NZ TRANSPORT AGENCY
WAKA KOTAHI

Technical Report No 2

Christchurch Southern Motorway Stage 2 and Main South Road Four Laning

Assessment of Traffic and Transportation Effects

November 2012

Quality Assurance Statement			
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This technical report has been produced in support of the Assessment of Environmental Effects (AEE) for the Main South Road Four Laning and Christchurch Southern Motorway Stage 2 Project. It is one of 20 Technical Reports produced (listed below), which form Volume 3 of the lodgement document. Technical information contained in the AEE is drawn from these Technical Reports, and cross-references to the relevant reports are provided in the AEE where appropriate.

A Construction Environmental Management Plan (CEMP) has been prepared to provide the framework, methods and tools for avoiding, remedying or mitigating environmental effects of the construction phase of the Project. The CEMP is supported by Specialised Environmental Management Plans (SEMPs), which are attached as appendices to the CEMP. These SEMPs are listed against the relevant Technical Reports in the table below. This Technical Report is highlighted in grey in the table below. For a complete understanding of the Project all Technical Reports need to be read in full along with the AEE itself; however where certain other Technical Reports are closely linked with this one they are shown in bold.

For further information on the structure of the lodgement documentation, refer to the 'Guide to the lodgement documentation' document issued with the AEE in Volume 1.

No.	Technical Report Title	Primary AEE Chapter Reference	SEMPs
1	**Design philosophy statement**	**4**	
2	Traffic and transportation effects report	11	Construction Traffic Management Plan
3	Assessment of stormwater disposal and water quality	19	Erosion and Sediment Control Plan, Accidental Aquifer Interception Management Plan
4	Landscape and visual effects	15	Landscape Management Plan
5	Assessment of effects - urban design	14	Landscape Management Plan
6	Urban and landscape design framework	14, 15	Landscape Management Plan
7	Landscape context report	15	Landscape Management Plan
8	Assessment of operational noise effects	17	
9	Assessment of construction noise & vibration	17	Construction Noise and Vibration Management Plan
10	Assessment of air quality effects	18	Air Quality Management Plan
11	Geotechnical engineering and geo-hazards assessment	3, 21	
12	Assessment of archaeological effects	24	
13	Social impact assessment	26	
14	Economic impact assessment	25	
15	Cultural impact assessment	23	
16	Contaminated land assessment	22	
17	Aquatic ecology assessment	20	
18	Terrestrial ecology assessment	20	
19	Lighting assessment	16	
20	Statutory provisions report	6, 28	
-	Construction Environmental Management Plan	5	

Contents

Appendices

Executive Summary

The NZ Transport Agency ('the NZTA') is intending to lodge Notices of Requirement and resource consent applications to construct, operate and maintain a four-lane median separated expressway and motorway between Main South Road at Rolleston and the southern end of the Christchurch Southern Motorway Stage 1 (CSM1) at Halswell Junction Road. At the southern end of this route, Main South Road Four Laning (MSRFL) involves the widening and upgrading of Main South Road to provide for a four-lane median separated expressway. Further north the construction of the Christchurch Southern Motorway Stage 2 (CSM2) connects the widened Main South Road with CSM1 with a new four-lane median separated motorway. Both of these elements, together with ancillary local road improvements, comprise the Project.

The Project completes the Southern Corridor of the Christchurch Motorways 'Roads of National Significance' (RoNS), one of three corridors around Christchurch which are identified as RoNS in terms of the 2009 Government Policy Statement on Land Transport Funding.

The effects of the Canterbury earthquakes have not been explicitly taken into account in the modelling undertaken for this Transportation Assessment. However, the NZTA has developed new demographic forecasts including the changes which have occurred in Canterbury, or are expected to occur. These forecasts indicate that residential and commerical growth in the south-western area of Christchurch is expected to exceed that predicted in the pre-earthquake forecasts used for the modelling in this assessment by 2026. This faster rate of growth is expected to be maintained out to 2041, with the number of households and employment numbers both forecast to be 5% higher than the pre-earthquake predictions. This predicted increased rate of development reinforces the need for this Project, as this higher rate of growth will increase the demand for travel from within the area served by the Project. However, the forecast increase in population and employment is not so large as to significantly alter the modelled outcomes reported here.

The objectives of this Project are detailed in Section 1.4. This Transportation Assessment has found that the Project will achieve these objectives in that it will:

- Contribute to the region's critical transport infrastructure and its land use and transport strategies by providing more predictable travel times and connections between the first stage of the Christchurch Southern Motorway and Rolleston for people and freight: Travel times on the Southern Corridor between Rolleston and Brougham Street are expected to be significantly lower with the Project, with travel time savings of up to 12 minutes predicted by 2041. Both general traffic and freight vehicles will benefit from these travel time savings. The reliability of these travel times is also expected to improve, as the improved level of service on CSM and Main South Road provided by the Project, and the new routing away from at-grade intersections, will reduce the likelihood of unexpected delays.
- Improve accessibility from Christchurch and the Port of Lyttelton to the south and west for individuals and businesses, while improving local access to work, shops and social amenity in Templeton and Hornby: The Project provides additional road capacity on sections of this corridor, and reduces travel times along the corridor linking Rolleston through to Brougham Street, and then on to the Port of Lyttelton. The rerouting of traffic onto this Project is expected to reduce traffic volumes through Templeton and Hornby by over 17,000 vehicles per day, with over 2,000 fewer trucks travelling through Templeton daily.

- Align traffic types and movements with the most appropriate routes by separating through traffic from local traffic to the south west of Christchurch and promoting other routes for passenger transport: The expected rerouting of heavy vehicles from Main South Road through Templeton and Hornby onto CSM removes this through traffic from the local streets in those areas and puts them onto a high standard motorway facility. The improved level of service provided on Main South Road is expected to lead to a decrease in traffic on Jones Road, the primary passenger transport route between Christchurch and Rolleston.
- Improve network resilience and safety by providing a route with enhanced safety standards and capacity: The Project will provide a high standard four-lane median divided road with grade separated interchanges between Rolleston and CSM1 at Halswell Junction Road. The existing route between these locations does not have median barriers, and is primarily two-lanes along its length. It also passes through a number of at-grade intersections, which will be bypassed by the Project. As a consequence, it is expected that the Project will be significantly safer than the current route (with a predicted 40% reduction in fatal and serious injury crashes), as well as providing more capacity.
- Manage the social, cultural, land use and other environmental impacts of the Project in the Project area and its communities by, so far as practicable avoiding, remedying or mitigating any such effects through route and alignment selection, design and conditions: The transport impacts of the Project are expected to be mainly positive, with improved travel times and reliability along the Southern Corridor, a reduction in serious crashes, and a reduction in traffic on the local roads currently used as alternative routes to the Project. The adverse effects relating to restrictions in access to properties, primarily along the MSRFL section, will be mitigated by the provision of alternative rear access routes on both sides of Main South Road.

This Transportation Assessment identifies some potential adverse effects of the Project on the transport system, for which mitigation measures have been developed. In summary, the identified adverse effects and the measures proposed to mitigate those effects, include:

- At the southern end of the Project, the end of the four laning at the current location of the Main South Road/Park Lane intersection merges traffic back into a single lane in the southbound direction on Main South Road. With the additional traffic drawn to the widened Main South Road and CSM2 from Rolleston, the level of service through this merge is expected to be worse than for the Baseline case, with slightly increased travel times. Capacity issues are still likely to remain at the Main South Road/ Rolleston Drive signalised intersection, even though the overall performance of this intersection is improved over that predicted for the Baseline.

  Although the NZTA does not currently have any specific projects on its 10 year programme to improve this section of the State highway network, it has a strategy for improvements as outlined in the CRETS[1] reports and will continue to monitor the performance of this part of the network. When this monitoring identifies the need for improvements, the adopted CRETS strategy improvements will be developed and implemented to resolve safety or congestion issues. These improvements involve the removal of the traffic signals on the Main South Road intersections with Hoskyns Road and Rolleston Drive, and provision of a grade separated connection between Rolleston and Jones Road.

[1] The Christchurch Rolleston and Environs Transportation Study (CRETS) was completed in 2007 and investigated the long term transport needs for areas south and west of Christchurch. The recommended CRETS strategy is a key document being used in the future planning of Greater Christchurch.

Improvements to the alternative routes bypassing this section of Main South Road to both the western and eastern sides of Rolleston are also being delivered as part of this Project. These routes are via Weedons interchange to Jones Road and Levi Road.

- Direct access will no longer be permitted to Main South Road on both the western and eastern sides along the MSRFL section. Alternative access will be provided to properties whose existing access is affected by the Project. A service lane will be constructed on the western side between Weedons Ross Road and Curraghs Road; and access to affected properties on the eastern side will be provided by an extension to Berketts Drive, and via new connections to the existing local road network and right of ways.
- The Halswell Junction Road/ Springs Road roundabout is expected to perform poorly some time between 2026 and 2041 in both the AM and PM peak periods. Although this expected performance is an improvement on that expected in the Baseline (i.e. it is not an adverse effect of this Project), it is still likely to result in significant delays on some approaches. The Shands Road interchange, provided as part of this Project, provides a nearby alternative access point to the motorway. Signage will be designed to encourage traffic to use Shands Road to access the motorway, rather than using Springs Road. The NZTA will also monitor the performance of this intersection, including crashes, travel time delay and queue lengths. If this monitoring indicates that the operation of this intersection is becoming unsatisfactory, the NZTA will work with Christchurch City Council through the UDS Transportation Group to improve its operation.
- At the northern end of the Southern Corridor, additional traffic will be drawn to Brougham Street, which is already expected to operate poorly in future years. Although the degree of congestion is not expected to worsen significantly with this Project completed, traffic volumes will be higher than in the Baseline. The NZTA is intending to progress a full corridor study from the City end of CSM to the Port of Lyttelton to investigate options for maintaining the efficient operation of this strategic corridor. Pending the results of this corridor study, the NZTA will continue its normal policy of making incremental operational improvements.

This Transportation Assessment also identifies construction and staging strategies to minimise the disruption caused during construction. These include:

- an overarching Construction Traffic Management Plan, supported by individual site specific temporary traffic management plans;
- an overall philosophy to construct local road connections first, along with associated structures and embankments, in order to maintain local connectivity whilst the CSM2 mainline is constructed; and
- the widening of Main South Road on its western side to allow traffic to continue using the existing carriageway, before being shifted to the new carriageway whilst the eastern side is constructed.

Overall it is considered that this Transportation Assessment demonstrates that the Project will assist in realising a number of positive effects in relation to the safe and efficient functioning of the transportation network, whilst the identified mitigation measures will avoid, remedy or mitigate the adverse transportation related environmental effects.

1. Introduction

1.1 Project Overview

The NZ Transport Agency (NZTA) seeks to improve access for people and freight to and from the south of Christchurch via State Highway 1 (SH1) to the Christchurch City centre and Lyttelton Port by constructing, operating and maintaining the Christchurch Southern Corridor. The Government has identified the Christchurch motorway projects, including the Christchurch Southern Corridor, as a road of national significance (RoNS).

The proposal forms part of the Christchurch Southern Corridor and is made up of two sections: Main South Road Four Laning (MSRFL) involves the widening and upgrading of Main South Road (MSR), also referred to as SH1, to provide for a four-lane median separated expressway; and the construction of the Christchurch Southern Motorway Stage 2 (CSM2) as a four-lane median separated motorway. The proposed construction, operation and maintenance of MSRFL and CSM2, together with ancillary local road improvements, are referred to hereafter as 'the Project'.

1.2 Purpose of Report

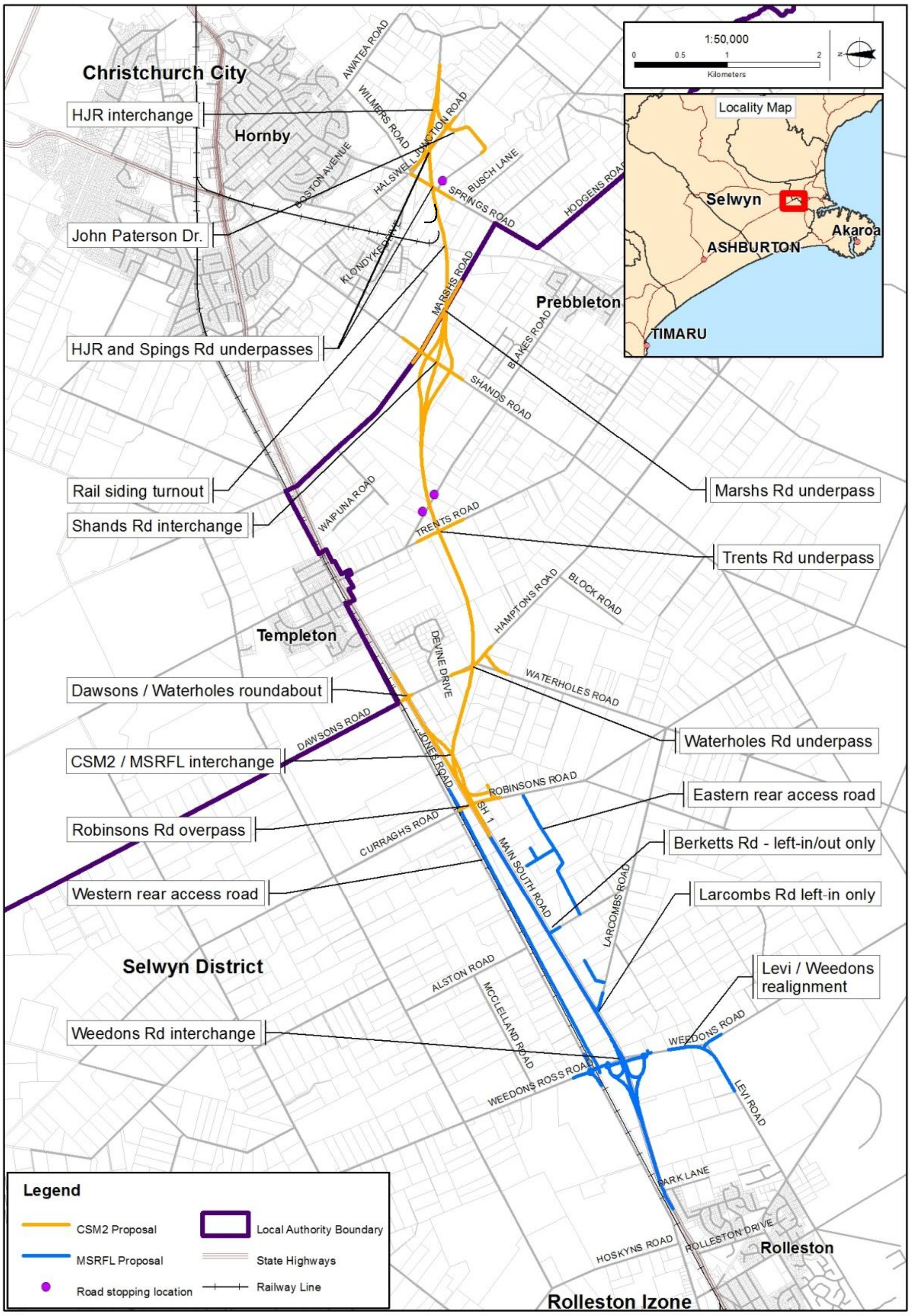
The purpose of this Assessment of Traffic and Transportation Effects report is to assess the potential effects of the works to be undertaken for the Project. This report considers the transportation effects of the Project once it is operational, including during the construction period. This report is part of a suite of documents prepared to inform the Assessment of Environmental Effects for the Project.

The Traffic and Transport assessment has been based around two typical scenarios; a "Baseline" scenario without the Project in place, and a "With Project" scenario. The criteria assessed include traffic impacts analysis (traffic volumes, level of service and travel times); intersection performance (level of service); heavy vehicles (traffic volumes); public transport (operational impacts); pedestrians and cycling (opportunities and impacts); safety (changes in frequency, severity and location of crashes); and access to property. A review against relevant transportation policy has also been undertaken. The assessment framework is described in more detail in Section 4.

1.3 Project Description

The Project is illustrated in **Figure 1-1**, and encompasses the MSRFL and CSM2 alignments between Rolleston and Halswell Junction Road.

Figure 1-1: Location Map of CSM2 and MSRFL Project



1.3.1 MSRFL

Main South Road will be increased in width to four lanes from its intersection with Park Lane north of Rolleston, for approximately 4.5 km to the connection with CSM2 at Robinsons Road. MSRFL will be an expressway consisting of two lanes in each direction, a median with barrier separating oncoming traffic, and sealed shoulders. An interchange at Weedons Road will provide full access on and off the expressway. MSFRL will connect with CSM2 via an interchange near Robinsons Road, and SH1 will continue on its current alignment towards Templeton.

Rear access for properties fronting the western side of MSRFL will be provided via a new road running parallel to the immediate east of the Main Trunk rail corridor from Weedons Ross Road to just north of Curraghs Road. For properties fronting the eastern side of MSRFL, rear access is to be provided via an extension of Berketts Drive and private rights of way.

The full length of MSRFL is located within the Selwyn District.

1.3.2 CSM2

CSM2 will extend from its link with SH1 / MSRFL at Robinsons Road for approximately 8.4 km to link with Christchurch Southern Motorway Stage 1 (CSM1, currently under construction) at Halswell Junction Road. The road will be constructed to a motorway standard comprising four lanes, with two lanes in each direction, with a median and barrier to separate oncoming traffic and provide for safety.[2] Access to CSM2 will be limited to an interchange at Shands Road, and a half-interchange with eastward facing ramps at Halswell Junction Road. At four places along the motorway, underpasses (local road over the motorway) will be used to enable connectivity for local roads, and at Robinsons / Curraghs Roads, an overpass (local road under the motorway) will be provided. CSM2 will largely be constructed at grade, with a number of underpasses where elevated structures provide for intersecting roads to pass above the proposed alignment.

CSM2 crosses the Selwyn District and Christchurch City Council boundary at Marshs Road, with approximately 6 km of the CSM2 section within the Selwyn District and the remaining 2.4 km within the Christchurch City limits.

1.3.3 Local Road Connections

The key design features and changes to the existing road network (from south to north) proposed are:

- a new full grade separated partial cloverleaf interchange at Weedons Road;
- a new roundabout at Weedons Ross / Jones Road;
- a realignment and intersection upgrade at Weedons / Levi Road;
- a new local road running to the immediate east of the rail corridor, to the west of Main South Road, between Weedons Ross Road and Curraghs Road;

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[2] CSM2 will not become a motorway until the Governor-General declares it to be a motorway upon request from the NZTA under section 71 of the Government Roading Powers Act 1989 (GRPA). However, for the purposes of this report, the term “motorway” may be used to describe the CSM2 section of the Project.

- alterations and partial closure of Larcombs Road intersection with Main South Road to left in only;
- alterations to Berketts Road intersection with Main South Road to left in and left out only;
- a new accessway running to the east of Main South Road, between Berketts Road and Robinsons Road;
- an overpass at Robinsons and Curraghs Roads (the local roads will link under the motorway);
- construction of a grade separated y-junction (interchange) with Main South Road near Robinsons Road;
- a link road connecting SH1 with Robinsons Road;
- a short new access road north of Curraghs Road, adjacent to the rail line;
- a new roundabout at SH1 / Dawsons Road / Waterholes Road;
- an underpass at Waterholes Road (the local road will pass over the motorway);
- an underpass at Trents Road (the local road will pass over the motorway);
- the closure of Blakes Road and conversion to two cul-de-sacs where it is severed by CSM2;
- a new full grade separated diamond interchange at Shands Road;
- an underpass at Marshs Road (the local road will pass over the motorway);
- providing a new walking and cycling path linking the Little River Rail Trail at Marshs Road to the shared use path being constructed as part of CSM1;
- an underpass at Springs Road (the local road will pass over the motorway);
- a new grade separated half interchange at Halswell Junction Road with east facing on and off ramps linking Halswell Junction Road to CSM1; and
- closure of John Paterson Drive at Springs Road and eastern extension of John Paterson Drive to connect with the CSM1 off-ramp via Halswell Junction Road roundabout (east of CSM2).

1.4 Project Objectives

The NZTA's objectives for the Project are to:

- Contribute to the region's critical transport infrastructure and it's land use and transport strategies by providing more predictable travel times and connections between the first stage of the Christchurch Southern Motorway and Rolleston for people and freight;
- Improve accessibility from Christchurch and the Port of Lyttelton to the south and west for individuals and businesses while improving local access to work, shops and social amenity in Templeton and Hornby;
- Align traffic types and movements with the most appropriate routes by separating through traffic from local traffic to the south west of Christchurch and promoting other routes for passenger transport;
- Improve network resilience and safety by providing a route with enhanced safety standards and capacity; and

- Manage the social, cultural and land use and other environmental impacts of the Project in the Project area and its communities by so far as practicable avoiding, remedying or mitigating any such effects through route and alignment selection, design and conditions.

These objectives have been developed taking into account both the national strategic context, but importantly the local context and land use planning carried out in the region. This context is discussed in Section 3 below.

1.5 Project Background

The Project has been established from a history of transport studies, with the initial concept for the Christchurch Southern Motorway dating back to the early 1960s through the work of the Christchurch Regional Planning Authority. The key studies in the development of the Project are summarised below, with further and more detailed background to the Project outlined in Chapter 7 of the AEE in relation to Consideration of Alternatives.

- The Christchurch Master Transportation Plan released in 1962[3] described the Southern Motorway as a major proposal from Waltham Road, extending to Halswell Junction Road near the intersection of Springs Road, to re-join State Highway 1 south of Dawsons Road near Templeton;
- In 1975, the Christchurch Regional Planning Authority released a second transport study which described an altered sequence of major road improvements based on the 1962 Transportation Plan with the note that[4]:

  "the Southern and Northern Motorways can be extended outward to meet the long term needs of external growth and inwards to distribute to the centre city and beyond."

- In 1979, the first component of the Southern Motorway involving the State Highway 75 Curletts Road link between Halswell Road and Yaldhurst was opened.
- The second section from Curletts Road to Brougham Street opened in 1981. This was originally to be a four lane motorway all the way through to Main South Road, west of Halswell Junction Road but was reduced in scope just prior to construction as a result of funding constraints.
- The remaining unbuilt length of the motorway route was redesignated in the early 1980s and generally followed the alignment developed in the original 1960s plan, but with a significantly reduced designation width. Of importance to CSM2, the termination point with State Highway 1 was also modified from its location near Rolleston to a point just south of Templeton.
- In 1994, the termination point with State Highway 1 shifted to the western end of Halswell Junction Road, as per the current form of CSM1 presently under construction and the original CSM2 designation was uplifted.
- During the 1990s, investigations focused on what is now recognised as Stage 1 of the CSM. These led to the Investigation and Reporting phase for CSM1 and production of a Scheme Assessment Report in 2002. It also recognised that further work would be required to assess transport requirements beyond Halswell Junction Road in the future. The designation and associated resource

[3] Christchurch Regional Planning Authority. Christchurch Master Transportation Plan. 1962.

[4] Christchurch Regional Planning Authority. Second Transport Study. Report No 210. 1975, Chapter 15, p.34.

consents for this project were confirmed in 2008 and construction of CSM1 commenced in 2010. Work is programmed for completion in 2013.

- In 2002, the Christchurch Rolleston and Environs Transportation Study (CRETS) was jointly funded by the then Transit New Zealand, Selwyn District Council, Christchurch City Council, Environment Canterbury and Christchurch International Airport Limited. Specific issues to be addressed included catering for growth on State Highway 1 between Hornby and Burnham and the location of the Southern Motorway Extension beyond the current proposal (CSM1)[5]. It was identified early that both of these issues were inter-related as traffic will divert from State Highway 1 to the future Southern Motorway Extension.
- Between 2002 and 2007, CRETS developed a number of options along the State Highway 1 corridor and refining the CSM2 alignment and connection to Main South Road. Analysis determined that due to the limited catchments of a passenger rail based service on the Main Trunk Line, rail options would not have a significant effect on the growth in private vehicle traffic and upgrade of the roading network would still be required.
- In 2007, the final CRETS strategy was adopted by the study partners and included the CSM2 extension and State Highway 1 four laning to Rolleston as part of an integrated transport strategy for southwest Christchurch. The analysis showed that these projects would be effective at addressing many of the issues raised including:
  - providing capacity for the projected future traffic volumes whilst enabling the highway to provide its primary function of mobility;
  - significantly decreasing traffic volumes on State Highway 1 through Hornby, Islington and Templeton;
  - significantly decreasing traffic on Halswell Junction Road west of Springs Road;
  - increased safety as a result of lower traffic volumes on State Highway 1 north of CSM2 connection and median divided four lane and intersection improvement on the southern section;
  - safer cross movements of State Highway 1 with an interchange at Weedons Road;
  - improved access to industrial areas to the north of Rolleston via Jones Road and the Weedons interchange, along with improved access to the Rolleston residential areas south of State Highway 1 via Weedons Road, Levi Road and Lowes Road and the Weedons interchange; and
  - provision of a key access corridor from the south, for increased traffic between Christchurch and Rolleston and for projected traffic demands travelling to and from Christchurch City and the Port of Lyttelton.
- In 2007, the Greater Christchurch Urban Development Strategy (UDS) was released. The development of the UDS was being carried out in parallel with CRETS, which ensured that there was a high degree of integration between transport and land use planning in the southwest area of Greater Christchurch. The UDS supports the strategic road improvements as proposed in CRETS to help accommodate the projected growth in Rolleston, Lincoln and Prebbleton, along with the Izone Southern Business hub at Rolleston.
- In March 2009 the Government announced the seven RoNS projects, which were identified as essential routes that required priority treatment to achieve economic growth and productivity.

[5] Christchurch, Rolleston and Environs Transportation Study. Issues. Options and Strategy Identification Report. April 2005, p.4.

Christchurch motorway projects were included as one of the seven RoNS and this Project formed part of the Southern Corridor package of work.

- In December 2009, the CSM2 Strategic Study was completed. Four alignment options were developed for CSM2 within the general corridor identified in CRETS. Two of these options were recommended to form the option alignment corridor in the scheme assessment phase. In addition, the CSM2 Strategic Study supported the inclusion of east facing Heavy Commercial Vehicle (HCV) ramps at Springs Road/Halswell Junction Road to[6]:

  > *"ensure that HCVs generated by adjacent industrial areas are able to quickly and efficiently access CSM, Lyttelton Port and Christchurch City while minimising impacts on local communities."*

- In 2010, the Investigation and Reporting phase for the Project commenced. The MSRFL Scoping Report[7] was completed in the earlier stages of the investigations and assessed State Highway 1 four-laning options starting from the proposed CSM2 connection near Robinsons Road and tying into the approach to the Hoskyns Road traffic signals just north of Rolleston. Due to safety concerns with four laning up to the Hoskyns Road signals, it was agreed that the southern extent of the Project would terminate at the end of the existing passing lanes north of Hoskyns Road. It is noted that scope for an eventual treatment of traffic signals at the State Highway 1 intersections with Hoskyns Road and Rolleston Drive has been identified through CRETS in collaboration with Selwyn District Council. This involves closure of the Hoskyns Road and Rolleston Drive signalised intersections with Main South Road and the provision of a grade separated connection between Rolleston and Jones Road. However, the development of any scheme at this location does not form part of the Project application and assessment.
- During 2011, more detailed CSM2 investigations were completed which considered alignments within a study corridor broadly defined by the options carried forward from the 2009 Strategic Study, along with an alternative more northerly option. Together with a detailed consultation process, a preferred alignment for CSM2 was produced.
- In June 2012, the final Scheme Assessment Report (SAR) was issued for CSM2 and MSRFL. During the preparation of this report the traffic modelling highlighted future capacity issues on Main South Road south of Templeton. This capacity issue would be exacerbated by the introduction of CSM2; in particular, delays and queuing associated with the convergence of the three lanes of traffic travelling southbound on CSM2 and MSR into a single lane. For these reasons, it was recommended that the four laning of Main South Road should be progressed simultaneously with CSM2, and be opened before or at the same time as the Southern Corridor is connected to Main South Road. The Project therefore combines both CSM2 and MSRFL, as both of these elements do not function well independently.
- At a high level, the key transport outcomes identified in the SAR include:
  - Improved capacity and efficiency for freight and motorists travelling on a national strategic route between the south of Christchurch and the city and Lyttelton Port;
  - Improved safety on a high standard, median separated highway, along with grade-separated interchanges and high degree of access control to remove conflicts associated with vehicle turning movements;

[6] SH73: Christchurch Southern Motorway Extension Stage 2 – Strategic Study. December 2009, p.3.

[7] SH1: Main South Road Four Laning. Final Scoping Report. June 2011.

- Improved access and amenity by significantly decreasing traffic volumes on Main South Road through Templeton; and
- Improved connectivity for pedestrians and cyclists through the provision of an off road pathway linking the CSM1 shared path at Halswell Junction Road with the Little River Rail Trail at Marshs Road.

1.6 Wider Transport Planning

As identified in Section 1.5 above, the Project was included in the final CRETS strategy as part of a wider package of transportation improvements in the Christchurch to Rolleston area. This strategy was developed to accommodate future population and employment growth to the southwest and south of Christchurch and has since been integrated into other key growth management documents, including the UDS and SWAP.

The Project is therefore a key individual component of a joint overall transport network solution. Primarily, the Project will complete the Christchurch RoNS Southern Corridor and provide the national strategic function of connecting the wider Canterbury and South Island areas to the Christchurch City Centre and Lyttelton Port.

To complement the Project, a number of other local road improvements are currently intended, as identified in CRETS and UDS partner local roading programmes, to service current and future demand from growth in the area. Whilst separate from the Project, these local road improvements will complement the strategic function of the Project by catering for local trips, while maintaining efficient access and connectivity to the arterial network.

Current examples include the upgrade of adjoining local roads and intersections to cater for traffic using the Project interchanges planned near Prebbleton and Rolleston, and the promotion of a route between Lincoln and Christchurch using Ellesmere Road, connecting to Magdala Place via Wigram Road, to reduce future traffic demand from Lincoln on Springs Road through Prebbleton. The upgrade of Selwyn Road and Lincoln Rolleston Road, in conjunction with Shands Road, has created a new district arterial that will connect to the proposed Project interchange on Shands Road to cater for traffic growth from expanding Rolleston southern residential areas.

The NZTA will continue to work with the UDS partners to develop local projects supporting the efficient and safe function of the wider network relating to the Project. In this regard, a short study on wider network operations is currently underway. This study is considering post-earthquake land use changes and the overall Project configuration, specifically the inclusion of motorway access ramps at Halswell Junction Road and the extent of the effects on the adjoining local network, such as Springs Road and Halswell Junction Road. The desired outcome of this study is to agree amongst the UDS partners the “best for network” solution taking these aspects into account. The study will also help inform other local road upgrades required in the wider study area that may be needed. This may include those already identified in CRETS and other local transport programmes. Projects outside the scope of this Project would be developed by the NZTA and the relevant council through a coordinated planning and funding approach to deliver these. Should the study identify new projects that would enhance the outcomes to be delivered by this Project, the NZTA will work with the relevant council to agree their planning, funding and delivery of such projects.

1.7 Approvals Sought

The NZTA is seeking all necessary Resource Management Act approvals to construct, operate and maintain the State highway and local road works required for the Project. This includes Notices of Requirement for new and altered designations within the Christchurch City and Selwyn District Plans. The Notice of Requirement applications also incorporate sufficient detail to satisfy Outline Plan requirements, pursuant to Section 176A(2)(b) of the RMA. Furthermore, all regional resource consents for the construction and operation of the road and associated drainage infrastructure are being sought.

1.8 Report Structure

The remainder of this report is structured as follows:

- Section 2 considers the land use and demographic context within which the Project has been developed, including the effects of the recent Canterbury Earthquakes;
- Section 3 identifies the national and regional policy context within which the Project has been developed;
- Section 4 describes the transportation assessment framework;
- Section 5 provides a description of the “existing” transportation environment;
- Section 6 quantifies the predicted operation of the road network without the Project;
- Section 7 assesses the effects of the Project on the transportation environment;
- Section 8 considers the effects of construction traffic and measures to mitigate such effects;
- Section 9 summarises the recommended mitigation measures to address any adverse effects of the Project; and
- Section 10 provides the assessment conclusions.

2. The Social and Economic Situation

2.1 Introduction

This section provides information on the demographic and economic rationale driving the need for this Project. It covers:

- Demographic changes, including forecast changes in household numbers and locations, and growth in employment;
- Forecast growth in the local and regional economy, with specific reference to those elements which require the movement of people and goods; and
- The effects of the Canterbury earthquakes in terms of the expected changes in travel patterns.

2.2 Demographic Forecasts

Demographic forecasts are an estimate of how the population and workforce of a region are expected to change over time, and have been used by the traffic models used to assess the effects of this Project (as will be explained in Section 4.2).

The demographic forecasts used in this assessment were produced before the 2010-2011 Canterbury earthquakes, so do not take account of the changes in household location and employment they have brought about. However, shown below is a comparison of the pre- and post-earthquake forecasts for the south-western area of Greater Christchurch, which indicate that population and employment growth in that area remain strong.

2.2.1 Population

Christchurch City is the economic hub of the South Island and has the second largest population in the country with an estimated 2011 residential population of 368,000[8]. The neighbouring districts of Selwyn to the south and Waimakariri to the north have 2011 population estimates of 41,100 and 48,600 respectively. Selwyn District was the fastest growing district in New Zealand (up 3.9% from 2010), and Waimakariri was the fourth fastest (up 2.0% from 2010). This is important as many of these residents travel to work, study and shop in Christchurch, increasing traffic on key arterial roads in and out of Christchurch.

Within the UDS, the Greater Christchurch area is defined by drawing a line around Christchurch City that takes in the communities within the “commuter belt” (approximately half an hour drive from the Central City) in Selwyn and Waimakariri Districts. Positive population growth is projected in the Greater Christchurch area, with the 2006 population base expected to grow from 414,000, to 501,000

[8] Statistics New Zealand subnational population estimates

in 2026 and 549,000 in 2041[9]. This represents an increase of approximately 135,000 (or around 30%) over the 35 year period from 2006 to 2041.

2.2.2 Households and Employment

In most transport projects, projected growth in population is considered as growth in households and employment. The growth in these two land use variables is then used in traffic models to determine the growth in the number of trips on the transport network. This is further explained in Section 4.2 below on overall modelling approach.

Projected post-earthquake household (HH) and employment (Empl) data for the Greater Christchurch UDS area is presented in **Table 2-1** below. This is based on a "Rapid Recovery" scenario.

Table 2-1: UDS Projected Household and Employment Growth – Post Earthquake

Area		2006	2011	2016	2026	2041	2006-2041
Christchurch City inside UDS	HH	140,700	144,200	150,300	174,000	195,300	54,600
	Empl	186,400	176,900	183,500	206,100	214,900	28,400
Waimakariri District inside UDS	HH	7,500	9,500	11,500	14,900	17,100	9,500
	Empl	7,100	8,600	9,800	11,300	12,800	5,700
Selwyn District inside UDS	HH	13,600	16,200	18,200	21,000	23,200	9,600
	Empl	8,100	9,000	10,100	12,200	14,200	6,100
Total	**HH**	**161,800**	**169,900**	**180,000**	**209,800**	**235,500**	**73,700**
	Empl	**201,600**	**194,500**	**203,400**	**229,600**	**241,800**	**40,300**

NZTA – Post Earthquake Rapid Recovery (Business as Usual) Growth Scenario

The household and employment forecasts presented in **Table 2-1** show that the growth in the total number of households is expected to continue strongly, despite the earthquakes. The total number of households within Christchurch City dropped by 4,000 following the earthquakes, but is expected to pick up again, reaching the pre-earthquake forecast level by 2026.

The number of people employed dropped after the earthquakes, falling by over 7,000 between 2006 and 2011. By 2016 employment numbers are expected to have only just passed the 2006 levels, and there remains a lag between the pre-earthquake forecasts and those developed post-earthquake.

Household and employment forecasts have been collated for the locales in the southwest area of Greater Christchurch near the vicinity of the Project. These are shown in **Table 2-2** below, showing the pre- and post-earthquake forecast figures.

[9] Greater Christchurch Urban Development Strategy 2009 Demographic Update. Projection is based on Statistics New Zealand medium/high growth scenario.

Table 2-2: Project Area Demographic Forecasts (Households and Employment) – Pre and Post Canterbury Earthquakes

		2016		2026		2041	
		Pre	Post	Pre	Post	Pre	Post
Rolleston	HH	5,063	4,527	7,374	6,319	9,373	8,269
	Emp	3,195	5,147	4,638	7,168	7,865	9,194
Prebbleton	HH	1,152	1,312	1,469	1,701	1,705	1,772
	Emp	707	452	731	463	745	463
Lincoln	HH	2,585	3,099	3,624	4,885	4,657	6,382
	Emp	3,530	3,212	3,740	3,346	3,876	3,413
Total	**HH**	**8,800**	**8,938**	**12,467**	**12,904**	**15,735**	**16,423**
	Emp	**7,432**	**8,811**	**9,109**	**10,977**	**12,486**	**13,069**

These show that in the outer south-western area (such as Rolleston, Prebbleton and Lincoln), by 2026 the number of households is forecast to have passed the number in the projections used for the assessment of this Project. This trend of slightly faster development than forecast pre-earthquakes continues through to 2041, at which point it is forecast that there will be 4% more households than were expected before the earthquakes.

The employment forecasts show that the number of people employed in the south-western area is expected to increase at a faster rate than was expected before the earthquakes. This faster growth in employment numbers is likely to lead to more commuter travel, as workers travel to and from their workplace, as well as more freight movements serving these employment locations.

2.3 Economic Forecasts

2.3.1 Key Economic Hubs

Lyttelton Port and Christchurch International Airport are identified as key import and export hubs for the Christchurch area, the Canterbury region and the South Island. They make large contributions to the Canterbury economy and both are essential infrastructure upon which significant amounts of regional economic activity is based.

The Airport is New Zealand's second largest and in 2011 handled 5.6 million passengers. Lyttelton Port is the South Island's largest port and the third largest port in New Zealand.

Table 2-3[10] shows trade figures for the two facilities, including the free-on-board (fob) value of exports and cost insurance freight (cif) value of imports.

[10] Statistics New Zealand overseas cargo statistics.

Table 2-3: Value of Lyttelton Port and Christchurch International Airport Imports and Exports - 2011

	Exports (fib $billion)	Imports (cif $billion)	Total ($billion)
Lyttelton Port	5.1	2.9	8.0
Christchurch Airport	3.4	0.6	4.0
Total Canterbury	9.3	3.9	13.1
Total New Zealand	50.4	46.3	96.8

Together, the Port and Airport contributed approximately 90% of the total value of regional imports and exports and nearly 12% of total New Zealand imports and exports. In addition to this, the Airport generates significant regional and national tourism benefits, contributing to approximately 7% of Canterbury's Gross Domestic Product[11].

Both of these facilities are expected to grow over the next 30 years with associated growth in freight movements. It is recognised that efficient access to, from and between these two facilities should be maintained and enhanced if possible. The forecast growth in trade at Lyttelton Port is discussed in more detail in Section 5.2.

Port of Lyttelton

The Port of Lyttelton is the major port in the Canterbury region, handling both international and domestic freight movements. Freight volumes through the Port have grown strongly over the last decade, and this growth is expected to continue over the next decade, especially with container operations no longer being handled by the Port of Timaru.

Between 1997 and 2011 there has been a three-fold growth in container movements, from 90,000 per annum to 271,000 per annum. This strong growth in container movements is forecast to continue, as shown in **Table 2-4**, which also shows the forecast growth for other commodities.

Table 2-4: Forecast Freight Movements through Port of Lyttelton

Commodity Type	2013	2022	Growth (2013 to 2022)
Containers (TEU)	337,000	711,000	111%
Coal (Tonnes)	2,319,000	5,047,000	118%
Fuel (Tonnes)	1,008,000	1,316,000	31%
Dry Bulk (Tonnes)	662,000	863,000	30%
Logs (Tonnes)	256,000	256,000	0%

Source: Memo from Lyttelton Port of Christchurch, 'GCTS – Freight Growth Assumptions', 6 June 2012

[11] Christchurch International Airport Ltd website

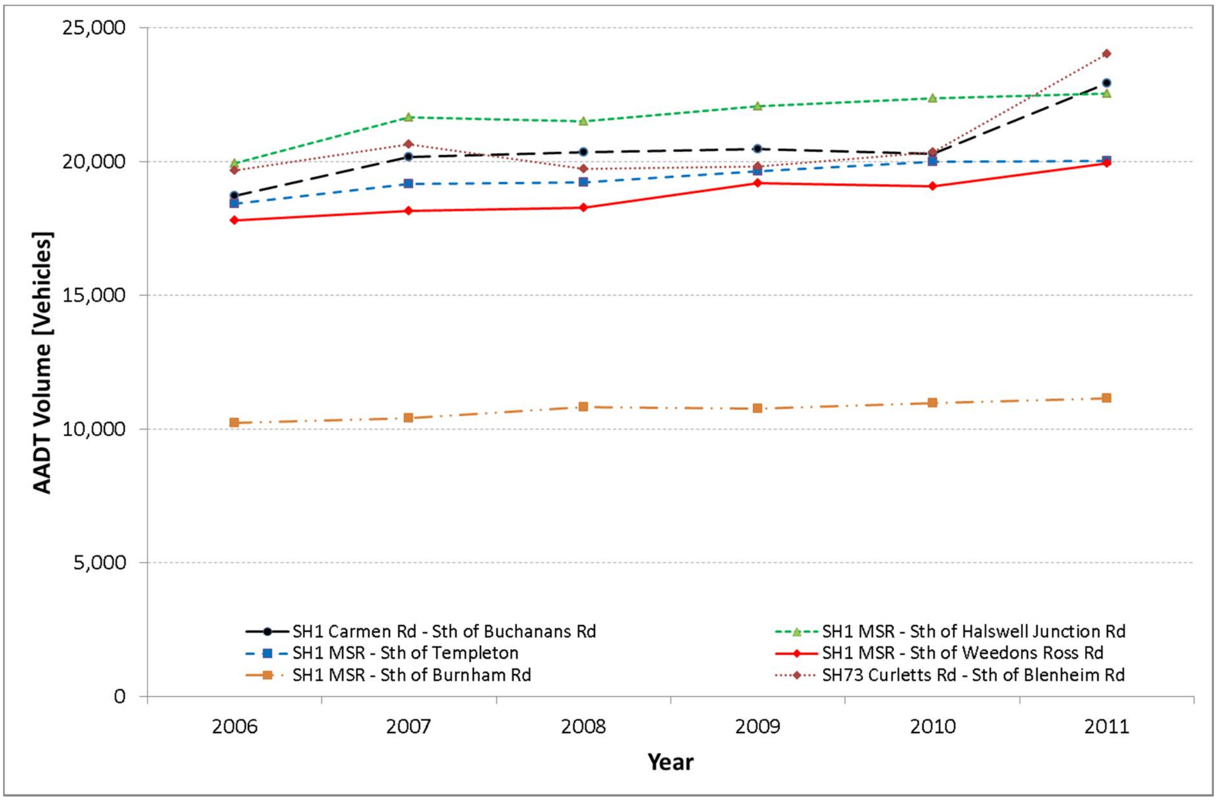
With containers and the other commodities (excluding coal) being primarily transported by road, providing efficient and effective road links between the Port and the rest of the region is crucial for maintaining the economic growth in Canterbury and the South Island.

2.4 Transportation Network Effects of Canterbury Earthquakes

Figure 2-1 shows the Annual Average Daily Traffic (AADT) volumes on SH1 and SH73 in the vicinity of the Project. Several points are clear from this:

- Traffic volumes on Main South Road for 2011 are generally consistent with the growth patterns seen in previous years.
- the State highway network around the southern and western edges of Christchurch (SH1 Carmen Road and SH73 Curletts Road) has seen a sharp increase in daily traffic volumes. This is likely to reflect the shift in employment from the central and east side of the City out towards the west. Congestion on the local orbital and radial routes (from traffic displaced from central city routes) is also likely to have pushed traffic onto these higher speed routes further out.

Figure 2-1: State Highway Traffic Volume Trends



Based on the observed traffic volumes at these sites, growth in traffic volumes in the south-western area of Greater Christchurch is unlikely to fall from pre-earthquake levels. In some locations, volumes have increased markedly in the last year, although it is not possible to draw any long term conclusions from this.

3. Strategic Context

3.1 Introduction

This section provides a summary of the policy context relevant to the Project and sets out the following aspects:

- The Christchurch RoNS;
- The national policy context; and
- The regional and local strategic context.

An assessment of the Project against the various policy and strategies is presented in Section 7.9.

3.2 Christchurch RoNS

In March 2009, the Government announced seven roading projects that are linked to New Zealand's economic prosperity. Referred to as the RoNS, the NZTA was charged with delivering these highway projects within the next 10 years. The seven RoNS projects are based around New Zealand's five largest population centres. The focus is on moving people and freight between and within these centres more safely and efficiently to support national economic growth and productivity.

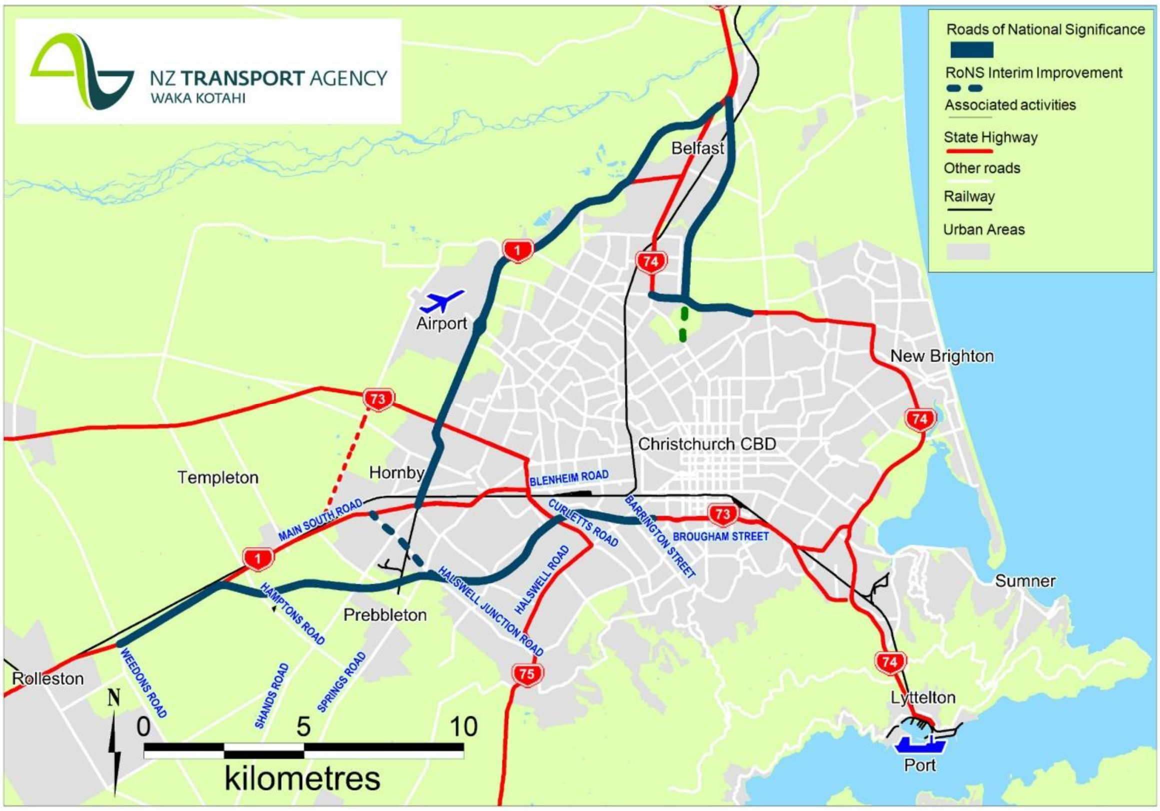
Christchurch motorways are included as one of the seven projects in the RoNS programme and are based around several sections of State highways that provide critical routes to the Christchurch International Airport, into the Christchurch City Centre and to the Lyttelton Port. They are important both nationally and regionally as they serve the South Island's largest economic centre, and support the growth context discussed in Section 2. The objectives of the Christchurch RoNS are to[12]:

- Give effect to the Government Policy Statement on Land Transport Funding, in particular to deliver the Christchurch motorways package;
- Improve economic growth and productivity;
- Improve travel time and reliability to the port, airport and Central Business District (CBD);
- Improve access to key activity and industrial areas (Hornby, Sockburn and Belfast);
- Improve land use integration;
- Improve access for public transport, walking and cycling in the UDS growth node of Belfast; and
- Improve safety and social amenity in the UDS Township areas, thereby giving effect to other UDS outcomes.

The Christchurch RoNS have been grouped into three corridors, as presented in **Figure 3-1**.

[12] NZ Transport Agency. Christchurch Motorways Roads of National Significance Network Plan. September 2010.

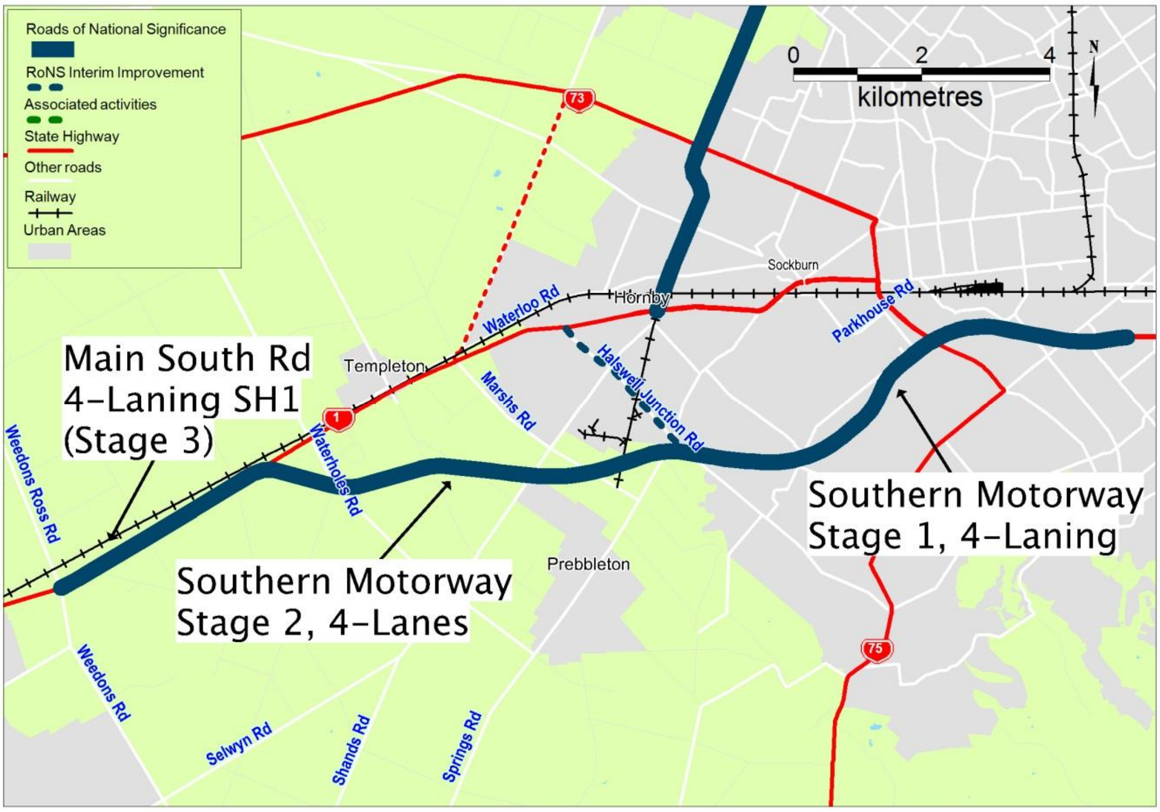
Figure 3-1: Christchurch Motorways RoNS Map



The three Christchurch RoNS corridors can be described as follows:

- The Christchurch Northern Corridor, which provides the main northern access to the Christchurch City Centre and the Port of Lyttelton via Queen Elizabeth II (QEII) Drive;
- The Christchurch Western Corridor, along the existing State Highway 1 between the Christchurch Northern Motorway and Hornby, which provides access to Christchurch International Airport and links north, south and east Christchurch; and
- The Christchurch Southern Corridor which provides the main southern access to Lyttelton Port and the Christchurch City Centre. The corridor includes the Southern Motorway Stage 1 (CSM1) from Barrington Street to Halswell Junction Road and this Project extending the motorway from Halswell Junction Road to State Highway 1 near Robinsons Road and four laning the existing State Highway 1 from Robinsons Road to just north of Rolleston (refer to **Figure 3-2** for a map of the southern corridor).

Figure 3-2: Christchurch Southern Corridor RoNS Map



The intended outcome of the Christchurch Southern Corridor package of projects was to reduce travel times and increase reliability for traffic and freight travelling to and from the south of Christchurch, contribute positively to safety and amenity in the local Templeton and Hornby areas, improve connectivity for the growing Selwyn District population and support the UDS framework for future development in the Southwest area.

The Project therefore contributes to several of the overall RoNS objectives particularly relating to access to the port and city centre.

3.3 National Context of the Project

At a national level, the Project is relevant to a number of legislative documents and strategic initiatives including the:

- Land Transport Management Act 2003 (LTMA);
- Government Policy Statement on Land Transport Funding 2012/13 – 2021/22 (GPS);
- National Infrastructure Plan (NIP) 2011;
- Safer Journeys Strategy 2010-2020;
- Connecting New Zealand 2011; and
- Resource Management Act 1991.

3.3.1 Land Transport Management Act 2003 (LTMA)

The LTMA is the main statute for New Zealand's land transport planning and funding system. The purpose of the LTMA is to contribute to the aim of achieving an affordable, integrated, safe, responsive and sustainable land transport system. It also sets out five key transport objectives of[13]:

- assisting economic development (improving trip reliability and reducing journey times on critical routes);
- assisting safety and personal security (reducing deaths and serious injuries as a result of road crashes);
- improving access and mobility (increasing mode share of public transport, walking and cycling and other active modes);
- protecting and promoting public health (reducing the number of people exposed to health endangering levels of noise and air pollution); and
- ensuring environmental sustainability (reducing the use of non-renewable resources and carbon emissions).

The LTMA provides for three national level planning documents: the National Land Transport Strategy, the GPS to guide land transport planning and investment, and the National Land Transport Programme which is an operational document prepared by the NZTA. At a regional level, the LTMA requires Regional Land Transport Strategies and Regional Land Transport Programmes, to be prepared.

A National Land Transport Strategy has never been issued under the LTMA since the LTMA was amended in 2008 to include the ability of the Minister to prepare a NZTS. The NZTS is non-statutory, but formed the context for the development of the GPS on Land Transport Funding. It sets the direction for the transport sector until 2040, by setting out targets under the five transport objectives listed in the LTMA. These objectives are also contained in the GPS.

3.3.2 Government Policy Statement 2012

The GPS on Land Transport Funding translates the long term direction for transport into specific short to medium-term impacts, to reflect the current government's priorities for land transport expenditure over a ten year outlook. The NZTA is required to give effect to the GPS when evaluating projects and preparing the National Land Transport Programme. The GPS is prepared under the LTMA and therefore must contribute to the purpose of the LTMA and to each of the five key transport objectives referred to in the preceding section.

The current GPS came into effect on 1 July 2012. It reflects the current government's priorities for land transport expenditure for the three year period to 2014/15. It also provides indicative expenditure targets for 2015/16 – 2021/22.

The government has three areas of focus for transport that are priorities for the GPS 2012:

- economic growth and productivity;

[13] Section 20 Land Transport Management Act 2003

- value for money; and
- road safety.

The short to medium term impacts that are expected to be achieved through the allocation of the National Land Transport Fund are:

- improvements in the provision of infrastructure and services that enhance transport efficiency and lower the cost of transportation through:
  - improvements in journey time reliability;
  - easing of severe congestion;
  - more efficient freight supply chains; and
  - better use of existing transport capacity.
- better access to markets, employment and areas that contribute to economic growth;
- reductions in deaths and serious injuries as a result of road crashes;
- more transport choices, particularly for those with limited access to a car;
- a secure and resilient transport network;
- reductions in adverse environmental effects from land transport; and
- contributions to positive health outcomes.

With regard to the RoNS, the GPS states that[14]:

> *"continuing to progress the seven RoNS is a critical part of the economic growth and productivity priority and a significant part of the government's National Infrastructure Plan and that the RoNS programme will be ongoing and an important part of the National Land Transport Programme.*"

3.3.3 National Infrastructure Plan 2011

The NIP (version 2) was released by the government in July 2011. The NIP outlines a framework for infrastructure development over a 20 year timeframe and sets out a vision that[15]:

> *"by 2030, New Zealand's infrastructure is resilient, coordinated and contributes to economic growth and increased quality of life."*

The NIP sets out the key issues, strategic opportunities and a vision for each of New Zealand's major infrastructure sectors including transport, telecommunications, energy, water and social infrastructure, as at 2011. For transport, the vision is for[16]:

> *"a transport sector that supports economic growth by achieving efficient and safe movement of freight and people."*

[14] Government Policy Statement on Land Transport Funding 2012/13 – 2021/22, p.8.

[15] National Infrastructure Plan 2011, p.11.

[16] National Infrastructure Plan 2011, p.26.

The NIP identifies the RoNS as a "current" investment priority in the transport sector to assist in supporting New Zealand's economic growth. The NIP is clear that the RoNS will be the major roading investment priority for the next ten years.

3.3.4 Safer Journeys Strategy 2010-2020

The Ministry of Transport's Road Safety Strategy for the period 2010-2020 is entitled Safer Journeys. The long-term goal for road safety in New Zealand is set out in the Safer Journeys vision for[17]:

"a safe road system increasingly free of death and serious injury."

This vision is a key focus area for the government to reduce the number of fatal and serious injuries as a result of road crashes. Of particular relevance to this Project is the action to improve the safety of our roads and roadsides.

3.3.5 Connecting New Zealand 2011

The purpose of Connecting New Zealand is to[18]:

"summarise the government's broad policy direction for the transport sector over the next decade. Connecting New Zealand sets out the government's objective for an effective, efficient, safe, secure, accessible and resilient transport system that supports the growth of our country's economy, in order to deliver greater prosperity, security and opportunities for all New Zealanders."

Connecting New Zealand draws together the policy direction from a number of documents, including the GPS, NIP and Safer Journeys Strategy described above. It is based around the government's three key areas of focus set out in the GPS including economic growth and productivity, value for money and road safety.

Connecting New Zealand specifically identifies the Christchurch motorway RoNS as a priority to improve the access to both the Airport and Port. This investment will help to:

"increase the capacity of roads to handle higher freight levels, as well as improving safety for all road users."

3.3.6 Resource Management Act 1991 (RMA)

The purpose and principles of the Resource Management Act 1991 (RMA) are set out in Part 2 of the Act and specifically in s5 which outlines that:

(1) The purpose of this Act is to promote the sustainable management of natural and physical resources.

(2) In this Act, sustainable management means managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to

[17] Safer Journeys Strategy 2010-2020, p.3.

[18] Connecting New Zealand 2011, p.5.

provide for their social, economic, and cultural well-being and for their health and safety while—

(a) sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and

(b) safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and

(c) avoiding, remedying, or mitigating any adverse effects of activities on the environment.

There are several sections under the RMA that are directly or indirectly applicable to land transport. Of particular note is the requirement under s75(3) that district plans give effect to regional policy statements and the opportunities this presents for promoting integrated transportation planning. In addition, regional councils have a specific responsibility for the strategic integration of infrastructure with land use, through objectives, policies and methods. Regional policy statements are therefore a very important instrument to promote transport integration as regional land transport strategies must not be inconsistent with the regional policy statement. Regional plans and district plans need to give effect to their objectives and policies in the regional policy statement. This is discussed further in the section below.

3.4 Regional and Local Strategic Context

The Project as proposed has been developed within the context of a number of regional and local strategic planning documents, including:

- Canterbury Regional Policy Statement 1998 (RPS) and the Proposed Canterbury Regional Policy Statement 2011 (PRPS);
- Canterbury Regional Land Transport Strategy 2012 – 2042 (RLTS);
- Canterbury Regional Land Transport Programme 2012 – 2042 (RLTP);
- Greater Christchurch Urban Development Strategy and Action Plan 2007 (UDS);
- Draft Christchurch Transport Plan 2012 – 2042 (DCTP);
- Christchurch Rolleston and Environs Transportation Study 2007 (CRETS); and
- South-West Christchurch Area Plan 2009 (SWAP).

These are outlined in more detail in Chapter 2 of the Assessment of Environmental Effects but are summarised here in relation to transport outcomes.

3.4.1 Canterbury Regional Policy Statement

The Operative RPS was adopted by the Canterbury Regional Council in 1998. It provides an overview of the resource management issues of the Canterbury Region and sets out how natural and physical resources are to be managed to meet the requirements of the RMA. A full review of the 1998 RPS commenced in 2006 in accordance with the RMA, which requires that Regional Policy Statements are reviewed every 10 years so it is well advanced. The PRPS was notified in June 2011 and submissions closed in August 2011. The hearings for the PRPS were held between January and March 2012 and on

19 July 2012, Canterbury Regional Council accepted the recommendations of the Hearing Commissioners.

In October 2011, the RPS was amended by the Minister of the Earthquake Recovery, as authorised by the Canterbury Earthquake Recovery Authority, to include Chapter 12A (Development of Greater Christchurch). This is based on the Proposed Change 1 (PC1) to the RPS but was updated as a result of the Canterbury earthquakes. However, the Minister's decision to included Chapter 12A was successfully challenged by judicial review in the High Court. As a result, Chapter 12A has been set aside and the previous version of the PC1 is now relevant for the purposes of this Project. The High Court decision has been appealed.

PC1 provides direction for future growth within greater Christchurch by setting out land use distribution, in particular identifying areas available for urban development including specifying residential densities and provision for businesses. Although PC1 promotes intensification of land use within existing urban areas it also identifies appropriate areas for Greenfield developments to accommodate projected growth and population relocation.

Of particular relevance to this Project is the Urban Limits boundary along Marshs Road (between Meadowlands Road and the Hornby industrial rail line west of Springs Road) and the inclusion of undeveloped land to the immediate north of the boundary as a greenfield business area.

The transport network objective set out in PC1 is:

Objective 7: Integration of Transport Infrastructure and Land Use

Ensure that the planning and provision of transport infrastructure is integrated with development and settlement patterns and facilitates the movement of goods and provision of services in Greater Christchurch, while:

- *(a) Limiting network congestion;*
- *(b) Reducing dependency on private motor vehicles;*
- *(c) Reducing emission of contaminants to air and energy use; and*
- *(d) Promoting the use of active transport modes.*

PC1 in the Operative RPS will be incorporated into the PRPS as Chapter 6 at the time PC1 becomes operative.

3.4.2 Canterbury Regional Land Transport Strategy 2012 – 2042

The RLTS was adopted in February 2012 by the Canterbury Regional Transport Committee on behalf of Canterbury Regional Council. It is prepared under the LTMA with regard to the GPS and sets the strategic direction for land transport within the region over the 30 year period to 2042.

The vision of the RLTS is that[19]:

[19] Canterbury Regional Land Transport Strategy 2012 – 2042, p.2.

> *"Canterbury has an accessible, affordable, integrated, safe, resilient and sustainable transport system."*

The vision is supported by objectives to:

- Ensure a resilient, environmentally sustainable and integrated transport system;
- Increase transport safety for all users;
- Protect and promote public health;
- Assist economic development; and
- Improve levels of accessibility for all.

The RLTS outlines a strategic direction based on a staged transition from high levels of investment in road improvements on strategic roads around Christchurch in the short term, to investment that provides a multi-modal transport system in the medium to long term[20]. This translates into a short term strategy to complete planned strategic infrastructure improvements with an initial expenditure focus on the Christchurch motorway RoNS. These will deliver desired outcomes in improved journey time reliability on the strategic transport network and key freight routes.

3.4.3 Canterbury Regional Land Transport Programme 2012 – 2022

The RLTP was adopted in June 2012. It is a three year programme of activities for the financial years 2012/13, 2013/14 and 2014/15, including a financial forecast of anticipated expenditure for activities for the 10 year period 2012 – 2022. The RLTP has been prepared with regard to the GPS 2012 and fits within the strategic context outlined in the RLTS.

The RLTP includes the investigation and design of the Project as approved activities that will not be fully completed prior to 1 July 2012. It also lists the Project as a regionally significant activity that is expected to commence in the three years following the current RLTP i.e. 2015 to 2018.

3.4.4 Greater Christchurch Urban Development Strategy (UDS) – 2007

From a land use planning perspective, the most relevant strategic document is the UDS formulated by project partners, (Christchurch City Council, Selwyn District Council, Waimakariri District Council, Environment Canterbury and the NZTA), and was published in 2007[21]. The UDS provides the primary strategic direction and an integrated planning framework for addressing future land use change, development and population growth in the wider Christchurch area out to the 2041 planning horizon. Specifically it seeks to integrate future land use planning with transport networks.

The City centre, port and airport are noted as the main economic hubs for the region with a need to provide good transport access to these destinations. Several other key commercial and business activity centres are also identified such as Belfast and Hornby on the City edges, which provide some of the focal points for employment and the transport network. The main district towns are identified as Rangiora and Kaiapoi in the north and Rolleston and Lincoln in the south, all of which require improved strategic road connections into Christchurch City.

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[20] Canterbury Regional Land Transport Strategy 2012 – 2042, p.6.

[21] http://www.greaterchristchurch.org.nz/

Transport is one of the key aspects underpinning the UDS, highlighting the importance of integrating land use development with the transport system. The UDS also recognises that increasing traffic volumes could have a number of adverse consequences for Greater Christchurch if the transport network is not managed and developed accordingly.

The UDS responds to this by recognising transport as a key component of an integrated approach to land use development so residential and employment growth is accommodated. For the strategic road network it states[22]:

> *"Securing the main north, west and southern corridors to ensure accessibility to the Port of Lyttelton and International Airport are top priorities".*

The Christchurch Motorway RoNS are therefore a fundamental component of the UDS strategic transport network. Specifically in relation to this Project, the UDS supports strategic road improvements through Selwyn District into Christchurch City to help accommodate the projected 11,900 new households around the main towns of Rolleston and Lincoln. To a lesser degree the UDS supports strategic improvements in West Melton and Prebbleton, along with the Izone Southern Business hub at Rolleston.

3.4.5 Draft Christchurch Transport Plan 2012 – 2042

The DCTP was released by Christchurch City Council in July 2012 for public consultation. Submissions closed on 23 August 2012 and hearings are scheduled during September/October 2012.

The DCTP details the transport actions for Christchurch City over the next 30 years. It is non-statutory and updates Christchurch's local transport policy to align with and deliver the RPS, RLTS and UDS described above.

The vision of the DCTP is to[23]:

> *"Keep Christchurch moving forward by providing transport choices to connect people and places."*

To achieve the vision, the DCTP focuses on the following four goals, each of which is supported by a series of objectives and actions:

- Improve access and choice;
- Create safe, healthy and liveable communities;
- Support economic vitality; and
- Create opportunities for environmental enhancements.

The key aspects of the DCTP that are relevant to the Project are based around improvements to the strategic road and freight network. The DCTP notes that[24]:

[22] Greater Christchurch Urban Development Strategy Summary 2008, p.2.

[23] Draft Christchurch Transport Plan, p.12.

[24] Draft Christchurch Transport Plan 2012-2042, p.26.

"new infrastructure is essential to improve access to the Airport and Lyttelton Port, cross boundary connections and to connect new commercial and residential growth areas in the city. Upgrading road infrastructure with some long-awaited improvements to key strategic routes will be needed early in the Plan's implementation to relieve communities of through-traffic and improve access to commercial centres. The need for new infrastructure in growth areas and to support growth is recognised within the UDS, CRETS, SWAP and Belfast Area Plan and is reflected in the NZTA's RoNS programme."

The DCTP recognises State highways as a core part of the strategic road and freight network that serve an important role for inter-regional and longer distance trips. The CSM2 component of the Project is included in the strategic network concept to maximise journey efficiency and reliability (especially for freight travelling to and from the Lyttelton Port) while supporting the land uses that surround the route.

3.4.6 Christchurch Rolleston and Environs Transportation Study – 2007

CRETS was commissioned in 2002. This study identified possible CSM2 routes and the need for four-laning Main South Road to Rolleston as part of an integrated transport strategy for southwest Christchurch. The final transport strategy published in 2007 was designed to accommodate a number of future urban growth scenarios in the southwest area to around the year 2021, and the connectivity into Christchurch City. The development of the UDS was being carried out in parallel with this study, which ensured that there was a high degree of integration between transport and land use planning in this part of Greater Christchurch.

In the Terms of Reference for CRETS, the objective was[25]:

"The study of transportation requirements in the Christchurch to Rolleston broad area is seen as a key component in the planning for the development of the roading network to the west and south of Christchurch for the ensuing 25 year period.

The key output of the study is the identification, justification and reporting of a strategy that details the most appropriate stages for the progression of improvement projects that will achieve an ideal roading network to satisfy projected demands."

CSM2 was included in the Christchurch Southern Access Corridor package of work as a medium term improvement. The project was described as a four lane extension of the Christchurch Southern Motorway south west from the Halswell Junction Road/ Springs Road intersection to connect to State Highway 1 about 2 km south of Templeton. A major interchange was identified at the Shands Road/ Marshs Road intersection with no motorway access provided at the Halswell Junction Road/ Springs Road intersection[26].

Analysis through CRETS identified the four-laning of Main South Road as part of the Hornby to Burnham package of improvements. It recommended the project be in place in the medium term (by

[25] Christchurch, Rolleston and Environs Transportation Study. Transport Strategy Final Report. September 2007, Executive Summary, p.1.

[26] The CSM2 Strategic Study, completed in 2009, supported the inclusion of east-facing HCV ramps at Halswell Junction Road. During the further investigation and development of the Project subsequent to the Strategic Study, these east-facing ramps were included without any restriction on the class of vehicle that could use them, as a result of safety concerns from the Road Safety Audit and consultation feedback from the community.

2021) when CSM2 is complete with construction of an interchange at Weedons Ross Road/ Weedons Road being an integral item of work associated with MSRFL. The Weedons interchange was anticipated to function as the main access point into Rolleston (via Levi and Lowes Road) and the industrial area (via Jones Road) with the existing Weedons Road and Weedons Ross Road becoming a district arterial between the Selwyn towns of West Melton and Lincoln. Implementation of the Weedons interchange was related to the eventual replacement of the current traffic lights on State Highway 1 at Hoskyns Road and Rolleston Drive with a new bridge over State Highway 1 connecting Rolleston Township and the industrial area.

3.4.7 South-West Christchurch Area Plan – 2009

The south-west area of Christchurch City is identified in the UDS as a major urban growth area, with 12,000 new households and approximately 200 ha of industrial expansion forecast by 2041. In response to this the South-West Christchurch Area Plan (SWAP) was developed by CCC in conjunction with other UDS partners, to provide a planning framework to help guide and manage future development. The SWAP integrates land use development with major infrastructure improvements including proposed long term roading improvements. The extension of the CSM2 component of the Project to the Christchurch City Council territorial boundary at Marshs Road is indicated within the SWAP planning maps.

With its strategic transport linkages to other parts of the City and the South Island, the SWAP notes that the south-west Christchurch area has a key role in the Canterbury Region's economic development. The business area is projected to provide for 20,000 jobs generating approximately 6% of Canterbury's Gross Domestic Product.

3.5 Summary

From a strategic context perspective there are a number of transport influences on the development of the Project. These influences are from:

- Population, employment and economic growth projections which show sustained growth, much of it anticipated in the southern corridor. There is also the economic importance nationally and to the region of the Port which relies on efficient transport connections;
- The inclusion of the Christchurch motorways as RoNS has been due to the economic contribution that these routes can provide;
- The regional statutory planning and transport context reflected in the RPS, the RLTS and the RLTP, all of which have strong support for the Project. The DCTP is also aligned with the delivery of the Project;
- The land use planning framework, particularly the UDS and PC1 (Chapter 12A) to the RPS, both of which plan for sustainable land use growth and specifically anticipate the Project. This growth is further supported at a detailed level by the SWAP;
- The long history of transport planning from the 1960s through to the present. This includes an assessment of transport options through CRETS and a more detailed consideration of options of CSM2 in the 2009 Strategic Study and CSM2 and MSRFL Scheme Assessment Report;
- The influence of the LTMA and the GPS in terms of the requirement of the NZTA to contribute to a achieving an affordable, integrated, safe, responsive and sustainable land transport system; and

- The purpose of sustainable management in Part 2 of the RMA. In relation to transport, the primary focus of this report is upon enhancing social and economic wellbeing. Effects of the Project on the environment are discussed more fully in Sections 7 and 8 of this report, the Assessment of Environmental Effects and other technical reports.

4. Assessment Framework

4.1 Approach to Assessment of Effects

This report details the expected transportation effects resulting from the construction and operation of the Project. Assessment of these expected effects has been undertaken both quantitatively and qualitatively, depending upon the transportation mode being assessed.

To determine the effects on the road network, the assessment of major transport infrastructure schemes require the effects to be quantified in a consistent and robust manner. The use of transportation models is a standard approach to assessing transportation effects, and has been used for this Project.

4.2 Overall Modelling Approach

The overall modelling approach for the Project has been based upon the following hierarchy of models:

- regional multi-modal modelling using the Christchurch Transport Model (CTM);
- regional traffic modelling using the CSM2 Project Model (CPM);
- detailed operational modelling of interchanges using VISSIM; and
- detailed operational modelling of intersections using SIDRA.

This hierarchy of models is required as it is not practical to develop a system in a single model to cover both the strategic demand issues across the region and the detailed local operational effects. This hierarchical system has been used successfully on most major projects across New Zealand and is a common modelling approach.

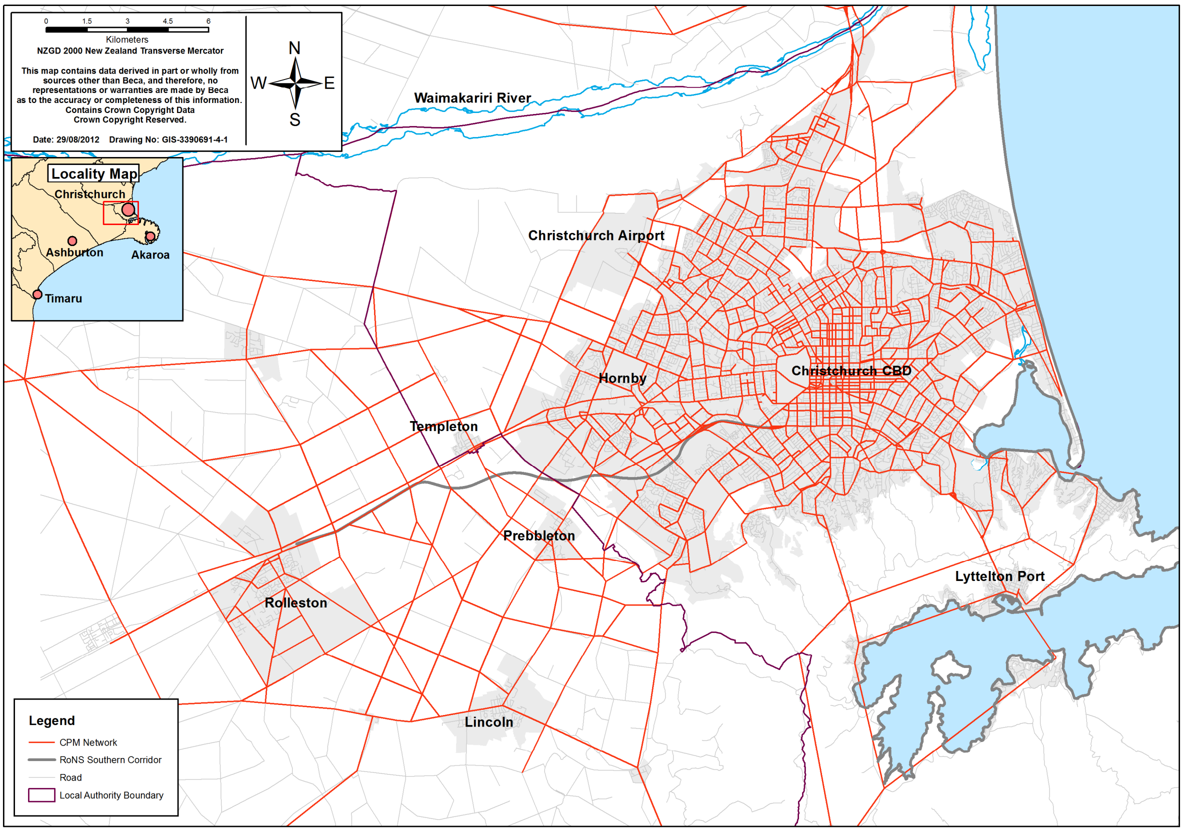
The models have been used to assess the performance of the transportation network for a historic base year of 2006 and future years of 2016, 2026 and 2041.

The year 2006 is the base year for both the CTM and CPM, being the latest year for which demographic information is available from the Census. This provides a basis for comparing the change in conditions on the transportation network between those which exist prior to the Project being constructed, and those which are predicted for the forecast years, both with and without the Project in place.

4.2.1 Christchurch Transport Model

The CTM is a traditional four stage multi-modal transport model covering the transport network in the Greater Christchurch UDS area. The coverage of the CTM network south of the Waimakariri River is shown in **Figure 4-1**, with the red lines showing the roads represented in the network model, and the light grey lines the underlying road network.

Figure 4-1: Coverage of CTM in Project Area



The CTM has been developed for the NZTA and its UDS partners (Environment Canterbury, Christchurch City Council, Waimakariri District Council and Selwyn District Council).

The CTM has a calibrated and validated base year of 2006. This has been developed using demographic information on the model area collected by the 2006 Census, information on trip making behaviour collated from household and roadside interview surveys and information on the transport infrastructure, and validated using traffic and passenger counts.

The CTM is able to represent the expected travel conditions in future years by combining land use forecasts with information on travel making behaviour derived during the development of the base year model, along with information on the expected configuration of the road and passenger transport networks.

Future year models have been developed for 2016, 2026 and 2041, using demographic forecasts including planned growth in the geographic area covered by the model. The growth used is consistent with the pre-earthquake UDS growth forecasts.

It is expected that this Project will significantly affect traffic in two ways:

- Through the rerouting of vehicles onto CSM2 and MSRFL to take advantage of reductions in travel time and, for some trips, reductions in the distance travelled; and

- Through the effects of induced traffic. The decreased “cost” of travel through this corridor will result in people changing their destination, travel time and/or modal choice, which will bring about vehicular trips on the road network that otherwise would not have been made at that time.

Consistent with the requirements of the NZTA’s Economic Evaluation Manual (EEM), a variable demand matrix (VDM) approach has been used to account for the induced traffic effects of the Project. This has been implemented by running the CTM demand model twice for each forecast year, once with the network excluding the Project and again with the network which includes the Project.

Version 2 of the CTM has been used as the basis for the project model developed to assess the Baseline situation and the effects of this Project.

The demographic forecasts used do not take account of the changes brought about by the recent Canterbury earthquake and subsequent aftershocks. At the time the modelling was undertaken, there was insufficient information to assess their likely long-term effects on household and employment numbers and location. As reported in Section 2.2, these forecasts have since been updated to reflect the post-earthquake demographic situation. The updated forecasts show that the rate of growth in the south-western area of Christchurch is likely to be faster than predicted before the earthquakes, although by 2041 the number of households will be similar and there is likely to be more jobs in that area than was earlier predicted.

The Central City Recovery Plan shows a commitment to retain the Christchurch CBD as the primary employment and business location for Christchurch. Combining this with the continued emphasis on development to the southwest of Christchurch, medium to long term travel patterns are expected to be similar to those predicted before the earthquakes for the area of influence of this Project.

4.2.2 CSM2 Project Model

The CSM2 Project Model (CPM) has been derived from the CTM (version 2). The CPM is an assignment only model, which means it takes the vehicular demands from the CTM and assigns them to a modelled road network. Compared to the CTM, the CPM has refined zoning and extra detail included on the roading infrastructure in the Project area, so will better represent travel behaviour. Consequently, the CTM is used for trip generation, trip distribution and mode choice, with only the results of the assignment of these trips being derived from the CPM.

The peak time periods represented by the CPM have compressed the busiest part of the CTM peak periods. The CTM represents conditions across a two hour period for the AM (7-9 am) and PM (4-6 pm) peak periods, whilst the CPM represents the busiest single hour within these time periods, so will exhibit higher levels of congestion. The Inter-peak period is the same for both models, representing the period between 9 am and 4 pm, although the CPM represents only a single (average) hour of this period.

With an enhanced level of detail of zoning and the roading infrastructure in the area likely to be most affected by this Project, an improved level of validation was achieved for the 2006 Base year CPM against that achieved for the CTM. The CPM Model Validation Report, detailing the development, calibration and validation of the Base year CPM, is included in **Appendix A**.

The Base year CPM, representing travel conditions in 2006, was peer reviewed by Traffic Design Group (who developed the CTM) in December 2010 and was considered fit for the purpose of assessing the future year traffic impacts of the Project. This Peer Review Report is included in **Appendix B** to this report.

The recently released CAST model, developed by Christchurch City Council, covers the same area as the CPM, but is not considered suitable for assessing this Project. This is because the low level of 'simulation' detail in the CAST network south of Marshs Road is likely to result in inconsistent route choices through the area of influence of this Project.

Baseline Network

The Baseline network has been developed from the calibrated and validated 2006 network, but includes all of the programmed and proposed roading infrastructure projects in the area covered by the model, aside from the Project. Forecast years of 2016, 2026 and 2041 have been modelled.

Project Network

The Project network uses the Baseline network with the inclusion of the CSM2 and MSRFL elements of the Project, thereby extending the Christchurch Southern Motorway from Halswell Junction Road through to Main South Road, which is four-laned almost to Rolleston.

The same forecast years of 2016, 2026 and 2041 used for the Baseline network have been used to predict the transport effects of the Project.

4.2.3 VISSIM Micro-simulation Modelling

VISSIM, a micro-simulation modelling package, has been used to assess the performance of the Shands Road interchange. VISSIM can represent more than one intersection at a time, and can account for upstream and downstream traffic effects on adjacent intersections.

As the intersections making up the Shands Road interchange are very close to the Shands Road/ Marshs Road intersection, it was considered necessary to check the overall operation of these intersections working as a whole, rather than consider each one in isolation.

4.2.4 SIDRA Intersection Modelling

Key intersections where interactions between adjacent intersections were not expected to be significant have been modelled in SIDRA to assess in more detail the effects of the Project upon the operational performance of individual intersections (due mainly to changes in volumes and patterns of traffic demand as identified by the CPM). The operational performance of new intersections proposed as part of the Project has also been assessed in SIDRA.

For each intersection assessed, SIDRA models were constructed for the three modelled weekday periods (AM peak hour, average Inter-peak hour and PM peak hour) for all modelled years. Traffic demands (for light and heavy vehicles separately) were extracted from the CPM and used in these SIDRA models.

4.3 Performance Measures

The performance measures used to assess the effects of the Project are defined in this section for the different transportation modes assessed.

4.3.1 Road Network Performance

Annual Daily Traffic volumes (ADT)

The Annual Daily Traffic (ADT) is the total number of vehicles on a road travelling in both directions on an average weekday. It provides an assessment of how "busy" a road is with the movement of people and freight.

As the effects on the road network have been evaluated using the hierarchy of models detailed in Section 4.2, for this assessment the ADT is calculated by combining modelled traffic volumes from the AM peak, inter-peak and PM peak hour assignments based on observed ratios of vehicles in each period relative to the all day traffic volume.

Appendix C to this report contains a detailed listing of forecast ADT traffic volumes.

Link Level of Service Evaluation

An assessment of the level of service (LoS) likely to be experienced by road users has been undertaken using outputs from the CPM. The assessment for the road sections between intersections uses link volumes taken directly from the CPM, whilst the assessment of intersections has been undertaken using VISSIM or SIDRA (as introduced in Sections 4.2.3 and 4.2.4 respectively) with the turning volumes from the CPM.

Level of service for road sections is a measure describing the operational conditions within a traffic stream, based on service measures such as speed, freedom to maneuver, traffic interruptions, and comfort and convenience. Six levels of service are defined, using the letters from A to F, with LoS A representing the best operating conditions and LoS F the worst[27].

For road sections, the calculation of the level of service is dependent on the type of road being assessed, with different criteria applied to multi-lane motorways and expressways, rural highways and urban roads. The reason for using different criteria for these different road types is due to differences in the expectations of road users on different types of roads. The level of service criteria used in this assessment for these different road types are detailed in **Appendix D** to this report.

For all road types, the level of service results included in this report are the lowest calculated from either direction and all three modelled time periods (AM peak, average inter-peak and PM peak hours). It also applies only to the link, so does not cover the impact of any increase or decrease in traffic on intersections at either end of the link.

[27] Highway Capacity Manual, Transportation Research Board of the National Research Council, 2000

For motorways and expressways, the level of service has been calculated using the link volume capacity ratio (VCR). This is defined as the ratio of the volume of traffic on a link over the capacity of the link to carry traffic. As motorways and expressways do not have at-grade intersections, traffic can still move smoothly at higher VCRs than on urban roads, where intersections interrupt the movement of vehicles.

For urban roads, level of service has also been calculated using the link VCR. Allowing for the effects of at-grade intersections means that the level of service reported for a given VCR is lower than for the same VCR on a motorway or expressway.

The level of service for rural highways is based on the volume of traffic on the link in both directions, as this affects how likely vehicles are to be held up by slower vehicles and the likelihood of being able to overtake those slower vehicles.

Level of service standards have been set for road segments on RoNS projects around New Zealand. For this Project the target for opening is LoS B, with the Project operating at no worse than LoS C after opening.

Road Travel Times

Travel times on major routes within the area likely to be affected by the Project have been extracted from the CPM for the historic base year and the three forecast future years. This allows comparison of the expected travel times on these routes without the Project and with the Project.

Journey Time Reliability

Although not directly forecast by the traffic models (which predict average journey times), journey time variability is known to increase as traffic levels approach the capacity on parts of the road network. Journey time reliability is closely linked with link and intersection level of service. As traffic volumes on a road increase, its level of service will decrease, and travel times will become more variable, especially at the poorer levels of service (LoS E and F). Similarly, travelling through at-grade intersections increases the variability of a trip, as delays at the intersection may differ between days. As the level of service of an intersection deteriorates, the variability in travel time through the intersection will also increase.

Greatly improved travel time reliability arises from reduced congestion, meaning that travellers will have more certainty regarding their expected arrival times at their destination, which is especially important for freight movements. Consequently, providing a better level of service on a road or at an intersection will reduce the variability associated with using that facility.

Intersection Level of Service Evaluation

At intersections, a different set of criteria are used to assess the level of service, with the letters A to F again used to characterise conditions. For signalised intersections and roundabouts, level of service is based on the average delay per vehicle on all approaches, whilst the level of service for priority controlled intersections is based on the average delay per vehicle for the movements which do not have priority through the intersection.

Reporting of the intersection level of service, in Section 6.4 for the Baseline transportation network and Section 7.4 for the Project transportation network, tabulates the level of service by approach and overall for signalised intersections and roundabouts. For priority intersections, all of the delays for vehicles on the minor arm(s) are reported for that approach, whilst for the major arms only the delay associated with right turning movements is reported for those approaches[28]. An overall level of service is not reported for these priority intersections.

The range of delay times given the same level of service grade is different for priority intersections compared with signalised intersections and roundabouts. At priority intersections, shorter delays are given worse level of service grades. Consequently, a LoS E given to a priority intersection and a signalised intersection will be associated with a different range of possible delays – 55 to 80 seconds for the signalised intersection, but only 35 to 50 seconds at the priority intersection.

Table 5 in **Appendix D** shows the range of control delay times for vehicles for each level of service band. The delay times also account for any geometric delay associated with vehicle movements. This geometric delay is the additional time taken for vehicles to slow down, safely negotiate the intersection and then speed up again to the speed limit.

4.3.2 Freight Network Performance

Assessment of the performance of the freight network is based on the major freight routes identified as part of the overall road network. The same criteria used to assess the road network performance are used to assess the performance of the freight network.

4.3.3 Passenger Transport Network Performance

The assessment of the passenger transport network has been based on the expected changes in travel time on the services directly affected by the Project.

4.3.4 Pedestrian and Cyclist Network Performance

Assessment of the effects on the pedestrian and cyclist network has been undertaken qualitatively with reference to any new pedestrian or cyclist infrastructure provided, as well as accessibility to Main South Road and the local road network.

4.3.5 Road Safety Network Performance

The road safety assessment has been based on the estimated changes in crash rates on the road network as a result of the Project. The assessment focuses on the parts of the road network expected to experience the most significant change in traffic volumes as informed by the CPM results.

[28] The through movement on the major arms of priority intersections experience no delay, whilst the left-turning vehicles do not have to give way to any other vehicles, so experience only the geometric delay.

5. Existing and Baseline Transportation Environment

This chapter describes the existing transport environment, in terms of the:

- road network and its operation;
- the freight network;
- the passenger transport network; and
- the pedestrian and cycle network.

These descriptions also include elements of the expected future transportation environment (excluding the Project), in terms of planned improvements to these networks.

5.1 The Existing Road Transportation Network

This section describes the existing transport network, in terms of the existing State highway, local road, freight, passenger transport, walking and cycling networks.

5.1.1 Existing State Highway Network

State Highway 1

Main South Road is a two lane undivided major arterial and forms part of SH1 south of Christchurch. It is a key part of the strategic road network within the Canterbury region with a primary function to carry through traffic towards or away from the Christchurch City Centre, the Lyttelton Port and industrial areas in the south and east of the city.

In addition to functioning as an inter-regional link, Main South Road is a strategic component of the Christchurch City and Selwyn District road networks currently providing access to various townships, including Templeton, Rolleston and further south to Burnham. It also passes through the major residential, retail and industrial hub at Hornby where it connects with SH73A.

Key parts of the route affected by the Project are (from south to north):

- Park Lane to Kirk Road: This rural section of SH1 provides an arterial standard road with a 100 km/h speed limit, one lane in each direction, and frequent intersections and accesses. There are two sets of passing lanes, located south of the Weedons Road/ Weedons Ross Road intersection and south of the Kirk Road/ Trents Road intersection. The Main South Road intersection with Park Lane, at the southern end of the Project, is being closed as part of a separate subdivision process by Selwyn District Council.
- Kirk Road to Halswell Junction Road: The speed limit drops to 70 km/h as the route passes through Templeton. There are frequent intersections and accesses.
- Halswell Junction Road to Carmen Road: SH1 becomes more urban in nature as the route passes through Hornby, with the speed limit reducing to 50 km/h. Within Hornby, the SH1/ Carmen Road

signalised intersection is a key intersection, with SH1 continuing north on Carmen Road towards the airport and Main South Road continuing east towards the city as SH73A.

Halswell Junction Road

Halswell Junction Road intersects with Main South Road at Islington, just south of Hornby. The 2.5 km section from Main South Road to Springs Road has a 70 km/h speed limit and is currently being upgraded as part of the CSM1 project. Upon completion, the improved route will provide a dual function as an arterial link to the new motorway extension as well as servicing the industrial and commercial development that fronts onto Halswell Junction Road. The upgraded Halswell Junction Road will become part of the State highway network under the management of the NZTA. When CSM2 is completed, Halswell Junction Road will revert to Christchurch City Council.

Christchurch Southern Motorway Stage 1

The CSM1 project is currently under construction and is programmed for completion in 2013. This will provide a median divided four-lane motorway from Barrington Street through to Halswell Junction Road at Springs Road. In the absence of the CSM2 component of this Project, motorway traffic will outlet onto the local arterial road network at Halswell Junction Road (as described above) to join up with Main South Road just south of Hornby.

Together with this Project, CSM1 makes up Christchurch's Southern Corridor RoNS package, aimed at providing more efficient and safer access to Lyttelton Port and the Christchurch city centre for people and freight from south of Christchurch.

5.1.2 Existing Local Road Network

The State highway network is supported by a network of local roads. Some of the local roads that will be affected in the vicinity of the Project include:

- Jones Road: This road runs parallel to the western side of the Main South Road alignment (immediately west of the railway line) between Templeton and Rolleston. The southern end of Jones Road is an alternative access to the Rolleston Izone;
- Levi Road: This road intersects with Weedons Road approximately 800 m east of Main South Road and provides a link into the east side of Rolleston Township;
- Lincoln Rolleston Road: This road connects Rolleston to Lincoln, turning into Boundary Road east of Waterholes Road. It provides an alternative route to Main South Road for vehicles heading north towards Hornby and Christchurch, joining on to Selwyn Road, and then on to Shands Road.
- Weedons Road: This road links Main South Road just north of Rolleston with the eastern edge of Lincoln. It also provides an alternative route into the eastern side of Rolleston via Levi Road.
- Weedons Ross Road: This road, which is a continuation of Weedons Road on the western side of Main South Road, connects Main South Road with West Melton and SH73 through to the west coast.
- Selwyn Road: This road continues the alternative route to Main South Road provided by Lincoln Rolleston Road. It also carries on southwards, parallel to Main South Road, crossing Ellesmere Junction Road.

- Shands Road: This is a key arterial road in the Selwyn District. Together with Selwyn Road and Lincoln Rolleston Road, it forms a key secondary route between Christchurch and Rolleston. It is also an alternative route to Springs Road between Christchurch and Lincoln;
- Springs Road: This is a strategic road between Lincoln and Hornby travelling through the Prebbleton Village;
- Kirk Road: This road, connecting Main South Road with SH73, provides the main access to Main South Road for Templeton. It intersections with Main South Road at a priority intersection.
- Trents Road: This road is the continuation of Kirk Road on the eastern side of Main South Road. It crosses Shands Road before terminating at Springs Road at the southern end of Prebbleton.
- Blakes Road: This road connects Trents Road directly through to the northern end of Prebbleton, crossing Shands Road on the way.
- Marshs Road: This road forms the boundary between Selwyn District and Christchurch City.

5.1.3 Planned Improvements to the Road Network

The Baseline transport network encompasses the "best estimate" transport network in place in 2018[29]. It includes a number of roading schemes which are currently under construction or at a late stage of investigation, including the other Christchurch RoNS, as well as local improvement schemes. Only four of these are likely to significantly impact on the operation of the road network in the vicinity of the Project as follows:

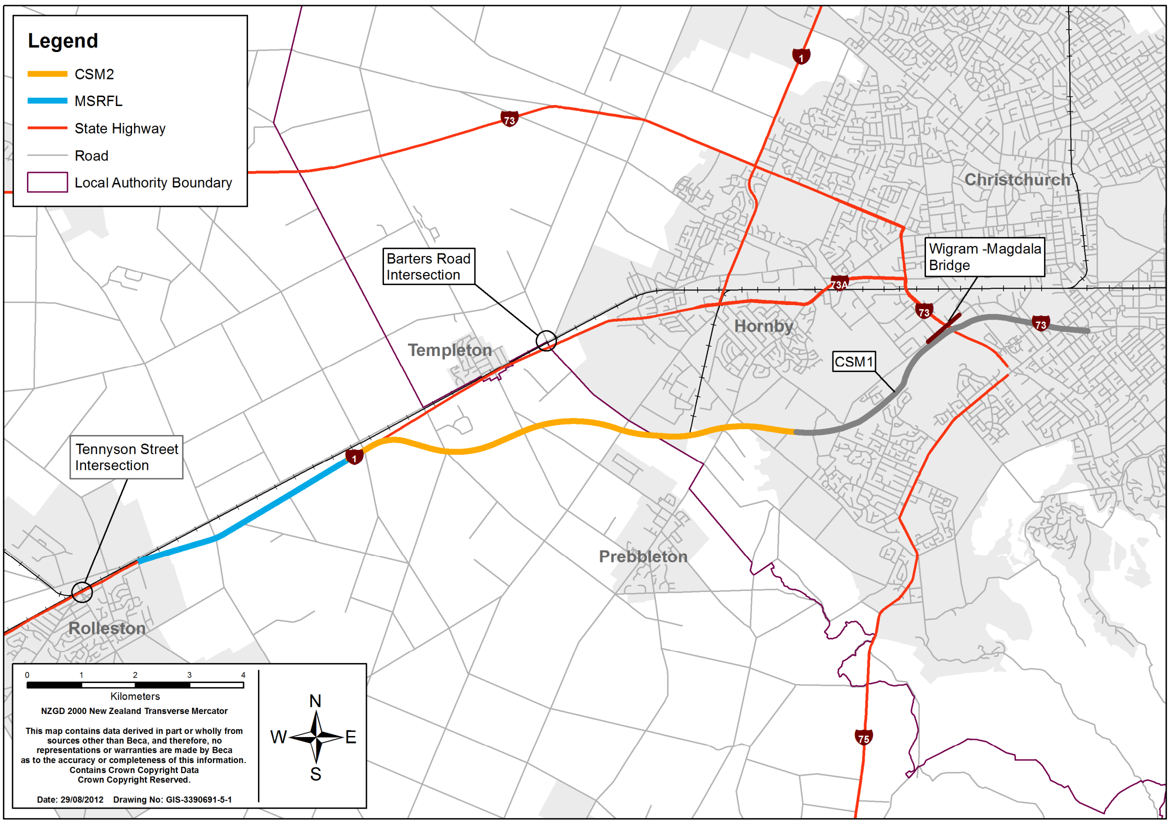
- Christchurch Southern Motorway Stage 1: This NZTA project, currently under construction (completion in 2013), is the latest link of the RoNS Southern Corridor (which the Project will complete). See Section 5.1.1 above for details.
- Wigram-Magdala Bridge: This Christchurch City Council project, currently under investigation, involves linking Wigram Road to Magdala Place via a bridge over Curletts Road, immediately north of the interchange with CSM1. It provides an alternative route to CSM1 for traffic from the residential developments at Aidanfield and Wigram to access the southern side of central Christchurch.
- Main South Road/ Barters Road Improvement Project: This NZTA project, currently in the latter stages of the scheme assessment phase, involves replacing the existing connection between Main South Road and Waterloo Road currently provided by Barters Road with a realignment and extension of Pound Road to connect directly onto Main South Road at a new signalised T-intersection. Although the main driver for this project is an improvement in safety at this location, it is also expected to significantly improve the ability of southbound vehicles to turn right onto Main South Road without the long delays currently being experienced at Barters Road.
- Main South Road/ Tennyson Street Improvement Project: This NZTA project, currently in the latter stages of scheme assessment, involves rationalising the access arrangements of Tennyson Street and Brookside Road with Main South Road within Rolleston. For northbound traffic, there will be no access to and from Main South Road at these two intersections i.e. right turns in and out will be prohibited. In the southbound direction, left in/left out access will be maintained with Main South Road for both Tennyson Street and Brookside Road. An additional southbound lane will also be provided for traffic turning into either Tennyson Street or Brookside Road, and for traffic coming

[29] The year 2018 has been used for the Baseline network as that is the earliest date at which the Project could be operational.

from these two roads. With the banning of right turns onto Main South Road, the signalised intersection of Main South Road with Rolleston Drive will become the primary access to the State highway for vehicles travelling north from Rolleston.

The location of each of these four roading schemes is shown in **Figure 5-1**.

Figure 5-1: Location of Significant Roading Schemes in Project Vicinity



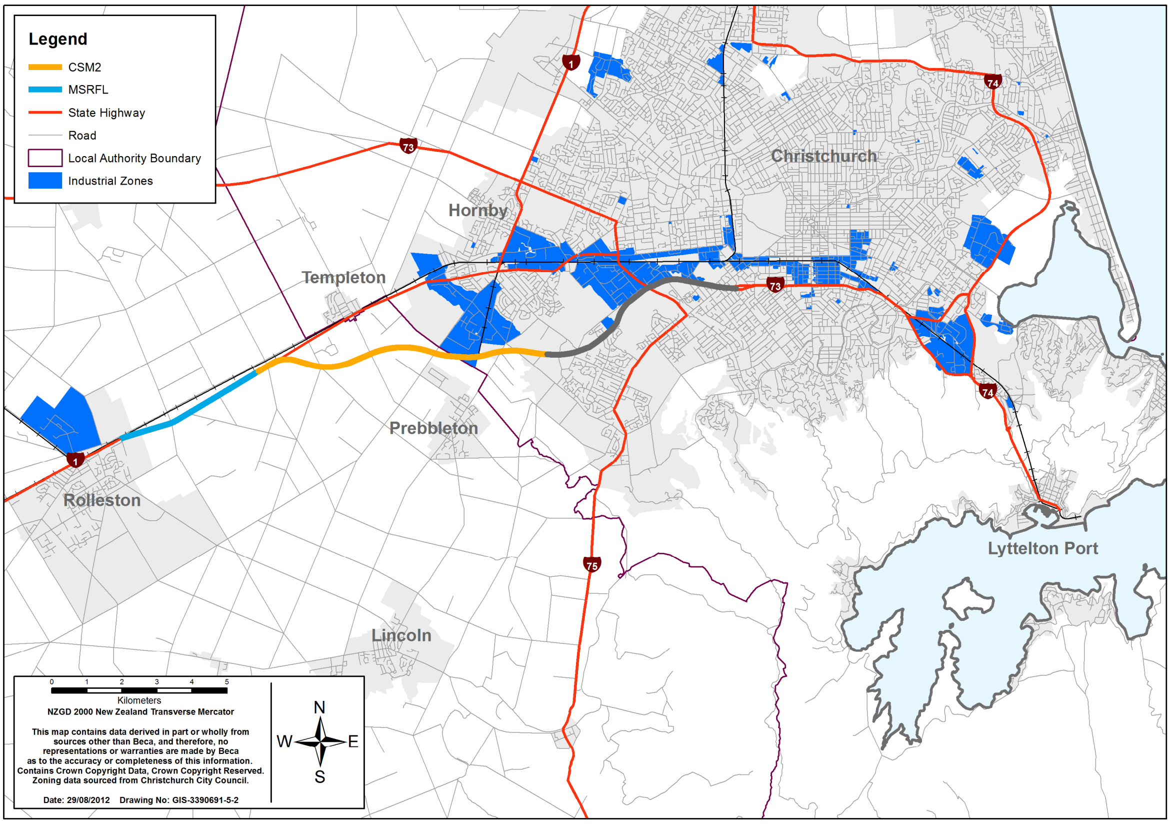
Other potential roading projects in the south western area of Christchurch, such as the West Hornby Bypass and connection of Pound Road through to Shands Road via an extension of Sir James Wattie Drive, have not been included in the modelled network. There are no firm commitments from either the NZTA or Christchurch City Council to progress these projects.

5.2 Freight Network

Within Canterbury, the majority of freight is moved on the road network. SH1, running north and south through the region, is the spine on which most of this freight travels. Connections from SH1 through to the Port of Lyttelton from the south are provided by SH73A, SH73 and SH74, the first two of which are on the RoNS Southern Corridor.

Significant industrial activity also occurs along this corridor, in Rolleston, around Halswell Junction Road, Sockburn and Woolston. These are shown in **Figure 5-2**, along with the routing of CSM1 and this Project.

Figure 5-2: Industrial Zoned Land along RoNS Southern Corridor Route



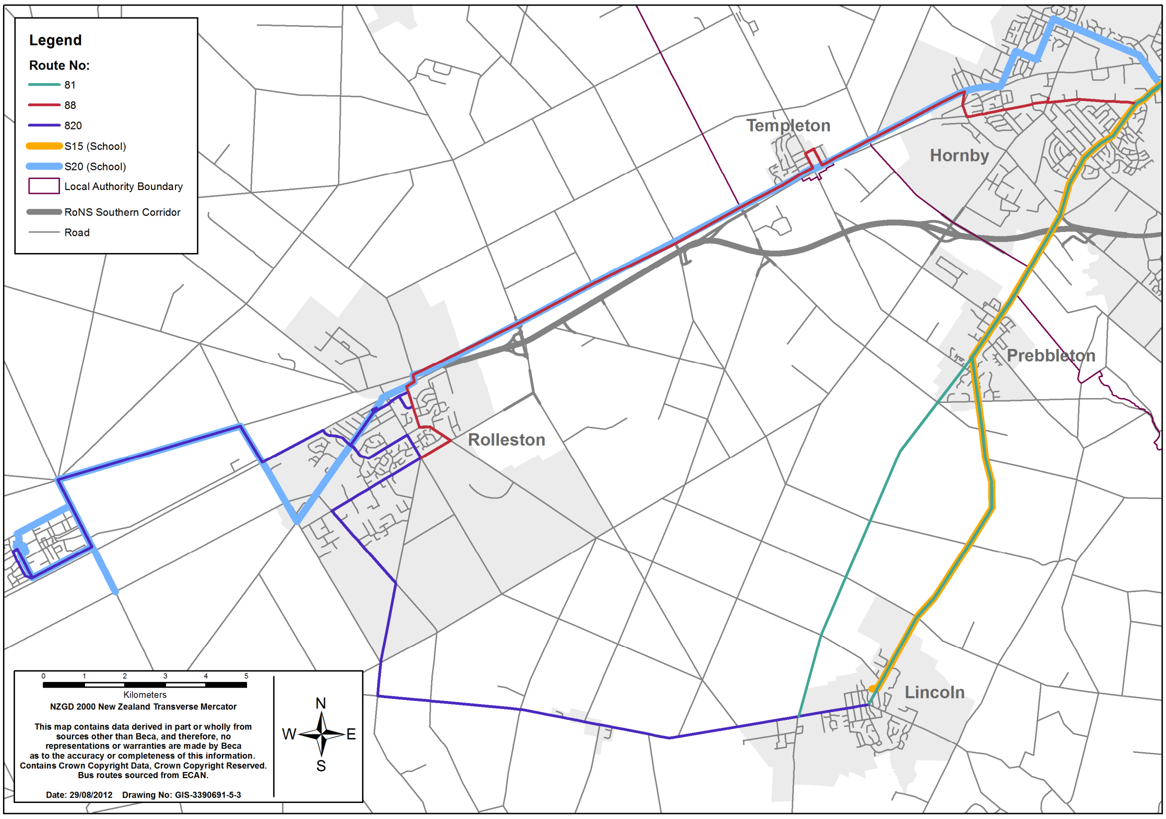
5.3 Existing Passenger Transport Network

This section describes the passenger transport network in the south-west area of Christchurch, with particular emphasis on services using roads which are directly affected by the Project.

5.3.1 Scheduled Public Bus Services

Two bus services operate on the road network that will be directly affected by the Project, which are Routes 81 (City to Lincoln) and 88 (City to Rolleston). A further service, Route 820, connects Rolleston (and Burnham) directly with Lincoln via Goulds Road and Ellesmere Junction Road. Their routes are shown in **Figure 5-3**.

Figure 5-3: Scheduled Public and School Bus Services in Project Area



The service headways (the time between services) of the two services which are directly affected by the Project are detailed in **Table 5-1**.

Table 5-1: Scheduled Public Bus Service Headways (Minutes)

Route No.	Route	Weekday			Weekend	
		AM Peak	Inter-Peak	PM Peak	Sat	Sun
81	Christchurch City to Lincoln via Prebbleton	20	20	20	30	60
81	Lincoln to Christchurch City via Prebbleton	15 to 20	20	20	30	60
88	Christchurch City to Rolleston via Hornby and Templeton	30	30	30	30	60
88	Rolleston to Christchurch City via Templeton and Hornby	30	30	30	30	60

5.3.2 School Bus Services

Two school bus routes operate in the area of the Project during school term time:

- S15 Lincoln Schools to City, travelling from Lincoln via Birches Road to Prebbleton, then using Springs Road to cross Halswell Junction Road and onwards to Hornby or Christchurch City; and
- S20 Burnham to Upper Riccarton Schools, travelling through Rolleston via Hornby on the Jones Road/ Waterloo Road corridor.

These two school services operate on similar routes to the Route 81 and Route 88 services in the area directly affected by the Project, and are also shown on **Figure 5-3**.

5.3.3 Scheduled Rail Services

Although the South Island Main Trunk Line runs adjacent to SH1 from Christchurch through to Rolleston, this line is not used for commuter rail services.

A single scheduled passenger service does use this section of the rail network, with the TranzAlpine service traveling daily between Christchurch and Greymouth with a scheduled stop at Rolleston. This service is provided primarily for tourists, with the service times and costs not being well suited for travel between Rolleston and Christchurch.

The Hornby Industrial Line branches off the main line at the Carmen Road intersection and heads towards the industrial area along Halswell Junction Road, terminating north of Marshs Road. No passenger services use this line.

5.4 Pedestrian and Cyclist Network

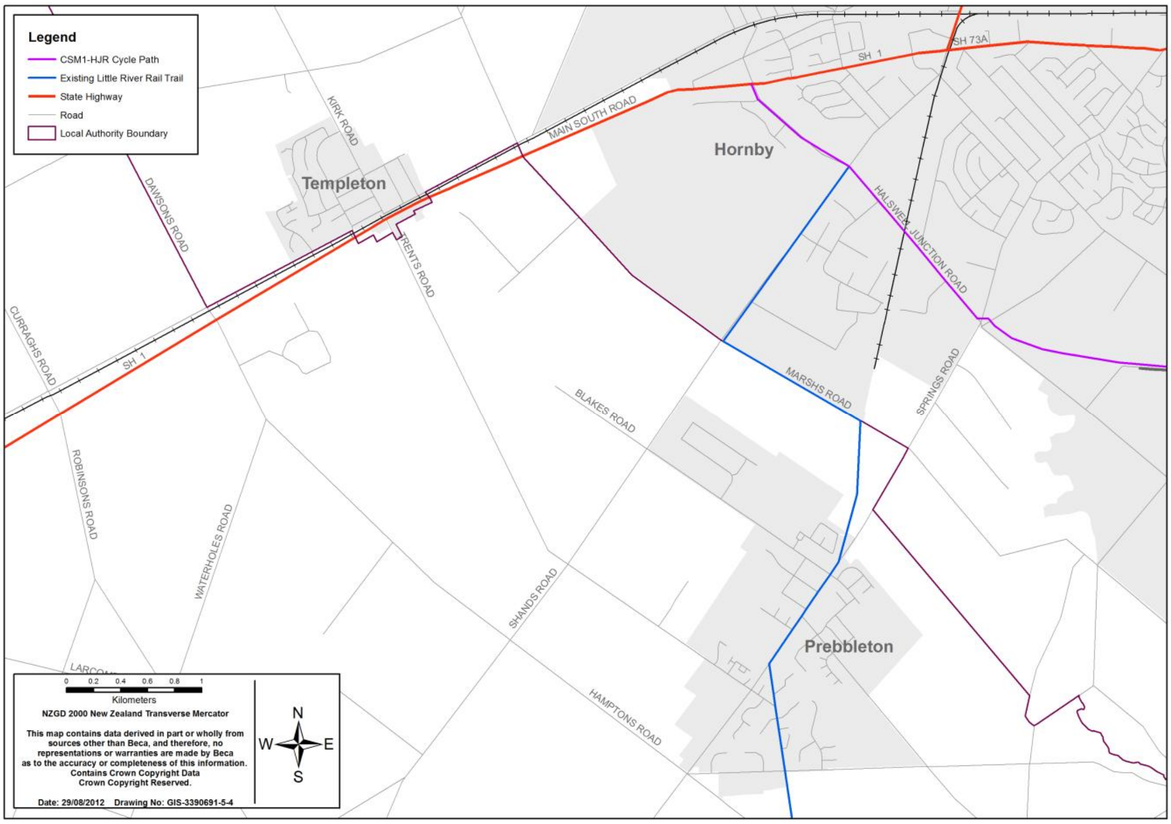
5.4.1 Overview of Existing Pedestrian and Cycle Connectivity

There is currently a limited pedestrian and cycle network in the vicinity of the proposed Project alignment. Selwyn District Council produced a Walking and Cycling Strategy, and an Action Plan, in January 2009, outlining the over-arching framework for the development of the walking and cycling network in the Selwyn district and the projects intended to give effect to the broader outcomes from the Strategy. The general connectivity achieved by proposed off-road cycle paths is identified, split between "within 10 years" and "10 years+" timeframes, with the former including:

- Main South Road between Rolleston and Templeton;
- Lincoln Rolleston Road and Boundary Road between Lincoln and Rolleston; and
- Ellesmere Junction Road between Lincoln and Springston.

The network plan shown in **Figure 5-4** provides an overview of the current cycle facilities in the Project area, along with those likely to be in place by 2018.

Figure 5-4: Pedestrian and Cycle Links to Strategic Network



Consultation with Selwyn District Council and Christchurch City Council has identified that their focus is to provide links to the Little River Rail Trail, and developing a cycle connection between Templeton and Prebbleton via Hamptons Road or Trents Road.

5.4.2 Baseline Pedestrian and Cycle Routes

Little River Rail Trail

The Little River Rail Trail is the primary recreational and commuter cycle facility within the vicinity of the Project, linking Hornby to Lincoln via Shands Road, Marshs Road, Springs Road and Birchs Road (shown by the blue line in **Figure 5-4**). The Rail Trail provides a shared use commuter and leisure facility for pedestrians and cyclists.

CSM1-Halswell Junction Road Shared Use Path

A shared use cycle route is currently under construction as part of CSM1. This route will provide an off-road pedestrian and cycle path from Barrington Street in the north through to Halswell Junction Road. It continues along the northern side of Halswell Junction Road as a shared use footpath, finishing at Main South Road. The shared use path connects with the Little River Rail Trail at Shands Road in Hornby.

Local Road Network

Apart from the Little River Rail Trail and CSM1 cycle path, the local road network is utilised by cyclists and pedestrians. Outside of the urban centres, the majority of these local roads are predominantly high speed rural roads, with no specific facilities for cyclists and only the shoulder available for pedestrians.

6. Baseline Transportation Network Operation

6.1 Introduction

To determine the transportation effects of the Project, the transport situation without the Project in place needs to be assessed. The Baseline transport network encompasses the "best estimate" of the transportation network in place prior to the completion of the Project. Details of the most significant changes to the current transportation network likely to affect the Project have been detailed in Section 5.1.3 above.

With regard to CSM1, it is noted that the Halswell Junction Road section currently under construction is only considered to be an interim solution to opening up the Southern Corridor. Consistent with earlier work, the Principal's Requirements[30] for the Design and Construction of CSM1 stated "it is not practical to design the Halswell Junction Road and Springs Road intersection for unconstrained growth beyond 2018". Consequently, both Halswell Junction Road and the intersections along it have been designed for the expected traffic demands up to 2018 only.

All reporting of the RoNS Southern Corridor uses the convention that the Corridor runs north-south, with intersecting roads running east-west.

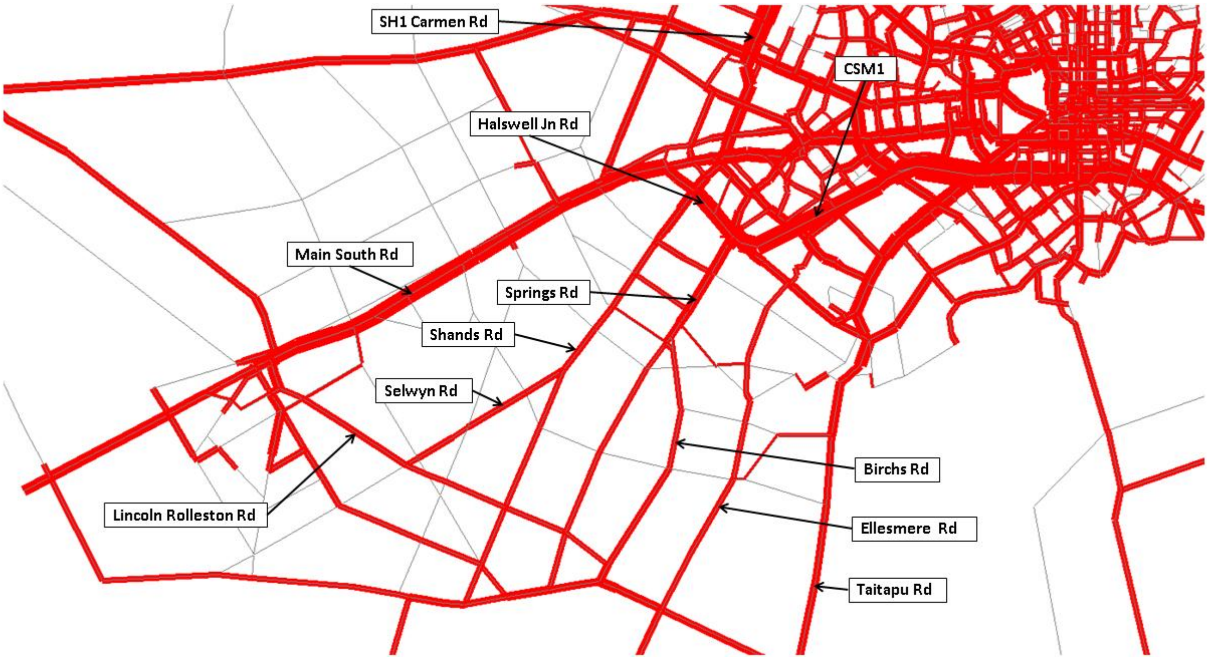
6.2 Travel Patterns

This section reports the travel patterns predicted by the CPM, and shows the ADT volumes forecast on the road network in future years under the Baseline assumptions. The intention is to identify areas of the road network where growth is forecast within the Baseline network. Daily traffic volumes from 2006 are reported for comparative purposes, although the inclusion of CSM1, the Wigram-Magdala Bridge, and the Barters Road and Tennyson Avenue improvement projects in the Baseline result in step changes in volumes on some roads relative to the 2006 network.

Figure 6-1 depicts graphically the ADT volumes forecast for 2041 for the Baseline road network. The red lines indicate the relative volume of traffic on each link, with thicker bars representing more vehicles than thinner bars i.e. the "wider" the road link, the more important it is for the movement of people and goods.

[30] The Principal's Requirements specify the minimum standards that need to be achieved for a project. In the context of the design of the intersections on Halswell Junction Road, design traffic volumes up to 2018 were provided, whereas for other intersections and interchanges the designs had to accommodate predicted traffic volumes for 2026.

Figure 6-1: Baseline ADT Volumes – 2041



As can be seen in **Figure 6-1**, the main routes for trips to and from the southwest area of Greater Christchurch and the southern side of Christchurch city are:

- along the route of the CSM1 corridor (comprising CSM1, Halswell Junction Road and Main South Road);
- Springs Road, Shands Road and Birchs Road on the Lincoln/Prebbleton corridor;
- Main South Road corridor from Halswell Junction Road through to SH1 Carmen Road in Hornby;
- Lincoln Rolleston Road and Selwyn Road through to Shands Road;
- Ellesmere Road; and
- Taitapu Road.

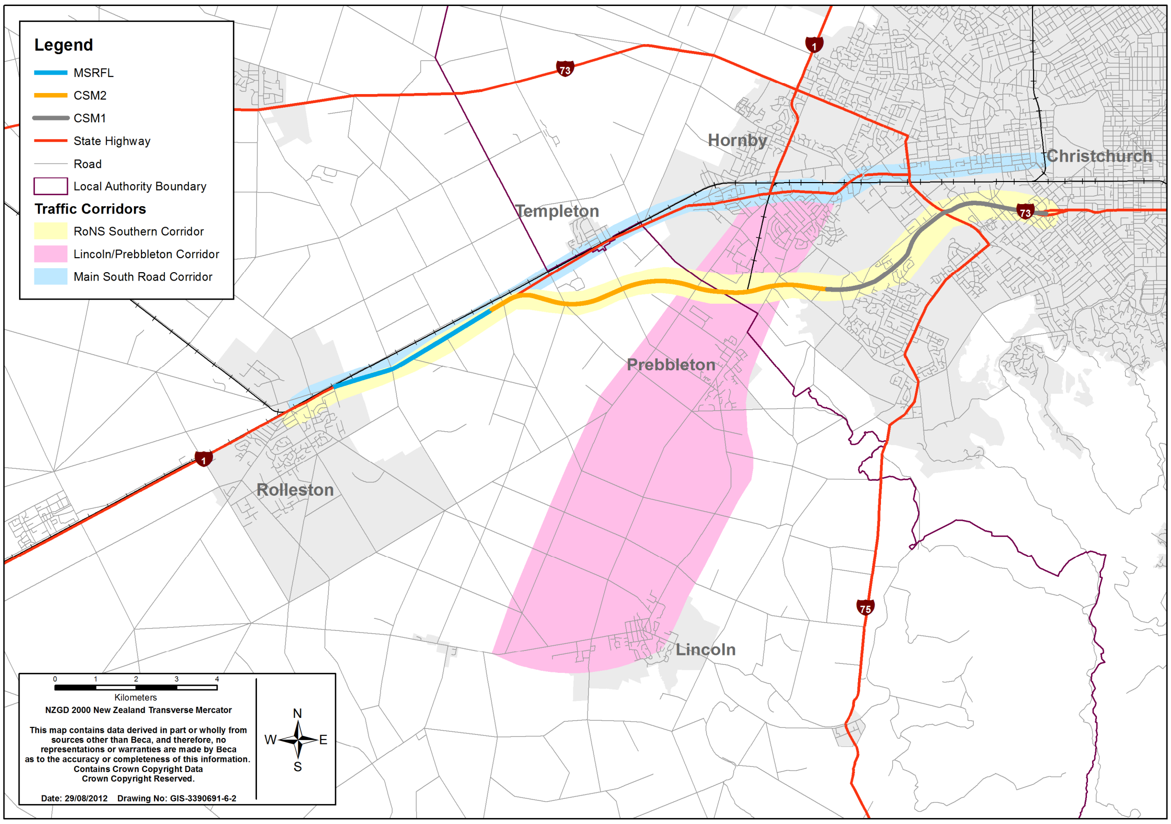
6.3 Road Network Performance

This section reports on how the Baseline road network is expected to operate without the Project. The performance measures used to assess the road network performance are specified in Section 4.3.1. Outputs from the CPM forecast year assignments have been grouped together for reporting of results:

- Baseline RoNS Southern Corridor Route: Covers SH73/ SH76/ SH1 from Brougham Street all the way through to Rolleston;
- Lincoln/Prebbleton corridor: Shands Road/ Springs Road /Birchs Road from Ellesmere Junction Road through to Halswell Junction Road; and
- Main South Road corridor: Main South Road, Waterloo Road/ Jones Road and Selwyn Road from Hornby to Rolleston.

These corridors are shown in **Figure 6-2**.

Figure 6-2: Traffic Effects Corridors



ADT and LoS performance measures are also reported for a number of local roads, identified in Section 5.1.2 as being affected by the Project. These have been grouped together for reporting purposes, although they do not share the common geographical connections of the three corridors identified above.

Note that journey time reliability is only reported for the RoNS Southern Corridor Route.

6.3.1 Baseline RoNS Southern Corridor Route

Average Daily Traffic Volumes

Table 6-1 lists the forecast ADT volumes for roads comprising the RoNS Southern Corridor route between Brougham Street and Rolleston. It is again noted that the completion of CSM1 between 2006 and 2016 results in a step change in daily traffic volumes on some roads along this corridor. From 2016 through to 2041, changes in traffic volumes on these roads are due entirely to growth in the demand for travel, with a small element of rerouting as travellers seek out less congested minor routes (which will decrease the daily traffic volumes on the reported main roads on this corridor).

Table 6-1: Historic Base and Baseline ADT Volumes – RoNS Southern Corridor

Road and Location	2006	2016	2026	2041
Brougham St: West of Selwyn St	33,000	46,500	49,500	51,500
CSM1: Between Barrington St & Curletts I/C	22,500	43,500	47,250	49,250
CSM1: Between Curletts I/C & Halswell Jn Rd	N/A*	33,000	37,250	40,750
Halswell Junction Rd: West of Springs Rd	15,750	29,750	34,250	37,750
MSR: South of Halswell Junction Rd	20,000	30,250	35,750	40,500
MSR: South of Marshs Rd/ Barters Rd	21,750	28,000	33,250	37,750
MSR: South of Trents Rd/ Kirk Rd	18,500	25,250	30,750	35,750
MSR: South of Robinsons Rd/ Curraghs Rd	17,750	25,000	31,000	36,750
MSR: South of Weedons Rd/ Weedons Ross Rd	17,750	24,750	30,500	35,250

* CSM1 only extended to Halswell Junction Road in 2013.

The completion of CSM1 is expected to increase traffic volumes on Brougham Street significantly, though capacity constraints on Brougham Street at the city end of CSM1 will limit increases between the future years. The NZTA is intending to progress a full corridor study from the City end of CSM1 to the Port of Lyttelton to investigate options for maintaining the efficient operation of this strategic corridor. Pending the results of this corridor study, the NZTA will continue its normal policy of making incremental operational improvements.

This limited capacity on Brougham Street also affects traffic volumes on CSM1, with limited growth in future years after an initial surge following opening.

The direct connection with the southern side of central Christchurch that CSM1 will provide leads to a large increase in traffic using Halswell Junction Road to access Main South Road. As a result, Halswell Junction Road is forecast to experience a growth pattern similar to that for Brougham Street, with a large increase in daily traffic volumes between 2006 and 2016 (after completion of CSM1), followed by smaller increases in the subsequent years.

South of where CSM1 re-joins Main South Road at Halswell Junction Road, traffic volumes are again expected to rise significantly. This is due to the growth in population and employment forecast in the southwest area (such as in Rolleston), and the increase in road movements associated with forecast increases in economic activity in the region.

The increase in traffic volumes follows a similar pattern along the other sections of Main South Road from south of Halswell Junction Road all the way through to Rolleston.

Link Level of Service

Table 6-2 provides a summary of the worst level of service values for sections of the Baseline RoNS Southern Corridor. Section 4.3.1 details the criteria used to assess the level of service, with the results reported here representing the poorest level of service in either direction across all three modelled time periods. Highlighted cells refer to links which are considered to have a poor level of service, with orange representing LoS E, and red LoS F.

It is again noted that the link level of service does not consider the effects of intersections at the end of any link. Consequently, any of the roads listed in **Table 6-2** which immediately pass through signalised intersections or roundabouts are likely to have a worse level of service than that shown, as the effect of the intersection will be to "choke" the capacity of the link to carry traffic. This effect can be seen with Brougham Street west of Selwyn Street having a LoS C in 2006, whereas this section of road was experiencing peak period congestion at that time.

Table 6-2: Historic Base and Baseline Link Level of Service on CSM1 Corridor

Road and Location	2006	2016	2026	2041
Brougham St: West of Selwyn St	C	E	E	E
CSM1: Between Barrington St & Curletts I/C	F	D	D	D
CSM1: Between Curletts I/C & Halswell Jn Rd	N/A*	C	C	C
Halswell Junction Rd: West of Springs Rd	E	E	E	F
MSR: South of Halswell Junction Rd	E	E	F	F
MSR: South of Marshs Rd/ Barters Rd	E	F	F	F
MSR: South of Robinsons Rd/ Curraghs Rd	E	F	F	F
MSR: South of Weedons Rd/ Weedons Ross Rd	E	E	E	F

* CSM1 only extended to Halswell Junction Road in 2013.

It is evident from **Table 6-2** that high levels of congestion are forecast along Brougham Street after completion of CSM1, as the extra capacity added to the existing motorway section and the extension to Halswell Junction Road, combined with growth in the south-western area of Christchurch, will attract traffic. It can also be seen from Brougham Street having only an acceptable LoS C in 2006 that the link level of service overestimates the capacity in areas with signalised intersections (and roundabouts), so producing an optimistically good level of service.

The completion of CSM1 will bring about significant relief on the motorway itself, with the change in operating environment (from two-lane undivided motorway to four-lane median-divided motorway) between Curletts Interchange and Barrington Street improving the level of service to an expected LoS D at peak periods. Between Curletts I/C and Halswell Junction Road, CSM1 is anticipated to operate at LoS C during peak periods.

Halswell Junction Road, becoming the access point to CSM1 from Main South Road, is expected to experience very high levels of congestion, reaching (link) capacity between 2026 and 2041. Note that Halswell Junction Road is being upgraded as part of CSM1, which will increase its capacity, but this will only provide short term relief.

The CSM2 Strategic Study, undertaken in 2009, identified capacity constraints on Halswell Junction Road as severely limiting access to CSM1 and requiring CSM2 to be progressed rapidly to bypass the bottleneck that Halswell Junction Road is expected to become. The results from the CPM Baseline still support this.

On Main South Road, the effect of growth in the area to the south-west of Christchurch is evident south of Halswell Junction Road. Immediately south of Halswell Junction Road, Main South Road is expected to decline from LoS E in 2006 to LoS F by 2026. Further south, the addition of traffic using

Pound Road to access Main South Road, combined with the higher volumes on Main South Road, are expected to result in LoS F on Main South Road from 2016 onwards through to Weedons Road.

Road Travel Times

Table 6-3 reports the historic Base and Baseline travel times for the RoNS Southern Corridor, between the Main South Road/ Rolleston Drive intersection in Rolleston and the Brougham Street/ Selwyn Street intersection at the Christchurch end of the corridor. The routing is similar between the historic Base and Baseline, except that CSM1 and Halswell Junction Road are used once CSM1 is completed in 2013 instead of Curletts Roads, Blenheim Road and Main South Road.

Table 6-3: Historic Base and Baseline Road Network Travel Times [Minutes] – Rolleston to Brougham Street

	AM Peak Hour		Inter-Peak		PM Peak Hour	
Year	To Chch	From Chch	To Chch	From Chch	To Chch	From Chch
2006	27.9	24.3	23.5	22.5	29.6	30.5
2016	20.7	17.7	17.7	17.4	19.7	21.9
2026	24.1	18.5	18.3	17.7	22.4	25.3
2041	28.0	20.7	19.2	18.5	25.8	29.5

Route distance of 21.0 km in 2006 and 22.3 km for subsequent years.

These travel times show:

- The completion of CSM1 is expected to produce significant time savings in both directions across all three periods, as shown by the decrease in travel times between 2006 and 2016;
- From 2016 onwards, travel times are expected to steadily increase, especially in the peak periods, as a result of growing demand for travel resulting from forecast population growth;
- This increase in travel times is greatest in the peak direction of each period (to Christchurch in the morning, from Christchurch in the afternoon), although it is not until 2041 that travel times are expected to rise to a similar level to those prevailing before completion of CSM1.

It can be seen from these travel times that completion of CSM1 is expected to allow faster travel times than those currently prevail for a period of 25 years. These travel time savings are achieved even with the growth in traffic volumes shown in **Table 6-1** and later in the section on the Main South Road corridor in **Table 6-7**.

Journey Time Reliability

The poor level of service on the roads comprising the Southern Corridor (with the exception of the CSM1 section) indicate that high levels of congestion will be present at some times of the day at least, especially as the level of service worsens over time. As high levels of congestion increase the variability of travel times, this indicates that the journey time variability on the Southern Corridor route is likely to increase over time.

Again with the exception of the CSM1 section, the route also passes through a number of at grade intersections, which will further increase the variability of the journey times.

6.3.2 Lincoln/ Prebbleton Corridor

Average Daily Traffic Volumes

Table 6-4 shows the forecast ADT volumes for the roads connecting the Lincoln and Prebbleton areas through to Hornby/Sockburn, including access to the motorway section of CSM1 at Halswell Junction Road.

Table 6-4: Historic Base and Baseline ADT Volumes – Lincoln/ Prebbleton Corridor

Road and Location	2006	2016	2026	2041
Springs Rd: North of Halswell Junction Rd	15,000	20,750	22,500	24,250
Springs Rd: North of Marshs Rd	11,500	18,500	21,250	23,250
Springs Rd: South of Marshs Rd (north side of Prebbleton)	11,500	17,250	17,750	20,000
Springs Rd: Between Blakes Rd & Tosswill Rd	8,750	14,500	15,250	17,750
Springs Rd: South of Trents Rd	5,250	4,750	4,750	5,000
Springs Rd: South of Robinsons Rd	5,750	5,000	5,250	5,500
Springs Rd: South of Boundary Rd	4,250	5,250	5,250	5,500
Shands Rd: North of Halswell Junction Rd	10,500	14,000	17,000	19,500
Shands Rd: North of Marshs Rd	6,250	7,000	10,750	13,250
Shands Rd: South of Marshs Rd	8,750	10,000	13,000	14,250
Shands Rd: South of Trents Rd	6,500	8,000	10,750	12,000
Shands Rd: South of Robinsons Rd	3,500	4,250	4,500	4,750
Birchs Rd: South of Boundary Rd	3,750	5,250	6,250	8,000

With the completion of CSM1 in 2013, traffic volumes on Springs Road through Prebbleton are expected to show an increase of almost 6,000 vehicles per day (a 65% increase) between 2006 and 2016 (6.5% p.a.), with the rate of growth slowing to 0.9% p. a. between 2016 and 2041.

It can also be seen that most of this increase in traffic on Springs Road appears to be driven by growth in traffic to and from Prebbleton itself, as traffic volumes south of Prebbleton on Springs Road remain static. This is consistent with the growth in households and population in Prebbleton, as reported in Table 2-2.

On Shands Road, there is a steady rise in traffic volumes at all locations along its length, as this provides a parallel route to Springs Road to access the Hornby area, and avoids the congested Halswell Junction Road/ Springs Road roundabout. It also provides an alternative route via Selwyn Road to Main South Road for travel between Rolleston and Christchurch, thereby avoiding Main South Road with its poor level of service.

Link Level of Service

Table 6-5 provides a summary of the maximum level of service values for the key links along the Lincoln/Prebbleton corridor. Note that the majority of roads listed are treated as rural highways for calculation of the level of service. Springs Road north of Halswell Junction Road and the section through Prebbleton (between Blakes and Tosswill Road), and Shands Road north of Marshs Road, have been treated as urban roads, which explains why the level of service appears to get better on these sections even though all day traffic volumes are higher than further south.

Table 6-5: Historic Base and Baseline Link Level of Service on Lincoln/ Prebbleton Corridor

Road and Location	2006	2016	2026	2041
Springs Rd: North of Halswell Junction Rd	B	C	C	C
Springs Rd: North of Marshs Rd	D	E	E	E
Springs Rd: South of Marshs Rd (north side of Prebbleton)	E	E	E	E
Springs Rd: Between Blakes Rd & Tosswill Rd	B	C	D	D
Springs Rd: South of Trents Rd	E	E	E	E
Springs Rd: South of Robinsons Rd	E	E	E	E
Springs Rd: South of Boundary Rd	D	E	E	E
Shands Rd: North of Halswell Junction Rd	C	C	D	E
Shands Rd: North of Marshs Rd	A	B	D	D
Shands Rd: South of Marshs Rd	E	E	E	E
Shands Rd: South of Trents Rd	D	E	E	E
Shands Rd: South of Robinsons Rd	C	C	C	C
Birchs Rd: South of Boundary Rd	A	B	C	D

Most of the rural roads in this corridor are expected to operate poorly in peak periods, generally being at LoS E.

Springs Road, leading to the southern end of CSM1, is expected to have increased congestion levels (particularly between Prebbleton and the motorway section of CSM1), as this road is used to access CSM1, as well as continue through to Main South Road/ Blenheim Road at Sockburn. Once past Halswell Junction Road, the level of service on Springs Road is expected to improve (although this is partly as a result of the change in the road environment from a rural to urban setting, and the consequent change in driver's expectations).

Shands Road north of Halswell Junction Road is also expected to see a slow drop in performance, falling to LoS E by 2041.

Road Travel Times

Table 6-6 reports the historic base and Baseline travel times on Springs Road between Lincoln and the intersection with Main South Road near Hornby, with the route passing through Prebbleton.

Table 6-6: Historic Base and Baseline Road Network Travel Times [Minutes] – Lincoln to Main South Road via Springs Road

Year	AM Peak Hour		Inter-Peak		PM Peak Hour	
	To Chch	From Chch	To Chch	From Chch	To Chch	From Chch
2006	12.1	12.0	11.9	11.9	12.2	12.2
2016	13.0	12.7	12.4	12.4	13.6	13.5
2026	14.5	13.4	12.5	12.5	14.5	14.8
2041	17.4	13.6	12.8	12.7	15.7	18.5

Route distance of 12.8 km.

These travel times show a steady increase in travel times in the peak periods, especially in the peak travel direction (towards Christchurch in the morning and from Christchurch in the afternoon). Although not discernible from these summary results, the increase in travel times is primarily as a result of increasing delays at the Springs Road/ Halswell Junction Road roundabout, as CSM1 brings additional traffic along the Christchurch Southern Corridor route to this location.

Inter-peak period travel times are relatively flat, with only a small increase between 2006 and 2016, coinciding with the opening of CSM1 and the increase in traffic volumes through the Springs Road/ Halswell Junction Road roundabout.

6.3.3 Main South Road Corridor

Average Daily Traffic Volumes

Table 6-7 shows the forecast ADT volumes for the Main South Road corridor, connecting Rolleston through to Hornby and SH1 heading north around Christchurch.

Table 6-7: Historic Base and Baseline ADT Volumes – Main South Road Corridor

Road and Location	2006	2016	2026	2041
MSR: South of SH1 Carmen Rd	19,000	19,250	22,250	25,500
MSR: North of Halswell Jn Rd	19,000	19,250	23,500	26,750
MSR: South of Halswell Jn Rd	20,000	30,250	35,750	40,500
MSR: South of Trents Rd/ Kirk Rd	18,500	25,250	30,750	35,750
MSR: South of Weedons Rd/ Weedons Ross Rd	17,750	24,750	30,500	35,250
MSR: Between Hoskyns Rd & Rolleston Dr	20,000	28,250	35,500	42,000
MSR: Between Rolleston Dr & Tennyson St	15,000	18,000	19,250	21,750
Waterloo Rd: South of SH1 Carmen Rd	7,500	7,250	7,500	8,000
Jones Rd: South of Kirk Rd (western side of Templeton)	2,000	2,250	2,750	4,000
Jones Rd: South of Weedons Ross Rd	1,750	1,000	1,500	2,000
Jones Rd: South of Hoskyns Rd	2,250	1,750	4,250	10,750
Selwyn Rd: Between Robinsons Rd & Shands Rd	5,250	6,000	7,750	9,000
Selwyn Rd: Between Weedons Rd & Waterholes Rd	4,250	4,750	6,500	7,750

It is evident that the completion of CSM1 (between 2006 and 2016) will initially relieve the growth in traffic on this corridor north of Halswell Junction Road, where traffic using CSM1 re-joins Main South Road. Between 2006 and 2016 there is virtually no growth in daily traffic volumes on Main South Road between Hornby and Halswell Junction Road. Following 2016, traffic volumes start to increase again.

Waterloo Road, the alternative routing to Main South Road for traffic travelling to and from SH1 Carmen Road, is expected to experience a drop in traffic volumes between 2006 and 2016. As this route is currently used by some traffic to avoid congestion and delays on Main South Road, this drop can be attributed to the improvement in travel conditions on Main South Road with the removal of CSM1 traffic. Even at 2041, daily traffic volumes are likely to be only slightly higher than those occurring in 2006.

As the Baseline road network includes the Barters Road improvement project, it is likely that the drops in traffic volumes are offset to an extent by traffic accessing Main South Road at the new signalised intersection of Main South Road/ Pound Road.

South of Halswell Junction Road, where traffic from CSM1 re-joins Main South Road, there is a steady increase in traffic volumes on Main South Road between the forecast years (as reported above in the section on the CSM1 corridor).

As traffic volumes build up on Main South Road, Jones Road becomes an attractive alternative route, with a steady increase in daily traffic volumes. South of Hoskyns Road, the growth in trips due to the Izone industrial area is evident in the significant increase in daily trips between 2016 and 2041.

Similarly to the situation on Jones Road, increasing traffic volumes on Main South Road lead to an increase in traffic using Selwyn Road to travel between Rolleston and the southern areas of

Christchurch, including Hornby. After Selwyn Road joins Shands Road south of Hamptons Road, this increase in daily traffic volumes is seen in the results for the Lincoln/Prebbleton corridor. Between 2006 and 2041, **Table 6-4** shows a doubling in the volume of traffic on Shands Road north of Selwyn Road, whilst south of Selwyn Road there is only a third more.

Link Level of Service

Table 6-8 provides a summary of the worst level of service values for the key links along the Main South Road corridor.

Table 6-8: Historic Base and Baseline Link Level of Service on Main South Road Corridor

Road and Location	2006	2016	2026	2041
MSR: South of SH1 Carmen Rd	B	B	C	C
MSR: North of Halswell Jn Rd	B	B	C	D
MSR: South of Halswell Jn Rd	C	E	E	F
MSR: South of Trents Rd/ Kirk Rd	D	E	E	E
MSR: South of Weedons Rd/ Weedons Ross Rd	C	E	E	F
MSR: Between Hoskyns Rd & Rolleston Dr	B	C	C	D
MSR: Between Rolleston Dr & Tennyson St	C	C	D	D
Waterloo Rd: South of SH1 Carmen Rd	C	D	C	C
Jones Rd: South of Kirk Rd (western side of Templeton)	A	A	A	B
Jones Rd: South of Weedons Ross Rd	A	A	A	A
Jones Rd: South of Hoskyns Rd	A	A	A	C
Selwyn Rd: Between Robinsons Rd & Shands Rd	D	D	E	E
Selwyn Rd: Between Weedons Rd & Waterholes Rd	D	D	E	E

It is evident from the level of service values reported that travel conditions on Main South Road are expected to worsen significantly between Halswell Junction Road, where the CSM1 traffic re-joins Main South Road, and Rolleston. In later years, more traffic diverts onto Jones Road to avoid the congested conditions predicted on the parallel Main South Road, although travel conditions are still expected to remain satisfactory.

Road Travel Times

Table 6-9 reports the historic base and Baseline travel times between the location of the CSM2/ Main South Road interchange and the south-western edge of the Four Avenues (corner of Deans and Moorhouse Avenues), travelling via Main South Road and Blenheim Road[31]. This route provides an

[31] Travel times for 2006 are based on the original Blenheim Road alignment, before the Blenheim Road deviation was completed.

alternative routing to that of the Christchurch Southern Corridor for travel between the southern side of Christchurch and Rolleston, although it travels through mainly urban streets with lower speed limits of 50-60 km/h compared to the high speed motorway environment provided by CSM1.

Table 6-9: Base and Baseline Road Network Travel Times [Minutes] – CSM2/ Main South Road Interchange Location to Four Avenues via Main South Road and Blenheim Road

	AM Peak Hour		Inter-Peak		PM Peak Hour	
Year	To Chch	From Chch	To Chch	From Chch	To Chch	From Chch
2006	22.9	19.6	19.1	18.4	23.1	24.1
2016	19.6	17.4	17.1	16.7	19.6	22.7
2026	22.0	17.8	17.5	17.0	21.8	25.4
2041	23.7	19.1	18.0	17.5	24.4	29.3

Route distance of 14.3 km.

These travel times show:

- The completion of CSM1 is expected to produce travel time savings in both directions across all three periods, shown by the decrease in travel times between 2006 and 2016, as vehicles reroute onto CSM1;
- From 2016 onwards, travel times are expected to steadily increase, especially in the peak periods;
- This increase in travel times is most noticeable in the PM peak hour, especially for vehicles travelling from Christchurch.

6.3.4 Other Key Roads

Average Daily Traffic Volumes

Table 6-10 shows the forecast ADT volumes for other key roads in the southwest area of Greater Christchurch likely to be affected by the Project.

Table 6-10: Historic Base and Baseline ADT Volumes – Other Key Roads

Road and Location	2006	2016	2026	2041
Weedons Ross Rd: West of Jones Rd	750	750	750	1,000
Marshs Rd: West of Springs Rd	1,750	1,250	4,500	5,500
Marshs Rd: West of Shands Rd	1,250	750	1,250	2,000
Levi Rd: South of Weedons Rd	500	1,250	1,750	3,500
Curraghs Rd: West of Jones Rd	1,000	750	500	500
Hamptons Rd: West of Shands Rd	750	1,000	1,250	1,750
Dawsons Rd: West of Jones Rd	500	750	750	750
Waterholes Rd: East of Main South Rd	1,250	2,000	2,250	3,000
Kirk Rd: West of Jones Rd	7,250	8,500	9,250	9,750
Trents Rd: East of Main South Rd	750	1,000	1,250	2,000
Blakes Rd: East of Shands Rd	1,500	1,750	3,750	5,500

Marshs Road west of Springs Road is expected to see a significant increase in traffic, with volumes almost tripling by 2041. Kirk Road, providing the main access into Templeton, has a high volume of traffic in 2006, and shows a slow and steady increase with the increase in population in Templeton.

