Results for Proposed HIF Programmes

HIF Programme	Number of dwellings (year complete)	Forecast traffic above capacity at development completion	Mode Shift Required to Reduce Demand at Shotover Bridge to 1,600v/h		
			Ladies Mile	Shotover Country/Lake Hayes	SH6 Park and Ride
1	450 (2023)	285	15%	25%	0%
2	750 (2025)	508	15%	25%	20%
3	1,100 (2028)	770	40%	40%	20%
4	2,185 (2037)	1,570	50%	50%	40%

It should be noted that combinations of different mode shares listed in ld be prohibitively expensive.

Table 7 can achieve the same result in regard to demand at the Shotover Bridge; the values shown are considered to be the most achievable. Lake Hayes and Shotover Country have higher assumed shares than Ladies Mile due to the planned Remarkables Gondola, which is expected to significantly reduce the number of private trips to Wakatipu High School. The completion date of 2023 for Programme 1 is considered too early to realistically construct a Park and Ride on SH6 with adequate ridership. However, a park and ride will be required in the 2025 reference case, in addition to the mode shift required by 2023.

The implications of these results, in terms of the level of service and practicalities of public transport provision, are discussed in Section 6.1. Service frequency and infrastructure triggers to support mode shift are discussed in Section 0. Sensitivity testing of key assumptions is discussed below.

4.5.2 Sensitivity Tests

Sensitivity test have been carried out around the reference case assumptions to assess the potential impact of different public transport mode share and traffic growth rates on future traffic demands. All other variables are constant as defined by the reference case. It should be noted that a park and ride is assumed to be constructed 2024-2025, with capacity doubling over the 2 years. The scenarios tested were:

- High (+5%), medium (reference), low (-5%) and lower (-10%) public transport mode shares
- High, medium and low growth rates (as per scenarios described previously)

Figure 19 shows that capacity on the corridor would be exceeded by approximately 70veh/hour in 2023 if public transport mode shares are 5% lower than stipulated in the reference case. This equates to an increase in queue length of approximately 500m, and an

extra delay per vehicle of 75 seconds. With the SH6 park and ride becoming operational (at a 5% lower capture rate) over 2024-2025, demand above capacity remains at a relatively constant rate (between 50v/h and 100v/h over capacity) until 2026.

If public transport mode shares are 10% lower than the reference case, capacity on the corridor would be exceeded by approximately 170veh/hour in 2023, creating additional queuing of approximately 1,000m.

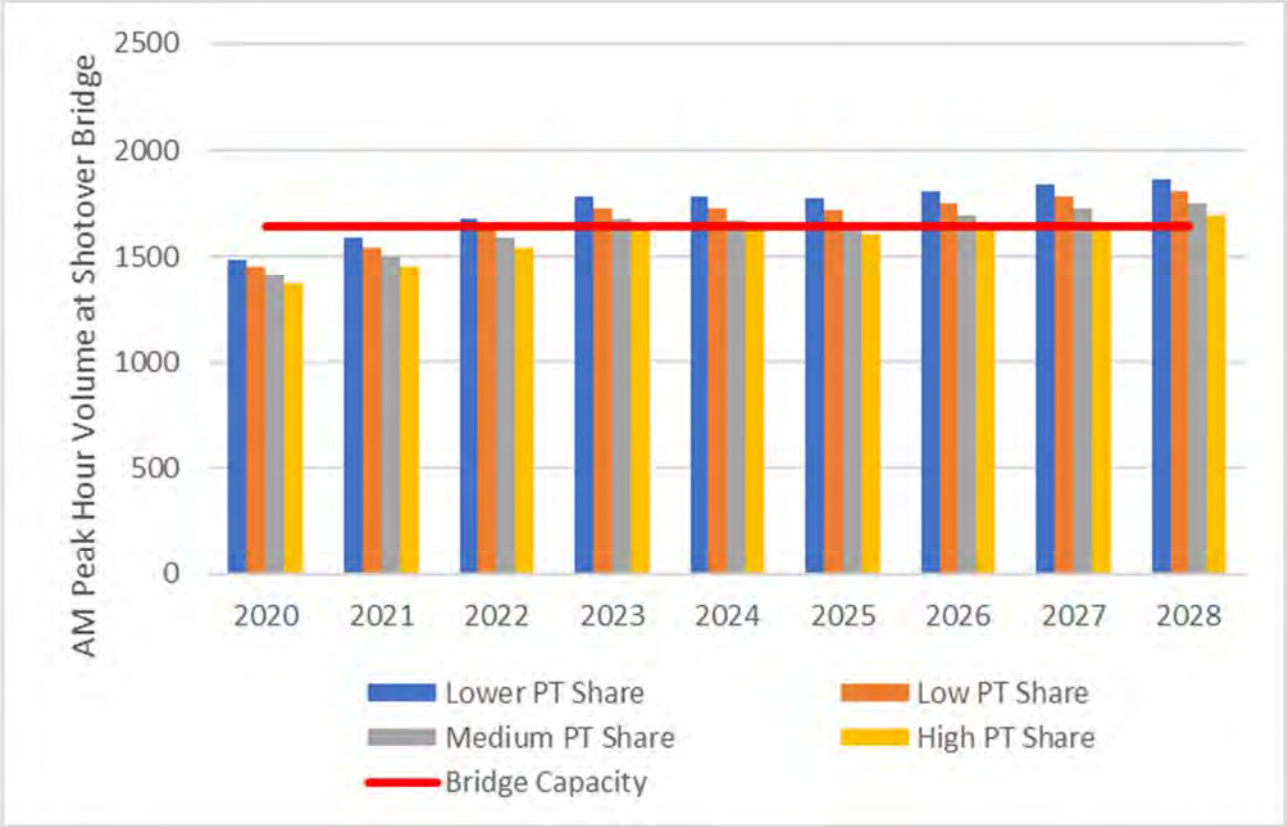


Figure 19 Public Transport Mode Share Sensitivity Test

Figure 20 shows that capacity on the corridor would be exceeded by 2023 if growth continues at observed 2-year annual rates (9.00%). Implementing the park and ride suppresses demand at the Shotover Bridge for 2 years before volumes begin to increase again.

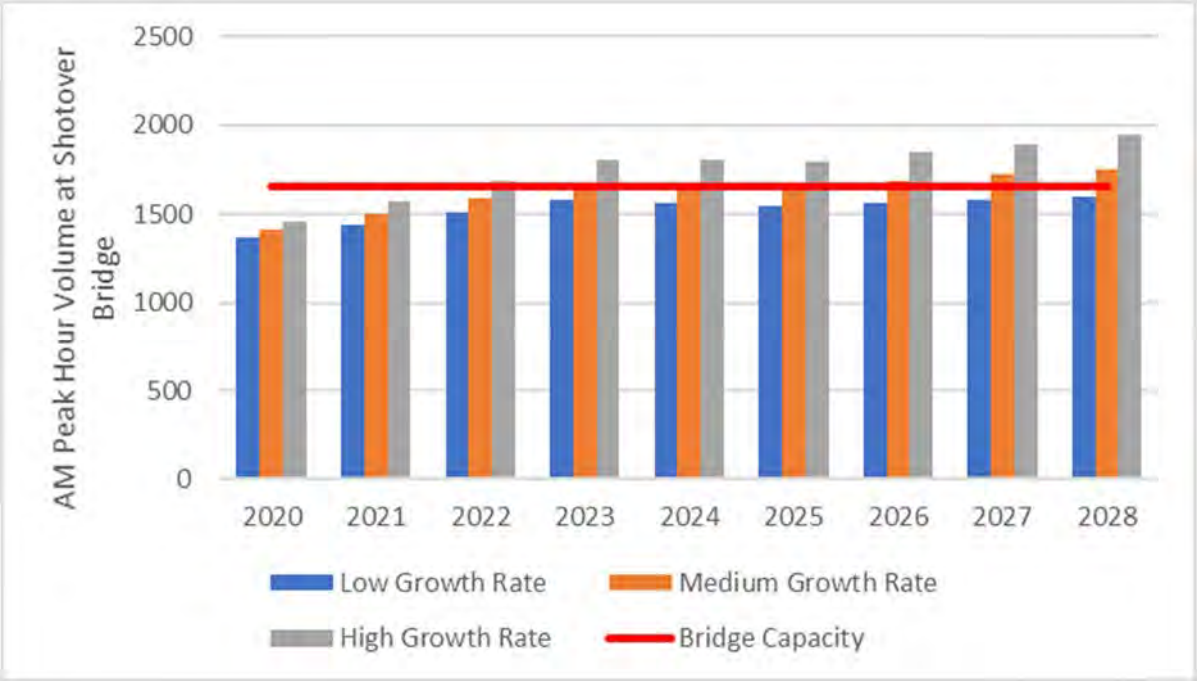


Figure 20 Traffic Growth Rate Sensitivity Test

Without any intervention to reduce forecast transport demand, capacity of the Shotover Bridge is expected to be reached by 2021, even under a low growth scenario (Figure 21). Although lower build rates mean that capacity on SH6 is reached later, it is still reached before the development would be complete as a result of background growth.

Growth Rate	Programme	Units/year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Medium to Low Growth	Programme 2	125	1451	1499	1604	1708	1811	1913	2014	2114	2177	2212	2246
Low Growth	Programme 2	125	1451	1479	1566	1652	1738	1825	1911	1998	2016	2035	2053
High Growth	Programme 2	125	1451	1525	1657	1789	1921	2053	2185	2317	2372	2427	2481
Medium to Low Growth	Programme 2	75	1451	1499	1581	1662	1741	1820	1898	1975	2073	2142	2212
Medium to Low Growth	Programme 2	100	1451	1499	1592	1685	1776	1867	1956	2044	2154	2212	2246
Medium to Low Growth	Programme 2	125	1451	1499	1604	1708	1811	1913	2014	2114	2177	2212	2246
Medium to Low Growth	Programme 1	125	1451	1499	1604	1708	1811	1890	1933	1975	2038	2073	2107
Medium to Low Growth	Programme 3	125	1451	1499	1604	1708	1811	1913	2014	2114	2235	2328	2409
Medium to Low Growth	Programme 4	125	1451	1499	1604	1708	1811	1913	2014	2114	2235	2328	2421

Figure 21 Forecast Traffic Demand at Shotover Bridge Without Increased Mode Share (red signifies capacity exceeded)

Figure 20 shows that for the reference case, a relatively high mode share of 25% is required to reach "perfect" equilibrium on the bridge – that is, the additional trips over 1,600v/h are all accommodated by other modes. By 2025, the required alternative mode share is likely to be above 20%, even under a low growth scenario. For the reference case, the required alternative mode share is expected to reach 30% by 2029. For context, the national average for alternative mode share in New Zealand was 18% between 2015 and 20173. Alternative modes made up 22% of commuter trips in Auckland and 35% of commuter trips in Wellington in the 2013 census.

It should be noted that the proportions given are relative to the Shotover Bridge capacity and refer to an increase from the existing alternative mode share. That is, 0% in Figure 22 represents the existing base mode share rather than zero alternative mode share.

[3] New Zealand Household Travel Survey (Ministry of Transport, December 2017)

Growth Rate	Programme	Units/year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Medium to Low Growth	Programme 2	125	0%	0%	0%	3%	10%	16%	21%	25%	27%	28%	29%
Low Growth	Programme 2	125	0%	0%	0%	0%	5%	11%	15%	20%	21%	22%	22%
High Growth	Programme 2	125	0%	0%	0%	9%	16%	23%	28%	33%	35%	37%	39%
Medium to Low Growth	Programme 2	75	0%	0%	0%	0%	6%	10%	15%	19%	22%	25%	28%
Medium to Low Growth	Programme 2	100	0%	0%	0%	2%	8%	13%	18%	22%	26%	28%	29%
Medium to Low Growth	Programme 1	125	0%	0%	0%	3%	10%	14%	17%	19%	21%	22%	23%
Medium to Low Growth	Programme 3	125	0%	0%	0%	3%	10%	16%	21%	25%	29%	33%	35%
Medium to Low Growth	Programme 4	125	0%	0%	0%	3%	10%	16%	21%	25%	29%	33%	36%

Figure 22 Alternative Mode Share Required to Meet Shotover Bridge Capacity (purple lines indicate development programme build time)

Figure 23 highlights the scale of demand over capacity in terms of the capacity of various public transport interventions. It is expected that by 2023, demand will exceed capacity at the Shotover Bridge by the amount of capacity offered by a Park and Ride facility (light blue), even under a low growth scenario, with individual bus capacity increasing to double deckers (dark blue) by 2027 in all but the low growth scenarios. By 2033, all scenarios in Figure 23 require low level Mass Rapid Transit, such as a gondola. However, this is an oversimplification, as in reality a range of measures would be more appropriate to serve the different trip patterns of local and longer distance traffic, and employment, visitor, education and retail trip types.

Growth Rate	Programme	Units/year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Medium to Low Growth	Programme 2	125	0	0	4	108	211	313	414	514	577	612	646	681	716	750	785	819
Low Growth	Programme 2	125	0	0	0	52	138	225	311	398	416	435	453	472	491	509	528	547
High Growth	Programme 2	125	0	0	57	189	321	453	585	717	772	827	881	936	990	1045	1100	1154
Medium to Low Growth	Programme 2	75	0	0	0	62	141	220	298	375	473	542	612	681	716	750	785	819
Medium to Low Growth	Programme 2	100	0	0	0	85	176	267	356	444	554	612	646	681	716	750	785	819
Medium to Low Growth	Programme 2	125	0	0	4	108	211	313	414	514	577	612	646	681	716	750	785	819
Medium to Low Growth	Programme 1	125	0	0	4	108	211	290	333	375	438	473	507	542	576	611	645	680
Medium to Low Growth	Programme 3	125	0	0	4	108	211	313	414	514	635	728	809	843	878	913	947	982
Medium to Low Growth	Programme 4	125	0	0	4	108	211	313	414	514	635	728	821	913	1006	1098	1191	1283

	Capacity	v/h	Load factor	Occupancy
Existing Load	40	4	40%	1
Existing Services	40	4	80%	1.3
Extra Local	40	8	80%	1.3
Bus P&R	40	14	100%	1.3
DD P&R	65	14	100%	1.3
Low MRT	10	180	100%	1.3
Max MRT	35	120	100%	1.3

Figure 23 Scale of Intervention Required to Meet Shotover Bridge Capacity

4.5.3 Intersection Modelling

SIDRA Intersection v7.0 has been used to assess the performance of proposed intersections under Programmes 1, 2 and 3 for the Ladies Mile development. Although traffic demand modelling indicates that anything beyond Programme 3 is likely to produce unsustainable traffic volumes from a corridor perspective, the performance of intersections under this loading has been tested. For each of the programmes, the AM peak and PM peak were analysed under the two layout options of Do Minimum, and Do Something.

Junction analysis confirmed that both roundabout and traffic signals would perform well under the proposed programmes. Traffic signals offer more efficient pedestrian access and allow for provision of bus priority, but roundabouts deliver higher capacity in the high-speed environment and reduce off peak delays for traffic. The Transport Agency have indicated that they would not support traffic signals on Ladies Mile due to safety concerns around signals on high speed roads (the environment would not support a reduction in posted speed limit) and the impact on efficiency for through traffic.

The Do Minimum option represents the simplest form of an access point for the development to take place. For the Howards Drive intersection, this means a simple priority-T intersection and for the Stalker Road roundabout, the intersection was assumed to remain as existing. The Do Minimum scenario assumes there will be no mode shift for all programmes.

The Do Something option represents the interventions discussed in Section 6 of this report, which are intended to reduce traffic demand of the corridor. These include mode shift to public transport through high occupancy vehicle priority and a park and ride facility. Based on vehicle occupancy surveys (discussed in Section 4.1.1), it is assumed that 25% of the light vehicles would use the transit lanes as well as all heavy vehicles and buses. A peak flow factor of 100% is used across all modelling, due to expected peak spreading resulting from congestion.

It should be noted that the intersection modelling has been undertaken on an isolated basis. That is, the traffic demand has been loaded onto each intersection in each scenario, to determine whether the proposed access arrangements are sufficient to accommodate such traffic levels. In the AM peak, the pinch point within the network is to the west of Ladies Mile, on the SH6 link through Shotover Bridge. This isolated intersection modelling is unable to take into account the complex relationship between this downstream pinch point and the operation of the two access intersections – this more complex network operation would require a more comprehensive traffic modelling exercise to be carried out, which is outside the scope of this assessment.

Summary Table

The results from the SIDRA analysis are summarised in Table 8. The full output summaries for all models can be found in Appendix B.

Table 8 SIDRA Modelling Results Summary – Stalker Road Roundabout

Programme	Time of day	Performance					
		Do Minimum			Do Something		
		Intersection LOS	Max DoS	Average Intersection Delay (s/v)	Intersection LOS	Max DoS	Average Intersection Delay (s/v)
Programme 1 2023	AM	F	1.81	71	A	0.64	8
	PM	A	0.57	9	A	0.51	8
Reference Case 2025	AM	F	2.46	132	A	0.76	9
	PM	A	0.67	10	A	0.51	9
Programme 3 2028	AM	F	2.72	168	A	0.69	9
	PM	A	0.91	13	A	0.58	9

The Do Something Option (Option 1) shows that the anticipated volumes can be supported with the recommended interventions under all three programmes, in both peak periods. In reality, in the AM peak period, the downstream link constraint at Shotover Bridge would result in some queueing back to this roundabout, as has been observed intermittently in 2018. However, the proposed shift to alternative modes ensures that such issues are of a similar level to the existing situation.

For the Do Minimum Option (Option 0), significant delays are predicted at the roundabout in the AM peak hour period, in particular on the Stalker Road approach, which must give way to all other westbound state highway traffic. In reality, the breakdown in westbound traffic flow due to the downstream constraint at this location would result in a more even split in delay to all approaches, as vehicles would push into the slow-moving traffic streams on the circulating lanes. However, it is the case that the lack of shift to other modes in this scenario results in poor operation of both the intersection and the wider network.

Table 9 SIDRA Modelling Summary - Howards Drive Intersection

programme	Time of day	Performance								
		Do Minimum						Do Something		
		Howards Drive South Priority Intersection			Howards Drive North Priority Intersection			Howards Drive Roundabout		
		LOS	Max DoS	Delay (s)	LOS	Max DoS	Delay (s)	LOS	Max DoS	Delay (s)
Programme 1 2023	AM	F	0.89	11	F	9.06	758	A	0.30	7
	PM	F	1.50	15	F	3.18	105	A	0.40	7
Reference Case 2025	AM	F	1.58	69	F	19.64	1596	A	0.34	7
	PM	F	3.48	54	F	5.25	186	A	0.38	8
Programme 2 2028	AM	F	3.18	202	F	49.5	5095	A	0.34	7
	PM	F	7.67	181	F	17.8	886	A	0.40	8

The Do Something Option (Option 1) shows that the anticipated volumes can be supported with the recommended interventions under all three programmes, in both peak periods. This demonstrates that the proposed access arrangements are of a suitable scope to accommodate forecast traffic levels, with only a negligible increase in travel times for through movements on SH6 (which are currently unopposed in the existing situation).

For the Do Minimum Option (Option 0), significant delays are predicted on the side roads at both intersections, predominantly due to minimal gaps available to traffic turning right out of both links. This shows that traffic from both the Ladies Mile development, and existing movements from Howards Drive are forecast to experience significant delay without such an intersection improvement proposed.

5 Transport Economic Analysis

Economics have been undertaken from a transport infrastructure investment perspective. Development Programmes 1 and 2 have been assessed in Do Minimum and Do Something scenarios, as in the intersection modelling, to ascertain the relative benefits of implementing the transport strategy described previously in this report.

The Do Minimum is a hypothetical scenario in which housing, and associated traffic generation, is assumed to have been built without any of the supporting transport improvements.

The Do Something scenario considers all housing to be in place, as well as the proposed transport improvements.

Approaching the economics with these scenarios enables an isolated assessment purely of the transport improvements without influence from the costs and benefits stemming from providing the housing itself.

Through traffic demand modelling, programmes 3 and 4 have been found to require step-change level public transport interventions, with travel demand reaching a level only provided by MRT. While network demand is forecast to reach such levels, population density would be too low to make MRT commercially viable. A single terminal would not provide for an adequate catchment while multiple terminals would further increase cost. Rough order costing, provided by Doppelmayr, for an MRT solution (gondola from Ladies Mile to Frankton) put the costs in the region of $80m to $95m. As presented later in this section, programmes 1 and 2 produce less than $15m in benefits, indicating that the additional cost of an MRT solution would far outweigh the

benefits provided for Programmes 3 and 4. These programmes were therefore not considered further.

5.1 Methodology

The methodology prescribed by the NZ Transport Agency's Economic Evaluation Manual (EEM) First Edition, Amendment 1 (January 2016) was used to evaluate the indicative Benefit Cost Ratio (BCR) for each programme. The EEM full evaluation procedures were used, specifically evaluating benefits associated with travel time benefits. The travel time benefits are based on SIDRA outputs, which represent isolated intersections and not a network model as discussed in Section 4.5.3.

Crash reduction analysis has not been undertaken as part of the economics as the majority of total crashes in the past 10 years have been either minor or non-injury crashes, as discussed in the Road Safety section. Therefore, it is considered that the crash reduction saving will not contribute significantly to the overall BCR.

The costs included in the analysis are the construction costs of the intersection upgrades and the estimated annual maintenance costs for existing and upgraded intersections.

The assumptions made in the economic analysis, the evaluation summaries and the construction costs are in Appendix C.

5.2 Results and Conclusions

The economics evaluation results for Programme 1 and 2 is summarised in Table 10 and Table 11 respectively, below.

Table 10 Programme 1 Economic Evaluation

ITEM	DO MINIMUM ($)	DO SOMETHING – PROGRAMME 1 CORRIDOR IMPROVEMENTS ($)	OPTION COMPARISON (NET BENEFIT AND COSTS OF DO SOMETHING $)
Travel Time Cost	18,982,000	8,329,000	10,653,000
Total NPV Benefits			**$10,653,000**
Capital Costs	486,000	5,400,000	$4,914,000
Maintenance Costs	157,000	157,000	-
Total NPV Costs			**$4,914,000**
BCR			**2.17**

Table 11 Programme 2 Economic Evaluation

ITEM	DO MINIMUM ($)	DO SOMETHING – PROGRAMME 2 CORRIDOR IMPROVEMENTS ($)	OPTION COMPARISON (NET BENEFIT AND COSTS OF DO SOMETHING $)
Travel Time Cost	22,504,000	8,975,000	13,529,000
Total NPV Benefits			**$13,529,000**
Capital Costs	486,000	5,400,000	$4,914,000
Maintenance Costs	157,000	157,000	-
Total NPV Costs			**$4,914,000**

BCR	2.75

The economics evaluation results summarised above show that the proposed highway infrastructure associated with both Programmes 1 and 2 generates strong BCRs of 2.17 and 2.75, respectively. By, including other sources of benefits, such as VOC, CO_2, and crash cost savings, the BCRs are likely to increase slightly.

Based on the BCR results above, the overall transport corridor improvements included in Programme 1 and 2 are considered sufficient to address the potential adverse transport effects caused by the development of Ladies Mile HIF and to provide a sustainable access for the Ladies Mile site.

6 HIF Site Strategy for Access and Movement

The level of demand that needs to be supressed to achieve future peak hour traffic volumes below 1,600 on SH6 is identified in the Transport Analysis section of this report. A range of public transport, active mode and Travel Demand Management (TDM) interventions need to be implemented in order to achieve the required mode shift and to not breach the 1600 vehicle threshold of the Shotover Bridge.

Interventions should be considered and designed in collaboration with regional and local plans such as the Wakatipu Active Transport Network DBC, SH6 Grant Road to Kawarau Falls DBC and Future PT Demand Analysis Projects.

It is also important to capitalise on the change opportunity that exists when new residents first move into the area and establish their travel behaviour. Individual transport interventions presented here are intended to be part of a system and will be less effective if implemented separately. Individual improvements are unlikely to generate step changes in alternative mode share at key trigger points (except Mass Rapid Transit and Park and Ride). Rather, transport choice should be provided from the outset and scaled to meet growing demands as development occurs.

The mode shift assumptions used in this assessment will not be achieved without significant and sustained efforts to encourage travel by alternative modes of transport. This involves the provision of improved public transport, walking and cycling facilities coupled with behavioural change initiatives. Some potential approaches are discussed below but these will need to be developed in more detailed through further studies.

6.1 Public Transport Improvements

Public transport should be frequent, reliable, timely and safe to be considered as a realistic alternative from single occupancy car trips. Buses travel in the same stream as private cars so need to be given priority in order to make them more attractive than travelling by car. Potential public transport interventions include:

- Increase in frequency (detailed in Phasing Strategy section of this report) of bus services through Ladies Mile, Lake Hayes and Shotover Country.
- Carefully designed bus routes. Convenient access needs to be provided throughout both the Ladies Mile site and existing developments, including express routes for residents close to the highway. Existing barriers to bus travel, such as interchange waits of 60 minutes and inconsistent service between inbound and outbound routes should be designed out of the new network.
- Safe and accessible bus stop infrastructure. All residents should be within 200m of a bus stop to maximise catchment. Bus stops should feel safe, be located in lit areas and match desire lines of pedestrians, whilst allowing for road crossings.

- Introduction of effective bus priority and transit lanes (as shown in Appendix D) on SH6. It is anticipated that priority at bottlenecks along SH6 will be investigated as part of the Future PT Demand Analysis project. The transit lanes should be designed to fit in with these priority measures.
- Offer promotional ridesharing 'Savvy' trips to encourage shared journeys where PT may not be available

6.2 Park and Ride

As discussed in the Transport Analysis section of this report, demand from regional and local traffic alone is expected to reach corridor capacity in the short term if left unabated. It is therefore important to capture a proportion of westbound regional traffic before it reaches the Shotover Bridge. The park and ride facility should:

- Provide frequent and direct routes and have priority over general traffic to ensure quicker journeys than by car
- Be designed within the highway strategy as demand for the facility is from regional traffic. The exact location of the facility should be determined as part of the highway strategy
- Be designed to discourage local residents from driving to the facility, as this would have the counter effect of increasing traffic volumes. The facility should be accessible by active modes for resident access
- Facilities must be good quality and comfortable for passengers to wait for and change buses

6.3 Walking and Cycling

Walking and cycling networks should be connected, direct and follow desire lines where practicable. Active mode provisions at Ladies Mile should:

- Connect Ladies Mile with key trip generators (supermarkets, schools, employment hubs) and destinations (Frankton, Queenstown CBD) and integrate well with public transport infrastructure (bus stops, Park and Ride).
- Provide cross-highway connectivity through an underpass to Lake Hayes estate and Shotover Country
- Provide paths with good sightlines and visibility, good lighting after dark and feel safe
- Provide cycle paths that are separated from traffic, direct, have minimal grades and be obstruction free
- Be designed in collaboration with the Wakatipu Active Travel Network DBC to maximise efficiency and utilise external strategic links. End of journey facilities, such as showers at work places and cycle racks should be implemented at destinations

6.4 Travel Demand Management

Travel Demand Management (TDM) can be used alongside physical infrastructure changes to encourage or redistribute people movements to different modes. TDM strategies used for similar developments to Ladies Mile have achieved a mode shift of up to 15% less car use. There are a range of measures that are relatively cheap to initiate and encourage behaviour change, such as:

- Targeted neighbourhood travel planning, providing information related to the local area and how to get to popular destinations
- Use of existing Choice app to assist in providing travel options for residents
- Incentives such as providing free Go Cards or subsidised public transport for a period of time
- Region-wide encouragement of travelling outside of peak times, working from home, using technology rather than travel to connect

- Potential to regulate requirements for the development to achieve a balanced mode share
- Advertise carpooling websites or apps where people can match to share commuter or recreational journeys
- Prioritise car parking for cars with 2+ occupants

6.5 Off-site Highway Improvements

An alternative to supressing demand at the Shotover Bridge is to provide additional capacity, through bridge widening or an additional link. A new bridge could double general traffic capacity or be implemented with bus lanes to prioritise public transport.

However, increasing capacity over the Shotover River will cause congestion at bottlenecks further west along the corridor. The bridge currently restricts the amount of traffic reaching Frankton Road, where capacity improvements are less feasible due to geographical constraints, Furthermore, a new bridge may be cost-prohibitive as the river is up to 400m wide and would require a significant structure. For these reasons, capacity upgrades over the Shotover River are unlikely in the short term.

7 Phasing and Delivery

This section sets out timing and triggers for the transport interventions recommended in previous sections of this report.

7.1 Phasing Strategy

The transport strategy laid out in Section 6 needs to be staged proactively such that required infrastructure is in place prior to capacity being reached on SH6. Staging should be tied in with other strategies and projects planned for the corridor, particularly with reference to the Future Public Transport Demand Analysis.

The phasing strategy presented here is based on the reference case and should be considered dynamic, in that it is centred on uncertain future conditions and should be updated depending on actual future conditions. If background traffic growth rates are higher than the assumed 5.69% or build rates are lower than 125 houses/year, it may be necessary to restrict construction of the development. Implementation of the strategy should also be cognisant of the lead times for design, procurement, consenting and construction to ensure interventions are in place in time. Effective monitoring of build rates and traffic growth rates is crucial to ensuring the success of the transport strategy.

Individual elements of the transport strategy are designed to be complimentary and should be implemented at the same time. For example, high quality bus stops alone are unlikely to affect mode share sufficiently and should be accompanied by active mode connections and priority measures on the network. Similarly, individual improvements are unlikely to generate step changes in alternative mode share at key trigger points (except Mass Rapid Transit and Park and Ride). Rather, transport choice should be provided from the outset and scaled to meet growing demands as development occurs.

7.2 Infrastructure Triggers

The triggers presented in A general allowance of 2 years should be made for infrastructure to be in place to allow for further business cases as required, funding, design, planning/consenting, land acquisition, procurement and construction to be completed.

Table 12 are based on the reference case assumptions adopted for this assessment (Section 4.3). It should be noted that if the assumed parameters are not achieved, demand is likely to exceed capacity at development completion; the additional demand cannot be accommodated by

bringing forward interventions. For example, a slower build rate will result in a later completion date and larger background traffic increase. Therefore, the same public transport mode share would not restrict demand below capacity at the time of completion.

These trigger points should be revisited and confirmed once more is known about construction phasing and the Transport Agency's requirements.

A general allowance of 2 years should be made for infrastructure to be in place to allow for further business cases as required, funding, design, planning/consenting, land acquisition, procurement and construction to be completed.

Table 12 Transport Intervention Triggers for Reference Case Only

		Build	Plan
Number of Dwellings (Year)	Prior to complete houses	Upgrade Howards Drive intersection to RAB Implement bus stops (detail in transport strategy) Build SH6 Underpass at Howards Drive Implement TDM Measures in Ladies Mile/Shotover Country	Design, consent future PnR Monitor traffic growth
	150 (2021)	Provide Ladies Mile bus at 60 minute frequency Provide Shotover Country/Lake Hayes bus at 10 minute frequency Provide bus priority on SH6	Monitor traffic growth
	300 (2022)		Monitor traffic growth Hold point at 450 dwellings if growth exceeds forecast
	450 (2023)	Increase Ladies Mile bus to 30 minute frequency Build park and ride Build westbound transit lanes on SH6	Monitor traffic growth
	600 (2024)	Park and Ride in place (100 spaces) with buses at 20 minute frequency Westbound transit lanes in place on SH6	Monitor traffic growth
	750 (2025)	Park and Ride in place (200 spaces) with buses at 10 minute frequency	Monitor traffic growth

8 Summary and Conclusions

This report has been prepared with the intention of supporting QLDC's business case for HIF funding towards lead transport infrastructure to enable housing development at the Ladies Mile site. The traffic impact of proposed development programmes has been assessed against the capacity of the SH6 corridor. Traffic modelling of existing and forecast conditions has informed a required package of integrated transport solutions, designed to encourage a sufficient uptake of alternative transport modes and supress traffic demand to below the corridor's capacity. The findings of the assessment can be summarised as follows:

- Traffic growth on SH6 is placing a significant strain on the already-busy corridor, with 2-year growth rates at 9.0%. With considerable development continuing in Frankton and the wider Queenstown area, growth rates are not expected to decrease significantly, other than in the event of economic downturn.
- The Ladies Mile site has significant accessibility challenges due to its' location, surrounding topography and limited connections to active modes and public transport. Car dependent development has prevailed in the past, as exemplified by Shotover County and Lake Hayes Estate; this is not sustainable into the future as there is very limited opportunity to increase highway capacity in an affordable way.
- Primary access is proposed to be directly onto SH6, which is the only regional highway to the east and north. The route is a lifeline for the Queenstown economy. As such, key stakeholders (such as NZ Transport Agency) require a level of operational efficiency and a safe environment to be maintained for all customers using the road.
- Recent surveys confirm that the pinch point in the network is in the vicinity of Shotover Bridge where the maximum traffic flow that can be accommodated in one hour is approximately 1,600 vehicles. The Transport Agency is not supportive of any scenarios that (in combination with background growth) result in peak traffic flows of more than 1,600 vehicles at this location.
- For each programme, a package of transport improvement measures have been identified with the intention of enabling the development to take place without breaching the capacity of the Shotover Bridge. These include concept designs for the immediate access points onto SH6, a range of Public Transport, walking and cycling and TDM improvements to encourage mode shift away from single occupancy car trips. Options for a Park and Ride site to capture westbound regional trips with associated bus priority measures on SH6, and the potential for re-routing some SH6 traffic via Arthurs Point have also been investigated.
- It is important to capitalise on the change opportunity when new residents first move into an area and establish their travel behaviour. Alternative travel choices should be available from the outset of the development.
- Junction analysis confirms that either roundabout or traffic signals would have capacity to cater for traffic demands at immediate access points for all proposed programmes. Therefore, it can be concluded that the highway capacity is the constraint, rather than the intersections. Traffic signals allow for more efficient pedestrian crossings, provide more control over traffic flow and allow priority to be maintained for SH6 traffic, while enabling bus priority measures at intersections to compliment the bus lanes. However, given the 80km/h speed environment, roundabouts provide higher capacity and offer a safer solution. For these reasons, NZ Transport Agency have indicated that they would not support traffic signals at the site.
- Based on a set of key assumptions, which have been sensitivity tested, traffic modelling indicates the following:

    - Programme 1 is forecast to generate 285 vehicles above capacity at completion. To keep peak hour flows at the bridge below 1,600 vehicles a mode shift of 15% and 25% is required at Ladies Mile and Lake Hayes/Shotover Country respectively.
    - Programme 2 is forecast to generate 508 vehicles above capacity at completion. To keep peak hour flows at the bridge below 1,600 vehicles a mode shift of 15% and 25% is required at Ladies Mile and Lake Hayes/Shotover Country respectively, in addition to a Park and Ride on SH6 with a turn in rate of 20%.
    - Programme 3 is forecast to generate 770 vehicles above capacity at completion. To keep peak hour flows at the bridge below 1,600 vehicles a mode shift of 40% and 40% is required at Ladies Mile and Lake Hayes/Shotover Country respectively, in addition to a Park and Ride on SH6 with a turn in rate of 20%. This would require a step change in transport infrastructure, including mass transit, an increase in highway capacity or a combination of the two.

- Programme 4 is forecast to generate 1,570 vehicles above capacity at completion. To keep peak hour flows at the bridge below 1,600 vehicles a mode shift of 50% and 50% is required at Ladies Mile and Lake Hayes/Shotover Country respectively, in addition to a Park and Ride on SH6 with a turn in rate of 40%. This would require a step change in transport infrastructure, including mass transit, an increase in highway capacity or a combination of the two.

- Economic analysis of the transport infrastructure indicates that a BCR of 2.17 can be achieved for Programme 1 and BCR of 2.75 can be achieved for Programme 2.
- Population density is considered to be too low to make MRT commercially viable at Ladies Mile. A single terminal would not provide for an sufficient catchment while multiple terminals would further increase cost. Rough order costing, provided by Doppelmayr, for an MRT solution (gondola from Ladies Mile to Frankton) put the costs in the region of $80m to $95m. Programmes 1 and 2 produce less than $15m in transport benefits, indicating that the additional cost of an MRT solution would far outweigh the benefits provided.

9 Acknowledgements

This report has been prepared by Chris Baker – Transport Engineer of WSP Opus Queenstown Offices, with professional engineering and design support and supervision provided by the following WSP Opus Team of professionally qualified engineering design specialists:

- Reece Gibson – Transportation Engineering Supervision
- Richard Hilliard – Transportation Engineering Supervision QA/QC
- Tim Cuthbert - Technical Executive - Integrated Transport Planning Lead - New Zealand
- Matthew Gatenby – Principal Engineer Transportation, modelling
- Chris Morahan – Transportation Engineering economic analysis
- Olivia Veltom – Transport Planning, public transport
- Gabriel Surja – Transportation Engineering economic analysis
- George Cheng – Civil Concept Design Draughting
- Sharmin Choudhury – Civil Concept Design Draughting
- Akaash Nanda – Transportation Engineering, intersection modelling
- Asha Shaeffer – Civil Engineering, traffic count assessments
- Liam Abott – Civil Engineering, traffic count assessments
- Brandon Ducharme – Project Management

10 Appendix A - Long List Options v1.0

TEMPLATE 1

Queenstown Lakes District Council
Housing Infrastructure Fund - Ladies Mile

Investor: QLDC
Facilitator: Tom Lucas
Initial Workshop: 12/12/2017
Version No.: 1
Last Modified by: Tom Lucas 12/12/2017

Strategic Response			Programme Options					
			Programme 0	**Programme 1**	**Programme 2**	**Programme 3**	**Programme 4**	**Programme 5**
Strategic Alternatives	**Strategic Options**	**Intervention options**	**Do Nothing**	**Do Minimum - 450 mixed lots on area D2 only (Stalker)**	**(Less ambitious?) - Programme 1 PLUS area B (Walker) PLUS 25ha at west end of D1**	**Programme 2 PLUS area A PLUS Henry's Land**	**Programme 3 Full Ladies Mile Master Plan (includes east end of D1 but excludes Area C)**	**BLAIR TO PROVIDE DWELLING NUMERS FOR EACH OF THESE PROGRAMMES**
To increase the supply of developable land	Road access to enable subdivision for new sections	Access to/from Spence paper road						
		Access to/from SH6		✓	✓	✓	✓	
		Access to/from SH6 AND local roads						
		Tee intersection on local road						
		Left In/Left Out entrance on SH6 (discounted for safety reasons)						
		Modify Stalker Rd roundabout for access						
		New roundabout on Sh6 at centre of development (existing tree lined driveway)		To be evaluated for proximity to Stalker Roundabout and loss of benefit from locating it at Howard Drive				
		New roundabout on SH6 at Howard Drive (or slightly relocated to avoid pet lodge)		✓	✓	✓	✓	
		Second access point on Lower Shotover Road				✓	✓	
		Second roundabout at east end of Ladies Mile					To be evaluated	
		Left in, travelling east on SH6 (only as an addition if Howard Drive roundabout installed)						
		Internal thru-roads (Developer cost)						
Improved Accessibility	Public transport	Bus stops internal to subdivision (Where? How many?)		QLDC/NZTA to confirm with ORC	QLDC/NZTA to confirm with ORC	QLDC/NZTA to confirm with ORC (although likely using collector bus as well as the express bus)	QLDC/NZTA to confirm with ORC (although likely using collector bus as well as the express bus)	
		One pair of Bus stops on SH6		✓	✓	✓	✓	
		Second pair of Bus stops on SH6						
		Location of bus stops at Stalker roundabout		QLDC/NZTA to confirm with ORC	QLDC/NZTA to confirm with ORC	QLDC/NZTA to confirm with ORC	QLDC/NZTA to confirm with ORC	
		Location of bus stops at Howards Drive roundabout		QLDC/NZTA to confirm with ORC	QLDC/NZTA to confirm with ORC	QLDC/NZTA to confirm with ORC	QLDC/NZTA to confirm with ORC	
		Park and ride facility adjacent to SH6, near bus stops	Already in NZTA 2018-2021 plan					
		Ladies Mile transport super-hub (parking, bike storage, shelter, etc)		QLDC/NZTA to confirm with ORC	QLDC/NZTA to confirm with ORC	QLDC/NZTA to confirm with ORC	QLDC/NZTA to confirm with ORC	
		Dedicated west-bound bus lane along SH6					NZTA to evaluate.	
	Active travel	Footbridge over Shotover River	Already in NZTA 2018-2021 plan					
		One SH6 underpass (EOI proposes Stalker roundabout location)		✓	✓	✓	✓	
		Location of underpass to suit bus stops		✓	✓	✓	✓	
		Second SH6 underpasses (Stalker Rd.)			Location to be evaluated	Location to be evaluated	Location to be evaluated	
		Second SH6 underpasses (Howards Drive)			Location to be evaluated	Location to be evaluated	Location to be evaluated	
		Second SH6 underpasses (Threepwood)			Location to be evaluated	Location to be evaluated	Location to be evaluated	
		Footpaths along SH6 (in setback reserve) to underpass and bus stops	Already in NZTA 2018-2021 plan	✓	✓	✓	✓	
		Footpaths along SH6 (in setback reserve) beyond underpass	Already in NZTA 2018-2021 plan					
	Note: the DBC should include tie-in with active travel links proposed by NZTA	Cycle paths along SH6 (in setback reserve)	Already in NZTA 2018-2021 plan					
		Cycle paths to tie in with existing at Lake Hayes	Already in NZTA 2018-2021 plan					
		Cycle paths to tie in with existing at Lake Hayes Estate	Already in NZTA 2018-2021 plan					

TEMPLATE 1

Queenstown Lakes District Council
Housing Infrastructure Fund - Ladies Mile

Investor: QLDC
Facilitator: Tom Lucas
Initial Workshop: 12/12/2017
Version No.: 1
Last Modified by: Tom Lucas 12/12/2017

Strategic Response			Programme Options					
			Programme 0	**Programme 1**	**Programme 2**	**Programme 3**	**Programme 4**	**Programme 5**
Strategic Alternatives	**Strategic Options**	**Intervention options**	**Do Nothing**	**Do Minimum - 450 mixed lots on area D2 only (Stalker)**	**(Less ambitious?) - Programme 1 PLUS area B (Walker) PLUS 25ha at west end of D1**	**Programme 2 PLUS area A PLUS Henry's Land**	**Programme 3 Full Ladies Mile Master Plan (includes east end of D1 but excludes Area C)**	**BLAIR TO PROVIDE DWELLING NUMERS FOR EACH OF THESE PROGRAMMES**
Efficient infrastructure that enables housing development	Water supply infrastructure	New dedicated stand-alone water source, treatment, storage and reticulation						
		Connect to existing watermain on SH6						
		Connect to existing reticulation in Shotover Country/Lake Hayes Estate						
		Use existing rising main along Old School Road						
		New dedicated rising and falling mains from Shotover Country borefield				To be evaluated	To be evaluated	
		New rising/falling main from Shotover Country borefield		✓	✓	To be evaluated	To be evaluated	
		Expansion of Shotover Country borefield (beyond 26 MLD) - requires at least one new bore		✓	✓	✓	✓	
		Reservoir at Site 1 (Stalker land, including pipe route-CHECK)		✓	✓	✓	✓	
		Reservoir at Site 2 (Threepwood, including pipe route-CHECK)					To be evaluated	
		Allow storage capacity for Queenstown Country Club		✓	✓	✓	✓	
		Trunk mains within the site						
		UV and chlorination treatment at bore		✓	✓	✓	✓	
		Trunk main along SH6 to Howards Drive		✓				
		Trunk main along SH6 beyond Howards Drive (east)			✓	✓	✓	
		Trunk main along Howards Drive (south), tie-in to Lake Hayes Estate at Jones Ave treatment plant			✓	✓	✓	
	Wastewater infrastructure	New wastewater treatment plant within development, with disposal to land or river (Shotover/Kawarau)						
		Dedicated rising main to Shotover WwTP						
		Connection to existing gravity sewer at Stalker roundabout (exsiting tee been installed?)		✓	✓	✓	✓	
		Connection to existing rising main at Howards Drive roundabout (requires pump station by Developer)			✓	✓	✓	
		Connection to existing gravity sewer at west end of Area A				✓	✓	
		Sewer trunk main along SH6 towards Howard Drive		T.B.C. (Ulrich)				
	Stormwater infrastructure	New pipeline to Shotover River (likely through the development, not SH6, but HIF funded only from boundary)				✓	✓	
		New pipeline to Lake Hayes (Creek?) in SH6 corridor			✓	✓	✓	
		Cut-off drains at base of slope on north side of subdivision (developer cost)						
		On-site detention basins (developer cost)						
		Secondary overland flowpaths (Developer cost)						
		Connect from boundary to existing Queenstown Country Club stormwater main		✓	✓	✓	✓	
		Crossing beneath SH6		✓	✓	✓	✓	
		Internal reticulation (developer cost)						
		Check	0	0	0	0	0	0

NOTES

1 The range of strategic alternatives/options that could respond to the identified problem and deliver the objectives for the expected benefits are listed in the left-hand columns.
2 Against the listed alternatives/options a spread of strategic programmes are structured to provide genuine alternative strategic responses to the problem.
3 Programmes should be titled to reflect the underlying strategy.
4 This is a balance of two factors: the importance of the intervention in delivering the objective and the likely effort/cost involved.