Levi Road, bypassing the traffic signals on Main South Road and providing an alternative access route into Rolleston, sees an increase in the volume of traffic, especially in 2041. This is driven by the increasing delays likely at the two sets of Main South Road traffic signals.

On other roads, volumes are generally low, with little or no change in traffic volumes through the future years.

Link Level of Service

Table 6-11 provides a summary of the worst level of service values for the other roads in the southwest area likely to be affected by the Project.

Table 6-11: Historic Base and Baseline Link Level of Service on Other Key Roads

Road and Location	2006	2016	2026	2041
Weedons Ross Rd: West of Jones Rd	D	D	D	D
Marshs Rd: West of Springs Rd	D	D	E	E
Marshs Rd: West of Shands Rd	D	D	D	D
Levi Rd: South of Weedons Rd	D	D	D	E
Curraghs Rd: West of Jones Rd	B	B	B	B
Hamptons Rd: West of Shands Rd	D	D	D	D
Dawsons Rd: West of Jones Rd	D	D	D	D
Waterholes Rd: East of Main South Rd	D	D	D	D
Kirk Rd: West of Jones Rd	A	B	B	B
Trents Rd: East of Main South Rd	D	D	D	D
Blakes Rd: East of Shands Rd	D	D	E	E

Marshs Road is expected to slowly fall to LoS E by 2041, from a current LoS D. Levi Road, with the increase in the volume of traffic using it to bypass the traffic lights on Main South Road, drops from LoS D in the earlier years to LoS E by 2041. Blakes Road also drops from LoS D to LOS E by 2026.

The other roads are expected to operate satisfactorily.

6.3.5 Summary of Road Conditions and Level of Service

The modelling results reported in this section show that significant growth in the demand for travel in the southwest area of Greater Christchurch is expected. Increasing volumes of traffic on the Baseline road network are likely to lead to a deterioration in level of service on the major routes in the area, with increasing travel times expected (even with the added capacity and connectivity provided by CSM1).

The Southern Corridor, providing the principal connection from the south through to Christchurch and the Port of Lyttelton, is expected to experience a doubling of daily traffic volumes at some locations, with significant growth along the remainder of the corridor. With the exception of the new motorway section of the CSM1, the level of service is expected to fall to Los F at all locations by 2041. Some sections of Main South Road are expected to operate at LoS F from at least 2016, with the remainder of the corridor being LoS E.

Travel times on the Southern Corridor are expected to increase by 50% between 2016 and 2041 for peak direction trips. With this increase, these peak period trips will have travel times which are longer than those experienced before the completion of CSM1.

Alternative parallel routes to Main South Road will carry increasing volumes of traffic, as drivers try to bypass congested sections of the Baseline network.

As an increased rate of growth in the medium term is expected in the south-western area of Greater Christchurch following the earthquakes of 2010 and 2011, the increased demand for travel is likely to result in the transport network performing worse than is indicated here. The resulting increase in congestion (on top of that already predicted) will further constrain the movement of people and goods through the Southern Corridor.

6.4 Intersection Performance

The predicted performance of Baseline intersections in the southwest area of Christchurch (the area of influence of the Project) likely to be significantly affected by changes in traffic volumes and travel patterns have been assessed. This assessment has been undertaken using the SIDRA Intersection modelling package. Only level of service results are presented in this section, as these results provide a good summary indication of how well an intersection is coping with the traffic demands placed on it.

Full SIDRA outputs for all years are included in **Appendix E** to this report.

6.4.1 CSM1/ Halswell Junction Road Roundabout

The motorway section of CSM1 terminates at Halswell Junction Road with a three legged roundabout. The expected level of service of this roundabout with traffic volumes from the Baseline CPM network are shown in **Table 6-12**.

Table 6-12: CSM1/ Halswell Junction Road Roundabout Level of Service

	AM Peak Hour			Inter-Peak			PM Peak Hour		
Approach	2016	2026	2041	2016	2026	2041	2016	2026	2041
Halswell Junction Rd – East	A	B	D	A	A	A	B	B	B
CSM1 – North	A	A	A	A	A	A	A	E	F
Halswell Junction Rd – West	A	A	B	A	A	A	A	A	A
Overall	**A**	**A**	**B**	**A**	**A**	**A**	**A**	**D**	**F**

The CSM1/ Halswell Junction Road roundabout is expected to initially operate satisfactorily, but by 2026 increasing delays on the motorway approach to the roundabout are likely in the PM peak hour, culminating in an overall LoS F by 2041.

This performance is consistent with the CSM1 and Halswell Junction Road intersections not being designed to accommodate traffic volumes past 2018 without CSM2 relieving the pressure on them.

6.4.2 Halswell Junction Road/ Springs Road Roundabout

Table 6-13 reports summary level of service results for the expected performance of the Halswell Junction Road/ Springs Road roundabout.

Table 6-13: Halswell Junction Road/Springs Road Roundabout Level of Service

Approach	AM Peak Hour			Inter-Peak			PM Peak Hour		
	2016	2026	2041	2016	2026	2041	2016	2026	2041
CSM1 (Halswell Junction Rd) – East	A	A	A	A	A	A	A	A	A
Springs Rd – North	E	F	C	A	B	C	F	F	F
Halswell Junction Rd – West	B	F	F	A	A	A	D	F	F
Springs Rd – South	B	D	E	A	A	B	C	C	C
Overall	**B**	**F**	**F**	**A**	**A**	**B**	**C**	**E**	**F**

From **Table 6-13** it can be seen that some approaches are likely to be performing poorly soon after the opening of CSM1. The CSM1 approach, from between the two roundabouts on Halswell Junction Road, is anticipated to perform well in all years and time periods. In the other direction, delays on the Halswell Junction Road approach are expected to start causing significant delays by 2026 in the AM peak hour, and in all years in the PM peak hour. Both of the Springs Road approaches are also likely to have unsatisfactory performance at one end of the day or the other from 2016 onwards.

Again, this performance is consistent with the Halswell Junction Road intersections not being designed to accommodate traffic volumes past 2018 without CSM2 relieving the pressure on them.

6.4.3 Halswell Junction Road/ Shands Road Signalised Intersection

The expected intersection performance of the Halswell Junction Road/ Shands Road signalised intersection has been assessed using SIDRA, with a summary of the expected level of service shown in **Table 6-14**.

Table 6-14: Halswell Junction Road/ Shands Road Signalised Intersection Level of Service

Approach	AM Peak Hour			Inter-Peak			PM Peak Hour		
	2016	2026	2041	2016	2026	2041	2016	2026	2041
Shands Rd SW	C	D	D	C	C	D	D	F	F
Halswell Junction Rd SE	D	E	E	C	C	D	D	F	F
Shands Rd NE	D	D	F	C	C	C	C	F	F
Halswell Junction Rd NW	D	D	E	C	C	C	D	F	F
Overall	**D**	**D**	**E**	**C**	**C**	**D**	**D**	**F**	**F**

These results show that by 2026 the Halswell Junction Road/ Shands Road intersection is expected to suffer from severe delays in the PM peak hour, with a LoS F on all four approaches. Performance during the other times of day is expected to be satisfactory, although the Halswell Junction Road south-eastern approach is expected to fall to LoS E in the AM peak hour. By 2041, in the AM peak hour, both Halswell Junction Road approaches are expected to drop to LoS E, and the Shands Road north-eastern approach is expected to operate at LoS F, with the intersection overall operating at LoS E.

With the increase in delays come increases in the length of over-capacity queues. In the PM peak hour these could extend for over a kilometre on all four approaches. On Halswell Junction Road these could extend as far as the Main South Road intersection to the northwest and the Springs Road roundabout to the southeast. On the Shands Road approaches, queued vehicles could extend to Main South Road to the northeast and Marshs Road to the southwest.

Apart from potentially affecting the operation of the adjacent intersections, the length of these queues is likely to make access to and from the industrial premises along Halswell Junction and Shands Road more difficult, especially for larger trucks.

This performance is consistent with the Halswell Junction Road intersections not being designed to accommodate traffic volumes past 2018 without CSM2 relieving the pressure on them.

6.4.4 Main South Road/ Halswell Junction Road Signalised Intersection

Table 6-15 shows the expected level of service of the Main South Road/ Halswell Junction Road signalised intersection.

Table 6-15: Main South Road/ Halswell Junction Road Signalised Intersection Level of Service

	AM Peak Hour			Inter-Peak			PM Peak Hour		
Approach	2016	2026	2041	2016	2026	2041	2016	2026	2041
Halswell Junction Rd S	B	B	B	B	B	B	B	B	B
Main South Rd E	B	B	C	B	B	C	B	C	D
Halswell Junction Rd N	C	C	C	B	C	C	C	D	E
Main South Rd W	C	C	C	C	C	C	C	C	D
Overall	**C**	**C**	**C**	**B**	**B**	**C**	**B**	**C**	**D**

From **Table 6-15** it can be seen that the Main South Road/ Halswell Junction Road signalised intersection is expected to operate satisfactorily for all years and time periods, although there is a slow deterioration in performance through to 2041. In the PM peak hour in 2041, the northern Halswell Junction Road approach is likely to be at LoS E, though the intersection overall will be LoS D.

6.4.5 Main South Road/ Kirk Road/ Trents Road Priority Intersection

Level of service results for the Main South Road/ Kirk Road/ Trents Road intersection, serving as the main access point from Main South Road into Templeton, are shown in **Table 6-16**.

Table 6-16: Main South Road/ Kirk Road/ Trents Road Priority Intersection Level of Service

Approach	AM Peak Hour			Inter-Peak			PM Peak Hour		
	2016	2026	2041	2016	2026	2041	2016	2026	2041
Trents Rd – East	F	F	F	F	F	F	F	F	F
Main South Rd – North	D	F	F	B	C	D	C	F	F
Kirk Rd – West	F	F	F	F	F	F	F	F	F
Main South Rd – South	B	B	D	B	B	C	D	E	F

* On the major approaches, only delay associated with right turning movements are reported – there is no delay to the through traffic on Main South Road and only geometric delay for the left turning vehicles.

The increasing volume of traffic on Main South Road, as shown in **Table 6-7**, will lead to fewer gaps between vehicles on Main South Road for crossing and turning traffic, leading to increasing delays for right turning vehicles on Main South Road and all vehicles on the Kirk Road and Trents Road approaches.

Both the minor arms at this intersection (Kirk Road and Trents Road) show a LoS F for all periods from 2016 onwards, indicating that vehicles on these side roads will have increasing delays turning onto or crossing Main South Road.

From the north, the level of service for vehicles turning right from Main South Road into Kirk Road (and Templeton) will deteriorate to LoS F by 2026 in both the AM and PM peak hours. For the northbound traffic on Main South Road, the delays at the right turn onto Trents Road will increase over time, going from an expected LoS D in 2016 to LoS F by 2041.

6.4.6 Main South Road/ Waterholes Road/ Dawsons Road Priority Intersection

The expected performance of the Main South Road/ Waterholes Road/ Dawsons Road priority intersection has been assessed, with a summary of the expected level of service shown in **Table 6-17**.

Table 6-17: Main South Road/ Waterholes Road/ Dawsons Road Priority Intersection Level of Service

Approach	AM Peak Hour			Inter-Peak			PM Peak Hour		
	2016	2026	2041	2016	2026	2041	2016	2026	2041
Waterholes Rd – East	F	F	F	F	F	F	F	F	F
Main South Rd – North	E	F	F	C	C	E	D	F	F
Dawsons Rd – West	F	F	F	F	F	F	F	F	F
Main South Rd – South	C	C	C	C	C	C	C	D	D

* On the major approaches, only delay associated with right turning movements are reported – there is no delay to the through traffic on Main South Road and only geometric delay for the left turning vehicles.

The increasing volume of traffic on Main South Road, as shown in **Table 6-7**, will make it harder for vehicles to cross or turn onto Main South Road, producing increasing delays for all vehicles on the Waterholes Road and Dawsons Road approaches, and for right turning vehicles on Main South Road.

Both the Waterholes Road and Dawsons Road minor arms are expected to experience a LoS F for all periods from 2016 onwards, indicating that vehicles on these side roads will have increasing delays turning onto or crossing Main South Road.

From the north, the level of service for vehicles turning right from Main South Road into Waterholes Road and Dawsons Road will deteriorate to LoS F by 2026 in both the AM and PM peak hours. During the middle of the day, these right turning vehicles will have a LoS E by 2041. Delays for right turning traffic from the south are expected to remain fairly low, with a level of service no worse than LoS D.

6.4.7 Main South Road/ Weedons Road/ Weedons Ross Road Priority Intersection

The existing Main South Road/ Weedons Road/ Weedons Ross Road intersection is a stop controlled intersection, with Main South Road comprising the major arms. With increasing traffic volumes on Main South Road, vehicles turning right into Weedons Road or Weedons Ross Road from Main South Road will experience increasing delays. Vehicles from Weedons Road and Weedons Ross Road trying to cross or turn right into Main South Road will also suffer from increasing delays. With increasing delays, there is likely to be an increase in the number of crashes occurring, as drivers impatient at waiting turn or cross using smaller gaps between vehicles on the major arms.

Table 6-18 shows the expected level of service for this intersection in the three forecast future years. Note that results for the main through movement on Main South Road are not included, as they experience no delay.

Table 6-18: Main South Road/ Weedons Road/ Weedons Ross Road Priority Intersection Level of Service

	AM Peak Hour			Inter-Peak			PM Peak Hour		
Approach	2016	2026	2041	2016	2026	2041	2016	2026	2041
Weedons Rd S	F	F	F	F	F	F	F	F	F
Main South Rd E*	F	F	F	C	C	E	C	F	F
Weedons Ross Rd N	F	F	F	F	F	F	F	F	F
Main South Rd W*	C	C	F	C	C	E	F	F	F

* On the major approaches, only delay associated with right turning movements are reported – there is no delay to the through traffic on Main South Road and only geometric delay for the left turning vehicles.

As is evident from **Table 6-18**, this intersection is likely to perform poorly for vehicles trying to cross or turn onto Main South Road. The increasing volume of traffic, as shown in **Table 6-7**, will lead to fewer gaps between vehicles on Main South Road for crossing and turning traffic, leading to increasing delays for right turning vehicles on Main South Road and all vehicles on the Weedons Road and Weedons Ross Road approaches.

6.4.8 Weedons Ross Road/ Jones Road Priority Intersection

The expected performance of the Weedons Ross Road/ Jones Road priority cross-roads intersection is shown in **Table 6-19**

Table 6-19: Weedons Ross Road/ Jones Road Priority Intersection Level of Service

Approach	AM Peak Hour			Inter-Peak			PM Peak Hour		
	2016	2026	2041	2016	2026	2041	2016	2026	2041
Weedons Ross Rd SE*	A	A	A	A	A	A	A	A	B
Jones Rd NE	B	C	C	B	B	B	B	C	C
Weedons Ross Rd NW*	A	A	B	A	A	A	A	A	A
Jones Rd SW	B	C	D	B	B	B	B	C	C

* On the major approaches, only delay associated with right turning movements are reported – there is no delay to the through traffic on Weedons Ross Road and only geometric delay for the left turning vehicles.

The results indicate that this intersection is expected to operate satisfactorily for all periods and years, although there is expected to be a slow decline in the performance of the two Jones Road minor arms (dropping from LoS B to LoS D at worst).

6.4.9 Weedons Road/ Levi Road Priority Intersection

The expected performance of the Weedons Road/ Levi Road priority T-intersection is shown in **Table 6-20**.

Table 6-20: Weedons Road/ Levi Road T-Intersection Level of Service

Approach#	AM Peak Hour			Inter-Peak			PM Peak Hour		
	2016	2026	2041	2016	2026	2041	2016	2026	2041
Weedons Rd – East*	-	-	-	-	-	-	-	-	-
Weedons Rd – West	B	B	B	B	B	B	B	B	B
Levi Rd – South	B	B	B	B	B	B	B	B	B

* No right turn movements from this major arm.

The results indicate that this intersection is expected to operate satisfactorily for all periods and years.

6.4.10 Main South Road/ Hoskyns Road Signalised Intersection

The Main South Road/ Hoskyns Road intersection provides the main access point into the Rolleston Izone industrial area west of Main South Road. Expected Baseline level of service results for this intersection are shown in **Table 6-21**.

Table 6-21: Main South Road/ Hoskyns Road Signalised Intersection Level of Service

Approach	AM Peak Hour			Inter-Peak			PM Peak Hour		
	2016	2026	2041	2016	2026	2041	2016	2026	2041
Main South Rd – NorthSH1 East	A	B	C	A	A	B	A	B	C
Hoskyns Rd – West	D	D	D	D	C	C	C	D	F
Main South Rd – South	A	B	B	A	A	B	B	C	E
Overall	**A**	**B**	**C**	**A**	**B**	**B**	**B**	**C**	**E**

This intersection is expected to operate satisfactorily through to 2026, but at some stage before 2041, the performance in the PM peak hour is likely to deteriorate, with an increasing number of vehicles trying to turn out of Hoskyns Road toward Rolleston, whilst traffic volumes on Main South Road keep increasing.

In the 2041 PM peak hour, overcapacity queues are likely to extend back through the Main South Road/ Rolleston Drive intersection, located only 170 m to the south. The disruption caused to the efficient operation of the Main South Road/ Rolleston Drive intersection can be minimised through intelligent co-ordination of the signals at these two intersections, but the queuing is unlikely to be eliminated without adversely affecting one or more of the other arms at this intersection.

Queued vehicles extending along Main South Road from the intersection with Rolleston Drive (see Section 6.4.11 below) are also likely to impact on the operation of this intersection in the AM peak hour from 2026 onwards, reducing the number of vehicles that can pass through it and potentially lowering its level of service.

6.4.11 Main South Road/ Rolleston Drive Signalised Intersection

The Main South Road/ Rolleston Drive intersection will be the main access point out of Rolleston for traffic heading towards Christchurch, especially with the NZTA and Selwyn District Council progressing the Main South Road/ Tennyson Street Improvement Scheme, which will ban right turns out of Tennyson Street and Brookside Road onto Main South Road northbound.

Expected Baseline level of service results for this intersection are shown in **Table 6-22**.

Table 6-22: Main South Road/ Rolleston Drive Signalised Intersection

Approach	AM Peak Hour			Inter-Peak			PM Peak Hour		
	2016	2026	2041	2016	2026	2041	2016	2026	2041
Rolleston Drive – East	D	E	F	C	C	D	D	D	F
Main South Rd – North	C	E	F	B	B	B	B	B	D
Main South Rd – South	B	C	D	B	B	B	B	B	C
Overall	**C**	**E**	**F**	**B**	**B**	**C**	**B**	**C**	**E**

From the results shown in **Table 6-22**, it is evident that it is likely that there will be problems arising from the number of vehicles using Rolleston Drive to access Main South Road in the AM peak hour from 2026, worsening to a LoS F by 2041. Performance in the PM peak hour is also likely to become unsatisfactory by 2041.

In 2041 for both the AM and PM peak hours, overcapacity queues[32] on the Main South Road eastern approach and on Rolleston Drive are likely as a result of the increasing delays. On Main South Road, the back of the queue is likely to extend through the Main South Road/ Hoskyns Road intersection as far as the current location of the Main South Road/ Park Lane intersection[33] in the AM peak hour, and even further in the PM peak hour. This will reduce the efficiency of the intersection with Hoskyns Road, and is likely to cause safety concerns for vehicles travelling south towards and through the merge at the end of the four-laning section of Main South Road.

6.4.12 Summary of Intersection Performance

With increasing traffic volumes across the south-western area of Greater Christchurch, intersection performance is predicted to steadily worsen.

On Halswell Junction Road, the intersections with Springs Road and Shands Road are expected to show significant delays on one or more approaches from at least 2026, and possibly earlier. They were only designed to cater for the traffic demands expected by 2018, so are likely to be severely over-capacity by 2026.

An increasing volume of traffic on Main South Road is likely to result in increasingly long delays on the minor arms of the intersecting roads, which is expected to lead to an increased risk of crashes as drivers undertake risky manoeuvres to shorten the time they have to wait.

6.5 Road Based Freight Movements

With freight being a key focus of the GPS, the movement of freight vehicles in the vicinity of the Project in the Baseline case is reported in **Table 6-23**. From this it can be seen that the opening of CSM1, providing a direct connection from the southern side of central Christchurch through to the industrial areas around Halswell Junction Road and further south, is expected to initially result in a large increase in freight vehicles on the city end of the Southern Corridor. The number of trucks on Brougham Street and on CSM1 north of Curletts Road is expected to increase by over 500 trucks per day between 2006 and 2016, although they are then expected to remain at that 2016 level through to 2041.

Further south, the number of freight vehicles is expected to grow significantly on Main South Road south of the industrial areas of Sockburn and Halswell Junction Road. This is likely to be driven by the forecast expansion of industrial activity in these areas, along with a wider expansion of the regional economy.

[32] Overcapacity queues occur when more vehicles approach an intersection than can pass through it. The length of the queue will continue to increase until the arrival rate of vehicles falls below the rate at which vehicles pass through the intersection.

[33] As noted in Section 5.1.1, the intersection of Main South Road and Park Lane will be closed prior to the opening of the Project as part of a separate subdivision process.

Table 6-23: Historic Base and Baseline Average Daily Traffic Volumes – Heavy Commercial Vehicles

Road and Location	2006	2016	2026	2041
Blenheim Rd: West of Curletts Rd	2,900	3,900	4,000	4,300
MSR: South of Springs Rd	2,750	2,450	2,950	3,700
MSR: West of SH1 Carmen Rd	1,550	1,650	2,200	3,000
MSR: East of Halswell Jn Rd	1,550	1,750	2,400	3,350
MSR: West of Weedons Rd	1,800	2,400	3,000	4,100
MSR: West of Halswell Jn Rd	1,650	2,300	3,000	4,050
CSM1: Between Curletts I/C & Halswell Jn Rd	N/A	1,550	1,600	1,750
CSM1: Between Barrington St & Curletts I/C	1,350	1,900	1,850	1,950
Brougham St: West of Selwyn St	2,950	3,500	3,400	3,500

6.6 Pedestrians and Cyclists

There is very little quantitative data available on where people walk or cycle in the area affected by the Project. The one exception to this is for the Little River Rail Trail, where cycle counts have been collected in 2007 and 2011.

These counts were undertaken at two locations on behalf of both Selwyn District Council and Christchurch City Council to determine the current usage of the rail trail. Of these two locations, the closest to the Project alignment was on Birchs Road, south of Robinsons Road (south of Prebbleton).

The results of this count, and comparison to previous counts, are shown in **Figure 6-3**.

Figure 6-3: Birchs Road Cycle Count Results[34]

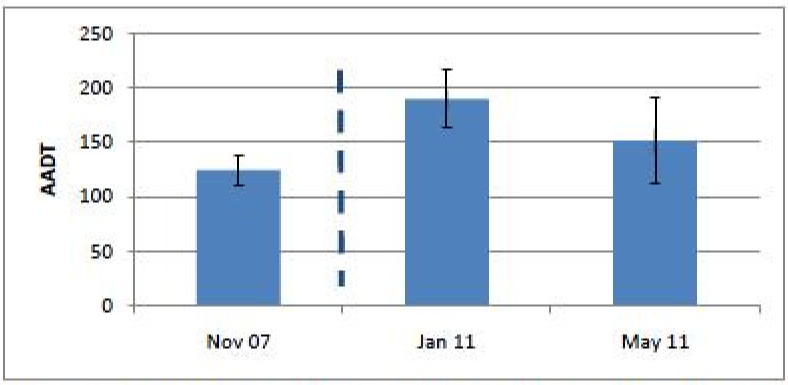


Figure 1: Birchs Road estimated AADTs with 90% confidence interval (black line)

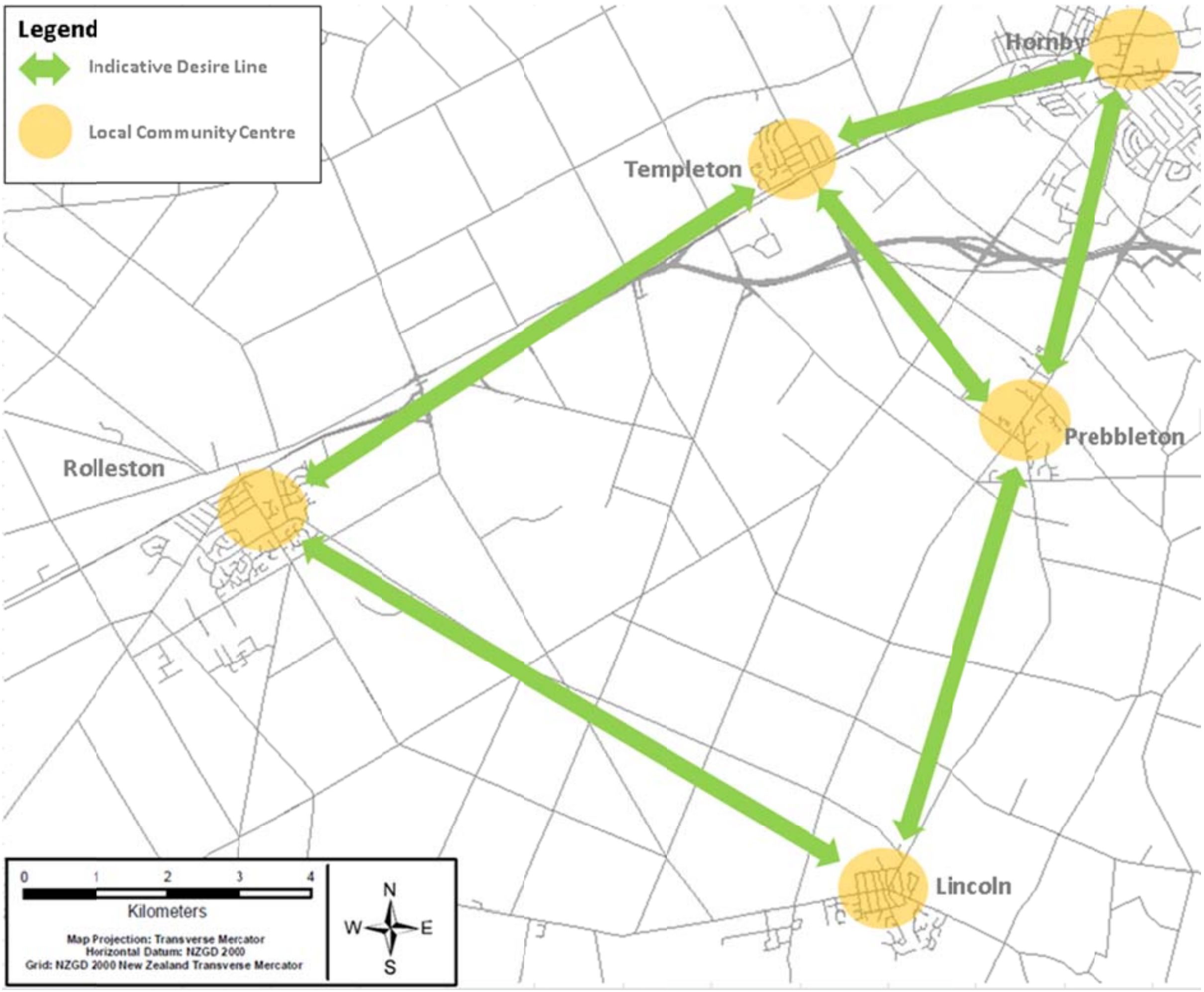
[34] Rail Trail Cycle Counting 2011, ViaStrada Ltd, August 2011, Figure 1

The results indicate that there has been a 35% increase in cycle use on the rail trail along Birches Road between 2007 and 2011, with average daily cyclist numbers increasing from 120 to 170. Although peak cycle use was observed during the summer months, the drop in cyclist numbers into autumn was not large. This agrees with the classification of the rail trail as primarily a commuter route north of Lincoln.

Walking demand in the Project area is mainly limited to local trips within the local community centres (Rolleston, Prebbleton, Lincoln, Templeton and Hornby). The distances between these centres discourages pedestrian activity, leaving cycling as the most preferred active mode between destinations. For cyclists, trips are either within the local community centres, between these centres or are recreational trips on facilities such as the Little River Rail Trail.

Indicative desire lines are shown in **Figure 6-4**. Apart from the Rail Trail (which connects Hornby, Prebbleton and Lincoln, and continuing southwards), there are currently no specific cycle facilities on routes serving these desire lines. However, the future network identified in the Selwyn District Council Walking and Cycling Strategy and Action Plan (as reported in Section 5.4.1), will complete many of these connections.

Figure 6-4: Indicative Active Transport Desire Lines

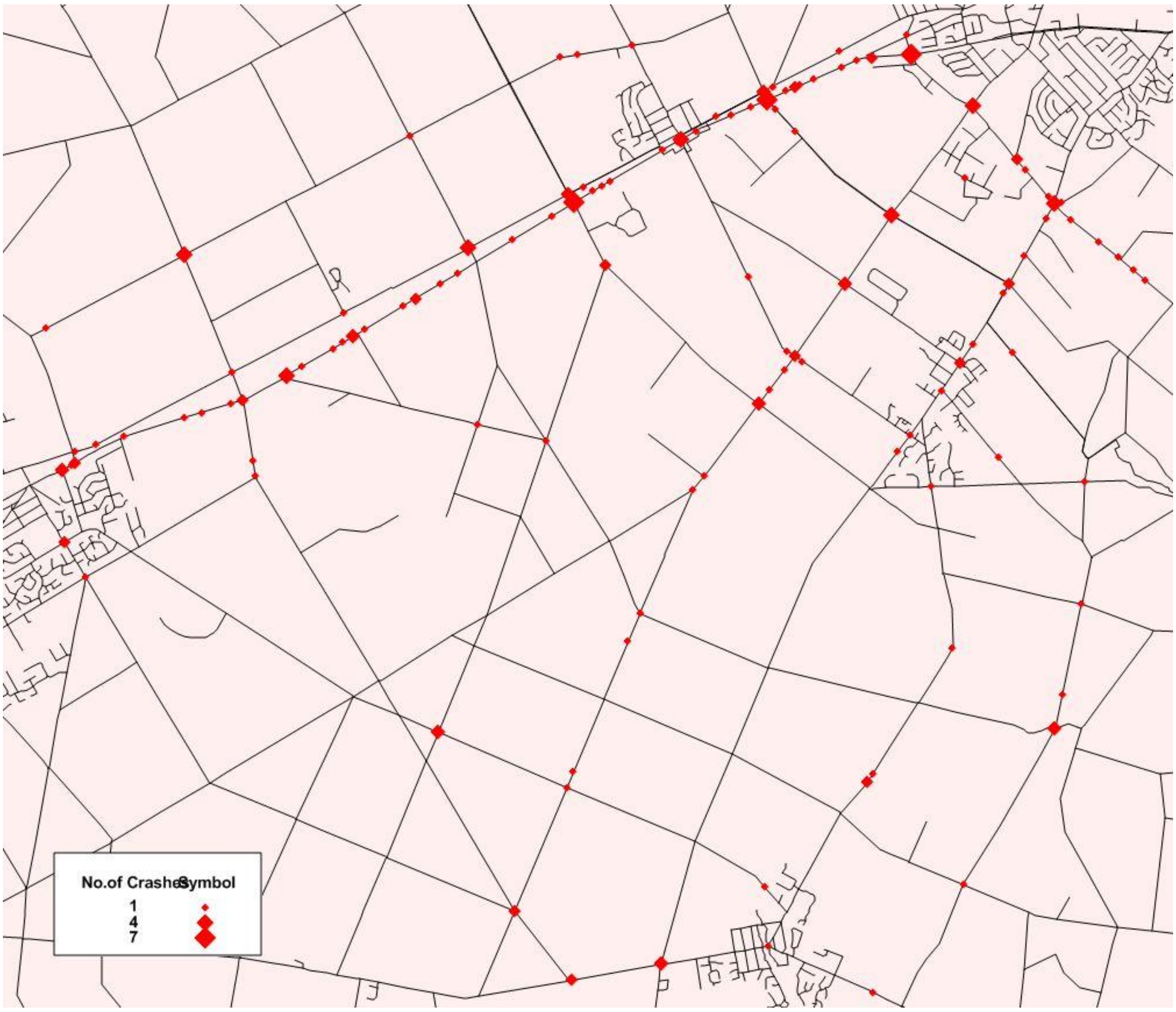


6.7 Road Safety

6.7.1 Reported Crash History – Wider Study Area

The reported injury crash history for the wider study area has been extracted from the NZTA crash database for the five year period 2006 to 2010 and these are shown schematically in **Figure 6-5**. This highlights that the majority of injury crashes occur along the strategic Main South Road/ Halswell Junction Road corridor. On the local road network, most injury crashes have occurred on the higher trafficked sections of Springs Road and Shands Road north of Hamptons Road.

Figure 6-5: Reported Injury Crashes in Wider Study Area



6.7.2 Reported Crash History – Strategic Corridor

A more focused analysis of reported crashes has been undertaken for the Main South Road corridor between Park Lane (near Rolleston) and Halswell Junction Road, and on Halswell Junction Road from Main South Road to Springs Road. The crash listings are attached in **Appendix F** to this report.

During the five year period from 2006 to 2010, there were 197 reported crashes comprising one fatal, 14 serious injury, 67 minor injury and 115 non-injury crashes. Crashes are summarised in **Table 6-24** and **Figure 6-6**.

Table 6-24: Reported Crash Summary – 2006 to 2010

Year	Fatal (F)	Serious (S)	Minor (M)	Non Injury (N)	Total
2006	1	3	14	34	52
2007	-	3	20	20	43
2008	-	2	13	20	35
2009	-	3	8	22	33
2010	-	3	12	19	34
Total	**1**	**14**	**67**	**115**	**197**

The table indicates a reduction in the number of reported crashes between 2006 and 2008, with total numbers remaining relatively similar in the three year period between 2008 and 2010. Of note, the decreasing trend between 2006 and 2008 is associated with minor and non-injury crashes. The reported number of higher severity fatal and serious crashes has not changed significantly over the five year period.

Some other general comments on reported crashes are as follows:

- 89 crashes (45%) occurred at intersections, 23 crashes at property accessways (12%), with the remaining 85 crashes (43%) on mid-block sections.
- 77 crashes (39%) were crossing direct/turning type movements.
- 47 crashes (24%) were rear end type crashes.
- 49 crashes (25%) were loss of control type movements.
- 14 crashes (7%) involved head on/overtaking movements.
- The fatal accident resulted from a head-on collision and alcohol was a factor.
- 60 crashes occurred in dark conditions, 68 in overcast conditions and 12 during the twilight period. This represents 71% of total crashes where light may have been a factor.
- 19 crashes involved trucks, two involved buses and four involved motorcycles.
- One crash involved a pedestrian and there were no reported crashes involving cyclists.

Figure 6-6: Crash Type Proportions – 2006 to 2010

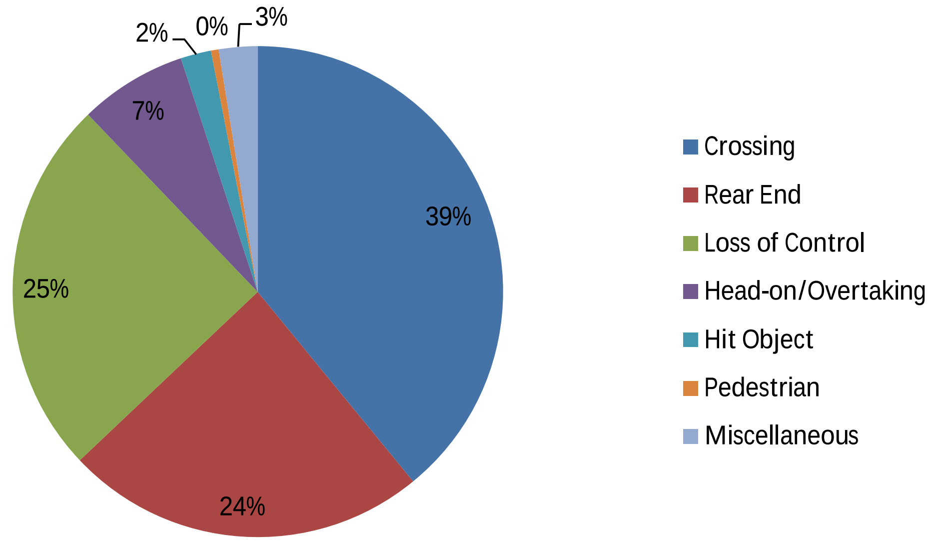


Table 6-25 separates the crashes into sections.

Table 6-25: Reported Crash Summary by Section – 2006 to 2010

			Mid-Block			Intersections			Total				
Road	**Section**	**Km**	**F+S**	**M**	**N**	**F+S**	**M**	**N**	**F+S**	**M**	**N**	**All**	**%**
Main South Road	Park Lane to Robinsons Road	4.7	5	10	23	0	7	14	5	17	37	59	30%
Main South Road	Robinson Road to Kirk Road	2.8	0	6	9	2	5	4	2	11	13	26	13%
Main South Road	Kirk Rd to Halswell Junction Road	2.9	2	8	14	4	19	31	6	27	45	78	40%
Halswell Junct Road	Main South Road to Springs Road	2.5	1	1	4	1	11	16	2	12	20	34	17%

F+S = Fatal and Serious injury crashes
M = Minor injury crashes
N = Non injury crashes

6.7.3 Reported Crash History – Mid-block Crashes

The extent of a crash problem can be measured by crash rates. This allows a road element to be compared to other similar elements to determine the extent of a problem or to assess trends.

For mid-blocks, crash rates are calculated by dividing the annual number of injury crashes (excluding intersections) by the number of vehicle-kilometres of travel passing along the section, which is referred to as “vehicle exposure”. The rates are reported as injury crash rates and do not include non-injury crashes due to inconsistency of reporting and relatively high levels of under-reporting.

Table 6-26 summarises mid-block crash rates along Main South Road and Halswell Junction Road. The calculation is based on 2008 traffic volumes, representing a mid-point for the 2006-2010 reported crash history.

Table 6-26: Reported Mid-Block Injury Crash Rate Summary – 2006 to 2010

Road	Section	2008 AADT	Length (km)	Speed Limit	Injury Crashes	Injury Crash Rate
Main South Rd	Park Lane to Robinsons Rd	18,270	4.7	100kph	15	9.6
Main South Rd	Robinsons Rd to Kirk Rd	19,220	2.8	100kph	6	6.1
Main South Rd	Kirk Rd to Halswell Jn Rd	21,500	2.9	70kph	10	8.8
Halswell Junction Rd	Main South Rd to Springs Rd	10,000	2.5	60kph	2	4.4

All crash rates are in injury crashes per 100 million vehicle kilometres.

Typical crash rates for mid-block sections are indicated in Appendix A6 of the NZTA EEM. For rural mid-block sections >80 km/h, on level terrain with a mean seal width of 10 m and carrying over 4,000 vehicles per day, the typical crash rate is 9.8 injury crashes per 100 million vehicle kilometres. This crash rate can be reduced by up to 25% if passing lanes are present. For urban arterial mid-block sections 50-70 km/h, carrying around 10,000 to 20,000 vehicles per day, the typical crash rate is around 11 – 12 injury crashes per 100 million vehicle kilometres, increasing to 13 – 15 in commercial/industrial areas.

The reported rate on the MSRFL section (Park Lane to Robinsons Road) is approximately 10-20% higher than typical, while the remaining section of Main South Road is lower than typical. Overall the 100 km/h section of the current route is slightly higher than what might be expected for a rural highway, given the presence of passing lanes south of Templeton and Weedons. The current crash rate on the Main South Road urban section to be bypassed by CSM2 is slightly lower than typical, whilst the rate on Halswell Junction Road is relatively low. However, as reported in the CSM1 Scheme Assessment Report "the section of Halswell Junction Road, between Springs Road and Main South Road, is likely to have a significant increase in accidents because of the increased traffic volume resulting from constructing CSM1 and its dual function of being a busy arterial and servicing the local industrial area with all of its associated side accesses."

6.7.4 Reported Crash History – Intersection Crashes

Of the 197 reported crashes along the Main South Road and Halswell Junction Road corridor, 114 crashes (58%) occurred within 50 metres of intersections. A summary of crashes at key intersections is tabulated below in **Table 6-27**. The criteria include all crashes coded as "I" in the NZTA crash database (89 crashes) and up to 50 m from the intersection (25 crashes).

Table 6-27: Intersection Crash History – 2006 to 2010

Intersection	Fatal/ Serious	Minor	Non-Injury	*Total*	Total Injury	Social Cost ($'000)	Predicted FSi
MSR/Weedons	-	2	7	*9*	2	78.5	1.0
MSR/Larcombs	-	3	1	*4*	3	74.9	0.2
MSR/Curraghs/Robinsons	-	-	3	*3*	-	7.4	0.0
MSR/Dawsons/Waterholes	2	5	4	*11*	7	1,960	2.7
MSR/Kirk/Trents	-	6	7	*13*	6	162	1.9
MSR/Barters/Marshs#	1	6	12	*19*	7	812	2.3
MSR/HJR	1	7	11	*19*	8	830	1.0
HJR/Shands*	1	4	2	*7*	5	903	1.0
HJR/Springs*	-	5	11	*16*	5	140	0.8

The form of this intersection is likely to change prior to the CSM2 and MSRFL opening.
* The form or configuration of these intersections are changing as part of the CSM1 extension.
Predicted FSi = Fatal and Serious Injury crashes

The Main South Road intersections with Dawsons Road/ Waterholes Road, Barters Road /Marshs Road and Halswell Junction Road have the highest social costs of the intersections. The social cost takes into account both the number and severity of crashes. In comparison with other intersections around Christchurch, the Dawsons Road/ Waterholes Road intersection is in the top 20 highest costs intersections in Christchurch.

Barters Road/ Marshs Road is currently a priority controlled crossroads intersection and is the subject of a separate NZTA Investigation and Reporting contract for an upgrade to traffic signals. Of the 19 crashes at Halswell Junction Road, 15 occurred when the intersection operated as a priority controlled crossroads. The junction was upgraded with traffic signals in 2009. The Dawsons Road/ Waterholes Road intersection is a priority controlled cross-roads. It will experience a reduction in crashes resulting from the significant decrease in traffic volumes when CSM2 is built. Similarly, there should be a reduction in the number of crashes at the Halswell Junction Road intersections at Shands Road and Springs Road.

Three of the intersections, Main South Road/ Dawsons Road/ Waterholes Road, Main South Road/ Kirk Road/ Trents Road and Main South Road/ Halswell Junction Road may be classified (due to a high predicted FSi) as high risk intersections (HRI), in terms of the criteria in the NZTA Draft High Risk Intersection Guide (HRIG). The installation of traffic signals at the Main South Road/ Halswell Junction Road has led to a reduction in injury crashes since the change, so it is no longer a HRI. With the predicted reduction in flows at the other two intersections following construction of the Project, they are also predicted to have reduced crash rates and no longer be classified as HRIs.

The objective of the HRIG is to reduce fatalities and serious injuries at New Zealand intersections. The term 'high risk intersection' takes into account both the consequences and likelihood of fatal and serious crashes occurring.

High risk intersections are intersections with a higher than normal risk that someone will die or be seriously injured in the future. It is important that high risk intersections are identified because they are where targeted safety improvements are most likely to prevent deaths and serious injuries.

This Project is consistent with this strategy by improving safety at such intersections. This supports the objective of the Ministry of Transport's 'Safer Journeys' Road Safety Strategy.

6.8 Access to Property

This section provides information on the current access arrangements for properties that have been identified as being directly affected by the Project.

6.8.1 Main South Road – Western Side

The number and location of property accesses on the western side of Main South Road is shown in **Table 6-28** below.

Table 6-28: Access to Property – Main South Road – Western Side

Location	Current Access	Number of Properties
Hoskyns Rd to Weedons Ross Rd	Main South Rd	3
	Via ROW to Weedons Ross Rd	1
Weedons Ross Rd	Weedons Ross Rd	2
Weedons Ross Rd to Curraghs Rd	Jones Rd	1
	Weedons Ross Rd	1
Curraghs Rd to Dawsons Rd	Main South Road	15
	Curraghs Rd	1
	Main South Rd	1
Dawsons Rd to Kirk Rd	Dawsons Rd	1

For most properties, access is directly off Main South Road. As Main South Road is a limited access road, these accesses are restricted to authorised crossing points only.

Direct property access onto Main South Road from a number of individual property accesses is likely to have a higher crash risk when compared with access to Main South Road from a standard side road intersection, due to:

- It being difficult for drivers on Main South Road to anticipate vehicles turning into or out of property accesses due to the low usage nature of most of these accesses and difficulty in identifying the access turning point, particularly as private property accesses are generally not "signposted" in advance;

- The 100 km/h operating speed on Main South Road, combined with the lack of acceleration or deceleration lanes, increases the collision risk between through traffic on the main road and vehicles turning into or out of property accesses;
- The high volume of traffic on Main South Road, which is forecast to keep increasing, create delays for vehicles turning onto Main South Road from property accesses, especially for right turns. This can lead to waiting drivers "accepting" insufficient gaps between vehicles to minimise their wait;
- Gravel and mud from unsealed property accesses can end up on the Main South Road carriageway and shoulders, increasing the potential loss of control risks (particularly for motorcyclists); and
- Slower moving agricultural vehicles need to use Main South Road to access some of the properties along its length, resulting in a significant vehicle speed differential, which may increase the crash risk.

6.8.2 Main South Road – Eastern Side

The number and location of property accesses on the eastern side of Main South Road is shown in **Table 6-29** below.

Table 6-29: Access to Property – Main South Road – Eastern Side

Location	Current Access	Number of Properties
Park Ln to Weedons Rd	Park Ln	1
	Main South Rd	3
	Weedons Rd	1
Weedons Rd	Weedons Rd	1
Weedons Rd to Larcombs Rd	Weedons Rd	2
	ROW off Paige Pl	2
	Larcombs Rd	1
Larcombs Rd to Berketts Rd	Larcombs Rd	1
	Main South Rd	2
	Berketts Rd	1
Berketts Rd to Robinsons Rd	Berketts Dr	1
	Main South Rd	6
Robinsons Rd to Waterholes Rd	Robinsons Rd	1
	Main South Rd	12
	Waterholes Rd	5
Waterholes Rd to Trents Rd	Waterholes Rd	1

With the increased number of intersecting side roads on this side of Main South Road, a smaller proportion of properties have direct access to Main South Road. Access to the remaining properties is via the side roads or Right of Ways to these side roads.

Similarly to the properties on the western side of Main South Road, there is a higher crash risk at the Main South Road access locations on the eastern side relative to accessing Main South Road via a side road intersection.

6.8.3 CSM2 Alignment

Table 6-30 below lists the number and location of property accesses affected by the CSM2 alignment (excluding those listed earlier in Sections 6.8.1 and 6.8.2 on Main South Road).

Table 6-30: Access to Property – CSM2 Alignment

Location	Current Access	Number of Properties
Waterholes Rd/ Hamptons Rd	Waterholes Rd	4
	Hamptons Rd	3
Trents Rd	Trents Rd	3
Blakes Rd	Blakes Rd	6
Shands Rd	Shands Rd	5
Marshs Rd	Marshs Rd	8
	Marshs Rd/ Sir James Wattie Dr	1
	Sir James Wattie Dr	2
Springs Rd	Springs Rd	8
John Paterson Dr	John Paterson Dr	8
Halswell Junction Rd	Halswell Junction Rd	5

7. Project Transportation Network Operation

7.1 Introduction

Similarly to the Baseline situation, the effects of the Project on the transport situation are assessed in this section. As reported in Section 4.2.2, the CPM model has been used to predict the operation of the road transport network with the Project operational, by adding the Project elements to the Baseline network.

7.2 Effects on Travel Patterns

The provision of any major new transport alternative, whether it is a new road, light rail service or increased bus service frequency, will produce a change in the travel patterns of the people in the areas serviced by these alternatives. Destinations which were previously considered to be "too hard" to get to may now be considered accessible due to improved travel times or additional mode choice.

For the Project, the main effect is on accessibility between the outlying areas southwest of Christchurch (such as Rolleston, Lincoln and Prebbleton) and the southern side of central Christchurch, including to the Port of Lyttelton. As will be shown in the following sections, there is a considerable reduction in the time taken to travel between these destinations, along with a reduction in the levels of congestion that would be experienced on these trips. These positive effects, combined with other factors, such as a higher standard road environment on the motorway, are expected to lead to an increase in car trips between areas served by the Project.

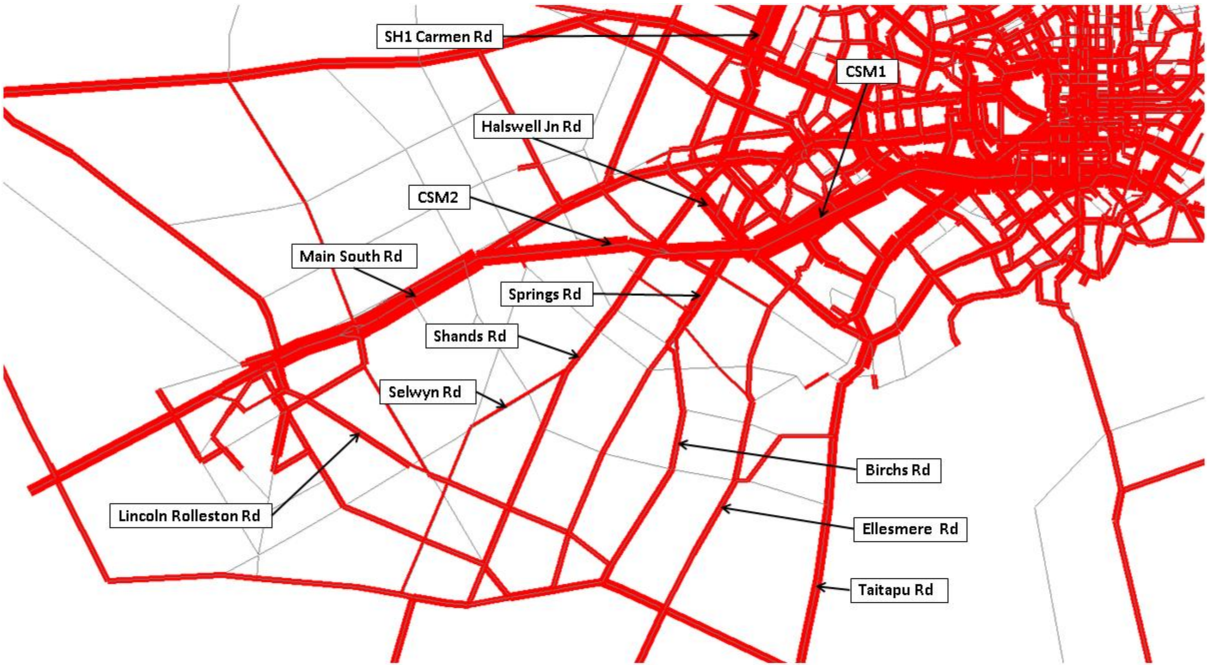
7.3 Effects on Road Network Performance

7.3.1 Daily Traffic volumes

As was done for the Baseline road network, ADT volumes for the Project are reported in this section for the three modelled future years. To allow for an appreciation of the expected changes in traffic volumes, Baseline ADT figures are also included. When comparing traffic volumes, it is again noted that different demand matrices have been used for the Baseline and Project assignments, so the number of vehicle trips travelling between locations served by the Project will be different (particularly between the south western and southern parts of Christchurch), although the total number of trips on the road network is virtually unchanged. The routing used will also change, as existing trips, as well as those trips changing their destination, use the new facility.

Figure 7-1 shows visually the all day traffic volumes on the CPM network with the Project included (similar to **Figure 6-1** for the Baseline network, and at the same scale). Again, the thicker the bars on the road network, the more vehicles are modelled as using those links on a daily basis.

Figure 7-1: Project Network Average Daily Traffic Volumes – 2041

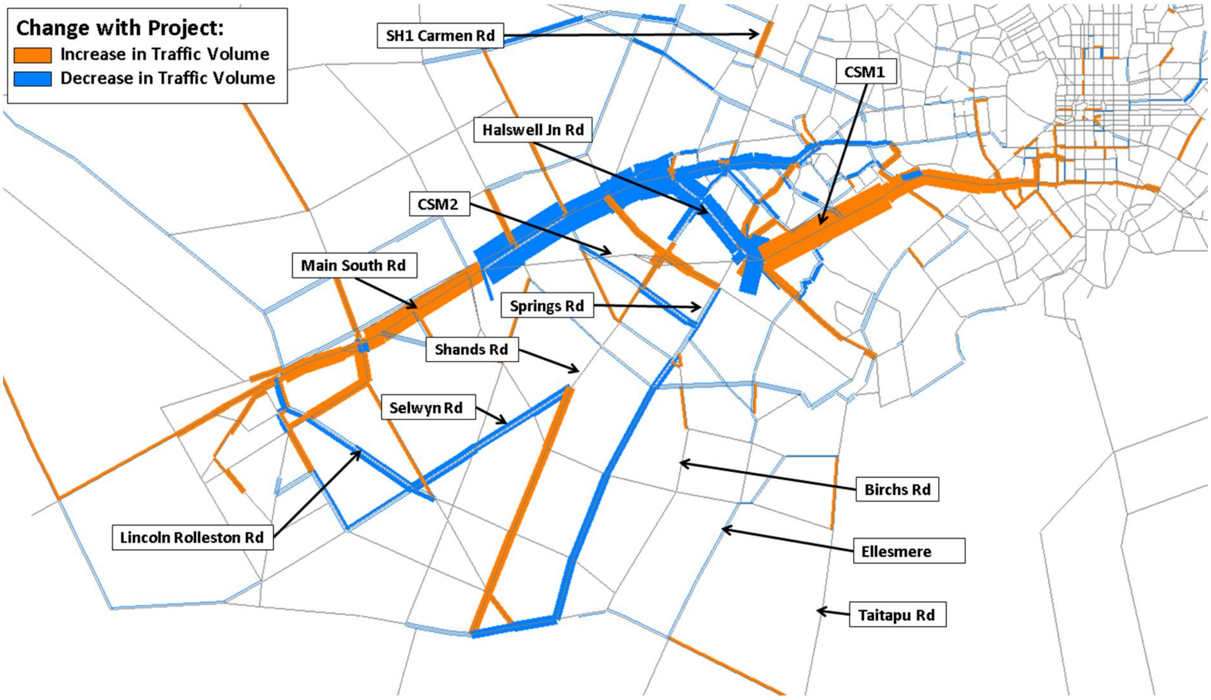


From **Figure 7-1**, it can be seen that the main routes for trips to and from the southwest area of Greater Christchurch and the southern side of central Christchurch city will be:

- Along the route of the RoNS Southern Corridor (comprising CSM1, CSM2 and MSRFL);
- Springs Road, Shands Road and Birchs Road on the Lincoln/Prebbleton corridor;
- Main South Road corridor from CSM2/ Main South Road interchange through to SH1 Carmen Road in Hornby;
- Ellesmere Road; and
- Taitapu Road.

Figure 7-2 shows the more significant differences in all day traffic volumes expected in 2041 with the Project completed. For clarity, traffic volumes on the CSM2 motorway links are not shown, as they would overwhelm the relative differences on other links within the network. Given the Baseline network does not include these links, they would have a zero volume.

Figure 7-2: Traffic Difference Plot – 2041 ADT (Project vs. Baseline)



Completion of the Project is expected to have the following effects on the route choices within the south-western area of Greater Christchurch:

- CSM2 between Halswell Junction Road and Main South Road will be used in preference to the Baseline routing of Halswell Junction Road and Main South Road;
- Traffic volumes on the bypassed section of the Southern Corridor, comprising Halswell Junction Road and Main South Road north of the CSM2 interchange have fallen, with a significant transfer of trips to CSM2.
- South of the CSM2/ Main South Road interchange, Main South Road will be used instead of the parallel alternative routes (Selwyn Road, Jones Road and Maddisons Road) as level of service improves and travel times decrease on Main South Road;
- Most trips between southern areas of Christchurch (including Hornby) and Rolleston will travel via Main South Road, rather than Selwyn Road and Shands Road;
- The new interchange on Shands Road will draw traffic from the parallel Springs Road routing, enabling access to the motorway without having to travel through the urban streets of Prebbleton or the Halswell Junction Road/ Springs Road roundabout;
- Marshs Road will see an increase in traffic volumes on both sides of the Shands Road interchange, as vehicles use it to access the motorway;
- Weedons Road and Levi Road are both expected to experience an increase in traffic volumes in both directions as vehicles use the Weedons interchange to access the eastern side of Rolleston.

7.3.2 RoNS Southern Corridor Route

Average Daily Traffic Volumes

Average daily traffic volumes have been calculated by the CPM for the forecast future years with the Project in place, and are shown in **Table 7-1** for the RoNS Southern Corridor. The Baseline ADT volumes, reported in the previous section, are also included for comparative purposes.

Table 7-1: Project and Baseline ADT Volumes – RoNS Southern Corridor

	Project			Baseline		
Road and Location	2016	2026	2041	2016	2026	2041
Brougham St: West of Selwyn St	47,750	50,750	54,500	46,500	49,500	51,500
CSM1: Between Barrington St & Curletts I/C	46,250	51,000	55,750	43,500	47,250	49,250
CSM1: Between Curletts I/C & Halswell Jn Rd	39,250	47,750	54,750	33,000	37,250	40,750
CSM2: Between Halswell Jn Rd & Shands I/C	19,750	27,250	32,750	N/A*	N/A*	N/A*
CSM2: Between Shands I/C & MSR	16,000	21,750	27,000	N/A*	N/A*	N/A*
[Halswell Jn Rd: West of Springs Rd]	20,750	24,250	28,000	29,750	34,250	37,750
[MSR: South of Halswell Jn Rd]	16,250	20,000	23,250	30,250	35,750	40,500
[MSR: South of Marshs Rd/ Barters Rd]	17,000	20,750	24,000	28,000	33,250	37,750
MSR: South of Robinsons Rd/ Curraghs Rd	26,750	36,250	45,750	25,000	31,000	36,750
MSR: South of Weedons Rd/ Weedons Ross Rd	27,000	34,000	40,750	24,750	30,500	35,250

Road locations enclosed in [] are bypassed by the Project.
* CSM2 between Halswell Junction Road and Main South Road does not exist in the Baseline model.

It is noted that predicted traffic volumes for 2016 with the Project in place are shown for comparative purposes only, as the earliest possible completion date for the Project is 2018.

At the northern end of CSM1, capacity constraints on Brougham Street (past Barrington Street) are expected to limit growth on this section of the Southern Corridor, with only an additional 3,000 vpd (5%) using Brougham Street.

On CSM1 through to Curletts Road, total traffic volumes are expected to increase more, rising by 6,500 vpd (10%). As can be deduced from the smaller increase on Brougham Street itself, the volume of traffic on Barrington Street also increases.

The completion of the extension of the Southern Motorway to Main South Road will lead to a significant increase in traffic between Curletts Road interchange and the current end of the motorway at Halswell Junction Road. Increases of up to 14,000 vpd are expected by 2041, with the majority of this traffic drawn from alternative routes.

With the Project allowing traffic travelling to and from the south to bypass Halswell Junction Road, traffic volumes will fall significantly, with a decrease of up to 10,000 vpd expected.

South of where CSM1 re-joins Main South Road at Halswell Junction Road, traffic volumes are expected to rise significantly, more than doubling by 2041. Again this is due to the increased capacity and more direct route provided by CSM1, as well as the growth forecast in the south west area (such as in Rolleston).

The Project will bypass the non-motorway standard roads at the end of CSM1, from Halswell Junction Road through to Main South Road at Robinsons Road. These roads (Halswell Junction Road and Main South Road from Halswell Junction Road through to Robinsons Road) have a lower speed limit and capacities, as well as at grade intersections which have higher delays, than the grade separated interchanges on the Project.

Link Level of Service

The worst link level of service values predicted with the Project in place are shown in **Table 7-2** for the same links as were reported for the Baseline.

Table 7-2: Project and Baseline Link Level of Service – RoNS Southern Corridor

	Project			Baseline		
Road and Location	2016	2026	2041	2016	2026	2041
Brougham St: West of Selwyn St	E	E	E	E	E	E
CSM1: Between Barrington St & Curletts I/C	D	D	E	D	D	D
CSM1: Between Curletts I/C & Halswell Jn Rd	C	D	D	C	C	C
CSM2: Between Halswell Jn Rd & Shands I/C	B	B	C	N/A*	N/A*	N/A*
CSM2: Between Shands I/C & MSR	A	B	B	N/A*	N/A*	N/A*
[Halswell Jn Rd: West of Springs Rd]	D	E	E	E	E	F
[MSR: South of Halswell Jn Rd]	E	E	E	E	F	F
[MSR: South of Marshs Rd/ Barters Rd]	E	E	F	F	F	F
MSR: South of Robinsons Rd/ Curraghs Rd	B	C	D	F	F	F
MSR: South of Weedons Rd/ Weedons Ross Rd	B	B	C	E	E	F
MSR: South of Park Ln	E	F	F	E	E	F

Road locations enclosed in [] are bypassed by the Project.
* CSM2 between Halswell Junction Road and Main South Road does not exist in the Baseline model.

These results indicate that capacity issues are still likely to be present at the northern end of the motorway, with the level of service on Brougham Street remaining at LoS E in each future year, the same as predicted without the Project. As previously reported in Section 6.3.1, the NZTA is intending to progress a full corridor study from the City end of CSM to the Port of Lyttelton to investigate options for maintaining the efficient operation of this strategic corridor. Pending the results of this corridor study, the NZTA will continue its normal policy of making incremental operational improvements.

Despite the forecast increase in daily traffic volumes, the predicted outcome is similar for CSM1 between Barrington Street and Curletts Road, which remains at LoS D except for 2041, when it is expected to fall to LoS E.

South of Curletts Road, the up to 35% increase in daily traffic volumes on CSM1 is expected to cause the level of service to only drop from LoS C to LoS D by 2026, remaining at this level of service through to 2041.

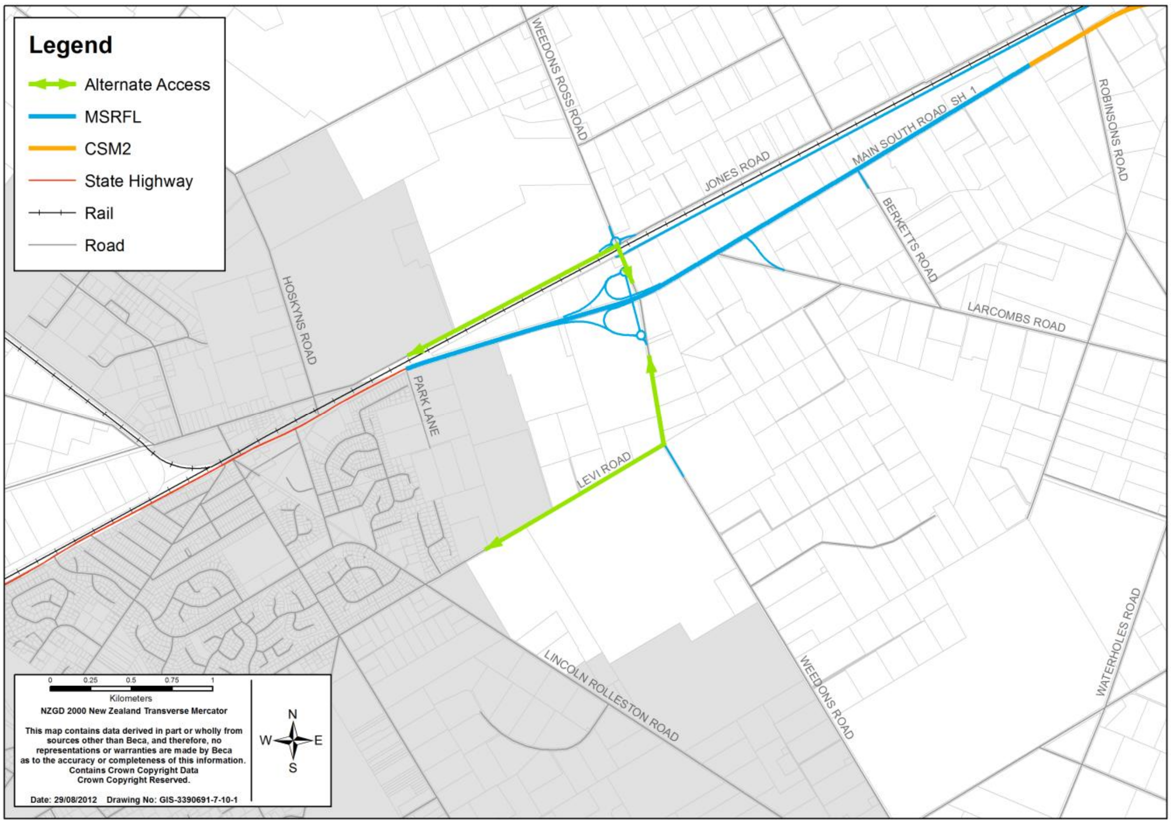
The direct route provided by CSM2 between Main South Road and CSM1 at Halswell Junction Road will allow a significant volume of traffic to bypass the section of Halswell Junction Road between Main South Road and CSM1. For 2016, it is expected that this would improve the level of service to LoS D compared to the LoS E for the Baseline. Even with the Southern Corridor traffic removed from Halswell Junction Road, the growth in both commercial and residential traffic to, from and through this area of Christchurch is still expected to lead to increases in the volume of traffic on this road. As such, the level of service is expected to fall both with and without the Project. Although the level of service for 2026 is the same in the Baseline as with the Project, the degree of congestion is lower, and by 2041 the level of service is expected to remain at LoS E with the Project, otherwise it would fall to LoS F.

The connection through to the southern edge of central Christchurch and the Port of Lyttelton is expected to generate more traffic on Main South Road south of the interchange with CSM2 in place than without. However, the extra capacity provided by the four laning of Main South Road means that the level of service through here will improve, even with the higher predicted traffic volumes.

Between Weedons interchange and Tennyson Street in Rolleston, the end of the four laning merges traffic back into a single lane in the southbound direction. With the additional traffic drawn to the widened Main South Road and CSM2 to or through Rolleston, the level of service through this merge is expected to be worse than for the Baseline case, with delays of up to two minutes forecast (although overall travel times on the Southern Corridor are predicted to be considerably faster than for the Baseline, even with this additional delay). Although the NZTA does not currently have any specific projects on its 10 year programme to improve this section of the State highway network, it has a strategy for improvements as outlined in the CRETS reports and will continue to monitor the performance of this part of the network. When this monitoring identifies the need for improvements, the adopted CRETS strategy improvements will be developed and implemented to resolve safety or congestion issues. These improvements involve the removal of the traffic signals on the Main South Road intersections with Hoskyns Road and Rolleston Drive, and provision of a grade separated connection between Rolleston and Jones Road.

Alternative routes bypassing this section of Main South Road to both the western and eastern sides of Rolleston are being delivered as part of this Project. These are via Weedons interchange to Jones Road and Levi Road respectively, and are shown in **Figure 7-3** below.

Figure 7-3: Alternative Access Routes from Weedons Interchange to Rolleston and the Izone



Road Travel Times

As was done with the Baseline, travel times for the same journeys have been extracted from the CPM for the three forecast future years with the Project in place.

Table 7-3 reports the travel times under the Baseline situation and after completion of the Project for the RoNS Southern Corridor, between the Main South Road/ Rolleston Drive intersection in Rolleston and the Brougham Street/ Selwyn Street intersection at the Christchurch end of the corridor. As reported earlier, the Baseline routing is Brougham Street, CSM1, Halswell Junction Road and Main South Road. Travel times with the Project in place bypass Halswell Junction Road by remaining on the CSM through to the widened Main South Road.

Table 7-3: Road Network Travel Times [Minutes] – Rolleston to Brougham Street

Year	Network	AM Peak Hour		Inter-peak		PM Peak Hour	
		To Chch	From Chch	To Chch	From Chch	To Chch	From Chch
2016	Baseline	20.7	17.7	17.7	17.4	19.7	21.9
	Project	14.2	13.5	13.5	13.4	14.0	14.2
	Saving	*6.6*	*4.2*	*4.2*	*4.0*	*5.7*	*7.7*
2026	Baseline	24.1	18.5	18.3	17.7	22.4	25.3
	Project	15.3	13.7	13.6	13.5	14.6	15.3
	Saving	*8.8*	*4.9*	*4.7*	*4.2*	*7.8*	*10.0*
2041	Baseline	28.0	20.7	19.2	18.5	25.8	29.5
	Project	17.0	14.0	13.8	13.7	15.7	17.7
	Savings	*11.0*	*6.7*	*5.4*	*4.8*	*10.1*	*11.8*

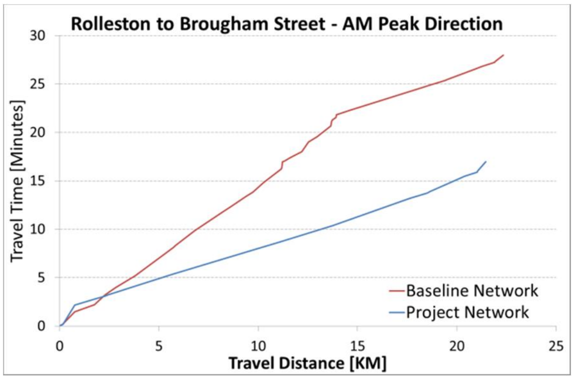
Route distance of 21.5 km with the Project and 22.3 km in the Baseline.

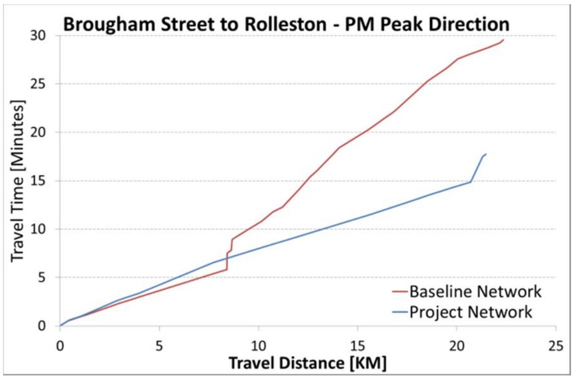
These travel times show that the completion of the Project is expected to produce immediate travel time savings on this route between Rolleston and the south side of Christchurch:

- Savings of seven minutes (30%) citybound in the AM peak hour and eight minutes (35%) Rolleston bound in the PM peak hour are expected in 2016, rising steadily to 11 (40%) and 12 (40%) minutes respectively by 2041;
- Slightly lower savings are expected in the non-peak directions, as well as during the inter-peak period;

Figure 7-4 shows time versus distance plots for the peak direction for the AM and PM peak hours, comparing the travel times on the Baseline network against those on the network with the Project in place. It is noted that without the Project, travel distances between these two locations are marginally longer (0.9 km), so the completion of the Southern Corridor will result in both significant time savings and a slightly shorter travel distance.

Figure 7-4: Time vs. Distance Plots of Road Network Travel Times between Rolleston and Brougham Street – 2041





Journey Time Reliability

Although not quantified in the journey time results in the preceding section, it is likely there will also be significant benefits in terms of the consistency of travel times for users of the extended motorway. The provision of two lanes in each direction along the full length of the Southern Corridor route virtually doubles the available capacity on the CSM2 and MSRFL sections of the Corridor. As such, the level of congestion will drop, as shown by the results in Table 7-2, which will produce more consistent travel times.

Travel time variability will also be reduced as the Southern Corridor with the provision of the grade separated interchanges along its length, removing the need to travel through a number of at-grade intersections, which will further reduce the variability of the travel times experienced.

7.3.3 Lincoln/ Prebbleton Corridor

Average Daily Traffic Volumes

Table 7-4 shows the forecast ADT volumes on the Lincoln/ Prebbleton corridor with and without the Project in place.

Table 7-4: Project and Baseline ADT Volumes – Lincoln/ Prebbleton Corridor

	Project			Baseline		
Road and Location	**2016**	**2026**	**2041**	**2016**	**2026**	**2041**
Springs Rd: North of Halswell Jn Rd	20,750	25,000	28,250	20,750	22,500	24,250
Springs Rd: North of Marshs Rd	17,250	20,500	23,000	18,500	21,250	23,250
Springs Rd: South of Marshs Rd (north side of Prebbleton)	15,250	16,500	18,750	17,250	17,750	20,000
Springs Rd: Between Blakes Rd & Tosswill Rd	12,250	13,250	16,250	14,500	15,250	17,750
Springs Rd: South of Trents Rd	2,500	2,500	2,500	4,750	4,750	5,000
Springs Rd: South of Robinsons Rd	2,750	3,000	3,250	5,000	5,250	5,500
Springs Rd: South of Boundary Rd	2,750	2,750	3,000	5,250	5,250	5,500
Shands Rd: North of Halswell Jn Rd	13,750	16,250	18,750	14,000	17,000	19,500
Shands Rd: North of Marshs Rd	6,500	11,000	14,750	7,000	10,750	13,250
Shands Rd: South of Marshs Rd	12,000	13,750	15,500	10,000	13,000	14,250
Shands Rd: South of Trents Rd	10,000	11,500	11,750	8,000	10,750	12,000
Shands Rd: South of Robinsons Rd	6,500	6,750	7,250	4,250	4,500	4,750
Birchs Rd: South of Boundary Rd	5,250	6,250	8,000	5,250	6,250	8,000

On the corridor connecting Lincoln and Prebbleton to Hornby and the rest of Christchurch, completion of the Project is expected to result in a transfer of traffic from Springs Road to Shands Road. This is likely to be a result of being able to access the motorway via the Shands Road interchange, rather than the Baseline situation of getting on or off the CSM1 section of the motorway from Springs Road.

Traffic volumes on Springs Road, the main road through Prebbleton, are expected to decrease slightly, due to the alternative access to the motorway provided by the Shands Road interchange. In Prebbleton itself, a 1,500 vpd (8%) drop in traffic is expected in the long term.

On Shands Road, the increase just north of Prebbleton (south of Marshs Road) is 1,250 vpd (9%). As Shands Road is of a similar standard to Springs Road, this transfer of vehicles is not expected to adversely impact the operation of Shands Road.

Link Level of Service

Table 7-5: Project and Baseline Link Level of Service – Lincoln/ Prebbleton Corridor

Road and Location	Project			Baseline		
	2016	2026	2041	2016	2026	2041
Springs Rd: North of Halswell Jn Rd	C	D	D	C	C	C
Springs Rd: North of Marshs Rd	E	E	E	E	E	E
Springs Rd: South of Marshs Rd (north side of Prebbleton)	E	E	E	E	E	E
Springs Rd: Between Blakes Rd & Tosswill Rd	C	C	D	C	D	D
Springs Rd: South of Trents Rd	D	D	D	E	E	E
Springs Rd: South of Robinsons Rd	D	D	D	E	E	E
Springs Rd: South of Boundary Rd	D	D	D	E	D	E
Shands Rd: North of Halswell Jn Rd	C	D	D	C	D	E
Shands Rd: North of Marshs Rd	A	C	D	B	D	D
Shands Rd: South of Marshs Rd	E	E	E	E	E	E
Shands Rd: South of Trents Rd	E	E	E	E	E	E
Shands Rd: South of Robinsons Rd	D	D	D	C	C	C
Birchs Rd: South of Boundary Rd	B	C	D	B	C	D

On the Lincoln/ Prebbleton corridor, the completion of the Project is expected to ease the level of congestion, although it is still predicted to be high on Springs Road north of Prebbleton (although an improvement over the Baseline situation).

The level of service on Shands Road is expected to be similar to the Baseline, even with more traffic using Shands Road due to the additional access to the motorway provided by the Shands Road interchange.

Road Travel Times

Table 7-6 compares the travel times on Springs Road between Lincoln and the intersection with Main South Road near Hornby between the Baseline network, and the network with the Project in place.

Table 7-6: Road Network Travel Times [Minutes] – Lincoln to Main South Road via Springs Road

Year	Network	AM Peak Hour		Inter-Peak		PM Peak Hour	
		To Chch	From Chch	To Chch	From Chch	To Chch	From Chch
2016	Baseline	13.0	12.7	12.4	12.4	13.6	13.5
	Project	12.7	12.5	12.3	12.3	12.7	13.0
	Saving	***0.3***	***0.3***	***0.1***	***0.1***	***0.9***	***0.5***
2026	Baseline	14.5	13.4	12.5	12.5	14.5	14.8
	Project	13.1	12.6	12.4	12.4	13.0	13.7
	Saving	***1.4***	***0.8***	***0.1***	***0.1***	***1.5***	***1.1***
2041	Baseline	17.4	13.6	12.8	12.7	15.7	18.5
	Project	14.6	12.8	12.5	12.5	13.4	15.2
	Savings	***2.8***	***0.8***	***0.2***	***0.2***	***2.3***	***3.4***

Route distance of 12.8 km.

These travel times show that the completion of the Project is expected to initially produce small travel time savings on this route between Lincoln and Hornby. As traffic volumes rise, travel time savings are expected to increase, until by 2041 savings of three minutes (16%) citybound in the AM peak hour and three minutes (18%) Lincoln bound in the PM peak hour are predicted by 2041.

The majority of these travel time savings come for reductions in the predicted delay at the Springs Road/ Halswell Junction Road roundabout.

In the non-peak directions, smaller travel time savings are expected, although they are not insignificant citybound in the PM peak hour.

7.3.4 Main South Road Corridor

Average Daily Traffic Volumes

Table 7-7 shows forecast ADT volumes on the Main South Road corridor with and without the Project in place.

Table 7-7: Project and Baseline ADT Volumes – Main South Road Corridor

	Project			Baseline		
Road and Location	**2016**	**2026**	**2041**	**2016**	**2026**	**2041**
MSR: South of SH1 Carmen Rd	16,750	19,000	21,000	19,250	22,250	25,500
MSR: North of Halswell Jn Rd	16,500	19,250	21,750	19,250	23,500	26,750
MSR: South of Halswell Jn Rd	16,250	20,000	23,250	30,250	35,750	40,500
MSR: South of Trents Rd/ Kirk Rd	12,000	15,000	19,000	25,250	30,750	35,750
MSR: South of Weedons Rd/ Weedons Ross Rd	27,000	34,000	40,750	24,750	30,500	35,250
MSR: Between Hoskyns Rd & Rolleston Dr	29,000	36,750	43,500	28,250	35,500	42,000
MSR: Between Rolleston Dr & Tennyson St	19,000	20,500	23,500	18,000	19,250	21,750
Waterloo Rd: South of SH1 Carmen Rd	7,000	7,500	7,500	7,250	7,500	8,000
Jones Rd: South of Kirk Rd (western side of Templeton)	2,000	2,000	2,500	2,250	2,750	4,000
Jones Rd: South of Weedons Ross Rd	1,000	1,000	1,500	1,000	1,500	2,000
Jones Rd: South of Hoskyns Rd	1,750	4,500	11,750	1,750	4,250	10,750
Selwyn Rd: Between Robinsons Rd & Shands Rd	6,000	6,000	6,500	6,000	7,750	9,000
Selwyn Rd: Between Weedons Rd & Waterholes Rd	4,250	4,250	4,750	4,750	6,500	7,750

With the Project in place, traffic volumes along Main South Road between Hornby and the CSM2 interchange are expected to drop. The decrease in traffic volumes is not as great as seen further south, as the earlier completion of CSM1 has already diverted traffic from this section.

On Main South Road between Halswell Junction Road and the CSM2 interchange, the drop in daily traffic volumes is significant, with traffic bypassing this section of Main South Road to remain on the motorway.

The parallel route to Main South Road provided by Waterloo Road and Jones Road sees a decrease in traffic volumes, as improved travel conditions on Main South Road attract traffic back on to that route.

Link Level of Service

Table 7-8: Project and Baseline Link Level of Service – Main South Road Corridor

	Project			Baseline		
Road and Location	2016	2026	2041	2016	2026	2041
MSR: South of SH1 Carmen Rd	B	B	B	B	C	C
MSR: North of Halswell Jn Rd	B	B	C	B	C	D
MSR: South of Halswell Jn Rd	B	C	C	E	E	F
MSR: South of Trents Rd/ Kirk Rd	C	C	D	E	E	E
MSR: South of Weedons/ Weedons Ross Rd	E	F	F	E	E	F
MSR: Between Hoskyns Rd & Rolleston Dr	C	D	D	C	C	D
MSR: Between Rolleston Dr & Tennyson St	D	D	E	C	D	D
Waterloo Rd: South of SH1 Carmen Rd	C	C	C	D	C	C
Jones Rd: South of Kirk Rd (western side of Templeton)	A	A	A	A	A	B
Jones Rd: South of Weedons Ross Rd	A	A	A	A	A	A
Jones Rd: South of Hoskyns Rd	A	A	C	A	A	C
Selwyn Rd: Between Robinsons & Shands Rd	D	D	D	D	E	E
Selwyn Rd: Between Weedons Rd & Waterholes Rd	D	D	D	D	E	E

North of the CSM2/ Main South Road interchange, the diversion of traffic to the Southern Corridor results in the same or an improved level of service on Main South Road from Hornby through to Halswell Junction Road.

South of Halswell Junction Road, the extension of the CSM provides a faster and more direct route through to the south, so a significant number of vehicles are expected to bypass this section of Main South Road entirely, staying on the motorway. Consequently, an improved level of service is expected on this section of Main South Road with the Project in place.

Through Templeton, with traffic volumes falling with the alternative routing provided by CSM2, an improved level of service is expected, although there is still likely to be a high volume of traffic accessing Templeton itself. Marshs Road also provides access to and from the Southern Corridor for Templeton residents.

On the widened section of Main South Road the level of service will improve significantly, which is the expected outcome of any widening scheme.

As noted for the RoNS Southern Corridor, between Weedons interchange and Tennyson Street in Rolleston, the end of the four laning merges traffic back into a single lane in the southbound direction. With the additional traffic drawn to the widened Main South Road and CSM2 to or through Rolleston, the level of service through this merge is expected to be worse than for the Baseline case.

Road Travel Times

Table 7-9 reports the Baseline travel times against those from the network with the Project in place, between the location of the CSM2/ Main South Road interchange and Hagley Park, travelling via Main South Road and Blenheim Road. This route provides an alternative routing to that of the Christchurch Southern Corridor for travel between the southern side of Christchurch and Rolleston.

Table 7-9: Road Network Travel Times [Minutes] – CSM2/ Main South Road Interchange Location to Hagley Park via Main South Road and Blenheim Road

Year	Network	AM Peak Hour		Inter-Peak		PM Peak Hour	
		To Chch	From Chch	To Chch	From Chch	To Chch	From Chch
2016	Baseline	19.6	17.4	17.1	16.7	19.6	22.7
	Project	18.1	17.3	16.9	16.7	18.8	21.0
	Saving	*1.6*	*0.0*	*0.2*	*0.0*	*0.9*	*1.7*
2026	Baseline	22.0	17.8	17.5	17.0	21.8	25.4
	Project	19.1	17.6	17.0	16.8	19.7	22.1
	Saving	*2.9*	*0.2*	*0.5*	*0.2*	*2.2*	*3.3*
2041	Baseline	23.7	19.1	18.0	17.5	24.4	29.3
	Project	20.0	18.1	17.2	17.0	21.1	24.3
	Savings	*3.8*	*1.0*	*0.8*	*0.4*	*3.3*	*4.9*

Route distance of 14.3 km.

These travel times show that the completion of the Project is expected to produce immediate travel time savings for vehicles travelling in the peak direction during the morning and afternoon peak hours. These travel time savings increase through to 2041, with vehicles travelling to Christchurch also benefiting in the PM peak hour.

In the inter-peak period, travel time savings are much lower, as the level of congestion is lower in this period.

7.3.5 Other Key Roads

Average Daily Traffic Volumes

Table 7-10 shows forecast ADT volumes on the other key roads likely to be affected by the Project.

Table 7-10: Project and Baseline ADT Volumes – Other Key Roads

	Project			Baseline		
Road and Location	2016	2026	2041	2016	2026	2041
Weedons Ross Rd: West of Jones Rd	750	750	1,750	750	750	1,000
Marshs Rd: West of Springs Rd	2,500	5,250	6,750	1,250	4,500	5,500
Marshs Rd: West of Shands Rd	3,000	3,500	4,000	750	1,250	2,000
Levi Rd: South of Weedons Rd	1,750	4,000	7,000	1,250	1,750	3,500
Curraghs Rd: West of Jones Rd	250	250	250	750	500	500
Hamptons Rd: West of Shands Rd	750	1,000	1,250	1,000	1,250	1,750
Dawsons Rd: West of Jones Rd	1,500	1,500	1,750	750	750	750
Waterholes Rd: East of Main South Rd	2,250	2,500	2,750	2,000	2,250	3,000
Kirk Rd: West of Jones Rd	9,000	10,000	10,750	8,500	9,250	9,750
Trents Rd: East of Main South Rd	750	750	1,000	1,000	1,250	2,000
Blakes Rd: East of Shands Rd	1,500	2,000	3,000	1,750	3,750	5,500

The improved access to and across Main South Road provided by the Weedons Road interchange is expected to lead to an increase in the volume of traffic on Weedons Ross Road between the interchange and Jones Road in 2041, thereby avoiding the delays associated with the Main South Road/ Hoskyns Road signalised intersections in later years. The increase in traffic flows occurs mainly in the PM peak hour.

The volume of traffic on Marshs Road is expected to increase along its length. The ability to access the motorway at the Shands Road interchange is behind this change, as traffic is drawn from Main South Road, as well as Springs Road (for traffic travelling southwards, which cannot use the Halswell Junction Road ramps to travel in that direction).

Blakes Road, which provides a connection between Springs Road and Shands Road on the north side of Prebbleton, is expected to see a decrease in daily traffic volumes. This is likely a consequence of some vehicles rerouting onto Marshs Road; for drivers heading towards Christchurch on the motorway, using Marshs Road to access the left turn slip lane on Shands Road is predicted to be faster than joining Shands Road via Blakes Road. In addition, the expected reduction in delays at the Halswell Junction Road/ Springs Road roundabout with the Project in place reduces the benefits for vehicles transferring from Springs Road to Shands Road via Blakes Road.

Levi Road, which provides the link between the Weedons interchange and the eastern side of Rolleston, is expected to see a significant increase in traffic volumes. In 2041, volumes with the Project in place are predicted to be twice those without the Project.

Link Level of Service

Table 7-11 reports the level of service for these other key roads in the south-western likely to be affected by the Project.

Table 7-11: Project and Baseline Link Level of Service – Other Key Roads

Road and Location	Project			Baseline		
	2016	2026	2041	2016	2026	2041
Weedons Ross Rd: West of Jones Rd	D	D	D	D	D	D
Marshs Rd: West of Springs Rd	D	E	E	D	E	E
Marshs Rd: West of Shands Rd	D	E	E	D	D	D
Levi Rd: South of Weedons Rd	D	E	E	D	D	E
Curraghs Rd: West of Jones Rd	A	A	A	B	B	B
Hamptons Rd: West of Shands Rd	D	D	D	D	D	D
Dawsons Rd: West of Jones Rd	D	D	D	D	D	D
Waterholes Rd: East of Main South Rd	D	D	D	D	D	D
Kirk Rd: West of Jones Rd	B	B	B	B	B	B
Trents Rd: East of Main South Rd	D	D	D	D	D	D
Weedons Ross Rd: West of Jones Rd	D	D	D	D	D	D
Blakes Rd: East of Shands Rd	D	D	D	D	E	E

The increased volume of traffic using Marshs Road leads it to operate at LoS E by 2026 on both sides of Shands Road. This level of service is unchanged west of Springs Road, but on the section between Main South Road and Shands Road it is slightly worse than the LoS D expected in the Baseline. This apparently poor level of service is unlikely to seriously affect the operation of Marshs Road, as it has been assessed using the Rural Highway criteria (see **Appendix D** for further explanation of the different road types and level of service criteria) which produces significantly lower level of service results than the Urban Road criteria.

Levi Road is also expected to reach LoS E by 2026 with the Project, compared to reaching LoS E by 2041 in the Baseline. Again this is not expected to signify that Levi Road operates poorly, rather that there are limited passing opportunities so vehicles have to travel at the same speed as the vehicles in front, rather than being able to choose their own preferred speed.

The decreased volume of traffic using Blakes Road leads it to operate at LoS D with the Project, compared to reaching LoS E by 2026 in the Baseline.

All other roads are generally unchanged with the Project, and all are expected to operate satisfactorily.

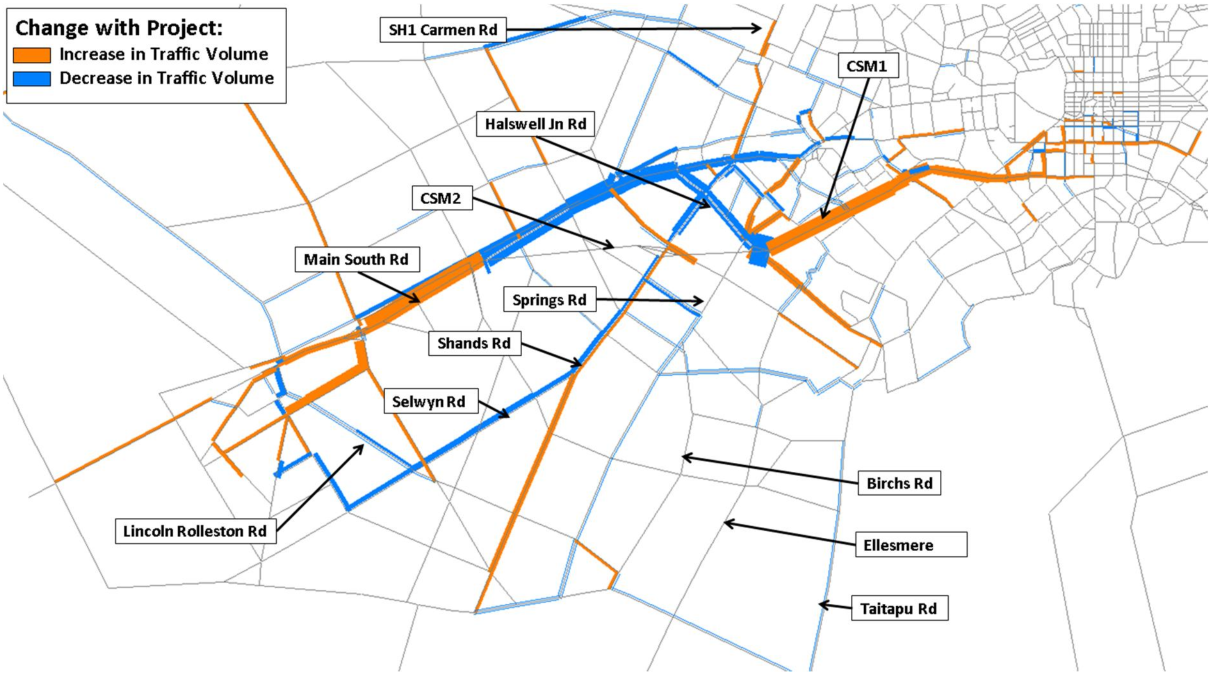
7.3.6 Period Traffic volumes

As mentioned earlier, the variable demand matrix approach used for the modelling produces two different demand matrices – one for the Baseline network and another for the Project network. Consequently, the differences shown will represent both rerouting effects (existing trips changing their route to take advantage of an improved level of service and reduced travel time) and induced trips (which may be new vehicular trips or existing trips that change destination as a result of the improved accessibility provided by the Project).

AM Peak Hour

Figure 7-5 shows the difference in forecast traffic volumes between the Baseline and Project networks for the 2041 AM peak hour. The blue lines in this bandwidth plot represent an increase in traffic volumes on road links with the Project included in the network, whilst the orange lines represent a decrease. For clarity, traffic volumes on the CSM2 motorway links are not shown, as they would overwhelm the relative differences on other links within the network.

Figure 7-5: Assigned Traffic Difference Plot – 2041 AM Peak Hour



There is a significant shift on the RoNS Southern Corridor between the end of the CSM1 motorway section and the CSM2/ Main South Road interchange. This is evident from the decrease in traffic volumes on Main South Road from the interchange through to, and then down, Halswell Junction Road. Traffic also reroutes from the northern end of Shands Road to use the motorway to access Christchurch via Curletts Road or Barrington Street.

At the southern (Rolleston) end of the corridor, drivers reroute from Selwyn Road (and then on to Shands Road) onto Main South Road to take advantage of the increased capacity, which provides an improved level of service and decreased travel times heading towards Christchurch. There is also an increase in the volume of traffic on Levi Road and Weedons Road, as vehicles use this route to access Main South Road via the Weedons interchange, thereby avoiding delays at the Main South Road/ Rolleston Drive intersection.

Induced traffic effects also lead to a larger increase in trips towards Christchurch than in the opposite direction, as the decrease in travel costs is greater towards Christchurch. This is consistent with what is expected from induced traffic, with more car trips taking advantage of the improvement in road conditions towards Christchurch.

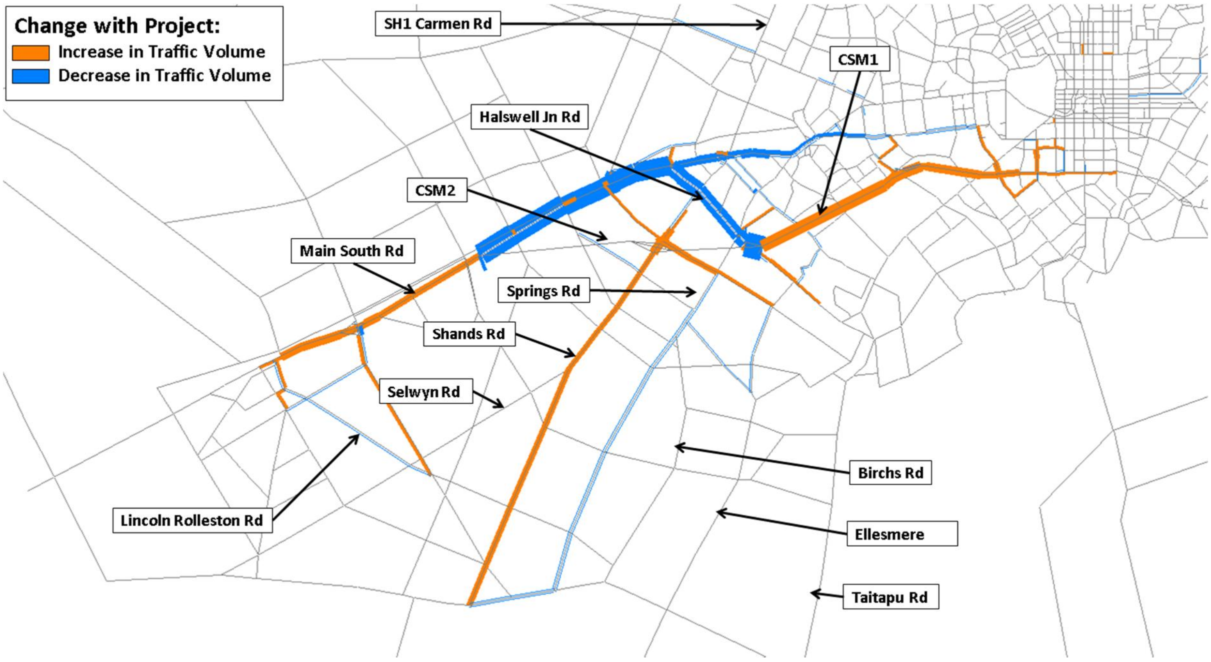
North of the CSM2/ Main South Road interchange, traffic volumes on Main South Road are also expected to be lower, as drivers take advantage of the faster travel on the motorway relative to that prevailing on Main South Road through to Blenheim Road.

Through Prebbleton, traffic volumes are expected to fall slightly, with a shift onto Shands Road.

Inter-Peak Period

Figure 7-6 shows the expected difference in forecast traffic volumes between the Baseline and Project networks for an average hour in the 2041 Inter-Peak period.

Figure 7-6: Assigned Traffic Difference Plot – 2041 Average Hour during Inter-Peak Period



During the Inter-peak period, there is an increase in traffic on CSM1 (shown by the blue banding), with a drop on the bypassed sections of Halswell Junction Road and Main South Road. At the southern end of CSM2, more traffic is forecast to use Main South Road, as the improved access to Christchurch induces drivers to travel to alternative destinations.

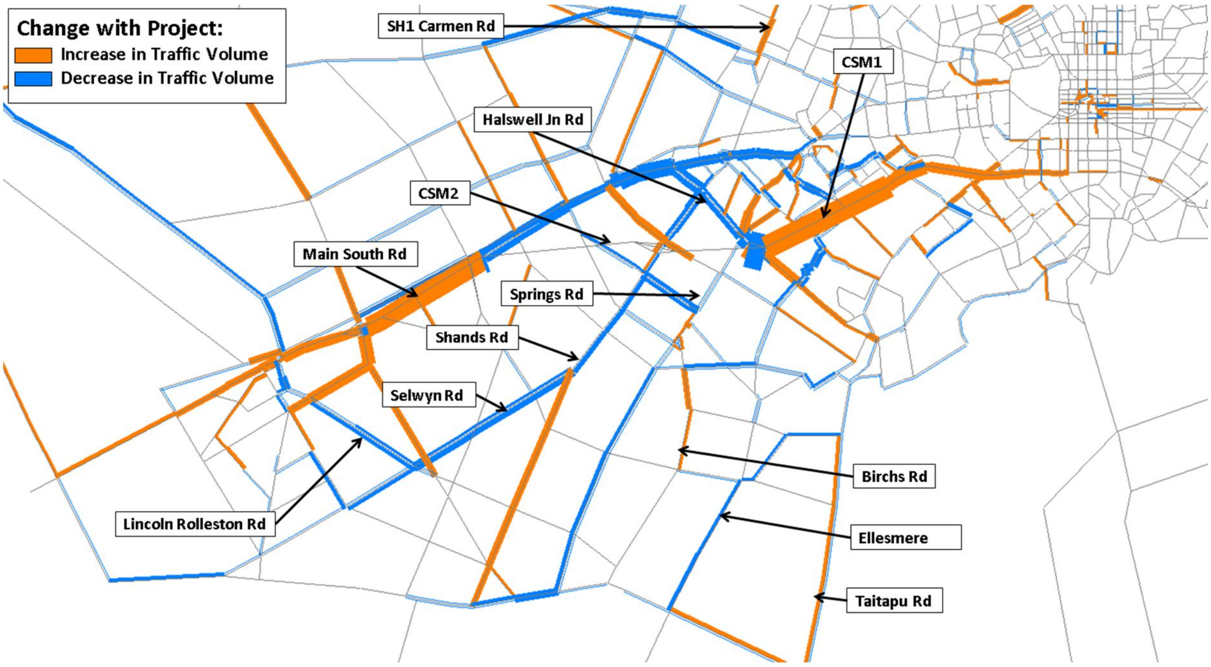
There is also a transfer of vehicles from Springs Road to Shands Road, accessing the motorway at Shands Road interchange. The provision of motorway access at Shands Road diverts this traffic from Springs Road, which was used previously to get to the motorway (CSM1) from Halswell Junction Road.

Also evident is more traffic in the vicinity of the Shands Road interchange, using the new interchange to get on and off the extended motorway.

PM Peak Hour

Similarly to the network diagrams above, **Figure 7-7** shows the difference in forecast traffic volumes between the Baseline and Project networks for the 2041 PM peak hour.

Figure 7-7: Assigned Traffic Difference Plot – 2041 PM Peak Hour



North of the CSM2/ Main South Road Interchange there is a large drop in traffic volumes on Main South Road and Halswell Junction Road, as vehicles reroute onto CSM2. This reflects the attractiveness of the CSM2, which provides a faster and shorter route and increased capacity from Brougham Street.

There is an increase in traffic volumes on Marshs Road and Shands Road, so as to access the CSM2 via the Shands Road Interchange.

The reduction in congestion at the Halswell Junction Road/ Springs Road roundabout, combined with the new access to the motorway provided by the Shands Road Interchange, results in a drop in traffic using Blakes Road to travel between Springs Road and Shands Road.

At the Rolleston end of the Southern Corridor, traffic volumes increase in both directions on Main South Road, as vehicles reroute from the alternative parallel routes (Jones Road and Selwyn Road) to take advantage of the improved travel times resulting from the increase in capacity from the widening. The interchange at Weedons Road also allows an increased number of vehicles to use Weedons Road and Levi Road to get to and from the eastern side of Rolleston.

Springs Road also sees a small drop in traffic volumes between Halswell Junction Road and Prebbleton.

7.4 Effects on Intersection Performance

The proposed intersections forming the connections between the Project and the local road network have been assessed using the SIDRA modelling package. Summary level of service results of this modelling are reported in this section, with the full SIDRA outputs for all years included in **Appendix E**.

7.4.1 CSM Westbound Off-Ramp/ Halswell Junction Road/ John Paterson Drive Roundabout

The roundabout on Halswell Junction Road at the terminus of the CSM westbound Off-Ramp has been modelled in SIDRA, with summary results in **Table 7-12**.

Table 7-12: CSM Westbound Off-Ramp/ Halswell Junction Road/ John Paterson Drive Roundabout Level of Service

Approach	AM Peak Hour			Inter-Peak			PM Peak Hour		
	2016	2026	2041	2016	2026	2041	2016	2026	2041
Halswell Junction Rd – East	A	B	C	A	A	A	C	E	D
CSM Off-Ramp – North	B	B	B	B	B	B	B	E	F
Halswell Junction Rd – West	A	A	A	A	A	A	A	A	A
John Paterson Dr – South	B	B	C	A	B	B	C	C	C
Overall	**A**	**B**	**B**	**A**	**A**	**A**	**B**	**D**	**E**

Table 7-12 shows that the roundabout is expected to perform satisfactorily in the AM peak hour and inter-peak period for all years, with an overall level of service no worse than LoS B, and no approach being worse than LoS C.

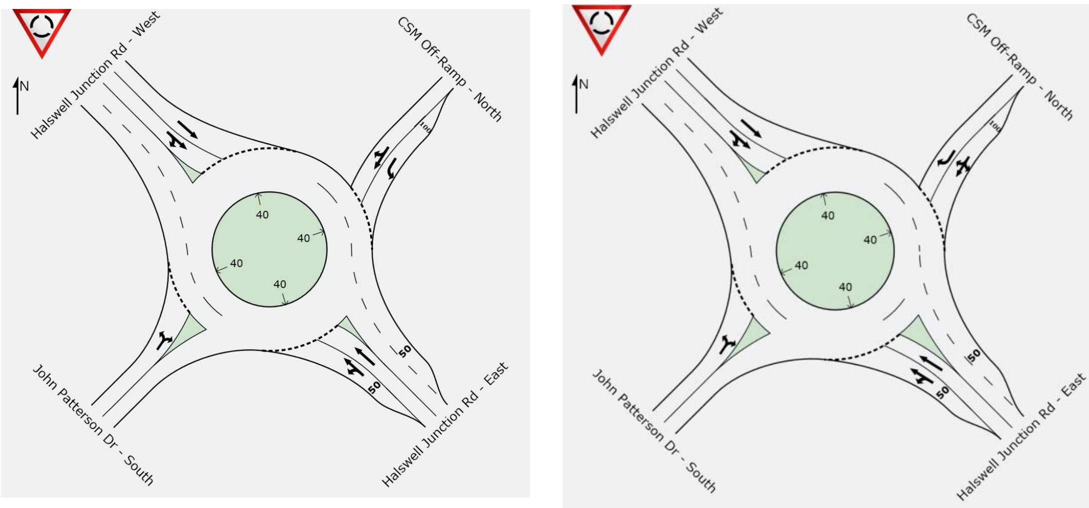
In the PM peak hour, the performance is initially satisfactory, but the overall level of service declines with the increasing traffic volumes forecast for later years. In particular, with an increasing volume of traffic turning right from the CSM off-ramp, this approach is expected to deteriorate to LoS E by 2026, falling to LoS F by 2041.

Two changes to the operation of the roundabout have been tested to improve its operation:

1. Traffic signals can be installed on the Halswell Junction Road western approach to meter the arrival of vehicles at the roundabout. This movement has priority over the CSM off-ramp traffic, so in normal operation the CSM off-ramp traffic has to give way to the vehicles on the roundabout travelling eastbound on Halswell Junction Road. With the signals in place, vehicles on the Halswell Junction Road western approach are held back from the stopline, allowing the CSM off-ramp traffic onto the roundabout with a significant decrease in delay.

2. The current roundabout layout has only a single lane for right turning traffic from the CSM off-ramp, as shown in **Figure 7-8**. Without changing the physical layout of the off-ramp or roundabout, the road markings could be changed to allow right turns from both lanes on the CSM off-ramp. This would significantly improve the overall performance of the roundabout, with an overall LoS B for the 2041 PM peak hour and the CSM off-ramp improving to LoS B. The downside to this layout is that there is a potential conflict between vehicles turning right into John Paterson Drive from the western approach of Halswell Junction Road and right turning vehicles in the outside lane from the CSM off-ramp.

Figure 7-8: Alternative Layouts for CSM Off-Ramp/ Halswell Junction Road Roundabout



7.4.2 Halswell Junction Road/ Springs Road Roundabout

The Halswell Junction Road/ Springs Road roundabout is physically unchanged from that being currently built as part of CSM1. Under the preferred option, lane markings are changed on the Halswell Junction Road southeast and Springs Road southwest approaches. A summary of the expected level of service results are shown in **Table 7-13**.

Table 7-13: Halswell Junction Road/ Springs Road Roundabout Level of Service

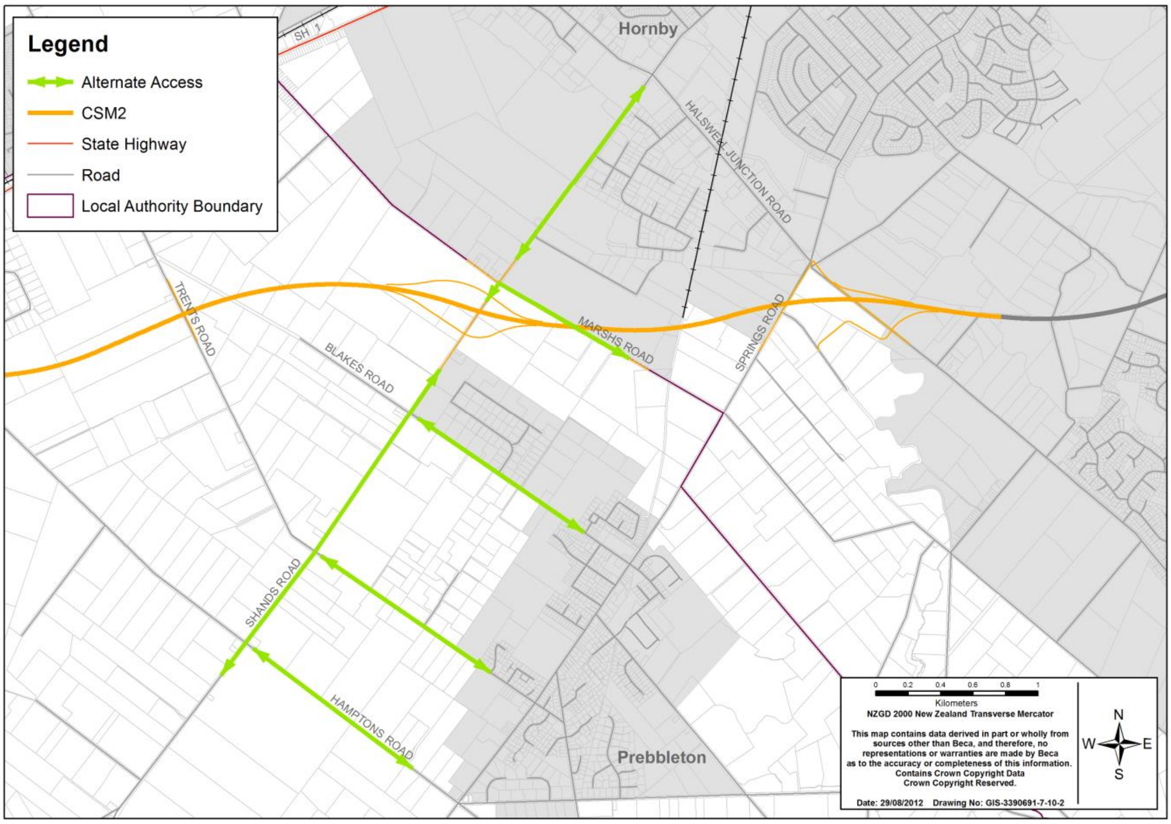
	AM Peak Hour			Inter-Peak			PM Peak Hour		
Approach	2016	2026	2041	2016	2026	2041	2016	2026	2041
Halswell Junction Rd SE	A	A	B	A	A	A	A	B	B
Springs Rd N	B	B	C	A	A	B	B	E	E
Halswell Junction Rd NW	A	B	D	A	A	A	B	F	F
Springs Rd SW	B	C	F	A	A	B	B	C	C
Overall	**A**	**B**	**E**	**A**	**A**	**A**	**B**	**E**	**F**

Table 7-13 shows that the Halswell Junction Road/ Springs Road roundabout is expected to operate satisfactorily initially, but by 2026, increasing levels of delay are predicted for the PM peak hour, especially on the Halswell Junction Road north-western approach. By 2041, operation in the PM is expected to worsen slightly, whilst in the AM peak hour significant delays are expected on the southwest approach from Springs Road.

An investigation into potential improvements for this intersection has been undertaken, but the preliminary results indicate that it is not possible to improve performance without making it significantly larger and more complex. The requirement for traffic to be able to u-turn from the

Halswell Junction Road southeast approach so as to access the eastbound on-ramp limits the options available. However, it is noted that the Shands Road interchange is located less than 3 km away, providing an alternative access point for drivers wanting to avoid these potential delays (see **Figure 7-9**).

Figure 7-9: Alternative Access Routes to Motorway via Shands Road Interchange



It is noted that the original concept for this section of the Southern Corridor restricted access to the Halswell Junction Road ramps to commercial vehicles only. Under this option, traffic volumes at the Halswell Junction Road/ Springs Road roundabout are considerably reduced, with a corresponding improvement in its performance. The option of restricting access to commercial vehicles was changed to allow access for all vehicles after concerns were expressed during the safety audit. In addition, during consultation some residents of Prebbleton expressed a preference for access to be retained.

It is recommended that the NZTA undertakes ongoing monitoring of the performance of this intersection, including crashes, travel time delay and queue lengths. If this monitoring indicates that the operation of this intersection is becoming unsatisfactory, the NZTA will work with Christchurch City Council through the UDS Transportation Group to improve its operation.

7.4.3 Halswell Junction Road/ Shands Road Signalised Intersection

With the completion of the Project, the expected pattern of traffic movements through this intersection change. The volume of traffic on Shands Road increases, as it provides access to and from CSM2 via the Shands Road interchange, whilst the extension of the motorway diverts vehicles from Halswell Junction Road.

Table 7-14 shows the expected performance of the Halswell Junction Road/ Shands Road signalised intersection.

Table 7-14: Halswell Junction Road/ Shands Road Signalised Intersection Level of Service

Approach	AM Peak Hour			Inter-Peak			PM Peak Hour		
	2016	2026	2041	2016	2026	2041	2016	2026	2041
Shands Rd - South	B	C	C	C	C	C	D	D	D
Halswell Junction Rd – East	D	D	D	C	C	D	D	E	E
Shands Rd – North	C	C	C	B	C	C	C	C	D
Halswell Junction Rd – West	C	C	C	C	C	C	E	E	F
Overall	**C**	**C**	**C**	**C**	**C**	**C**	**D**	**D**	**E**

These results show that the operation of this intersection is expected to improve with the Project. Traffic volumes on Halswell Junction Road are expected to decrease, as through traffic reroutes onto CSM2. As a result, in 2041 the intersection is expected to operate at LoS C in the AM peak hour, compared with LoS E in the Baseline (see **Table 6-14**). In the PM peak hour, the expected performance is LoS E (compared to LoS F in the Baseline), with only the Halswell Junction Road western approach being LoS F (compared to all approaches being at LoS F in the Baseline). In the PM peak hour of 2026, the intersection is predicted to operate at LoS D compared to the LoS F for the Baseline.

7.4.4 Main South Road/ Halswell Junction Road Signalised Intersection

Table 7-15 shows the expected level of service of the Main South Road/ Halswell Junction Road signalised intersection after completion of the Project.

Table 7-15: Main South Road/ Halswell Junction Road Signalised Intersection Level of Service

Approach	AM Peak Hour			Inter-Peak			PM Peak Hour		
	2016	2026	2041	2016	2026	2041	2016	2026	2041
Halswell Junction Rd – East	B	B	B	B	B	B	B	B	C
Main South Rd – North	B	B	B	B	B	B	B	B	C
Halswell Junction Rd – West	C	C	C	B	B	C	C	C	C
Main South Rd – South	B	B	B	B	B	B	B	B	C
Overall	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**C**

From **Table 7-15** it can be seen that the Main South Road/ Halswell Junction Road signalised intersection is expected to operate satisfactorily in all years and for all time periods. This is a slight improvement over the Baseline situation, as shown in **Table 6-15**. This is due to a reduction in traffic volumes through this intersection with this Project completing the extension of the Southern Corridor.

7.4.5 Main South Road/ Kirk Road/ Trents Road Priority Intersection

Level of service results for the Main South Road/ Kirk Road/ Trents Road intersection are shown in **Table 7-16**.

Table 7-16: Main South Road/ Kirk Road/ Trents Road Priority Intersection Level of Service

Approach	AM Peak Hour			Inter-Peak			PM Peak Hour		
	2016	2026	2041	2016	2026	2041	2016	2026	2041
Trents Rd – East	D	F	F	C	C	D	F	F	F
Main South Rd – North	B	B	C	A	A	B	B	B	C
Kirk Rd – West	F	F	F	D	F	F	F	F	F
Main South Rd – South	A	A	B	A	A	A	B	B	C

These results show that this intersection, serving as the main access point from Main South Road into Templeton, is expected to perform better than in the Baseline (see **Table 6-16**), although there are still expected to be significant delays for traffic on the two minor arms of Kirk Road and Trents Road. However, the deterioration of the Trents Road approach to LoS F is expected to occur after 2016 in the AM peak hour, whilst this approach is expected to be no worse than LoS D in the interpeak period (compared with LoS F for all years in the Baseline).

Delays for right turning traffic on Main South Road are also predicted to be considerably lower than in the Baseline.

Overall, the rerouting of traffic away from Main South Road onto the Project will decrease delays at this intersection.

7.4.6 Main South Road/ Waterholes Road/ Dawsons Road Roundabout

The roundabout proposed for the Main South Road/ Waterholes Road/ Dawsons Road roundabout has been modelled in SIDRA, with summary level of service results shown in **Table 7-17**.

Table 7-17: Main South Road/ Waterholes Road/ Dawsons Road Roundabout Level of Service

Approach	AM Peak Hour			Inter-Peak			PM Peak Hour		
	2016	2026	2041	2016	2026	2041	2016	2026	2041
Waterholes Rd – East	B	B	B	B	B	B	B	B	B
Main South Rd – North	B	B	B	B	B	B	B	B	B
Dawsons Rd – West	B	B	B	B	B	B	B	B	B
Main South Rd – South	B	B	B	B	B	B	B	B	B
Overall	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**

As can be seen, the Main South Road/ Waterholes Road/ Dawsons Road roundabout is expected to operate satisfactorily in all time periods and years for all approaches. Most of the delay is associated with the additional time to negotiate the geometry of the roundabout, compared to the current crossroads, rather than waiting for an acceptable gap in the circulating traffic stream.

This performance represents a significant improvement over the expected operation of the intersection in the Baseline, as shown in **Table 6-17**.

7.4.7 Weedons Interchange – Northern Ramps Roundabout

The proposed form of roundabout on Weedons Ross Road at the terminus of the Main South Road eastbound off- and on- ramps has been modelled in SIDRA, with summary results in **Table 7-18**.

Table 7-18: Weedons Interchange Northern Roundabout Level of Service

	AM Peak Hour			Inter-Peak			PM Peak Hour		
Approach	2016	2026	2041	2016	2026	2041	2016	2026	2041
Weedons Ross Rd – East	A	A	A	A	A	A	A	A	A
Diggalink – North	A	A	A	A	A	A	A	A	A
Weedons Ross Rd – West	A	A	A	A	A	A	A	A	A
Main South Rd Ramps – South	A	A	A	A	A	A	A	A	A
Overall	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**

As shown in **Table 7-18**, every approach to the Weedons Interchange Northern Ramps roundabout is predicted to operate at LoS A in all time periods and all years out to 2041.

7.4.8 Weedons Interchange – Southern Ramps Roundabout

The proposed form of roundabout on Weedons Ross Road at the terminus of the Main South Road westbound off- and on- ramps has been modelled in SIDRA, with summary results in **Table 7-19**.

Table 7-19: Weedons Interchange Southern Roundabout Level of Service

	AM Peak Hour			Inter-Peak			PM Peak Hour		
Approach	2016	2026	2041	2016	2026	2041	2016	2026	2041
Weedons Rd – East	A	A	A	A	A	A	A	A	A
Weedons Rd – West	A	A	A	A	A	A	A	B	A
Main South Rd Ramps – South	A	B	B	A	A	B	B	B	B
Overall	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**B**	**B**

Table 7-19 shows that none of the approaches to the Weedons Interchange Southern Ramps roundabout are predicted to operate at worse than LoS B in any period through to 2041, and the overall intersection performance is expected to be LoS A, except for the PM peak hour when it declines to LoS B in 2026 and 2041.

7.4.9 Weedons Ross Road/ Jones Road Roundabout

The proposed form of roundabout at the intersection of Weedons Ross Road and Jones Road has been modelled in SIDRA, with summary results in **Table 7-20**.

Table 7-20: Weedons Ross Road/ Jones Road Roundabout Level of Service

	AM Peak Hour			Inter-Peak			PM Peak Hour		
Approach	**2016**	**2026**	**2041**	**2016**	**2026**	**2041**	**2016**	**2026**	**2041**
Weedons Ross Rd – West	A	A	A	A	A	A	A	A	A
Jones Rd – North	A	A	B	A	A	A	A	A	B
Weedons Ross Rd – East	A	A	A	A	A	A	A	A	A
Jones Rd – South	A	A	B	A	A	A	A	B	B
Overall	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**

As shown in **Table 7-20**, the roundabout is expected to operate well in all periods and all years out to 2041, with all approaches operating at LoS B or better.

7.4.10 Weedons Road/ Levi Road Priority Intersection

The realigned intersection of Weedons Road and Levi Road has been modelled in SIDRA, with summary results in **Table 7-21**. Full outputs from SIDRA are shown in **Appendix E**.

Table 7-21: Weedons Road/ Levi Road T-Intersection Level of Service

	AM Peak Hour			Inter-Peak			PM Peak Hour		
Approach	**2016**	**2026**	**2041**	**2016**	**2026**	**2041**	**2016**	**2026**	**2041**
Weedons Rd – East	B	B	C	B	B	B	B	C	D
Weedons Rd – West*	-	-	-	-	-	-	-	-	-
Levi Rd – South*	B	B	B	B	B	B	B	B	C

* On the major approaches, only delay associated with right turning movements are reported – there is no delay to the through traffic between Weedons Road west and Levi Road.

It is noted again that the level of service results shown in **Table 7-21** do not include the through movements from Weedons Road north to and from Levi Road, which have no delay.

As shown in **Table 7-21**, the modelling indicates that the minor approach to the intersection will operate satisfactorily in all periods and years, with the worst movement being LoS D for the minor approach from Weedons Road south in the PM peak hour in 2041. This is slightly worse than the performance of the existing intersection, shown in **Table 6-20**, where the poorest level of service was LoS B.

7.4.11 Main South Road/ Hoskyns Road Signalised Intersection

The current form of the Main South Road/ Hoskyns Road signalised intersection has been modelled in SIDRA, as no change to this intersection is proposed as part of the Project. Summary results are shown in **Table 7-22**.

Table 7-22: Main South Road/ Hoskyns Road Signalised Intersection Level of Service

	AM Peak Hour			Inter-Peak			PM Peak Hour		
Approach	**2016**	**2026**	**2041**	**2016**	**2026**	**2041**	**2016**	**2026**	**2041**
Main South Rd – North	A	C	B	A	A	B	A	A	C
Hoskyns Rd – West	D	D	E	D	C	D	D	D	D
Main South Rd – South	A	B	B	A	A	B	A	B	C
Overall	**A**	**C**	**C**	**A**	**B**	**C**	**B**	**B**	**C**

The SIDRA modelling indicates that the intersection is expected to operate satisfactorily through to 2041. In the AM peak hour of 2041, the increasing traffic volumes on Main South Road leads to less time being given to the Hoskyns Road approach, with the level of service on this approach dropping to E, although overall the intersection operates satisfactorily at LoS C.

Performance in the PM peak hour is an improvement over that expected under the Baseline traffic volumes, as the volume of traffic on Hoskyns Road decreases due to the improved access across Main South Road provided by the Weedons Road overbridge.

7.4.12 Main South Road/ Rolleston Drive Signalised Intersection

The current layout of the Main South Road/ Rolleston Drive intersection has been modelled in SIDRA, as no change to this intersection is proposed as part of this Project. Summary level of service results are shown in **Table 7-23**.

Table 7-23: Main South Road/ Rolleston Drive Signalised Intersection Level of Service

	AM Peak Hour			Inter-Peak			PM Peak Hour		
Approach	**2016**	**2026**	**2041**	**2016**	**2026**	**2041**	**2016**	**2026**	**2041**
Rolleston Dr – East	D	E	F	C	C	D	D	E	F
Main South Rd – North	C	D	F	B	B	B	B	C	D
Main South Rd – South	B	C	C	A	B	B	A	B	B
Overall	**C**	**D**	**F**	**B**	**B**	**C**	**B**	**C**	**D**

The SIDRA modelling again indicates that the intersection is expected to operate satisfactorily for the most part until some time between 2026 and 2041.

By 2026 there are expected to be increasing delays on the Rolleston Drive approach in both peak periods, although overall the intersection operates at LoS D or better in that year. However, by 2041 the increasing number of vehicles using Rolleston Drive to access Main South Road in the morning, combined with increasing through volumes on Main South Road, lead to a drop in performance to LoS F on these approaches, and LoS F overall. In the PM peak hour, the increasing traffic volumes on Main South Road again leads to less time being given to the movement out of Rolleston Drive, giving this approach a LoS F (although again the intersection as a whole operates satisfactorily with LoS D).

Although this intersection is expected to operate at LoS F in the AM peak hour by 2041, it is noted that the overall performance is better than is predicted for the Baseline situation. Even with an increased volume of traffic on Main South Road, the alternative access provided by the Weedons Interchange is expected to reduce the number of vehicles turning out of Rolleston Drive, allowing for the intersection to operate more efficiently compared to the Baseline. However, high delays for some movements are still likely to lead to an increased risk of crashes, as drivers run the amber light to avoid a further wait.

As has been noted earlier in this report, the NZTA has a strategy for improvements in this area as outlined in the CRETS reports and will continue to monitor the performance of this part of the network. When this monitoring identifies the need for improvements, the adopted CRETS strategy improvements will be developed and implemented to resolve safety or congestion issues. These improvements involve the removal of the traffic signals on the Main South Road intersections with Hoskyns Road and Rolleston Drive, and provision of a grade separated connection between Rolleston and Jones Road. The alternative access route to and from Rolleston and the Izone provided by the Weedons interchange, combined with the direct grade separated connection across Main South Road at Rolleston, will allow for all of the movements currently provided by the two sets of traffic signals on Main South Road.

7.4.13 VISSIM Modelling of Shands Road Interchange and Shands Road/ Marshs Road Intersection

Microsimulation modelling using VISSIM has been undertaken of the interchange between CSM2 and Shands Road, and the adjacent Shands Road/ Marshs Road intersection. Due to the proximity of Marshs Road to the northern ramps on Shands Road, it was not considered appropriate to use SIDRA to predict intersection performance, as SIDRA cannot be used to assess interactions between adjacent intersections. In VISSIM it is possible to model all of the intersections within the one network, so queuing from one intersection can impact on the performance of upstream intersections. Additionally, the effects of the correct lane selection for downstream movements are accounted for automatically, rather than being estimated through SIDRA parameters such as lane utilisation.

Results for the two ramp terminus intersections and the Shands Road/ Marshs Road intersection area are shown in **Appendix E**, with a summary of results for the three intersections shown in **Table 7-24** for 2041.

Table 7-24: CSM2/ Shands Road Interchange – Southern Ramps VISSIM Results

Intersection	2041		
	AM Peak Hr	Inter-Peak	PM Peak Hr
Southern Ramp Intersection (Southbound On and Off)	C	B	C
Northern Ramp Intersection (Northbound On and Off)	A	B	B
Shands Rd/ Marshs Rd Intersection	C	C	B

These results indicate that in 2041, the two ramp terminus intersections within the interchange itself are expected to operate with a lowest LoS C (for the southern off-ramp).

At the Shands Road/Marshs Road intersection, the intersection will operate at worst at LoS C, for the AM peak and Inter-peak hours, improving to LoS B in the PM peak hour.

7.5 Effects on Road Based Freight Movements

This section reports on the change in heavy vehicle volumes on the roads along the Southern Corridor, and on Main South Road south of Hornby. Predicted heavy vehicle daily traffic volumes with the Project in place are shown in **Table 7-25**, with forecast Baseline volumes also shown at the same locations.

Table 7-25: Project and Baseline Heavy Vehicle Average Daily Traffic Volumes – Main South Road Corridor

Road and Location	Project			Baseline		
	2016	2026	2041	2016	2026	2041
Brougham St: West of Selwyn St	3,600	3,600	3,850	3,500	3,400	3,500
CSM1: Between Barrington St & Curletts I/C	2,300	2,450	2,850	1,900	1,850	1,950
CSM1: Between Curletts I/C & Halswell Jn Rd	2,300	2,700	3,400	1,550	1,600	1,750
CSM2: Between Halswell Jn Rd & Shands I/C	1,500	2,000	2,650	N/A	N/A	N/A
CSM2: Between Shands I/C & MSR	1,400	1,950	2,800	N/A	N/A	N/A
MSR: West of Halswell Jn Rd	950	1,250	1,650	2,300	3,000	4,050
MSR: West of Weedons Rd	2,500	3,550	4,900	2,400	3,000	4,100
Blenheim Rd: West of Curletts Rd	3,400	3,250	3,150	3,900	4,000	4,300
MSR: South of Springs Rd	1,750	1,900	2,200	2,450	2,950	3,700
MSR: West of SH1 Carmen Rd	950	1,200	1,550	1,650	2,200	3,000
MSR: East of Halswell Jn Rd	950	1,250	1,600	1,750	2,400	3,350

The daily traffic volumes in **Table 7-25** show that an increase in heavy vehicles is expected along the full length of the Southern Corridor, as trucks transfer from alternative routes to the CSM, which will provide for faster travel.

On Brougham Street and CSM1 through to Curletts Road, daily truck volumes are expected to be up to 900 vehicles a day more with the Project in place in 2041. This difference is expected become larger on the section of CSM1 through to Halswell Junction Road, as heavy vehicles heading south using this route do not have to travel along the congested Halswell Junction Road to reach Main South Road.

The alternative routing to CSM, using Blenheim Road and Main South Road through Hornby, is expected to see a significant decrease in truck volumes through Hornby. South of the connection to the Western Corridor at Hornby, truck volumes are forecast to halve with the Project in place. This rerouting of heavy vehicles from the urban areas of Hornby should have a positive impact on the amenity in that area, as well as improving local access for other road users.

7.6 Effects on Passenger Transport Network

7.6.1 Scheduled Public Bus Services

Two scheduled public bus services were identified in Section 0 as being directly affected by the Project, Routes 81 (City to Lincoln) and 88 (City to Rolleston). Although neither of these services follow the alignment of CSM2 or MSRFL, their routes are affected by changes to the local road network being proposed as part of this Project:

- Route 81 travels on Springs Road between Prebbleton and either Boston Road or Main South Road, passing over CSM2 on the Springs Road overbridge and through the Springs Road/ Halswell Junction Road roundabout. The effects of the Project on Route 81 are marginal improvements in travel time as buses travel across the CSM 1 corridor at Halswell Junction Road. This is because traffic that previously terminated at the southern end of CSM1 and travelled through the Halswell Junction Road / Springs Road intersection is now able to continue on to CSM2 and MSRFL, which reduces congestion at this location. This is based on a comparison of the Baseline and with CSM2 and MSRFL traffic models for the 2041 AM and PM peak periods.
- Route 88 follows Waterloo Road / Jones Road and travels through the Jones Road / Weedons Road. No discernible change in travel times are predicted for Route 88, which travels along Waterloo Road/ Jones Road. This is also based a comparison of the Baseline and with CSM2 and MSRFL CPM results for the 2041 AM and PM peak periods.

As Route 820 operates well to the south of the Project alignment, it will not be directly affected by the Project.

7.6.2 School Bus Services

The effects of the Project on the school bus services are similar to those reported for the scheduled public bus services:

- Route S15 travels on Springs Road, so the effects are the same as for Route 81; and
- Route S20 travels on Jones Road through the new Weedons Ross Road roundabout, with the same effects as for Route 88.

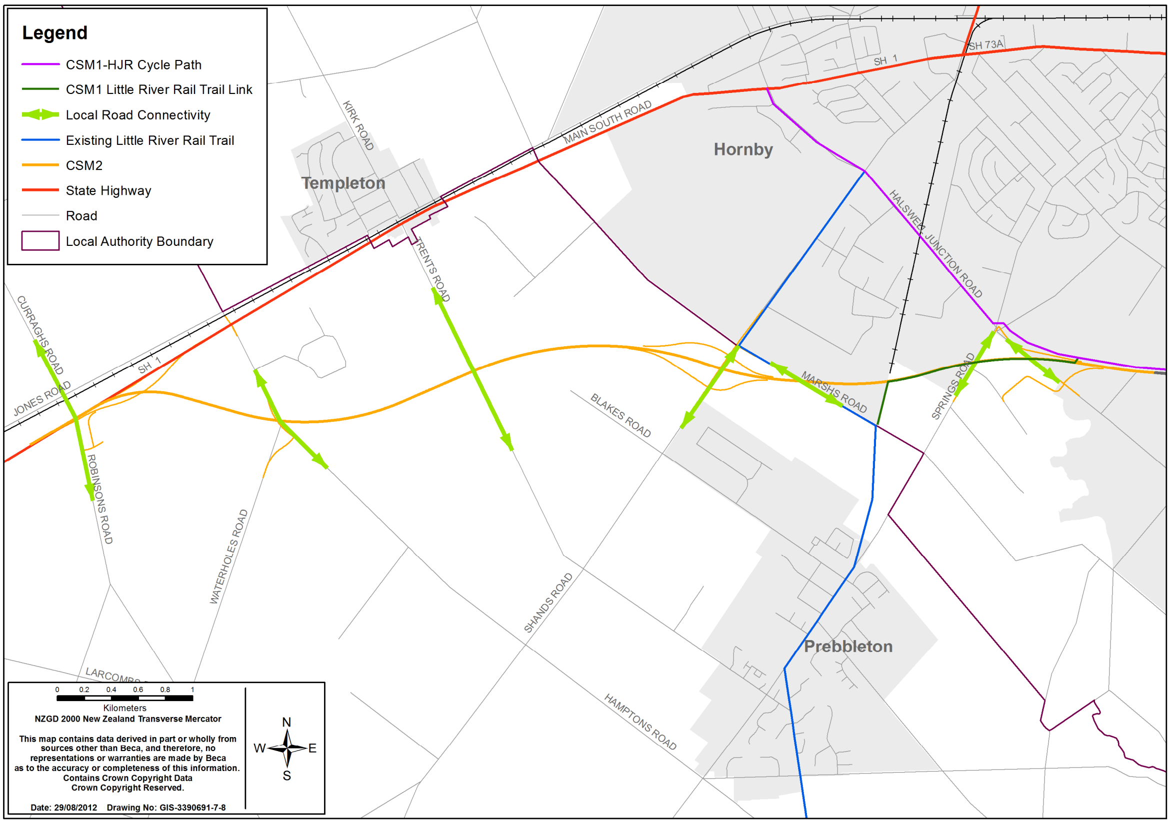
7.7 Effects on Pedestrians and Cyclists

Provisions for pedestrians and cyclists have been developed as part of the Project through a series of workshops with Selwyn District Council and Christchurch City Council. This section outlines the proposed concept, namely:

- New dedicated facility linking the CSM1 shared use path with the Little River Rail Trail;
- Maintained pedestrian and cycle connections at local road crossings; and
- Maintained cycle use along Main South Road.

An overall plan of the pedestrian and cycle provision is presented in **Figure 7-10.**

Figure 7-10: Proposed Pedestrian and Cycle Provision



7.7.1 CSM1 – Little River Rail Trail Link

A new shared use path for pedestrians and cyclists is proposed as part of this Project, connecting the CSM1 shared use path at the Owaka subway to the Little River Rail Trail at Marshs Road.

The proposed route (shown in dark green in **Figure 7-10**) follows the CSM2 alignment within the motorway designation on the southern side, passing under the Halswell Junction Road and Springs Road overbridges to the disused rail corridor north of Marsh Road. The path then continues a short distance south along the rail corridor to connect with the Little River Rail Trail on Marshs Road.

The existing Marshs Road section of the Little River Rail Trail will be maintained and the new signalised intersection associated with the Shands Road interchange will facilitate a safe crossing between Marshs Road and Shands Road. This maintains pedestrian and cycle access to Hornby via Shands Road.

A shared use path on the southern side of Halswell Junction Road will connect the southbound off-ramp roundabout to the new CSM1 – Little River Rail Trail path.

7.7.2 Local Road Connections

Pedestrian and cycle movements will be accommodated at each of the nine local road connections across the Project alignment. This will maintain walking and cycling connectivity and safeguard for the development of any local walking and cycling facilities in the area. All of the bridges have an allowance of 4 m for the provision of pedestrian and cyclist facilities, as well as a 1.5 m shoulder on each side of the carriageway. The pedestrian and cyclist facilities could be in the form of a 2 m footpath on both sides of the bridge, or a 3.5 m shared use path on one side. The final configuration at each bridge will be determined during detailed design.

Lower speed limits are also proposed on local roads in the vicinity of the Shands Road and Halswell Junction Road interchanges. These have been agreed in principle with Christchurch City Council and Selwyn District Council, and cover the following roads:

- Shands Road between Blakes Road and Marshs Road: 60 km/h;
- Marshs Road between Shands Road and Springs Road: 80 km/h (or lower);
- Springs Road between Marshs Road and Halswell Junction Road: 80 km/h (or lower); and
- Halswell Junction Road between Springs Road and new westbound off-ramp roundabout on Halswell Junction Road: 60 km/h.

These lower speed limits are expected to provide a safer environment for pedestrians and cyclists in these areas, whilst recognising that the Project, along with proposed developments in the area, will change the environment through which these roads currently travel.

The current proposed design at the nine bridges is described below:

- Weedons interchange – the Weedons Road/ Weedons Ross Road bridge includes 2.0 m wide separated footpaths on both sides of the carriageway. 1.5 m wide shoulders are provided along the carriageway;
- Robinsons/ Curraghs Road overpass – provides 1.5 m on-road shoulders and 2.0 m wide separated footpaths on both sides of the road carriageway;
- CSM2/ Main South Road interchange –2.5 m wide on-road shoulders provide for northbound cyclists on Main South Road. Main South Road southbound on-ramp bridge provides a 2.0 m wide footpath and 2.0 m wide shoulders along the carriageway;
- Waterholes Road underpass – provides 1.5 m on-road shoulders and 2.0 m wide separated footpaths on both sides of the road carriageway;
- Trents Road underpass - provides 1.5 m on-road shoulders and a shared used path on the north-eastern side of the structure. The width of the path is to be determined during the detailed design phase, with provision for a barrier separating the shared use path from traffic. No footpath is required on the south-western side of the structure;

- Shands Road interchange - the Shands Road bridge includes 2.0 m wide separated footpaths on both sides of the carriageway. 1.5 m wide shoulders are provided along the carriageway;
- Marshs Road underpass – provides 1.5 m on-road shoulders and 3.5 m wide separated shared use path on the southern side of the carriageway, continuing the Little River Rail Trail over this structure;
- Springs Road underpass - provides 1.5 m on-road shoulders and 2.0 m wide separated footpaths on both sides of the road carriageway; and
- Halswell Junction Road underpass – provides 1.5 m on-road shoulders on both sides of the road carriageway. A 2.0 m wide footpath is provided on both sides of the road carriageway.

7.7.3 Main South Road

Cyclists will be permitted to ride in the 2.5 m wide outer shoulder of the proposed Expressway maintaining connectivity on Main South Road north and south of the Project. It is expected that confident cyclists will choose to ride along the proposed Expressway.

Pedestrian and cycle connections across Robinsons/ Curraghs Road and Weedons/ Weedons Ross Road will also provide an opportunity for less confident cyclists to use either Jones Road or the proposed western rear access road. It is noted that a Jones Road facility is identified in the Selwyn District Council Walking and Cycling Strategy, but does not form part of the Notices of requirement or this transportation assessment.

7.8 Effects on Road Safety

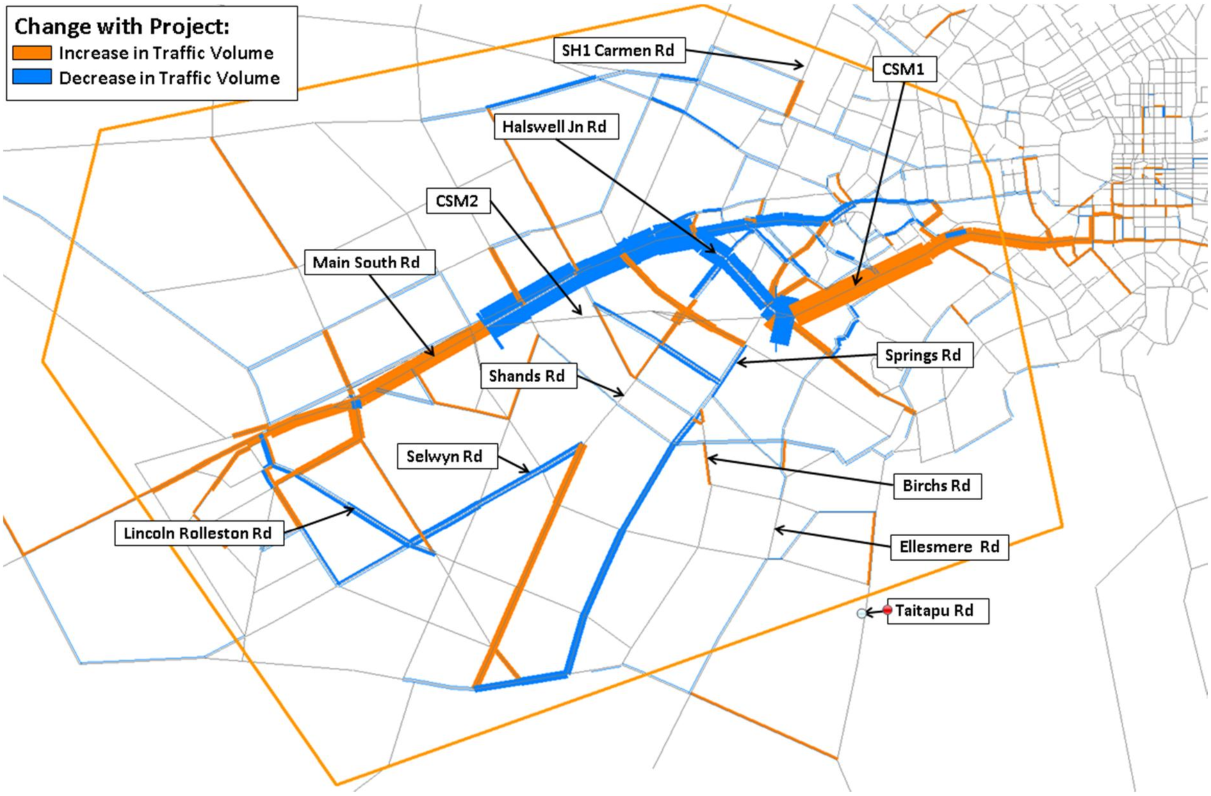
7.8.1 Method of Assessment

The change in crashes for mid-blocks and intersections within the study area has been assessed using the crash rates and crash prediction models in Appendix A6 of the EEM. The Interchange Safety Analysis Tool (ISAT) has been utilised for assessing the safety of interchanges, as described below. The analysis has adopted a network type approach in consideration of the area wide changes predicted to occur when the Project is introduced.

Output from the CPM has been used to analyse ADT data and highlight key links and intersections that experience the most significant change in traffic volumes in 2016, 2026 and 2041. In order to focus on the major accident costs/savings, those links that experience an approximate ±20% change in volumes have been captured in the assessment. A minimum ADT threshold of 500 vpd was also applied to the selection criteria to put a sensible limit on the number of links and intersections analysed.

Overall, 25 intersections and 37 mid-block sections were analysed totalling approximately 110 km of road. The area evaluated is shown within the orange boundary line in **Figure 7-11.**

Figure 7-11: Area of Evaluation for Safety Analysis



7.8.2 Mid-block Analysis

The mid-block analysis was undertaken using the accident models contained in Appendix A6 of the EEM. These models calculate a typical injury crash rate for various road types. Prior to application, the typical rates were first compared with the reported accident history for the five year period 2006 to 2010. The comparative results are summarised in **Table 7-26** below.

Table 7-26: Comparison of Reported and Predicted Injury Crash Rates

Road Type	Length (km)	Average Reported Rate	Predicted Rate	Difference
Rural State Highway	8	8.2	7.6	+10%
Rural Local	95	8.8	17.1	-50%
Urban	8	9.1	15	-40%

All crash rates are in injury crashes per 100 million vehicle kilometres.

The analysis highlighted reported crash rates along the Main South Road 100 km/h corridor approximately 10% higher than the typical rate. This is not unexpected and most likely reflects the relatively high side friction on the approach to Christchurch compared to a typical rural highway.

In contrast, the site specific crash rates for the rural local roads are low. This probably reflects the good clearways and visibility of the Canterbury Plains, and the general absence of low design speed curves.

The average reported rate for the urban sections is lower than typical. A good proportion of this group of roads is represented by the busy urban sections of Main South Road between Templeton and Hornby, and Halswell Junction Road from Main South Road to Springs Road. As previously mentioned in Section 6.7, the Halswell Junction Road section is predicted to experience a significant increase in traffic following the completion of CSM1 and an associated increase in crashes. Therefore the reported rate from **Table 6-25** for the baseline situation is somewhat under-represented.

As a result of the analysis, the typical rates for rural State highways and rural local roads were adjusted to better represent observed crash rates when calculating overall accident costs. Typical rates for the urban sections were not adjusted. **Table 7-27** shows the predicted number of midblock crashes for the Baseline case, and with the Project in place.

Table 7-27: Predicted Annual Injury Crashes – Mid-block (2016)

Road Type	Project	Baseline
Rural Divided State Highway	9.00	3.34
Rural Undivided State Highway	0.75	5.10
Rural Local	4.53	3.74
Urban	3.03	6.09
Total	**17.3**	**18.3**

As shown in **Table 7-27**, mid-block benefits mainly accrue from a significant amount of traffic transferring from the Main South Road/ Halswell Junction Road corridor onto the safer motorway. The four-laning on Main South Road results in further crash savings, due to the higher standard median divided highway and diversion of traffic from surrounding local roads onto this safer route.