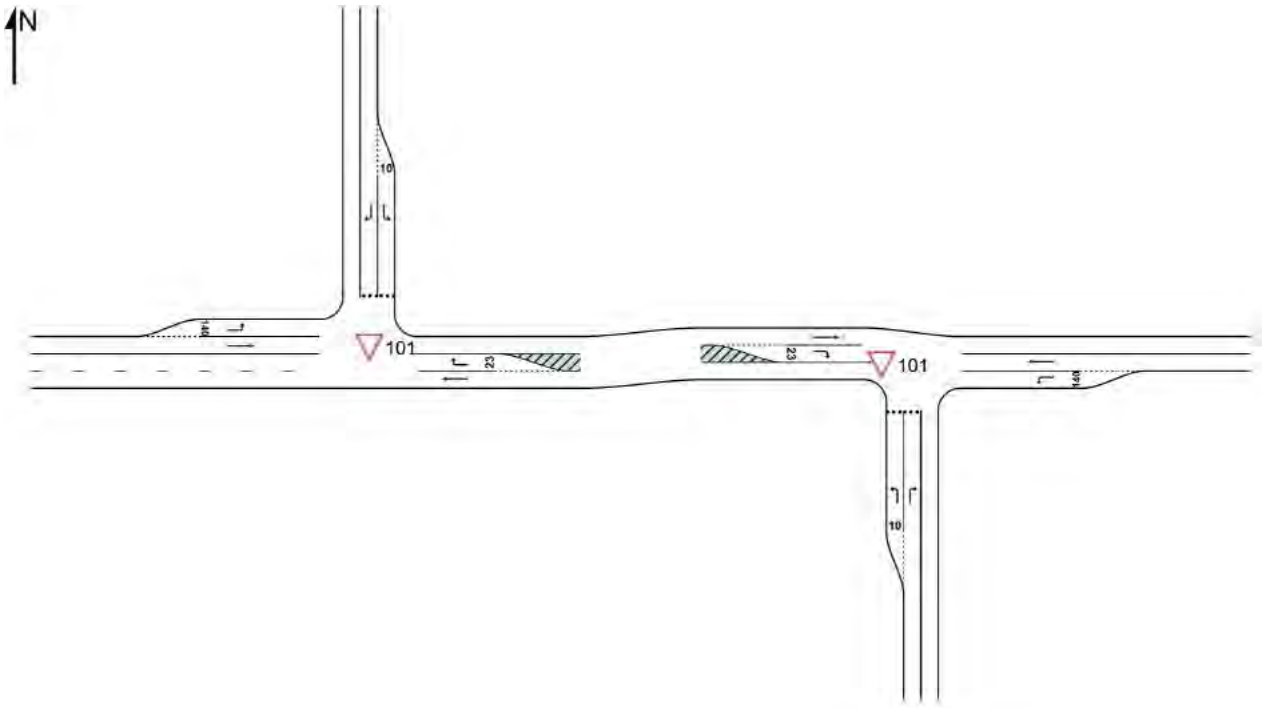
11 Appendix B - Modelling and Scenario Analysis

Do Nothing Scenario

NETWORK LAYOUT

Network: N101 [AM Base 2023]

New Network



SITES IN NETWORK		
Site ID	**CCG ID**	**Site Name**
▽101	NA	Howards Drive Intersection N AM Base 2023
▽101	NA	Howards Drive Intersection S AM Base 2023

MOVEMENT SUMMARY

Site: 101 [Howards Drive Intersection N AM Base 2023]

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Ladies Mile E											
5	T1	1193	7.0	0.640	0.0	LOS A	0.0	0.0	0.00	0.00	79.5
6	R2	21	0.0	0.028	5.8	LOS A	0.1	0.7	0.53	0.68	43.5
Approach		1214	6.9	0.640	0.1	NA	0.1	0.7	0.01	0.01	78.4
North: Access											
7	L2	27	0.0	0.036	7.3	LOS A	0.1	0.9	0.49	0.67	40.9
9	R2	209	0.0	9.063	7314.7	LOS F	139.3	974.8	1.00	2.47	0.5
Approach		236	0.0	9.063	6478.7	LOS F	139.3	974.8	0.94	2.27	0.5
West: Ladies Mile W											
10	L2	60	0.0	0.032	6.9	LOS A	0.0	0.0	0.00	0.63	65.4
11	T1	507	8.0	0.274	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
Approach		567	7.2	0.274	0.8	NA	0.0	0.0	0.00	0.07	76.8
All Vehicles		2017	6.2	9.063	758.3	NA	139.3	974.8	0.12	0.29	2.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Howards Drive Intersection N IP Base 2023]

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Ladies Mile E											
5	T1	924	7.0	0.495	0.0	LOS A	0.0	0.0	0.00	0.00	79.7
6	R2	21	0.0	0.035	7.1	LOS A	0.1	0.9	0.59	0.75	42.2
Approach		945	6.8	0.495	0.2	NA	0.1	0.9	0.01	0.02	78.2
North: Access											
7	L2	22	0.0	0.035	8.2	LOS A	0.1	0.8	0.53	0.72	40.2
9	R2	140	0.0	2.870	1746.5	LOS F	65.3	457.2	1.00	3.19	2.0
Approach		162	0.0	2.870	1510.4	LOS F	65.3	457.2	0.94	2.85	2.1
West: Ladies Mile W											
10	L2	102	0.0	0.055	6.9	LOS A	0.0	0.0	0.00	0.63	65.4
11	T1	608	8.0	0.328	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
Approach		710	6.9	0.328	1.0	NA	0.0	0.0	0.00	0.09	75.8
All Vehicles		1817	6.2	2.870	135.2	NA	65.3	457.2	0.09	0.30	12.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Howards Drive Intersection N PM Base 2023]

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Ladies Mile E											
5	T1	861	7.0	0.462	0.0	LOS A	0.0	0.0	0.00	0.00	79.7
6	R2	26	0.0	0.073	12.0	LOS B	0.2	1.7	0.77	0.89	38.2
Approach		887	6.8	0.462	0.4	NA	0.2	1.7	0.02	0.03	77.3
North: Access											
7	L2	22	0.0	0.054	11.7	LOS B	0.2	1.2	0.71	0.86	37.5
9	R2	103	0.0	3.182	2050.7	LOS F	52.8	369.8	1.00	2.57	1.7
Approach		125	0.0	3.182	1691.8	LOS F	52.8	369.8	0.95	2.27	1.8
West: Ladies Mile W											
10	L2	166	0.0	0.089	7.0	LOS A	0.0	0.0	0.00	0.63	65.4
11	T1	845	8.0	0.456	0.1	LOS A	0.0	0.0	0.00	0.00	79.7
Approach		1011	6.7	0.456	1.2	NA	0.0	0.0	0.00	0.10	75.3
All Vehicles		2023	6.3	3.182	105.3	NA	52.8	369.8	0.07	0.20	15.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Howards Drive Intersection S AM Base 2023]

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Howards Drive											
1	L2	369	1.0	0.867	27.9	LOS D	7.8	55.0	0.94	1.61	28.5
3	R2	55	7.0	0.891	161.8	LOS F	4.1	30.2	0.99	1.28	16.1
Approach		424	1.8	0.891	45.3	LOS E	7.8	55.0	0.95	1.57	24.4
East: Ladies Mile E											
4	L2	58	10.0	0.033	7.1	LOS A	0.0	0.0	0.00	0.63	62.1
5	T1	824	7.0	0.442	0.1	LOS A	0.0	0.0	0.00	0.00	79.8
Approach		882	7.2	0.442	0.5	NA	0.0	0.0	0.00	0.04	77.2
West: Ladies Mile W											
11	T1	534	7.0	0.286	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
12	R2	107	3.0	0.254	11.5	LOS B	1.0	7.0	0.76	0.91	38.5
Approach		641	6.3	0.286	1.9	NA	1.0	7.0	0.13	0.15	67.7
All Vehicles		1947	5.7	0.891	10.7	NA	7.8	55.0	0.25	0.41	50.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Howards Drive Intersection S IP Base 2023]

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Howards Drive											
1	L2	259	1.0	0.450	11.5	LOS B	2.2	15.5	0.70	0.97	37.6
3	R2	40	7.0	0.612	94.8	LOS F	2.1	15.5	0.97	1.08	22.8
Approach		299	1.8	0.612	22.7	LOS C	2.2	15.5	0.74	0.98	32.8
East: Ladies Mile E											
4	L2	69	10.0	0.040	7.1	LOS A	0.0	0.0	0.00	0.63	62.1
5	T1	665	7.0	0.357	0.0	LOS A	0.0	0.0	0.00	0.00	79.8
Approach		734	7.3	0.357	0.7	NA	0.0	0.0	0.00	0.06	76.3
West: Ladies Mile W											
11	T1	631	7.0	0.338	0.0	LOS A	0.0	0.0	0.00	0.00	79.8
12	R2	214	3.0	0.383	10.0	LOS A	1.8	13.2	0.71	0.93	39.7
Approach		845	6.0	0.383	2.5	NA	1.8	13.2	0.18	0.23	63.6
All Vehicles		1878	5.8	0.612	5.0	NA	2.2	15.5	0.20	0.28	58.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Howards Drive Intersection S PM Base 2023]

New Site
Giveway / Yield (Two-Way)

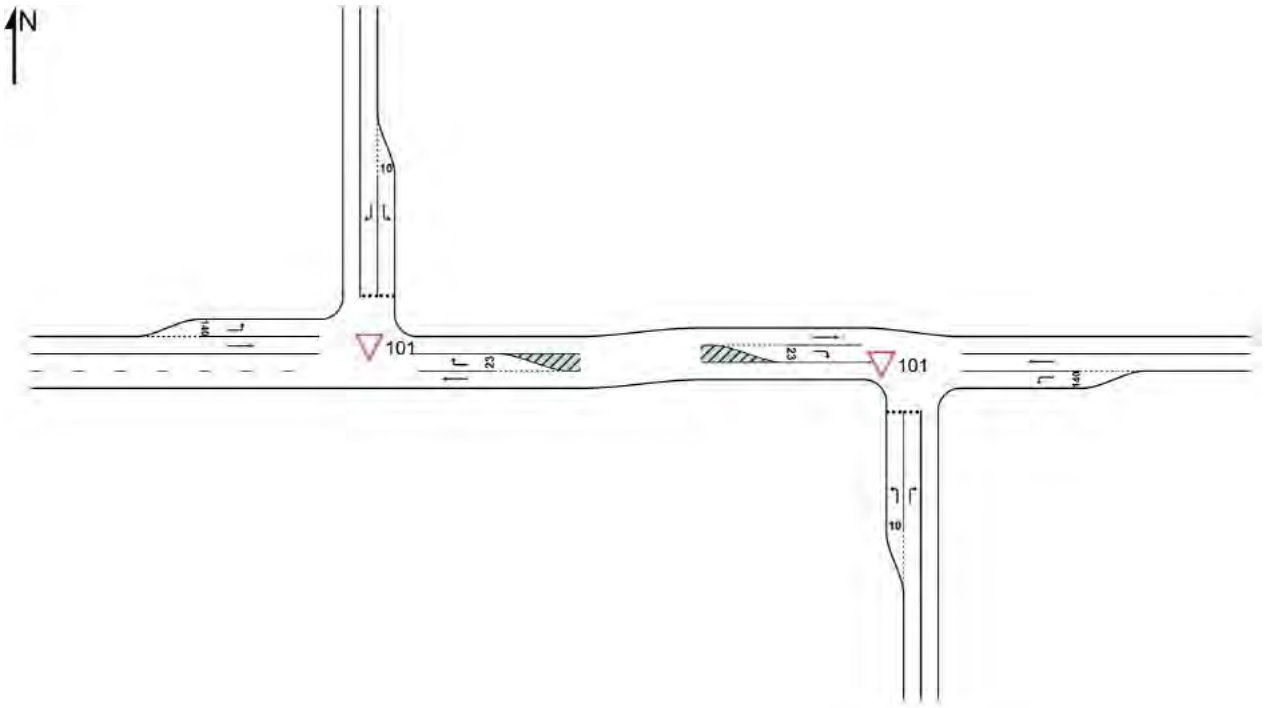
Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Howards Drive											
1	L2	207	1.0	0.353	10.5	LOS B	1.5	10.8	0.66	0.90	38.4
3	R2	33	7.0	1.501	713.0	LOS F	11.2	83.0	1.00	1.60	4.4
Approach		240	1.8	1.501	107.1	LOS F	11.2	83.0	0.71	1.00	13.8
East: Ladies Mile E											
4	L2	95	10.0	0.055	7.1	LOS A	0.0	0.0	0.00	0.63	62.1
5	T1	654	7.0	0.351	0.0	LOS A	0.0	0.0	0.00	0.00	79.8
Approach		749	7.4	0.351	0.9	NA	0.0	0.0	0.00	0.08	75.2
West: Ladies Mile W											
11	T1	867	7.0	0.701	2.0	LOS A	6.2	45.8	0.65	0.00	73.9
12	R2	368	3.0	0.670	14.3	LOS B	4.8	34.3	0.83	1.12	36.4
Approach		1235	5.8	0.701	5.7	NA	6.2	45.8	0.71	0.33	56.6
All Vehicles		2224	5.9	1.501	15.0	NA	11.2	83.0	0.47	0.32	44.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

NETWORK LAYOUT

Network: N101 [AM Base 2025]

New Network



SITES IN NETWORK		
Site ID	**CCG ID**	**Site Name**
▽101	NA	Howards Drive Intersection N AM Base 2025
▽101	NA	Howards Drive Intersection S AM Base 2025

MOVEMENT SUMMARY

Site: 101 [Howards Drive Intersection N AM Base 2025]

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Ladies Mile E											
5	T1	1342	5.0	0.711	0.0	LOS A	0.0	0.0	0.00	0.00	79.3
6	R2	21	0.0	0.030	6.2	LOS A	0.1	0.8	0.55	0.70	43.1
Approach		1363	4.9	0.711	0.1	NA	0.1	0.8	0.01	0.01	78.3
North: Access											
7	L2	27	0.0	0.039	7.6	LOS A	0.1	0.9	0.51	0.69	40.6
9	R2	209	0.0	19.637	16859.1	LOS F	170.8	1195.5	1.00	1.75	0.2
Approach		236	0.0	19.637	14931.2	LOS F	170.8	1195.5	0.94	1.63	0.2
West: Ladies Mile W											
10	L2	60	0.0	0.032	6.9	LOS A	0.0	0.0	0.00	0.63	65.4
11	T1	549	8.0	0.296	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
Approach		609	7.2	0.296	0.7	NA	0.0	0.0	0.00	0.06	77.0
All Vehicles		2208	5.0	19.637	1596.2	NA	170.8	1195.5	0.11	0.20	1.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Howards Drive Intersection N IP Base 2025]

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Ladies Mile E											
5	T1	1033	5.0	0.547	0.0	LOS A	0.0	0.0	0.00	0.00	79.6
6	R2	21	0.0	0.038	7.7	LOS A	0.1	0.9	0.62	0.78	41.7
Approach		1054	4.9	0.547	0.2	NA	0.1	0.9	0.01	0.02	78.2
North: Access											
7	L2	22	0.0	0.038	8.8	LOS A	0.1	0.9	0.57	0.75	39.7
9	R2	140	0.0	4.698	3397.6	LOS F	81.3	569.3	1.00	2.66	1.0
Approach		162	0.0	4.698	2937.3	LOS F	81.3	569.3	0.94	2.40	1.1
West: Ladies Mile W											
10	L2	102	0.0	0.055	6.9	LOS A	0.0	0.0	0.00	0.63	65.4
11	T1	659	8.0	0.356	0.0	LOS A	0.0	0.0	0.00	0.00	79.8
Approach		761	6.9	0.356	1.0	NA	0.0	0.0	0.00	0.08	76.0
All Vehicles		1977	5.3	4.698	241.2	NA	81.3	569.3	0.08	0.24	7.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Howards Drive Intersection N PM Base 2025]

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Ladies Mile E											
5	T1	954	5.0	0.505	0.0	LOS A	0.0	0.0	0.00	0.00	79.7
6	R2	26	0.0	0.086	13.9	LOS B	0.3	1.9	0.80	0.91	36.8
Approach		980	4.9	0.505	0.4	NA	0.3	1.9	0.02	0.02	77.3
North: Access											
7	L2	22	0.0	0.063	13.3	LOS B	0.2	1.4	0.75	0.88	36.3
9	R2	103	0.0	5.248	3922.6	LOS F	65.5	458.3	1.00	2.15	0.9
Approach		125	0.0	5.248	3234.6	LOS F	65.5	458.3	0.96	1.93	1.0
West: Ladies Mile W											
10	L2	166	0.0	0.089	7.0	LOS A	0.0	0.0	0.00	0.63	65.4
11	T1	916	8.0	0.494	0.1	LOS A	0.0	0.0	0.00	0.00	79.7
Approach		1082	6.8	0.494	1.1	NA	0.0	0.0	0.00	0.10	75.5
All Vehicles		2187	5.5	5.248	185.6	NA	65.5	458.3	0.06	0.17	9.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Howards Drive Intersection S AM Base 2025]

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Howards Drive											
1	L2	450	1.0	1.228	232.2	LOS F	60.8	429.0	1.00	5.17	7.1
3	R2	66	7.0	1.584	660.0	LOS F	20.2	149.7	1.00	2.16	4.8
Approach		516	1.8	1.584	286.9	LOS F	60.8	429.0	1.00	4.79	6.4
East: Ladies Mile E											
4	L2	70	10.0	0.040	7.1	LOS A	0.0	0.0	0.00	0.63	62.1
5	T1	892	7.0	0.478	0.1	LOS A	0.0	0.0	0.00	0.00	79.7
Approach		962	7.2	0.478	0.6	NA	0.0	0.0	0.00	0.05	76.9
West: Ladies Mile W											
11	T1	575	7.0	0.308	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
12	R2	131	3.0	0.366	14.7	LOS B	1.5	10.7	0.82	0.97	36.2
Approach		706	6.3	0.366	2.7	NA	1.5	10.7	0.15	0.18	65.2
All Vehicles		2184	5.6	1.584	68.9	NA	60.8	429.0	0.29	1.21	20.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Howards Drive Intersection S IP Base 2025]

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Howards Drive											
1	L2	314	1.0	0.600	14.4	LOS B	3.4	24.2	0.79	1.10	35.6
3	R2	48	7.0	1.073	294.4	LOS F	6.8	50.3	1.00	1.48	10.0
Approach		362	1.8	1.073	51.5	LOS F	6.8	50.3	0.82	1.15	22.7
East: Ladies Mile E											
4	L2	82	10.0	0.047	7.1	LOS A	0.0	0.0	0.00	0.63	62.1
5	T1	719	7.0	0.385	0.1	LOS A	0.0	0.0	0.00	0.00	79.8
Approach		801	7.3	0.385	0.8	NA	0.0	0.0	0.00	0.06	76.0
West: Ladies Mile W											
11	T1	681	7.0	0.560	1.2	LOS A	3.7	27.1	0.60	0.00	76.2
12	R2	255	3.0	0.512	12.7	LOS B	2.7	19.7	0.79	1.01	37.6
Approach		936	5.9	0.560	4.3	NA	3.7	27.1	0.65	0.27	59.5
All Vehicles		2099	5.7	1.073	11.1	NA	6.8	50.3	0.43	0.34	49.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Howards Drive Intersection S PM Base 2025]

New Site
Giveway / Yield (Two-Way)

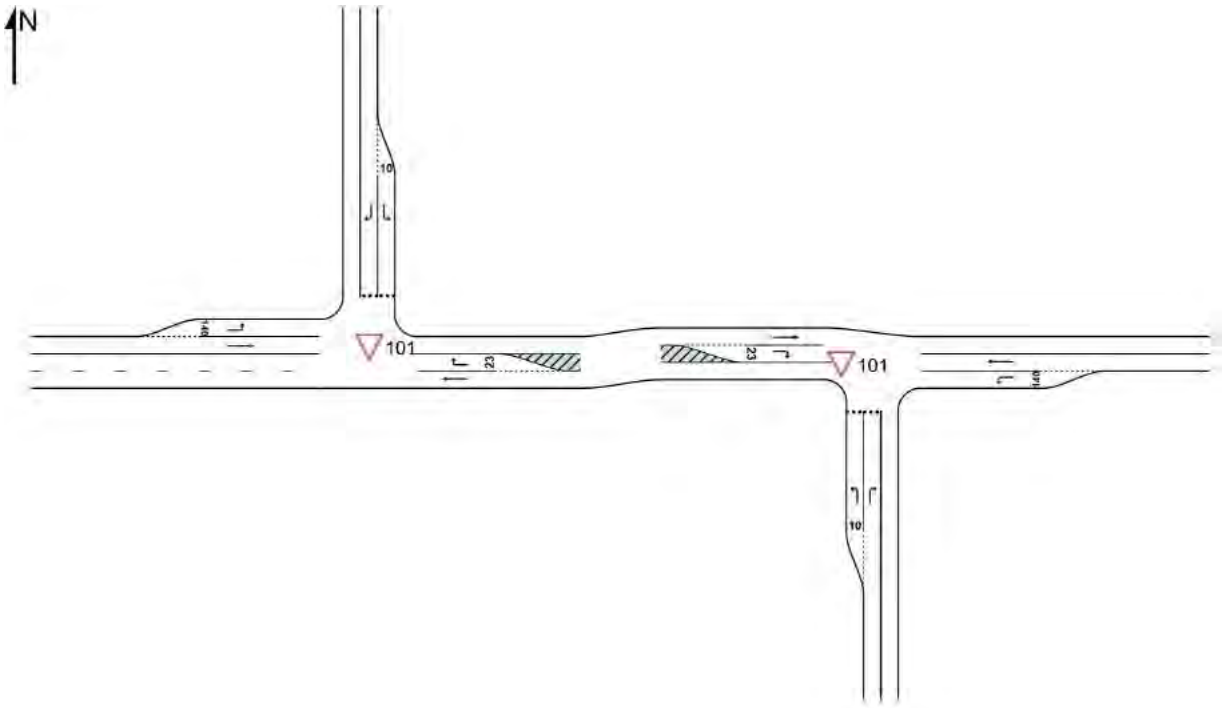
Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Howards Drive											
1	L2	248	1.0	0.462	12.3	LOS B	2.2	15.7	0.73	0.99	37.0
3	R2	42	7.0	3.475	2450.7	LOS F	27.3	202.7	1.00	1.66	1.3
Approach		290	1.9	3.475	365.5	LOS F	27.3	202.7	0.77	1.08	5.0
East: Ladies Mile E											
4	L2	112	10.0	0.065	7.1	LOS A	0.0	0.0	0.00	0.63	62.1
5	T1	705	7.0	0.378	0.1	LOS A	0.0	0.0	0.00	0.00	79.8
Approach		817	7.4	0.378	1.0	NA	0.0	0.0	0.00	0.09	74.9
West: Ladies Mile W											
11	T1	939	7.0	0.828	16.6	LOS C	20.5	151.9	0.79	0.00	47.5
12	R2	435	3.0	0.889	28.1	LOS D	10.6	76.0	0.94	1.54	29.0
Approach		1374	5.7	0.889	20.2	NA	20.5	151.9	0.84	0.49	39.5
All Vehicles		2481	5.8	3.475	54.3	NA	27.3	202.7	0.55	0.42	23.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

NETWORK LAYOUT

Network: N101 [AM Base 2028]

New Network



SITES IN NETWORK		
Site ID	**CCG ID**	**Site Name**
▽101	NA	Howards Drive Intersection N AM Base 2028
▽101	NA	Howards Drive Intersection S AM Base 2028

MOVEMENT SUMMARY

Site: 101 [Howards Drive Intersection N AM Base 2028]

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Ladies Mile E											
5	T1	1489	5.0	0.788	0.0	LOS A	0.0	0.0	0.00	0.00	78.9
6	R2	30	0.0	0.049	7.1	LOS A	0.2	1.2	0.58	0.76	42.3
Approach		1519	4.9	0.788	0.2	NA	0.2	1.2	0.01	0.02	77.6
North: Access											
7	L2	38	0.0	0.060	8.3	LOS A	0.2	1.4	0.54	0.75	40.1
9	R2	297	0.0	49.500	43748.0	LOS F	291.9	2043.2	1.00	1.45	0.1
Approach		335	0.0	49.500	38786.5	LOS F	291.9	2043.2	0.95	1.37	0.1
West: Ladies Mile W											
10	L2	85	0.0	0.046	6.9	LOS A	0.0	0.0	0.00	0.63	65.4
11	T1	611	8.0	0.330	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
Approach		696	7.0	0.330	0.9	NA	0.0	0.0	0.00	0.08	76.3
All Vehicles		2550	4.8	49.500	5095.8	NA	291.9	2043.2	0.13	0.21	0.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Howards Drive Intersection N IP Base 2028]

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Ladies Mile E											
5	T1	1147	5.0	0.607	0.0	LOS A	0.0	0.0	0.00	0.00	79.5
6	R2	30	0.0	0.066	9.5	LOS A	0.2	1.6	0.70	0.86	40.2
Approach		1177	4.9	0.607	0.3	NA	0.2	1.6	0.02	0.02	77.6
North: Access											
7	L2	31	0.0	0.061	9.8	LOS A	0.2	1.4	0.63	0.83	38.8
9	R2	200	0.0	14.314	12058.3	LOS F	151.2	1058.2	1.00	1.96	0.3
Approach		231	0.0	14.314	10441.4	LOS F	151.2	1058.2	0.95	1.80	0.3
West: Ladies Mile W											
10	L2	144	0.0	0.078	7.0	LOS A	0.0	0.0	0.00	0.63	65.4
11	T1	735	8.0	0.397	0.1	LOS A	0.0	0.0	0.00	0.00	79.8
Approach		879	6.7	0.397	1.2	NA	0.0	0.0	0.00	0.10	75.3
All Vehicles		2287	5.1	14.314	1055.2	NA	151.2	1058.2	0.11	0.23	2.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Howards Drive Intersection N PM Base 202□]

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Ladies Mile E											
5	T1	1060	5.0	0.561	0.0	LOS A	0.0	0.0	0.00	0.00	79.6
6	R2	37	0.0	0.180	20.5	LOS C	0.6	4.0	0.88	0.95	32.7
Approach		1097	4.8	0.561	0.7	NA	0.6	4.0	0.03	0.03	75.9
North: Access											
7	L2	32	0.0	0.121	16.9	LOS C	0.4	2.5	0.82	0.92	34.1
9	R2	147	0.0	17.818	15258.0	LOS F	128.7	900.7	1.00	1.59	0.2
Approach		179	0.0	17.818	12533.3	LOS F	128.7	900.7	0.97	1.47	0.3
West: Ladies Mile W											
10	L2	236	0.0	0.127	7.0	LOS A	0.0	0.0	0.00	0.63	65.4
11	T1	1023	8.0	0.552	0.1	LOS A	0.0	0.0	0.00	0.00	79.6
Approach		1259	6.5	0.552	1.4	NA	0.0	0.0	0.00	0.12	74.7
All Vehicles		2535	5.3	17.818	886.0	NA	128.7	900.7	0.08	0.18	2.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Howards Drive Intersection S AM Base 2028]

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Howards Drive											
1	L2	490	1.0	1.743	688.6	LOS F	137.8	972.7	1.00	8.13	2.6
3	R2	71	7.0	3.181	2088.5	LOS F	38.8	287.8	1.00	2.14	1.6
Approach		561	1.8	3.181	865.7	LOS F	137.8	972.7	1.00	7.37	2.3
East: Ladies Mile E											
4	L2	74	10.0	0.043	7.1	LOS A	0.0	0.0	0.00	0.63	62.1
5	T1	999	7.0	0.536	0.1	LOS A	0.0	0.0	0.00	0.00	79.7
Approach		1073	7.2	0.536	0.6	NA	0.0	0.0	0.00	0.04	77.0
West: Ladies Mile W											
11	T1	649	7.0	0.348	0.0	LOS A	0.0	0.0	0.00	0.00	79.8
12	R2	142	3.0	0.512	21.3	LOS C	2.2	15.6	0.89	1.03	32.2
Approach		791	6.3	0.512	3.8	NA	2.2	15.6	0.16	0.19	63.1
All Vehicles		2425	5.6	3.181	201.8	NA	137.8	972.7	0.28	1.79	8.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Howards Drive Intersection S IP Base 2028]

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Howards Drive											
1	L2	341	1.0	0.772	21.0	LOS C	5.4	38.1	0.90	1.34	31.7
3	R2	52	7.0	2.015	1077.5	LOS F	22.0	163.0	1.00	1.98	3.0
Approach		393	1.8	2.015	160.8	LOS F	22.0	163.0	0.91	1.43	10.2
East: Ladies Mile E											
4	L2	86	10.0	0.050	7.1	LOS A	0.0	0.0	0.00	0.63	62.1
5	T1	806	7.0	0.432	0.1	LOS A	0.0	0.0	0.00	0.00	79.8
Approach		892	7.3	0.432	0.7	NA	0.0	0.0	0.00	0.06	76.1
West: Ladies Mile W											
11	T1	766	7.0	0.679	2.4	LOS A	6.1	45.1	0.72	0.00	72.9
12	R2	274	3.0	0.654	17.7	LOS C	3.9	27.8	0.87	1.11	34.3
Approach		1040	5.9	0.679	6.4	NA	6.1	45.1	0.76	0.29	56.2
All Vehicles		2325	5.8	2.015	30.3	NA	22.0	163.0	0.49	0.40	32.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Howards Drive Intersection S PM Base 2028]

New Site
Giveway / Yield (Two-Way)

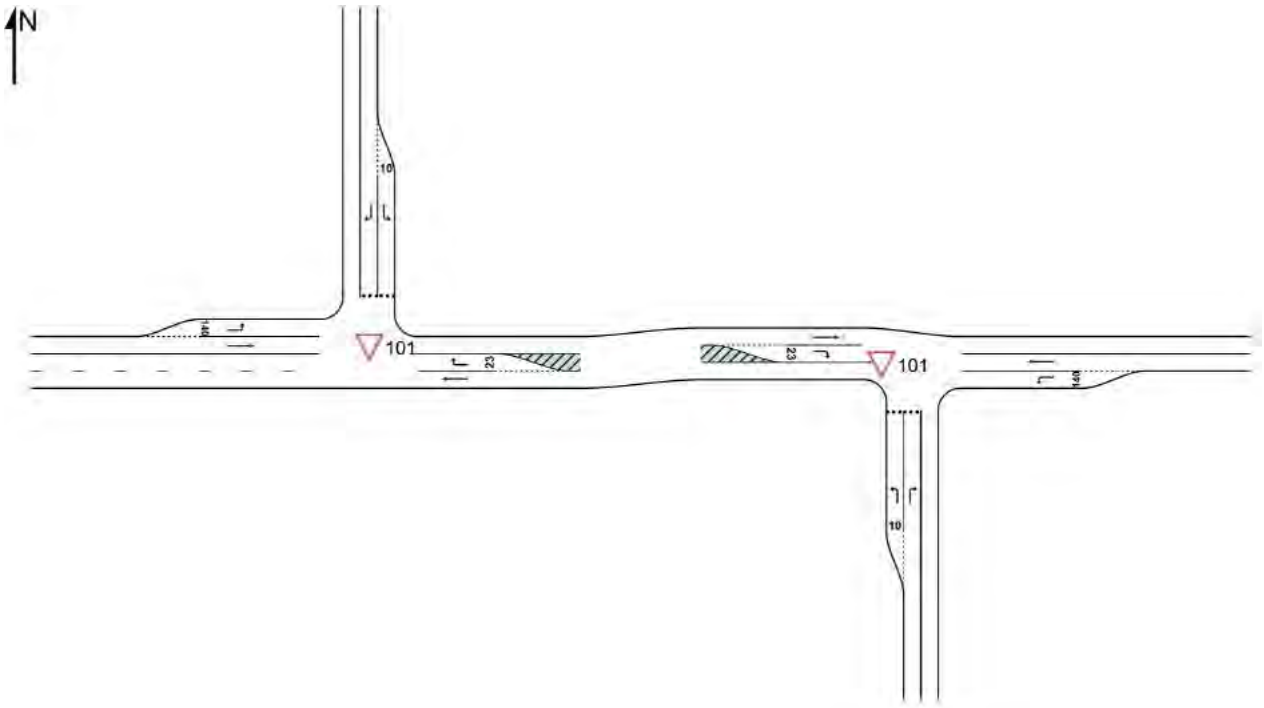
Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Howards Drive											
1	L2	268	1.0	0.590	15.9	LOS C	3.1	21.8	0.82	1.10	34.7
3	R2	46	7.0	7.667	6276.8	LOS F	42.7	316.6	1.00	1.41	0.5
Approach		314	1.9	7.667	933.1	LOS F	42.7	316.6	0.85	1.15	2.1
East: Ladies Mile E											
4	L2	117	10.0	0.067	7.1	LOS A	0.0	0.0	0.00	0.63	62.1
5	T1	792	7.0	0.425	0.1	LOS A	0.0	0.0	0.00	0.00	79.8
Approach		909	7.4	0.425	1.0	NA	0.0	0.0	0.00	0.08	75.1
West: Ladies Mile W											
11	T1	1054	7.0	1.103	124.5	LOS F	99.2	735.7	1.00	0.00	12.9
12	R2	466	3.0	1.133	152.1	LOS F	45.8	328.5	1.00	3.23	10.1
Approach		1520	5.8	1.133	132.9	NA	99.2	735.7	1.00	0.99	11.9
All Vehicles		2743	5.9	7.667	180.8	NA	99.2	735.7	0.65	0.71	9.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

NETWORK LAYOUT

Network: N101 [AM Base 2037]

New Network



SITES IN NETWORK		
Site ID	**CCG ID**	**Site Name**
▽101	NA	Howards Drive Intersection N AM Base 2037
▽101	NA	Howards Drive Intersection S AM Base 2037

MOVEMENT SUMMARY

Site: 101 [Howards Drive Intersection N AM Base 2037]

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Ladies Mile E											
5	T1	2190	5.0	1.160	5.5	LOS A	0.0	0.0	0.00	0.00	19.0
6	R2	33	0.0	0.083	10.8	LOS B	0.3	1.9	0.74	0.88	39.1
Approach		2223	4.9	1.160	5.6	NA	0.3	1.9	0.01	0.01	19.1
North: Access											
7	L2	41	0.0	0.099	11.8	LOS B	0.3	2.2	0.71	0.86	37.4
9	R2	330	0.0	55.000	48652.5	LOS F	295.0	2065.3	1.00	1.53	0.1
Approach		371	0.0	55.000	43277.1	LOS F	295.0	2065.3	0.97	1.46	0.1
West: Ladies Mile W											
10	L2	94	0.0	0.051	6.9	LOS A	0.0	0.0	0.00	0.63	65.4
11	T1	840	8.0	0.453	0.1	LOS A	0.0	0.0	0.00	0.00	79.8
Approach		934	7.2	0.453	0.8	NA	0.0	0.0	0.00	0.06	76.8
All Vehicles		3528	5.0	55.000	4554.7	NA	295.0	2065.3	0.11	0.18	0.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Howards Drive Intersection N IP Base 2037]

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Ladies Mile E											
5	T1	1663	5.0	0.881	0.0	LOS A	0.0	0.0	0.00	0.00	77.9
6	R2	33	0.0	0.131	16.6	LOS C	0.4	2.9	0.85	0.93	35.0
Approach		1696	4.9	0.881	0.4	NA	0.4	2.9	0.02	0.02	76.1
North: Access											
7	L2	35	0.0	0.124	16.0	LOS C	0.4	2.6	0.81	0.91	34.6
9	R2	222	0.0	37.000	32488.4	LOS F	208.1	1456.8	1.00	1.48	0.1
Approach		257	0.0	37.000	28066.1	LOS F	208.1	1456.8	0.97	1.40	0.1
West: Ladies Mile W											
10	L2	160	0.0	0.086	7.0	LOS A	0.0	0.0	0.00	0.63	65.4
11	T1	998	8.0	0.538	0.1	LOS A	0.0	0.0	0.00	0.00	79.6
Approach		1158	6.9	0.538	1.0	NA	0.0	0.0	0.00	0.09	75.8
All Vehicles		3111	5.2	37.000	2319.1	NA	208.1	1456.8	0.09	0.16	0.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Howards Drive Intersection N PM Base 2037]

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Ladies Mile E											
5	T1	1506	5.0	0.797	0.0	LOS A	0.0	0.0	0.00	0.00	78.9
6	R2	42	0.0	0.732	123.0	LOS F	2.4	16.8	0.99	1.07	12.0
Approach		1548	4.9	0.797	3.4	NA	2.4	16.8	0.03	0.03	68.5
North: Access											
7	L2	35	0.0	0.506	72.3	LOS F	1.4	10.1	0.97	1.04	17.3
9	R2	163	0.0	27.167	23651.5	LOS F	151.4	1059.5	1.00	1.48	0.2
Approach		198	0.0	27.167	19483.4	LOS F	151.4	1059.5	1.00	1.40	0.2
West: Ladies Mile W											
10	L2	262	0.0	0.141	7.0	LOS A	0.0	0.0	0.00	0.63	65.4
11	T1	1377	8.0	0.743	0.3	LOS A	0.0	0.0	0.00	0.00	79.1
Approach		1639	6.7	0.743	1.3	NA	0.0	0.0	0.00	0.10	75.0
All Vehicles		3385	5.5	27.167	1141.8	NA	151.4	1059.5	0.07	0.14	1.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Howards Drive Intersection S AM Base 2037]

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Howards Drive											
1	L2	501	1.0	76.214	67763.3	LOS F	473.0	3339.0	1.00	1.51	0.0
3	R2	72	7.0	12.000	10056.5	LOS F	64.8	480.9	1.00	1.47	0.3
Approach		573	1.8	76.214	60512.2	LOS F	473.0	3339.0	1.00	1.51	0.0
East: Ladies Mile E											
4	L2	75	10.0	0.043	7.1	LOS A	0.0	0.0	0.00	0.63	62.1
5	T1	1689	7.0	0.906	0.8	LOS A	0.0	0.0	0.00	0.00	77.3
Approach		1764	7.1	0.906	1.1	NA	0.0	0.0	0.00	0.03	75.8
West: Ladies Mile W											
11	T1	882	7.0	7.776	6603.5	LOS F	710.0	5268.3	1.00	0.00	0.3
12	R2	145	3.0	10.353	8506.7	LOS F	106.0	761.4	1.00	1.66	0.2
Approach		1027	6.4	10.353	6872.2	NA	710.0	5268.3	1.00	0.24	0.3
All Vehicles		3364	6.0	76.214	12405.8	NA	710.0	5268.3	0.48	0.34	0.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Howards Drive Intersection S IP Base 2037]

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Howards Drive											
1	L2	349	1.0	3.709	2463.3	LOS F	169.3	1195.5	1.00	5.72	0.8
3	R2	54	7.0	9.000	7411.2	LOS F	48.9	363.1	1.00	1.44	0.5
Approach		403	1.8	9.000	3126.3	LOS F	169.3	1195.5	1.00	5.14	0.7
East: Ladies Mile E											
4	L2	87	10.0	0.050	7.1	LOS A	0.0	0.0	0.00	0.63	62.1
5	T1	1315	7.0	0.705	0.2	LOS A	0.0	0.0	0.00	0.00	79.3
Approach		1402	7.2	0.705	0.6	NA	0.0	0.0	0.00	0.04	76.9
West: Ladies Mile W											
11	T1	1032	7.0	2.273	1204.9	LOS F	419.4	3111.9	1.00	0.00	1.5
12	R2	279	3.0	2.731	1589.0	LOS F	118.7	852.5	1.00	4.00	1.2
Approach		1311	6.1	2.731	1286.7	NA	419.4	3111.9	1.00	0.85	1.4
All Vehicles		3116	6.1	9.000	946.0	NA	419.4	3111.9	0.55	1.04	2.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Howards Drive Intersection S PM Base 2037]

New Site
Giveway / Yield (Two-Way)

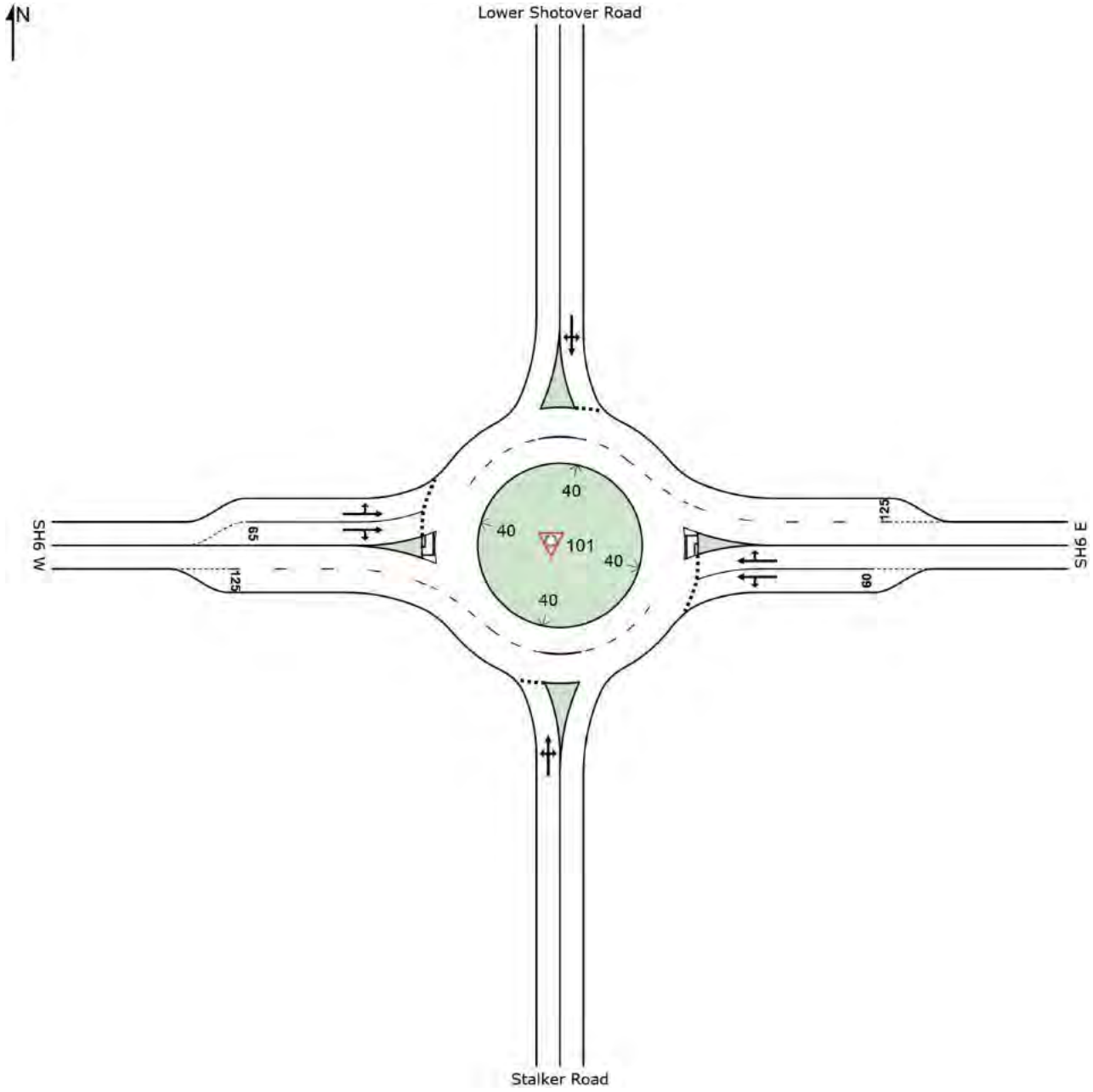
Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Howards Drive											
1	L2	273	1.0	2.059	984.4	LOS F	94.2	665.3	1.00	5.56	1.9
3	R2	47	7.0	7.833	6351.0	LOS F	41.0	304.2	1.00	1.45	0.5
Approach		320	1.9	7.833	1772.6	LOS F	94.2	665.3	1.00	4.96	1.2
East: Ladies Mile E											
4	L2	119	10.0	0.069	7.1	LOS A	0.0	0.0	0.00	0.63	62.1
5	T1	1233	7.0	0.661	0.2	LOS A	0.0	0.0	0.00	0.00	79.4
Approach		1352	7.3	0.661	0.8	NA	0.0	0.0	0.00	0.06	76.1
West: Ladies Mile W											
11	T1	1412	7.0	2.863	1705.0	LOS F	620.8	4606.2	1.00	0.00	1.1
12	R2	476	3.0	3.679	2430.4	LOS F	227.7	1634.7	1.00	5.22	0.8
Approach		1888	6.0	3.679	1887.9	NA	620.8	4606.2	1.00	1.32	1.0
All Vehicles		3560	6.1	7.833	1160.8	NA	620.8	4606.2	0.62	1.16	1.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 101 [Stalker Road/SH6 AM Roundabout Existing 2023]

New Site
Roundabout



MOVEMENT SUMMARY

Site: 101 [Stalker Road/SH6 AM Roundabout Existing 2023]

New Site
Roundabout

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Stalker Road											
1	L2	398	2.0	1.811	379.6	LOS F	75.5	536.4	1.00	3.84	8.3
2	T1	27	0.0	1.811	379.0	LOS F	75.5	536.4	1.00	3.84	8.4
3	R2	42	0.0	1.811	385.2	LOS F	75.5	536.4	1.00	3.84	8.4
Approach		467	1.7	1.811	380.1	LOS F	75.5	536.4	1.00	3.84	8.3
East: SH6 E											
4	L2	31	5.0	0.811	15.2	LOS B	12.6	91.7	0.96	0.97	50.5
5	T1	1337	5.0	0.892	18.1	LOS B	18.5	134.8	0.98	1.03	57.6
6	R2	34	5.0	0.892	27.3	LOS B	18.5	134.8	1.00	1.08	50.1
Approach		1402	5.0	0.892	18.3	LOS B	18.5	134.8	0.98	1.03	57.3
North: Lower Shotover Road											
7	L2	21	5.0	0.222	7.9	LOS A	1.0	7.1	0.59	0.82	60.0
8	T1	18	0.0	0.222	8.2	LOS A	1.0	7.1	0.59	0.82	54.2
9	R2	150	5.0	0.222	15.3	LOS B	1.0	7.1	0.59	0.82	62.0
Approach		189	4.5	0.222	13.8	LOS A	1.0	7.1	0.59	0.82	61.0
West: SH6 W											
10	L2	198	8.0	0.269	5.7	LOS A	1.8	13.4	0.26	0.46	56.7
11	T1	612	8.0	0.296	5.9	LOS A	2.1	15.6	0.25	0.48	67.3
12	R2	113	5.0	0.296	12.7	LOS A	2.1	15.6	0.25	0.49	59.8
Approach		923	7.6	0.296	6.7	LOS A	2.1	15.6	0.25	0.48	63.8
All Vehicles		2981	5.3	1.811	71.1	LOS F	75.5	536.4	0.73	1.29	30.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Stalker Road/SH6 IP Roundabout Existing 2023]

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Stalker Road											
1	L2	259	2.0	0.491	7.7	LOS A	3.0	21.3	0.81	0.94	52.4
2	T1	20	0.0	0.491	7.1	LOS A	3.0	21.3	0.81	0.94	54.4
3	R2	40	0.0	0.491	13.3	LOS A	3.0	21.3	0.81	0.94	54.5
Approach		319	1.6	0.491	8.4	LOS A	3.0	21.3	0.81	0.94	52.8
East: SH6 E											
4	L2	22	5.0	0.367	7.1	LOS A	2.5	18.2	0.59	0.59	54.8
5	T1	1005	5.0	0.403	7.2	LOS A	3.0	22.2	0.58	0.57	66.1
6	R2	38	5.0	0.403	13.9	LOS A	3.0	22.2	0.57	0.56	58.5
Approach		1065	5.0	0.403	7.4	LOS A	3.0	22.2	0.58	0.57	65.6
North: Lower Shotover Road											
7	L2	26	5.0	0.287	9.1	LOS A	1.4	9.8	0.69	0.88	59.4
8	T1	35	0.0	0.287	9.4	LOS A	1.4	9.8	0.69	0.88	53.7
9	R2	148	5.0	0.287	16.5	LOS B	1.4	9.8	0.69	0.88	61.4
Approach		209	4.2	0.287	14.4	LOS A	1.4	9.8	0.69	0.88	59.7
West: SH6 W											
10	L2	172	8.0	0.354	5.8	LOS A	2.5	19.0	0.33	0.47	56.3
11	T1	858	8.0	0.389	6.1	LOS A	3.0	22.4	0.32	0.49	66.8
12	R2	163	5.0	0.389	12.9	LOS A	3.0	22.4	0.31	0.51	59.3
Approach		1193	7.6	0.389	7.0	LOS A	3.0	22.4	0.32	0.49	64.0
All Vehicles		2786	5.7	0.491	7.9	LOS A	3.0	22.4	0.50	0.60	62.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Stalker Road/SH6 PM Roundabout Existing 2023]

New Site
Roundabout

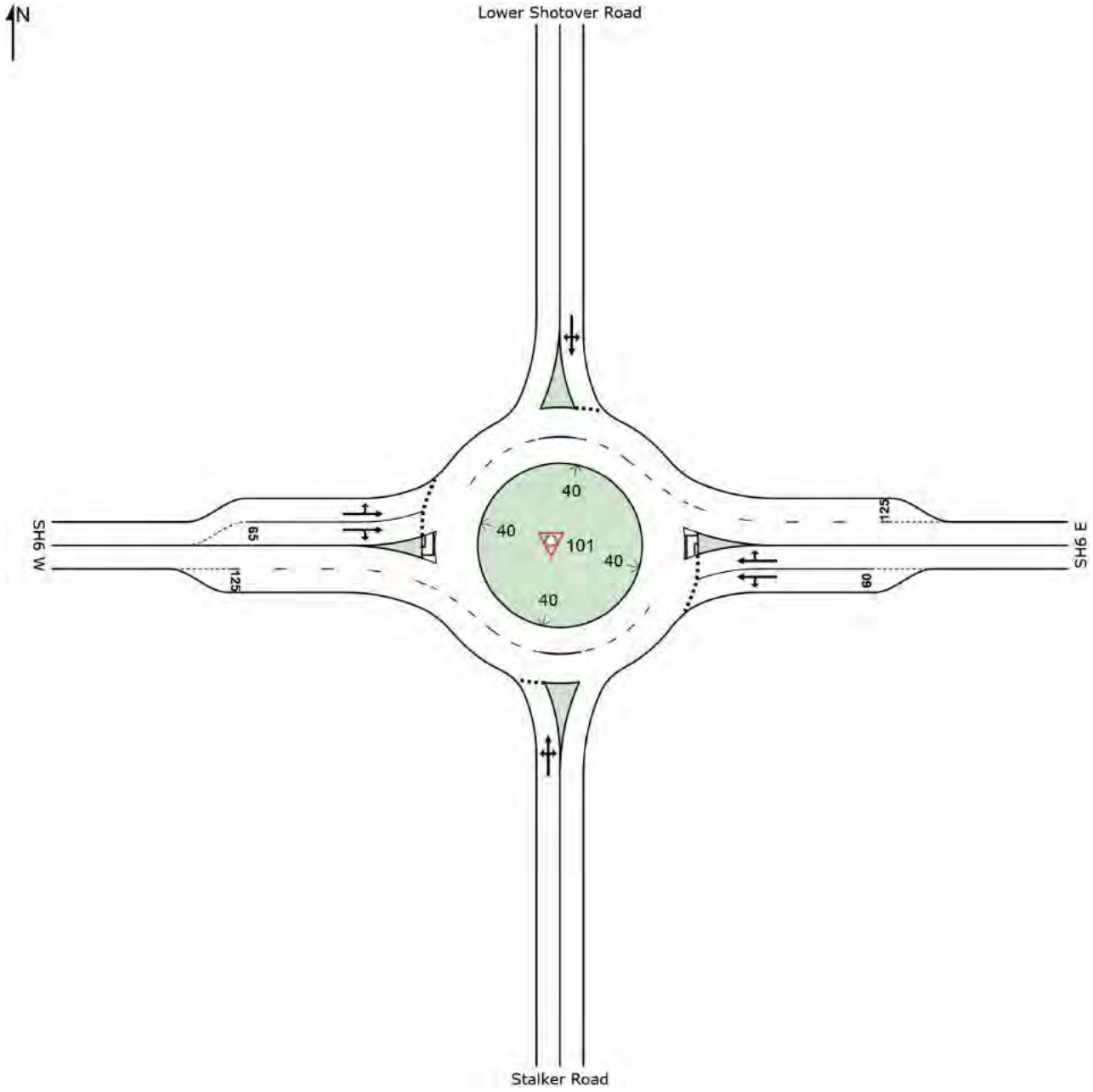
Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Stalker Road											
1	L2	177	2.0	0.371	6.3	LOS A	2.0	14.3	0.77	0.86	53.1
2	T1	17	0.0	0.371	5.7	LOS A	2.0	14.3	0.77	0.86	55.1
3	R2	47	0.0	0.371	11.9	LOS A	2.0	14.3	0.77	0.86	55.3
Approach		241	1.5	0.371	7.3	LOS A	2.0	14.3	0.77	0.86	53.7
East: SH6 E											
4	L2	18	5.0	0.368	8.0	LOS A	2.6	18.8	0.69	0.66	54.2
5	T1	897	5.0	0.405	7.9	LOS A	3.2	23.6	0.69	0.63	65.2
6	R2	50	5.0	0.405	14.5	LOS B	3.2	23.6	0.68	0.62	57.7
Approach		965	5.0	0.405	8.3	LOS A	3.2	23.6	0.69	0.63	64.5
North: Lower Shotover Road											
7	L2	38	5.0	0.529	15.5	LOS B	3.4	24.8	0.87	1.03	54.5
8	T1	60	0.0	0.529	15.7	LOS B	3.4	24.8	0.87	1.03	49.7
9	R2	178	5.0	0.529	22.9	LOS B	3.4	24.8	0.87	1.03	56.2
Approach		276	3.9	0.529	20.3	LOS B	3.4	24.8	0.87	1.03	54.4
West: SH6 W											
10	L2	184	8.0	0.518	6.1	LOS A	4.4	33.3	0.43	0.49	55.7
11	T1	1294	8.0	0.569	6.3	LOS A	5.4	39.8	0.42	0.51	66.1
12	R2	248	5.0	0.569	13.1	LOS A	5.4	39.8	0.41	0.52	58.7
Approach		1726	7.6	0.569	7.3	LOS A	5.4	39.8	0.42	0.51	63.7
All Vehicles		3208	6.0	0.569	8.7	LOS A	5.4	39.8	0.56	0.62	62.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 101 [Stalker Road/SH6 AM Roundabout Existing 2025]

New Site
Roundabout



MOVEMENT SUMMARY

Site: 101 [Stalker Road/SH6 AM Roundabout Existing 2025]

New Site
Roundabout

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Stalker Road											
1	L2	480	2.0	2.458	668.2	LOS F	116.6	827.9	1.00	4.33	5.0
2	T1	28	0.0	2.458	667.6	LOS F	116.6	827.9	1.00	4.33	5.1
3	R2	52	0.0	2.458	673.7	LOS F	116.6	827.9	1.00	4.33	5.1
Approach		560	1.7	2.458	668.7	LOS F	116.6	827.9	1.00	4.33	5.0
East: SH6 E											
4	L2	41	5.0	0.926	25.2	LOS B	21.6	157.4	1.00	1.20	44.7
5	T1	1473	5.0	1.018	35.2	LOS C	35.7	260.3	1.00	1.35	45.8
6	R2	37	5.0	1.018	50.7	LOS D	35.7	260.3	1.00	1.48	38.3
Approach		1551	5.0	1.018	35.3	LOS C	35.7	260.3	1.00	1.35	45.6
North: Lower Shotover Road											
7	L2	21	5.0	0.239	8.2	LOS A	1.1	7.8	0.61	0.85	59.8
8	T1	20	0.0	0.239	8.5	LOS A	1.1	7.8	0.61	0.85	54.0
9	R2	155	5.0	0.239	15.6	LOS B	1.1	7.8	0.61	0.85	61.8
Approach		196	4.5	0.239	14.1	LOS A	1.1	7.8	0.61	0.85	60.7
West: SH6 W											
10	L2	215	8.0	0.296	5.7	LOS A	2.0	15.3	0.27	0.46	56.7
11	T1	666	8.0	0.325	5.9	LOS A	2.4	17.8	0.25	0.48	67.2
12	R2	137	5.0	0.325	12.7	LOS A	2.4	17.8	0.25	0.49	59.6
Approach		1018	7.6	0.325	6.8	LOS A	2.4	17.8	0.26	0.48	63.7
All Vehicles		3325	5.2	2.458	132.0	LOS F	116.6	827.9	0.75	1.55	20.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Stalker Road/SH6 IP Roundabout Existing 2025]

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Stalker Road											
1	L2	314	2.0	0.646	10.8	LOS A	4.7	33.7	0.89	1.06	50.2
2	T1	21	0.0	0.646	10.2	LOS A	4.7	33.7	0.89	1.06	52.0
3	R2	49	0.0	0.646	16.4	LOS B	4.7	33.7	0.89	1.06	52.1
Approach		384	1.6	0.646	11.5	LOS A	4.7	33.7	0.89	1.06	50.5
East: SH6 E											
4	L2	31	5.0	0.416	7.5	LOS A	2.9	21.5	0.64	0.62	54.5
5	T1	1101	5.0	0.458	7.5	LOS A	3.6	26.6	0.63	0.60	65.7
6	R2	41	5.0	0.458	14.2	LOS A	3.6	26.6	0.63	0.58	58.1
Approach		1173	5.0	0.458	7.8	LOS A	3.6	26.6	0.63	0.60	65.0
North: Lower Shotover Road											
7	L2	26	5.0	0.325	9.9	LOS A	1.6	11.7	0.74	0.91	58.8
8	T1	38	0.0	0.325	10.1	LOS A	1.6	11.7	0.74	0.91	53.2
9	R2	153	5.0	0.325	17.2	LOS B	1.6	11.7	0.74	0.91	60.8
Approach		217	4.1	0.325	15.1	LOS B	1.6	11.7	0.74	0.91	59.1
West: SH6 W											
10	L2	187	8.0	0.399	6.0	LOS A	3.0	22.8	0.38	0.48	56.1
11	T1	940	8.0	0.439	6.2	LOS A	3.6	27.0	0.37	0.50	66.4
12	R2	202	5.0	0.439	12.9	LOS A	3.6	27.0	0.36	0.52	58.9
Approach		1329	7.5	0.439	7.2	LOS A	3.6	27.0	0.37	0.50	63.5
All Vehicles		3103	5.6	0.646	8.5	LOS A	4.7	33.7	0.56	0.64	61.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Stalker Road/SH6 PM Roundabout Existing 2025]

New Site
Roundabout

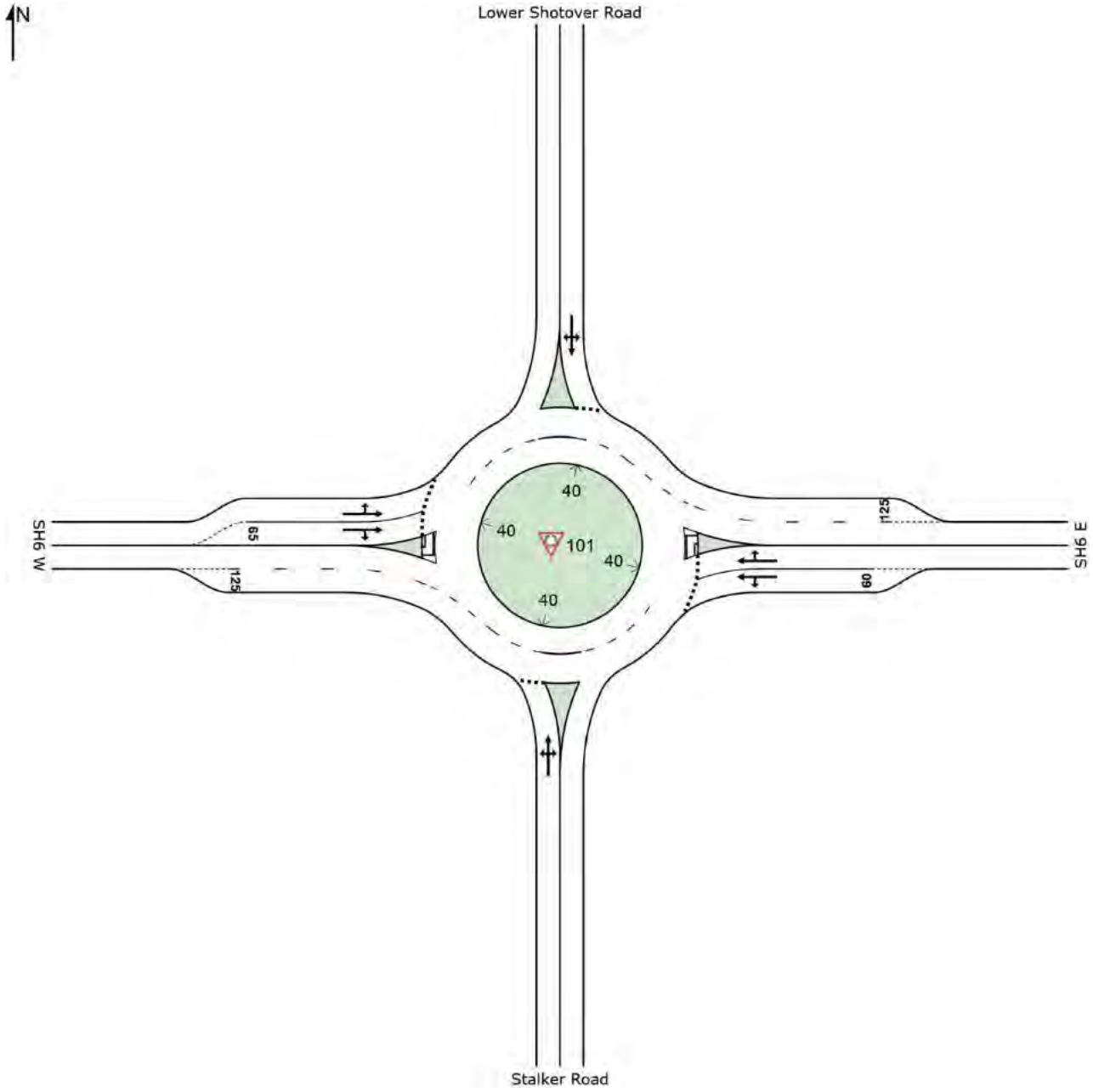
Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Stalker Road											
1	L2	217	2.0	0.489	8.0	LOS A	3.1	21.7	0.84	0.96	51.9
2	T1	18	0.0	0.489	7.4	LOS A	3.1	21.7	0.84	0.96	53.8
3	R2	56	0.0	0.489	13.6	LOS A	3.1	21.7	0.84	0.96	54.0
Approach		291	1.5	0.489	9.0	LOS A	3.1	21.7	0.84	0.96	52.4
East: SH6 E											
4	L2	28	5.0	0.426	8.7	LOS A	3.1	22.7	0.76	0.71	53.9
5	T1	975	5.0	0.468	8.5	LOS A	4.0	29.0	0.76	0.68	64.6
6	R2	54	5.0	0.468	15.1	LOS B	4.0	29.0	0.76	0.66	57.2
Approach		1057	5.0	0.468	8.9	LOS A	4.0	29.0	0.76	0.68	63.9
North: Lower Shotover Road											
7	L2	38	5.0	0.665	23.0	LOS B	5.1	36.9	0.94	1.13	49.4
8	T1	65	0.0	0.665	23.2	LOS B	5.1	36.9	0.94	1.13	45.4
9	R2	184	5.0	0.665	30.4	LOS C	5.1	36.9	0.94	1.13	50.8
Approach		287	3.9	0.665	27.8	LOS B	5.1	36.9	0.94	1.13	49.2
West: SH6 W											
10	L2	200	8.0	0.587	6.3	LOS A	5.6	41.8	0.50	0.51	55.3
11	T1	1424	8.0	0.645	6.5	LOS A	6.8	50.8	0.49	0.53	65.5
12	R2	311	5.0	0.645	13.2	LOS A	6.8	50.8	0.48	0.54	58.2
Approach		1935	7.5	0.645	7.6	LOS A	6.8	50.8	0.49	0.53	63.0
All Vehicles		3570	6.0	0.665	9.7	LOS A	6.8	50.8	0.64	0.66	60.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 101 [Stalker Road/SH6 AM Roundabout Existing 2028]

New Site
Roundabout



MOVEMENT SUMMARY

Site: 101 [Stalker Road/SH6 AM Roundabout Existing 2028]

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Stalker Road											
1	L2	515	2.0	2.720	785.4	LOS F	132.5	941.1	1.00	4.46	4.3
2	T1	30	0.0	2.720	784.8	LOS F	132.5	941.1	1.00	4.46	4.4
3	R2	56	0.0	2.720	791.0	LOS F	132.5	941.1	1.00	4.46	4.4
Approach		601	1.7	2.720	785.9	LOS F	132.5	941.1	1.00	4.46	4.3
East: SH6 E											
4	L2	44	5.0	1.070	59.8	LOS E	44.8	326.8	1.00	1.73	31.6
5	T1	1700	5.0	1.176	81.4	LOS F	68.6	500.5	1.00	2.00	29.3
6	R2	41	5.0	1.176	107.3	LOS F	68.6	500.5	1.00	2.23	24.3
Approach		1785	5.0	1.176	81.5	LOS F	68.6	500.5	1.00	1.99	29.2
North: Lower Shotover Road											
7	L2	21	5.0	0.254	8.6	LOS A	1.2	8.5	0.65	0.87	59.4
8	T1	22	0.0	0.254	9.0	LOS A	1.2	8.5	0.65	0.87	53.7
9	R2	155	5.0	0.254	16.0	LOS B	1.2	8.5	0.65	0.87	61.4
Approach		198	4.4	0.254	14.5	LOS A	1.2	8.5	0.65	0.87	60.2
West: SH6 W											
10	L2	241	8.0	0.333	5.7	LOS A	2.4	17.9	0.27	0.46	56.7
11	T1	760	8.0	0.366	5.9	LOS A	2.8	21.0	0.26	0.48	67.2
12	R2	147	5.0	0.366	12.7	LOS A	2.8	21.0	0.25	0.49	59.7
Approach		1148	7.6	0.366	6.7	LOS A	2.8	21.0	0.26	0.48	63.7
All Vehicles		3732	5.2	2.720	168.4	LOS F	132.5	941.1	0.75	1.87	17.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Stalker Road/SH6 IP Roundabout Existing 2028]

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Stalker Road											
1	L2	337	2.0	0.794	17.8	LOS B	7.2	51.3	0.95	1.24	45.9
2	T1	22	0.0	0.794	17.1	LOS B	7.2	51.3	0.95	1.24	47.4
3	R2	52	0.0	0.794	23.3	LOS B	7.2	51.3	0.95	1.24	47.5
Approach		411	1.6	0.794	18.5	LOS B	7.2	51.3	0.95	1.24	46.2
East: SH6 E											
4	L2	33	5.0	0.485	7.9	LOS A	3.6	26.6	0.70	0.65	54.2
5	T1	1266	5.0	0.533	7.8	LOS A	4.6	33.3	0.69	0.62	65.2
6	R2	46	5.0	0.533	14.5	LOS A	4.6	33.3	0.69	0.60	57.8
Approach		1345	5.0	0.533	8.1	LOS A	4.6	33.3	0.69	0.62	64.6
North: Lower Shotover Road											
7	L2	26	5.0	0.370	11.3	LOS A	2.0	14.5	0.79	0.95	57.8
8	T1	43	0.0	0.370	11.5	LOS A	2.0	14.5	0.79	0.95	52.3
9	R2	153	5.0	0.370	18.7	LOS B	2.0	14.5	0.79	0.95	59.6
Approach		222	4.0	0.370	16.4	LOS B	2.0	14.5	0.79	0.95	57.9
West: SH6 W											
10	L2	210	8.0	0.455	6.1	LOS A	3.7	27.8	0.42	0.50	55.8
11	T1	1074	8.0	0.500	6.3	LOS A	4.5	33.3	0.41	0.51	66.1
12	R2	219	5.0	0.500	13.0	LOS A	4.5	33.3	0.40	0.52	58.7
Approach		1503	7.6	0.500	7.2	LOS A	4.5	33.3	0.41	0.51	63.3
All Vehicles		3481	5.6	0.794	9.5	LOS A	7.2	51.3	0.61	0.67	60.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Stalker Road/SH6 PM Roundabout Existing 2028]

New Site
Roundabout

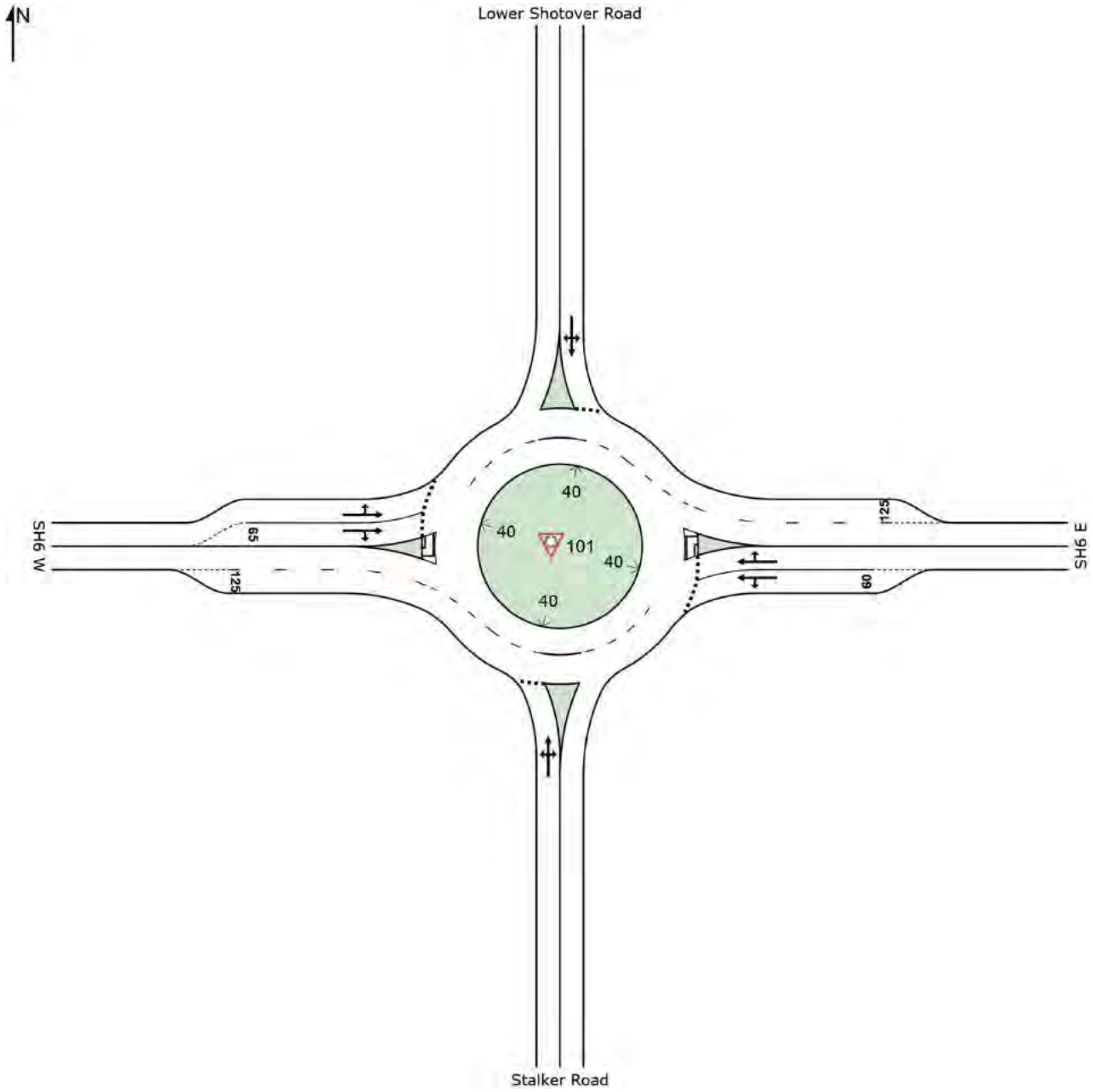
Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Stalker Road											
1	L2	234	2.0	0.602	10.8	LOS A	4.2	30.0	0.91	1.05	50.0
2	T1	19	0.0	0.602	10.2	LOS A	4.2	30.0	0.91	1.05	51.7
3	R2	60	0.0	0.602	16.4	LOS B	4.2	30.0	0.91	1.05	51.9
Approach		313	1.5	0.602	11.9	LOS A	4.2	30.0	0.91	1.05	50.4
East: SH6 E											
4	L2	33	5.0	0.502	9.8	LOS A	4.2	30.8	0.82	0.82	53.6
5	T1	1114	5.0	0.552	9.5	LOS A	5.4	39.5	0.82	0.78	64.1
6	R2	60	5.0	0.552	16.0	LOS B	5.4	39.5	0.83	0.74	56.8
Approach		1207	5.0	0.552	9.8	LOS A	5.4	39.5	0.82	0.77	63.4
North: Lower Shotover Road											
7	L2	38	5.0	0.905	56.9	LOS E	10.7	77.3	1.00	1.40	34.5
8	T1	73	0.0	0.905	56.9	LOS E	10.7	77.3	1.00	1.40	32.5
9	R2	184	5.0	0.905	64.3	LOS E	10.7	77.3	1.00	1.40	35.2
Approach		295	3.8	0.905	61.5	LOS E	10.7	77.3	1.00	1.40	34.4
West: SH6 W											
10	L2	225	8.0	0.671	6.6	LOS A	7.3	54.5	0.60	0.54	54.9
11	T1	1627	8.0	0.737	6.8	LOS A	9.6	71.4	0.59	0.54	64.9
12	R2	339	5.0	0.737	13.5	LOS A	9.6	71.4	0.58	0.55	57.7
Approach		2191	7.5	0.737	7.8	LOS A	9.6	71.4	0.59	0.54	62.5
All Vehicles		4006	6.0	0.905	12.7	LOS A	10.7	77.3	0.71	0.72	58.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 101 [Stalker Road/SH6 AM Roundabout Existing 2028]

New Site
Roundabout



MOVEMENT SUMMARY

Site: 101 [Stalker Road/SH6 AM Roundabout Existing 2037]

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Stalker Road											
1	L2	524	2.0	2.616	738.5	LOS F	132.4	940.3	1.00	4.58	4.6
2	T1	34	0.0	2.616	737.9	LOS F	132.4	940.3	1.00	4.58	4.6
3	R2	58	0.0	2.616	744.1	LOS F	132.4	940.3	1.00	4.58	4.6
Approach		616	1.7	2.616	739.0	LOS F	132.4	940.3	1.00	4.58	4.6
East: SH6 E											
4	L2	45	5.0	1.654	308.7	LOS F	169.3	1235.9	1.00	4.00	10.2
5	T1	2412	5.0	1.818	347.3	LOS F	209.0	1525.8	1.00	4.21	9.6
6	R2	45	5.0	1.818	388.4	LOS F	209.0	1525.8	1.00	4.40	8.7
Approach		2502	5.0	1.818	347.3	LOS F	209.0	1525.8	1.00	4.21	9.6
North: Lower Shotover Road											
7	L2	31	5.0	0.437	11.5	LOS A	2.5	18.5	0.78	0.97	57.0
8	T1	30	0.0	0.437	11.7	LOS A	2.5	18.5	0.78	0.97	51.8
9	R2	234	5.0	0.437	18.8	LOS B	2.5	18.5	0.78	0.97	58.9
Approach		295	4.5	0.437	17.3	LOS B	2.5	18.5	0.78	0.97	57.9
West: SH6 W											
10	L2	343	8.0	0.429	5.7	LOS A	3.5	26.5	0.29	0.46	56.6
11	T1	991	8.0	0.472	5.9	LOS A	4.2	31.4	0.28	0.47	67.3
12	R2	150	5.0	0.472	12.8	LOS A	4.2	31.4	0.28	0.47	59.8
Approach		1484	7.7	0.472	6.6	LOS A	4.2	31.4	0.28	0.47	63.7
All Vehicles		4897	5.4	2.616	273.4	LOS F	209.0	1525.8	0.77	2.93	11.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Stalker Road/SH6 IP Roundabout Existing 2037]

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Stalker Road											
1	L2	343	2.0	1.215	130.4	LOS F	34.8	247.3	1.00	2.60	19.1
2	T1	25	0.0	1.215	129.7	LOS F	34.8	247.3	1.00	2.60	19.3
3	R2	53	0.0	1.215	135.9	LOS F	34.8	247.3	1.00	2.60	19.3
Approach		421	1.6	1.215	131.0	LOS F	34.8	247.3	1.00	2.60	19.1
East: SH6 E											
4	L2	35	5.0	0.647	10.6	LOS A	7.1	51.8	0.86	0.87	53.3
5	T1	1586	5.0	0.711	10.5	LOS A	9.5	69.3	0.86	0.84	63.9
6	R2	55	5.0	0.711	17.1	LOS B	9.5	69.3	0.86	0.82	56.6
Approach		1676	5.0	0.711	10.7	LOS A	9.5	69.3	0.86	0.84	63.3
North: Lower Shotover Road											
7	L2	35	5.0	0.632	20.1	LOS B	4.8	34.5	0.92	1.10	51.1
8	T1	57	0.0	0.632	20.3	LOS B	4.8	34.5	0.92	1.10	46.8
9	R2	206	5.0	0.632	27.5	LOS B	4.8	34.5	0.92	1.10	52.6
Approach		298	4.0	0.632	25.2	LOS B	4.8	34.5	0.92	1.10	51.2
West: SH6 W											
10	L2	317	8.0	0.571	6.2	LOS A	5.4	40.4	0.48	0.51	55.5
11	T1	1349	8.0	0.628	6.4	LOS A	6.6	49.1	0.47	0.51	65.8
12	R2	223	5.0	0.628	13.2	LOS A	6.6	49.1	0.46	0.52	58.6
Approach		1889	7.6	0.628	7.2	LOS A	6.6	49.1	0.47	0.51	63.0
All Vehicles		4284	5.8	1.215	22.0	LOS B	34.8	247.3	0.71	0.89	51.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Stalker Road/SH6 PM Roundabout Existing 2037]

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Stalker Road											
1	L2	239	2.0	0.852	27.8	LOS B	8.1	57.1	1.00	1.33	40.8
2	T1	21	0.0	0.852	27.1	LOS B	8.1	57.1	1.00	1.33	41.9
3	R2	61	0.0	0.852	33.3	LOS C	8.1	57.1	1.00	1.33	42.0
Approach		321	1.5	0.852	28.8	LOS C	8.1	57.1	1.00	1.33	41.1
East: SH6 E											
4	L2	34	5.0	0.653	10.6	LOS A	7.3	53.4	0.87	0.87	53.2
5	T1	1545	5.0	0.717	10.5	LOS A	9.8	71.7	0.88	0.85	63.6
6	R2	90	5.0	0.717	17.0	LOS B	9.8	71.7	0.89	0.83	56.4
Approach		1669	5.0	0.717	10.8	LOS A	9.8	71.7	0.88	0.85	62.9
North: Lower Shotover Road											
7	L2	46	5.0	2.440	686.0	LOS F	80.6	582.1	1.00	2.46	5.1
8	T1	97	0.0	2.440	686.0	LOS F	80.6	582.1	1.00	2.46	5.1
9	R2	223	5.0	2.440	693.4	LOS F	80.6	582.1	1.00	2.46	5.1
Approach		366	3.7	2.440	690.5	LOS F	80.6	582.1	1.00	2.46	5.1
West: SH6 W											
10	L2	361	8.0	0.850	9.1	LOS A	15.1	113.1	0.90	0.67	53.4
11	T1	2008	8.0	0.934	9.5	LOS A	25.5	189.5	0.88	0.65	62.8
12	R2	346	5.0	0.934	16.4	LOS B	25.5	189.5	0.87	0.64	56.1
Approach		2715	7.6	0.934	10.3	LOS A	25.5	189.5	0.88	0.65	60.4
All Vehicles		5071	6.1	2.440	60.8	LOS E	80.6	582.1	0.90	0.89	33.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

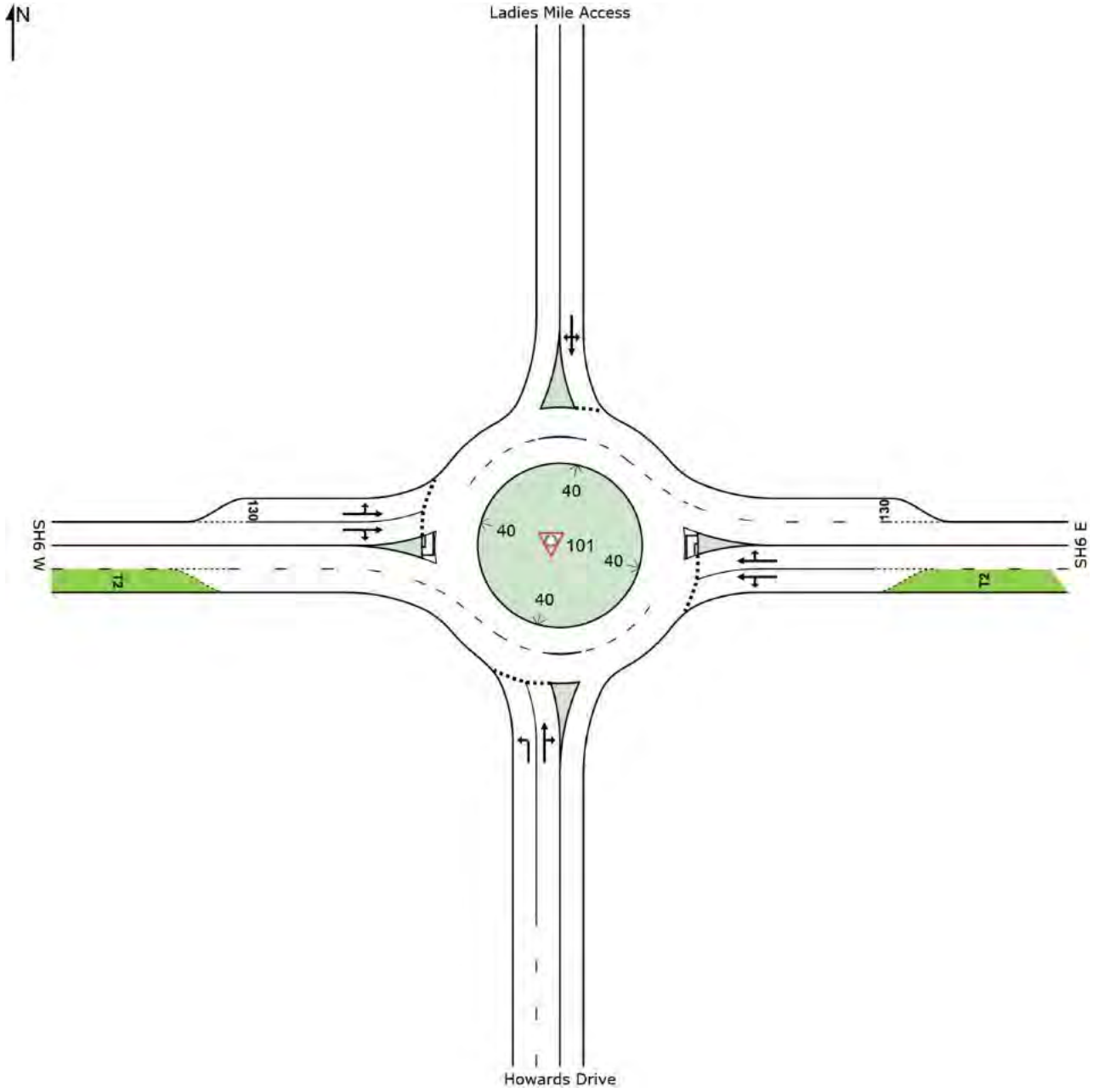
11 Appendix B - Modelling and Scenario Analysis