7.8.3 Intersections and Interchanges

Similar to the mid-block links, the intersection analysis calculated typical accident rates by applying the accident prediction models contained in Appendix A6 of the EEM.

The assessment has been completed for 25 intersections. Seven of these are located along Main South Road. The remaining intersections are on the Shands Road and Springs Road corridors, plus the Weedons Road intersections with Jones Road and Levi Road, which are to be upgraded as part of the new Weedons interchange.

The four interchanges located within the network area were subject to a more detailed safety assessment to take account of ramp merges and diverges. The ISAT crash prediction tool for motorway interchanges developed in the United States has been utilised for this assessment.

Motorway crash patterns in the United States show some variation from those observed on the New Zealand motorway network. To increase the accuracy of ISAT crash predictions for the Project interchanges, a calibration exercise was undertaken using data from three interchanges on the Christchurch Northern Motorway. These interchanges were:

- Christchurch Northern Motorway: SH1/Tram Road;
- Christchurch Northern Motorway: SH1/Ohaka Road/Cosgrove Road; and
- Christchurch Northern Motorway: SH1/Lineside Road.

Crash modification factors were calculated by comparing the ISAT crash predictions for mainlines, ramps, ramp terminals and cross roads at the eight selected calibration interchanges with the actual number of crashes occurring on each interchange element in the 2005-2009 period. Overall, the total number of crashes at the eight interchanges was observed to be between 40% and 80% lower than the ISAT predictions for the four different types of element. The resulting calibration factors are 0.43 for mainline segments, 0.20 for ramps, 0.58 for ramp terminals and 0.60 for cross roads. Crashes occurring on these four types of elements at the four Project interchanges are reported after adjusting the raw ISAT predictions with these factors. **Table 7-28** shows the predicted number of intersection and interchange crashes for the Baseline case and with the Project completed.

Table 7-28: Predicted Annual Injury Crashes – Interchanges & Intersections (2016)

Road Type	Project	Baseline
Interchanges	5.49	0
Main South Road Intersections	3.83	5.83
Other Intersections	6.18	9.27
Total	15.5	15.1

With the Project, the reduction in traffic volumes along the bypassed Main South Road/ Halswell Junction Road corridor results in positive safety benefits. This is off-set by crashes at the new motorway interchanges. The introduction of MSRFL and associated left-in/left-out access control results in significant accident savings along the Main South Road corridor due to the reduction in risk of high severity turning/crossing type crashes. This is slightly offset by an increase in exposure at the Jones Road and Levi Road intersections, but overall there are positive crash savings. Again this is off-set by the crashes at the new interchange ramps and terminal intersections.

7.8.4 Severity Assessment

The Ministry of Transport's Road Safety Strategy for the period 2010-2020 is entitled Safer Journeys, as described earlier in Section 3.3.4.

The safety analysis undertaken for the Project has highlighted a reduction in injury crashes. A second assessment has been carried out to understand how these benefits translate into a reduction in the severity of crashes, and what contribution the scheme will have towards the Safer Journeys vision.

The severity assessment has been based on the calculated injury crash rates for 2016 and distributing these into fatal, serious and minor injury categories using data contained in the NZTA Draft High Risk Intersection Guide and New Zealand mid-block crash statistics extracted from the NZTA crash database. **Table 7-29** summarises the results of this assessment.

Table 7-29: Predicted Annual Injury Crashes – 2016

Accident Severity	Project	Baseline
Fatal	1.4	2.6
Serious	6.2	11.4
Minor	25.2	19.9
Total	**32.8**	**33.4**

The table indicates reductions in the high severity fatal and serious categories. This highlights the effectiveness that high standard, median separated, limited access highways have in reducing the risk of high severity crashes.

The increase in minor injury accidents is reflective of the addition of new interchanges to the network, with associated increased exposure to the risk of having an accident. The interchanges do however, separate potential conflicts between large volumes of traffic travelling at high speeds, and play a key role in improving road safety. They also help to improve traffic flows and support an efficient motorway route.

Overall, the Project is estimated to contribute towards a 40 % reduction in fatal and serious injury accidents in the study area.

7.9 Effects on Access to Property

The completion of the Project will have a direct effect on access to some of the properties along the alignment.

Details of the effects on access to properties are shown in the following tables, which report the access arrangements for each property affected with and without the Project in place. Full details of the access changes are included in **Appendix G** to this report.

7.9.1 Main South Road – Western Side

On the western side of Main South Road, there will be no direct access from properties to Main South Road (with the sole exception of Property 181). Alternative access will be provided via a rear access road to the west of the properties, adjacent to the railway line from Weedons Ross Road to just north of Curraghs Road. A summary of the change in access arrangements for the properties on the western side of Main South Road is presented in **Table 7-30.**

Table 7-30: Access to Property – Main South Road – Western Side

Location	Current Access	Changed Access	#	Change in Distance (From/To)			
				North	South	West	East
Hoskyns Rd to Weedons Ross Rd	Main South Rd	Left-In/Left-Out to Main South Rd	1	2.9/-	-/1.9	-/0.3	-/0.2
	Main South Rd	Via ROW to Weedons Ross Rd	2	0.8/0.5	0.9/1.2	(0.2)/ (0.5)	0.1/0.3
	Via ROW to Weedons Ross Rd	Via ROW to Weedons Ross Rd	1	0.6/0.3	(0.1)/ 2.3	0.3/-	-/0.2
Weedons Ross Rd	Weedons Ross Rd	Left-In/Left-Out to Weedons Ross Rd	1	0.7/0.6	(0.2)/ 0.6	-/-	-/0.3
	Weedons Ross Rd	No change	2	-	-	-	-
Weedons Ross Rd to Curraghs Rd	Weedons Ross Rd	Weedons I/C western roundabout	1	-	-	-	-
	Main South Road	Rear access road between Weedons Ross Rd and Curraghs Rd	15	0.5/0.2	0.3/0.4	(0.1)/ (0.2)	0.1/0.1
	Total Purchase by the NZTA		1	-	-	-	-
Curraghs Rd to Dawsons Rd	Curraghs Rd	Rear access road off Curraghs Rd	1	2.1/1.6	2.7/0.6	-/-	0.1/0.2
	Main South Rd	Rear access road off Curraghs Rd	1	2.1/1.6	2.7/0.6	(0.1)/ (0.1)	-/0.1
	Dawsons Rd	No change	1	-	-	-	-
Dawsons Rd to Kirk Rd	Dawsons Rd	No change	1	-	-	-	-

A total of 28 properties are affected, with one of these being totally purchased by the NZTA. Four properties have no change in access arrangements and the remaining 23 properties have changes to access arrangements.

For these 23 properties, the majority have their access changed from being directly onto Main South Road to access via the rear access road parallel to the railway line. For the majority of these properties, this change in access results in a need to travel further to access properties. This is the case for travel from most directions. In a limited number of instances, travel distances are reduced, but only by small amounts.

The removal of direct access to Main South Road does produce a number of safety benefits in terms of reduced crash risks, both for vehicles using these property access points and for the other vehicles travelling on Main South Road:

- Vehicles travelling to and from these properties will only be able to access Main South Road either via the grade-separated Weedons Interchange or at properly formed intersections with side roads. The crash risk at the Weedons Interchange, and the severity of any crashes that do occur, is expected to be lower due to the removal of cross movements and their replacement by merging and diverging movements, along with lower speed roundabout intersections. The provision of acceleration and deceleration lanes at the intersecting side roads should also decrease the crash risk relative to the current property accesses;
- The speed environment on the rear access road directly accessed by these properties will be lower than is currently the case for Main South Road; and
- Slower moving agricultural vehicles will not need to use Main South Road to access properties, instead using the rear access road.

A reduction in the delays associated with access directly onto Main South Road, or crossing Main South Road, is also anticipated, offsetting to an extent the increased travel distance associated with some trips.

Also, travel times for trips to and from the north are also likely to benefit from the overall improvements in travel time anticipated from the completion of the Southern Corridor.

7.9.2 Main South Road – Eastern Side

On the eastern side of Main South Road there will be no direct property access via Main South Road. Alternative access will be provided through a combination of the extension of Berketts Drive to Robinsons Road and via right of ways. A summary of the change in access arrangements for the properties on the eastern side of Main South Road is presented in **Table 7-31.**

Table 7-31: Access to Property – Main South Road – Eastern Side

Location	Current Access	New Access	#	Change in Distance (From/To)			
				North	South	West	East
Park Ln to Weedons Rd	Park Ln	No change	1	-	-	-	-
	Main South Rd	Via new subdivision access to Marlowe Pl	2	3.5/3.5	1.0/1.0	1.1/1.1	(0.4)/ (2.0)
	Total Purchase by the NZTA		1	-	-	-	-
	Weedons Rd	No change	1	-	-	-	-
Weedons Rd to Larcombs Rd	Weedons Rd	No change	2	-	-	-	-
	ROW off Paige Pl	No change	2	-/4.4	5.7/1.8	3.1/0.9	-/-
	Larcombs Rd	No change	1	-/4.4	5.7/1.8	3.1/0.9	-/-
Larcombs Rd to Berketts Rd	Larcombs Rd	No change, though Larcombs Rd changed to Left-In only	1	-/5.2	9.9/3.1	9.3/3.2	-/-
	Main South Rd	Via ROW from Berketts Rd	3	0.7/6.1	10.0/ 3.1	9.2/3.4	(0.3)/ (0.3)
	Berketts Rd	No change, though Berketts Rd changed to Left-In/ Left-Out	1	-/2.3	4.0/-	0.4/0.4	-/-
Berketts Rd to Robinsons Rd	Berketts Dr	No change	1	-/0.7	-/0.4	-/0.4	-/-
	Main South Rd	Berketts Dr	6	2.0/0.7	0.4/0.4	0.4/0.4	0.7/0.5
	Total Purchase by the NZTA		1	-	-	-	-
Robinsons Rd to Waterholes Rd	Total Purchase by the NZTA		12	-	-	-	-
	Main South Rd	Via new MSR southbound off-slip link to Robinsons Rd	3	0.3/0.6	0.5/0.9	0.1/0.1	(0.4)/ (0.4)
	Waterholes Rd	No change	3	-	-	-	-
Waterholes Rd to Trents Rd	Waterholes Rd	No change	1	-	-	-	-

A total of 42 properties are affected, with 14 of these being totally purchased by the NZTA. For the remaining properties, eight have no change in access arrangements, with 20 properties having changes to access arrangements.

For the 20 properties with changes to access, the majority have their access changed from being directly onto Main South Road to accessing them via an extension of Berketts Drive or via a number of right of ways off the local roads. Changes to how vehicles travel to and from these locations also occur as a result of the change in movements possible at the side road intersections. The changes to property access arrangements results in a need to travel further to access these properties from most directions. In a limited number of instances, travel distances are reduced, but only by small amounts.

Safety benefits are also expected as a result of the removal of direct access to Main South Road, similar to that reported above in Section 7.9.1. Delays in vehicles entering or leaving these properties are also expected to reduce, as drivers no longer have to wait for gaps between vehicles on Main South Road, instead accessing lower volume local roads.

7.9.3 CSM2 Alignment

A summary of the change in access arrangements for the properties along the CSM2 alignment is presented in **Table 7-32.**

Table 7-32: Access to Property – CSM2 Alignment

Location	Current Access	New Access	#	Change in Distance (From/To)			
				North	South	West	East
Waterholes Rd/ Hamptons Rd	Hamptons Rd	No change	1	-	-	-	-
	Total Purchase by the NZTA		6	-	-	-	-
Trents Rd	Trents Rd	No change	1	-	-	-	-
	Total Purchase by the NZTA		2	-	-	-	-
Blakes Rd	Blakes Rd	Blakes Rd severed to west	1	3.7/3.8	-/-	3.7/3.8	-/-
	Total Purchase by the NZTA		5	-	-	-	-
Shands Rd	Shands Rd	No change	2	-	-	-	-
	Total Purchase by the NZTA		3	-	-	-	-
Marshs Rd	Marshs Rd	No change	6	-	-	-	-
	Sir James Wattie Dr	No change	0.9*	-	-	-	-
	Sir James Wattie Dr	Marshs Rd	0.1*	0.4/0.4	(0.2)/(0.2)	(0.2)/(0.2)	(1.7)/(1.7)
	Total Purchase by the NZTA		4	-	-	-	-
Springs Rd	Springs Rd	No change	2	-	-	-	-
	Total Purchase by the NZTA		6	-	-	-	-
John Paterson Dr	Springs Rd via John Paterson Dr	Halswell Junction Rd via John Paterson Dr	7	0.5/0.4	1.2/1.2	1.1/1.1	(0.9)/ (0.9)
	Total Purchase by the NZTA		1	-	-	-	-
Halswell Junction Rd	Halswell Junction Rd	Via John Paterson Dr roundabout	2	-	-	-	-
	Total Purchase by the NZTA		3	-	-	-	-

* Refers to Calder Stewart property at corner of Shands Road and Marshs Road, which is split by the motorway alignment.

For the majority of properties along CSM2, there are no changes to access arrangements. At two locations, the severing of Blakes Road and the rerouting of John Paterson Drive will result in extra travel distance being required to travel to or from some directions. For the properties currently using John Paterson Drive, its rerouting from Springs Road to Halswell Junction Road will result in shorter travel distances to and from the east.

7.10 Effects on Transportation Policy

There are several statutory and non-statutory documents of relevance to the Project. These have been described earlier in Section 3, with further assessment against some of the key transport outcomes and objectives presented below. The assessment confirms that the Project is consistent with the direction of transportation policy at both the national and regional level. The involvement of Selwyn District Council and Christchurch City Council as partners through the RLTS, UDS and CRETS process indicates good support for the Project at a district level.

7.10.1 LTMA Assessment

The relevance against the five key transport objectives is:

- **Economic development:** The Project will improve journey times and ease congestion on a National strategic route from the south to the Christchurch CBD, Lyttelton Port and industrial areas in the south-west of the city. This will result in benefits for all traffic, included road-based freight movements. The Project will improve access and support planned growth in the south-west and Selwyn District such as the Izone industrial park in Rolleston. The improved access and more efficient strategic route will support the economy by making it easier for the movement of people, goods and services, leading to productivity gains from a reduction in time and costs involved with transport. The connection to the Port in particular, will support freight movements to what is a key freight destination in the South Island for international exporting and domestic coastal shipping.
- **Safety and personal security:** The Project will transfer a significant amount of traffic from the busy Main South Road/ Halswell Junction Road corridor onto the higher standard, safer highway. The divided median will separate oncoming traffic and reduce the risk of high severity head-on and crossing type crashes. Grade separated interchanges and controlled access will also remove conflicts associated with vehicle turning movements.
- **Access and mobility:** The Project offers improved access on an inter-regional link between the south of Christchurch and the city and Lyttelton Port for both local traffic and freight movements. The Project will bypass the existing built-up area of Templeton reducing traffic and congestion along this section of Main South Road and improving local access. Linkages for cyclists will be improved through provision of a new path between CSM1 and the Little River Rail Trail. With the exception of Blakes Road, the existing local roads crossed by the Project will be maintained for all vehicles including pedestrians and cyclists.
- **Protecting and promoting public health:** A specialist operational noise assessment, air quality assessment, and a social impact assessment have been completed for the AEE. They are included as Technical Reports 8, 10 and 13 in Volume 3 of the lodgement documents.
- **Environmental sustainability**: A number of specialist environmental assessments were completed for the AEE and are included in Volume 3 of the lodgement documents.

7.10.2 GPS Assessment

As part of the Christchurch motorways RoNS package, the Project is strongly aligned with encouraging economic growth and productivity, which is one of the key priority areas of the GPS. The relevance of the Project to the short to medium term impacts of the GPS is:

- **Improvements in the provision of infrastructure and services that enhance transport efficiency and lower the cost of transportation:** The Project will lead to significant improvements in journey times and ease congestion on a National strategic route. The Project also provides a more efficient supply chain for road-based freight movements to the Lyttelton Port, which is recognised as the major deep water port and key economic hub in the South Island.
- **Better access to markets, employment and areas that contribute to economic growth:** Along with the Port, the corridor will also link to key industrial areas such as around Halswell Junction Road and the Rolleston Izone. Rolleston is identified as becoming the main town for the Selwyn district, with the Izone remaining as the employment area. The Project will improve access for the growing Selwyn District population into Christchurch City employment areas.
- **Reductions in deaths and serious injuries as a result of road crashes**: An estimated 40% reduction in fatal and serious injury crashes has been assessed for the Project.
- **More transport choices, particularly for those with limited access to a car**: The Project will improve transport for private vehicle users, but is not expected to improve transport choices for non-private vehicle users. However, the Project does not preclude improvements for other transport modes.
- **A secure and resilient transport network:** The Project provides a route with enhanced safety standards and capacity, and will be designed to modern engineering standards. The CSM2 alignment provides a second strategic route into the city.
- **Reductions in adverse environmental effects from land transport**: A number of specialist environmental assessments were completed for the AEE and are included in Volume 3 of the lodgement document.
- **Contributions to positive health outcomes:** A specialist operational noise assessment, air quality assessment, and a social impact assessment have been completed for the AEE. They are included as Technical Reports 8, 10 and 13 in Volume 3 of the lodgement documents.

7.10.3 Safer Journeys Assessment

The Safer Journeys Strategy to reduce the number of fatal and serious injuries as a result of road crashes is a key focus area for the government. The Project has been assessed to have positive safety effects and will contribute to achieving the Safer Journeys vision of a reduction in deaths and serious injuries on our roads.

7.10.4 Connecting New Zealand Assessment

Connecting New Zealand draws together the policy direction set out in a number of guidance documents including the GPS and Safer Journeys Strategy. As described above, the Project is consistent with the aims of these documents through its contribution to supporting economic growth and road safety. In particular, the more efficient delivery of goods to the Port will benefit both domestic and international markets by reducing the cost of transport.

Connecting New Zealand identifies the Christchurch RoNS as one of the government’s key land transport actions, being an important part of the Christchurch re-build. This demonstrates that the Project is consistent with the government’s key focus areas for transport.

7.10.5 RPS Assessment

As described in Section 3.4.1, PC1 to the RPS (Chapter 12A) provides direction for the growth, development and enhancement of the urban and rural areas of the Greater Christchurch sub-region for the period to 2041. PC1 also provides the sub–regional policy framework under the RMA to implement the UDS[35].

Policy 9 seeks to ensure that *'"Canterbury Regional Council, territorial councils and transport infrastructure providers ensure that the transport networks within Greater Christchurch provide for the safe, sustainable, integrated movement of goods and people both within the sub-region, and to and from locations outside the sub-region'"*.

The Project will contribute this policy by providing key infrastructure, serving an important function for inter-regional and longer distance travel, especially freight travelling to the Port.

7.10.6 RLTS and RLTP Assessment

Section 3 of this report lists the vision and five objectives of the Canterbury RLTS which are strongly aligned with the key priorities in the GPS and the principles of the LTMA described above.

The RLTS provides the strategic context for the Canterbury RLTP, which identifies that the Project will progress through the investigation and design phase over next three years. As explained in Section 3.4.3, the Project is also identified as a regionally significant activity that is expected to commence in the three years following the current RLTP i.e. 2015 to 2018.

The inclusion of the Project highlights that is it not inconsistent with the vision of the RLTS and that it is a key component of land transport improvements in the Canterbury region.

7.10.7 DCTP Assessment

The DCTP is a non-statutory document that supports the RPS and RLTS. The Project is strongly aligned with the DCTP, which outlines a commitment to improve the efficiency of Christchurch's strategic road network and support the RoNS[36]. The completion of the current package of proposed RoNS improvements is an early priority for the DCTP[37].

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[35] Canterbury Regional Policy Statement Chapter 12A, p.1.

[36] Draft Christchurch Transport Plan 2012-2042, p.20.

[37] Draft Christchurch Transport Plan 2012-2042, p.28.

8. Construction Traffic Effects and Mitigation Measures

8.1 Introduction

This section sets out a high level qualitative assessment of the potential traffic and transportation effects expected to arise during the construction phase of the Project. There has been no contractor involvement with regard to the construction traffic management at this stage, so the sequences set out in this section are indicative only.

This assessment of the construction traffic effects occurs from south to north along the alignment of the Project, which is for reporting purposes only. It is not intended to be a reflection of the order in which the construction will actually occur.

8.2 Overall Philosophy

It has been assumed that the duration of construction for the Project would be in the order of three to four years. As a general rule, the construction is anticipated to take place in the following order:

- The rail sidings in the vicinity of Halswell Junction Road and Springs Road to be in the early works, along with adjusting the transmission lines at the Shands Road interchange, the relocation of businesses and construction of Main South Road rear property access roads and accesses;
- Local road connections to be constructed along with the associated structures and embankments. Alternative pedestrian and cycle connections would also be provided at this time; and
- The mainline motorway construction and Main South Road widening. For the CSM2 section of the Project, it is noted that this Project benefits from having the alignment run through greenfield land for the majority of the route. The widening of Main South Road principally to the western side of the current alignment also enables the existing carriageway to remain operational, so construction of the additional lanes can take place offline.

A critical component of the mitigation strategy around construction is early and clear communication with local property owners and businesses. It is recommended that a newsletter detailing construction progress, along with current and upcoming works affecting the local roads, is delivered on a regular basis to properties likely to be affected by the works. The newsletter would be supplemented with targeted letter drops to properties directly affected by the works. These measures would be additional to any requirements for Public Notices for specific road closures.

Additionally, the Project will utilise an overall Construction Traffic Management Plan (CTMP) to manage the potential effects during the construction works. It will outline the procedures for the production of Site Specific Traffic Management Plans (SSTMPs) and the relevant standards that must be complied with. The CTMP will be supported by multiple SSTMPs detailing the specific traffic management set ups at each worksite as well as any mitigation measures for identified impacts of the works.

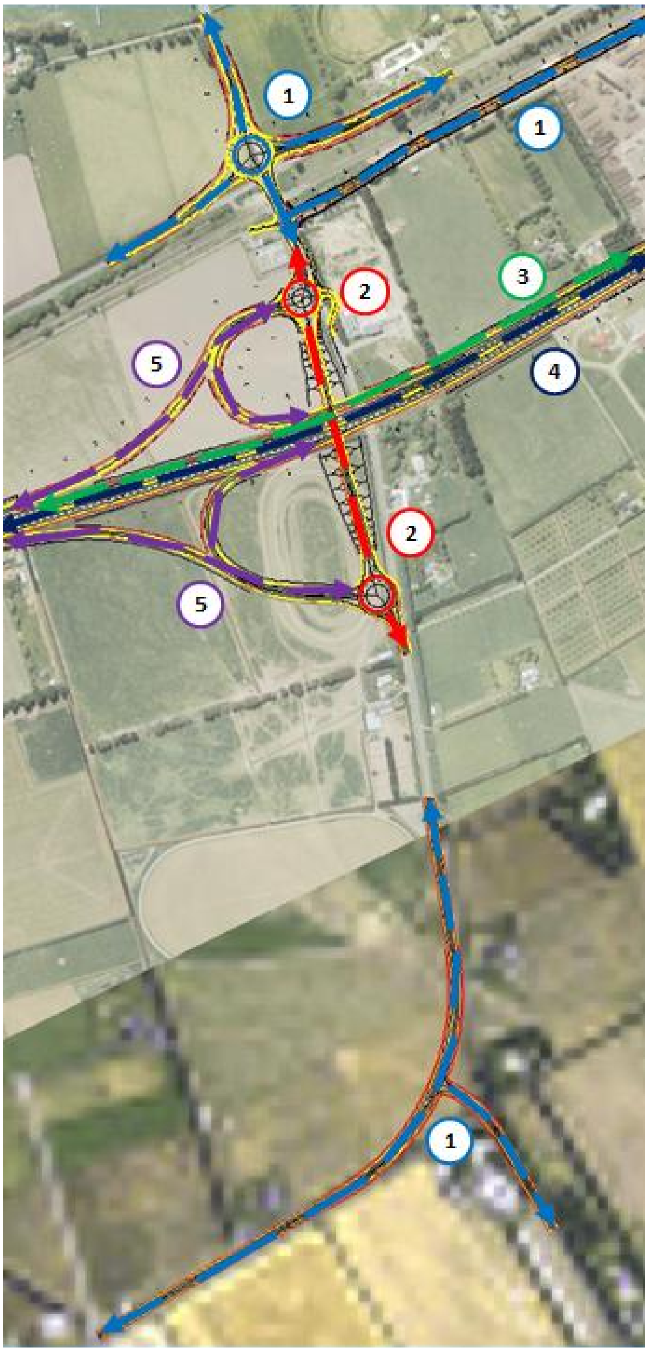
Due to the predominantly rural nature of the motorway alignment, only a limited number of pedestrians and cyclists are likely to be affected by the construction works. However, each SSTMP will allow for pedestrian and cyclist movements through the work site with temporary foot and cycle paths where existing paths have been disrupted by the works. Reduced speeds through some sites will also help to protect these pedestrians and cyclists.

8.3 MSRFL Section including Weedons Road Interchange

8.3.1 Anticipated Construction Sequence

The anticipated construction sequence for the Main South Road four laning section is shown in **Figure 8-1** below.

Figure 8-1: Main South Road Four Laning Indicative Construction Sequencing



This sequence can be summarised as:

- Stage 1 – Construct the alternative property access lanes between Weedons Ross Road and Curraghs Road, and the extension to Berketts Drive. Also construct the roundabout at the Jones Road/ Weedons Ross Road intersection as well as the Weedons Road/Levi Road intersection;
- Stage 2 – Close Weedons Ross Road between Main South Road and the property access lane to allow the construction of the roundabout, embankments and bridge. The eastern embankment and bridge approach can be constructed off-line. Traffic detour to utilise Jones Road, accessed via Curraghs Road or Hoskyns Road;
- Stage 3 – Construct the widening to the western side of the carriageway, which is predominantly off-line;
- Stage 4 – Re-construct the eastern carriageway and adjust Larcombs Road and Berketts Road intersections; and
- Stage 5 – Construction of the remainder of the Weedons Road interchange, including the tie in to Weedons Road.

8.3.2 Assessment of Transport Effects

The potential traffic effects associated with the Main South Road Four Laning are summarised in **Table 8-1**. This table also outlines the indicative impact of the works and the proposed mitigation measures (in addition to standard temporary traffic management) to minimise the anticipated effects.

Table 8-1: Summary of Main South Road Construction Traffic Effects

Activity	Road	Impact	Mitigation
Construction of access road tie-in to Weedons Road and Curraghs Road	Weedons Road and Curraghs Road	Slow traffic through temporary works zone.	Effects likely to be minor as these are low volume roads and new access road will link to existing roads.
Widening and re-construction on Main South Road	Main South Road	Slow traffic through temporary works zone.	Off-line widening expected to minimise length of temporary speed limit zone.
Construction of Weedons Road roundabouts	Weedons Road and Jones Road	Slow traffic through temporary works zone.	Effects likely to be minor as these are low volume roads and each work site will be relatively short.
Temporary Closure of Weedons Ross Road	Weedons Ross Road	Route Severence. Pedestrian and cyclist access past site to be maintained.	Install detour routes.

8.3.3 Construction Traffic Routing

Construction traffic for this element of works is partially dependent on the phase of works. Access to Main South Road will be available via Weedons Road and Waterholes Road, assuming the Curraghs Road culvert has been constructed, thereby closing access to the State highway at that location. Direct access to Main South Road will also be available during the widening works.

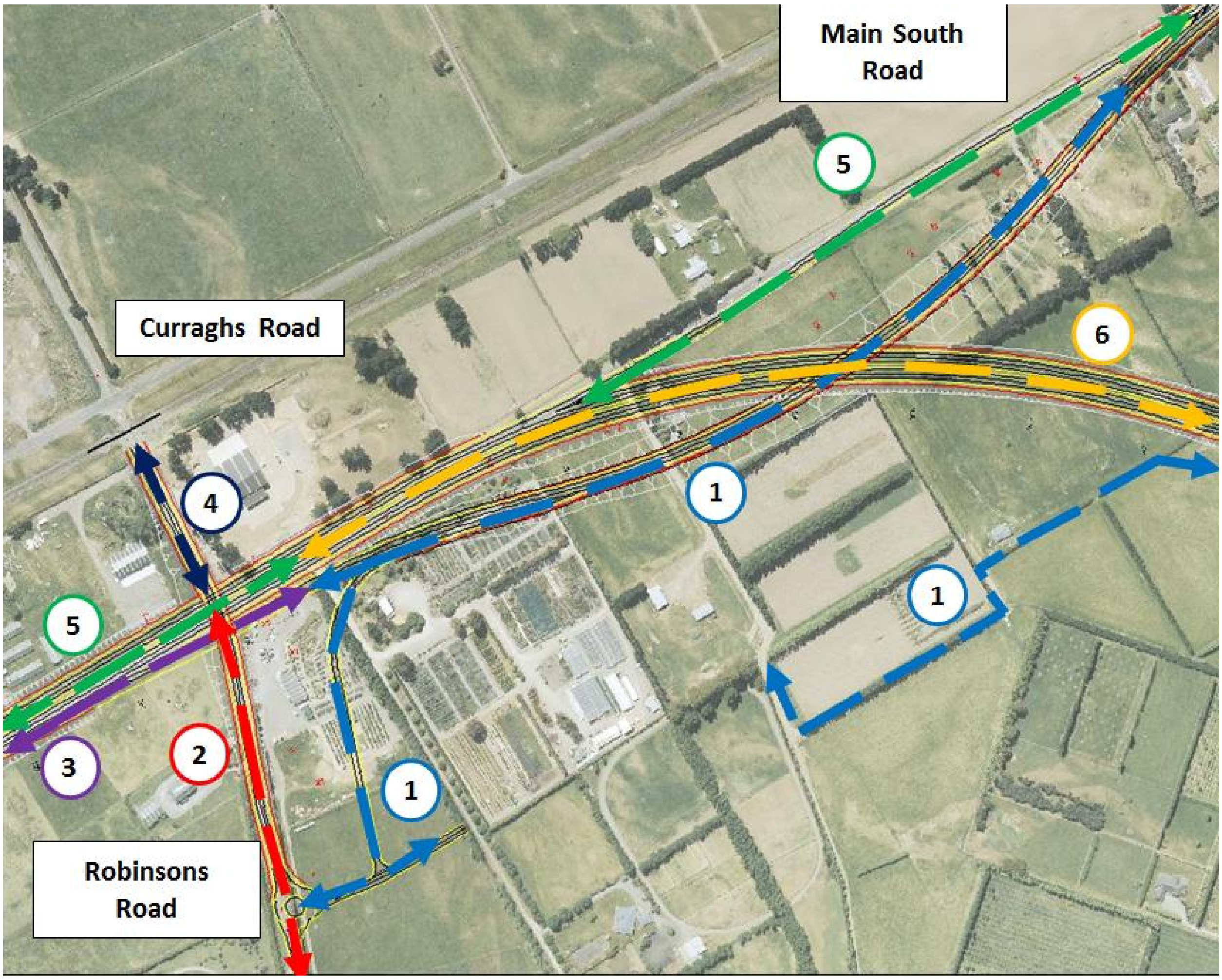
8.4 Robinsons Road/ Curraghs Road

8.4.1 Anticipated Construction Sequence

The anticipated construction sequence at Curraghs Road is shown in **Figure 8-2** and summarised as:

- Stage 1 – Construct alternative access arrangements to properties on the eastern and western sides of Main South Road and the southbound slip lanes;
- Stage 2 –Partially construct the Robinsons Road overbridge, which would require closure of Robinsons Road between the new roundabout and Main South Road. Traffic would be diverted to Waterholes Road as the diversion route.
- Stage 3 – Construct the connection between the southbound slip lane and Main South Road over the eastern side of Robinsons Road;
- Stage 4 – Divert all Main South Road traffic to the southbound slip lanes, which would be used for two-way traffic. Complete construction of the Robinsons Road overbridge to allow this route to be re-opened, which would require closure of Robinsons Road between the new roundabout and Jones Road;
- Stage 5 – Make adjustments to Main South Road under the western side of the under bridge and upgrade the off-ramp from CSM2 to Main South Road; and
- Stage 6 – Construct the mainline motorway and its linkage with Main South Road.

Figure 8-2: Robinsons Road / Curraghs Road Indicative Construction Sequencing



8.4.2 Assessment of Transport Effects

The potential traffic effects associated with the construction works at Robinsons Road are summarised in **Table 8-2**. This table also outlines the indicative impact of the works and the proposed mitigation measures (in addition to standard temporary traffic management) to minimise the anticipated effects.

Table 8-2: Summary of Robinsons Road Construction Traffic Effects

Activity	Road	Impact	Mitigation
Construction of Robinsons Road overbridge	Curraghs Road and Robinsons Road	Requires use of Waterholes Road as a diversion, so additional travel time required.	None proposed as the diversion is not significant.
Use of southbound lanes for two-way running	Main South Road	Slow speeds through the works zone, leading to congestion.	Congestion and delays to be monitored.

8.4.3 Construction Traffic Routing

Construction traffic will have access to Main South Road via Curraghs Road and Robinsons Road. There will also be direct access to Main South Road during the widening works. The preferred route for construction traffic past Templeton will be Main South Road, rather than utilising Jones Road, so as to minimise adverse effects on Templeton residents.

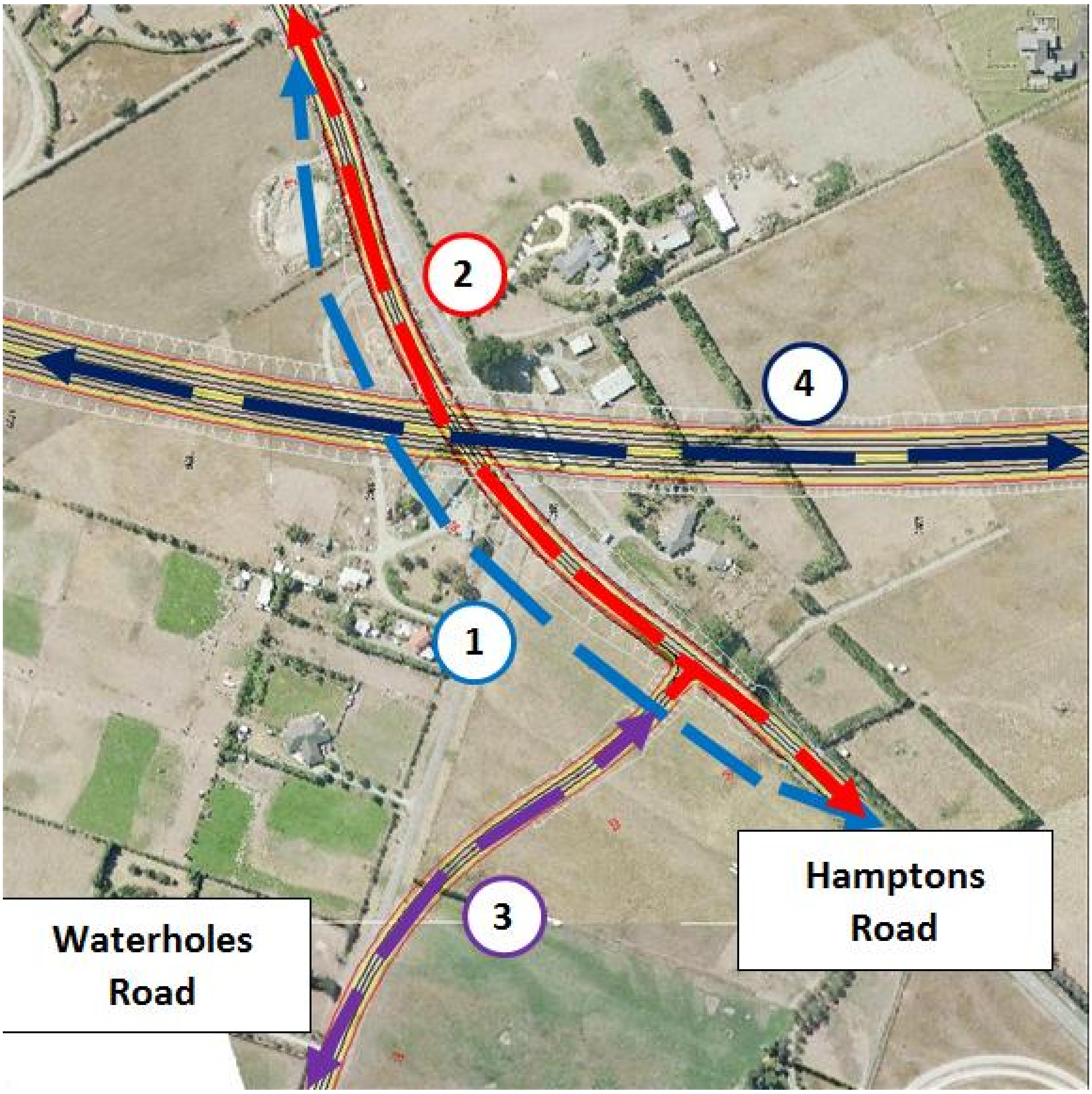
8.5 Waterholes Road

8.5.1 Anticipated Construction Sequence

The construction sequence set out below is intended to minimise the traffic effects to the local road network. The construction staging is shown in **Figure 8-3** and broadly summarised as:

- Stage 1 – Construct a temporary diversion west of Waterholes Road and Hamptons Road around the footing of where the embankment will be for this road. The southern arm of Waterholes Road will intersect with this diversion;
- Stage 2 – Construct the future Waterholes Road alignment, including the Hampton Road intersection, and the embankments and bridge for Waterholes Road over the motorway alignment;
- Stage 3 – Divert traffic to the new Waterholes Road alignment and the new bridge over the motorway. Construct new alignment of Waterholes Road up to the intersection with Hamptons Road; and
- Stage 4 – Divert traffic to the new alignments and construct the motorway.

Figure 8-3: Waterholes Road Indicative Construction Sequencing



8.5.2 Assessment of Transport Effects

The potential sources of disruption associated with the construction works at Waterholes Road and Hamptons Road are summarised in **Table 8-3** below. This table also outlines the indicative impact of the works and the proposed mitigation measures (in addition to standard temporary traffic management) to minimise the anticipated effects.

Table 8-3: Summary of Waterholes Road Construction Traffic Effects

Activity	Road	Impact	Mitigation
Construction of Waterholes Road temporary alignment	Waterholes Road and Hamptons Road	Reduced speed limit through works zone.	Waterholes Road is a low volume road able to remain open to traffic at all times. Therefore, no specific mitigation is proposed.
Construction of tie-in between the existing and proposed alignments	Waterholes Road and Hamptons Road	Reduced speed limit through works zone.	Waterholes Road is a low volume road able to remain open to traffic at all times. Therefore, no specific mitigation is proposed.

8.5.3 Construction Traffic Routing

Construction traffic to/ from this site is anticipated to use either Waterholes Road to access Main South Road, or Shands Road and Halswell Junction Road depending on the stage of construction and ability to access the wider road network. It is anticipated that construction traffic would be required to avoid travelling through Prebbleton in order to avoid adverse effects on those businesses and residents.

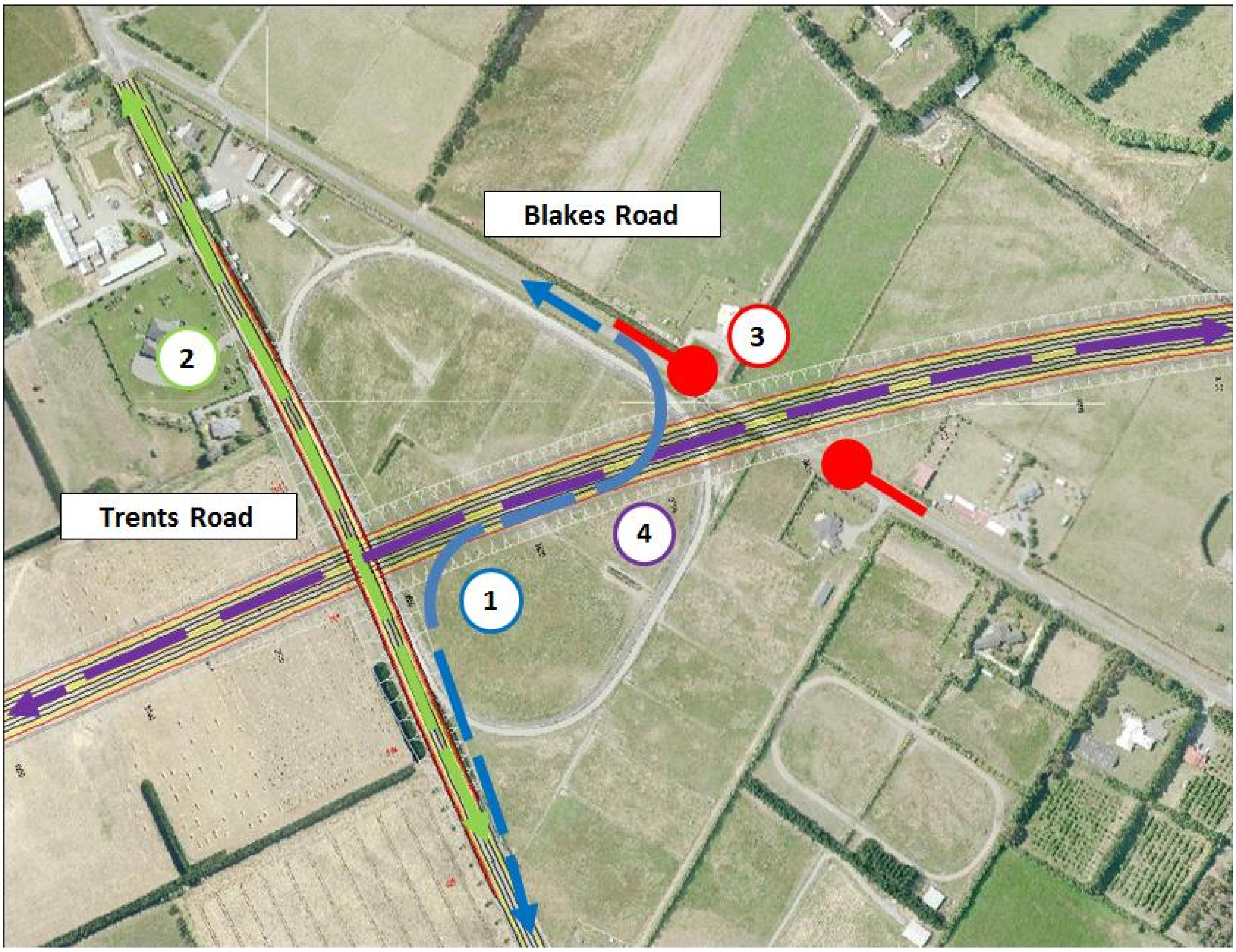
8.6 Trents Road

8.6.1 Anticipated Construction Sequence

The construction sequencing set out below has been determined in order to minimise the adverse traffic effects where practicable. The anticipated construction sequence at Trents Road is shown in **Figure 8-4** and summarised as:

- Stage 1 – Construct temporary realignment of Trents Road to intersect with Blakes Road;
- Stage 2 – Construct the bridge and embankments on Trents Road over the motorway alignment;
- Stage 3 – Remove diversion and direct traffic onto the new Trents Road overbridge. Terminate Blakes Road either side of the motorway; and
- Stage 4 – Construct the motorway along alignment.

Figure 8-4: Trents Road Indicative Construction Sequencing



8.6.2 Assessment of Transport Effects

The potential sources of congestion associated with the construction works at Trents Road are summarised in **Table 8-4**. This table also outlines the indicative impact of the works and the proposed mitigation measures (in addition to standard temporary traffic management) to minimise the anticipated effects.

Table 8-4: Summary of Trents Road Construction Traffic Effects

Activity	Road	Impact	Mitigation
Construction of Trents Road temporary alignment	Trents Road	Reduced speed limit through works zone.	Trents Road is a low volume road able to remain open to traffic at all times. Therefore, no specific mitigation is proposed.
Permanent Closure of Blakes Road	Blakes Road	Route Severence.	Inform local resident, advertise and install signage on site.

8.6.3 Construction Traffic Routing

Construction traffic to/ from this site is anticipated to use either Trents Road to access Main South Road, or Shands Road and Halswell Junction Road, depending on the stage of construction and ability to access the wider road network. It is anticipated that construction traffic would be required to avoid travelling through Prebbleton wherever practicable in order to limit adverse effects on those businesses and residents.

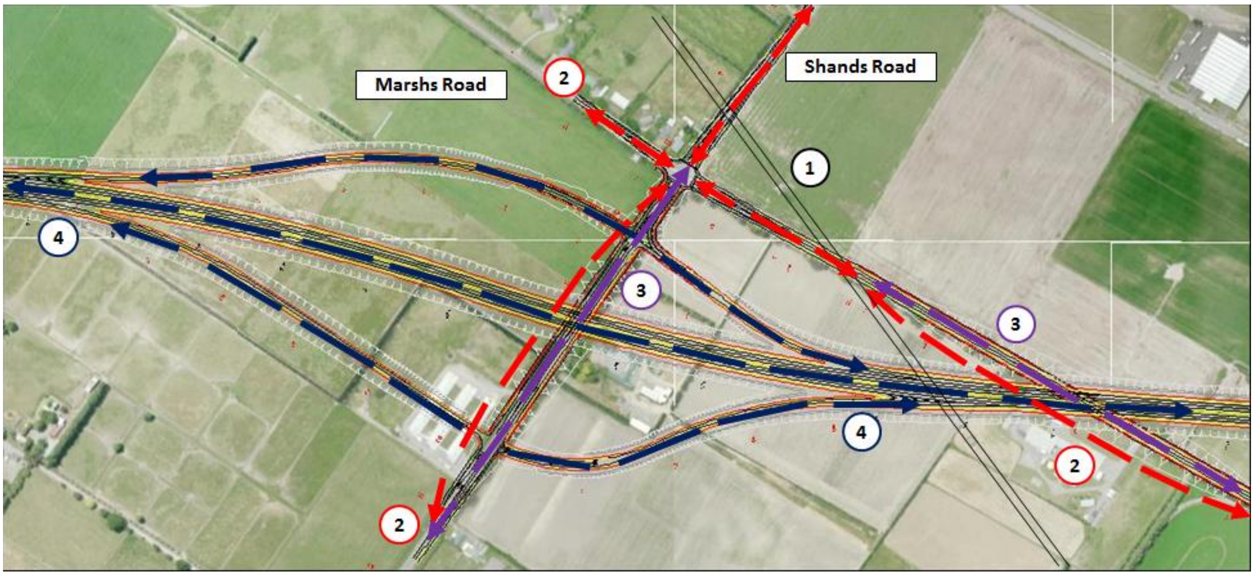
8.7 Shands Road/ Marshs Road

8.7.1 Anticipated Construction Sequence

The construction sequencing set out below has been determined in order to minimise the adverse traffic effects where practicable. The anticipated construction sequence at Shands Road is shown in **Figure 8-5** and summarised as:

- Stage 1 – Lift the overhead power lines at the interchange and relocate the businesses on the alignment;
- Stage 2 – Construct temporary diversion for both Shands Road and Marshs Road to enable the construction of the bridges and embankments as well as the Shands Road/ Marshs Road intersection;
- Stage 3 – Construct the bridges and embankments for the Shands Road and Marshs Road bridges over the motorway alignment, including the leads for the on and off ramps; and
- Stage 4 – The permanent alignment for Shands Road would be used and Marshs Road will be reopened having completed the structures over the motorway alignment. The mainline motorway and remainder of the on and off-ramps would be constructed at this time.

Figure 8-5: Shands Road / Marshs Road Interchange Indicative Construction Sequencing



8.7.2 Assessment of Transport Effects

The potential sources of congestion associated with the construction works at Shands Road are summarised in **Table 8-5**. This table also outlines the indicative impact of the works and the proposed mitigation measures (in addition to standard temporary traffic management) to minimise the anticipated effects.

Table 8-5: Summary of Shands Road Construction Traffic Effects

Activity	Road	Impact	Mitigation
Construction of Shands Road and Marshs Road temporary alignment	Shands Road	Reduced speed limit through works zone.	Although Shands Road carries over 9,000 vpd, no specific mitigation beyond what is required by COPTTM is proposed. Marshs Road is a low volume road, so no specific mitigation is proposed.
Construction of Shands Road / Marshs Road intersection	Shands Road / Marshs Road	Reduced speed through works zone and reduced capacity at intersection.	Although Shands Road carries over 9,000 vpd, no specific mitigation beyond what is required by COPTTM is proposed. Marshs Road is a low volume road, so no specific mitigation is proposed.

8.7.3 Construction Traffic Routing

Construction traffic is anticipated to use Shands Road and Halswell Junction Road to access quarries in Waimakariri. Shands Road and Halswell Junction Road are classified as minor and major arterial roads in the Christchurch City Plan. Therefore it is likely that these will be able to accommodate construction traffic without significant adverse traffic effects. This will need to be confirmed during the development of the detailed SSTMP for this location.

8.8 Halswell Junction Road / Springs Road

8.8.1 Anticipated Construction Sequence

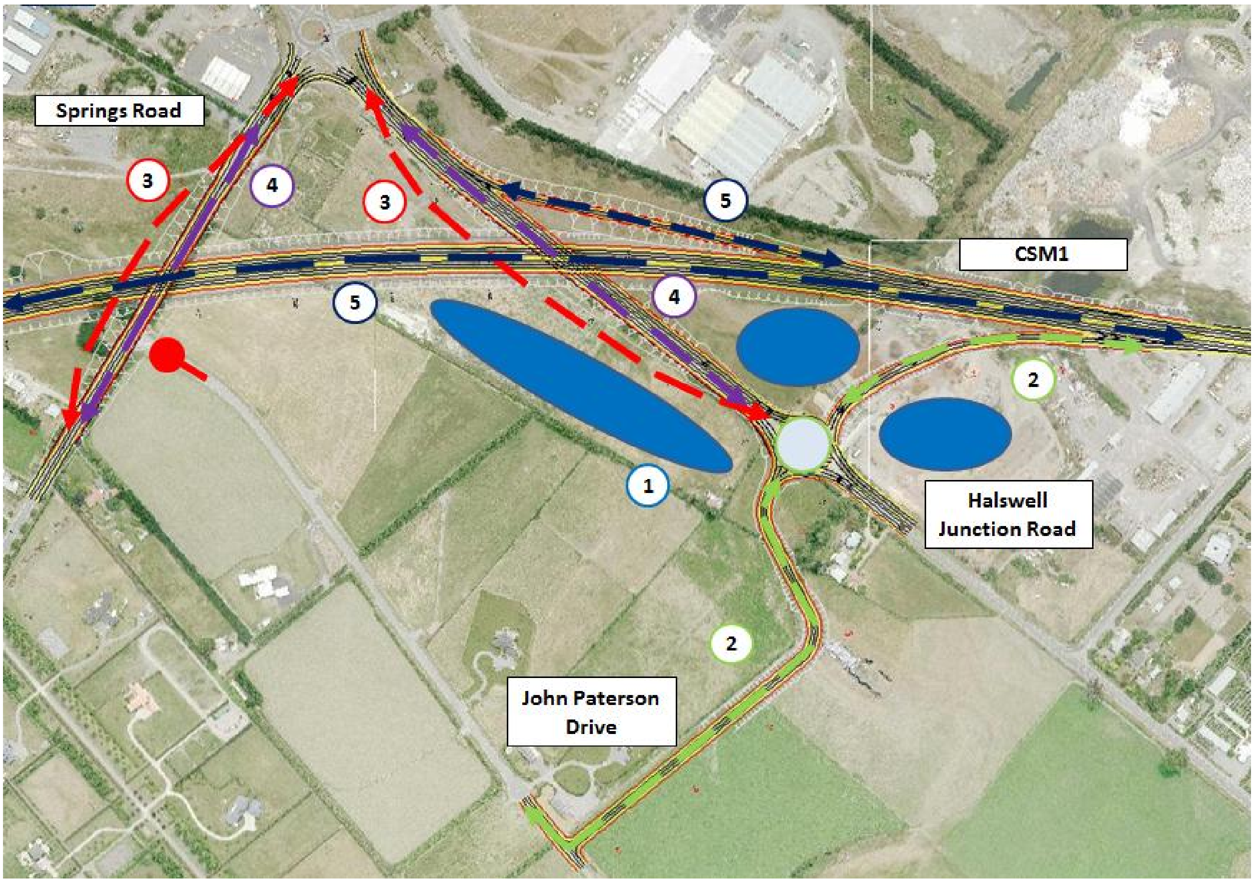
The construction sequencing set out below has been determined in order to minimise the adverse traffic effects where practicable. The anticipated construction sequence at Halswell Junction Road / Springs Road is shown in **Figure 8-6** and summarised as:

- Stage 1 – Construct new stormwater retention ponds and associated facilities.
- Stage 2 – Construct the new CSM1 off-ramp as two lanes, plus the Halswell Junction Road roundabout. Traffic would then be diverted to use the roundabout and off-ramp to enter and exit

CSM1. John Paterson Drive can also be connected through to the new roundabout on Halswell Junction Road, with residents using the existing alignment to continue accessing Springs Road during this stage;

- Stage 3 – Construct temporary diversion routes for Halswell Junction Road and Springs Road traffic, around the site of the bridge structures and embankments over the alignment. Terminate John Paterson Drive's connection to Springs Road and direct traffic to use the new alignment. Deconstruction of the existing Halswell Junction Road/CSM1 roundabout would occur at this stage to allow bridge and embankment construction;
- Stage 4 – With traffic using the diversion routes, disruption can be minimised whilst construction of the bridges and embankments for Halswell Junction Road and Springs Road over the motorway alignment proceeds; and
- Stage 5 – Traffic would be routed back to Halswell Junction Road and Springs Road. The final step would be to construct the mainline motorway and the on-ramp and tie in with the adjacent CSM1.

Figure 8-6: Halswell Junction Road Indicative Construction Sequencing



8.8.2 Assessment of Transport Effects

The potential sources of disruption associated with the construction works at Halswell Junction Road and Springs Road are summarised in **Table 8-6**. This table also outlines the indicative impact of the works and the proposed mitigation measures (in addition to standard temporary traffic management) to minimise the anticipated effects.

Table 8-6: Summary of Springs Road Construction Traffic Effects

Activity	Road	Impact	Mitigation
Construction of Halswell Junction Road Roundabout and tie-in to John Paterson Drive	Halswell Junction Road	Congestion as traffic travels through the works zone. Not considered to be significant.	Undertake works during periods of low traffic flows.
Construction of the Halswell Junction Road under bridge	Halswell Junction Road	Additional traffic delay at the Springs Road roundabout because of 'U'-turning traffic from Halswell Junction Road to access CSM1 city-bound.	Volume of 'U'-turning traffic expected to be low, so disruption expected to be minimal.
Construction of the Halswell Junction Road and Springs Road under bridges	Halswell Junction Road and Springs Road	Traffic delay because of speed restrictions on the temporary road.	None proposed as length of temporary road is fairly short.
Construction of tie-in at Springs Road	Springs Road	Traffic delay because of speed restrictions on the temporary road.	None proposed as length of temporary road is fairly short.
Duration of the works until CSM2 is open	CSM1 southbound off-ramp	Traffic delay because of reduced capacity (note that there are currently two lanes in each direction between Springs Road and CSM1).	Utilise off-ramp shoulder to provide additional traffic lane.

8.8.3 Construction Traffic Routing

Traffic associated with the construction of these works is anticipated to predominantly arrive from/ depart to Halswell Junction Road to the north in order to access quarries in Waimakariri. Halswell Junction Road and Springs Road are classified as major and minor arterial roads respectively in the Christchurch City Plan. As such, they are considered to be suitable to accommodate construction traffic without resulting in significant adverse traffic effects.

8.9 Temporary Traffic Management Objectives, Requirements and Special Considerations

SSTMPs will be required for each of the work areas to minimise the effects of the construction activities on existing traffic and to provide a safe working environment for contractors. This section sets out the key requirements, objectives and special considerations for the SSTMPs.

8.9.1 Requirements

The SSTMPs will be required to be developed in line with the current NZTA Code of Practice for Temporary Traffic Management (COPTTM) which applies at the time of preparing and implementing the plans. COPTTM sets out the requirements for the planning, design and implementation of temporary traffic management. The following documents will be used to supplement COPTTM, as appropriate:

- NZTA Geometric Design Manual;
- NZTA Manual of Traffic Signs and Road Marking (MOTSAM);
- NZTA Traffic Control Devices Manual (replacing MOTSAM in stages);
- AustRoads Guide to Road Design; and
- AustRoads Guide to Traffic Management.

The SSTMPs will be submitted to the appropriate Road Controlling Authorities for approval, which are Selwyn District Council, Christchurch City Council and the NZTA.

8.9.2 Objectives

The objectives of temporary traffic management for the construction of the Project are:

- adherence to the standards set out in COPTTM wherever reasonably practicable. Engineering exception decisions (EED's), which authorise temporary traffic management measures to differ from the layouts given in COPTTM, will need to gain approval and be signed-off by the Road Controlling Authority or authorised representatives;
- minimise disruption on State highways and local roads as far as is practicable and maintain existing flows and travel times;
- minimise the number of construction vehicle trips and their effects on local roads and seek to avoid residential areas where practicable;
- minimise the effects of construction vehicle parking;
- develop traffic management plans that have consideration of all key stakeholders, including:
  - Christchurch City Council
  - Selwyn District Council
  - residents;
- gain approval of SSTMPs at least five working days ahead of implementation;
- provide for effective communication and the gathering of feedback from key affected parties; and
- provide a safe environment for the general public and construction staff.

8.9.3 Special Considerations

Co-ordination of Traffic Management

An overarching construction sequencing plan will be prepared that identifies the various activities that will take place and when. The outline details of the temporary traffic management will be included in the construction sequencing plan in order to identify the potential cumulative traffic effects associated with several construction locations being active at the same time. One aim of the sequencing plan will be to avoid and/ or mitigate significant cumulative traffic effects arising from multiple construction activities (which individually would only result in minimal effects). Possible controls could be placed on the Contractor to restrict impact on the surrounding areas, such as predetermined haul routes and site access points or amendments to COPTTM to impose a greater lead in time for submissions of TMPs. Any controls would have to be agreed by all RCA's.

Traffic Effects

Whilst increased traffic congestion is to be anticipated for the majority of temporary traffic management, COPTTM sets a threshold of five-minutes delay unless otherwise approved by the Road Controlling Authority. This applies to traffic on a given route and on diversion routes.

Traffic modelling may be required of some temporary traffic management activities to identify whether the five-minute threshold is likely to be exceeded. Alternative methodologies may need to be considered or mitigation measures to minimise the effects, such as:

- undertaking works at times of low traffic flow (school holidays or night works); and
- advanced communication of the works to pre-warn the public or enable them to think of alternative routes.

Site Access

The construction site accesses will need to be considered as part of the SSTMPs. These accesses will need to operate in a safe manner that does not cause undue disruption to general traffic flows. The SSTMPs will need to consider the following with regard to site accesses:

- signage to identify the accesses for delivery vehicles and suppliers;
- permitted vehicles (trucks/articulated trucks/cars) and permitted uses (visitors/deliveries/staff);
- permitted movements and/or movement restrictions e.g. left in/left out;
- pedestrian, cyclist and public safety; and
- deceleration and acceleration requirements to minimise traffic disruption and provide for safe access/ egress.

Diversions

Road closures are anticipated to be required on some of the local roads to enable the construction of structures. These closures and the proposed diversion routes would be discussed with the Road Controlling Authorities prior to implementation. The diversion routes would utilise arterial roads and avoid residential areas where possible.

Traffic modelling may be required at critical points of the diversion route in order to understand whether this will result in delays of greater than five-minutes. As identified earlier, alternative methodologies may be required in order to minimise traffic delay.

Property Access

The SSTMPs will include measures to minimise the effects on property access (including turning restrictions) and on-site parking/ manoeuvring. Consultation will be undertaken with affected property owners to identify the impact on their access, duration and date of work. All reasonable steps to maintain property access or a satisfactory alternative route will be implemented.

Passenger Transport

All practical steps will be taken to minimise the effects of the SSTMPs on passenger transport services. The activities that are likely to affect bus services are those taking place on Jones Road and on Springs Road through to the Springs Road/ Halswell Junction Road intersection.

Consultation will be undertaken early in the construction planning stage to identify the potential passenger transport effects. This consultation will include:

- Environment Canterbury;
- Christchurch City Council;
- Selwyn District Council;
- Passenger Transport Operators; and
- Ministry of Education (with regard to school bus services)

Walking and Cycling

Pedestrian and cyclist requirements (including the mobility impaired) will be considered when preparing the SSTMPs and the likely effects identified. Suitable alternative access will be incorporated into the SSTMPs, which may include the following:

- temporary access in accordance with COPTTM;
- temporary diversions or routes;
- safety fencing and protection barriers from traffic; and
- temporary bridges across uneven surfaces.

Long-term closures or diversions will be discussed and agreed with the appropriate Road Controlling Authority.

8.10 Summary

This section has set out a high level qualitative assessment of the potential traffic and transport effects during the construction phase of the Project. This has been indicative only because there has been limited contractor involvement to date.

The overall philosophy is to construct local road connections and temporary road diversions first, along with the associated structures and embankments in order to maintain local connectivity. The motorway mainline is generally proposed to be constructed last as it is through greenfield land and would not be open to traffic. This approach will minimise the disruption experienced by road users and residents, although it will not be possible to eliminate adverse effects on road users due to the need to make changes to the existing, operational road network.

The specific details of the CTMP and SSTMPs are yet to be determined, but the requirements and objectives have been outlined. These are focussed on minimising traffic congestion, maintaining accessibility through the works and providing a safe environment for road users, residents and contractors.

9. Recommended Mitigation

9.1 Introduction

This report has identified the expected transportation and traffic effects of the construction and operation of the Project. These effects are mostly considered beneficial to the users of the transport system in the south western area of Greater Christchurch. However, there are some adverse effects to road users as well as residents located in the vicinity of the Project. This section sets out the recommended mitigation measures to remedy the identified adverse effects.

9.2 MSRFL

9.2.1 Mitigation of Property Access Impacts

The MSRFL element of the Project is likely to have some adverse effects on property access on both sides of Main South Road. These are detailed in Section 7.9, and are summarised below, together with proposed mitigation measures:

- Removal of direct access to Main South Road for properties on the western side will be mitigated by the construction of a service road between Weedons Road and Curraghs Road, allowing access to Main South Road via Weedons interchange or at the new Main South Road/ Waterholes Road/ Dawsons Road roundabout.
- Removal of direct access to Main South Road for properties on the eastern side will be mitigated by using the existing local road network, Right of Ways and the extension of Berketts Drive.

9.2.2 Mitigation of Construction Impacts

Section 8.3 through to Section 8.5 set out the anticipated construction impacts of the MSRFL element of the Project, along with mitigation measures to minimise any adverse traffic effects. These proposed mitigation measures are summarised below:

- An overall CTMP will be developed, specifying the general approach to traffic management to be adopted during construction of the Project.
- SSTMPs will be developed for each stage of the construction work at every work site on the MSRFL section of the Project, detailing specific mitigation measures for specific locations along Main South Road, and the cross roads directly affected.
- Widening will be undertaken west of the existing carriageway, maintaining one lane in each direction on Main South Road. Once completed, traffic will be switched on to the new carriageway, whilst the eastern side is reconstructed.
- At Curraghs Road, alternative accesses to properties on the eastern side of Main South Road will occur first, followed by construction of the Curraghs Road culvert. The construction of this culvert will require a diversion of traffic to Waterholes Road, which will maintain connectivity between both sides of Main South Road.

9.2.3 Mitigation of Operational Impacts

Between Weedons interchange and Tennyson Street in Rolleston, the end of the four laning reduces the number of lanes southbound from two to one. With the additional traffic using the widened Main South Road, the level of service on this section of Main South Road is expected to be worse than for the Baseline case. The NZTA has a strategy for improvements in this area as outlined in the CRETS reports and will continue to monitor the performance of this part of the network. When this monitoring identifies the need for improvements, the adopted CRETS strategy improvements will be developed and implemented to resolve safety or congestion issues. These improvements involve the removal of the traffic signals on the Main South Road intersections with Hoskyns Road and Rolleston Drive, and provision of a grade separated connection between Rolleston and Jones Road.

Alternative routes bypassing this section of Main South Road to both the western and eastern sides of Rolleston are also being delivered as part of this Project. These are via Weedons interchange to Jones Road and Levi Road respectively, and are shown in **Figure 7-3**. These alternative routes will enable vehicles to bypass any congestion that occurs at the merge.

9.3 CSM2

9.3.1 Mitigation of Property Access Impacts

The CSM2 element of the Project is expected to have only minor adverse effects on local access in the immediate vicinity of the Project. These locations have been detailed in Section 7.9, and include:

- The severance of Blakes Road between Trents Road and Shands Road will require a slightly longer routing via Trents Road for vehicles currently using Blakes Road. Residents on Blakes Road may also need to travel further depending upon the location of their property and their destination.
- The relocation of John Paterson Drive from Springs Road to Halswell Junction Road will result in some trips becoming longer, whilst others become shorter. Access onto the local road network will be eased by the connection to the new roundabout at the CSM southbound off-ramp on Halswell Junction Road compared to the existing T-intersection with Springs Road.

9.3.2 Mitigation of Construction Impacts

Section 8.6 through to Section 8.8 set out the anticipated construction impacts of the CSM2 element of the Project, along with mitigation measures to minimise any adverse traffic effects. These proposed mitigation measures are summarised below:

- An overall CTMP will be developed, specifying the general approach to traffic management to be adopted during construction of the Project.
- SSTMPs will be developed for each stage of the construction work at every work site on the CSM2 section of the Project, specifying how traffic will be managed at that site.
- A temporary road will be provided around the Waterholes Road overbridge as it is constructed, maintaining this connection at all times. The realignment of the Waterholes Road/ Hamptons Road intersection will be undertaken after the overbridge is constructed, maintaining this link.

- A temporary road will be provided between Trents Road and Blakes Road whilst the Trents Road overbridge is constructed, maintaining this connection at all times.
- At the Shands Road interchange, the Shands Road and Marshs Road connections are to be retained via the use of a temporary road around each overbridge as they are constructed.
- The indicative construction sequencing for the Springs Road and Halswell Junction Road overbridges is likely to minimise disruptions to road users during construction, by maintaining temporary connections on each of these roads during construction of the overbridges.

9.3.3 Mitigation of Operational Impacts

At the northern end of the Christchurch Southern Corridor, the traffic modelling indicates that there will be capacity issues on Brougham Street for both the Baseline and "With Project" scenarios. The NZTA is intending to progress a full corridor study from the City end of CSM to the Port of Lyttelton to investigate options for maintaining the efficient operation of this strategic corridor. Pending the results of this corridor study, the NZTA will continue its normal policy of making incremental operational improvements.

Modelling of the performance of the Halswell Junction Road/ Springs Road roundabout indicates that its performance may become unsatisfactory in the PM peak hour by 2026. Alternative access to the motorway is provided at Shands Road, as shown in **Figure 7-9**, and signage will direct road users to the Shands Road interchange in preference to the Halswell Junction Road ramps. The NZTA will also undertake on-going monitoring of the performance of this intersection, including crashes, travel time delay and queue lengths.

The CSM off-ramp/ Halswell Junction Road roundabout is predicted to start operating poorly some time between 2026 and 2041 during the PM peak hour. Two changes to the operation of the roundabout have been proposed, either of which would significantly improve its expected operation. It is recommended that the underground ducting necessary for metering traffic signals on the Halswell Junction Road western approach be included at the time of construction, allowing these signals to be set up with minimal disruption to road users in the future.

10. Conclusions

This Project will provide significant transport infrastructure that completes the Southern Corridor of the Christchurch RoNS. The Project is predicted to significantly improve travel times for through traffic between Rolleston and the southern side of Christchurch, reducing the travel time in 2041 by 11 minutes in the weekday morning peak and 12 minutes in the weekday evening peak. With traffic diverting to the high standard road provided by the Project, other roads in the vicinity of the Project will operate with improved travel times, relieving congestion and facilitating planned growth to the south and west of Greater Christchurch and around Rolleston.

This Transportation Assessment demonstrates the Project is consistent with the stated Project objectives (as set out in Section 1.4) in that it:

- Contributes to the region's critical transport infrastructure and its land use and transport strategies by providing more predictable travel times and connections between the first stage of the Christchurch Southern Motorway and Rolleston for people and freight: Travel times on the Southern Corridor between Rolleston and Brougham Street are expected to be significantly lower with the Project, with travel time savings of up to 12 minutes predicted by 2041 (down from 30 minutes without the Project). The reliability of these travel times is also expected to improve, as the improved level of service on CSM and Main South Road provided by the Project, and the new routing away from at-grade intersections, will reduce the degree of variability likely to be experienced by road users.
- Improve accessibility from Christchurch and the Port of Lyttelton to the south and west for individuals and businesses while improving local access to work, shops and social amenity in Templeton and Hornby: The Project provides additional road capacity on sections of this corridor, and reduces travel times along the corridor linking Rolleston through to Brougham Street, and then on to the Port of Lyttelton. The rerouting of traffic onto this Project is expected to reduce traffic volumes through Templeton and Islington by over 17,000 vehicles per day, with over 2,000 fewer trucks travelling through Templeton daily.
- Align traffic types and movements with the most appropriate routes by separating through traffic from local traffic to the south west of Christchurch and promoting other routes for passenger transport: The expected rerouting of heavy vehicles from Main South Road through Templeton and Hornby onto CSM removes this through traffic from the local streets in those areas and puts them onto a high class motorway facility. The improved level of service provided on Main South Road is expected to lead to a decrease in traffic on Jones Road, the primary passenger transport route between Christchurch and Rolleston.
- Improve network resilience and safety by providing a route with enhanced safety standards and capacity: The Project will provide a high standard four-lane median divided road with grade separated interchanges between Rolleston and CSM1 at Halswell Junction Road. The existing route between these locations does not have median barriers, and is primarily two-lanes along its length. It also passes through a number of at-grade intersections, which will be bypassed by the Project. As a consequence, it is expected that the Project will be significantly safer than the current route (with a predicted 40% reduction in fatal and serious injury crashes), as well as providing more capacity.
- Manage the social, cultural, land use and other environmental impacts of the Project in the Project area and its communities by so far as practicable avoiding, remedying or mitigating any such

effects through route and alignment selection, design and conditions: The transport impacts of the Project are expected to be mainly positive, with improved travel times and reliability along the Corridor, a reduction in serious crashes, and a reduction in traffic on some local roads currently used as alternative routes to the Project. The adverse effects relating to restrictions in access to properties, primarily along the MSRFL section, will be mitigated by the provision of alternative rear access routes on both sides of Main South Road.

This transportation assessment identifies some potential negative effects of the Project on the transport system, for which mitigation measures have been developed. In summary, the mitigation measures proposed includes:

- alternative access will be provided to properties whose existing access is affected by the Project;
- an overarching Project CTMP, supported by individual SSTMPs, will mitigate as far as is reasonably practicable the adverse effects on the road network of the construction of this Project;
- on-going monitoring by the NZTA of the performance of Main South Road where it reduces to a single lane southbound at the end of the MSRFL section through to Hoskyns Road in Rolleston, to identify the point in time at which the strategy for improvements at this location, set out in the CRETS reports, become necessary; and
- signage for access to the motorway will direct vehicles to the Shands Road interchange in preference to the Halswell Junction Road ramps, reducing the volume of traffic using the Halswell Junction Road/ Springs Road roundabout. The NZTA will also monitor the performance of the roundabout, and if this monitoring shows unsatisfactory operation, the NZTA will work with Christchurch City Council through the UDS Transportation Group to address the issue.

Overall it is considered that this transportation assessment demonstrates that the proposed Project and identified mitigation measures will avoid, remedy or mitigate the adverse transportation related environmental effects and assist in realising a number of positive effects in relation to the safe and efficient functioning of the transportation network.

Technical Report No 2

Christchurch Southern Motorway Stage 2 and Main South Road Four Laning

Assessment of Traffic and Transportation Effects

Appendix A: CSM2 Project Model Validation Report

Christchurch Southern Motorway Stage 2 and Main South Road Four Laning

Transport Model Validation Report

10 February 2010

Quality Assurance Statement			
GHD Beca	Prepared by:	Matt Soper / Karl Jarvis	Date: 07/10/10
	Reviewed by:	John Row / Melissa Foster	Date: 07/10/10
	Approved for Issue	Chris Gregory Team Leader	Date: 07/10/10
	Project Manager (NZTA):	Joe Colgan	Date:
Location: D:\Users\mpj\Documents\Beca\ProjectMeridio\Working Copies\NZ1-4035555-CSM Model Validation Report_inc. peer comments.doc			

Revision Schedule

Rev. No	Date	Description	Prepared by	Reviewed by	Approved for issue
V1	07/10/10	Draft report	Matt Soper	John Row	Chris Gregory
V2	10/02/11	Report incorporating peer comment	Matt Soper	John Row	Chris Gregory

Contents

Appendices

Executive Summary

The CSM2 (Christchurch Southern Motorway 2 and Main South Road Four Laning) model is a highway assignment only model which has been developed by refining the existing four-stage CTM (Christchurch Transport Model). The purpose of the model build is to investigate the impact of the extension of the Christchurch Southern Motorway (Stage 2) and the Main South Road Four Laning project. The CSM2 model covers the entirety of the Christchurch region but focuses on the area of Selwyn District to the south west of Christchurch which includes the towns of Lincoln, Rolleston, Prebbleton and Templeton.

The CSM2 traffic model identifies peak one flows within the following time periods:

- AM peak: 07:00-08:59;
- Inter-peak: 09:00-15:59; and
- PM peak: 16:00-17:59.

The CTM has been peer reviewed and accepted by Christchurch City Council and the NZTA. This report details the refinements made to the CTM in the development of the CSM2 model, as well as the calibration and validation results of the CSM2 model. Following a review of the model network in the study area, a number of local roads have been added to the network coupled with zonal disaggregation to increase the level of local detail.

A process of matrix estimation has been undertaken to raise the level of confidence in the model within the study area. The matrix estimation process has the potential to adversely affect other areas outside of our study area, and therefore additional efforts have been taken to minimise the level of alteration in the level of performance across all screenlines within the CTM.

The CSM2 traffic model has been validated against NZTA criteria in terms of individual link counts, screenline counts, travel times and turning flows. The model also meets the convergence criteria as set out in the Economic Evaluation Manual and is therefore deemed fit for the purpose of this study and can therefore be taken forward for forecasting.

Model outputs corresponding to the aforementioned time periods will be used to generate daily values, which will be used for any option assessment and economic analysis.

1. Introduction

1.1 Project Brief

Beca Infrastructure Ltd (Beca) has been commissioned by the NZTA to develop a traffic model that can be used to assess the proposed Main South Road Four Laning and the Christchurch Southern Motorway Stage 2 schemes.

An existing four stage multi-modal CUBE VOYAGER model of Christchurch, known as the Christchurch Transport Model (CTM), has been used and refined to test various strategies and policies across the region. The model represents AM, inter and PM peak period light and heavy vehicle trips for an average weekday for the base year 2006 and for the future years 2016, 2026 and 2041. In order to assess the proposed CSM2 and MSRFL scheme the development of a new base year traffic model was required necessitating new data collection in order to calibrate and validate to observed conditions.

This report documents the refined model development and validation process.

1.2 Report Structure

The remainder of this report is structured as follows:

Chapter 2	Describes the proposed Christchurch Southern Motorway Stage 2 and Main South Road Four Laning;
Chapter 3	Provides details regarding the existing CTM and its performance in terms of validation along screenlines in our area of interest;
Chapter 4	Provides an outline to the CSM2 model and its structure;
Chapter 5	Describes the refinements to the CTM that have been undertaken to create the CSM2 model in terms of new zone structure and network alterations;
Chapter 6	Provides information regarding the validation points and travel time routes used in the CSM2 model assignments;
Chapter 7	Summarises the results of the initial CSM2 assignment and highlights the need for matrix estimation;

Chapter 8	Describes the matrix estimation process used in the CSM2 model;
Chapter 9	Shows the results and level of validation for the final CSM2 model assignments;
Chapter 10	Describes the journey time validation;
Chapter 11	Discusses model convergence; and
Chapter 12	Provides an overall conclusion

2. The Proposed Scheme

2.1 Background

Christchurch currently suffers from peak hour travel delays, in part, as a result of the volume of traffic travelling to and from the southern end of the city. Traffic volumes and congestion are likely to worsen over the next decade without significant improvements to the highway network due to planned land use growth in the city's south and southwest regions. In order to address these issues the NZTA are undertaking a staged Christchurch Southern Corridor upgrade:

Stage 1 - Christchurch Southern Motorway (CSM1) will connect the Brougham Street Arterial (SH 73) in the east with Main South Road (SH 1 via Halswell Junction Road) in the west with a four-lane median separated motorway. Stage 1 construction works commenced in February 2010.

Stage 2 – Christchurch Southern Motorway Stage 2 (CSM2) will consist of a four-lane median separated motorway, which extends from Halswell Junction Road to an interchange with Main South Road (SH 1) south of Waterholes Road.

Stage 3 - Main South Road Four Laning (MSRFL) involves four laning the existing two lane SH1 from Robinsons Road to Rolleston.

The proposed project involves the investigation and reporting of the extension of the Christchurch Southern Motorway Stage 2 (CSM2) which includes a major intersection at Shands Road and Halswell Junction Road. The MSRFL also includes an interchange at the intersection with Weedons Road, the effect of which shall also be investigated as part of the modelling together with the downstream impact on adjacent local roads and intersections.

The CSM2 section is approximately 7.5 kilometres in length and will bypass the existing urban areas of Templeton and Hornby, with the aim of reducing traffic in these areas and thereby improving safety and easing community severance. This proposed motorway will be a four lane road with two lanes in each direction, with a dividing median, and shall provide a safe and efficient connection between SH1, Christchurch City Centre and Lyttelton Port. It is the intention that the CSM2 will reduce the number of vehicles on local roads around Templeton, Hornby and Prebbleton, making these roads safer for local residents, particularly school children and the elderly.

Main South Road will be upgraded to four lanes, which will increase capacity and improve safety of SH1 from where CSM2 joins near Robinsons Road to Rolleston. This section is approximately 5.5 kilometres in length.

The MSRFL scheme also includes:

1. A full grade separated interchange of SH1 at Weedons Road Intersection with on and off-ramps;
2. Restricted left in left out turns at all other roads intersecting with SH1, meaning that vehicles attempting to cross the SH1 will need to use the Weedons Road Intersection to cross SH1; and
3. A connection to CSM2 which will provide access to Christchurch City Centre and Lyttelton Port.

These improvements aim to ease congestion, particularly in light of the planned development in the south and southwest of Christchurch and in Selwyn over the next 30 years. Introducing a raised median on MSRFL, as well as restricting right-hand turns across the busy state highway will improve safety along this road.

Figure 2.1 shows the location of the project and key intersections that will be modified as part of the works, with Figure 2.2 showing the proposed corridor of alignment for the CSM2.

Within the broad corridor, the route options have:

- Avoided residential subdivisions (such as Claremont and Aberdeen);
- Avoided power pylons; and
- Aligned with the CSM1 which begun construction in February 2010.

The 'area of interest' referred to in this report is defined as the approximate area contained within the shaded portion of Figure 2.3.

Figure 2.1: Proposed CSM Scheme

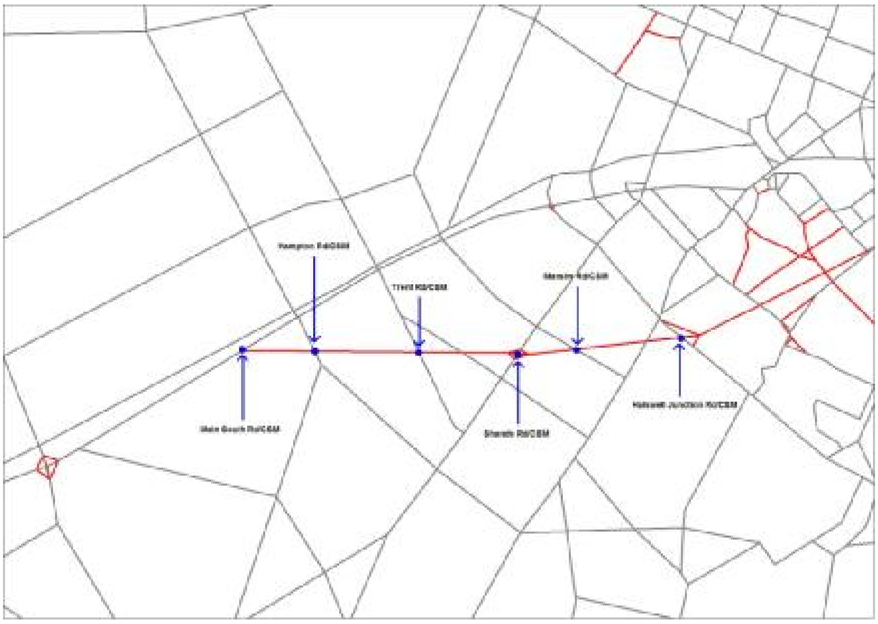
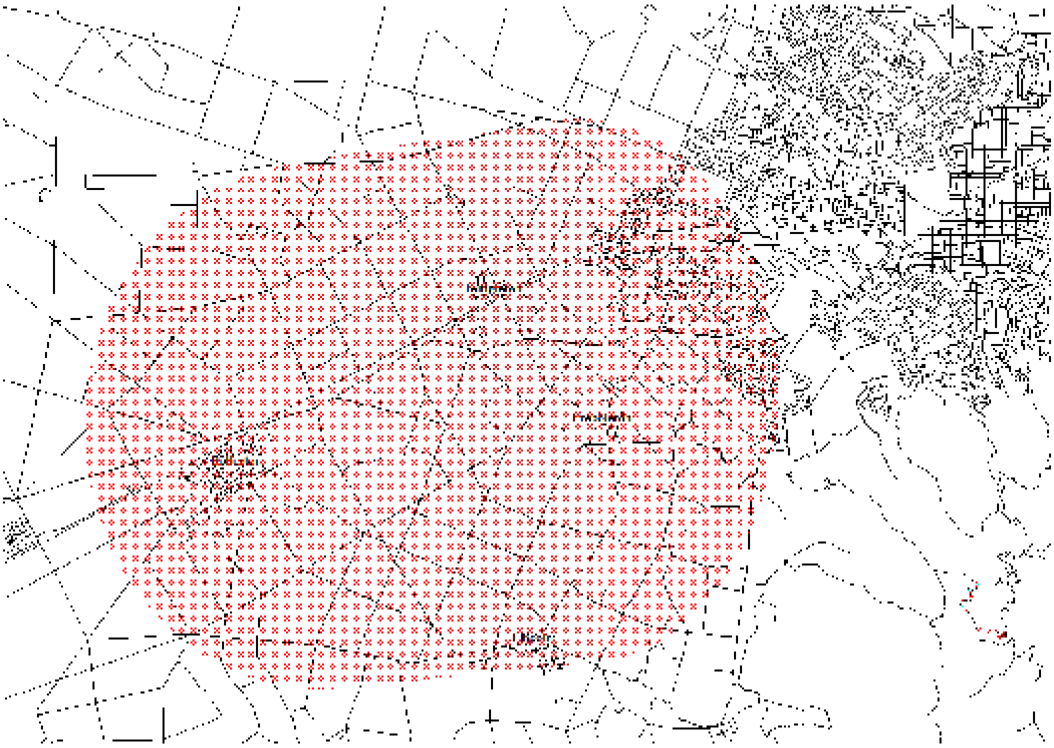


Figure 2.2: Proposed CSM Alignment

Figure 2.3: Area of Interest within the CTM



3. CTM Base Model

This chapter provides an initial review of the CTM and its level of screenline validation in the immediate area surrounding the proposed extension to the CSM. The aim of the review is to understand where the model requires improvements in the area of interest.

3.1 CTM_v2

CTM_v2 is a CUBE VOYAGER based four-stage multi-modal model covering the main urban areas of Christchurch City, Waimakariri and Selwyn Districts and parts of Banks Peninsula. The model was developed in 2008 and represents a 2006 base year.

The data collected for the CTM build included:

- Household Interview Surveys (nearly 2500 surveys);
- Roadside Interview Surveys (22 sites);
- Public Transport Passenger Interview Survey (over 6000 surveys); and
- Automatic Traffic Counts (418 counts).

The model represents daily person travel on an average weekday. The modelled modes include walking, cycling, public transport and light vehicle trips. The models' main purpose is to test strategic plans and policies for the Christchurch area.

The CTM has 398 zones which have been aggregated from 2006 meshblock data and assigned trips for the following model time periods:

- AM peak, 07:00-08:59;
- Inter peak, 09:00-15:59;
- PM peak, 16:00-17:59; and
- Overnight, 18:00-06:59

The delivered CTM included two zoning systems, one with 398 zones, the other with 498 zones, the latter included an additional 100 spare zones, many of which (zones 414 to 450 inclusive) were reallocated to the Belfast area during the investigation of the Belfast Bypass.

The CTM is a strategic model covering the entire Christchurch City Council area and therefore due to the scale of the model and the intended purpose for which was built there is a prior expectation that there are some areas within the model which may have lower levels of calibration/validation.

3.2 Screenline performance

3.2.1 Total Vehicles

The CTM was validated using observed screenline counts against modelled link flows. The original screenlines, which are of particular interest due to their close proximity to the CSM extension, are ‘J’ (West Christchurch), ‘P’ (South of City to West), ‘V’ (Outer South West Christchurch), ‘W’ (Selwyn – Christchurch Western Cordon), and ‘X’ (Shands Rd, Selwyn). It was recorded in the CTM Validation Final Report (May 2009) that across the model for light vehicles the total difference between observed and modelled flows for light vehicles (which represents the majority of person trips) was approximately 1% whilst the highest discrepancy for total flow (two-directional) across a screenline was 10%, which is considered acceptable for a strategic model.

However due to the sensitive nature of the model particular focus should be given to the aforementioned key screenlines, as route choice along these links will be directly influenced by the introduction of the extended CSM. Table 3.1 below summarises the performance of these screenlines in terms of directional screenline totals for each of the modelled time periods.

The GEH statistic is a form of the Chi squared goodness of fit statistic which is used to show the closeness of modelled flows against observed data. A GEH less than 4 is considered a good match between modelled and observed hourly flows on screenlines.

Table 3.1 - Key Screenline Performance – Total Vehicles

Screenline		Direction	AM Peak		Inter Peak		PM Peak	
			% diff.	GEH	% diff.	GEH	% diff.	GEH
J	West Christchurch	East	-10%	7.8	-11%	7.1	-11%	9.9
		West	-5%	4	-13%	9	-16%	14.4
P	South of City to West	North	-6%	6.2	-9%	8.4	-8%	8.7
		South	-8%	8.6	-9%	8.4	-5%	6.7
V	Outer South West ChCh	North	-3%	1.5	5%	2	7%	3.5
		South	-14%	5.7	8%	2.8	15%	8.3
W	Selwyn-ChCh Western Cordon	Inbound	-9%	5.7	7%	2.9	3%	1.6
		Outbound	4%	2	-3%	1.4	-5%	3.6
X	Shands Rd, Selwyn	East	2%	0.7	3%	1.1	1%	0.4
		West	-15%	6.3	-2%	0.7	7%	3

*diff = modelled flow-observed flow; AM Peak = 0700-0859; Inter Peak = 0900-1559; PM Peak = 1600-1759

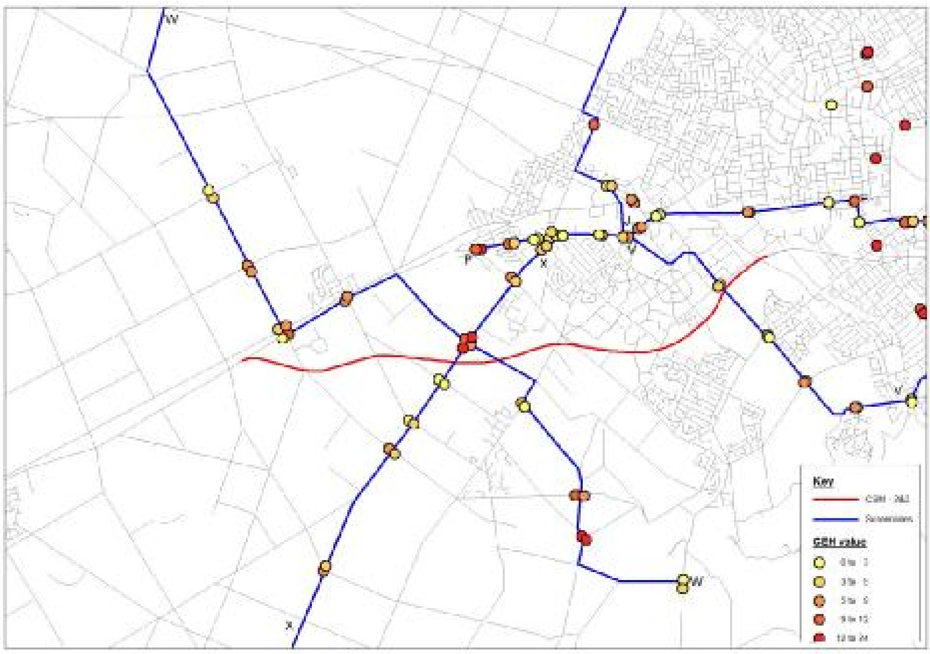
For screenlines J and P it can be seen that the CTM model underestimates flow in both directions in all three model time periods. A discrepancy of 10%, in terms of directional screenline totals, is considered an acceptable threshold for strategic modelling; however the table above shows that around 25% of the discrepancies were greater than this threshold for screenlines close to the proposed CSM. During the AM peak period modelled flow is seen to be generally lower than that of the observed across the majority of the key screenlines.

It is noted in the Model Calibration and Validation Report (May 2009) that the underestimated total flow at screenline J could be associated with routing and that the model is marginally low for east-west movements to the west of the city. Screenlines W and V were both slightly overestimated across the course of the day, which suggests that the underestimated flow in the model is focussed on the west side of the city in urban areas.

Across all screenlines, not just those listed in Table 3.1 above, CTM underestimated model flow against its observed equivalent by 12,018 vehicles (4% of total) during the AM peak and by 6,776 vehicles (2% of total) in the PM peak. However it should be appreciated that an element of double counting may exist as vehicles may pass (or not pass) through more than one screenline.

In order to identify whether this underestimation of flow was an issue across the entire length of the screenlines or just specific to certain areas, the link validation data along screenlines was extracted from the CTM Validation Report and imported into ArcGIS software. This exercise not only allows the modeller to ascertain which links have a particular poor representation of the local highway network, but also which links provide greater modelling accuracy and whose data could potentially be confidence weighed in the validation process for the refined model. Figures 3.1 to 3.3 highlight each screenline point close to the CSM2 and the corresponding GEH value for the AM, Inter and PM peak periods respectively, with darker colours representing the higher GEH values.

Figure 3.1: Screenline Link Performance – AM Peak



With reference to Figure 3.1 it can be seen that points with low GEH values exist along screenline 'W', specifically those along Dawson's Road between the intersections of Newton's Road and Jones Road. However, points at the intersection of Shands Road/Marshs Road have GEH values of 23.5 eastbound and 16.1 westbound which represent a poor level of model confidence, and are as a result of around a 75% discrepancy between observed and modelled flows. This location is a key intersection due to direct access onto the CSM and is therefore important that model validation at this point is as accurate as possible. Two additional points, along screenline 'X', are also in place at this intersection and have better GEH values of 10.0 and 5.6 for the north and south directions respectively. However these values are still considered to be too high for an intersection which would be susceptible to changes in route choice following the introduction of the CSM extension.

Elsewhere in the immediate surrounding areas, poor levels of validation with the CTM occur at the intersections of Longstaffs Rd/North Trices Rd (W12-S), Trices Rd/East Ellesmere (W18-E/W) and Halswell Junction Rd/South Main South (P01-N/S). There are however numerous points along Shands Road, the SH73A which have low GEH values.

Figure 3.2: Screenline Link Performance – Inter peak

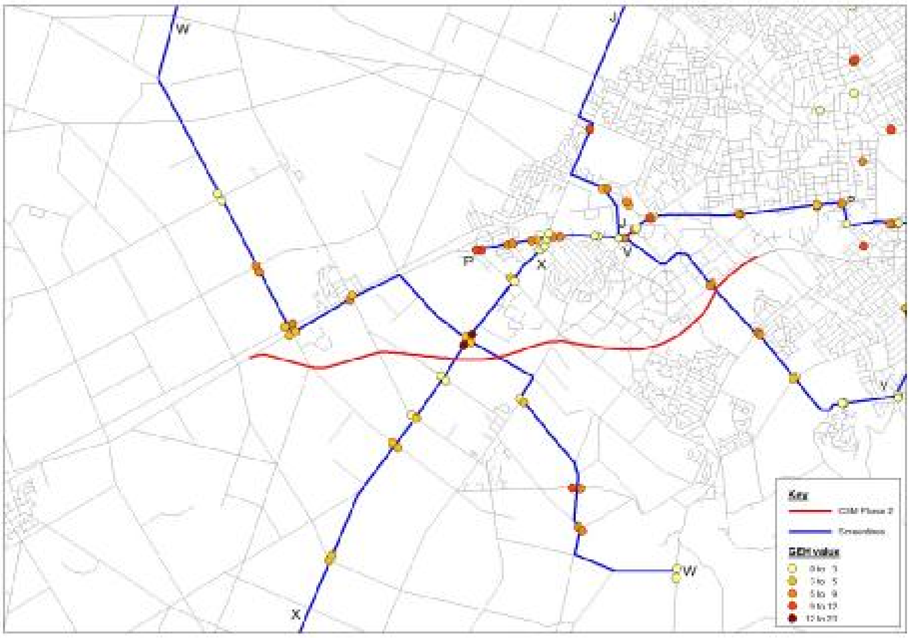


Figure 3.2 shows that the screenline performance during the inter peak period is greater level than for the AM peak period, with a far greater proportion of count locations with lower GEH values. This is to be expected during the inter peak period when there are lower levels of traffic flow across the network.

Figure 3.3: Screenline Link Performance – PM Peak

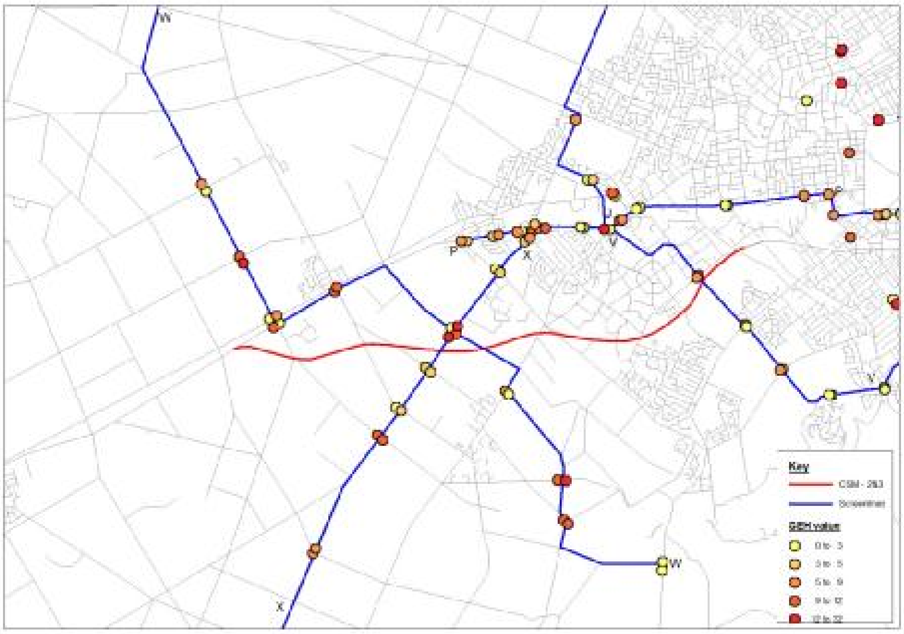


Figure 3.3 shows screenline performance at the individual link level for the PM peak period revealing a similar pattern to the AM peak period. The poor performance again at the Shands Road/Marshs Road intersection enforces the need to modify the refined modelled network to improve validation in this area. In addition, poorly validated results appear at the SH1/Templeton Rd and at the Hamptons Rd/East Shands intersections.

3.2.2 Directional Flow

The previous performance tests have shown that in the AM and PM peak periods have shown that the overall level of modelled flow is lower than that of the observed flow across the majority of the screenlines. The following exercise acts as a second performance test by identifying whether the overall movement of vehicles across a link in either direction of flow matches to a satisfactory level. Table 3.2 summarises the aggregated difference in two-directional link flow for screenline points within the area of interest close to the CSM.

Table 3.2 – Aggregated Difference in Flow (Observed – Modelled)

Location	Ref.	AM		IP		PM	
		Abs. diff	% diff	Abs. diff	% diff	Abs. diff	% diff
Halswell Junction Rd South Main South	P01-N	-286	-64%	-842	-67%	-66	-17%
	P01-S	-259	-52%	-987	-64%	-184	-33%
Seymour St South Main South	P02-N	243	122%	356	67%	69	22%
	P02-S	70	34%	525	103%	155	78%
Goulding Ave West Shands	P03-W	2	1%	-379	-28%	-31	-8%

Location	Ref.	AM		IP		PM	
		Abs. diff	% diff	Abs. diff	% diff	Abs. diff	% diff
	P03-E	1	0%	-646	-36%	-181	-30%
Shands Rd North Aymes	P04-N	-71	-6%	172	5%	379	36%
	P04-S	125	10%	135	3%	149	11%
Springs Rd South Main South	P09-N	-173	-9%	-323	-7%	-607	-32%
	P09-S	-202	-16%	739	18%	-51	-3%
Symes Rd East Main South	P10-W	-102	-20%	-619	-32%	-246	-43%
	P10-E	299	43%	62	4%	206	60%
SH73 East Dawson’s	W03-E	-54	-7%	359	25%	308	72%
	W03-W	306	109%	398	31%	-28	-3%
Maddisons Rd East Dawson	W05-E	-76	-85%	-192	-81%	-73	-89%
	W05-W	-46	-79%	-193	-80%	-124	-93%
Jones Rd East Dawson	W06-E	53	70%	-78	-22%	-30	-19%
	W06-W	-71	-46%	-211	-45%	-122	-49%
SH1 South Templeton	W07-E	414	23%	1352	33%	451	31%
	W07-W	390	35%	541	14%	507	27%
Trents Rd West Shands	W08-N	25	48%	45	30%	24	42%
	W08-S	35	95%	120	89%	26	46%
Shands Rd South Marsh	W10-N	-775	-75%	-1291	-68%	-532	-62%
	W10-S	-409	-69%	-1237	-68%	-488	-46%
Aymes Rd East Shands	X01-E	77	16%	121	6%	-106	-11%
	X01-W	-100	-16%	-33	-2%	182	26%
Halswell Junction Rd East Shands	X02-E	229	24%	354	12%	-52	-5%
	X02-W	-164	-16%	90	3%	157	15%
Marshs Rd East Shands	X05-E	-174	-65%	-218	-45%	36	18%
	X05-W	-81	-49%	-172	-42%	-173	-69%
Blakes Rd East Shands	X06-E	-8	-8%	-46	-14%	54	30%
	X06-W	-15	-13%	-33	-13%	32	37%

*% diff = % difference between total observed link flow and total difference between link observed and modelled flow

With reference to the above table it is can be seen that certain links on screenlines at intersections close to the CSM have particularly poor levels of validation. Discrepancies between modelled and observed data above 30% have been highlighted. In general the quality of the validation for screenlines tends to be consistent across each of the modelled time periods suggesting a daily deficit of trips.

3.2.3 Heavy Vehicles

Although light vehicles comprise the vast majority of traffic along all screenlines, it is important for the assessment of the CSM2 that heavy vehicle traffic at points which directly link into industrial areas within the area of interest are calibrated to an acceptable levels for heavy, as well as light, vehicles. Table 3.3 below summarises link performance for points close to the existing and future industrial areas.

Table 3.3 – Heavy Vehicle Key Screenline Performance

Area ref.	Screenline ref.	AM peak				Inter peak				PM peak			
		Obs.	Est.	Diff.	GEH	Obs.	Est.	Diff.	GEH	Obs.	Est.	Diff.	GEH
1	P01-S	85	10	-88%	8.4	336	41	-88%	8.1	62	8	-87%	7.3
1	P01-N	65	11	-83%	6.8	238	37	-84%	6.5	41	5	-88%	6.0
1+2+3	X02-E	184	138	-25%	2.8	649	570	-12%	1.2	116	98	-16%	1.4
1+2+3	X02-W	168	148	-12%	1.2	578	544	-6%	0.5	98	95	-3%	0.2
2	X01-E	46	32	-30%	1.7	167	126	-25%	1.3	45	21	-53%	3.3
2	X01-W	51	34	-33%	2.0	153	118	-23%	1.1	41	25	-39%	2.2
3	W10-N	56	27	-52%	3.5	156	97	-38%	2.0	50	19	-62%	4.2
3	W10-S	34	23	-32%	1.6	127	89	-30%	1.4	33	25	-24%	1.2
5	W11-N	51	48	-6%	0.3	161	176	9%	0.4	40	31	-23%	1.2
5	W11-S	41	49	20%	0.9	113	211	87%	2.9	27	31	15%	0.6

The largest disparities between observed and modelled traffic flows for key points recording heavy vehicles were those at the intersections of Main South Road/Halswell Junction Road (screenline ref: P01) and those adjacent to the southern industrial areas along Halswell Junction Road. As this is a key intersection which experiences a significant level of heavy vehicle traffic, the refined model endeavours to improve the validation of heavy vehicles at these screenline points through the network refinement and matrix estimation processes.

3.2.4 Areas of Industrial Growth

A key aspect in developing the base year CSM2 model is to allow for any proposed and planned development in the future years through an appropriate base year zoning system. Existing areas that are used for office and industrial purposes as well as any future growth areas that have been identified by Christchurch City and Selwyn District Councils will need to be incorporated into the base model zoning system. The modelled base network will use the same zone structure as that for the future scenarios, which is why growth areas have been identified as zonal disaggregation may be required to more accurately model the effects of these growth areas. Key areas close to the proposed CSM extension are noted below in Table 3.4.

Table 3.4 – Areas of Future Industrial Growth within the Area of Interest

Ref	Location	Note
1	Halswell Junction Road – between Main South Road and Shands Road	
2	Halswell Junction Road / Shands Road / Amyes Road / Branston Road quadrant	
3	Halswell Junction Road / Shands Road / Springs Road / Marshs Road	

	quadrant	
4	Area bounded by the Margaret Egger Drive / Branston Street / Boston Avenue / Springs Road quadrant	Partially vacant
5	Area bounded by Wilmers Road / Halswell Junction Road / McTelgue Road	Partially vacant

The area bound by the Margaret Egger Drive/Branston Street (ref. 4) is especially important as the proposed CSM phases 2 extension would pass directly through this area. Therefore this land is likely to prove particularly attractive to potential developers due to the excellent transport connections, and hence lead to a large increase in heavy vehicle traffic from the corresponding connected zone.

3.3 Summary

The model validation for all vehicle movements by screenline was within acceptable tolerances given the strategic nature of the model. However as the modelled traffic flows were underestimated along key screenlines in the western side of the city and at key points near industrial centres close to the CSM2, it is necessary that a series of steps are taken in order to bring the level of validation between the modelled and observed data to as high a level as possible. These steps are as follows:

- Matrix estimation - to increase the number of trips through key areas to the west of the city and to generate trips between newly created zones;
- Network coding – confirm that there are no unnecessary restrictions to flow and code in new links to ensure that there are a sufficient number of route choices near to the CSM;
- Surveying – if necessary, to undertake new surveys at screenline points or otherwise to create additional validation/calibration points.

4. CSM2 Model Background

4.1 Background

As discussed in Chapter 1, Beca have been commissioned by the NZTA to develop a traffic model that can be used to assess the proposed extension of the CSM2 and the MSRFL as described in Chapter 2.

The model will provide for the following:

- The likely traffic demands on the project to inform the scheme design process;
- Allow for demand growth in this key growth segment of Christchurch;
- An assessment of the wider network effects of the proposed schemes; and
- An economic evaluation of the schemes.

4.2 CSM2 Model Development

The method for developing the refined CTM_v2 model, to be known as the CSM2 model, was to use the existing highway assignment modules in the CTM as a starting point and from that develop a standalone model which used the assigned output CTM matrices and networks. These matrices and networks were then adjusted accordingly in order to achieve acceptable levels of validation in the area of interest.

The CTM is a four stage model with separate stages for trip generation, mode choice, distribution and assignment. The CSM2 model however is a vehicle only assignment model that does not refine modal choice further, but rather uses matrix adjustment to modify the total light and heavy vehicular trips for each zone. Parking and public transport alterations have not been made to the CSM model.

The development of the CSM2 model is structured as follows:

- Network build. The CTM network was updated within the area of interest.
- Matrix preparation. The new, and more refined, zonal structure necessary for the CSM2 model is read in and the assigned CTM matrices are split according to zone split factors determined by census data and regression analysis, described later in Chapter 5.
- Matrix estimation. An initial assignment process is undertaken to generate paths for light and heavy vehicles. The first stage of matrix estimation is then performed based on link counts across the area of interest for both light and heavy vehicles and using an initial level of matrix confidence. Assignment is then carried out once more, with a higher level of matrix confidence introduced before a second stage of matrix

estimation. The final estimated matrix is then capped to ensure that origin and destination totals for each matrix cells does not alter by more than 20%. The capped matrix is then balanced to achieve matrix consistency.

- Final assignment. This module performs the final assignment based on the parameters used within the CTM and also generates a comparison between the CTM network and CSM2 network. In the assignment process the peak period matrices from the CTM are factored into peak one hour matrices, based on the following factors, as included in the CTM:

Table 4.1 – Peak Period to Peak One Hour Factors

Peak period	CTM time	Peak 1 hour factor
AM	07:00 - 08:59	0.6
IP	09:00 – 15:59	0.143
PM	16:00 – 17:59	0.633

5. Network Development

5.1 New Zones

A key aspect of the refinement for the CSM2 was to disaggregate the existing zone structure in order to generate additional zones to the west of Christchurch and in the near vicinity of Rolleston and Templeton. New zones were introduced for the following reasons:

- To reflect areas of future year development;
- To improve the level of demand loading onto the network; and
- For zonal refinement around the proposed scheme.

In total an additional 38 zones were introduced to the modelled CSM2 network from the initial 498 zones within the CTM network that also included 24 unallocated zones. The CSM2 model has a total of 536 zones. Key areas for change were where the CSM2 project has dissected existing zones, and around the Rolleston, Prebbleton and Lincoln areas where large levels of employment and residential growth are forecast.

5.1.1 Zone Disaggregation

The new zone structure for the CSM2 model, like the CTM, has been initially structured based on census meshblocks. Where possible, zones have been split according to the internal dissection by the meshblocks, although due to the rural nature of many of the zones within the area of interest and the requirement to split zones based on the proposed alignment of the extended CSM, this has not always been possible. Where one meshblock has been split, assumptions regarding the likely household and workplace demographics of the new zones have been made – based on either data from regional plans or from aerial photographs.

The process for disaggregating zones which were split purely based on meshblocks was to first generate 12 regression formulae - for origins and destinations for both vehicle types across all three time periods. The zone origin and destination trip ends were extracted from the final assigned network in the CTM for each period with spare zones ignored in the calculation for all formulae, as well as Christchurch CBD zones being ignored in the calculation for heavy vehicle regression formulae. Tables 5.1-5.3 provide a summary of the regression statistics and the generated formulae used in the zone disaggregation process. Employment statistics used in calculations refer to full time employment.

Table 5.1 – Light Vehicle Regression Statistics

Light vehicles	AM		IP		PM	
	Origin	Destination	Origin	Destination	Origin	Destination
Multiple R	0.980	0.952	0.924	0.915	0.937	0.958
R Square	0.961	0.907	0.853	0.838	0.878	0.917
Adjusted R Square	0.959	0.904	0.851	0.835	0.875	0.915
Standard Error	79.027	147.195	574.162	613.310	201.970	145.486
Observations	489	489	489	489	489	489

Table 5.2 – Heavy Vehicle Regression Statistics

Heavy vehicles	AM		IP		PM	
	Origin	Destination	Origin	Destination	Origin	Destination
Multiple R	0.808	0.818	0.813	0.810	0.816	0.824
R Square	0.652	0.670	0.661	0.656	0.666	0.678
Adjusted R Square	0.649	0.667	0.658	0.653	0.663	0.675
Standard Error	15.540	14.509	52.708	54.142	10.444	10.495
Observations	451	451	451	451	451	451

Table 5.3 – Regression Formulae

		Households		Employment
AM light origins	=	0.7514	+	0.1374
AM light destinations	=	0.2755	+	0.5110
IP light origins	=	1.7036	+	1.1725
IP light destination	=	1.6057	+	1.2361
PM light origins	=	0.4383	+	0.5621
PM light destinations	=	0.8139	+	0.2672
AM heavy origins	=	-0.0002	+	0.0335
AM heavy destinations	=	0.0003	+	0.0324
IP heavy origins	=	0.0006	+	0.1155
IP heavy destinations	=	0.0002	+	0.1174
PM heavy origins	=	0.0010	+	0.0229
PM heavy destinations	=	0.0014	+	0.0235

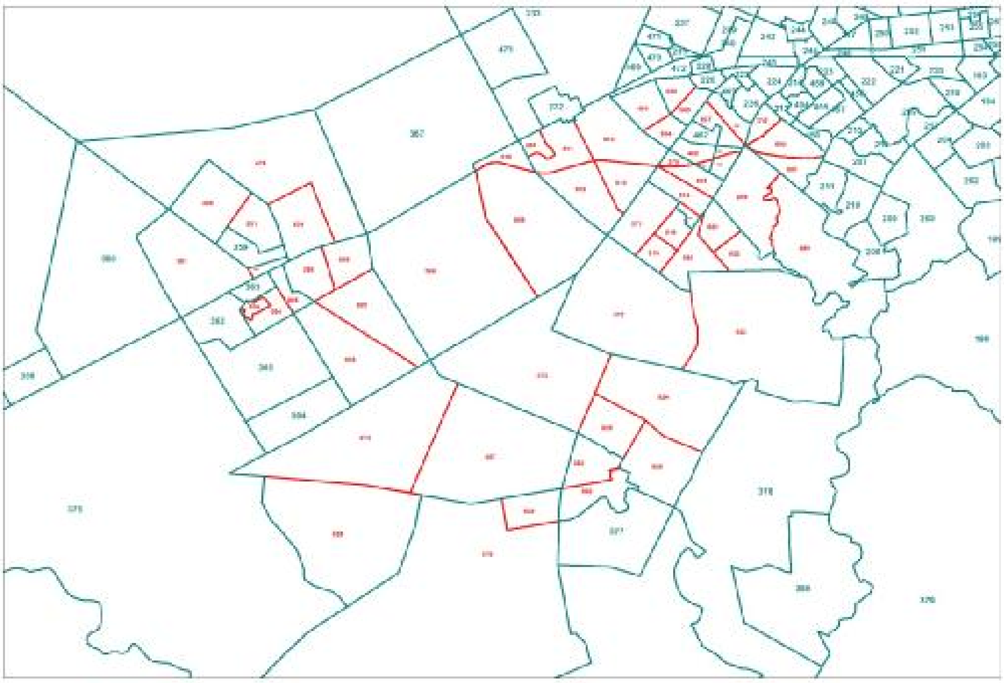
The regression formulae in Table 5.3 were applied at all census meshblocks together with census data to generate estimated origin and destination trips from each meshblock. Zones were then split into smaller zones by identifying which meshblocks lay within each new zone and then calculating the zone split factor based on these trips.

For example: Zone X, previously comprising of meshblocks 001 and 002 has been split to create new zones X1 (meshblock id: 001) and X2 (meshblock id: 001). If say, AM light origin trips from meshblocks 001 and 002 are equal to 10 and 30 respectively, the old zone X would therefore be split 25% for AM light origin trips to new zone X1 and 75% to new zone X2.

It is noted that the coefficient for household trips for AM heavy origins is negative. However this value is considered acceptable as the value is very small. Checks to ensure that negative demands were not created for this demand category were undertaken in the calculations for zone splits.

The new zone structure is shown in Figure 5.1. Red zones represent changes to the original CTM network.

Figure 5.1 – CSM New Zone Structure



5.2 Network Modifications

5.2.1 Links

The most influential component of the calibration and validation process was the refinement of the existing CTM network within the area of interest. Network refinement was initially made through alterations to link type and link free flow speeds. In the CTM a global free flow speed of 100km/h was coded on all links to the south west of Christchurch beyond Halswell Junction Road, excluding those in the urban areas of Rolleston, Lincoln, Prebbleton and Templeton. This global speed is unrealistic for the rural environment, and therefore the free flow speed on each link was reviewed. Key roads within the model, which provide alternative routes to the CSM and Main South Road, have been set to the following free flow speeds, as highlighted in Table 5.4. It should be noted that free flow speeds on road links may differ to those outlined below due to their location within the strategic road network i.e. those links which pass through or close to urban environments have been assigned slower speeds.

Table 5.4 – Modelled Free Flow Speeds

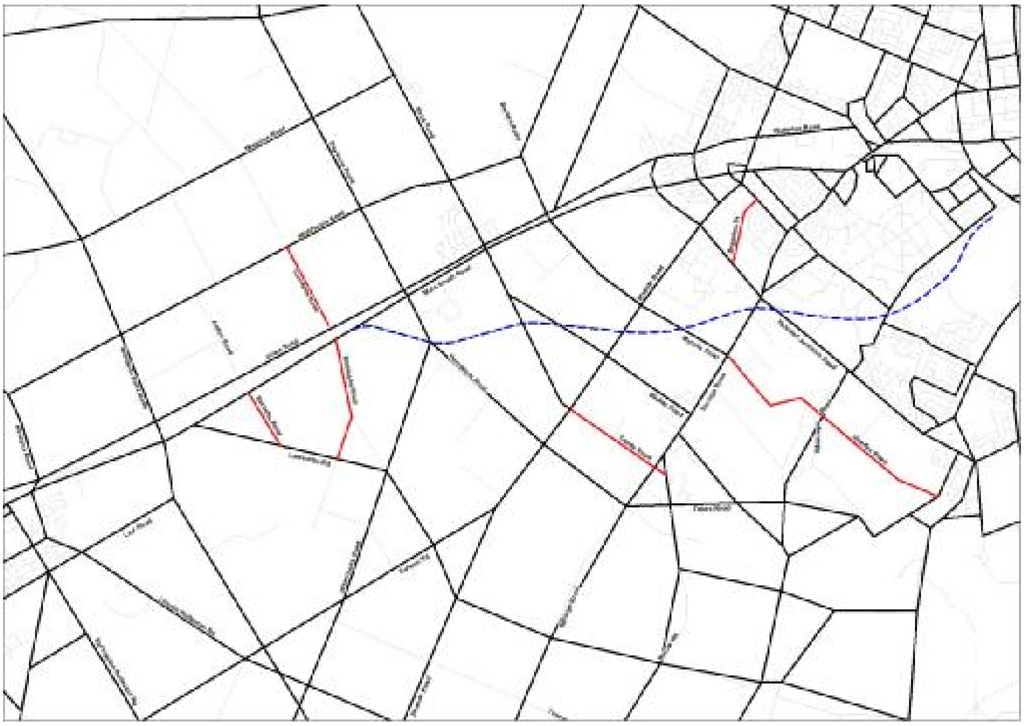
CSM modelled speed (km/h)	CTM modelled speed (km/h)	Roads
50	100	Boundary Rd, Curraghs Rd, Dawsons Rd, Trents Rd
55	100	Blakes Rd, Lincoln Rolleston Road, Robinsons Rd, Weedons Rd
60	100	Ellesmere Junction Rd, Halswell Junction Rd, Hamptons Rd, Hoskyns Rd, Lowes Road, Maddisons Road, Marshs Rd, Newton's Rd, Weedons Ross Rd
65	100	Ellesmere Rd, Waterholes Rd
70	100	Birch's Rd, Jones Rd, Springs Rd
75	100	Shands Rd

Throughout the network refinement process the link parameters for distance and lane allocation were not altered on any links. Note that a distance of 0.5km has been applied to each new zone connector.

Figure 5.2 provides a superimposed image of the existing Christchurch road network with the 2006 modelled network from the CTM. Additional roads have been highlighted as these have been coded into both the CSM2 base and future year networks due to their strategic location in the area of interest as these links have the potential to be influential on existing and future route choice in the area.

The additional links, excluding zone connectors, which are also included in the refined model network, are: Berketts Road, Robinson Road, Aiston Road, Trents Road (between Shands Road and Springs Road), Blakes Road (between Shands Road and Trents Road), Branston Street, Marshes Road (Springs Road to Whincops Road) and Quaifes Road.

Figure 5.2: Additional Links Included Within the CSM Model



5.2.2 Intersections

The introduction of the new zone structure, including new zone connectors and road links required a significant level of minor intersection coding to remove any errors from the network. In total 125 intersections were modified using a standard set of parameters identified by comparison with intersections in the CTM or by taking the midpoint of the range of acceptable values – namely setting the critical gap for all movements at junctions at 4 seconds and setting the follow-up time for all movements to 3.5 seconds.

It is noted that in 2006 the intersections between SH1/Rolleston Drive/Hoskyns Road were not signalised. However within the model these have been coded as signalised intersections to allow consistency with travel time surveys and traffic counts from 2010 when the intersections were signalised.

5.2.3 Nodes

In total 6 additional nodes have been added to the CSM2 model network so that additional links, which are in the Christchurch road network but not represented in the CTM network, can be included to provide alternative route choice to Main South Road and the CSM2 for the future year models.

In the CTM network the Main South Road/Rolleston Drive and the Main South Road/Main South Road junctions has been coded as one intersection. As these junctions are both signalised, and are also seen to be potentially influential to traffic flow and therefore route choice, an additional node was added so that two signalised intersections could be coded.

5.2.4 Speed flow curves

Akcelik speed-flow curves were used in the CSM model based on the equation below:

$$TC = T0 + 15 \cdot D\left\{\left(\frac{V}{C} - 1\right) + \sqrt{\left[\left(\frac{V}{C} - 1\right)^2 + \frac{8k_d\left(\frac{V}{C} - x_0\right)}{C}\right]}\right\} \text{where } k_d = \frac{2C\left(\frac{1}{v_m - v_f} - 1\right)^2}{v_f^2(1 - x_0)}$$

and TC = link travel time (congested) (mins); T0 = link free flow travel time (mins); D = link distance (km); V/C = volume to capacity ratio.

The values used for the variables X0 and Vn/Vt in the CSM model are provided in Table 5.5 below. These parameters are unchanged from the CTM.

Table 5.5 - Speed Flow Curve Parameters

Link type	Vn / Vf	X0
All users	0.4	0
Heavy only	0.4	0

5.2.5 Network Review

Having reviewed the CTM network in the area of interest it was noted that the lane capacities were predominantly coded at 1800 vehicles per hour for each link. This was felt to be an over-estimation of lane capacity considering the number of narrow rural roads in the study area. An over-estimate of capacity was likely to reduce the effect of the speed flow curves under more congested conditions.

Lane capacities on the links within the area of interest have therefore been assigned new capacities based on link type. This is not a global setting for the entire network.

Table 5.6 - Link Types

Link Type No.	Link Type Name	Lane Capacity
1	Motorways	2000
2	State Highways	1800
3	Major Roads	1400
4	Minor Roads	1200
5	Collector	1100
6	Local Roads	900

The number of lanes and the link types coded were reviewed as part of network calibration/validation process and adjusted appropriately. The free flow speeds were calibrated making use of inter-peak journey time data where the road network is more lightly trafficked and could be expected to be reaching free flow speed levels.

6. Data Collection

6.1 Count Data

As previously mentioned the existing CTM was calibrated and validated using survey points along defined screenlines; the most south-westerly of which are those which run along Dawsons Road and Shands Road. Although useful, the quantity of observed data in the area of interest was insufficient for calibrating the CSM2 model, and therefore additional observed data was required for the recalibration process in the base year project model.

NZTA State Highway links counts plus further link counts sourced from Selwyn District Council (SDC) and Christchurch City Council (CCC) formed most of the count sites used for the calibration and validation of the CSM2 model.

However further surveys were required for model development at a number of key junctions through which realistic alternative routes between Rolleston and Christchurch pass, these were:

- Main South Road/ Rolleston Drive;
- Main South Road/ Tennyson Street;
- Main South Road/ Hoskyns Road;
- Main South Road/ Weedons Road;
- Main South Road/ Curraghs Road;
- Shands Road/ Marshs Road; and
- Weedons Road/ Levi Road.

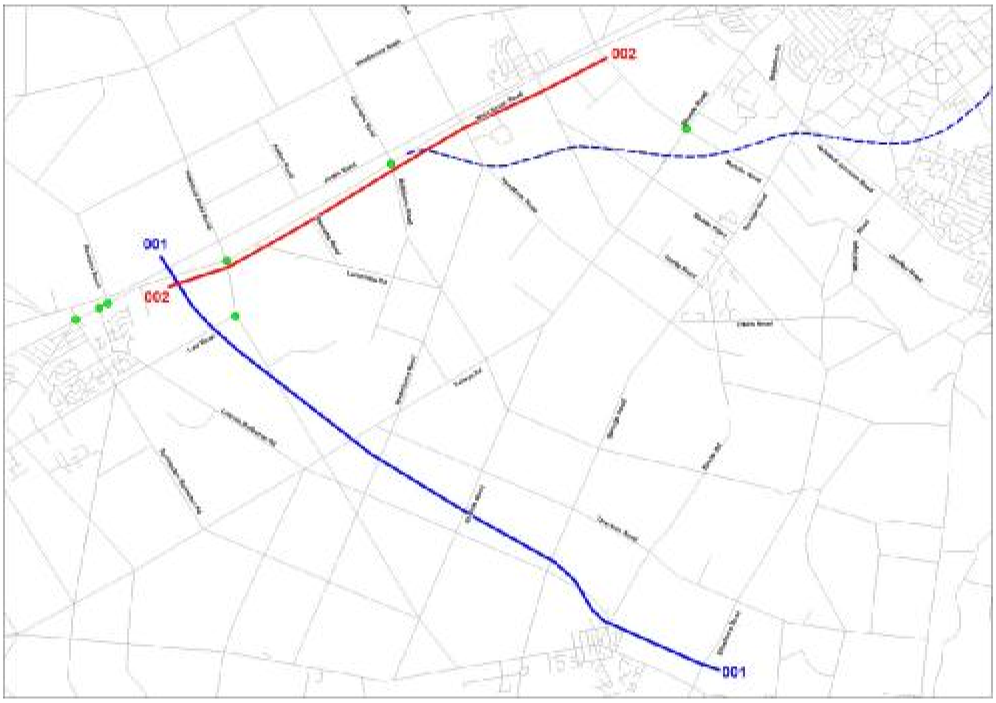
These additional surveys allowed for the formation of two new screenlines to capture traffic flow movements though the proposed scheme area, which are shown in Figure 6.1. Listed below are the links that comprise each screenline:

Screenline 1: Jones Rd (Hoskyns Rd – Weedons Ross Rd); Levi Rd (Weedons Rd – Lincoln Rolleston Rd); Waterholes Rd (Tancreds Rd – Boundary Rd); Shands Rd (Tancreds Rd – Boundary Rd); Springs Rd (Tancreds Rd – Boundary Rd); Birchs Rd (Tancreds Rd – Boundary Rd); and Ellesmere Rd (Boundary Rd – Robinson Rd).

Screenline 2: Weedons Rd (Levi Rd – Main South Rd); Robinson Rd (Waterholes Rd - Main South Rd); Waterholes Rd (Hamptons Rd – Main South Rd); Trents Rd (Blakes Rd – Main South Rd); and Marshs Rd (Shands Rd – Main South Rd).

Screenline 1 is aimed at capturing the movement of traffic between the greater Selwyn district and Christchurch City, whilst Screenline 2 captures the east-west movement of traffic which passes across Main South Road.

Figure 6.1 – CSM New Screenlines and Survey Locations



The base year model represents 2006 with count data from NZTA, SDC and CCC from the same year. Therefore the survey data was factored to bring the flows back from 2010 to 2006 traffic levels. A 2% growth has been taken from the New Zealand Economic Evaluation Manual for the Canterbury region, which therefore means that a factor of 0.924 (1 / (1.02^4)) has been applied to all 2010 surveyed flows. AADT annual growth between 2006 and 2009, obtained from the NZTA Transit database, was 2% for all counts in the Canterbury region and 3% for the 5 counts along Main South Road. As Main South Road is likely to experience more growth than connecting rural roads 2% can be seen to be an acceptable annual growth level.

Two of the counts along Main South Road that were extracted from the NZTA TMS database have been used for validation purposes. To format that data to the needs of the model, hourly vehicle flow data was extracted from counts taken in January and August 2006 and then converted into the light and heavy categories using the yearly AADT data and HCV proportions.

6.2 Journey Time Data

Travel time routes undertaken in 2006 were used in the calibration of the CTM base model. However these routes only extend to the Main South Road/Marshs Road intersection and do not cover routes further south along Main South Road, nor along Jones Road, Selwyn Road, Shands Road or Springs Road.

In order to ensure the modelled network accurately reflects speeds and delays, particularly in the surrounds of the scheme, five new journey time surveys were undertaken for the AM, Inter-peak and PM time periods in both directions for the following routes:

Route 1 EB – Jones Road/Waterloo Road Eastbound between Two Chain Road and Carmen Road;

Route 1 WB – Waterloo Road/Jones Road Westbound between Carmen Road and Two Chain Road;

Route 2 EB – Main South Road Eastbound between Dunns Crossing Road and Carmen Road;

Route 2 WB – Main South Road Westbound between Carmen Road and Walkers Road;

Route 3 NB – Selwyn Road / Shands Road Northbound between Lincoln Rolleston Rd and Carmen Road;

Route 3 SB – Shands Road / Selwyn Road Southbound between Carmen Road and Lincoln Rolleston Road;

Route 4 NB – Shands Road Northbound between Ellesmere Junction Road and Carmen Road;

Route 4 SB – Shands Road Southbound between Carmen Road and Ellesmere Junction Road;

Route 5 NB – Springs Road Northbound between Ellesmere Junction Road and Amyes Road; and

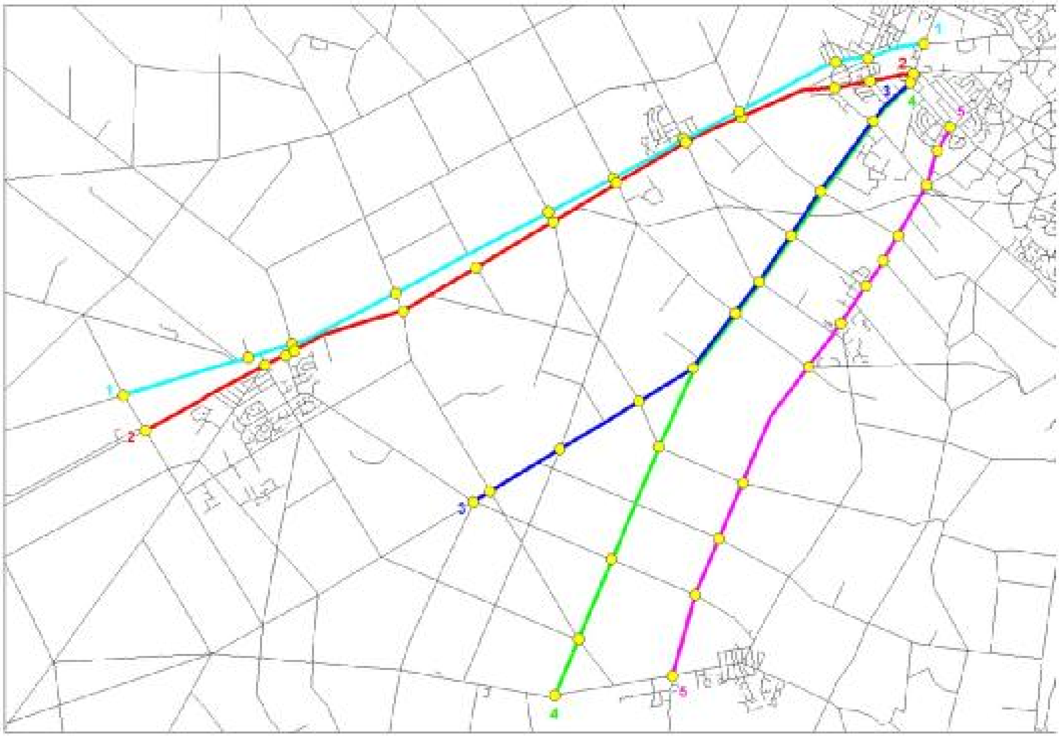
Route 5 SB – Springs Road Southbound between Amyes Road and Ellesmere Junction Road.

The routes are shown in Figure 6.2 along with the locations at which survey route timings were taken.

Each route was traversed 5 times so that an average journey time for that route could be ascertained. It should be noted that route 3 was only surveyed during the PM period.

The 2010 travel time survey data has not been factored or adjusted as to correspond to 2006 as comparable travel time surveys within the study area was not available. Due to the slightly lower volume of traffic in 2006 than 2010 it would be expected that travel times would be slightly faster in 2006 than those in 2010. However as this change cannot be quantified, the 2010 travel times have been used for validation purposes.

Figure 6.2 – Travel Time Routes



A summary of the surveyed travel time results is provided in Table 6.1.

Table 6.1 – Average Surveyed Journey Time

Route	Direction	Average journey time (secs)			Standard deviation		
		AM	IP	PM	AM	IP	PM
1	Northbound	887	879	879	31	33	57
	Southbound	888	859	862	15	29	26
2	Northbound	787	742	780	26	33	36
	Southbound	764	735	754	41	41	19
3	Northbound	-	-	677	-	-	40
	Southbound	-	-	687	-	-	36
4	Northbound	706	718	710	33	79	64
	Southbound	685	646	639	83	55	25
5	Northbound	609	582	583	77	58	25
	Southbound	583	593	633	37	63	55

From the above table it is seen that the standard deviation in travel times across the five separate runs which were made for each route was greatest for Route 4 (Shands Road). This is due in large part to variable delays at signalised intersections on Halswell Junction Road. The Jones Road route (route 1) experienced the lowest level of standard deviation due to a lack of signalised intersections and a lower traffic volume during each peak period than along alternative routes.

Overall the low standard deviations indicate that there is relatively low variability in the travel times on these routes.

7. Prior Matrix Estimation Assignment

7.1 Validation Criteria

The model has been validated to 2006 conditions against the following observed data:

- Individual link and screenline flows by period and direction;
- Turning flows at a validation counts within the area of interest; and
- Travel times on key routes.

The validation has been undertaken using the guidelines in the Economic Evaluation Manual (EEM), and using other local and international practice. Specifically, this has included the following assessments:

- Absolute and percentage differences between model and counts on individual links;
- GEH statistics on individual links. This is a form of Chi-squared statistic that is designed to be tolerant of larger relative errors in low flows;
- Global assessment of model fit using the correlation coefficient (R^2 statistic). The EEM suggests a target value of >0.85 in the wider model area and >0.95 in the key study area;
- Global assessment of model fit using the Root Mean Square Error (RMSE). The EEM suggests a target value of less than 30%; and
- Cumulative and total differences in travel times.

The GEH statistic is calculated as follows:

$$GEH = \sqrt{\frac{(q_{model} - q_{obs})^2}{(q_{model} + q_{obs})/2}}$$

Where q_{obs} = observed hourly flow

q_{model} = modelled hourly flow

This measure is calculated for each link and screenline. The EEM suggests the following criteria for an acceptable fit of the model:

- At least 60% of individual link flows should have GEH less than 5;
- At least 95% of individual link flows should have GEH less than 10;
- All individual link flows should have GEH less than 12; and

- Screenline flows should have a GEH less than 4 in most cases.

7.2 Initial Results

Initial model assignments were undertaken without matrix factoring or matrix estimation techniques. Tables 7.1 – 7.3 shows the level of correlation achieved between all count data within the area of interest (both matrix estimation and validation), and the assigned flows, prior to matrix estimation, for all vehicles and both light vehicles and HCVs in terms of the GEH statistic, R^2 and RMSE. Please note that R^2 and RMSE statistics have been based on calculations between modelled and surveyed data, and have not been derived from line of best fit graphs.

Tables 7.4 - 7.6 display this comparison for the validation count set only. Tables 7.7 and 7.8 display the screenline statistics. Note that figures highlighted in red refer to count data which do not pass the target criteria.

Table 7.1 - Model Fit Before Matrix Estimation Against ALL Count Data (All Vehicles)

EEM Criteria	Target	AM Peak	Inter-peak	PM Peak
GEH < 5	60%	73.3%	75.4%	69.6%
GEH < 10	95%	89.2%	93.8%	90.8%
GEH < 12	100%	94.6%	98.3%	93.8%
R2 (all data)	>0.85	0.82	0.84	0.83
RMSE	<30%	8.84%	11.02%	7.41%

Table 7.2: Model Fit Before Matrix Estimation Against ALL Count Data (Light Vehicles)

EEM Criteria	Target	AM Peak	Inter-peak	PM Peak
GEH < 5	60%	49.2%	65.8%	52.5%
GEH < 10	95%	78.3%	89.2%	84.2%
GEH < 12	100%	89.2%	96.7%	88.3%
R2 (all data)	>0.85	0.78	0.82	0.78
RMSE	<30%	6.50%	7.43%	5.46%

Table 7.3: Model Fit Before Matrix Estimation Against ALL Count Data (HCV's)

EEM Criteria	Target	AM Peak	Inter-peak	PM Peak
GEH < 5	60%	97.5%	85.0%	86.7%
GEH < 10	95%	100.0%	98.3%	97.5%
GEH < 12	100%	100.0%	100.0%	99.2%
R2 (all data)	>0.85	0.81	0.63	0.48
RMSE	<30%	22.89%	20.66%	17.72%

Table 7.4: Model Fit Before Matrix Estimation Against VALIDATION Data (All Vehicles)

EEM Criteria	Target	AM Peak	Inter-peak	PM Peak
GEH < 5	60%	79.4%	89.0%	75.7%
GEH < 10	95%	95.6%	100.0%	93.4%
GEH < 12	100%	98.5%	100.0%	94.9%
R2 (all data)	>0.85	0.93	0.97	0.83
RMSE	<30%	9.38%	11.50%	8.24%

Table 7.5: Model Fit Before Matrix Estimation Against VALIDATION Data (Light Vehicles)

EEM Criteria	Target	AM Peak	Inter-peak	PM Peak
GEH < 5	60%	60.3%	83.8%	60.3%
GEH < 10	95%	91.2%	100.0%	89.7%
GEH < 12	100%	97.1%	100.0%	91.2%
R2 (all data)	>0.85	0.92	0.98	0.81
RMSE	<30%	6.90%	8.82%	6.12%

Table 7.6: Model Fit Before Matrix Estimation Against VALIDATION Data (HCV's)

EEM Criteria	Target	AM Peak	Inter-peak	PM Peak
GEH < 5	60%	98.5%	94.1%	91.2%
GEH < 10	95%	100.0%	100.0%	97.1%
GEH < 12	100%	100.0%	100.0%	98.5%
R2 (all data)	>0.85	0.90	0.94	0.62
RMSE	<30%	24.30%	20.60%	17.61%

Table 7.7: Model Fit Before Matrix Estimation For Screenline Totals (Light Vehicles)

Screenline	Direction	Target	AM Peak	Inter-peak	PM Peak
1	Northbound	(GEH ≤ 4)	6	2	2
	Southbound	(GEH ≤ 4)	1	1	6
2	Eastbound	(GEH ≤ 4)	3	1	1
	Westbound	(GEH ≤ 4)	4	2	3

Table 7.8: Statistics For Validation Data - Screenline Totals (Heavy Vehicles)

Screenline	Direction	Target	AM Peak	Inter-peak	PM Peak
1	Northbound	(GEH ≤ 4)	1	0	5
	Southbound	(GEH ≤ 4)	1	0	1
2	Eastbound	(GEH ≤ 4)	0	2	2
	Westbound	(GEH ≤ 4)	0	1	1

Tables 7.1 – 7.8 demonstrate that the initial model runs did not meet all of the EEM validation criteria for all modelled time periods, and therefore it was necessary to apply some matrix estimation to the base year model. This is also demonstrated in Figures 7.3 – 7.5, which provide scatter plots for hourly surveyed vs. hourly modelled flows. For the AM and PM peak for all count data the level of base validation is particularly poor for light vehicles.

Figure 7.1: Modelled vs. Observed Flows – AM Peak (Light Vehicles) – Prior Matrix

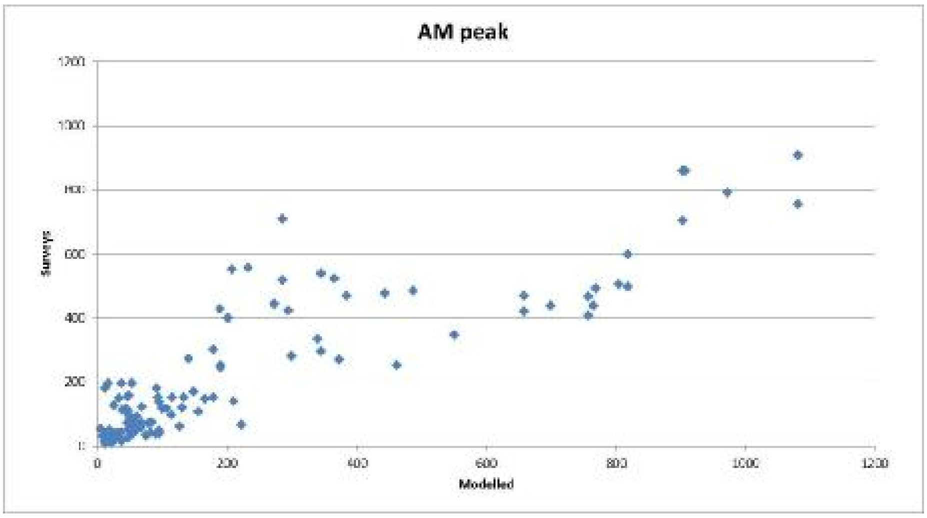


Figure 7.2: Modelled vs. Observed flows – IP Peak (Light Vehicles) – Prior Matrix

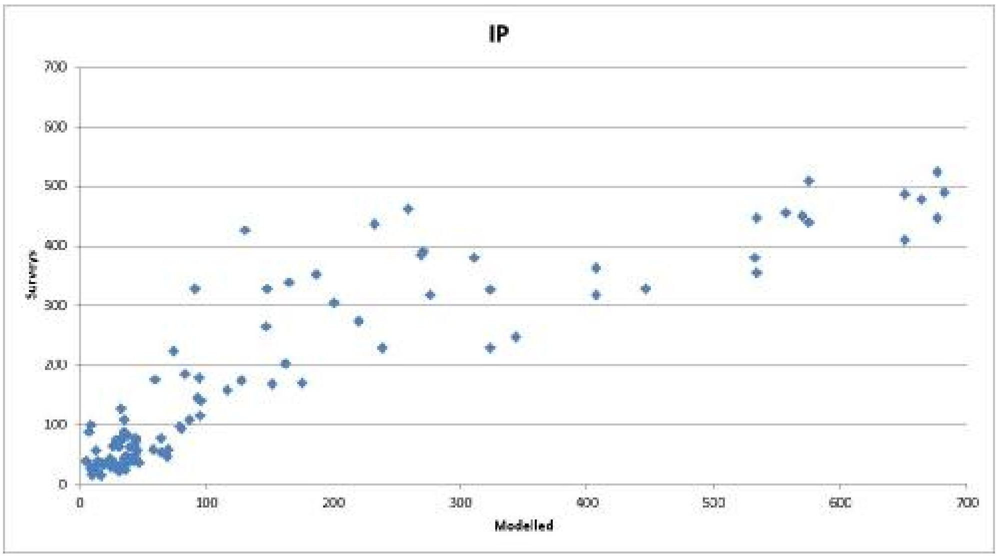
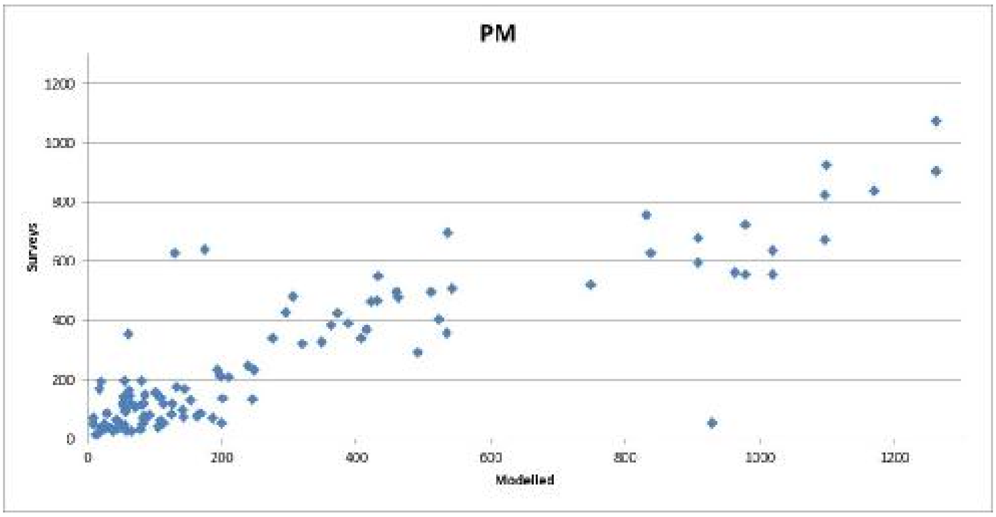


Figure 7.3: Modelled vs. Observed Flows – PM Peak (Light Vehicles) – Prior Matrix



7.3 Summary

With reference to the above results it can be seen that in order to achieve acceptable levels of calibration/validation within the study area a process of matrix estimation is required so that modelled links are able to achieve a closer fit with that of the observed counts. In particular it has been identified that for 'all counts' prior to matrix estimation, the model fails to pass all criteria for acceptable calibration/validation (see Tables 7.1 and 7.2). Screenline 1 also fails during the AM and PM peak periods although screenline 2 passes for all periods.

8. Matrix Development and Assignment

8.1 Overview

The CSM model represents peak one hour traffic demand for the AM, IP and PM periods which have been derived from the peak period CTM following a factoring and re-zoning process.

8.2 Matrix Estimation

To further refine the disaggregated CTM matrices, matrix estimation was used to produce a robust set of demand matrices, reflecting the observed traffic volumes whilst maintaining the pattern of trips from the original CTM. Matrix estimation is also used to infill trips between disaggregated zones as well as to correct for the over/under representation of flows.

The matrix estimation process can adjust the number of trips between each origin and destination pair in the demand matrices so assigned link volumes matches a set of "target" counts. This adjustment process creates an "estimated matrix" which better represents the demand for trips within the modelled area and, when assigned, more accurately recreates the movements of that traffic through the network. Count sites not used for the matrix estimation have been retained as an independent count for the purpose of model validation.

Matrix estimation was undertaken for light and heavy vehicles separately using CUBE Analyst. The inputs to the program included:

- Initial highway assignment origin to destination routings (path files) by vehicle class;
- A prior matrix extracted directly from the CTM and disaggregated;
- Count data; and
- Confidence levels for both count data and matrix data.