Do Something Scenario

SITE LAYOUT

Site: 101 [Howards Drive/SH6 AM Roundabout 2023]

New Site
Roundabout



MOVEMENT SUMMARY

Site: 101 [Howards Drive/SH6 AM Roundabout 2023]

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Howards Drive											
1	L2	277	1.0	0.285	4.7	LOS A	1.5	10.8	0.70	0.67	54.8
2	T1	1	0.0	0.090	4.8	LOS A	0.4	2.8	0.65	0.81	45.9
3	R2	55	7.0	0.090	11.3	LOS A	0.4	2.8	0.65	0.81	51.0
Approach		333	2.0	0.285	5.8	LOS A	1.5	10.8	0.69	0.69	54.1
East: SH6 E											
4	L2	58	10.0	0.319	6.9	LOS A	2.0	16.3	0.52	0.58	55.2
5	T1	824	7.0	0.340	6.9	LOS A	2.4	16.7	0.50	0.55	68.2
6	R2	21	0.0	0.340	13.5	LOS A	2.4	16.7	0.49	0.53	59.1
Approach		903	7.0	0.340	7.1	LOS A	2.4	16.7	0.50	0.55	66.9
North: Ladies Mile Access											
7	L2	27	0.0	0.217	4.0	LOS A	0.9	6.5	0.54	0.74	52.0
8	T1	1	0.0	0.217	3.4	LOS A	0.9	6.5	0.54	0.74	46.9
9	R2	178	0.0	0.217	9.6	LOS A	0.9	6.5	0.54	0.74	53.6
Approach		206	0.0	0.217	8.8	LOS A	0.9	6.5	0.54	0.74	53.3
West: SH6 W											
10	L2	60	0.0	0.205	5.5	LOS A	1.3	9.3	0.26	0.45	56.7
11	T1	507	8.0	0.218	5.9	LOS A	1.4	10.4	0.25	0.48	67.3
12	R2	107	3.0	0.218	12.7	LOS A	1.4	10.4	0.24	0.51	59.5
Approach		674	6.5	0.218	7.0	LOS A	1.4	10.4	0.25	0.48	64.8
All Vehicles		2116	5.4	0.340	7.0	LOS A	2.4	16.7	0.45	0.57	62.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Howards Drive/SH6 IP Roundabout 2023]

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Howards Drive											
1	L2	218	1.0	0.203	4.0	LOS A	1.0	7.1	0.60	0.57	55.2
2	T1	1	0.0	0.061	4.2	LOS A	0.2	1.8	0.59	0.75	46.3
3	R2	40	7.0	0.061	10.6	LOS A	0.2	1.8	0.59	0.75	51.5
Approach		259	1.9	0.203	5.0	LOS A	1.0	7.1	0.60	0.60	54.5
East: SH6 E											
4	L2	69	10.0	0.267	6.9	LOS A	1.6	12.8	0.50	0.58	55.3
5	T1	665	7.0	0.285	6.9	LOS A	1.9	13.0	0.48	0.55	68.4
6	R2	21	0.0	0.285	13.5	LOS A	1.9	13.0	0.47	0.53	59.3
Approach		755	7.1	0.285	7.1	LOS A	1.9	13.0	0.48	0.55	66.7
North: Ladies Mile Access											
7	L2	22	0.0	0.167	4.3	LOS A	0.7	4.9	0.57	0.76	52.0
8	T1	1	0.0	0.167	3.8	LOS A	0.7	4.9	0.57	0.76	46.9
9	R2	126	0.0	0.167	9.9	LOS A	0.7	4.9	0.57	0.76	53.6
Approach		149	0.0	0.167	9.1	LOS A	0.7	4.9	0.57	0.76	53.3
West: SH6 W											
10	L2	90	0.0	0.260	5.5	LOS A	1.7	12.2	0.23	0.44	56.9
11	T1	608	8.0	0.277	5.9	LOS A	1.8	13.6	0.22	0.49	67.2
12	R2	173	3.0	0.277	12.7	LOS A	1.8	13.6	0.22	0.53	59.2
Approach		871	6.2	0.277	7.2	LOS A	1.8	13.6	0.22	0.49	64.3
All Vehicles		2034	5.5	0.285	7.0	LOS A	1.9	13.6	0.39	0.55	62.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Howards Drive/SH6 PM Roudabout 2023]

New Site
Roundabout

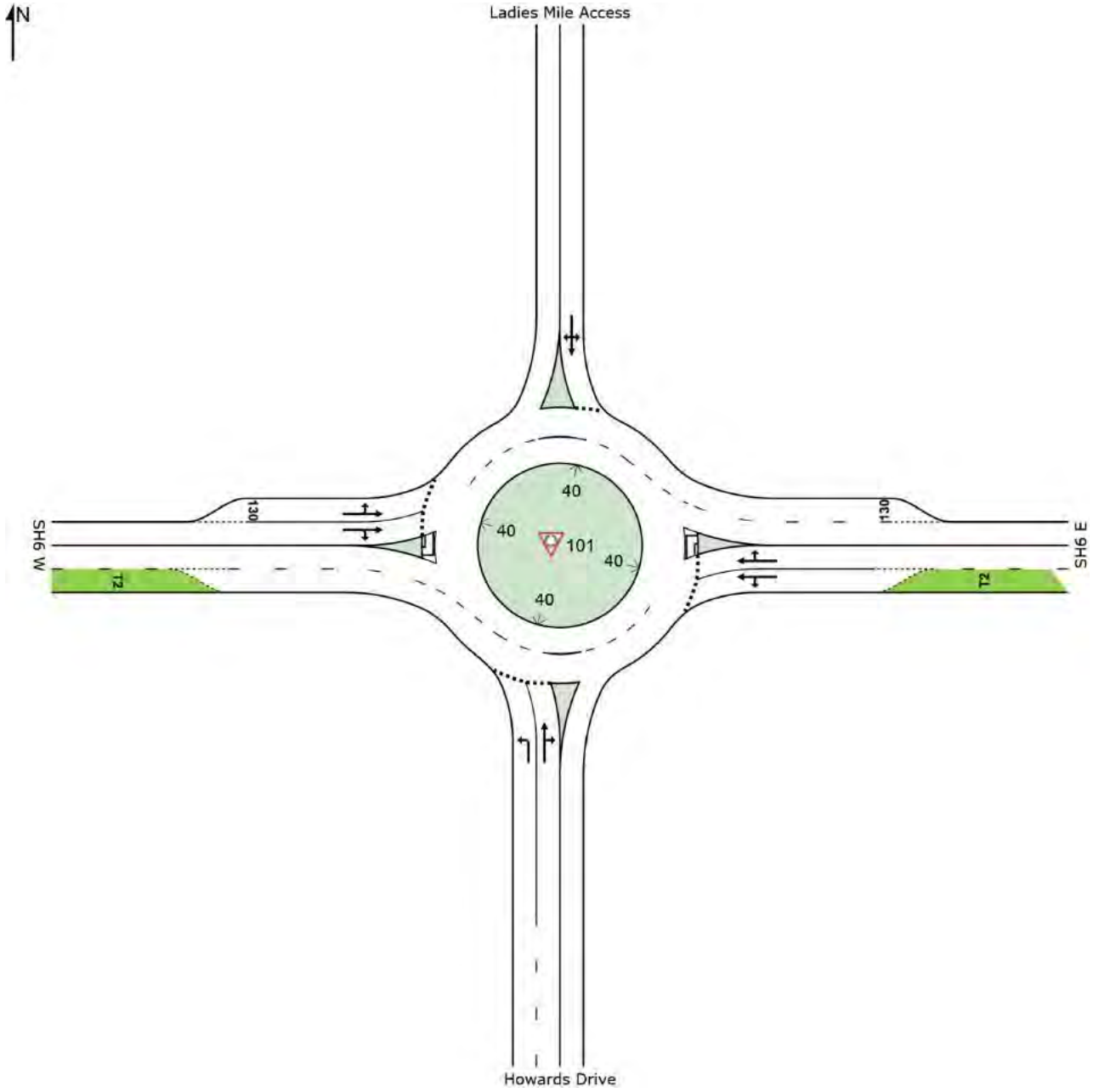
Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Howards Drive											
1	L2	207	1.0	0.194	3.9	LOS A	1.0	6.8	0.60	0.56	55.2
2	T1	1	0.0	0.051	4.1	LOS A	0.2	1.5	0.59	0.74	46.4
3	R2	33	7.0	0.051	10.5	LOS A	0.2	1.5	0.59	0.74	51.6
Approach		241	1.8	0.194	4.8	LOS A	1.0	6.8	0.60	0.58	54.6
East: SH6 E											
4	L2	95	10.0	0.290	7.4	LOS A	1.7	14.0	0.56	0.62	55.1
5	T1	654	7.0	0.305	7.3	LOS A	2.0	14.2	0.54	0.58	67.9
6	R2	26	0.0	0.305	13.8	LOS A	2.0	14.2	0.53	0.56	58.8
Approach		775	7.1	0.305	7.5	LOS A	2.0	14.2	0.54	0.59	65.7
North: Ladies Mile Access											
7	L2	22	0.0	0.164	5.4	LOS A	0.7	5.1	0.65	0.83	51.5
8	T1	1	0.0	0.164	4.8	LOS A	0.7	5.1	0.65	0.83	46.5
9	R2	103	0.0	0.164	11.0	LOS A	0.7	5.1	0.65	0.83	53.1
Approach		126	0.0	0.164	10.0	LOS A	0.7	5.1	0.65	0.83	52.8
West: SH6 W											
10	L2	141	0.0	0.374	5.5	LOS A	2.7	19.7	0.26	0.45	56.8
11	T1	845	8.0	0.399	5.9	LOS A	3.0	22.0	0.25	0.49	66.9
12	R2	276	3.0	0.399	12.7	LOS A	3.0	22.0	0.24	0.53	58.9
Approach		1262	6.0	0.399	7.4	LOS A	3.0	22.0	0.24	0.50	63.8
All Vehicles		2404	5.6	0.399	7.3	LOS A	3.0	22.0	0.40	0.55	62.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 101 [Howards Drive/SH6 AM Roundabout 2025]

New Site
Roundabout



MOVEMENT SUMMARY

Site: 101 [Howards Drive/SH6 AM Roundabout 2025]

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Howards Drive											
1	L2	345	1.0	0.336	4.5	LOS A	1.8	12.9	0.68	0.64	54.9
2	T1	1	0.0	0.103	4.5	LOS A	0.4	3.2	0.62	0.80	46.1
3	R2	66	7.0	0.103	11.0	LOS A	0.4	3.2	0.62	0.80	51.2
Approach		412	2.0	0.336	5.5	LOS A	1.8	12.9	0.67	0.66	54.2
East: SH6 E											
4	L2	70	10.0	0.282	7.0	LOS A	1.7	13.9	0.53	0.58	55.2
5	T1	695	7.0	0.301	7.0	LOS A	2.0	14.3	0.50	0.55	68.2
6	R2	21	0.0	0.301	13.5	LOS A	2.0	14.3	0.49	0.54	59.1
Approach		786	7.1	0.301	7.1	LOS A	2.0	14.3	0.50	0.55	66.5
North: Ladies Mile Access											
7	L2	27	0.0	0.225	4.2	LOS A	1.0	6.8	0.57	0.77	51.9
8	T1	1	0.0	0.225	3.7	LOS A	1.0	6.8	0.57	0.77	46.8
9	R2	178	0.0	0.225	9.8	LOS A	1.0	6.8	0.57	0.77	53.5
Approach		206	0.0	0.225	9.1	LOS A	1.0	6.8	0.57	0.77	53.2
West: SH6 W											
10	L2	60	0.0	0.227	5.6	LOS A	1.4	10.5	0.28	0.45	56.6
11	T1	549	8.0	0.242	6.0	LOS A	1.6	11.8	0.27	0.49	67.0
12	R2	131	3.0	0.242	12.7	LOS A	1.6	11.8	0.26	0.52	59.2
Approach		740	6.5	0.242	7.2	LOS A	1.6	11.8	0.27	0.49	64.5
All Vehicles		2144	5.2	0.336	7.0	LOS A	2.0	14.3	0.46	0.57	61.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Howards Drive/SH6 IP Roundabout 2025]

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Howards Drive											
1	L2	267	1.0	0.247	4.0	LOS A	1.3	8.9	0.61	0.57	55.2
2	T1	1	0.0	0.072	4.1	LOS A	0.3	2.2	0.58	0.75	46.3
3	R2	48	7.0	0.072	10.5	LOS A	0.3	2.2	0.58	0.75	51.5
Approach		316	1.9	0.247	5.0	LOS A	1.3	8.9	0.61	0.60	54.5
East: SH6 E											
4	L2	82	10.0	0.265	7.1	LOS A	1.6	12.7	0.53	0.60	55.3
5	T1	630	7.0	0.283	7.0	LOS A	1.8	12.9	0.50	0.56	68.2
6	R2	21	0.0	0.283	13.6	LOS A	1.8	12.9	0.49	0.54	59.1
Approach		733	7.1	0.283	7.2	LOS A	1.8	12.9	0.50	0.56	66.2
North: Ladies Mile Access											
7	L2	22	0.0	0.168	4.3	LOS A	0.7	5.0	0.57	0.77	52.0
8	T1	1	0.0	0.168	3.8	LOS A	0.7	5.0	0.57	0.77	46.9
9	R2	126	0.0	0.168	10.0	LOS A	0.7	5.0	0.57	0.77	53.6
Approach		149	0.0	0.168	9.1	LOS A	0.7	5.0	0.57	0.77	53.3
West: SH6 W											
10	L2	90	0.0	0.261	5.5	LOS A	1.7	12.3	0.25	0.45	56.8
11	T1	571	8.0	0.278	5.9	LOS A	1.9	13.7	0.24	0.50	66.9
12	R2	208	3.0	0.278	12.7	LOS A	1.9	13.7	0.23	0.54	58.8
Approach		869	6.0	0.278	7.5	LOS A	1.9	13.7	0.24	0.50	63.6
All Vehicles		2067	5.3	0.283	7.1	LOS A	1.9	13.7	0.41	0.56	62.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Howards Drive/SH6 PM Roudabout 2025]

New Site
Roundabout

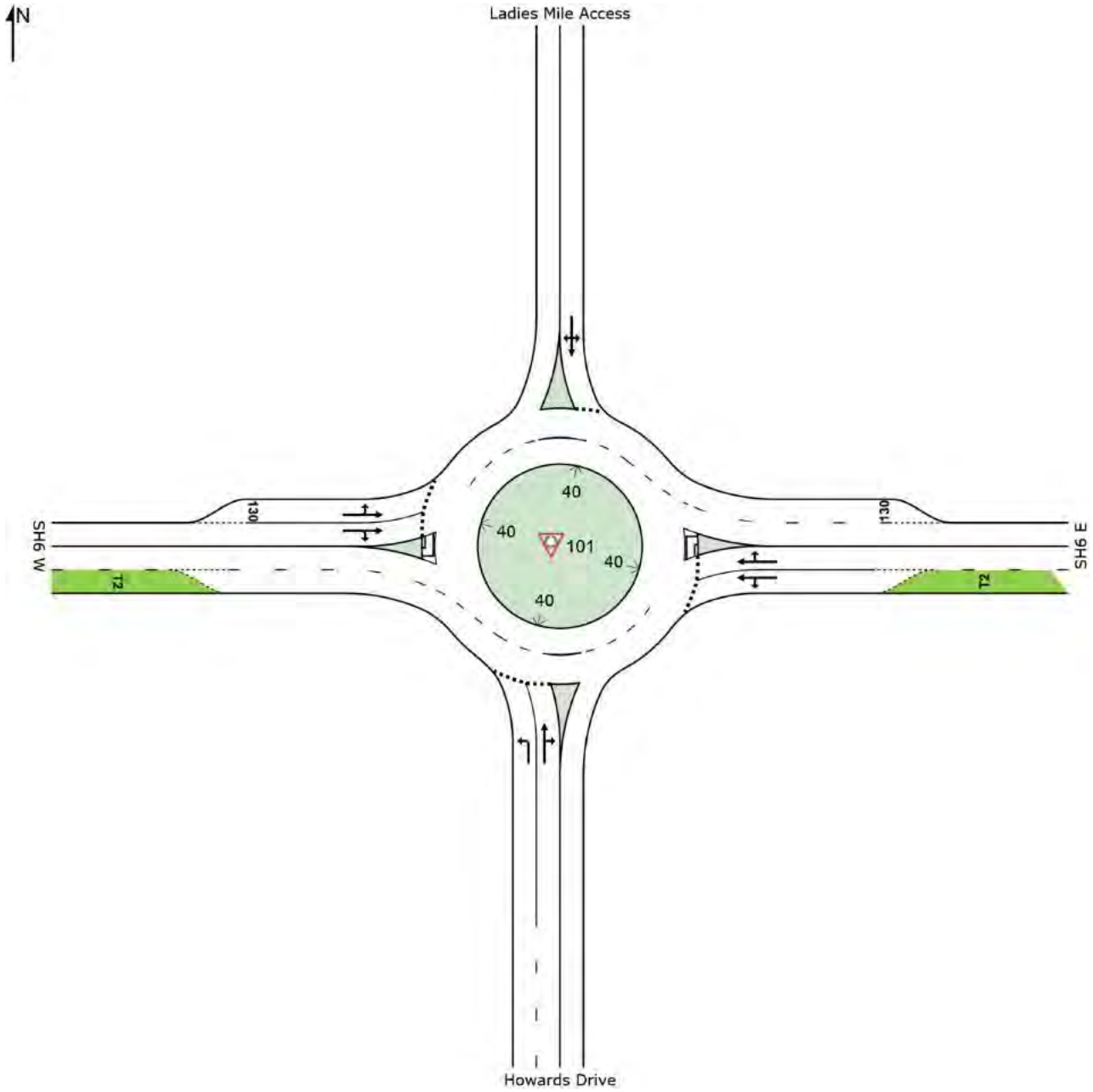
Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Howards Drive											
1	L2	248	1.0	0.241	4.1	LOS A	1.3	8.9	0.64	0.59	55.0
2	T1	1	0.0	0.066	4.3	LOS A	0.3	2.1	0.61	0.76	46.3
3	R2	42	7.0	0.066	10.7	LOS A	0.3	2.1	0.61	0.76	51.4
Approach		291	1.9	0.241	5.1	LOS A	1.3	8.9	0.64	0.61	54.4
East: SH6 E											
4	L2	112	10.0	0.335	7.8	LOS A	2.1	16.9	0.62	0.66	54.8
5	T1	705	7.0	0.338	7.7	LOS A	2.4	16.5	0.59	0.61	67.5
6	R2	26	0.0	0.338	14.1	LOS A	2.4	16.5	0.58	0.58	58.5
Approach		843	7.2	0.338	7.9	LOS A	2.4	16.9	0.60	0.61	65.2
North: Ladies Mile Access											
7	L2	22	0.0	0.160	5.2	LOS A	0.7	4.9	0.64	0.82	51.7
8	T1	1	0.0	0.160	4.6	LOS A	0.7	4.9	0.64	0.82	46.6
9	R2	103	0.0	0.160	10.8	LOS A	0.7	4.9	0.64	0.82	53.3
Approach		126	0.0	0.160	9.8	LOS A	0.7	4.9	0.64	0.82	52.9
West: SH6 W											
10	L2	141	0.0	0.357	5.6	LOS A	2.5	18.5	0.27	0.45	56.7
11	T1	720	8.0	0.380	6.0	LOS A	2.8	20.7	0.26	0.50	66.6
12	R2	332	3.0	0.380	12.7	LOS A	2.8	20.7	0.25	0.56	58.3
Approach		1193	5.7	0.380	7.8	LOS A	2.8	20.7	0.26	0.51	62.8
All Vehicles		2453	5.4	0.380	7.6	LOS A	2.8	20.7	0.44	0.57	61.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 101 [Howards Drive/SH6 AM Roundabout 2025]

New Site
Roundabout



MOVEMENT SUMMARY

Site: 101 [Howards Drive/SH6 AM Roundabout 2028]

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Howards Drive											
1	L2	294	1.0	0.301	4.6	LOS A	1.6	11.5	0.70	0.66	54.8
2	T1	1	0.0	0.116	4.8	LOS A	0.5	3.7	0.65	0.83	45.9
3	R2	71	7.0	0.116	11.3	LOS A	0.5	3.7	0.65	0.83	51.0
Approach		366	2.2	0.301	5.9	LOS A	1.6	11.5	0.69	0.69	53.9
East: SH6 E											
4	L2	74	10.0	0.319	7.1	LOS A	2.0	16.3	0.55	0.59	55.1
5	T1	778	7.0	0.340	7.1	LOS A	2.4	16.8	0.53	0.56	67.9
6	R2	30	0.0	0.340	13.6	LOS A	2.4	16.8	0.52	0.55	58.9
Approach		882	7.0	0.340	7.3	LOS A	2.4	16.8	0.53	0.56	66.3
North: Ladies Mile Access											
7	L2	38	0.0	0.248	4.5	LOS A	1.1	7.8	0.60	0.79	52.0
8	T1	1	0.0	0.248	4.0	LOS A	1.1	7.8	0.60	0.79	46.9
9	R2	178	0.0	0.248	10.1	LOS A	1.1	7.8	0.60	0.79	53.6
Approach		217	0.0	0.248	9.1	LOS A	1.1	7.8	0.60	0.79	53.3
West: SH6 W											
10	L2	85	0.0	0.260	5.7	LOS A	1.7	12.3	0.31	0.47	56.4
11	T1	611	8.0	0.277	6.1	LOS A	1.9	13.8	0.30	0.50	66.8
12	R2	142	3.0	0.277	12.8	LOS A	1.9	13.8	0.29	0.52	59.1
Approach		838	6.3	0.277	7.2	LOS A	1.9	13.8	0.30	0.50	64.2
All Vehicles		2303	5.3	0.340	7.2	LOS A	2.4	16.8	0.48	0.58	61.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Howards Drive/SH6 IP Roundabout 2028]

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Howards Drive											
1	L2	253	1.0	0.247	4.3	LOS A	1.3	9.1	0.65	0.61	55.0
2	T1	1	0.0	0.082	4.5	LOS A	0.3	2.5	0.62	0.78	46.1
3	R2	52	7.0	0.082	10.9	LOS A	0.3	2.5	0.62	0.78	51.3
Approach		306	2.0	0.247	5.4	LOS A	1.3	9.1	0.64	0.64	54.3
East: SH6 E											
4	L2	86	10.0	0.299	7.1	LOS A	1.8	14.8	0.55	0.60	55.1
5	T1	707	7.0	0.319	7.1	LOS A	2.2	15.2	0.52	0.57	68.0
6	R2	30	0.0	0.319	13.6	LOS A	2.2	15.2	0.51	0.55	58.9
Approach		823	7.1	0.319	7.4	LOS A	2.2	15.2	0.52	0.57	66.0
North: Ladies Mile Access											
7	L2	31	0.0	0.206	4.6	LOS A	0.9	6.3	0.60	0.79	52.0
8	T1	1	0.0	0.206	4.0	LOS A	0.9	6.3	0.60	0.79	46.9
9	R2	146	0.0	0.206	10.2	LOS A	0.9	6.3	0.60	0.79	53.6
Approach		178	0.0	0.206	9.2	LOS A	0.9	6.3	0.60	0.79	53.3
West: SH6 W											
10	L2	102	0.0	0.282	5.6	LOS A	1.8	13.5	0.28	0.46	56.6
11	T1	636	8.0	0.301	6.0	LOS A	2.0	15.1	0.27	0.50	66.8
12	R2	190	3.0	0.301	12.8	LOS A	2.0	15.1	0.26	0.53	58.9
Approach		928	6.1	0.301	7.3	LOS A	2.0	15.1	0.27	0.50	63.8
All Vehicles		2235	5.4	0.319	7.2	LOS A	2.2	15.2	0.44	0.57	62.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Howards Drive/SH6 PM Roudabout 2028]

New Site
Roundabout

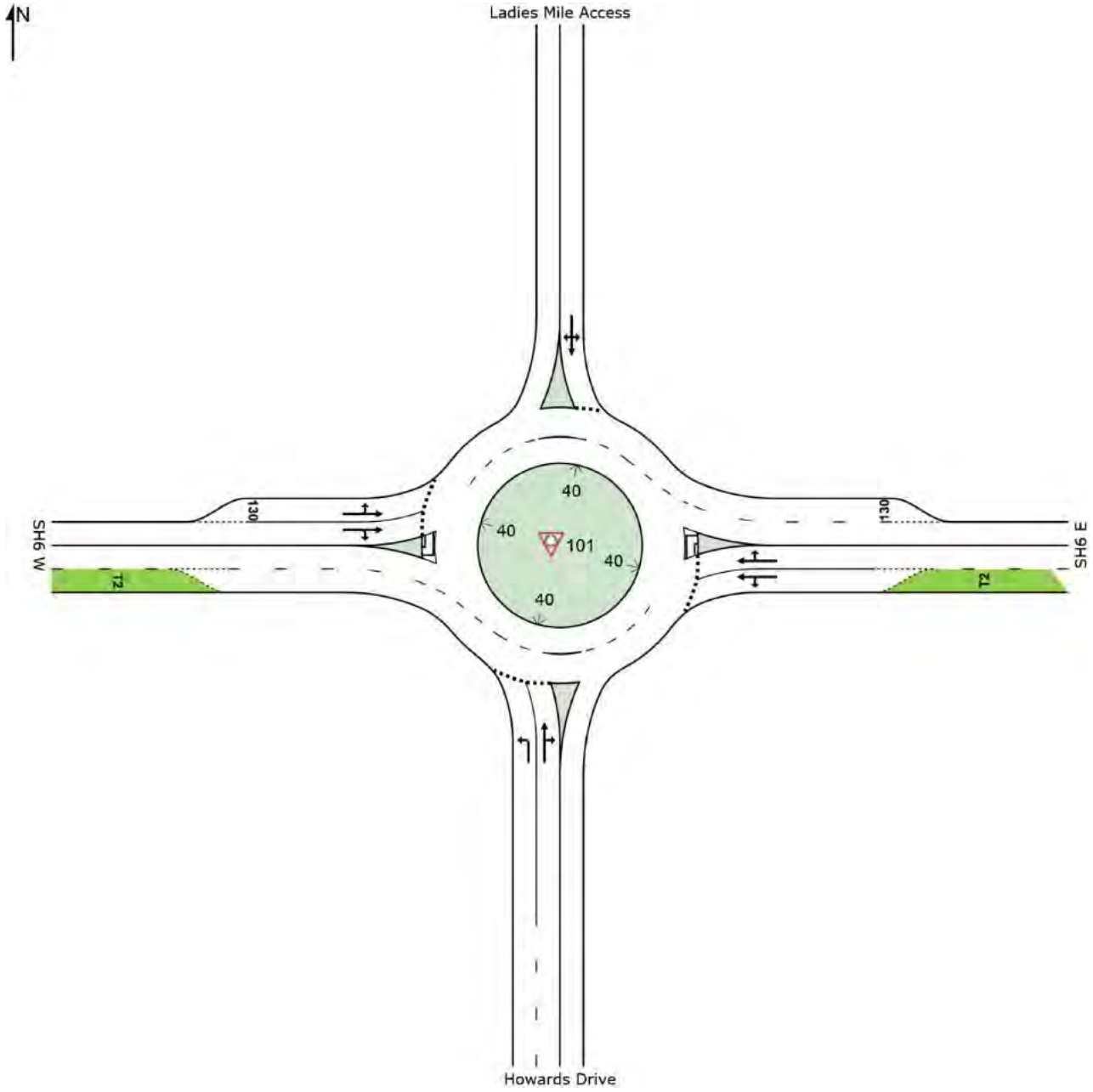
Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Howards Drive											
1	L2	268	1.0	0.282	4.6	LOS A	1.6	11.0	0.71	0.66	54.7
2	T1	1	0.0	0.077	4.8	LOS A	0.3	2.5	0.66	0.80	46.0
3	R2	46	7.0	0.077	11.2	LOS A	0.3	2.5	0.66	0.80	51.1
Approach		315	1.9	0.282	5.6	LOS A	1.6	11.0	0.70	0.68	54.1
East: SH6 E											
4	L2	117	10.0	0.368	7.9	LOS A	2.4	19.2	0.63	0.66	54.7
5	T1	792	7.0	0.385	7.7	LOS A	2.8	19.6	0.61	0.61	67.3
6	R2	37	0.0	0.385	14.2	LOS A	2.8	19.6	0.60	0.59	58.3
Approach		946	7.1	0.385	8.0	LOS A	2.8	19.6	0.61	0.62	65.0
North: Ladies Mile Access											
7	L2	31	0.0	0.235	5.5	LOS A	1.1	7.6	0.68	0.85	51.4
8	T1	1	0.0	0.235	4.9	LOS A	1.1	7.6	0.68	0.85	46.4
9	R2	147	0.0	0.235	11.1	LOS A	1.1	7.6	0.68	0.85	53.0
Approach		179	0.0	0.235	10.1	LOS A	1.1	7.6	0.68	0.85	52.7
West: SH6 W											
10	L2	142	0.0	0.371	5.7	LOS A	2.6	19.4	0.31	0.46	56.5
11	T1	802	8.0	0.396	6.1	LOS A	3.0	21.8	0.30	0.50	66.5
12	R2	280	3.0	0.396	12.8	LOS A	3.0	21.8	0.29	0.54	58.6
Approach		1224	5.9	0.396	7.6	LOS A	3.0	21.8	0.30	0.51	63.3
All Vehicles		2664	5.5	0.396	7.6	LOS A	3.0	21.8	0.48	0.59	61.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 101 [Howards Drive/SH6 AM Roundabout 2037]

New Site
Roundabout



MOVEMENT SUMMARY

Site: 101 [Howards Drive/SH6 AM Roundabout 2037]

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Howards Drive											
1	L2	201	1.0	0.227	5.0	LOS A	1.2	8.7	0.73	0.72	54.7
2	T1	1	0.0	0.121	5.2	LOS A	0.5	4.1	0.70	0.86	45.7
3	R2	72	7.0	0.121	11.7	LOS A	0.5	4.1	0.70	0.86	50.8
Approach		274	2.6	0.227	6.8	LOS A	1.2	8.7	0.72	0.75	53.5
East: SH6 E											
4	L2	75	10.0	0.398	7.0	LOS A	2.7	21.7	0.55	0.58	55.0
5	T1	1027	7.0	0.425	7.0	LOS A	3.2	22.3	0.53	0.56	67.9
6	R2	33	0.0	0.425	13.5	LOS A	3.2	22.3	0.51	0.54	58.9
Approach		1135	7.0	0.425	7.2	LOS A	3.2	22.3	0.53	0.56	66.6
North: Ladies Mile Access											
7	L2	42	0.0	0.224	5.1	LOS A	1.0	7.1	0.66	0.84	51.9
8	T1	1	0.0	0.224	4.6	LOS A	1.0	7.1	0.66	0.84	46.8
9	R2	132	0.0	0.224	10.8	LOS A	1.0	7.1	0.66	0.84	53.5
Approach		175	0.0	0.224	9.4	LOS A	1.0	7.1	0.66	0.84	53.1
West: SH6 W											
10	L2	94	0.0	0.336	5.8	LOS A	2.3	17.3	0.34	0.47	56.3
11	T1	840	8.0	0.358	6.1	LOS A	2.7	19.6	0.33	0.49	66.8
12	R2	145	3.0	0.358	12.9	LOS A	2.7	19.6	0.32	0.51	59.2
Approach		1079	6.6	0.358	7.0	LOS A	2.7	19.6	0.33	0.49	64.6
All Vehicles		2663	5.9	0.425	7.2	LOS A	3.2	22.3	0.48	0.57	63.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Howards Drive/SH6 IP Roundabout 2037]

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Howards Drive											
1	L2	213	1.0	0.241	5.1	LOS A	1.3	9.3	0.74	0.72	54.6
2	T1	1	0.0	0.095	5.3	LOS A	0.4	3.1	0.69	0.84	45.7
3	R2	54	7.0	0.095	11.7	LOS A	0.4	3.1	0.69	0.84	50.7
Approach		268	2.2	0.241	6.4	LOS A	1.3	9.3	0.73	0.75	53.7
East: SH6 E											
4	L2	87	10.0	0.400	7.0	LOS A	2.7	21.8	0.56	0.59	55.0
5	T1	1017	7.0	0.427	7.0	LOS A	3.2	22.4	0.53	0.56	67.9
6	R2	33	0.0	0.427	13.6	LOS A	3.2	22.4	0.52	0.54	58.9
Approach		1137	7.0	0.427	7.2	LOS A	3.2	22.4	0.53	0.56	66.4
North: Ladies Mile Access											
7	L2	35	0.0	0.208	4.9	LOS A	0.9	6.5	0.64	0.82	51.9
8	T1	1	0.0	0.208	4.4	LOS A	0.9	6.5	0.64	0.82	46.8
9	R2	133	0.0	0.208	10.6	LOS A	0.9	6.5	0.64	0.82	53.6
Approach		169	0.0	0.208	9.4	LOS A	0.9	6.5	0.64	0.82	53.2
West: SH6 W											
10	L2	89	0.0	0.319	5.7	LOS A	2.2	16.0	0.30	0.46	56.5
11	T1	801	8.0	0.340	6.0	LOS A	2.4	18.1	0.29	0.49	67.0
12	R2	151	3.0	0.340	12.8	LOS A	2.4	18.1	0.28	0.51	59.3
Approach		1041	6.6	0.340	7.0	LOS A	2.4	18.1	0.29	0.49	64.8
All Vehicles		2615	5.9	0.427	7.2	LOS A	3.2	22.4	0.46	0.57	63.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Howards Drive/SH6 PM Roudabout 2037]

New Site
Roundabout

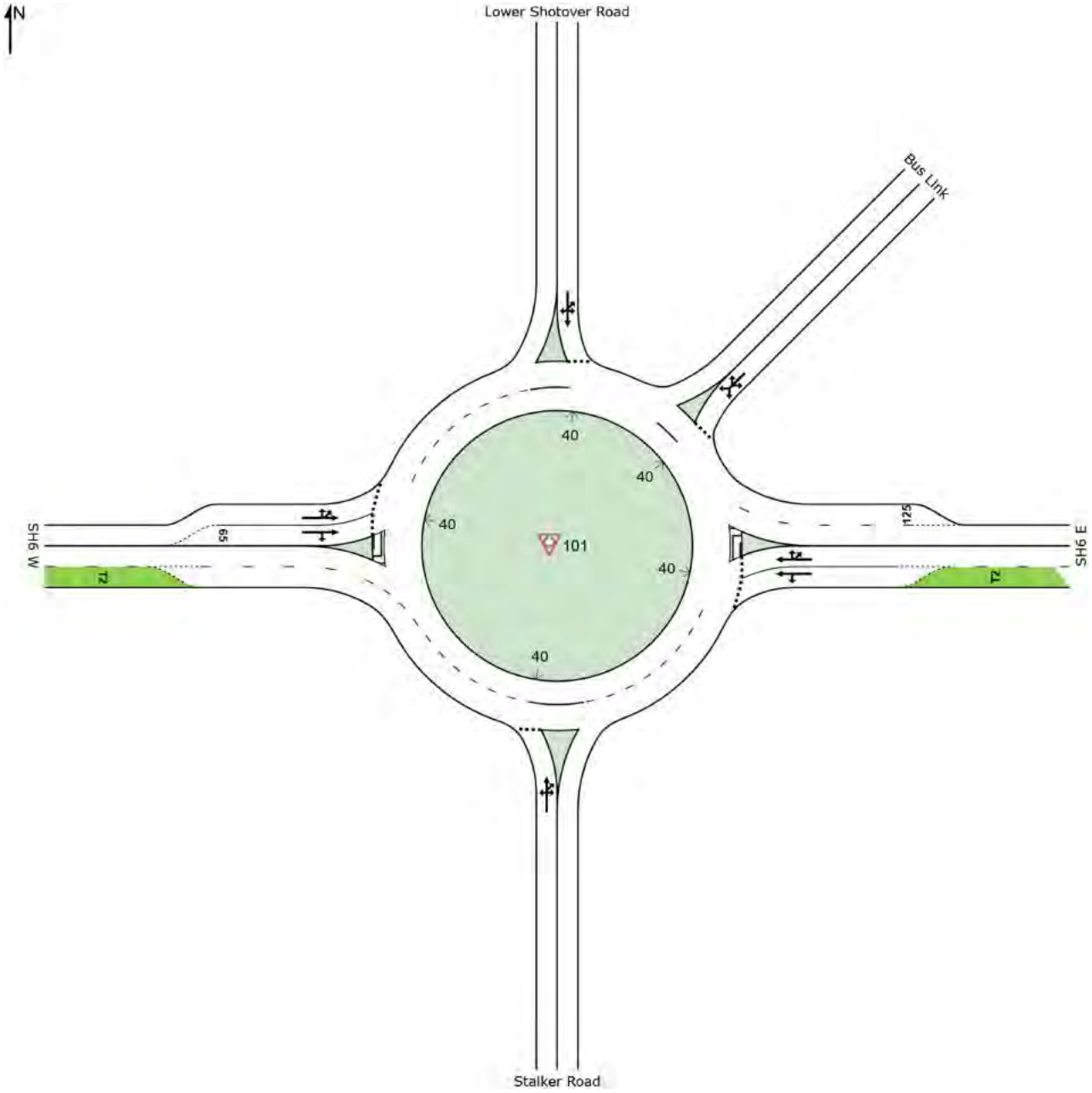
Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Howards Drive											
1	L2	273	1.0	0.378	6.9	LOS A	2.4	17.1	0.87	0.93	53.7
2	T1	1	0.0	0.097	6.4	LOS A	0.5	3.5	0.78	0.89	45.1
3	R2	47	7.0	0.097	12.9	LOS A	0.5	3.5	0.78	0.89	50.0
Approach		321	1.9	0.378	7.7	LOS A	2.4	17.1	0.85	0.92	53.1
East: SH6 E											
4	L2	119	10.0	0.515	7.8	LOS A	3.9	31.2	0.68	0.66	54.4
5	T1	1233	7.0	0.549	7.7	LOS A	4.7	32.6	0.65	0.61	66.9
6	R2	42	0.0	0.549	14.1	LOS A	4.7	32.6	0.64	0.58	58.2
Approach		1394	7.0	0.549	7.9	LOS A	4.7	32.6	0.65	0.61	65.4
North: Ladies Mile Access											
7	L2	35	0.0	0.267	5.6	LOS A	1.2	8.7	0.70	0.86	51.3
8	T1	1	0.0	0.267	5.1	LOS A	1.2	8.7	0.70	0.86	46.4
9	R2	163	0.0	0.267	11.3	LOS A	1.2	8.7	0.70	0.86	52.9
Approach		199	0.0	0.267	10.3	LOS A	1.2	8.7	0.70	0.86	52.6
West: SH6 W											
10	L2	105	0.0	0.378	5.7	LOS A	2.7	20.2	0.32	0.46	56.4
11	T1	939	8.0	0.403	6.1	LOS A	3.1	22.8	0.31	0.49	66.8
12	R2	190	3.0	0.403	12.8	LOS A	3.1	22.8	0.30	0.51	59.2
Approach		1234	6.5	0.403	7.1	LOS A	3.1	22.8	0.31	0.49	64.5
All Vehicles		3148	5.9	0.549	7.7	LOS A	4.7	32.6	0.54	0.61	62.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 101 [Stalker Road/SH6 AM Roundabout 2023]

New Site
Roundabout



MOVEMENT SUMMARY

Site: 101 [Stalker Road/SH6 AM Roundabout 2023]

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Stalker Road											
1	L2	298	2.0	0.638	11.6	LOS A	4.6	32.9	0.88	1.07	49.7
2	T1	27	0.0	0.638	11.0	LOS A	4.6	32.9	0.88	1.07	51.5
3a	R1	1	100.0	0.638	22.1	LOS B	4.6	32.9	0.88	1.07	44.9
3	R2	42	0.0	0.638	17.2	LOS B	4.6	32.9	0.88	1.07	51.6
Approach		368	1.9	0.638	12.3	LOS A	4.6	32.9	0.88	1.07	50.0
East: SH6 E											
4	L2	31	5.0	0.424	6.9	LOS A	3.0	23.2	0.57	0.58	54.9
5	T1	1213	5.0	0.466	7.0	LOS A	3.7	26.0	0.55	0.56	67.7
6	R2	34	5.0	0.466	13.7	LOS A	3.7	26.0	0.54	0.54	58.7
6b	R3	1	100.0	0.466	17.0	LOS B	3.7	26.0	0.54	0.54	59.4
Approach		1279	5.1	0.466	7.2	LOS A	3.7	26.0	0.55	0.56	67.0
NorthEast: Bus Link											
24b	L3	1	100.0	0.009	8.3	LOS A	0.0	0.5	0.63	0.66	43.4
24a	L1	1	100.0	0.009	7.1	LOS A	0.0	0.5	0.63	0.66	45.6
26a	R1	1	100.0	0.009	12.6	LOS A	0.0	0.5	0.63	0.66	44.2
26b	R3	1	100.0	0.009	14.7	LOS B	0.0	0.5	0.63	0.66	47.6
Approach		4	100.0	0.009	10.7	LOS A	0.0	0.5	0.63	0.66	45.1
North: Lower Shotover Road											
7b	L3	1	100.0	0.227	11.3	LOS A	1.0	7.4	0.60	0.83	51.1
7	L2	21	5.0	0.227	7.9	LOS A	1.0	7.4	0.60	0.83	60.0
8	T1	18	0.0	0.227	8.2	LOS A	1.0	7.4	0.60	0.83	54.2
9	R2	150	5.0	0.227	15.2	LOS B	1.0	7.4	0.60	0.83	62.0
Approach		190	5.0	0.227	13.7	LOS A	1.0	7.4	0.60	0.83	60.9
West: SH6 W											
10	L2	198	8.0	0.277	5.8	LOS A	1.9	13.9	0.33	0.48	65.2
10a	L1	1	100.0	0.277	6.6	LOS A	1.9	13.9	0.33	0.48	57.9
11	T1	612	8.0	0.305	6.0	LOS A	2.2	16.4	0.32	0.49	66.8
12	R2	113	5.0	0.305	12.8	LOS A	2.2	16.4	0.31	0.50	59.4
Approach		924	7.7	0.305	6.8	LOS A	2.2	16.4	0.32	0.49	65.5
All Vehicles		2765	5.7	0.638	8.2	LOS A	4.6	32.9	0.52	0.62	63.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Stalker Road/SH6 IP Roundabout 2023]

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Stalker Road											
1	L2	214	2.0	0.408	6.7	LOS A	2.3	16.1	0.77	0.87	53.1
2	T1	20	0.0	0.408	6.0	LOS A	2.3	16.1	0.77	0.87	55.1
3a	R1	1	100.0	0.408	15.8	LOS B	2.3	16.1	0.77	0.87	47.6
3	R2	40	0.0	0.408	12.2	LOS A	2.3	16.1	0.77	0.87	55.2
Approach		275	1.9	0.408	7.5	LOS A	2.3	16.1	0.77	0.87	53.5
East: SH6 E											
4	L2	22	5.0	0.343	7.0	LOS A	2.3	17.5	0.56	0.58	54.9
5	T1	949	5.0	0.377	7.0	LOS A	2.8	19.7	0.55	0.56	67.7
6	R2	38	5.0	0.377	13.7	LOS A	2.8	19.7	0.54	0.55	58.7
6b	R3	1	100.0	0.377	17.0	LOS B	2.8	19.7	0.54	0.55	59.4
Approach		1010	5.1	0.377	7.3	LOS A	2.8	19.7	0.55	0.56	67.0
NorthEast: Bus Link											
24b	L3	1	100.0	0.011	9.7	LOS A	0.0	0.5	0.67	0.70	42.7
24a	L1	1	100.0	0.011	8.5	LOS A	0.0	0.5	0.67	0.70	44.8
26a	R1	1	100.0	0.011	14.0	LOS A	0.0	0.5	0.67	0.70	43.5
26b	R3	1	100.0	0.011	16.2	LOS B	0.0	0.5	0.67	0.70	46.7
Approach		4	100.0	0.011	12.1	LOS A	0.0	0.5	0.67	0.70	44.4
North: Lower Shotover Road											
7b	L3	1	100.0	0.276	12.7	LOS A	1.3	9.2	0.66	0.87	50.9
7	L2	26	5.0	0.276	8.6	LOS A	1.3	9.2	0.66	0.87	59.8
8	T1	35	0.0	0.276	8.9	LOS A	1.3	9.2	0.66	0.87	54.0
9	R2	148	5.0	0.276	16.0	LOS B	1.3	9.2	0.66	0.87	61.8
Approach		210	4.6	0.276	13.9	LOS A	1.3	9.2	0.66	0.87	60.1
West: SH6 W											
10	L2	172	8.0	0.331	5.8	LOS A	2.3	17.1	0.33	0.47	65.1
10a	L1	1	100.0	0.331	6.6	LOS A	2.3	17.1	0.33	0.47	57.9
11	T1	805	8.0	0.365	6.1	LOS A	2.7	20.2	0.32	0.49	66.9
12	R2	135	5.0	0.365	12.9	LOS A	2.7	20.2	0.31	0.50	59.4
Approach		1113	7.7	0.365	6.9	LOS A	2.7	20.2	0.32	0.49	65.6
All Vehicles		2612	6.0	0.408	7.7	LOS A	2.8	20.2	0.48	0.59	64.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Stalker Road/SH6 PM Roundabout 2023]

New Site
Roundabout

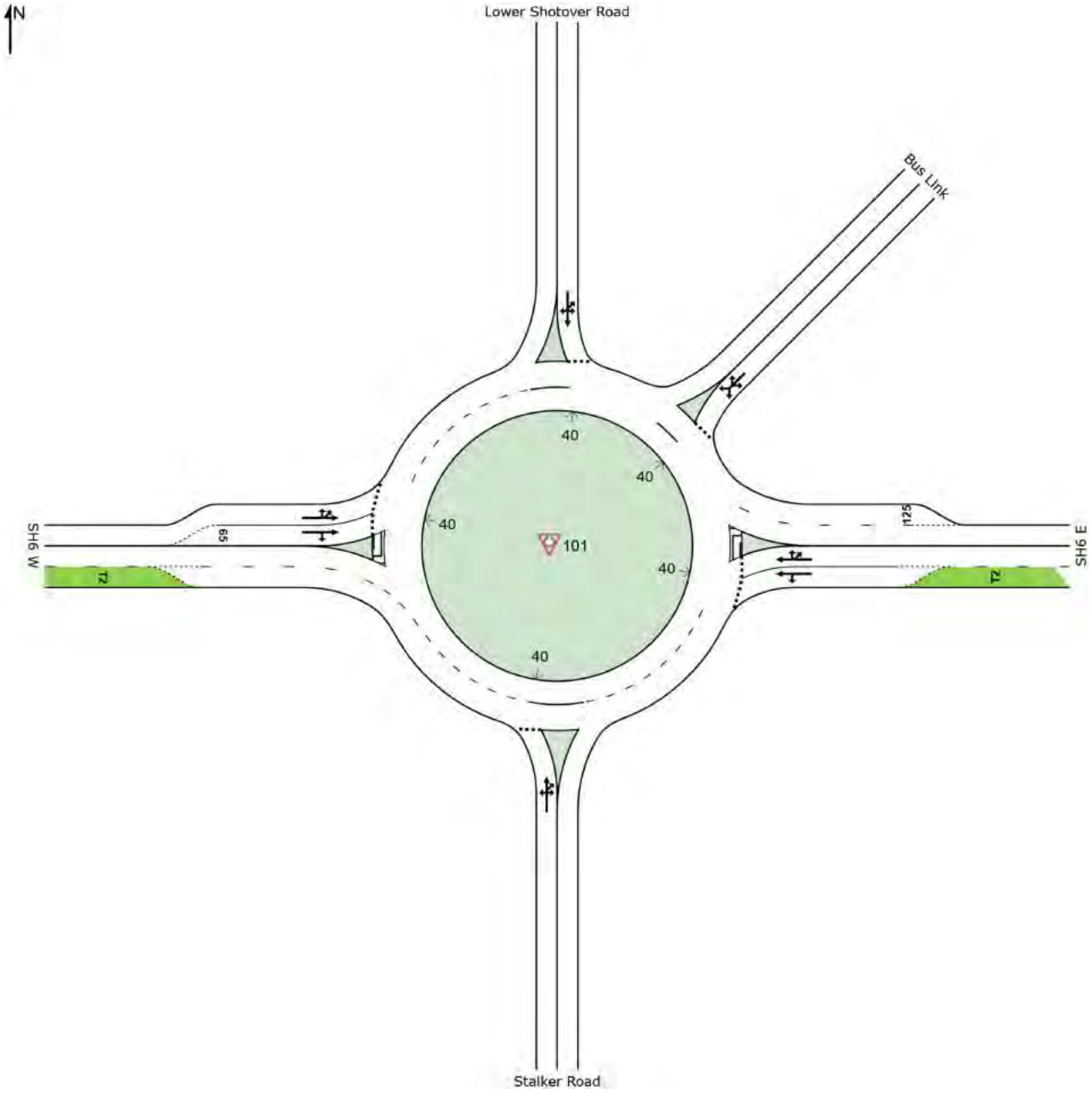
Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Stalker Road											
1	L2	177	2.0	0.369	6.3	LOS A	2.0	14.2	0.77	0.86	53.1
2	T1	17	0.0	0.369	5.7	LOS A	2.0	14.2	0.77	0.86	55.1
3a	R1	1	100.0	0.369	15.3	LOS B	2.0	14.2	0.77	0.86	47.6
3	R2	47	0.0	0.369	11.9	LOS A	2.0	14.2	0.77	0.86	55.2
Approach		242	1.9	0.369	7.4	LOS A	2.0	14.2	0.77	0.86	53.6
East: SH6 E											
4	L2	18	5.0	0.355	7.6	LOS A	2.4	18.7	0.65	0.64	54.4
5	T1	897	5.0	0.391	7.6	LOS A	3.1	21.6	0.64	0.61	66.8
6	R2	50	5.0	0.391	14.2	LOS A	3.1	21.6	0.64	0.59	58.0
6b	R3	1	100.0	0.391	17.8	LOS B	3.1	21.6	0.64	0.59	58.7
Approach		966	5.1	0.391	8.0	LOS A	3.1	21.6	0.64	0.61	66.0
NorthEast: Bus Link											
24b	L3	1	100.0	0.016	15.2	LOS B	0.1	0.8	0.79	0.81	40.2
24a	L1	1	100.0	0.016	14.0	LOS A	0.1	0.8	0.79	0.81	42.1
26a	R1	1	100.0	0.016	19.5	LOS B	0.1	0.8	0.79	0.81	40.9
26b	R3	1	100.0	0.016	21.7	LOS B	0.1	0.8	0.79	0.81	43.8
Approach		4	100.0	0.016	17.6	LOS B	0.1	0.8	0.79	0.81	41.7
North: Lower Shotover Road											
7b	L3	1	100.0	0.464	18.0	LOS B	2.7	19.7	0.81	0.99	48.9
7	L2	38	5.0	0.464	12.4	LOS A	2.7	19.7	0.81	0.99	57.1
8	T1	60	0.0	0.464	12.6	LOS A	2.7	19.7	0.81	0.99	51.7
9	R2	178	5.0	0.464	19.7	LOS B	2.7	19.7	0.81	0.99	58.9
Approach		277	4.3	0.464	17.2	LOS B	2.7	19.7	0.81	0.99	56.9
West: SH6 W											
10	L2	184	8.0	0.465	6.1	LOS A	3.7	27.7	0.41	0.49	64.5
10a	L1	1	100.0	0.465	7.1	LOS A	3.7	27.7	0.41	0.49	57.4
11	T1	1177	8.0	0.513	6.3	LOS A	4.5	33.2	0.40	0.50	66.4
12	R2	186	5.0	0.513	13.0	LOS A	4.5	33.2	0.39	0.51	59.0
Approach		1548	7.7	0.513	7.0	LOS A	4.5	33.2	0.40	0.50	65.1
All Vehicles		3037	6.2	0.513	8.3	LOS A	4.5	33.2	0.54	0.61	63.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 101 [Stalker Road/SH6 AM Roundabout 2025]

New Site
Roundabout



MOVEMENT SUMMARY

Site: 101 [Stalker Road/SH6 AM Roundabout 2025]

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Stalker Road											
1	L2	367	2.0	0.756	14.3	LOS A	6.6	46.8	0.92	1.18	48.0
2	T1	28	0.0	0.756	13.7	LOS A	6.6	46.8	0.92	1.18	49.6
3a	R1	1	100.0	0.756	25.0	LOS B	6.6	46.8	0.92	1.18	43.5
3	R2	52	0.0	0.756	19.9	LOS B	6.6	46.8	0.92	1.18	49.7
Approach		448	1.9	0.756	15.0	LOS B	6.6	46.8	0.92	1.18	48.2
East: SH6 E											
4	L2	41	5.0	0.412	7.1	LOS A	2.9	22.2	0.59	0.59	54.8
5	T1	1140	5.0	0.453	7.1	LOS A	3.6	25.0	0.57	0.57	67.5
6	R2	37	5.0	0.453	13.8	LOS A	3.6	25.0	0.56	0.55	58.6
6b	R3	1	100.0	0.453	17.2	LOS B	3.6	25.0	0.56	0.55	59.2
Approach		1219	5.1	0.453	7.4	LOS A	3.6	25.0	0.57	0.57	66.7
NorthEast: Bus Link											
24b	L3	1	100.0	0.010	9.0	LOS A	0.0	0.5	0.65	0.68	43.0
24a	L1	1	100.0	0.010	7.8	LOS A	0.0	0.5	0.65	0.68	45.2
26a	R1	1	100.0	0.010	13.3	LOS A	0.0	0.5	0.65	0.68	43.9
26b	R3	1	100.0	0.010	15.4	LOS B	0.0	0.5	0.65	0.68	47.1
Approach		4	100.0	0.010	11.4	LOS A	0.0	0.5	0.65	0.68	44.8
North: Lower Shotover Road											
7b	L3	1	100.0	0.248	11.9	LOS A	1.1	8.2	0.63	0.86	50.9
7	L2	21	5.0	0.248	8.2	LOS A	1.1	8.2	0.63	0.86	59.7
8	T1	20	0.0	0.248	8.5	LOS A	1.1	8.2	0.63	0.86	54.0
9	R2	155	5.0	0.248	15.6	LOS B	1.1	8.2	0.63	0.86	61.7
Approach		197	5.0	0.248	14.0	LOS A	1.1	8.2	0.63	0.86	60.6
West: SH6 W											
10	L2	215	8.0	0.309	5.9	LOS A	2.2	16.1	0.36	0.49	65.0
10a	L1	1	100.0	0.309	6.8	LOS A	2.2	16.1	0.36	0.49	57.7
11	T1	666	8.0	0.341	6.1	LOS A	2.6	19.1	0.35	0.51	66.5
12	R2	137	5.0	0.341	12.9	LOS A	2.6	19.1	0.35	0.51	59.1
Approach		1019	7.7	0.341	7.0	LOS A	2.6	19.1	0.35	0.50	65.1
All Vehicles		2887	5.6	0.756	8.9	LOS A	6.6	46.8	0.55	0.66	62.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Stalker Road/SH6 IP Roundabout 2025]

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Stalker Road											
1	L2	263	2.0	0.506	7.8	LOS A	3.2	22.4	0.81	0.94	52.3
2	T1	21	0.0	0.506	7.2	LOS A	3.2	22.4	0.81	0.94	54.2
3a	R1	1	100.0	0.506	17.2	LOS B	3.2	22.4	0.81	0.94	47.0
3	R2	49	0.0	0.506	13.3	LOS A	3.2	22.4	0.81	0.94	54.3
Approach		334	1.9	0.506	8.6	LOS A	3.2	22.4	0.81	0.94	52.7
East: SH6 E											
4	L2	31	5.0	0.357	7.2	LOS A	2.4	18.4	0.60	0.61	54.8
5	T1	951	5.0	0.392	7.3	LOS A	3.0	20.8	0.58	0.58	67.4
6	R2	41	5.0	0.392	13.9	LOS A	3.0	20.8	0.57	0.56	58.5
6b	R3	1	100.0	0.392	17.4	LOS B	3.0	20.8	0.57	0.56	59.1
Approach		1024	5.1	0.392	7.6	LOS A	3.0	20.8	0.58	0.58	66.5
NorthEast: Bus Link											
24b	L3	1	100.0	0.011	10.1	LOS A	0.0	0.6	0.68	0.71	42.5
24a	L1	1	100.0	0.011	8.9	LOS A	0.0	0.6	0.68	0.71	44.6
26a	R1	1	100.0	0.011	14.5	LOS A	0.0	0.6	0.68	0.71	43.3
26b	R3	1	100.0	0.011	16.6	LOS B	0.0	0.6	0.68	0.71	46.5
Approach		4	100.0	0.011	12.5	LOS A	0.0	0.6	0.68	0.71	44.1
North: Lower Shotover Road											
7b	L3	1	100.0	0.294	13.0	LOS A	1.4	9.9	0.68	0.87	50.8
7	L2	26	5.0	0.294	8.8	LOS A	1.4	9.9	0.68	0.87	59.6
8	T1	38	0.0	0.294	9.1	LOS A	1.4	9.9	0.68	0.87	53.9
9	R2	153	5.0	0.294	16.2	LOS B	1.4	9.9	0.68	0.87	61.7
Approach		218	4.6	0.294	14.0	LOS A	1.4	9.9	0.68	0.87	59.9
West: SH6 W											
10	L2	187	8.0	0.346	5.9	LOS A	2.4	18.3	0.36	0.49	64.9
10a	L1	1	100.0	0.346	6.8	LOS A	2.4	18.3	0.36	0.49	57.7
11	T1	795	8.0	0.382	6.1	LOS A	2.9	21.6	0.35	0.50	66.5
12	R2	169	5.0	0.382	12.9	LOS A	2.9	21.6	0.34	0.52	59.0
Approach		1152	7.6	0.382	7.1	LOS A	2.9	21.6	0.35	0.50	65.0
All Vehicles		2732	5.9	0.506	8.0	LOS A	3.2	22.4	0.52	0.62	63.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Stalker Road/SH6 PM Roundabout 2025]

New Site
Roundabout

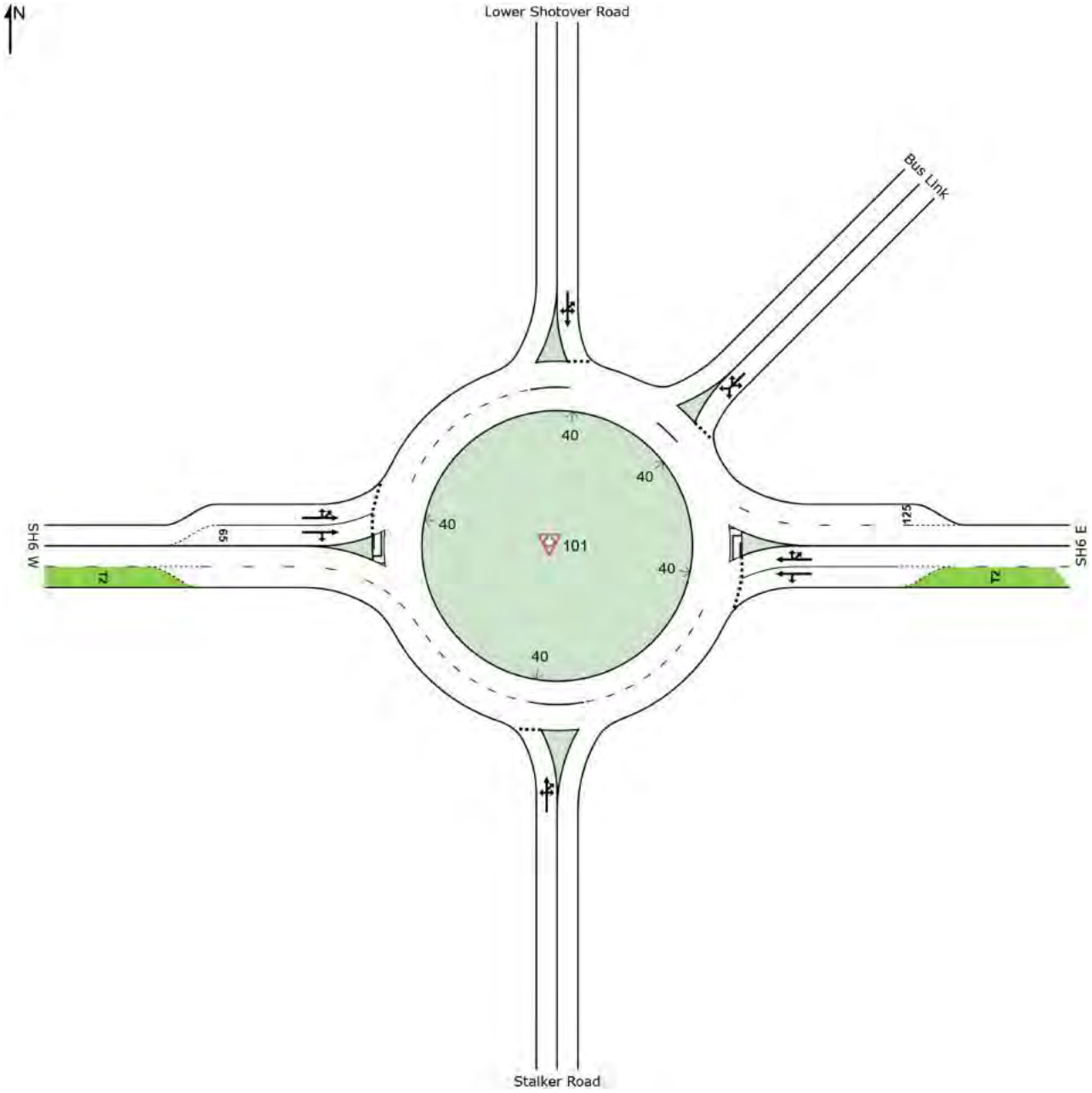
Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Stalker Road											
1	L2	217	2.0	0.474	7.7	LOS A	2.9	20.7	0.82	0.95	52.1
2	T1	18	0.0	0.474	7.1	LOS A	2.9	20.7	0.82	0.95	54.0
3a	R1	1	100.0	0.474	17.2	LOS B	2.9	20.7	0.82	0.95	46.8
3	R2	56	0.0	0.474	13.3	LOS A	2.9	20.7	0.82	0.95	54.1
Approach		292	1.8	0.474	8.8	LOS A	2.9	20.7	0.82	0.95	52.6
East: SH6 E											
4	L2	28	5.0	0.395	8.1	LOS A	2.8	21.4	0.71	0.68	54.2
5	T1	975	5.0	0.435	8.0	LOS A	3.6	25.0	0.70	0.64	66.5
6	R2	28	5.0	0.435	14.6	LOS B	3.6	25.0	0.70	0.61	57.8
6b	R3	1	100.0	0.435	18.5	LOS B	3.6	25.0	0.70	0.61	58.4
Approach		1032	5.1	0.435	8.2	LOS A	3.6	25.0	0.70	0.64	65.8
NorthEast: Bus Link											
24b	L3	1	100.0	0.016	15.4	LOS B	0.1	0.8	0.79	0.81	40.1
24a	L1	1	100.0	0.016	14.2	LOS A	0.1	0.8	0.79	0.81	42.0
26a	R1	1	100.0	0.016	19.8	LOS B	0.1	0.8	0.79	0.81	40.8
26b	R3	1	100.0	0.016	21.9	LOS B	0.1	0.8	0.79	0.81	43.7
Approach		4	100.0	0.016	17.8	LOS B	0.1	0.8	0.79	0.81	41.6
North: Lower Shotover Road											
7b	L3	1	100.0	0.477	18.0	LOS B	2.8	20.5	0.82	0.99	48.9
7	L2	38	5.0	0.477	12.4	LOS A	2.8	20.5	0.82	0.99	57.0
8	T1	65	0.0	0.477	12.7	LOS A	2.8	20.5	0.82	0.99	51.7
9	R2	184	5.0	0.477	19.8	LOS B	2.8	20.5	0.82	0.99	58.9
Approach		288	4.2	0.477	17.2	LOS B	2.8	20.5	0.82	0.99	56.8
West: SH6 W											
10	L2	200	8.0	0.460	6.0	LOS A	3.8	28.6	0.40	0.48	64.6
10a	L1	1	100.0	0.460	6.9	LOS A	3.8	28.6	0.40	0.48	57.4
11	T1	1099	8.0	0.508	6.2	LOS A	4.6	34.4	0.39	0.50	66.2
12	R2	239	5.0	0.508	13.0	LOS A	4.6	34.4	0.38	0.52	58.7
Approach		1539	7.6	0.508	7.2	LOS A	4.6	34.4	0.39	0.50	64.7
All Vehicles		3155	6.0	0.508	8.6	LOS A	4.6	34.4	0.57	0.63	62.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 101 [Stalker Road/SH6 AM Roundabout 2028]

New Site
Roundabout



MOVEMENT SUMMARY

Site: 101 [Stalker Road/SH6 AM Roundabout 2028]

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Stalker Road											
1	L2	309	2.0	0.686	12.6	LOS A	5.3	37.9	0.90	1.11	49.0
2	T1	30	0.0	0.686	12.0	LOS A	5.3	37.9	0.90	1.11	50.7
3a	R1	1	100.0	0.686	23.0	LOS B	5.3	37.9	0.90	1.11	44.3
3	R2	56	0.0	0.686	18.1	LOS B	5.3	37.9	0.90	1.11	50.8
Approach		396	1.8	0.686	13.4	LOS A	5.3	37.9	0.90	1.11	49.4
East: SH6 E											
4	L2	44	5.0	0.426	7.2	LOS A	3.0	23.3	0.61	0.60	54.7
5	T1	1165	5.0	0.469	7.2	LOS A	3.8	26.4	0.59	0.58	67.4
6	R2	41	5.0	0.469	13.9	LOS A	3.8	26.4	0.58	0.56	58.4
6b	R3	1	100.0	0.469	17.4	LOS B	3.8	26.4	0.58	0.56	59.1
Approach		1251	5.1	0.469	7.5	LOS A	3.8	26.4	0.59	0.58	66.5
NorthEast: Bus Link											
24b	L3	1	100.0	0.011	9.9	LOS A	0.0	0.6	0.68	0.70	42.6
24a	L1	1	100.0	0.011	8.6	LOS A	0.0	0.6	0.68	0.70	44.7
26a	R1	1	100.0	0.011	14.2	LOS A	0.0	0.6	0.68	0.70	43.4
26b	R3	1	100.0	0.011	16.3	LOS B	0.0	0.6	0.68	0.70	46.6
Approach		4	100.0	0.011	12.2	LOS A	0.0	0.6	0.68	0.70	44.3
North: Lower Shotover Road											
7b	L3	1	100.0	0.267	12.7	LOS A	1.2	9.1	0.67	0.88	50.7
7	L2	21	5.0	0.267	8.6	LOS A	1.2	9.1	0.67	0.88	59.4
8	T1	22	0.0	0.267	8.9	LOS A	1.2	9.1	0.67	0.88	53.7
9	R2	155	5.0	0.267	16.0	LOS B	1.2	9.1	0.67	0.88	61.4
Approach		199	4.9	0.267	14.4	LOS A	1.2	9.1	0.67	0.88	60.1
West: SH6 W											
10	L2	241	8.0	0.351	6.0	LOS A	2.5	19.0	0.39	0.50	64.8
10a	L1	1	100.0	0.351	7.0	LOS A	2.5	19.0	0.39	0.50	57.6
11	T1	760	8.0	0.387	6.2	LOS A	3.0	22.6	0.38	0.51	66.4
12	R2	147	5.0	0.387	13.0	LOS A	3.0	22.6	0.37	0.52	59.0
Approach		1149	7.7	0.387	7.0	LOS A	3.0	22.6	0.38	0.51	65.0
All Vehicles		2999	5.8	0.686	8.5	LOS A	5.3	37.9	0.56	0.64	62.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Stalker Road/SH6 IP Roundabout 2028]

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Stalker Road											
1	L2	244	2.0	0.509	8.3	LOS A	3.2	22.7	0.83	0.96	51.8
2	T1	22	0.0	0.509	7.7	LOS A	3.2	22.7	0.83	0.96	53.8
3a	R1	1	100.0	0.509	17.9	LOS B	3.2	22.7	0.83	0.96	46.6
3	R2	52	0.0	0.509	13.8	LOS A	3.2	22.7	0.83	0.96	53.9
Approach		319	1.8	0.509	9.2	LOS A	3.2	22.7	0.83	0.96	52.3
East: SH6 E											
4	L2	33	5.0	0.385	7.2	LOS A	2.6	20.4	0.61	0.61	54.7
5	T1	1025	5.0	0.423	7.3	LOS A	3.3	23.2	0.60	0.58	67.3
6	R2	46	5.0	0.423	14.0	LOS A	3.3	23.2	0.59	0.57	58.4
6b	R3	1	100.0	0.423	17.4	LOS B	3.3	23.2	0.59	0.57	59.0
Approach		1105	5.1	0.423	7.6	LOS A	3.3	23.2	0.60	0.58	66.4
NorthEast: Bus Link											
24b	L3	1	100.0	0.012	10.7	LOS A	0.0	0.6	0.70	0.73	42.2
24a	L1	1	100.0	0.012	9.5	LOS A	0.0	0.6	0.70	0.73	44.3
26a	R1	1	100.0	0.012	15.0	LOS B	0.0	0.6	0.70	0.73	43.0
26b	R3	1	100.0	0.012	17.1	LOS B	0.0	0.6	0.70	0.73	46.2
Approach		4	100.0	0.012	13.1	LOS A	0.0	0.6	0.70	0.73	43.9
North: Lower Shotover Road											
7b	L3	1	100.0	0.310	13.4	LOS A	1.5	10.7	0.70	0.88	50.7
7	L2	26	5.0	0.310	9.0	LOS A	1.5	10.7	0.70	0.88	59.5
8	T1	43	0.0	0.310	9.3	LOS A	1.5	10.7	0.70	0.88	53.8
9	R2	153	5.0	0.310	16.4	LOS B	1.5	10.7	0.70	0.88	61.5
Approach		223	4.5	0.310	14.2	LOS A	1.5	10.7	0.70	0.88	59.6
West: SH6 W											
10	L2	210	8.0	0.368	6.0	LOS A	2.7	19.9	0.38	0.49	64.8
10a	L1	1	100.0	0.368	6.9	LOS A	2.7	19.9	0.38	0.49	57.6
11	T1	849	8.0	0.406	6.2	LOS A	3.2	23.6	0.37	0.51	66.5
12	R2	158	5.0	0.406	13.0	LOS A	3.2	23.6	0.36	0.51	59.0
Approach		1218	7.7	0.406	7.0	LOS A	3.2	23.6	0.37	0.51	65.1
All Vehicles		2869	5.9	0.509	8.0	LOS A	3.3	23.6	0.53	0.62	63.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Stalker Road/SH6 PM Roundabout 2028]

New Site
Roundabout

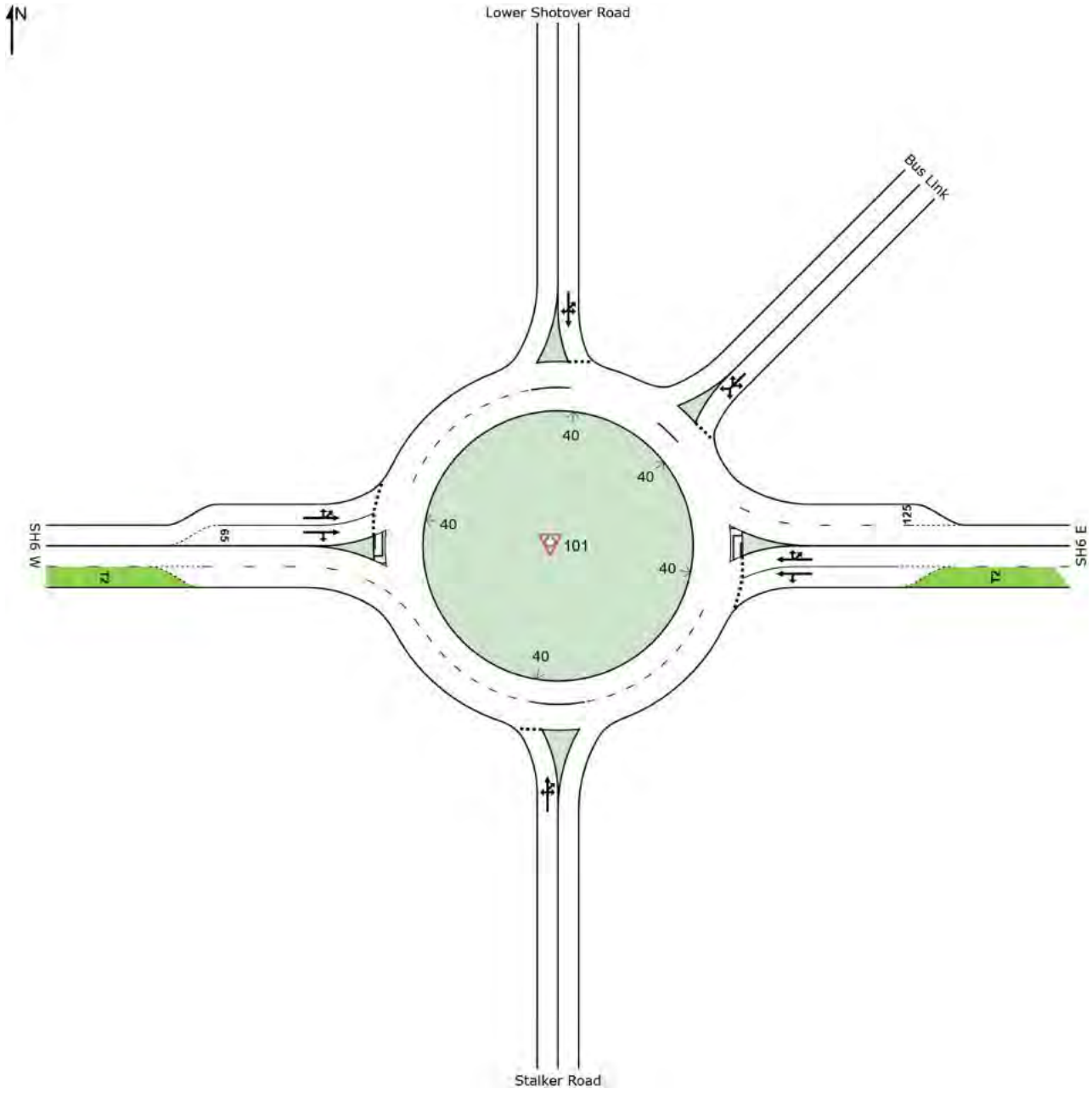
Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Stalker Road											
1	L2	234	2.0	0.577	10.4	LOS A	3.9	28.0	0.89	1.03	50.2
2	T1	19	0.0	0.577	9.8	LOS A	3.9	28.0	0.89	1.03	52.0
3a	R1	1	100.0	0.577	20.5	LOS B	3.9	28.0	0.89	1.03	45.3
3	R2	60	0.0	0.577	16.0	LOS B	3.9	28.0	0.89	1.03	52.1
Approach		314	1.8	0.577	11.5	LOS A	3.9	28.0	0.89	1.03	50.7
East: SH6 E											
4	L2	33	5.0	0.457	8.1	LOS A	3.4	26.0	0.73	0.68	54.1
5	T1	1114	5.0	0.502	8.0	LOS A	4.3	30.5	0.72	0.64	66.2
6	R2	60	5.0	0.502	14.6	LOS B	4.3	30.5	0.72	0.62	57.5
6b	R3	1	100.0	0.502	18.5	LOS B	4.3	30.5	0.72	0.62	58.2
Approach		1208	5.1	0.502	8.4	LOS A	4.3	30.5	0.72	0.64	65.3
NorthEast: Bus Link											
24b	L3	1	100.0	0.017	16.0	LOS B	0.1	0.9	0.80	0.81	39.9
24a	L1	1	100.0	0.017	14.8	LOS B	0.1	0.9	0.80	0.81	41.7
26a	R1	1	100.0	0.017	20.3	LOS B	0.1	0.9	0.80	0.81	40.6
26b	R3	1	100.0	0.017	22.4	LOS B	0.1	0.9	0.80	0.81	43.4
Approach		4	100.0	0.017	18.3	LOS B	0.1	0.9	0.80	0.81	41.4
North: Lower Shotover Road											
7b	L3	1	100.0	0.506	18.6	LOS B	3.1	22.7	0.83	1.00	48.6
7	L2	38	5.0	0.506	12.9	LOS A	3.1	22.7	0.83	1.00	56.7
8	T1	73	0.0	0.506	13.2	LOS A	3.1	22.7	0.83	1.00	51.4
9	R2	184	5.0	0.506	20.3	LOS B	3.1	22.7	0.83	1.00	58.5
Approach		296	4.1	0.506	17.6	LOS B	3.1	22.7	0.83	1.00	56.3
West: SH6 W											
10	L2	225	8.0	0.477	6.2	LOS A	3.9	29.0	0.46	0.52	64.2
10a	L1	1	100.0	0.477	7.4	LOS A	3.9	29.0	0.46	0.52	57.1
11	T1	1127	8.0	0.526	6.4	LOS A	4.7	34.9	0.45	0.53	65.9
12	R2	203	5.0	0.526	13.1	LOS A	4.7	34.9	0.44	0.53	58.6
Approach		1556	7.7	0.526	7.3	LOS A	4.7	34.9	0.45	0.53	64.6
All Vehicles		3378	6.0	0.577	9.0	LOS A	4.7	34.9	0.62	0.66	62.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 101 [Stalker Road/SH6 AM Roundabout 2028]

New Site
Roundabout



MOVEMENT SUMMARY

Site: 101 [Stalker Road/SH6 AM Roundabout 2037]

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Stalker Road											
1	L2	210	2.0	0.598	12.3	LOS A	4.2	29.8	0.90	1.07	49.0
2	T1	34	0.0	0.598	11.7	LOS A	4.2	29.8	0.90	1.07	50.7
3a	R1	1	100.0	0.598	22.9	LOS B	4.2	29.8	0.90	1.07	44.3
3	R2	58	0.0	0.598	17.9	LOS B	4.2	29.8	0.90	1.07	50.8
Approach		303	1.7	0.598	13.4	LOS A	4.2	29.8	0.90	1.07	49.5
East: SH6 E											
4	L2	45	5.0	0.482	7.5	LOS A	3.6	28.1	0.68	0.63	54.3
5	T1	1252	5.0	0.530	7.6	LOS A	4.6	32.5	0.67	0.60	66.7
6	R2	63	5.0	0.530	14.2	LOS A	4.6	32.5	0.66	0.59	57.9
6b	R3	1	100.0	0.530	17.9	LOS B	4.6	32.5	0.66	0.59	58.5
Approach		1361	5.1	0.530	7.9	LOS A	4.6	32.5	0.67	0.61	65.7
NorthEast: Bus Link											
24b	L3	1	100.0	0.014	13.5	LOS A	0.1	0.8	0.76	0.77	40.9
24a	L1	1	100.0	0.014	12.3	LOS A	0.1	0.8	0.76	0.77	42.9
26a	R1	1	100.0	0.014	17.8	LOS B	0.1	0.8	0.76	0.77	41.7
26b	R3	1	100.0	0.014	19.9	LOS B	0.1	0.8	0.76	0.77	44.6
Approach		4	100.0	0.014	15.9	LOS B	0.1	0.8	0.76	0.77	42.5
North: Lower Shotover Road											
7b	L3	1	100.0	0.398	15.9	LOS B	2.2	16.3	0.79	0.96	49.4
7	L2	31	5.0	0.398	10.9	LOS A	2.2	16.3	0.79	0.96	57.7
8	T1	30	0.0	0.398	11.2	LOS A	2.2	16.3	0.79	0.96	52.3
9	R2	187	5.0	0.398	18.3	LOS B	2.2	16.3	0.79	0.96	59.6
Approach		249	4.8	0.398	16.5	LOS B	2.2	16.3	0.79	0.96	58.3
West: SH6 W											
10	L2	343	8.0	0.461	6.3	LOS A	3.7	27.5	0.48	0.54	64.3
10a	L1	1	100.0	0.461	7.5	LOS A	3.7	27.5	0.48	0.54	57.2
11	T1	991	8.0	0.509	6.4	LOS A	4.5	33.2	0.46	0.53	65.9
12	R2	150	5.0	0.509	13.2	LOS A	4.5	33.2	0.46	0.53	58.7
Approach		1485	7.8	0.509	7.1	LOS A	4.5	33.2	0.46	0.53	64.7
All Vehicles		3402	6.0	0.598	8.7	LOS A	4.6	33.2	0.61	0.64	62.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Stalker Road/SH6 IP Roundabout 2037]

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Stalker Road											
1	L2	202	2.0	0.560	11.5	LOS A	3.8	26.7	0.89	1.04	49.5
2	T1	25	0.0	0.560	10.9	LOS A	3.8	26.7	0.89	1.04	51.3
3a	R1	1	100.0	0.560	22.1	LOS B	3.8	26.7	0.89	1.04	44.7
3	R2	53	0.0	0.560	17.1	LOS B	3.8	26.7	0.89	1.04	51.4
Approach		281	1.8	0.560	12.6	LOS A	3.8	26.7	0.89	1.04	50.0
East: SH6 E											
4	L2	35	5.0	0.485	7.6	LOS A	3.7	28.6	0.69	0.64	54.3
5	T1	1258	5.0	0.533	7.6	LOS A	4.7	33.1	0.68	0.61	66.6
6	R2	69	5.0	0.533	14.2	LOS A	4.7	33.1	0.67	0.59	57.8
6b	R3	1	100.0	0.533	17.9	LOS B	4.7	33.1	0.67	0.59	58.5
Approach		1363	5.1	0.533	7.9	LOS A	4.7	33.1	0.68	0.61	65.7
NorthEast: Bus Link											
24b	L3	1	100.0	0.014	12.8	LOS A	0.1	0.7	0.75	0.76	41.2
24a	L1	1	100.0	0.014	11.6	LOS A	0.1	0.7	0.75	0.76	43.2
26a	R1	1	100.0	0.014	17.2	LOS B	0.1	0.7	0.75	0.76	42.0
26b	R3	1	100.0	0.014	19.3	LOS B	0.1	0.7	0.75	0.76	45.0
Approach		4	100.0	0.014	15.2	LOS B	0.1	0.7	0.75	0.76	42.8
North: Lower Shotover Road											
7b	L3	1	100.0	0.416	15.5	LOS B	2.3	17.0	0.77	0.95	49.9
7	L2	35	5.0	0.416	10.6	LOS A	2.3	17.0	0.77	0.95	58.4
8	T1	57	0.0	0.416	10.9	LOS A	2.3	17.0	0.77	0.95	52.9
9	R2	184	5.0	0.416	18.0	LOS B	2.3	17.0	0.77	0.95	60.4
Approach		277	4.3	0.416	15.6	LOS B	2.3	17.0	0.77	0.95	58.4
West: SH6 W											
10	L2	300	8.0	0.426	6.2	LOS A	3.2	24.1	0.44	0.52	64.5
10a	L1	1	100.0	0.426	7.4	LOS A	3.2	24.1	0.44	0.52	57.3
11	T1	953	8.0	0.470	6.4	LOS A	3.9	29.0	0.43	0.52	66.2
12	R2	130	5.0	0.470	13.1	LOS A	3.9	29.0	0.42	0.52	59.0
Approach		1384	7.8	0.470	7.0	LOS A	3.9	29.0	0.43	0.52	65.1
All Vehicles		3309	6.0	0.560	8.6	LOS A	4.7	33.1	0.60	0.64	63.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Stalker Road/SH6 PM Roundabout 2037]