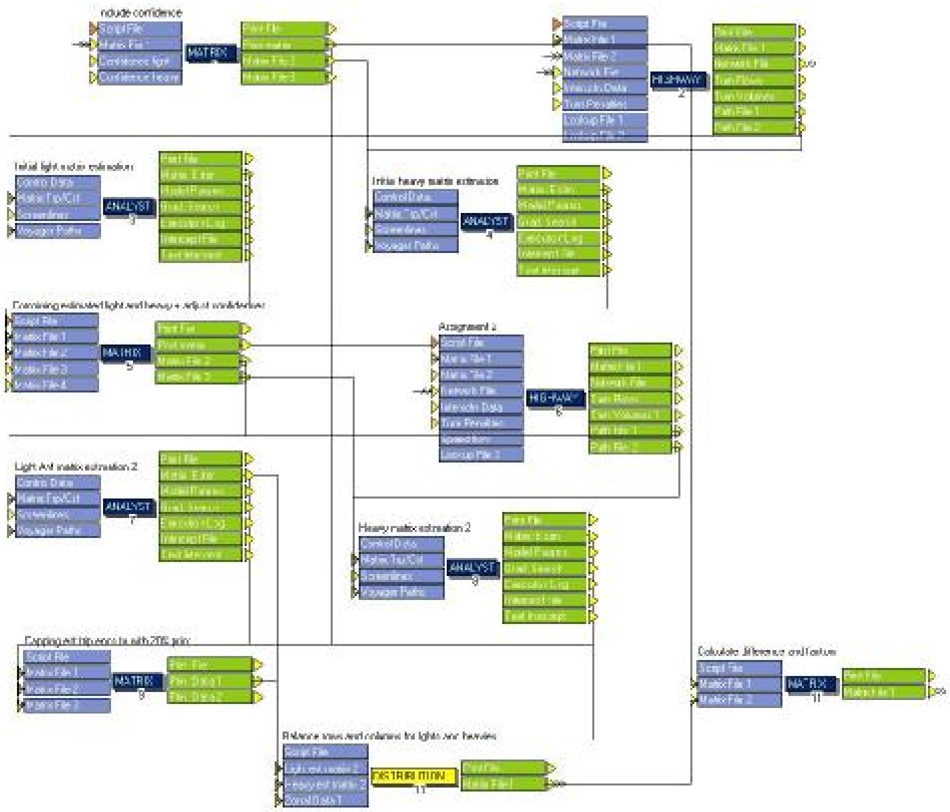
Confidence levels affect the level of matrix estimation by determining how confident the modeller is in the initial matrices. Confidence levels for the prior matrix have been initially set as 50 for zones within the Christchurch CBD and 60 for all other outer zones. This gives a higher level of confidence to areas outside the CBD. However as model refinement has only been undertaken within the area of interest, there are unlikely to be any significant changes to origin and destination trips to/from zones within the CBD.

This level of confidence has been set to allow the matrix estimation module the flexibility to manipulate zones within our area of interest whilst adding some restriction to the level at which the prior matrix can be altered. This is an important step as the final matrix following estimation ensures that the trips ends for origins and destinations are capped to a 20% change from the prior matrix for each individual zone, and so it is important that that prior matrix does not initially alter too greatly.

Confidence levels for the count data for matrix estimation has been based on the type of count received. Higher confidence indices of 100 have been applied to survey counts undertaken by Beca, and indices of 80 have been placed on any counts used from SDC within the matrix estimation process. All count data is based on individual link counts.

Following the initial matrix estimation processes, for both vehicle classes, the matrices were combined and then reassigned to the network from where new path files were generated. The matrix estimation was then repeated with a higher confidence level set for the input prior matrix (to 80 for CBD zone and 90 for other zones) which at this stage in the estimation process has already been through one pass of the CUBE Analyst module. Figure 8.1 shows the structure of the matrix estimation process in CUBE VOYAGER.

Figure 8.1 – Matrix Estimation Process in CUBE Voyager



The following checks were undertaken on the matrix estimation to see that travel patterns had not been distorted as matrix estimation can sometimes lead to an increased number of short distance trips:

- Trip length distributions for pre and post matrix estimation assignments;

- Sector matrices were produced to compare both the absolute and percentage differences between prior and post matrix estimation matrices; and
- Checks were undertaken on individual cell changes.

Following both sets of matrix estimation and the 20% capping of zonal changes, a further step was taken to rebalance the row and column totals using a furnessing process. These processes take place after the second round of matrix estimation.

8.2.1 CTM Screenlines

As mentioned in Chapter 5, the existing level of screenline validation within the CTM is poor for all screenlines which pass close or through the area of interest – namely screenlines J, P, V, W, and X. The model refinement process is intended to improve the level of validation within the area of interest whilst attempting to either minimise the levels of change or to improve model performance for the wider modelled network. It has therefore been considered necessary to include the screenline totals for screenlines J, V, W and X within the matrix estimation process so that the volume of traffic leaving/entering the area of interest to/from the city closely matches the observed levels.

9. Final Assignment Validation

9.1 Link Counts

Figures 9.1 - 9.3 show the effects of matrix estimation on the goodness of fit of the model for all count data within the area of interest (shown for all vehicles). Note that the blue markings refer to matrix estimated (ME) counts, whilst red markings refer to the independent validation (V) counts. The R^2 value included within the graphs refers to the total combined datasets of validation and matrix estimated counts.

Note that 52 link counts have been used in the matrix estimation process and 62 have been used in the validation of the model.

Figure 9.1: Modelled vs. Observed Flows – AM Peak (Light Vehicles) – Final Matrix

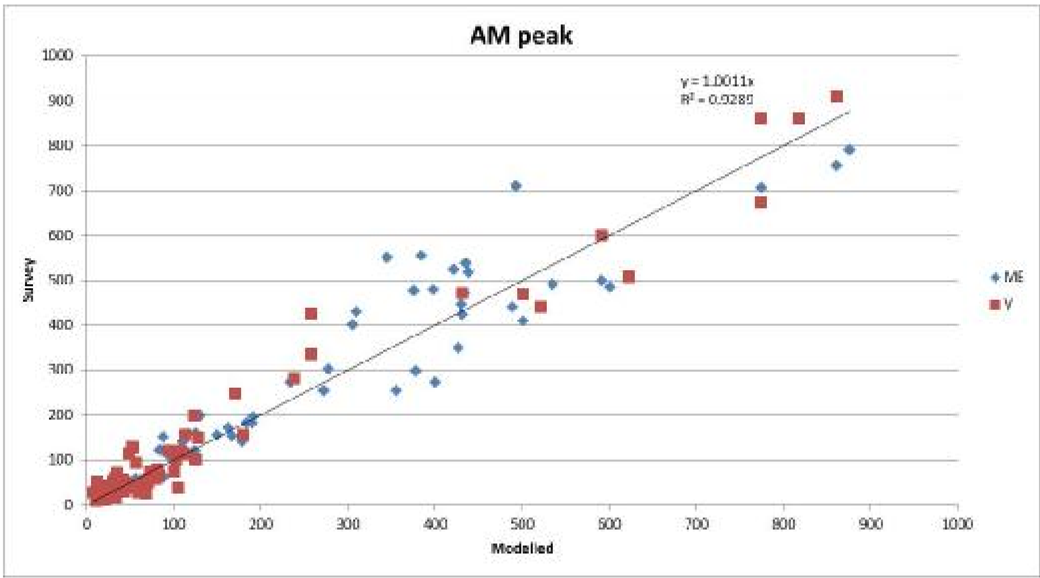


Figure 9.2: Modelled vs. Observed Flows – Inter-Peak (Light Vehicles) – Final Matrix

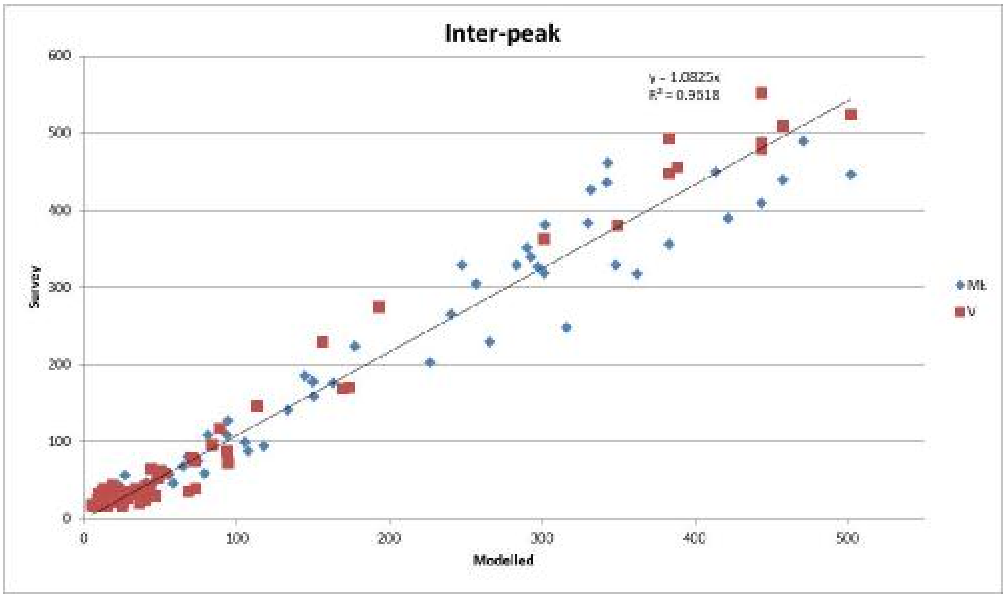
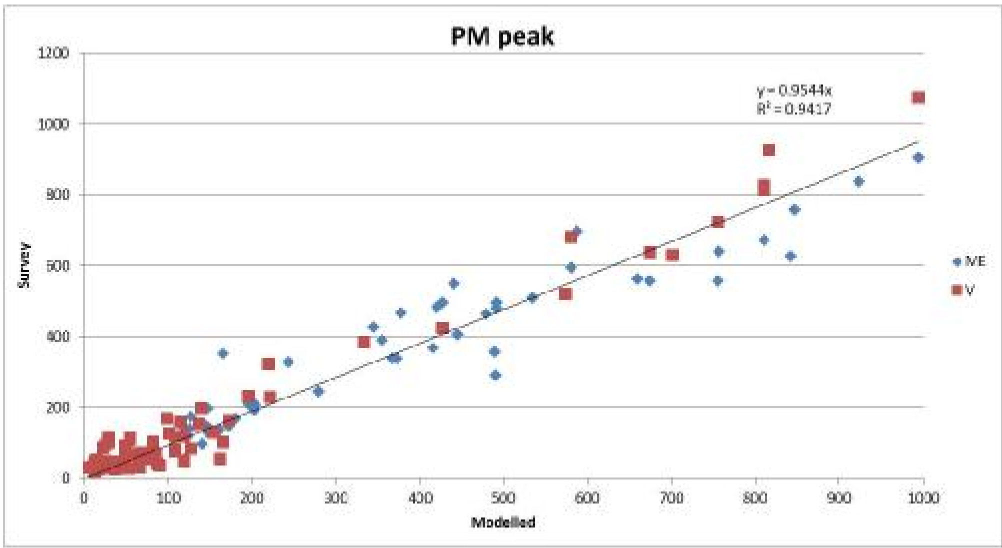


Figure 9.3: Modelled vs. Observed flows – PM Peak (Light Vehicles) – Final Matrix



Further analysis of observed versus assigned flows on a count-by-count basis is provided in Appendix A. With reference to Figures 9.1-9.3 it can be seen that the R^2 values closely matches the requirement of 0.85 for a wide area model, and indeed in all cases is close to 0.95 which is the target for a study area model.

A summary of the comparison against all counts within the area of interest of the modelled GEH error statistics against the EEM criteria is provided within Table 9.1 for all vehicles, with Tables 9.2 and 9.3 displaying the same for light vehicles and heavy vehicles respectively. Tables 9.4 - 9.6 display the statistics for the validation data set, with Table 9.7 and 9.8 displaying the screenline statistics.

Table 9.1: Statistics for All Count Data (All Vehicles)

EEM Criteria	Target	AM Peak	Inter-peak	PM Peak
GEH < 5	60%	90.8%	95.4%	86.3%
GEH < 10	95%	100.0%	100.0%	97.6%
GEH < 12	100%	100.0%	100.0%	100.0%
R2 (all data)	>0.85	0.95	0.97	0.96
RMSE	<30%	9.38%	11.45%	8.35%

Table 9.2: Statistics for All Count Data (Light Vehicles)

EEM Criteria	Target	AM Peak	Inter-peak	PM Peak
GEH < 5	60%	84.2%	95.0%	77.5%
GEH < 10	95%	100.0%	100.0%	95.8%
GEH < 12	100%	100.0%	100.0%	100.0%
R2 (all data)	>0.85	0.93	0.96	0.94
RMSE	<30%	6.95%	7.62%	6.15%

Table 9.3: Statistics for All Count Data (Heavy Vehicles)

EEM Criteria	Target	AM Peak	Inter-peak	PM Peak
GEH < 5	60%	97.5%	95.8%	95.0%
GEH < 10	95%	100.0%	100.0%	100.0%
GEH < 12	100%	100.0%	100.0%	100.0%
R2 (all data)	>0.85	0.81	0.77	0.73
RMSE	<30%	22.81%	23.84%	20.41%

Table 9.4: Statistics for Validation Data (All Vehicles)

EEM Criteria	Target	AM Peak	Inter-peak	PM Peak
GEH < 5	60%	92.6%	96.3%	83.8%
GEH < 10	95%	100.0%	100.0%	98.5%
GEH < 12	100%	100.0%	100.0%	100.0%
R2 (all data)	>0.85	0.97	0.98	0.97
RMSE	<30%	11.07%	13.95%	10.16%

Table 9.5: Statistics for Validation Data (Light Vehicles)

EEM Criteria	Target	AM Peak	Inter-peak	PM Peak
GEH < 5	60%	86.8%	92.6%	77.5%
GEH < 10	95%	100.0%	100.0%	95.8%

GEH < 12	100%	100.0%	100.0%	100.0%
R2 (all data)	>0.85	0.96	0.98	0.97
RMSE	<30%	8.26%	10.70%	7.57%

Table 9.6: Statistics for Validation Data (Heavy Vehicles)

EEM Criteria	Target	AM Peak	Inter-peak	PM Peak
GEH < 5	60%	98.5%	100.0%	94.1%
GEH < 10	95%	100.0%	100.0%	100.0%
GEH < 12	100%	100.0%	100.0%	100.0%
R2 (all data)	>0.85	0.90	0.94	0.82
RMSE	<30%	24.22%	24.90%	20.78%

Table 9.7: GEH Statistics for Validation Data - Screenline Totals (Light Vehicles)

Screenline	Direction	Target	AM Peak	Inter-peak	PM Peak
1	Northbound	(GEH ≤ 4)	1	1	0
	Southbound	(GEH ≤ 4)	3	1	1
2	Eastbound	(GEH ≤ 4)	0	3	3
	Westbound	(GEH ≤ 4)	0	4	3

Table 9.8: GEH Statistics for Validation Data - Screenline Totals (Heavy vehicles)

Screenline	Direction	Target	AM Peak	Inter-peak	PM Peak
1	Northbound	(GEH ≤ 4)	0	1	1
	Southbound	(GEH ≤ 4)	1	1	1
2	Eastbound	(GEH ≤ 4)	0	1	2
	Westbound	(GEH ≤ 4)	0	1	1

Tables 9.1 – 9.8 show that following matrix estimation the model reaches satisfactory levels of calibration and validation for all time periods.

It can be seen the good levels of validation are achieved for the criteria of 60% of links to obtain a GEH less than 5. The AM, IP and PM periods achieved 84.2%, 95.0% and 77.5% respectively of links with a GEH less than 5 for light vehicle flow, which is well within the EEM target (see Table 9.2).

Across all periods it can be seen that the criteria for all link count sites to have a GEH value of less than 12 is achieved. However two counts achieve a GEH close to 12 in the PM peak, which are both a result of the model underestimating the movement of northbound traffic along Hoskyns Road from the intersection of Hoskyns Road and Jones Road. A validation link count however just to the north of this intersection, also along Hoskyns Road, achieves an excellent fit to the survey data with GEH value of 1 for the northbound movement, which suggests a conflict in the surveyed flow. This is further supported as the junction to the south of this link at the Main South Road/Hoskyns Road intersection also achieves good levels of validation.

This intersection will however be closely looked at in the development of future year models as there may still be potential for traffic to use adjacent intersections along Main South Road to make the east-west movement.

With regards to achieving the R^2 value of greater than 0.85, this fails for heavy vehicles in all periods (see Table 9.3). The R^2 value in the PM peak period is equal to 0.73, which is below the target but still represents a significant improvement from the prior matrix assignment which achieved a value of 0.48. In the AM the R^2 value remains at 0.81 whilst in the inter-peak period the R^2 rises significantly to 0.77, which are both values that are close to the target level. It should also be appreciated that this criteria is more challenging to achieve for heavy vehicle validation where the total flow of vehicles is considerably lower than that of light vehicles.

The results of the matrix estimation identified the following:

- The fit to the total data set is significantly improved following the application of matrix estimation;
- There is an improvement in the fit of the independent data following matrix estimation, showing that the estimation process has not compromised the model in areas away from the estimation sites;
- Validation link counts are seen to be a better fit than those matrix estimated sites. Although this seems counter intuitive, it should be appreciated that the level of model fit to the validation counts prior to matrix estimation was far greater than the fit to the matrix estimated count sites;
- The AM and PM peak periods perform to similar levels with regards to the percentage of sites which achieve a GEH value less than 5;
- Heavy vehicle flow comparisons are difficult due to the low level of traffic flow and the lack of count data during the inter-peak period. However the model still achieves all the required standards aside from the R^2 value in the inter and PM peak periods; and
- Overall, a good fit is shown against the full data set, and an acceptable fit is indicated against the independent validation data.

Appendix A contains the full observed count against modelled flow comparison, with Appendix B providing further details regarding screenline performance.

9.2 Turning Counts

Turning count data was obtained from the 2010 surveys. Traffic flows from four of these surveys were used in the matrix estimation process, whilst three were used for model validation, namely intersections of Main South Road/Rolleston, Main South Road/Weedons Road and Weedons Road/Levi Road. Table 9.9 below highlights the levels of validation for turns at the aforementioned intersections (total of 24 turning movements).

Table 9.9: Model Fit After Matrix Estimation on Turning Count VALIDATION - GEH

EEM Criteria	Target	AM light	AM heavy	IP light	IP heavy	PM light	PM heavy
GEH < 5	60%	83%	100%	92%	100%	79%	96%
GEH < 10	95%	100%	100%	100%	100%	100%	100%
GEH < 12	100%	100%	100%	100%	100%	100%	100%

With reference to Table 9.9 it can be seen that high levels of model fit are obtained across the 24 turning movements included within the validation.

Further details regarding turning counts are provided in Appendix D.

9.3 CTM Original Screenline Comparison

The above results have shown that a positive change has been made to level of model validation/calibration within the area of interest. Table 9.10 below highlights the effect that network changes within the area of interest together with matrix estimation (including CTM screenline J, V, W and X totals) have had across the whole model. The table provides a comparison between the levels of calibration with survey data in terms of directional GEH for each screenline for both the CTM and the CSM^2 models.

Table 9.10: Screenline Performance Comparison (Light Vehicles)

Screenline		AM peak		Inter-peak		PM peak	
		CSM2	CTM	CSM2	CTM	CSM2	CTM
B	East	0	0	0	0	0	0
	West	0	0	0	0	0	0
C	North	1	1	2	2	1	1
	South	3	3	1	1	0	0
D	North/East	6	6	1	1	3	3
	South/West	5	5	1	1	2	2
E	North	3	3	2	2	4	4
	South	4	4	1	1	3	3
F	North/East	3	9	4	3	1	4
	South/West	2	9	4	3	1	3
G	East	7	1	3	3	6	2
	West	1	4	4	3	8	5
H	North	4	0	4	6	16	9
	South	1	1	0	1	3	3
J	East	3	9	2	8	3	13

Screenline		AM peak		Inter-peak		PM peak	
		CSM2	CTM	CSM2	CTM	CSM2	CTM
	West	0	5	1	9	5	18
K	North	1	3	2	2	3	5
	South	9	8	1	0	3	4
L	North/East	1	0	3	1	5	2
	South/West	1	4	1	3	3	0
M	North/East	1	1	5	4	11	7
	South/West	3	4	1	2	6	2
N	North/East	2	2	2	4	4	6
	South/West	8	11	4	4	0	2
P	North	2	5	5	7	6	8
	South	8	10	3	8	6	7
Q	North/East	2	4	5	3	2	5
	South/West	6	10	2	1	2	2
R	North/East	9	8	2	2	3	3
	South/West	2	1	4	4	3	3
S	East	4	5	1	2	12	11
	West	2	0	0	1	1	2
T	North/East	11	11	2	3	1	2
	South/West	0	1	2	2	2	2
U	North/East	4	4	4	4	2	2
	South/West	6	6	2	2	2	2
V	North	0	2	0	6	4	6
	South	0	1	0	5	3	12
W	North/East	1	4	0	1	2	2
	South/West	2	0	0	0	3	5
X	North/East	2	3	1	2	0	1
	South/West	1	8	1	1	1	4

The above table highlights that following the refinement of the model the majority of screenlines perform to similar levels as observed in the CTM. As would be expected, significant improvements have been seen for screenlines where matrix estimation on total movements has been included. However, slight decreases in the levels of validation for screenline G have appeared as a focus was given to screenlines closes to the study area. It is not anticipated that this change in performance will be an issue in the future model as the screenline is city centre based which is away from the area of interest. A similar pattern is observed in the levels of calibration for heavy vehicles. Table 9.11 highlights the screenline results close to the area of interest for heavy vehicles. Screenlines which have seen higher GEH values in the CSM2 model when compared to the CTM model are along screenlines G-East, H-North and M-North/East.

Table 9.11: Screenline Performance Comparison (Heavy Vehicles)

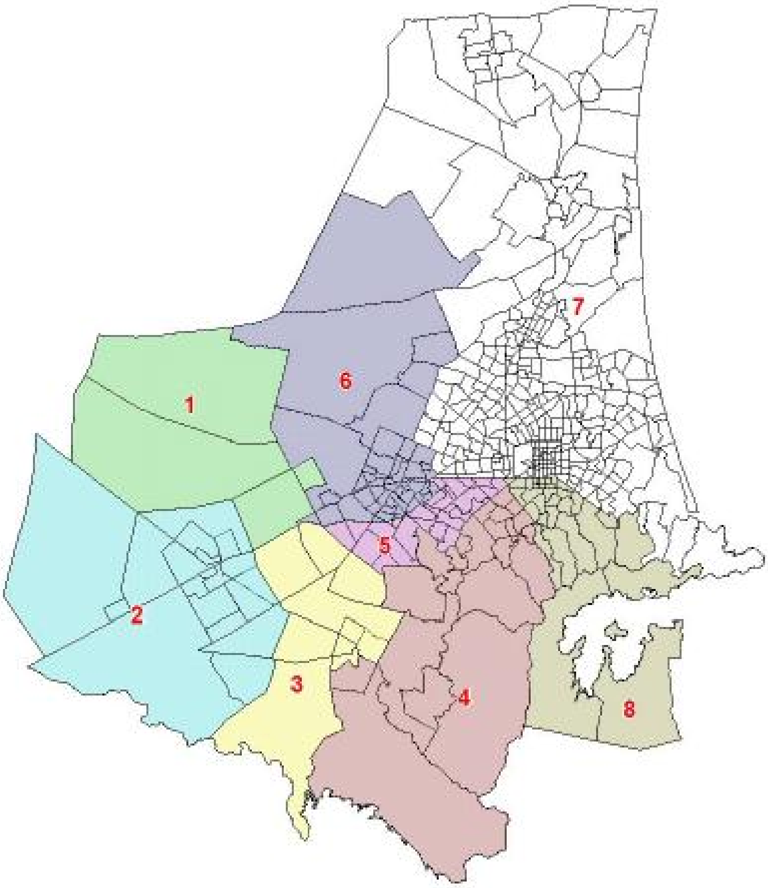
Screenline		AM peak		Inter-peak		PM peak	
		CSM2	CTM	CSM2	CTM	CSM2	CTM
J	East	0	1	1	2	0	1
	West	2	3	3	5	3	6
P	North	1	3	5	6	0	1
	South	0	2	4	5	3	4
V	North	2	4	3	4	1	2
	South	3	4	3	3	2	2
W	North/East	1	1	1	2	1	1
	South/West	3	1	1	1	2	1
X	North/East	6	8	6	7	4	6
	South/West	5	7	5	5	4	4

From the above table there can be seen to be minor increases in the GEH values following the CSM2 refinement for screenline J-West and X-South/West during the PM peak. Otherwise GEH values can be been to generally be consistent or lower than those in the CTM model.

9.4 Effects of Matrix Estimation

The effects of matrix estimation on travel demands have been assessed on a sector to sector basis. The sectors defined are shown in Figure 9.4. Sectors were determined based on key travel routes between each sector in the area of interest and by the location of the CSM.

Figure 9.4 – Eight Sector Plan



The effects of matrix estimation at an all vehicle level are summarised in Tables 9.12 – 9.14 below, with actual figures for before and after matrix estimation displayed in Appendix C. Appendix C also contains tables showing the effect of matrix estimation on light vehicles and HCVs separately.

Table 9.12: AM Peak – Effect of Matrix Estimation (prior vs. post) – All vehicles

	1	2	3	4	5	6	7	8	Total
1	-2%	30%	78%	35%	12%	1%	22%	22%	17%
2	42%	12%	7%	-7%	-22%	-28%	-23%	-21%	-10%
3	30%	4%	-8%	-17%	-10%	23%	4%	-20%	1%
4	45%	13%	11%	-5%	-6%	46%	-3%	-3%	1%
5	16%	-3%	-7%	-7%	-2%	14%	-1%	-4%	0%
6	-5%	-31%	-1%	21%	17%	8%	24%	20%	16%
7	2%	-30%	-10%	-2%	0%	12%	0%	0%	0%
8	12%	-19%	-12%	-3%	-2%	13%	0%	0%	0%
Total	9%	-8%	-1%	-2%	0%	11%	1%	0%	1%

Table 9.13: Inter-Peak – Effect of Matrix Estimation (prior vs. post) – All vehicles

	1	2	3	4	5	6	7	8	Total
1	-3%	44%	61%	67%	36%	-9%	5%	11%	11%
2	87%	20%	16%	11%	-5%	-35%	-31%	-26%	-5%
3	72%	15%	-3%	-6%	3%	-2%	6%	-19%	4%
4	42%	4%	-7%	-9%	-10%	35%	-6%	-6%	-3%
5	19%	-6%	-4%	-11%	-2%	22%	0%	-5%	1%
6	-13%	-31%	11%	44%	21%	3%	21%	22%	14%
7	6%	-25%	1%	-6%	-1%	22%	0%	0%	1%
8	9%	-23%	-24%	-6%	-5%	22%	0%	0%	0%
Total	16%	-3%	4%	-3%	1%	14%	1%	0%	1%

Table 9.14: PM Peak – Effect of Matrix Estimation (prior vs. post) – All vehicles

	1	2	3	4	5	6	7	8	Total
1	-11%	15%	64%	-19%	8%	-3%	16%	8%	8%
2	22%	25%	8%	-13%	-17%	-32%	-23%	-31%	-7%
3	73%	15%	0%	2%	4%	-4%	9%	-17%	7%
4	-25%	-19%	-12%	-12%	-13%	13%	-8%	-7%	-8%
5	12%	-21%	-6%	-13%	-10%	17%	-3%	-8%	-3%
6	0%	-36%	25%	-10%	1%	6%	23%	4%	11%
7	32%	-22%	5%	-8%	-9%	29%	0%	0%	1%
8	22%	-35%	-23%	-8%	-13%	14%	0%	0%	-1%
Total	18%	-9%	5%	-9%	-8%	17%	1%	-1%	1%

The following can be determined from Tables 9.12 – 9.14:

- The largest change in trips occurs in trips to and from sectors 1 and 6. This is in large part due to the matrix estimation process attempting to more closely match the survey data along the original CTM screenline J. In the CTM the modelled flow was approximately 10% lower than the surveyed data, and hence a closer match to the survey data in the CSM^2 model has led to changes in the trip ends to zones in sectors 1 and 6. The proportional change in trips ends in these zones may also appear greater as the absolute number of trips in the prior matrix was initially low.
- There has been little change in the internal trips for sectors 7 and 8. As these areas are far removed from the area of interest this suggests that the model refinement process has had little effect on trips which do not pass through the area of interest. This indicates a close match to traffic flows for these sectors in the original CTM and have therefore not been subject to matrix estimation.

- Across all time periods the total change in trips to and from sectors 7 and 8 is no greater than 1%.
- The largest percentage change in the matrix occurs between zones whose route passes through the area of interest – namely zones 4 to 6 and 1 to 3.
- A significant increase in internal trips can be seen for sectors 2 and 5, which is a result of the matrix estimation and new zone structure raising the level of trips in this region.

It should be noted that the greatest change in the matrix occurs during the PM peak time. This is attributed to the greater number of total trips during this period all vehicles

9.4.1 Trip Length Distribution

Figures 9.5 to 9.7 illustrate the impacts of the matrix estimation process on the trip length distribution for all vehicles by way of trip-length frequency plots. The ‘Final’ columns for each period refer to distribution of trips after matrix estimation.

Figure 9.5: Trip Length Distance Distribution – AM Peak (Light Vehicles)

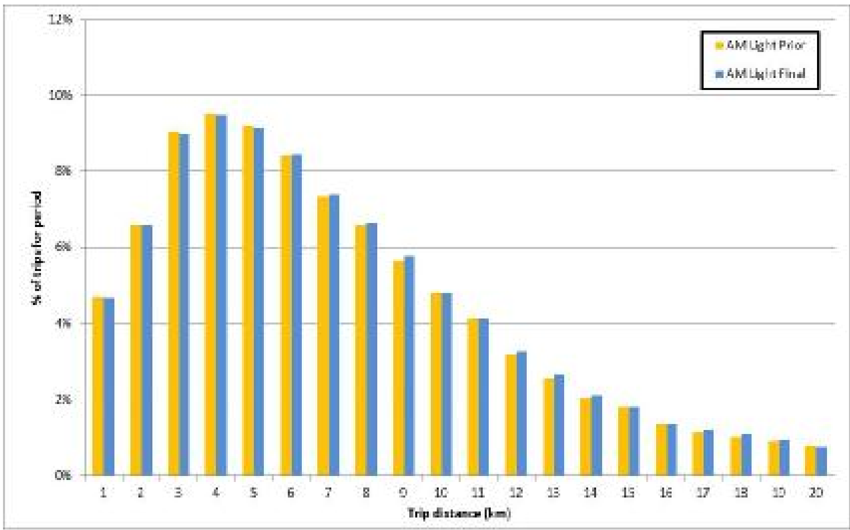


Figure 9.6: Trip Length Distance Distribution – Inter peak (Light Vehicles)

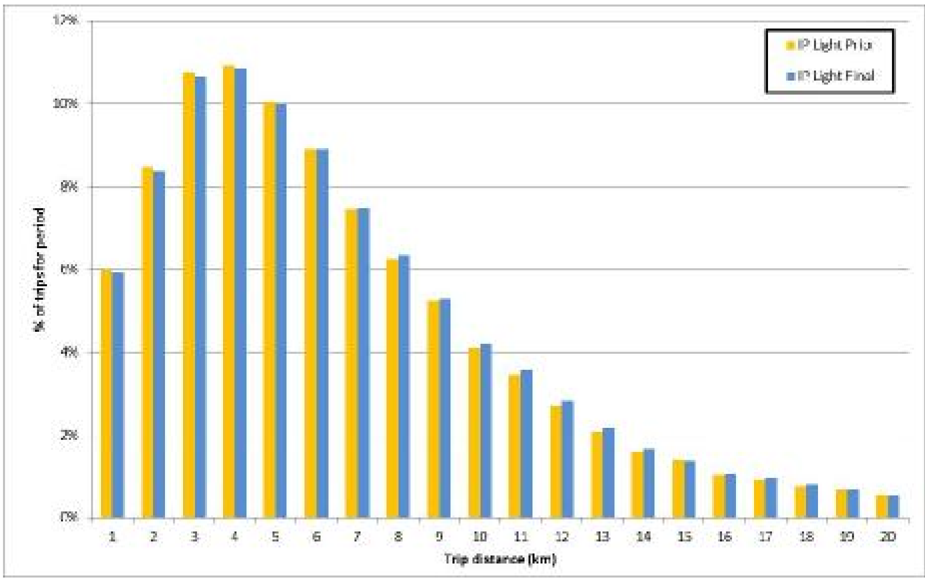
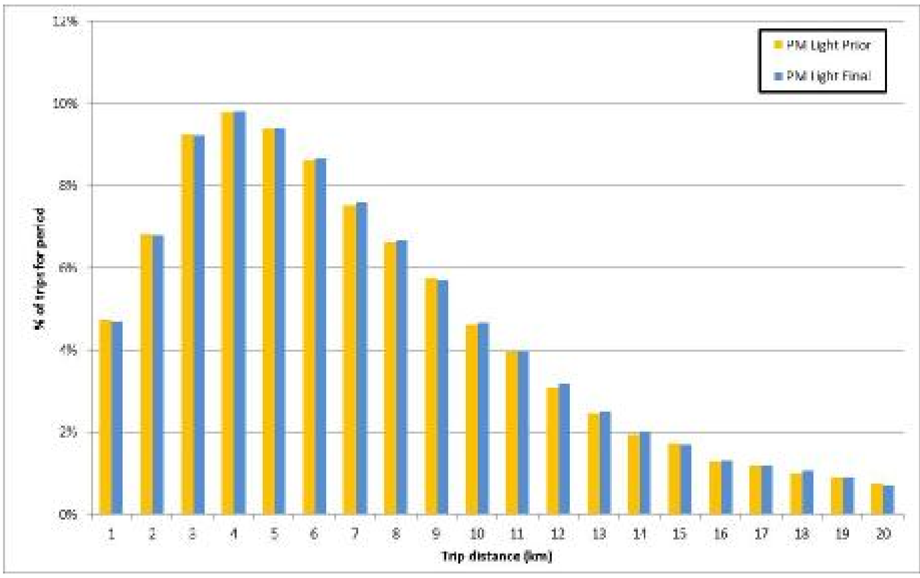


Figure 9.7: Trip Length Distance Distribution – Inter peak (Light Vehicles)



From Figures 9.5 – 9.7 it is identified that the distribution of trip length distances has not changed greatly post matrix estimation across all time periods. The following Table 9.15 shows the average vehicle trip length across the model and the change in trip length prior and post matrix estimation.

Table 9.15 - Change in Average Trip Length (kms)

Peak Period	Vehicle	Prior Matrix Estimation	Post Matrix Estimation	Difference	% Difference
AM	Light	8.5	8.6	0.1	1.0%
	Heavy	13.4	13.0	0.4	3.1%
Inter-Peak	Light	7.4	7.4	0.0	0.5%
	Heavy	13.6	13.0	0.6	4.6%

PM	Light	8.6	8.5	0.1	1.0%
	Heavy	15.1	14.6	0.5	3.3%

Table 9.15 shows that following matrix average trip length across the network does not change by more than 1km, which is the target level for average trip length across a wide strategic model. Following estimation the average trip length for both vehicle types across all peak periods decreases between 0.5% and 4.6% of the matrix estimated assigned network. This could be attributed to the increase in internal trips within sector 2 (see Figure 9.4) due to the zone disaggregation which has resulted in the increase in short distance trips.

The above tests show that following the matrix estimation process the trip distribution for both light and heavy vehicles has not deviated significantly from the distribution associated with the prior matrices.

10. Journey Time Validation

10.1 Route performance

Tables 10.1 - 10.3 provide a summary of the validation of the modelled journey times against the observed average journey times for 2010. It should be noted that it has not been possible to factor the travel times back to 2006 due to a lack of comparable data. In the absence of guidance within the EEM regarding the acceptability of modelled journey times, reference has been made to UK Design Manual for Roads and Bridges (DMRB) standards which suggests at least 85% of routes should be within 1 minute or 15% of observed journey times (whichever is the greatest).

Table 10.1 - Journey Time Validation (sec) - AM Peak

Route	Modelled	Survey	% Difference	Difference	OK?
1 Northbound	828.8	887.1	7%	58	YES
1 Southbound	826.7	888.0	7%	61	YES
2 Northbound	777.2	787.8	1%	11	YES
2 Southbound	753.8	764.1	1%	10	YES
4 Eastbound	668.8	705.9	5%	37	YES
4 Westbound	666.6	684.6	3%	18	YES
5 Eastbound	608.9	609.3	0%	0	YES
5 Westbound	608.8	583.4	4%	-25	YES

Table 10.2 - Journey Time Validation (sec) – Inter-Peak

Route	Modelled	Survey	% Difference	Difference	OK?
1 Northbound	826.0	878.5	6%	53	YES
1 Southbound	826.9	859.3	4%	32	YES
2 Northbound	765.3	741.8	3%	-23	YES
2 Southbound	763.2	735.0	4%	-28	YES
4 Eastbound	664.3	718.1	7%	54	YES
4 Westbound	664.2	645.8	3%	-18	YES
5 Eastbound	605.5	581.7	4%	-24	YES
5 Westbound	604.1	592.5	2%	-12	YES

Table 10.3 - Journey Time Validation (sec) – PM Peak

Route	Modelled	Survey	% Difference	Difference	OK?
1 Northbound	829.0	879.5	6%	51	YES
1 Southbound	887.9	861.5	3%	-26	YES
2 Northbound	763.7	780.1	2%	16	YES
2 Southbound	779.0	754.6	3%	-24	YES
3 Eastbound	697.0	677.3	3%	-20	YES
3 Westbound	638.2	687.3	7%	49	YES
4 Eastbound	668.7	709.8	6%	41	YES
4 Westbound	670.5	639.8	5%	-31	YES
5 Eastbound	613.5	582.8	5%	-31	YES
5 Westbound	610.5	632.9	4%	22	YES

From Tables 10.1 – 10.3 it can be seen that the all routes in all three peak periods satisfactorily meet the journey time criteria. The greatest disparity between modelled and surveyed flow is 9% which occurred on the Route 3 Westbound route, which is still well within the 15% target. The average difference between modelled and surveyed flow across all routes is 27, 31 and 32 seconds for the AM, Inter and PM peaks respectively. Route 1 southbound during the AM peak is the only instance when a difference in travel time between observed and modelled over 60 seconds is recorded. In this instance the difference is 61 seconds, which can be considered acceptable as the difference is so close to the target criteria and achieves a difference of 7% which is well within target limits.

10.2 Journey Time Stage Performance

Appendix E shows a graphical comparison of observed and modelled journey times for each stage of the route combined with the higher and lower limits of acceptability against the average observed time.

These show that the model is representing the travel speeds and delays at approximately the correct locations along the routes. The modelled flow breaches the 15% higher and lower limits of deviation from the surveyed data on 3 occasions, namely: Route 1 WB, Route 3 SB and Route 5 NB. However on each occasion the deviation is brief and occurs across only one section of the route rather than across a more sustained period of the travel route, and therefore is considered acceptable.

11. Model Sensibility Checks

11.1 Model Convergence

The Economics Evaluation Manual specifies criteria that need to be attained to achieve "good" convergence and stability, as well as allowing for additional stability and convergence measures to be reported. The criteria used for this model are:

- The normalised gap, which expresses the flow-weighted difference between total costs and the costs incurred if all traffic were to use the minimum cost routes should be less than 1%. This is referred to as the relative gap.
- The proportion of links across the entire network with flow changing less than 5% between the final and penultimate iteration should be greater than 95%. This is referred to in the VOYAGER assignment output results as the Pdiff.

The assignment parameters which are consistent with those used in the CTM are:

LAMBDA=0, GAP=0.0015, AAD=0, RAAD=0, PDIFF=0.95, RMSE=0, PDIFFVALUE=0.05 and RELATIVEGAP=0.015.

The convergence statistics of the base year assignment are shown in Table 11.1.

Table 11.1: Convergence Statistics for All Periods

	AM	Inter-peak	PM
	Assignment/Simulation Convergence		
Number of assignment/ simulation iterations required for convergence	15	11	30
Relative gap (%)	1.2%	0.5%	1.4%
Pdiff (%)	97.9%	98.1%	99.8%

With reference to the table above it can be seen that convergence criteria are achieved aside from the relative gap for the AM and PM peak assignments. This is because the assignment parameters have been set to match those used within the CTM meaning that convergence is satisfied once the relative gap reaches 1.5% rather than 1%.

12. Conclusions

The CSM2 model has been primarily developed to assess the proposed Christchurch Southern Motorway extension and Great South Road Four Laning schemes.

A key objective in the calibration and validation of the CSM2 base model was to ensure that the surveyed data and link count data obtained from the NZTA, CCC and SDC, as well as the original screenline data included within the CTM was a close fit to the modelled link flows, turning count flows and travel times.

The CTM final assigned highway matrices and network were used as a starting point in developing the CSM2 model. Initial assignments of the model indicated that some adjustments of the zoning system, network and demand matrices were required to calibrate the model within the project area to international and local standards. The manipulation of the demand matrices was undertaken using the Analyst module of the CUBE VOYAGER software.

This process of matrix estimation has enhanced the base model when compared to the observed data, with the EEM criteria met across all modelled time periods. Comparison against an independent set of validation data demonstrated that the matrix estimation has not compromised model flows away from the study area, and indeed the validation levels were improved overall and easily exceeded the required EEM criteria in most cases. For the original screenlines included within the CTM, the level of validation on these screenlines has been seen to either change marginally or to improve following the refinement in the CSM2 model.

Additionally journey time validation met the EEM criteria for disparity between modelled and surveyed time to be within 1 minute or 15% for all times periods and for all routes.

Overall the base model is considered fit for the purpose of assessing the traffic impacts of the CSM2 and MSRFL project for forecasting purposes.

13. Peer review

Traffic Design Group Ltd (TDG) has conducted a two-phase review of the CSM2 model for the client (NZTA) by providing an initial check of the critical modelling elements and a further thorough full model review. In the summary of the Peer Review Report it was commented that:

Overall the CSM2 model is well developed and is deemed suitable for assessing the transport effects of the Main South Road Four-Laning and Christchurch Southern Motorway Stage 2 schemes. The methodology adopted for the model development is appropriate and robust, and the model validates well to EEM criteria in the base year (2006).

The issues and recommendations that have arisen through the CSM2 model review process have been addressed in a revised project model and throughout this revised version of this Transport Model Validation Report.

13.1 Modelling issues

Issues related to the modelling process that are noted in the Peer Review Report, but which are further to those addressed in the initial review are listed below:

- It was recommended by TDG that although the scope of the model does not extend to the segmentation of traffic volumes into trip purpose or into single vs. high vehicle occupancy, it is recommended that the adjustment calculated in the matrix estimation process be applied to the full set of traffic demand tables, and not just for total light and heavy vehicles for each time period. Following the peer review, the model has been adjusted accordingly so that the cells in previously untouched matrices (those AM/IP/PM matrices by trip purpose) are adjusted by the same proportions as their corresponding peak period matrix estimated matrices.
- As per TDG recommendation, all modules throughout the model have a consistent number of decimal places for tables.
- An assignment coding issue as noted in the peer review report has since been corrected. This error in the scripting however referred to the generation of a matrix which was not otherwise made reference to, and therefore this correction has no influence upon model performance or results.
- The preloaded bus traffic has been coded to account for specific time period as per instruction from the peer reviewer.

Appendix A – Observed vs. modelled link flows

Summary of modelled vs observed at matrix estimation and validation link count sites
Type: Link based
All periods

Type	Source	ME/V	Location	A node	B node	ID	A_B	Confidence	Importance	AM Light Modelled	AM Light Survey	AM Light GEH	AM Heavy Modelled	AM Heavy Survey	AM Heavy GEH	IP Light Modelled	IP Light Survey	IP Light GEH	IP Heavy Modelled	IP Heavy Survey	IP Heavy GEH	PM Light Modelled	PM Light Survey	PM Light GEH	PM Heavy Modelled	PM Heavy Survey	PM Heavy GEH
Link count	SDC	ME	Jones Rd	2469	2461	101	2469_2461	100	1	18	34	3	4	3	1	16	42	5	1	3	1	34	73	5	2	2	0
Link count	SDC	ME				102	2461_2469	100	1	13	68	9	2	7	2	27	56	5	4	5	0	21	118	12	0	4	3
Link count	SDC	ME	Shands Rd	2053	2059	105	2053_2059	100	1	115	120	0	5	7	1	75	75	0	6	8	1	149	197	4	4	7	1
Link count	SDC	ME				106	2059_2053	100	1	127	198	6	6	9	1	74	77	0	5	7	1	122	119	0	2	4	1
Link count	SDC	ME	Birchs Rd	2066	2482	107	2066_2482	100	1	192	197	0	10	12	1	108	88	2	9	9	0	203	193	1	12	10	0
Link count	SDC	ME				108	2482_2066	100	1	191	181	1	11	10	0	104	99	1	7	7	0	180	170	1	7	6	0
Link count	SDC	ME	Ellesmere Rd	2735	2736	109	2735_2736	100	1	90	151	6	5	5	0	53	63	1	3	3	0	126	139	1	2	3	0
Link count	SDC	ME				110	2736_2735	100	1	124	119	0	3	3	0	55	57	0	3	3	0	118	146	2	2	2	0
Link count	SDC	ME	Springs Rd @ 1261m	3507	3508	117	3507_3508	100	1	354	255	6	22	21	0	264	230	2	21	15	1	444	405	2	15	13	1
Link count	SDC	ME				118	3508_3507	100	1	431	349	4	24	20	1	315	248	4	20	17	1	494	358	7	16	14	0
Link count	NZTA	ME	Main Road South	5087	5110	120	5087_5110	100	1	916	792	4	79	73	1	471	490	1	85	45	5	747	640	4	101	59	5
Link count	NZTA	ME	01S00355			121	5110_5087	100	1	538	492	2	79	46	4	420	450	1	62	42	3	965	839	4	67	78	1
Link count	Beca	ME	MSR-Hoskyns	2461	5197	210	2461_5197	100	1	204	182	2	24	45	4	134	141	1	17	24	2	252	328	5	10	7	1
Link count	Beca	ME		5152	5197	211	5152_5197	100	1	500	409	4	78	91	1	393	356	2	61	77	2	834	673	6	60	35	4
Link count	Beca	ME		2462	5197	212	2462_5197	100	1	860	756	4	66	64	0	499	446	2	85	70	2	744	557	7	92	33	8
Link count	Beca	ME		5197	2461	213	5197_2461	100	1	172	141	2	14	46	6	122	94	3	16	36	4	170	97	6	8	7	0
Link count	Beca	ME		5197	5152	214	5197_5152	100	1	798	707	3	72	69	0	445	409	2	86	79	1	668	558	4	96	36	7
Link count	Beca	ME		5197	2462	215	5197_2462	100	1	594	500	4	82	85	0	459	440	1	61	56	1	991	904	3	59	32	4
Link count	Beca	ME	MSR-Tenyson	2462	2052	221	2462_2052	100	1	431	423	0	71	62	1	303	319	1	55	73	2	580	595	1	56	31	4
Link count	Beca	ME		5264	2052	222	5264_2052	100	1	166	154	1	7	14	2	78	109	3	2	4	1	145	142	0	2	2	0
Link count	Beca	ME		2052	3802	223	2052_3802	100	1	488	441	2	75	67	1	348	329	1	56	69	2	664	564	4	57	30	4
Link count	Beca	ME		2052	5264	225	2052_5264	100	1	76	72	0	3	5	1	149	177	2	8	6	1	143	148	0	3	4	0
Link count	Beca	ME	Shands_Marshs	5177	4015	240	5177_4015	100	1	148	155	1	15	20	1	150	179	2	16	18	1	359	389	2	7	11	1
Link count	Beca	ME		5178	4015	241	5178_4015	100	1	71	67	0	4	5	0	41	48	1	3	5	1	169	138	3	7	1	3
Link count	Beca	ME		5180	4015	242	5180_4015	100	1	307	430	6	15	20	1	152	159	1	13	16	1	197	209	1	5	7	1
Link count	Beca	ME		5179	4015	243	5179_4015	100	1	60	59	0	5	4	1	39	44	1	7	9	0	88	63	3	19	1	6
Link count	Beca	ME		4015	5177	244	4015_5177	100	1	301	401	5	16	22	1	164	176	1	16	24	2	190	211	1	8	9	0
Link count	Beca	ME		4015	5178	245	4015_5178	100	1	86	123	4	3	2	1	47	49	0	4	4	0	116	85	3	17	1	5
Link count	Beca	ME		4015	5180	246	4015_5180	100	1	164	172	1	12	15	1	145	186	3	13	13	0	367	467	5	7	10	1
Link count	Beca	ME		4015	5179	247	4015_5179	100	1	35	45	2	8	9	0	26	32	1	5	8	1	140	53	9	6	1	3
Link count	Beca	ME	Hoskyns-Jones	5375	2461	250	5375_2461	100	1	129	159	3	14	30	3	94	108	1	11	29	4	175	148	2	3	9	2
Link count	Beca	ME		3801	2461	253	3801_2461	100	1	101	109	1	13	10	1	78	58	2	10	5	2	139	133	1	7	3	2
Link count	Beca	ME		2461	5375	254	2461_5375	100	1	115	158	4	8	41	6	92	127	3	12	32	4	162	354	12	4	9	2
Link count	Beca	ME		2461	3801	257	2461_3801	100	1	88	62	3	11	8	1	57	46	2	5	3	1	83	75	1	7	2	2
Link count	CCC	ME	Halswell Junction - Shands	3937	1398	401	3937_1398	100	1	435	539	5	25	28	1	292	352	3	20	19	0	500	498	0	25	26	0
Link count	CCC	ME		3774	1398	402	3774_1398	100	1	433	447	1	21	24	0	282	329	3	12	17	1	475	466	0	22	25	0
Link count	CCC	ME		3953	1398	403	3953_1398	100	1	341	552	10	39	29	2	258	305	3	26	16	2	407	370	2	26	19	1
Link count	CCC	ME		5406	1398	404	5406_1398	100	1	277	302	1	11	16	1	246	329	5	15	17	0	311	428	6	11	23	3
Link count	CCC	ME		1398	3937	405	1398_3937	100	1	486	711	9	31	37	1	343	462	6	23	24	0	580	695	5	24	37	2
Link count	CCC	ME		1398	3774	406	1398_3774	100	1	388	557	8	25	29	1	330	427	5	23	22	0	461	480	1	22	25	1
Link count	CCC	ME		1398	3953	407	1398_3953	100	1	376	298	4	28	16	3	227	202	2	18	11	2	378	340	2	26	18	2
Link count	CCC	ME		1398	5406	408	1398_5406	100	1	236	274	2	12	14	1	176	223	3	10	12	1	274	246	2	11	13	1
Link count	SDC	ME	Lincoln Rolleston Rd @ 1480m	2505	2466	409	2505_2466	100	1	111	140	3	9	21	3	65	68	0	14	21	2	75	76	0	4	9	2
Link count	SDC	ME				410	2466_2505	100	1	76	73	0	8	21	3	67	81	2	10	20	3	121	175	4	5	11	2
Link count	CCC	ME	Halswell Junction - Springs	6003	1399	301	6003_1399	100	1	407	273	7	49	84	4	420	390	2	57	97	5	842	627	8	34	37	1
Link count	CCC	ME		2452	1399	302	2452_1399	100	1	418	472	3	28	57	5	332	384	3	44	68	3	533	509	1	21	37	3
Link count	CCC	ME		5185	1399	303	5185_1399	100	1	438	519	4	17	38	4	246	265	1	18	36	3	361	340	1	14	13	0
Link count	CCC	ME		5102	1399	304	5102_1399	100	1	397	479	4	23	41	3	308	381	4	21	29	2	437	551	5	16	22	1
Link count	CCC	ME		1399	6003	305	1399_6003	100	1	608	485	5	36	76	5	366	318	3	48	88	5	483	291	10	22	33	2
Link count	CCC	ME		1399	2452	306	1399_2452	100	1	415	525	5	32	81	7	350	436	4	30	78	6	424	483	3	22	40	3
Link count	CCC	ME		1399	5185	307	1399_5185	100	1	275	255	1	26	38	2	294	339	3	32	32	0	828	757	3	24	16	2
Link count	CCC	ME		1399	5102	308	1399_5102	100	1	362	478	6	23	25	0	296	327	2	31	32	0	437	496	3	16	20	1
Link count	SDC	V	Birchs Rd @ 390	2472	6005		2472_6005	100	1	36	92	7	14	10	1	21	80	8	12	8	1	83	152	6	10	9	1
Link count	SDC	V					6005_2472	100	1	129	149	2	17	10	2	82	96	1	13	8	2	111	118	1	10	7	1
Link count	SDC	V	Blakes Rd @ 487m	1545	5273		1545_5273	100	1	30	52	3	0	2	2	13	29	4	0	2	2	36	39	0	0	1	1
Link count	SDC	V					5273_1545	100	1	19	42	4	0	2	2	12	35	5	0	2	2	21	86	9	0	2	2
Link count	SDC	V	Blakes Rd @ 1060m	5274	3514		5274_3514	100	1	74	74	0	1	2	1	37	36	0	0	2	2	48	57	1	0	1	1
Link count	SDC	V					3514_5274	100	1	48	46	0	0	4	2	40	42	0	0	5	3	54	108	6	0	6	3
Link count	SDC	V	Brookside Rd @ 0m	3802	5265		3802_5265	100	1	53	41	2	1	4	2	53	59	1	1	3	2	99	169	6	0	5	3
Link count	SDC	V					5265_3802	100	1	93	121	3	1	5	2	48	53	1	1	4	2	67	52	2	0	2	2
Link count	SDC	V	Brookside Rd @ 1710m	5380	3815		5380_3815	100	1	23	32	2	0	3	2	34	39	1	0	2	2	70	73	0	0	2	1
Link count	SDC	V					3815_5380	100	1	42	55	2	0	3	2	23	37	3	0	3	2	24	49	4	0	2	1
Link count	SDC	V	Ellesmere Rd @ 150m	3841	3835		3841_3835	100	1	51	45	1	11	9	1	28	26	0	10	9	0	87	41	6	11	10	0
Link count	SDC	V					3835_3841	100	1	68	43	3	14	3	4	31	36	1	9	2	3	64	69	1	11	1	4
Link count	SDC	V	Ellesmere Rd @ 3356m	2730	2735		2730_2735	100	1	56	129	8	2	3	1	44	65	3	1	2	1	115	159	4	1	2	0
Link count	SDC	V					2735_2730	100	1	113	155	4	1	3	1	49	63	2	1	2	0	101	126	2	1	3	1
Link count	SDC	V	Hoskyns Rd @ 3496m	2551	2557		2551_2557	100	1	115	112	0	7	17	3	92	72	2	10	17	2	162	101	5	3	6	2
Link count	SDC	V					2557_2551	100	1	129	99	3	11	17	2	94	88	1	10	18	2	175	163	1	2	11	3
Link count	SDC	V	Lincoln Rolleston Rd @ 597m	2480	2505		2480_2505	100	1	106	38	8	9	5	2	68	36	4	13	6	2	87	69	2	4	3	0
Link count	SDC	V					2505_2480	100	1	84	64	2	8	6	0	73	39	5	9	6	1	122	83	4	5	3	1
Link count	SDC	V	Maddisons Rd @ 0m	6000	2428		6000_2428	100	1	27	25	0	3	3	0	25	22	1	4	3	0	110	80	3	2	3	0
Link count	SDC	V					2428_6000	100	1	99	75	3	3	5	1	40	24	3	3	3	0	47	37	2	2	2	0
Link count	SDC	V	Maddisons Rd @ 660m	5386	2046		5386_2046	100	1	58	28	5	4	3	1	47	30	3	2	2	0	53	116	7	1	5	2
Link count	SDC	V					2046_5386	100	1	48	115	7	3	2	1	34	32	0	5	1	2	65	49	2	3	1	2
Link count	SDC	V	Marshs Rd @ 2810m	5178	4020		5178_4020	100	1	82	59	3	3	6	1	44	40	1	4	8	1	115	76	4	17	6	3
Link count	SDC	V					4020_5178	100	1	67	53	2	4	8	1	38	30	2	2	8	2	171	55	11	7	5	1
Link count	SDC	V	Robinsons Rd @ 9930m	6001	5110		6001_5110	100	1	31	27	1	3	1	1	12	20	2	4	1	2	12	16	1	1	1	0
Link count	SDC	V					5110_6001	100	1	11	9	1	1	1	1	10	17	2	2	1	1	31	32	0	1	1	0
Link count	SDC	V	Shands Rd @ 7230m	2059	2065		2059_2065	100	1	109	120	1	5	7	1	73	75	0	6	8	1	141	197	4	4	7	1
Link count	SDC	V					2065_2059	100	1	119	198	6	6	9	1	72	77	1	5	7	1	117	119	0	2	4	1
Link count	SDC	V	Springs Rd @ 1913m	2472	2459		2472_2459	100	1	277	335	3	5	19	4	204	229	2	6	15	3	273	323	3	3	12	3
Link count	SDC	V					2459_2472	100	1	241	282	3	4	15	3	193	274	5	4	17	4	336	385	3	3	13	3
Link count	SDC	V	Springs Rd @ 7591m	2062	2067		2062_2067	100	1	170	246	5	2	9	3	88	116	3	3	5	1	152	130	2	2	5	2
Link count	SDC	V					2067_2062	100	1	105	99	1	2	6	2	111	146	3	2	6	2	224	232	1	1	5	2
Link count	SDC	V	Trices Rd @ 150m	3835	3838		3835_3838	100	1	31	24	1	8	2	3	12	18	2	7	3	2	54	27	4	10	1	4
Link count	SDC	V					3838_3835	100	1	33	18	3	11	1	4	14	15	0	7	2	2	41	27	2	9	1	4
Link count	SDC	V	Waterholes Rd @ 3097m	2056	2468		2056_2468	100	1	32	39	1	2	1	1	26	32	1	1	1	0	50	91	5	1	1	0
Link count	SDC	V					2468_2056	100	1	83	78	1	2	1	0	38	35	1	2	1	0	51	67	2	2	2	0
Link count	SDC	V	Weedons Ross @ 1840m	2048	2483		2048_2483	100	1	17	43	5	1	4	1	30	28	0	2	3	1	20	37	3	1	2	1
Link count	SDC	V					2483_2048	100	1	11	25	3	2	5	1	13	24	2	1	4	2	14	50	6	1	3	2
Link count	SDC	V	Weedons Ross @ 9130m	2041	2040		2041_2040	100	1	10	17	2	0	2	1	25	16	2	0	1	1	19	25	1	0	1	1
Link count	SDC	V					2040_2041	100	1	18	12	1	1	3	2	14	17	1	1	1	1	12	21	2	0	1	1
Link count	Beca	V	MS-Rolleston	2052	2462		2052_2462	100	1	624	508	5	61	58	0	350	380	2	76	66	1	562	521	2	88	36	7
Link count	Beca	V		5197	2462		5197_2462	100	1	594	602	0	82	71	1	459	509	2	61	58	0	991	1075	3	59	30	4
Link count	Beca	V		5379	2462		5379_2462	100	1	256	426	9	5	10	2	167	169	0	9	9	0	197	232	2	4	2	1
Link count	Beca	V		2462	2052		2462_2052	100	1	431	472	2	71	67	1	303	363	3	55	50	1	580	680	4	56	26	5
Link count	Beca	V		2462	5197		2462_5197	100	1	860	910	2	66	65	0	499	524	1	85	75	1	744	722	1	92	38	7
Link count	Beca	V		2462	5379		2462_5379	100	1	183	155	2	11	7	1	174	171	0	6	8	1	426	426	0	3	4	0
Link count	Beca	V	Main South Rd - Weedons Rd	5153	2050		5153_2050	100	1	527	441	4	79	58	3	403	456	3	63	72	1	876	926	2	63	36	4
Link count	Beca	V		5154	2050		5154_2050	100	1	54	50	1	4	3	1	17	36	3	2	2	0	31	26	1	2	1	2
Link count	Beca	V		5152	2050		5152_2050	100	1	798	861	2	72	91	2	445	487	2	86	90	0	668	639	1	96	46	6
Link count	Beca	V		5151	2050		5151_2050	100	1	12	53	7	1	1	0	9	32	5	1	1	0	14	32	4	0	3	2
Link count	Beca	V		2050	5153		2050_5153	100	1	850	862	0	76	91	2	444	479	2	88	88	0	693	629	2	98	47	6
Link count	Beca	V		2050	5154		2050_5154	100	1	22	35	3	2	2	0	13	40	5	2	3	0	28	115	10	2	2	1
Link count	Beca	V		2050	5152		2050_5152	100	1	500	469	1	78	58	2	393	448	3	61	71	1	834	826	0	60	37	3
Link count	Beca	V		2050	5151		2050_5151	100	1	19	39	4	0	2	2	24	44	3	0	3	2	34	53	3	0	1	0
Link count	SDC	V	Marshs Rd	2395	5407		2395_5407	100	1	60	37	3	5	4	1	39	35	1	7	4	1	88	102	1	19	6	4
Link count	SDC	V					5407_2395	100	1	35	71	5	8	5	1	26	35	2	5	3	1	140	48	9	6	2	2
Link count	SDC	V	Trents Rd	1541	1545		1541_1545	100	1	44	30	2	1	2	1	22	22	0	0	3	2	67	31	5	1	1	1
Link count	SDC	V					1545_1541	100	1	37	28	1	0	3	2	22	28	1	1	3	2	34	46	2	1	2	1
Link count	SDC	V	Waterholes Rd	2047	2475		2047_2475	100	1	73	49	3	3	3	0	37	26	2	2	2	1	91	36	7	2	1	0
Link count	SDC	V					2475_2047	100	1	69	24	7	1	3	1	36	21	3	1	3	1	75	55	2	1	2	1
Link count	NZTA	V	Main Road South	5197	5152		5197_5152	100	1	798	674	5	72	62	1	445	552	5	86	51	4	668	635	1	96	59	4
Link count	NZTA	V	01S00366				5152_5197	100	1	500	469	1	78	43	4	393	492	5	61	46	2	834	814	1	60	75	2
Link count	Beca	V	Weedons-Levi Rd	5154	2481		5154_2481	100	1	22	28	1	2	3	1	13	32	4	2	6	2	28	101	9	2	3	0
Link count	Beca	V		2055	2481		2055_2481	100	1	7	27	5	1	4	2	6	16	3	0	3	2	16	26	2	0	5	3
Link count	Beca	V		2492	2481		2492_2481	100	1	48	36	2	3	3	0	12	21	2	2	1	1	17	27	2	2	2	0
Link count	Beca	V		2481	5154		2481_5154	100	1	54	44	1	4	4	0	17	26	2	2	3	0	31	30	0	2	4	1
Link count	Beca	V		2481	2055		2481_2055	100	1	11	28	4	0	5	3	5	18	4	1	4	2	5	30	6	0	4	2
Link count	Beca	V		2481	2492		2481_2492	100	1	12	18	2	1	2	0	9	25	4	2	3	1	25	95	9	2	3	0

Appendix B – Screenline performance

Summary of screenline performance post matrix estimation
Type: Link based
All periods

										AM						IP						PM					
										Light			Heavy			Light			Heavy			Light			Heavy		
Screenline	Source	ME/V	Location	A node	B node	ID	A_B	Confidence	Importance	Modelled	Survey	GEH	Modelled	Survey	GEH	Modelled	Survey	GEH	Modelled	Survey	GEH	Modelled	Survey	GEH	Modelled	Survey	GEH
1	Various	V	Jones Rd	2461	2469	001_A_N	2461_2469	1	1	13	68	9	2	7	2	27	56	5	4	5	0	21	118	12	0	4	3
1	Various	V				001_A_S	2469_2461	1	1	18	34	3	4	3	1	16	42	5	1	3	1	34	73	5	2	2	0
1	Various	V	Levi Road	2492	2481	001_C_N	2492_2481	1	1	48	36	2	3	3	0	12	21	2	2	1	1	17	27	2	2	2	0
1	Various	V				001_C_S	2481_2492	1	1	12	18	2	1	2	0	9	25	4	2	3	1	25	95	9	2	3	0
1	Various	V	Waterholes Road	2468	2056	001_E_N	2468_2056	1	1	83	78	1	2	1	1	38	35	1	2	1	1	51	91	5	1	1	0
1	Various	V				001_E_S	2056_2468	1	1	32	39	1	2	1	1	26	32	1	1	1	0	50	67	2	1	2	1
1	Various	V	Shands Road	2059	2053	001_F_N	2059_2053	1	1	127	198	6	6	9	1	74	77	0	5	7	1	122	119	0	2	4	1
1	Various	V				001_F_S	2053_2059	1	1	115	120	0	5	7	1	75	75	0	6	8	1	149	197	4	4	7	1
1	Various	V	Springs Road	2062	2133	001_G_N	2062_2133	1	1	221	99	10	4	6	1	173	146	2	8	6	1	340	232	6	3	5	1
1	Various	V				001_G_S	2133_2062	1	1	273	246	2	5	9	2	146	116	3	5	5	0	272	130	10	3	5	1
1	Various	V	Birchs Road	2066	2482	001_H_N	2066_2482	1	1	192	181	1	10	10	0	108	85	2	9	8	0	203	170	2	12	6	2
1	Various	V				001_H_S	2482_2066	1	1	191	197	0	11	12	0	104	66	4	7	7	0	180	193	1	7	10	1
1	Various	V	Ellesmere Road	2736	2735	001_I_N	2736_2735	1	1	124	119	0	3	3	0	55	57	0	3	3	0	118	146	2	2	2	0
1	Various	V				001_I_S	2735_2736	1	1	90	151	6	5	5	0	53	63	1	3	3	0	126	139	1	2	3	0
2	Various	V	Weedons Road	5154	2481	002_A_E	5154_2481	1	1	22	28	1	2	3	1	13	32	4	2	6	2	28	101	9	2	3	0
2	Various	V				002_A_W	2481_5154	1	1	54	44	1	4	2	1	17	26	2	2	3	0	31	30	0	2	3	0
2	Various	V	Robinson Road	5110	6001	002_C_E	5110_6001	1	1	11	27	4	1	1	0	10	20	2	2	1	1	31	16	3	1	1	0
2	Various	V				002_C_W	6001_5110	1	1	31	9	5	3	1	2	12	17	2	4	1	2	12	32	4	1	1	0
2	Various	V	Waterholes Road	2475	2476	002_D_E	2475_2476	1	1	56	49	1	2	3	0	25	26	0	1	2	1	63	36	4	2	1	0
2	Various	V				002_D_W	2476_2475	1	1	48	24	4	1	3	1	25	21	1	1	3	1	66	55	1	1	2	1
2	Various	V	Trents Road	1545	5273	002_E_E	1545_5273	1	1	30	30	0	0	2	1	13	22	2	0	3	2	36	31	1	0	1	1
2	Various	V				002_E_W	5273_1545	1	1	19	28	2	0	3	2	12	28	4	0	3	2	21	46	4	0	2	1
2	Various	V	Marshs Road	2395	5407	002_F_E	2395_5407	1	1	60	37	3	5	4	1	39	35	1	7	4	1	88	102	1	19	6	4
2	Various	V				002_F_W	5407_2395	1	1	35	71	5	8	5	1	26	35	2	5	3	1	140	48	9	6	2	2

Appendix C – Effect of matrix estimation on sector by sector basis

Summary of matrix totals pre and post matrix estimation
Type: Trip end based
All periods

AM lights prior matrix

	1	2	3	4	5	6	7	8	Total
1	100	96	25	17	46	176	318	28	806
2	61	787	218	115	171	468	839	111	2771
3	10	125	114	53	63	116	235	44	760
4	16	141	115	708	531	430	2363	1021	5325
5	18	107	64	269	478	412	1391	346	3086
6	59	243	93	184	457	1179	2408	320	4943
7	147	760	329	1098	1655	3737	49218	5076	62021
8	17	102	55	535	379	385	4400	2737	8610
Total	429	2361	1012	2980	3780	6904	61172	9683	88322

AM lights post matrix

	1	2	3	4	5	6	7	8	Total
1	99	119	45	23	51	177	382	35	930
2	72	885	225	107	138	330	672	90	2519
3	14	122	105	44	58	145	250	35	773
4	23	158	125	675	502	617	2292	989	5381
5	21	108	57	250	463	467	1370	326	3061
6	56	163	93	213	541	1264	3016	389	5734
7	149	534	298	1072	1644	4174	49231	5065	62168
8	19	83	48	522	369	435	4396	2732	8604
Total	452	2171	996	2906	3766	7608	61609	9661	89171

AM Difference matrix between prior and post lights

	1	2	3	4	5	6	7	8	Total
1	-2	23	20	6	5	0	65	6	124
2	11	97	7	-8	-33	-139	-167	-21	-252
3	4	-3	-9	-9	-5	29	15	-8	13
4	7	16	11	-33	-28	187	-72	-32	56
5	3	0	-7	-18	-16	55	-21	-20	-25
6	-4	-80	0	29	83	85	608	69	791
7	2	-226	-32	-26	-11	437	13	-11	147
8	2	-19	-7	-13	-9	50	-4	-5	-6
Total	24	-190	-16	-73	-14	704	436	-22	849

AM % change matrix between prior and post lights

	1	2	3	4	5	6	7	8	Total
1	-2%	24%	82%	36%	11%	0%	20%	23%	15%
2	19%	12%	3%	-7%	-19%	-30%	-20%	-19%	-9%
3	36%	-2%	-8%	-17%	-8%	25%	6%	-19%	2%
4	47%	12%	9%	-5%	-5%	43%	-3%	-3%	1%
5	15%	0%	-11%	-7%	-3%	13%	-2%	-6%	-1%
6	-6%	-33%	0%	16%	18%	7%	25%	22%	16%
7	2%	-30%	-10%	-2%	-1%	12%	0%	0%	0%
8	11%	-18%	-13%	-2%	-2%	13%	0%	0%	0%
Total	6%	-8%	-2%	-2%	0%	10%	1%	0%	1%

AM heavies prior matrix

	1	2	3	4	5	6	7	8	Total
1	1	2	0	1	3	4	16	3	30
2	1	8	2	5	12	17	87	14	146
3	0	2	1	1	4	5	16	3	32
4	1	5	1	3	12	12	42	12	88
5	2	12	4	11	68	63	195	52	408
6	4	18	5	12	68	94	221	50	473
7	10	95	17	41	191	189	1189	256	1987
8	2	15	3	12	54	45	240	78	449
Total	21	157	34	86	412	428	2006	468	3613

AM heavies post matrix

	1	2	3	4	5	6	7	8	Total
1	0	5	1	1	3	4	16	3	34
2	2	15	10	5	10	16	61	11	131
3	0	11	1	1	3	5	12	3	36
4	1	8	1	2	11	24	38	11	97
5	3	9	3	11	71	74	204	56	429
6	5	18	5	30	78	109	243	54	542
7	11	64	12	37	195	215	1223	264	2022
8	2	12	3	11	56	53	247	79	464
Total	25	141	35	97	427	501	2045	482	3755

AM Difference matrix between prior and post heavies

	1	2	3	4	5	6	7	8	Total
1	0	3	0	0	0	0	0	0	4
2	1	7	8	1	-2	-1	-25	-3	-15
3	0	9	0	0	-1	0	-4	0	4
4	0	3	0	-1	-1	13	-4	0	10
5	0	-3	-1	-1	2	11	8	3	21
6	1	0	-1	18	10	15	22	5	69
7	1	-30	-5	-4	5	27	34	8	35
8	0	-4	0	-1	2	8	7	2	15
Total	4	-16	1	11	16	73	39	14	142

AM % change matrix between prior and post heavies

	1	2	3	4	5	6	7	8	Total
1	-7%	199%	50%	4%	0%	0%	1%	6%	12%
2	76%	82%	392%	11%	-16%	-5%	-29%	-20%	-10%
3	3%	436%	42%	-41%	-28%	1%	-22%	-14%	11%
4	25%	60%	-23%	-34%	-7%	108%	-9%	-3%	11%
5	15%	-26%	-24%	-7%	3%	18%	4%	7%	5%
6	21%	0%	-11%	143%	15%	16%	10%	9%	15%
7	11%	-32%	-31%	-10%	3%	14%	3%	3%	2%
8	24%	-25%	-13%	-6%	4%	18%	3%	2%	3%
Total	18%	-10%	3%	13%	4%	17%	2%	3%	4%

AM total prior matrix

	1	2	3	4	5	6	7	8	Total
1	101	97	25	18	49	181	334	31	836
2	62	795	220	120	183	485	926	125	2917
3	10	127	115	54	67	121	251	47	792
4	16	146	116	712	543	442	2405	1033	5412
5	21	119	68	280	547	475	1587	398	3494
6	63	261	99	196	525	1273	2629	369	5416
7	157	855	347	1139	1846	3926	50407	5332	64008
8	19	117	58	547	433	430	4640	2814	9059
Total	450	2518	1047	3066	4192	7333	63178	10151	91934

AM total post matrix

	1	2	3	4	5	6	7	8	Total
1	99	123	46	24	54	181	399	38	964
2	75	899	235	112	148	346	734	102	2650
3	14	132	106	45	61	150	262	38	809
4	24	166	126	677	513	641	2330	1000	5478
5	24	117	60	261	533	541	1574	382	3491
6	60	182	98	242	618	1373	3259	443	6276
7	160	599	310	1109	1840	4389	50454	5329	64190
8	21	95	51	533	426	488	4643	2811	9068
Total	477	2313	1032	3004	4193	8110	63654	10143	92925

AM Difference matrix between prior and post totals

	1	2	3	4	5	6	7	8	Total
1	-2	26	21	6	5	0	65	7	128
2	12	104	15	-8	-35	-140	-192	-24	-267
3	4	6	-9	-9	-6	29	11	-9	17
4	7	20	10	-34	-29	199	-75	-32	66
5	3	-3	-8	-19	-14	66	-13	-16	-4
6	-3	-80	0	46	93	100	630	74	860
7	3	-256	-37	-30	-6	463	48	-3	182
8	2	-23	-7	-14	-7	58	3	-3	9
Total	27	-206	-15	-62	1	777	476	-7	991

AM % change matrix between prior and post totals

	1	2	3	4	5	6	7	8	Total
1	-2%	27%	82%	34%	11%	0%	19%	21%	15%
2	20%	13%	7%	-7%	-19%	-29%	-21%	-19%	-9%
3	35%	5%	-8%	-17%	-9%	24%	4%	-19%	2%
4	46%	13%	9%	-5%	-5%	45%	-3%	-3%	1%
5	15%	-2%	-12%	-7%	-2%	14%	-1%	-4%	0%
6	-5%	-31%	0%	23%	18%	8%	24%	20%	16%
7	2%	-30%	-11%	-3%	0%	12%	0%	0%	0%
8	12%	-19%	-13%	-3%	-2%	13%	0%	0%	0%
Total	6%	-8%	-1%	-2%	0%	11%	1%	0%	1%

IP lights prior matrix

	1	2	3	4	5	6	7	8	Total
1	58	58	11	12	20	104	145	12	421
2	55	609	111	99	94	294	452	60	1775
3	10	108	71	57	44	90	158	29	567
4	10	82	55	682	310	272	1422	684	3516
5	15	81	37	301	361	370	1170	268	2603
6	76	232	71	239	331	1197	2199	237	4582
7	110	392	130	1337	1153	2528	42627	3750	52028
8	10	54	24	625	240	243	3607	2269	7071
Total	344	1616	510	3352	2553	5099	51781	7309	72564

IP lights post matrix

	1	2	3	4	5	6	7	8	Total
1	56	83	17	21	28	94	150	13	462
2	100	724	122	107	92	183	315	45	1687
3	19	121	69	54	46	89	171	23	593
4	14	84	51	619	278	356	1330	646	3379
5	18	77	36	268	351	449	1158	251	2608
6	66	160	79	335	400	1230	2666	288	5226
7	116	298	135	1254	1137	3091	42704	3749	52484
8	10	42	18	590	225	297	3605	2269	7056
Total	400	1589	529	3248	2557	5789	52099	7284	73495

IP Difference matrix between prior and post lights

	1	2	3	4	5	6	7	8	Total
1	-2	25	7	9	8	-10	5	1	41
2	45	114	11	8	-2	-111	-137	-16	-88
3	9	13	-2	-3	2	-1	14	-5	26
4	4	2	-4	-63	-32	84	-92	-38	-137
5	3	-4	-1	-33	-11	79	-12	-17	5
6	-10	-72	8	97	69	32	467	51	644
7	5	-94	6	-83	-16	563	77	-2	456
8	1	-12	-5	-35	-15	54	-2	0	-15
Total	56	-27	19	-104	3	690	318	-25	931

IP % change matrix between prior and post lights

	1	2	3	4	5	6	7	8	Total
1	-3%	42%	63%	70%	37%	-10%	3%	7%	10%
2	83%	19%	10%	8%	-2%	-38%	-30%	-26%	-5%
3	89%	12%	-3%	-6%	4%	-1%	9%	-19%	5%
4	42%	3%	-7%	-9%	-10%	31%	-6%	-6%	-4%
5	19%	-4%	-2%	-11%	-3%	21%	-1%	-6%	0%
6	-13%	-31%	11%	41%	21%	3%	21%	22%	14%
7	5%	-24%	4%	-6%	-1%	22%	0%	0%	1%
8	6%	-22%	-23%	-6%	-6%	22%	0%	0%	0%
Total	16%	-2%	4%	-3%	0%	14%	1%	0%	1%

IP heavies prior matrix

	1	2	3	4	5	6	7	8	Total
1	0	1	0	1	2	3	11	2	22
2	1	7	2	6	12	17	102	16	165
3	0	2	1	1	3	4	13	3	27
4	1	5	1	3	10	11	40	11	81
5	2	11	3	10	54	56	157	43	335
6	3	15	4	10	56	77	179	42	388
7	10	83	14	39	152	190	1047	200	1735
8	2	14	3	10	43	42	208	64	386
Total	20	138	28	80	332	401	1759	381	3138

IP heavies post matrix

	1	2	3	4	5	6	7	8	Total
1	0	1	1	1	3	5	12	2	26
2	3	11	16	12	8	21	63	11	145
3	0	10	1	1	2	4	10	2	30
4	1	9	1	3	9	26	38	10	96
5	3	7	3	10	54	79	157	43	357
6	4	12	6	33	65	91	193	46	451
7	14	60	11	45	157	261	1051	200	1798
8	3	11	2	11	44	63	208	64	405
Total	28	121	41	116	341	550	1734	378	3308

IP Difference matrix between prior and post heavies

	1	2	3	4	5	6	7	8	Total
1	0	0	0	0	0	2	1	0	4
2	1	3	14	6	-4	4	-39	-5	-20
3	0	9	0	0	-1	0	-4	-1	3
4	0	4	0	0	-1	15	-2	-1	15
5	1	-4	0	1	0	24	1	0	22
6	1	-4	2	23	9	14	14	4	63
7	4	-23	-3	6	5	70	4	0	63
8	1	-3	-1	1	1	21	0	0	19
Total	8	-17	13	36	8	150	-25	-3	169

IP % change matrix between prior and post heavies

	1	2	3	4	5	6	7	8	Total
1	-1%	23%	108%	46%	9%	56%	8%	13%	20%
2	118%	46%	692%	108%	-32%	23%	-38%	-34%	-12%
3	27%	486%	71%	-18%	-38%	-6%	-28%	-28%	11%
4	43%	86%	-19%	-14%	-10%	144%	-5%	-8%	19%
5	37%	-33%	-10%	5%	0%	43%	1%	0%	7%
6	34%	-23%	41%	215%	16%	18%	8%	10%	16%
7	38%	-28%	-18%	15%	3%	37%	0%	0%	4%
8	45%	-23%	-19%	8%	2%	49%	0%	0%	5%
Total	42%	-12%	45%	44%	3%	37%	-1%	-1%	5%

IP total prior matrix

	1	2	3	4	5	6	7	8	Total
1	58	59	11	13	23	108	157	15	443
2	56	617	113	104	106	311	555	76	1940
3	10	110	72	58	47	95	171	32	594
4	10	86	56	685	320	283	1462	694	3597
5	18	92	40	311	415	425	1327	311	2938
6	79	247	76	249	387	1275	2378	279	4970
7	120	475	144	1376	1305	2718	43674	3950	53763
8	12	67	27	636	283	285	3815	2333	7457
Total	364	1754	538	3432	2885	5500	53539	7690	75702

IP total post matrix

	1	2	3	4	5	6	7	8	Total
1	56	84	18	22	30	99	163	16	488
2	103	734	138	119	101	204	378	55	1832
3	19	131	70	55	48	93	181	26	623
4	15	93	52	621	287	382	1368	656	3475
5	21	84	39	279	404	528	1315	294	2965
6	71	172	85	368	465	1321	2859	334	5676
7	129	358	147	1299	1294	3352	43755	3948	54282
8	13	53	21	601	268	359	3813	2332	7461
Total	428	1710	570	3364	2897	6340	53833	7662	76802

IP Difference matrix between prior and post totals

	1	2	3	4	5	6	7	8	Total
1	-2	25	7	9	8	-8	6	1	45
2	47	118	25	14	-6	-107	-176	-21	-107
3	9	22	-2	-3	1	-1	10	-6	28
4	4	6	-4	-63	-33	100	-94	-39	-122
5	4	-7	-1	-32	-11	103	-12	-17	27
6	-9	-75	10	119	78	46	482	55	707
7	9	-118	3	-77	-11	634	81	-2	518
8	1	-15	-6	-34	-14	74	-3	0	4
Total	64	-44	32	-68	12	840	293	-28	1100

IP % change matrix between prior and post totals

	1	2	3	4	5	6	7	8	Total
1	-3%	42%	64%	69%	34%	-8%	4%	8%	10%
2	84%	19%	22%	13%	-6%	-35%	-32%	-28%	-6%
3	88%	20%	-2%	-6%	2%	-1%	6%	-20%	5%
4	42%	7%	-7%	-9%	-10%	35%	-6%	-6%	-3%
5	22%	-8%	-3%	-10%	-3%	24%	-1%	-5%	1%
6	-11%	-30%	13%	48%	20%	4%	20%	20%	14%
7	7%	-25%	2%	-6%	-1%	23%	0%	0%	1%
8	13%	-22%	-22%	-5%	-5%	26%	0%	0%	0%
Total	18%	-3%	6%	-2%	0%	15%	1%	0%	1%

PM lights prior matrix

	1	2	3	4	5	6	7	8	Total
1	80	89	16	22	28	129	234	22	620
2	112	899	148	172	142	417	949	122	2962
3	25	196	101	109	73	141	386	65	1095
4	21	140	78	870	368	347	1876	809	4508
5	42	181	70	548	489	577	2074	458	4438
6	195	542	147	526	517	1711	4551	485	8674
7	345	1005	299	2870	1805	3817	67074	6028	83243
8	29	127	52	1081	370	406	5931	3150	11145
Total	849	3179	910	6198	3790	7545	83075	11139	116686

PM lights post matrix

	1	2	3	4	5	6	7	8	Total
1	70	104	26	17	29	123	266	23	658
2	144	1127	156	145	115	280	708	79	2754
3	45	218	100	111	76	135	420	52	1157
4	15	107	67	767	318	407	1719	755	4155
5	47	134	63	475	436	674	2004	418	4251
6	196	350	181	467	517	1811	5609	503	9634
7	456	771	311	2640	1623	4940	67311	6013	84065
8	36	77	38	998	315	467	5924	3148	11004
Total	1009	2887	943	5620	3429	8839	83960	10991	117678

PM Difference matrix between prior and post lights

	1	2	3	4	5	6	7	8	Total
1	-10	15	10	-5	1	-6	32	1	38
2	31	228	8	-27	-27	-137	-242	-43	-207
3	20	22	-1	2	3	-6	34	-12	62
4	-6	-33	-11	-103	-50	60	-158	-54	-353
5	5	-47	-6	-73	-53	98	-69	-40	-187
6	1	-192	34	-59	0	100	1058	18	960
7	112	-234	12	-230	-181	1123	237	-15	822
8	7	-50	-13	-82	-54	61	-7	-2	-142
Total	160	-292	33	-578	-361	1294	885	-148	993

PM % change matrix between prior and post lights

	1	2	3	4	5	6	7	8	Total
1	-12%	16%	65%	-23%	3%	-5%	14%	3%	6%
2	28%	25%	6%	-16%	-19%	-33%	-25%	-35%	-7%
3	81%	11%	-1%	2%	4%	-4%	9%	-19%	6%
4	-28%	-24%	-14%	-12%	-14%	17%	-8%	-7%	-8%
5	11%	-26%	-9%	-13%	-11%	17%	-3%	-9%	-4%
6	1%	-35%	23%	-11%	0%	6%	23%	4%	11%
7	32%	-23%	4%	-8%	-10%	29%	0%	0%	1%
8	23%	-39%	-25%	-8%	-15%	15%	0%	0%	-1%
Total	19%	-9%	4%	-9%	-10%	17%	1%	-1%	1%

PM heavies prior matrix

	1	2	3	4	5	6	7	8	Total
1	0	1	0	1	2	3	13	2	22
2	1	7	2	6	12	17	115	17	177
3	0	1	0	1	2	3	13	2	23
4	1	4	1	2	7	8	38	8	68
5	2	9	2	6	32	34	144	28	257
6	3	14	3	8	42	64	170	31	335
7	13	82	13	35	155	187	1008	200	1693
8	2	12	2	7	27	28	194	46	318
Total	23	130	24	64	280	345	1694	335	2894

PM heavies post matrix

	1	2	3	4	5	6	7	8	Total
1	0	1	0	1	2	3	15	3	26
2	1	15	7	8	9	12	85	14	152
3	0	6	0	1	2	3	12	3	28
4	1	5	1	1	7	16	39	8	78
5	2	8	2	6	35	42	152	31	278
6	3	8	3	19	48	73	194	36	385
7	17	63	11	35	168	227	1046	208	1774
8	3	11	2	6	30	35	200	47	333
Total	28	118	27	77	302	411	1743	349	3055

PM Difference matrix between prior and post heavies

	1	2	3	4	5	6	7	8	Total
1	0	0	0	0	0	0	2	1	4
2	0	8	5	2	-3	-5	-30	-3	-25
3	0	5	0	0	0	-1	-1	1	4
4	0	1	0	-1	0	8	1	0	10
5	1	-1	0	0	3	8	8	3	21
6	0	-5	0	11	6	9	25	5	50
7	3	-19	-2	0	13	39	38	7	81
8	1	-1	0	0	3	7	5	1	15
Total	5	-12	3	13	22	66	49	14	161

PM % change matrix between prior and post heavies

	1	2	3	4	5	6	7	8	Total
1	-25%	10%	28%	38%	24%	14%	18%	27%	19%
2	20%	124%	301%	34%	-23%	-29%	-26%	-19%	-14%
3	7%	334%	29%	12%	-12%	-18%	-7%	31%	17%
4	16%	26%	-17%	-33%	3%	107%	3%	1%	15%
5	33%	-9%	0%	-5%	9%	23%	6%	9%	8%
6	4%	-40%	-5%	143%	14%	14%	15%	17%	15%
7	26%	-23%	-15%	1%	9%	21%	4%	4%	5%
8	35%	-11%	0%	-4%	10%	24%	3%	3%	5%
Total	23%	-9%	14%	20%	8%	19%	3%	4%	6%

PM total prior matrix

	1	2	3	4	5	6	7	8	Total
1	81	90	16	23	30	132	247	24	642
2	114	906	150	178	153	434	1065	140	3139
3	25	198	101	110	75	144	398	67	1119
4	21	144	78	872	374	355	1914	817	4576
5	44	189	72	554	521	611	2218	486	4695
6	198	555	150	534	560	1775	4721	516	9009
7	358	1087	313	2905	1959	4004	68081	6228	84936
8	31	139	54	1087	397	434	6126	3196	11464
Total	872	3309	934	6262	4070	7890	84769	11474	119580

PM total post matrix

	1	2	3	4	5	6	7	8	Total
1	71	105	26	18	31	127	281	26	684
2	145	1142	164	153	124	292	793	93	2906
3	45	224	101	112	78	138	431	55	1185
4	16	112	67	769	325	423	1758	763	4233
5	49	141	65	481	471	716	2157	449	4530
6	200	358	184	486	565	1884	5803	539	10019
7	473	834	322	2675	1791	5167	68357	6220	85839
8	38	88	41	1005	345	502	6124	3195	11337
Total	1037	3005	970	5697	3731	9250	85703	11340	120733

PM Difference matrix between prior and post totals

	1	2	3	4	5	6	7	8	Total
1	-10	15	10	-5	1	-5	35	1	42
2	32	237	14	-25	-29	-141	-272	-46	-233
3	20	26	-1	2	3	-6	33	-12	66
4	-6	-32	-11	-103	-50	69	-156	-53	-343
5	5	-48	-6	-73	-50	106	-61	-38	-166
6	1	-197	34	-48	5	109	1082	23	1010
7	115	-254	10	-230	-168	1163	275	-8	903
8	7	-52	-13	-82	-51	67	-2	-1	-126
Total	165	-304	37	-565	-339	1360	934	-134	1154

PM % change matrix between prior and post totals

	1	2	3	4	5	6	7	8	Total
1	-12%	16%	64%	-21%	4%	-4%	14%	5%	7%
2	28%	26%	9%	-14%	-19%	-33%	-26%	-33%	-7%
3	80%	13%	-1%	2%	4%	-4%	8%	-17%	6%
4	-27%	-22%	-14%	-12%	-13%	19%	-8%	-7%	-7%
5	12%	-25%	-9%	-13%	-10%	17%	-3%	-8%	-4%
6	1%	-35%	22%	-9%	1%	6%	23%	4%	11%
7	32%	-23%	3%	-8%	-9%	29%	0%	0%	1%
8	24%	-37%	-24%	-8%	-13%	16%	0%	0%	-1%
Total	19%	-9%	4%	-9%	-8%	17%	1%	-1%	1%

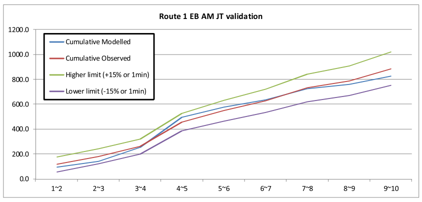
Appendix D – Turning count validation summary

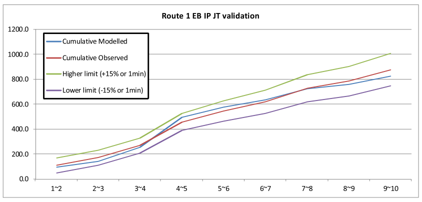
Turn count validation post matrix estimation
Type: Turn based
All periods

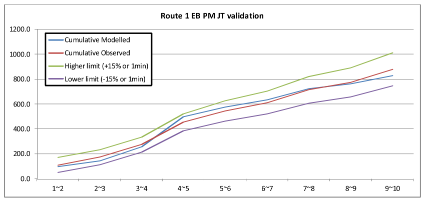
						AM						IP						PM					
						Light			Heavy			Light			Heavy			Light			Heavy		
						Modelled	Survey	GEH	Modelled	Survey	GEH	Modelled	Survey	GEH	Modelled	Survey	GEH	Modelled	Survey	GEH	Modelled	Survey	GEH
MS-Rolleston	V	2052	2462	5197	2052_2462_5197	616	500	5	60	57	0	345	375	2	76	66	1	551	505	2	80	36	6
	V	2052	2462	5379	2052_2462_5379	4	8	2	0	1	1	5	5	0	0	0	0	4	16	4	0	0	0
	V	5197	2462	5379	5197_2462_5379	179	147	2	16	6	3	168	166	0	6	8	1	419	410	0	6	4	1
	V	5197	2462	2052	5197_2462_2052	416	455	2	54	65	1	290	343	3	55	50	1	564	665	4	32	26	1
	V	5379	2462	2052	5379_2462_2052	15	17	0	0	2	2	13	20	2	0	0	0	7	15	2	0	0	0
	V	5379	2462	5197	5379_2462_5197	237	410	10	8	9	0	154	149	0	9	9	0	182	217	3	5	2	1
Main South Rd - Weedons Rd	V	5153	2050	5154	5153_2050_5154	18	13	1	1	1	1	11	25	3	2	1	1	23	92	9	5	0	3
	V	5153	2050	5152	5153_2050_5152	489	411	4	63	56	1	385	415	1	63	70	1	787	811	1	33	36	0
	V	5153	2050	5151	5153_2050_5151	20	17	1	0	2	2	1	17	5	0	1	1	3	23	6	0	0	0
	V	5154	2050	5152	5154_2050_5152	0	30	8	0	2	2	0	16	6	0	1	1	0	7	4	0	0	0
	V	5154	2050	5151	5154_2050_5151	2	14	4	0	0	1	2	16	4	0	1	0	8	19	3	0	1	0
	V	5154	2050	5153	5154_2050_5153	54	6	9	3	1	2	15	4	4	2	1	1	22	1	6	2	0	2
	V	5152	2050	5151	5152_2050_5151	1	8	3	0	1	1	16	12	1	0	1	1	2	11	4	0	0	0
	V	5152	2050	5153	5152_2050_5153	790	853	2	67	90	3	429	470	2	86	87	0	636	624	0	83	46	5
	V	5152	2050	5154	5152_2050_5154	0	1	1	0	1	1	0	5	3	0	2	2	0	4	3	0	0	0
	V	5151	2050	5153	5151_2050_5153	1	4	2	0	0	1	1	5	2	0	0	0	1	5	2	0	1	0
	V	5151	2050	5154	5151_2050_5154	4	22	5	1	1	0	2	11	3	1	1	0	4	19	4	1	2	1
	V	5151	2050	5152	5151_2050_5152	7	28	5	0	0	0	6	17	3	0	1	1	9	9	0	0	1	1
Weedons-Levi Rd	V	5154	2481	2055	5154_2481_2055	11	17	2	1	3	1	5	13	3	1	4	2	5	18	4	1	3	2
	V	5154	2481	2492	5154_2481_2492	11	14	1	1	1	1	8	22	4	2	3	1	22	92	9	5	1	3
	V	2055	2481	2492	2055_2481_2492	1	6	3	0	1	1	1	6	3	0	1	1	2	12	4	0	2	2
	V	2055	2481	5154	2055_2481_5154	6	23	5	0	3	2	6	11	2	0	2	2	14	17	1	1	3	2
	V	2492	2481	5154	2492_2481_5154	50	25	4	3	1	2	12	17	1	2	1	1	16	15	0	2	1	1
	V	2492	2481	2055	2492_2481_2055	0	14	5	0	2	2	0	7	4	0	1	1	0	14	5	0	1	1

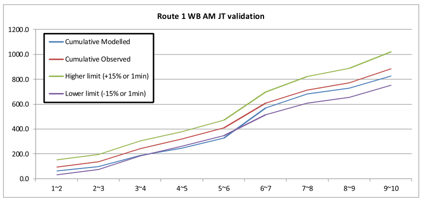
Appendix E – Journey time stage performance

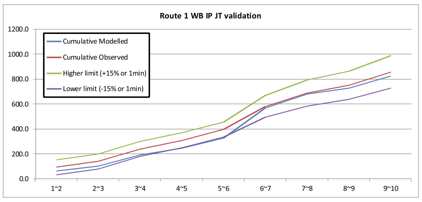
Journey time stage performance
All periods

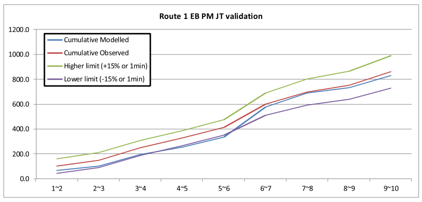


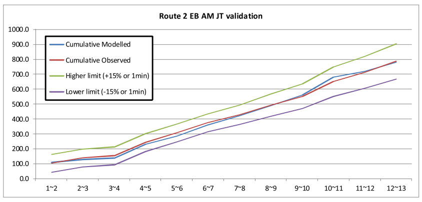


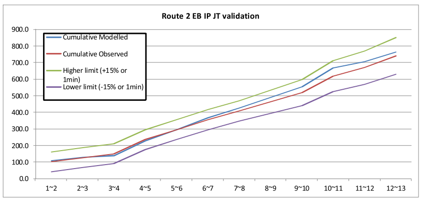


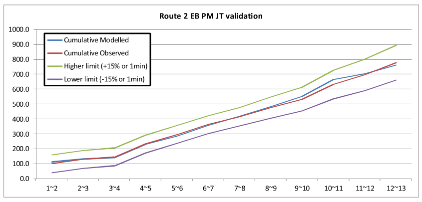


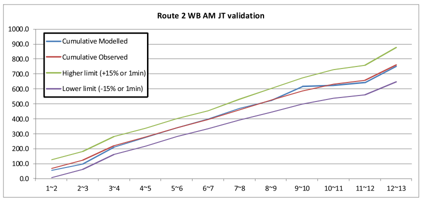


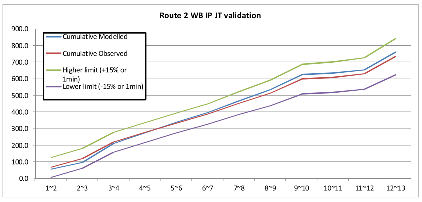


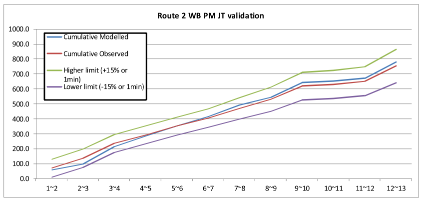


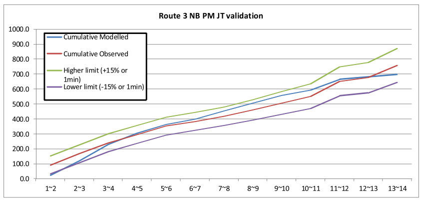


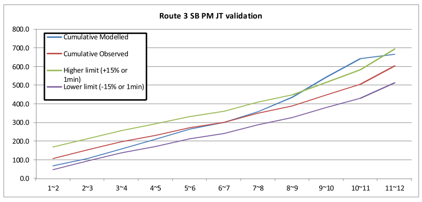


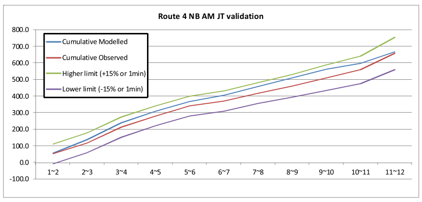


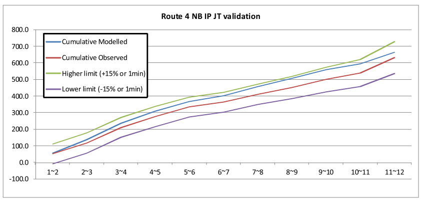


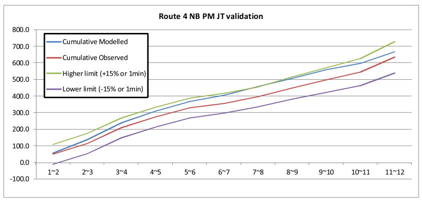


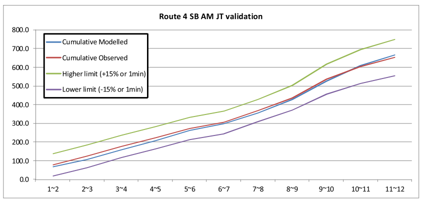


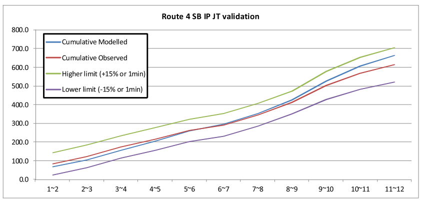


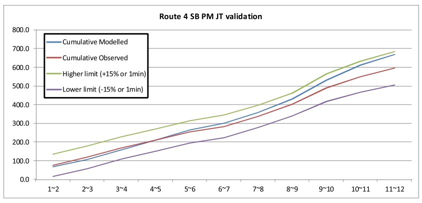


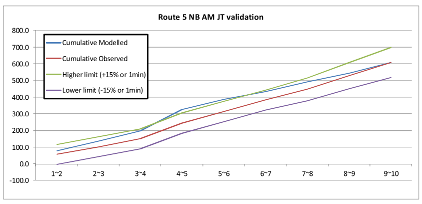


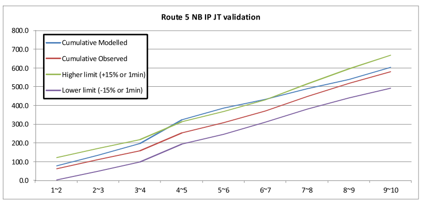


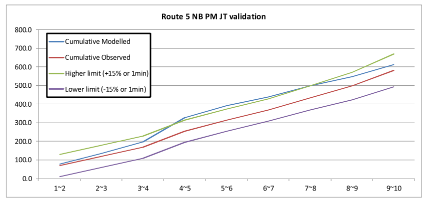


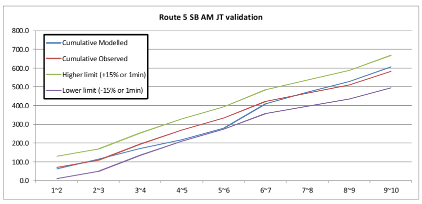


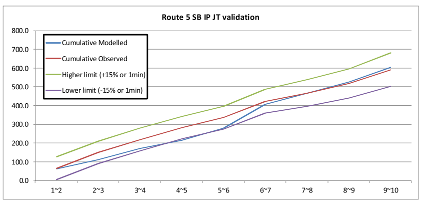


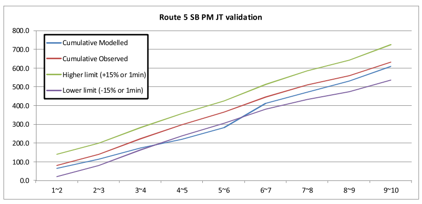












Technical Report No 2

Christchurch Southern Motorway Stage 2 and Main South Road Four Laning

Assessment of Traffic and Transportation Effects

Appendix B: CSM2 Project Model Peer Review Report

NZ Transport Agency

CSM2 / MSR4L Model Review

Peer Review Report

Traffic Design Group

November 2010

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New Zealand

csm2 model review.doc

NZ Transport Agency

CSM2 / MSR4L Model Review

Peer Review Report
Quality Assurance Statement

Prepared by:

Alistair Smith
Senior Transport Planner

Reviewed by:

Julie Ballantyne
Senior Associate/ Branch Manager

Approved for Issue by:

Julie Ballantyne
Senior Associate/ Branch Manager

Status: Final

Date: 26 November 2010

Table of Contents

1. Introduction

Traffic Design Group (TDG) has been commissioned by the New Zealand Transport Agency (NZTA) to undertake a peer review of the Christchurch Southern Motorway Stage 2 (CSM2) Model, developed by Beca Infrastructure Ltd (Beca).

The CSM2 Model will be used to assess the proposed Main South Road Four-Laning and the Christchurch Southern Motorway Stage 2 schemes. The model and the accompanying validation report ("Christchurch Southern Motorway Stage 2 and Main South Road Four Laning: Transport Model Validation Report" (v1), 8 October 2010, GHD / Beca), to which this review refers, were provided to TDG on 4 November 2010.

The model is based on Version 2 of the Christchurch Transportation Model (CTM), which is a four-stage strategic model using CUBE VOYAGER software. The CSM2 Model is not a development of the CTM but a standalone road assignment-only model: it uses final (converged) CTM demand matrices as input, and its road networks and zone systems are based on those in the CTM.

There have been two phases in this model review. TDG was requested first to provide an initial review of the critical elements of the CSM2 Model, so that work involving application of the model could progress. This initial review was provided to NZTA and Beca on 8 November 2010 via email. The second phase was to continue towards a full review of the model, which has been conducted by TDG; the outcomes of both phases are documented in this report.

This report is structured as:

- The initial review of critical modelling elements in the CSM2 Model;
- Modelling methodology;
- General recommendations - issues relating to the report as a whole; and
- Particular recommendations - issues relating to particular sections of the report.

2. Initial review

On 8 November 2010 Traffic Design Group provided initial peer review comments via email on the critical modelling elements of the CSM2 Model. As mentioned in the Introduction, this initial review was requested by NZTA so that work involving application of the model could progress prior to delivery of the full review report. While general and methodological aspects were included in the preliminary checks of the model, the issues that arose as potentially problematic involved the implementation of the model in CUBE VOYAGER software.

Beca's response to these issues was received on 16 November ("CSM2 Base Model – Peer Review Response"), which included comments and summaries of updated results where applicable.

The initial TDG review is provided in Appendix A along with Beca's response for each issue. Our further comments are provided below.

2.1 Issue 1 - Network Building

A road link in the CSM2 network had the attribute for the number of lanes set to zero (lanes=0). This has the effect in CUBE VOYAGER of implementing infinite traffic volume capacity for that link. Since the traffic volume was relatively low on that link, the increase in capacity had negligible effect. Nonetheless it was a coding error, and we accept that it has been corrected in the model.

2.2 Issue 2 - Matrix Estimation

The CSM2 Model includes processes for generating routing (path) files for use in the Matrix Estimation (ME) modules, but incorrect routing files had been used as input into ME. We accept that this error has been corrected, and are pleased that it has led to improved levels of model validation.

2.3 Issue 3 - Matrix Estimation

Matrix Estimation had been applied in the CSM2 Model for total light and heavy vehicles for each time period, but not for the segmentations of these (i.e. trip purpose and single vs high vehicle occupancy), which are present in the input demand files. Beca have responded that anticipated uses of the model do not require these segmentations of vehicle trips, but note that the script may need to be changed if segmentation is required. It is acknowledged that the scope of the model does not extend to segmentation of traffic volumes into trip purpose or single vs. high vehicle occupancy, but we would still however recommend that the adjustment calculated in the Matrix Estimation process be applied to the full set of traffic demand tables, not just total light and heavy vehicles for each time period. This is because: the adjustment differences and factors are already calculated; it is a relatively quick coding task to extend the application of these adjustments to all demand tables present; and it may create problems for future users of the model who may well be unaware the adjustment is not applied to all tables in the input demand file.

2.4 Issue 4 - Matrix Manipulation

Although unlikely to have a significant effect on model outputs, the numerical rounding of demand had not been set consistently in the CSM2 Model. Beca have accepted the point and set decimals to 4 places in all modules. There are still inconsistencies in the application of these settings, however. Many modules have the decimals set for only some of the tables in the files, for example, in the first module in the 'Estimation' application, there are 60 tables but only the first 2 tables are set.

2.5 Issue 5 - Assignment

There was a technical VOYAGER software issue regarding the priority setting of banned turns, which would have been unlikely to create a problem. Junction coding and fixed penalty coding (both of which can be used to ban turns) had been coded with equal precedence, but this has now been corrected.

2.6 Issue 6 - Assignment

An AM Peak quantity is referenced in the CSM2 assignment module for all time periods. Beca have responded that the issue is related to the naming of files (many had names with "_AM" regardless of the period to which they refer) rather than the wrong files being referenced, and have removed the "_AM" for clarity. While we support this filename change, we maintain that the issue is not about filenames but that an AM table is referenced across all time periods. The "{Time period}" is a CSM2 variable that is set to 1 for AM Peak, 2 for Inter-Peak and 3 for PM Peak, but it has been incorrectly coded in the assignment script as always being 1, ie AM Peak. Line 91 of the final assignment script file is:

```
MW[13] = MW[2*{Time period}+19]-MW[1+30]
```

which needs to be corrected to:

```
MW[13] = MW[2*{Time period}+19]-MW[{Time period}+30]
```

2.7 Issue 7 - Assignment

The "Bus Preload" traffic volumes in the Inter-Peak and PM Peak periods incorrectly referenced the AM values in CSM2 Model, but this has been now been corrected.

However, it is important to note that, although Beca have stated that the script is copied directly from the CTM and that the error was present in the CTM, we maintain that the CTM is correct and that the error was introduced with the CSM2 Model. The coding from all three models is reproduced below. We would be happy to discuss this issue further if required.

CTM (and CTM_V2):

```
IF(@RDPeak@=1) LW.BUSPRELOAD=LI.AMBUSPERHR
IF(@RDPeak@=2) LW.BUSPRELOAD=LI.IPBUSPERHR
IF(@RDPeak@=3) LW.BUSPRELOAD=LI.PMBUSPERHR
```

CSM2:

```
LW.BUSPRELOAD=LI.AMBUSPERHR
```

CSM2 updated:

```
IF ({Time period}=1) LW.BUSPRELOAD=LI.AMBUSPERHR
IF ({Time period}=2) LW.BUSPRELOAD=LI.IPBUSPERHR
IF ({Time period}=3) LW.BUSPRELOAD=LI.PMBUSPERHR
```

3. Modelling Methodology

The CSM2 Model is a vehicle assignment-only standalone model, based on networks and final demand matrices from the CTM, with a series of developments designed to improve levels of validation in the southwest of Christchurch, in order to produce a model that is well-suited for the assessment of the Christchurch Southern Motorway Stage 2 and Main South Road Four-Laning schemes. Our comments on the model development are grouped into broad categories and are provided below.

3.1 Network Changes

Additional road links have been added to the network to increase the level of detail. Many link capacities and free-flow speeds have been altered from the CTM values. This process of making changes to the network is expected in the development of a project model such as this, and the changes made appear appropriate. The more notable changes to the road links are the free-flow speeds, but journey time validation is good across all time periods, indicating that the link speed settings are suitable.

Intersection coding has been added where required by new link connections. In general these are appropriate, but see particular comments and recommendations in Section 5.4.

3.2 Zone Disaggregation

Some zones in the southwest area have been disaggregated to increase model detail and allow for more flexible connectivity of generated traffic onto the road network. This is natural in such a project model, and has been implemented in an entirely appropriate manner. Effort has been made to align zones with meshblocks, and the new zoning structure, shown in Figure 5.1 of the model validation report, appears well-suited to planned and proposed landuse patterns.

The division of demand among disaggregated zones has been performed according to the total number of households and the level of employment in the disaggregated zone. This appears to be a logical and robust approach, allowing future demands to be tied to landuse forecasts. The trip distribution for disaggregated zones is inherited from the parent zone, but is allowed to vary slightly through the Matrix Estimation process.

3.3 Matrix Estimation

Two rounds of Matrix Estimation are performed on the disaggregated matrix, to a comprehensive set of link counts. The estimated matrices are then capped so that there is no change more than 20% from the respective prior matrix at trip-end level. This is a sound approach. As a result of the Estimation, the number of trips increases slightly, but the average trip length decreases slightly.

3.4 Base Year Validation

Validation of the CSM2 Model is documented for screenline volumes, link volumes, turn volumes and journey times. The model generally performs well against EEM validation criteria, improving on the CTM in the southwest part of Christchurch. Documentation of the model validation is generally good, aside from some reporting issues, discussed in Section 5.

3.5 Demand Forecasting

The methodology for adjusting future (forecast) demand from the CTM, based on the results of the Base year Matrix Estimation process, is not documented in the CSM2 Model report. However, as the model itself has been provided for review, the method for adjustment is easily inferred.

For each time period and vehicle class, the demand changes at origin-destination level are available (as outputs of the Matrix Estimation procedure) as: 1) the *absolute* difference between prior and estimated demand; and 2) the *relative* (proportional) difference between prior and estimated demand. There is difference of opinion in the transport modelling community as to the respective merits of applying the absolute difference vs. the relative difference to future demand.

The adjustment of future demand in the CSM2 Model is the average of the results obtained from these two approaches. Then, if a negative demand value is created for any origin-destination pair, as can occasionally occur with the absolute difference method, it is capped at zero for that pair.

This is an entirely suitable approach to matrix adjustment. We would only refer back to Section 2.3 (Matrix Estimation – Issue 3), which discusses adjusting all tables in the demand file including those for demand segmentations, given that this issue carries forward into the adjustment of future demand.

3.6 Overall

In general the methodology adopted for the development of the CSM2 Model is appropriate in terms of transport modelling practice and in the context of its intended applications, and it validates well to EEM criteria in the Base Year.

The issues and recommendations that have arisen through the model review process are largely related to the reporting of the model. These are covered in Sections 4 and 5.

4. General Recommendations

4.1 Time Periods

It is stated in the Executive Summary of the model validation report that “the CSM2 traffic model looks at three average one hour peaks”, while the time periods in CSM2 are actually two hours for the AM and PM Peaks, and 7 hours for Inter-Peak (consistent with the CTM). The link volume validation for the CSM2 Model is for these period intervals, not for average hours within each. Therefore we recommend that the time periods be clarified in the report. The one-hour averages are only calculated for road assignment, after which the one-hour link volumes are converted back to represent the full period.

Second, it isn’t stated in the report how model outputs corresponding to these time periods will be combined to form daily values. It is expected that daily quantities will provide key information for option assessment and economic analysis.

4.2 Terms Calibration and Validation

The word calibration is used in the report in several places to mean what we would have termed validation. For example, in section 3.2.2, it is stated that “certain links… have particularly poor levels of calibration”. In strategic modelling contexts, the word calibration usually refers to the derivation of generation, mode split and distribution equations to survey (eg. household interview) data, whereas validation usually refers to the agreement between modelled traffic volumes to traffic counts and travel times to journey surveys. Therefore we recommend that, for clarity, occurrences of the word calibration be revised, which will in most cases probably mean replacement with the word validation.

4.3 Traffic Demand

The possibilities for the poor level of CTM calibration (validation) are listed in the report (in Section 3.2.1) as: 1) low generation; 2) a high level of local attractions (ie resulting in short trips); and 3) the modal choice for car is too low. These possibilities are however not directly revisited throughout the remainder of the report. The average trip length is shown in Table 9.15 to decrease with Matrix Estimation across all time periods and vehicle classes, ruling out the second possibility. The total number of trips is shown to increase by 1% in each time period with Matrix Estimation, which presumably is magnified to approximately 10% in the southwest of Christchurch. Some discussion on this would be helpful.

4.4 Productions and Attractions

There is mention throughout the report of “productions” and “attractions”, which apparently refer to the row and column totals of trip matrices. We would therefore recommend that, to improve clarity, these terms be replaced with “origins” and “destinations”. Trip productions and attractions relate to the generation (cause) of the trip, and not necessarily where it is coming from (origin) and going to (destination). For example, for a trip from one’s place of work to their home in the PM Peak, the production zone is the home zone, but the origin zone is the work zone.

5. Particular Recommendations

5.1 Section 3.1

The CTM periods are listed as AM, IP and PM, while they are actually AM, IP, PM and ON (Overnight, 1800-0659).

5.2 Section 4.2

In the section on Matrix Estimation, it is not clear what is meant by the phrases "Initial confidence is included for the CTM network" and "new network confidence is included". In the Matrix Estimation modules, confidences are attached to the input demands and to the target link volumes. The network is not a Matrix Estimation input.

There is also an implication in this section that different confidence is implemented in the second round of Matrix Estimation, but confidences remain the same.

Third, we recommend that either the reference to matrix adjustment be removed from this section or that documentation of the methodology for adjusting future (forecast) demand be included. In the base year model, although adjustment is implemented, the adjustment is effectively replacing the prior demands with the matrix estimated demands.

5.3 Section 5.1

The regression variables are presented in Table 5.3 as Households and Employment. Presumably the employment here is the number of full time jobs, or similar. Some clarification is needed here.

Notwithstanding the issue regarding "productions" and "attractions" mentioned in Section 4.4, it appears in Table 5.3 that some of the row headings are incorrect. For example, it seems that the 5^{th} and 6^{th} rows should be headed "PM light Origins" and "PM light Destinations" respectively.

There is a negative coefficient (-0.0002 trips per household) used in calculating the "AM heavy Productions", which is counterintuitive. It is acceptable to keep the negative coefficient, given that the coefficient is only slightly negative, provided that a check be put in place ensuring negative demands for this demand category aren't created.

5.4 Section 5.2

Some intersections are coded with critical gaps and follow-up times in the mid-range of what the CUBE VOYAGER software states are recommended ranges. It is further stated that the CTM network generates errors, because the CTM has values input that are outside the recommended ranges. It should be noted however that these ranges are only recommended, and may or may not be applicable to New Zealand conditions. The CTM parameters have been calibrated, sometimes falling outside the ranges, with small follow-up times for two-lane roundabouts for example. When a parameter outside the recommended range is used, a warning is generated with the VOYAGER software, not an error, and the assignment program continues to run without any problems. The parameters implemented in the CSM2 Model do appear appropriate, however.

The intersections between SH1 and Rolleston Drive and Hoskyns Road have been signalised in the CSM2 2006 model. This is technically incorrect, as they were not signalised in 2006. It is acceptable to keep the signalisation however, to keep consistent with travel time surveys and traffic counts from 2010 when the intersections are signalised, and also allowing smoother forecasting into the future.

5.5 Section 6.1

Total daily vehicle flow data were extracted from counts, but it isn't stated how these data were further factored to period level, or if hourly count data were available.

5.6 Section 6.2

It is noted that the 2010 journey time survey data are not in any way factored or adjusted to correspond to 2006. There is not a straight forward or obvious way to do so, however. We recommend that comment be included in the report that it is likely that 2006 travel times were slightly lower than in 2010.

5.7 Section 7.1

It is stated that GEH statistics are designed to be "tolerant of larger errors in low flows". This should be changed to "tolerant of larger *relative* errors in low flows."

5.8 Section 7.2

It is counterintuitive that the HCV validation (against validation data only) has all GEH less than 5 in the PM but giving an R^2 of only 0.62. We have not checked these values as the appendix tables only relate to final assignment validation.

It appears that the R^2 values (also in Section 9.1) have been extracted from MS Excel plots of modelled vs. surveyed traffic volumes (although not all values in the plots match the values in the text). We would recommend alternative means of calculating these values. This is because: 1) the R^2 value in these graphs is based on the best fit line, which is based on minimising the sum of the squares of the *vertical* deviations of the data points from the line, and therefore the modelled flows need to be on the vertical axis for the R^2 value to represent the level of error of the model; and 2) the R^2 value technically shouldn't be based on the best fit line but on the diagonal, as it is the deviation from the surveyed data that is relevant to model validation, not the deviation from the best fit line.

It would also be helpful if it is clarified within or near the graphs that modelled and surveyed flows are hourly.

5.9 Section 7.3

Reference is made to "modelled link counts". We recommend avoiding using "modelled" and "counts" together, as the word "counts" can be interpreted as meaning they were surveyed, not modelled.

5.10 Section 8.2

It is stated that a prior matrix is extracted directly from the CTM, but the prior matrices are actually disaggregated from the CTM matrices.

5.11 Section 10.1

The journey time validation for the base model is good, but there are problems with the graphs of cumulative journey time in Appendix E. The route directions don't match the corresponding directions in the text, some values don't match the text, there are no dimensions on the graphs, and the horizontal (distance) axis appears to be scaled in categories rather than quantitatively.

6. Summary

The CSM2 Model has been developed by Beca for NZTA, to be used to assess the proposed Main South Road Four-Laning and Christchurch Southern Motorway Stage 2 schemes.

TDG have conducted a two-phase review of the CSM2 Model for NZTA, initially to check the critical modelling elements, and then to provide a full model review.

Overall the CSM2 Model is well-developed and is deemed suitable for the assessing the transport effects of the schemes mentioned above. The methodology adopted for the model development is appropriate and robust, and the model validates well to EEM criteria in the Base Year (2006).

The issues and recommendations that have arisen through the CSM2 Model review process, and as documented in this report, are largely related to the reporting of the model. Where these recommendations lead to different reported validation statistics, we would require these be included in an updated version of the modelling report, but do not expect these to compromise the good level of model validation.

Traffic Design Group Ltd
26 November 2010

Appendix A – Initial Model Review Correspondence

Reproduced in this Appendix are the initial review comments made by TDG (8 November 2010) (*italicized*) and the response to each issue made by Beca (16 November 2010). Background this correspondence and further comments and discussion on these issues are given in Section 2 of this report.

Issue 1 – Network Building

TDG:"We've not done a full check of the CSM model network, but have noticed an error with the number of lanes on one of the road links. The error doesn't seem to affect output volumes, but we have [not rerun][1] with the error corrected to be sure of this."

[1] Grammatical error corrected

Beca: "It is agreed that on link 2558_2557 the number of lanes was incorrectly coded as zero rather than one, and that the error does not appear to have affected the output volumes. This link attribute has however since been corrected and the model has been re-run to ensure that this error will not restrict flow though the corresponding corridor. To ensure that this is an isolated incident, the network files in terms of link attributes has been exported and reviewed in Excel. By applying filters to this data assurance can be gained that links with lanes=0 are those which have the 'centroid connector', 'walk' or 'PT' hierarchy only. For all road links the number of lanes varies between one and three."

Issue 2 – Matrix Estimation

TDG: "Incorrect routing files are used in the Matrix Estimation process. It is difficult to know the effect that this has"

*Beca: "*This issue has been corrected in the new version of the model. Previously light and heavy vehicle paths were being combined into a single path file, but following this comment, paths for light and heavy vehicles have been kept separate for the Matrix Estimation process. As shown in section 3, this correction has resulted in an improvement in base model calibration and validation for both light and heavy vehicles."

Issue 3 – Matrix Estimation

TDG: "The matrix estimated adjustment is only applied to total light vehicles and total heavy vehicles for each time period. Demand representing segmentations of these (i.e. trip purpose, single vs. high occupant vehicles etc.) are not adjusted. This doesn't affect model validation or total forecast volumes, but it does mean that quantities such as high-occupant vehicles can't legitimately be extracted from the model as it is currently."

Beca: "The scope of the work was to calibrate and validate a project base model for assigning light and heavy vehicles only. Anticipated uses of the model do not require more detailed segmentation of the vehicle trips. It is noted however that the script may need to be changed for economic assessment of future year tests where the splits of the journey purpose segmentation from the CTM model could be used."

Issue 4 – Matrix Manipulation

TDG: "Numerical rounding of demand isn't consistent throughout the model. This creates rounding differences that are probably insignificant in the context of their effect on final link volumes, but create discrepancies nonetheless."

*Beca: "*A consistent approach has now been applied throughout the model so that the same number of decimal places is used for each matrix cell to reduce the effect of potential rounding errors. It is agreed that this change is likely to be insignificant in terms of final link volumes."

Issue 5 – Assignment

TDG: "There is a priority conflict between inputs (intersection coding and banned turns) in the traffic assignment program. This has no effect given the base model networks currently used, but could potentially create problems in the future."

*Beca: "*The refinement process in the CSM2 Model has resulted in a large number of minor network modifications. However no additional banned turns were coded into the network during this process and none of the original banned turns which have been directly imported from the CTM_v2 model relate to intersections which are within our area of interest. Therefore there will not be any potential priority conflicts within our area of interest. However it is appreciated that this is a valid issue, particularly as banned turns may be included within the area of interest for the future year model, and hence the "set" value for the banned turns now differs from the "set" value as included within the intersection coding."

Issue 6 – Assignment

TDG: "The single occupant demand in the inter-peak and PM peak periods incorrectly reference an AM quantity in their calculation. As with 3, this doesn't affect model validation or total forecast volumes."

*Beca: "*This issue is related to the naming of files rather than the wrong files being referenced for different periods. The three demand files, which are saved and referenced correctly in separate scenario folders, have included a "_AM" in the file name regardless of which period they refer to. It is appreciated that this may have caused the reviewer initial confusion, and for clarity the "_AM" has been removed from each file name."

Issue 7 – Assignment

TDG: "The "Bus Preload" traffic volumes in the Inter-peak and PM peak periods incorrectly reference the AM values. These quantities are mostly low, so this isn't likely to have a significant effect on the total Inter-peak and PM peak volumes."

*Beca: "*The assignment process used in the CSM2 Model has been directly copied from the CTM_v2 road assignment module. In this module the AM bus preloaded traffic volumes are included for all time periods, which is the reason for the inter-peak and PM peak periods also including the AM preloaded traffic. It is however agreed that although the quantities are low and are unlikely to have a significant impact, the inter-peak and PM peak periods should be assigned the corresponding bus preload traffic. In the updated model this has been coded into the assignment process.

Technical Report No 2

Christchurch Southern Motorway Stage 2 and Main South Road Four Laning

Assessment of Traffic and Transportation Effects

Appendix C: Annual Daily Traffic Volume Forecasts

Annual Daily Traffic (ADT) Forecasts - CPM Model

	2006	2016			2026			2041		
	Base	Baseline	CSM 2&3	Diff	Baseline	CSM 2&3	Diff	Baseline	CSM 2&3	Diff
Brougham St: West of Selwyn St	32,888	46,386	47,795	1,409	49,622	50,858	1,236	51,594	54,481	2,887
CSM1: Between Barrington St & Curletts I/C	22,598	43,573	46,217	2,644	47,197	51,107	3,911	49,292	55,741	6,449
CSM1: Between Curletts I/C & Halswell Jn Rd	-	32,940	39,194	6,254	37,241	47,661	10,419	40,831	54,754	13,923
Halswell Jn Rd: North of Springs Rd	15,634	29,803	20,763	-9,040	34,319	24,300	-10,018	37,851	27,923	-9,927
Main South Rd: East of Halswell Jn Rd	19,112	19,251	16,396	-2,855	23,427	19,348	-4,079	26,862	21,706	-5,157
Main South Rd: West of SH1 Carmen Rd	19,112	19,362	16,688	-2,674	22,237	19,101	-3,136	25,492	20,988	-4,504
Main South Rd: West of Halswell Jn Rd	19,929	30,166	16,278	-13,888	35,866	19,917	-15,949	40,490	23,306	-17,185
Main South Rd: West of Marshs Rd/ Barters Rd	21,827	27,994	16,994	-11,000	33,155	20,638	-12,516	37,799	24,002	-13,797
Main South Rd: West of Trents Rd/ Kirks Rd	18,438	25,188	11,967	-13,221	30,873	15,099	-15,774	35,723	18,985	-16,738
Main South Rd: West of Robinsons Rd/ Curraghs Rd	17,852	25,125	26,809	1,684	31,063	36,132	5,069	36,688	45,857	9,168
Main South Rd: West of Weedons Rd/ Weedons Ross Rd	17,799	24,743	26,951	2,208	30,398	34,116	3,718	35,193	40,815	5,622
Main South Rd: West of Park Ln	17,799	24,743	26,951	2,208	30,398	34,116	3,718	35,193	40,815	5,622
Main South Rd: Between Hoskyns Rd & Rolleston Dr	19,895	28,352	29,091	739	35,579	36,863	1,284	42,115	43,603	1,488
Main South Rd: Between Rolleston Dr & Tennyson St	14,914	18,113	18,920	807	19,201	20,594	1,393	21,632	23,570	1,938
Main South Rd: West of Tennyson St	13,185	13,406	13,971	565	14,821	15,697	876	16,656	17,867	1,210
Waterloo Rd: West of SH1 Carmen Rd	7,353	7,081	6,855	-226	7,466	7,294	-172	7,888	7,463	-425
Jones Rd: West of Kirks Rd (western side of Templeton)	2,049	2,353	1,983	-370	2,791	2,155	-636	4,017	2,605	-1,412
Jones Rd: West of Weedons Ross Rd	1,679	953	868	-85	1,449	1,010	-439	2,054	1,444	-610
Jones Rd: West of Hoskyns Rd	2,112	1,623	1,716	93	4,031	4,271	240	10,535	11,603	1,068
Halswell Jn Rd: West of Wigram Rd	10,666	5,886	6,831	945	10,294	12,467	2,173	14,245	16,968	2,723
Shands Rd: North of Halswell Jn Rd	10,453	13,939	13,809	-130	17,045	16,282	-763	19,418	18,668	-750
Shands Rd: North of Marshs Rd	6,372	6,899	6,602	-297	10,819	10,994	175	13,310	14,726	1,417
Shands Rd: South of Marshs Rd	8,772	9,923	12,079	2,156	13,036	13,817	782	14,167	15,392	1,225
Shands Rd: South of Trents Rd	6,479	7,980	9,993	2,013	10,734	11,427	693	11,850	11,811	-39
Shands Rd: South of Robinsons Rd	3,497	4,326	6,483	2,157	4,609	6,792	2,183	4,918	7,286	2,368
Shands Rd: South of Boundary Rd	3,497	4,291	6,480	2,189	4,571	6,785	2,214	4,856	7,268	2,412
Springs Rd: South of Main South Rd	19,522	16,102	16,542	440	16,221	17,008	788	16,731	18,142	1,411
Springs Rd: East of Brynley St	15,124	13,069	13,141	72	13,683	14,406	723	14,788	16,018	1,230
Springs Rd: North of Halswell Jn Rd	15,124	20,783	20,710	-73	22,599	24,901	2,302	24,294	28,277	3,982
Springs Rd: North of Marshs Rd	11,488	18,420	17,264	-1,156	21,249	20,459	-789	23,172	22,998	-174
Springs Rd: South of Marshs Rd (north side of Prebbleton)	11,435	17,218	15,226	-1,992	17,866	16,396	-1,470	20,122	18,696	-1,426
Springs Rd: Between Tosswill Rd & Blakes Rd	8,847	14,562	12,195	-2,367	15,294	13,257	-2,038	17,785	16,259	-1,525
Springs Rd: Between Trents Rd & Birchs Rd	8,355	11,104	9,229	-1,875	11,211	9,427	-1,785	11,813	10,172	-1,641
Springs Rd: South of Trents Rd	5,298	4,861	2,546	-2,315	4,809	2,542	-2,267	5,005	2,523	-2,482
Springs Rd: Between Robinsons Rd & Hamptons Rd	4,977	4,274	1,964	-2,310	4,356	2,095	-2,261	4,820	2,552	-2,268
Springs Rd: South of Robinsons Rd	5,771	5,062	2,754	-2,308	5,141	2,882	-2,259	5,608	3,340	-2,268
Springs Rd: South of Boundary Rd	4,146	5,137	2,806	-2,331	5,132	2,840	-2,291	5,466	2,974	-2,492
Birchs Rd: South of Trents Rd	2,945	6,389	6,483	94	7,117	7,281	164	8,510	8,454	-57
Birchs Rd: South of Trices Rd	3,695	7,300	7,378	78	7,993	8,209	216	8,963	9,411	448
Birchs Rd: North of Robinsons Rd	2,967	6,558	6,596	38	7,165	7,260	96	8,077	8,250	173
Birchs Rd: South of Tancreds Rd	2,967	6,461	6,492	31	7,163	7,233	71	8,383	8,373	-10
Birchs Rd: South of Boundary Rd	3,692	5,196	5,217	21	6,205	6,159	-46	8,078	8,105	27
CSM2: Between Halswell Jn Rd & Shands I/C	-	0	19,781	19,781	0	27,146	27,146	0	32,850	32,850
CSM2: Between Shands I/C & Main South Rd	-	0	15,962	15,962	0	21,700	21,700	0	27,120	27,120
Selwyn Rd: Between Robinsons Rd & Shands Rd	4,924	5,848	5,736	-112	7,465	5,847	-1,619	8,856	6,222	-2,634
Selwyn Rd: Between Weedons Rd & Waterholes Rd	4,081	4,593	3,996	-597	6,143	4,106	-2,037	7,578	4,493	-3,084
Weedons Ross Rd: West of Jones Rd	801	625	656	31	708	842	134	1,012	1,643	632
Weedons Ross Rd: Between Maddisons Rd & Newtons Rd	974	1,108	1,141	33	1,381	1,365	-17	2,227	2,425	198
Weedons Rd: East of Main South Rd	611	1,268	2,487	1,219	1,859	4,760	2,901	3,424	8,296	4,872
Marshs Rd: West of Shands Rd	1,286	588	3,253	2,665	1,077	3,679	2,602	2,023	4,155	2,133
Marshs Rd: West of Springs Rd	1,629	1,371	2,386	1,015	4,613	5,223	610	5,393	6,804	1,410
Marshs Rd: East of Springs Rd	2,060	144	320	176	867	827	-40	1,690	1,875	184
Levi Rd: South of Weedons Rd	448	1,215	1,687	472	1,830	3,883	2,052	3,438	6,891	3,452
Curraghs Rd: West of Jones Rd	912	683	128	-555	585	138	-447	559	156	-403
Hamptons Rd: West of Shands Rd	732	969	731	-238	1,300	1,055	-245	1,840	1,240	-600
Dawsons Rd: West of Jones Rd	520	667	1,451	784	719	1,600	881	814	1,715	901
Dawsons Rd: Between West Coast Rd & Ivey Rd	302	355	422	67	440	564	124	516	695	179
Waterholes Rd: East of Main South Rd	926	1,632	1,852	220	1,937	2,076	138	2,477	2,282	-196
Kirk Rd: West of Jones Rd	7,203	8,535	8,993	458	9,271	9,887	616	9,865	10,719	854
Kirk Rd: West of Main South Rd	5,853	8,992	10,166	1,174	9,013	11,249	2,236	8,974	12,199	3,225
Kirk Rd: Between Bailey St & Maddisons Rd	2,704	3,535	3,878	343	4,368	4,805	437	5,269	5,760	490
Trents Rd: East of Main South Rd	873	1,156	918	-238	1,359	922	-437	1,967	1,128	-839
Blakes Rd: West of Springs Rd	1,291	1,676	1,344	-332	3,517	1,927	-1,590	5,346	2,807	-2,539
Blakes Rd: East of Shands Rd	1,419	1,804	1,472	-332	3,645	2,055	-1,590	5,474	2,935	-2,539
Ellesmere Rd: Between Tosswill Rd & Trices Rd	1,240	1,240	1,240	0	1,298	1,297	-1	1,539	1,476	-63
Ellesmere Rd: South of Robinsons Rd	2,630	3,898	3,853	-45	6,305	6,399	93	8,839	8,456	-383

	2006	OBSERVED		Difference							
	Base	Adjusted to 2006	Original	Absolute	Relative			Source			
Brougham St: West of Selwyn St	44,340	32,888	32,888	11,452	26%	TRUE	31,426		Jerrold St - EB + WB	2006	
CSM1: Between Barrington St & Curletts I/C	40,422	22,598	22,598	17,824	44%	TRUE			Sthern Motorway West of Wrights Rd Underpass		
CSM1: Between Curletts I/C & Halswell Jn Rd	-										
Halswell Jn Rd: North of Springs Rd	13,682	15,634	15,634	-1,952	-14%	FALSE			HJR Sth of Shands	2006	
Main South Rd: East of Halswell Jn Rd	9,230	19,112	19,112	-9,882	-107%	TRUE			Main Sth Rd Sth of Parker St		
Main South Rd: West of SH1 Carmen Rd	17,462	19,112	19,112	-1,650	-9%	FALSE			Virtual - Sth of SH73 Junction (Inc+Dec)		
Main South Rd: West of Halswell Jn Rd	13,767	19,929	19,929	-6,162	-45%	TRUE			Sth of Halswell Junction Rd		
Main South Rd: West of Marshs Rd/ Barters Rd	20,250			-1,577							
Main South Rd: West of Trents Rd/ Kirks Rd	16,861	18,438	18,438	-1,577	-9%	FALSE			Main Rd 1.74km Sth of Templeton		
Main South Rd: West of Robinsons Rd/ Curraghs Rd	16,275			-1,577							
Main South Rd: West of Weedons Rd/ Weedons Ross Rd	15,013			-2,786							
Main South Rd: West of Park Ln	15,013	17,799	17,799	-2,786	-19%	FALSE			Rolleston - Sth of Weedons Ross Rd		
Main South Rd: Between Hoskyns Rd & Rolleston Dr	17,110			-2,786							
Main South Rd: Between Rolleston Dr & Tennyson St	12,128			-2,786							
Main South Rd: West of Tennyson St	13,185										
Waterloo Rd: West of SH1 Carmen Rd	9,384	7,353	7,503	2,031	22%	FALSE			Waterloo west of Car	2007	
Jones Rd: West of Kirks Rd (western side of Templeton)	917	2,049	2,009	-1,132	-123%	TRUE			Jones west of Globe	2005	
Jones Rd: West of Weedons Ross Rd	823	1,679	1,713	-856	-104%	TRUE			**[S026 JONES] !5742**	2007	
Jones Rd: West of Hoskyns Rd	2,298	2,112	2,247	186	8%	FALSE			**[S329H] JONES RD**	2009	
Halswell Jn Rd: West of Wigram Rd	9,826	10,666	10,666	-840	-9%	FALSE			HJR Sth of Springs	2006	
Shands Rd: North of Halswell Jn Rd	10,294	10,453	10,666	-159	-2%	FALSE			Shands Nth of HJR	2007	
Shands Rd: North of Marshs Rd	4,982	6,372	6,372	-1,390	-28%	TRUE		CCC	Shands Nth of Marsh	2006	Aug-05
Shands Rd: South of Marshs Rd	4,884	8,772	8,951	-3,888	-80%	TRUE			**[A07_011 SHANDS I**	2007	
Shands Rd: South of Trents Rd	4,016			-2,463							
Shands Rd: South of Robinsons Rd	2,459	3,497	3,428	-1,038	-42%	TRUE			**[S085 SHANDS] 667**	2005	
Shands Rd: South of Boundary Rd	2,367	3,497	3,428	-1,129	-48%	TRUE			**[S086 SHANDS] 779**	2005	
Springs Rd: South of Main South Rd	16,523	19,522	19,522	-2,999	-18%	FALSE		CCC	Springs Sth of MSR	2006	Apr-06
Springs Rd: East of Brynley St	13,224	15,124	15,754	-1,900	-14%	FALSE		CCC	Springs East of Brynl	2008	Aug-08
Springs Rd: North of Halswell Jn Rd	11,124	15,124	15,754	-4,000	-36%	TRUE			Springs East of Brynl	2008	
Springs Rd: North of Marshs Rd	9,843	11,488	11,488	-1,645	-17%	FALSE		CCC	Springs Sth of HJR	2006	Mar-06
Springs Rd: South of Marshs Rd (north side of Prebbleton)	9,789			-1,645			3,117		**[S078 SPRINGS] 52!**	2005	
Springs Rd: Between Tosswill Rd & Blakes Rd	9,468	8,847	8,674	620	7%	FALSE		SDC	[S128 SPRINGS] 12(	2005	Nov-05
Springs Rd: Between Trents Rd & Birchs Rd	5,567	8,355	8,191	-2,788	-50%	TRUE		SDC	[S130 SPRINGS] 19:	2005	Oct-05
Springs Rd: South of Trents Rd	5,298										
Springs Rd: Between Robinsons Rd & Hamptons Rd	5,754	4,977	4,879	777	14%	FALSE		SDC	[S079 SPRINGS] 29:	2005	Oct-05
Springs Rd: South of Robinsons Rd	5,771									2005	
Springs Rd: South of Boundary Rd	3,279	4,146	4,065	-867	-26%	TRUE		SDC	**[S080 SPRINGS] 75!**	2005	Oct-05
Birchs Rd: South of Trents Rd	1,004	2,945	3,133	-1,941	-193%	TRUE		SDC	**[S7A] BIRCHS RD a**	2009	Aug-09
Birchs Rd: South of Trices Rd	653	3,695	3,931	-3,042	-466%	TRUE		SDC	**[S7B] BIRCHS RD a**	2009	Aug-09
Birchs Rd: North of Robinsons Rd	173	2,967	2,909	-2,794	-1616%	TRUE		SDC	**[S087 BIRCHS] 508!**	2005	
Birchs Rd: South of Tancreds Rd	355	2,967	2,909	-2,612	-736%	TRUE		SDC	**[S087 BIRCHS] 508!**	2005	Oct-05
Birchs Rd: South of Boundary Rd	3,692										
CSM2: Between Halswell Jn Rd & Shands I/C	-										
CSM2: Between Shands I/C & Main South Rd	-										
Selwyn Rd: Between Robinsons Rd & Shands Rd	1,152			-3,772							
Selwyn Rd: Between Weedons Rd & Waterholes Rd	309	4,081	4,341	-3,772	-1221%	TRUE			**[S77E] SELWYN RD**	2009	
Weedons Ross Rd: West of Jones Rd	801										
Weedons Ross Rd: Between Maddisons Rd & Newtons Rd	508	974	955	-467	-92%	TRUE		SDC	[S037] Weedons Ros	2005	Apr-05
Weedons Rd: East of Main South Rd	611										
Marshs Rd: West of Shands Rd	1,073	1,286	1,368	-214	-20%	FALSE	1,368	SDC	[S59A] Marshs - 150ı	2009	May-09
Marshs Rd: West of Springs Rd	1,629										
Marshs Rd: East of Springs Rd	2,060										
Levi Rd: South of Weedons Rd	448										
Curraghs Rd: West of Jones Rd	912										
Hamptons Rd: West of Shands Rd	732										
Dawsons Rd: West of Jones Rd	520										
Dawsons Rd: Between West Coast Rd & Ivey Rd	128	302	315	-175	-137%	TRUE		CCC	Dawsons Sth of SH7.	2008	May-08
Waterholes Rd: East of Main South Rd	1,329	926	907	404	30%	TRUE		SDC	[S061 WATERHOLE	2005	Apr-05
Kirk Rd: West of Jones Rd	7,203										
Kirk Rd: West of Main South Rd	5,140	5,853	5,853	-713	-14%	FALSE		CCC	Kirk Nth of Rail Cros	2006	Mar-06
Kirk Rd: Between Bailey St & Maddisons Rd	2,132	2,704	2,704	-572	-27%	TRUE		CCC	Kirk Nth of Bailey	2006	May-06
Trents Rd: East of Main South Rd	786	873	891	-87	-11%	FALSE		SDC	[S081 TRENTS] !00n	2007	Apr-07
Blakes Rd: West of Springs Rd	395	1,291	1,266	-897	-227%	TRUE		SDC	[S099 BLAKES] 487r	2005	Nov-05
Blakes Rd: East of Shands Rd	395	1,419	1,510	-1,025	-260%	TRUE		SDC	[S8] BLAKES RD at	2009	Aug-09
Ellesmere Rd: Between Tosswill Rd & Trices Rd	36	1,240	1,265	-1,204	-3333%	TRUE		SDC	[A07_003 ELLESMEI	2007	May-07
Ellesmere Rd: South of Robinsons Rd	2,017	2,630	2,684	-613	-30%	TRUE		SDC	[S137 ELLESMERE]	2007	Mar-07

Technical Report No 2

Christchurch Southern Motorway Stage 2 and Main South Road Four Laning

Assessment of Traffic and Transportation Effects

Appendix D: Road and Intersection Level of Service Standards

1. Level of Service Criteria

For road sections, the calculation of the level of service is dependent on the type of road being assessed, with different criteria applied to multi-lane motorways and expressways, rural highways and urban roads. The level of service criteria for these different road types are shown in:

- Table 1-1 for multi-lane motorways (such as CSM1 and CSM2);
- Table 1-2 for multi-lane expressways (such as Main South Road after four-laning);
- Table 1-3 for rural highways (such as Main South Road before four-laning); and
- Table 1-4 for urban roads.

All of these criteria are based on the Highway Capacity Manual 2000 (HCM), published by the Transportation Research Board of the National Academies.

Level of service is a measure describing the operational conditions within a traffic stream, based on service measures such as speed, freedom to maneuver, traffic interruptions, and comfort and convenience. Six LoS are defined, using the letters from A to F, with LoS A representing the best operating conditions and LoS F the worst.

Table 1-1: Level of Service for Multi-Lane Motorways (Exhibit 13-6 HCM)

	Number of Lanes	FFS (km/hr)	Service Volumes (veh/hr) for LoS				
			A	B	C	D	E
Urban	2	98	1230	1940	2820	3680	4110
	3	101	1900	2980	4340	5570	6200
	4	103	2590	4070	5920	7500	8310
	5	106	3320	5210	7550	9450	10,450
Rural	2	120	1440	2260	3150	3770	4120
	3	120	2160	3400	4720	5660	6180
	4	120	2880	4530	6300	7540	8240
	5	120	3600	5660	7870	9430	10,300

Notes:

Assumptions: Urban: 110 km/hr base free-flow speed, 3.6 m wide lanes, 1.8 m wide shoulders, level terrain, 5 percent heavy vehicles, no driver population adjustment, 0.92 PHF, 0.63 interchanges per kilometre.
Rural: 120 km/hr base free-flow speed, 3.6 m wide lanes, 1.8 m wide shoulders, level terrain, 5 percent heavy vehicles, no driver population adjustment, 0.88 PHF, 0.31 interchanges per kilometre.