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Stalker Road											
1	L2	239	2.0	0.944	49.8	LOS D	11.9	84.5	1.00	1.59	32.9
2	T1	21	0.0	0.944	49.2	LOS D	11.9	84.5	1.00	1.59	33.6
3a	R1	1	100.0	0.944	62.6	LOS E	11.9	84.5	1.00	1.59	30.7
3	R2	61	0.0	0.944	55.3	LOS D	11.9	84.5	1.00	1.59	33.7
Approach		322	1.8	0.944	50.9	LOS D	11.9	84.5	1.00	1.59	33.1
East: SH6 E											
4	L2	34	5.0	0.643	10.3	LOS A	6.6	50.8	0.86	0.87	53.3
5	T1	1545	5.0	0.707	10.1	LOS A	9.4	65.8	0.86	0.82	65.0
6	R2	90	5.0	0.707	16.6	LOS B	9.4	65.8	0.86	0.80	56.6
6b	R3	1	100.0	0.707	20.9	LOS B	9.4	65.8	0.86	0.80	57.2
Approach		1670	5.1	0.707	10.5	LOS A	9.4	65.8	0.86	0.82	64.2
NorthEast: Bus Link											
24b	L3	1	100.0	0.018	18.3	LOS B	0.1	1.0	0.82	0.83	38.9
24a	L1	1	100.0	0.018	17.1	LOS B	0.1	1.0	0.82	0.83	40.7
26a	R1	1	100.0	0.018	22.6	LOS B	0.1	1.0	0.82	0.83	39.6
26b	R3	1	100.0	0.018	24.7	LOS B	0.1	1.0	0.82	0.83	42.3
Approach		4	100.0	0.018	20.7	LOS B	0.1	1.0	0.82	0.83	40.4
North: Lower Shotover Road											
7b	L3	1	100.0	0.636	21.3	LOS B	4.7	34.1	0.89	1.07	47.2
7	L2	46	5.0	0.636	15.4	LOS B	4.7	34.1	0.89	1.07	54.8
8	T1	97	0.0	0.636	15.6	LOS B	4.7	34.1	0.89	1.07	49.9
9	R2	223	5.0	0.636	22.8	LOS B	4.7	34.1	0.89	1.07	56.5
Approach		367	3.9	0.636	20.0	LOS B	4.7	34.1	0.89	1.07	54.3
West: SH6 W											
10	L2	323	8.0	0.499	6.5	LOS A	4.1	30.4	0.51	0.55	64.0
10a	L1	1	100.0	0.499	7.9	LOS A	4.1	30.4	0.51	0.55	56.9
11	T1	1127	8.0	0.550	6.6	LOS A	5.0	37.0	0.50	0.54	65.8
12	R2	139	5.0	0.550	13.3	LOS A	5.0	37.0	0.49	0.54	58.6
Approach		1590	7.8	0.550	7.1	LOS A	5.0	37.0	0.50	0.54	64.7
All Vehicles		3953	5.9	0.944	13.3	LOS A	11.9	84.5	0.73	0.79	58.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

12 Appendix C – Economic Evaluation

1.1 Assumptions

The following assumptions have been made in the economics analysis:

- Time zero of 1 July 2018
- Earliest construction start is in FY2019/20
- Construction period of 8 months
- Discount period of 40 years with 6% discount factor
- Travel time costs have been taken from Table A4.1(a) of the EEM using the “base values of time for uncongested traffic”, and Table A4.2 for vehicle and freight travel times.
- Due to the high-level nature of this assessment, vehicle Operating Cost (VOC) and Carbon Dioxide (CO2) costs savings have not been calculated.
- Due to the high-level nature of this assessment, periodic maintenance costs have not been calculated.
- Due to the high-level nature of this assessment, walking and cycling benefits have not been calculated.
- The assumed proportion of high occupancy vehicle (>1 person/vehicle) is 25% of overall traffic, based on a recent occupancy survey at Lower Shotover Bridge
- The expected mode shift between private car to public transport for each programme is as discussed in Section on Modelling
- Bus service frequency for year 0 is as per the current service frequency along SH6, which is approximately 2 buses/hr in each direction in the peak periods. The Do Minimum scenario in both programmes assumes a bus service frequency of 4 buses/hr in each direction along SH6 in peak periods.
- The assumed bus service frequency along SH6 for the Do Something scenario in each programme is based on the estimated mode shift to public transport for each programme. For Programme 1, the estimated peak hour bus service is 8 buses in each direction, and for Programme 2, the estimated peak hour bus service is 13 buses in each direction.
- Due to the high-level nature of this assessment, no further background traffic growth beyond the completed year of each programme has been considered. Side road traffic volumes are expected to stay reasonably constant without further development. State Highway 6 traffic volumes are constrained by the capacity of the highway upstream and downstream, so cannot grow significantly higher.
- All movement delays are capped at 300 seconds, to reflect drivers rerouting or changing travel behaviour once delays become excessive.
- The annual peak periods included in the analysis are AM (490hrs/year), IP (1715 hrs/year), PM (490hrs/year)
- No sensitivity tests have been undertaken

1.2 Economic Evaluations

Programme 1

Worksheet 1: Evaluation summary

	Evaluation summary	
(1)	Evaluator(s)	Gabriela Surja
	Reviewer(s)	Chris Morahan
(2)	**Project/package details**	
	Approved organisation name	WSP Opus
	Project/package name	Ladies Mile Housing Infrastructure Fund
	Your reference	
	Project description	Programme 1 : Developing 450 lots in the area to the North of SH6 between Howards Drive and Stalker Road. Access via new intersection at the Howards Drive junction
	Describe the predominant type of problem	The need to address the potential adverse transport effects caused by the development, and to identify a sustainable access strategy for the Ladies Mile site.
(3)	**Location**	
	Brief description of location	SH6 between Stalker Rd/Lower Shotover Rd and McDowell Dr
(4)	**Alternatives and options**	
	Describe the do minimum	The minimum transport corridor improvements needed to accommodate 450 new residential houses to the north of SH6 between Howards Dr and Stalker Rd. This includes maintaining the existing Stalker Rd roundabout and creating a new northern priorirty at Howards Drive.
	Summarise the options assessed	Creating a new roundabout intersection at Howards Drive, installing a westbound T2 lane along the corridor, and implementing a P&R facility east of the project area.
(5)	**Timing**	
	Earliest construction start date (mm/yyyy)	01/07/2019
	Expected construction start date (mm/yyyy)	01/07/2019
	Expected duration of construction (months)	8
(6)	**Economic efficiency**	
	Date economic evaluation completed (mm/yyyy)	25/06/2018
	Time zero	01/07/2018
	Base date for costs and benefits	01/07/2017
	PV cost of do minimum	$0
	PV net cost of preferred option	$4,914,266
	PV net benefits of preferred option	$10,653,275
(7)	**BCR**	2.2
(8)	**FYRR**	2%
(9)	**Non-monetised impacts**	-
(10)	**National strategic factors**	-

Worksheet 3: Cost - Benefit Cost Analysis

1. Project Options	Do Minimum	Do Something	Option Comparison
COSTS:			Net Costs of the Project Options ($)
2. Capital Costs	$485.849,06	$5.400.115	$4.914.266
3. Maintenance Costs	$157.374,93	$157.375	$0
4. Operating Costs			$0
5. Total Costs (2) to (4)			**$4.914.266**
BENEFITS:			Net Benefits of the Project Options ($)
6. Travel Time Costs	$18.981.930	$8.328.655	$10.653.275
7. Vehicle Operating Costs	$0	$0	$0
8. Carbon Dioxide	$0	$0	$0
9. Crash Costs	$0	$0	$0
12 Total Benefits (6) to (10)			**$10.653.275**
13 B/C Ratio (11) / (5)			2,17

Worksheet 1: Evaluation summary

	Evaluation summary	
(1)	Evaluator(s)	Gabriela Surja
	Reviewer(s)	Chris Morahan
(2)	**Project/package details**	
	Approved organisation name	WSP Opus
	Project/package name	Ladies Mile House Infrastructure Fund
	Your reference	
	Project description	Programme 2: Developing 750 lots in the area to the north of SH6 between Howards Dr and Stalker Dr plus area to east of Howards Dr and west of Stalker Rd.
	Describe the predominant type of problem	The need to address the potential adverse transport effects caused by the development, and to identify a sustainanble access strategy for the Ladies Mile site
(3)	**Location**	
	Brief description of location	SH6 between Stalker Rd/Lower Shotover Rd and McDowell Dr
(4)	**Alternatives and options**	
	Describe the do minimum	The minimum transport corridor improvements needed to accommodate 750 new residential houses to the north of SH6 between Howards Dr and Stalker Rd. This includes maintaining the existing Stalker Rd roundabout and creating a new northern priority access at Howard Dr.
	Summarise the options assessed	Creating a new roundabout at Howards Dr, installing westbound T2 lane along the corridor and a P&R facility east of the project area.
(5)	**Timing**	
	Earliest construction start date (mm/yyyy)	01/07/2019
	Expected construction start date (mm/yyyy)	01/07/2019
	Expected duration of construction (months)	8
(6)	**Economic efficiency**	
	Date economic evaluation completed (mm/yyyy)	25/06/2018
	Time zero	01/07/2018
	Base date for costs and benefits	01/07/2017
	PV cost of do minimum	$0
	PV net cost of preferred option	$4,914,266
	PV net benefits of preferred option	$13,529,364
(7)	**BCR**	2.8
(8)	**FYRR**	2%
(9)	**Non-monetised impacts**	-
(10)	**National strategic factors**	-

Worksheet 3: Cost - Benefit Cost Analysis

1. Project Options	Do Minimum	Do Something	Option Comparison
COSTS:			Net Costs of the Project Options ($)
2. Capital Costs	$485.849,06	$5.400.115	$4.914.266
3. Maintenance Costs	$157.374,93	$157.375	$0
4. Operating Costs			$0
5. Total Costs (2) to (4)			**$4.914.266**
BENEFITS:			Net Benefits of the Project Options ($)
6. Travel Time Costs	$22.503.883	$8.974.519	$13.529.364
7. Vehicle Operating Costs	$0	$0	$0
8. Carbon Dioxide	$0	$0	$0
9. Crash Costs	$0	$0	$0
12 Total Benefits (6) to (10)			**$13.529.364**
13 B/C Ratio (11) / (5)			2,75

1.3 Construction Costs

Construction Cost for Economics

Stalker Rd	Construction Estimate Sept 2017	Construction Estimate Mar 2018 (*1.03)
Do Min (RAB without bus link)	0	$ -
Do Something (RAB with bus link)	500000	$ 515.000,00
Howards Rd		
Do Min : Staggered T-intersection	500000	$ 515.000,00
Do Something : Roundabout	5057400	$ 5.209.122,00

Maintenance Cost for Economics (based on RCME curve, Nov 2008, with index multiplier of 1.15 to update to Mar 2018 quarter)

Stalker Rd	Maintenance Cost/km (based on RMCE) - based on 2lane, 2-way rural road (single lane each direction)	length of project	Lane multiplier	Maintenance Cost Mar 2018 (*1.03)
Do Min (RAB without bus link)	2821	0,75	2	$ 4.358,45
Do SOmething (RAB with bus link)	2821	1	2	$ 5.811,26
Howards Rd				
Do Min Staggered T-intersection	2821	0,75	2	$ 4.358,45
Do Something Roundabout	2821	0,75	2	$ 4.358,45
Maintenance cost of Howards Rd T-junction (existing) - before staggered leg is constructed	2821	0,5	2	$ 2.821,00

13 Appendix D - Designs

Roundabout Concept

QUEENSTOWN LAKES DISTRICT COUNCIL
HOUSING INFRASTRUCTURE FUND
LADIES MILE SH6

CONCEPT DESIGN

Project No: 6-XQ074.01

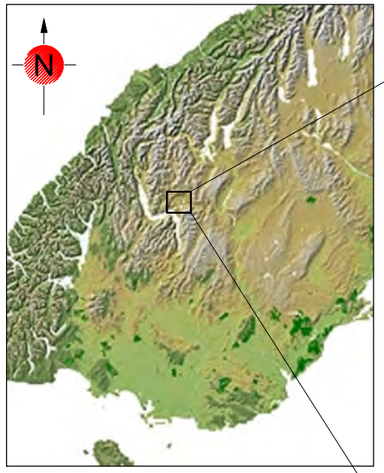
Date: MARCH 2018

DRAWING INDEX

SHEET #	TITLE
GENERAL	
G00	COVER SHEET / DRAWING INDEX
G01	LOCATION PLAN
G02	SITE LAYOUT PLAN
RISING MAIN	
C01	LOWER SHOTOVER ROAD T JUNCTION PLAN
C02.1	HOWARD DRIVE ROUNDABOUT PLAN - OPTION 1
C02.2	HOWARD DRIVE ROUNDABOUT PLAN - OPTION 2
C02.3	HOWARD DRIVE ROUNDABOUT PLAN - OPTION 3
C03	McDOWELL DRIVE ROUNDABOUT PLAN

QUEENSTOWN LAKES DISTRICT COUNCIL
HOUSING INFRASTRUCTURE FUND

LADIES MILE SH6



LOCATION MAP

LOCATION PLAN
SCALE 1:50,000 (A1)
1:100,000 (A3)

CONCEPT DESIGN

Revision	Amendment	Approved	Revision Date
A	CONCEPT DESIGN		

QUEENSTOWN LAKES DISTRICT COUNCIL

OPUS
Nelson Office
+64 3 548 1099
Private Bag 36
Nelson 7042
New Zealand

Designed	Approved	Approved Date
H. TREGOWETH		

Drawn	Scales
S. FORBES	AS SHOWN

Project
QUEENSTOWN LAKES DISTRICT COUNCIL HOUSING INFRASTRUCTURE FUND LADIES MILE SH6

Sheet
LOCATION PLAN

Project No.	Sheet. No.	Revision
6-XQ074.01	G01	A

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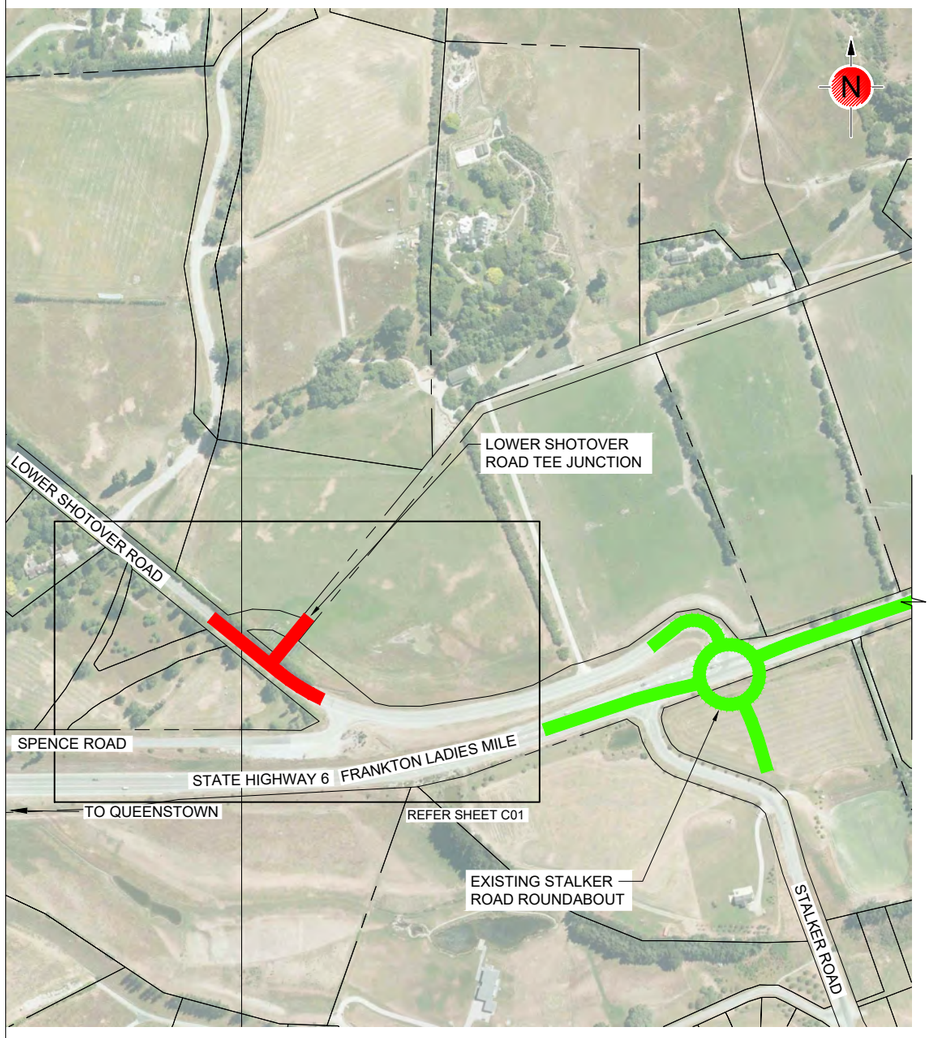

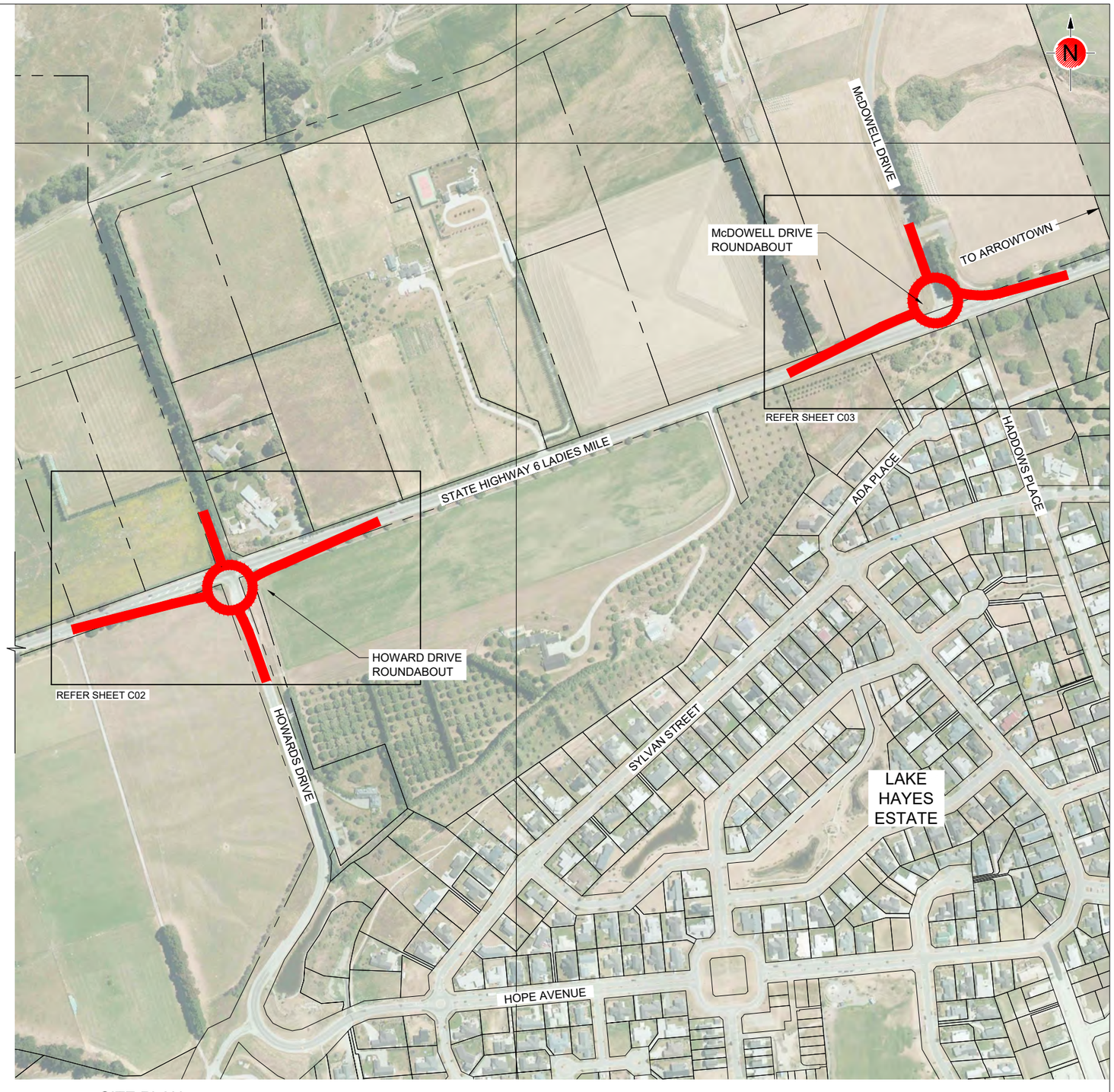

SITE PLAN

SCALE 1:2,500 (A1)
1:5,000 (A3)

CONCEPT DESIGN

1:2500 @ A1
1:5000 @ A3
0 40 80 120 160 200 240 m

Revision	Amendment	Approved	Revision Date
A	CONCEPT DESIGN		

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New Zealand

Designed	Approved	Approved Date
H. TREGOWETH		

Drawn	Scales
S. FORBES	AS SHOWN

Project
QUEENSTOWN LAKES DISTRICT COUNCIL
HOUSING INFRASTRUCTURE FUND
LADIES MILE SH6

Sheet
SITE PLAN

Project No.	Sheet. No.	Revision
6-XQ074.01	G02	A

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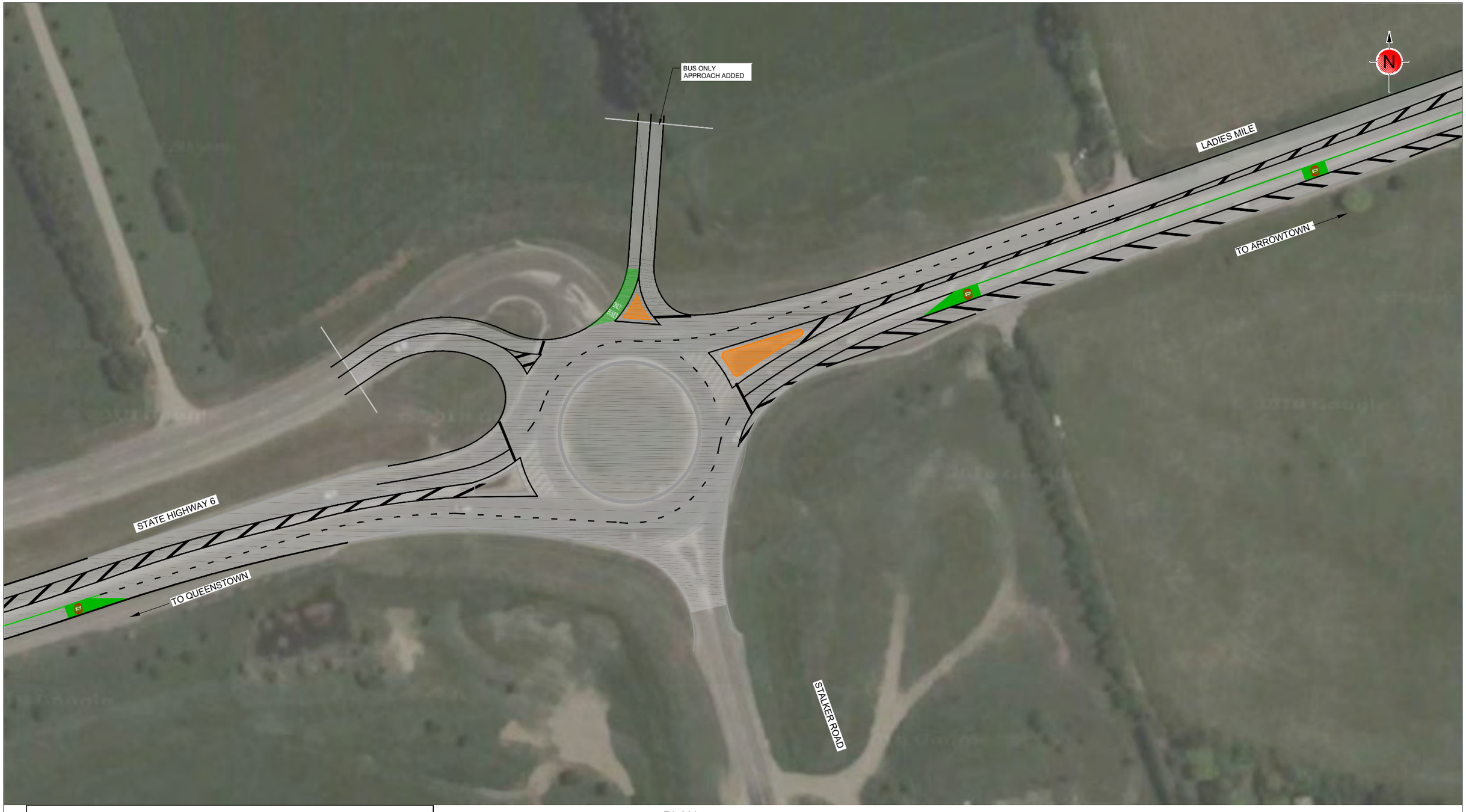
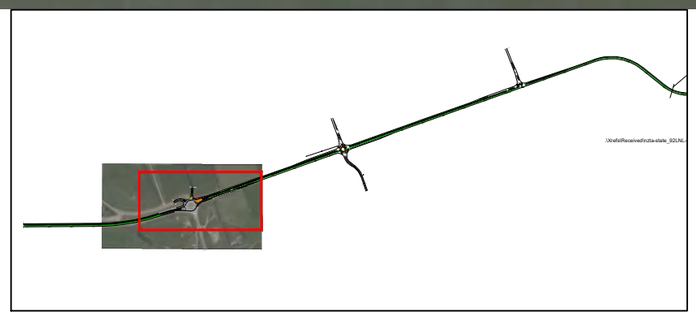


300 mm
200
100
50
10 mm
0



1:500 @ A1
1:1000 @ A3
0 5 10 15 20 25 30 35 40 45 50 m

PLAN

SCALE 1:500 (A1)
1:1000 (A3)

NOTE:
1. BUS ONLY APPROACH ADDED TO EXISTING ROUNDABOUT

CONCEPT DESIGN

Revision	Amendment	Approved	Revision Date
A	CONCEPT DESIGN		

QUEENSTOWN LAKES DISTRICT COUNCIL

WSP OPUS
Dunedin Office
+64 3 471 5500
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Dunedin 9016
New Zealand

Designed	Approved	Approved Date
S C		

Drawn	Scales
S C	AS SHOWN

Project
QUEENSTOWN LAKES DISTRICT COUNCIL
HOUSING INFRASTRUCTURE FUND
LADIES MILE SH6

Sheet
PLAN
STALKER ROAD INTERSECTION

Project No.	Sheet. No.	Revision
6-XQ074.01	C04	A

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300 mm
200
100
50
10 mm
0

PLAN

SCALE 1:500 (A1)
1:1000 (A3)

DRAWIN□ IN □RO□RESS

PLOTTED ON 2018-3-9 AT 1:08 PM

CONCEPT DESIGN

Revision	Amendment	Approved	Revision Date
A	CONCEPT DESIGN		

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OPUS
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+64 3 471 5500
Private Bag 1913
Dunedin 9016
New Zealand

Designed	Approved	Approved Date
S.A.		

Drawn	Scales
T.S.	AS SHOWN

Project
QUEENSTOWN LAKES DISTRICT COUNCIL
HOUSING INFRASTRUCTURE FUND
LADIES MILE SH6

Sheet
PLAN
LOWER SHOTOVER ROAD T JUNCTION

Project No.	Sheet. No.	Revision
6-XQ074.01	C01	A

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1:1000@ A3
0 5 10 15 20 25 30 35 40 45 50 m

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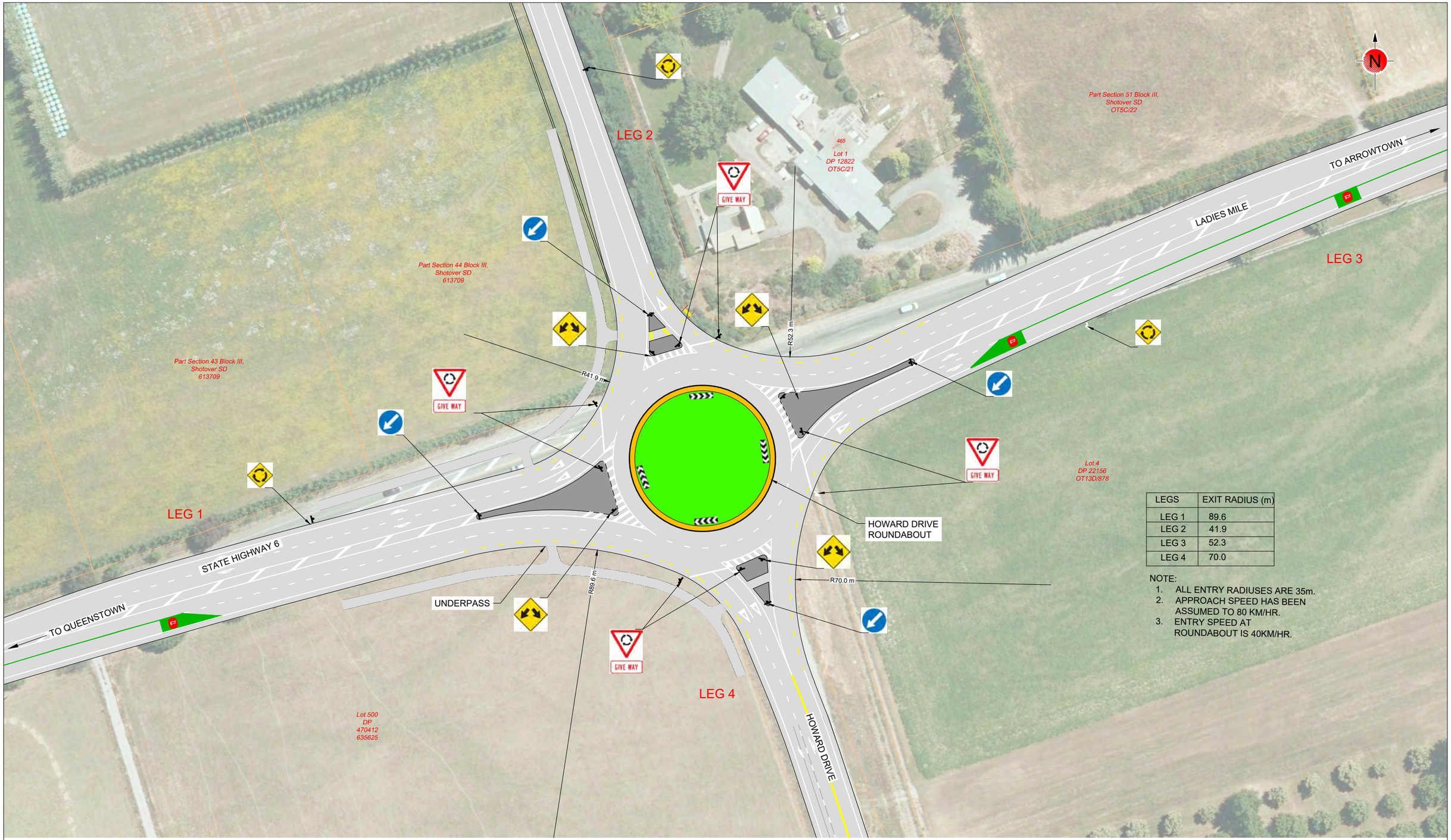


LEGS	EXIT RADIUS (m)
LEG 1	89.6
LEG 2	41.9
LEG 3	52.3
LEG 4	70.0

NOTE:
1. ALL ENTRY RADIUSES ARE 35m.
2. APPROACH SPEED HAS BEEN ASSUMED TO 80 KM/HR.
3. ENTRY SPEED AT ROUNDABOUT IS 40KM/HR.

PLAN

SCALE 1:500 (A1)
1:1000 (A3)

CONCEPT DESIGN

Revision	Amendment	Approved	Revision Date
A	CONCEPT DESIGN		

qldc logo.png

OPUS
Dunedin Office
+64 3 471 5500
Private Bag 1913
Dunedin 9016
New Zealand

Designed	Approved	Approved Date
V DUBE		

Drawn	Scales
V DUBE	AS SHOWN

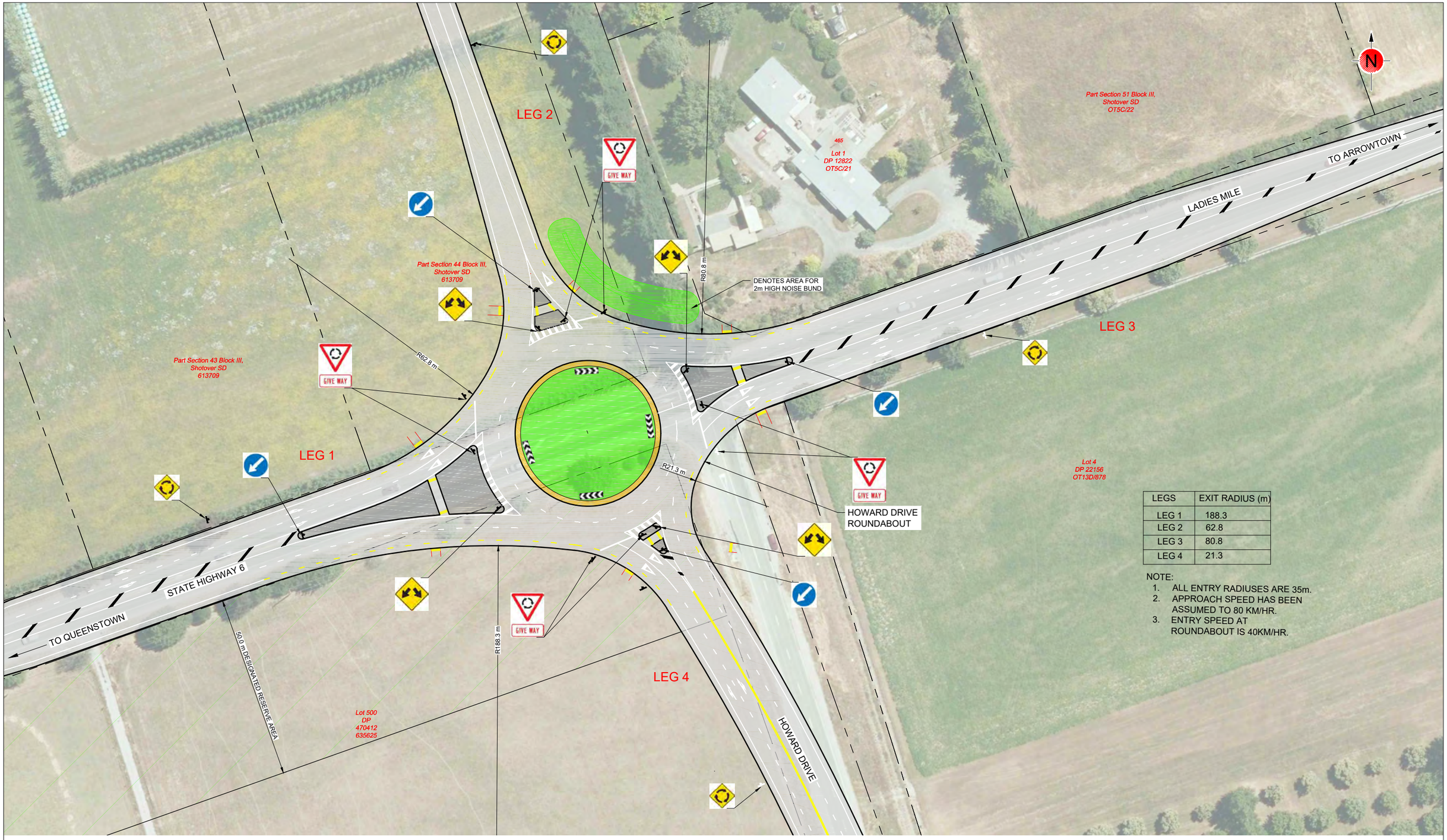
Project
QUEENSTOWN LAKES DISTRICT COUNCIL
HOUSING INFRASTRUCTURE FUND
LADIES MILE SH6

Sheet
PLAN
HOWARD DRIVE ROUNDABOUT

Project No.	Sheet. No.	Revision
6-XQ074.01	C02	A

1:500 @ A1
1:1000 @ A3
0 5 10 15 20 25 30 35 40 45 50 m

Original Sheet Size A1 [841x594] Plot Date 2018-06-27 at 1:22:07 PM Path G:\NZTA\Reg 13\Ladies Mile HIF\6-XQ074.01 - Ladies Mile Concept Drawings\6-XQ074.01_C02.dwg C02



LEGS	EXIT RADIUS (m)
LEG 1	188.3
LEG 2	62.8
LEG 3	80.8
LEG 4	21.3

NOTE:
1. ALL ENTRY RADIUSES ARE 35m.
2. APPROACH SPEED HAS BEEN ASSUMED TO 80 KM/HR.
3. ENTRY SPEED AT ROUNDABOUT IS 40KM/HR.

PLAN

SCALE 1:500 (A1)
1:1000 (A3)

CONCEPT DESIGN

1:500 @ A1
1:1000 @ A3
0 5 10 15 20 25 30 35 40 45 50 m

Revision	Amendment	Approved	Revision Date
A	CONCEPT DESIGN		

QUEENSTOWN LAKES DISTRICT COUNCIL

OPUS
Dunedin Office
+64 3 471 5500
Private Bag 1913
Dunedin 9016
New Zealand

Designed	Approved	Approved Date
V DUBE		

Drawn	Scales
V DUBE	AS SHOWN

Project
QUEENSTOWN LAKES DISTRICT COUNCIL
HOUSING INFRASTRUCTURE FUND
LADIES MILE SH6

Sheet
PLAN
HOWARD DRIVE ROUNDABOUT - OPTION 2

Project No.	Sheet. No.	Revision
6-XQ074.01	C02.2	A

Original Sheet Size A1 [841x594] Plot Date 2018-03-09 at 3:52:48 PM Path G:\projectdata\other_offices\Queenstown\6-XQ074.01 - Ladies Mile Concept Design\Drawings\6-XQ074.01_C02 - OPT 2.dwg C02

13 Appendix D - Designs

Signals Concept

PLAN
NOT TO SCALE

CONCEPT DESIGN

Revision	Amendment	Approved	Revision Date
A	CONCEPT DESIGN		

QUEENSTOWN LAKES DISTRICT COUNCIL

WSP OPUS
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New Zealand

Designed	Approved	Approved Date
S C		

Drawn	Scales
S C	AS SHOWN

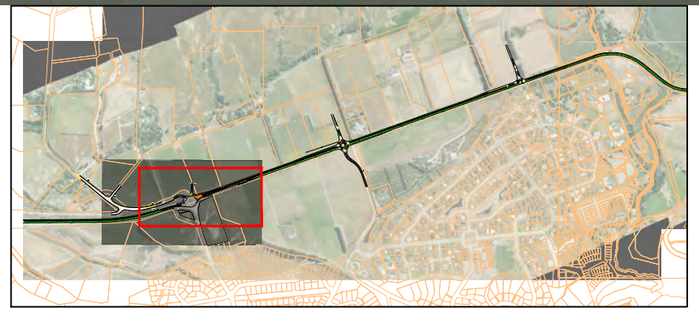
Project
QUEENSTOWN LAKES DISTRICT COUNCIL
HOUSING INFRASTRUCTURE FUND
LADIES MILE SH6

Sheet
PLAN
SITE PLAN

Project No.	Sheet. No.	Revision
6-XQ074.01	C03	A

1:500 @ A1
1:1000 @ A3
0 5 10 15 20 25 30 35 40 45 50 m

Original Sheet Size A1 [841x594] Plot Date 2018-06-15 at 10:58:27 AM Path C:\Sharmin\Projects\6-XQ074.01_Ladies Mile\6-XQ074.01 - Ladies Mile Concept Drawings\6-XQ074.01_C04_ConceptR1.dwg C03



1:500 @ A1
1:1000 @ A3
0 5 10 15 20 25 30 35 40 45 50 m

PLAN

SCALE 1:500 (A1)
1:1000 (A3)

NOTE:
1. BUS ONLY APPROACH ADDED TO EXISTING ROUNDABOUT

CONCEPT DESIGN

Revision	Amendment	Approved	Revision Date
A	CONCEPT DESIGN		

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Dunedin 9016
New Zealand

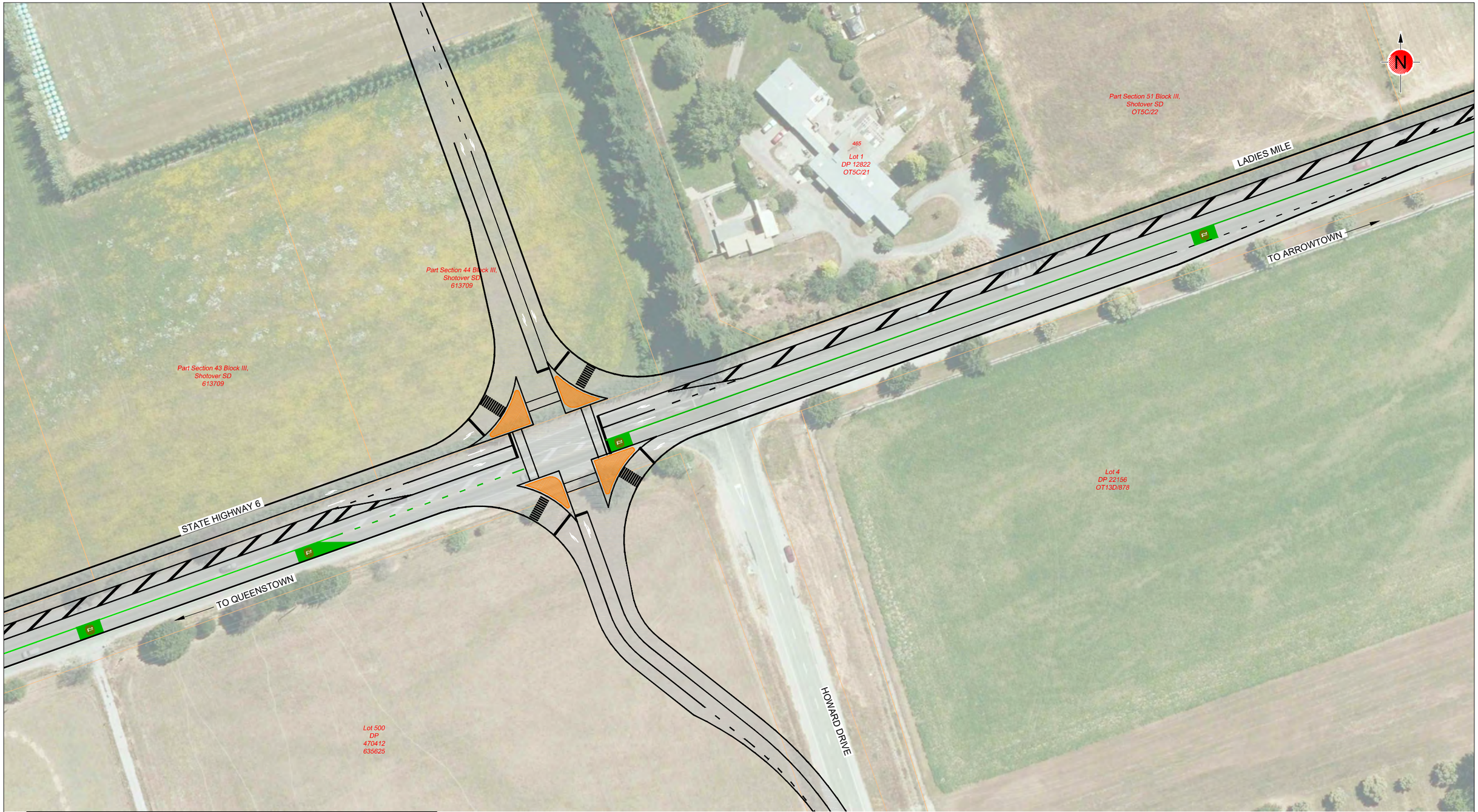
Designed	Approved	Approved Date
S C		
Drawn	Scales	
S C	AS SHOWN	

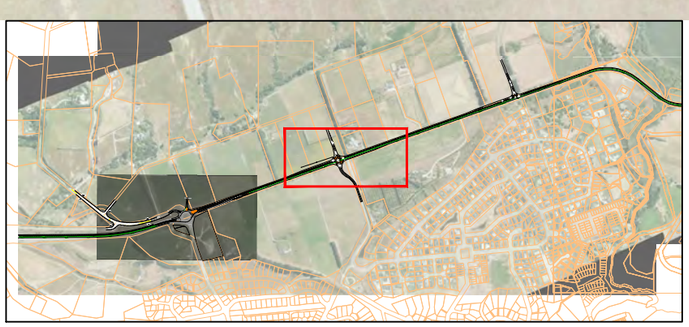
Project
QUEENSTOWN LAKES DISTRICT COUNCIL
HOUSING INFRASTRUCTURE FUND
LADIES MILE SH6

Sheet
PLAN
STALKER ROAD INTERSECTION

Project No.	Sheet. No.	Revision
6-XQ074.01	C04	A

Original Sheet Size A1 [841x594] Plot Date 2018-06-15 at 10:58:33 AM Path C:\Sharmin\Projects\6-XQ074.01_Ladies Mile\6-XQ074.01 - Ladies Mile Concept Drawings\6-XQ074.01_C04_ConceptR1.dwg C04





1:500 @ A1
1:1000 @ A3
0 5 10 15 20 25 30 35 40 45 50 m

300 mm
200
100
50
10 mm
0

PLAN

SCALE 1:500 (A1)
1:1000 (A3)

NOTE:
1. ALL LEGS ACCOMMODATE THE SEMI-TRAILER SWEPT PATHS.
2. ALL LEGS PROVIDED WITH LT SLIP LANE

CONCEPT DESIGN

Revision	Amendment	Approved	Revision Date
A	CONCEPT DESIGN		

QUEENSTOWN LAKES DISTRICT COUNCIL

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Dunedin 9016
New Zealand

Designed	Approved	Approved Date
S C		

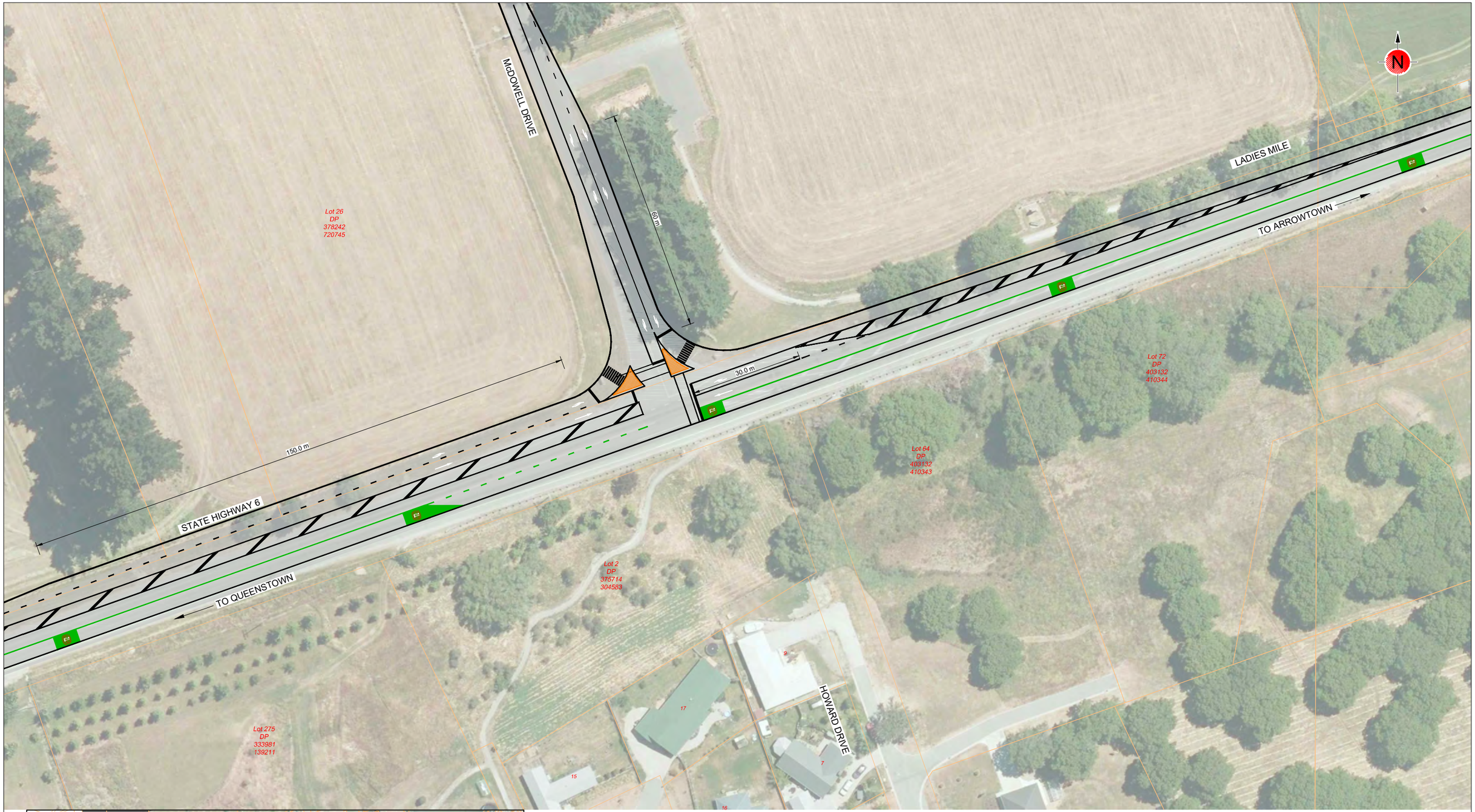
Drawn	Scales
S C	AS SHOWN

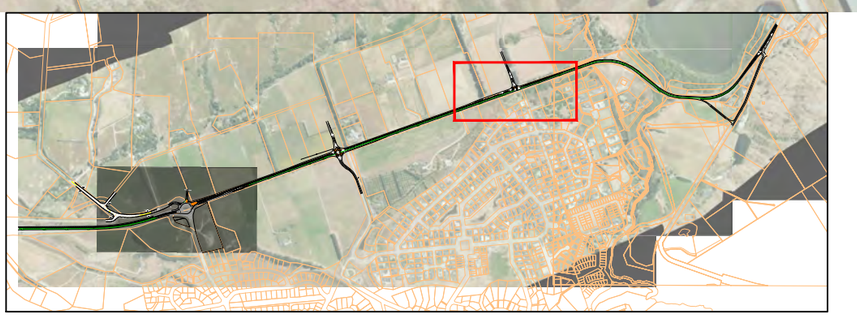
Project
QUEENSTOWN LAKES DISTRICT COUNCIL
HOUSING INFRASTRUCTURE FUND
LADIES MILE SH6

Sheet
PLAN
HOWARD DRIVE INTERSECTION

Project No.	Sheet. No.	Revision
6-XQ074.01	C05	A

Original Sheet Size A1 [841x594] Plot Date 2018-06-15 at 10:58:37 AM Path C:\Sharmin\Projects\6-XQ074.01_Ladies Mile\6-XQ074.01 - Ladies Mile Concept Drawings\6-XQ074.01_C04_ConceptR1.dwg C05





1:500 @ A1
1:1000 @ A3
0 5 10 15 20 25 30 35 40 45 50 m

PLAN

SCALE 1:500 (A1)
1:1000 (A3)

NOTE:
1. ALL LEGS ACCOMMODATE THE 13.5m BUS SWEPT PATHS.
2. TWO LEGS PROVIDED WITH LT SLIP LANE

CONCEPT DESIGN

Revision	Amendment	Approved	Revision Date
A	CONCEPT DESIGN		

QUEENSTOWN LAKES DISTRICT COUNCIL

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Dunedin 9016
New Zealand

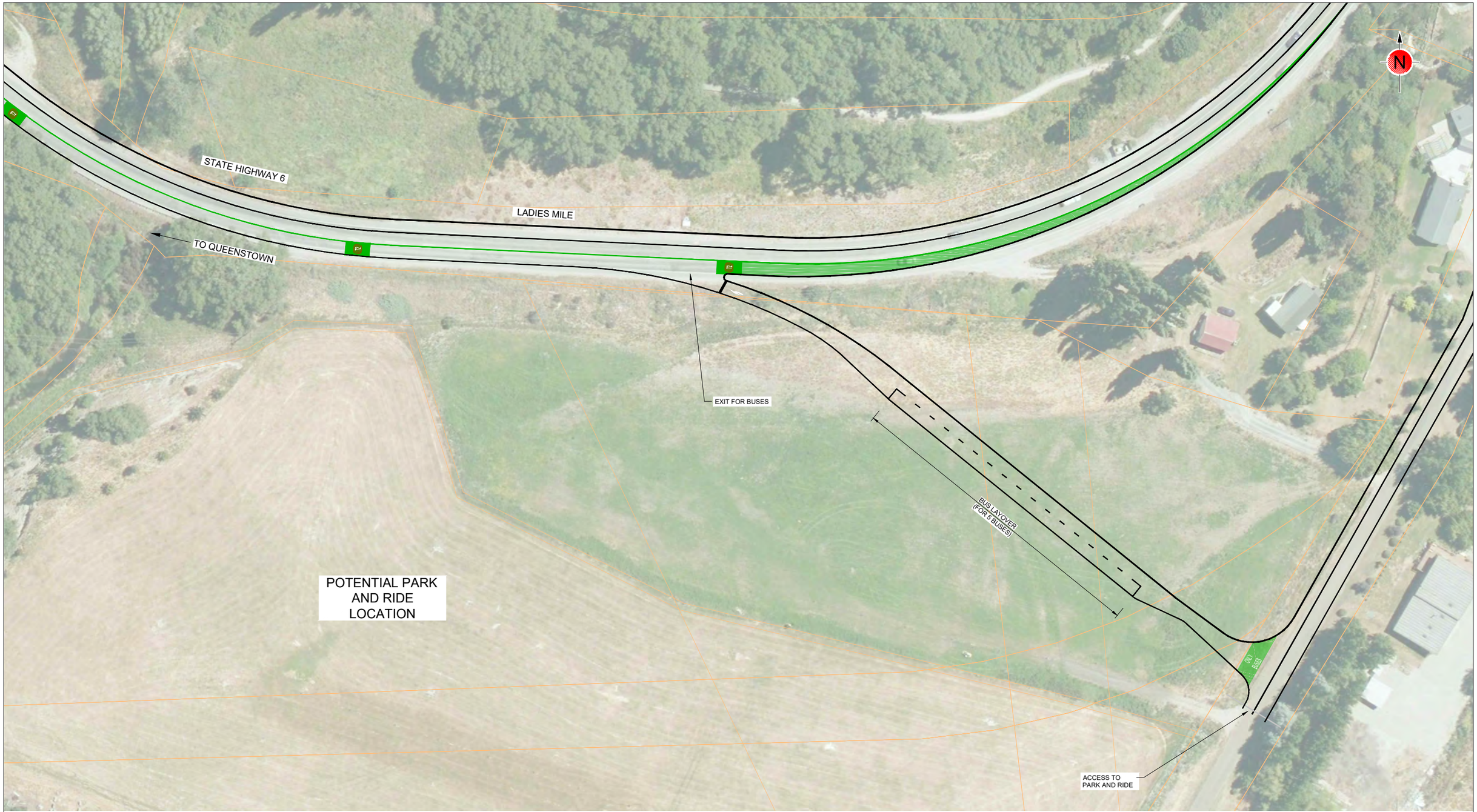
Designed	Approved	Approved Date
S C		
Drawn	Scales	
S C	AS SHOWN	

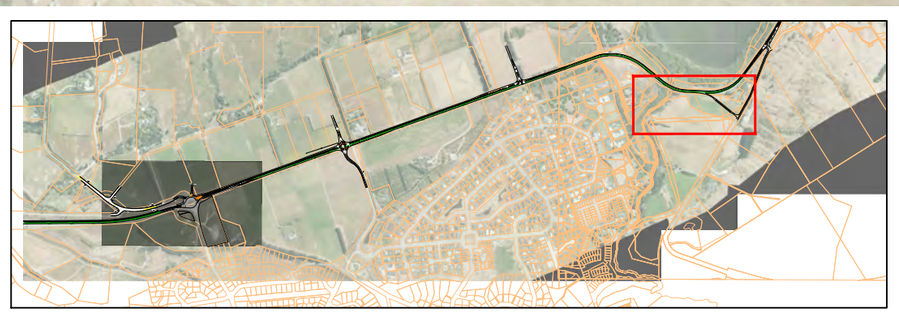
Project
QUEENSTOWN LAKES DISTRICT COUNCIL
HOUSING INFRASTRUCTURE FUND
LADIES MILE SH6

Sheet
PLAN
McDOWELL DRIVE INTERSECTION

Project No.	Sheet. No.	Revision
6-XQ074.01	C06	A

Original Sheet Size A1 [841x594] Plot Date 2018-06-15 at 10:58:42 AM Path C:\Sharmin\Projects\6-XQ074.01_Ladies Mile\6-XQ074.01 - Ladies Mile Concept Drawings\6-XQ074.01_C04_ConceptR1.dwg C06





1:500 @ A1
1:1000 @ A3
0 5 10 15 20 25 30 35 40 45 50 m

PLAN

SCALE 1:500 (A1)
1:1000 (A3)

CONCEPT DESIGN

Revision	Amendment	Approved	Revision Date
A	CONCEPT DESIGN		

QUEENSTOWN LAKES DISTRICT COUNCIL

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Private Bag 1913
Dunedin 9016
New Zealand

Designed	Approved	Approved Date
S C		

Drawn	Scales
S C	AS SHOWN

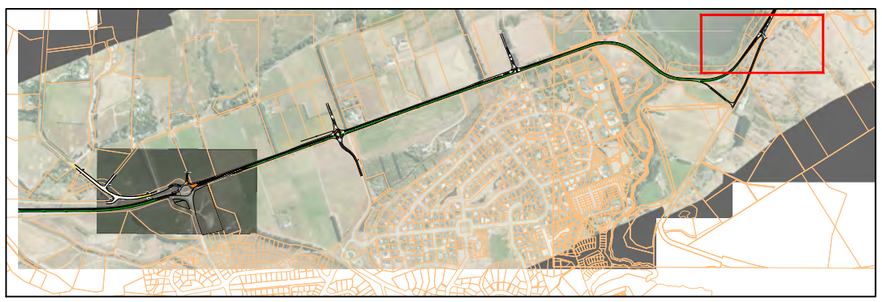
Project
QUEENSTOWN LAKES DISTRICT COUNCIL
HOUSING INFRASTRUCTURE FUND
LADIES MILE SH6

Sheet
PLAN
BUS EXIT AND PARK AND RIDE

Project No.	Sheet. No.	Revision
6-XQ074.01	C07	A

Original Sheet Size A1 [841x594] Plot Date 2018-06-15 at 10:58:47 AM Path C:\Sharmin\Projects\6-XQ074.01_Ladies Mile\6-XQ074.01 - Ladies Mile Concept Drawings\6-XQ074.01_C04_ConceptR1.dwg C07

300 mm
200
100
50
10 mm
0



1:500 @ A1
1:1000 @ A3
0 5 10 15 20 25 30 35 40 45 50 m

PLAN

SCALE 1:500 (A1)
1:1000 (A3)

CONCEPT DESIGN

Revision	Amendment	Approved	Revision Date
A	CONCEPT DESIGN		

QUEENSTOWN LAKES DISTRICT COUNCIL

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Private Bag 1913
Dunedin 9016
New Zealand

Designed	Approved	Approved Date
S C		

Drawn	Scales
S C	AS SHOWN

Project
QUEENSTOWN LAKES DISTRICT COUNCIL
HOUSING INFRASTRUCTURE FUND
LADIES MILE SH6

Sheet
PLAN
ALEC ROBINS INTERSECTION

Project No.	Sheet. No.	Revision
6-XQ074.01	C08	A

Original Sheet Size A1 [841x594] Plot Date 2018-06-15 at 10:58:52 AM Path C:\Sharmin\Projects\6-XQ074.01_Ladies Mile\6-XQ074.01 - Ladies Mile Concept Drawings\6-XQ074.01_C04_ConceptR1.dwg C08

14 Appendix E - Intersection Estimates ROC

SUMMARY ESTIMATE SHEET

Project: QLDC LADIES MILE - HOWARD DRIVE
File No: XQ074.01
Office: Queenstown
Status: Preliminary Assessment
SUMMARY ESTIMATE FOR: Proposed Roading Connection
Purpose: ROC
Option 1
Cost Index: 1116 (Sept 2017)

Approved: Giulio Chapman-Olla Date: 26-Jun-18 Page: 1 of 1

Item	Description	Unit	Quantity	Rate	$	$
1	CONTRACTORS QUALITY PLAN (incorporating Site Safety Plan, Environmental Management Plan and Sediment Control & Site Management Plan)					
1.1	Preparation of CQP incl SSP, EMP & SCP	LS	1	10000	$10,000.00	
1.2	Management of CQP incl SSP, EMP & SCP	LS	1	30000	$30,000.00	$40,000.00
2	TRAFFIC MANAGEMENT PLAN					
2.1	Preparation of Temporary Traffic Management Plan	LS	1	3000	$3,000.00	
2.2	Management of TTMP/Traffic Control	LS	1	45000	$45,000.00	$48,000.00
3	ESTABLISHMENT	LS	1	20000	$20,000.00	$20,000.00
4	DAYWORKS					
4.1	Labour	hr	80	50	$4,000.00	
4.2	Plant	%	1.1	10000	$11,000.00	
4.3	Materials	%	1.1	8000	$8,800.00	$23,800.00
5	LOCATION & PROTECTION OF SERVICES					
5.1	Location of Services & Liaison with Utility Authorities	LS	1	10000	$10,000.00	
5.2	Relocation & Protection of Services	PS	1	30000	$30,000.00	$40,000.00
6	EARTHWORKS					
6.1	Clearing of Site	LS	1	20000	$20,000.00	
6.2	Topsoil Stripping - 200mm deep (to waste)	m^3	2350	50	$117,500.00	
6.3	Cut & Undercut to Waste	m^3	5480	50	$274,000.00	
6.4	Sawcut Existing Kerb & Seal	m	30	15	$450.00	
6.5	Granular Bulk Fill	m^3	3530	50	$176,500.00	$588,450.00
7	DRAINAGE					
7.1	Supply and Install 750mm Dia. PVC-U SN8 Pipe (Incl. bedding & pipe connection) (Pipe size to be confirmed by Design)	m	160	800	$128,000.00	
7.2	Supply and Install 600mm Dia. PVC-U SN8 Pipe (Incl. bedding & pipe connection) (Pipe size to be confirmed by Design)	m	50	650	$32,500.00	
7.3	Supply and Install 225mm Dia. PVC-U SN8 Pipe (Incl. bedding & pipe connection)	m	0	300	$0.00	
7.4	Supply and Install 1.05m Dia.SWMH Chamber 1.5m deep with HD Lid (Incl. bedding & pipe connection)	ea	0	10000	$0.00	
7.5	Supply and Install 1.5m Dia.SWMH Chamber 2.0m deep with HD Lid (Incl. bedding & pipe connection)	ea	4	13000	$52,000.00	

OPUS

Item	Description	Unit	Quantity	Rate	$	$
7.6	Supply and Install Double Back Entry Sump (Incl. bedding & pipe connection)	ea	4	7000	$28,000.00	
7.7	Supply and Install Single Back Entry Sump (Incl. bedding & pipe connection)	ea	8	3500	$28,000.00	
7.8	Supply and Install NZTA F2 110mm dia Subsoil drainage pipe (Incl.bedding, Filter material, pipe connection, Geotextile filter wrap & cleaning eye)	m	600	60	$36,000.00	
7.9	Arrow Irrgation Pipe Bypass Works	LS	0	40000	$0.00	
7.10	Remove Existing SW Sump and Manhole ConnectionPipe	ea	0	1000	$0.00	
7.11	Site Stormwater Diversion Works	PS	1	100000	$100,000.00	
7.12	Remove Existing Concrete Kerb & Channel	m	100	50	$5,000.00	$409,500.00
8	CONCRETE WORKS					
8.1	500mm Wide Kerb & Channel	m	1350	120	$162,000.00	
8.2	Construct 300mm Wide Semi-Mountable kerb	m	426	100	$42,600.00	
8.3	Form Pedestrian Kerb	m	20	100	$2,000.00	
8.4	100mm Concrete Island Infill with embedded stones	m^2	580	150	$87,000.00	$293,600.00
			475			
9	PAVEMENT CONSTRUCTION (CBR4)					
9.1	300mm Sub-base AP65 (solid measure)	m^3	4965	160	$794,400.00	
9.2	180mm Basecourse AP40 (solid measure)	m^3	2980	190	$566,200.00	
9.3	Running Course (looase measure)	m^3	70	350	$24,500.00	$1,385,100.00
10	SURFACING					
10.1	Nominal 50mm AC14 Asphaltic Concrete	m^2	4200	50	$210,000.00	
10.2	Nominal 100mm AC20 Asphaltic Concrete	m^2	4200	120	$504,000.00	
10.3	Membrane Seal	m^2	4200	8	$33,600.00	
10.4	Chipseal surfacing (2 Coat 3/5)	m^2	10700	10	$107,000.00	$854,600.00
11	FOOTPATH CONSTRUCTION - (NOT SHOWN ON CONCEPT PLAN)					
11.1	Timber Batten Edging incl Pegs	m	720	20	$14,400.00	
11.2	100mm AP40 Basecourse (solid measure)	m^3	145	170	$24,650.00	
11.3	Nominal 25mm Mix 10 Asphaltic Concrete	m^2	1080	35	$37,800.00	
11.4	Cycle Coloured Surface (AS2700 G13 Emerald Green or Similar)	m^2	0	120	$0.00	
11.5	Fun Yellow Tactile Audio Pavers	m^2	24	500	$12,000.00	
11.6	Resting Rails	ea	16	1200	$19,200.00	
11.7	Provisional Sum for Pedestrian Solution and bus stops	lot	1	955000	$955,000.00	$1,063,050.00
12	ROAD LIGHTING					
12.1	Relocate Existing Lighting Column (Incl. Fitting luminares and power disconnection)	ea	2	2000	$4,000.00	
12.2	Supply & Install New 12m High Lighting Column with 3m Outreach Arm (Incl. 152W LED luminaires)	ea	3	4500	$13,500.00	
12.3	Supply & Install New 8m High Lighting Column with Post Top Luminaire Mounting Spigot (Incl. 102W LED luminaires) (Based on 45m spacing)	ea	15	3500	$52,500.00	
12.4	Power Cable Installation (Incl. Trenching and ducting if required)	LS	1	10000	$10,000.00	
12.5	Commisioning of Lighting Columns	LS	1	3000	$3,000.00	$83,000.00
13	PAVEMENT MARKINGS					

Item	Description	Unit	Quantity	Rate	$	$
13.1	Reflectorised Pavement marking	LS	1	7000	$7,000.00	
13.20	Redundant Pavement Marking Removal (Sand Blasting)	LS	1	2000	$2,000.00	$9,000.00
14	TRAFFIC SERVICES					
14.1	Install PW-8 Rotary Junction Sign	ea	4	750	$3,000.00	
14.2	Install RG-6R Rotary Give Way Sign	ea	8	750	$6,000.00	
14.3	Install RG-17 Keep Left (inc. Duroflex PS 03 mounting)	ea	4	350	$1,400.00	
14.4	Install PW-5 Diverge Sign	ea	4	1200	$4,800.00	
14.5	Install PW-69 Chevron Board	ea	4	1200	$4,800.00	
14.6	Install RG-1 50 km/hr speed limit sign	ea	4	750	$3,000.00	
14.7	Install RG-1 80 km/hr speed limit sign	ea	4	750	$3,000.00	
14.8	SN-1 Street Sign	ea	4	250	$1,000.00	$27,000.00
15	LANDSCAPING					
15.1	Existing Tree Removal	LS	1	20000	$20,000.00	
15.2	Imported Topsoil 100mm Min. depth (solid measure)	m^3	350	100	$35,000.00	
15.3	Grassing and Hydroseeding (Grass for road berm areas only)	m^2	3500	2.8	$9,800.00	
15.4	Realignment of existing Timber Post and 7 Wire fence	m	475	100	$47,500.00	$112,300.00
16	RETAINING WALLS					
16.1	Slope Stabilisation Works (Allowance for Soil Nailing based on square metre rate for Andrews Rd Soil Nailing 2017) (4000m2 x $150)	PS	0	600000	$0.00	
16.1	Post & Rail H5 Timber Retaining Wall (under 1.5m High)	PS	0	100000	$0.00	$0.00
17	AS-BUILT DATA & RAMM					
17.1	Road construction RAMM information	LS	1	4000	$4,000.00	
17.2	As Built drawings	LS	1	6000	$6,000.00	$10,000.00
	TOTAL					$5,007,400.00
	Main Uncertainies					
A	Pavement Design (To be confirmed after testing)					
B	Lighting Design					
C	Services (To be confirmed after pot-holing)					

SUMMARY ESTIMATE SHEET

Project: QLDC LADIES MILE - LOWER SHOTOVER ROAD
File No: XQ074.01
Office: Queenstown
Status: Preliminary Assessment
SUMMARY ESTIMATE FOR: Proposed Roading Connection
Purpose: ROC
T Junction
Cost Index: 1116 (Sept 2017)

Approved: Giulio Chapman-Olla Date: 15-May-18

Item	Description	Unit	Quantity	Rate	$	$
1	CONTRACTORS QUALITY PLAN (incorporating Site Safety Plan, Environmental Management Plan and Sediment Control & Site Management Plan)					
1.1	Preparation of CQP incl SSP, EMP & SCP	LS	1	10000	$10,000.00	
1.2	Management of CQP incl SSP, EMP & SCP	LS	1	30000	$30,000.00	$40,000.00
2	TRAFFIC MANAGEMENT PLAN					
2.1	Preparation of Temporary Traffic Management Plan	LS	1	2000	$2,000.00	
2.2	Management of TTMP/Traffic Control	LS	1	35000	$35,000.00	$37,000.00
3	ESTABLISHMENT	LS	1	20000	$20,000.00	$20,000.00
4	DAYWORKS					
4.1	Labour	hr	80	50	$4,000.00	
4.2	Plant	%	10000	1.1	$11,000.00	
4.3	Materials	%	8000	1.1	$8,800.00	$23,800.00
5	LOCATION & PROTECTION OF SERVICES					
5.1	Location of Services & Liaison with Utility Authorities	LS	1	10000	$10,000.00	
5.2	Relocation & Protection of Services	PS	1	30000	$30,000.00	$40,000.00
6	EARTHWORKS					
6.1	Clearing of Site	LS	1	20000	$20,000.00	
6.2	Topsoil Stripping - 200mm deep (to waste)	m^3	1850	50	$92,500.00	
6.3	Cut & Undercut to Waste	m^3	2300	50	$115,000.00	
6.4	Sawcut Existing Kerb & Seal	m	45	15	$675.00	
6.5	Granular Bulk Fill	m^3	2300	50	$115,000.00	$343,175.00
7	DRAINAGE					
7.1	Supply and Install 750mm Dia. PVC-U SN8 Pipe (Incl. bedding & pipe connection) (Pipe size to be confirmed by Design)	m	50	800	$40,000.00	
7.2	Supply and Install 600mm Dia. PVC-U SN8 Pipe (Incl. bedding & pipe connection) (Pipe size to be confirmed by Design)	m	540	650	$351,000.00	
7.3	Supply and Install 225mm Dia. PVC-U SN8 Pipe (Incl. bedding & pipe connection)	m	30	300	$9,000.00	
7.4	Supply and Install 1.05m Dia.SWMH Chamber 1.5m deep with HD Lid (Incl. bedding & pipe connection)	ea	6	10000	$60,000.00	
7.5	Supply and Install 1.5m Dia.SWMH Chamber 2.0m deep with HD Lid (Incl. bedding & pipe connection)	ea	2	13000	$26,000.00	

OPUS

Item	Description	Unit	Quantity	Rate	$	$
7.6	Supply and Install Double Back Entry Sump (Incl. bedding & pipe connection)	ea	2	7000	$14,000.00	
7.7	Supply and Install Single Back Entry Sump (Incl. bedding & pipe connection)	ea	6	3500	$21,000.00	
7.8	Supply and Install NZTA F2 110mm dia Subsoil drainage pipe (Incl.bedding, Filter material, pipe connection, Geotextile filter wrap & cleaning eye)	m	1080	60	$64,800.00	
7.9	Arrow Irrgation Pipe Bypass Works	LS	1	40000	$40,000.00	
7.10	Remove Existing SW Sump and Manhole ConnectionPipe	ea	0	1000	$0.00	
7.11	Site Stormwater Diversion Works	PS	1	100000	$100,000.00	
7.12	Remove Existing Concrete Kerb & Channel	m	0	50	$0.00	
7.13	Reuse and install existing 300mm Dia. Culvert	m	10	300	$3,000.00	
7.14	Culvert Headwalls	ea	4	300	$1,200.00	$730,000.00
8	CONCRETE WORKS					
8.1	500mm Wide Kerb & Channel	m	145	120	$17,400.00	
8.2	Construct 300mm Wide Semi-Mountable kerb	m	0	100	$0.00	
8.3	Form Pedestrian Kerb	m	0	100	$0.00	
8.4	100mm Concrete Island Infill with embedded stones	m^2	0	150	$0.00	$17,400.00
9	PAVEMENT CONSTRUCTION (CBR4)					
9.1	375mm Sub-base AP65 (solid measure)	m^3	2570	160	$411,200.00	
9.2	160mm Basecourse AP40 (solid measure)	m^3	1020	190	$193,800.00	
9.3	Running Course (looase measure)	m^3	8	350	$2,800.00	$607,800.00
10	SURFACING					
10.1	Nominal 50mm DG14 Asphaltic Concrete	m^2	2650	50	$132,500.00	
10.2	Membrane Seal	m^2	2650	8	$21,200.00	
10.3	Chipseal surfacing (2 Coat 3/5)	m^2	3685	10	$36,850.00	$190,550.00
11	FOOTPATH CONSTRUCTION - (NOT SHOWN ON CONCEPT PLAN)					
11.1	Timber Batten Edging incl Pegs	m	300	20	$6,000.00	
11.2	100mm AP40 Basecourse (solid measure)	m^3	23	170	$3,910.00	
11.3	Nominal 25mm Mix 10 Asphaltic Concrete	m^2	225	35	$7,875.00	
11.4	Cycle Coloured Surface (AS2700 G13 Emerald Green or Similar)	m^2	0	120	$0.00	
11.5	Fun Yellow Tactile Audio Pavers	m^2	2	500	$1,000.00	
11.6	Resting Rails	ea	2	1200	$2,400.00	$21,185.00
12	ROAD LIGHTING					
12.1	Relocate Existing Lighting Column (Incl. Fitting luminares and power disconnection)	ea	0	2000	$0.00	
12.2	Supply & Install New 12m High Lighting Column with 3m Outreach Arm (Incl. 152W LED luminaires)	ea	4	4500	$18,000.00	
12.3	Supply & Install New 8m High Lighting Column with Post Top Luminaire Mounting Spigot (Incl. 102W LED luminaires) (Baed on 45m spacing)	ea	5	3500	$17,500.00	
12.4	Power Cable Installation (Incl. Trenching and ducting if required)	LS	1	20000	$20,000.00	
12.5	Commisioning of Lighting Columns	LS	1	3000	$3,000.00	$58,500.00
13	PAVEMENT MARKINGS					

Item	Description	Unit	Quantity	Rate	$	$
13.1	Reflectorised Pavement marking	LS	1	9000	$9,000.00	
13.20	Redundant Pavement Marking Removal (Sand Blasting)	LS	1	2000	$2,000.00	$11,000.00
14	TRAFFIC SERVICES					
14.1	Install RG-6 Give Way Sign	ea	2	750	$1,500.00	
14.2	Install PW-26 Curve Advisoy with minor road on left & right Sign	ea	2	750	$1,500.00	
14.3	Reinstall PW-17 Curve Advisory Sign	ea	1	750	$750.00	
14.4	Install RG-1 80km Speed Limit Sign	ea	4	1200	$4,800.00	
14.5	Install RG-1 50km Speed Limit Sign	ea	1	1200	$1,200.00	
14.6	Reinstall PW-34 School Bus & PW34.1 Bus Route Sign	ea	1	750	$750.00	
14.7	Install SN-1 Street Sign	ea	2	250	$500.00	$11,000.00
15	LANDSCAPING					
15.1	Existing Tree/Hedge Removal	LS	1	10000	$10,000.00	
15.2	Imported Topsoil 100mm Min. depth (solid measure)	m^3	22	100	$2,200.00	
15.3	Grassing and Hydroseeding (Grass for road berm areas only)	m^2	215	2.8	$602.00	
15.4	New & Realigned existing Timber Post and 7 Wire fence	m	200	100	$20,000.00	$32,802.00
17	AS-BUILT DATA & RAMM					
17.1	Road construction RAMM information	LS	1	4000	$4,000.00	
17.2	As Built drawings	LS	1	6000	$6,000.00	$10,000.00
	TOTAL					$2,194,212.00
	Main Uncertainies					
A	Pavement Design (To be confirmed after testing)					
B	Lighting Design					
C	Services (To be confirmed after pot-holing)					

SUMMARY ESTIMATE SHEET

Project: QLDC LADIES MILE - McDOWEL DRIVE
File No: XQ074.01
Office: Queenstown
Status: Preliminary Assessment
SUMMARY ESTIMATE FOR: Proposed Roading Connection
Purpose: ROC
Roundabout
Cost Index: 1116 (Sept 2017)

Approved: Giulio Chapman-Olla Date: 15-May-18 Page: 1 of 1

Item	Description	Unit	Quantity	Rate	$	$
1	CONTRACTORS QUALITY PLAN (incorporating Site Safety Plan, Environmental Management Plan and Sediment Control & Site Management Plan)					
1.1	Preparation of CQP incl SSP, EMP & SCP	LS	1	10000	$10,000.00	
1.2	Management of CQP incl SSP, EMP & SCP	LS	1	30000	$30,000.00	$40,000.00
2	TRAFFIC MANAGEMENT PLAN					
2.1	Preparation of Temporary Traffic Management Plan	LS	1	3000	$3,000.00	
2.2	Management of TTMP/Traffic Control	LS	1	45000	$45,000.00	$48,000.00
3	ESTABLISHMENT	LS	1	20000	$20,000.00	$20,000.00
4	DAYWORKS					
4.1	Labour	hr	80	50	$4,000.00	
4.2	Plant	%	10000	1.1	$11,000.00	
4.3	Materials	%	8000	1.1	$8,800.00	$23,800.00
5	LOCATION & PROTECTION OF SERVICES					
5.1	Relocation of existing power pole by Utility Authority	LS	1	10000	$10,000.00	
5.2	Location of Services & Liaison with Utility Authorities	LS	1	10000	$10,000.00	
5.3	Relocation & Protection of Services	PS	2	30000	$60,000.00	$80,000.00
6	EARTHWORKS					
6.1	Clearing of Site	LS	1	20000	$20,000.00	
6.2	Topsoil Stripping - 200mm deep (to waste)	m^3	2000	50	$100,000.00	
6.3	Cut & Undercut to Waste	m^3	2700	50	$135,000.00	
6.4	Sawcut Existing Kerb & Seal	m	30	15	$450.00	
6.5	Granular Bulk Fill	m^3	2900	50	$145,000.00	$400,450.00
7	DRAINAGE					
7.1	Supply and Install 750mm Dia. PVC-U SN8 Pipe (Incl. bedding & pipe connection) (Pipe size to be confirmed by Design)	m	160	800	$128,000.00	
7.2	Supply and Install 600mm Dia. PVC-U SN8 Pipe (Incl. bedding & pipe connection) (Pipe size to be confirmed by Design)	m	0	650	$0.00	
7.3	Supply and Install 225mm Dia. PVC-U SN8 Pipe (Incl. bedding & pipe connection)	m	0	300	$0.00	
7.4	Supply and Install 1.05m Dia.SWMH Chamber 1.5m deep with HD Lid (Incl. bedding & pipe connection)	ea	4	10000	$40,000.00	
7.5	Supply and Install 1.5m Dia.SWMH Chamber 2.0m deep with HD Lid (Incl. bedding & pipe connection)	ea	4	13000	$52,000.00	

OPUS

Item	Description	Unit	Quantity	Rate	$	$
7.6	Supply and Install Double Back Entry Sump (Incl. bedding & pipe connection)	ea	2	7000	$14,000.00	
7.7	Supply and Install Single Back Entry Sump (Incl. bedding & pipe connection)	ea	8	3500	$28,000.00	
7.8	Supply and Install NZTA F2 110mm dia Subsoil drainage pipe (Incl.bedding, Filter material, pipe connection, Geotextile filter wrap & cleaning eye)	m	600	60	$36,000.00	
7.9	Arrow Irrgation Pipe Bypass Works	LS	0	40000	$0.00	
7.10	Remove Existing SW Sump and Manhole ConnectionPipe	ea	0	1000	$0.00	
7.11	Site Stormwater Diversion Works	PS	1	20000	$20,000.00	
7.12	Remove Existing Concrete Kerb & Channel	m	0	50	$0.00	$318,000.00
8	CONCRETE WORKS					
8.1	500mm Wide Kerb & Channel	m	460	120	$55,200.00	
8.2	Construct 300mm Wide Semi-Mountable kerb	m	400	100	$40,000.00	
8.3	Form Pedestrian Kerb	m	18	100	$1,800.00	
8.4	100mm Concrete Island Infill with embedded stones	m^2	705	150	$105,750.00	$202,750.00
9	PAVEMENT CONSTRUCTION (CBR4)					
9.1	300mm Sub-base AP65 (solid measure)	m^3	4160	160	$665,600.00	
9.2	180mm Basecourse AP40 (solid measure)	m^3	2500	190	$475,000.00	
9.3	Running Course (looase measure)	m^3	60	350	$21,000.00	$1,161,600.00
10	SURFACING					
10.1	Nominal 50mm AC14 Asphaltic Concrete	m^2	4000	50	$200,000.00	
10.2	Nominal 100mm AC20 Asphaltic Concrete	m^2	4000	120	$480,000.00	
10.3	Membrane Seal	m^2	4000	8	$32,000.00	
10.4	Chipseal surfacing (2 Coat 3/5)	m^2	8450	10	$84,500.00	$796,500.00
11	FOOTPATH CONSTRUCTION - (NOT SHOWN ON CONCEPT PLAN)					
11.1	Timber Batten Edging incl Pegs	m	650	20	$13,000.00	
11.2	100mm AP40 Basecourse (solid measure)	m^3	51	170	$8,670.00	
11.3	Nominal 25mm Mix 10 Asphaltic Concrete	m^2	510	35	$17,850.00	
11.4	Cycle Coloured Surface (AS2700 G13 Emerald Green or Similar)	m^2	0	120	$0.00	
11.5	Fun Yellow Tactile Audio Pavers	m^2	13.2	500	$6,600.00	
11.6	Resting Rails	ea	12	1200	$14,400.00	$60,520.00
12	ROAD LIGHTING					
12.1	Relocate Existing Lighting Column (Incl. Fitting luminares and power disconnection)	ea	1	2000	$2,000.00	
12.2	Supply & Install New 12m High Lighting Column with 3m Outreach Arm (Incl. 152W LED luminaires)	ea	3	4500	$13,500.00	
12.3	Supply & Install New 8m High Lighting Column with Post Top Luminaire Mounting Spigot (Incl. 102W LED luminaires) (Baed on 45m spacing)	ea	12	3500	$42,000.00	
12.4	Power Cable Installation (Incl. Trenching and ducting if required)	LS	1	40000	$40,000.00	
12.5	Commisioning of Lighting Columns	LS	1	3000	$3,000.00	$100,500.00
13	PAVEMENT MARKINGS					
13.1	Reflectorised Pavement marking	LS	1	7000	$7,000.00	

Item	Description	Unit	Quantity	Rate	$	$
13.20	Redundant Pavement Marking Removal (Sand Blasting)	LS	1	2000	$2,000.00	$9,000.00
14	TRAFFIC SERVICES					
14.1	Install RG-19.1 Give Way Sign Supplemetary	ea	6	750	$4,500.00	
14.2	Install RG-6R Rotary Give Way Sign	ea	6	750	$4,500.00	
14.3	Install RG-17 Keep Left (inc. Duroflex PS 03 mounting)	ea	3	350	$1,050.00	
14.4	Install RG-1 50m Speed Limit Sign	ea	3	1200	$3,600.00	
14.5	Install PW-69 Chevron Board	ea	5	1200	$6,000.00	
14.6	Relocate PW-29 Pedestrians Sign & TW-4B Slippery	ea	2	500	$1,000.00	
14.7	Install AD-5 Sign	ea	3	5000	$15,000.00	
14.8	Install PW-5 Diverge Signs	ea	3	500	$1,500.00	
14.9	Relocate SN-1 Street Sign, Memorial and Track Signs	ea	4	250	$1,000.00	$38,150.00
15	LANDSCAPING					
15.1	Existing Tree Removal	LS	1	20000	$20,000.00	
15.2	Imported Topsoil 100mm Min. depth (solid measure)	m^3	300	100	$30,000.00	
15.3	Grassing and Hydroseeding (Grass for road berm areas only)	m^2	2975	2.8	$8,330.00	
15.4	Realignment of existing Timber Post and 7 Wire fence	m	285	100	$28,500.00	$86,830.00
16	GUARDRAIL					
16.1	Adjustments to Timber Post Guardrail	PS	1	100000	$100,000.00	$100,000.00
17	AS-BUILT DATA & RAMM					
17.1	Road construction RAMM information	LS	1	4000	$4,000.00	
17.2	As Built drawings	LS	1	6000	$6,000.00	$10,000.00
	TOTAL					$3,496,100.00
	Main Uncertainies					
A	Pavement Design (To be confirmed after testing)					
B	Guardrail Design - Existing to be amended					
C	Lighting Design					
D	Services (To be confirmed after pot-holing)					

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Memorandum

To	Warren Ladbrook
Copy	Simon Leary
From	Chris Baker
Office	Queenstown Office
Date	9 July 2018
File	6-XQ074.01
Subject	Ladies Mile HIF Integrated Transport Assessment Amendment A - Detailed Analysis of Programme 3

1 Introduction

This memorandum serves as an addendum to the Ladies Mile HIF Integrated Transport Assessment (issued 29 June 2018). The intention of this addendum is to provide additional detail regarding the traffic impact of construction of the preferred Programme 3 (1,100 houses) at the Ladies Mile Housing Infrastructure Fund (HIF) site. Section 3.2 discusses the interventions required to achieve the Programme without traffic demands exceeding the capacity of Shotover Bridge.