Table 1-2: Level of Service for Multi-Lane Expressways (Exhibit 12-5 HCM)

FFS (km/hr)	Number of Lanes	Terrain	Service Volumes (veh/hr)				
			A	B	C	D	E
100	2	Level	1200	1880	2700	3450	4060
		Rolling	1140	1800	2570	3290	3870
		Mountainous	1040	1640	2350	3010	3540
	3	Level	1800	2830	4050	5180	6100
		Rolling	1710	2700	3860	4940	5810
		Mountainous	1570	2470	3530	4520	5320
80	2	Level	960	1510	2190	2920	3520
		Rolling	910	1440	2090	2790	3360
		Mountainous	830	1310	1910	2550	3070
	3	Level	1440	2260	3290	4390	5290
		Rolling	1370	2160	3140	4180	5040
		Mountainous	1250	1970	2870	3830	4610

Notes:

Assumptions: highway with 100 km/hr FFS has 5 access points/ km; highway with 80 km/hr FFS has 15 access points/ km; lane width = 3.6 m; shoulder width > 1.8 m; divided highway; PHF = 0.88; 5 percent trucks; and regular commuters.

Table 1-3: Level of Service for Rural Highways (Exhibit 12-15 HCM)

FFS (km/hr)	Terrain	Service Volumes (veh/h)				
		A	B	C	D	E
100	Level	260	490	900	1570	2680
90	Level	N/A	490	900	1570	2680
80	Level	N/A	N/A	490	1420	2680
70	Level	N/A	N/A	N/A	490	2680

Notes:

Assumptions: 60/40 directional split; 20, 40, and 60 percent no-passing zones for level, rolling, and mountainous terrain respectively; 14 percent trucks; and 4 percent RVs.
N/A = not achievable for the given condition
Source: Hardwood et al. (7).

Table 1-4: Level of Service for Urban Roads

Level of Service	Degree of Saturation (VCR)	Description
A	VCR ≤ 25%	Below capacity – free flow conditions
B	25% < VCR ≤ 40%	Below capacity – very minor delays
C	40% < VCR ≤ 60%	Below capacity – stable conditions but some delays
D	60% < VCR ≤ 80%	Approaching capacity – high-density but stable flow, road user's speed and freedom to manoeuvre is becoming restricted
E	80% < VCR ≤ 100%	At or near capacity – low (though relatively uniform) speeds and the ability to manoeuvre being severely restricted
F	100% < VCR	Above capacity – total breakdown in traffic flow, with queues forming upstream from such locations and travel on the link being typically "stop and go"

The level of service criteria for intersections are also based on the HCM. For signalised intersections and roundabouts, LoS is based on the average delay per vehicle on all approaches, whilst the LoS for priority controlled intersections is based on the average delay per vehicle for the most congested arm into the intersection.

Table 1-5 shows the range of control delay times for vehicles for each LoS band. The delay times also account for any geometric delay associated with vehicle movements. This geometric delay is the additional time taken for vehicles to slow down, safely negotiate the intersection and then speed up again to the speed limit.

The LoS results included in this report have been calculated from the worst VCR in either direction and all three modelled time periods (AM peak, average inter-peak and PM peak hours). It also applies only to the link, so does not cover the impact of any increase or decrease in traffic on intersections at either end of the link (this applies more to urban links, rather than motorway or highway type links).

Table 1-5: Level of Service at Intersections (HCM Delay Method)

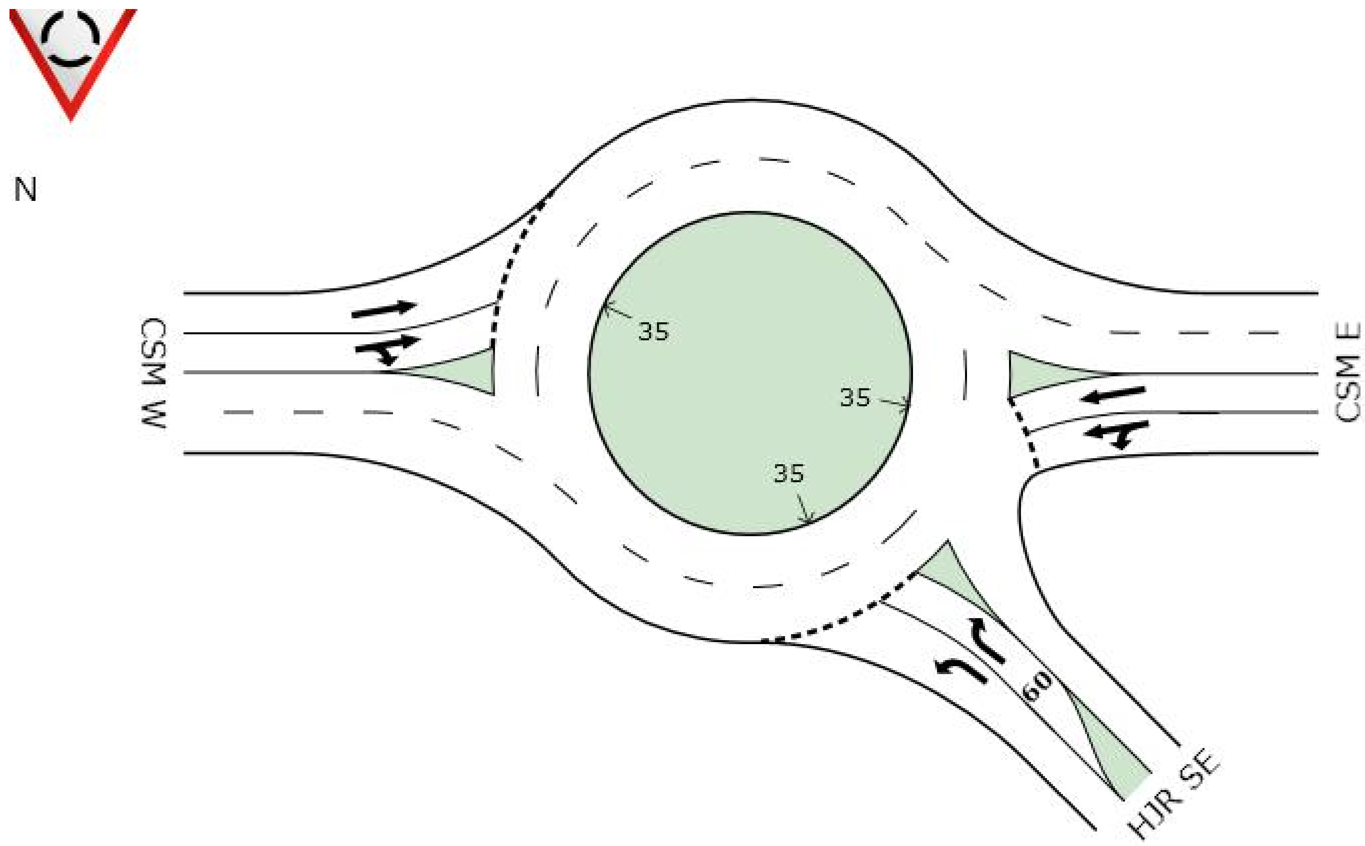
Level of Service	Control Delay per Vehicle in Seconds (d)		
	Signals	Roundabouts	Stop & Giveway
A	$d \leq 10$	$d \leq 10$	$d \leq 10$
B	$10 < d \leq 20$	$10 < d \leq 20$	$10 < d \leq 15$
C	$20 < d \leq 35$	$20 < d \leq 35$	$15 < d \leq 25$
D	$35 < d \leq 55$	$35 < d \leq 55$	$25 < d \leq 35$
E	$55 < d \leq 80$	$55 < d \leq 80$	$35 < d \leq 50$
F	$80 < d$	$80 < d$	$50 < d$

Technical Report No 2

Christchurch Southern Motorway Stage 2 and Main South Road Four Laning

Assessment of Traffic and Transportation Effects

Appendix E: Intersection Performance Modelling Outputs



N
CSM W
CSM E
35
35
35
60
HJR SE

MOVEMENT SUMMARY

Site: CSM1 CSM/HJR 2016 AM

CSM1 - CSM/HJR
2016 AM - EPA Vols - Baseline Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: HJR SE											
21	L	378	4.8	0.390	4.8	LOS A	2.5	18.4	0.70	0.58	43.2
23	R	54	5.6	0.085	13.3	LOS B	0.4	3.0	0.63	0.86	39.1
Approach		432	4.9	0.390	5.9	LOS B	2.5	18.4	0.69	0.61	42.5
East: CSM E											
4	L	49	2.0	0.441	4.6	LOS A	3.5	25.6	0.33	0.51	44.5
5	T	1210	5.5	0.443	2.4	LOS A	3.5	25.6	0.34	0.28	45.5
Approach		1259	5.4	0.443	2.5	LOS A	3.5	25.6	0.34	0.29	45.4
West: CSM W											
11	T	1930	3.9	0.662	2.2	LOS A	8.1	59.3	0.33	0.25	44.1
12	R	121	9.9	0.661	8.1	LOS A	8.1	59.3	0.35	0.74	40.7
Approach		2051	4.3	0.662	2.6	LOS A	8.1	59.3	0.33	0.28	43.9
All Vehicles		3742	4.7	0.662	2.9	LOS A	8.1	59.3	0.37	0.32	44.3

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

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SIDRA INTERSECTION 5.0.2.1437
Project: \\beca.net\projects\339\3390691\TTR\FinalScheme_1203\SIDRA_Baseline\Baseline_1_CSM&HJR_EPAVols.sip
8000924, BECA INFRASTRUCTURE LIMITED, FLOATING

MOVEMENT SUMMARY

CSM1 - CSM/HJR
2016 IP - EPA Vols - Baseline Network
Roundabout

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: HJR SE											
21	L	212	5.2	0.199	3.6	LOS A	1.1	8.1	0.57	0.41	44.0
23	R	47	4.3	0.069	12.6	LOS B	0.3	2.4	0.57	0.80	39.5
Approach		259	5.0	0.199	5.2	LOS B	1.1	8.1	0.57	0.48	43.0
East: CSM E											
4	L	38	5.3	0.342	5.0	LOS A	2.3	17.3	0.39	0.54	44.2
5	T	837	7.3	0.341	2.9	LOS A	2.3	17.3	0.40	0.32	45.1
Approach		875	7.2	0.341	2.9	LOS A	2.3	17.3	0.40	0.33	45.0
West: CSM W											
11	T	1034	5.5	0.408	2.1	LOS A	3.4	24.8	0.20	0.23	45.2
12	R	227	4.8	0.408	7.8	LOS A	3.3	24.3	0.21	0.71	40.5
Approach		1261	5.4	0.408	3.1	LOS A	3.4	24.8	0.20	0.31	44.2
All Vehicles		2395	6.0	0.408	3.3	LOS A	3.4	24.8	0.31	0.34	44.4

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: CSM1 CSM/HJR 2016 PM

CSM1 - CSM/HJR
2016 PM - EPA Vols - Baseline Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: HJR SE											
21	L	217	4.1	0.432	9.9	LOS A	3.6	25.8	0.95	1.02	40.4
23	R	80	2.5	0.220	17.1	LOS B	1.4	10.2	0.88	0.96	36.7
Approach		297	3.7	0.432	11.8	LOS B	3.6	25.8	0.93	1.00	39.3
East: CSM E											
4	L	52	3.8	0.813	6.1	LOS A	12.6	91.0	0.71	0.63	43.2
5	T	2177	3.4	0.812	4.3	LOS A	13.0	93.7	0.74	0.52	42.9
Approach		2229	3.4	0.812	4.3	LOS A	13.0	93.7	0.74	0.52	42.9
West: CSM W											
11	T	1935	3.9	0.706	2.4	LOS A	9.9	71.3	0.46	0.28	42.9
12	R	185	3.8	0.706	8.3	LOS A	9.7	70.4	0.48	0.70	40.5
Approach		2120	3.9	0.706	3.0	LOS A	9.9	71.3	0.46	0.32	42.7
All Vehicles		4646	3.6	0.812	4.2	LOS A	13.0	93.7	0.63	0.46	42.5

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: CSM1 CSM/HJR 2026 AM

CSM1 - CSM/HJR
2026 AM - EPA Vols - Baseline Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: HJR SE											
21	L	703	3.0	0.810	11.1	LOS B	9.5	68.5	0.91	1.20	39.5
23	R	150	2.0	0.254	14.0	LOS B	1.4	9.9	0.72	0.90	38.6
Approach		853	2.8	0.810	11.6	LOS B	9.5	68.5	0.88	1.14	39.3
East: CSM E											
4	L	73	2.7	0.537	4.7	LOS A	5.3	38.6	0.44	0.50	44.1
5	T	1414	5.2	0.535	2.6	LOS A	5.3	38.6	0.45	0.30	44.7
Approach		1487	5.1	0.535	2.7	LOS A	5.3	38.6	0.45	0.31	44.7
West: CSM W											
11	T	2189	3.6	0.830	3.6	LOS A	14.1	102.0	0.76	0.42	40.6
12	R	137	8.8	0.830	9.9	LOS A	14.1	102.0	0.79	0.72	40.4
Approach		2326	3.9	0.830	3.9	LOS A	14.1	102.0	0.76	0.44	40.6
All Vehicles		4666	4.1	0.830	5.0	LOS A	14.1	102.0	0.68	0.53	41.7

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

Processed: Thursday, 3 May 2012 5:04:54 p.m.
SIDRA INTERSECTION 5.0.2.1437
Project: \\beca.net\projects\339\3390691\TTR\FinalScheme_1203\SIDRA_Baseline\Baseline_1_CSM&HJR_EPAVols.sip
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SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: CSM1 CSM/HJR 2026 IP

CSM1 - CSM/HJR
2026 IP - EPA Vols - Baseline Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: HJR SE											
21	L	383	3.1	0.388	4.1	LOS A	2.6	18.5	0.69	0.49	43.2
23	R	64	3.1	0.101	12.8	LOS B	0.5	3.7	0.62	0.85	39.3
Approach		447	3.1	0.388	5.4	LOS B	2.6	18.5	0.68	0.54	42.6
East: CSM E											
4	L	58	3.4	0.439	5.9	LOS A	3.4	25.1	0.57	0.62	43.6
5	T	935	7.2	0.438	3.8	LOS A	3.4	25.1	0.57	0.44	43.9
Approach		993	6.9	0.438	4.0	LOS A	3.4	25.1	0.57	0.45	43.9
West: CSM W											
11	T	1133	4.6	0.501	2.2	LOS A	4.7	34.3	0.27	0.24	44.5
12	R	393	3.3	0.501	7.9	LOS A	4.6	33.6	0.28	0.65	40.2
Approach		1526	4.3	0.501	3.6	LOS A	4.7	34.3	0.27	0.35	43.2
All Vehicles		2966	5.0	0.501	4.0	LOS A	4.7	34.3	0.43	0.41	43.4

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: CSM1 CSM/HJR 2026 PM

CSM1 - CSM/HJR
2026 PM - EPA Vols - Baseline Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: HJR SE											
21	L	223	4.0	0.578	15.8	LOS B	5.2	37.6	1.00	1.10	36.3
23	R	113	1.8	0.433	23.3	LOS C	3.0	21.5	0.93	1.03	33.5
Approach		336	3.3	0.578	18.3	LOS C	5.2	37.6	0.98	1.08	35.2
East: CSM E											
4	L	121	1.7	1.061	76.5	LOS E	83.8	602.3	1.00	2.96	17.9
5	T	2365	3.3	1.065	75.6	LOS E	83.8	602.3	1.00	2.93	17.8
Approach		2486	3.2	1.066	75.7	LOS E	83.8	602.3	1.00	2.94	17.8
West: CSM W											
11	T	2115	4.1	0.851	3.1	LOS A	17.1	123.6	0.76	0.37	40.4
12	R	352	2.6	0.850	9.0	LOS A	15.9	115.1	0.81	0.62	39.7
Approach		2467	3.9	0.851	4.0	LOS A	17.1	123.6	0.77	0.41	40.3
All Vehicles		5289	3.5	1.066	38.6	LOS D	83.8	602.3	0.89	1.64	24.0

Level of Service (Aver. Int. Delay): LOS D. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS E. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: CSM1 CSM/HJR 2041 AM

CSM1 - CSM/HJR
2041 AM - EPA Vols - Baseline Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: HJR SE											
21	L	718	2.8	0.988	42.0	LOS D	25.4	181.9	1.00	2.20	24.9
23	R	257	1.2	0.501	17.2	LOS B	3.5	24.7	0.84	1.02	36.7
Approach		975	2.4	0.987	35.4	LOS D	25.4	181.9	0.96	1.89	27.4
East: CSM E											
4	L	80	2.5	0.650	4.9	LOS A	7.9	57.4	0.54	0.50	43.7
5	T	1724	4.6	0.651	2.8	LOS A	7.9	57.4	0.56	0.32	44.0
Approach		1804	4.5	0.651	2.9	LOS A	7.9	57.4	0.56	0.33	44.0
West: CSM W											
11	T	2257	4.0	0.950	13.2	LOS B	30.6	221.4	1.00	1.07	35.0
12	R	139	9.4	0.952	20.6	LOS C	29.8	217.0	1.00	1.13	32.7
Approach		2396	4.3	0.950	13.6	LOS C	30.6	221.4	1.00	1.07	34.8
All Vehicles		5175	4.0	0.987	14.0	LOS B	30.6	221.4	0.84	0.97	35.6

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: CSM1 CSM/HJR 2041 IP

CSM1 - CSM/HJR
2041 IP - EPA Vols - Baseline Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: HJR SE											
21	L	595	2.4	0.681	6.8	LOS A	6.5	46.6	0.87	0.90	42.2
23	R	63	3.2	0.111	13.1	LOS B	0.6	4.3	0.68	0.88	39.1
Approach		658	2.4	0.680	7.4	LOS B	6.5	46.6	0.85	0.90	41.8
East: CSM E											
4	L	61	3.3	0.560	7.7	LOS A	5.6	41.3	0.73	0.82	43.1
5	T	1080	6.9	0.559	5.9	LOS A	5.6	41.3	0.73	0.72	42.9
Approach		1141	6.7	0.559	6.0	LOS A	5.6	41.3	0.73	0.73	42.9
West: CSM W											
11	T	1234	4.2	0.578	2.2	LOS A	6.2	45.0	0.30	0.25	44.2
12	R	536	2.2	0.578	8.0	LOS A	6.1	44.0	0.32	0.62	39.9
Approach		1770	3.6	0.578	3.9	LOS A	6.2	45.0	0.31	0.36	42.7
All Vehicles		3569	4.4	0.680	5.2	LOS A	6.5	46.6	0.54	0.58	42.6

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: CSM1 CSM/HJR 2041 PM

CSM1 - CSM/HJR
2041 PM - EPA Vols - Baseline Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: HJR SE											
21	L	272	3.3	0.554	10.6	LOS B	4.7	34.1	0.97	1.05	39.9
23	R	128	1.6	0.378	18.3	LOS B	2.5	18.0	0.89	0.99	36.0
Approach		400	2.8	0.554	13.1	LOS B	4.7	34.1	0.94	1.03	38.4
East: CSM E											
4	L	189	1.1	1.286	268.8	LOS F	214.9	1547.2	1.00	7.31	6.7
5	T	2378	3.7	1.285	267.4	LOS F	214.9	1547.2	1.00	7.05	6.8
Approach		2567	3.5	1.285	267.5	LOS F	214.9	1547.2	1.00	7.07	6.8
West: CSM W											
11	T	2191	4.5	0.936	4.7	LOS A	26.7	192.4	1.00	0.54	38.7
12	R	487	2.3	0.935	11.7	LOS B	26.7	192.4	1.00	0.66	38.7
Approach		2678	4.1	0.936	6.0	LOS B	26.7	192.4	1.00	0.56	38.7
All Vehicles		5645	3.7	1.285	125.4	LOS F	214.9	1547.2	1.00	3.55	11.3

Level of Service (Aver. Int. Delay): LOS F. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

Processed: Thursday, 3 May 2012 5:04:55 p.m.
SIDRA INTERSECTION 5.0.2.1437

Project: \\beca.net\projects\339\3390691\TTR\FinalScheme_1203\SIDRA_Baseline\Baseline_1_CSM&HJR_EPAVols.sip
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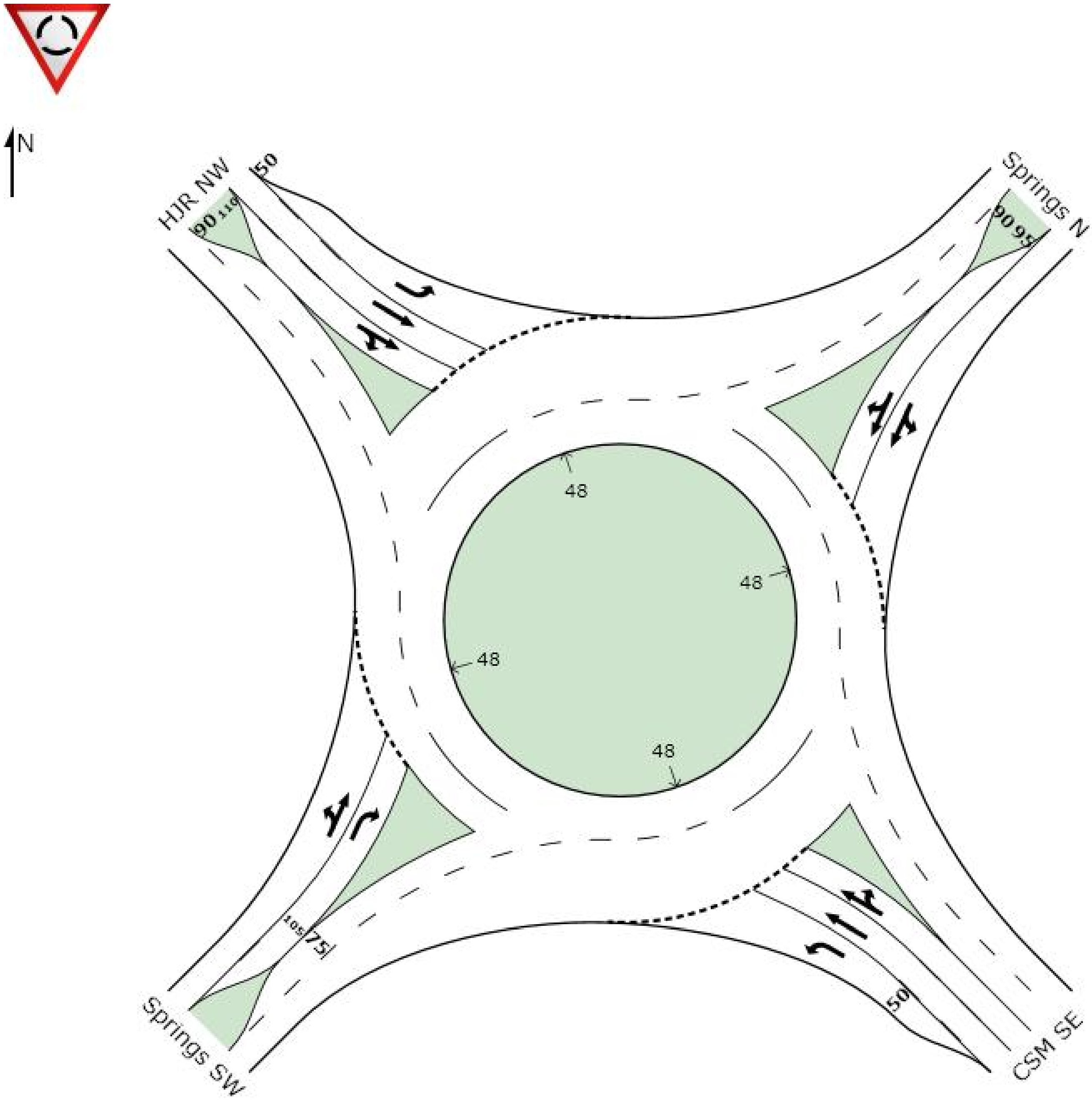

N
HJR NW
50
90
110
Springs N
90
95
48
48
48
48
105
75
Springs SW
50
CSM SE

MOVEMENT SUMMARY

Site: CSM1 HJR/CSM/Springs - 2016 AM BL - FP

CSM1 - Springs/HJR/CSM
2016 AM - EPA Vols - Baseline Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: CSM SE											
21	L	362	6.1	0.308	3.9	LOS A	2.2	16.1	0.57	0.42	41.7
22	T	854	6.2	0.447	1.8	LOS A	3.8	28.2	0.60	0.23	42.5
23	R	373	2.9	0.447	9.8	LOS A	3.5	25.2	0.63	0.79	39.1
Approach		1589	5.4	0.447	4.1	LOS A	3.8	28.2	0.60	0.41	41.4
North East: Springs N											
24	L	225	5.3	0.889	66.1	LOS E	17.3	127.4	1.00	1.79	19.4
25	T	238	7.1	0.888	67.5	LOS E	17.3	127.4	1.00	1.71	18.8
26	R	125	12.0	0.887	79.2	LOS E	12.3	93.3	1.00	1.61	19.0
Approach		588	7.5	0.889	69.4	LOS E	17.3	127.4	1.00	1.72	19.1
North West: HJR NW											
27	L	141	15.6	0.159	6.1	LOS A	1.3	10.7	0.83	0.66	42.0
28	T	1253	3.7	0.776	13.3	LOS B	13.6	98.4	1.00	1.29	37.8
29	R	83	9.6	0.776	22.4	LOS C	10.5	76.4	1.00	1.29	35.6
Approach		1477	5.1	0.776	13.1	LOS C	13.6	98.4	0.98	1.23	38.0
South West: Springs SW											
30	L	65	13.8	0.596	10.7	LOS B	4.9	36.8	0.87	1.02	40.8
31	T	280	6.8	0.596	9.0	LOS A	4.9	36.8	0.87	1.00	40.9
32	R	573	5.1	0.670	15.4	LOS B	7.1	52.0	0.91	1.12	37.8
Approach		918	6.2	0.670	13.1	LOS B	7.1	52.0	0.90	1.08	38.8
All Vehicles		4572	5.8	0.889	17.2	LOS B	17.3	127.4	0.84	0.98	34.2

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS E. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

Processed: Thursday, 3 May 2012 5:14:10 p.m.
SIDRA INTERSECTION 5.0.2.1437

Project: P:\339\3390691\TTR\FinalScheme_1203\SIDRA_Baseline\Baseline_2_HJR&Springs_EPAVols.sip
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SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: CSM1 HJR/CSM/Springs - 2016 IP BL - FP

CSM1 - Springs/HJR/CSM
2016 IP - EPA Vols - Baseline Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: CSM SE											
21	L	234	7.3	0.194	3.7	LOS A	1.2	9.1	0.49	0.40	42.3
22	T	602	7.3	0.289	1.6	LOS A	2.1	15.7	0.50	0.21	43.5
23	R	212	5.2	0.289	9.6	LOS A	1.9	14.3	0.52	0.78	39.8
Approach		1048	6.9	0.289	3.7	LOS A	2.1	15.7	0.50	0.37	42.3
North East: Springs N											
24	L	195	5.6	0.342	5.9	LOS A	2.6	19.1	0.79	0.64	42.8
25	T	186	7.5	0.341	4.8	LOS A	2.6	19.1	0.79	0.62	42.1
26	R	143	8.4	0.341	13.3	LOS B	2.3	17.2	0.78	0.95	39.7
Approach		524	7.1	0.341	7.5	LOS B	2.6	19.1	0.79	0.72	41.6
North West: HJR NW											
27	L	221	9.0	0.217	4.7	LOS A	1.4	10.7	0.63	0.51	43.2
28	T	724	5.1	0.328	2.5	LOS A	2.6	18.9	0.66	0.32	43.9
29	R	86	9.3	0.328	10.7	LOS B	2.3	16.6	0.67	0.95	42.1
Approach		1031	6.3	0.328	3.7	LOS B	2.6	18.9	0.65	0.41	43.6
South West: Springs SW											
30	L	83	9.6	0.376	6.0	LOS A	2.4	18.2	0.71	0.68	43.6
31	T	209	6.7	0.376	4.3	LOS A	2.4	18.2	0.71	0.56	43.4
32	R	343	6.1	0.327	10.7	LOS B	2.2	16.3	0.69	0.77	39.9
Approach		635	6.8	0.376	8.0	LOS B	2.4	18.2	0.70	0.69	41.4
All Vehicles		3238	6.7	0.376	5.1	LOS A	2.6	19.1	0.63	0.50	42.4

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: CSM1 HJR/CSM/Springs - 2016 PM BL - FP

CSM1 - Springs/HJR/CSM
2016 PM - EPA Vols - Baseline Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: CSM SE											
21	L	559	4.1	0.482	4.3	LOS A	4.0	28.9	0.67	0.48	41.0
22	T	1203	3.9	0.677	3.0	LOS A	8.0	58.1	0.74	0.42	41.3
23	R	632	1.9	0.677	11.6	LOS B	7.7	55.1	0.79	0.91	38.2
Approach		2394	3.4	0.677	5.6	LOS B	8.0	58.1	0.74	0.57	40.3
North East: Springs N											
24	L	294	2.7	0.997	99.6	LOS F	28.5	205.0	1.00	2.33	14.8
25	T	278	4.7	0.996	101.1	LOS F	28.5	205.0	1.00	2.17	14.4
26	R	122	7.4	1.000[3]	111.3	LOS F	20.2	148.5	1.00	2.04	15.2
Approach		694	4.3	0.998	102.2	LOS F	28.5	205.0	1.00	2.21	14.7
North West: HJR NW											
27	L	134	7.5	0.153	7.7	LOS A	1.5	11.5	0.94	0.79	41.5
28	T	1361	3.9	0.967	54.5	LOS D	39.0	282.2	1.00	2.35	21.6
29	R	98	7.1	0.970	63.2	LOS E	27.3	198.5	1.00	2.18	22.1
Approach		1593	4.4	0.967	51.1	LOS E	39.0	282.2	0.99	2.21	22.5
South West: Springs SW											
30	L	19	10.5	0.731	25.0	LOS C	7.2	53.0	0.97	1.23	32.0
31	T	250	6.4	0.744	23.3	LOS C	7.2	53.0	0.97	1.23	32.0
32	R	465	4.7	0.849	36.6	LOS D	12.9	94.0	1.00	1.50	28.3
Approach		734	5.4	0.848	31.8	LOS D	12.9	94.0	0.99	1.40	29.4
All Vehicles		5415	4.1	0.998	34.9	LOS C	39.0	282.2	0.88	1.37	25.8

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

MOVEMENT SUMMARY

Site: CSM1 HJR/CSM/Springs - 2026 AM BL - FP

CSM1 - Springs/HJR/CSM
2026 AM - EPA Vols - Baseline Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: CSM SE											
21	L	448	5.4	0.371	3.8	LOS A	2.8	20.2	0.58	0.42	41.6
22	T	1090	5.4	0.596	2.1	LOS A	6.0	43.9	0.66	0.28	42.1
23	R	580	2.1	0.596	10.4	LOS B	5.9	41.9	0.70	0.82	38.5
Approach		2118	4.5	0.596	4.7	LOS B	6.0	43.9	0.65	0.46	40.8
North East: Springs N											
24	L	216	5.6	1.029	155.2	LOS F	33.5	246.2	1.00	2.59	10.6
25	T	254	6.7	1.028	156.4	LOS F	33.5	246.2	1.00	2.41	10.4
26	R	106	8.5	1.029	167.1	LOS F	23.3	173.5	1.00	2.21	11.2
Approach		576	6.6	1.030	157.9	LOS F	33.5	246.2	1.00	2.44	10.6
North West: HJR NW											
27	L	81	13.6	0.117	9.6	LOS A	1.2	9.5	1.00	0.82	40.7
28	T	1439	3.7	1.312	246.4	LOS F	170.7	1232.9	1.00	5.56	7.2
29	R	76	10.5	1.027	108.4	LOS F	39.2	285.7	1.00	2.76	15.6
Approach		1596	4.5	1.311	227.8	LOS F	170.7	1232.9	1.00	5.19	7.8
South West: Springs SW											
30	L	27	22.2	0.551	13.3	LOS B	4.4	33.7	0.91	1.05	39.1
31	T	223	8.5	0.552	11.5	LOS B	4.4	33.7	0.91	1.03	39.1
32	R	673	4.2	1.001	66.2	LOS E	31.2	225.9	1.00	2.46	20.9
Approach		923	5.7	1.002	51.4	LOS E	31.2	225.9	0.98	2.08	23.6
All Vehicles		5213	4.9	1.311	98.2	LOS F	170.7	1232.9	0.85	2.41	14.1

Level of Service (Aver. Int. Delay): LOS F. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

Processed: Thursday, 3 May 2012 5:14:11 p.m.
SIDRA INTERSECTION 5.0.2.1437

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8000924, BECA INFRASTRUCTURE LIMITED, FLOATING

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: CSM1 HJR/CSM/Springs - 2026 IP BL - FP

CSM1 - Springs/HJR/CSM
2026 IP - EPA Vols - Baseline Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: CSM SE											
21	L	307	5.9	0.266	3.9	LOS A	1.8	13.2	0.56	0.43	41.7
22	T	741	6.9	0.376	1.8	LOS A	3.0	22.2	0.59	0.24	42.6
23	R	270	3.7	0.376	9.8	LOS A	2.7	19.8	0.61	0.81	39.5
Approach		1318	6.0	0.376	4.0	LOS A	3.0	22.2	0.59	0.40	41.7
North East: Springs N											
24	L	203	5.4	0.498	9.4	LOS A	4.8	35.4	0.93	1.04	41.3
25	T	229	6.6	0.498	8.6	LOS A	4.8	35.4	0.92	1.01	40.4
26	R	176	8.0	0.499	17.9	LOS B	4.1	30.4	0.89	1.06	36.9
Approach		608	6.6	0.498	11.6	LOS B	4.8	35.4	0.92	1.03	39.5
North West: HJR NW											
27	L	251	8.4	0.269	5.2	LOS A	1.9	14.4	0.72	0.57	42.7
28	T	918	3.6	0.461	3.5	LOS A	4.3	30.9	0.79	0.46	43.0
29	R	100	8.0	0.461	12.1	LOS B	3.8	27.6	0.79	1.04	41.4
Approach		1269	4.9	0.461	4.5	LOS B	4.3	30.9	0.78	0.53	42.8
South West: Springs SW											
30	L	66	12.1	0.528	8.7	LOS A	4.1	30.7	0.82	0.96	42.4
31	T	280	5.4	0.526	7.0	LOS A	4.1	30.7	0.82	0.92	42.6
32	R	406	5.4	0.439	12.1	LOS B	3.5	26.0	0.80	0.91	39.5
Approach		752	6.0	0.526	9.9	LOS B	4.1	30.7	0.81	0.92	40.7
All Vehicles		3947	5.7	0.526	6.4	LOS A	4.8	35.4	0.74	0.64	41.4

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: CSM1 HJR/CSM/Springs - 2026 PM BL - FP

CSM1 - Springs/HJR/CSM
2026 PM - EPA Vols - Baseline Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: CSM SE											
21	L	749	3.2	0.590	4.0	LOS A	5.8	41.8	0.65	0.45	41.0
22	T	1276	4.1	0.625	1.8	LOS A	6.6	47.6	0.64	0.24	42.2
23	R	564	1.8	0.625	10.0	LOS B	6.6	47.1	0.68	0.78	39.0
Approach		2589	3.3	0.625	4.2	LOS B	6.6	47.6	0.65	0.42	41.0
North East: Springs N											
24	L	262	3.1	1.083	187.9	LOS F	39.9	287.5	1.00	2.82	9.1
25	T	250	4.8	1.087	188.7	LOS F	39.9	287.5	1.00	2.54	9.0
26	R	65	9.2	1.083	197.7	LOS F	27.6	203.2	1.00	2.37	9.8
Approach		577	4.5	1.085	189.4	LOS F	39.9	287.5	1.00	2.65	9.1
North West: HJR NW											
27	L	58	10.3	0.070	7.5	LOS A	0.7	5.2	0.92	0.74	41.5
28	T	1652	3.7	1.214	172.4	LOS F	142.7	1030.6	1.00	5.00	9.7
29	R	28	21.4	1.037	91.3	LOS F	39.4	286.4	1.00	2.67	17.6
Approach		1738	4.2	1.214	165.6	LOS F	142.7	1030.6	1.00	4.82	10.1
South West: Springs SW											
30	L	25	8.0	0.625	15.8	LOS B	5.3	39.0	0.93	1.11	37.2
31	T	246	6.1	0.623	14.2	LOS B	5.3	39.0	0.93	1.09	37.2
32	R	554	5.1	0.871	33.7	LOS C	14.0	102.2	1.00	1.55	29.3
Approach		825	5.5	0.871	27.4	LOS C	14.0	102.2	0.98	1.40	31.3
All Vehicles		5729	4.0	1.214	75.2	LOS E	142.7	1030.6	0.84	2.12	16.6

Level of Service (Aver. Int. Delay): LOS E. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: CSM1 HJR/CSM/Springs - 2041 AM BL - FP

CSM1 - Springs/HJR/CSM
2041 AM - EPA Vols - Baseline Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: CSM SE											
21	L	549	4.6	0.443	3.8	LOS A	3.6	26.2	0.59	0.42	41.5
22	T	1150	5.4	0.660	2.2	LOS A	7.5	54.8	0.68	0.29	42.0
23	R	741	1.6	0.660	10.6	LOS B	7.4	52.9	0.73	0.81	37.9
Approach		2440	4.1	0.660	5.1	LOS B	7.5	54.8	0.68	0.48	40.4
North East: Springs N											
24	L	276	4.3	0.704	24.9	LOS C	9.3	67.8	1.00	1.31	31.5
25	T	254	7.9	0.704	26.6	LOS C	9.3	67.8	0.99	1.28	30.0
26	R	67	9.0	0.705	36.0	LOS D	7.2	53.6	0.99	1.27	29.3
Approach		597	6.4	0.704	26.9	LOS D	9.3	67.8	1.00	1.29	30.5
North West: HJR NW											
27	L	92	13.0	0.147	12.0	LOS B	1.6	12.5	1.00	0.84	38.9
28	T	1479	4.3	1.517	381.1	LOS F	243.3	1766.4	1.00	6.62	4.9
29	R	40	20.0	1.026	120.1	LOS F	39.1	286.8	1.00	2.73	14.5
Approach		1611	5.2	1.517	353.5	LOS F	243.3	1766.4	1.00	6.19	5.3
South West: Springs SW											
30	L	33	9.1	0.702	20.3	LOS C	6.3	47.3	0.95	1.18	34.2
31	T	241	8.7	0.695	18.6	LOS B	6.3	47.3	0.95	1.17	34.2
32	R	605	4.1	1.037	94.3	LOS F	37.8	273.9	1.00	2.84	16.8
Approach		879	5.3	1.037	70.8	LOS F	37.8	273.9	0.99	2.32	19.6
All Vehicles		5527	4.8	1.517	119.5	LOS F	243.3	1766.4	0.85	2.52	12.1

Level of Service (Aver. Int. Delay): LOS F. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: CSM1 HJR/CSM/Springs - 2041 IP BL - FP

CSM1 - Springs/HJR/CSM
2041 IP - EPA Vols - Baseline Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: CSM SE											
21	L	380	5.0	0.337	4.1	LOS A	2.4	17.6	0.62	0.45	41.3
22	T	914	6.6	0.496	2.1	LOS A	4.3	32.1	0.67	0.27	41.9
23	R	381	2.6	0.496	10.4	LOS B	4.1	29.8	0.69	0.86	39.1
Approach		1675	5.3	0.496	4.4	LOS B	4.3	32.1	0.66	0.45	41.0
North East: Springs N											
24	L	211	4.7	0.706	20.4	LOS C	9.1	66.4	1.00	1.27	34.0
25	T	254	6.3	0.706	19.8	LOS B	9.1	66.4	1.00	1.26	33.1
26	R	199	5.0	0.706	30.3	LOS C	7.3	53.2	0.99	1.24	30.9
Approach		664	5.4	0.706	23.1	LOS C	9.1	66.4	1.00	1.26	32.6
North West: HJR NW											
27	L	267	8.6	0.324	6.2	LOS A	2.6	19.6	0.83	0.68	42.0
28	T	1081	2.9	0.637	7.4	LOS A	8.4	60.5	0.96	1.01	41.6
29	R	99	10.1	0.639	16.3	LOS B	6.8	49.5	0.93	1.14	38.9
Approach		1447	4.4	0.637	7.8	LOS B	8.4	60.5	0.93	0.96	41.5
South West: Springs SW											
30	L	66	12.1	0.695	15.0	LOS B	6.5	48.1	0.92	1.13	37.7
31	T	286	6.3	0.692	13.3	LOS B	6.5	48.1	0.92	1.12	37.7
32	R	477	4.8	0.624	16.2	LOS B	6.5	47.3	0.94	1.12	37.3
Approach		829	5.9	0.692	15.1	LOS B	6.5	48.1	0.93	1.12	37.4
All Vehicles		4615	5.2	0.706	10.1	LOS B	9.1	66.4	0.84	0.84	38.8

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

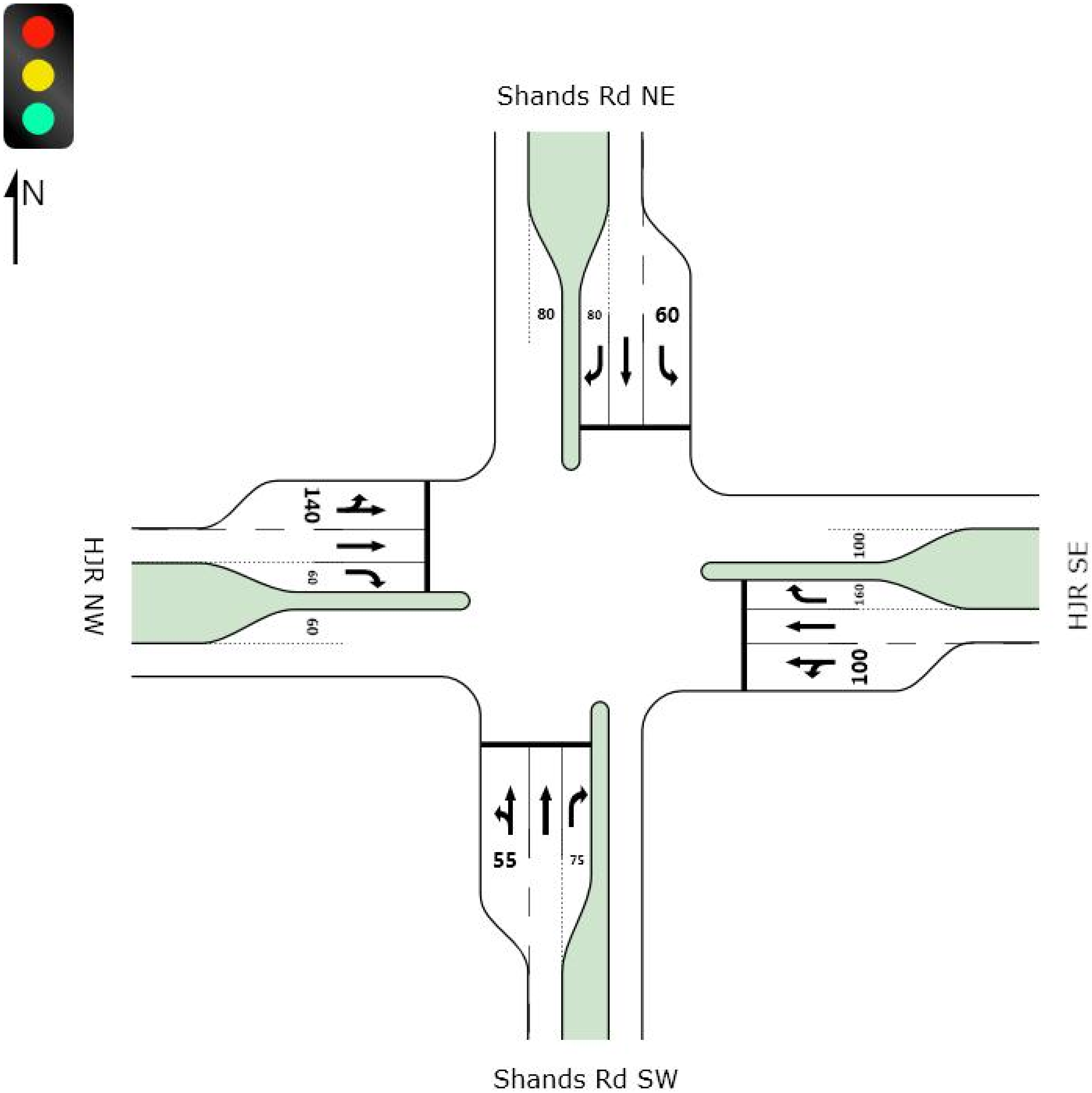
Site: CSM1 HJR/CSM/Springs - 2041 PM BL - FP

CSM1 - Springs/HJR/CSM
2041 PM - EPA Vols - Baseline Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: CSM SE											
21	L	855	3.0	0.668	3.8	LOS A	6.8	49.2	0.62	0.43	41.3
22	T	1278	4.8	0.580	1.5	LOS A	6.0	44.0	0.54	0.20	43.0
23	R	516	1.7	0.580	9.4	LOS A	5.7	41.0	0.58	0.72	39.5
Approach		2649	3.6	0.668	3.8	LOS A	6.8	49.2	0.58	0.38	41.6
North East: Springs N											
24	L	251	2.4	1.101	202.5	LOS F	33.4	239.2	1.00	2.71	8.5
25	T	204	4.9	1.103	207.9	LOS F	33.4	239.2	1.00	2.35	8.3
26	R	7	0.0	1.167	216.6	LOS F	23.2	169.0	1.00	2.28	9.1
Approach		462	3.5	1.103	205.1	LOS F	33.4	239.2	1.00	2.55	8.4
North West: HJR NW											
27	L	23	17.4	0.031	7.9	LOS A	0.3	2.4	0.92	0.69	41.6
28	T	1778	4.3	1.476	334.3	LOS F	267.8	1944.3	1.00	7.29	5.5
29	R	47	10.6	1.022	92.3	LOS F	39.1	285.2	1.00	2.71	17.4
Approach		1848	4.7	1.475	324.1	LOS F	267.8	1944.3	1.00	7.09	5.7
South West: Springs SW											
30	L	16	6.3	0.516	11.0	LOS B	3.9	28.9	0.88	1.01	40.7
31	T	252	5.2	0.513	9.4	LOS A	3.9	28.9	0.88	0.99	40.7
32	R	648	3.9	0.877	28.8	LOS C	14.1	102.2	1.00	1.54	31.2
Approach		916	4.3	0.877	23.2	LOS C	14.1	102.2	0.97	1.38	33.2
All Vehicles		5875	4.0	1.475	123.4	LOS F	267.8	1944.3	0.80	2.82	11.7

Level of Service (Aver. Int. Delay): LOS F. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.



N
Shands Rd NE
80
80
60
140
60
60
HJR NW
100
160
100
HJR SE
55
75
Shands Rd SW

MOVEMENT SUMMARY

Site: CSM1 HJR/Shands - 2016 AM

CSM1 - HJR/Shands
2016 AM - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 85 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shands Rd SW											
1	L	15	0.0	0.503	38.1	LOS D	7.2	53.5	0.89	0.81	28.8
2	T	355	7.1	0.504	31.3	LOS C	9.6	71.2	0.91	0.74	27.4
3	R	85	27.2	0.453	34.2	LOS C	3.9	33.5	0.97	0.76	29.8
Approach		455	10.6	0.504	32.1	LOS C	9.6	71.2	0.92	0.75	27.9
East: HJR SE											
4	L	140	11.3	0.697	38.2	LOS D	15.3	114.1	0.93	0.88	32.1
5	T	623	5.9	0.697	29.4	LOS C	16.0	118.0	0.94	0.82	34.6
6	R	248	1.3	0.896	59.8	LOS E	14.0	98.8	1.00	1.05	23.1
Approach		1012	5.5	0.896	38.1	LOS D	16.0	118.0	0.95	0.89	30.8
North: Shands Rd NE											
7	L	378	0.8	0.818	32.8	LOS C	14.5	101.9	0.81	0.90	30.0
8	T	362	5.8	0.854	42.3	LOS D	17.9	131.7	1.00	1.05	23.8
9	R	23	9.1	0.079	30.2	LOS C	1.1	8.1	0.84	0.70	31.3
Approach		763	3.4	0.853	37.3	LOS D	17.9	131.7	0.90	0.97	26.9
West: HJR NW											
10	L	7	28.6	0.895	52.8	LOS D	27.1	195.6	1.00	1.07	27.3
11	T	1043	3.2	0.893	43.5	LOS D	27.1	195.6	1.00	1.08	28.8
12	R	15	0.0	0.053	42.1	LOS D	0.8	5.8	0.88	0.69	28.7
Approach		1065	3.4	0.893	43.5	LOS D	27.1	195.6	1.00	1.07	28.7
All Vehicles		3295	5.0	0.896	38.8	LOS D	27.1	195.6	0.95	0.95	28.8

Level of Service (Aver. Int. Delay): LOS D. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS E. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

MOVEMENT SUMMARY

CSM1 - HJR/Shands
2016 IP - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 60 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shands Rd SW											
1	L	16	0.0	0.447	35.1	LOS D	4.7	34.5	0.96	0.78	29.9
2	T	214	7.4	0.448	27.5	LOS C	4.7	34.5	0.96	0.75	28.7
3	R	87	18.1	0.314	27.2	LOS C	3.0	24.6	0.93	0.76	32.7
Approach		317	10.0	0.448	27.8	LOS C	4.7	34.5	0.96	0.76	29.9
East: HJR SE											
4	L	88	13.1	0.649	32.0	LOS C	10.6	78.9	0.95	0.87	36.0
5	T	542	5.8	0.649	22.9	LOS C	10.6	78.9	0.95	0.82	38.3
6	R	198	0.5	0.724	38.0	LOS D	7.8	55.0	1.00	0.89	30.4
Approach		828	5.3	0.724	27.5	LOS C	10.6	78.9	0.96	0.84	36.0
North: Shands Rd NE											
7	L	295	0.4	0.475	22.9	LOS C	8.1	57.0	0.87	0.80	34.4
8	T	186	7.9	0.746	30.8	LOS C	7.6	56.5	1.00	0.92	27.5
9	R	15	14.3	0.047	25.4	LOS C	0.5	4.0	0.85	0.68	33.5
Approach		496	3.6	0.746	26.0	LOS C	8.1	57.0	0.92	0.84	31.6
West: HJR NW											
10	L	9	22.2	0.689	33.0	LOS C	11.6	84.6	0.96	0.90	36.6
11	T	675	4.2	0.689	23.6	LOS C	11.6	84.6	0.96	0.85	38.2
12	R	19	0.0	0.069	32.9	LOS C	0.8	5.4	0.89	0.70	32.9
Approach		703	4.3	0.689	24.0	LOS C	11.6	84.6	0.96	0.84	38.0
All Vehicles		2344	5.3	0.746	26.2	LOS C	11.6	84.6	0.95	0.83	34.6

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

MOVEMENT SUMMARY

Site: CSM1 HJR/Shands - 2016 PM

CSM1 - HJR/Shands
2016 PM - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 99 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shands Rd SW											
1	L	15	0.0	0.621	37.2	LOS D	9.0	64.6	0.83	0.83	29.1
2	T	528	3.4	0.621	31.7	LOS C	16.1	115.8	0.89	0.75	27.3
3	R	124	11.0	0.644	52.9	LOS D	7.7	59.0	0.99	0.85	23.9
Approach		667	4.7	0.644	35.8	LOS D	16.1	115.8	0.91	0.77	26.5
East: HJR SE											
4	L	80	18.4	0.894	46.1	LOS D	22.9	168.7	0.89	1.02	29.2
5	T	1023	3.7	0.896	42.0	LOS D	35.2	254.6	0.96	1.00	29.2
6	R	328	1.3	0.665	43.4	LOS D	15.6	110.6	0.95	0.84	28.2
Approach		1432	4.0	0.896	42.6	LOS D	35.2	254.6	0.95	0.96	29.0
North: Shands Rd NE											
7	L	463	0.7	0.910	24.8	LOS C	15.3	107.6	0.66	0.83	33.5
8	T	307	6.2	0.554	32.1	LOS C	14.1	104.0	0.90	0.77	27.2
9	R	31	6.9	0.190	50.0	LOS D	2.1	15.3	0.92	0.74	24.6
Approach		801	3.0	0.910	28.6	LOS C	15.3	107.6	0.76	0.80	30.5
West: HJR NW											
10	L	19	11.1	0.816	51.6	LOS D	21.8	160.5	1.00	0.95	27.5
11	T	797	5.5	0.820	42.8	LOS D	21.8	160.5	1.00	0.95	29.0
12	R	21	0.0	0.071	46.8	LOS D	1.3	9.4	0.88	0.71	27.0
Approach		837	5.5	0.820	43.1	LOS D	21.8	160.5	1.00	0.95	28.9
All Vehicles		3737	4.3	0.910	38.5	LOS D	35.2	254.6	0.91	0.89	28.8

Level of Service (Aver. Int. Delay): LOS D. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: CSM1 HJR/Shands - 2026 AM

CSM1 - HJR/Shands
2026 AM - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 95 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shands Rd SW											
1	L	25	0.0	0.840	49.8	LOS D	13.2	96.8	0.90	1.03	25.1
2	T	624	6.4	0.838	42.7	LOS D	20.8	153.3	0.97	0.99	23.7
3	R	256	7.4	0.968	67.7	LOS E	15.1	112.4	1.00	1.26	20.7
Approach		905	6.5	0.968	50.0	LOS D	20.8	153.3	0.97	1.07	22.8
East: HJR SE											
4	L	243	6.9	0.965	48.1	LOS D	22.9	168.7	1.00	0.90	27.5
5	T	734	5.2	0.965	63.4	LOS E	35.3	258.0	1.00	1.18	22.9
6	R	232	1.4	0.934	73.5	LOS E	15.3	108.1	1.00	1.11	20.1
Approach		1208	4.8	0.965	62.3	LOS E	35.3	258.0	1.00	1.11	23.0
North: Shands Rd NE											
7	L	353	0.9	0.817	34.6	LOS C	14.5	102.5	0.78	0.89	29.3
8	T	447	5.6	0.932	59.8	LOS E	27.7	203.1	1.00	1.27	19.8
9	R	23	9.1	0.084	30.3	LOS C	1.1	8.0	0.88	0.70	31.2
Approach		823	3.7	0.932	48.2	LOS D	27.7	203.1	0.90	1.09	23.5
West: HJR NW											
10	L	6	33.3	0.888	58.0	LOS E	27.8	200.8	1.00	1.06	25.6
11	T	972	3.4	0.894	48.5	LOS D	27.8	200.8	1.00	1.07	27.1
12	R	23	0.0	0.093	47.9	LOS D	1.5	10.3	0.91	0.71	26.6
Approach		1001	3.5	0.894	48.6	LOS D	27.8	200.8	1.00	1.06	27.0
All Vehicles		3938	4.6	0.968	53.0	LOS D	35.3	258.0	0.97	1.08	24.0

Level of Service (Aver. Int. Delay): LOS D. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS E. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

MOVEMENT SUMMARY

Site: CSM1 HJR/Shands - 2026 IP

CSM1 - HJR/Shands
2026 IP - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 65 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shands Rd SW											
1	L	19	0.0	0.465	35.1	LOS D	6.2	45.5	0.95	0.80	29.9
2	T	285	6.6	0.465	27.5	LOS C	6.2	45.5	0.95	0.76	28.8
3	R	183	9.8	0.668	29.8	LOS C	6.6	49.8	1.00	0.84	31.4
Approach		487	7.6	0.668	28.6	LOS C	6.6	49.8	0.97	0.79	29.8
East: HJR SE											
4	L	139	10.6	0.784	36.9	LOS D	14.8	110.2	0.99	0.95	33.0
5	T	656	6.1	0.784	27.9	LOS C	14.8	110.2	0.99	0.93	35.2
6	R	202	0.5	0.801	43.2	LOS D	8.8	62.2	1.00	0.94	28.3
Approach		997	5.6	0.801	32.3	LOS C	14.8	110.2	0.99	0.94	33.4
North: Shands Rd NE											
7	L	362	0.3	0.544	23.7	LOS C	10.3	72.0	0.87	0.81	34.0
8	T	245	6.9	0.768	31.9	LOS C	10.0	74.3	1.00	0.95	27.1
9	R	15	14.3	0.047	25.7	LOS C	0.5	4.2	0.83	0.68	33.4
Approach		622	3.2	0.768	27.0	LOS C	10.3	74.3	0.92	0.86	31.0
West: HJR NW											
10	L	8	25.0	0.732	35.4	LOS D	13.9	100.0	0.97	0.92	35.2
11	T	760	3.0	0.734	25.9	LOS C	13.9	100.0	0.97	0.88	36.8
12	R	22	0.0	0.087	35.8	LOS D	1.0	6.9	0.90	0.71	31.5
Approach		791	3.2	0.734	26.3	LOS C	13.9	100.0	0.97	0.87	36.6
All Vehicles		2897	4.8	0.801	28.9	LOS C	14.8	110.2	0.97	0.88	33.0

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: CSM1 HJR/Shands - 2026 PM

CSM1 - HJR/Shands
2026 PM - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 150 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shands Rd SW											
1	L	23	0.0	1.000[3]	63.2	LOS E	14.0	100.4	0.99	0.82	21.9
2	T	749	3.2	1.123	247.9	LOS F	101.9	733.4	1.00	1.84	7.1
3	R	114	8.3	0.332	32.7	LOS C	6.2	46.4	0.74	0.76	30.2
Approach		886	3.8	1.123	215.4	LOS F	101.9	733.4	0.96	1.67	8.1
East: HJR SE											
4	L	287	5.1	1.000[3]	62.1	LOS E	23.2	169.1	1.00	0.86	22.8
5	T	889	4.6	1.461	842.4	LOS F	280.3	2039.6	1.00	3.70	2.6
6	R	285	1.5	0.876	84.3	LOS F	23.5	166.9	1.00	0.95	18.2
Approach		1462	4.1	1.460	541.1	LOS F	280.3	2039.6	1.00	2.61	3.9
North: Shands Rd NE											
7	L	301	0.7	1.000[3]	34.4	LOS C	15.3	107.8	0.72	0.79	29.3
8	T	677	4.7	1.369	746.7	LOS F	206.5	1493.5	1.00	3.39	2.6
9	R	37	8.6	0.120	36.3	LOS D	2.1	16.1	0.83	0.72	28.9
Approach		1015	3.1	1.369	509.9	LOS F	206.5	1493.5	0.91	2.52	3.9
West: HJR NW											
10	L	19	11.1	1.001	72.2	LOS E	33.3	243.7	1.00	0.87	21.6
11	T	984	5.2	1.321	400.7	LOS F	156.8	1146.8	1.00	2.09	5.3
12	R	84	0.0	0.432	77.6	LOS E	7.6	53.0	0.98	0.78	19.3
Approach		1087	4.9	1.321	370.0	LOS F	156.8	1146.8	1.00	1.96	5.7
All Vehicles		4451	4.0	1.460	427.3	LOS F	280.3	2039.6	0.97	2.25	4.7

Level of Service (Aver. Int. Delay): LOS F. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

MOVEMENT SUMMARY

Site: CSM1 HJR/Shands - 2041 AM

CSM1 - HJR/Shands
2041 AM - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 95 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shands Rd SW											
1	L	26	4.0	0.656	23.2	LOS C	9.2	67.1	0.61	0.85	35.1
2	T	873	5.1	0.655	17.7	LOS B	22.3	163.2	0.74	0.66	33.6
3	R	268	5.5	1.000[3]	91.5	LOS F	17.8	130.8	1.00	1.39	17.1
Approach		1167	5.1	1.000	34.8	LOS C	22.3	163.2	0.80	0.83	27.1
East: HJR SE											
4	L	209	4.0	0.953	64.1	LOS E	23.5	168.3	1.00	1.05	22.7
5	T	587	1.8	0.953	64.5	LOS E	25.9	183.7	1.00	1.17	22.6
6	R	156	2.0	0.913	69.6	LOS E	10.5	74.7	1.00	1.07	20.9
Approach		953	2.3	0.953	65.2	LOS E	25.9	183.7	1.00	1.13	22.3
North: Shands Rd NE											
7	L	100	1.1	0.208	20.4	LOS C	3.4	23.9	0.60	0.73	35.7
8	T	649	5.5	0.954	64.9	LOS E	43.7	320.2	1.00	1.31	18.9
9	R	27	15.4	0.148	36.6	LOS D	1.5	12.1	0.78	0.73	28.9
Approach		777	5.3	0.954	58.2	LOS E	43.7	320.2	0.94	1.22	20.5
West: HJR NW											
10	L	6	33.3	0.857	56.6	LOS E	20.0	144.1	1.00	1.00	26.0
11	T	716	2.9	0.857	47.1	LOS D	20.0	144.1	1.00	1.00	27.5
12	R	43	2.4	0.254	53.6	LOS D	2.9	20.5	0.96	0.74	24.8
Approach		765	3.2	0.857	47.5	LOS D	20.0	144.1	1.00	0.98	27.4
All Vehicles		3662	4.0	1.000	50.3	LOS D	43.7	320.2	0.92	1.02	24.2

Level of Service (Aver. Int. Delay): LOS D. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

Processed: Thursday, 3 May 2012 5:22:54 p.m.
SIDRA INTERSECTION 5.0.2.1437
Project: P:\339\3390691\TTR\FinalScheme_1203\SIDRA_Baseline\Baseline_3_HJR&Shands_EPAVols.SIP
8000924, BECA INFRASTRUCTURE LIMITED, FLOATING

SIDRA INTERSECTION

MOVEMENT SUMMARY

CSM1 - HJR/Shands
2041 IP - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 70 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shands Rd SW											
1	L	14	0.0	0.496	35.0	LOS C	7.0	52.1	0.92	0.81	30.0
2	T	348	6.9	0.495	27.6	LOS C	7.5	55.9	0.93	0.76	28.8
3	R	202	6.8	0.754	32.1	LOS C	7.7	56.8	1.00	0.89	30.4
Approach		564	6.7	0.754	29.4	LOS C	7.7	56.8	0.95	0.81	29.4
East: HJR SE											
4	L	171	7.4	0.826	42.5	LOS D	15.6	112.8	1.00	0.98	29.9
5	T	579	1.5	0.827	33.6	LOS C	15.6	112.8	1.00	0.98	32.3
6	R	251	1.3	0.807	44.1	LOS D	11.1	78.4	1.00	0.94	28.0
Approach		1000	2.4	0.827	37.8	LOS D	15.6	112.8	1.00	0.97	30.8
North: Shands Rd NE											
7	L	192	0.5	0.249	20.6	LOS C	5.5	38.4	0.73	0.77	35.6
8	T	298	6.4	0.787	33.1	LOS C	12.4	91.7	1.00	0.97	26.7
9	R	11	20.0	0.036	26.3	LOS C	0.4	3.3	0.83	0.67	33.2
Approach		500	4.4	0.787	28.2	LOS C	12.4	91.7	0.89	0.89	29.9
West: HJR NW											
10	L	9	22.2	0.754	39.2	LOS D	13.6	98.5	0.99	0.91	33.1
11	T	674	3.1	0.747	29.9	LOS C	13.6	98.5	0.99	0.90	34.6
12	R	20	0.0	0.064	35.2	LOS D	0.9	6.4	0.87	0.70	31.7
Approach		703	3.3	0.747	30.2	LOS C	13.6	98.5	0.98	0.89	34.5
All Vehicles		2767	3.9	0.827	32.4	LOS C	15.6	112.8	0.97	0.90	31.2

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

MOVEMENT SUMMARY

Site: CSM1 HJR/Shands - 2041 PM

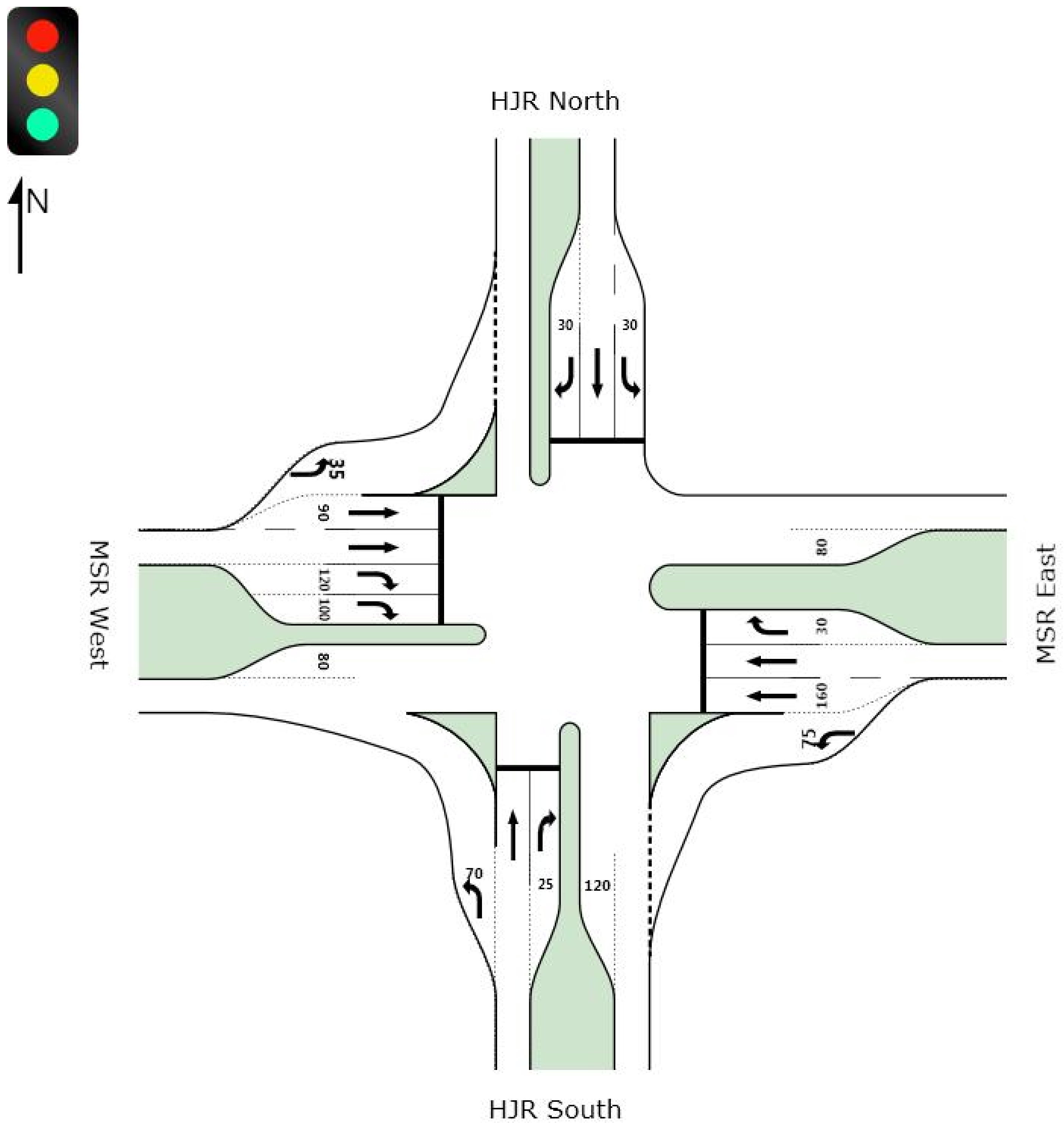
CSM1 - HJR/Shands
2041 PM - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 150 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shands Rd SW											
1	L	23	0.0	1.000[3]	60.7	LOS E	14.0	100.4	1.00	0.82	22.5
2	T	822	3.2	1.106	227.7	LOS F	107.9	776.1	1.00	1.77	7.6
3	R	116	9.1	0.399	36.9	LOS D	6.0	44.9	0.88	0.77	28.7
Approach		961	3.8	1.106	200.7	LOS F	107.9	776.1	0.98	1.62	8.6
East: HJR SE											
4	L	184	5.1	1.000[3]	64.6	LOS E	23.1	169.0	1.00	0.85	22.5
5	T	820	4.9	1.330	555.8	LOS F	190.1	1386.1	1.00	2.76	3.9
6	R	192	2.7	1.002	145.6	LOS F	21.7	155.1	1.00	1.19	11.9
Approach		1196	4.6	1.330	414.4	LOS F	190.1	1386.1	1.00	2.22	5.0
North: Shands Rd NE											
7	L	165	2.5	0.569	35.1	LOS D	9.0	64.2	0.69	0.76	29.1
8	T	753	4.9	1.344	700.3	LOS F	221.8	1618.0	1.00	3.47	2.8
9	R	35	6.1	0.111	35.0	LOS D	1.9	14.0	0.83	0.71	29.3
Approach		953	4.5	1.344	560.6	LOS F	221.8	1618.0	0.94	2.90	3.5
West: HJR NW											
10	L	7	14.3	1.012	65.7	LOS E	31.5	231.3	1.00	0.87	23.2
11	T	1053	5.4	1.231	314.0	LOS F	146.7	1074.1	1.00	1.94	6.6
12	R	121	0.9	0.625	79.6	LOS E	10.4	73.6	1.00	0.80	19.0
Approach		1181	5.0	1.231	288.4	LOS F	146.7	1074.1	1.00	1.82	7.1
All Vehicles		4291	4.5	1.344	364.3	LOS F	221.8	1618.0	0.98	2.13	5.4

Level of Service (Aver. Int. Delay): LOS F. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.


N
HJR North
30
30
35
90
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MSR West
80
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160
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MSR East
70
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120
HJR South

MOVEMENT SUMMARY

Site: CSM1 MSR/HJR - 2016 AM

CSM1 - MSR/HJR
2016 AM - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 50 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: HJR South											
1	L	498	6.6	0.278	9.7	NA[9]	NA[9]	NA[9]	0.00	0.65	54.6
2	T	103	1.0	0.439	23.8	LOS C	3.6	25.6	0.97	0.75	38.1
3	R	2	0.0	0.011	32.3	LOS C	0.1	0.5	0.92	0.61	35.5
Approach		603	5.6	0.439	12.2	LOS B	3.6	25.6	0.17	0.67	50.7
East: MSR East											
4	L	3	0.0	0.004	14.6	LOS B	0.1	0.4	0.55	0.65	48.5
5	T	280	24.4	0.421	19.9	LOS B	4.5	38.3	0.92	0.73	40.8
6	R	1	0.0	0.003	22.0	LOS C	0.0	0.2	0.69	0.62	42.0
Approach		284	24.1	0.421	19.9	LOS B	4.5	38.3	0.91	0.73	40.9
North: HJR North											
7	L	5	0.0	0.019	31.4	LOS C	0.2	1.3	0.90	0.65	35.7
8	T	161	3.3	0.696	25.9	LOS C	5.7	41.2	1.00	0.86	36.8
9	R	16	6.7	0.093	34.5	LOS C	0.6	4.5	0.95	0.68	34.5
Approach		182	3.5	0.696	26.8	LOS C	5.7	41.2	0.99	0.84	36.5
West: MSR West											
10	L	9	0.0	0.010	10.5	LOS B	0.1	0.4	0.29	0.66	52.8
11	T	591	10.0	0.798	25.3	LOS C	9.7	74.1	1.00	0.96	37.1
12	R	888	2.7	0.774	29.9	LOS C	12.8	92.0	0.96	0.93	36.8
Approach		1488	5.6	0.798	27.9	LOS C	12.8	92.0	0.97	0.94	37.0
All Vehicles		2558	7.5	0.798	23.2	LOS C	12.8	92.0	0.78	0.85	40.0

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

9 Continuous movement

MOVEMENT SUMMARY

Site: CSM1 MSR/HJR - 2016 IP

CSM1 - MSR/HJR
2026 IP - EPA Vols - Baseline Network
Signals - Fixed Time Cycle Time = 40 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: HJR South											
1	L	472	6.0	0.262	9.6	NA[9]	NA[9]	NA[9]	0.00	0.65	54.6
2	T	75	1.4	0.255	17.4	LOS B	2.1	14.8	0.92	0.70	42.7
3	R	2	0.0	0.009	26.7	LOS C	0.1	0.4	0.89	0.62	38.7
Approach		548	5.4	0.262	10.8	LOS B	2.1	14.8	0.13	0.66	52.5
East: MSR East											
4	L	1	0.0	0.001	11.8	LOS B	0.0	0.1	0.46	0.63	51.4
5	T	300	20.4	0.587	19.0	LOS B	4.4	35.9	0.97	0.80	41.3
6	R	1	0.0	0.003	21.8	LOS C	0.0	0.2	0.76	0.61	42.1
Approach		302	20.2	0.587	19.0	LOS B	4.4	35.9	0.97	0.80	41.4
North: HJR North											
7	L	1	0.0	0.003	25.6	LOS C	0.0	0.2	0.87	0.60	39.3
8	T	100	2.1	0.343	17.8	LOS B	2.8	19.9	0.94	0.72	42.4
9	R	17	0.0	0.067	27.2	LOS C	0.5	3.4	0.91	0.69	38.4
Approach		118	1.8	0.343	19.2	LOS B	2.8	19.9	0.93	0.72	41.8
West: MSR West											
10	L	6	0.0	0.006	10.6	LOS B	0.0	0.2	0.33	0.66	52.6
11	T	326	24.2	0.639	19.6	LOS B	4.7	39.8	0.99	0.84	40.8
12	R	578	4.0	0.650	25.9	LOS C	7.2	52.1	0.95	0.86	39.4
Approach		911	11.2	0.650	23.5	LOS C	7.2	52.1	0.96	0.85	40.0
All Vehicles		1879	10.4	0.650	18.8	LOS B	7.2	52.1	0.72	0.78	43.4

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

9 Continuous movement

MOVEMENT SUMMARY

Site: CSM1 MSR/HJR - 2016 PM

CSM1 - MSR/HJR
2016 PM - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 45 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: HJR South											
1	L	865	3.5	0.473	9.6	NA[9]	NA[9]	NA[9]	0.00	0.65	54.5
2	T	146	2.9	0.567	21.6	LOS C	4.6	33.1	0.98	0.79	39.5
3	R	44	0.0	0.206	30.7	LOS C	1.5	10.3	0.94	0.73	36.3
Approach		1056	3.3	0.567	12.1	LOS B	4.6	33.1	0.18	0.67	50.8
East: MSR East											
4	L	1	0.0	0.001	13.3	LOS B	0.0	0.1	0.52	0.62	49.8
5	T	676	5.5	0.743	19.4	LOS B	9.7	70.7	0.97	0.89	41.0
6	R	3	0.0	0.010	24.5	LOS C	0.1	0.6	0.80	0.64	40.1
Approach		680	5.4	0.743	19.5	LOS B	9.7	70.7	0.97	0.89	41.0
North: HJR North											
7	L	14	15.4	0.055	29.9	LOS C	0.4	3.5	0.90	0.69	37.0
8	T	196	2.7	0.758	24.1	LOS C	6.4	45.5	1.00	0.91	37.9
9	R	23	0.0	0.132	32.6	LOS C	0.8	5.7	0.97	0.69	35.3
Approach		233	3.2	0.758	25.3	LOS C	6.4	45.5	0.99	0.87	37.5
West: MSR West											
10	L	7	0.0	0.008	10.8	LOS B	0.1	0.4	0.34	0.66	52.5
11	T	483	15.0	0.551	16.9	LOS B	6.5	51.1	0.92	0.76	43.1
12	R	597	6.2	0.767	31.3	LOS C	8.9	65.3	0.99	0.94	36.1
Approach		1087	10.1	0.767	24.8	LOS C	8.9	65.3	0.96	0.86	39.0
All Vehicles		3056	6.2	0.767	19.3	LOS B	9.7	70.7	0.69	0.80	42.8

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

9 Continuous movement

SIDRA INTERSECTION

MOVEMENT SUMMARY

CSM1 - MSR/HJR
2026 AM - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 60 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: HJR South											
1	L	602	5.6	0.334	9.6	NA[9]	NA[9]	NA[9]	0.00	0.65	54.6
2	T	114	0.9	0.581	30.3	LOS C	4.8	33.9	1.00	0.80	34.4
3	R	7	0.0	0.046	38.4	LOS D	0.3	2.3	0.94	0.66	32.5
Approach		723	4.8	0.581	13.2	LOS B	4.8	33.9	0.17	0.67	49.6
East: MSR East											
4	L	14	0.0	0.015	14.2	LOS B	0.2	1.7	0.49	0.68	48.9
5	T	481	21.7	0.502	20.0	LOS B	7.9	65.6	0.88	0.73	40.9
6	R	4	0.0	0.014	24.6	LOS C	0.1	0.9	0.70	0.66	40.1
Approach		499	20.9	0.502	19.8	LOS B	7.9	65.6	0.87	0.73	41.1
North: HJR North											
7	L	13	8.3	0.058	37.7	LOS D	0.6	4.1	0.93	0.68	32.7
8	T	133	4.0	0.690	31.6	LOS C	5.7	41.0	1.00	0.85	33.7
9	R	13	8.3	0.099	41.4	LOS D	0.6	4.5	0.98	0.66	31.3
Approach		158	4.7	0.691	32.9	LOS C	5.7	41.0	0.99	0.82	33.4
West: MSR West											
10	L	3	0.0	0.004	10.4	LOS B	0.0	0.2	0.26	0.65	53.0
11	T	766	11.7	0.739	23.6	LOS C	12.7	98.0	0.96	0.89	38.2
12	R	845	2.9	0.745	32.1	LOS C	13.7	98.1	0.95	0.90	35.6
Approach		1615	7.0	0.745	28.0	LOS C	13.7	98.1	0.96	0.89	36.8
All Vehicles		2995	8.7	0.745	23.3	LOS C	13.7	98.1	0.75	0.81	39.8

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

9 Continuous movement

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: CSM1 MSR/HJR - 2026 IP

CSM1 - MSR/HJR
2026 IP - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 50 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: HJR South											
1	L	582	6.3	0.324	9.7	NA[9]	NA[9]	NA[9]	0.00	0.65	54.6
2	T	81	1.3	0.346	23.5	LOS C	2.9	20.4	0.96	0.73	38.4
3	R	1	0.0	0.005	32.0	LOS C	0.0	0.3	0.92	0.59	35.6
Approach		664	5.7	0.346	11.4	LOS B	2.9	20.4	0.12	0.66	51.9
East: MSR East											
4	L	1	0.0	0.001	12.5	LOS B	0.0	0.1	0.45	0.63	50.7
5	T	446	19.3	0.592	20.0	LOS C	6.9	56.7	0.94	0.78	40.7
6	R	1	0.0	0.003	22.7	LOS C	0.0	0.2	0.71	0.62	41.5
Approach		448	19.2	0.592	20.0	LOS B	6.9	56.7	0.94	0.78	40.7
North: HJR North											
7	L	1	0.0	0.004	31.0	LOS C	0.0	0.3	0.90	0.60	36.0
8	T	85	1.2	0.364	23.5	LOS C	3.0	21.4	0.96	0.73	38.3
9	R	8	12.5	0.049	33.4	LOS C	0.3	2.4	0.93	0.67	35.1
Approach		95	2.2	0.364	24.5	LOS C	3.0	21.4	0.96	0.72	38.0
West: MSR West											
10	L	7	0.0	0.007	10.3	LOS B	0.0	0.3	0.27	0.66	53.0
11	T	451	25.2	0.605	20.4	LOS C	6.9	59.0	0.95	0.80	40.4
12	R	680	2.8	0.632	27.0	LOS C	9.3	66.6	0.92	0.85	38.6
Approach		1138	11.7	0.632	24.2	LOS C	9.3	66.6	0.93	0.83	39.4
All Vehicles		2345	11.0	0.632	19.8	LOS B	9.3	66.6	0.70	0.77	42.5

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

9 Continuous movement

MOVEMENT SUMMARY

Site: CSM1 MSR/HJR - 2026 PM

CSM1 - MSR/HJR
2026 PM - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 65 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: HJR South											
1	L	702	4.9	0.387	9.6	NA [9]	NA [9]	NA [9]	0.00	0.65	54.5
2	T	143	3.7	0.345	24.1	LOS C	5.4	39.1	0.89	0.71	38.1
3	R	92	0.0	0.525	39.4	LOS D	4.1	28.5	0.96	0.78	32.0
Approach		937	4.3	0.525	14.7	LOS B	5.4	39.1	0.23	0.67	48.1
East: MSR East											
4	L	2	0.0	0.003	16.3	LOS B	0.0	0.3	0.54	0.64	46.8
5	T	919	4.0	0.883	33.0	LOS C	19.0	137.7	1.00	1.04	33.1
6	R	8	0.0	0.034	30.6	LOS C	0.3	2.3	0.80	0.67	36.3
Approach		929	4.0	0.883	32.9	LOS C	19.0	137.7	1.00	1.03	33.1
North: HJR North											
7	L	35	6.1	0.155	33.5	LOS C	1.4	10.4	0.85	0.73	34.7
8	T	371	1.7	0.883	36.9	LOS D	15.5	110.3	1.00	1.05	31.3
9	R	35	9.1	0.173	36.8	LOS D	1.5	11.6	0.90	0.73	33.4
Approach		440	2.6	0.883	36.6	LOS D	15.5	110.3	0.98	1.00	31.7
West: MSR West											
10	L	12	0.0	0.014	10.5	LOS B	0.1	0.6	0.26	0.66	53.0
11	T	753	12.7	0.747	25.9	LOS C	13.4	104.3	0.97	0.89	36.8
12	R	672	6.6	0.833	42.4	LOS D	13.5	100.0	1.00	0.97	30.8
Approach		1436	9.8	0.833	33.5	LOS C	13.5	104.3	0.98	0.93	33.8
All Vehicles		3742	6.1	0.883	29.0	LOS C	19.0	137.7	0.80	0.90	36.0

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

9 Continuous movement

MOVEMENT SUMMARY

Site: CSM1 MSR/HJR - 2041 AM

CSM1 - MSR/HJR
2041 AM - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 60 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: HJR South											
1	L	432	2.0	0.233	9.5	NA [9]	NA [9]	NA [9]	0.00	0.65	54.6
2	T	123	0.9	0.629	30.8	LOS C	5.2	36.8	1.00	0.82	34.1
3	R	29	0.0	0.182	39.2	LOS D	1.3	9.3	0.96	0.71	32.1
Approach		584	1.6	0.629	15.5	LOS B	5.2	36.8	0.26	0.69	47.0
East: MSR East											
4	L	17	0.0	0.017	12.7	LOS B	0.2	1.7	0.42	0.68	50.4
5	T	785	16.1	0.614	17.0	LOS B	11.5	91.6	0.87	0.75	43.2
6	R	22	9.5	0.091	29.7	LOS C	0.8	6.1	0.80	0.71	37.1
Approach		824	15.6	0.614	17.3	LOS B	11.5	91.6	0.85	0.74	43.1
North: HJR North											
7	L	51	14.6	0.266	39.3	LOS D	2.2	17.4	0.96	0.74	32.1
8	T	115	1.8	0.589	30.4	LOS C	4.9	34.6	1.00	0.80	34.3
9	R	14	7.7	0.107	41.4	LOS D	0.6	4.8	0.98	0.67	31.3
Approach		179	5.9	0.589	33.8	LOS C	4.9	34.6	0.99	0.77	33.4
West: MSR West											
10	L	5	0.0	0.006	10.4	LOS B	0.0	0.3	0.26	0.66	53.0
11	T	994	14.8	0.754	20.6	LOS C	15.4	121.3	0.94	0.88	40.3
12	R	632	2.8	0.755	36.2	LOS D	11.3	80.9	0.99	0.91	33.5
Approach		1631	10.1	0.755	26.6	LOS C	15.4	121.3	0.95	0.89	37.4
All Vehicles		3218	9.7	0.755	22.6	LOS C	15.4	121.3	0.80	0.81	40.0

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

9 Continuous movement

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: CSM1 MSR/HJR - 2041 IP

CSM1 - MSR/HJR
2041 IP - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 55 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: HJR South											
1	L	487	1.3	0.262	9.5	NA[9]	NA[9]	NA[9]	0.00	0.65	54.6
2	T	91	1.2	0.424	26.6	LOS C	3.5	25.0	0.97	0.75	36.4
3	R	1	0.0	0.006	34.8	LOS C	0.0	0.3	0.93	0.59	34.2
Approach		579	1.3	0.424	12.2	LOS B	3.5	25.0	0.15	0.67	50.6
East: MSR East											
4	L	1	0.0	0.001	12.2	LOS B	0.0	0.1	0.41	0.63	51.0
5	T	680	22.9	0.656	18.7	LOS B	10.3	86.0	0.92	0.79	41.8
6	R	3	0.0	0.011	26.1	LOS C	0.1	0.7	0.76	0.64	39.1
Approach		684	22.8	0.656	18.7	LOS B	10.3	86.0	0.91	0.79	41.8
North: HJR North											
7	L	1	0.0	0.004	33.7	LOS C	0.0	0.3	0.91	0.59	34.5
8	T	89	1.2	0.420	26.6	LOS C	3.5	24.7	0.97	0.75	36.4
9	R	9	11.1	0.064	37.4	LOS D	0.4	3.1	0.96	0.66	33.1
Approach		100	2.1	0.419	27.7	LOS C	3.5	24.7	0.97	0.74	36.1
West: MSR West											
10	L	9	0.0	0.010	10.4	LOS B	0.1	0.4	0.26	0.66	53.0
11	T	645	25.4	0.617	18.3	LOS B	9.4	80.4	0.91	0.78	42.1
12	R	591	3.0	0.648	30.8	LOS C	9.3	66.5	0.95	0.85	36.3
Approach		1245	14.6	0.648	24.2	LOS C	9.4	80.4	0.92	0.81	39.2
All Vehicles		2608	13.3	0.656	20.2	LOS C	10.3	86.0	0.75	0.77	41.8

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

9 Continuous movement

Processed: Sunday, 22 April 2012 5:47:55 p.m.
SIDRA INTERSECTION 5.0.2.1437

Project: P:\339\3390691\TTR\FinalScheme_1203\SIDRA_Baseline\Baseline_4_MSR&HJR_EPAVols.SIP
8000924, BECA INFRASTRUCTURE LIMITED, FLOATING

MOVEMENT SUMMARY

CSM1 - MSR/HJR
2041 PM - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 70 seconds

Movement Performance - Vehicles

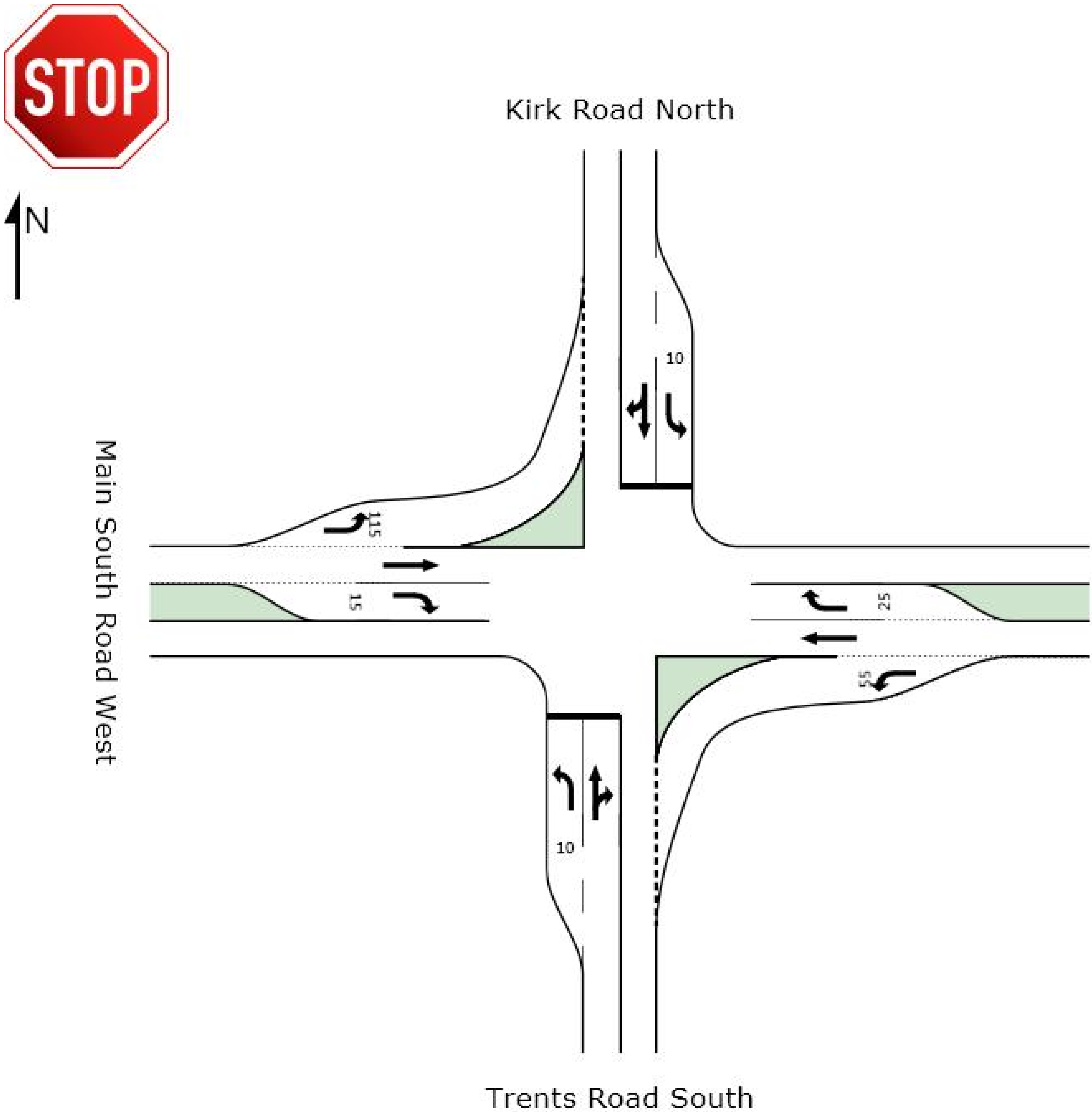
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: HJR South											
1	L	598	6.0	0.332	9.6	NA[9]	NA[9]	NA[9]	0.00	0.65	54.6
2	T	121	2.6	0.257	23.5	LOS C	4.7	33.9	0.85	0.68	38.6
3	R	161	0.7	0.988	43.5	LOS D	7.4	52.4	1.00	0.82	30.3
Approach		880	4.5	0.989	17.7	LOS B	7.4	52.4	0.30	0.69	45.4
East: MSR East											
4	L	16	0.0	0.021	18.5	LOS B	0.4	3.0	0.58	0.68	44.9
5	T	1038	7.6	0.942	43.6	LOS D	26.0	193.6	1.00	1.15	28.7
6	R	49	0.0	0.224	35.0	LOS D	2.1	15.0	0.86	0.74	34.0
Approach		1103	7.2	0.942	42.8	LOS D	26.0	193.6	0.99	1.13	29.1
North: HJR North											
7	L	81	3.9	0.376	35.0	LOS D	3.4	24.5	0.86	0.76	33.9
8	T	457	1.4	0.963	55.7	LOS E	23.8	168.6	1.00	1.24	25.0
9	R	42	2.5	0.202	35.3	LOS D	1.9	13.3	0.86	0.74	33.9
Approach		580	1.8	0.963	51.4	LOS D	23.8	168.6	0.97	1.14	26.4
West: MSR West											
10	L	15	0.0	0.018	10.4	LOS B	0.1	0.8	0.24	0.67	53.1
11	T	952	13.2	0.874	34.9	LOS C	20.1	156.4	1.00	1.05	32.2
12	R	678	7.5	0.976	72.5	LOS E	19.0	141.4	1.00	1.22	22.0
Approach		1644	10.7	0.976	50.2	LOS D	20.1	156.4	0.99	1.11	27.1
All Vehicles		4207	7.3	0.989	41.6	LOS D	26.0	193.6	0.84	1.03	30.1

Level of Service (Aver. Int. Delay): LOS D. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS E. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

9 Continuous movement

Processed: Sunday, 22 April 2012 5:47:55 p.m.
SIDRA INTERSECTION 5.0.2.1437

Project: P:\339\3390691\TTR\FinalScheme_1203\SIDRA_Baseline\Baseline_4_MSR&HJR_EPAVols.SIP
8000924, BECA INFRASTRUCTURE LIMITED, FLOATING


STOP
N
Kirk Road North
10
Main South Road West
115
15
Main South Road East
25
55
10
Trents Road South

MOVEMENT SUMMARY

Site: Baseline - MSR/Kirk/Trents - 2016 AM

MSR/Kirks Rd/Trents Rd
EPA Flows - 2016 AM - Baseline Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Trents Road South											
1	L	11	0.0	0.025	15.1	LOS C	0.1	0.6	0.60	0.90	39.8
2	T	36	2.9	0.994	369.3	LOS F	9.2	66.0	1.00	1.26	5.1
3	R	11	0.0	0.957	370.3	LOS F	9.2	66.0	1.00	1.25	5.6
Approach		57	1.9	1.000	303.9	LOS F	9.2	66.0	0.93	1.19	6.3
East: Main South Road East											
4	L	11	0.0	0.009	8.1	LOS A	0.0	0.3	0.06	0.59	53.5
5	T	749	12.2	0.415	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
6	R	204	7.2	0.685	28.9	LOS D	3.7	27.2	0.94	1.16	33.4
Approach		964	11.0	0.685	6.2	LOS D	3.7	27.2	0.20	0.25	57.3
North: Kirk Road North											
7	L	219	4.3	0.999[3]	30.7	LOS D	4.4	31.9	1.00	1.00	31.8
8	T	88	2.9	2.188	3457.9	LOS F	68.1	569.3	1.00	4.10	0.6
9	R	43	61.0	2.158	3462.1	LOS F	68.1	569.3	1.00	3.83	0.7
Approach		349	11.1	2.178	1312.7	LOS F	68.1	569.3	1.00	2.13	1.7
West: Main South Road West											
10	L	241	10.0	0.218	9.4	LOS A	1.2	9.3	0.36	0.63	51.5
11	T	1273	5.8	0.677	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
12	R	14	0.0	0.017	11.7	LOS B	0.1	0.5	0.55	0.77	49.3
Approach		1527	6.4	0.677	1.6	LOS B	1.2	9.3	0.06	0.11	66.3
All Vehicles		2898	8.4	2.178	167.2	NA	68.1	569.3	0.24	0.42	11.3

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: Baseline - MSR/Kirk/Trents - 2016 IP

MSR/Kirks Rd/Trents Rd
EPA Flows - 2016 IP - Baseline Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Trents Road South											
1	L	11	0.0	0.022	13.7	LOS B	0.1	0.5	0.54	0.87	40.7
2	T	19	5.6	0.421	73.1	LOS F	1.5	11.2	0.96	1.05	18.5
3	R	11	0.0	0.421	74.0	LOS F	1.5	11.2	0.96	1.04	19.8
Approach		40	2.6	0.419	57.7	LOS F	1.5	11.2	0.85	1.00	22.2
East: Main South Road East											
4	L	11	0.0	0.009	8.1	LOS A	0.0	0.3	0.05	0.59	53.5
5	T	585	14.0	0.328	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
6	R	205	5.6	0.292	13.3	LOS B	1.4	10.6	0.68	0.93	44.0
Approach		801	11.7	0.328	3.5	LOS B	1.4	10.6	0.18	0.25	61.0
North: Kirk Road North											
7	L	226	5.6	0.623	23.1	LOS C	3.3	24.4	0.78	1.20	35.3
8	T	29	3.6	2.679	1708.1	LOS F	80.0	625.2	1.00	4.21	1.2
9	R	149	15.5	2.768	1709.9	LOS F	80.0	625.2	1.00	4.03	1.3
Approach		405	9.1	2.774	767.8	LOS F	80.0	625.2	0.88	2.47	2.8
West: Main South Road West											
10	L	39	73.0	0.064	12.0	LOS B	0.3	3.6	0.41	0.63	50.6
11	T	838	11.7	0.462	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
12	R	11	0.0	0.012	10.7	LOS B	0.0	0.3	0.48	0.70	50.5
Approach		887	14.2	0.462	0.7	LOS B	0.3	3.6	0.02	0.04	68.7
All Vehicles		2134	12.1	2.774	148.5	NA	80.0	625.2	0.26	0.59	12.5

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

Processed: Tuesday, 16 October 2012 11:59:10 p.m.
SIDRA INTERSECTION 5.0.2.1437
Project: D:\3390691_CSM2__Final\99_ModelOutputs\02_SIDRA_Baseline\Baseline_MSR&Kirks&Trents_EPAVols.sip
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SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: Baseline - MSR/Kirk/Trents - 2016 PM

MSR/Kirks Rd/Trents Rd
EPA Flows - 2016 PM - Baseline Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Trents Road South											
1	L	11	0.0	0.053	27.8	LOS D	0.2	1.4	0.87	1.00	32.9
2	T	36	2.9	0.994	916.8	LOS F	11.3	81.0	1.00	1.48	2.2
3	R	11	0.0	0.957	917.9	LOS F	11.3	81.0	1.00	1.47	2.4
Approach		57	1.9	1.000	752.4	LOS F	11.3	81.0	0.98	1.39	2.7
East: Main South Road East											
4	L	11	0.0	0.009	8.1	LOS A	0.0	0.3	0.06	0.59	53.5
5	T	1453	4.2	0.765	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
6	R	200	2.1	0.519	20.9	LOS C	2.6	18.4	0.88	1.06	38.1
Approach		1663	3.9	0.765	2.6	LOS C	2.6	18.4	0.11	0.13	63.8
North: Kirk Road North											
7	L	96	3.3	0.326	25.2	LOS D	1.5	11.1	0.85	1.05	34.2
8	T	57	1.9	2.992	2712.4	LOS F	86.8	616.5	1.00	4.54	0.8
9	R	124	1.7	3.030	2713.5	LOS F	86.8	616.5	1.00	4.45	0.8
Approach		277	2.3	3.018	1783.1	LOS F	86.8	616.5	0.95	3.29	1.2
West: Main South Road West											
10	L	46	70.5	0.074	11.8	LOS B	0.4	4.1	0.40	0.63	50.8
11	T	1165	9.0	0.633	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
12	R	14	0.0	0.073	26.2	LOS D	0.3	1.8	0.90	0.97	36.7
Approach		1225	11.3	0.633	0.7	LOS D	0.4	4.1	0.03	0.03	68.5
All Vehicles		3222	6.5	3.018	168.1	NA	86.8	616.5	0.16	0.39	11.4

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

Processed: Tuesday, 16 October 2012 11:59:55 p.m.
SIDRA INTERSECTION 5.0.2.1437
Project: D:\3390691_CSM2__Final\99_ModelOutputs\02_SIDRA_Baseline\Baseline_MSR&Kirks&Trents_EPAVols.sip
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SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: Baseline - MSR/Kirk/Trents - 2026 AM

MSR/Kirks Rd/Trents Rd
EPA Flows - 2026 AM - Baseline Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Trents Road South											
1	L	11	0.0	0.033	18.7	LOS C	0.1	0.8	0.74	0.98	37.6
2	T	52	2.0	1.032	510.6	LOS F	13.1	93.1	1.00	1.60	3.8
3	R	11	0.0	1.053	511.6	LOS F	13.1	93.1	1.00	1.57	4.1
Approach		73	1.4	1.035	439.4	LOS F	13.1	93.1	0.96	1.50	4.5
East: Main South Road East											
4	L	11	0.0	0.009	8.1	LOS A	0.0	0.3	0.06	0.59	53.5
5	T	1009	13.1	0.561	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
6	R	216	6.2	0.998	77.5	LOS F	9.9	73.2	1.00	1.67	19.1
Approach		1235	11.8	1.000	13.6	LOS F	9.9	73.2	0.18	0.30	48.6
North: Kirk Road North											
7	L	164	3.6	0.998	37.6	LOS E	4.2	30.4	1.00	1.01	29.0
8	T	50	2.9	1.611	12310.3	LOS F	70.8	614.7	1.00	6.91	0.2
9	R	45	55.8	1.561	12314.2	LOS F	70.8	614.7	1.00	6.47	0.2
Approach		259	12.6	1.587	4550.0	LOS F	70.8	614.7	1.00	3.10	0.5
West: Main South Road West											
10	L	317	2.3	0.273	9.3	LOS A	1.6	11.4	0.38	0.64	51.4
11	T	1388	5.7	0.739	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
12	R	15	0.0	0.029	14.5	LOS B	0.1	0.8	0.72	0.92	46.2
Approach		1720	5.0	0.738	1.8	LOS B	1.6	11.4	0.08	0.13	65.7
All Vehicles		3286	8.1	1.587	374.3	NA	70.8	614.7	0.21	0.46	5.6

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: Baseline - MSR/Kirk/Trents - 2026 IP

MSR/Kirks Rd/Trents Rd
EPA Flows - 2026 IP - Baseline Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Trents Road South											
1	L	11	0.0	0.028	16.3	LOS C	0.1	0.6	0.66	0.93	39.1
2	T	21	5.0	1.003	399.6	LOS F	6.6	47.5	1.00	1.23	4.7
3	R	11	0.0	0.957	400.6	LOS F	6.6	47.5	1.00	1.22	5.2
Approach		42	2.5	1.000	304.0	LOS F	6.6	47.5	0.91	1.15	6.3
East: Main South Road East											
4	L	11	0.0	0.009	8.1	LOS A	0.0	0.3	0.05	0.59	53.5
5	T	843	13.6	0.471	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
6	R	211	5.5	0.462	18.3	LOS C	2.3	17.1	0.84	1.04	40.0
Approach		1064	11.9	0.471	3.7	LOS C	2.3	17.1	0.17	0.21	61.2
North: Kirk Road North											
7	L	236	4.9	0.836	28.3	LOS D	4.2	30.4	0.92	1.13	32.8
8	T	34	3.1	2.591	1912.0	LOS F	68.6	571.0	1.00	3.97	1.1
9	R	119	27.4	2.531	1914.5	LOS F	68.6	571.0	1.00	3.79	1.2
Approach		388	11.7	2.544	769.2	LOS F	68.6	571.0	0.95	2.19	2.8
West: Main South Road West											
10	L	61	63.8	0.094	11.6	LOS B	0.5	5.1	0.41	0.64	50.8
11	T	1053	12.4	0.583	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
12	R	11	0.0	0.015	12.6	LOS B	0.1	0.4	0.62	0.80	48.3
Approach		1124	15.1	0.583	0.7	LOS B	0.5	5.1	0.03	0.04	68.5
All Vehicles		2619	13.1	2.544	120.8	NA	68.6	571.0	0.24	0.45	14.8

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: Baseline - MSR/Kirk/Trents - 2026 PM

MSR/Kirks Rd/Trents Rd
EPA Flows - 2026 PM - Baseline Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Trents Road South											
1	L	29	7.1	0.198	36.5	LOS E	0.8	5.7	0.91	1.01	29.4
2	T	47	4.4	1.008	1696.1	LOS F	15.9	115.1	1.00	1.94	1.2
3	R	11	0.0	0.957	1697.1	LOS F	15.9	115.1	1.00	1.92	1.3
Approach		87	4.8	1.000	1136.3	LOS F	15.9	115.1	0.97	1.63	1.8
East: Main South Road East											
4	L	11	0.0	0.009	8.1	LOS A	0.0	0.3	0.07	0.59	53.4
5	T	1561	1.4	0.808	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
6	R	138	6.1	0.901	77.5	LOS F	5.5	40.9	0.99	1.35	19.1
Approach		1709	1.8	0.903	6.3	LOS F	5.5	40.9	0.08	0.11	58.2
North: Kirk Road North											
7	L	43	4.9	0.260	35.3	LOS E	1.1	7.8	0.91	1.03	29.8
8	T	65	1.6	2.611	3844.8	LOS F	76.2	539.8	1.00	5.06	0.5
9	R	92	1.1	2.617	3846.0	LOS F	76.2	539.8	1.00	4.96	0.6
Approach		200	2.1	2.614	3023.3	LOS F	76.2	539.8	0.98	4.14	0.7
West: Main South Road West											
10	L	73	52.2	0.090	10.3	LOS B	0.5	4.7	0.32	0.59	51.8
11	T	1431	9.3	0.778	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
12	R	19	0.0	0.159	36.8	LOS E	0.5	3.7	0.94	0.99	30.8
Approach		1522	11.3	0.778	0.9	LOS E	0.5	4.7	0.03	0.04	68.0
All Vehicles		3519	6.0	2.614	203.5	NA	76.2	539.8	0.13	0.35	9.7

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

Processed: Wednesday, 17 October 2012 12:02:33 a.m.
SIDRA INTERSECTION 5.0.2.1437
Project: D:\3390691_CSM2__Final\99_ModelOutputs\02_SIDRA_Baseline\Baseline_MSR&Kirks&Trents_EPAVols.sip
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SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: Baseline - MSR/Kirk/Trents - 2041 AM

MSR/Kirks Rd/Trents Rd
EPA Flows - 2041 AM - Baseline Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Trents Road South											
1	L	13	0.0	0.065	28.5	LOS D	0.3	1.8	0.87	1.00	32.6
2	T	60	1.8	1.224	1381.9	LOS F	23.2	164.4	1.00	2.46	1.5
3	R	14	0.0	1.244	1383.0	LOS F	23.2	164.4	1.00	2.41	1.6
Approach		86	1.2	1.228	1184.0	LOS F	23.2	164.4	0.98	2.24	1.8
East: Main South Road East											
4	L	11	0.0	0.009	8.1	LOS A	0.0	0.3	0.06	0.59	53.5
5	T	1440	13.1	0.801	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
6	R	150	4.6	1.013	121.0	LOS F	10.0	72.8	1.00	1.71	13.8
Approach		1600	11.8	1.012	11.4	LOS F	10.0	72.8	0.09	0.16	51.5
North: Kirk Road North											
7	L	116	10.0	0.957	49.8	LOS E	4.0	30.4	1.00	1.04	25.2
8	T	44	2.4	1.382	254461.5	LOS F	236.8	2161.4	1.00	28.82	0.0
9	R	39	73.0	1.391	254466.3	LOS F	236.8	2161.4	1.00	26.75	0.0
Approach		199	20.6	1.386	106392.1	LOS F	236.8	2161.4	1.00	12.25	0.0
West: Main South Road West											
10	L	209	5.0	0.168	8.8	LOS A	0.9	6.7	0.28	0.60	52.0
11	T	1509	4.3	0.795	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
12	R	15	0.0	0.083	27.2	LOS D	0.3	2.0	0.91	0.97	36.0
Approach		1734	4.3	0.795	1.3	LOS D	0.9	6.7	0.04	0.08	67.0
All Vehicles		3619	8.4	1.386	5882.7	NA	236.8	2161.4	0.14	0.84	0.4

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: Baseline - MSR/Kirk/Trents - 2041 IP

MSR/Kirks Rd/Trents Rd
EPA Flows - 2041 IP - Baseline Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Trents Road South											
1	L	11	0.0	0.035	21.7	LOS C	0.1	1.0	0.80	1.00	36.0
2	T	38	2.8	0.997	879.9	LOS F	11.6	82.5	1.00	1.50	2.3
3	R	11	0.0	0.957	880.9	LOS F	11.6	82.5	1.00	1.48	2.5
Approach		59	1.8	1.000	726.8	LOS F	11.6	82.5	0.96	1.41	2.8
East: Main South Road East											
4	L	11	0.0	0.009	8.1	LOS A	0.0	0.3	0.07	0.59	53.4
5	T	1129	14.8	0.635	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
6	R	214	4.9	0.742	31.8	LOS D	4.1	30.2	0.95	1.20	32.0
Approach		1354	13.1	0.741	5.1	LOS D	4.1	30.2	0.15	0.19	59.4
North: Kirk Road North											
7	L	221	4.2	0.998	30.5	LOS D	4.4	32.0	1.00	1.00	31.9
8	T	50	2.4	2.267	8260.1	LOS F	81.1	701.1	1.00	6.72	0.3
9	R	85	42.0	2.244	8263.3	LOS F	81.1	701.1	1.00	6.36	0.3
Approach		356	13.0	2.252	3157.1	LOS F	81.1	701.1	1.00	3.09	0.7
West: Main South Road West											
10	L	134	37.0	0.162	10.5	LOS B	0.9	7.9	0.40	0.64	51.3
11	T	1195	15.3	0.674	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
12	R	19	0.0	0.053	17.5	LOS C	0.2	1.4	0.81	0.94	43.3
Approach		1347	17.3	0.674	1.3	LOS C	0.9	7.9	0.05	0.08	67.2
All Vehicles		3116	14.7	2.252	377.0	NA	81.1	701.1	0.22	0.50	5.6

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: Baseline - MSR/Kirk/Trents - 2041 PM

MSR/Kirks Rd/Trents Rd
EPA Flows - 2041 PM - Baseline Network
Stop (Two-Way)

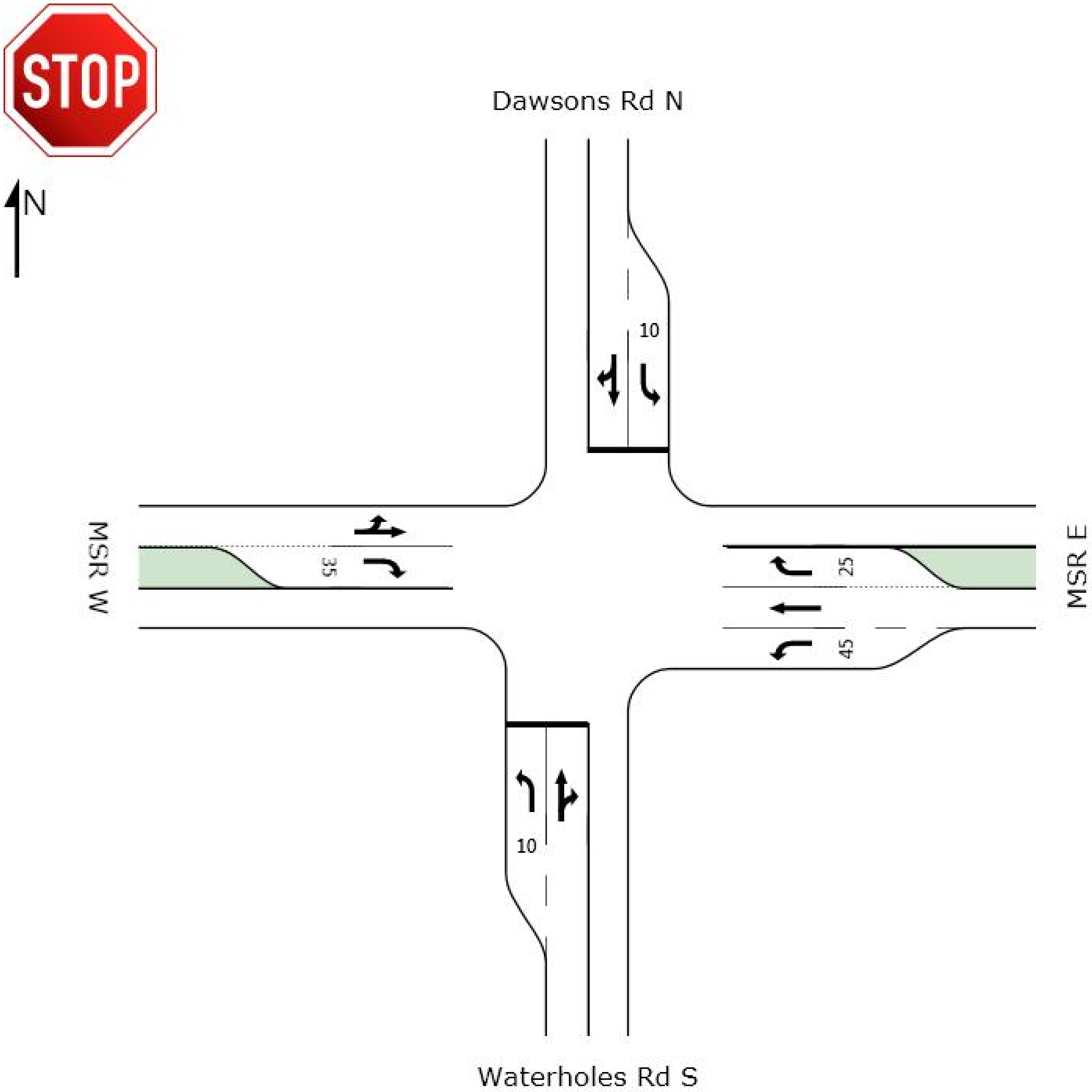
Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Trents Road South											
1	L	11	0.0	0.085	38.7	LOS E	0.3	2.2	0.92	1.00	28.5
2	T	58	3.6	1.135	2307.2	LOS F	25.2	181.0	1.00	2.80	0.9
3	R	11	0.0	1.170	2308.2	LOS F	25.2	181.0	1.00	2.75	1.0
Approach		79	2.7	1.140	2004.9	LOS F	25.2	181.0	0.99	2.55	1.0
East: Main South Road East											
4	L	17	0.0	0.014	8.3	LOS A	0.1	0.4	0.15	0.57	52.9
5	T	1674	1.8	0.869	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
6	R	98	5.4	1.020	161.4	LOS F	8.3	60.5	1.00	1.54	11.0
Approach		1788	2.0	1.022	8.9	LOS F	8.3	60.5	0.06	0.09	54.8
North: Kirk Road North											
7	L	45	7.0	0.330	42.8	LOS E	1.4	10.0	0.93	1.04	27.2
8	T	121	0.9	2.284	3339.4	LOS F	66.2	469.5	1.00	4.03	0.6
9	R	17	6.3	2.406	3340.9	LOS F	66.2	469.5	1.00	3.96	0.7
Approach		183	2.9	2.298	2524.9	LOS F	66.2	469.5	0.98	3.29	0.8
West: Main South Road West											
10	L	13	16.7	0.011	8.8	LOS A	0.1	0.4	0.21	0.56	52.5
11	T	1508	12.7	0.837	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
12	R	64	3.6	1.007	195.7	LOS F	6.1	44.1	1.00	1.31	9.2
Approach		1585	12.2	1.002	8.0	LOS F	6.1	44.1	0.04	0.06	56.3
All Vehicles		3636	6.5	2.298	178.6	NA	66.2	469.5	0.12	0.29	10.8

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

Processed: Wednesday, 17 October 2012 12:07:53 a.m.
SIDRA INTERSECTION 5.0.2.1437
Project: D:\3390691_CSM2__Final\99_ModelOutputs\02_SIDRA_Baseline\Baseline_MSR&Kirks&Trents_EPAVols.sip
8000924, BECA INFRASTRUCTURE LIMITED, FLOATING

SIDRA INTERSECTION



STOP
N
Dawsons Rd N
10
MSR W
35
25
45
MSR E
10
Waterholes Rd S

MOVEMENT SUMMARY

Site: Baseline - MSR/Waterholes - 2016 AM

MSR/ Waterholes Rd/ Dawsons Rd
2016 AM - EPA Vols - Baseline Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Waterholes Rd S											
1	L	24	4.3	0.062	18.9	LOS C	0.2	1.1	0.63	0.96	55.9
2	T	37	2.9	1.351	452.2	LOS F	19.0	135.7	1.00	1.63	4.6
3	R	44	2.4	1.351	453.4	LOS F	19.0	135.7	1.00	1.61	5.8
Approach		105	3.0	1.351	353.0	LOS F	19.0	135.7	0.92	1.47	6.8
East: MSR E											
4	L	37	2.9	0.020	12.4	LOS B	0.0	0.0	0.00	0.75	64.8
5	T	761	15.4	0.429	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
6	R	11	0.0	0.084	38.3	LOS E	0.2	1.5	0.94	0.98	36.2
Approach		808	14.6	0.429	1.1	LOS E	0.2	1.5	0.01	0.05	96.3
North: Dawsons Rd N											
7	L	15	28.6	1.000[3]	399.3	LOS F	2.9	24.9	1.00	1.07	6.4
8	T	40	2.6	1.158	321.4	LOS F	12.5	90.8	1.00	1.47	6.8
9	R	29	7.1	1.158	321.1	LOS F	12.5	90.8	1.00	1.46	7.8
Approach		84	8.8	1.158	334.9	LOS F	12.5	90.8	1.00	1.40	7.1
West: MSR W											
10	L	56	0.0	0.819	12.5	LOS B	0.0	0.0	0.00	1.53	63.3
11	T	1478	6.3	0.819	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
12	R	41	2.6	0.049	15.3	LOS C	0.2	1.2	0.56	0.83	60.1
Approach		1575	5.9	0.819	0.8	LOS C	0.2	1.2	0.01	0.08	97.0
All Vehicles		2573	8.6	1.351	26.3	NA	19.0	135.7	0.08	0.17	51.3

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

MOVEMENT SUMMARY

Site: Baseline - MSR/Waterholes - 2016 IP

MSR/ Waterholes Rd/ Dawsons Rd
2016 IP - EPA Vols - Baseline Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Waterholes Rd S											
1	L	20	5.3	0.049	18.3	LOS C	0.1	0.9	0.60	0.93	56.6
2	T	16	0.0	0.511	73.5	LOS F	1.6	11.5	0.96	1.05	22.0
3	R	25	4.2	0.511	75.0	LOS F	1.6	11.5	0.96	1.05	26.6
Approach		61	3.4	0.511	56.0	LOS F	1.6	11.5	0.84	1.01	30.9
East: MSR E											
4	L	27	3.8	0.015	12.4	LOS B	0.0	0.0	0.00	0.75	64.8
5	T	713	14.8	0.401	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
6	R	11	0.0	0.016	16.7	LOS C	0.1	0.4	0.64	0.84	56.6
Approach		751	14.2	0.401	0.7	LOS C	0.1	0.4	0.01	0.04	97.5
North: Dawsons Rd N											
7	L	13	16.7	0.056	24.3	LOS C	0.1	1.2	0.79	1.00	44.5
8	T	17	6.3	0.621	84.5	LOS F	2.1	14.7	0.97	1.09	20.3
9	R	32	0.0	0.621	83.4	LOS F	2.1	14.7	0.97	1.09	22.8
Approach		61	5.2	0.621	71.5	LOS F	2.1	14.7	0.93	1.07	24.6
West: MSR W											
10	L	31	3.4	0.491	12.7	LOS B	0.0	0.0	0.00	1.55	63.3
11	T	845	14.6	0.491	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
12	R	20	5.3	0.022	15.1	LOS C	0.1	0.6	0.53	0.78	60.7
Approach		896	14.0	0.491	0.8	LOS C	0.1	0.6	0.01	0.07	97.3
All Vehicles		1768	13.4	0.621	5.1	NA	2.1	14.7	0.07	0.12	83.5

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: Baseline - MSR/Waterholes - 2016 PM

MSR/ Waterholes Rd/ Dawsons Rd
2016 PM - EPA Vols - Baseline Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Waterholes Rd S											
1	L	38	5.6	0.236	38.4	LOS E	0.8	5.6	0.91	1.01	40.6
2	T	37	2.9	1.474	532.9	LOS F	22.8	162.8	1.00	1.83	3.9
3	R	52	2.0	1.474	534.1	LOS F	22.8	162.8	1.00	1.81	5.0
Approach		126	3.3	1.474	385.0	LOS F	22.8	162.8	0.97	1.58	6.3
East: MSR E											
4	L	54	0.0	0.029	12.2	LOS B	0.0	0.0	0.00	0.75	64.8
5	T	1526	3.9	0.803	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
6	R	13	16.7	0.054	27.2	LOS D	0.2	1.2	0.86	0.97	45.2
Approach		1593	3.9	0.803	0.6	LOS D	0.2	1.2	0.01	0.03	97.8
North: Dawsons Rd N											
7	L	24	8.7	0.178	38.6	LOS E	0.5	3.9	0.92	1.01	36.1
8	T	55	1.9	2.263	1215.1	LOS F	52.7	381.0	1.00	3.24	2.0
9	R	81	5.2	2.263	1214.7	LOS F	52.7	381.0	1.00	3.19	2.2
Approach		160	4.6	2.263	1036.9	LOS F	52.7	381.0	0.99	2.88	2.5
West: MSR W											
10	L	42	0.0	0.657	12.5	LOS B	0.0	0.0	0.00	1.53	63.3
11	T	1149	11.8	0.657	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
12	R	43	4.9	0.129	22.8	LOS C	0.4	3.0	0.83	0.96	50.8
Approach		1235	11.2	0.657	1.2	LOS C	0.4	3.0	0.03	0.09	95.8
All Vehicles		3114	6.8	2.263	69.7	NA	52.7	381.0	0.11	0.26	28.7

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: Baseline - MSR/Waterholes - 2026 AM

MSR/ Waterholes Rd/ Dawsons Rd
2026 AM - EPA Vols - Baseline Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Waterholes Rd S											
1	L	43	4.9	0.149	23.4	LOS C	0.4	3.0	0.78	1.00	51.7
2	T	54	2.0	1.596	635.2	LOS F	27.3	194.4	1.00	2.02	3.3
3	R	42	2.5	1.596	636.5	LOS F	27.3	194.4	1.00	1.99	4.2
Approach		139	3.0	1.596	445.6	LOS F	27.3	194.4	0.93	1.69	5.4
East: MSR E											
4	L	40	2.6	0.022	12.4	LOS B	0.0	0.0	0.00	0.75	64.8
5	T	1018	15.4	0.574	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
6	R	11	0.0	0.169	65.4	LOS F	0.4	2.9	0.97	1.00	24.9
Approach		1068	14.8	0.574	1.1	LOS F	0.4	2.9	0.01	0.04	96.2
North: Dawsons Rd N											
7	L	60	82.5	1.000[3]	62.6	LOS F	2.1	24.9	1.00	1.02	29.2
8	T	49	10.6	1.421	488.8	LOS F	20.8	159.6	1.00	1.98	4.7
9	R	36	11.8	1.421	488.4	LOS F	20.8	159.6	1.00	1.95	5.3
Approach		145	40.6	1.421	312.6	LOS F	20.8	159.6	1.00	1.58	7.7
West: MSR W											
10	L	52	0.0	0.874	12.5	LOS B	0.0	0.0	0.00	1.53	63.3
11	T	1627	2.2	0.874	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
12	R	42	2.5	0.069	17.3	LOS C	0.2	1.7	0.68	0.92	57.3
Approach		1721	2.1	0.874	0.8	LOS C	0.2	1.7	0.02	0.07	97.2
All Vehicles		3074	8.4	1.596	35.7	NA	27.3	194.4	0.10	0.20	43.8

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: Baseline - MSR/Waterholes - 2026 IP

MSR/ Waterholes Rd/ Dawsons Rd
2026 IP - EPA Vols - Baseline Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Waterholes Rd S											
1	L	26	8.0	0.089	22.5	LOS C	0.2	1.8	0.74	1.00	52.7
2	T	20	5.3	1.000 [4]	336.4	LOS F	6.7	48.7	1.00	1.19	6.0
3	R	24	4.3	1.000 [4]	337.6	LOS F	6.7	48.7	1.00	1.19	7.6
Approach		71	6.0	1.000	219.7	LOS F	6.7	48.7	0.90	1.12	10.6
East: MSR E											
4	L	27	3.8	0.015	12.4	LOS B	0.0	0.0	0.00	0.75	64.8
5	T	943	15.6	0.533	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
6	R	11	0.0	0.030	21.3	LOS C	0.1	0.6	0.81	0.95	50.5
Approach		981	15.1	0.533	0.6	LOS C	0.1	0.6	0.01	0.03	97.9
North: Dawsons Rd N											
7	L	11	0.0	0.063	31.6	LOS D	0.2	1.3	0.89	1.00	39.3
8	T	18	0.0	1.000 [4]	270.2	LOS F	6.8	47.3	1.00	1.28	8.0
9	R	37	0.0	1.000 [4]	269.5	LOS F	6.8	47.3	1.00	1.27	9.1
Approach		65	0.0	1.000	231.3	LOS F	6.8	47.3	0.98	1.23	10.0
West: MSR W											
10	L	36	2.9	0.639	12.7	LOS B	0.0	0.0	0.00	1.55	63.3
11	T	1098	15.3	0.639	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
12	R	27	7.7	0.043	17.1	LOS C	0.1	1.1	0.64	0.88	58.0
Approach		1161	14.8	0.639	0.8	LOS C	0.1	1.1	0.02	0.07	97.2
All Vehicles		2278	14.2	1.000	14.1	NA	6.8	48.7	0.07	0.12	66.2

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

4 x = 1.00 due to minimum capacity

Processed: Wednesday, 22 August 2012 12:38:36 p.m.
SIDRA INTERSECTION 5.0.2.1437
Project: D:\3390691_CSM2__Final\99_ModelOutputs\02_SIDRA_Baseline\Baseline_MSR&Waterholes_EPAVols.sip
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SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: Baseline - MSR/Waterholes - 2026 PM

MSR/ Waterholes Rd/ Dawsons Rd
2026 PM - EPA Vols - Baseline Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Waterholes Rd S											
1	L	45	2.3	0.338	46.1	LOS E	1.1	7.9	0.94	1.03	36.5
2	T	43	7.3	1.474	523.5	LOS F	22.4	163.0	1.00	1.86	4.0
3	R	45	2.3	1.474	524.4	LOS F	22.4	163.0	1.00	1.84	5.1
Approach		134	3.9	1.474	362.2	LOS F	22.4	163.0	0.98	1.57	6.7
East: MSR E											
4	L	55	0.0	0.029	12.2	LOS B	0.0	0.0	0.00	0.75	64.8
5	T	1621	1.3	0.838	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
6	R	15	28.6	0.515	181.0	LOS F	1.3	11.5	0.99	1.02	10.8
Approach		1691	1.5	0.838	2.0	LOS F	1.3	11.5	0.01	0.03	93.5
North: Dawsons Rd N											
7	L	12	9.1	0.547	249.7	LOS F	1.4	10.6	0.99	1.03	9.7
8	T	64	1.6	2.158	1114.8	LOS F	48.0	338.1	1.00	3.28	2.1
9	R	65	0.0	2.158	1114.0	LOS F	48.0	338.1	1.00	3.23	2.4
Approach		141	1.5	2.158	1043.5	LOS F	48.0	338.1	1.00	3.08	2.4
West: MSR W											
10	L	48	0.0	0.839	12.5	LOS B	0.0	0.0	0.00	1.53	63.3
11	T	1475	11.6	0.839	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
12	R	60	8.8	0.234	27.7	LOS D	0.8	5.7	0.88	0.98	46.3
Approach		1583	11.1	0.839	1.4	LOS D	0.8	5.7	0.03	0.08	95.1
All Vehicles		3548	5.9	2.158	56.7	NA	48.0	338.1	0.10	0.23	33.1

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: Baseline - MSR/Waterholes - 2041 AM

MSR/ Waterholes Rd/ Dawsons Rd
2041 AM - EPA Vols - Baseline Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Waterholes Rd S											
1	L	119	1.8	0.550	39.1	LOS E	2.3	16.2	0.93	1.09	40.1
2	T	86	3.7	2.421	1351.2	LOS F	58.4	419.0	1.00	2.97	1.6
3	R	59	1.8	2.421	1352.3	LOS F	58.4	419.0	1.00	2.93	2.0
Approach		264	2.4	2.421	760.7	LOS F	58.4	419.0	0.97	2.11	3.3
East: MSR E											
4	L	34	3.1	0.019	12.4	LOS B	0.0	0.0	0.00	0.75	64.8
5	T	1312	11.9	0.725	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
6	R	60	82.5	1.000[3]	151.6	LOS F	3.9	46.8	1.00	1.28	12.8
Approach		1405	14.7	1.000	6.8	LOS F	3.9	46.8	0.04	0.07	81.1
North: Dawsons Rd N											
7	L	13	16.7	1.000[3]	587.7	LOS F	2.9	23.5	1.00	1.11	4.5
8	T	36	11.8	1.263	356.4	LOS F	14.8	108.3	1.00	1.67	6.2
9	R	40	0.0	1.263	355.0	LOS F	14.8	108.3	1.00	1.65	7.1
Approach		88	7.1	1.263	388.8	LOS F	14.8	108.3	1.00	1.58	6.2
West: MSR W											
10	L	46	0.0	0.907	12.5	LOS B	0.0	0.0	0.00	1.53	63.3
11	T	1674	4.3	0.907	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
12	R	45	4.7	0.108	20.4	LOS C	0.4	2.6	0.79	0.95	53.4
Approach		1765	4.2	0.907	0.9	LOS C	0.4	2.6	0.02	0.06	97.0
All Vehicles		3523	8.3	2.421	69.9	NA	58.4	419.0	0.12	0.26	28.6

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

Processed: Wednesday, 22 August 2012 12:38:36 p.m.
SIDRA INTERSECTION 5.0.2.1437
Project: D:\3390691_CSM2__Final\99_ModelOutputs\02_SIDRA_Baseline\Baseline_MSR&Waterholes_EPAVols.sip
8000924, BECA INFRASTRUCTURE LIMITED, FLOATING

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: Baseline - MSR/Waterholes - 2041 IP

MSR/ Waterholes Rd/ Dawsons Rd
2041 IP - EPA Vols - Baseline Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Waterholes Rd S											
1	L	36	8.8	0.164	30.6	LOS D	0.5	4.0	0.86	1.00	46.0
2	T	21	0.0	1.000[4]	340.0	LOS F	7.0	50.3	1.00	1.16	6.0
3	R	24	4.3	1.000[4]	341.5	LOS F	7.0	50.3	1.00	1.16	7.5
Approach		81	5.2	1.000	203.8	LOS F	7.0	50.3	0.94	1.09	11.4
East: MSR E											
4	L	27	3.8	0.015	12.4	LOS B	0.0	0.0	0.00	0.75	64.8
5	T	1197	17.0	0.681	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
6	R	11	0.0	0.077	36.1	LOS E	0.2	1.4	0.93	0.98	37.6
Approach		1235	16.5	0.681	0.6	LOS E	0.2	1.4	0.01	0.02	97.9
North: Dawsons Rd N											
7	L	11	0.0	0.224	88.7	LOS F	0.6	4.1	0.97	1.01	21.9
8	T	20	5.3	1.228	341.5	LOS F	14.0	104.1	1.00	1.60	6.5
9	R	54	7.8	1.228	341.0	LOS F	14.0	104.1	1.00	1.58	7.4
Approach		84	6.3	1.228	309.6	LOS F	14.0	104.1	1.00	1.52	7.8
West: MSR W											
10	L	43	2.4	0.779	12.7	LOS B	0.0	0.0	0.00	1.55	63.3
11	T	1323	17.5	0.779	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
12	R	37	8.6	0.087	20.4	LOS C	0.3	2.1	0.77	0.94	53.7
Approach		1403	16.8	0.779	0.9	LOS C	0.3	2.1	0.02	0.07	96.8
All Vehicles		2803	16.0	1.228	15.9	NA	14.0	104.1	0.07	0.12	63.5

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

4 x = 1.00 due to minimum capacity

MOVEMENT SUMMARY

Site: Baseline - MSR/Waterholes - 2041 PM

MSR/ Waterholes Rd/ Dawsons Rd
2041 PM - EPA Vols - Baseline Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Waterholes Rd S											
1	L	41	2.6	0.313	46.1	LOS E	1.3	9.0	0.94	1.02	36.5
2	T	52	6.1	1.474	3587.0	LOS F	38.1	277.4	1.00	2.99	0.6
3	R	36	2.9	1.432	3588.1	LOS F	38.1	277.4	1.00	2.95	0.8
Approach		128	4.1	1.456	2455.4	LOS F	38.1	277.4	0.98	2.35	1.0
East: MSR E											
4	L	65	1.6	0.036	12.3	LOS B	0.0	0.0	0.00	0.75	64.8
5	T	1626	1.6	0.843	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
6	R	15	28.6	0.737	310.6	LOS F	2.3	20.4	1.00	1.03	6.6
Approach		1706	1.9	0.843	3.2	LOS F	2.3	20.4	0.01	0.04	90.0
North: Dawsons Rd N											
7	L	22	52.4	1.005	3125.7	LOS F	3.0	30.6	1.00	1.07	0.9
8	T	63	5.0	2.429	5540.4	LOS F	73.1	521.6	1.00	5.00	0.4
9	R	80	0.0	2.353	5539.4	LOS F	73.1	521.6	1.00	4.92	0.5
Approach		165	8.9	2.386	5216.9	LOS F	73.1	521.6	1.00	4.44	0.5
West: MSR W											
10	L	42	0.0	0.859	12.5	LOS B	0.0	0.0	0.00	1.53	63.3
11	T	1517	11.9	0.861	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
12	R	127	8.3	0.503	32.8	LOS D	2.4	17.8	0.92	1.04	42.2
Approach		1686	11.4	0.861	2.8	LOS D	2.4	17.8	0.07	0.12	90.9
All Vehicles		3686	6.6	2.386	322.2	NA	73.1	521.6	0.11	0.35	8.0

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

Processed: Friday, 24 August 2012 3:51:09 p.m.
SIDRA INTERSECTION 5.0.2.1437
Project: D:\3390691_CSM2__Final\99_ModelOutputs\02_SIDRA_Baseline\Baseline_MSR&Waterholes_EPAVols.sip
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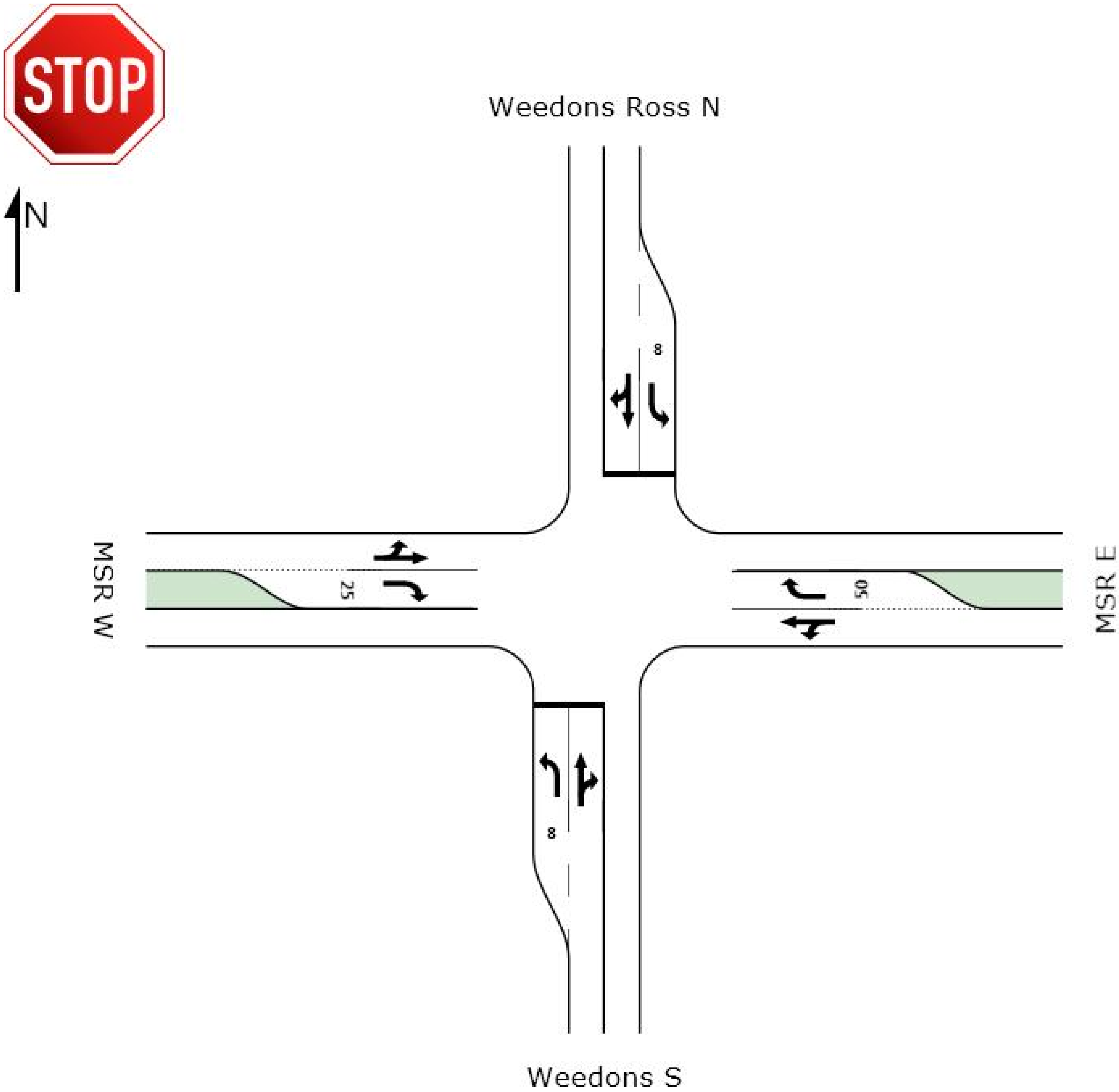

STOP
N
Weedons Ross N
8
MSR W
25
MSR E
50
8
Weedons S

MOVEMENT SUMMARY

Site: Baseline MSR/Weedons - 2016 AM

Baseline - MSR/Weedons/Weedons Ross
2016 AM - EPA Vols - Baseline Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons S											
1	L	11	0.0	0.034	20.5	LOS C	0.1	0.7	0.68	0.95	59.6
2	T	11	10.0	1.053	416.6	LOS F	10.4	79.2	1.00	1.39	5.0
3	R	51	10.4	1.011	416.9	LOS F	10.4	79.2	1.00	1.38	6.4
Approach		72	8.8	1.018	358.6	LOS F	10.4	79.2	0.95	1.32	7.1
East: MSR E											
4	L	21	20.0	0.439	14.3	LOS B	0.0	0.0	0.00	1.43	68.1
5	T	747	15.8	0.436	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
6	R	11	0.0	0.118	51.5	LOS F	0.4	2.9	0.96	0.99	29.6
Approach		779	15.7	0.436	1.1	LOS F	0.4	2.9	0.01	0.05	96.5
North: Weedons Ross N											
7	L	11	0.0	0.206	81.2	LOS F	0.7	4.7	0.97	1.01	23.2
8	T	11	10.0	0.957	412.7	LOS F	4.3	31.7	1.00	1.17	4.9
9	R	11	0.0	0.957	412.9	LOS F	4.3	31.7	1.00	1.16	6.2
Approach		32	3.3	0.983	302.3	LOS F	4.3	31.7	0.99	1.11	7.6
West: MSR W											
10	L	29	0.0	0.797	12.4	LOS B	0.0	0.0	0.00	1.32	63.6
11	T	1462	6.2	0.796	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
12	R	11	0.0	0.017	17.0	LOS C	0.1	0.5	0.65	0.82	62.2
Approach		1502	6.0	0.796	0.4	LOS C	0.1	0.5	0.00	0.03	98.7
All Vehicles		2384	9.2	1.018	15.4	NA	10.4	79.2	0.05	0.09	65.0

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: Baseline MSR/Weedons - 2016 IP

Baseline - MSR/Weedons/Weedons Ross
2016 IP - EPA Vols - Baseline Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons S											
1	L	11	0.0	0.031	19.3	LOS C	0.1	0.6	0.63	0.92	61.0
2	T	11	0.0	0.526	74.8	LOS F	2.1	15.3	0.96	1.04	22.9
3	R	32	10.0	0.518	75.8	LOS F	2.1	15.3	0.96	1.04	27.8
Approach		53	6.0	0.519	64.3	LOS F	2.1	15.3	0.89	1.02	30.2
East: MSR E											
4	L	26	16.0	0.399	14.1	LOS B	0.0	0.0	0.00	1.39	68.1
5	T	681	15.0	0.399	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
6	R	11	0.0	0.018	17.8	LOS C	0.1	0.6	0.68	0.84	54.9
Approach		718	14.8	0.399	0.8	LOS C	0.1	0.6	0.01	0.06	97.5
North: Weedons Ross N											
7	L	11	0.0	0.036	18.4	LOS C	0.1	0.7	0.71	0.97	47.8
8	T	11	10.0	0.270	52.3	LOS F	1.0	7.2	0.93	1.02	25.2
9	R	15	0.0	0.268	52.5	LOS F	1.0	7.2	0.93	1.02	30.4
Approach		36	2.9	0.268	42.4	LOS F	1.0	7.2	0.87	1.01	32.5
West: MSR W											
10	L	31	0.0	0.463	12.4	LOS B	0.0	0.0	0.00	1.32	63.6
11	T	788	15.5	0.461	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
12	R	11	0.0	0.015	16.3	LOS C	0.1	0.5	0.61	0.79	63.3
Approach		829	14.7	0.461	0.7	LOS C	0.1	0.5	0.01	0.06	97.7
All Vehicles		1636	14.2	0.519	3.7	NA	2.1	15.3	0.06	0.11	88.1

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: Baseline MSR/Weedons - 2016 PM

Baseline - MSR/Weedons/Weedons Ross
2016 PM - EPA Vols - Baseline Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons S											
1	L	11	0.0	0.153	63.6	LOS F	0.5	3.6	0.96	1.00	31.3
2	T	11	10.0	0.957	906.5	LOS F	12.2	94.5	1.00	1.37	2.3
3	R	42	12.5	1.003	907.0	LOS F	12.2	94.5	1.00	1.36	3.0
Approach		63	10.0	1.000	766.4	LOS F	12.2	94.5	0.99	1.30	3.4
East: MSR E											
4	L	231	2.3	0.823	13.3	LOS B	0.0	0.0	0.00	1.20	68.1
5	T	1323	4.2	0.823	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
6	R	11	0.0	0.036	24.5	LOS C	0.1	1.0	0.84	0.96	47.0
Approach		1564	3.9	0.823	2.1	LOS C	0.1	1.0	0.01	0.18	93.2
North: Weedons Ross N											
7	L	11	0.0	0.056	29.2	LOS D	0.2	1.5	0.88	1.00	40.6
8	T	11	10.0	0.957	661.8	LOS F	7.8	56.5	1.00	1.14	3.1
9	R	13	0.0	0.972	662.0	LOS F	7.8	56.5	1.00	1.14	4.0
Approach		34	3.1	1.000	464.2	LOS F	7.8	56.5	0.96	1.09	5.2
West: MSR W											
10	L	11	0.0	0.619	12.4	LOS B	0.0	0.0	0.00	1.32	63.6
11	T	1114	11.6	0.620	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
12	R	11	0.0	0.153	62.6	LOS F	0.5	3.6	0.97	0.99	31.0
Approach		1135	11.4	0.620	0.7	LOS F	0.5	3.6	0.01	0.02	97.6
All Vehicles		2796	7.1	1.000	24.4	NA	12.2	94.5	0.04	0.15	53.9

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: Baseline MSR/Weedons - 2026 AM

Baseline - MSR/Weedons/Weedons Ross
2026 AM - EPA Vols - Baseline Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons S											
1	L	11	0.0	0.059	30.0	LOS D	0.2	1.3	0.86	1.00	49.9
2	T	11	30.0	1.053	878.8	LOS F	17.6	135.2	1.00	1.59	2.4
3	R	56	7.5	1.116	877.4	LOS F	17.6	135.2	1.00	1.59	3.1
Approach		77	9.6	1.105	761.5	LOS F	17.6	135.2	0.98	1.51	3.5
East: MSR E											
4	L	24	30.4	0.605	14.9	LOS B	0.0	0.0	0.00	1.48	68.1
5	T	1032	15.6	0.599	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
6	R	11	0.0	0.310	131.5	LOS F	1.0	7.0	0.99	1.00	14.2
Approach		1066	15.8	0.599	1.6	LOS F	1.0	7.0	0.01	0.04	94.7
North: Weedons Ross N											
7	L	11	0.0	0.554	268.7	LOS F	1.7	11.9	0.99	1.02	9.1
8	T	11	10.0	0.957	868.1	LOS F	8.0	58.4	1.00	1.17	2.4
9	R	13	0.0	0.972	868.3	LOS F	8.0	58.4	1.00	1.16	3.1
Approach		34	3.1	1.000	680.8	LOS F	8.0	58.4	1.00	1.12	3.6
West: MSR W											
10	L	51	0.0	0.871	12.4	LOS B	0.0	0.0	0.00	1.32	63.6
11	T	1614	2.2	0.867	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
12	R	11	0.0	0.034	23.4	LOS C	0.1	1.0	0.83	0.96	54.5
Approach		1675	2.1	0.867	0.5	LOS C	0.1	1.0	0.01	0.05	98.2
All Vehicles		2852	7.5	1.105	29.5	NA	17.6	135.2	0.04	0.10	49.2

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: Baseline MSR/Weedons - 2026 IP

Baseline - MSR/Weedons/Weedons Ross
2026 IP - EPA Vols - Baseline Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons S											
1	L	11	0.0	0.045	24.7	LOS C	0.1	1.0	0.79	1.00	54.9
2	T	11	10.0	0.957	455.9	LOS F	8.3	65.9	1.00	1.30	4.6
3	R	38	16.7	0.997	456.8	LOS F	8.3	65.9	1.00	1.29	5.8
Approach		59	12.5	1.000	379.5	LOS F	8.3	65.9	0.96	1.24	6.7
East: MSR E											
4	L	52	12.2	0.537	13.9	LOS B	0.0	0.0	0.00	1.35	68.1
5	T	899	15.9	0.539	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
6	R	11	0.0	0.036	24.4	LOS C	0.1	1.0	0.84	0.96	47.1
Approach		961	15.6	0.539	1.0	LOS C	0.1	1.0	0.01	0.08	96.7
North: Weedons Ross N											
7	L	11	0.0	0.063	28.4	LOS D	0.2	1.4	0.87	1.00	41.1
8	T	11	10.0	0.810	247.6	LOS F	3.0	21.8	0.99	1.09	7.7
9	R	13	0.0	0.789	247.8	LOS F	3.0	21.8	0.99	1.09	9.8
Approach		34	3.1	0.792	179.1	LOS F	3.0	21.8	0.96	1.06	12.0
West: MSR W											
10	L	36	0.0	0.617	12.4	LOS B	0.0	0.0	0.00	1.32	63.6
11	T	1048	15.8	0.612	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
12	R	11	0.0	0.025	20.2	LOS C	0.1	0.8	0.77	0.92	58.1
Approach		1095	15.1	0.612	0.6	LOS C	0.1	0.8	0.01	0.05	97.9
All Vehicles		2148	15.0	1.000	14.0	NA	8.3	65.9	0.05	0.11	67.0

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Baseline - MSR/Weedons/Weedons Ross
2026 PM - EPA Vols - Baseline Network
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons S											
1	L	11	0.0	0.188	77.2	LOS F	0.6	4.3	0.97	1.00	27.2
1	L	11	0.0	0.211	85.6	LOS F	0.7	4.8	0.97	1.01	25.2
2	T	45	16.3	1.741	3470.0	LOS F	46.1	350.5	1.00	2.99	0.6
2	T	11	10.0	0.957	3019.8	LOS F	20.1	158.5	1.00	1.82	0.7
3	R	60	5.3	1.765	3469.3	LOS F	46.1	350.5	1.00	2.99	0.8
3	R	47	15.6	1.008	3020.6	LOS F	20.1	158.5	1.00	1.79	0.9
Approach		116	9.1	1.754	3161.2	LOS F	46.1	350.5	1.00	2.81	0.8
South: Weedons S											
1	L	11	0.0	0.188	77.2	LOS F	0.6	4.3	0.97	1.00	27.2
1	L	11	0.0	0.211	85.6	LOS F	0.7	4.8	0.97	1.01	25.2
2	T	45	16.3	1.741	3470.0	LOS F	46.1	350.5	1.00	2.99	0.6
2	T	11	10.0	0.957	3019.8	LOS F	20.1	158.5	1.00	1.82	0.7
3	R	60	5.3	1.765	3469.3	LOS F	46.1	350.5	1.00	2.99	0.8
3	R	47	15.6	1.008	3020.6	LOS F	20.1	158.5	1.00	1.79	0.9
Approach		68	12.3	1.000	2568.9	LOS F	20.1	158.5	1.00	1.68	1.0
East: MSR E											
4	L	117	7.2	0.800	13.6	LOS B	0.0	0.0	0.00	1.30	68.1
4	L	367	0.6	0.879	13.2	LOS B	0.0	0.0	0.00	1.13	68.1
5	T	1321	12.4	0.798	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
5	T	1315	1.4	0.879	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
6	R	53	22.0	0.993	1224.6	LOS F	10.7	88.8	1.00	1.76	1.7
6	R	11	0.0	0.162	67.2	LOS F	0.6	3.9	0.97	1.00	24.4
Approach		1491	12.4	1.000	44.3	LOS F	10.7	88.8	0.04	0.16	39.2
East: MSR E											
4	L	117	7.2	0.800	13.6	LOS B	0.0	0.0	0.00	1.30	68.1
4	L	367	0.6	0.879	13.2	LOS B	0.0	0.0	0.00	1.13	68.1
5	T	1321	12.4	0.798	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
5	T	1315	1.4	0.879	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
6	R	53	22.0	0.993	1224.6	LOS F	10.7	88.8	1.00	1.76	1.7
6	R	11	0.0	0.162	67.2	LOS F	0.6	3.9	0.97	1.00	24.4
Approach		1693	1.2	0.879	3.3	LOS F	0.6	3.9	0.01	0.25	89.7
North: Weedons Ross N											
7	L	11	10.0	0.957	650.3	LOS F	3.2	24.5	1.00	1.05	4.1
7	L	11	0.0	0.310	126.0	LOS F	1.0	6.9	0.98	1.01	16.9
8	T	16	6.7	0.987	2420.4	LOS F	10.1	73.3	1.00	1.35	0.9
8	T	23	18.2	1.007	2230.5	LOS F	14.6	110.3	1.00	1.69	1.0
9	R	9	0.0	1.053	2420.8	LOS F	10.1	73.3	1.00	1.35	1.1
9	R	21	0.0	1.003	2230.3	LOS F	14.6	110.3	1.00	1.71	1.2
Approach		36	5.9	1.000	1899.9	LOS F	10.1	73.3	1.00	1.27	1.3
North: Weedons Ross N											
7	L	11	10.0	0.957	650.3	LOS F	3.2	24.5	1.00	1.05	4.1
7	L	11	0.0	0.310	126.0	LOS F	1.0	6.9	0.98	1.01	16.9
8	T	16	6.7	0.987	2420.4	LOS F	10.1	73.3	1.00	1.35	0.9
8	T	23	18.2	1.007	2230.5	LOS F	14.6	110.3	1.00	1.69	1.0
9	R	9	0.0	1.053	2420.8	LOS F	10.1	73.3	1.00	1.35	1.1
9	R	21	0.0	1.003	2230.3	LOS F	14.6	110.3	1.00	1.71	1.2
Approach		55	7.7	1.000	1825.7	LOS F	14.6	110.3	1.00	1.57	1.4
West: MSR W											
10	L	114	2.8	0.932	12.5	LOS B	0.0	0.0	0.00	1.32	63.6
10	L	15	0.0	0.819	12.4	LOS B	0.0	0.0	0.00	1.32	63.6

11	T	1651	4.0	0.931	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
11	T	1461	11.3	0.812	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
12	R	11	0.0	0.139	57.9	LOS F	0.5	3.3	0.96	0.99	32.7
12	R	11	0.0	0.351	155.0	LOS F	1.1	8.0	0.99	1.01	15.3
Approach		1775	3.9	0.931	1.1	LOS F	0.5	3.3	0.01	0.09	96.1
West: MSR W											
10	L	114	2.8	0.932	12.5	LOS B	0.0	0.0	0.00	1.32	63.6
10	L	15	0.0	0.819	12.4	LOS B	0.0	0.0	0.00	1.32	63.6
11	T	1651	4.0	0.931	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
11	T	1461	11.3	0.812	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
12	R	11	0.0	0.139	57.9	LOS F	0.5	3.3	0.96	0.99	32.7
12	R	11	0.0	0.351	155.0	LOS F	1.1	8.0	0.99	1.01	15.3
Approach		1486	11.1	0.812	1.2	LOS F	1.1	8.0	0.01	0.02	95.9
All Vehicles		3417	7.8	1.754	146.9	NA	46.1	350.5	0.06	0.23	16.1

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).

Approach LOS values are based on the worst delay for any vehicle movement.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: Baseline MSR/Weedons - 2041 AM

Baseline - MSR/Weedons/Weedons Ross
2041 AM - EPA Vols - Baseline Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons S											
1	L	11	0.0	0.188	77.2	LOS F	0.6	4.3	0.97	1.00	27.2
2	T	45	16.3	1.741	3470.0	LOS F	46.1	350.5	1.00	2.99	0.6
3	R	60	5.3	1.765	3469.3	LOS F	46.1	350.5	1.00	2.99	0.8
Approach		116	9.1	1.754	3161.2	LOS F	46.1	350.5	1.00	2.81	0.8
East: MSR E											
4	L	117	7.2	0.800	13.6	LOS B	0.0	0.0	0.00	1.30	68.1
5	T	1321	12.4	0.798	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
6	R	53	22.0	0.993	1224.6	LOS F	10.7	88.8	1.00	1.76	1.7
Approach		1491	12.4	1.000	44.3	LOS F	10.7	88.8	0.04	0.16	39.2
North: Weedons Ross N											
7	L	11	10.0	0.957	650.3	LOS F	3.2	24.5	1.00	1.05	4.1
8	T	16	6.7	0.987	2420.4	LOS F	10.1	73.3	1.00	1.35	0.9
9	R	9	0.0	1.053	2420.8	LOS F	10.1	73.3	1.00	1.35	1.1
Approach		36	5.9	1.000	1899.9	LOS F	10.1	73.3	1.00	1.27	1.3
West: MSR W											
10	L	114	2.8	0.932	12.5	LOS B	0.0	0.0	0.00	1.32	63.6
11	T	1651	4.0	0.931	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
12	R	11	0.0	0.139	57.9	LOS F	0.5	3.3	0.96	0.99	32.7
Approach		1775	3.9	0.931	1.1	LOS F	0.5	3.3	0.01	0.09	96.1
All Vehicles		3417	7.8	1.754	146.9	NA	46.1	350.5	0.06	0.23	16.1

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: Baseline MSR/Weedons - 2041 IP

Baseline - MSR/Weedons/Weedons Ross
2041 IP - EPA Vols - Baseline Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons S											
1	L	11	0.0	0.068	35.9	LOS E	0.2	1.7	0.90	1.00	45.2
2	T	11	10.0	0.957	1481.0	LOS F	15.6	124.7	1.00	1.53	1.4
3	R	46	18.2	1.007	1482.1	LOS F	15.6	124.7	1.00	1.51	1.9
Approach		67	14.1	1.000	1256.0	LOS F	15.6	124.7	0.98	1.44	2.1
East: MSR E											
4	L	276	3.1	0.711	13.3	LOS B	0.0	0.0	0.00	1.13	68.1
5	T	958	21.2	0.711	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
6	R	11	0.0	0.113	49.6	LOS E	0.4	2.8	0.95	0.99	30.4
Approach		1244	17.0	0.711	3.4	LOS E	0.4	2.8	0.01	0.26	89.5
North: Weedons Ross N											
7	L	11	0.0	0.188	74.3	LOS F	0.6	4.4	0.97	1.01	24.6
8	T	12	9.1	0.965	815.9	LOS F	7.8	57.0	1.00	1.15	2.6
9	R	11	0.0	0.957	816.1	LOS F	7.8	57.0	1.00	1.15	3.3
Approach		33	3.2	1.000	576.7	LOS F	7.8	57.0	0.99	1.10	4.2
West: MSR W											
10	L	41	0.0	0.760	12.4	LOS B	0.0	0.0	0.00	1.32	63.6
11	T	1293	17.9	0.762	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
12	R	11	0.0	0.068	35.0	LOS E	0.3	1.8	0.92	0.98	44.5
Approach		1344	17.2	0.762	0.7	LOS E	0.3	1.8	0.01	0.05	97.7
All Vehicles		2688	16.9	1.000	40.4	NA	15.6	124.7	0.04	0.19	41.4

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: Baseline MSR/Weedons - 2041 PM

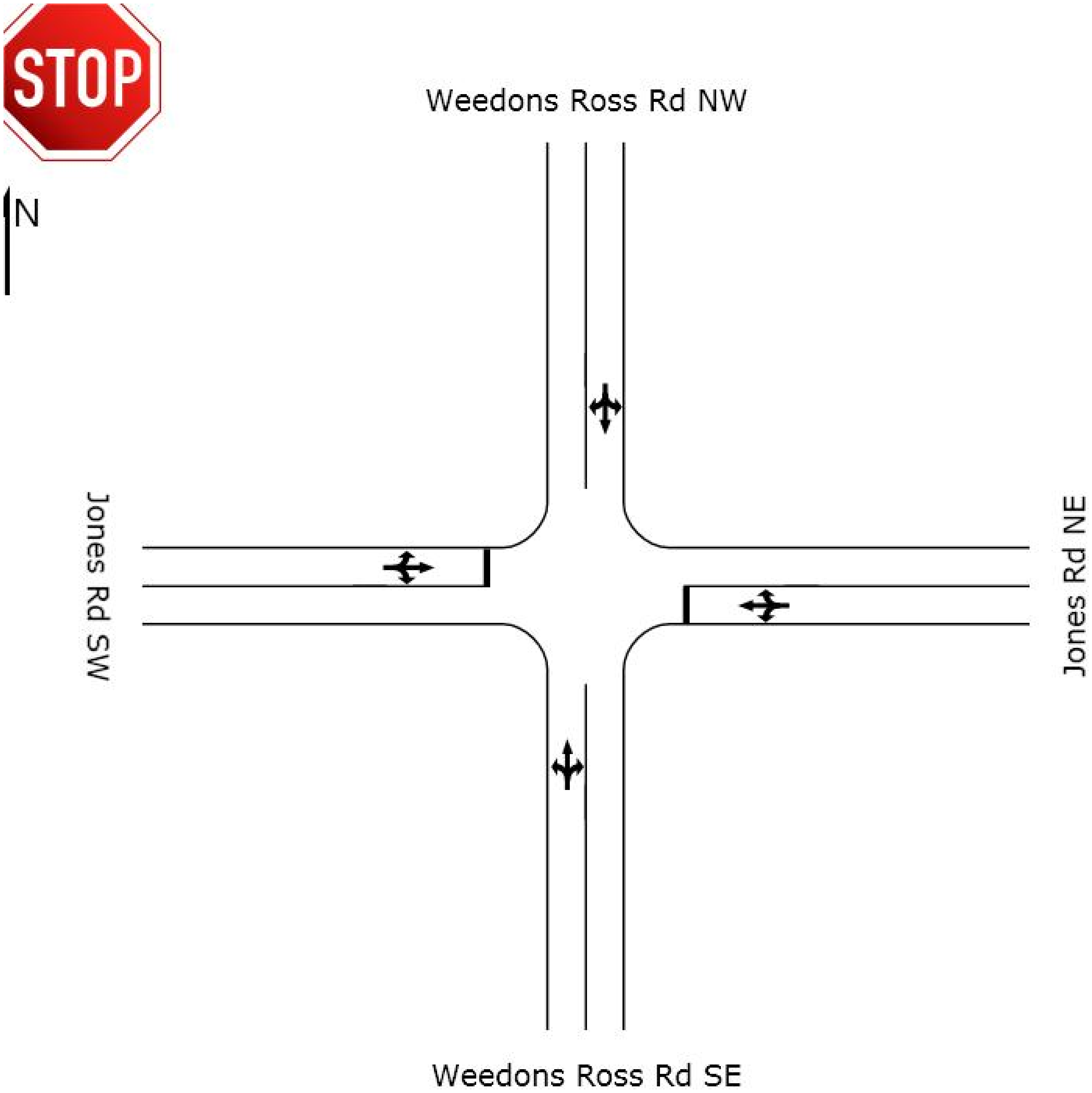
Baseline - MSR/Weedons/Weedons Ross
2041 PM - EPA Vols - Baseline Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons S											
1	L	11	0.0	0.191	77.9	LOS F	0.6	4.4	0.97	1.00	27.0
2	T	14	7.7	1.053	2839.6	LOS F	26.7	210.5	1.00	2.21	0.8
3	R	51	16.7	1.075	2840.7	LOS F	26.7	210.5	1.00	2.17	1.0
Approach		75	12.7	1.070	2451.4	LOS F	26.7	210.5	1.00	2.01	1.1
East: MSR E											
4	L	564	0.7	0.930	13.2	LOS B	0.0	0.0	0.00	1.05	68.1
5	T	1199	2.2	0.929	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
6	R	11	0.0	0.351	155.4	LOS F	1.1	8.0	0.99	1.01	12.3
Approach		1774	1.7	0.929	5.1	LOS F	1.1	8.0	0.01	0.34	84.8
North: Weedons Ross N											
7	L	11	0.0	0.702	394.8	LOS F	2.2	15.3	1.00	1.04	6.5
8	T	54	5.9	1.917	2437.6	LOS F	48.4	346.9	1.00	3.66	0.9
9	R	63	0.0	1.974	2438.0	LOS F	48.4	346.9	1.00	3.71	1.1
Approach		127	2.5	1.947	2268.9	LOS F	48.4	346.9	1.00	3.47	1.1
West: MSR W											
10	L	28	0.0	0.888	12.4	LOS B	0.0	0.0	0.00	1.32	63.6
11	T	1583	9.5	0.878	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
12	R	11	0.0	0.702	442.6	LOS F	2.3	16.2	1.00	1.02	6.0
Approach		1622	9.3	0.877	3.1	LOS F	2.3	16.2	0.01	0.03	90.3
All Vehicles		3598	5.4	1.947	135.2	NA	48.4	346.9	0.06	0.35	17.4

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

SIDRA INTERSECTION


STOP
N
Weedons Ross Rd NW
Jones Rd SW
Jones Rd NE
Weedons Ross Rd SE

MOVEMENT SUMMARY

Site: Baseline Weedons Ross/ Jones - 2016 AM

Baseline - Weedons Ross Rd/ Jones Rd
2016 AM - EPA Vols
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Ross Rd SE											
1	L	53	0.0	0.100	8.6	LOS A	0.6	4.8	0.26	0.55	43.9
2	T	53	24.0	0.100	0.4	LOS A	0.6	4.8	0.26	0.00	51.5
3	R	53	0.0	0.100	8.9	LOS A	0.6	4.8	0.26	0.72	43.8
Approach		158	8.0	0.100	6.0	LOS A	0.6	4.8	0.26	0.43	46.1
East: Jones Rd NE											
4	L	53	0.0	0.222	13.3	LOS B	1.2	8.4	0.33	0.81	44.5
5	T	53	2.0	0.222	13.0	LOS B	1.2	8.4	0.33	0.93	44.8
6	R	53	0.0	0.222	13.1	LOS B	1.2	8.4	0.33	0.99	44.6
Approach		158	0.7	0.223	13.1	LOS B	1.2	8.4	0.33	0.91	44.6
North: Weedons Ross Rd NW											
7	L	53	0.0	0.096	8.6	LOS A	0.6	4.5	0.28	0.54	48.1
8	T	53	0.0	0.096	0.5	LOS A	0.6	4.5	0.28	0.00	53.8
9	R	53	0.0	0.096	8.9	LOS A	0.6	4.5	0.28	0.72	48.1
Approach		158	0.0	0.096	6.0	LOS A	0.6	4.5	0.28	0.42	49.9
West: Jones Rd SW											
10	L	53	0.0	0.223	13.3	LOS B	1.2	8.4	0.35	0.81	44.5
11	T	53	2.0	0.223	13.0	LOS B	1.2	8.4	0.35	0.93	44.8
12	R	53	0.0	0.223	13.1	LOS B	1.2	8.4	0.35	0.99	44.7
Approach		158	0.7	0.223	13.1	LOS B	1.2	8.4	0.35	0.91	44.7
All Vehicles		632	2.3	0.223	9.6	NA	1.2	8.4	0.31	0.67	46.2

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: Baseline Weedons Ross/ Jones - 2016 IP

Baseline - Weedons Ross Rd/ Jones Rd
2016 IP - EPA Vols
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Ross Rd SE											
1	L	53	0.0	0.097	8.6	LOS A	0.6	4.5	0.26	0.55	43.9
2	T	53	6.0	0.097	0.4	LOS A	0.6	4.5	0.26	0.00	51.4
3	R	53	0.0	0.097	8.9	LOS A	0.6	4.5	0.26	0.72	43.8
Approach		158	2.0	0.097	6.0	LOS A	0.6	4.5	0.26	0.42	46.1
East: Jones Rd NE											
4	L	53	0.0	0.222	13.3	LOS B	1.2	8.4	0.33	0.81	44.5
5	T	53	2.0	0.222	13.0	LOS B	1.2	8.4	0.33	0.93	44.8
6	R	53	0.0	0.222	13.1	LOS B	1.2	8.4	0.33	0.99	44.7
Approach		158	0.7	0.222	13.1	LOS B	1.2	8.4	0.33	0.91	44.6
North: Weedons Ross Rd NW											
7	L	53	0.0	0.096	8.6	LOS A	0.6	4.5	0.27	0.55	48.2
8	T	53	0.0	0.096	0.4	LOS A	0.6	4.5	0.27	0.00	54.0
9	R	53	0.0	0.096	8.9	LOS A	0.6	4.5	0.27	0.72	48.1
Approach		158	0.0	0.096	6.0	LOS A	0.6	4.5	0.27	0.42	49.9
West: Jones Rd SW											
10	L	53	0.0	0.222	13.3	LOS B	1.2	8.4	0.33	0.81	44.5
11	T	53	2.0	0.222	13.0	LOS B	1.2	8.4	0.33	0.93	44.8
12	R	53	0.0	0.222	13.1	LOS B	1.2	8.4	0.33	0.99	44.7
Approach		158	0.7	0.222	13.1	LOS B	1.2	8.4	0.33	0.91	44.6
All Vehicles		632	0.8	0.222	9.5	NA	1.2	8.4	0.30	0.67	46.3

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: Baseline Weedons Ross/ Jones - 2016 PM

Baseline - Weedons Ross Rd/ Jones Rd
2016 PM - EPA Vols
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Ross Rd SE											
1	L	53	0.0	0.097	8.7	LOS A	0.7	4.6	0.30	0.53	43.8
2	T	53	0.0	0.097	0.5	LOS A	0.7	4.6	0.30	0.00	50.5
3	R	53	0.0	0.097	9.0	LOS A	0.7	4.6	0.30	0.72	43.7
Approach		158	0.0	0.097	6.1	LOS A	0.7	4.6	0.30	0.42	45.8
East: Jones Rd NE											
4	L	53	0.0	0.228	13.5	LOS B	1.2	8.6	0.38	0.81	44.4
5	T	53	2.0	0.228	13.2	LOS B	1.2	8.6	0.38	0.93	44.7
6	R	53	0.0	0.228	13.3	LOS B	1.2	8.6	0.38	0.99	44.6
Approach		158	0.7	0.228	13.3	LOS B	1.2	8.6	0.38	0.91	44.5
North: Weedons Ross Rd NW											
7	L	53	0.0	0.106	8.6	LOS A	0.6	5.2	0.26	0.55	48.2
8	T	53	58.0	0.106	0.4	LOS A	0.6	5.2	0.26	0.00	54.0
9	R	53	0.0	0.106	8.9	LOS A	0.6	5.2	0.26	0.72	48.1
Approach		158	19.3	0.106	6.0	LOS A	0.6	5.2	0.26	0.43	50.0
West: Jones Rd SW											
10	L	53	0.0	0.227	13.5	LOS B	1.2	8.5	0.34	0.81	44.3
11	T	53	2.0	0.227	13.1	LOS B	1.2	8.5	0.34	0.94	44.7
12	R	53	0.0	0.227	13.3	LOS B	1.2	8.5	0.34	1.00	44.5
Approach		158	0.7	0.227	13.3	LOS B	1.2	8.5	0.34	0.92	44.5
All Vehicles		632	5.2	0.228	9.7	NA	1.2	8.6	0.32	0.67	46.1

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

Processed: Monday, 15 October 2012 1:35:21 p.m.
SIDRA INTERSECTION 5.0.2.1437
Project: P:\339\3390691\TTR\EPA_Submission\99_ModelOutputs\02_SIDRA_Baseline \Baseline_xx_WeedonsRoss&Jones_EPAVols.sip
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SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: Baseline Weedons Ross/ Jones - 2026 AM

Baseline - Weedons Ross Rd/ Jones Rd
2026 AM - EPA Vols
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Ross Rd SE											
1	L	53	0.0	0.189	8.7	LOS A	1.2	11.2	0.26	0.63	44.4
2	T	161	70.6	0.189	0.5	LOS A	1.2	11.2	0.26	0.00	52.1
3	R	53	0.0	0.189	8.9	LOS A	1.2	11.2	0.26	0.82	44.2
Approach		266	42.7	0.189	3.8	LOS A	1.2	11.2	0.26	0.29	48.7
East: Jones Rd NE											
4	L	53	0.0	0.294	16.2	LOS C	1.6	11.6	0.38	0.81	42.1
5	T	53	2.0	0.294	15.8	LOS C	1.6	11.6	0.38	1.00	42.4
6	R	53	0.0	0.294	16.0	LOS C	1.6	11.6	0.38	1.03	42.2
Approach		158	0.7	0.294	16.0	LOS C	1.6	11.6	0.38	0.95	42.2
North: Weedons Ross Rd NW											
7	L	53	0.0	0.107	9.7	LOS A	0.8	5.6	0.49	0.38	47.5
8	T	53	8.0	0.107	1.5	LOS A	0.8	5.6	0.49	0.00	49.7
9	R	53	0.0	0.107	10.0	LOS A	0.8	5.6	0.49	0.77	47.6
Approach		158	2.7	0.107	7.1	LOS A	0.8	5.6	0.49	0.38	48.3
West: Jones Rd SW											
10	L	53	0.0	0.315	17.0	LOS C	1.9	13.3	0.60	0.93	41.7
11	T	56	1.9	0.315	16.7	LOS C	1.9	13.3	0.60	1.03	42.0
12	R	53	6.0	0.315	17.2	LOS C	1.9	13.3	0.60	1.04	41.9
Approach		161	2.6	0.316	17.0	LOS C	1.9	13.3	0.60	1.00	41.9
All Vehicles		743	16.6	0.316	9.9	NA	1.9	13.3	0.41	0.60	45.1

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

Processed: Monday, 15 October 2012 1:35:21 p.m.
SIDRA INTERSECTION 5.0.2.1437
Project: P:\339\3390691\TTR\EPA_Submission\99_ModelOutputs\02_SIDRA_Baseline\Baseline_xx_WeedonsRoss&Jones_EPAVols.sip
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SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: Baseline Weedons Ross/ Jones - 2026 IP

Baseline - Weedons Ross Rd/ Jones Rd
2026 IP - EPA Vols
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Ross Rd SE											
1	L	53	0.0	0.097	8.6	LOS A	0.6	4.6	0.26	0.55	43.9
2	T	53	10.0	0.097	0.4	LOS A	0.6	4.6	0.26	0.00	51.4
3	R	53	0.0	0.097	8.9	LOS A	0.6	4.6	0.26	0.72	43.8
Approach		158	3.3	0.097	6.0	LOS A	0.6	4.6	0.26	0.42	46.1
East: Jones Rd NE											
4	L	53	0.0	0.222	13.3	LOS B	1.2	8.4	0.33	0.81	44.5
5	T	53	2.0	0.222	13.0	LOS B	1.2	8.4	0.33	0.93	44.8
6	R	53	0.0	0.222	13.1	LOS B	1.2	8.4	0.33	0.99	44.7
Approach		158	0.7	0.222	13.1	LOS B	1.2	8.4	0.33	0.91	44.6
North: Weedons Ross Rd NW											
7	L	53	0.0	0.096	8.6	LOS A	0.6	4.5	0.27	0.55	48.2
8	T	53	0.0	0.096	0.4	LOS A	0.6	4.5	0.27	0.00	54.0
9	R	53	0.0	0.096	8.9	LOS A	0.6	4.5	0.27	0.72	48.1
Approach		158	0.0	0.096	6.0	LOS A	0.6	4.5	0.27	0.42	49.9
West: Jones Rd SW											
10	L	53	0.0	0.222	13.3	LOS B	1.2	8.4	0.34	0.81	44.5
11	T	53	2.0	0.222	13.0	LOS B	1.2	8.4	0.34	0.93	44.8
12	R	53	0.0	0.222	13.1	LOS B	1.2	8.4	0.34	0.99	44.7
Approach		158	0.7	0.223	13.1	LOS B	1.2	8.4	0.34	0.91	44.6
All Vehicles		632	1.2	0.223	9.5	NA	1.2	8.4	0.30	0.67	46.3

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

Processed: Monday, 15 October 2012 1:35:21 p.m.
SIDRA INTERSECTION 5.0.2.1437
Project: P:\339\3390691\TTR\EPA_Submission\99_ModelOutputs\02_SIDRA_Baseline\Baseline_xx_WeedonsRoss&Jones_EPAVols.sip
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SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: Baseline Weedons Ross/ Jones - 2026 PM

Baseline - Weedons Ross Rd/ Jones Rd
2026 PM - EPA Vols
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Ross Rd SE											
1	L	53	0.0	0.106	9.5	LOS A	0.8	5.5	0.46	0.41	43.2
2	T	53	14.0	0.106	1.3	LOS A	0.8	5.5	0.46	0.00	46.5
3	R	53	0.0	0.106	9.7	LOS A	0.8	5.5	0.46	0.76	43.3
Approach		158	4.7	0.106	6.8	LOS A	0.8	5.5	0.46	0.39	44.3
East: Jones Rd NE											
4	L	53	0.0	0.288	15.9	LOS C	1.6	11.3	0.56	0.89	42.6
5	T	53	2.0	0.288	15.6	LOS C	1.6	11.3	0.56	1.01	42.9
6	R	53	0.0	0.288	15.7	LOS C	1.6	11.3	0.56	1.03	42.8
Approach		158	0.7	0.287	15.8	LOS C	1.6	11.3	0.56	0.98	42.7
North: Weedons Ross Rd NW											
7	L	53	8.0	0.170	8.9	LOS A	1.0	9.8	0.26	0.62	48.5
8	T	127	81.0	0.170	0.5	LOS A	1.0	9.8	0.26	0.00	54.4
9	R	53	0.0	0.170	8.9	LOS A	1.0	9.8	0.26	0.80	48.4
Approach		233	46.2	0.170	4.3	LOS A	1.0	9.8	0.26	0.32	51.5
West: Jones Rd SW											
10	L	53	0.0	0.277	15.3	LOS C	1.5	10.4	0.38	0.80	42.8
11	T	53	2.0	0.277	15.0	LOS C	1.5	10.4	0.38	0.99	43.1
12	R	53	0.0	0.277	15.2	LOS C	1.5	10.4	0.38	1.02	42.9
Approach		158	0.7	0.277	15.2	LOS C	1.5	10.4	0.38	0.94	42.9
All Vehicles		706	16.5	0.287	9.9	NA	1.6	11.3	0.40	0.62	45.8

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: Baseline Weedons Ross/ Jones - 2041 AM

Baseline - Weedons Ross Rd/ Jones Rd
2041 AM - EPA Vols
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Ross Rd SE											
1	L	53	0.0	0.223	9.2	LOS A	1.5	14.9	0.37	0.55	44.3
2	T	191	83.4	0.223	1.0	LOS A	1.5	14.9	0.37	0.00	49.5
3	R	53	0.0	0.223	9.4	LOS A	1.5	14.9	0.37	0.84	44.2
Approach		296	53.7	0.223	3.9	LOS A	1.5	14.9	0.37	0.25	47.5
East: Jones Rd NE											
4	L	53	0.0	0.402	21.6	LOS C	2.5	17.8	0.58	0.90	38.4
5	T	53	2.0	0.402	21.2	LOS C	2.5	17.8	0.58	1.06	38.6
6	R	53	0.0	0.402	21.4	LOS C	2.5	17.8	0.58	1.07	38.5
Approach		158	0.7	0.402	21.4	LOS C	2.5	17.8	0.58	1.01	38.5
North: Weedons Ross Rd NW											
7	L	53	0.0	0.146	10.3	LOS B	1.0	9.3	0.54	0.36	47.6
8	T	74	98.6	0.146	2.1	LOS A	1.0	9.3	0.54	0.00	49.1
9	R	53	0.0	0.146	10.5	LOS B	1.0	9.3	0.54	0.83	47.5
Approach		179	40.6	0.146	7.0	LOS B	1.0	9.3	0.54	0.35	48.2
West: Jones Rd SW											
10	L	53	12.0	0.731	32.7	LOS D	7.1	52.6	0.84	1.40	32.6
11	T	101	6.3	0.732	31.9	LOS D	7.1	52.6	0.84	1.32	32.7
12	R	106	4.0	0.733	32.0	LOS D	7.1	52.6	0.84	1.32	32.7
Approach		260	6.5	0.732	32.1	LOS D	7.1	52.6	0.84	1.34	32.7
All Vehicles		893	27.9	0.732	15.8	NA	7.1	52.6	0.58	0.72	39.9

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: Baseline Weedons Ross/ Jones - 2041 IP

Baseline - Weedons Ross Rd/ Jones Rd
2041 IP - EPA Vols
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Ross Rd SE											
1	L	53	0.0	0.101	8.6	LOS A	0.6	4.9	0.27	0.55	43.9
2	T	53	32.0	0.101	0.4	LOS A	0.6	4.9	0.27	0.00	51.3
3	R	53	0.0	0.101	8.9	LOS A	0.6	4.9	0.27	0.72	43.7
Approach		158	10.7	0.101	6.0	LOS A	0.6	4.9	0.27	0.42	46.1
East: Jones Rd NE											
4	L	53	0.0	0.226	13.4	LOS B	1.2	8.5	0.35	0.81	44.4
5	T	53	2.0	0.226	13.1	LOS B	1.2	8.5	0.35	0.94	44.7
6	R	53	0.0	0.226	13.2	LOS B	1.2	8.5	0.35	0.99	44.6
Approach		158	0.7	0.226	13.2	LOS B	1.2	8.5	0.35	0.91	44.6
North: Weedons Ross Rd NW											
7	L	53	0.0	0.099	8.7	LOS A	0.6	4.7	0.28	0.54	48.1
8	T	53	18.0	0.099	0.5	LOS A	0.6	4.7	0.28	0.00	53.7
9	R	53	0.0	0.099	8.9	LOS A	0.6	4.7	0.28	0.72	48.1
Approach		158	6.0	0.099	6.0	LOS A	0.6	4.7	0.28	0.42	49.8
West: Jones Rd SW											
10	L	53	0.0	0.226	13.4	LOS B	1.2	8.5	0.36	0.81	44.4
11	T	53	2.0	0.226	13.1	LOS B	1.2	8.5	0.36	0.94	44.7
12	R	53	0.0	0.226	13.2	LOS B	1.2	8.5	0.36	0.99	44.6
Approach		158	0.7	0.226	13.3	LOS B	1.2	8.5	0.36	0.91	44.6
All Vehicles		632	4.5	0.226	9.6	NA	1.2	8.5	0.31	0.67	46.2

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

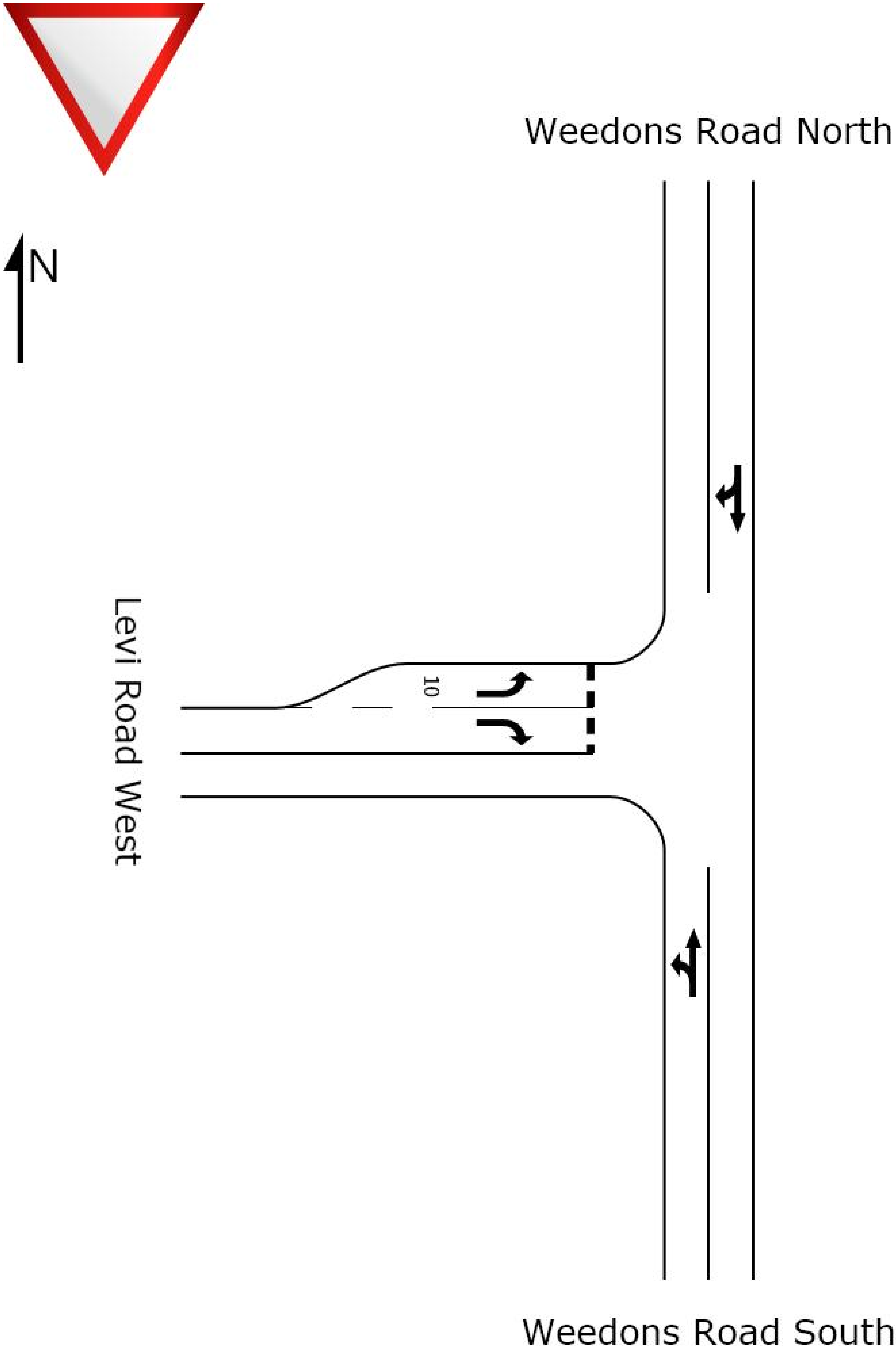
Site: Baseline Weedons Ross/ Jones - 2041 PM

Baseline - Weedons Ross Rd/ Jones Rd
2041 PM - EPA Vols
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Ross Rd SE											
1	L	53	0.0	0.150	10.3	LOS B	1.0	9.7	0.54	0.36	43.2
2	T	83	83.5	0.150	2.1	LOS A	1.0	9.7	0.54	0.00	45.1
3	R	53	0.0	0.150	10.6	LOS B	1.0	9.7	0.54	0.84	43.1
Approach		188	36.9	0.150	6.8	LOS B	1.0	9.7	0.54	0.34	44.0
East: Jones Rd NE											
4	L	53	2.0	0.396	21.3	LOS C	2.4	17.3	0.68	1.04	38.8
5	T	53	2.0	0.396	20.9	LOS C	2.4	17.3	0.68	1.07	39.0
6	R	53	0.0	0.396	21.0	LOS C	2.4	17.3	0.68	1.08	38.9
Approach		158	1.3	0.396	21.0	LOS C	2.4	17.3	0.68	1.06	38.9
North: Weedons Ross Rd NW											
7	L	65	4.8	0.228	9.3	LOS A	1.5	15.3	0.39	0.53	48.4
8	T	193	76.0	0.228	1.0	LOS A	1.5	15.3	0.39	0.00	52.1
9	R	53	0.0	0.228	9.5	LOS A	1.5	15.3	0.39	0.83	48.4
Approach		311	48.1	0.228	4.2	LOS A	1.5	15.3	0.39	0.25	50.7
West: Jones Rd SW											
10	L	53	0.0	0.381	20.6	LOS C	2.4	16.7	0.58	0.89	39.1
11	T	53	2.0	0.381	20.2	LOS C	2.4	16.7	0.58	1.05	39.3
12	R	53	0.0	0.381	20.4	LOS C	2.4	16.7	0.58	1.07	39.2
Approach		158	0.7	0.382	20.4	LOS C	2.4	16.7	0.58	1.00	39.2
All Vehicles		815	27.3	0.396	11.2	NA	2.4	17.3	0.52	0.57	44.1

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.



N
Weedons Road North
Levi Road West
10
Weedons Road South

MOVEMENT SUMMARY

Site: Baseline - Weedons/Levi - 2016 AM

Weedons Rd/Levi Rd
EPA Flows - 2016 AM - Baseline Network
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Road South											
1	L	11	0.0	0.011	12.6	LOS B	0.0	0.0	0.00	1.00	69.1
2	T	11	0.0	0.011	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
Approach		21	0.0	0.011	6.3	LOS B	0.0	0.0	0.00	0.50	81.9
North: Weedons Road North											
8	T	12	9.1	0.020	0.1	LOS A	0.1	0.6	0.07	0.00	94.6
9	R	21	20.0	0.020	14.1	LOS B	0.1	0.6	0.07	0.89	69.2
Approach		33	16.1	0.020	9.1	LOS B	0.1	0.6	0.07	0.58	76.6
West: Levi Road West											
10	L	52	10.2	0.083	13.5	LOS B	0.2	1.2	0.17	0.66	67.9
12	R	11	0.0	0.011	12.5	LOS B	0.0	0.2	0.13	0.71	68.8
Approach		62	8.5	0.083	13.3	LOS B	0.2	1.2	0.17	0.67	68.1
All Vehicles		116	9.1	0.083	10.8	NA	0.2	1.2	0.11	0.61	72.6

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

Processed: Wednesday, 22 August 2012 11:37:43 a.m.
SIDRA INTERSECTION 5.0.2.1437
Project: D:\3390691_CSM2__Final\99_ModelOutputs\02_SIDRA_Baseline\Baseline_Weedons&Levi_EPAVols.sip
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SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: Baseline - Weedons/Levi - 2016 IP

Weedons Rd/Levi Rd
EPA Flows - 2016 IP - Baseline Network
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Road South											
1	L	11	0.0	0.011	12.6	LOS B	0.0	0.0	0.00	1.00	69.1
2	T	11	0.0	0.011	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
Approach		21	0.0	0.011	6.3	LOS B	0.0	0.0	0.00	0.50	81.9
North: Weedons Road North											
8	T	12	9.1	0.023	0.1	LOS A	0.1	0.7	0.07	0.00	94.6
9	R	27	15.4	0.023	13.7	LOS B	0.1	0.7	0.07	0.86	69.2
Approach		39	13.5	0.023	9.6	LOS B	0.1	0.7	0.07	0.60	75.3
West: Levi Road West											
10	L	32	10.0	0.051	13.4	LOS B	0.1	0.7	0.11	0.70	68.4
12	R	11	0.0	0.011	12.5	LOS B	0.0	0.2	0.14	0.71	68.8
Approach		42	7.5	0.051	13.2	LOS B	0.1	0.7	0.11	0.70	68.5
All Vehicles		102	8.2	0.051	10.4	NA	0.1	0.7	0.07	0.62	73.5

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: Baseline - Weedons/Levi - 2016 PM

Weedons Rd/Levi Rd
EPA Flows - 2016 PM - Baseline Network
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Road South											
1	L	11	0.0	0.012	12.6	LOS B	0.0	0.0	0.00	1.02	69.1
2	T	12	9.1	0.012	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
Approach		22	4.8	0.012	6.0	LOS B	0.0	0.0	0.00	0.48	82.6
North: Weedons Road North											
8	T	11	0.0	0.138	0.1	LOS A	0.6	4.2	0.08	0.00	93.8
9	R	235	2.2	0.138	12.7	LOS B	0.6	4.2	0.08	0.74	68.9
Approach		245	2.1	0.138	12.1	LOS B	0.6	4.2	0.08	0.71	69.7
West: Levi Road West											
10	L	42	12.5	0.070	13.6	LOS B	0.1	1.0	0.14	0.68	68.1
12	R	11	0.0	0.014	13.8	LOS B	0.0	0.3	0.34	0.71	67.1
Approach		53	10.0	0.070	13.6	LOS B	0.1	1.0	0.18	0.69	67.9
All Vehicles		320	3.6	0.138	11.9	NA	0.6	4.2	0.09	0.69	70.2

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: Baseline - Weedons/Levi - 2026 AM

Weedons Rd/Levi Rd
EPA Flows - 2026 AM - Baseline Network
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Road South											
1	L	11	0.0	0.011	12.6	LOS B	0.0	0.0	0.00	1.00	69.1
2	T	11	0.0	0.011	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
Approach		21	0.0	0.011	6.3	LOS B	0.0	0.0	0.00	0.50	81.9
North: Weedons Road North											
8	T	12	9.1	0.023	0.1	LOS A	0.1	0.8	0.08	0.00	94.2
9	R	24	30.4	0.023	14.9	LOS B	0.1	0.8	0.08	0.88	69.2
Approach		36	23.5	0.023	10.1	LOS B	0.1	0.8	0.08	0.59	75.8
West: Levi Road West											
10	L	62	11.9	0.102	13.6	LOS B	0.2	1.5	0.22	0.64	67.6
12	R	11	0.0	0.011	12.5	LOS B	0.0	0.2	0.14	0.71	68.8
Approach		73	10.1	0.102	13.5	LOS B	0.2	1.5	0.21	0.65	67.8
All Vehicles		129	12.2	0.102	11.4	NA	0.2	1.5	0.14	0.61	71.9

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: Baseline - Weedons/Levi - 2026 IP

Weedons Rd/Levi Rd
EPA Flows - 2026 IP - Baseline Network
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Road South											
1	L	11	0.0	0.011	12.6	LOS B	0.0	0.0	0.00	1.00	69.1
2	T	11	0.0	0.011	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
Approach		21	0.0	0.011	6.3	LOS B	0.0	0.0	0.00	0.50	81.9
North: Weedons Road North											
8	T	12	9.1	0.038	0.0	LOS A	0.1	1.1	0.07	0.00	94.5
9	R	53	12.0	0.038	13.4	LOS B	0.1	1.1	0.07	0.80	69.1
Approach		64	11.5	0.038	11.0	LOS B	0.1	1.1	0.07	0.66	72.6
West: Levi Road West											
10	L	39	16.2	0.068	13.9	LOS B	0.1	1.0	0.14	0.68	68.1
12	R	11	0.0	0.011	12.7	LOS B	0.0	0.3	0.18	0.70	68.6
Approach		49	12.8	0.068	13.6	LOS B	0.1	1.0	0.15	0.68	68.2
All Vehicles		135	10.2	0.068	11.2	NA	0.1	1.1	0.09	0.64	72.2

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: Baseline - Weedons/Levi - 2026 PM

Weedons Rd/Levi Rd
EPA Flows - 2026 PM - Baseline Network
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Road South											
1	L	13	0.0	0.013	12.6	LOS B	0.0	0.0	0.00	0.99	69.1
2	T	12	9.1	0.013	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
Approach		24	4.3	0.013	6.6	LOS B	0.0	0.0	0.00	0.51	81.3
North: Weedons Road North											
8	T	11	0.0	0.223	0.1	LOS A	1.0	7.3	0.09	0.00	93.0
9	R	385	1.6	0.223	12.6	LOS B	1.0	7.3	0.09	0.73	68.8
Approach		396	1.6	0.223	12.3	LOS B	1.0	7.3	0.09	0.71	69.3
West: Levi Road West											
10	L	47	15.6	0.082	13.9	LOS B	0.1	1.2	0.16	0.67	68.0
12	R	11	0.0	0.017	15.0	LOS B	0.1	0.4	0.44	0.75	65.3
Approach		58	12.7	0.082	14.1	LOS B	0.1	1.2	0.21	0.69	67.5
All Vehicles		478	3.1	0.223	12.2	NA	1.0	7.3	0.10	0.70	69.6

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: Baseline - Weedons/Levi - 2041 AM

Weedons Rd/Levi Rd
EPA Flows - 2041 AM - Baseline Network
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Road South											
1	L	11	0.0	0.012	12.6	LOS B	0.0	0.0	0.00	1.02	69.1
2	T	12	9.1	0.012	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
Approach		22	4.8	0.012	6.0	LOS B	0.0	0.0	0.00	0.48	82.6
North: Weedons Road North											
8	T	12	9.1	0.076	0.1	LOS A	0.3	2.3	0.07	0.00	94.1
9	R	121	7.0	0.076	13.0	LOS B	0.3	2.3	0.07	0.76	69.0
Approach		133	7.1	0.076	11.9	LOS B	0.3	2.3	0.07	0.69	70.6
West: Levi Road West											
10	L	104	8.1	0.162	13.5	LOS B	0.3	2.4	0.34	0.57	66.8
12	R	13	0.0	0.015	13.1	LOS B	0.0	0.3	0.25	0.70	68.1
Approach		117	7.2	0.162	13.4	LOS B	0.3	2.4	0.33	0.59	66.9
All Vehicles		272	7.0	0.162	12.1	NA	0.3	2.4	0.18	0.63	69.8

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: Baseline - Weedons/Levi - 2041 IP

Weedons Rd/Levi Rd
EPA Flows - 2041 IP - Baseline Network
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Road South											
1	L	11	0.0	0.011	12.6	LOS B	0.0	0.0	0.00	1.00	69.1
2	T	11	0.0	0.011	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
Approach		21	0.0	0.011	6.3	LOS B	0.0	0.0	0.00	0.50	81.9
North: Weedons Road North											
8	T	12	9.1	0.106	0.0	LOS A	0.4	3.2	0.07	0.00	94.2
9	R	177	4.8	0.106	12.8	LOS B	0.4	3.2	0.07	0.75	68.9
Approach		188	5.0	0.106	12.1	LOS B	0.4	3.2	0.07	0.70	70.1
West: Levi Road West											
10	L	46	18.2	0.083	14.1	LOS B	0.1	1.2	0.17	0.66	67.9
12	R	11	0.0	0.013	13.4	LOS B	0.0	0.3	0.30	0.71	67.8
Approach		57	14.8	0.083	14.0	LOS B	0.1	1.2	0.20	0.67	67.9
All Vehicles		266	6.7	0.106	12.0	NA	0.4	3.2	0.09	0.68	70.4

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: Baseline - Weedons/Levi - 2041 PM

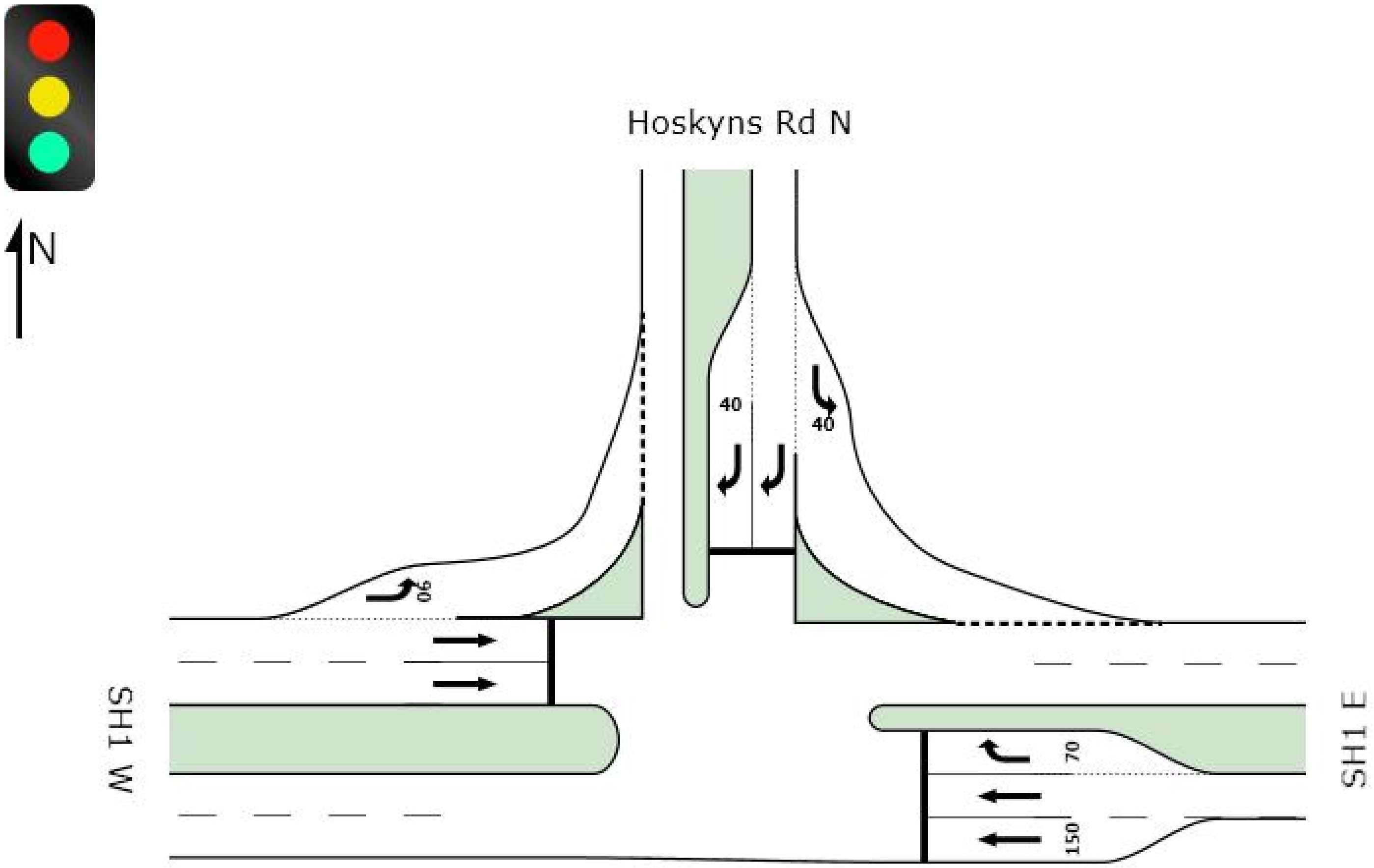
Weedons Rd/Levi Rd
EPA Flows - 2041 PM - Baseline Network
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Road South											
1	L	22	0.0	0.019	12.6	LOS B	0.0	0.0	0.00	0.92	69.1
2	T	13	8.3	0.019	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
Approach		35	3.0	0.019	8.0	LOS B	0.0	0.0	0.00	0.58	78.0
North: Weedons Road North											
8	T	12	9.1	0.266	0.1	LOS A	1.3	9.1	0.11	0.00	91.1
9	R	457	1.6	0.266	12.7	LOS B	1.3	9.1	0.11	0.72	68.6
Approach		468	1.8	0.266	12.3	LOS B	1.3	9.1	0.11	0.70	69.1
West: Levi Road West											
10	L	53	14.0	0.089	13.8	LOS B	0.2	1.3	0.16	0.68	68.0
12	R	11	0.0	0.019	15.7	LOS C	0.1	0.4	0.48	0.78	64.2
Approach		63	11.7	0.089	14.1	LOS C	0.2	1.3	0.21	0.69	67.3
All Vehicles		566	3.0	0.266	12.3	NA	1.3	9.1	0.12	0.69	69.4

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

SIDRA INTERSECTION


Hoskyns Rd N
N
40
40
90
SH1 W
SH1 E
70
150

MOVEMENT SUMMARY

Site: Baseline - MSR/Hoskyns - 2016 AM

Baseline - MSR/Hoskyns Road
2016 AM - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 90 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: SH1 E											
5	T	684	15.1	0.273	3.2	LOS A	6.3	50.0	0.31	0.27	69.6
6	R	74	20.0	0.335	16.9	LOS B	1.7	13.7	0.57	0.76	49.2
Approach		758	15.6	0.335	4.5	LOS A	6.3	50.0	0.34	0.32	67.2
North: Hoskyns Rd N											
7	L	64	14.8	0.222	12.5	LOS B	1.3	10.3	0.36	0.71	48.2
9	R	231	7.3	0.646	54.7	LOS D	6.8	50.9	1.00	0.83	26.2
Approach		295	8.9	0.646	45.5	LOS D	6.8	50.9	0.86	0.80	29.2
West: SH1 W											
10	L	218	8.2	0.160	10.2	LOS B	0.5	3.6	0.06	0.67	57.1
11	T	1427	5.7	0.648	5.1	LOS A	13.2	97.0	0.34	0.31	65.8
Approach		1645	6.0	0.648	5.8	LOS A	13.2	97.0	0.31	0.36	64.6
All Vehicles		2698	9.0	0.648	9.8	LOS A	13.2	97.0	0.37	0.40	57.6

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

Processed: Thursday, 3 May 2012 5:55:36 p.m.
SIDRA INTERSECTION 5.0.2.1437

Project: P:\339\3390691\TTR\FinalScheme_1203\SIDRA_Baseline\Baseline_6_Hoskyns&Rolleston_EPAVols.sip
8000924, BECA INFRASTRUCTURE LIMITED, FLOATING

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: Baseline - MSR/Hoskyns - 2016 IP

Baseline - MSR/Hoskyns Road
2016 IP - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 70 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: SH1 E											
5	T	653	13.9	0.266	3.7	LOS A	5.6	43.6	0.37	0.32	68.0
6	R	43	26.8	0.138	15.6	LOS B	0.7	6.4	0.51	0.72	50.9
Approach		696	14.7	0.266	4.5	LOS A	5.6	43.6	0.38	0.35	66.8
North: Hoskyns Rd N											
7	L	45	23.3	0.116	11.2	LOS B	0.5	4.1	0.29	0.68	49.7
9	R	175	4.2	0.420	42.4	LOS D	4.2	30.3	0.97	0.77	30.2
Approach		220	8.1	0.420	36.0	LOS D	4.2	30.3	0.83	0.75	32.9
West: SH1 W											
10	L	164	7.7	0.120	10.1	LOS B	0.3	2.0	0.06	0.67	57.1
11	T	774	14.4	0.432	7.0	LOS A	7.5	58.8	0.42	0.36	62.1
Approach		938	13.2	0.432	7.6	LOS A	7.5	58.8	0.35	0.42	61.3
All Vehicles		1854	13.2	0.432	9.8	LOS A	7.5	58.8	0.42	0.43	57.2

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

MOVEMENT SUMMARY

Site: Baseline - MSR/Hoskyns - 2016 PM

Baseline - MSR/Hoskyns Road
2016 PM - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 60 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: SH1 E											
5	T	1281	4.4	0.522	6.0	LOS A	11.7	85.2	0.57	0.51	62.6
6	R	55	1.9	0.156	18.3	LOS B	1.0	6.9	0.73	0.75	47.1
Approach		1336	4.3	0.522	6.5	LOS A	11.7	85.2	0.57	0.52	61.9
North: Hoskyns Rd N											
7	L	69	7.6	0.119	13.4	LOS B	1.2	8.9	0.47	0.71	47.1
9	R	352	8.4	0.662	38.0	LOS D	6.9	52.0	0.99	0.86	32.0
Approach		421	8.2	0.662	33.9	LOS C	6.9	52.0	0.91	0.83	33.8
West: SH1 W											
10	L	207	2.0	0.142	10.0	LOS B	0.3	2.1	0.06	0.67	57.1
11	T	1055	11.8	0.700	11.9	LOS B	13.6	104.4	0.70	0.62	53.7
Approach		1262	10.2	0.700	11.6	LOS B	13.6	104.4	0.60	0.63	54.2
All Vehicles		3019	7.3	0.700	12.4	LOS B	13.6	104.4	0.63	0.61	52.7

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

MOVEMENT SUMMARY

Site: Baseline - MSR/Hoskyns - 2026 AM

Baseline - MSR/Hoskyns Road
2026 AM - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 75 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: SH1 E											
5	T	793	15.8	0.323	3.7	LOS A	7.0	55.4	0.37	0.32	68.2
6	R	251	13.9	0.794	32.6	LOS C	9.7	75.8	1.00	0.95	36.2
Approach		1043	15.3	0.794	10.6	LOS B	9.7	75.8	0.52	0.47	57.2
North: Hoskyns Rd N											
7	L	63	18.3	0.170	16.6	LOS B	1.7	13.5	0.53	0.73	44.7
9	R	300	7.4	0.789	50.2	LOS D	7.7	57.6	1.00	0.93	27.6
Approach		363	9.3	0.789	44.4	LOS D	7.7	57.6	0.92	0.89	29.5
West: SH1 W											
10	L	491	19.1	0.430	10.6	LOS B	1.3	10.2	0.09	0.67	56.9
11	T	1601	1.6	0.801	9.8	LOS A	22.3	158.5	0.62	0.58	56.8
Approach		2092	5.7	0.801	10.0	LOS B	22.3	158.5	0.49	0.60	56.8
All Vehicles		3498	8.9	0.801	13.8	LOS B	22.3	158.5	0.55	0.59	51.9

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

MOVEMENT SUMMARY

Site: Baseline - MSR/Hoskyns - 2026 IP

Baseline - MSR/Hoskyns Road
2026 IP - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 70 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: SH1 E											
5	T	820	13.2	0.340	4.4	LOS A	7.4	57.8	0.42	0.36	66.5
6	R	93	37.5	0.380	18.4	LOS B	1.8	16.8	0.68	0.77	48.1
Approach		913	15.7	0.380	5.8	LOS A	7.4	57.8	0.44	0.41	64.3
North: Hoskyns Rd N											
7	L	92	32.2	0.244	13.0	LOS B	1.6	14.4	0.41	0.71	48.1
9	R	264	3.6	0.562	42.1	LOS D	6.0	43.5	0.98	0.80	30.3
Approach		356	10.9	0.562	34.6	LOS C	6.0	43.5	0.84	0.78	33.5
West: SH1 W											
10	L	246	6.8	0.183	10.2	LOS B	0.5	3.4	0.06	0.67	57.1
11	T	993	13.7	0.567	8.4	LOS A	10.8	84.8	0.50	0.44	59.4
Approach		1239	12.3	0.567	8.7	LOS A	10.8	84.8	0.42	0.49	59.0
All Vehicles		2507	13.4	0.567	11.3	LOS B	10.8	84.8	0.49	0.50	54.7

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

Processed: Thursday, 3 May 2012 5:55:38 p.m.
SIDRA INTERSECTION 5.0.2.1437

Project: P:\339\3390691\TTR\FinalScheme_1203\SIDRA_Baseline\Baseline_6_Hoskyns&Rolleston_EPAVols.sip
8000924, BECA INFRASTRUCTURE LIMITED, FLOATING

MOVEMENT SUMMARY

Site: Baseline - MSR/Hoskyns - 2026 PM

Baseline - MSR/Hoskyns Road
2026 PM - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 80 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: SH1 E											
5	T	1292	1.2	0.616	12.3	LOS B	18.7	132.4	0.71	0.63	53.3
6	R	44	4.8	0.186	27.6	LOS C	1.3	9.4	0.91	0.74	39.3
Approach		1336	1.3	0.616	12.8	LOS B	18.7	132.4	0.71	0.64	52.7
North: Hoskyns Rd N											
7	L	214	8.4	0.435	19.0	LOS B	6.0	44.8	0.59	0.74	42.6
9	R	701	12.8	0.939	55.1	LOS E	25.3	196.4	0.96	1.02	26.2
Approach		915	11.7	0.939	46.6	LOS D	25.3	196.4	0.88	0.96	28.8
West: SH1 W											
10	L	297	3.5	0.188	10.1	LOS B	0.6	4.3	0.06	0.67	57.1
11	T	1263	11.8	0.914	28.0	LOS C	31.4	241.7	0.91	0.91	39.3
Approach		1560	10.2	0.914	24.6	LOS C	31.4	241.7	0.75	0.86	41.5
All Vehicles		3811	7.5	0.939	25.7	LOS C	31.4	241.7	0.77	0.81	40.3

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS E. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

MOVEMENT SUMMARY

Site: Baseline - MSR/Hoskyns - 2041 AM

Baseline - MSR/Hoskyns Road
2041 AM - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 75 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: SH1 E											
5	T	999	19.9	0.419	4.4	LOS A	9.6	74.3	0.42	0.37	65.3
6	R	331	1.4	1.000[3]	76.5	LOS E	17.3	122.7	1.00	1.17	20.9
Approach		1329	12.4	1.000	22.3	LOS C	17.3	122.7	0.57	0.57	44.2
North: Hoskyns Rd N											
7	L	78	31.1	0.225	19.8	LOS B	2.4	21.3	0.61	0.74	42.4
9	R	400	7.6	0.937	59.2	LOS E	11.3	83.9	1.00	1.07	25.0
Approach		478	11.5	0.937	52.8	LOS D	11.3	83.9	0.94	1.01	26.8
West: SH1 W											
10	L	719	14.5	0.589	10.7	LOS B	2.6	20.7	0.11	0.69	56.7
11	T	1686	2.7	0.871	13.7	LOS B	30.2	216.1	0.72	0.70	51.6
Approach		2405	6.2	0.871	12.8	LOS B	30.2	216.1	0.54	0.70	52.9
All Vehicles		4213	8.7	1.000	20.4	LOS C	30.2	216.1	0.59	0.69	45.1

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS E. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

MOVEMENT SUMMARY

Site: Baseline - MSR/Hoskyns - 2041 IP

Baseline - MSR/Hoskyns Road
2041 IP - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 60 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: SH1 E											
5	T	733	18.5	0.334	5.5	LOS A	6.7	54.0	0.49	0.43	63.9
6	R	236	28.6	0.813	30.2	LOS C	6.8	59.2	1.00	0.94	38.0
Approach		968	21.0	0.813	11.5	LOS B	6.8	59.2	0.62	0.55	55.6
North: Hoskyns Rd N											
7	L	211	29.0	0.424	16.6	LOS B	4.7	41.1	0.63	0.76	44.8
9	R	458	3.2	0.749	38.6	LOS D	8.9	63.7	1.00	0.91	31.7
Approach		668	11.3	0.749	31.7	LOS C	8.9	63.7	0.88	0.86	34.9
West: SH1 W											
10	L	427	5.4	0.329	10.2	LOS B	0.7	5.3	0.07	0.67	57.0
11	T	1125	15.2	0.792	14.7	LOS B	16.9	133.7	0.79	0.73	50.2
Approach		1553	12.5	0.792	13.5	LOS B	16.9	133.7	0.59	0.71	51.8
All Vehicles		3189	14.9	0.813	16.7	LOS B	16.9	133.7	0.66	0.70	47.9

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

SIDRA INTERSECTION

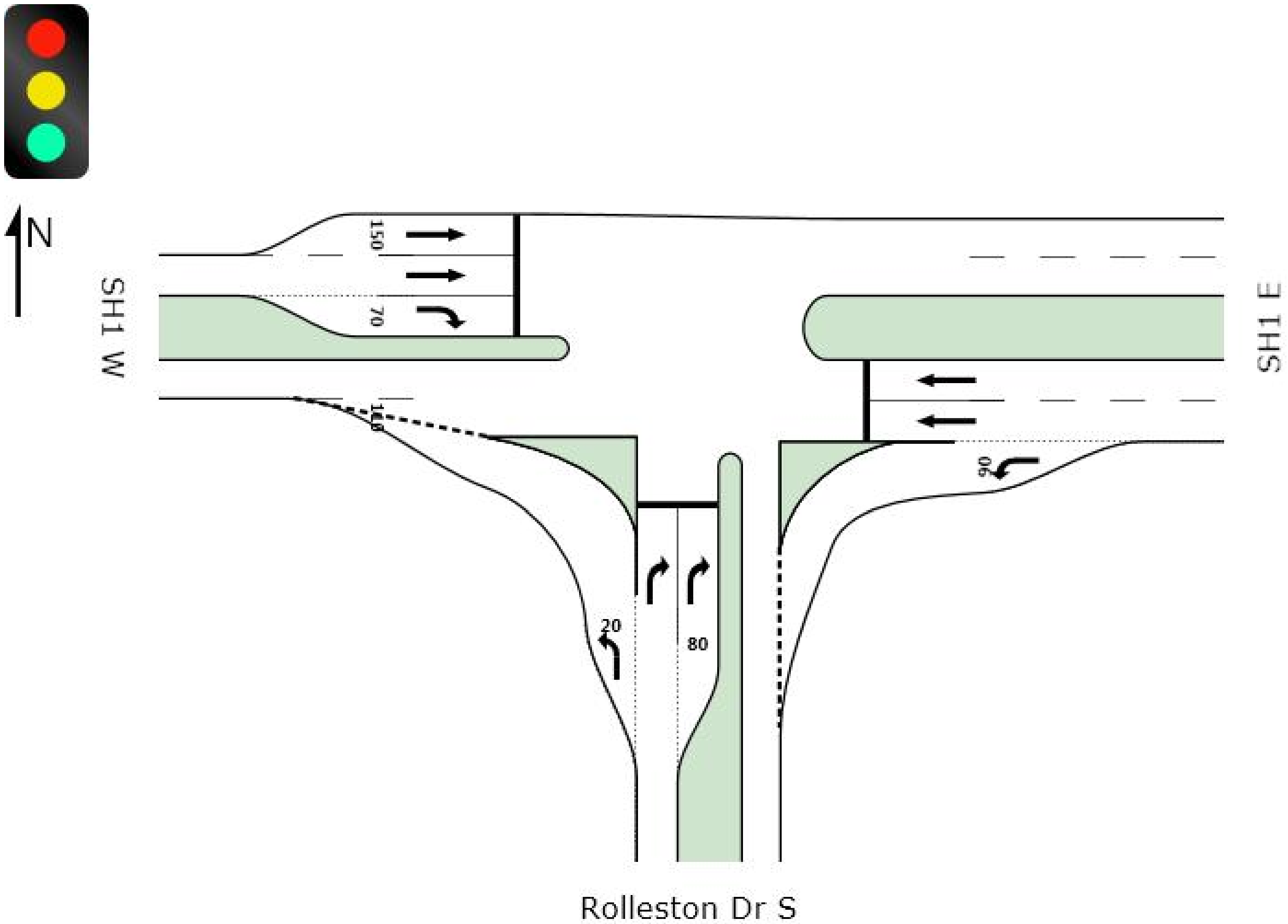
MOVEMENT SUMMARY

Baseline - MSR/Hoskyns Road
2041 PM - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 135 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: SH1 E											
5	T	1228	1.8	0.805	33.2	LOS C	39.8	283.0	0.88	0.80	36.4
6	R	34	12.5	0.257	46.3	LOS D	2.0	15.6	0.98	0.72	29.5
Approach		1262	2.1	0.805	33.6	LOS C	39.8	283.0	0.88	0.80	36.2
North: Hoskyns Rd N											
7	L	334	1.3	0.902	26.2	LOS C	11.7	82.4	0.60	0.83	37.9
9	R	1052	10.5	1.045	113.8	LOS F	90.7	692.1	1.00	1.12	16.1
Approach		1385	8.3	1.045	92.7	LOS F	90.7	692.1	0.90	1.05	18.7
West: SH1 W											
10	L	505	11.0	0.358	10.3	LOS B	2.0	15.5	0.07	0.67	57.0
11	T	1279	11.4	1.050	86.6	LOS F	72.9	560.5	0.98	1.16	20.4
Approach		1784	11.3	1.050	65.0	LOS E	72.9	560.5	0.73	1.02	24.4
All Vehicles		4432	7.7	1.050	64.7	LOS E	90.7	692.1	0.82	0.97	24.4

Level of Service (Aver. Int. Delay): LOS E. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.



N
SH1 W
150
70
140
SH1 E
90
20
80
Rolleston Dr S

MOVEMENT SUMMARY

Site: Baseline - MSR/Rolleston - 2016 AM

Baseline - MSR/Rolleston Drive
2016 AM - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 65 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Rolleston Dr S											
1	L	15	0.0	0.036	11.7	LOS B	0.3	1.8	0.43	0.63	42.9
3	R	1062	1.7	0.876	39.0	LOS D	21.5	152.9	0.99	1.03	29.0
Approach		1077	1.7	0.876	38.6	LOS D	21.5	152.9	0.98	1.02	29.1
East: SH1 E											
4	L	233	9.0	0.156	10.1	LOS B	0.4	2.8	0.06	0.67	40.0
5	T	682	14.4	0.875	27.8	LOS C	17.5	137.9	0.92	0.88	26.1
Approach		915	13.0	0.875	23.3	LOS C	17.5	137.9	0.70	0.83	27.9
West: SH1 W											
11	T	583	13.9	0.338	14.2	LOS B	7.5	58.4	0.66	0.64	51.7
12	R	25	0.0	0.084	24.3	LOS C	0.7	5.0	0.89	0.71	41.6
Approach		608	13.3	0.338	14.6	LOS B	7.5	58.4	0.67	0.64	51.2
All Vehicles		2600	8.4	0.876	27.6	LOS C	21.5	152.9	0.81	0.86	32.6

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

MOVEMENT SUMMARY

Baseline - MSR/Rolleston Drive
2016 IP - EPA Vols - Baseline Network
Signals - Fixed Time Cycle Time = 55 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Rolleston Dr S											
1	L	11	0.0	0.025	10.2	LOS B	0.1	0.9	0.40	0.63	44.1
3	R	486	3.2	0.608	29.9	LOS C	7.9	56.9	0.95	0.83	32.5
Approach		497	3.2	0.608	29.5	LOS C	7.9	56.9	0.94	0.83	32.7
East: SH1 E											
4	L	241	3.1	0.166	10.0	LOS A	0.3	2.4	0.06	0.67	40.0
5	T	586	15.3	0.640	15.3	LOS B	10.1	80.3	0.77	0.65	36.1
Approach		827	11.7	0.640	13.8	LOS B	10.1	80.3	0.56	0.66	36.9
West: SH1 W											
11	T	453	24.0	0.236	9.3	LOS A	4.3	36.5	0.53	0.55	58.5
12	R	44	0.0	0.107	18.6	LOS B	0.9	6.2	0.76	0.73	46.7
Approach		497	21.8	0.236	10.1	LOS B	4.3	36.5	0.55	0.56	57.2
All Vehicles		1821	12.1	0.640	17.1	LOS B	10.1	80.3	0.66	0.68	39.7

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

MOVEMENT SUMMARY

Site: Baseline - MSR/Rolleston - 2016 PM

Baseline - MSR/Rolleston Drive
2016 PM - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 85 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Rolleston Dr S											
1	L	14	0.0	0.065	13.1	LOS B	0.3	2.3	0.42	0.65	41.9
3	R	568	1.3	0.764	46.0	LOS D	13.6	96.3	1.00	0.91	26.8
Approach		582	1.3	0.764	45.2	LOS D	13.6	96.3	0.99	0.90	27.0
East: SH1 E											
4	L	523	1.0	0.341	9.9	LOS A	1.3	9.2	0.08	0.67	39.9
5	T	1109	7.2	0.770	12.4	LOS B	21.8	161.8	0.63	0.57	40.3
Approach		1633	5.2	0.770	11.6	LOS B	21.8	161.8	0.45	0.60	40.2
West: SH1 W											
11	T	694	17.5	0.324	9.2	LOS A	8.4	67.7	0.46	0.51	58.5
12	R	48	0.0	0.183	21.8	LOS C	1.2	8.7	0.75	0.75	43.7
Approach		742	16.3	0.324	10.1	LOS B	8.4	67.7	0.47	0.53	57.2
All Vehicles		2957	7.2	0.770	17.8	LOS B	21.8	161.8	0.56	0.64	38.5

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

MOVEMENT SUMMARY

Site: Baseline - MSR/Rolleston - 2026 AM

Baseline - MSR/Rolleston Drive
2026 AM - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 120 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Rolleston Dr S											
1	L	23	0.0	0.086	13.6	LOS B	0.7	4.7	0.36	0.63	41.6
3	R	1494	1.4	1.003	71.9	LOS E	88.1	624.2	1.00	1.07	20.8
Approach		1517	1.4	1.003	71.0	LOS E	88.1	624.2	0.99	1.06	21.0
East: SH1 E											
4	L	382	7.4	0.258	10.1	LOS B	1.3	9.5	0.07	0.67	40.0
5	T	711	16.7	1.013	79.3	LOS E	41.5	332.0	0.94	1.06	12.5
Approach		1093	13.5	1.013	55.1	LOS E	41.5	332.0	0.64	0.92	15.4
West: SH1 W											
11	T	598	16.4	0.490	33.7	LOS C	15.7	125.7	0.81	0.74	35.3
12	R	36	0.0	0.224	44.3	LOS D	2.2	15.2	0.97	0.72	30.2
Approach		634	15.4	0.490	34.3	LOS C	15.7	125.7	0.82	0.74	35.0
All Vehicles		3243	8.2	1.013	58.5	LOS E	88.1	624.2	0.84	0.95	21.4

Level of Service (Aver. Int. Delay): LOS E. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS E. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

MOVEMENT SUMMARY

Baseline - MSR/Rolleston Drive
2026 IP - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 60 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Rolleston Dr S											
1	L	16	0.0	0.041	10.6	LOS B	0.2	1.6	0.40	0.64	43.8
3	R	737	2.7	0.706	30.4	LOS C	12.0	86.1	0.95	0.88	32.3
Approach		753	2.7	0.706	30.0	LOS C	12.0	86.1	0.94	0.88	32.5
East: SH1 E											
4	L	472	3.1	0.318	10.0	LOS A	0.8	6.0	0.08	0.67	39.9
5	T	613	16.8	0.736	19.8	LOS B	12.6	100.8	0.84	0.74	31.7
Approach		1084	10.9	0.736	15.5	LOS B	12.6	100.8	0.51	0.71	34.1
West: SH1 W											
11	T	502	26.4	0.289	11.7	LOS B	5.7	48.8	0.60	0.59	55.0
12	R	55	0.0	0.154	21.3	LOS C	1.3	9.3	0.83	0.74	44.2
Approach		557	23.8	0.289	12.6	LOS B	5.7	48.8	0.63	0.61	53.7
All Vehicles		2394	11.3	0.736	19.4	LOS B	12.6	100.8	0.67	0.74	37.2

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

Processed: Thursday, 3 May 2012 5:55:56 p.m.
SIDRA INTERSECTION 5.0.2.1437

Project: P:\339\3390691\TTR\FinalScheme_1203\SIDRA_Baseline\Baseline_6_Hoskyns&Rolleston_EPAVols.sip
8000924, BECA INFRASTRUCTURE LIMITED, FLOATING

MOVEMENT SUMMARY

Site: Baseline - MSR/Rolleston - 2026 PM

Baseline - MSR/Rolleston Drive
2026 PM - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 85 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Rolleston Dr S											
1	L	25	0.0	0.124	16.3	LOS B	0.7	5.2	0.51	0.67	39.8
3	R	812	1.2	0.875	50.4	LOS D	20.9	148.0	1.00	1.01	25.5
Approach		837	1.1	0.875	49.4	LOS D	20.9	148.0	0.98	1.00	25.8
East: SH1 E											
4	L	858	1.0	0.546	10.0	LOS B	2.8	19.9	0.10	0.68	39.7
5	T	1135	8.5	0.895	23.8	LOS C	33.4	250.6	0.81	0.80	28.9
Approach		1993	5.3	0.895	17.9	LOS B	33.4	250.6	0.51	0.75	31.8
West: SH1 W											
11	T	748	19.8	0.386	12.0	LOS B	10.4	85.0	0.55	0.57	54.5
12	R	71	0.0	0.298	27.5	LOS C	2.2	15.3	0.90	0.76	39.2
Approach		819	18.1	0.386	13.3	LOS B	10.4	85.0	0.58	0.59	52.8
All Vehicles		3648	7.2	0.895	24.1	LOS C	33.4	250.6	0.63	0.77	33.1

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

MOVEMENT SUMMARY

Baseline - MSR/Rolleston Drive
2041 AM - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 135 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Rolleston Dr S											
1	L	11	0.0	0.042	13.8	LOS B	0.3	2.3	0.34	0.62	41.5
3	R	1698	1.6	1.164	167.4	LOS F	172.9	1226.7	1.00	1.34	11.5
Approach		1708	1.6	1.164	166.5	LOS F	172.9	1226.7	1.00	1.33	11.5
East: SH1 E											
4	L	395	9.9	0.280	10.2	LOS B	1.6	12.0	0.07	0.67	40.0
5	T	796	18.8	1.181	175.4	LOS F	75.3	611.7	0.96	1.37	6.4
Approach		1191	15.8	1.181	120.6	LOS F	75.3	611.7	0.66	1.14	8.1
West: SH1 W											
11	T	706	17.1	0.627	41.1	LOS D	22.0	176.4	0.87	0.79	31.5
12	R	57	0.0	0.400	50.7	LOS D	3.9	27.0	1.00	0.74	27.7
Approach		763	15.9	0.627	41.9	LOS D	22.0	176.4	0.88	0.78	31.2
All Vehicles		3662	9.2	1.181	125.6	LOS F	172.9	1226.7	0.86	1.15	12.4

Level of Service (Aver. Int. Delay): LOS F. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

MOVEMENT SUMMARY

Site: Baseline - MSR/Rolleston - 2041 IP

Baseline - MSR/Rolleston Drive
2041 IP - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 65 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Rolleston Dr S											
1	L	24	0.0	0.064	12.1	LOS B	0.4	3.1	0.45	0.65	42.6
3	R	994	2.8	0.878	40.3	LOS D	19.8	142.1	1.00	1.03	28.6
Approach		1018	2.7	0.878	39.6	LOS D	19.8	142.1	0.99	1.02	28.8
East: SH1 E											
4	L	458	4.4	0.302	10.0	LOS B	0.9	6.5	0.07	0.67	39.9
5	T	731	17.7	0.865	25.4	LOS C	18.2	146.4	0.89	0.86	27.5
Approach		1188	12.6	0.865	19.5	LOS B	18.2	146.4	0.58	0.78	30.4
West: SH1 W											
11	T	559	29.9	0.334	13.1	LOS B	6.9	60.8	0.63	0.61	53.2
12	R	59	0.0	0.194	24.0	LOS C	1.6	11.0	0.89	0.74	41.9
Approach		618	27.1	0.334	14.1	LOS B	6.9	60.8	0.66	0.63	51.9
All Vehicles		2824	12.2	0.878	25.6	LOS C	19.8	146.4	0.74	0.84	33.1

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

MOVEMENT SUMMARY

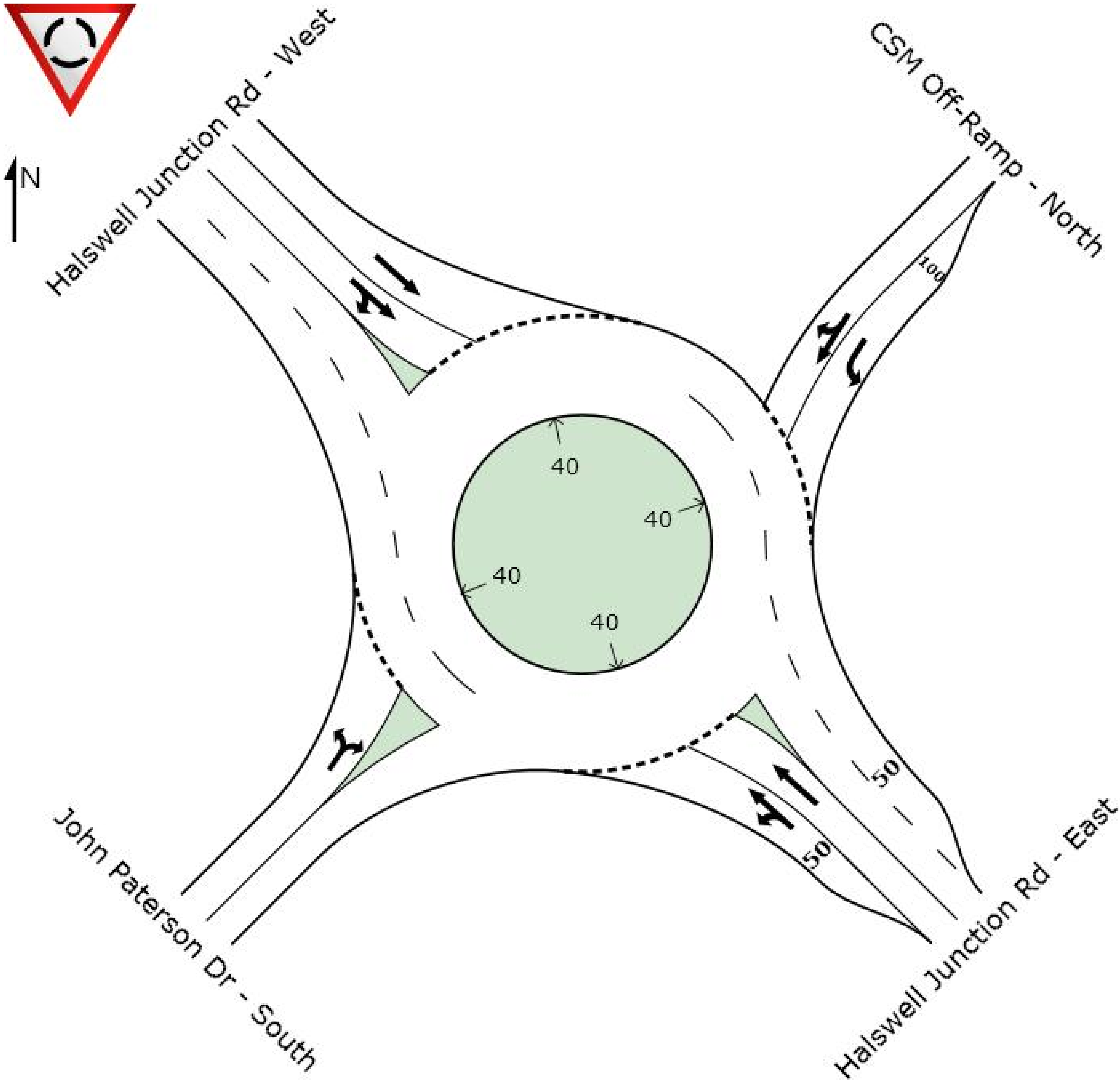
Site: Baseline - MSR/Rolleston - 2041 PM

Baseline - MSR/Rolleston Drive
2041 PM - EPA Vols - Baseline Network
Signals - Fixed Time   Cycle Time = 140 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Rolleston Dr S											
1	L	42	0.0	0.307	29.5	LOS C	2.4	16.9	0.58	0.67	32.8
3	R	1011	1.4	1.082	128.7	LOS F	80.6	570.8	1.00	1.16	14.0
Approach		1053	1.3	1.082	124.7	LOS F	80.6	570.8	0.98	1.14	14.4
East: SH1 E											
4	L	778	2.2	0.526	10.2	LOS B	3.4	24.0	0.10	0.68	39.6
5	T	1504	7.8	1.099	105.5	LOS F	123.7	923.3	0.86	1.21	10.0
Approach		2282	5.9	1.100	73.0	LOS E	123.7	923.3	0.60	1.03	12.4
West: SH1 W											
11	T	774	24.4	0.476	20.0	LOS C	19.3	163.4	0.60	0.61	45.5
12	R	97	1.1	0.710	49.5	LOS D	5.5	38.5	1.00	0.79	28.2
Approach		871	21.8	0.710	23.3	LOS C	19.3	163.4	0.64	0.63	42.5
All Vehicles		4205	8.0	1.100	75.7	LOS E	123.7	923.3	0.71	0.97	16.3

Level of Service (Aver. Int. Delay): LOS E. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.



N
Halswell Junction Rd - West
CSM Off-Ramp - North
John Paterson Dr - South
Halswell Junction Rd - East
40
40
40
40
100
50
50

MOVEMENT SUMMARY

Site: CSM2 CSM/HJR - 2016 AM

CSM2 - CSM/HJR
2016 AM - EPA Vols - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Halswell Junction Rd - East											
21	L	11	0.0	0.251	7.9	LOS A	2.4	17.3	0.80	0.75	48.3
22	T	441	4.5	0.250	7.6	LOS A	2.4	17.3	0.80	0.71	48.2
Approach		452	4.4	0.250	7.6	LOS A	2.4	17.3	0.80	0.72	48.2
North East: CSM Off-Ramp - North											
24	L	72	2.9	0.075	5.8	LOS A	0.4	2.5	0.32	0.49	50.6
25	T	11	0.0	0.526	3.3	LOS A	3.8	27.5	0.40	0.36	49.6
26	R	756	3.8	0.515	12.1	LOS B	3.8	27.5	0.40	0.67	45.2
Approach		838	3.6	0.515	11.5	LOS B	3.8	27.5	0.39	0.65	45.6
North West: Halswell Junction Rd - West											
28	T	183	8.0	0.078	3.5	LOS A	0.6	4.4	0.07	0.30	54.3
29	R	11	0.0	0.078	9.7	LOS A	0.6	4.4	0.07	1.04	46.6
Approach		194	7.6	0.078	3.8	LOS A	0.6	4.4	0.07	0.34	53.8
South West: John Paterson Dr - South											
30	L	11	0.0	0.035	9.2	LOS A	0.2	1.6	0.75	0.69	41.7
32	R	11	0.0	0.035	15.9	LOS B	0.2	1.6	0.75	0.80	39.2
Approach		21	0.0	0.034	12.5	LOS B	0.2	1.6	0.75	0.75	40.4
All Vehicles		1504	4.3	0.515	9.3	LOS A	3.8	27.5	0.48	0.63	47.1

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: CSM2 CSM/HJR - 2016 IP

CSM2 - CSM/HJR
2016 IP - EPA Vols - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Halswell Junction Rd - East											
21	L	11	0.0	0.120	6.1	LOS A	1.0	7.0	0.60	0.59	49.2
22	T	256	5.3	0.120	5.6	LOS A	1.0	7.0	0.61	0.53	49.6
Approach		266	5.1	0.120	5.6	LOS A	1.0	7.0	0.61	0.53	49.6
North East: CSM Off-Ramp - North											
24	L	59	5.4	0.065	6.2	LOS A	0.3	2.2	0.37	0.53	50.2
25	T	11	0.0	0.376	3.4	LOS A	2.3	17.0	0.41	0.37	49.5
26	R	508	5.6	0.374	12.3	LOS B	2.3	17.0	0.41	0.70	45.2
Approach		578	5.5	0.374	11.5	LOS B	2.3	17.0	0.40	0.67	45.7
North West: Halswell Junction Rd - West											
28	T	278	4.9	0.112	3.4	LOS A	0.8	6.1	0.07	0.30	54.4
29	R	11	0.0	0.112	9.7	LOS A	0.8	6.1	0.07	1.06	46.6
Approach		288	4.7	0.112	3.6	LOS A	0.8	6.1	0.07	0.33	54.0
South West: John Paterson Dr - South											
30	L	11	0.0	0.025	6.1	LOS A	0.1	1.0	0.58	0.56	43.5
32	R	11	0.0	0.025	12.8	LOS B	0.1	1.0	0.58	0.75	41.1
Approach		21	0.0	0.025	9.5	LOS B	0.1	1.0	0.58	0.65	42.2
All Vehicles		1154	5.1	0.374	8.1	LOS A	2.3	17.0	0.37	0.55	48.2

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

Processed: Monday, 3 September 2012 11:16:49 a.m.
SIDRA INTERSECTION 5.0.2.1437
Project: P:\339\3390691\TTR\EPA_Submission\99_ModelOutputs\02_SIDRA_CSM2&MSRFL
\CSM2_1_CSM&HJR_EPAVols.sip
8000924, BECA INFRASTRUCTURE LIMITED, FLOATING

MOVEMENT SUMMARY

CSM2 - CSM/HJR
2016 PM - EPA Vols - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Halswell Junction Rd - East											
21	L	11	0.0	0.501	21.8	LOS C	7.0	50.2	1.00	1.02	37.5
22	T	373	3.1	0.509	23.3	LOS C	7.0	50.2	1.00	1.06	36.7
Approach		383	3.0	0.509	23.2	LOS C	7.0	50.2	1.00	1.06	36.7
North East: CSM Off-Ramp - North											
24	L	85	3.7	0.095	6.3	LOS A	0.5	3.3	0.38	0.54	50.1
25	T	11	0.0	0.877	7.7	LOS A	16.6	118.8	0.81	0.80	45.0
26	R	1240	2.5	0.879	16.5	LOS B	16.6	118.8	0.81	0.89	42.7
Approach		1336	2.5	0.879	15.8	LOS B	16.6	118.8	0.79	0.87	43.0
North West: Halswell Junction Rd - West											
28	T	292	2.9	0.117	3.4	LOS A	1.0	7.1	0.08	0.30	54.3
29	R	11	0.0	0.117	9.7	LOS A	1.0	7.1	0.08	1.06	46.7
Approach		302	2.8	0.117	3.6	LOS A	1.0	7.1	0.08	0.33	53.9
South West: John Paterson Dr - South											
30	L	11	0.0	0.088	23.7	LOS C	0.8	5.4	1.00	0.91	32.6
32	R	11	0.0	0.088	30.4	LOS C	0.8	5.4	1.00	0.91	31.8
Approach		21	0.0	0.088	27.1	LOS C	0.8	5.4	1.00	0.91	32.2
All Vehicles		2042	2.6	0.879	15.5	LOS B	16.6	118.8	0.72	0.83	42.8

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: CSM2 CSM/HJR - 2026 AM

CSM2 - CSM/HJR
2026 AM - EPA Vols - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Halswell Junction Rd - East											
21	L	11	0.0	0.554	10.8	LOS B	7.2	51.4	0.96	0.95	46.8
22	T	935	2.4	0.557	11.0	LOS B	7.2	51.4	0.95	0.97	46.1
Approach		945	2.3	0.557	11.0	LOS B	7.2	51.4	0.95	0.97	46.1
North East: CSM Off-Ramp - North											
24	L	109	2.9	0.120	6.2	LOS A	0.6	4.2	0.38	0.54	50.2
25	T	11	0.0	0.554	3.6	LOS A	4.3	30.9	0.48	0.41	48.6
26	R	793	3.3	0.563	12.4	LOS B	4.3	30.9	0.48	0.71	44.8
Approach		913	3.2	0.562	11.6	LOS B	4.3	30.9	0.47	0.68	45.4
North West: Halswell Junction Rd - West											
28	T	258	7.3	0.107	3.4	LOS A	0.9	6.4	0.08	0.30	54.3
29	R	11	0.0	0.106	9.7	LOS A	0.9	6.4	0.08	1.05	46.7
Approach		268	7.1	0.107	3.7	LOS A	0.9	6.4	0.08	0.33	53.9
South West: John Paterson Dr - South											
30	L	11	0.0	0.060	15.5	LOS B	0.5	3.2	0.92	0.85	37.1
32	R	11	0.0	0.060	22.2	LOS C	0.5	3.2	0.92	0.89	35.6
Approach		21	0.0	0.060	18.9	LOS C	0.5	3.2	0.92	0.87	36.3
All Vehicles		2147	3.3	0.562	10.4	LOS B	7.2	51.4	0.64	0.77	46.5

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: CSM2 CSM/HJR - 2026 IP

CSM2 - CSM/HJR
2026 IP - EPA Vols - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Halswell Junction Rd - East											
21	L	11	0.0	0.211	6.3	LOS A	1.9	13.4	0.66	0.60	49.0
22	T	453	3.7	0.213	5.8	LOS A	1.9	13.4	0.66	0.55	49.2
Approach		463	3.6	0.213	5.8	LOS A	1.9	13.4	0.66	0.55	49.2
North East: CSM Off-Ramp - North											
24	L	95	3.3	0.113	6.9	LOS A	0.5	3.9	0.46	0.61	49.6
25	T	11	0.0	0.421	4.0	LOS A	2.6	19.0	0.51	0.44	48.2
26	R	523	4.8	0.414	12.9	LOS B	2.6	19.0	0.51	0.76	44.7
Approach		628	4.5	0.414	11.8	LOS B	2.6	19.0	0.51	0.74	45.4
North West: Halswell Junction Rd - West											
28	T	473	3.6	0.186	3.4	LOS A	1.5	10.9	0.07	0.30	54.3
29	R	11	0.0	0.185	9.7	LOS A	1.5	10.9	0.07	1.07	46.7
Approach		483	3.5	0.186	3.5	LOS A	1.5	10.9	0.07	0.32	54.1
South West: John Paterson Dr - South											
30	L	11	0.0	0.028	6.9	LOS A	0.2	1.2	0.65	0.62	43.1
32	R	11	0.0	0.028	13.6	LOS B	0.2	1.2	0.65	0.77	40.6
Approach		21	0.0	0.028	10.3	LOS B	0.2	1.2	0.65	0.70	41.7
All Vehicles		1596	3.9	0.414	7.5	LOS A	2.6	19.0	0.42	0.56	48.7

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: CSM2 CSM/HJR - 2026 PM

CSM2 - CSM/HJR
2026 PM - EPA Vols - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Halswell Junction Rd - East											
21	L	11	0.0	0.810	57.0	LOS E	16.3	116.5	1.00	1.40	22.9
22	T	532	2.4	0.812	58.8	LOS E	16.3	116.5	1.00	1.39	23.0
Approach		542	2.3	0.812	58.8	LOS E	16.3	116.5	1.00	1.39	23.0
North East: CSM Off-Ramp - North											
24	L	202	2.1	0.254	7.7	LOS A	1.3	9.4	0.55	0.69	48.9
25	T	11	0.0	1.053	68.3	LOS E	69.4	495.2	1.00	3.15	19.4
26	R	1293	2.2	1.056	77.1	LOS E	69.4	495.2	1.00	3.15	20.7
Approach		1505	2.2	1.056	67.7	LOS E	69.4	495.2	0.94	2.82	22.2
North West: Halswell Junction Rd - West											
28	T	621	1.9	0.243	3.4	LOS A	2.3	16.2	0.09	0.30	54.2
29	R	11	0.0	0.245	9.7	LOS A	2.3	16.2	0.09	1.07	46.7
Approach		632	1.8	0.243	3.5	LOS A	2.3	16.2	0.09	0.32	54.1
South West: John Paterson Dr - South											
30	L	11	0.0	0.117	25.6	LOS C	0.8	5.9	0.96	0.97	31.7
32	R	11	0.0	0.117	32.3	LOS C	0.8	5.9	0.96	0.99	31.1
Approach		21	0.0	0.117	28.9	LOS C	0.8	5.9	0.96	0.98	31.4
All Vehicles		2700	2.1	1.056	50.6	LOS D	69.4	495.2	0.75	1.93	25.9

Level of Service (Aver. Int. Delay): LOS D. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS E. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

Processed: Monday, 3 September 2012 11:16:50 a.m.
SIDRA INTERSECTION 5.0.2.1437
Project: P:\339\3390691\TTR\EPA_Submission\99_ModelOutputs\02_SIDRA_CSM2&MSRFL \CSM2_1_CSM&HJR_EPAVols.sip
8000924, BECA INFRASTRUCTURE LIMITED, FLOATING

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: CSM2 CSM/HJR - 2041 AM

CSM2 - CSM/HJR
2041 AM - EPA Vols v2 - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Halswell Junction Rd - East											
21	L	11	0.0	0.877	25.4	LOS C	19.5	139.1	1.00	1.36	35.3
22	T	1249	2.1	0.855	28.0	LOS C	19.5	139.1	1.00	1.41	34.0
Approach		1260	2.1	0.854	28.0	LOS C	19.5	139.1	1.00	1.41	34.0
North East: CSM Off-Ramp - North											
24	L	122	2.6	0.138	6.5	LOS A	0.7	4.8	0.41	0.57	49.9
25	T	11	0.0	0.658	4.5	LOS A	6.1	43.6	0.58	0.52	47.5
26	R	886	3.2	0.647	13.3	LOS B	6.1	43.6	0.58	0.77	44.4
Approach		1019	3.1	0.647	12.4	LOS B	6.1	43.6	0.56	0.75	45.0
North West: Halswell Junction Rd - West											
28	T	325	6.1	0.132	3.4	LOS A	1.1	8.1	0.08	0.30	54.3
29	R	11	0.0	0.132	9.7	LOS A	1.1	8.1	0.08	1.06	46.7
Approach		336	6.0	0.132	3.6	LOS A	1.1	8.1	0.08	0.32	54.0
South West: John Paterson Dr - South											
30	L	11	0.0	0.140	27.6	LOS C	0.8	5.5	0.93	0.96	30.8
32	R	11	0.0	0.140	34.3	LOS C	0.8	5.5	0.93	0.98	30.3
Approach		21	0.0	0.141	30.9	LOS C	0.8	5.5	0.93	0.97	30.5
All Vehicles		2636	3.0	0.854	18.9	LOS B	19.5	139.1	0.71	1.01	39.8

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

Processed: Monday, 3 September 2012 11:16:51 a.m.
SIDRA INTERSECTION 5.0.2.1437
Project: P:\339\3390691\TTR\EPA_Submission\99_ModelOutputs\02_SIDRA_CSM2&MSRFL\CSM2_1_CSM&HJR_EPAVols.sip
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SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: CSM2 CSM/HJR - 2041 IP

CSM2 - CSM/HJR
2041 IP - EPA Vols v2 - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Halswell Junction Rd - East											
21	L	11	0.0	0.340	7.2	LOS A	3.3	23.9	0.79	0.67	48.3
22	T	647	2.6	0.338	6.7	LOS A	3.3	23.9	0.79	0.64	48.2
Approach		658	2.6	0.338	6.7	LOS A	3.3	23.9	0.79	0.64	48.2
North East: CSM Off-Ramp - North											
24	L	98	2.2	0.124	7.5	LOS A	0.6	4.3	0.51	0.67	49.2
25	T	11	0.0	0.526	5.2	LOS A	4.0	29.1	0.62	0.59	47.0
26	R	625	4.4	0.521	14.0	LOS B	4.0	29.1	0.62	0.86	44.3
Approach		734	4.0	0.521	13.0	LOS B	4.0	29.1	0.61	0.83	44.9
North West: Halswell Junction Rd - West											
28	T	640	2.6	0.250	3.4	LOS A	2.2	16.0	0.08	0.30	54.2
29	R	11	0.0	0.251	9.7	LOS A	2.2	16.0	0.08	1.07	46.7
Approach		651	2.6	0.250	3.5	LOS A	2.2	16.0	0.08	0.32	54.1
South West: John Paterson Dr - South											
30	L	11	0.0	0.036	8.8	LOS A	0.2	1.7	0.76	0.71	42.0
32	R	11	0.0	0.036	15.5	LOS B	0.2	1.7	0.76	0.82	39.4
Approach		21	0.0	0.036	12.2	LOS B	0.2	1.7	0.76	0.76	40.6
All Vehicles		2063	3.1	0.521	8.0	LOS A	4.0	29.1	0.50	0.61	48.4

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

Processed: Monday, 3 September 2012 11:16:51 a.m.
SIDRA INTERSECTION 5.0.2.1437
Project: P:\339\3390691\TTR\EPA_Submission\99_ModelOutputs\02_SIDRA_CSM2&MSRFL\CSM2_1_CSM&HJR_EPAVols.sip
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SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: CSM2 CSM/HJR - 2041 PM

CSM2 - CSM/HJR
2041 PM - EPA Vols v2 - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Halswell Junction Rd - East											
21	L	11	0.0	0.810	50.2	LOS D	18.1	129.2	1.00	1.44	24.8
22	T	658	2.2	0.840	51.8	LOS D	18.1	129.2	1.00	1.42	24.9
Approach		668	2.2	0.840	51.7	LOS D	18.1	129.2	1.00	1.42	24.9
North East: CSM Off-Ramp - North											
24	L	268	1.2	0.358	8.9	LOS A	2.1	14.6	0.64	0.81	48.3
25	T	11	0.0	1.170	139.9	LOS F	118.0	841.7	1.00	5.24	11.6
26	R	1292	2.3	1.139	148.7	LOS F	118.0	841.7	1.00	5.24	12.8
Approach		1571	2.1	1.139	124.7	LOS F	118.0	841.7	0.94	4.49	14.5
North West: Halswell Junction Rd - West											
28	T	844	1.7	0.327	3.4	LOS A	3.4	23.8	0.09	0.30	54.1
29	R	11	0.0	0.329	9.7	LOS A	3.4	23.8	0.09	1.06	46.7
Approach		855	1.7	0.327	3.4	LOS A	3.4	23.8	0.09	0.31	54.0
South West: John Paterson Dr - South											
30	L	11	0.0	0.104	24.6	LOS C	0.8	5.4	0.96	0.97	32.1
32	R	11	0.0	0.104	31.3	LOS C	0.8	5.4	0.96	0.99	31.5
Approach		21	0.0	0.104	28.0	LOS C	0.8	5.4	0.96	0.98	31.8
All Vehicles		3115	2.0	1.139	75.1	LOS E	118.0	841.7	0.72	2.66	20.2

Level of Service (Aver. Int. Delay): LOS E. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

Processed: Monday, 3 September 2012 11:16:51 a.m.
SIDRA INTERSECTION 5.0.2.1437
Project: P:\339\3390691\TTR\EPA_Submission\99_ModelOutputs\02_SIDRA_CSM2&MSRFL
\CSM2_1_CSM&HJR_EPAVols.sip
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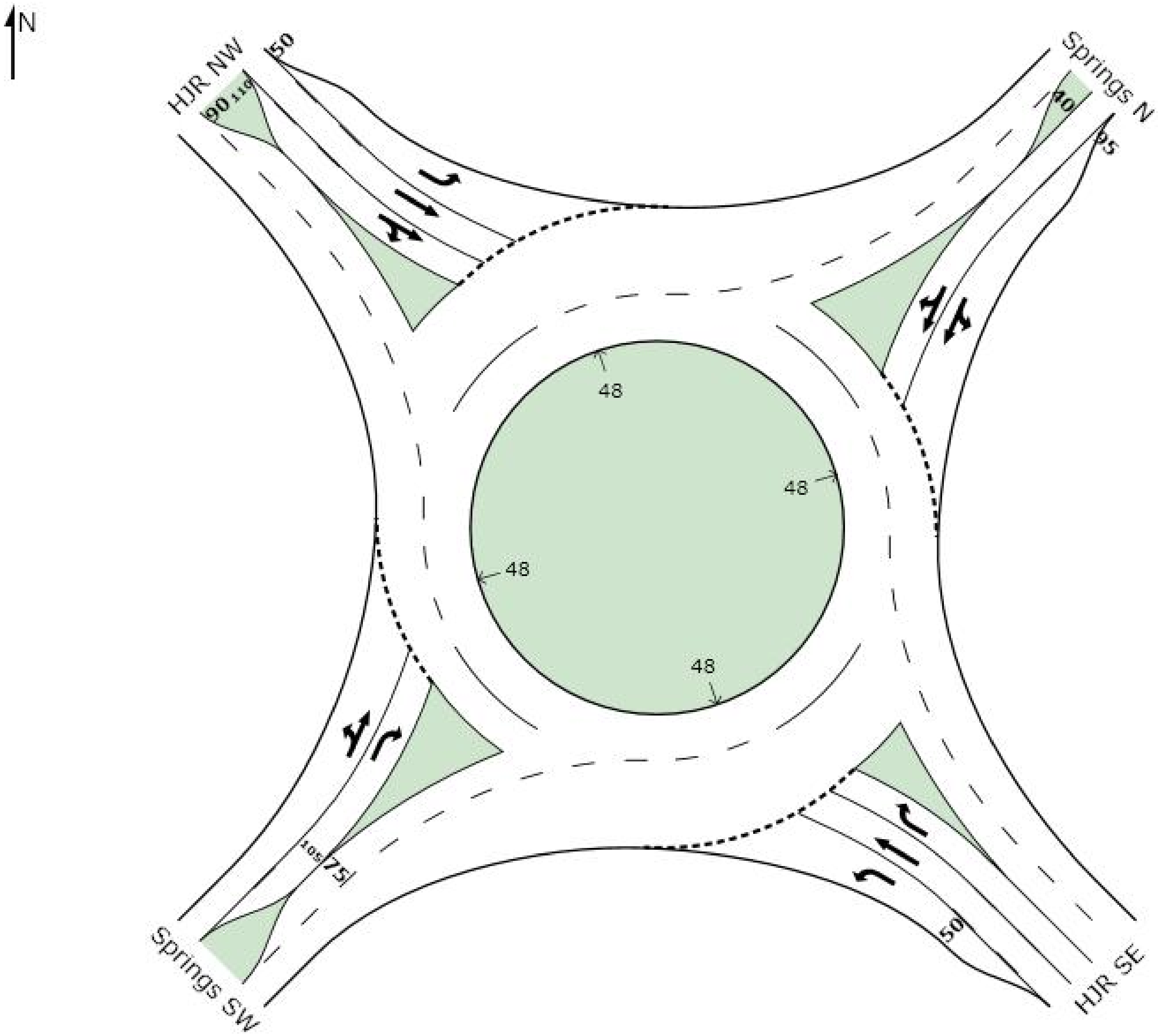
SIDRA INTERSECTION


N
HJR NW
50
90
110
Springs N
40
95
48
48
48
48
105
75
Springs SW
50
HJR SE

MOVEMENT SUMMARY

Site: CSM2 HJR/Springs - 2016 AM

CSM2 - HJR/Springs
2016 AM - EPA Vols - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: HJR SE											
21	L	214	4.4	0.181	5.9	LOS A	1.2	8.5	0.55	0.53	49.2
22	T	596	4.4	0.383	3.9	LOS A	3.0	22.2	0.60	0.38	50.2
23	R	386	3.0	0.343	13.1	LOS B	2.4	17.2	0.61	0.77	44.3
Approach		1196	4.0	0.383	7.2	LOS B	3.0	22.2	0.59	0.53	47.8
North East: Springs N											
24	L	192	6.0	0.453	9.5	LOS A	4.1	30.2	0.87	0.91	47.7
25	T	337	8.4	0.453	8.9	LOS A	4.1	30.2	0.86	0.88	46.8
26	R	102	12.4	0.452	18.5	LOS B	3.6	27.0	0.85	1.04	42.8
Approach		631	8.3	0.453	10.7	LOS B	4.1	30.2	0.86	0.91	46.3
North West: HJR NW											
27	L	129	14.6	0.142	7.7	LOS A	1.0	8.2	0.75	0.67	47.8
28	T	628	5.0	0.382	6.0	LOS A	3.5	25.6	0.84	0.59	47.9
29	R	115	7.3	0.382	15.4	LOS B	2.9	21.4	0.81	1.00	45.1
Approach		873	6.8	0.383	7.5	LOS B	3.5	25.6	0.82	0.66	47.5
South West: Springs SW											
30	L	98	9.7	0.515	8.5	LOS A	4.4	33.2	0.81	0.81	48.5
31	T	385	7.7	0.516	6.9	LOS A	4.4	33.2	0.81	0.73	48.2
32	R	408	3.9	0.566	17.1	LOS B	4.7	34.0	0.82	1.02	42.5
Approach		892	6.1	0.566	11.7	LOS B	4.7	34.0	0.81	0.87	45.3
All Vehicles		3591	6.0	0.566	9.0	LOS A	4.7	34.0	0.75	0.71	46.8

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

SIDRA INTERSECTION

CSM2 - HJR/Springs
2016 IP - EPA Vols - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: HJR SE											
21	L	174	5.5	0.141	5.7	LOS A	0.8	6.1	0.47	0.51	49.8
22	T	355	5.6	0.216	3.6	LOS A	1.5	10.7	0.46	0.35	51.4
23	R	236	4.9	0.193	12.7	LOS B	1.2	8.6	0.48	0.72	44.8
Approach		764	5.4	0.216	6.9	LOS B	1.5	10.7	0.47	0.50	48.6
North East: Springs N											
24	L	177	6.0	0.288	6.8	LOS A	2.0	14.7	0.66	0.61	49.0
25	T	209	11.6	0.287	5.6	LOS A	2.0	14.7	0.67	0.55	48.6
26	R	143	7.4	0.287	14.5	LOS B	1.8	13.5	0.67	0.92	45.2
Approach		529	8.5	0.287	8.4	LOS B	2.0	14.7	0.67	0.67	47.6
North West: HJR NW											
27	L	165	9.6	0.160	6.6	LOS A	1.0	7.3	0.58	0.58	48.9
28	T	496	5.3	0.226	4.4	LOS A	1.6	11.7	0.59	0.43	50.0
29	R	75	11.3	0.226	13.5	LOS B	1.4	10.5	0.61	0.92	46.6
Approach		736	6.9	0.226	5.8	LOS B	1.6	11.7	0.59	0.51	49.4
South West: Springs SW											
30	L	120	7.0	0.345	6.4	LOS A	2.3	17.1	0.62	0.57	49.5
31	T	271	8.6	0.345	4.9	LOS A	2.3	17.1	0.62	0.47	49.7
32	R	246	4.7	0.272	13.7	LOS B	1.6	11.8	0.61	0.82	44.5
Approach		637	6.8	0.345	8.6	LOS B	2.3	17.1	0.62	0.63	47.3
All Vehicles		2666	6.8	0.345	7.3	LOS A	2.3	17.1	0.58	0.57	48.3

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: CSM2 HJR/Springs - 2016 PM

CSM2 - HJR/Springs
2016 PM - EPA Vols - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: HJR SE											
21	L	347	3.0	0.338	6.6	LOS A	2.5	17.9	0.69	0.59	48.2
22	T	626	3.0	0.636	7.0	LOS A	6.6	47.7	0.83	0.76	48.4
23	R	640	2.0	0.447	12.9	LOS B	4.0	28.3	0.72	0.77	43.9
Approach		1614	2.6	0.637	9.3	LOS B	6.6	47.7	0.75	0.73	46.3
North East: Springs N											
24	L	323	2.6	0.768	18.0	LOS B	10.1	73.2	1.00	1.23	40.7
25	T	435	5.1	0.768	18.5	LOS B	10.1	73.2	0.99	1.22	39.3
26	R	104	11.1	0.766	28.6	LOS C	8.2	61.1	0.98	1.22	36.7
Approach		862	4.9	0.768	19.5	LOS C	10.1	73.2	0.99	1.22	39.4
North West: HJR NW											
27	L	104	9.1	0.112	9.2	LOS A	1.1	7.9	0.88	0.76	46.9
28	T	952	2.4	0.683	15.4	LOS B	11.1	79.2	1.00	1.19	42.0
29	R	165	4.5	0.683	25.3	LOS C	8.4	60.7	0.98	1.21	38.4
Approach		1221	3.3	0.683	16.2	LOS C	11.1	79.2	0.98	1.15	41.8
South West: Springs SW											
30	L	123	1.7	0.645	10.0	LOS A	6.3	45.6	0.91	1.01	47.9
31	T	406	5.4	0.645	8.5	LOS A	6.3	45.6	0.91	0.93	47.4
32	R	279	3.4	0.478	16.7	LOS B	3.5	25.1	0.84	1.00	42.8
Approach		808	4.2	0.645	11.6	LOS B	6.3	45.6	0.88	0.97	45.6
All Vehicles		4505	3.5	0.768	13.5	LOS B	11.1	79.2	0.89	0.98	43.5

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: CSM2 HJR/Springs - 2026 AM

CSM2 - HJR/Springs
2026 AM - EPA Vols - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: HJR SE											
21	L	336	3.1	0.312	6.3	LOS A	2.2	16.0	0.65	0.57	48.4
22	T	747	3.5	0.511	4.4	LOS A	4.8	34.3	0.72	0.44	49.2
23	R	645	2.0	0.633	15.2	LOS B	6.4	45.8	0.81	0.96	43.5
Approach		1728	2.9	0.633	8.8	LOS B	6.4	45.8	0.74	0.66	46.6
North East: Springs N											
24	L	260	4.9	0.652	14.5	LOS B	7.8	57.3	0.98	1.15	43.6
25	T	422	8.2	0.651	14.4	LOS B	7.8	57.3	0.96	1.13	42.4
26	R	123	11.1	0.652	24.4	LOS C	6.4	48.7	0.94	1.15	39.0
Approach		805	7.6	0.651	15.9	LOS C	7.8	57.3	0.96	1.14	42.2
North West: HJR NW											
27	L	199	9.5	0.314	10.9	LOS B	2.6	19.8	0.92	0.94	46.5
28	T	660	4.9	0.543	12.5	LOS B	7.0	51.3	0.99	1.07	44.6
29	R	112	7.5	0.544	22.2	LOS C	5.3	39.1	0.96	1.11	40.3
Approach		971	6.2	0.543	13.3	LOS C	7.0	51.3	0.97	1.05	44.3
South West: Springs SW											
30	L	83	11.4	0.711	13.2	LOS B	7.6	56.9	0.96	1.13	45.4
31	T	429	7.8	0.710	11.6	LOS B	7.6	56.9	0.96	1.12	45.5
32	R	439	3.6	0.854	30.0	LOS C	10.1	72.7	0.97	1.30	34.9
Approach		952	6.2	0.854	20.2	LOS C	10.1	72.7	0.96	1.21	39.6
All Vehicles		4456	5.2	0.854	13.5	LOS B	10.1	72.7	0.88	0.95	43.6

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: CSM2 HJR/Springs - 2026 IP

CSM2 - HJR/Springs
2026 IP - EPA Vols - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: HJR SE											
21	L	239	4.4	0.207	6.0	LOS A	1.3	9.6	0.54	0.53	49.2
22	T	437	4.8	0.278	3.8	LOS A	2.0	14.8	0.55	0.37	50.6
23	R	300	3.5	0.263	13.1	LOS B	1.7	12.4	0.56	0.76	44.5
Approach		976	4.3	0.278	7.2	LOS B	2.0	14.8	0.55	0.53	48.1
North East: Springs N											
24	L	203	5.2	0.397	7.8	LOS A	3.1	23.2	0.78	0.71	48.2
25	T	268	10.6	0.397	6.8	LOS A	3.1	23.2	0.78	0.68	47.6
26	R	173	6.1	0.397	16.0	LOS B	2.9	21.3	0.78	0.98	44.1
Approach		644	7.7	0.397	9.5	LOS B	3.1	23.2	0.78	0.77	46.7
North West: HJR NW											
27	L	188	8.9	0.204	7.4	LOS A	1.4	10.5	0.70	0.65	48.2
28	T	606	4.3	0.315	5.2	LOS A	2.6	19.1	0.74	0.51	48.8
29	R	97	8.7	0.315	14.4	LOS B	2.2	16.3	0.73	0.96	45.9
Approach		892	5.8	0.315	6.6	LOS B	2.6	19.1	0.73	0.59	48.3
South West: Springs SW											
30	L	98	9.7	0.468	7.6	LOS A	3.7	27.8	0.74	0.70	49.0
31	T	391	6.7	0.468	6.0	LOS A	3.7	27.8	0.74	0.61	48.8
32	R	282	4.1	0.351	14.5	LOS B	2.2	16.2	0.70	0.87	44.1
Approach		771	6.1	0.468	9.3	LOS B	3.7	27.8	0.72	0.72	46.8
All Vehicles		3282	5.8	0.468	8.0	LOS A	3.7	27.8	0.68	0.64	47.6

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: CSM2 HJR/Springs - 2026 PM

CSM2 - HJR/Springs
2026 PM - EPA Vols - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: HJR SE											
21	L	392	2.7	0.387	6.7	LOS A	2.9	21.1	0.72	0.60	48.0
22	T	707	2.5	0.733	8.4	LOS A	8.9	63.7	0.89	0.95	47.8
23	R	725	1.7	0.514	13.3	LOS B	5.0	35.6	0.76	0.80	43.7
Approach		1824	2.3	0.733	10.0	LOS B	8.9	63.7	0.80	0.82	46.0
North East: Springs N											
24	L	361	2.3	0.978	60.5	LOS E	26.2	188.6	1.00	1.97	22.7
25	T	445	5.2	0.979	62.7	LOS E	26.2	188.6	1.00	1.89	22.0
26	R	128	8.2	0.980	74.3	LOS E	19.6	144.8	1.00	1.81	21.9
Approach		935	4.5	0.979	63.5	LOS E	26.2	188.6	1.00	1.91	22.2
North West: HJR NW											
27	L	108	8.7	0.146	12.2	LOS B	1.6	11.9	1.00	0.83	45.2
28	T	1313	1.8	1.202	191.8	LOS F	126.2	897.4	1.00	4.29	9.7
29	R	156	4.7	1.032	112.5	LOS F	39.9	285.7	1.00	2.58	16.4
Approach		1577	2.6	1.202	171.6	LOS F	126.2	897.4	1.00	3.88	10.7
South West: Springs SW											
30	L	137	1.5	0.894	22.4	LOS C	14.2	102.5	1.00	1.41	38.0
31	T	517	4.7	0.897	20.9	LOS C	14.2	102.5	1.00	1.41	38.1
32	R	255	3.7	0.489	17.7	LOS B	3.7	26.5	0.88	1.01	42.1
Approach		908	3.9	0.897	20.2	LOS C	14.2	102.5	0.97	1.30	39.2
All Vehicles		5244	3.1	1.202	69.9	LOS E	126.2	897.4	0.93	2.02	21.0

Level of Service (Aver. Int. Delay): LOS E. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: CSM2 HJR/Springs - 2041 AM

CSM2 - HJR/Springs
2041 AM - EPA Vols - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: HJR SE											
21	L	321	3.9	0.302	6.4	LOS A	2.2	16.2	0.69	0.57	48.2
22	T	873	3.1	0.924	17.1	LOS B	18.8	135.3	1.00	1.41	41.0
23	R	943	1.7	0.679	14.5	LOS B	8.2	58.3	0.84	0.93	43.3
Approach		2137	2.6	0.925	14.4	LOS B	18.8	135.3	0.88	1.07	43.0
North East: Springs N											
24	L	314	4.0	0.825	25.9	LOS C	13.7	101.3	1.00	1.40	35.5
25	T	475	9.3	0.826	26.6	LOS C	13.7	101.3	1.00	1.38	34.3
26	R	146	8.6	0.827	37.3	LOS D	10.9	82.4	1.00	1.36	32.4
Approach		935	7.4	0.826	28.1	LOS D	13.7	101.3	1.00	1.38	34.4
North West: HJR NW											
27	L	276	8.4	0.655	34.4	LOS C	8.4	62.8	1.00	1.27	31.0
28	T	705	4.5	0.798	50.7	LOS D	19.2	139.5	1.00	1.58	25.2
29	R	118	7.1	0.797	58.0	LOS E	12.8	93.7	1.00	1.49	25.6
Approach		1099	5.7	0.798	47.4	LOS E	19.2	139.5	1.00	1.49	26.4
South West: Springs SW											
30	L	60	15.8	1.429	400.8	LOS F	89.5	678.4	1.00	4.63	5.0
31	T	373	8.8	1.411	399.0	LOS F	89.5	678.4	1.00	4.71	5.1
32	R	463	3.0	0.881	40.5	LOS D	13.3	95.4	1.00	1.43	30.4
Approach		896	6.2	1.414	213.8	LOS F	89.5	678.4	1.00	3.01	9.3
All Vehicles		5066	4.8	1.414	59.3	LOS E	89.5	678.4	0.95	1.56	23.5

Level of Service (Aver. Int. Delay): LOS E. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: CSM2 HJR/Springs - 2041 IP

CSM2 - HJR/Springs
2041 IP - EPA Vols - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: HJR SE											
21	L	334	3.5	0.313	6.3	LOS A	2.2	15.6	0.64	0.57	48.6
22	T	553	3.8	0.371	4.0	LOS A	3.0	21.6	0.64	0.39	49.8
23	R	385	2.7	0.365	13.3	LOS B	2.6	18.6	0.66	0.78	44.1
Approach		1272	3.4	0.371	7.5	LOS B	3.0	21.6	0.65	0.56	47.5
North East: Springs N											
24	L	222	4.7	0.546	10.3	LOS B	5.3	39.9	0.90	1.02	47.6
25	T	333	11.1	0.546	9.4	LOS A	5.3	39.9	0.89	0.95	46.3
26	R	204	5.2	0.546	19.0	LOS B	4.7	34.9	0.88	1.06	41.9
Approach		759	7.6	0.546	12.3	LOS B	5.3	39.9	0.89	1.00	45.2
North West: HJR NW											
27	L	218	7.2	0.265	8.2	LOS A	2.0	15.0	0.80	0.73	47.5
28	T	727	3.5	0.439	6.7	LOS A	4.4	31.5	0.88	0.68	47.7
29	R	104	10.1	0.440	16.4	LOS B	3.7	26.9	0.85	1.03	44.5
Approach		1049	4.9	0.439	8.0	LOS B	4.4	31.5	0.86	0.72	47.3
South West: Springs SW											
30	L	116	8.2	0.629	10.3	LOS B	6.4	47.6	0.87	1.03	48.1
31	T	451	7.7	0.628	8.7	LOS A	6.4	47.6	0.87	0.95	47.7
32	R	317	4.3	0.466	16.6	LOS B	3.5	25.6	0.80	0.98	42.9
Approach		883	6.6	0.628	11.7	LOS B	6.4	47.6	0.85	0.97	45.8
All Vehicles		3963	5.3	0.628	9.5	LOS A	6.4	47.6	0.79	0.78	46.6

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: CSM2 HJR/Springs - 2041 PM

CSM2 - HJR/Springs
2041 PM - EPA Vols - CSM2&MSRFL Network
Roundabout

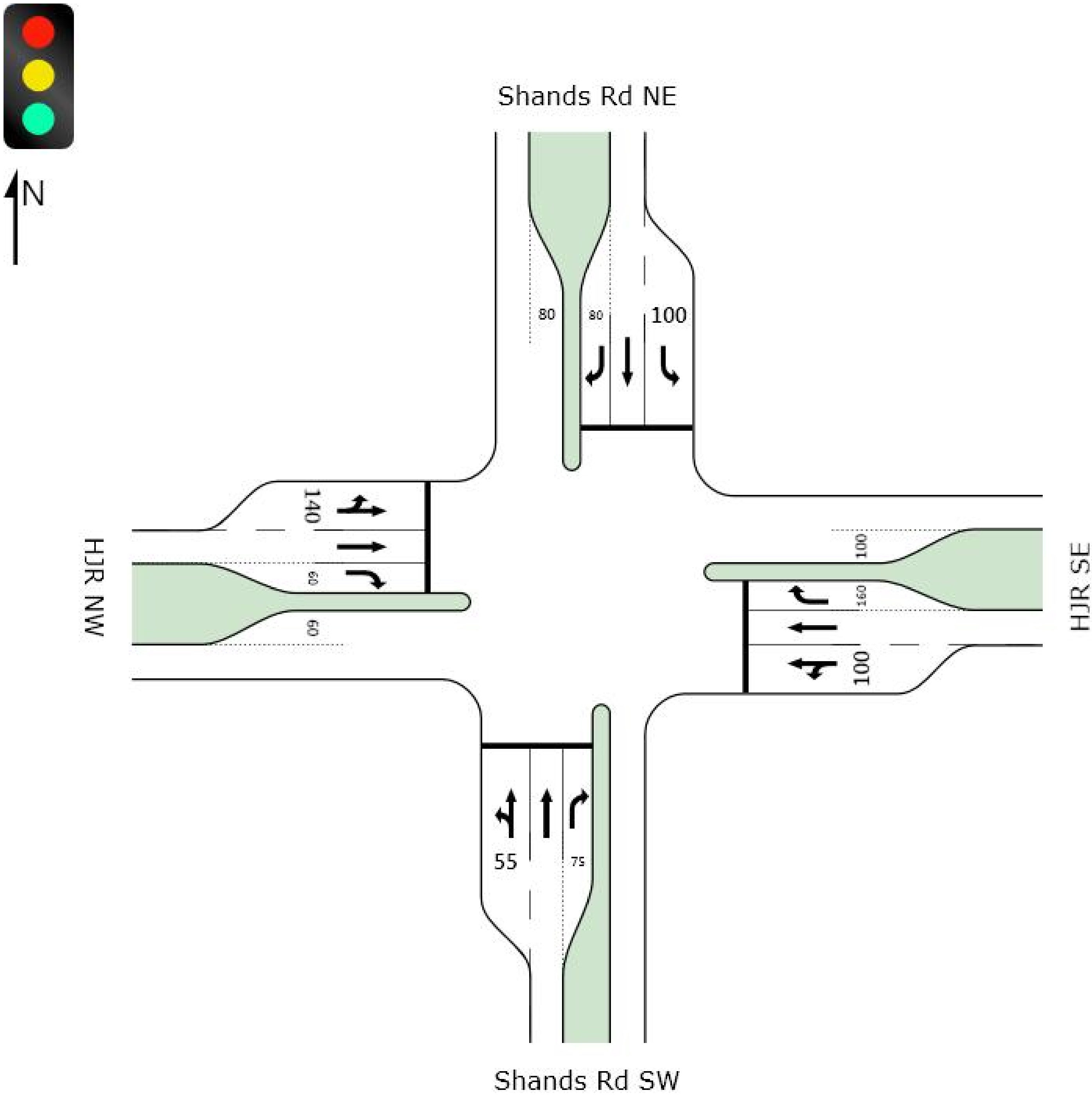
Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: HJR SE											
21	L	462	2.5	0.470	7.6	LOS A	4.3	30.6	0.79	0.71	47.6
22	T	761	2.6	0.555	5.4	LOS A	6.3	45.0	0.82	0.56	48.4
23	R	726	1.7	0.761	18.9	LOS B	11.0	78.0	0.95	1.10	41.3
Approach		1949	2.3	0.762	11.0	LOS B	11.0	78.0	0.86	0.80	45.1
North East: Springs N											
24	L	331	2.2	0.999	83.0	LOS F	22.6	161.9	1.00	1.95	18.4
25	T	505	4.8	1.001 [3]	75.7	LOS E	30.1	220.6	1.00	2.15	19.6
26	R	63	11.7	1.003	83.9	LOS F	30.1	220.6	1.00	2.14	20.3
Approach		899	4.3	1.000	79.0	LOS F	30.1	220.6	1.00	2.07	19.2
North West: HJR NW											
27	L	167	5.0	0.222	12.4	LOS B	2.5	18.3	1.00	0.85	44.9
28	T	1491	2.0	1.390	302.6	LOS F	210.1	1495.5	1.00	5.66	6.5
29	R	116	8.2	1.025	110.4	LOS F	39.7	285.5	1.00	2.56	16.7
Approach		1774	2.7	1.390	262.7	LOS F	210.1	1495.5	1.00	5.00	7.4
South West: Springs SW											
30	L	132	1.6	0.920	24.6	LOS C	15.0	108.6	1.00	1.45	36.6
31	T	514	4.9	0.917	23.1	LOS C	15.0	108.6	1.00	1.45	36.7
32	R	286	2.9	0.576	18.9	LOS B	4.5	32.6	0.90	1.04	41.3
Approach		932	3.8	0.917	22.0	LOS C	15.0	108.6	0.97	1.32	38.1
All Vehicles		5554	3.0	1.390	104.2	LOS F	210.1	1495.5	0.95	2.43	15.9

Level of Service (Aver. Int. Delay): LOS F. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

SIDRA INTERSECTION



N
Shands Rd NE
80
80
100
HJR NW
140
60
60
HJR SE
100
160
100
55
75
Shands Rd SW

MOVEMENT SUMMARY

Site: CSM2&3 HJR/Shands - 2016 AM

CSM2&3 - HJR/Shands
2016 AM - EPA Vols v2 - CSM2&3 Network
Signals - Fixed Time   Cycle Time = 60 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shands Rd SW											
1	L	11	0.0	0.230	21.5	LOS C	3.2	24.0	0.70	0.81	36.1
2	T	257	9.4	0.230	14.2	LOS B	4.5	34.0	0.72	0.58	35.8
3	R	121	19.1	0.438	25.3	LOS C	3.8	31.2	0.95	0.77	33.6
Approach		388	12.2	0.438	17.8	LOS B	4.5	34.0	0.79	0.65	35.0
East: HJR SE											
4	L	134	11.8	0.798	41.4	LOS D	8.4	63.2	1.00	0.94	29.9
5	T	279	2.3	0.798	32.2	LOS C	8.4	63.2	1.00	0.94	33.0
6	R	298	1.1	0.821	39.3	LOS D	11.5	81.0	1.00	0.97	29.9
Approach		711	3.6	0.821	36.9	LOS D	11.5	81.0	1.00	0.95	31.1
North: Shands Rd NE											
7	L	427	0.7	0.485	18.0	LOS B	9.7	68.4	0.68	0.80	37.2
8	T	303	6.6	0.802	29.7	LOS C	11.4	84.3	1.00	1.00	27.9
9	R	17	12.5	0.063	29.6	LOS C	0.7	5.1	0.84	0.70	31.6
Approach		747	3.4	0.802	23.0	LOS C	11.4	84.3	0.81	0.88	32.9
West: HJR NW											
10	L	6	33.3	0.464	37.3	LOS D	5.0	36.7	0.97	0.81	34.3
11	T	240	3.9	0.466	27.5	LOS C	5.0	36.7	0.97	0.76	35.8
12	R	15	0.0	0.040	29.7	LOS C	0.6	3.9	0.83	0.69	34.6
Approach		261	4.4	0.466	27.9	LOS C	5.0	36.7	0.96	0.76	35.7
All Vehicles		2107	5.2	0.821	27.3	LOS C	11.5	84.3	0.89	0.84	33.0

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

Processed: Wednesday, 29 August 2012 12:22:08 p.m.
SIDRA INTERSECTION 5.0.2.1437
Project: D:\3390691_CSM2__Final\99_ModelOutputs\02_SIDRA_CSM2&MSRFL\CSM1_X_HJR&Shands_EPAVols.SIP
8000924, BECA INFRASTRUCTURE LIMITED, FLOATING

MOVEMENT SUMMARY

Site: CSM2&3 HJR/Shands - 2016 IP

CSM2&3 - HJR/Shands
2016 IP - EPA Vols v2 - CSM2&3 Network
Signals - Fixed Time   Cycle Time = 50 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shands Rd SW											
1	L	12	0.0	0.312	28.8	LOS C	3.3	24.7	0.92	0.78	32.6
2	T	182	8.1	0.311	21.2	LOS C	3.3	24.7	0.92	0.71	31.6
3	R	126	12.5	0.362	22.0	LOS C	3.4	26.3	0.92	0.77	35.2
Approach		320	9.5	0.362	21.8	LOS C	3.4	26.3	0.92	0.74	33.0
East: HJR SE											
4	L	128	8.2	0.757	35.9	LOS D	6.4	47.1	1.00	0.90	32.2
5	T	226	1.9	0.757	26.9	LOS C	6.4	47.1	1.00	0.90	35.7
6	R	220	0.5	0.755	33.9	LOS C	7.5	52.9	1.00	0.91	32.4
Approach		575	2.7	0.757	31.6	LOS C	7.5	52.9	1.00	0.91	33.6
North: Shands Rd NE											
7	L	332	0.3	0.374	17.9	LOS B	7.1	50.1	0.71	0.79	37.2
8	T	172	8.6	0.575	22.6	LOS C	5.7	42.5	0.97	0.80	30.9
9	R	13	16.7	0.032	20.2	LOS C	0.3	2.7	0.79	0.67	36.2
Approach		516	3.5	0.575	19.5	LOS B	7.1	50.1	0.80	0.79	35.0
West: HJR NW											
10	L	7	28.6	0.520	33.7	LOS C	4.4	32.3	0.98	0.80	36.4
11	T	241	3.1	0.520	24.1	LOS C	4.4	32.3	0.98	0.77	37.8
12	R	13	0.0	0.043	28.3	LOS C	0.4	3.0	0.87	0.68	35.4
Approach		261	3.6	0.520	24.6	LOS C	4.4	32.3	0.98	0.77	37.6
All Vehicles		1672	4.4	0.757	24.9	LOS C	7.5	52.9	0.92	0.82	34.5

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

MOVEMENT SUMMARY

Site: CSM2&3 HJR/Shands - 2016 PM

CSM2&3 - HJR/Shands
2016 PM - EPA Vols v2 - CSM2&3 Network
Signals - Fixed Time   Cycle Time = 145 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shands Rd SW											
1	L	19	0.0	0.581	60.4	LOS E	8.6	62.2	0.89	0.79	22.4
2	T	317	5.3	0.581	55.6	LOS E	15.6	114.0	0.94	0.77	20.7
3	R	56	24.5	0.197	37.3	LOS D	3.5	29.4	0.76	0.74	28.7
Approach		392	7.8	0.580	53.2	LOS D	15.6	114.0	0.91	0.77	21.7
East: HJR SE											
4	L	92	16.1	0.316	40.9	LOS D	7.3	56.5	0.70	0.80	29.8
5	T	262	3.2	0.316	33.4	LOS C	12.9	93.0	0.74	0.63	33.2
6	R	519	1.0	0.942	64.8	LOS E	37.2	262.4	1.00	0.90	21.9
Approach		873	3.3	0.942	52.8	LOS D	37.2	262.4	0.89	0.81	25.4
North: Shands Rd NE											
7	L	591	0.5	0.750	21.3	LOS C	16.3	114.6	0.75	0.83	35.2
8	T	182	9.2	0.490	55.7	LOS E	13.0	98.5	0.94	0.78	20.7
9	R	14	15.4	0.042	35.8	LOS D	0.9	7.0	0.73	0.68	29.1
Approach		786	2.8	0.750	29.5	LOS C	16.3	114.6	0.80	0.81	30.5
West: HJR NW											
10	L	19	11.1	0.464	67.5	LOS E	12.1	87.9	0.95	0.84	22.6
11	T	299	3.5	0.464	58.5	LOS E	12.1	87.9	0.95	0.77	24.2
12	R	38	0.0	0.188	72.6	LOS E	3.6	24.9	0.94	0.74	20.2
Approach		356	3.6	0.464	60.5	LOS E	12.1	87.9	0.95	0.77	23.7
All Vehicles		2406	3.9	0.942	46.4	LOS D	37.2	262.4	0.87	0.80	25.9

Level of Service (Aver. Int. Delay): LOS D. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS E. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

MOVEMENT SUMMARY

Site: CSM2&3 HJR/Shands - 2026 AM

CSM2&3 - HJR/Shands
2026 AM - EPA Vols v2 - CSM2&3 Network
Signals - Fixed Time   Cycle Time = 75 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shands Rd SW											
1	L	13	0.0	0.305	25.3	LOS C	4.4	32.5	0.72	0.81	34.1
2	T	316	8.7	0.304	18.3	LOS B	7.0	52.9	0.75	0.61	33.3
3	R	152	15.3	0.666	31.7	LOS C	5.9	47.0	1.00	0.83	30.7
Approach		480	10.5	0.666	22.7	LOS C	7.0	52.9	0.83	0.69	32.4
East: HJR SE											
4	L	181	9.3	0.826	48.2	LOS D	12.1	89.6	1.00	0.97	27.1
5	T	334	1.9	0.826	39.1	LOS D	12.1	89.6	1.00	0.97	30.0
6	R	357	0.9	0.818	43.4	LOS D	15.5	109.2	1.00	0.95	28.2
Approach		872	3.0	0.826	42.8	LOS D	15.5	109.2	1.00	0.96	28.7
North: Shands Rd NE											
7	L	445	0.7	0.539	18.3	LOS B	11.1	78.3	0.62	0.79	37.0
8	T	369	6.0	0.860	38.7	LOS D	16.7	123.2	1.00	1.08	24.9
9	R	15	14.3	0.056	33.1	LOS C	0.7	5.4	0.81	0.70	30.2
Approach		829	3.3	0.860	27.6	LOS C	16.7	123.2	0.79	0.92	30.6
West: HJR NW											
10	L	6	33.3	0.470	41.8	LOS D	6.9	50.4	0.95	0.83	31.8
11	T	293	3.2	0.469	32.0	LOS C	6.9	50.4	0.95	0.76	33.5
12	R	19	0.0	0.048	32.2	LOS C	0.8	5.9	0.79	0.70	33.3
Approach		318	3.6	0.469	32.2	LOS C	6.9	50.4	0.94	0.76	33.5
All Vehicles		2499	4.6	0.860	32.6	LOS C	16.7	123.2	0.89	0.87	30.6

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

Processed: Wednesday, 29 August 2012 12:23:53 p.m.
SIDRA INTERSECTION 5.0.2.1437
Project: D:\3390691_CSM2__Final\99_ModelOutputs\02_SIDRA_CSM2&MSRFL\CSM1_X_HJR&Shands_EPAVols.SIP
8000924, BECA INFRASTRUCTURE LIMITED, FLOATING

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: CSM2&3 HJR/Shands - 2026 IP

CSM2&3 - HJR/Shands
2026 IP - EPA Vols v2 - CSM2&3 Network
Signals - Fixed Time   Cycle Time = 50 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shands Rd SW											
1	L	14	0.0	0.455	30.4	LOS C	4.3	32.1	0.96	0.79	31.9
2	T	235	7.2	0.454	22.8	LOS C	4.3	32.1	0.96	0.75	30.7
3	R	160	9.9	0.450	22.9	LOS C	4.4	33.4	0.94	0.78	34.7
Approach		408	8.0	0.454	23.1	LOS C	4.4	33.4	0.95	0.77	32.3
East: HJR SE											
4	L	187	6.2	0.797	36.1	LOS D	7.7	56.3	1.00	0.95	31.7
5	T	247	2.1	0.797	27.2	LOS C	7.7	56.3	1.00	0.94	35.7
6	R	233	0.5	0.798	35.2	LOS D	8.1	57.0	1.00	0.95	31.7
Approach		667	2.7	0.798	32.5	LOS C	8.1	57.0	1.00	0.95	33.2
North: Shands Rd NE											
7	L	416	0.5	0.492	19.3	LOS B	9.3	65.3	0.78	0.81	36.4
8	T	219	7.2	0.831	28.7	LOS C	7.9	58.9	1.00	1.04	28.3
9	R	11	20.0	0.030	21.0	LOS C	0.3	2.4	0.81	0.67	35.8
Approach		645	3.1	0.831	22.5	LOS C	9.3	65.3	0.85	0.89	33.4
West: HJR NW											
10	L	7	28.6	0.506	32.6	LOS C	4.9	35.3	0.97	0.81	37.0
11	T	276	2.7	0.506	23.0	LOS C	4.9	35.3	0.97	0.76	38.5
12	R	15	0.0	0.050	28.4	LOS C	0.5	3.5	0.87	0.69	35.4
Approach		298	3.2	0.506	23.5	LOS C	4.9	35.3	0.96	0.76	38.3
All Vehicles		2019	4.0	0.831	26.1	LOS C	9.3	65.3	0.94	0.86	33.8

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

MOVEMENT SUMMARY

Site: CSM2&3 HJR/Shands - 2026 PM

CSM2&3 - HJR/Shands
2026 PM - EPA Vols v2 - CSM2&3 Network
Signals - Fixed Time   Cycle Time = 140 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shands Rd SW											
1	L	20	0.0	0.731	61.9	LOS E	10.9	78.7	0.90	0.88	22.1
2	T	420	4.5	0.730	56.2	LOS E	19.8	144.1	0.96	0.84	20.5
3	R	104	13.1	0.323	36.2	LOS D	5.9	45.6	0.81	0.77	29.0
Approach		544	6.0	0.730	52.6	LOS D	19.8	144.1	0.93	0.83	21.9
East: HJR SE											
4	L	178	8.9	0.476	43.1	LOS D	10.8	80.9	0.76	0.80	28.4
5	T	342	1.8	0.476	37.0	LOS D	18.4	130.9	0.83	0.71	31.5
6	R	477	1.1	0.944	77.1	LOS E	37.1	262.4	1.00	0.96	19.4
Approach		997	2.7	0.944	57.3	LOS E	37.1	262.4	0.90	0.85	24.1
North: Shands Rd NE											
7	L	634	0.5	0.806	23.2	LOS C	18.3	128.9	0.81	0.85	34.3
8	T	273	6.9	0.698	56.0	LOS E	18.5	137.4	0.98	0.84	20.6
9	R	18	5.9	0.049	34.0	LOS C	1.1	8.0	0.76	0.69	29.7
Approach		924	2.5	0.806	33.1	LOS C	18.5	137.4	0.86	0.84	28.9
West: HJR NW											
10	L	26	8.0	0.692	67.7	LOS E	17.7	127.0	0.99	0.84	22.6
11	T	469	2.2	0.692	58.8	LOS E	17.7	127.0	0.99	0.84	24.1
12	R	32	0.0	0.151	69.5	LOS E	2.9	20.3	0.94	0.73	20.9
Approach		527	2.4	0.692	59.9	LOS E	17.7	127.0	0.99	0.83	23.8
All Vehicles		2993	3.2	0.944	49.4	LOS D	37.1	262.4	0.91	0.84	24.9

Level of Service (Aver. Int. Delay): LOS D. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS E. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: CSM2&3 HJR/Shands - 2041 AM

CSM2&3 - HJR/Shands
2041 AM - EPA Vols v2 - CSM2&3 Network
Signals - Fixed Time   Cycle Time = 75 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shands Rd SW											
1	L	24	0.0	0.480	26.1	LOS C	6.8	49.8	0.75	0.82	33.7
2	T	505	5.6	0.481	19.6	LOS B	11.1	81.5	0.80	0.67	32.6
3	R	195	11.9	0.834	36.7	LOS D	8.0	61.6	1.00	0.97	28.7
Approach		724	7.1	0.834	24.4	LOS C	11.1	81.5	0.85	0.76	31.4
East: HJR SE											
4	L	259	5.7	0.884	51.8	LOS D	15.5	113.4	1.00	1.05	25.7
5	T	387	1.9	0.884	42.9	LOS D	15.5	113.4	1.00	1.06	28.7
6	R	344	0.9	0.888	51.5	LOS D	16.6	117.0	1.00	1.04	25.4
Approach		991	2.6	0.888	48.2	LOS D	16.6	117.0	1.00	1.05	26.8
North: Shands Rd NE											
7	L	428	1.0	0.538	19.5	LOS B	11.2	79.1	0.65	0.79	36.3
8	T	382	6.1	0.890	42.4	LOS D	18.1	133.2	1.00	1.15	23.8
9	R	19	11.1	0.081	33.3	LOS C	0.9	6.8	0.82	0.71	30.0
Approach		829	3.6	0.889	30.3	LOS C	18.1	133.2	0.82	0.96	29.4
West: HJR NW											
10	L	11	20.0	0.547	40.1	LOS D	8.9	64.8	0.96	0.85	32.5
11	T	397	3.7	0.549	30.8	LOS C	8.9	64.8	0.96	0.78	34.1
12	R	43	0.0	0.111	34.5	LOS C	2.0	13.7	0.84	0.73	32.1
Approach		451	3.7	0.549	31.4	LOS C	8.9	64.8	0.94	0.78	33.9
All Vehicles		2995	4.1	0.889	35.0	LOS C	18.1	133.2	0.90	0.91	29.5

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

MOVEMENT SUMMARY

Site: CSM2&3 HJR/Shands - 2041 IP

CSM2&3 - HJR/Shands
2041 IP - EPA Vols v2 - CSM2&3 Network
Signals - Fixed Time   Cycle Time = 60 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shands Rd SW											
1	L	16	0.0	0.421	33.0	LOS C	5.3	39.4	0.94	0.80	30.8
2	T	258	7.3	0.421	25.4	LOS C	5.3	39.4	0.94	0.75	29.7
3	R	192	8.2	0.638	27.4	LOS C	6.3	47.1	0.99	0.83	32.5
Approach		465	7.5	0.638	26.4	LOS C	6.3	47.1	0.96	0.78	30.9
East: HJR SE											
4	L	235	4.9	0.816	40.4	LOS D	10.5	76.1	1.00	0.96	29.7
5	T	297	2.1	0.816	31.5	LOS C	10.5	76.1	1.00	0.96	33.5
6	R	297	0.7	0.816	39.0	LOS D	11.4	80.1	1.00	0.96	30.0
Approach		828	2.4	0.816	36.7	LOS D	11.4	80.1	1.00	0.96	31.2
North: Shands Rd NE											
7	L	487	0.4	0.573	19.9	LOS B	11.8	82.8	0.75	0.82	36.0
8	T	238	6.6	0.756	29.4	LOS C	9.2	67.8	1.00	0.94	28.0
9	R	17	12.5	0.049	23.7	LOS C	0.6	4.3	0.82	0.68	34.3
Approach		742	2.7	0.756	23.1	LOS C	11.8	82.8	0.83	0.85	33.2
West: HJR NW											
10	L	11	10.0	0.478	34.6	LOS C	6.1	43.8	0.95	0.83	35.3
11	T	308	2.4	0.477	25.6	LOS C	6.1	43.8	0.95	0.76	36.9
12	R	16	0.0	0.043	29.8	LOS C	0.6	4.2	0.83	0.69	34.6
Approach		335	2.5	0.477	26.1	LOS C	6.1	43.8	0.95	0.76	36.8
All Vehicles		2371	3.5	0.816	28.9	LOS C	11.8	82.8	0.93	0.87	32.5

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

SIDRA INTERSECTION

MOVEMENT SUMMARY

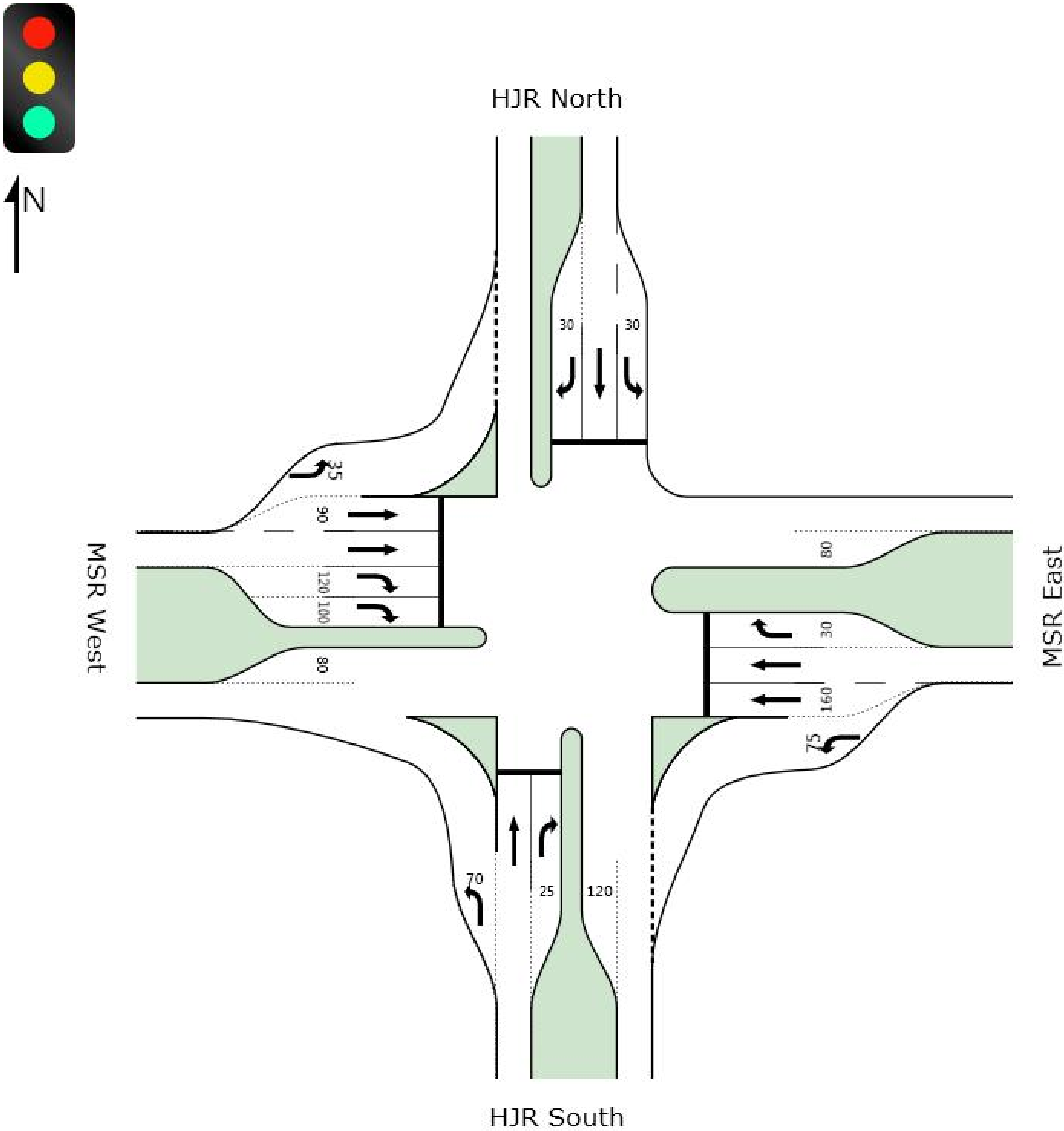
Site: CSM2&3 HJR/Shands - 2041 PM

CSM2&3 - HJR/Shands
2041 PM - EPA Vols v2 - CSM2&3 Network
Signals - Fixed Time   Cycle Time = 145 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shands Rd SW											
1	L	23	0.0	0.736	55.8	LOS E	11.2	80.2	0.83	0.89	23.5
2	T	531	3.6	0.737	50.4	LOS D	25.7	185.3	0.93	0.82	21.8
3	R	137	8.5	0.453	36.6	LOS D	7.0	52.7	0.88	0.77	28.7
Approach		691	4.4	0.737	47.9	LOS D	25.7	185.3	0.92	0.81	23.1
East: HJR SE											
4	L	157	8.7	0.617	51.4	LOS D	14.0	103.5	0.84	0.83	25.9
5	T	435	1.7	0.617	45.7	LOS D	22.7	161.5	0.90	0.78	28.0
6	R	400	1.6	0.972	103.3	LOS F	37.0	262.4	1.00	1.05	15.6
Approach		992	2.8	0.972	69.8	LOS E	37.0	262.4	0.93	0.89	21.2
North: Shands Rd NE											
7	L	620	1.0	0.795	21.7	LOS C	17.5	123.4	0.77	0.83	35.1
8	T	509	4.1	0.962	93.6	LOS F	48.2	349.5	1.00	1.23	15.0
9	R	16	6.7	0.042	31.0	LOS C	0.9	6.6	0.74	0.69	30.9
Approach		1145	2.5	0.963	53.8	LOS D	48.2	349.5	0.87	1.01	22.4
West: HJR NW											
10	L	20	5.3	0.921	90.3	LOS F	27.7	197.7	1.00	1.07	18.1
11	T	619	2.0	0.920	81.9	LOS F	27.7	197.7	1.00	1.07	19.5
12	R	76	0.0	0.376	74.4	LOS E	6.7	46.8	0.97	0.77	19.9
Approach		715	1.9	0.920	81.4	LOS F	27.7	197.7	1.00	1.04	19.5
All Vehicles		3542	2.8	0.972	62.7	LOS E	48.2	349.5	0.92	0.94	21.5

Level of Service (Aver. Int. Delay): LOS E. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.