The ITA focussed on delivery of Programme 2 (750 houses), which through traffic forecasting, was determined to be the largest development feasible without a step-change in public transport provision or an increase in river crossing capacity, both of which would require significant investment.

This memo provides more detail on the demand expected to be generated by Programme 3, and the steps required to enable development, keeping demand below the capacity of the Shotover Bridge.

2 Traffic Modelling Results

Further to the sensitivity tests presented in the ITA, this addendum introduces a vehicle occupancy parameter that is used to test the effect of a higher average number of people per vehicle on the corridor. Existing occupancy of private vehicles on the corridor has been surveyed at approximately 1.3 people per vehicle.

The Reference Case discussed in this section is the same set of base assumptions used in the ITA, except for the number of dwellings increasing to Programme 3. The assumptions are summarised in Table 1.

Table 1 Reference Case Parameters

Growth Rate	Low – SH6: 3.07%; Local: 1.15% Medium – SH6: 5.69%; Local: 1.72% High – SH6: 9.00%; Local: 2.30% Medium to Low – As Medium with SH6 growth tapering by 0.1% per year and local growth tapering by 0.05% per year	Growth rates for SH6 traffic were determined using data from counters on SH6. Growth rates for local traffic were determined from the 2018 build-out of Lake Hayes and Shotover Country and expected completion date.
Number of Dwellings	Programme 1: 450 lots Programme 2: 750 lots Programme 3: 1,100 lots Programme 4: 2,185 lots	Various proposals were put forward for different development sizes as part of the HIF DBC, ranging from realistic to more aspirational dwelling numbers. Road access to the site differs depending on the scale of development.
Construction Start	2020 2022 2024	Year in which construction begins – effect of background traffic by time of completion
Build Rate (dwellings/y)	75 100 125	Build rates were adopted based on observed rates at other local developments, cognisant that there is a finite supply of labour available locally.
Arthurs Point Diversion	0 – 20%	The effect of increasing the attractiveness of the route into Queenstown through Arthurs Point was examined as a way of reducing regional trips along Ladies Mile.
Trip Reduction Factor	0 – 20%	A trip reduction factor was used for a general sensitivity test of demands on the corridor.

2.1 Future Unconstrained Volumes

Figure 1 provides forecast corridor demands under Programme 3 (without any transport interventions) for different growth rates, build rates and vehicle occupancy. The forecast shows that baseline demand would likely exceed the existing bridge capacity of 1,600 veh/hr in 2020-2024, before development completion (black boxes).

A low-growth, high-occupancy scenario would result in 2,000 veh/hr crossing the Shotover Bridge in 2028, indicating that a 20% alternative mode share would produce sufficiently low volumes. However, people willing to shift to high-occupancy vehicles are most likely to be those transferring to public transport. As such, a combined higher occupancy and public transport mode share is considered unlikely. A high-growth, existing-occupancy scenario with 20% alternative mode share would see capacity reached in 2023.

Growth Rate	Programme	Units/year	Occupancy	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Medium to Low	Programme 3	125	1.3	1451	1499	1604	1708	1811	1913	2014	2114	2214	2312	2399	2438	2477	2516	2553	2590	2627
Low	Programme 3	125	1.3	1451	1479	1566	1652	1738	1825	1911	1998	2074	2151	2216	2235	2253	2272	2291	2309	2328
High	Programme 3	125	1.3	1451	1525	1657	1789	1921	2054	2186	2318	2430	2543	2644	2699	2754	2808	2863	2918	2972
Medium to Low	Programme 3	75	1.3	1451	1499	1581	1662	1742	1821	1898	1975	2051	2127	2202	2276	2350	2423	2495	2567	2627
Medium to Low	Programme 3	100	1.3	1451	1499	1593	1685	1777	1867	1956	2045	2132	2220	2306	2392	2477	2516	2553	2590	2627
Medium to Low	Programme 3	125	1.4	1347	1392	1494	1595	1694	1793	1891	1988	2085	2180	2264	2301	2337	2372	2407	2442	2476
Low	Programme 3	125	1.4	1347	1374	1458	1542	1627	1711	1795	1880	1955	2030	2094	2111	2129	2146	2163	2181	2198
High	Programme 3	125	1.4	1347	1416	1543	1670	1797	1923	2050	2177	2286	2395	2492	2543	2593	2644	2695	2746	2796
Medium to Low	Programme 3	75	1.4	1347	1392	1471	1548	1625	1700	1775	1849	1922	1995	2067	2138	2209	2280	2349	2419	2476
Medium to Low	Programme 3	100	1.4	1347	1392	1482	1571	1660	1747	1833	1919	2003	2088	2171	2254	2337	2372	2407	2442	2476
Medium to Low	Programme 3	125	1.5	1258	1299	1398	1496	1593	1689	1785	1879	1973	2066	2159	2251	2343	2434	2525	2568	2600
Low	Programme 3	125	1.5	1257	1282	1365	1447	1530	1612	1695	1778	1852	1926	2000	2074	2149	2223	2297	2371	2445
High	Programme 3	125	1.5	1258	1322	1444	1566	1689	1811	1933	2055	2161	2266	2360	2407	2455	2502	2549	2597	2644
Medium to Low	Programme 3	75	1.5	1258	1299	1375	1450	1523	1596	1668	1740	1810	1880	1950	2019	2087	2155	2223	2290	2356
Medium to Low	Programme 3	100	1.5	1258	1299	1387	1473	1558	1643	1726	1809	1891	1973	2054	2135	2215	2295	2374	2452	2530

*black boxes signify development completion date

Figure 1 Forecast Baseline Westbound Demand at Shotover Bridge (Without Transport Interventions)

2.2 Mode Shift Required

In order to develop the site to Programme 3 without traffic demand exceeding existing capacity, traffic modelling indicates that 40% of trips from Ladies Mile and Shotover Country/Lake Hayes Estate would need to be by modes other than car and a Park and Ride on SH6 would need to capture 20% of westbound regional traffic (Table 2). Note that different proportions of mode shift could achieve the same reduction in demand; those shown are considered the most realistic.

Implementing a Park and Ride would require significant investment and further investigation is needed to identify the optimum size and location for an appropriate facility. Based on international experience, a turn in rate of 1 in 5 vehicles (a mode shift of 20%) is likely to be achievable subject to the charging regime adopted and the level of priority afforded to the Park and Ride buses.

Achieving a mode shift of 40% for trips associated with the Ladies Mile is unlikely to be achievable without a step change in public transport provision (for example Mass Transit). The Reference Case is forecast to require a Mass Rapid Transit (MRT) scale solution by development completion. As explored in the ITA, due to the high costs involved and the complexity of construction, MRT solutions are typically only justifiable in dense urban areas where they serve significant populations. As such MRT solutions, including gondolas at Ladies Mile, were found to be uneconomical in the ITA.

Evidence from Europe and Australia indicates that the maximum mode shift achievable by coupling improvements to conventional public transport services with programmes of Travel Demand Management is around 15%.

Table 2 Traffic Demand Analysis Results for Proposed HIF Programmes

HIF Programme	Number of dwellings (year complete)	Forecast traffic above capacity at development completion	Mode Shift Required to Reduce Demand at Shotover Bridge to 1,600v/h		
			Ladies Mile	Shotover Country/Lake Hayes	SH6 Park and Ride
1	450 (2023)	285	15%	25%	0%
2	750 (2025)	508	15%	25%	20%
3	**1,100 (2028)**	**770**	**40%**	**40%**	**20%**
4	2,185 (2037)	1,570	50%	50%	40%

The capacity of the public transport network is unknown at this stage (this is expected to be an output of the Future Public Transport Demand Analysis project). However, significant improvements are likely to be required to achieve the figures above. Furthermore, a system with high capacity does not necessarily translate into high patronage; the service needs to provide an attractive alternative to private vehicles.

To summarise the analysis of Programme 3, it is anticipated that mode shift alone will be insufficient to prevent congestion on SH6 by the time the development is complete.

3 Outcomes

The modelling results above indicate that mode shift alone is unlikely to enable the development of 1,100 houses at Ladies Mile; capacity improvements are likely to be required. This section explores potential impacts and mitigations to enable the construction of Programme 3, cognisant of the corridor context insofar that capacity upgrades at the Shotover Bridge have the potential to migrate congestion downstream.

3.1 Potential Congestion

The assessment of the Ladies Mile HIF site is based on a capacity constraint of 1,600 veh/hr at the Shotover Bridge. The result of traffic flows exceeding capacity is delay and queueing. For the Programme 3 Reference Case (refer Table 1), average westbound delays are expected to reach 4 minutes with queues up to 1.5km in 2028 (development completion). In the absence of a detailed traffic model, delays have been approximated based on the volume in excess of 1,600 veh/hr, and as such refer to additional delay and queues rather than total delay and queue lengths.

It should be noted that a level of congestion can be consistent with encouraging uptake in more sustainable modes of transport; albeit this has to be managed carefully and weighed against the operational efficiency of the State Highway network. Key to improving alternative mode share is to provide a service that is more attractive than private vehicles. This typically results from a level of inconvenience for car travel (congestion, inconvenient parking, expensive fuel) as well as an efficient public transport service (fast, reliable, affordable).

The ITA focussed on the morning peak due to its higher volumes and the traffic impacts being centred on Ladies Mile. Morning peak congestion causes queueing on Ladies Mile itself, which provides storage without affecting key intersections on the network. In the evening peak, congestion is more likely to affect other intersections in Frankton with greater potential to create critical network issues. Recent surveys have indicated that the PM outbound peak hour traffic demand is similar to the inbound AM demand. It is therefore anticipated that similar levels of interventions to those indicated within the ITA would be required in the eastbound direction within Frankton Flats.

3.1.1 Peak Spreading

Peak spreading occurs when commuters change their behaviour to avoid driving at busy times. No detailed modelling of peak spreading has been undertaken in this analysis, but it could potentially enable levels of service be maintained across the Shotover Bridge through a longer peak period.

3.2 Capacity Improvements

Traffic forecasting has shown that demand is likely to exceed the capacity of the Shotover Bridge in 2025 as the development is built out (assuming transport interventions presented in the ITA). Improving transport choice through the strategy identified in the ITA will delay capacity being reached, but upgrades will be required at some stage.

High investment site-specific capacity upgrades, such as MRT, were dismissed in the ITA from an economics perspective. Broader highway capacity improvements are more likely to have an economic case as they provide benefits to more people.

It is acknowledged that the constraint at the Shotover River currently acts as a valve, metering traffic arriving in Frankton. Increasing capacity over the Shotover River will have a downstream impact, possibly negating investment by migrating congestion into Frankton.

A series of potential capacity improvements are discussed here. Any capacity improvements should be part of a wider network strategy.

3.2.1 High Occupancy Vehicle Lanes

Providing transit lanes or bus lanes on SH6 up to the Shotover Bridge would encourage a shift towards higher occupancy vehicles (HOV), thereby reducing traffic volumes. The solution would capitalise on existing congestion by creating a more attractive alternative to private vehicles. Extra lanes, or the conversion of existing traffic lanes for the use by high occupancy vehicles, could be provided in both directions on SH6, addressing both morning peak westbound and evening peak eastbound congestion. This solution avoids causing congestion downstream, which is likely to occur with general traffic capacity improvements.

High occupancy lanes are comparatively cheaper to other potential capacity improvements, and could be staged such that the lanes are extended across the Shotover River in a potential future bridge upgrade (Section 3.2.3). Any additional structure should provide active mode facilities to maximise the alternative mode share.

It should also be noted that increasing vehicle occupancy is a somewhat paradoxical solution in that a high-occupancy lane will itself become more congested as occupancy increases, thus reducing its effectiveness in managing demand.

3.2.2 Traffic Signals

Improvements to route capacity can be made without providing additional road space. Signals could tie in with the HOV lanes option to give priority to buses or high occupancy vehicles. Priority could be provided at intersections along the corridor and at a 'gate' at the Shotover Bridge.

Traffic signals also offer a method of metering the amount of traffic reaching the bottleneck or providing priority without the need for comparatively expensive capital works. Signalisation of intersections through Ladies Mile (on SH6) would provide control over traffic flows, spreading congestion across the corridor rather than it reaching unstable levels at a single bottleneck.

It is noted that NZ Transport Agency have indicated their disapproval of implementing signals on this relatively high-speed section of SH6. The area is planned to remain an 80km/h speed zone, within which traffic signals are less safe than the existing roundabouts. The Agency also has a duty to maintain efficiency on the highway and roundabouts have higher capacity in this speed environment.

3.2.3 Duplication of Shotover Bridge

A supplementary conventional river crossing would effectively double the general traffic capacity of the route. A new bridge would have the benefit of providing extra eastbound capacity, addressing concerns about congestion caused by the Shotover Bridge during the evening peak blocking key intersections.

However, there are capacity constraints to the west of the Shotover River that reduce the effectiveness of localised improvements. Single-lane sections of road to the east of Hawthorne Drive between Grant Road and SH6A, and within the road network within Frankton Flats, are medium-term constraints on corridor capacity, while Frankton Road is unlikely to have increased capacity in the long-term. Similarly, the destination of Frankton and its internal network does not have the capacity to cater to the resulting increase in demand.

Consequently, any duplication of the bridge would need to be focussed on increasing the capacity to move people (rather than vehicles), in the form of high-occupancy or public transport lanes (refer Section 3.2.1) and active mode provision.

Additionally, a new bridge is anticipated to be costly due to the long spans required across the width of the Shotover River, hilly terrain at potential landing sites and the presence of critical infrastructure.

3.2.4 *New Route*

Frankton is increasingly becoming the main regional destination for retail, commerce and services, while residential areas are increasingly being developed alongside SH6. As land use patterns around Queenstown change, the function of the state highway is becoming more access focussed. A new strategic route would increase overall network capacity and resilience by separating movement and access functions, allowing SH6 to cater to regional movement and another route to provide local access.

As with the other options requiring major investment, a new route is likely to be cost-prohibitive in the short term given the comparatively low traffic volumes currently present.

3.3 Arthur's Point Diversion

A Select Link Analysis indicates that the town centre is currently a destination for 30% of westbound traffic arriving at Arrow Junction, representing 155 veh/hr. Frankton is increasingly becoming the main destination for commuters. Similarly, the town centre is expected to be the destination for 30% of traffic generated by the Ladies Mile site, reducing to 17% by 2045.

Accounting for growth up to 2028, there is expected to be approximately 200 veh/hr travelling to the town centre from Arrow Junction. The number of trips from the Ladies Mile site to the town centre is expected to be approximately 130 veh/hr.

However, it is understood that a proportion of regional trips are already using this route (and therefore would not reduce demand at the Shotover Bridge) and that the additional distance will dissuade drivers from using the route. The diversion would be 37% longer than SH6 for regional traffic and 60% longer for Ladies Mile traffic. It is therefore expected that, in its existing condition (with safety and capacity issues), the route would not be used by Ladies Mile traffic and a maximum of 20% of regional traffic would use the route. The resulting reduction in volumes on SH6 would be negligible in relation to the capacity of the Shotover Bridge.

For the route to be a realistic option, travel time would have to be better than, or at least similar to, travel time experienced on SH6. Under existing conditions, there would need to be approximately 6 minutes average delay on SH6 (or corridor improvements to provide 6 minutes travel time savings) for the Malaghans Road option to be equitable. As congestion grows and travel times increase on SH6, an upgraded alternative route through Arthur's Point may become more practical. With Reference Case assumptions, this could reduce demand on SH6 by a maximum of 330 veh/hr (assuming all traffic into Queenstown uses the route), the equivalent of extending the capacity of Shotover Bridge by 3 years.

It should be noted that the existing alternative route would require significant upgrades to be suitable for higher traffic volumes and heavy vehicles. Additionally, the Edith Cavell bridge is currently a one-way bridge with minimal spare capacity in the peak hours.

4 Staging

Practical staging of the improvements required cannot be simplified to triggers based on completion of houses at Ladies Mile. The timing of upgrades is dependent on realisation of multiple variables, the most critical being background traffic growth. Staging is therefore presented in relation to years, based on stated assumptions.

Table 3 shows potential staging of interventions for the Reference Case, as well as sensitivities for higher background traffic growth and a lower Ladies Mile house build rate. Capacity improvements are expected to be required before completion of Programme 3 in all scenarios. If traffic growth continues at the observed 2-year rate (9%), all interventions are expected to be brought forward by 2 years, including capacity improvements by 2024. A slower build rate of Ladies Mile houses has negligible effect on the timing of improvements required as background traffic growth would continue at the same rate. The consequence of a slower build rate is higher traffic volumes by the time development is complete. The low background traffic growth rate is expected to enable improvements to be delayed by 2 years from the Reference Case.

Detailed staging of the required capacity improvements is not given as these will be influenced by wider network strategies outside the scope of this assessment. As discussed in Section 3.2, elements of capacity improvements could be staged and scaled according to demand, such as providing high occupancy lanes up to the Shotover Bridge before potential duplication of the bridge itself.

Table 3 Transport Intervention Triggers and Staging for Programme 3

	Timeframe	Reference Case - 125 houses/yr; 5.69% annual growth on SH	High Traffic Growth - 125 houses/yr; 9.00% annual growth on SH	Low Build Rate - 75 houses/yr; 5.69% annual growth on SH
Number of Dwellings (Year)	Prior to complete houses	Upgrade Howards Drive intersection to RAB	Upgrade Howards Drive intersection to RAB	Upgrade Howards Drive intersection to RAB
		Implement bus stops (detail in transport strategy)	Implement bus stops (detail in transport strategy)	Implement bus stops (detail in transport strategy)
		Build SH6 Underpass at Howards Drive	Build SH6 Underpass at Howards Drive	Build SH6 Underpass at Howards Drive
		Provide high quality walking and cycling connections	Provide high quality walking and cycling connections	Provide high quality walking and cycling connections
		Implement TDM Measures in Ladies Mile/Shotover Country	Implement TDM Measures in Ladies Mile/Shotover Country	Implement TDM Measures in Ladies Mile/Shotover Country
	2021	Provide frequent Ladies Mile bus service (60 minutes required for capacity; higher frequency required for satisfactory service)	Provide frequent Ladies Mile bus service (60 minutes required for capacity; higher frequency required for satisfactory service)	Provide frequent Ladies Mile bus service (60 minutes required for capacity; higher frequency required for satisfactory service)
		Provide Shotover Country/Lake Hayes bus at 30 minute frequency	Provide Shotover Country/Lake Hayes bus at 20 minute frequency	Provide Shotover Country/Lake Hayes bus at 30 minute frequency
		Provide bus priority on SH6	Provide bus priority on SH6	Provide bus priority on SH6
			Begin park and ride	
			Begin westbound transit lanes on SH6	
	2022	Increase Shotover Country/Lake Hayes bus to 20 minute frequency	Park and Ride in place (100 spaces) with buses at 20 minute frequency	Increase Shotover Country/Lake Hayes bus to 20 minute frequency
			Westbound transit lanes in place on SH6	
	2023	Increase Ladies Mile bus to at least 30 minute frequency	Increase Ladies Mile bus to at least 30 minute frequency	Begin park and ride
		Begin park and ride	Increase Shotover Country/Lake Hayes bus to 10 minute frequency	Begin westbound transit lanes on SH6
		Begin westbound transit lanes on SH6	Park and Ride in place (200 spaces) with buses at 10 minute frequency	
	2024	Park and Ride in place (100 spaces) with buses at 20 minute frequency	Capacity improvements in place	Park and Ride in place (100 spaces) with buses at 20 minute frequency
		Westbound transit lanes in place on SH6		Westbound transit lanes in place on SH6
		Increase Shotover Country/Lake Hayes bus to 10 minute frequency		Increase Shotover Country/Lake Hayes bus to 10 minute frequency
	2025	Park and Ride in place (200 spaces) with buses at 10 minute frequency		Park and Ride in place (200 spaces) with buses at 10 minute frequency
	2026	Capacity improvements in place		Capacity improvements in place
	2027			Increase Ladies Mile bus to at least 30 minute frequency

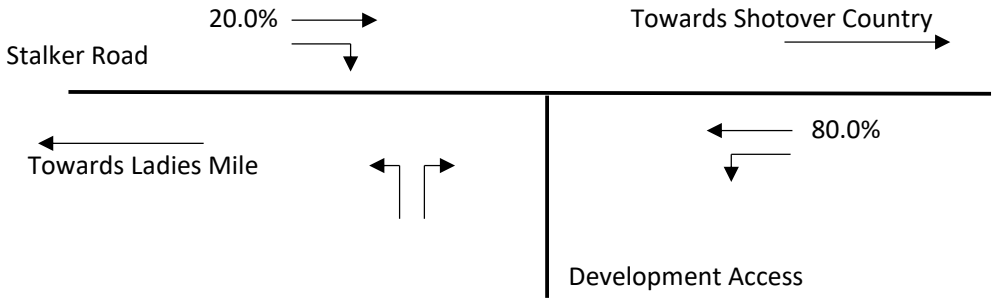
5 Conclusions

Based on the further analysis provided in this addendum, the following conclusions can be made:

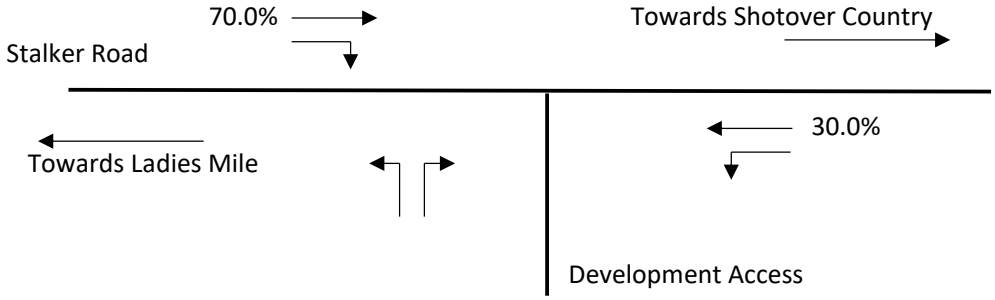
- Construction of Programme 3 at the Ladies Mile HIF site will result in traffic volumes exceeding the 1,600 veh/hr approximate capacity of the Shotover Bridge before the development is complete.
- By investing in public transport, Park and Ride and active mode improvements, significant mode shift away from single occupancy car travel can be achieved. However, this is expected to be insufficient to reduce demand to levels below available capacity. As such, capacity upgrades are also likely to be required to enable construction of Programme 3.
- There are multiple options available to increase capacity at existing bottlenecks. However, increasing general traffic capacity at the Shotover Bridge will potentially migrate congestion to critical downstream sections of the network. Constructing a new bridge or an entirely new route are also considered expensive, long-term solutions.
- Adding supplementary high-occupancy vehicle lanes across the Shotover Bridge is expected to present a more cost-effective solution without causing congestion downstream. The option is expected to reduce demand across the Shotover Bridge by increasing vehicle occupancy as well as increasing capacity. Construction could be staged to meet demand by preceding the bridge upgrade with transit lanes on SH6 up to the bridge approaches.
- Lower cost options include traffic signals on SH6, which could be used to meter demand arriving at the Shotover Bridge to distribute delay and queues across the corridor. Signals could also be used to provide bus priority at the Shotover Bridge merge. However, the implementation of traffic signals on SH6 is unlikely to be favourable to NZTA on the grounds of safety and efficiency.
- The consequence of traffic demand exceeding capacity is flow breakdown occurring, which ultimately results in longer average delays. NZ Transport Agency has indicated its objective is to minimise the increase in traffic demands from significantly exceeding the capacity of the Shotover Bridge (1,600 veh/hr), though the amount of acceptable delay on SH6 is not currently defined. Furthermore, the effect of peak spreading has not been assessed in detail and could lead to levels of service being maintained across the Shotover Bridge through a longer peak period.
- Staging of required improvements cannot be tied exclusively to the number of houses built at Ladies Mile as it is dependent on the realisation of background traffic growth rates and the rate of building achieved at the Ladies Mile site. Capacity improvements are highly likely to be required before the construction of Programme 3 is complete.

Appendix B Peak Period Traffic Generation and Distribution

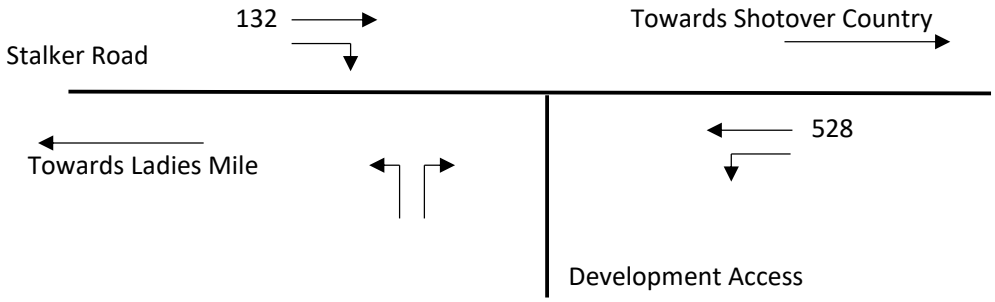
Shotover Country - am peak traffic distribution



Shotover Country - pm peak distribution



Shotover Country - am peak traffic

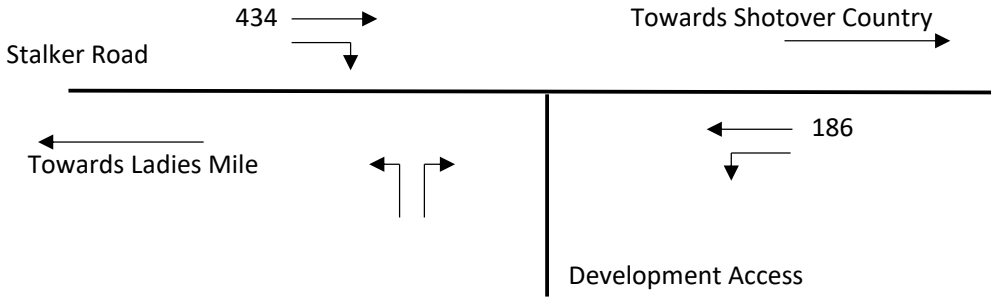


Based on:

1000 Residential Dwellings

0.66 Average hourly traffic generation per dwelling

Shotover Country - pm peak traffic

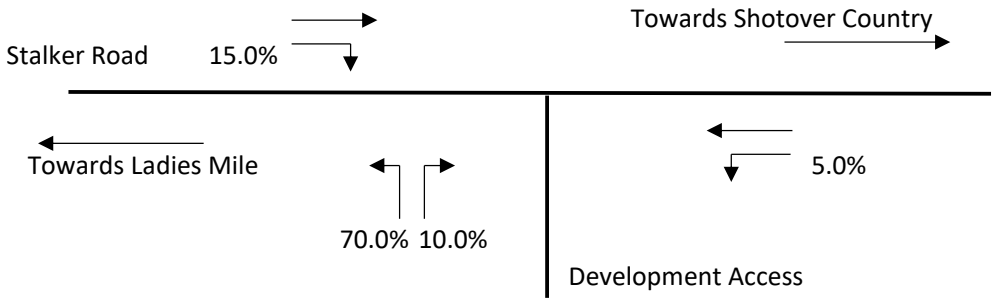


Based on:

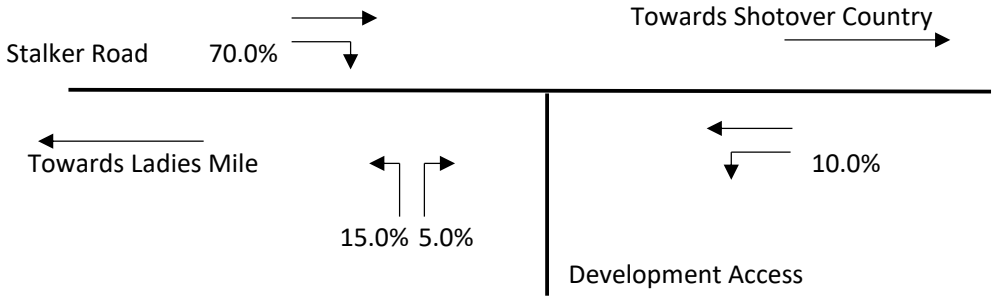
1000 Residential Dwellings

0.62 Average hourly traffic generation per dwelling

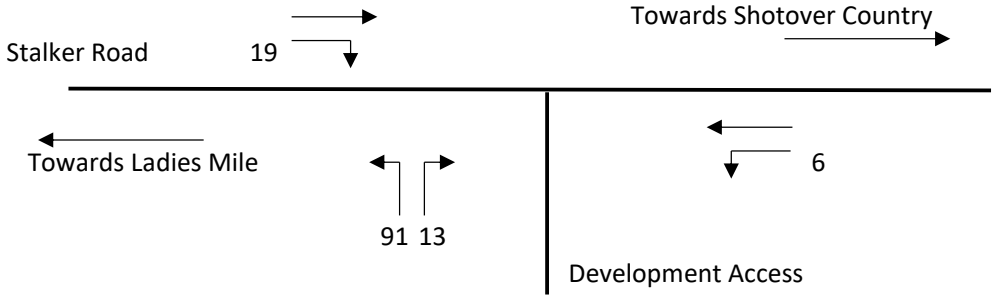
Development Traffic - am peak traffic distribution



Development Traffic - pm peak distribution



Development Traffic - am peak traffic

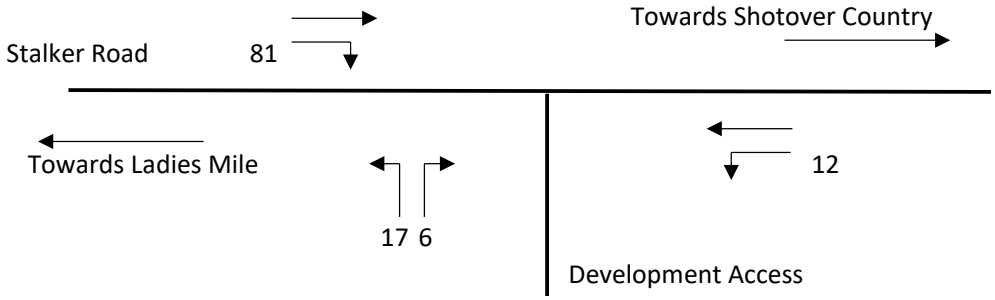


Based on:

160 Residential Dwellings

0.81 85th percentile hourly traffic generation per dwelling

Development Traffic - pm peak traffic

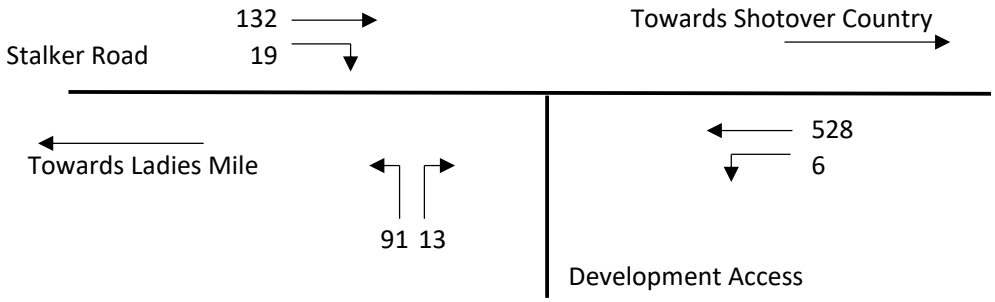


Based on:

160 Residential Dwellings

0.72 85th percentile hourly traffic generation per dwelling

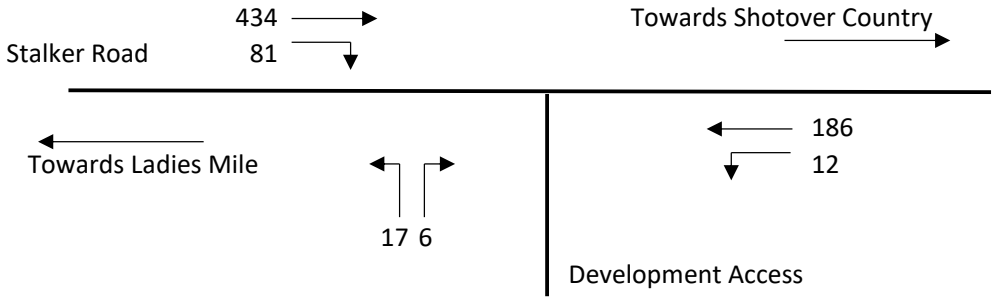
Combined Traffic - am peak period



Traffic Flows for Design

Right turn in		Left turn in	
Q_R	19	Q_L	6
Q_M	666	Q_M	528

Combined Traffic - pm peak period



Traffic Flows for Design

Right turn in		Left turn in	
Q_R	81	Q_L	12
Q_M	632	Q_M	186

Appendix C Proposed Access Intersection Design

The following Clark Fortune McDonald Preliminary intersection Design, Road Marking and Signage, Drawing 13496 E001, Sheet 009, Revision C, Dated 14/12/2018 is attached.

SIGHT DISTANCES:

SISD FOR SOUTHBOUND APPROACH
OPERATING SPEED 50km/h
AVERAGE DOWNHILL GRADE -11.6%
SISD = 110m

SISD FOR NORTHBOUND APPROACH
OPERATING SPEED 50km/h
AVERAGE UPHILL GRADE +10%
SISD = 84m

ASD
OPERATING SPEED 30km/h
UPHILL GRADE +4%

SURFACING FOR ALL CARRIAGEWAYS (INCLUDING PRIVATE ACCESSWAYS) - 30mm COMPACTED DEPTH No.10 MIX AC.

WIP PLOT 09.10.2018

Shotover Design Limited trading as
Clark Fortune McDonald & Associates
Licensed Cadastral Surveyors - Land Development - Planning Consultants

LAUREL HILLS
Queenstown, New Zealand

Rev.	Date	Revision Details	By
B	7.12.2018	BUS STOPS, ISLAND ETC	TS
B	14.12.2018	ADD SPLITTER ISLAND, REMOVE FOOTPATH ETC	TS

LAUREL HILLS LIMITED RESIDENTIAL DEVELOPMENT
PRELIMINARY INTERSECTION DESIGN
ROAD MARKING AND SIGNAGE

Client: LAUREL HILLS LIMITED

Notes:
All dimensions shown are in meters unless shown otherwise.
Any person using Clark Fortune McDonald drawings and other data accepts the risk of:
- Using the drawings and other data in electronic form without requesting and checking them for accuracy against the original hard copy versions.

	Surveyed	Signed	Date	Job No. 13496	Drawing No. E001 SHEET 009
Drawn TPS		Signed	Date 09.18	Scale 1:250 @ A1 1:500 @ A3	
Designed CH		Signed	Date 19.18	Datum & Level MSL	Rev. C

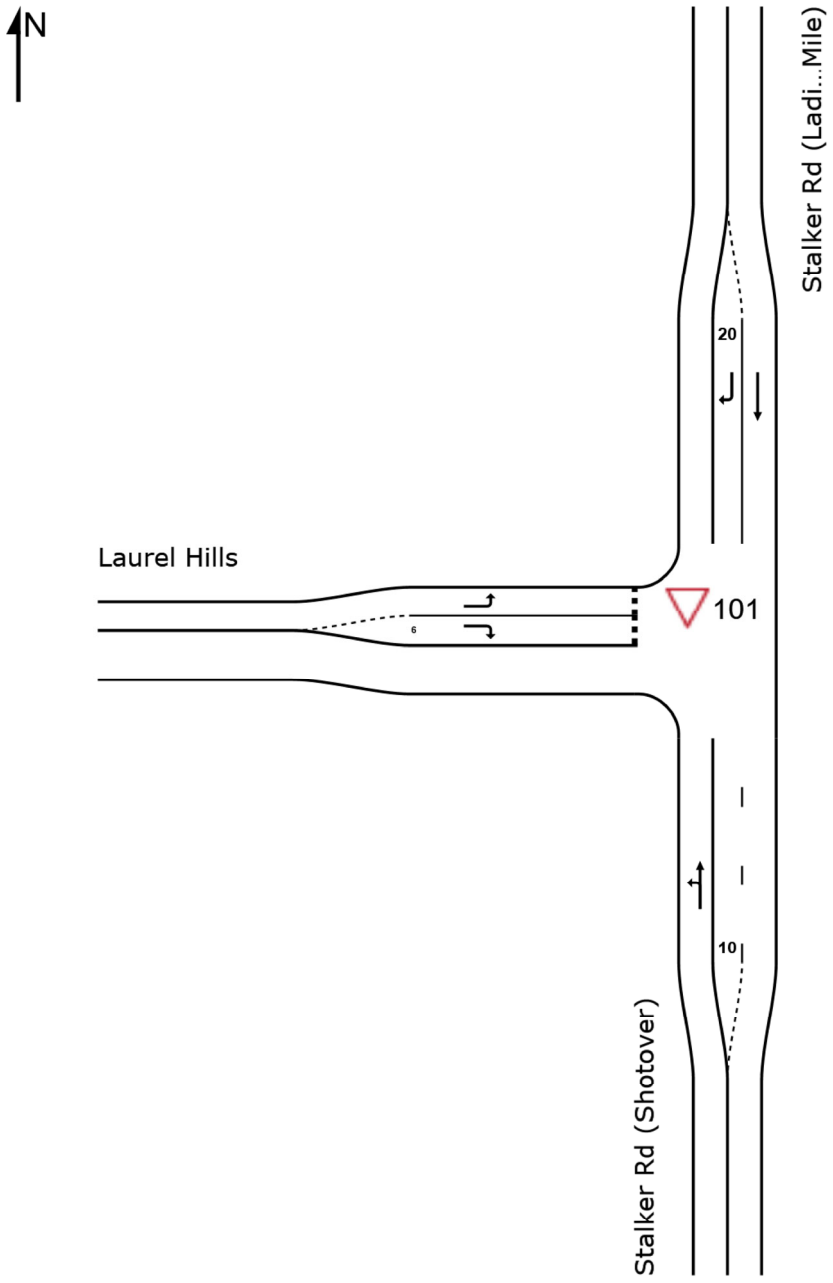
S:\JOBS\13400\13496\acad\ENGINEERING\CURRENT\13496_E001_PRELIM_INTERSN_DESIGN_REV_C.dwg, 14/12/2018 1:38:53 PM, DWG To PDF.pc3

Appendix D SIDRA Modelling Output

SITE LAYOUT

Site: 101 [Laurel Hills am peak]

Laurel Hills Intersection
Site Category: (None)
Giveway / Yield (Two-Way)



MOVEMENT SUMMARY

Site: 101 [Laurel Hills am peak]

Laurel Hills Intersection
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Stalker Rd (Shotover)												
1	L2	6	2.0	0.312	4.6	LOS A	0.0	0.0	0.00	0.01	0.00	49.4
2	T1	556	4.0	0.312	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	49.9
Approach		562	4.0	0.312	0.1	NA	0.0	0.0	0.00	0.01	0.00	49.9
North: Stalker Rd (Ladies Mile)												
8	T1	139	4.0	0.073	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
9	R2	20	2.0	0.021	7.0	LOS A	0.1	0.6	0.53	0.64	0.53	45.2
Approach		159	3.7	0.073	0.9	NA	0.1	0.6	0.07	0.08	0.07	49.3
West: Laurel Hills												
10	L2	96	2.0	0.115	7.7	LOS A	0.5	3.4	0.57	0.74	0.57	44.8
12	R2	6	2.0	0.016	12.1	LOS B	0.1	0.4	0.67	0.75	0.67	42.4
Approach		102	2.0	0.115	8.0	LOS A	0.5	3.4	0.58	0.74	0.58	44.6
All Vehicles		823	3.7	0.312	1.2	NA	0.5	3.4	0.08	0.11	0.08	49.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Laurel Hills pm peak]

Laurel Hills Intersection
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Stalker Rd (Shotover)												
1	L2	13	2.0	0.116	4.6	LOS A	0.0	0.0	0.00	0.03	0.00	49.3
2	T1	196	4.0	0.116	0.0	LOS A	0.0	0.0	0.00	0.03	0.00	49.8
Approach		208	3.9	0.116	0.3	NA	0.0	0.0	0.00	0.03	0.00	49.8
North: Stalker Rd (Ladies Mile)												
8	T1	457	4.0	0.240	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
9	R2	85	2.0	0.058	5.3	LOS A	0.3	1.9	0.32	0.53	0.32	45.8
Approach		542	3.7	0.240	0.9	NA	0.3	1.9	0.05	0.08	0.05	49.3
West: Laurel Hills												
10	L2	18	2.0	0.013	5.3	LOS A	0.1	0.4	0.31	0.51	0.31	45.8
12	R2	6	2.0	0.016	12.1	LOS B	0.1	0.4	0.67	0.75	0.67	42.4
Approach		24	2.0	0.016	7.1	LOS A	0.1	0.4	0.41	0.57	0.41	44.9
All Vehicles		775	3.7	0.240	0.9	NA	0.3	1.9	0.05	0.09	0.05	49.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.