N
HJR North
30
30
35
90
120
100
80
MSR West
80
30
160
75
MSR East
70
25
120
HJR South

MOVEMENT SUMMARY

Site: CSM2&3 MSR/HJR - 2016 AM

CSM2&3 - MSR/HJR
2016 AM - EPA Vols v2 - CSM2&3 Network
Signals - Fixed Time   Cycle Time = 40 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: HJR South											
1	L	135	1.6	0.073	9.5	NA[9]	NA[9]	NA[9]	0.00	0.65	54.6
2	T	118	0.9	0.401	17.9	LOS B	3.3	23.1	0.95	0.74	42.2
3	R	11	0.0	0.048	28.2	LOS C	0.3	2.2	0.93	0.67	37.8
Approach		263	1.2	0.401	14.0	LOS B	3.3	23.1	0.46	0.69	47.5
East: MSR East											
4	L	11	0.0	0.009	11.0	LOS B	0.1	0.5	0.39	0.67	52.2
5	T	181	19.2	0.211	13.5	LOS B	2.3	18.4	0.83	0.64	46.4
6	R	11	0.0	0.037	26.1	LOS C	0.3	2.1	0.88	0.68	39.1
Approach		202	17.2	0.211	14.0	LOS B	2.3	18.4	0.81	0.65	46.2
North: HJR North											
7	L	11	0.0	0.038	26.3	LOS C	0.3	2.1	0.88	0.68	38.8
8	T	126	2.5	0.434	18.1	LOS B	3.5	25.1	0.95	0.74	42.1
9	R	29	3.6	0.132	28.8	LOS C	0.9	6.4	0.94	0.70	37.6
Approach		166	2.5	0.434	20.5	LOS C	3.5	25.1	0.94	0.73	41.0
West: MSR West											
10	L	12	0.0	0.012	10.8	LOS B	0.1	0.5	0.36	0.66	52.4
11	T	466	6.1	0.492	14.6	LOS B	5.6	41.1	0.90	0.74	45.1
12	R	131	2.4	0.242	27.1	LOS C	1.8	13.2	0.92	0.75	38.5
Approach		608	5.2	0.492	17.3	LOS B	5.6	41.1	0.89	0.74	43.6
All Vehicles		1240	5.9	0.492	16.5	LOS B	5.6	41.1	0.79	0.71	44.4

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

9 Continuous movement

MOVEMENT SUMMARY

Site: CSM2&3 MSR/HJR - 2016 IP

CSM2&3 - MSR/HJR
2016 IP - EPA Vols v2 - CSM2&3 Network
Signals - Fixed Time   Cycle Time = 36 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: HJR South											
1	L	127	1.7	0.069	9.5	NA[9]	NA[9]	NA[9]	0.00	0.65	54.6
2	T	98	1.1	0.300	15.3	LOS B	2.4	17.2	0.92	0.70	44.4
3	R	11	0.0	0.040	24.9	LOS C	0.3	1.9	0.89	0.67	40.0
Approach		236	1.3	0.300	12.6	LOS B	2.4	17.2	0.42	0.68	49.1
East: MSR East											
4	L	11	0.0	0.009	10.9	LOS B	0.1	0.5	0.40	0.66	52.2
5	T	205	15.9	0.352	15.6	LOS B	2.6	21.0	0.92	0.72	44.2
6	R	11	0.0	0.034	23.9	LOS C	0.3	1.8	0.86	0.68	40.6
Approach		226	14.4	0.352	15.7	LOS B	2.6	21.0	0.90	0.71	44.3
North: HJR North											
7	L	11	0.0	0.035	24.1	LOS C	0.3	1.8	0.86	0.68	40.3
8	T	105	2.0	0.325	15.4	LOS B	2.6	18.6	0.92	0.71	44.4
9	R	24	4.3	0.090	25.3	LOS C	0.6	4.6	0.90	0.70	39.8
Approach		140	2.3	0.325	17.8	LOS B	2.6	18.6	0.91	0.71	43.2
West: MSR West											
10	L	11	0.0	0.010	10.7	LOS B	0.1	0.4	0.37	0.66	52.3
11	T	219	14.9	0.366	15.6	LOS B	2.7	21.7	0.93	0.72	44.1
12	R	135	2.3	0.225	24.8	LOS C	1.7	12.1	0.90	0.75	40.1
Approach		364	9.8	0.366	18.9	LOS B	2.7	21.7	0.90	0.73	42.7
All Vehicles		966	7.7	0.366	16.4	LOS B	2.7	21.7	0.78	0.71	44.6

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

9 Continuous movement

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: CSM2&3 MSR/HJR - 2016 PM

CSM2&3 - MSR/HJR
2016 PM - EPA Vols v2 - CSM2&3 Network
Signals - Fixed Time   Cycle Time = 40 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: HJR South											
1	L	127	2.5	0.069	9.5	NA[9]	NA[9]	NA[9]	0.00	0.65	54.6
2	T	137	1.5	0.401	16.9	LOS B	3.7	25.9	0.93	0.73	43.1
3	R	20	0.0	0.100	28.6	LOS C	0.6	4.3	0.94	0.69	37.6
Approach		284	1.9	0.401	14.4	LOS B	3.7	25.9	0.51	0.69	47.0
East: MSR East											
4	L	11	0.0	0.009	11.3	LOS B	0.1	0.6	0.41	0.67	52.0
5	T	483	5.0	0.575	15.9	LOS B	6.1	44.8	0.94	0.77	43.9
6	R	11	0.0	0.037	26.1	LOS C	0.3	2.1	0.88	0.68	39.1
Approach		504	4.8	0.575	16.0	LOS B	6.1	44.8	0.92	0.77	43.9
North: HJR North											
7	L	13	16.7	0.044	26.2	LOS C	0.3	2.8	0.86	0.69	39.4
8	T	204	3.1	0.604	18.1	LOS B	5.5	39.4	0.97	0.81	42.0
9	R	81	0.0	0.332	28.3	LOS C	2.4	16.5	0.95	0.75	37.8
Approach		298	2.8	0.604	21.2	LOS C	5.5	39.4	0.96	0.79	40.7
West: MSR West											
10	L	11	0.0	0.011	10.8	LOS B	0.1	0.5	0.36	0.66	52.4
11	T	318	9.6	0.381	15.0	LOS B	4.0	30.1	0.89	0.71	44.8
12	R	113	2.8	0.209	27.0	LOS C	1.6	11.4	0.91	0.74	38.6
Approach		441	7.6	0.381	18.0	LOS B	4.0	30.1	0.88	0.72	43.2
All Vehicles		1527	4.7	0.604	17.3	LOS B	6.1	44.8	0.84	0.74	43.6

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

9 Continuous movement

Processed: Wednesday, 29 August 2012 12:38:34 p.m.
SIDRA INTERSECTION 5.0.2.1437

Project: D:\3390691_CSM2__Final\99_ModelOutputs\02_SIDRA_CSM2&MSRFL\CSM1_X_MSR&HJR_EPAVols.SIP
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SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: CSM2&3 MSR/HJR - 2026 AM

CSM2&3 - MSR/HJR
2026 AM - EPA Vols v2 - CSM2&3 Network
Signals - Fixed Time   Cycle Time = 40 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: HJR South											
1	L	158	1.3	0.085	9.4	NA[9]	NA[9]	NA[9]	0.00	0.65	54.6
2	T	137	0.8	0.465	18.2	LOS B	3.8	26.7	0.96	0.75	42.0
3	R	14	0.0	0.063	28.3	LOS C	0.4	2.9	0.93	0.67	37.8
Approach		308	1.0	0.465	14.2	LOS B	3.8	26.7	0.47	0.70	47.4
East: MSR East											
4	L	11	0.0	0.009	11.0	LOS B	0.1	0.5	0.39	0.67	52.2
5	T	313	14.8	0.356	14.1	LOS B	3.9	30.6	0.86	0.69	45.7
6	R	11	0.0	0.037	26.1	LOS C	0.3	2.1	0.88	0.68	39.1
Approach		334	13.9	0.356	14.3	LOS B	3.9	30.6	0.85	0.69	45.7
North: HJR North											
7	L	11	0.0	0.038	26.3	LOS C	0.3	2.1	0.88	0.68	38.8
8	T	124	2.5	0.427	18.1	LOS B	3.5	24.7	0.95	0.74	42.1
9	R	51	8.3	0.247	29.5	LOS C	1.5	11.5	0.96	0.73	37.3
Approach		185	4.0	0.427	21.6	LOS C	3.5	24.7	0.95	0.73	40.5
West: MSR West											
10	L	15	0.0	0.015	10.8	LOS B	0.1	0.7	0.36	0.67	52.4
11	T	581	7.4	0.618	15.6	LOS B	7.1	52.7	0.94	0.80	44.1
12	R	192	1.6	0.353	27.5	LOS C	2.7	19.2	0.94	0.77	38.3
Approach		787	5.9	0.618	18.4	LOS B	7.1	52.7	0.93	0.79	42.7
All Vehicles		1615	6.4	0.618	17.1	LOS B	7.1	52.7	0.82	0.75	43.8

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

9 Continuous movement

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: CSM2&3 MSR/HJR - 2026 IP

CSM2&3 - MSR/HJR
2026 IP - EPA Vols v2 - CSM2&3 Network
Signals - Fixed Time   Cycle Time = 36 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: HJR South											
1	L	141	1.5	0.076	9.4	NA[9]	NA[9]	NA[9]	0.00	0.65	54.6
2	T	105	1.0	0.323	15.4	LOS B	2.6	18.4	0.92	0.71	44.4
3	R	11	0.0	0.041	24.9	LOS C	0.3	1.9	0.89	0.67	40.0
Approach		257	1.2	0.323	12.5	LOS B	2.6	18.4	0.41	0.68	49.2
East: MSR East											
4	L	11	0.0	0.009	10.9	LOS B	0.1	0.5	0.40	0.67	52.2
5	T	304	14.5	0.518	16.1	LOS B	3.9	30.7	0.95	0.76	43.6
6	R	11	0.0	0.034	23.9	LOS C	0.3	1.8	0.86	0.68	40.6
Approach		325	13.6	0.518	16.2	LOS B	3.9	30.7	0.93	0.75	43.7
North: HJR North											
7	L	11	0.0	0.035	24.1	LOS C	0.3	1.8	0.86	0.68	40.3
8	T	115	1.8	0.354	15.5	LOS B	2.8	20.2	0.93	0.72	44.3
9	R	37	8.6	0.144	25.8	LOS C	1.0	7.2	0.91	0.72	39.6
Approach		162	3.2	0.354	18.4	LOS B	2.8	20.2	0.92	0.72	42.8
West: MSR West											
10	L	11	0.0	0.010	10.7	LOS B	0.1	0.4	0.37	0.66	52.3
11	T	316	14.0	0.525	16.2	LOS B	4.0	31.1	0.96	0.77	43.5
12	R	162	1.9	0.270	24.9	LOS C	2.0	14.5	0.91	0.76	40.0
Approach		488	9.7	0.525	19.0	LOS B	4.0	31.1	0.93	0.76	42.4
All Vehicles		1233	8.1	0.525	16.8	LOS B	4.0	31.1	0.82	0.74	44.1

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

9 Continuous movement

Processed: Wednesday, 29 August 2012 12:35:16 p.m.
SIDRA INTERSECTION 5.0.2.1437
Project: D:\3390691_CSM2__Final\99_ModelOutputs\02_SIDRA_CSM2&MSRFL\CSM1_X_MSR&HJR_EPAVols.SIP
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SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: CSM2&3 MSR/HJR - 2026 PM

CSM2&3 - MSR/HJR
2026 PM - EPA Vols v2 - CSM2&3 Network
Signals - Fixed Time   Cycle Time = 45 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: HJR South											
1	L	143	1.5	0.077	9.4	NA[9]	NA[9]	NA[9]	0.00	0.65	54.6
2	T	124	1.7	0.287	16.4	LOS B	3.4	24.4	0.87	0.69	43.7
3	R	94	0.0	0.532	33.8	LOS C	3.2	22.5	1.00	0.76	34.6
Approach		361	1.2	0.532	18.2	LOS B	3.4	24.4	0.56	0.69	44.2
East: MSR East											
4	L	11	0.0	0.011	12.2	LOS B	0.1	0.8	0.46	0.67	50.9
5	T	655	5.3	0.719	18.9	LOS B	9.2	67.6	0.97	0.87	41.4
6	R	11	0.0	0.042	28.9	LOS C	0.3	2.4	0.90	0.68	37.3
Approach		676	5.1	0.719	19.0	LOS B	9.2	67.6	0.96	0.86	41.5
North: HJR North											
7	L	22	9.5	0.074	25.7	LOS C	0.6	4.7	0.81	0.71	39.5
8	T	325	1.9	0.752	20.8	LOS C	9.3	66.3	0.99	0.92	40.0
9	R	117	2.7	0.386	28.5	LOS C	3.5	25.1	0.92	0.78	37.7
Approach		464	2.5	0.752	23.0	LOS C	9.3	66.3	0.96	0.87	39.4
West: MSR West											
10	L	13	0.0	0.013	10.6	LOS B	0.1	0.6	0.32	0.67	52.6
11	T	462	9.6	0.510	16.7	LOS B	6.2	46.6	0.91	0.75	43.3
12	R	149	2.1	0.311	30.2	LOS C	2.4	17.1	0.94	0.75	36.6
Approach		624	7.6	0.510	19.8	LOS B	6.2	46.6	0.91	0.75	41.7
All Vehicles		2125	4.6	0.752	20.0	LOS B	9.3	67.6	0.88	0.80	41.5

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

9 Continuous movement

MOVEMENT SUMMARY

Site: CSM2&3 MSR/HJR - 2041 AM

CSM2&3 - MSR/HJR
2041 AM - EPA Vols v2 - CSM2&3 Network
Signals - Fixed Time   Cycle Time = 45 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: HJR South											
1	L	183	1.7	0.099	9.5	NA[9]	NA[9]	NA[9]	0.00	0.65	54.6
2	T	168	0.6	0.552	20.5	LOS C	5.1	35.8	0.97	0.78	40.3
3	R	11	0.0	0.055	31.1	LOS C	0.4	2.5	0.94	0.67	36.1
Approach		362	1.2	0.552	15.2	LOS B	5.1	35.8	0.48	0.71	46.3
East: MSR East											
4	L	11	0.0	0.009	11.6	LOS B	0.1	0.7	0.41	0.67	51.7
5	T	462	14.4	0.421	13.8	LOS B	5.8	45.4	0.83	0.69	46.1
6	R	11	0.0	0.042	28.9	LOS C	0.3	2.4	0.90	0.68	37.3
Approach		483	13.7	0.421	14.0	LOS B	5.8	45.4	0.83	0.69	46.0
North: HJR North											
7	L	11	0.0	0.037	28.0	LOS C	0.3	2.3	0.87	0.68	37.7
8	T	162	2.6	0.538	20.4	LOS C	4.9	35.0	0.97	0.77	40.4
9	R	68	4.6	0.366	32.6	LOS C	2.3	16.9	0.98	0.74	35.4
Approach		241	3.1	0.538	24.2	LOS C	4.9	35.0	0.97	0.76	38.7
West: MSR West											
10	L	18	0.0	0.019	10.8	LOS B	0.1	0.9	0.35	0.67	52.5
11	T	717	9.3	0.620	15.1	LOS B	8.8	66.5	0.91	0.78	44.7
12	R	280	3.0	0.587	31.6	LOS C	4.5	32.2	0.98	0.82	35.8
Approach		1015	7.4	0.620	19.6	LOS B	8.8	66.5	0.92	0.79	41.9
All Vehicles		2101	7.3	0.620	18.1	LOS B	8.8	66.5	0.83	0.75	43.1

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

9 Continuous movement

MOVEMENT SUMMARY

Site: CSM2&3 MSR/HJR - 2041 IP

CSM2&3 - MSR/HJR
2041 IP - EPA Vols v2 - CSM2&3 Network
Signals - Fixed Time   Cycle Time = 40 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: HJR South											
1	L	177	1.2	0.095	9.4	NA[9]	NA[9]	NA[9]	0.00	0.65	54.6
2	T	123	0.9	0.419	18.0	LOS B	3.4	24.1	0.95	0.74	42.2
3	R	11	0.0	0.048	28.2	LOS C	0.3	2.2	0.93	0.67	37.8
Approach		311	1.0	0.419	13.5	LOS B	3.4	24.1	0.41	0.69	48.2
East: MSR East											
4	L	11	0.0	0.009	11.0	LOS B	0.1	0.5	0.39	0.67	52.2
5	T	371	16.5	0.426	14.4	LOS B	4.6	36.7	0.88	0.71	45.4
6	R	11	0.0	0.037	26.1	LOS C	0.3	2.1	0.88	0.68	39.1
Approach		392	15.6	0.426	14.6	LOS B	4.6	36.7	0.87	0.71	45.4
North: HJR North											
7	L	11	0.0	0.038	26.3	LOS C	0.3	2.1	0.88	0.68	38.8
8	T	124	1.7	0.425	18.0	LOS B	3.4	24.5	0.95	0.74	42.1
9	R	49	8.5	0.233	29.4	LOS C	1.5	11.2	0.95	0.73	37.3
Approach		184	3.4	0.425	21.6	LOS C	3.4	24.5	0.95	0.73	40.5
West: MSR West											
10	L	12	0.0	0.012	10.8	LOS B	0.1	0.5	0.36	0.66	52.4
11	T	377	15.6	0.421	14.4	LOS B	4.6	36.3	0.88	0.72	45.4
12	R	187	1.7	0.346	27.5	LOS C	2.6	18.7	0.94	0.76	38.3
Approach		576	10.8	0.421	18.6	LOS B	4.6	36.3	0.89	0.73	42.9
All Vehicles		1462	9.1	0.426	16.8	LOS B	4.6	36.7	0.79	0.72	44.3

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

9 Continuous movement

Processed: Monday, 20 August 2012 10:58:57 p.m.
SIDRA INTERSECTION 5.0.2.1437
Project: D:\3390691_CSM2__Final\99_ModelOutputs\02_SIDRA_CSM2&MSRFL
\CSM1_X_MSR&HJR_EPAVols.SIP
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SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: CSM2&3 MSR/HJR - 2041 PM

CSM2&3 - MSR/HJR
2041 PM - EPA Vols v2 - CSM2&3 Network
Signals - Fixed Time   Cycle Time = 55 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: HJR South											
1	L	158	1.3	0.085	9.4	NA[9]	NA[9]	NA[9]	0.00	0.65	54.6
2	T	127	2.5	0.201	14.6	LOS B	3.6	25.8	0.76	0.61	45.6
3	R	179	0.0	0.825	41.1	LOS D	7.3	51.0	1.00	0.97	31.3
Approach		464	1.1	0.825	23.1	LOS C	7.3	51.0	0.59	0.76	40.7
East: MSR East											
4	L	11	0.0	0.011	13.3	LOS B	0.2	1.1	0.47	0.67	49.8
5	T	740	6.5	0.847	27.6	LOS C	13.3	98.5	1.00	1.00	35.8
6	R	11	0.0	0.051	34.5	LOS C	0.4	3.0	0.92	0.68	34.2
Approach		761	6.4	0.847	27.5	LOS C	13.3	98.5	0.99	0.99	35.9
North: HJR North											
7	L	26	8.0	0.089	23.9	LOS C	0.8	5.7	0.71	0.72	40.7
8	T	428	1.7	0.672	18.2	LOS B	12.0	85.5	0.92	0.81	42.1
9	R	156	2.7	0.561	27.3	LOS C	4.9	34.8	0.84	0.80	38.5
Approach		611	2.2	0.672	20.7	LOS C	12.0	85.5	0.89	0.80	41.1
West: MSR West											
10	L	17	0.0	0.018	10.4	LOS B	0.1	0.7	0.27	0.67	53.0
11	T	658	8.6	0.746	24.1	LOS C	10.8	81.3	0.98	0.90	37.9
12	R	234	1.8	0.593	37.4	LOS D	4.6	32.7	1.00	0.81	32.9
Approach		908	6.7	0.746	27.2	LOS C	10.8	81.3	0.97	0.88	36.7
All Vehicles		2744	4.7	0.847	25.2	LOS C	13.3	98.5	0.90	0.87	38.0

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

9 Continuous movement

Processed: Monday, 20 August 2012 10:59:24 p.m.
SIDRA INTERSECTION 5.0.2.1437
Project: D:\3390691_CSM2__Final\99_ModelOutputs\02_SIDRA_CSM2&MSRFL\CSM1_X_MSR&HJR_EPAVols.SIP
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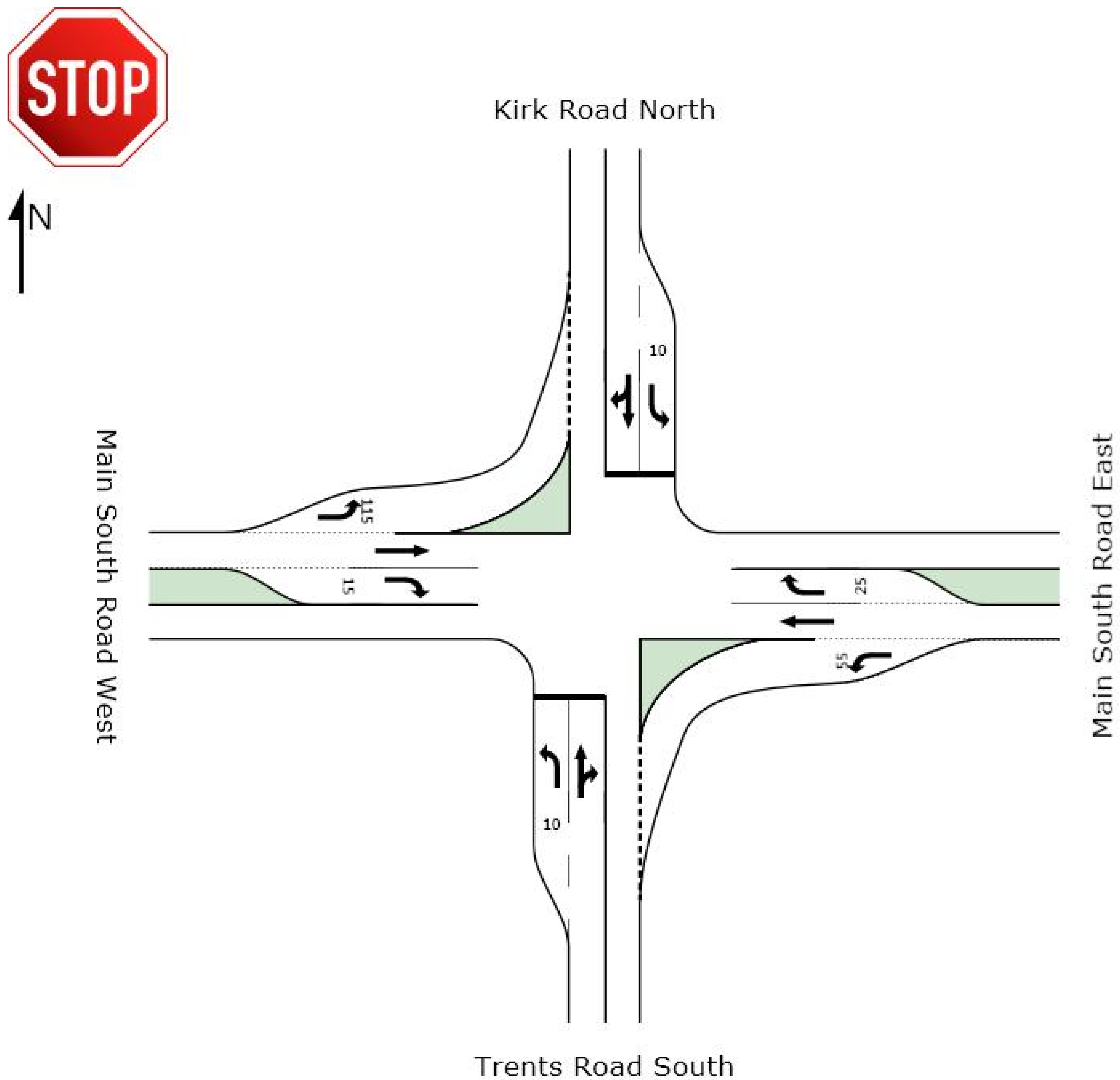

STOP
N
Kirk Road North
10
Main South Road West
115
15
Main South Road East
25
55
10
Trents Road South

MOVEMENT SUMMARY

Site: CSM2&3 - MSR/Kirk/Trents - 2016 AM

MSR/Kirk Rd/Trents Rd
EPA Flows - 2016 AM - CSM2&3 Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Trents Road South											
1	L	11	0.0	0.017	11.2	LOS B	0.0	0.3	0.29	0.84	42.2
2	T	34	3.1	0.263	27.6	LOS D	1.1	7.7	0.84	1.03	30.9
3	R	21	0.0	0.263	28.6	LOS D	1.1	7.7	0.84	1.03	32.5
Approach		65	1.6	0.262	25.3	LOS D	1.1	7.7	0.75	1.00	32.9
East: Main South Road East											
4	L	11	0.0	0.009	8.1	LOS A	0.0	0.3	0.05	0.59	53.5
5	T	177	16.1	0.100	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
6	R	222	6.6	0.220	10.8	LOS B	1.1	7.8	0.53	0.83	46.4
Approach		409	10.5	0.220	6.1	LOS B	1.1	7.8	0.29	0.46	54.9
North: Kirk Road North											
7	L	408	3.1	0.853	17.3	LOS C	4.2	30.4	0.71	1.10	38.6
8	T	25	4.2	1.148	193.0	LOS F	27.6	215.0	1.00	3.19	8.9
9	R	198	14.4	1.144	194.7	LOS F	27.6	215.0	1.00	3.03	9.7
Approach		632	6.7	1.144	79.9	LOS F	27.6	215.0	0.81	1.79	18.8
West: Main South Road West											
10	L	40	73.7	0.069	12.3	LOS B	0.3	3.9	0.43	0.65	50.2
11	T	616	4.1	0.324	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
12	R	11	0.0	0.010	9.2	LOS A	0.0	0.2	0.25	0.63	51.7
Approach		666	8.2	0.324	0.9	LOS B	0.3	3.9	0.03	0.05	68.2
All Vehicles		1773	8.0	1.144	31.1	NA	27.6	215.0	0.39	0.80	33.6

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: CSM2&3 - MSR/Kirk/Trents - 2016 IP

MSR/Kirk Rd/Trents Rd
EPA Flows - 2016 IP - CSM2&3 Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Trents Road South											
1	L	11	0.0	0.017	11.3	LOS B	0.0	0.3	0.30	0.84	42.2
2	T	18	5.9	0.077	17.5	LOS C	0.3	2.3	0.67	0.99	36.2
3	R	11	0.0	0.077	18.4	LOS C	0.3	2.3	0.67	1.00	37.7
Approach		39	2.7	0.077	16.1	LOS C	0.3	2.3	0.57	0.95	38.2
East: Main South Road East											
4	L	11	0.0	0.009	8.1	LOS A	0.0	0.3	0.05	0.59	53.5
5	T	187	14.0	0.105	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
6	R	215	5.9	0.186	9.5	LOS A	0.8	5.8	0.38	0.69	47.2
Approach		413	9.4	0.186	5.1	LOS A	0.8	5.8	0.20	0.38	56.0
North: Kirk Road North											
7	L	263	4.8	0.467	13.7	LOS B	2.0	14.2	0.48	0.97	40.8
8	T	20	5.3	0.513	25.1	LOS D	2.9	23.4	0.81	1.16	32.1
9	R	135	17.2	0.512	26.9	LOS D	2.9	23.4	0.81	1.14	33.7
Approach		418	8.8	0.512	18.5	LOS D	2.9	23.4	0.60	1.04	37.8
West: Main South Road West											
10	L	38	72.2	0.063	12.1	LOS B	0.3	3.5	0.42	0.64	50.5
11	T	324	9.1	0.176	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
12	R	11	0.0	0.010	9.3	LOS A	0.0	0.2	0.25	0.63	51.7
Approach		373	15.3	0.176	1.5	LOS B	0.3	3.5	0.05	0.08	67.0
All Vehicles		1242	10.8	0.512	8.9	NA	2.9	23.4	0.30	0.53	49.7

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: CSM2&3 - MSR/Kirk/Trents - 2016 PM

MSR/Kirk Rd/Trents Rd
EPA Flows - 2016 PM - CSM2&3 Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Trents Road South											
1	L	11	0.0	0.023	13.9	LOS B	0.1	0.5	0.55	0.87	40.6
2	T	25	4.2	0.505	79.9	LOS F	1.9	13.9	0.97	1.07	17.4
3	R	11	0.0	0.501	80.9	LOS F	1.9	13.9	0.97	1.06	18.7
Approach		46	2.3	0.510	65.1	LOS F	1.9	13.9	0.87	1.02	20.6
East: Main South Road East											
4	L	12	0.0	0.010	8.1	LOS A	0.0	0.3	0.05	0.59	53.5
5	T	666	3.0	0.348	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
6	R	420	2.5	0.393	11.3	LOS B	2.5	18.2	0.57	0.91	45.8
Approach		1098	2.8	0.393	4.4	LOS B	2.5	18.2	0.22	0.36	58.5
North: Kirk Road North											
7	L	382	2.2	0.783	17.7	LOS C	4.3	30.4	0.68	1.15	38.3
8	T	39	2.7	1.855	895.1	LOS F	45.1	361.4	1.00	3.65	2.2
9	R	92	23.0	1.869	897.3	LOS F	45.1	361.4	1.00	3.46	2.4
Approach		513	6.0	1.853	241.5	LOS F	45.1	361.4	0.76	1.75	8.0
West: Main South Road West											
10	L	42	75.0	0.110	16.6	LOS C	0.5	5.9	0.59	0.81	45.6
11	T	588	5.2	0.312	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
12	R	11	0.0	0.013	10.9	LOS B	0.0	0.3	0.49	0.71	50.3
Approach		641	9.7	0.312	1.3	LOS C	0.5	5.9	0.05	0.06	67.4
All Vehicles		2298	5.4	1.853	57.6	NA	45.1	361.4	0.31	0.60	24.4

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: CSM2&3 - MSR/Kirk/Trents - 2026 AM

MSR/Kirk Rd/Trents Rd
EPA Flows - 2026 AM - CSM2&3 Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Trents Road South											
1	L	11	0.0	0.019	12.2	LOS B	0.1	0.4	0.43	0.84	41.7
2	T	32	3.3	0.564	66.9	LOS F	2.3	16.5	0.96	1.10	19.5
3	R	20	0.0	0.556	67.9	LOS F	2.3	16.5	0.96	1.09	20.9
Approach		62	1.7	0.562	57.9	LOS F	2.3	16.5	0.87	1.05	22.1
East: Main South Road East											
4	L	11	0.0	0.009	8.1	LOS A	0.0	0.3	0.05	0.59	53.5
5	T	381	10.5	0.209	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
6	R	253	5.4	0.330	13.0	LOS B	1.7	12.8	0.67	0.94	44.3
Approach		644	8.3	0.330	5.2	LOS B	1.7	12.8	0.26	0.38	57.2
North: Kirk Road North											
7	L	395	2.4	1.000[3]	18.8	LOS C	4.3	30.4	0.88	1.00	37.8
8	T	69	4.5	2.459	1441.1	LOS F	69.9	584.9	1.00	4.41	1.4
9	R	98	36.6	2.447	1443.9	LOS F	69.9	584.9	1.00	4.08	1.5
Approach		562	8.4	2.451	441.2	LOS F	69.9	584.9	0.91	1.95	4.7
West: Main South Road West											
10	L	62	64.4	0.104	12.3	LOS B	0.5	5.6	0.46	0.67	50.0
11	T	840	4.4	0.443	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
12	R	11	0.0	0.011	9.8	LOS A	0.0	0.3	0.37	0.65	51.1
Approach		913	8.4	0.443	1.0	LOS B	0.5	5.6	0.04	0.05	68.0
All Vehicles		2181	8.2	2.451	117.3	NA	69.9	584.9	0.35	0.67	14.9

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

MOVEMENT SUMMARY

Site: CSM2&3 - MSR/Kirk/Trents - 2026 IP

MSR/Kirk Rd/Trents Rd
EPA Flows - 2026 IP - CSM2&3 Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Trents Road South											
1	L	11	0.0	0.017	11.5	LOS B	0.0	0.3	0.34	0.84	42.1
2	T	19	5.6	0.105	20.9	LOS C	0.4	3.0	0.76	1.00	34.2
3	R	11	0.0	0.105	21.9	LOS C	0.4	3.0	0.76	1.00	35.8
Approach		40	2.6	0.105	18.7	LOS C	0.4	3.0	0.65	0.96	36.6
East: Main South Road East											
4	L	11	0.0	0.009	8.1	LOS A	0.0	0.3	0.05	0.59	53.5
5	T	235	15.7	0.133	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
6	R	236	4.9	0.207	9.8	LOS A	0.9	6.8	0.44	0.74	47.0
Approach		481	10.1	0.207	5.0	LOS A	0.9	6.8	0.22	0.37	56.5
North: Kirk Road North											
7	L	297	4.3	0.562	15.6	LOS C	2.8	20.6	0.56	1.09	39.6
8	T	22	4.8	1.005	102.5	LOS F	15.0	122.3	1.00	2.30	14.7
9	R	182	20.8	1.012	104.5	LOS F	15.0	122.3	1.00	2.19	15.8
Approach		501	10.3	1.009	51.7	LOS F	15.0	122.3	0.74	1.54	24.5
West: Main South Road West											
10	L	52	79.6	0.095	12.9	LOS B	0.5	5.6	0.46	0.67	49.6
11	T	418	9.3	0.227	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
12	R	11	0.0	0.011	9.4	LOS A	0.0	0.2	0.29	0.63	51.5
Approach		480	16.7	0.227	1.6	LOS B	0.5	5.6	0.06	0.09	66.8
All Vehicles		1502	12.1	1.009	19.9	NA	15.0	122.3	0.35	0.69	40.3

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: CSM2&3 - MSR/Kirk/Trents - 2026 PM

MSR/Kirk Rd/Trents Rd
EPA Flows - 2026 PM - CSM2&3 Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Trents Road South											
1	L	11	0.0	0.029	16.6	LOS C	0.1	0.7	0.67	0.94	38.9
2	T	19	5.6	0.997	435.5	LOS F	6.4	46.1	1.00	1.24	4.4
3	R	11	0.0	0.957	436.4	LOS F	6.4	46.1	1.00	1.22	4.8
Approach		40	2.6	1.000	325.5	LOS F	6.4	46.1	0.91	1.16	6.0
East: Main South Road East											
4	L	13	0.0	0.011	8.1	LOS A	0.0	0.3	0.05	0.59	53.5
5	T	939	3.0	0.491	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
6	R	474	2.2	0.528	13.2	LOS B	3.8	27.4	0.68	1.02	44.0
Approach		1425	2.7	0.528	4.5	LOS B	3.8	27.4	0.23	0.35	58.8
North: Kirk Road North											
7	L	433	2.2	1.000[3]	17.8	LOS C	4.3	30.4	0.87	1.00	38.4
8	T	41	2.8	1.307	1510.9	LOS F	27.9	251.0	1.00	3.10	1.3
9	R	39	64.9	1.343	1515.3	LOS F	27.9	251.0	1.00	2.89	1.5
Approach		513	7.0	1.324	249.6	LOS F	27.9	251.0	0.89	1.31	7.8
West: Main South Road West											
10	L	57	81.5	0.182	19.6	LOS C	0.9	10.1	0.66	0.86	42.9
11	T	729	5.6	0.388	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
12	R	11	0.0	0.016	12.8	LOS B	0.1	0.4	0.63	0.81	48.1
Approach		797	11.0	0.388	1.6	LOS C	0.9	10.1	0.06	0.07	66.9
All Vehicles		2775	5.9	1.324	53.5	NA	27.9	251.0	0.31	0.46	25.7

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: CSM2&3 - MSR/Kirk/Trents - 2041 AM

MSR/Kirk Rd/Trents Rd
EPA Flows - 2041 AM - CSM2&3 Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Trents Road South											
1	L	11	0.0	0.022	13.7	LOS B	0.1	0.5	0.54	0.87	40.7
2	T	38	2.8	0.947	203.2	LOS F	5.2	36.8	1.00	1.32	8.6
3	R	12	0.0	0.965	204.2	LOS F	5.2	36.8	1.00	1.29	9.3
Approach		60	1.8	0.942	170.2	LOS F	5.2	36.8	0.92	1.23	10.2
East: Main South Road East											
4	L	11	0.0	0.009	8.1	LOS A	0.0	0.3	0.05	0.59	53.5
5	T	618	9.5	0.337	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
6	R	287	4.8	0.470	15.6	LOS C	2.7	19.4	0.79	1.03	42.0
Approach		916	7.9	0.471	5.0	LOS C	2.7	19.4	0.25	0.33	58.2
North: Kirk Road North											
7	L	330	2.3	1.000 [3]	21.7	LOS C	4.3	30.4	0.94	1.00	36.2
8	T	107	3.7	2.664	3140.0	LOS F	78.4	681.6	1.00	5.30	0.7
9	R	53	80.0	2.632	3145.1	LOS F	78.4	681.6	1.00	4.78	0.7
Approach		489	10.8	2.653	1036.3	LOS F	78.4	681.6	0.96	2.34	2.1
West: Main South Road West											
10	L	155	41.5	0.220	11.7	LOS B	1.2	11.2	0.49	0.71	50.3
11	T	986	0.0	0.506	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
12	R	11	0.0	0.013	10.8	LOS B	0.0	0.3	0.49	0.71	50.4
Approach		1152	5.6	0.506	1.7	LOS B	1.2	11.2	0.07	0.10	66.6
All Vehicles		2617	7.3	2.653	200.2	NA	78.4	681.6	0.32	0.63	9.7

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

Processed: Wednesday, 17 October 2012 12:59:31 a.m.
SIDRA INTERSECTION 5.0.2.1437
Project: D:\3390691_CSM2__Final\99_ModelOutputs\02_SIDRA_CSM2&MSRFL\CSM2&3_MSR&Kirk&Trents_EPAVols.sip
8000924, BECA INFRASTRUCTURE LIMITED, FLOATING

MOVEMENT SUMMARY

Site: CSM2&3 - MSR/Kirk/Trents - 2041 IP

MSR/Kirk Rd/Trents Rd
EPA Flows - 2041 IP - CSM2&3 Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Trents Road South											
1	L	11	0.0	0.018	12.0	LOS B	0.1	0.4	0.41	0.83	41.8
2	T	26	4.0	0.178	26.1	LOS D	0.7	4.9	0.84	1.01	31.6
3	R	11	0.0	0.178	27.1	LOS D	0.7	4.9	0.84	1.00	33.2
Approach		47	2.2	0.177	23.2	LOS D	0.7	4.9	0.74	0.97	33.9
East: Main South Road East											
4	L	11	0.0	0.009	8.1	LOS A	0.0	0.3	0.05	0.59	53.5
5	T	323	17.3	0.184	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
6	R	249	4.2	0.220	10.3	LOS B	1.1	7.8	0.49	0.79	46.8
Approach		583	11.4	0.220	4.5	LOS B	1.1	7.8	0.21	0.35	57.9
North: Kirk Road North											
7	L	322	3.6	0.657	18.3	LOS C	3.9	28.3	0.64	1.22	37.9
8	T	31	3.4	2.035	1026.2	LOS F	94.3	767.2	1.00	5.89	1.9
9	R	236	21.0	2.087	1028.3	LOS F	94.3	767.2	1.00	5.48	2.1
Approach		588	10.6	2.080	475.3	LOS F	94.3	767.2	0.80	3.17	4.4
West: Main South Road West											
10	L	76	86.1	0.151	13.8	LOS B	0.8	9.4	0.49	0.71	48.8
11	T	505	10.6	0.277	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
12	R	11	0.0	0.011	9.7	LOS A	0.0	0.2	0.35	0.64	51.2
Approach		592	20.1	0.277	1.9	LOS B	0.8	9.4	0.07	0.10	66.2
All Vehicles		1811	13.7	2.080	157.2	NA	94.3	767.2	0.37	1.20	11.8

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

SIDRA INTERSECTION

MOVEMENT SUMMARY

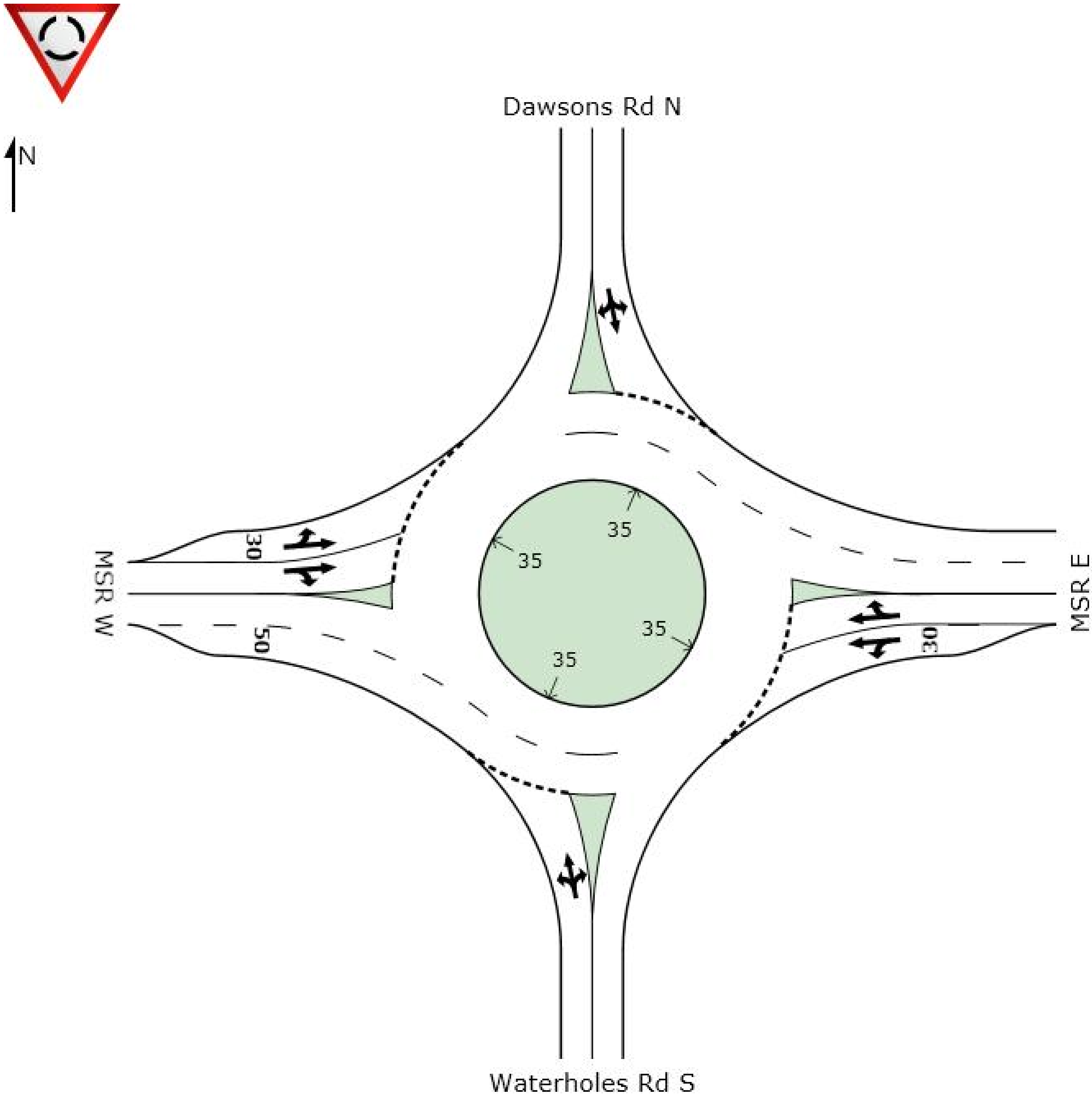
Site: CSM2&3 - MSR/Kirk/Trents - 2041 PM

MSR/Kirk Rd/Trents Rd
EPA Flows - 2041 PM - CSM2&3 Network
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Trents Road South											
1	L	11	0.0	0.036	19.9	LOS C	0.1	0.9	0.77	1.00	36.9
2	T	35	3.0	0.992	742.4	LOS F	10.7	76.4	1.00	1.41	2.7
3	R	11	0.0	0.957	743.5	LOS F	10.7	76.4	1.00	1.39	2.9
Approach		56	1.9	1.000	606.3	LOS F	10.7	76.4	0.96	1.33	3.3
East: Main South Road East											
4	L	13	0.0	0.011	8.1	LOS A	0.0	0.3	0.05	0.59	53.5
5	T	1154	3.8	0.606	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
6	R	475	2.2	0.789	21.1	LOS C	6.9	49.5	0.90	1.34	37.9
Approach		1641	3.3	0.789	6.2	LOS C	6.9	49.5	0.26	0.39	56.7
North: Kirk Road North											
7	L	318	2.3	0.949	22.3	LOS C	4.3	30.4	0.92	1.03	35.8
8	T	52	2.0	1.075	548.7	LOS F	14.3	104.2	1.00	1.68	3.5
9	R	13	16.7	1.053	550.6	LOS F	14.3	104.2	1.00	1.65	3.9
Approach		382	2.8	1.070	110.8	LOS F	14.3	104.2	0.93	1.14	14.9
West: Main South Road West											
10	L	61	82.8	0.199	19.9	LOS C	0.9	11.2	0.67	0.86	42.6
11	T	987	5.9	0.526	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
12	R	11	0.0	0.024	15.6	LOS C	0.1	0.6	0.76	0.93	45.2
Approach		1059	10.2	0.526	1.3	LOS C	0.9	11.2	0.05	0.06	67.4
All Vehicles		3138	5.6	1.070	27.9	NA	14.3	104.2	0.28	0.39	36.5

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.


Dawsons Rd N
N
MSR W
30
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35
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MSR E
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Waterholes Rd S

MOVEMENT SUMMARY

Site: MSRFL - MSR/Waterholes - 2016 AM

MSR/ Waterholes Rd/ Dawsons Rd
2016 AM - EPA Vols - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Waterholes Rd S											
1	L	11	10.0	0.130	11.7	LOS B	0.7	5.0	0.44	0.66	60.8
2	T	36	2.9	0.130	7.8	LOS A	0.7	5.0	0.44	0.56	57.1
3	R	87	1.2	0.130	18.3	LOS B	0.7	5.0	0.44	0.80	56.4
Approach		134	2.4	0.130	14.9	LOS B	0.7	5.0	0.44	0.72	56.9
East: MSR E											
4	L	46	2.3	0.096	11.3	LOS B	0.4	3.4	0.27	0.60	64.9
5	T	309	17.7	0.201	12.2	LOS B	1.5	11.8	0.27	0.56	68.5
6	R	22	4.8	0.201	16.6	LOS B	1.5	11.8	0.27	0.86	57.8
Approach		378	15.0	0.201	12.4	LOS B	1.5	11.8	0.27	0.58	67.4
North: Dawsons Rd N											
7	L	88	4.8	0.172	9.2	LOS A	0.9	6.8	0.53	0.68	53.6
8	T	40	2.6	0.172	7.4	LOS A	0.9	6.8	0.53	0.60	51.1
9	R	33	3.2	0.173	16.2	LOS B	0.9	6.8	0.53	0.87	50.6
Approach		161	3.9	0.172	10.2	LOS B	0.9	6.8	0.53	0.70	52.3
West: MSR W											
10	L	54	2.0	0.225	11.4	LOS B	1.2	8.8	0.34	0.63	63.8
11	T	475	10.4	0.224	12.0	LOS B	1.7	12.8	0.33	0.58	67.8
12	R	25	4.2	0.224	17.6	LOS B	1.7	12.8	0.33	0.83	58.8
Approach		554	9.3	0.224	12.2	LOS B	1.7	12.8	0.33	0.60	67.0
All Vehicles		1226	9.6	0.224	12.3	LOS B	1.7	12.8	0.35	0.62	63.5

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: MSRFL - MSR/Waterholes - 2016 IP

MSR/ Waterholes Rd/ Dawsons Rd
2016 IP - EPA Vols - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Waterholes Rd S											
1	L	11	10.0	0.072	11.5	LOS B	0.4	2.7	0.39	0.63	61.2
2	T	16	0.0	0.072	7.5	LOS A	0.4	2.7	0.39	0.52	57.7
3	R	51	2.1	0.072	18.1	LOS B	0.4	2.7	0.39	0.77	56.5
Approach		77	2.7	0.072	15.0	LOS B	0.4	2.7	0.39	0.70	57.3
East: MSR E											
4	L	37	2.9	0.081	11.2	LOS B	0.4	2.7	0.21	0.60	65.5
5	T	261	18.5	0.169	12.1	LOS B	1.2	9.5	0.20	0.55	69.2
6	R	26	4.0	0.169	16.4	LOS B	1.2	9.5	0.20	0.87	57.7
Approach		324	15.6	0.169	12.4	LOS B	1.2	9.5	0.20	0.59	67.9
North: Dawsons Rd N											
7	L	42	10.0	0.089	8.5	LOS A	0.4	3.3	0.40	0.59	54.3
8	T	18	5.9	0.089	6.6	LOS A	0.4	3.3	0.40	0.52	52.1
9	R	33	0.0	0.089	15.3	LOS B	0.4	3.3	0.40	0.79	51.1
Approach		93	5.7	0.089	10.5	LOS B	0.4	3.3	0.40	0.65	52.7
West: MSR W											
10	L	28	11.1	0.131	11.5	LOS B	0.6	4.8	0.25	0.62	64.5
11	T	261	19.8	0.131	12.3	LOS B	0.9	7.1	0.24	0.56	68.8
12	R	14	7.7	0.130	17.5	LOS B	0.9	7.1	0.24	0.85	58.9
Approach		303	18.4	0.131	12.5	LOS B	0.9	7.1	0.24	0.58	67.9
All Vehicles		797	14.3	0.169	12.4	LOS B	1.2	9.5	0.26	0.60	64.5

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: MSRFL - MSR/Waterholes - 2016 PM

MSR/ Waterholes Rd/ Dawsons Rd
2016 PM - EPA Vols - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Waterholes Rd S											
1	L	11	10.0	0.199	13.2	LOS B	1.2	8.4	0.61	0.79	59.2
2	T	40	2.6	0.198	9.2	LOS A	1.2	8.4	0.61	0.69	54.9
3	R	116	0.9	0.198	19.8	LOS B	1.2	8.4	0.61	0.88	55.2
Approach		166	1.9	0.198	16.8	LOS B	1.2	8.4	0.61	0.83	55.3
East: MSR E											
4	L	60	1.8	0.180	11.5	LOS B	0.9	6.7	0.33	0.63	64.4
5	T	614	6.3	0.376	11.9	LOS B	3.3	24.5	0.36	0.58	67.3
6	R	87	2.4	0.377	16.7	LOS B	3.3	24.5	0.36	0.82	57.6
Approach		761	5.5	0.376	12.4	LOS B	3.3	24.5	0.36	0.61	66.0
North: Dawsons Rd N											
7	L	46	9.1	0.172	9.4	LOS A	0.9	6.9	0.55	0.69	53.4
8	T	57	1.9	0.171	7.5	LOS A	0.9	6.9	0.55	0.61	50.9
9	R	51	2.1	0.171	16.3	LOS B	0.9	6.9	0.55	0.87	50.5
Approach		154	4.1	0.171	11.0	LOS B	0.9	6.9	0.55	0.72	51.5
West: MSR W											
10	L	36	0.0	0.231	11.9	LOS B	1.3	9.7	0.44	0.67	62.9
11	T	460	12.4	0.230	12.6	LOS B	1.8	13.6	0.44	0.62	66.6
12	R	28	11.1	0.231	18.3	LOS B	1.8	13.6	0.43	0.83	58.8
Approach		524	11.4	0.230	12.9	LOS B	1.8	13.6	0.44	0.63	65.9
All Vehicles		1605	7.0	0.376	12.9	LOS B	3.3	24.5	0.43	0.65	63.0

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: MSRFL - MSR/Waterholes - 2026 AM

MSR/ Waterholes Rd/ Dawsons Rd
2026 AM - EPA Vols - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Waterholes Rd S											
1	L	11	20.0	0.157	12.7	LOS B	0.9	6.3	0.51	0.72	60.3
2	T	49	2.1	0.156	8.3	LOS A	0.9	6.3	0.51	0.61	56.3
3	R	88	1.2	0.156	18.8	LOS B	0.9	6.3	0.51	0.83	56.2
Approach		148	2.8	0.156	14.8	LOS B	0.9	6.3	0.51	0.75	56.5
East: MSR E											
4	L	43	2.4	0.125	11.5	LOS B	0.6	4.6	0.31	0.61	64.6
5	T	413	17.6	0.261	12.3	LOS B	2.0	16.4	0.32	0.57	67.9
6	R	24	4.3	0.260	16.7	LOS B	2.0	16.4	0.32	0.84	57.8
Approach		480	15.6	0.261	12.5	LOS B	2.0	16.4	0.32	0.59	67.1
North: Dawsons Rd N											
7	L	87	6.0	0.215	10.2	LOS B	1.2	9.0	0.63	0.76	52.9
8	T	43	2.4	0.215	8.4	LOS A	1.2	9.0	0.63	0.68	50.2
9	R	40	7.9	0.215	17.4	LOS B	1.2	9.0	0.63	0.93	49.9
Approach		171	5.6	0.215	11.4	LOS B	1.2	9.0	0.63	0.78	51.5
West: MSR W											
10	L	67	1.6	0.340	11.6	LOS B	1.9	14.6	0.39	0.64	63.4
11	T	734	9.8	0.340	12.2	LOS B	2.9	21.8	0.39	0.59	67.1
12	R	34	9.4	0.340	17.9	LOS B	2.9	21.8	0.39	0.82	58.8
Approach		835	9.1	0.340	12.4	LOS B	2.9	21.8	0.39	0.60	66.5
All Vehicles		1634	10.1	0.340	12.5	LOS B	2.9	21.8	0.40	0.63	63.7

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

Processed: Thursday, 3 May 2012 8:18:56 p.m.
SIDRA INTERSECTION 5.0.2.1437
Project: P:\339\3390691\TTR\FinalScheme_1203\SIDRA_CSM2&MSRFL\MSRFL_8_MSR&Waterholes_EPAVols.sip
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SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: MSRFL - MSR/Waterholes - 2026 IP

MSR/ Waterholes Rd/ Dawsons Rd
2026 IP - EPA Vols - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Waterholes Rd S											
1	L	11	10.0	0.083	11.9	LOS B	0.4	3.1	0.46	0.67	60.7
2	T	20	5.3	0.083	8.0	LOS A	0.4	3.1	0.46	0.57	56.9
3	R	52	2.0	0.083	18.5	LOS B	0.4	3.1	0.46	0.80	56.3
Approach		82	3.8	0.083	15.1	LOS B	0.4	3.1	0.46	0.73	57.0
East: MSR E											
4	L	29	3.6	0.108	11.3	LOS B	0.5	3.8	0.25	0.61	65.3
5	T	363	20.3	0.226	12.3	LOS B	1.7	13.7	0.24	0.56	68.8
6	R	27	3.8	0.226	16.5	LOS B	1.7	13.7	0.24	0.86	57.7
Approach		420	18.0	0.226	12.5	LOS B	1.7	13.7	0.24	0.58	67.8
North: Dawsons Rd N											
7	L	43	9.8	0.106	8.9	LOS A	0.5	4.0	0.46	0.64	53.9
8	T	21	5.0	0.106	7.0	LOS A	0.5	4.0	0.46	0.56	51.5
9	R	39	2.7	0.106	15.8	LOS B	0.5	4.0	0.46	0.82	50.9
Approach		103	6.1	0.106	11.1	LOS B	0.5	4.0	0.46	0.69	52.2
West: MSR W											
10	L	37	17.1	0.184	11.8	LOS B	0.9	7.1	0.28	0.62	64.3
11	T	365	20.5	0.184	12.4	LOS B	1.3	10.8	0.27	0.56	68.5
12	R	18	11.8	0.184	17.8	LOS B	1.3	10.8	0.26	0.84	58.9
Approach		420	19.8	0.185	12.6	LOS B	1.3	10.8	0.27	0.58	67.7
All Vehicles		1025	16.4	0.226	12.6	LOS B	1.7	13.7	0.29	0.60	64.8

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

Processed: Thursday, 3 May 2012 8:18:56 p.m.
SIDRA INTERSECTION 5.0.2.1437
Project: P:\339\3390691\TTR\FinalScheme_1203\SIDRA_CSM2&MSRFL\MSRFL_8_MSR&Waterholes_EPAVols.sip
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SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: MSRFL - MSR/Waterholes - 2026 PM

MSR/ Waterholes Rd/ Dawsons Rd
2026 PM - EPA Vols - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Waterholes Rd S											
1	L	14	15.4	0.258	14.7	LOS B	1.7	12.0	0.72	0.87	58.4
2	T	54	2.0	0.258	10.5	LOS B	1.7	12.0	0.72	0.79	53.7
3	R	115	0.9	0.258	21.0	LOS C	1.7	12.0	0.72	0.94	54.1
Approach		182	2.3	0.259	17.4	LOS C	1.7	12.0	0.72	0.89	54.3
East: MSR E											
4	L	59	1.8	0.238	11.8	LOS B	1.3	9.6	0.41	0.65	63.9
5	T	864	5.8	0.498	12.2	LOS B	5.0	36.9	0.48	0.61	66.1
6	R	56	3.8	0.498	17.1	LOS B	5.0	36.9	0.49	0.81	57.8
Approach		979	5.5	0.498	12.5	LOS B	5.0	36.9	0.47	0.62	65.5
North: Dawsons Rd N											
7	L	39	10.8	0.229	10.2	LOS B	1.3	9.6	0.63	0.75	52.9
8	T	83	1.3	0.230	8.2	LOS A	1.3	9.6	0.63	0.67	50.3
9	R	63	1.7	0.230	17.0	LOS B	1.3	9.6	0.63	0.93	50.0
Approach		185	3.4	0.230	11.6	LOS B	1.3	9.6	0.63	0.77	50.7
West: MSR W											
10	L	43	0.0	0.313	11.9	LOS B	1.8	14.1	0.46	0.67	62.8
11	T	625	13.1	0.313	12.7	LOS B	2.6	20.4	0.46	0.62	66.3
12	R	40	10.5	0.313	18.3	LOS B	2.6	20.4	0.46	0.82	58.8
Approach		708	12.2	0.313	12.9	LOS B	2.6	20.4	0.46	0.63	65.7
All Vehicles		2055	7.3	0.498	13.0	LOS B	5.0	36.9	0.50	0.66	62.8

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: MSRFL - MSR/Waterholes - 2041 AM

MSR/ Waterholes Rd/ Dawsons Rd
2041 AM - EPA Vols - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Waterholes Rd S											
1	L	18	11.8	0.252	13.2	LOS B	1.5	11.0	0.62	0.78	59.4
2	T	82	5.1	0.250	9.2	LOS A	1.5	11.0	0.62	0.68	55.2
3	R	114	0.9	0.250	19.7	LOS B	1.5	11.0	0.62	0.90	55.4
Approach		214	3.4	0.250	15.1	LOS B	1.5	11.0	0.62	0.81	55.7
East: MSR E											
4	L	39	2.7	0.168	11.6	LOS B	0.9	6.5	0.35	0.63	64.4
5	T	562	13.7	0.352	12.3	LOS B	3.1	24.7	0.38	0.58	67.2
6	R	39	48.6	0.351	18.4	LOS B	3.1	24.7	0.39	0.84	57.8
Approach		640	15.1	0.352	12.6	LOS B	3.1	24.7	0.38	0.60	66.5
North: Dawsons Rd N											
7	L	67	32.8	0.301	12.8	LOS B	1.8	14.2	0.73	0.87	52.1
8	T	57	5.6	0.301	10.1	LOS B	1.8	14.2	0.73	0.81	49.4
9	R	53	6.0	0.301	18.9	LOS B	1.8	14.2	0.73	0.96	48.6
Approach		177	16.1	0.300	13.7	LOS B	1.8	14.2	0.73	0.88	50.1
West: MSR W											
10	L	77	1.4	0.437	12.2	LOS B	2.8	21.2	0.52	0.69	62.2
11	T	918	9.3	0.436	12.7	LOS B	4.1	30.7	0.53	0.64	65.6
12	R	27	7.7	0.434	18.4	LOS B	4.1	30.7	0.53	0.82	58.8
Approach		1022	8.7	0.436	12.8	LOS B	4.1	30.7	0.53	0.65	65.2
All Vehicles		2053	10.8	0.436	13.1	LOS B	4.1	30.7	0.51	0.67	62.9

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: MSRFL - MSR/Waterholes - 2041 IP

MSR/ Waterholes Rd/ Dawsons Rd
2041 IP - EPA Vols - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Waterholes Rd S											
1	L	11	20.0	0.086	12.9	LOS B	0.5	3.3	0.52	0.71	60.2
2	T	19	0.0	0.086	8.4	LOS A	0.5	3.3	0.52	0.62	56.2
3	R	48	2.2	0.086	19.0	LOS B	0.5	3.3	0.52	0.82	56.0
Approach		78	4.1	0.086	15.6	LOS B	0.5	3.3	0.52	0.76	56.5
East: MSR E											
4	L	31	3.4	0.136	11.4	LOS B	0.6	5.0	0.27	0.61	65.0
5	T	458	21.4	0.284	12.4	LOS B	2.3	18.5	0.28	0.56	68.3
6	R	28	3.7	0.284	16.6	LOS B	2.3	18.5	0.28	0.85	57.8
Approach		517	19.3	0.284	12.6	LOS B	2.3	18.5	0.28	0.58	67.6
North: Dawsons Rd N											
7	L	40	7.9	0.120	9.2	LOS A	0.6	4.6	0.51	0.67	53.5
8	T	20	5.3	0.120	7.4	LOS A	0.6	4.6	0.51	0.59	51.1
9	R	52	2.0	0.120	16.1	LOS B	0.6	4.6	0.51	0.83	50.5
Approach		112	4.7	0.120	12.1	LOS B	0.6	4.6	0.51	0.73	51.6
West: MSR W											
10	L	49	23.4	0.238	12.1	LOS B	1.1	9.7	0.29	0.62	64.2
11	T	453	24.9	0.238	12.7	LOS B	1.8	15.1	0.28	0.56	68.3
12	R	18	17.6	0.239	18.0	LOS B	1.8	15.1	0.28	0.84	58.9
Approach		520	24.5	0.238	12.8	LOS B	1.8	15.1	0.28	0.58	67.6
All Vehicles		1226	19.2	0.284	12.8	LOS B	2.3	18.5	0.32	0.61	64.9

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

Processed: Thursday, 3 May 2012 8:18:57 p.m.
SIDRA INTERSECTION 5.0.2.1437
Project: P:\339\3390691\TTR\FinalScheme_1203\SIDRA_CSM2&MSRFL\MSRFL_8_MSR&Waterholes_EPAVols.sip
8000924, BECA INFRASTRUCTURE LIMITED, FLOATING

SIDRA INTERSECTION

MOVEMENT SUMMARY

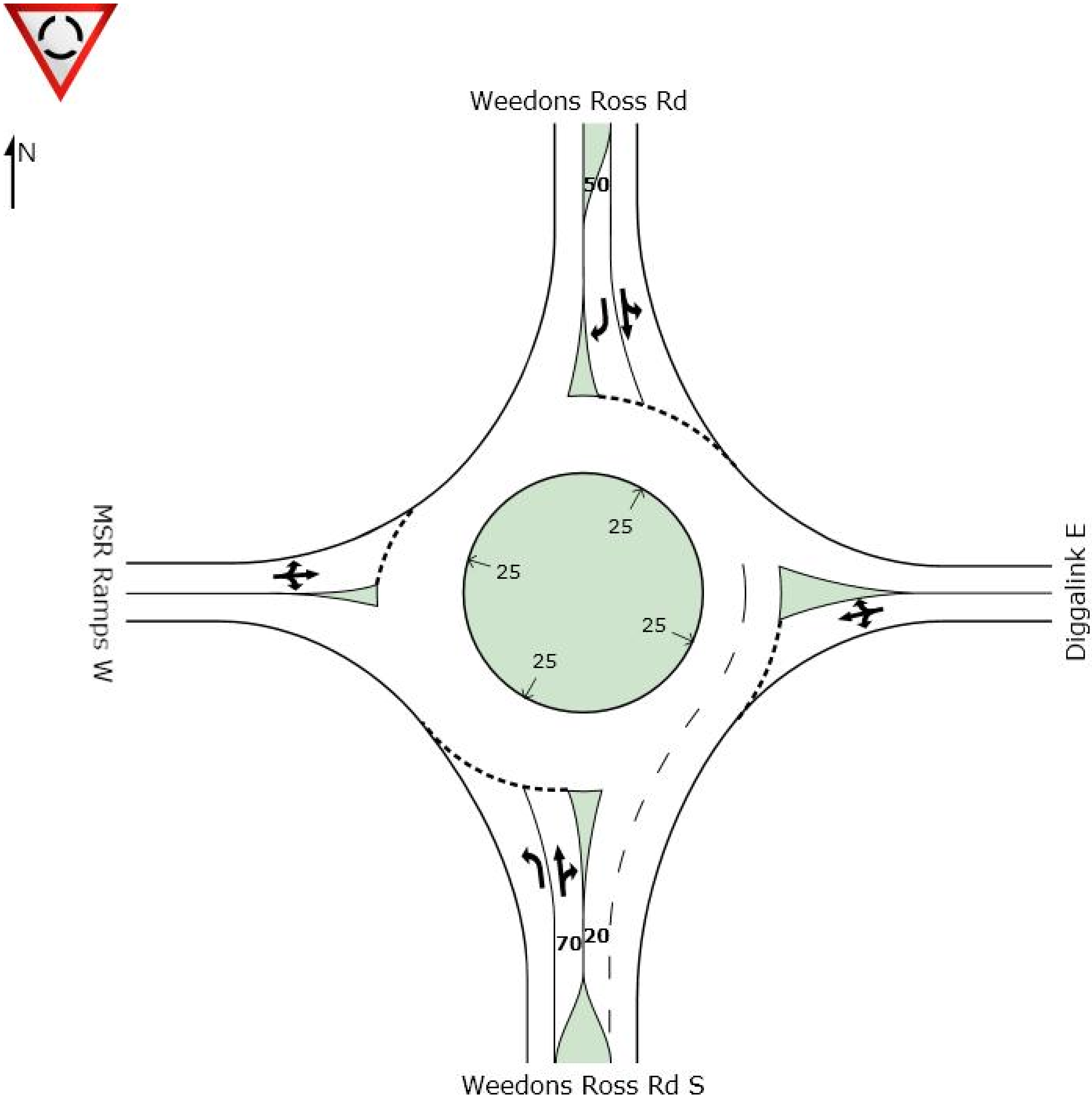
Site: MSRFL - MSR/Waterholes - 2041 PM

MSR/ Waterholes Rd/ Dawsons Rd
2041 PM - EPA Vols - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Waterholes Rd S											
1	L	11	10.0	0.277	15.5	LOS B	1.9	14.0	0.80	0.92	57.6
2	T	62	3.4	0.281	11.6	LOS B	1.9	14.0	0.80	0.87	53.1
3	R	96	2.2	0.281	22.1	LOS C	1.9	14.0	0.80	0.97	53.2
Approach		168	3.1	0.281	17.8	LOS C	1.9	14.0	0.80	0.93	53.4
East: MSR E											
4	L	73	2.9	0.288	12.3	LOS B	1.8	12.7	0.50	0.68	63.1
5	T	948	3.6	0.604	12.6	LOS B	6.8	50.0	0.62	0.65	64.5
6	R	100	23.2	0.602	18.4	LOS B	6.8	50.0	0.65	0.82	57.7
Approach		1121	5.3	0.604	13.1	LOS B	6.8	50.0	0.61	0.67	63.8
North: Dawsons Rd N											
7	L	53	42.0	0.405	13.5	LOS B	2.7	20.5	0.76	0.91	51.7
8	T	117	1.8	0.406	10.4	LOS B	2.7	20.5	0.76	0.88	49.3
9	R	86	1.2	0.405	19.2	LOS B	2.7	20.5	0.76	1.00	48.4
Approach		256	9.9	0.406	14.0	LOS B	2.7	20.5	0.76	0.93	49.4
West: MSR W											
10	L	53	0.0	0.424	12.3	LOS B	2.8	20.8	0.54	0.70	62.1
11	T	864	10.4	0.425	12.9	LOS B	3.9	29.6	0.54	0.65	65.4
12	R	55	7.7	0.424	18.5	LOS B	3.9	29.6	0.55	0.82	58.6
Approach		972	9.6	0.425	13.2	LOS B	3.9	29.6	0.54	0.67	64.9
All Vehicles		2517	7.3	0.604	13.6	LOS B	6.8	50.0	0.61	0.71	61.6

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.



Weedons Ross Rd
N
50
MSR Ramps W
25
25
25
25
Diggalink E
70
20
Weedons Ross Rd S

MOVEMENT SUMMARY

Site: MSRFL MSR/WeedonsNth - 2016 AM

MSRFL - MSR/Weedons Northern Ramps
2016 AM - EPA Vols - CSM2&MSRFL Network

Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Ross Rd S											
1	L	99	6.4	0.064	6.8	LOS A	0.4	3.2	0.19	0.50	40.9
2	T	53	2.0	0.050	5.2	LOS A	0.3	2.0	0.20	0.41	43.1
3	R	5	0.0	0.050	8.8	LOS A	0.3	2.0	0.20	0.72	34.2
Approach		157	4.7	0.064	6.3	LOS A	0.4	3.2	0.19	0.47	41.4
East: Diggalink E											
4	L	5	0.0	0.014	1.7	LOS A	0.1	0.5	0.28	0.24	30.9
5	T	5	0.0	0.014	1.5	LOS A	0.1	0.5	0.28	0.21	31.1
6	R	5	0.0	0.014	6.4	LOS A	0.1	0.5	0.28	0.67	29.0
Approach		16	0.0	0.014	3.2	LOS A	0.1	0.5	0.28	0.38	30.2
North: Weedons Ross Rd											
7	L	5	0.0	0.037	8.0	LOS A	0.2	1.7	0.18	0.56	33.2
8	T	53	2.0	0.037	5.1	LOS A	0.2	1.7	0.18	0.41	40.6
9	R	53	0.0	0.046	11.4	LOS B	0.2	1.7	0.20	0.64	33.0
Approach		111	1.0	0.046	8.2	LOS B	0.2	1.7	0.19	0.52	36.0
West: MSR Ramps W											
10	L	53	0.0	0.082	6.2	LOS A	0.5	3.6	0.19	0.47	46.5
11	T	5	0.0	0.082	8.0	LOS A	0.5	3.6	0.19	0.58	44.4
12	R	53	0.0	0.082	11.4	LOS B	0.5	3.6	0.19	0.70	41.7
Approach		111	0.0	0.082	8.8	LOS B	0.5	3.6	0.19	0.58	43.8
All Vehicles		394	2.1	0.082	7.4	LOS A	0.5	3.6	0.20	0.51	40.7

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: MSRFL MSR/WeedonsNth - 2016 IP

MSRFL - MSR/Weedons Northern Ramps
2016 IP - EPA Vols - CSM2&MSRFL Network

Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Ross Rd S											
1	L	53	2.0	0.038	6.5	LOS A	0.2	1.7	0.19	0.49	40.8
2	T	53	2.0	0.043	5.1	LOS A	0.2	1.7	0.18	0.40	43.3
3	R	5	0.0	0.042	8.7	LOS A	0.2	1.7	0.18	0.72	34.3
Approach		111	1.9	0.043	5.9	LOS A	0.2	1.7	0.19	0.46	41.7
East: Diggalink E											
4	L	5	0.0	0.014	1.7	LOS A	0.1	0.5	0.28	0.24	30.9
5	T	5	0.0	0.014	1.5	LOS A	0.1	0.5	0.28	0.21	31.1
6	R	5	0.0	0.014	6.4	LOS A	0.1	0.5	0.28	0.67	29.0
Approach		16	0.0	0.014	3.2	LOS A	0.1	0.5	0.28	0.38	30.2
North: Weedons Ross Rd											
7	L	5	0.0	0.037	8.0	LOS A	0.2	1.7	0.18	0.56	33.2
8	T	53	2.0	0.037	5.1	LOS A	0.2	1.7	0.18	0.41	40.6
9	R	53	0.0	0.046	11.4	LOS B	0.2	1.7	0.20	0.64	33.0
Approach		111	1.0	0.046	8.2	LOS B	0.2	1.7	0.19	0.52	36.0
West: MSR Ramps W											
10	L	53	0.0	0.082	6.2	LOS A	0.5	3.5	0.19	0.47	46.5
11	T	5	0.0	0.082	8.0	LOS A	0.5	3.5	0.19	0.58	44.4
12	R	53	0.0	0.082	11.4	LOS B	0.5	3.5	0.19	0.70	41.7
Approach		111	0.0	0.082	8.8	LOS B	0.5	3.5	0.19	0.58	43.8
All Vehicles		347	0.9	0.082	7.5	LOS A	0.5	3.5	0.19	0.52	40.7

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: MSRFL MSR/WeedonsNth - 2016 PM

MSRFL - MSR/Weedons Northern Ramps
2016 PM - EPA Vols - CSM2&MSRFL Network

Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Ross Rd S											
1	L	53	2.0	0.038	6.5	LOS A	0.2	1.7	0.19	0.49	40.8
2	T	53	2.0	0.043	5.1	LOS A	0.2	1.7	0.18	0.40	43.3
3	R	5	0.0	0.042	8.7	LOS A	0.2	1.7	0.18	0.72	34.3
Approach		111	1.9	0.043	5.9	LOS A	0.2	1.7	0.19	0.46	41.7
East: Diggalink E											
4	L	5	0.0	0.014	1.7	LOS A	0.1	0.5	0.28	0.24	30.9
5	T	5	0.0	0.014	1.5	LOS A	0.1	0.5	0.28	0.21	31.1
6	R	5	0.0	0.014	6.4	LOS A	0.1	0.5	0.28	0.67	29.0
Approach		16	0.0	0.014	3.2	LOS A	0.1	0.5	0.28	0.38	30.2
North: Weedons Ross Rd											
7	L	5	0.0	0.037	8.0	LOS A	0.2	1.7	0.18	0.56	33.2
8	T	53	0.0	0.037	5.0	LOS A	0.2	1.7	0.18	0.41	40.6
9	R	53	0.0	0.046	11.4	LOS B	0.2	1.7	0.20	0.64	33.0
Approach		111	0.0	0.046	8.2	LOS B	0.2	1.7	0.19	0.52	36.0
West: MSR Ramps W											
10	L	53	0.0	0.082	6.2	LOS A	0.5	3.5	0.19	0.47	46.5
11	T	5	0.0	0.082	8.0	LOS A	0.5	3.5	0.19	0.58	44.4
12	R	53	0.0	0.082	11.4	LOS B	0.5	3.5	0.19	0.70	41.7
Approach		111	0.0	0.082	8.8	LOS B	0.5	3.5	0.19	0.58	43.8
All Vehicles		347	0.6	0.082	7.4	LOS A	0.5	3.5	0.19	0.52	40.7

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: MSRFL MSR/WeedonsNth - 2026 AM

MSRFL - MSR/Weedons Northern Ramps
2026 AM - EPA Vols - CSM2&MSRFL Network

Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Ross Rd S											
1	L	594	1.4	0.360	6.6	LOS A	3.2	22.6	0.25	0.50	40.3
2	T	53	2.0	0.061	5.3	LOS A	0.4	2.5	0.23	0.41	42.7
3	R	5	0.0	0.061	9.0	LOS A	0.4	2.5	0.23	0.72	34.1
Approach		652	1.5	0.360	6.5	LOS A	3.2	22.6	0.25	0.50	40.4
East: Diggalink E											
4	L	5	0.0	0.014	1.7	LOS A	0.1	0.5	0.28	0.25	30.9
5	T	5	0.0	0.014	1.5	LOS A	0.1	0.5	0.28	0.21	31.1
6	R	5	0.0	0.014	6.4	LOS A	0.1	0.5	0.28	0.67	29.0
Approach		16	0.0	0.014	3.2	LOS A	0.1	0.5	0.28	0.38	30.2
North: Weedons Ross Rd											
7	L	5	0.0	0.037	8.0	LOS A	0.2	1.7	0.19	0.56	33.2
8	T	53	2.0	0.037	5.1	LOS A	0.2	1.7	0.19	0.41	40.6
9	R	53	10.0	0.049	11.8	LOS B	0.3	2.0	0.20	0.63	33.0
Approach		111	5.7	0.049	8.4	LOS B	0.3	2.0	0.19	0.52	36.0
West: MSR Ramps W											
10	L	53	0.0	0.082	6.2	LOS A	0.5	3.6	0.19	0.47	46.5
11	T	5	0.0	0.082	8.0	LOS A	0.5	3.6	0.19	0.58	44.4
12	R	53	0.0	0.082	11.4	LOS B	0.5	3.6	0.19	0.70	41.7
Approach		111	0.0	0.082	8.8	LOS B	0.5	3.6	0.19	0.58	43.8
All Vehicles		888	1.8	0.360	7.0	LOS A	3.2	22.6	0.23	0.51	40.4

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: MSRFL MSR/WeedonsNth - 2026 IP

MSRFL - MSR/Weedons Northern Ramps
2026 IP - EPA Vols - CSM2&MSRFL Network

Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Ross Rd S											
1	L	53	2.0	0.038	6.5	LOS A	0.2	1.7	0.19	0.49	40.8
2	T	53	2.0	0.043	5.1	LOS A	0.2	1.7	0.18	0.40	43.3
3	R	5	0.0	0.042	8.7	LOS A	0.2	1.7	0.18	0.72	34.3
Approach		111	1.9	0.043	5.9	LOS A	0.2	1.7	0.19	0.46	41.7
East: Diggalink E											
4	L	5	0.0	0.014	1.7	LOS A	0.1	0.5	0.28	0.24	30.9
5	T	5	0.0	0.014	1.5	LOS A	0.1	0.5	0.28	0.21	31.1
6	R	5	0.0	0.014	6.4	LOS A	0.1	0.5	0.28	0.67	29.0
Approach		16	0.0	0.014	3.2	LOS A	0.1	0.5	0.28	0.38	30.2
North: Weedons Ross Rd											
7	L	5	0.0	0.037	8.0	LOS A	0.2	1.7	0.18	0.56	33.2
8	T	53	2.0	0.037	5.1	LOS A	0.2	1.7	0.18	0.41	40.6
9	R	53	0.0	0.046	11.4	LOS B	0.2	1.7	0.20	0.64	33.0
Approach		111	1.0	0.046	8.2	LOS B	0.2	1.7	0.19	0.52	36.0
West: MSR Ramps W											
10	L	53	0.0	0.082	6.2	LOS A	0.5	3.5	0.19	0.47	46.5
11	T	5	0.0	0.082	8.0	LOS A	0.5	3.5	0.19	0.58	44.4
12	R	53	0.0	0.082	11.4	LOS B	0.5	3.5	0.19	0.70	41.7
Approach		111	0.0	0.082	8.8	LOS B	0.5	3.5	0.19	0.58	43.8
All Vehicles		347	0.9	0.082	7.5	LOS A	0.5	3.5	0.19	0.52	40.7

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

Processed: Thursday, 19 April 2012 9:03:08 p.m.
SIDRA INTERSECTION 5.0.2.1437
Project: P:\339\3390691\TTR\FinalScheme_1203\SIDRA_CSM2&MSRFL \MSRFL_3_MSR&WeedonsNth_EPAVols.sip
8000924, BECA INFRASTRUCTURE LIMITED, FLOATING

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: MSRFL MSR/WeedonsNth - 2026 PM

MSRFL - MSR/Weedons Northern Ramps
2026 PM - EPA Vols - CSM2&MSRFL Network

Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Ross Rd S											
1	L	68	12.3	0.054	7.2	LOS A	0.4	2.7	0.21	0.50	40.7
2	T	79	2.7	0.062	5.1	LOS A	0.4	2.6	0.19	0.41	43.3
3	R	5	0.0	0.062	8.7	LOS A	0.4	2.6	0.19	0.73	34.3
Approach		153	6.9	0.062	6.2	LOS A	0.4	2.7	0.20	0.46	41.8
East: Diggalink E											
4	L	5	0.0	0.014	1.7	LOS A	0.1	0.5	0.28	0.24	30.9
5	T	5	0.0	0.014	1.5	LOS A	0.1	0.5	0.28	0.21	31.1
6	R	5	0.0	0.014	6.4	LOS A	0.1	0.5	0.28	0.67	29.0
Approach		16	0.0	0.014	3.2	LOS A	0.1	0.5	0.28	0.38	30.2
North: Weedons Ross Rd											
7	L	5	0.0	0.037	8.0	LOS A	0.2	1.8	0.19	0.56	33.2
8	T	53	2.0	0.037	5.1	LOS A	0.2	1.8	0.19	0.41	40.5
9	R	53	0.0	0.046	11.4	LOS B	0.2	1.7	0.20	0.63	33.0
Approach		111	1.0	0.046	8.2	LOS B	0.2	1.8	0.19	0.52	36.0
West: MSR Ramps W											
10	L	53	0.0	0.085	6.3	LOS A	0.5	3.7	0.23	0.48	46.1
11	T	5	0.0	0.085	8.2	LOS A	0.5	3.7	0.23	0.58	44.0
12	R	53	0.0	0.085	11.6	LOS B	0.5	3.7	0.23	0.69	41.5
Approach		111	0.0	0.085	8.9	LOS B	0.5	3.7	0.23	0.58	43.6
All Vehicles		389	3.0	0.085	7.4	LOS A	0.5	3.7	0.21	0.51	40.7

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: MSRFL MSR/WeedonsNth - 2041 AM

MSRFL - MSR/Weedons Northern Ramps
2041 AM - EPA Vols - CSM2&MSRFL Network

Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Ross Rd S											
1	L	933	1.2	0.581	6.9	LOS A	6.7	47.2	0.41	0.52	38.8
2	T	175	1.8	0.186	5.7	LOS A	1.2	8.8	0.32	0.45	41.8
3	R	5	0.0	0.188	9.3	LOS A	1.2	8.8	0.32	0.72	33.8
Approach		1113	1.3	0.581	6.8	LOS A	6.7	47.2	0.39	0.51	39.2
East: Diggalink E											
4	L	5	0.0	0.014	1.8	LOS A	0.1	0.5	0.31	0.27	30.6
5	T	5	0.0	0.014	1.6	LOS A	0.1	0.5	0.31	0.24	30.7
6	R	5	0.0	0.014	6.5	LOS A	0.1	0.5	0.31	0.67	28.9
Approach		16	0.0	0.014	3.3	LOS A	0.1	0.5	0.31	0.39	30.0
North: Weedons Ross Rd											
7	L	5	0.0	0.045	8.1	LOS A	0.3	2.3	0.21	0.56	32.9
8	T	53	10.0	0.045	5.4	LOS A	0.3	2.3	0.21	0.41	40.2
9	R	81	14.3	0.072	11.9	LOS B	0.4	3.1	0.20	0.63	33.0
Approach		139	12.1	0.072	9.3	LOS B	0.4	3.1	0.21	0.54	35.2
West: MSR Ramps W											
10	L	53	0.0	0.093	6.8	LOS A	0.6	4.2	0.35	0.51	45.0
11	T	5	0.0	0.092	8.6	LOS A	0.6	4.2	0.35	0.60	43.2
12	R	53	0.0	0.093	12.0	LOS B	0.6	4.2	0.35	0.70	41.1
Approach		111	0.0	0.093	9.4	LOS B	0.6	4.2	0.35	0.60	42.9
All Vehicles		1378	2.3	0.581	7.2	LOS A	6.7	47.2	0.37	0.52	39.2

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: MSRFL MSR/WeedonsNth - 2041 IP

MSRFL - MSR/Weedons Northern Ramps
2041 IP - EPA Vols - CSM2&MSRFL Network

Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Ross Rd S											
1	L	68	10.8	0.047	7.0	LOS A	0.3	2.3	0.19	0.49	40.8
2	T	53	2.0	0.048	5.1	LOS A	0.3	1.9	0.20	0.41	43.2
3	R	5	0.0	0.048	8.8	LOS A	0.3	1.9	0.20	0.72	34.2
Approach		126	6.7	0.048	6.3	LOS A	0.3	2.3	0.19	0.47	41.5
East: Diggalink E											
4	L	5	0.0	0.014	1.7	LOS A	0.1	0.5	0.28	0.24	30.9
5	T	5	0.0	0.014	1.5	LOS A	0.1	0.5	0.28	0.21	31.1
6	R	5	0.0	0.014	6.4	LOS A	0.1	0.5	0.28	0.67	29.0
Approach		16	0.0	0.014	3.2	LOS A	0.1	0.5	0.28	0.38	30.2
North: Weedons Ross Rd											
7	L	5	0.0	0.037	8.0	LOS A	0.2	1.8	0.19	0.56	33.2
8	T	53	4.0	0.037	5.1	LOS A	0.2	1.8	0.19	0.40	40.6
9	R	53	0.0	0.046	11.4	LOS B	0.2	1.7	0.20	0.64	33.0
Approach		111	1.9	0.046	8.3	LOS B	0.2	1.8	0.19	0.52	36.0
West: MSR Ramps W											
10	L	53	0.0	0.082	6.2	LOS A	0.5	3.6	0.19	0.47	46.5
11	T	5	0.0	0.082	8.0	LOS A	0.5	3.6	0.19	0.58	44.4
12	R	53	0.0	0.082	11.4	LOS B	0.5	3.6	0.19	0.70	41.7
Approach		111	0.0	0.082	8.8	LOS B	0.5	3.6	0.19	0.58	43.8
All Vehicles		363	2.9	0.082	7.5	LOS A	0.5	3.6	0.19	0.51	40.6

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: MSRFL MSR/WeedonsNth - 2041 PM

MSRFL - MSR/Weedons Northern Ramps
2041 PM - EPA Vols - CSM2&MSRFL Network

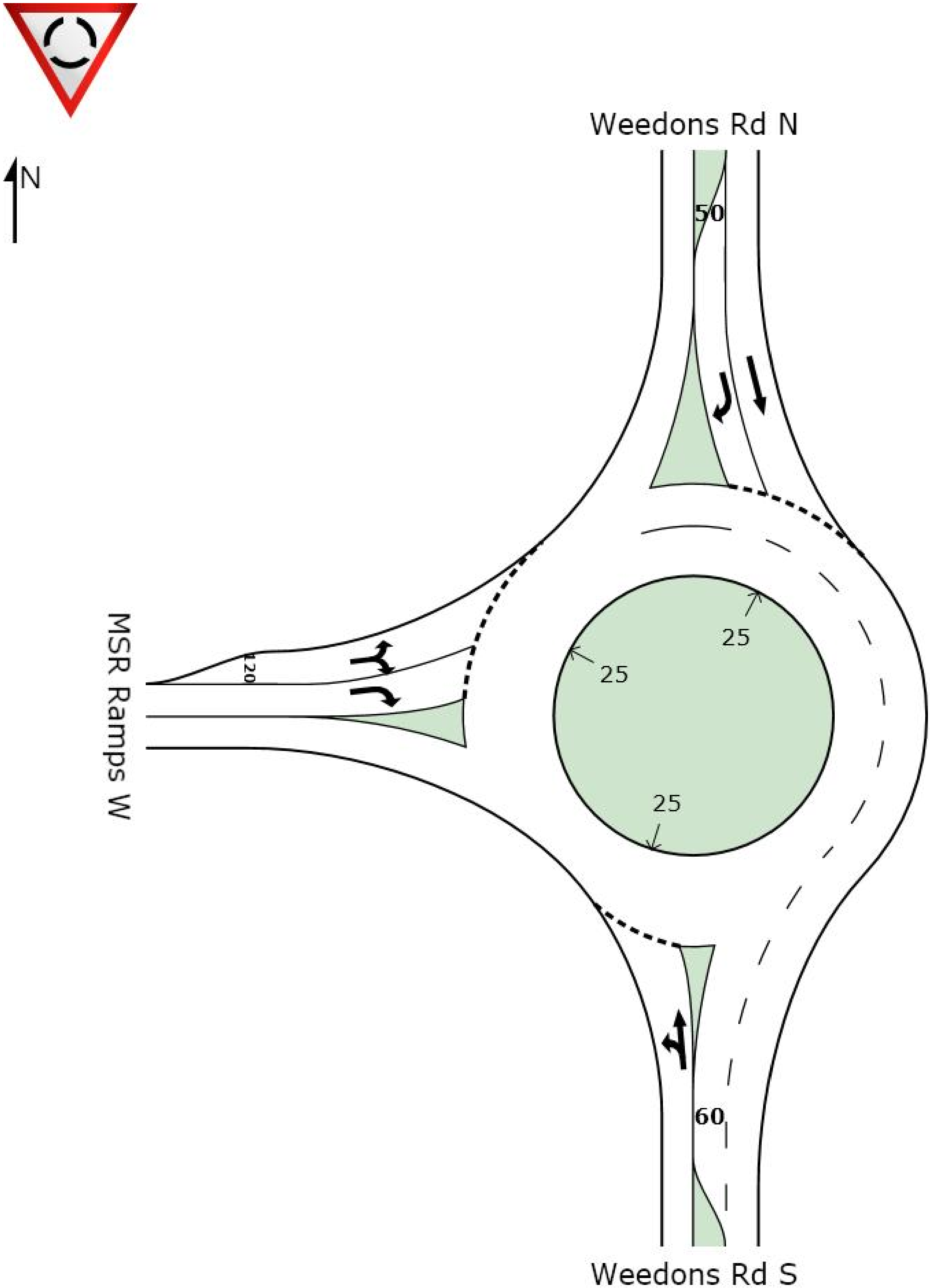
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Ross Rd S											
1	L	404	2.6	0.269	7.0	LOS A	2.2	15.5	0.35	0.53	39.3
2	T	102	2.1	0.108	5.9	LOS A	0.7	5.2	0.36	0.47	41.2
3	R	5	0.0	0.107	9.6	LOS A	0.7	5.2	0.36	0.72	33.5
Approach		512	2.5	0.269	6.8	LOS A	2.2	15.5	0.35	0.52	39.7
East: Diggalink E											
4	L	5	0.0	0.016	2.3	LOS A	0.1	0.6	0.40	0.34	29.9
5	T	5	0.0	0.016	2.1	LOS A	0.1	0.6	0.40	0.31	29.9
6	R	5	0.0	0.016	7.0	LOS A	0.1	0.6	0.40	0.69	28.7
Approach		16	0.0	0.016	3.8	LOS A	0.1	0.6	0.40	0.44	29.4
North: Weedons Ross Rd											
7	L	5	0.0	0.103	8.0	LOS A	0.7	5.3	0.20	0.57	33.1
8	T	158	4.7	0.103	5.2	LOS A	0.7	5.3	0.20	0.41	40.5
9	R	109	24.0	0.123	12.3	LOS B	0.7	5.6	0.23	0.62	32.8
Approach		273	12.4	0.123	8.1	LOS B	0.7	5.6	0.21	0.50	36.6
West: MSR Ramps W											
10	L	53	0.0	0.088	6.4	LOS A	0.6	4.0	0.27	0.48	45.7
11	T	5	0.0	0.088	8.3	LOS A	0.6	4.0	0.27	0.58	43.7
12	R	53	0.0	0.088	11.7	LOS B	0.6	4.0	0.27	0.69	41.4
Approach		111	0.0	0.088	9.0	LOS B	0.6	4.0	0.27	0.59	43.3
All Vehicles		911	5.1	0.269	7.4	LOS A	2.2	15.5	0.30	0.52	39.3

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

SIDRA INTERSECTION



Weedons Rd N
N
50
25
25
25
120
MSR Ramps W
60
Weedons Rd S

MOVEMENT SUMMARY

Site: MSRFL MSR/WeedonsSth - 2016 AM

MSRFL - MSR/Weedons Southern Ramps
2016 AM - EPA Vols - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Rd S											
1	L	58	0.0	0.126	6.2	LOS A	0.9	6.3	0.19	0.51	50.5
2	T	118	5.4	0.126	5.2	LOS A	0.9	6.3	0.19	0.40	51.5
Approach		176	3.6	0.126	5.5	LOS A	0.9	6.3	0.19	0.44	51.2
North: Weedons Rd N											
8	T	53	2.0	0.037	5.1	LOS A	0.2	1.5	0.16	0.42	43.7
9	R	53	0.0	0.046	11.4	LOS B	0.2	1.6	0.16	0.64	36.0
Approach		105	1.0	0.046	8.2	LOS B	0.2	1.6	0.16	0.53	39.2
West: MSR Ramps W											
10	L	53	0.0	0.038	6.6	LOS A	0.3	1.8	0.26	0.50	45.7
12	R	53	8.0	0.038	12.0	LOS B	0.3	1.9	0.28	0.63	41.0
Approach		105	4.0	0.038	9.3	LOS B	0.3	1.9	0.27	0.56	43.1
All Vehicles		386	3.0	0.126	7.3	LOS A	0.9	6.3	0.20	0.50	46.7

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: MSRFL MSR/WeedonsSth - 2016 IP

MSRFL - MSR/Weedons Southern Ramps
2016 IP - EPA Vols - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Rd S											
1	L	53	0.0	0.077	6.1	LOS A	0.5	3.6	0.18	0.50	50.5
2	T	53	2.0	0.077	5.1	LOS A	0.5	3.6	0.18	0.40	51.5
Approach		105	1.0	0.077	5.6	LOS A	0.5	3.6	0.18	0.45	51.0
North: Weedons Rd N											
8	T	53	2.0	0.037	5.1	LOS A	0.2	1.4	0.15	0.42	43.8
9	R	53	0.0	0.046	11.4	LOS B	0.2	1.5	0.16	0.65	36.0
Approach		105	1.0	0.046	8.2	LOS B	0.2	1.5	0.15	0.53	39.3
West: MSR Ramps W											
10	L	53	0.0	0.037	6.3	LOS A	0.2	1.6	0.17	0.49	46.5
12	R	53	8.0	0.037	11.6	LOS B	0.2	1.8	0.18	0.64	41.5
Approach		105	4.0	0.037	9.0	LOS B	0.2	1.8	0.17	0.56	43.7
All Vehicles		316	2.0	0.077	7.6	LOS A	0.5	3.6	0.17	0.51	45.6

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

Processed: Thursday, 3 May 2012 6:20:55 p.m.
SIDRA INTERSECTION 5.0.2.1437
Project: P:\339\3390691\TTR\FinalScheme_1203\SIDRA_CSM2&MSRFL\MSRFL_4_MSR&WeedonsSth_EPAVols.sip
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SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: MSRFL MSR/WeedonsSth - 2016 PM

MSRFL - MSR/Weedons Southern Ramps
2016 PM - EPA Vols - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Rd S											
1	L	73	0.0	0.098	6.1	LOS A	0.7	5.0	0.20	0.50	50.4
2	T	63	3.3	0.098	5.1	LOS A	0.7	5.0	0.20	0.40	51.4
Approach		136	1.6	0.098	5.7	LOS A	0.7	5.0	0.20	0.45	50.9
North: Weedons Rd N											
8	T	53	0.0	0.042	5.7	LOS A	0.2	1.6	0.35	0.49	41.4
9	R	53	0.0	0.046	12.1	LOS B	0.2	1.7	0.36	0.67	34.9
Approach		105	0.0	0.046	8.9	LOS B	0.2	1.7	0.36	0.58	37.6
West: MSR Ramps W											
10	L	53	0.0	0.116	6.4	LOS A	0.8	5.4	0.20	0.48	46.1
12	R	286	2.2	0.116	11.5	LOS B	0.8	5.8	0.20	0.65	41.4
Approach		339	1.9	0.116	10.7	LOS B	0.8	5.8	0.20	0.62	42.0
All Vehicles		580	1.5	0.116	9.2	LOS A	0.8	5.8	0.23	0.57	43.9

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: MSRFL MSR/WeedonsSth - 2026 AM

MSRFL - MSR/Weedons Southern Ramps
2026 AM - EPA Vols - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Rd S											
1	L	84	0.0	0.468	6.3	LOS A	4.7	33.6	0.27	0.52	50.1
2	T	622	1.5	0.467	5.2	LOS A	4.7	33.6	0.27	0.42	51.0
Approach		706	1.3	0.467	5.3	LOS A	4.7	33.6	0.27	0.43	50.9
North: Weedons Rd N											
8	T	53	2.0	0.037	5.1	LOS A	0.2	1.8	0.19	0.41	43.3
9	R	53	0.0	0.048	11.4	LOS B	0.3	1.8	0.19	0.63	35.8
Approach		105	1.0	0.048	8.2	LOS B	0.3	1.8	0.19	0.52	39.0
West: MSR Ramps W											
10	L	53	0.0	0.061	9.0	LOS A	0.5	3.4	0.65	0.64	42.8
12	R	53	14.0	0.061	15.5	LOS B	0.5	3.4	0.66	0.75	38.5
Approach		105	7.0	0.061	12.3	LOS B	0.5	3.4	0.66	0.69	40.4
All Vehicles		917	2.0	0.467	6.4	LOS A	4.7	33.6	0.30	0.47	48.9

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

Processed: Thursday, 3 May 2012 6:20:55 p.m.
SIDRA INTERSECTION 5.0.2.1437
Project: P:\339\3390691\TTR\FinalScheme_1203\SIDRA_CSM2&MSRFL\MSRFL_4_MSR&WeedonsSth_EPAVols.sip
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SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: MSRFL MSR/WeedonsSth - 2026 IP

MSRFL - MSR/Weedons Southern Ramps
2026 IP - EPA Vols - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Rd S											
1	L	66	0.0	0.094	6.1	LOS A	0.6	4.5	0.19	0.50	50.5
2	T	63	1.7	0.094	5.1	LOS A	0.6	4.5	0.19	0.40	51.5
Approach		129	0.8	0.094	5.6	LOS A	0.6	4.5	0.19	0.45	51.0
North: Weedons Rd N											
8	T	53	2.0	0.037	5.1	LOS A	0.2	1.5	0.16	0.42	43.7
9	R	53	0.0	0.046	11.4	LOS B	0.2	1.5	0.16	0.65	36.0
Approach		105	1.0	0.046	8.2	LOS B	0.2	1.5	0.16	0.53	39.2
West: MSR Ramps W											
10	L	53	0.0	0.038	6.4	LOS A	0.2	1.7	0.19	0.49	46.3
12	R	53	12.0	0.038	11.8	LOS B	0.2	1.9	0.20	0.63	41.4
Approach		105	6.0	0.038	9.1	LOS B	0.2	1.9	0.19	0.56	43.6
All Vehicles		340	2.5	0.094	7.5	LOS A	0.6	4.5	0.18	0.51	46.0

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: MSRFL MSR/WeedonsSth - 2026 PM

MSRFL - MSR/Weedons Southern Ramps
2026 PM - EPA Vols - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Rd S											
1	L	53	0.0	0.109	6.2	LOS A	0.8	6.0	0.21	0.51	50.4
2	T	93	10.2	0.109	5.3	LOS A	0.8	6.0	0.21	0.40	51.3
Approach		145	6.5	0.109	5.6	LOS A	0.8	6.0	0.21	0.44	51.0
North: Weedons Rd N											
8	T	53	2.0	0.052	6.8	LOS A	0.3	1.9	0.53	0.60	39.5
9	R	53	0.0	0.061	13.4	LOS B	0.3	2.2	0.54	0.77	34.0
Approach		105	1.0	0.061	10.1	LOS B	0.3	2.2	0.53	0.69	36.3
West: MSR Ramps W											
10	L	55	1.9	0.278	6.7	LOS A	2.2	15.5	0.29	0.49	45.3
12	R	747	1.3	0.277	11.7	LOS B	2.2	15.8	0.30	0.64	40.9
Approach		802	1.3	0.277	11.4	LOS B	2.2	15.8	0.30	0.63	41.2
All Vehicles		1053	2.0	0.277	10.4	LOS B	2.2	15.8	0.31	0.61	42.4

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: MSRFL MSR/WeedonsSth - 2041 AM

MSRFL - MSR/Weedons Southern Ramps
2041 AM - EPA Vols - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Rd S											
1	L	53	0.0	0.721	6.5	LOS A	11.8	83.4	0.43	0.50	49.3
2	T	1066	1.3	0.725	5.4	LOS A	11.8	83.4	0.43	0.42	49.8
Approach		1119	1.2	0.725	5.5	LOS A	11.8	83.4	0.43	0.42	49.7
North: Weedons Rd N											
8	T	53	6.0	0.041	5.6	LOS A	0.3	2.0	0.33	0.45	41.6
9	R	53	4.0	0.049	11.9	LOS B	0.3	2.1	0.34	0.63	35.0
Approach		105	5.0	0.049	8.7	LOS B	0.3	2.1	0.34	0.54	37.8
West: MSR Ramps W											
10	L	53	4.0	0.193	14.5	LOS B	1.9	13.9	0.95	0.85	37.3
12	R	155	5.4	0.193	20.7	LOS C	1.9	13.9	0.93	0.89	34.1
Approach		207	5.1	0.193	19.1	LOS C	1.9	13.9	0.94	0.88	34.8
All Vehicles		1432	2.1	0.725	7.7	LOS A	11.8	83.4	0.50	0.50	46.9

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: MSRFL MSR/WeedonsSth - 2041 IP

MSRFL - MSR/Weedons Southern Ramps
2041 IP - EPA Vols - CSM2&MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Rd S											
1	L	97	0.0	0.134	6.2	LOS A	1.0	7.1	0.20	0.50	50.4
2	T	87	9.6	0.134	5.3	LOS A	1.0	7.1	0.20	0.40	51.4
Approach		184	4.6	0.134	5.8	LOS A	1.0	7.1	0.20	0.45	50.9
North: Weedons Rd N											
8	T	53	2.0	0.041	5.6	LOS A	0.2	1.6	0.33	0.47	41.6
9	R	53	2.0	0.046	12.0	LOS B	0.2	1.7	0.34	0.66	35.0
Approach		105	2.0	0.046	8.8	LOS B	0.2	1.7	0.33	0.57	37.8
West: MSR Ramps W											
10	L	53	0.0	0.102	6.5	LOS A	0.7	4.9	0.24	0.48	45.7
12	R	236	3.6	0.102	11.7	LOS B	0.7	5.0	0.25	0.65	41.2
Approach		288	2.9	0.102	10.7	LOS B	0.7	5.0	0.25	0.62	41.9
All Vehicles		578	3.3	0.134	8.8	LOS A	1.0	7.1	0.25	0.55	44.7

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: MSRFL MSR/WeedonsSth - 2041 PM

MSRFL - MSR/Weedons Southern Ramps
2041 PM - EPA Vols - CSM2&MSRFL Network
Roundabout

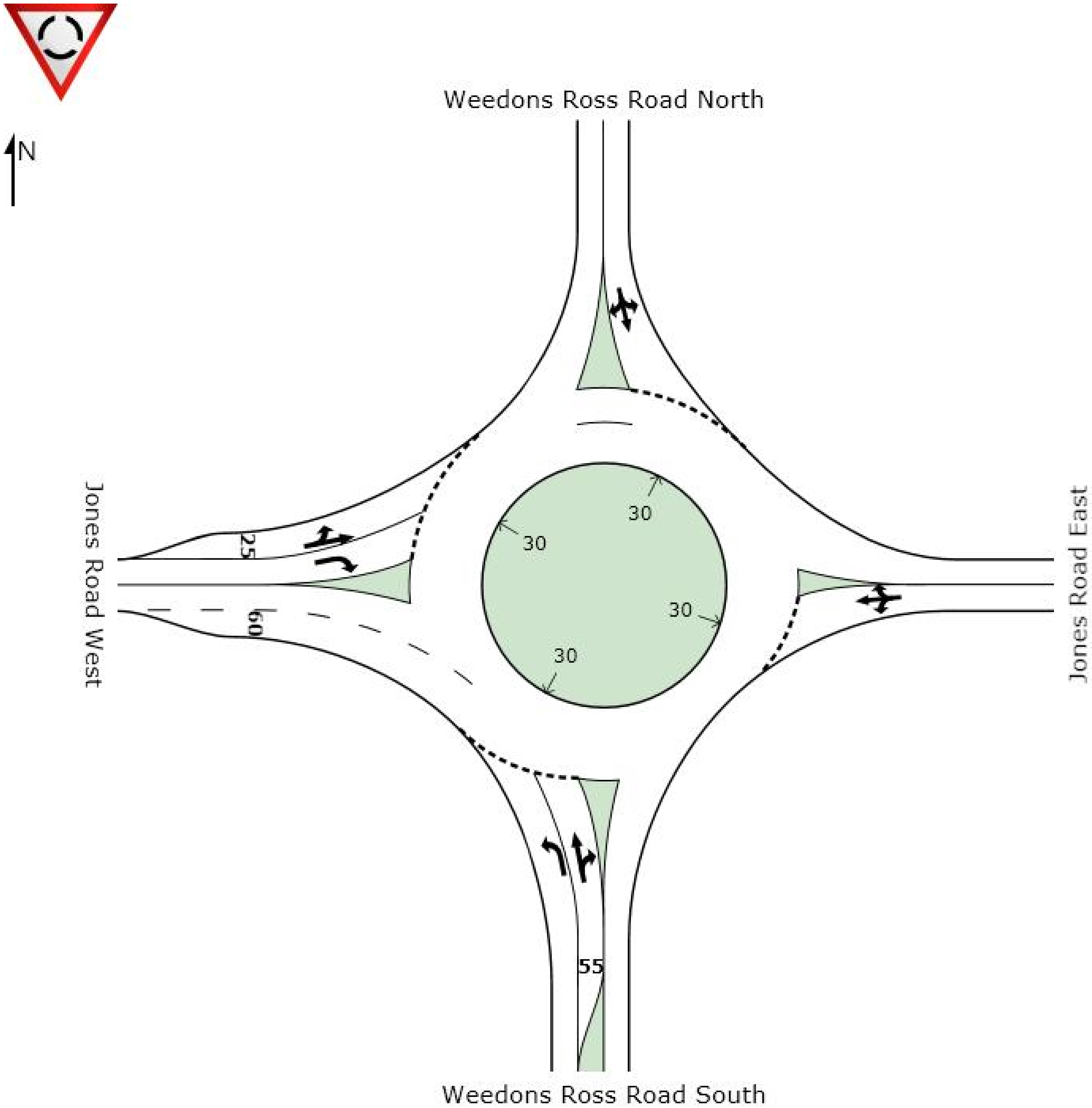
Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Rd S											
1	L	53	0.0	0.371	6.2	LOS A	3.8	26.7	0.27	0.51	50.2
2	T	498	2.3	0.372	5.2	LOS A	3.8	26.7	0.27	0.42	51.0
Approach		551	2.1	0.372	5.3	LOS A	3.8	26.7	0.27	0.43	50.9
North: Weedons Rd N											
8	T	155	4.8	0.187	7.5	LOS A	1.2	8.6	0.69	0.65	37.8
9	R	53	0.0	0.096	14.9	LOS B	0.5	3.7	0.67	0.88	32.7
Approach		207	3.6	0.187	9.4	LOS B	1.2	8.6	0.68	0.71	36.3
West: MSR Ramps W											
10	L	53	2.0	0.478	9.3	LOS A	4.6	32.0	0.74	0.74	41.6
12	R	929	0.5	0.477	14.7	LOS B	4.6	32.0	0.75	0.82	38.7
Approach		982	0.5	0.477	14.4	LOS B	4.6	32.0	0.75	0.81	38.8
All Vehicles		1740	1.4	0.477	10.9	LOS B	4.6	32.0	0.59	0.68	42.7

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

Processed: Thursday, 3 May 2012 6:20:56 p.m.
SIDRA INTERSECTION 5.0.2.1437
Project: P:\339\3390691\TTR\FinalScheme_1203\SIDRA_CSM2&MSRFL \MSRFL_4_MSR&WeedonsSth_EPAVols.sip
8000924, BECA INFRASTRUCTURE LIMITED, FLOATING

SIDRA INTERSECTION



N
Weedons Ross Road North
Jones Road West
Jones Road East
Weedons Ross Road South
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MOVEMENT SUMMARY

Site: MSRFL - Weedons - Jones 2016 AM

Jones/Weedons Rd
EPA Flows - 2016 AM - CSM2 & MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Ross Road South											
1	L	53	0.0	0.045	8.3	LOS A	0.3	2.1	0.35	0.54	49.3
2	T	54	3.9	0.081	6.8	LOS A	0.5	3.6	0.32	0.45	50.8
3	R	53	0.0	0.081	13.9	LOS B	0.5	3.6	0.32	0.74	44.9
Approach		159	1.3	0.081	9.7	LOS B	0.5	3.6	0.33	0.58	48.1
East: Jones Road East											
4	L	53	0.0	0.128	8.2	LOS A	0.9	6.5	0.36	0.55	54.4
5	T	53	0.0	0.128	7.0	LOS A	0.9	6.5	0.36	0.47	55.2
6	R	53	0.0	0.128	14.2	LOS B	0.9	6.5	0.36	0.75	50.1
Approach		158	0.0	0.128	9.8	LOS B	0.9	6.5	0.36	0.59	53.1
North: Weedons Ross Road North											
7	L	53	0.0	0.137	7.8	LOS A	0.8	5.8	0.32	0.54	54.9
8	T	53	2.0	0.137	7.0	LOS A	0.8	5.8	0.32	0.49	55.5
9	R	53	0.0	0.137	14.1	LOS B	0.8	5.8	0.32	0.78	50.2
Approach		158	0.7	0.137	9.6	LOS B	0.8	5.8	0.32	0.60	53.4
West: Jones Road West											
10	L	53	0.0	0.103	8.1	LOS A	0.5	3.5	0.32	0.56	54.8
11	T	53	0.0	0.103	6.8	LOS A	0.5	3.5	0.32	0.47	55.7
12	R	53	2.0	0.044	14.2	LOS B	0.3	2.2	0.35	0.65	49.1
Approach		158	0.7	0.103	9.7	LOS B	0.5	3.5	0.33	0.56	52.9
All Vehicles		633	0.7	0.137	9.7	LOS A	0.9	6.5	0.34	0.58	52.1

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: MSRFL - Weedons - Jones 2016 IP

Jones/Weedons Rd
EPA Flows - 2016 IP - CSM2 & MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Ross Road South											
1	L	53	2.0	0.044	8.4	LOS A	0.3	2.2	0.35	0.54	49.3
2	T	53	2.0	0.071	6.7	LOS A	0.5	3.6	0.32	0.45	50.8
3	R	53	0.0	0.071	13.9	LOS B	0.5	3.6	0.32	0.74	44.9
Approach		158	1.3	0.071	9.7	LOS B	0.5	3.6	0.33	0.58	48.1
East: Jones Road East											
4	L	53	0.0	0.128	8.2	LOS A	0.9	6.5	0.36	0.55	54.4
5	T	53	0.0	0.128	7.0	LOS A	0.9	6.5	0.36	0.47	55.1
6	R	53	0.0	0.128	14.2	LOS B	0.9	6.5	0.36	0.75	50.1
Approach		158	0.0	0.128	9.8	LOS B	0.9	6.5	0.36	0.59	53.1
North: Weedons Ross Road North											
7	L	53	0.0	0.138	7.8	LOS A	0.8	5.9	0.32	0.54	54.9
8	T	54	2.0	0.138	7.0	LOS A	0.8	5.9	0.32	0.49	55.5
9	R	53	0.0	0.138	14.1	LOS B	0.8	5.9	0.32	0.78	50.2
Approach		159	0.7	0.138	9.6	LOS B	0.8	5.9	0.32	0.60	53.4
West: Jones Road West											
10	L	53	0.0	0.071	8.1	LOS A	0.5	3.5	0.32	0.56	54.8
11	T	53	0.0	0.071	6.8	LOS A	0.5	3.5	0.32	0.47	55.7
12	R	53	0.0	0.044	14.2	LOS B	0.3	2.1	0.34	0.65	49.2
Approach		158	0.0	0.071	9.7	LOS B	0.5	3.5	0.33	0.56	53.0
All Vehicles		633	0.5	0.138	9.7	LOS A	0.9	6.5	0.34	0.58	52.1

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: MSRFL - Weedons - Jones 2016 PM

Jones/Weedons Rd
EPA Flows - 2016 PM - CSM2 & MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Ross Road South											
1	L	53	0.0	0.044	8.3	LOS A	0.3	2.1	0.35	0.54	49.3
2	T	53	2.0	0.071	6.7	LOS A	0.5	3.6	0.32	0.45	50.8
3	R	53	0.0	0.071	13.9	LOS B	0.5	3.6	0.32	0.74	44.9
Approach		158	0.7	0.071	9.7	LOS B	0.5	3.6	0.33	0.58	48.1
East: Jones Road East											
4	L	53	0.0	0.128	8.2	LOS A	0.9	6.5	0.36	0.55	54.4
5	T	53	0.0	0.128	7.0	LOS A	0.9	6.5	0.36	0.47	55.2
6	R	53	0.0	0.128	14.2	LOS B	0.9	6.5	0.36	0.75	50.1
Approach		158	0.0	0.128	9.8	LOS B	0.9	6.5	0.36	0.59	53.1
North: Weedons Ross Road North											
7	L	53	0.0	0.137	7.8	LOS A	0.8	5.8	0.32	0.54	54.9
8	T	53	0.0	0.137	6.9	LOS A	0.8	5.8	0.32	0.49	55.5
9	R	53	0.0	0.137	14.1	LOS B	0.8	5.8	0.32	0.78	50.2
Approach		158	0.0	0.137	9.6	LOS B	0.8	5.8	0.32	0.60	53.4
West: Jones Road West											
10	L	53	0.0	0.071	8.1	LOS A	0.5	3.5	0.32	0.56	54.8
11	T	53	0.0	0.071	6.8	LOS A	0.5	3.5	0.32	0.47	55.7
12	R	53	0.0	0.044	14.2	LOS B	0.3	2.1	0.34	0.65	49.2
Approach		158	0.0	0.071	9.7	LOS B	0.5	3.5	0.33	0.56	53.0
All Vehicles		632	0.2	0.137	9.7	LOS A	0.9	6.5	0.34	0.58	52.1

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: MSRFL - Weedons - Jones 2026 AM

Jones/Weedons Rd
EPA Flows - 2026 AM - CSM2 & MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Ross Road South											
1	L	53	0.0	0.044	8.3	LOS A	0.3	2.1	0.35	0.54	49.3
2	T	53	4.0	0.080	6.8	LOS A	0.5	3.6	0.33	0.45	50.8
3	R	53	0.0	0.080	13.9	LOS B	0.5	3.6	0.33	0.74	44.9
Approach		158	1.3	0.080	9.7	LOS B	0.5	3.6	0.33	0.58	48.1
East: Jones Road East											
4	L	53	0.0	0.128	8.2	LOS A	0.9	6.5	0.37	0.55	54.4
5	T	53	0.0	0.128	7.0	LOS A	0.9	6.5	0.37	0.48	55.1
6	R	53	0.0	0.128	14.2	LOS B	0.9	6.5	0.37	0.75	50.1
Approach		158	0.0	0.128	9.8	LOS B	0.9	6.5	0.37	0.59	53.0
North: Weedons Ross Road North											
7	L	53	0.0	0.138	7.8	LOS A	0.8	5.9	0.33	0.55	54.8
8	T	53	2.0	0.138	7.0	LOS A	0.8	5.9	0.33	0.49	55.5
9	R	53	0.0	0.138	14.1	LOS B	0.8	5.9	0.33	0.78	50.2
Approach		158	0.7	0.138	9.7	LOS B	0.8	5.9	0.33	0.60	53.3
West: Jones Road West											
10	L	53	0.0	0.107	8.1	LOS A	0.5	3.8	0.33	0.56	54.8
11	T	53	10.0	0.107	7.1	LOS A	0.5	3.8	0.33	0.47	55.7
12	R	53	12.0	0.048	14.6	LOS B	0.3	2.5	0.36	0.65	49.1
Approach		158	7.3	0.107	9.9	LOS B	0.5	3.8	0.34	0.56	52.9
All Vehicles		632	2.3	0.138	9.8	LOS A	0.9	6.5	0.34	0.58	52.1

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: MSRFL - Weedons - Jones 2026 IP

Jones/Weedons Rd
EPA Flows - 2026 IP - CSM2 & MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Ross Road South											
1	L	53	0.0	0.044	8.3	LOS A	0.3	2.1	0.35	0.54	49.3
2	T	53	2.0	0.071	6.7	LOS A	0.5	3.6	0.32	0.45	50.8
3	R	53	0.0	0.071	13.9	LOS B	0.5	3.6	0.32	0.74	44.9
Approach		158	0.7	0.071	9.7	LOS B	0.5	3.6	0.33	0.58	48.1
East: Jones Road East											
4	L	53	0.0	0.128	8.2	LOS A	0.9	6.5	0.36	0.55	54.4
5	T	53	0.0	0.128	7.0	LOS A	0.9	6.5	0.36	0.47	55.2
6	R	53	0.0	0.128	14.2	LOS B	0.9	6.5	0.36	0.75	50.1
Approach		158	0.0	0.128	9.8	LOS B	0.9	6.5	0.36	0.59	53.1
North: Weedons Ross Road North											
7	L	53	0.0	0.137	7.8	LOS A	0.8	5.8	0.32	0.54	54.9
8	T	53	2.0	0.137	7.0	LOS A	0.8	5.8	0.32	0.49	55.5
9	R	53	0.0	0.137	14.1	LOS B	0.8	5.8	0.32	0.78	50.2
Approach		158	0.7	0.137	9.6	LOS B	0.8	5.8	0.32	0.60	53.4
West: Jones Road West											
10	L	53	0.0	0.071	8.1	LOS A	0.5	3.5	0.32	0.56	54.8
11	T	53	0.0	0.071	6.8	LOS A	0.5	3.5	0.32	0.47	55.7
12	R	53	0.0	0.044	14.2	LOS B	0.3	2.1	0.34	0.65	49.2
Approach		158	0.0	0.071	9.7	LOS B	0.5	3.5	0.33	0.56	53.0
All Vehicles		632	0.3	0.137	9.7	LOS A	0.9	6.5	0.34	0.58	52.1

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: MSRFL - Weedons - Jones 2026 PM

Jones/Weedons Rd
EPA Flows - 2026 PM - CSM2 & MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Ross Road South											
1	L	53	2.0	0.045	8.4	LOS A	0.3	2.2	0.35	0.54	49.3
2	T	54	2.0	0.072	6.8	LOS A	0.5	3.6	0.33	0.45	50.8
3	R	53	0.0	0.072	14.0	LOS B	0.5	3.6	0.33	0.74	44.9
Approach		159	1.3	0.072	9.7	LOS B	0.5	3.6	0.34	0.58	48.1
East: Jones Road East											
4	L	53	0.0	0.132	8.2	LOS A	1.0	7.0	0.37	0.55	54.4
5	T	54	11.8	0.132	7.3	LOS A	1.0	7.0	0.37	0.48	55.1
6	R	53	0.0	0.132	14.2	LOS B	1.0	7.0	0.37	0.75	50.1
Approach		159	4.0	0.132	9.9	LOS B	1.0	7.0	0.37	0.59	53.0
North: Weedons Ross Road North											
7	L	53	0.0	0.138	7.8	LOS A	0.8	5.9	0.32	0.54	54.9
8	T	54	2.0	0.138	7.0	LOS A	0.8	5.9	0.32	0.49	55.5
9	R	53	0.0	0.138	14.1	LOS B	0.8	5.9	0.32	0.78	50.2
Approach		159	0.7	0.138	9.6	LOS B	0.8	5.9	0.32	0.60	53.4
West: Jones Road West											
10	L	53	0.0	0.071	8.1	LOS A	0.5	3.5	0.32	0.56	54.8
11	T	53	0.0	0.071	6.8	LOS A	0.5	3.5	0.32	0.47	55.7
12	R	53	0.0	0.044	14.2	LOS B	0.3	2.1	0.35	0.65	49.1
Approach		158	0.0	0.071	9.7	LOS B	0.5	3.5	0.33	0.56	52.9
All Vehicles		635	1.5	0.138	9.7	LOS A	1.0	7.0	0.34	0.58	52.1

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: MSRFL - Weedons - Jones 2041 AM

Jones/Weedons Rd
EPA Flows - 2041 AM - CSM2 & MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Ross Road South											
1	L	53	4.0	0.054	8.9	LOS A	0.4	2.7	0.41	0.56	48.8
2	T	194	1.1	0.188	6.9	LOS A	1.3	9.4	0.39	0.50	50.4
3	R	53	0.0	0.188	14.1	LOS B	1.3	9.4	0.39	0.79	45.4
Approach		299	1.4	0.188	8.6	LOS B	1.3	9.4	0.39	0.56	49.1
East: Jones Road East											
4	L	53	0.0	0.162	8.8	LOS A	1.2	9.7	0.43	0.56	53.9
5	T	54	60.8	0.163	9.1	LOS A	1.2	9.7	0.43	0.52	54.5
6	R	53	0.0	0.162	14.8	LOS B	1.2	9.7	0.43	0.75	49.8
Approach		159	20.5	0.163	10.9	LOS B	1.2	9.7	0.43	0.61	52.6
North: Weedons Ross Road North											
7	L	53	0.0	0.150	8.0	LOS A	0.9	6.7	0.38	0.57	54.4
8	T	59	5.4	0.149	7.3	LOS A	0.9	6.7	0.38	0.51	55.0
9	R	53	0.0	0.150	14.3	LOS B	0.9	6.7	0.38	0.78	50.1
Approach		164	1.9	0.149	9.8	LOS B	0.9	6.7	0.38	0.62	53.1
West: Jones Road West											
10	L	53	0.0	0.166	9.6	LOS A	0.8	7.4	0.52	0.60	53.5
11	T	53	70.0	0.166	10.1	LOS B	0.8	7.4	0.52	0.59	53.9
12	R	53	26.0	0.065	16.4	LOS B	0.4	3.8	0.52	0.69	48.4
Approach		158	32.0	0.166	12.0	LOS B	0.8	7.4	0.52	0.63	51.7
All Vehicles		780	11.6	0.188	10.0	LOS A	1.3	9.7	0.42	0.60	51.4

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: MSRFL - Weedons - Jones 2041 IP

Jones/Weedons Rd
EPA Flows - 2041 IP - CSM2 & MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Ross Road South											
1	L	53	0.0	0.044	8.3	LOS A	0.3	2.1	0.35	0.54	49.3
2	T	53	2.0	0.080	6.7	LOS A	0.5	3.6	0.32	0.45	50.8
3	R	53	0.0	0.080	13.9	LOS B	0.5	3.6	0.32	0.74	44.9
Approach		158	0.7	0.080	9.7	LOS B	0.5	3.6	0.33	0.58	48.1
East: Jones Road East											
4	L	53	0.0	0.128	8.2	LOS A	0.9	6.5	0.36	0.55	54.4
5	T	53	0.0	0.128	7.0	LOS A	0.9	6.5	0.36	0.47	55.2
6	R	53	0.0	0.128	14.2	LOS B	0.9	6.5	0.36	0.75	50.1
Approach		158	0.0	0.128	9.8	LOS B	0.9	6.5	0.36	0.59	53.1
North: Weedons Ross Road North											
7	L	53	0.0	0.137	7.8	LOS A	0.8	5.8	0.32	0.54	54.9
8	T	53	2.0	0.137	7.0	LOS A	0.8	5.8	0.32	0.49	55.5
9	R	53	0.0	0.137	14.1	LOS B	0.8	5.8	0.32	0.78	50.2
Approach		158	0.7	0.137	9.6	LOS B	0.8	5.8	0.32	0.60	53.4
West: Jones Road West											
10	L	53	0.0	0.103	8.1	LOS A	0.5	3.5	0.32	0.56	54.8
11	T	53	0.0	0.103	6.8	LOS A	0.5	3.5	0.32	0.47	55.7
12	R	53	2.0	0.044	14.2	LOS B	0.3	2.1	0.35	0.65	49.2
Approach		158	0.7	0.103	9.7	LOS B	0.5	3.5	0.33	0.56	53.0
All Vehicles		632	0.5	0.137	9.7	LOS A	0.9	6.5	0.34	0.58	52.1

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

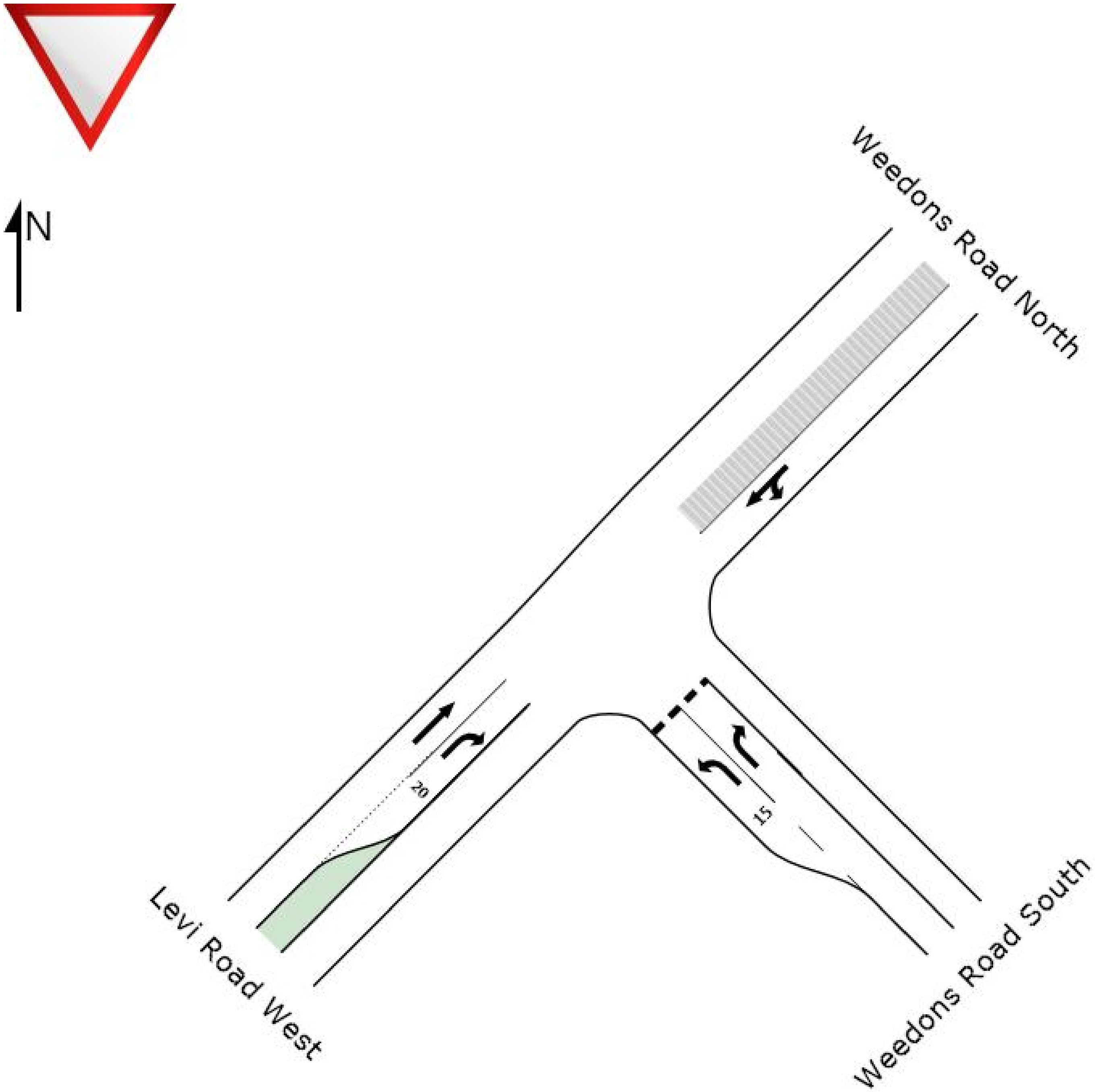
Site: MSRFL - Weedons - Jones 2041 PM

Jones/Weedons Rd
EPA Flows - 2041 PM - CSM2 & MSRFL Network
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Weedons Ross Road South											
1	L	53	2.0	0.051	8.8	LOS A	0.4	2.5	0.42	0.56	48.7
2	T	107	1.0	0.112	6.9	LOS A	0.9	6.1	0.40	0.49	50.2
3	R	53	0.0	0.112	14.1	LOS B	0.9	6.1	0.40	0.77	45.1
Approach		213	1.0	0.112	9.2	LOS B	0.9	6.1	0.40	0.57	48.4
East: Jones Road East											
4	L	53	12.0	0.219	11.2	LOS B	1.6	14.2	0.61	0.66	52.6
5	T	53	88.0	0.219	11.9	LOS B	1.6	14.2	0.61	0.70	52.7
6	R	53	0.0	0.219	16.8	LOS B	1.6	14.2	0.61	0.78	48.0
Approach		158	33.3	0.220	13.3	LOS B	1.6	14.2	0.61	0.71	51.0
North: Weedons Ross Road North											
7	L	53	0.0	0.259	8.2	LOS A	1.7	12.2	0.43	0.60	54.3
8	T	179	0.6	0.259	7.4	LOS A	1.7	12.2	0.43	0.55	54.7
9	R	53	0.0	0.259	14.5	LOS B	1.7	12.2	0.43	0.82	50.4
Approach		284	0.4	0.259	8.8	LOS B	1.7	12.2	0.43	0.61	53.8
West: Jones Road West											
10	L	53	0.0	0.088	8.6	LOS A	0.6	5.1	0.41	0.57	54.2
11	T	53	36.0	0.088	8.2	LOS A	0.6	5.1	0.41	0.51	54.9
12	R	78	33.8	0.089	16.0	LOS B	0.6	5.5	0.45	0.68	48.6
Approach		183	24.7	0.089	11.6	LOS B	0.6	5.5	0.43	0.60	51.8
All Vehicles		838	12.1	0.259	10.4	LOS B	1.7	14.2	0.45	0.62	51.6

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.



N
Weedons Road North
Levi Road West
Weedons Road South
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MOVEMENT SUMMARY

Site: MSRFL - Weedons/Levi - 2016 AM

Weedons Rd/Levi Rd
EPA Flows - 2016 AM - CSM2 & MSRFL Network
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Weedons Road South											
21	L	11	0.0	0.013	11.0	LOS B	0.0	0.3	0.12	0.67	58.2
23	R	66	0.0	0.053	11.4	LOS B	0.3	1.9	0.26	0.68	57.7
Approach		77	0.0	0.053	11.3	LOS B	0.3	1.9	0.24	0.68	57.8
North East: Weedons Road North											
24	L	11	10.0	0.024	11.4	LOS B	0.0	0.0	0.00	1.12	58.9
25	T	32	16.7	0.024	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		42	15.0	0.024	2.9	LOS B	0.0	0.0	0.00	0.28	73.5
South West: Levi Road West											
31	T	109	5.8	0.058	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
32	R	11	0.0	0.010	11.0	LOS B	0.0	0.2	0.13	0.67	58.2
Approach		120	5.3	0.058	1.0	LOS B	0.0	0.2	0.01	0.06	77.5
All Vehicles		239	5.3	0.058	4.6	NA	0.3	1.9	0.08	0.30	69.3

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

Processed: Wednesday, 2 May 2012 11:15:13 p.m.
SIDRA INTERSECTION 5.0.2.1437
Project: P:\339\3390691\TTR\FinalScheme_1203\SIDRA_CSM2&MSRFL\MSRFL_6_Weedons&Levi_EPAVols.sip
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SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: MSRFL - Weedons/Levi - 2016 IP

Weedons Rd/Levi Rd
EPA Flows - 2016 IP - CSM2 & MSRFL Network
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Weedons Road South											
21	L	11	0.0	0.013	11.1	LOS B	0.0	0.3	0.12	0.67	58.2
23	R	56	0.0	0.042	11.1	LOS B	0.2	1.5	0.20	0.68	58.0
Approach		66	0.0	0.042	11.1	LOS B	0.2	1.5	0.19	0.68	58.1
North East: Weedons Road North											
24	L	11	10.0	0.027	11.4	LOS B	0.0	0.0	0.00	1.15	58.9
25	T	39	10.8	0.027	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		49	10.6	0.027	2.4	LOS B	0.0	0.0	0.00	0.25	74.4
South West: Levi Road West											
31	T	44	2.4	0.023	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
32	R	11	0.0	0.010	11.0	LOS B	0.0	0.2	0.14	0.66	58.2
Approach		55	1.9	0.023	2.1	LOS B	0.0	0.2	0.03	0.13	74.7
All Vehicles		171	3.7	0.042	5.7	NA	0.2	1.5	0.08	0.38	67.2

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: MSRFL - Weedons/Levi - 2016 PM

Weedons Rd/Levi Rd
EPA Flows - 2016 PM - CSM2 & MSRFL Network
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Weedons Road South											
21	L	11	0.0	0.014	12.1	LOS B	0.0	0.3	0.37	0.67	56.8
23	R	86	1.2	0.085	12.4	LOS B	0.4	3.0	0.42	0.73	57.0
Approach		97	1.1	0.085	12.4	LOS B	0.4	3.0	0.41	0.73	56.9
North East: Weedons Road North											
24	L	11	0.0	0.159	10.9	LOS B	0.0	0.0	0.00	1.31	58.9
25	T	295	2.1	0.159	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		305	2.1	0.159	0.4	LOS B	0.0	0.0	0.00	0.05	79.0
South West: Levi Road West											
31	T	49	2.1	0.026	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
32	R	11	0.0	0.011	11.8	LOS B	0.0	0.3	0.37	0.65	56.9
Approach		60	1.8	0.026	2.1	LOS B	0.0	0.3	0.07	0.11	74.8
All Vehicles		462	1.8	0.159	3.1	NA	0.4	3.0	0.09	0.20	72.7

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

Processed: Wednesday, 2 May 2012 11:15:14 p.m.
SIDRA INTERSECTION 5.0.2.1437
Project: P:\339\3390691\TTR\FinalScheme_1203\SIDRA_CSM2&MSRFL\MSRFL_6_Weedons&Levi_EPAVols.sip
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SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: MSRFL - Weedons/Levi - 2026 AM

Weedons Rd/Levi Rd
EPA Flows - 2026 AM - CSM2 & MSRFL Network
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Weedons Road South											
21	L	11	0.0	0.013	11.1	LOS B	0.0	0.3	0.13	0.67	58.2
23	R	92	1.1	0.125	14.4	LOS B	0.6	4.3	0.56	0.85	54.4
Approach		102	1.0	0.125	14.0	LOS B	0.6	4.3	0.52	0.83	54.8
North East: Weedons Road North											
24	L	11	10.0	0.027	11.4	LOS B	0.0	0.0	0.00	1.15	58.9
25	T	37	20.0	0.027	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		47	17.8	0.027	2.5	LOS B	0.0	0.0	0.00	0.25	74.2
South West: Levi Road West											
31	T	616	1.5	0.319	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
32	R	11	0.0	0.010	11.0	LOS B	0.0	0.2	0.14	0.66	58.2
Approach		626	1.5	0.319	0.2	LOS B	0.0	0.2	0.00	0.01	79.5
All Vehicles		776	2.4	0.319	2.1	NA	0.6	4.3	0.07	0.13	74.8

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: MSRFL - Weedons/Levi - 2026 IP

Weedons Rd/Levi Rd
EPA Flows - 2026 IP - CSM2 & MSRFL Network
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Weedons Road South											
21	L	11	0.0	0.013	11.1	LOS B	0.0	0.3	0.14	0.66	58.1
23	R	72	0.0	0.056	11.2	LOS B	0.3	2.0	0.23	0.68	57.9
Approach		82	0.0	0.056	11.2	LOS B	0.3	2.0	0.22	0.68	57.9
North East: Weedons Road North											
24	L	11	10.0	0.034	11.4	LOS B	0.0	0.0	0.00	1.19	58.9
25	T	49	14.9	0.034	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		60	14.0	0.034	2.0	LOS B	0.0	0.0	0.00	0.21	75.4
South West: Levi Road West											
31	T	58	1.8	0.030	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
32	R	11	0.0	0.010	11.1	LOS B	0.0	0.2	0.16	0.66	58.1
Approach		68	1.5	0.030	1.7	LOS B	0.0	0.2	0.02	0.10	75.7
All Vehicles		211	4.5	0.056	5.5	NA	0.3	2.0	0.09	0.36	67.6

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: MSRFL - Weedons/Levi - 2026 PM

Weedons Rd/Levi Rd
EPA Flows - 2026 PM - CSM2 & MSRFL Network
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Weedons Road South											
21	L	11	0.0	0.020	16.0	LOS C	0.1	0.6	0.63	0.82	52.4
23	R	33	3.2	0.056	15.8	LOS C	0.3	1.8	0.61	0.86	52.9
Approach		43	2.4	0.056	15.8	LOS C	0.3	1.8	0.61	0.85	52.8
North East: Weedons Road North											
24	L	11	10.0	0.405	11.4	LOS B	0.0	0.0	0.00	1.39	58.9
25	T	762	1.2	0.400	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		773	1.4	0.400	0.2	LOS B	0.0	0.0	0.00	0.02	79.6
South West: Levi Road West											
31	T	78	10.8	0.043	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
32	R	11	0.0	0.013	14.1	LOS B	0.1	0.4	0.59	0.74	54.7
Approach		88	9.5	0.043	1.7	LOS B	0.1	0.4	0.07	0.09	75.9
All Vehicles		904	2.2	0.400	1.1	NA	0.3	1.8	0.04	0.07	77.4

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: MSRFL - Weedons/Levi - 2041 AM

Weedons Rd/Levi Rd
EPA Flows - 2041 AM - CSM2 & MSRFL Network
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Weedons Road South											
21	L	11	0.0	0.013	11.6	LOS B	0.0	0.3	0.28	0.65	57.3
23	R	104	1.0	0.263	20.6	LOS C	1.3	9.1	0.78	0.97	47.8
Approach		115	0.9	0.263	19.8	LOS C	1.3	9.1	0.73	0.94	48.5
North East: Weedons Road North											
24	L	14	7.7	0.098	11.3	LOS B	0.0	0.0	0.00	1.30	58.9
25	T	169	6.8	0.099	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		183	6.9	0.099	0.8	LOS B	0.0	0.0	0.00	0.10	78.0
South West: Levi Road West											
31	T	976	1.3	0.505	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
32	R	11	0.0	0.010	11.4	LOS B	0.0	0.3	0.29	0.64	57.4
Approach		986	1.3	0.505	0.1	LOS B	0.0	0.3	0.00	0.01	79.7
All Vehicles		1284	2.0	0.505	2.0	NA	1.3	9.1	0.07	0.10	75.2

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

Processed: Wednesday, 2 May 2012 11:15:15 p.m.
SIDRA INTERSECTION 5.0.2.1437
Project: P:\339\3390691\TTR\FinalScheme_1203\SIDRA_CSM2&MSRFL\MSRFL_6_Weedons&Levi_EPAVols.sip
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SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: MSRFL - Weedons/Levi - 2041 IP

Weedons Rd/Levi Rd
EPA Flows - 2041 IP - CSM2 & MSRFL Network
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Weedons Road South											
21	L	11	0.0	0.014	11.9	LOS B	0.0	0.3	0.34	0.66	57.0
23	R	100	0.0	0.097	12.3	LOS B	0.5	3.4	0.41	0.73	57.0
Approach		111	0.0	0.097	12.2	LOS B	0.5	3.4	0.40	0.73	57.0
North East: Weedons Road North											
24	L	11	10.0	0.135	11.4	LOS B	0.0	0.0	0.00	1.35	58.9
25	T	246	3.4	0.135	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		257	3.7	0.135	0.5	LOS B	0.0	0.0	0.00	0.06	78.9
South West: Levi Road West											
31	T	82	9.0	0.045	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
32	R	11	0.0	0.010	11.6	LOS B	0.0	0.3	0.34	0.64	57.1
Approach		93	8.0	0.045	1.3	LOS B	0.0	0.3	0.04	0.07	76.6
All Vehicles		460	3.7	0.135	3.5	NA	0.5	3.4	0.10	0.22	71.9

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: MSRFL - Weedons/Levi - 2041 PM

Weedons Rd/Levi Rd
EPA Flows - 2041 PM - CSM2 & MSRFL Network
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Weedons Road South											
21	L	11	0.0	0.035	21.7	LOS C	0.1	1.0	0.80	0.95	46.7
23	R	82	1.3	0.317	27.5	LOS D	1.5	10.4	0.87	1.00	42.1
Approach		93	1.1	0.317	26.8	LOS D	1.5	10.4	0.86	0.99	42.6
North East: Weedons Road North											
24	L	101	1.0	0.565	11.0	LOS B	0.0	0.0	0.00	1.25	58.9
25	T	984	1.2	0.563	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		1085	1.2	0.563	1.0	LOS B	0.0	0.0	0.00	0.12	77.5
South West: Levi Road West											
31	T	419	2.5	0.218	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
32	R	11	0.0	0.019	16.8	LOS C	0.1	0.6	0.70	0.84	51.6
Approach		429	2.5	0.218	0.4	LOS C	0.1	0.6	0.02	0.02	79.0
All Vehicles		1607	1.5	0.563	2.3	NA	1.5	10.4	0.05	0.14	74.4

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

Processed: Wednesday, 2 May 2012 11:15:15 p.m.
SIDRA INTERSECTION 5.0.2.1437
Project: P:\339\3390691\TTR\FinalScheme_1203\SIDRA_CSM2&MSRFL\MSRFL_6_Weedons&Levi_EPAVols.sip
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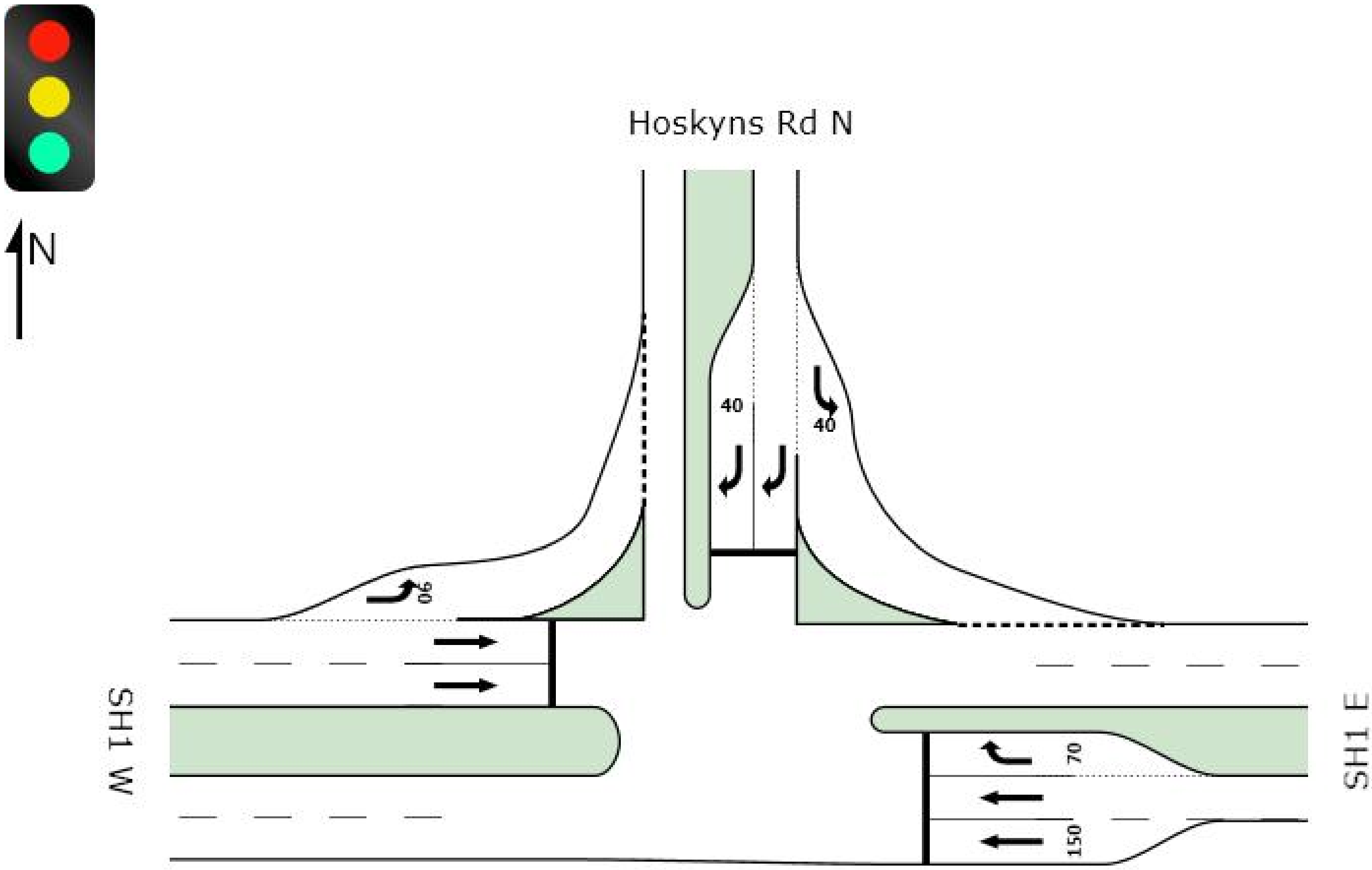
SIDRA INTERSECTION



N
Hoskyns Rd N
40
40
90
SH1 W
SH1 E
70
150

MOVEMENT SUMMARY

Site: MSRFL - MSR/Hoskyns - 2016 AM

MSRFL - MSR/Hoskyns Road
2016 AM - EPA Vols - CSM2&MSRFL Network
Signals - Fixed Time   Cycle Time = 95 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: SH1 E											
5	T	725	14.2	0.285	3.1	LOS A	6.8	53.2	0.30	0.26	69.9
6	R	135	10.9	0.533	17.7	LOS B	3.8	29.4	0.67	0.79	48.0
Approach		860	13.7	0.533	5.4	LOS A	6.8	53.2	0.36	0.34	65.7
North: Hoskyns Rd N											
7	L	63	21.7	0.248	13.0	LOS B	1.4	11.8	0.37	0.71	47.9
9	R	228	6.9	0.674	57.9	LOS E	7.2	53.1	1.00	0.84	25.4
Approach		292	10.1	0.674	48.2	LOS D	7.2	53.1	0.86	0.81	28.3
West: SH1 W											
10	L	156	6.8	0.117	10.1	LOS B	0.4	2.7	0.06	0.67	57.1
11	T	1548	5.8	0.683	4.5	LOS A	13.9	102.2	0.32	0.29	67.1
Approach		1704	5.9	0.683	5.0	LOS A	13.9	102.2	0.29	0.32	66.2
All Vehicles		2856	8.7	0.683	9.5	LOS A	13.9	102.2	0.37	0.38	58.1

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS E. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: MSRFL - MSR/Hoskyns - 2016 IP

MSRFL - MSR/Hoskyns Road
2016 IP - EPA Vols - CSM2&MSRFL Network
Signals - Fixed Time   Cycle Time = 80 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: SH1 E											
5	T	696	13.0	0.280	3.6	LOS A	6.3	49.2	0.35	0.30	68.4
6	R	99	12.8	0.288	15.2	LOS B	1.8	13.9	0.50	0.75	50.9
Approach		795	13.0	0.288	5.1	LOS A	6.3	49.2	0.37	0.36	65.9
North: Hoskyns Rd N											
7	L	42	22.5	0.129	11.0	LOS B	0.5	3.8	0.25	0.67	49.9
9	R	175	4.2	0.426	47.0	LOS D	4.7	33.9	0.97	0.77	28.6
Approach		217	7.8	0.426	40.0	LOS D	4.7	33.9	0.83	0.75	31.2
West: SH1 W											
10	L	115	11.0	0.089	10.2	LOS B	0.2	1.7	0.06	0.66	57.1
11	T	818	14.2	0.422	5.7	LOS A	7.3	57.0	0.33	0.29	64.8
Approach		933	13.8	0.422	6.3	LOS A	7.3	57.0	0.30	0.34	63.9
All Vehicles		1944	12.8	0.426	9.5	LOS A	7.3	57.0	0.39	0.39	57.9

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

MOVEMENT SUMMARY

Site: MSRFL - MSR/Hoskyns - 2016 PM

MSRFL - MSR/Hoskyns Road
2016 PM - EPA Vols - CSM2&MSRFL Network
Signals - Fixed Time   Cycle Time = 70 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: SH1 E											
5	T	1455	5.7	0.586	6.0	LOS A	15.0	110.4	0.55	0.50	62.7
6	R	138	3.8	0.440	18.5	LOS B	2.8	20.6	0.75	0.79	47.0
Approach		1593	5.6	0.586	7.1	LOS A	15.0	110.4	0.57	0.52	61.1
North: Hoskyns Rd N											
7	L	66	9.5	0.147	12.6	LOS B	1.1	8.6	0.40	0.71	47.9
9	R	318	1.0	0.597	41.4	LOS D	7.0	49.6	0.98	0.81	30.5
Approach		384	2.5	0.597	36.4	LOS D	7.0	49.6	0.88	0.80	32.6
West: SH1 W											
10	L	137	3.1	0.099	10.0	LOS B	0.2	1.7	0.06	0.67	57.1
11	T	1107	11.6	0.642	9.6	LOS A	13.2	101.8	0.57	0.51	57.4
Approach		1244	10.7	0.642	9.6	LOS A	13.2	101.8	0.51	0.53	57.3
All Vehicles		3221	7.2	0.642	11.6	LOS B	15.0	110.4	0.59	0.56	54.1

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

Processed: Thursday, 19 April 2012 10:15:32 p.m.
SIDRA INTERSECTION 5.0.2.1437
Project: P:\339\3390691\TTR\FinalScheme_1203\SIDRA_CSM2&MSRFL\MSRFL_7_Hoskyns&Rolleston_EPAVols.sip
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MOVEMENT SUMMARY

Site: MSRFL - MSR/Hoskyns - 2026 AM

MSRFL - MSR/Hoskyns Road
2026 AM - EPA Vols - CSM2&MSRFL Network
Signals - Fixed Time   Cycle Time = 70 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: SH1 E											
5	T	900	14.7	0.363	3.7	LOS A	7.6	59.7	0.39	0.34	67.5
6	R	319	10.9	1.000[3]	75.9	LOS E	16.2	124.1	1.00	1.19	21.1
Approach		1219	13.6	1.000	22.6	LOS C	16.2	124.1	0.55	0.57	44.3
North: Hoskyns Rd N											
7	L	96	45.1	0.284	21.2	LOS C	3.0	29.0	0.67	0.75	41.7
9	R	303	7.3	0.850	50.8	LOS D	7.7	57.2	1.00	0.99	27.4
Approach		399	16.4	0.850	43.7	LOS D	7.7	57.2	0.92	0.93	29.9
West: SH1 W											
10	L	313	6.4	0.241	10.3	LOS B	0.6	4.2	0.07	0.67	57.1
11	T	1687	6.0	0.896	15.5	LOS B	32.0	235.2	0.76	0.76	49.7
Approach		2000	6.1	0.896	14.7	LOS B	32.0	235.2	0.65	0.75	50.6
All Vehicles		3618	9.7	1.000	20.5	LOS C	32.0	235.2	0.65	0.71	45.0

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS E. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

Processed: Thursday, 19 April 2012 10:15:34 p.m.
SIDRA INTERSECTION 5.0.2.1437
Project: P:\339\3390691\TTR\FinalScheme_1203\SIDRA_CSM2&MSRFL\MSRFL_7_Hoskyns&Rolleston_EPAVols.sip
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SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: MSRFL - MSR/Hoskyns - 2026 IP

MSRFL - MSR/Hoskyns Road
2026 IP - EPA Vols - CSM2&MSRFL Network
Signals - Fixed Time   Cycle Time = 70 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: SH1 E											
5	T	915	12.0	0.376	4.5	LOS A	8.3	64.4	0.43	0.38	66.1
6	R	174	23.6	0.602	19.9	LOS B	4.2	34.9	0.80	0.82	46.2
Approach		1088	13.8	0.601	7.0	LOS A	8.3	64.4	0.49	0.45	62.3
North: Hoskyns Rd N											
7	L	97	35.9	0.265	13.7	LOS B	1.9	17.5	0.45	0.72	47.5
9	R	265	3.6	0.564	42.1	LOS D	6.1	43.7	0.98	0.80	30.3
Approach		362	12.2	0.564	34.5	LOS C	6.1	43.7	0.84	0.78	33.6
West: SH1 W											
10	L	182	9.2	0.144	10.2	LOS B	0.3	2.6	0.06	0.67	57.1
11	T	1056	13.5	0.603	8.6	LOS A	11.8	92.2	0.52	0.46	59.0
Approach		1238	12.8	0.603	8.8	LOS A	11.8	92.2	0.46	0.49	58.8
All Vehicles		2688	13.2	0.603	11.5	LOS B	11.8	92.2	0.52	0.51	54.5

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

MOVEMENT SUMMARY

Site: MSRFL - MSR/Hoskyns - 2026 PM

MSRFL - MSR/Hoskyns Road
2026 PM - EPA Vols - CSM2&MSRFL Network
Signals - Fixed Time   Cycle Time = 70 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: SH1 E											
5	T	1678	5.8	0.703	7.9	LOS A	20.0	147.2	0.67	0.61	59.0
6	R	106	16.8	0.411	23.4	LOS C	2.8	22.7	0.87	0.79	42.8
Approach		1784	6.5	0.703	8.9	LOS A	20.0	147.2	0.68	0.62	57.8
North: Hoskyns Rd N											
7	L	229	11.5	0.490	18.4	LOS B	6.3	48.2	0.68	0.78	43.1
9	R	502	1.7	0.861	48.1	LOS D	12.5	88.6	1.00	1.01	28.2
Approach		732	4.7	0.861	38.8	LOS D	12.5	88.6	0.90	0.94	31.6
West: SH1 W											
10	L	278	2.3	0.189	10.0	LOS B	0.5	3.8	0.06	0.67	57.1
11	T	1367	11.2	0.838	15.2	LOS B	23.3	179.1	0.77	0.73	49.9
Approach		1645	9.7	0.838	14.3	LOS B	23.3	179.1	0.65	0.72	50.9
All Vehicles		4161	7.5	0.861	16.3	LOS B	23.3	179.1	0.71	0.71	48.2

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

Processed: Thursday, 19 April 2012 10:15:35 p.m.
SIDRA INTERSECTION 5.0.2.1437
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SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: MSRFL - MSR/Hoskyns - 2041 AM

MSRFL - MSR/Hoskyns Road
2041 AM - EPA Vols - CSM2&MSRFL Network
Signals - Fixed Time   Cycle Time = 95 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: SH1 E											
5	T	1260	17.8	0.537	5.5	LOS A	15.4	118.9	0.45	0.41	62.8
6	R	333	7.5	1.000 [3]	69.2	LOS E	16.6	123.6	1.00	1.07	22.5
Approach		1593	13.3	1.000	18.8	LOS B	16.6	123.6	0.56	0.54	47.0
North: Hoskyns Rd N											
7	L	144	40.1	0.547	28.2	LOS C	6.2	58.5	0.72	0.79	37.3
9	R	394	7.5	0.913	65.4	LOS E	14.0	104.4	1.00	1.00	23.5
Approach		538	16.2	0.913	55.4	LOS E	14.0	104.4	0.93	0.94	26.1
West: SH1 W											
10	L	518	4.7	0.384	10.4	LOS B	1.7	12.2	0.08	0.68	56.8
11	T	1756	7.3	0.932	22.4	LOS C	48.6	361.2	0.81	0.82	43.5
Approach		2274	6.7	0.932	19.6	LOS B	48.6	361.2	0.64	0.79	45.7
All Vehicles		4404	10.2	1.000	23.7	LOS C	48.6	361.2	0.65	0.72	42.2

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS E. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

MOVEMENT SUMMARY

Site: MSRFL - MSR/Hoskyns - 2041 IP

MSRFL - MSR/Hoskyns Road
2041 IP - EPA Vols - CSM2&MSRFL Network
Signals - Fixed Time   Cycle Time = 65 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: SH1 E											
5	T	926	17.2	0.409	5.4	LOS A	8.8	70.4	0.49	0.43	64.1
6	R	345	15.2	0.893	42.1	LOS D	11.6	92.1	1.00	1.05	31.3
Approach		1272	16.6	0.893	15.4	LOS B	11.6	92.1	0.63	0.60	50.9
North: Hoskyns Rd N											
7	L	213	27.2	0.446	17.9	LOS B	5.2	44.7	0.63	0.75	43.8
9	R	466	6.3	0.844	45.6	LOS D	10.2	75.6	1.00	1.00	29.1
Approach		679	12.9	0.844	36.9	LOS D	10.2	75.6	0.88	0.92	32.5
West: SH1 W											
10	L	339	7.1	0.276	10.3	LOS B	0.7	5.2	0.07	0.67	57.0
11	T	1215	14.3	0.886	21.6	LOS C	23.8	187.3	0.88	0.87	43.8
Approach		1554	12.7	0.887	19.1	LOS B	23.8	187.3	0.70	0.83	45.9
All Vehicles		3504	14.2	0.893	21.2	LOS C	23.8	187.3	0.71	0.76	43.9

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

MOVEMENT SUMMARY

Site: MSRFL - MSR/Hoskyns - 2041 PM

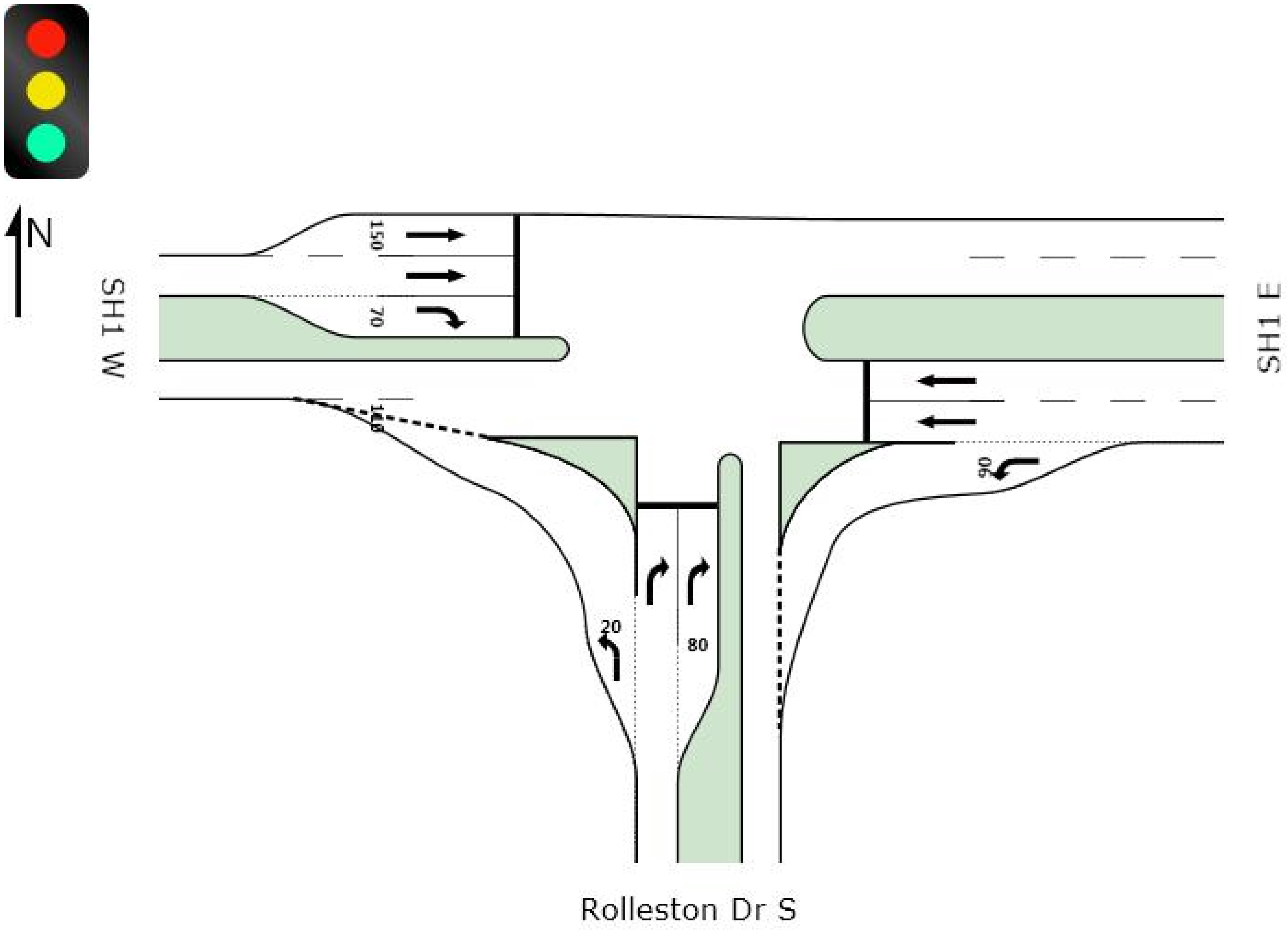
MSRFL - MSR/Hoskyns Road
2041 PM - EPA Vols - CSM2&MSRFL Network
Signals - Fixed Time   Cycle Time = 75 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: SH1 E											
5	T	1826	5.8	0.890	25.9	LOS C	38.9	285.8	0.92	0.97	40.6
6	R	178	13.0	0.757	31.6	LOS C	5.2	40.6	1.00	0.85	36.8
Approach		2004	6.5	0.890	26.4	LOS C	38.9	285.8	0.93	0.96	40.2
North: Hoskyns Rd N											
7	L	498	1.7	0.936	22.4	LOS C	11.5	81.6	0.72	0.88	40.2
9	R	775	3.3	0.971	58.8	LOS E	28.3	203.5	0.98	1.06	25.1
Approach		1273	2.6	0.971	44.5	LOS D	28.3	203.5	0.88	0.99	29.5
West: SH1 W											
10	L	402	3.4	0.269	10.2	LOS B	0.8	6.0	0.07	0.67	57.1
11	T	1248	15.3	0.952	33.5	LOS C	33.9	268.5	0.94	1.00	36.1
Approach		1651	12.4	0.952	27.8	LOS C	33.9	268.5	0.73	0.92	39.3
All Vehicles		4927	7.5	0.971	31.6	LOS C	38.9	285.8	0.85	0.95	36.5

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS E. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

SIDRA INTERSECTION


N
SH1 W
SH1 E
150
70
140
20
80
90
Rolleston Dr S

MOVEMENT SUMMARY

Site: MSRFL - MSR/Rolleston - 2016 AM

MSRFL - MSR/Rolleston Drive
2016 AM - EPA Vols - CSM2&MSRFL Network
Signals - Fixed Time   Cycle Time = 70 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Rolleston Dr S											
1	L	13	0.0	0.033	12.1	LOS B	0.2	1.7	0.43	0.63	42.6
3	R	1076	1.7	0.874	39.4	LOS D	23.6	167.8	0.97	1.01	28.8
Approach		1088	1.6	0.874	39.1	LOS D	23.6	167.8	0.97	1.01	28.9
East: SH1 E											
4	L	237	8.9	0.157	10.1	LOS B	0.4	3.0	0.06	0.67	40.0
5	T	719	13.8	0.896	30.7	LOS C	20.1	157.6	0.92	0.90	24.6
Approach		956	12.6	0.895	25.6	LOS C	20.1	157.6	0.71	0.84	26.5
West: SH1 W											
11	T	628	13.1	0.367	15.5	LOS B	8.6	66.9	0.68	0.65	50.1
12	R	23	0.0	0.084	25.8	LOS C	0.7	5.0	0.90	0.70	40.5
Approach		652	12.6	0.367	15.8	LOS B	8.6	66.9	0.69	0.66	49.7
All Vehicles		2696	8.2	0.895	28.7	LOS C	23.6	167.8	0.81	0.86	32.0

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

MOVEMENT SUMMARY

Site: MSRFL - MSR/Rolleston - 2016 IP

MSRFL - MSR/Rolleston Drive
2016 IP - EPA Vols - CSM2&MSRFL Network
Signals - Fixed Time   Cycle Time = 55 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Rolleston Dr S											
1	L	8	0.0	0.021	10.1	LOS B	0.1	0.7	0.40	0.63	44.1
3	R	457	4.1	0.627	31.1	LOS C	7.7	55.6	0.96	0.84	32.0
Approach		465	4.1	0.627	30.7	LOS C	7.7	55.6	0.95	0.84	32.2
East: SH1 E											
4	L	252	2.9	0.174	9.9	LOS A	0.3	2.5	0.06	0.67	40.0
5	T	618	14.7	0.638	14.3	LOS B	10.3	81.4	0.74	0.64	37.3
Approach		869	11.3	0.638	13.1	LOS B	10.3	81.4	0.55	0.65	37.9
West: SH1 W											
11	T	476	23.0	0.239	8.8	LOS A	4.4	36.7	0.52	0.54	59.3
12	R	41	0.0	0.099	18.1	LOS B	0.8	5.5	0.74	0.73	47.2
Approach		517	21.2	0.239	9.5	LOS A	4.4	36.7	0.53	0.55	58.1
All Vehicles		1852	12.2	0.638	16.5	LOS B	10.3	81.4	0.65	0.67	40.2

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

SIDRA INTERSECTION

MOVEMENT SUMMARY

MSRFL - MSR/Rolleston Drive
2016 PM - EPA Vols - CSM2&MSRFL Network
Signals - Fixed Time   Cycle Time = 95 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Rolleston Dr S											
1	L	14	0.0	0.074	13.2	LOS B	0.3	2.4	0.40	0.65	41.8
3	R	521	2.2	0.744	50.0	LOS D	13.7	97.6	1.00	0.89	25.6
Approach		535	2.2	0.744	49.1	LOS D	13.7	97.6	0.98	0.88	25.9
East: SH1 E											
4	L	572	0.9	0.381	10.0	LOS A	1.6	11.4	0.08	0.68	39.9
5	T	1202	6.7	0.771	10.5	LOS B	23.2	171.9	0.56	0.51	43.3
Approach		1774	4.9	0.771	10.4	LOS B	23.2	171.9	0.41	0.56	42.4
West: SH1 W											
11	T	723	16.7	0.331	9.0	LOS A	9.2	73.8	0.43	0.50	58.9
12	R	45	0.0	0.190	21.9	LOS C	1.3	8.9	0.71	0.75	43.7
Approach		768	15.8	0.331	9.8	LOS A	9.2	73.8	0.44	0.51	57.7
All Vehicles		3077	7.1	0.771	16.9	LOS B	23.2	171.9	0.52	0.61	39.3

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: MSRFL - MSR/Rolleston - 2026 AM

MSRFL - MSR/Rolleston Drive
2026 AM - EPA Vols - CSM2&MSRFL Network
Signals - Fixed Time   Cycle Time = 90 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Rolleston Dr S											
1	L	21	0.0	0.067	13.5	LOS B	0.5	3.7	0.42	0.64	41.6
3	R	1311	1.7	0.985	59.7	LOS E	54.0	383.8	0.99	1.07	23.3
Approach		1332	1.7	0.985	59.0	LOS E	54.0	383.8	0.98	1.06	23.4
East: SH1 E											
4	L	401	7.1	0.260	10.1	LOS B	1.0	7.2	0.07	0.67	40.0
5	T	764	15.7	0.963	48.5	LOS D	30.8	244.9	0.93	0.99	18.2
Approach		1165	12.7	0.963	35.3	LOS D	30.8	244.9	0.63	0.88	21.2
West: SH1 W											
11	T	687	14.2	0.452	21.9	LOS C	12.5	98.4	0.75	0.70	43.7
12	R	32	0.0	0.148	32.8	LOS C	1.3	9.2	0.94	0.71	35.9
Approach		719	13.6	0.452	22.4	LOS C	12.5	98.4	0.76	0.70	43.3
All Vehicles		3216	8.3	0.985	42.2	LOS D	54.0	383.8	0.80	0.92	25.9

Level of Service (Aver. Int. Delay): LOS D. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS E. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

Processed: Thursday, 19 April 2012 10:15:38 p.m.
SIDRA INTERSECTION 5.0.2.1437
Project: P:\339\3390691\TTR\FinalScheme_1203\SIDRA_CSM2&MSRFL\MSRFL_7_Hoskyns&Rolleston_EPAVols.sip
8000924, BECA INFRASTRUCTURE LIMITED, FLOATING

MOVEMENT SUMMARY

Site: MSRFL - MSR/Rolleston - 2026 IP

MSRFL - MSR/Rolleston Drive
2026 IP - EPA Vols - CSM2&MSRFL Network
Signals - Fixed Time   Cycle Time = 60 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Rolleston Dr S											
1	L	15	0.0	0.040	10.9	LOS B	0.2	1.5	0.42	0.64	43.5
3	R	707	3.7	0.726	31.8	LOS C	11.9	86.0	0.97	0.90	31.7
Approach		722	3.6	0.726	31.4	LOS C	11.9	86.0	0.95	0.89	31.9
East: SH1 E											
4	L	519	2.2	0.346	10.0	LOS A	0.9	6.7	0.08	0.67	39.9
5	T	661	16.2	0.752	19.1	LOS B	13.4	107.0	0.83	0.74	32.3
Approach		1180	10.1	0.752	15.1	LOS B	13.4	107.0	0.50	0.71	34.6
West: SH1 W											
11	T	532	25.0	0.294	11.1	LOS B	5.8	49.6	0.59	0.59	55.7
12	R	45	0.0	0.128	21.0	LOS C	1.1	7.4	0.82	0.73	44.5
Approach		577	23.0	0.294	11.9	LOS B	5.8	49.6	0.61	0.60	54.7
All Vehicles		2479	11.2	0.752	19.1	LOS B	13.4	107.0	0.66	0.74	37.3

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

MOVEMENT SUMMARY

Site: MSRFL - MSR/Rolleston - 2026 PM

MSRFL - MSR/Rolleston Drive
2026 PM - EPA Vols - CSM2&MSRFL Network
Signals - Fixed Time Cycle Time = 120 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Rolleston Dr S											
1	L	23	0.0	0.153	25.5	LOS C	1.2	8.1	0.58	0.67	34.6
3	R	848	1.2	0.963	71.8	LOS E	39.4	278.9	0.98	1.01	20.8
Approach		872	1.2	0.962	70.6	LOS E	39.4	278.9	0.97	1.00	21.1
East: SH1 E											
4	L	798	1.5	0.527	10.0	LOS B	3.3	23.7	0.10	0.68	39.7
5	T	1383	6.8	0.959	35.6	LOS D	64.8	480.4	0.83	0.89	22.6
Approach		2181	4.9	0.959	26.3	LOS C	64.8	480.4	0.56	0.81	25.7
West: SH1 W											
11	T	797	18.8	0.430	14.9	LOS B	15.4	124.8	0.54	0.57	50.8
12	R	60	0.0	0.369	39.6	LOS D	3.0	21.3	0.97	0.76	32.3
Approach		857	17.4	0.430	16.6	LOS B	15.4	124.8	0.57	0.59	48.9
All Vehicles		3909	6.8	0.962	34.0	LOS C	64.8	480.4	0.65	0.80	27.5

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS E. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

MOVEMENT SUMMARY

Site: MSRFL - MSR/Rolleston - 2041 AM

MSRFL - MSR/Rolleston Drive
2041 AM - EPA Vols - CSM2&MSRFL Network
Signals - Fixed Time   Cycle Time = 135 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Rolleston Dr S											
1	L	27	0.0	0.125	16.0	LOS B	1.0	7.0	0.39	0.64	40.0
3	R	1487	1.9	1.084	120.2	LOS F	124.1	882.7	1.00	1.19	14.8
Approach		1515	1.9	1.084	118.3	LOS F	124.1	882.7	0.99	1.18	14.9
East: SH1 E											
4	L	413	9.2	0.290	10.1	LOS B	1.6	12.0	0.07	0.67	40.0
5	T	872	17.3	1.095	122.1	LOS F	68.7	552.0	0.94	1.22	8.8
Approach		1284	14.7	1.095	86.1	LOS F	68.7	552.0	0.66	1.04	10.8
West: SH1 W											
11	T	786	15.7	0.632	36.9	LOS D	24.1	191.3	0.84	0.77	33.6
12	R	42	0.0	0.296	48.0	LOS D	2.7	19.1	0.99	0.73	28.7
Approach		828	14.9	0.632	37.5	LOS D	24.1	191.3	0.85	0.77	33.3
All Vehicles		3627	9.4	1.095	88.4	LOS F	124.1	882.7	0.84	1.04	16.0

Level of Service (Aver. Int. Delay): LOS F. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

MOVEMENT SUMMARY

Site: MSRFL - MSR/Rolleston - 2041 IP

MSRFL - MSR/Rolleston Drive
2041 IP - EPA Vols - CSM2&MSRFL Network
Signals - Fixed Time   Cycle Time = 70 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Rolleston Dr S											
1	L	28	0.0	0.083	13.0	LOS B	0.6	4.2	0.46	0.65	42.0
3	R	955	3.0	0.857	40.4	LOS D	20.1	144.4	0.99	1.01	28.5
Approach		983	2.9	0.857	39.6	LOS D	20.1	144.4	0.97	1.00	28.8
East: SH1 E											
4	L	565	3.7	0.367	10.0	LOS B	1.3	9.1	0.08	0.67	39.9
5	T	791	16.5	0.876	26.5	LOS C	20.8	166.5	0.89	0.86	26.9
Approach		1356	11.2	0.876	19.6	LOS B	20.8	166.5	0.55	0.78	30.1
West: SH1 W											
11	T	597	28.0	0.348	13.6	LOS B	7.7	67.1	0.63	0.62	52.4
12	R	56	0.0	0.197	25.3	LOS C	1.6	11.0	0.90	0.74	40.9
Approach		653	25.6	0.348	14.6	LOS B	7.7	67.1	0.65	0.63	51.2
All Vehicles		2992	11.6	0.876	25.1	LOS C	20.8	166.5	0.71	0.82	33.1

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

MOVEMENT SUMMARY

Site: MSRFL - MSR/Rolleston - 2041 PM

MSRFL - MSR/Rolleston Drive
2041 PM - EPA Vols - CSM2&MSRFL Network
Signals - Fixed Time   Cycle Time = 145 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Rolleston Dr S											
1	L	45	0.0	0.413	41.4	LOS D	3.2	22.5	0.70	0.68	28.3
3	R	708	2.1	1.011	99.8	LOS F	43.2	307.8	0.99	1.03	16.8
Approach		754	2.0	1.011	96.3	LOS F	43.2	307.8	0.98	1.01	17.3
East: SH1 E											
4	L	858	1.2	0.580	10.2	LOS B	4.1	28.8	0.13	0.69	39.4
5	T	1743	6.9	1.029	56.2	LOS E	121.7	902.4	0.79	0.95	16.5
Approach		2601	5.1	1.030	41.0	LOS D	121.7	902.4	0.57	0.87	19.3
West: SH1 W											
11	T	941	20.1	0.476	13.0	LOS B	19.3	158.4	0.47	0.54	53.2
12	R	80	1.3	0.608	53.8	LOS D	5.5	39.1	1.00	0.76	26.7
Approach		1021	18.7	0.608	16.2	LOS B	19.3	158.4	0.51	0.55	49.3
All Vehicles		4376	7.7	1.030	44.8	LOS D	121.7	902.4	0.63	0.82	23.1

Level of Service (Aver. Int. Delay): LOS D. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

Processed: Thursday, 19 April 2012 10:15:40 p.m.
SIDRA INTERSECTION 5.0.2.1437
Project: P:\339\3390691\TTR\FinalScheme_1203\SIDRA_CSM2&MSRFL\MSRFL_7_Hoskyns&Rolleston_EPAVols.sip
8000924, BECA INFRASTRUCTURE LIMITED, FLOATING

SIDRA INTERSECTION

Technical Report No 2

Christchurch Southern Motorway Stage 2 and Main South Road Four Laning

Assessment of Traffic and Transportation Effects

Appendix F: Safety Analysis Spreadsheets

Signalised Crossroads Crash Prediction Models

Project: CSM2 and MSRFL
Analysis Year: 2016
Intersection: HJR/Shands

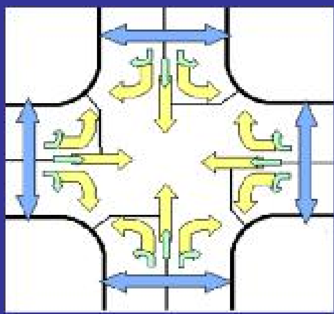
FLOWS

All flows entered must be entered as average annual daily flows (veh/day, cyc/day and ped/day) and factored to the analysis year. Pedestrian flows are the number of pedestrians crossing each approach in either

☐ Use Cyclist Counts
☐ Use Pedestrian Counts

	1	2	3
Cycles			
MV	161	2969	1611

	Cycles	**MV**	**Peds**		**Peds**	**MV**	**Cycles**	
12		99				1251		**4**
11		1622				1346		**5**
10		396				493		**6**



	9	8	7
Peds			
MV	462	3704	661
Cycles			

TOTAL CRASHES

		Maj	Min	
0.71	**Total crashes per year**	9241	5535	OK
0.00				
0.00				

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	N	E	S	W	Total
All Crashes Involving Motor Vehicles						
Crossing (No turns)	HA	0.047	0.044	0.047	0.052	0.190
Right turn Against	LB	0.073	0.040	0.045	0.071	0.230
Rear end	FA to FE	0.015	0.009	0.015	0.006	0.045
Loss of control	C and D	0.009	0.006	0.009	0.004	0.028
Other	Other	0.062	0.051	0.062	0.043	0.217
Total		**0.205**	**0.150**	**0.179**	**0.176**	**0.710**
Cycle Crashes						
Same Direction	A, E, F, G					
Right Turn Against	LB					
Other	Other					
Total						
Pedestrian Crashes						
Intersecting	NA, NB					
Right Turning	ND, NF					
Other	Other					
Total						

Four-Arm Roundabout Crash Prediction Models	
Project:	CSM2 and MSRFL
Analysis Year:	2016
Intersection:	Springs/Blakes

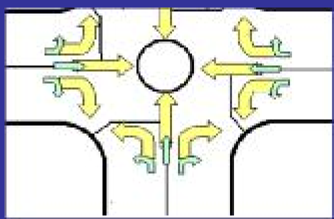
FLOWS

All flows entered must be entered as average annual daily flows (veh/day, and cyc/day) and factored to the analysis year.

	1	2	3
Cycles			
MV	0	0	0

☐ Use Cyclist Counts

	Cycles	MV
12		
11		4141
10		371



	MV	Cycles
4		
5	4698	
6	1281	

	9	8	7
MV	339		1160
Cycles			

TOTAL CRASHES

0.76
0.00

Maj	Min	
10414	1575	OK

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	N	E	S	W	Total
Motor Vehicle Only Crashes						
Entering vs Circulating	HA, LB, JA, MB, K	0.000	0.052	0.083	0.074	0.208
Rear-end	FA to FD	0.000	0.017	0.004	0.013	0.034
Loss-of-control	C and D	0.000	0.036	0.016	0.030	0.083
Other	Other	0.000	0.022	0.015	0.020	0.057
Total		**0.000**	**0.127**	**0.118**	**0.137**	**0.381**
						0.762
Cycle Crashes						
Entering vs Circulating	HA, LB, JA, MB, K					
Other	Other					
Total						

Rural Priority T-Junction Crash Prediction Models

Project: CSM2 and MSRFL

Analysis Year: 2016

Intersection:

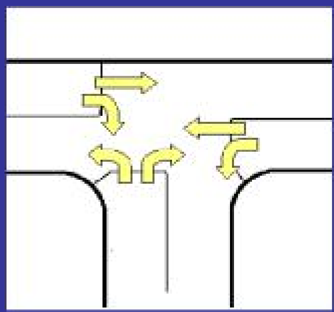
FLOWS

All flows entered must be entered as average annual daily flows (veh/day) and factored to the analysis year.

Mean Speed of Approaching Veh.

104

			MV			MV	
4	261				369		5
3	1083				156		6



Visibility Deficiency

1

MV	781	20
	2	**1**

TOTAL CRASHES

0.12 **Total crashes per year**

Maj	Stem	
1651	2041	OK

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	Approach 1	Approach 2	Approach 3	Total
All Crashes Involving Motor Vehicles					
Crossing – Vehicle Turning	JA	-	-	0.001	0.001
RT and Following Vehicle	GC, GD and GE	-	0.092	-	0.092
Other (Approach 3)	Other	-	-	0.005	0.005
Other (Approach 2)	Other	-	0.012	-	0.012
Other (Approach 1)	All	0.013	-	-	0.013
Total		**0.013**	**0.104**	**0.005**	**0.123**

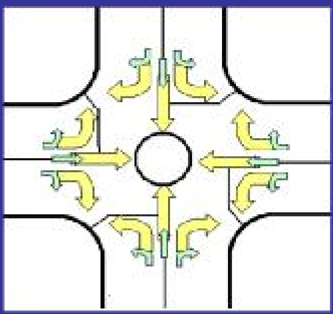
Four-Arm Roundabout Crash Prediction Models	
Project:	CSM2 and MSRFL
Analysis Year:	2016
Intersection:	Jones/Weedons

FLOWS
All flows entered must be entered as average annual daily flows (veh/day, and cyc/day) and factored to the analysis year.

☐ Use Cyclist Counts

	1	2	3
Cycles			
MV	65	1542	0

	Cycles	MV
12		117
11		88
10		945



MV	Cycles	
2		4
237		5
28		6

	9	8	7
MV	1042	1065	19
Cycles			

TOTAL CRASHES
0.55
0.00

Maj	Min	
3716	1434	OK

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	N	E	S	W	Total
Motor Vehicle Only Crashes						
Entering vs Circulating	HA, LB, JA, MB, K	0.046	0.031	0.031	0.040	0.148
Rear-end	FA to FD	0.004	0.001	0.005	0.003	0.012
Loss-of-control	C and D	0.017	0.006	0.020	0.014	0.057
Other	Other	0.015	0.010	0.016	0.014	0.055
Total		**0.082**	**0.047**	**0.073**	**0.071**	**0.273**
						0.546
Cycle Crashes						
Entering vs Circulating	HA, LB, JA, MB, K					
Other	Other					
Total						

Signalised Crossroads Crash Prediction Models

Project:	CSM2 and MSRFL
Analysis Year:	2016
Intersection:	MSR/HJR

FLOWS

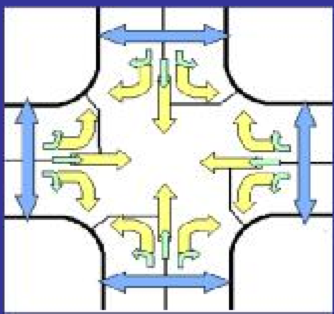
All flows entered must be entered as average annual daily flows (veh/day, cyc/day and ped/day) and factored to the analysis year. Pedestrian flows are the number of pedestrians crossing each approach in either

☐ Use Cyclist Counts

☐ Use Pedestrian Counts

	1	2	3
Cycles			
MV	86	877	44

	Cycles	**MV**	**Peds**
12		0	
11		1904	
10		992	



Peds	**MV**	**Cycles**	
	18		**4**
	1761		**5**
	0		**6**

Peds			
MV	0	801	98
Cycles			
	9	8	7

TOTAL CRASHES

		Maj	**Min**	
0.42	**Total crashes per year**	4284	2297	Min Low
0.00				
0.00				

CRASHES BY TYPE AND APPROACH

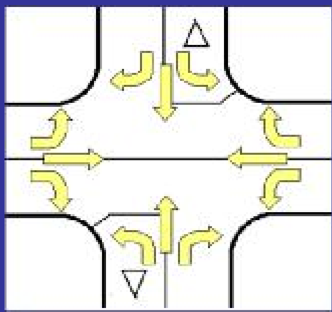
Crash Type	Crash Code	Approach N	Approach E	Approach S	Approach W	Total
All Crashes Involving Motor Vehicles						
Crossing (No turns)	HA	0.032	0.031	0.030	0.030	0.123
Right turn Against	LB	0.018	0.067	0.016	0.013	0.115
Rear end	FA to FE	0.003	0.005	0.002	0.009	0.019
Loss of control	C and D	0.002	0.004	0.002	0.006	0.013
Other	Other	0.030	0.039	0.029	0.049	0.148
Total		**0.085**	**0.146**	**0.080**	**0.107**	**0.418**
Cycle Crashes						
Same Direction	A, E, F, G					
Right Turn Against	LB					
Other	Other					
Total						
Pedestrian Crashes						
Intersecting	NA, NB					
Right Turning	ND, NF					
Other	Other					
Total						

Priority Crossroads Crash Prediction Models

Project: CSM2 and MSRFL
Analysis Year: 2016
Intersection: MSR/Kirk

FLOWS
All flows entered must be entered as average annual daily flows (veh/day) and factored to the analysis year.

	1	2	3
MV	2517	304	3339

	MV		MV	
12	553		2897	4
11	3920		1435	5
10	29		70	6

	9	8	7
MV	21	281	76

TOTAL CRASHES
0.64 **Total crashes per year**

Maj	Min	
10105	5335	OK

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	Approach 1	2	3	4	Total
All Crashes Involving Motor Vehicles						
Crossing (No turns)	HA	0.074	0.050	0.048	0.071	0.244
Right turn Against	LB	0.011	0.008	0.054	0.069	0.141
Crossing (Vehicle turning)	JA	0.002	0.003	0.000	0.039	0.044
Loss of control	C and D	0.015	0.014	0.006	0.014	0.048
Others	Other	0.055	0.046	0.011	0.046	0.158
Total		**0.157**	**0.119**	**0.120**	**0.240**	**0.636**

Rural Priority Crossroads Crash Prediction Models

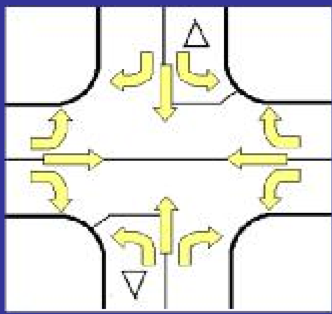
Project:	CSM2 and MSRFL
Analysis Year:	2016
Intersection:	Selwyn/Waterholes

FLOWS

All flows entered must be entered as average annual daily flows (veh/day) and factored to the analysis year.

	1	2	3
MV	1	154	0

	MV		MV
12	4	4	0
11	114	5	62
10	0	6	544
	1		1 RTB



	9	8	7
MV	0	204	846

TOTAL CRASHES

0.10 **Total crashes per year**

Maj	Min	
1054	873	Maj Low

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	Approach 1	2	3	4	Total
All Crashes Involving Motor Vehicles						
Crossing (No turns)		0.012	-	0.019	-	0.031
Right turn Against		0.012	-	0.010	-	0.022
Crossing (Vehicle turning)		-	0.000	-	0.000	0.000
Loss of control			0.014		0.004	0.018
Others			0.019		0.012	0.031
Total		**0.024**	**0.033**	**0.029**	**0.016**	**0.102**

Rural Priority T-Junction Crash Prediction Models

Project: CSM2 and MSRFL

Analysis Year: 2016

Intersection: Weedons/Levi

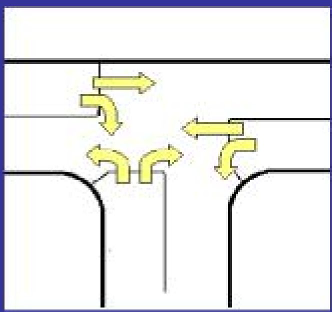
FLOWS

All flows entered must be entered as average annual daily flows (veh/day) and factored to the analysis year.

Mean Speed of Approaching Veh.

104

Approach	MV		MV	Approach
4	864		881	5
3	1694		32	6



Visibility Deficiency

1

MV	4242	43
	2	1

TOTAL CRASHES

0.29 **Total crashes per year**

Maj	Stem	
4751	6012	OK

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	Approach 1	Approach 2	Approach 3	Total
All Crashes Involving Motor Vehicles					
Crossing – Vehicle Turning	JA	-	-	0.002	0.002
RT and Following Vehicle	GC, GD and GE	-	0.253	-	0.253
Other (Approach 3)	Other	-	-	0.008	0.008
Other (Approach 2)	Other	-	0.016	-	0.016
Other (Approach 1)	All	0.012	-	-	0.012
Total		**0.012**	**0.269**	**0.010**	**0.292**

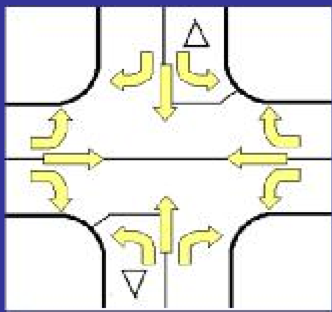
Rural Priority Crossroads Crash Prediction Models	
Project:	CSM2 and MSRFL
Analysis Year:	2016
Intersection:	Trent/Shands

FLOWS

All flows entered must be entered as average annual daily flows (veh/day) and factored to the analysis year.

	1	2	3
MV	24	244	64

Movement	MV	Movement	MV
12	56	4	84
11	4789	5	3722
10	82	6	60
	1		1 **RTB**



	9	8	7
MV	32	222	22

TOTAL CRASHES

0.52 **Total crashes per year**

Maj	Min	
8724	678	Min Low

CRASHES BY TYPE AND APPROACH

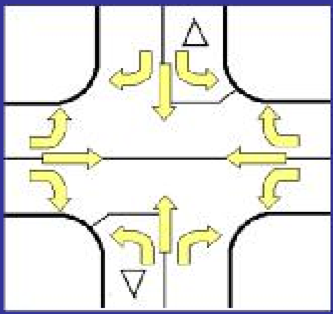
Crash Type	Crash Code	Approach 1	2	3	4	Total
All Crashes Involving Motor Vehicles						
Crossing (No turns)		0.083	-	0.087	-	0.171
Right turn Against		0.074	-	0.064	-	0.138
Crossing (Vehicle turning)		-	0.008	-	0.011	0.019
Loss of control			0.058		0.070	0.128
Others			0.031		0.033	0.063
Total		**0.157**	**0.097**	**0.151**	**0.113**	**0.518**

Priority Crossroads Crash Prediction Models

Project: CSM2 and MSRFL
Analysis Year: 2016
Intersection: MSR/Dawsons

FLOWS
All flows entered must be entered as average annual daily flows (veh/day) and factored to the analysis year.

	1	2	3
MV	386	330	549



Approach	MV
12	382
11	3601
10	98

Approach	MV
4	227
5	3414
6	332

	9	8	7
MV	55	274	351

TOTAL CRASHES
0.56 **Total crashes per year**

Maj	Min	
8204	1794	OK

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	Approach 1	2	3	4	Total
All Crashes Involving Motor Vehicles						
Crossing (No turns)	HA	0.074	0.072	0.067	0.069	0.282
Right turn Against	LB	0.022	0.014	0.022	0.021	0.079
Crossing (Vehicle turning)	JA	0.001	0.014	0.000	0.016	0.031
Loss of control	C and D	0.009	0.013	0.007	0.013	0.042
Others	Other	0.022	0.043	0.016	0.044	0.124
Total		**0.128**	**0.157**	**0.113**	**0.162**	**0.559**

Signalised Crossroads Crash Prediction Models

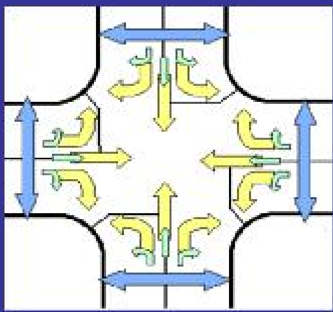
Project: CSM2 and MSRFL
Analysis Year: 2016
Intersection: MSR/Carmen

FLOWS
All flows entered must be entered as average annual daily flows (veh/day, cyc/day and ped/day) and factored to the analysis year. Pedestrian flows are the number of pedestrians crossing each approach in either

☐ Use Cyclist Counts
☐ Use Pedestrian Counts

	1	2	3
Cycles			
MV	1825	4615	6375

	Cycles	**MV**	**Peds**
12		1446	
11		4016	
10		1	



Peds	**MV**	**Cycles**	
	5310		4
	7610		5
	2567		6

	9	8	7
Peds			
MV	80	4097	3319
Cycles			

TOTAL CRASHES

		Maj	Min	
1.42	**Total crashes per year**	22087	19174	OK
0.00				
0.00				

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	N	E	S	W	Total
All Crashes Involving Motor Vehicles						
Crossing (No turns)	HA	0.077	0.098	0.095	0.074	0.344
Right turn Against	LB	0.178	0.008	0.131	0.202	0.519
Rear end	FA to FE	0.043	0.052	0.024	0.017	0.136
Loss of control	C and D	0.023	0.028	0.014	0.010	0.075
Other	Other	0.098	0.106	0.076	0.066	0.346
Total		**0.419**	**0.292**	**0.340**	**0.370**	**1.420**
Cycle Crashes						
Same Direction	A, E, F, G					
Right Turn Against	LB					
Other	Other					
Total						
Pedestrian Crashes						
Intersecting	NA, NB					
Right Turning	ND, NF					
Other	Other					
Total						

Four-Arm Roundabout Crash Prediction Models

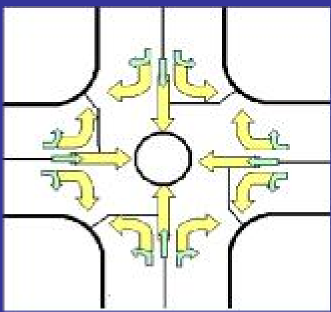
Project: CSM2 and MSRFL
Analysis Year: 2016
Intersection: HJR/Springs

FLOWS
All flows entered must be entered as average annual daily flows (veh/day, and cyc/day) and factored to the analysis year.

☐ Use Cyclist Counts

	1	2	3
Cycles			
MV	1157	4388	1

	Cycles	MV
12		1286
11		890
10		6



	MV	Cycles
4	1	
5	734	
6	118	

	9	8	7
MV	23	4882	132
Cycles			

TOTAL CRASHES

1.10	
0.00	

Maj	Min	
10631	2986	OK

CRASHES BY TYPE AND APPROACH

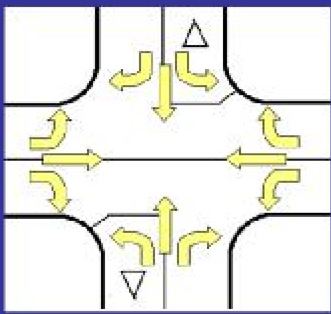
Crash Type	Crash Code	N	E	S	W	Total
Motor Vehicle Only Crashes						
Entering vs Circulating	HA, LB, JA, MB, K	0.077	0.070	0.095	0.100	0.341
Rear-end	FA to FD	0.016	0.002	0.014	0.006	0.038
Loss-of-control	C and D	0.034	0.012	0.032	0.020	0.099
Other	Other	0.021	0.013	0.021	0.017	0.071
Total		**0.148**	**0.097**	**0.162**	**0.142**	**0.548**
						1.097
Cycle Crashes						
Entering vs Circulating	HA, LB, JA, MB, K					
Other	Other					
Total						

Rural Priority Crossroads Crash Prediction Models	
Project:	CSM2 and MSRFL
Analysis Year:	2016
Intersection:	Weedons/Selwyn

FLOWS
All flows entered must be entered as average annual daily flows (veh/day) and factored to the analysis year.

	1	2	3
MV	0	63	0

	MV		MV	
12	0		0	4
11	869		896	5
10	38		0	6
	1		1 RTB	



	17	117	0
MV	9	8	7

	9	8	7
MV	17	117	0

TOTAL CRASHES
0.18 **Total crashes per year**

Maj	Min	
1792	208	Min Low

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	Approach 1	2	3	4	Total
All Crashes Involving Motor Vehicles						
Crossing (No turns)		0.021	-	0.030	-	0.051
Right turn Against		0.020	-	0.026	-	0.047
Crossing (Vehicle turning)		-	0.000	-	0.001	0.001
Loss of control			0.019		0.019	0.038
Others			0.021		0.021	0.041
Total		**0.041**	**0.040**	**0.056**	**0.041**	**0.179**

Priority T-Junction Crash Prediction Models

Project: CSM2 and MSRFL

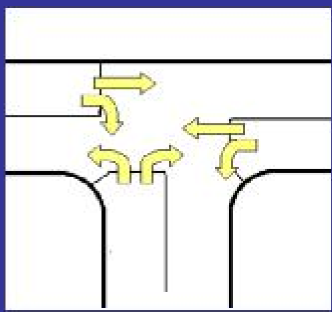
Analysis Year: 2016

Intersection: MSR/Larcombs

FLOWS

All flows entered must be entered as average annual daily flows (veh/day) and factored to the analysis year.

Approach	MV
4	13531
3	0
5	11531
6	0
2	155
1	0



TOTAL CRASHES

0.28 **Total crashes per year**

Maj	Stem	
25139	155	Stem Low

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	Approach 1	Approach 2	Approach 3	Total
All Crashes Involving Motor Vehicles					
Right turn Against	LB	-	-	0.000	0.000
Rear end	FA to FD	0.000	0.049	0.034	0.083
Crossing (Vehicles turning)	JA	-	-	0.000	0.000
Loss of control	C and D	0.007	0.028	0.027	0.062
Other	Other	0.007	0.066	0.061	0.134
Total		**0.014**	**0.143**	**0.000**	**0.279**

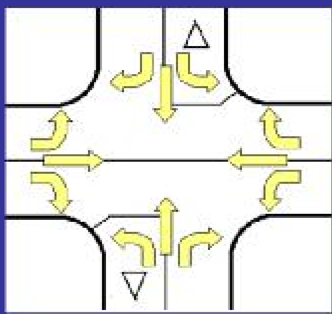
Rural Priority Crossroads Crash Prediction Models	
Project:	CSM2 and MSRFL
Analysis Year:	2016
Intersection:	Shands/Blakes

FLOWS

All flows entered must be entered as average annual daily flows (veh/day) and factored to the analysis year.

	1	2	3
MV	7	4	128

	MV		MV	
12	7		138	4
11	4846		3847	5
10	22		1369	6
	1		1 RTB	



	12	1	1457
MV	12	1	1457
	9	8	7

TOTAL CRASHES

0.26 Total crashes per year

Maj	Min	
10263	1575	OK

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	Approach 1	2	3	4	Total
All Crashes Involving Motor Vehicles						
Crossing (No turns)		0.007	-	0.003	-	0.010
Right turn Against		0.014	-	0.007	-	0.021
Crossing (Vehicle turning)		-	0.010	-	0.007	0.017
Loss of control			0.074		0.069	0.144
Others			0.034		0.033	0.066
Total		**0.021**	**0.118**	**0.010**	**0.109**	**0.258**

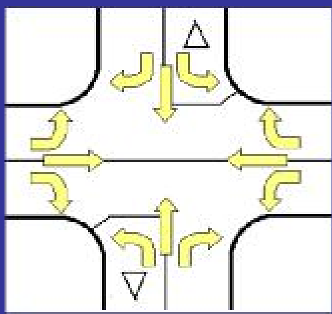
Rural Priority Crossroads Crash Prediction Models	
Project:	CSM2 and MSRFL
Analysis Year:	2016
Intersection:	Shands/Hamptons

FLOWS

All flows entered must be entered as average annual daily flows (veh/day) and factored to the analysis year.

	1	2	3
MV	41	222	136

	MV		MV	
12	28		149	4
11	3968		3066	5
10	0		479	6
	1		1 **RTB**	



	9	8	7
MV	0	193	728

TOTAL CRASHES

0.45 **Total crashes per year**

Maj	Min	
7814	1195	OK

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	Approach 1	2	3	4	Total
All Crashes Involving Motor Vehicles						
Crossing (No turns)		0.073	-	0.074	-	0.147
Right turn Against		0.066	-	0.055	-	0.121
Crossing (Vehicle turning)		-	0.008	-	0.000	0.008
Loss of control			0.056		0.060	0.116
Others			0.030		0.031	0.061
Total		**0.138**	**0.094**	**0.130**	**0.090**	**0.453**

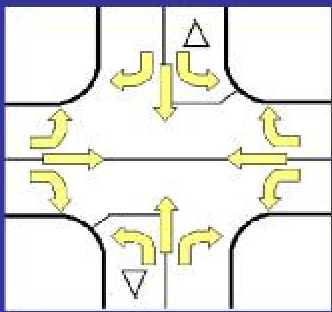
Rural Priority Crossroads Crash Prediction Models

Project: CSM2 and MSRFL
Analysis Year: 2016
Intersection: Springs/Marshs

FLOWS
All flows entered must be entered as average annual daily flows (veh/day) and factored to the analysis year.

	1	2	3
MV	6	890	1286

	MV (west)		MV (east)	
12	23		1157	4
11	4882		4388	5
10	23		1	6
	1		1 RTB	



	9	8	7
MV	118	734	1

TOTAL CRASHES
0.85 **Total crashes per year**

Maj	Min	
10577	2931	OK

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	Approach 1	Approach 2	Approach 3	Approach 4	Total
All Crashes Involving Motor Vehicles						
Crossing (No turns)		0.194	-	0.180	-	0.374
Right turn Against		0.125	-	0.110	-	0.236
Crossing (Vehicle turning)		-	0.025	-	0.007	0.032
Loss of control			0.076		0.070	0.146
Others			0.034		0.033	0.067
Total		**0.319**	**0.135**	**0.291**	**0.109**	**0.854**

Priority T-Junction Crash Prediction Models

Project: CSM2 and MSRFL

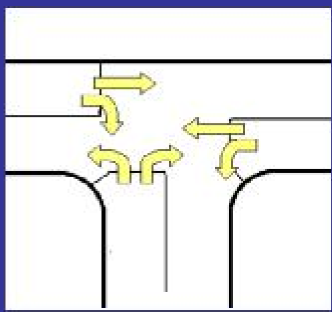
Analysis Year: 2016

Intersection: Springs/Tosswill

FLOWS

All flows entered must be entered as average annual daily flows (veh/day) and factored to the analysis year.

	MV		MV		
4	5249		4528	5	
3	11		58	6	



MV	12	70
	2	1

TOTAL CRASHES

0.20 **Total crashes per year**

Maj	Stem	
9852	151	Stem Low

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	Approach 1	Approach 2	Approach 3	Total
All Crashes Involving Motor Vehicles					
Right turn Against	LB	-	-	0.011	0.011
Rear end	FA to FD	0.000	0.006	0.004	0.010
Crossing (Vehicles turning)	JA	-	-	0.046	0.046
Loss of control	C and D	0.006	0.021	0.020	0.047
Other	Other	0.005	0.041	0.038	0.084
Total		**0.011**	**0.068**	**0.000**	**0.198**

Rural Priority T-Junction Crash Prediction Models

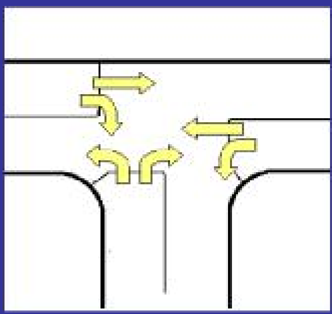
Project: CSM2 and MSRFL
Analysis Year: 2016
Intersection: Blakes/Trents

FLOWS
All flows entered must be entered as average annual daily flows (veh/day) and factored to the analysis year.

Mean Speed of Approaching Veh.

104

	MV		MV		
4	264		250	5
3	18		32	6



Visibility Deficiency

1

MV	14	21
	2	1

TOTAL CRASHES
0.04 **Total crashes per year**

Maj	Stem	
557	85	OK

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	Approach 1	Approach 2	Approach 3	Total
All Crashes Involving Motor Vehicles					
Crossing – Vehicle Turning	JA	-	-	0.001	0.001
RT and Following Vehicle	GC, GD and GE	-	0.014	-	0.014
Other (Approach 3)	Other	-	-	0.003	0.003
Other (Approach 2)	Other	-	0.005	-	0.005
Other (Approach 1)	All	0.014	-	-	0.014
Total		**0.014**	**0.019**	**0.003**	**0.036**

Rural Priority T-Junction Crash Prediction Models

Project: CSM2 and MSRFL

Analysis Year: 2016

Intersection: Waterholes/Trents

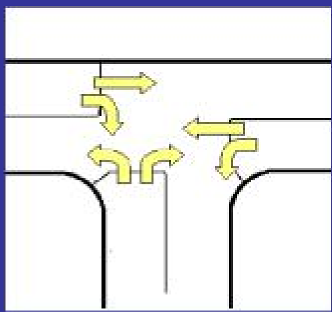
FLOWS

All flows entered must be entered as average annual daily flows (veh/day) and factored to the analysis year.

Mean Speed of Approaching Veh.

104

Approach	MV
4	193
3	0
5	141
6	403



Visibility Deficiency

1

MV	2	1
	0	375

TOTAL CRASHES

0.05 **Total crashes per year**

Maj	Stem	
723	778	OK

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	Approach 1	Approach 2	Approach 3	Total
All Crashes Involving Motor Vehicles					
Crossing – Vehicle Turning	JA	-	-	0.029	0.029
RT and Following Vehicle	GC, GD and GE	-	0.000	-	0.000
Other (Approach 3)	Other	-	-	0.005	0.005
Other (Approach 2)	Other	-	0.004	-	0.004
Other (Approach 1)	All	0.013	-	-	0.013
Total		**0.013**	**0.004**	**0.034**	**0.052**

ISAT - CSM/Halswell Junction Road Interchange

2016

Interchange element type	Number of sites	Number of predicted crashes during analysis period			MVMT	MEV	Crash rate
		Total	FI	PDO			(per MVMT or MEV)
Mainline freeway segments	9	3.7	1.1	2.6	4.473		0.834
Ramps	4	1.6	0.8	0.8	1.873		0.860
Crossroad ramp terminals & ints	1	1.3	0.5	0.7		8.802	0.143
Crossroad segments	6	0.4	0.1	0.3	1.097		0.389
Total	20	7.0	2.6	4.4	7.443		0.944

2026

Interchange element type	Number of sites	Number of predicted crashes during analysis period			MVMT	MEV	Crash rate
		Total	FI	PDO			(per MVMT or MEV)
Mainline freeway segments	9	4.8	1.5	3.3	5.860		0.817
Ramps	4	1.6	0.8	0.8	1.952		0.844
Crossroad ramp terminals & ints	1	1.9	0.8	1.1		13.144	0.145
Crossroad segments	6	0.7	0.2	0.5	1.782		0.378
Total	20	9.0	3.3	5.7	9.593		0.940

2041

Interchange element type	Number of sites	Number of predicted crashes during analysis period			MVMT	MEV	Crash rate
		Total	FI	PDO			(per MVMT or MEV)
Mainline freeway segments	9	5.6	1.7	3.9	6.996		0.806
Ramps	4	1.7	0.9	0.8	2.057		0.822
Crossroad ramp terminals & ints	1	2.4	1.0	1.4		16.926	0.144
Crossroad segments	6	0.9	0.3	0.6	2.337		0.371
Total	20	10.6	3.9	6.7	11.389		0.934

ISAT - CSM2/MSR Interchange

2016

Interchange element type	Number of sites	Number of predicted crashes during analysis period			MVMT	MEV	Crash rate
		Total	FI	PDO			(per MVMT or MEV)
Mainline freeway segments	6	3.4	1.0	2.4	3.981		0.851
Ramps	2	2.0	0.7	1.3	2.115		0.948
Crossroad ramp terminals & ints	0						
Crossroad segments	0						
Total	8	5.4	1.7	3.7	6.096		0.885

2026

Interchange element type	Number of sites	Number of predicted crashes during analysis period			MVMT	MEV	Crash rate
		Total	FI	PDO			(per MVMT or MEV)
Mainline freeway segments	6	4.5	1.4	3.2	5.452		0.830
Ramps	2	2.6	1.1	1.5	2.948		0.882
Crossroad ramp terminals & ints	0						
Crossroad segments	0						
Total	8	7.1	2.4	4.7	8.399		0.849

2041

Interchange element type	Number of sites	Number of predicted crashes during analysis period			MVMT	MEV	Crash rate
		Total	FI	PDO			(per MVMT or MEV)
Mainline freeway segments	6	5.7	1.7	4.0	7.029		0.813
Ramps	2	3.3	1.5	1.8	3.939		0.835
Crossroad ramp terminals & ints	0						
Crossroad segments	0						
Total	8	9.0	3.3	5.7	10.968		0.821

ISAT - Shands Interchange

2016

Interchange element type	Number of sites	Number of predicted crashes during analysis period			MVMT	MEV	Crash rate
		Total	FI	PDO			(per MVMT or MEV)
Mainline freeway segments	9	4.3	1.3	3.0	4.868		0.875
Ramps	4	1.5	0.4	1.1	1.244		1.218
Crossroad ramp terminals & ints	2	8.8	3.8	5.0		15.476	0.568
Crossroad segments	6	0.3	0.1	0.2	0.777		0.394
Total	21	14.9	5.6	9.3	6.889		2.158

2026

Interchange element type	Number of sites	Number of predicted crashes during analysis period			MVMT	MEV	Crash rate
		Total	FI	PDO			(per MVMT or MEV)
Mainline freeway segments	9	4.2	1.3	3.0	4.827		0.875
Ramps	4	1.5	0.4	1.1	1.244		1.218
Crossroad ramp terminals & ints	2	10.4	4.5	5.8		19.057	0.543
Crossroad segments	6	0.4	0.1	0.3	0.961		0.388
Total	21	16.5	6.4	10.1	7.031		2.342

2041

Interchange element type	Number of sites	Number of predicted crashes during analysis period			MVMT	MEV	Crash rate
		Total	FI	PDO			(per MVMT or MEV)
Mainline freeway segments	9	3.3	1.0	2.3	3.698		0.894
Ramps	4	1.5	0.4	1.1	1.208		1.229
Crossroad ramp terminals & ints	2	11.1	5.0	6.2		21.438	0.518
Crossroad segments	6	0.4	0.1	0.3	1.119		0.384
Total	21	16.3	6.5	9.8	6.025		2.710

ISAT - Weedons Interchange

2016

Interchange element type	Number of sites	Number of predicted crashes during analysis period			MVMT	MEV	Crash rate
		Total	FI	PDO			(per MVMT or MEV)
Mainline freeway segments	9	5.6	1.7	3.9	6.701		0.837
Ramps	4	1.3	0.5	0.9	0.344		3.889
Crossroad ramp terminals & ints	2	0.4	0.2	0.2		2.528	0.160
Crossroad segments	6	0.5	0.1	0.4	0.163		2.912
Total	21	7.8	2.5	5.4	7.208		1.086

2026

Interchange element type	Number of sites	Number of predicted crashes during analysis period			MVMT	MEV	Crash rate
		Total	FI	PDO			(per MVMT or MEV)
Mainline freeway segments	9	7.3	2.2	5.1	8.927		0.818
Ramps	4	1.9	0.7	1.2	0.636		2.923
Crossroad ramp terminals & ints	2	0.7	0.3	0.4		4.917	0.148
Crossroad segments	6	0.7	0.2	0.5	0.323		2.087
Total	21	10.6	3.4	7.2	9.886		1.069

2041

Interchange element type	Number of sites	Number of predicted crashes during analysis period			MVMT	MEV	Crash rate
		Total	FI	PDO			(per MVMT or MEV)
Mainline freeway segments	9	8.9	2.7	6.2	11.037		0.804
Ramps	4	2.4	0.9	1.5	1.145		2.082
Crossroad ramp terminals & ints	2	1.3	0.6	0.7		9.208	0.136
Crossroad segments	6	0.9	0.2	0.7	0.581		1.582
Total	21	13.4	4.4	9.1	12.763		1.052

Signalised Crossroads Crash Prediction Models

Project: Baseline

Analysis Year: 2016

Intersection: MSR/Hoskyns

FLOWS

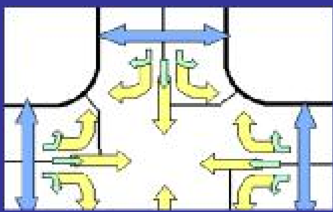
All flows entered must be entered as average annual daily flows (veh/day, cyc/day and ped/day) and factored to the analysis year. Pedestrian flows are the number of pedestrians crossing each approach in either

☐ Use Cyclist Counts

☐ Use Pedestrian Counts

	1	2	3
Cycles			
MV	2809		1211

	Cycles	MV	Peds	Peds	MV	Cycles	
12		2386			950		4
11		8904			8752		5
10							6



	9	8	7
Peds			
MV			
Cycles			

TOTAL CRASHES

		Maj	Min	
0.51	**Total crashes per year**	21334	3679	OK
0.00				
0.00				

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	Approach N	Approach E	Approach S	Approach W	Total
All Crashes Involving Motor Vehicles						
Crossing (No turns)	HA	0.000	0.000	0.000	0.000	0.000
Right turn Against	LB	0.000	0.000	0.000	0.146	0.146
Rear end	FA to FE	0.012	0.032	0.000	0.037	0.081
Loss of control	C and D	0.008	0.018	0.000	0.020	0.046
Other	Other	0.057	0.086	0.000	0.092	0.235
Total		**0.077**	**0.135**	**0.000**	**0.296**	**0.508**
Cycle Crashes						
Same Direction	A, E, F, G					
Right Turn Against	LB					
Other	Other					
Total						
Pedestrian Crashes						
Intersecting	NA, NB					
Right Turning	ND, NF					
Other	Other					
Total						

Signalised Crossroads Crash Prediction Models	
Project:	Baseline
Analysis Year:	2016
Intersection:	MSR/Rolleston

FLOWS

All flows entered must be entered as average annual daily flows (veh/day, cyc/day and ped/day) and factored to the analysis year. Pedestrian flows are the number of pedestrians crossing each approach in either

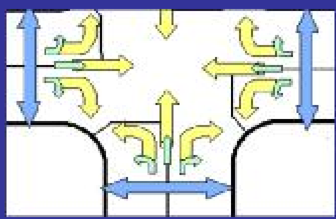
☐ Use Cyclist Counts

☐ Use Pedestrian Counts

North approach (movements 1, 2, 3): Cycles; MV; Peds

Movement	Cycles (W)	MV (W)	MV (E)	Cycles (E)	Movement
12					4
11		7691	7932		5
10		161	3629		6

West approach: Peds. East approach: Peds.



	9	8	7
Peds			
MV	152		3599
Cycles			

TOTAL CRASHES

		Maj	Min	
0.41	**Total crashes per year**	19394	3771	OK
0.00				
0.00				

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	N	E	S	W	Total
All Crashes Involving Motor Vehicles						
Crossing (No turns)	HA	0.000	0.000	0.000	0.000	0.000
Right turn Against	LB	0.000	0.066	0.000	0.000	0.066
Rear end	FA to FE	0.000	0.038	0.011	0.025	0.075
Loss of control	C and D	0.000	0.021	0.007	0.015	0.043
Other	Other	0.000	0.093	0.055	0.078	0.226
Total		**0.000**	**0.218**	**0.074**	**0.118**	**0.410**
Cycle Crashes						
Same Direction	A, E, F, G					
Right Turn Against	LB					
Other	Other					
Total						
Pedestrian Crashes						
Intersecting	NA, NB					
Right Turning	ND, NF					
Other	Other					
Total						

Signalised Crossroads Crash Prediction Models	
Project:	Baseline
Analysis Year:	2016
Intersection:	Shands/HJR

FLOWS

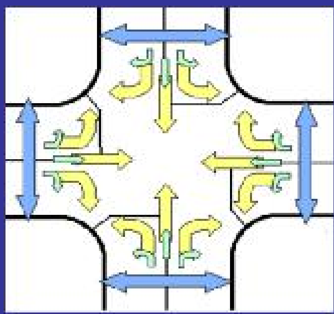
All flows entered must be entered as average annual daily flows (veh/day, cyc/day and ped/day) and factored to the analysis year. Pedestrian flows are the number of pedestrians crossing each approach in either

☐ Use Cyclist Counts

☐ Use Pedestrian Counts

	1	2	3
Cycles			
MV	145	2889	2538

	Cycles	MV	Peds	Peds	MV	Cycles	
12		135			2202		4
11		6943			6640		5
10		125			907		6



	9	8	7
Peds			
MV	104	3119	990
Cycles			

TOTAL CRASHES

		Maj	Min	
1.11	Total crashes per year	17156	9581	OK
0.00				
0.00				

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	N	E	S	W	Total
All Crashes Involving Motor Vehicles						
Crossing (No turns)	HA	0.081	0.078	0.082	0.081	0.322
Right turn Against	LB	0.085	0.054	0.040	0.184	0.363
Rear end	FA to FE	0.017	0.032	0.013	0.023	0.085
Loss of control	C and D	0.010	0.018	0.008	0.013	0.050
Other	Other	0.066	0.086	0.058	0.075	0.286
Total		**0.261**	**0.268**	**0.201**	**0.376**	**1.106**
Cycle Crashes						
Same Direction	A, E, F, G					
Right Turn Against	LB					
Other	Other					
Total						
Pedestrian Crashes						
Intersecting	NA, NB					
Right Turning	ND, NF					
Other	Other					
Total						

Four-Arm Roundabout Crash Prediction Models

Project: Baseline
Analysis Year: 2016
Intersection: Springs/Blakes

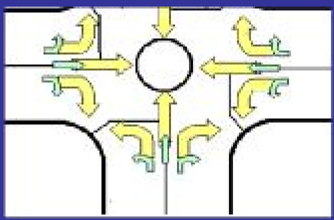
FLOWS

All flows entered must be entered as average annual daily flows (veh/day, and cyc/day) and factored to the analysis year.

	1	2	3
Cycles			
MV	0	0	0

☐ Use Cyclist Counts

	Cycles	MV
12		
11		6589
10		714



	MV	Cycles
4		
5	7850	
6	274	

	9	8	7
MV	434		363
Cycles			

TOTAL CRASHES

0.83
0.00

Maj	Min	
15332	893	OK

CRASHES BY TYPE AND APPROACH

Crash Type	**Crash Code**	**Approach N**	**E**	**S**	**W**	**Total**
Motor Vehicle Only Crashes						
Entering vs Circulating	HA, LB, JA, MB, K	0.000	0.077	0.078	0.056	0.212
Rear-end	FA to FD	0.000	0.025	0.002	0.022	0.048
Loss-of-control	C and D	0.000	0.042	0.012	0.040	0.094
Other	Other	0.000	0.023	0.013	0.023	0.059
Total		**0.000**	**0.168**	**0.104**	**0.140**	**0.413**
						0.825
Cycle Crashes						
Entering vs Circulating	HA, LB, JA, MB, K					
Other	Other					
Total						

Four-Arm Roundabout Crash Prediction Models	
Project:	Baseline
Analysis Year:	2016
Intersection:	CSM1/HJR

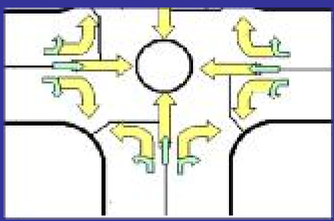
FLOWS

All flows entered must be entered as average annual daily flows (veh/day, and cyc/day) and factored to the analysis year.

	1	2	3
Cycles			
MV	0	0	0

Use Cyclist Counts

	Cycles	MV
12		
11		15819
10		3138



MV	Cycles	
		4
14798		5
539		6

	9	8	7
MV	3306		540
Cycles			

TOTAL CRASHES

1.68

0.00

Maj	Min	
34378	3761	Maj High

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	N	E	S	W	Total
Motor Vehicle Only Crashes						
Entering vs Circulating	HA, LB, JA, MB, K	0.000	0.187	0.198	0.099	0.483
Rear-end	FA to FD	0.000	0.051	0.011	0.064	0.125
Loss-of-control	C and D	0.000	0.061	0.028	0.068	0.157
Other	Other	0.000	0.028	0.019	0.029	0.076
Total		**0.000**	**0.326**	**0.255**	**0.261**	**0.842**
						1.684
Cycle Crashes						
Entering vs Circulating	HA, LB, JA, MB, K					
Other	Other					
Total						

Signalised Crossroads Crash Prediction Models

Project: Baseline
Analysis Year: 2016
Intersection: MSR/HJR

FLOWS

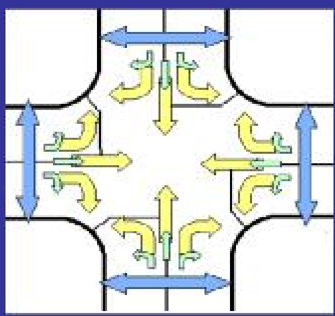
All flows entered must be entered as average annual daily flows (veh/day, cyc/day and ped/day) and factored to the analysis year. Pedestrian flows are the number of pedestrians crossing each approach in either

	1	2	3
Cycles			
MV	61	1027	72

☐ Use Cyclist Counts

☐ Use Pedestrian Counts

	Cycles	MV	Peds
12		0	
11		5212	
10		5831	



	Peds	MV	Cycles
4		47	
5		4026	
6		0	

	9	8	7
Peds			
MV	0	962	46
Cycles			

TOTAL CRASHES

0.76	**Total crashes per year**
0.00	
0.00	

Maj	Min	
12266	5017	OK

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	Approach N	Approach E	Approach S	Approach W	Total
All Crashes Involving Motor Vehicles						
Crossing (No turns)	HA	0.050	0.044	0.044	0.047	0.185
Right turn Against	LB	0.014	0.210	0.016	0.032	0.272
Rear end	FA to FE	0.003	0.012	0.003	0.036	0.055
Loss of control	C and D	0.002	0.008	0.002	0.020	0.032
Other	Other	0.032	0.058	0.030	0.091	0.211
Total		**0.102**	**0.332**	**0.095**	**0.226**	**0.755**
Cycle Crashes						
Same Direction	A, E, F, G					
Right Turn Against	LB					
Other	Other					
Total						
Pedestrian Crashes						
Intersecting	NA, NB					
Right Turning	ND, NF					
Other	Other					
Total						

Priority Crossroads Crash Prediction Models

Project: Baseline

Analysis Year: 2016

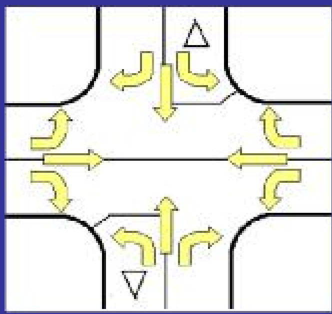
Intersection: MSR/Kirk

FLOWS

All flows entered must be entered as average annual daily flows (veh/day) and factored to the analysis year.

	1	2	3
MV	2033	440	2418

	MV		MV	
12	2134		2219	4
11	10381		8327	5
10	106		44	6



	9	8	7
MV	76	349	33

TOTAL CRASHES

1.00 **Total crashes per year**

Maj	Min	
23239	5320	OK

CRASHES BY TYPE AND APPROACH

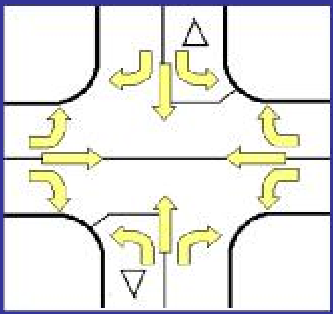
Crash Type	Crash Code	Approach 1	2	3	4	Total
All Crashes Involving Motor Vehicles						
Crossing (No turns)	HA	0.125	0.114	0.104	0.114	0.457
Right turn Against	LB	0.007	0.016	0.050	0.066	0.138
Crossing (Vehicle turning)	JA	0.003	0.014	0.001	0.107	0.124
Loss of control	C and D	0.014	0.018	0.006	0.019	0.058
Others	Other	0.048	0.075	0.012	0.083	0.219
Total		**0.197**	**0.237**	**0.173**	**0.388**	**0.996**

Priority Crossroads Crash Prediction Models

Project: Baseline
Analysis Year: 2016
Intersection: MSR/Weedons

FLOWS
All flows entered must be entered as average annual daily flows (veh/day) and factored to the analysis year.

	1	2	3
MV	7	71	7

	MV		MV	
12	176		5	4
11	9939		9517	5
10	0		803	6

	9	8	7
MV	86	1929	136

TOTAL CRASHES
0.85 **Total crashes per year**

Maj	Min	
20066	2610	OK

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	Approach 1	2	3	4	Total
All Crashes Involving Motor Vehicles						
Crossing (No turns)	HA	0.059	0.058	0.217	0.221	0.556
Right turn Against	LB	0.013	0.000	0.004	0.004	0.020
Crossing (Vehicle turning)	JA	0.000	0.030	0.000	0.009	0.038
Loss of control	C and D	0.004	0.018	0.011	0.018	0.050
Others	Other	0.005	0.074	0.030	0.073	0.183
Total		**0.080**	**0.180**	**0.262**	**0.325**	**0.847**

Rural Priority Crossroads Crash Prediction Models

Project: Baseline

Analysis Year: 2016

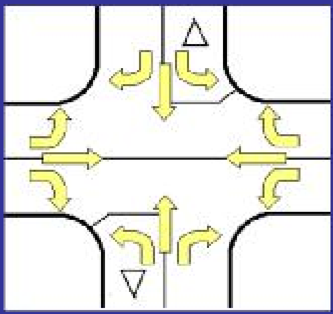
Intersection: Selwyn/Waterholes

FLOWS

All flows entered must be entered as average annual daily flows (veh/day) and factored to the analysis year.

	1	2	3
MV	1	139	0

	MV		MV	
12	1		0	4
11	471		361	5
10	0		404	6
	1		1 RTB	



	9	8	7
MV	0	181	661

TOTAL CRASHES

0.16 **Total crashes per year**

Maj	Min	
1365	853	Maj Low

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	Approach 1	2	3	4	Total
All Crashes Involving Motor Vehicles						
Crossing (No turns)		0.023	-	0.030	-	0.054
Right turn Against		0.021	-	0.021	-	0.042
Crossing (Vehicle turning)		-	0.000	-	0.000	0.000
Loss of control			0.017		0.012	0.029
Others			0.020		0.017	0.037
Total		**0.045**	**0.037**	**0.052**	**0.029**	**0.162**

Rural Priority T-Junction Crash Prediction Models

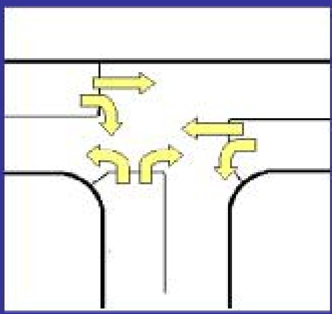
Project: Baseline
Analysis Year: 2016
Intersection: Weedons/Levi

FLOWS
All flows entered must be entered as average annual daily flows (veh/day) and factored to the analysis year.

Mean Speed of Approaching Veh.

104

	MV		MV	
4	48		132	5
3	825		34	6



Visibility Deficiency

1

MV	2018	3
	2	1

TOTAL CRASHES

0.05 **Total crashes per year**

Maj	Stem	
1621	2880	OK

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	Approach 1	Approach 2	Approach 3	Total
All Crashes Involving Motor Vehicles					
Crossing – Vehicle Turning	JA	-	-	0.000	0.000
RT and Following Vehicle	GC, GD and GE	-	0.026	-	0.026
Other (Approach 3)	Other	-	-	0.002	0.002
Other (Approach 2)	Other	-	0.009	-	0.009
Other (Approach 1)	All	0.013	-	-	0.013
Total		**0.013**	**0.036**	**0.002**	**0.050**

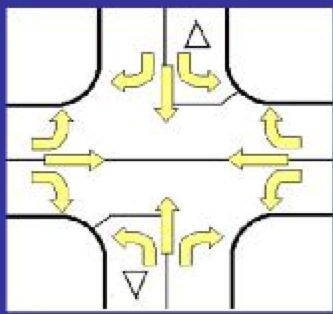
Rural Priority Crossroads Crash Prediction Models	
Project:	Baseline
Analysis Year:	2016
Intersection:	Trents/Shands

FLOWS

All flows entered must be entered as average annual daily flows (veh/day) and factored to the analysis year.

	1	2	3
MV	32	152	14

	MV		MV	
12	29		15	**4**
11	2681		2242	**5**
10	123		95	**6**
	1		1 **RTB**	



	122	138	42
MV	122	138	42
	9	**8**	**7**

TOTAL CRASHES

0.34 **Total crashes per year**

Maj	Min	
5159	526	Min Low

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	Approach 1	2	3	4	Total
All Crashes Involving Motor Vehicles						
Crossing (No turns)		0.051	-	0.052	-	0.103
Right turn Against		0.047	-	0.042	-	0.090
Crossing (Vehicle turning)		-	0.003	-	0.007	0.009
Loss of control			0.040		0.046	0.086
Others			0.027		0.028	0.055
Total		**0.099**	**0.069**	**0.094**	**0.081**	**0.343**

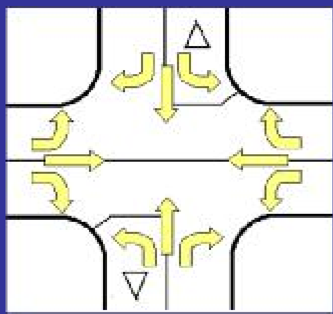
Priority Crossroads Crash Prediction Models	
Project:	Baseline
Analysis Year:	2016
Intersection:	MSR/Dawsons

FLOWS

All flows entered must be entered as average annual daily flows (veh/day) and factored to the analysis year.

	1	2	3
MV	427	327	17

	MV		MV	
12	419		78	**4**
11	12180		9955	**5**
10	326		403	**6**



	9	8	7
MV	292	289	424

TOTAL CRASHES

0.90 **Total crashes per year**

Maj	Min	
23328	1809	OK

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	Approach 1	2	3	4	Total
All Crashes Involving Motor Vehicles						
Crossing (No turns)	HA	0.118	0.109	0.104	0.112	0.443
Right turn Against	LB	0.024	0.027	0.024	0.014	0.088
Crossing (Vehicle turning)	JA	0.001	0.051	0.001	0.064	0.117
Loss of control	C and D	0.008	0.018	0.008	0.019	0.053
Others	Other	0.017	0.075	0.019	0.085	0.195
Total		**0.166**	**0.280**	**0.156**	**0.295**	**0.897**

Signalised Crossroads Crash Prediction Models	
Project:	Baseline
Analysis Year:	2016
Intersection:	MSR/Carmen

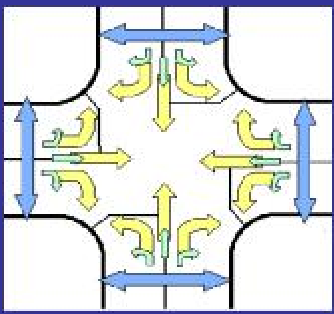
FLOWS
All flows entered must be entered as average annual daily flows (veh/day, cyc/day and ped/day) and factored to the analysis year. Pedestrian flows are the number of pedestrians crossing each approach in either

☐ Use Cyclist Counts

☐ Use Pedestrian Counts

	1	2	3
Cycles			
MV	1905	4626	6460

	Cycles	**MV**	**Peds**
12		1394	
11		5121	
10		10	



Peds	**MV**	**Cycles**	
	5134		4
	8334		5
	2092		6

	9	8	7
Peds			
MV	24	3842	3303
Cycles			

TOTAL CRASHES

1.48	**Total crashes per year**
0.00	
0.00	

Maj	Min	
23615	18629	OK

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	N	E	S	W	Total
All Crashes Involving Motor Vehicles						
Crossing (No turns)	HA	0.085	0.101	0.096	0.079	0.361
Right turn Against	LB	0.178	0.021	0.129	0.225	0.553
Rear end	FA to FE	0.043	0.052	0.023	0.021	0.139
Loss of control	C and D	0.023	0.028	0.013	0.012	0.077
Other	Other	0.098	0.107	0.075	0.071	0.351
Total		**0.428**	**0.309**	**0.336**	**0.408**	**1.481**
Cycle Crashes						
Same Direction	A, E, F, G					
Right Turn Against	LB					
Other	Other					
Total						
Pedestrian Crashes						
Intersecting	NA, NB					
Right Turning	ND, NF					
Other	Other					
Total						

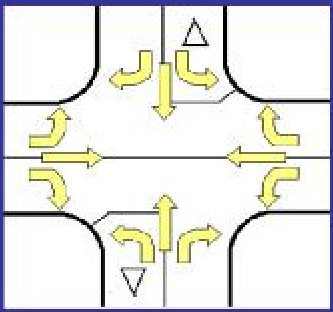
Rural Priority Crossroads Crash Prediction Models	
Project:	Baseline
Analysis Year:	2016
Intersection:	Marshs/Shands

FLOWS

All flows entered must be entered as average annual daily flows (veh/day) and factored to the analysis year.

	1	2	3
MV	57	405	232

	MV		MV	
12	89		151	**4**
11	2211		2097	**5**
10	735		136	**6**
	1		1 **RTB**	



	9	8	7
MV	310	216	120

TOTAL CRASHES

0.43 **Total crashes per year**

Maj	Min	
5222	1535	OK

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	Approach 1	2	3	4	Total
All Crashes Involving Motor Vehicles						
Crossing (No turns)		0.090	-	0.063	-	0.153
Right turn Against		0.064	-	0.049	-	0.113
Crossing (Vehicle turning)		-	0.005	-	0.010	0.015
Loss of control			0.040		0.048	0.088
Others			0.027		0.029	0.056
Total		**0.154**	**0.073**	**0.112**	**0.087**	**0.426**

Four-Arm Roundabout Crash Prediction Models

Project: Baseline
Analysis Year: 2016
Intersection: HJR/Springs

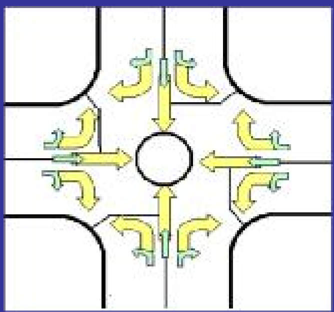
FLOWS

All flows entered must be entered as average annual daily flows (veh/day, and cyc/day) and factored to the analysis year.

☐ Use Cyclist Counts

	1	2	3
Cycles			
MV	541	7158	9

	Cycles	MV
12		1020
11		380
10		6



	MV	Cycles
4	159	
5	248	
6	140	

	9	8	7
MV	7	8147	131
Cycles			

TOTAL CRASHES

1.12

0.00

Maj	Min	
16311	1634	OK

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	Approach N	Approach E	Approach S	Approach W	Total
Motor Vehicle Only Crashes						
Entering vs Circulating	HA, LB, JA, MB, K	0.066	0.066	0.088	0.103	0.323
Rear-end	FA to FD	0.023	0.001	0.025	0.003	0.053
Loss-of-control	C and D	0.041	0.009	0.043	0.016	0.109
Other	Other	0.023	0.011	0.024	0.015	0.073
Total		**0.154**	**0.088**	**0.179**	**0.136**	**0.558**
						1.115
Cycle Crashes						
Entering vs Circulating	HA, LB, JA, MB, K					
Other	Other					
Total						

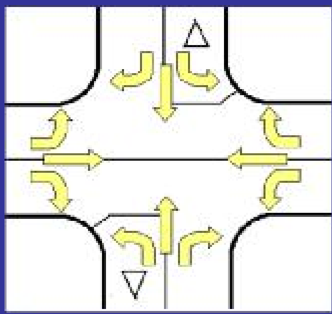
Rural Priority Crossroads Crash Prediction Models	
Project:	Baseline
Analysis Year:	2016
Intersection:	Jones/Weedons

FLOWS

All flows entered must be entered as average annual daily flows (veh/day) and factored to the analysis year.

	1	2	3
MV	0	167	18

	MV		MV	
12	0		39	**4**
11	160		278	**5**
10	90		0	**6**
	1		1 **RTB**	



	9	8	7
MV	132	235	0

TOTAL CRASHES

0.13 **Total crashes per year**

Maj	**Min**	
577	542	Maj Low

CRASHES BY TYPE AND APPROACH

Crash Type	**Crash Code**	**Approach 1**	**2**	**3**	**4**	**Total**
All Crashes Involving Motor Vehicles						
Crossing (No turns)		0.024	-	0.023	-	0.047
Right turn Against		0.014	-	0.021	-	0.035
Crossing (Vehicle turning)		-	0.000	-	0.000	0.001
Loss of control			0.009		0.007	0.016
Others			0.016		0.015	0.030
Total		**0.038**	**0.025**	**0.044**	**0.022**	**0.129**

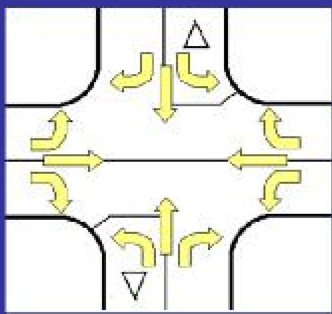
Rural Priority Crossroads Crash Prediction Models

Project: Baseline
Analysis Year: 2016
Intersection: Weedons/Selwyn

FLOWS
All flows entered must be entered as average annual daily flows (veh/day) and factored to the analysis year.

	1	2	3
MV	0	362	0

	MV		MV	
12	0		0	**4**
11	50		163	**5**
10	0		0	**6**
	1		1 **RTB**	



	9	8	7
MV	4	471	0

TOTAL CRASHES
0.12 **Total crashes per year**

Maj	Min	
835	215	Maj Low

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	Approach 1	2	3	4	Total
All Crashes Involving Motor Vehicles						
Crossing (No turns)		0.030	-	0.022	-	0.052
Right turn Against		0.012	-	0.022	-	0.033
Crossing (Vehicle turning)		-	0.000	-	0.000	0.000
Loss of control			0.005		0.002	0.007
Others			0.013		0.010	0.023
Total		**0.042**	**0.018**	**0.044**	**0.012**	**0.116**

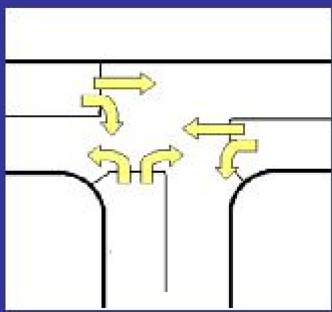
Priority T-Junction Crash Prediction Models

Project: Baseline
Analysis Year: 2016
Intersection: MSR/Larcombs

FLOWS

All flows entered must be entered as average annual daily flows (veh/day) and factored to the analysis year.

Approach	MV
4	11693
3	182
5	10198
6	0
2	127
1	0



TOTAL CRASHES

0.30 **Total crashes per year**

Maj	Stem	
22045	309	OK

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	Approach 1	Approach 2	Approach 3	Total
All Crashes Involving Motor Vehicles					
Right turn Against	LB	-	-	0.052	0.052
Rear end	FA to FD	0.000	0.036	0.026	0.062
Crossing (Vehicles turning)	JA	-	-	0.000	0.000
Loss of control	C and D	0.007	0.027	0.026	0.059
Other	Other	0.006	0.062	0.057	0.125
Total		**0.013**	**0.125**	**0.000**	**0.299**

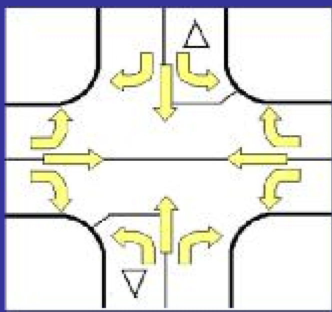
Priority Crossroads Crash Prediction Models	
Project:	Baseline
Analysis Year:	2016
Intersection:	MSR/Robinsons

FLOWS

All flows entered must be entered as average annual daily flows (veh/day) and factored to the analysis year.

	1	2	3
MV	459	37	415

	MV		MV	
12	11		202	**4**
11	12336		10325	**5**
10	0		147	**6**



	9	8	7
MV	0	23	175

TOTAL CRASHES

0.57 **Total crashes per year**

Maj	Min	
23365	765	Min Low

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	Approach 1	2	3	4	Total
All Crashes Involving Motor Vehicles						
Crossing (No turns)	HA	0.050	0.046	0.039	0.041	0.176
Right turn Against	LB	0.013	0.000	0.020	0.022	0.056
Crossing (Vehicle turning)	JA	0.000	0.036	0.000	0.068	0.104
Loss of control	C and D	0.008	0.018	0.005	0.019	0.050
Others	Other	0.018	0.076	0.008	0.082	0.184
Total		**0.090**	**0.177**	**0.071**	**0.232**	**0.569**

Rural Priority Crossroads Crash Prediction Models

Project: Baseline

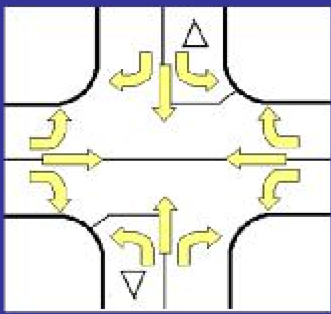
Analysis Year: 2016

Intersection: Sahnds/Blakes

FLOWS

All flows entered must be entered as average annual daily flows (veh/day) and factored to the analysis year.

	1	2	3
MV	7	295	192

	MV		MV	
12	8		117	4
11	2724		2179	5
10	5		167	6
	1		1 RTB	

	9	8	7
MV	166	305	119

TOTAL CRASHES

0.43 **Total crashes per year**

Maj	Min	
5293	990	OK

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	Approach 1	2	3	4	Total
All Crashes Involving Motor Vehicles						
Crossing (No turns)		0.075	-	0.084	-	0.160
Right turn Against		0.062	-	0.057	-	0.119
Crossing (Vehicle turning)		-	0.005	-	0.002	0.007
Loss of control			0.041		0.045	0.086
Others			0.027		0.028	0.055
Total		**0.138**	**0.073**	**0.141**	**0.075**	**0.427**

Rural Priority Crossroads Crash Prediction Models

Project: Baseline

Analysis Year: 2016

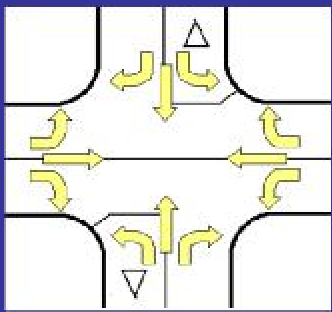
Intersection: Jones/Hoskyns

FLOWS

All flows entered must be entered as average annual daily flows (veh/day) and factored to the analysis year.

	1	2	3
MV	29	102	126

	MV		MV	
12	29		482	4
11	3014		2689	5
10	20		165	6
	1		1 RTB	



	9	8	7
MV	47	173	880

TOTAL CRASHES

0.37 **Total crashes per year**

Maj	Min	
6593	1165	OK

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	Approach 1	2	3	4	Total
All Crashes Involving Motor Vehicles						
Crossing (No turns)		0.044	-	0.062	-	0.106
Right turn Against		0.043	-	0.050	-	0.093
Crossing (Vehicle turning)		-	0.011	-	0.004	0.015
Loss of control			0.052		0.049	0.101
Others			0.029		0.029	0.058
Total		**0.086**	**0.092**	**0.112**	**0.081**	**0.372**

Rural Priority Crossroads Crash Prediction Models

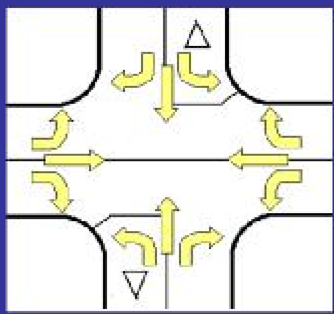
Project:	Baseline
Analysis Year:	2016
Intersection:	Shands/Hamptons

FLOWS

All flows entered must be entered as average annual daily flows (veh/day) and factored to the analysis year.

	1	2	3
MV	42	417	20

	MV		MV	
12	34		19	**4**
11	2453		2053	**5**
10	0		242	**6**
	1		1 **RTB**	



	0	422	266
MV			
	9	**8**	**7**

TOTAL CRASHES

0.46 **Total crashes per year**

Maj	**Min**	
4817	1151	OK

CRASHES BY TYPE AND APPROACH

Crash Type	**Crash Code**	**Approach** 1	2	3	4	**Total**
All Crashes Involving Motor Vehicles						
Crossing (No turns)		0.091	-	0.098	-	0.189
Right turn Against		0.068	-	0.063	-	0.132
Crossing (Vehicle turning)		-	0.003	-	0.000	0.003
Loss of control			0.039		0.042	0.081
Others			0.027		0.027	0.054
Total		**0.159**	**0.069**	**0.162**	**0.069**	**0.458**

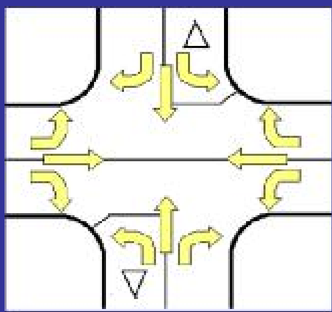
Rural Priority Crossroads Crash Prediction Models	
Project:	Baseline
Analysis Year:	2016
Intersection:	Springs/Marshs

FLOWS

All flows entered must be entered as average annual daily flows (veh/day) and factored to the analysis year.

	1	2	3
MV	6	380	1020

	MV		MV	
12	7		541	4
11	8147		7158	5
10	7		9	6
	1		1	RTB



	9	8	7
MV	140	248	159

TOTAL CRASHES

0.77 **Total crashes per year**

Maj	Min	
16249	1572	OK

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	Approach 1	2	3	4	Total
All Crashes Involving Motor Vehicles						
Crossing (No turns)		0.142	-	0.115	-	0.257
Right turn Against		0.112	-	0.089	-	0.200
Crossing (Vehicle turning)		-	0.032	-	0.008	0.040
Loss of control			0.098		0.102	0.200
Others			0.037		0.038	0.075
Total		**0.253**	**0.167**	**0.204**	**0.148**	**0.772**

Priority T-Junction Crash Prediction Models

Project: Baseline

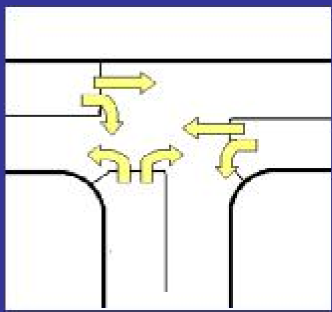
Analysis Year: 2016

Intersection: Springs/Tosswill

FLOWS

All flows entered must be entered as average annual daily flows (veh/day) and factored to the analysis year.

Approach	MV
4	7317
3	11
5	6067
6	166
2	13
1	138



TOTAL CRASHES

0.26 **Total crashes per year**

Maj	Stem	
13548	328	OK

CRASHES BY TYPE AND APPROACH

Crash Type	Crash Code	Approach 1	Approach 2	Approach 3	Total
All Crashes Involving Motor Vehicles					
Right turn Against	LB	-	-	0.013	0.013
Rear end	FA to FD	0.000	0.012	0.008	0.021
Crossing (Vehicles turning)	JA	-	-	0.071	0.071
Loss of control	C and D	0.007	0.023	0.022	0.053
Other	Other	0.007	0.048	0.045	0.100
Total		**0.014**	**0.084**	**0.000**	**0.257**

Rural Priority T-Junction Crash Prediction Models

Project: Baseline

Analysis Year: 2016

Intersection: Blakes/Trents

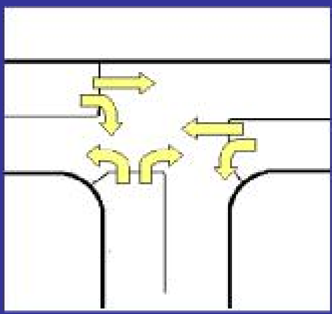
FLOWS

All flows entered must be entered as average annual daily flows (veh/day) and factored to the analysis year.

Mean Speed of Approaching Veh.

104

	MV		MV	
4	150		171	**5**
3	0		317	**6**



Visibility Deficiency

1

MV	0	229
	2	**1**

TOTAL CRASHES

0.04 **Total crashes per year**

Maj	Stem	
593	545	OK

CRASHES BY TYPE AND APPROACH

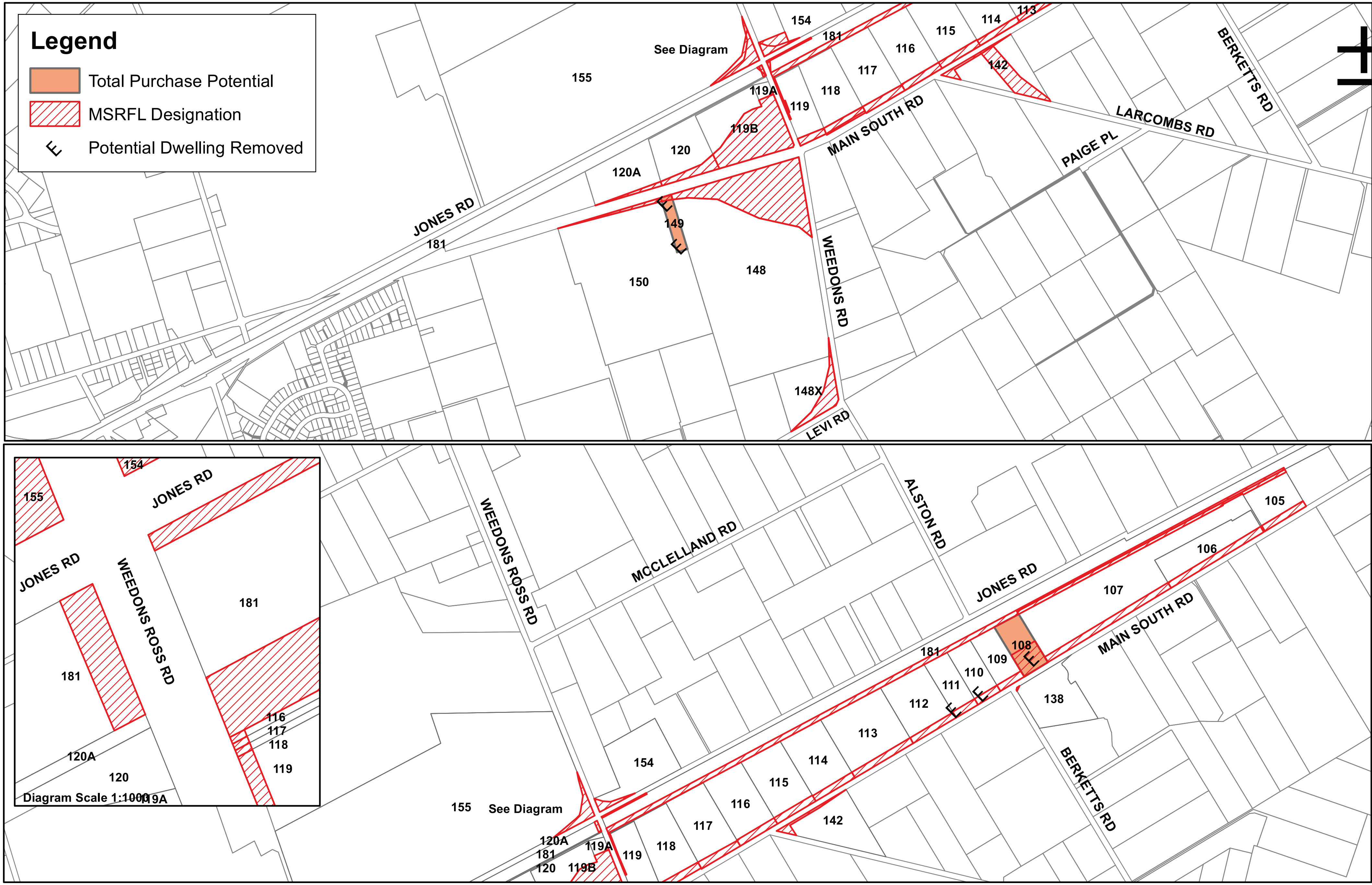
Crash Type	Crash Code	Approach 1	Approach 2	Approach 3	Total
All Crashes Involving Motor Vehicles					
Crossing – Vehicle Turning	JA	-	-	0.016	0.016
RT and Following Vehicle	GC, GD and GE	-	0.000	-	0.000
Other (Approach 3)	Other	-	-	0.004	0.004
Other (Approach 2)	Other	-	0.004	-	0.004
Other (Approach 1)	All	0.013	-	-	0.013
Total		**0.013**	**0.004**	**0.020**	**0.037**

Technical Report No 2

Christchurch Southern Motorway Stage 2 and Main South Road Four Laning

Assessment of Traffic and Transportation Effects

Appendix G: Property Access



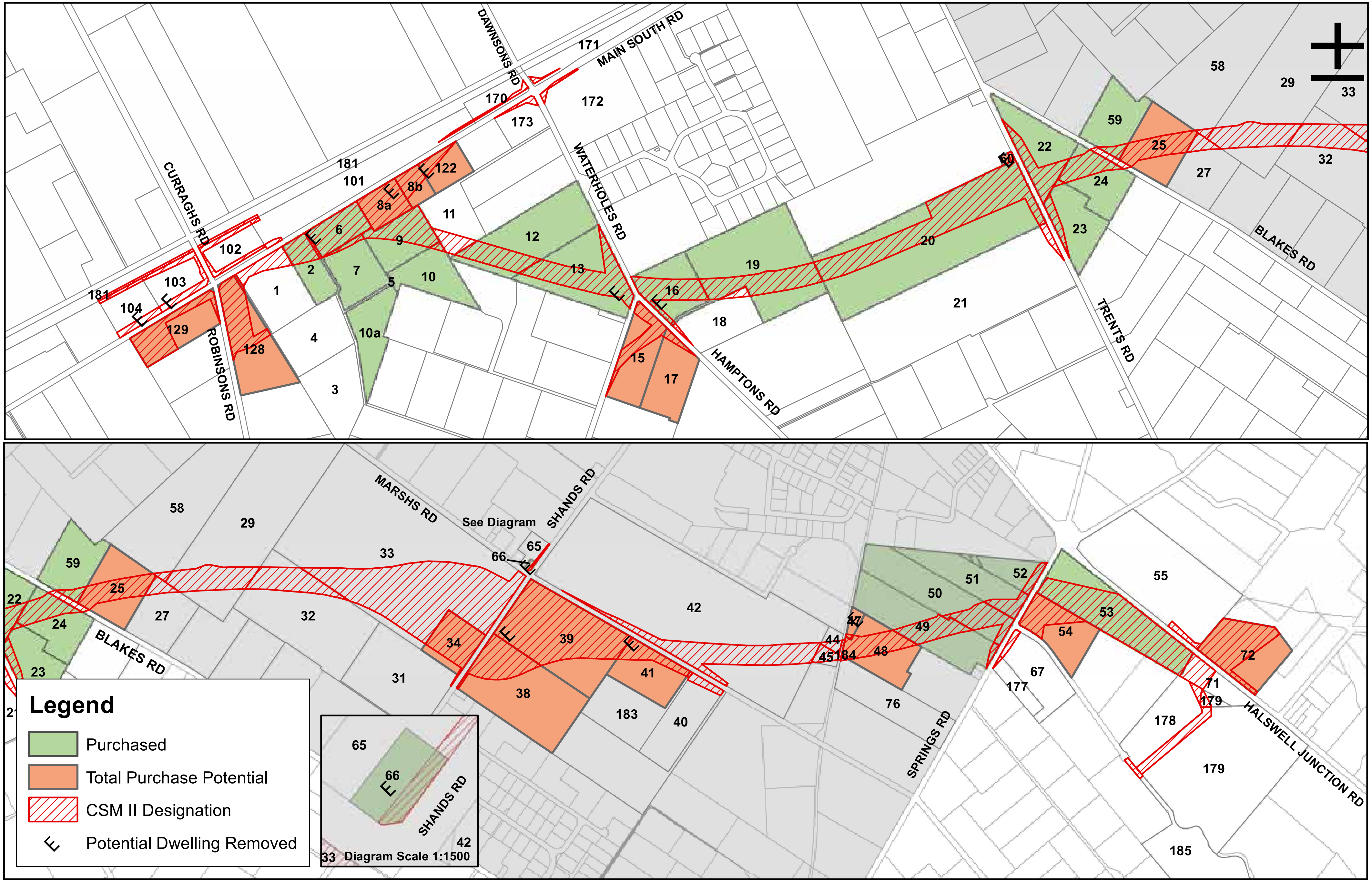
NZ TRANSPORT AGENCY
WAKA KOTAHI

the propertygroup
Corporate Property Advisors and Negotiators®

Acquisition Type
Main South Road 4 Laning

A3 Scale 1:12,500

Date: 1/08/2012



A3 Scale 1:12,500

Acquisition Type

Christchurch Southern Motorway Stage II

Date: 1/08/2012

NZ TRANSPORT AGENCY
WAKA KOTAHI

the propertygroup

Access to Property – Main South Road Western Side

Hoskyns Road to Weedons Ross Road

Legal Description	Owner	Ref	Total Purchase by NZTA?	Legal Access to MSR?	Current Access to Property	Change to Access?	Pre CSM2 Routing	Pre CSM2 Routing Distance [KM]	Post CSM2 Access?	Post CSM2 Routing	Post CSM2 Routing Distance [KM]
Lot 3, DP 387453		121		6	Via MSR	Access changed to Left-In/Left-Out only	From North: MSR southbound (might be hard to turn into property as access is located on southbound & northbound passing lanes)	0.8	Left in/left out onto MSR	From North: MSR southbound past property and U-turn at Hoskyns Rd, then MSR northbound || MSR southbound, off at Weedons I/C, then Jones, Hoskyns & MSR northbound	3.7 || 4.8
							From South: MSR northbound	N/A		From South: MSR northbound (no change)	N/A
							From West: Hoskyns Rd, MSR northbound || Weedons Ross Rd, MSR southbound (see note on "From North" above)	N/A II 1.8		From West: Hoskyns Rd, MSR northbound (no change) || Weedons Ross Rd, Jones Rd, Hoskyns Rd, MSR northbound	N/A || 4.2
							From East: Rolleston Dr, MSR northbound || Weedons Rd, MSR southbound (see note on "From North" above)	N/A II 1.7		From East: Rolleston Dr, MSR northbound (no change) || Weedons Rd, Weedons Ross Rd, Jones Rd, Hoskyns Rd, MSR northbound	N/A || 4.8
							To North: MSR northbound	N/A		To North: MSR northbound (no change)	N/A
							To South: MSR southbound (might be hard to turn right out of property as access is located on southbound and northbound passing lanes)	1.4		To South: MSR northbound, Weedons I/C, MSR southbound	3.3
							To West: MSR northbound, Weedons Ross Rd	1.8 (1.5)		To West: MSR Northbound, Weedons I/C, Weedons Ross Rd or Jones Rd to Hoskyns Rd	1.6 (3.1)
							To East: MSR northbound, Weedons Rd	1.7		To East: MSR northbound, Weedons I/C, Weedons Rd	1.9
Lot 3, DP 387453	Lawrence John Manion Carol Mary Manion	120a		2	Via MSR	No access to MSR	From North: MSR southbound (might be hard to turn into property as access is located on southbound & northbound passing lanes)	0.4	Via ROW to Weedons Ross Rd	From North: MSR southbound, Weedons I/C, Weedons Ross Rd, ROW	1.2
							From South: MSR northbound	1.7			
							From West: Weedons Ross Rd, MSR southbound (see note on "From North" above)	0.8		From South: MSR northbound, Weedons I/C, Weedons Ross Rd, ROW	2.6
							From East: Weedons Rd, MSR southbound (see note on "From North" above)	0.4			
Lot 1, DP 387453	Lawrence John Manion Carol Mary Manion	119b		1			To North: MSR northbound	0.4		From West: Weedons Ross Rd, Weedons I/C western roundabout, Weedons Ross Rd, ROW	0.6
							To South: MSR southbound (might be hard to turn right out of property as access is located on southbound and northbound passing lanes)	1.7			
							To West: MSR northbound, Weedons Ross Rd	0.8		From East: Weedons Rd, Weedons Ross Rd, ROW (no change)	0.5
							To East: MSR northbound, Weedons Rd	0.4			
Lot 2, DP 387453	Lawrence John Manion Carol Mary Manion	120		No	Via ROW to Weedons Ross Rd	Access changed to Left-In/Left-Out only	From North: MSR southbound, Weedons Ross Rd, ROW	0.6		To North: ROW, Weedons Ross Rd, Jones Rd roundabout, Weedons Ross Rd, Weedons I/C, MSR northbound	0.9
							From South: MSR northbound, Weedons Ross Rd, ROW	2.7			
							From West: Weedons Ross Rd, ROW	0.3		To South: ROW, Weedons Ross Rd, Jones Rd roundabout, Weedons Ross Rd, Weedons I/C, MSR southbound	2.9
							From East: Weedons Rd, Weedons Ross Rd, ROW	0.5			
							To North: ROW, Weedons Ross Rd, MSR northbound	0.6		To West: ROW, Weedons Ross Rd	0.3
							To South: ROW, Weedons Ross Rd, MSR southbound	0.6			
							To West: ROW, Weedons Ross Rd	0.3		To East: ROW, Weedons Ross Rd, Jones Rd roundabout, Weedons Ross Rd, Weedons Rd	0.7
							To East: ROW, Weedons Ross Rd, Weedons Rd	0.5			

Weedons Ross Road

Legal Description	Owner	Ref	Total Purchase by NZTA?	Legal Access to MSR?	Current Access to Property	Change to Access?	Pre CSM2 Routing	Pre CSM2 Routing Distance [KM]	Post CSM2 Access?	Post CSM2 Routing	Post CSM2 Routing Distance [KM]
Lot 4, DP 387453	Orion Ltd	119A		N/A	Via Weedons Ross Rd	Access changed to Left-In/Left-Out only	From North: MSR southbound, Weedons Ross Rd	0	Via left turn out or left turn in from Weedons Ross Rd	From North: MSR southbound, Weedons I/C, Weedons Ross Rd	0.7
							From South: MSR northbound, Weedons Ross Rd	0		From South: MSR northbound, Weedons I/C, Weedons Ross Rd	-0.2
							From West: Weedons Ross Rd	0		From West: Weedons Ross Rd (no change)	0
							From East: Weedons Rd, Weedons Ross Rd	0		From East: Weedons Rd, Weedons Ross Rd (no change)	0
							To North: Weedons Ross Rd, MSR northbound	0		To North: Weedons Ross Rd, Jones Rd roundabout, Weedons Ross Rd, Weedons I/C, MSR northbound	0.6
							To South: Weedons Ross Rd, MSR southbound	0		To South: Weedons Ross Rd, Jones Rd roundabout, Weedons Ross Rd, Weedons I/C, MSR southbound	0.6
							To West: Weedons Ross Rd	0		To West: Weedons Ross Rd (no change)	0
							To East: Weedons Ross Rd, Weedons Rd	0		To East: Weedons Ross Rd, Jones Rd roundabout, Weedons Ross Rd, Weedons Rd	0.3
Lot 2, DP 25718	Timargo Holdings Limited	154		N/A	Via Jones Rd	No change	All movements possible from Jones Rd	N/A	Via Jones Rd	All movements possible from Jones Rd	N/A
Lot 1, DP 489	Lawrence John Manion Carol Mary Manion Denis Alfeld Lee Michael Christopher Robinson	155		N/A	Via Weedons Ross Rd	No change	All movements possible from Weedons Ross Rd	N/A	Via Weedons Ross Rd	All movements possible from Weedons Ross Rd	N/A

Weedons Ross Road to Curraghs Road

Legal Description	Owner	Ref	Total Purchase by NZTA?	Legal Access to MSR?	Current Access to Property	Change to Access?	Pre CSM2 Routing	Pre CSM2 Routing Distance [KM]	Post CSM2 Access?	Post CSM2 Routing	Post CSM2 Routing Distance [KM]
Pt Lot 1, DP 47768	Giltrap Holdings Limited	119		1	Via Weedons Ross Rd	Access diverted to connect directly onto Weedons I/C western roundabout	All movements possible from Weedons Ross Rd	N/A	Direct connection to Weedons Ross Rd at Weedons I/C western roundabout	All movements possible from Weedons I/C western roundabout	N/A
Pt Lot 3, DP 25904	MacLee Holdings Limited	118		1	Via MSR	No access to MSR	From North: MSR southbound	Nth: 2.2 / Sth: 3.7	Via rear access road between Weedons Ross Rd and Curraghs Rd	From North: MSR southbound, Robinsons Rd "off-ramp", Robinsons Rd, Curraghs Rd, rear	Nth: 2.7 / Sth 4.3
Lot 2, DP 25904	Lois Kathleen Odering	117		1							
Lot 1, DP 25904	Southern Horticultural Products Limited	116		1			From South: MSR northbound	Nth: 4.5 / Sth: 2.9		From South: MSR northbound, Weedons I/C, Weedons Ross Rd, U-turn at Jones Rd roundabout, Weedons Ross Rd, rear access road || MSR northbound, Hoskyns Rd, Jones Rd, Weedons Ross Rd, rear access road	Nth: 4.8 / Sth: 3.2
Lot 1, DP 22430	Philip Barry Brien Vivienne Ann Brien	115		1							
Lot 2, DP 22430	Phyllis Merrilynne Sitarz Worcester Trustee Services Limited	114		1			From West: Curraghs Rd, MSR southbound || Weedons Ross Rd, MSR northbound	Nth: 2.5 / Sth: 4.0 || Nth: 3.9 / Sth: 2.4		From West: Curraghs Rd, rear access road || Weedons Ross Rd, rear access road	Nth: 2.4 / Sth: 3.9 || Nth: 4.0 / Sth: 2.4
Lot 3, DP 22430	William Gordon Cameron Gavin William Eastwick	113		3							
Lot 4, DP 22430	Brinks South Island Limited	112		2			From East: Robinsons Rd, MSR southbound || Weedons Rd, MSR northbound	Nth: 2.0 / Sth: 3.6 || Nth: 3.3 / Sth: 1.7		From East: Robinsons Rd, Curraghs Rd, rear access road || Weedons Rd, Weedons Ross Rd, U-turn at Jones Rd roundabout, Weedons	Nth: 2.1 / Sth: 3.7 || Nth: 3.8 / Sth: 2.2
Lot 1, DP 20292	Brinks South Island Limited	111		2							
Lot 2, DP 20292	Brinks South Island Limited	110		2			To North: MSR northbound	Nth: 3.6 / Sth: 5.2		To North: Rear access road northbound, Curraghs Rd, Jones Rd, Dawsons Rd, MSR northbound || Rear access road southbound, Weedons Ross Rd, Weedons I/C, MSR	Nth: 3.8 / Sth: 5.4 || Nth: 8.9 / Sth: 7.3
Lot 3, DP 20292	Kevin William Barron Cynthia Maryan Barron	109		1							
Lot 4, DP 20292	Ronald John Thomson Marie Michele Thomson	108	Yes	2			To South: MSR southbound	Nth: 4.5 / Sth: 2.9		To South: Rear access road southbound, Weedons Ross Rd, Weedons I/C, MSR southbound	Nth: 4.9 / Sth: 3.4
Lot 2, DP 83245	Christopher Selwyn Warren	107		1							
Lot 1, DP 83245	Lester Clarence Warren	106		1			To West: MSR northbound, Curraghs Rd || MSR southbound, Weedons Ross Rd	Nth: 2.5 / Sth: 4.0 || Nth: 4.2 / Sth: 2.6		To West: Rear access road northbound, Curraghs Rd || Rear access road southbound, Weedons Ross Rd eastbound, U-turn at	Nth: 2.3 / Sth: 3.9 || Nth: 4.2 / Sth: 2.6
Lot 2, DP 69734	Cropmark Seeds Limited	105		1							
Lot 1, DP 69734	Lamond Paulty Limited	104		1			To East: MSR northbound, Robinsons Rd || MSR southbound, Weedons Rd	Nth: 2.0 / Sth: 3.6 || Nth: 3.3 / Sth: 1.7		To East: Rear access road northbound, Curraghs Rd, Robinsons Rd || Rear access road southbound, Weedons Ross Rd eastbound, Weedons Rd	Nth: 2.1 / Sth: 3.7 || Nth: 3.6 / Sth: 2.0
Lot 2, DP 18353	Templeton Investments Limited	103		2	Via Curraghs Rd and MSR						

Curraghs Road to Dawsons Road

Legal Description	Owner	Ref	Total Purchase by NZTA?	Legal Access to MSR?	Current Access to Property	Change to Access?	Pre CSM2 Routing	Pre CSM2 Routing Distance [KM]	Post CSM2 Access?	Post CSM2 Routing	Post CSM2 Routing Distance [KM]
RS 40376	Curraghs Holdings Limited	102		1	Access off Curraghs Rd	No access to MSR	From North: MSR southbound, Curraghs Rd || Jones Rd southbound, Curraghs Rd	1.5 || 1.4	Via rear access road off Curraghs Rd	From North: MSR southbound, Robinsons Rd "off-ramp", Robinsons Rd, Curraghs Rd, rear access road	102: 2.0 / 101: 2.7
							From South: MSR northbound, Curraghs Rd || Jones Rd northbound, Curraghs Rd	5.4 || 5.3			
							From West: Curraghs Rd	1.6		From South: MSR northbound, Dawsons Rd, Jones Rd southbound, Curraghs Rd, rear access road || MSR northbound, Weedons I/C, Weedons Ross Rd, Jones Rd northbound, Curraghs Rd, rear access road	102: 8.2 || 5.6 / 101: 8.8 || 6.2
							From East: Robinsons Rd, Curraghs Rd	1.3			
							To North: Curraghs Rd, MSR northbound || Curraghs Rd, Jones Rd northbound	1.5 || 1.4			
							To South: Curraghs Rd, MSR southbound || Curraghs Rd, Jones Rd southbound	5.4 || 5.3			
							To West: Curraghs Rd	1.6		From West: Curraghs Rd, rear access road	102: 1.6 / 101: 2.3
							To East: Curraghs Rd, Robinsons Rd	1.3		From East: Robinsons Rd, Curraghs Rd, rear access road	102: 1.4 / 101: 2.0
RS 7416	Gulf Central Properties Limited	101		2	Access off MSR		From North: MSR southbound	0.6			
							From South: MSR northbound	6.1		To North: rear access road, Curraghs Rd, Jones Rd northbound, Dawsons Rd, MSR northbound	102: 1.6 / 101: 2.2
							From West: Curraghs Rd, MSR northbound	2.4			
							From East: Robinsons Rd, MSR northbound	2.0		To South: rear access road, Curraghs Rd, Jones Rd southbound, Weedons Ross Rd, Weedons I/C, MSR southbound	102: 6.0 / 101: 6.7
							To North: MSR northbound	0.6			
							To South:MSR southbound	6.1		To West: rear access road, Curraghs Rd	102: 1.6 / 101: 2.3
							To West: MSR southbound, Curraghs Rd	2.4		To East: rear access road, Curraghs Rd, Robinsons Rd	102: 1.5 / 101: 2.1
							To East: MSR southbound, Robinsons Rd	2.0			
Lot 1 , DP 334582	Suzette Meroiti Andrew Meroiti Antonia Lamont	170		-	Access off Dawsons Rd	No Change	All movements possible from Dawsons Rd	N/A	No change	All movements possible from Dawsons Rd	N/A

Dawsons Road to Kirk Road

Legal Description	Owner	Ref	Total Purchase by NZTA?	Legal Access to MSR?	Current Access to Property	Change to Access?	Pre CSM2 Routing	Pre CSM2 Routing Distance [KM]	Post CSM2 Access?	Post CSM2 Routing	Post CSM2 Routing Distance [KM]
Lot 1, DP 406023	Gary John Cross Gerard Joseph Twaites	171			Access off Dawsons Rd	No Change	All movements possible from Dawsons Rd	N/A	No change	All movements possible from Dawsons Rd	N/A

Access to Property – Main South Road Eastern Side
Park Lane to Weedons Road

Legal Description	Owner	Ref	Total Purchase by NZTA?	Legal Access to MSR?	Current Access to Property	Change to Access?	Pre CSM2 Routing	Pre CSM2 Routing Distance [KM]	Post CSM2 Access?	Post CSM2 Routing	Post CSM2 Routing Distance [KM]
	Min Kyu Park	152		No	Via Park Lane	No change due to Project (Note that Park Ln access to MSR is to be closed and alternative access to Marlowe Pl provided through separate SDC sub-division process)	All movements possible via Park Lane	N/A	No change	All movements possible via Park Lane	N/A
Lot 3, DP 74253	Bruce Cedric Coles Michelle Anne Coles	151		1	Via MSR	No access to MSR	From North: MSR southbound	0.9	Access through to Marlowe Pl	From North: MSR southbound, Rolleston Dr, Dryden Ave, Overbury Cresc, Marlowe Pl	4.4
							From South: MSR northbound	4.3		From South: MSR northbound, Rolleston Dr, Dryden Ave, Overbury Cresc, Marlowe Pl	5.3
							From West: Weedons Ross Rd, MSR southbound || Hoskyns Rd, MSR northbound	2.7 II 2.8		From West: Weedons Ross Rd, MSR southbound, Rolleston Dr, Dryden Ave, Overbury Cresc, Marlowe Pl || Hoskyns Rd, MSR southbound, Rolleston Dr, Dryden Ave, Overbury Cresc, Marlowe Pl	6.3 II 3.9
							From East: Weedons Rd, MSR southbound || Lincoln Rolleston Rd, Masefield Dr, Rolleston Dr, MSR northbound	8.7 II 5.9		From East: Weedons Rd, MSR southbound, Rolleston Dr, Dryden Ave, Overbury Cresc, Marlowe Pl || Lincoln Rolleston Rd, Masefield Dr, Dryden Ave, Overbury Cresc, Marlowe Pl	12.3 II 5.5
Lot 4, DP 74253	Bruce Cedric Coles Michelle Anne Coles	150		1			To North: MSR northbound	0.9		To North: Marlowe Pl, Overbury Cresc, Dryden Ave, Rolleston Dr, MSR northbound	4.4
							To South: MSR southbound	4.3		To South: Marlowe Pl, Overbury Cresc, Dryden Ave, Rolleston Dr, MSR southbound	5.3
							To West: MSR northbound, Weedons Ross Rd || MSR southbound, Hoskyns Rd	2.7 II 2.8		To West: Marlowe Pl, Overbury Cresc, Dryden Ave, Rolleston Dr, MSR northbound, Weedons I/C, Weedons Ross Rd || Marlowe Pl, Overbury Cresc, Dryden Ave, Rolleston Dr, MSR northbound, Hoskyns Rd	6.1 II 3.9
							To East: MSR northbound, Weedons Rd || MSR southbound, Rolleston Dr, Masefield Dr, Lincoln Rolleston Rd	8.7 II 5.9		To East: Marlowe Pl, Overbury Cresc, Dryden Ave, Rolleston Dr, MSR northbound, Weedons I/C, Weedons Rd || Marlowe Pl, Overbury Cresc, Dryden Ave, Masefield Dr, Lincoln Rolleston Rd	12.6 II 3.9
Lot 1, DP 13617	Noel Francis Welbeloved Colleen Lola Welbeloved	149	Yes	1							
Lot 3, DP 343777	William Frederick Fletcher Fay Patricia Fletcher	148		1	Via Weedons Rd	No access to MSR, but no change to access via Weedons Rd	From & To North, South & West:Weedons Rd to MSR/Weedons intersection	N/A	Via Weedons Rd	From & To North, South & West:Weedons Rd to MSR or Weedons Ross Rd via Weedons I/C	N/A
							From & To East: Weedons Rd	N/A		From & To East: Weedons Rd (unchanged)	N/A

Weedons Road

Legal Description	Owner	Ref	Total Purchase by NZTA?	Legal Access to MSR?	Current Access to Property	Change to Access?	Pre CSM2 Routing	Pre CSM2 Routing Distance [KM]	Post CSM2 Access?	Post CSM2 Routing	Post CSM2 Routing Distance [KM]
Lot 2, DP 343777	William Frederick Fletcher Fay Patricia Fletcher	148x		N/A	Via Weedons Rd	New access location on realigned Weedons Road	All movements possible from access	N/A	Via Weedons Rd	No change	N/A

Weedons Road to Larcombs Road

Legal Description	Owner	Ref	Total Purchase by NZTA?	Legal Access to MSR?	Current Access to Property	Change to Access?	Pre CSM2 Routing	Pre CSM2 Routing Distance [KM]	Post CSM2 Access?	Post CSM2 Routing	Post CSM2 Routing Distance [KM]
Lot 1, DP 22179	Gary Edward Doyle Elizabeth Jean Doyle	147		2	Via Weedons Rd	Access to current Weedons Rd maintained, which will be turned into a service lane accessing "new" Weedons Rd east of Weedons I/C eastern roundabout	To/From North, South, West: Weedons Rd, then all movements possible at Weedons I/C	N/A	Via Weedons Rd east of Weedons I/C eastern roundabout	To/From North, South, West: Weedons Rd, then all movements possible at Weedons I/C	N/A
#N/A	#N/A	146		1	Via Weedons Rd		To/From East: Weedons Rd	N/A		To/From East: Weedons Rd	N/A
Lot 31, DP 363037	Graeme Albert McDonald Lee Sok Chuey McDonald	145		-	Via ROW off Paige Pl	Larcombs Rd changed to Left In only - no access out	From North: MSR southbound, Larcombs Rd [Paige Pl]	N/A	Via ROW off Paige Pl - Larcombs Rd restricted to Left In only from MSR southbound	From North: MSR southbound, Larcombs Rd [Paige Pl] (unchanged)	N/A
							From South: MSR northbound, Larcombs Rd [Paige Pl]	4.2		From South: MSR northbound, Weedons I/C, Weedons Ross Rd, Jones Rd, Curraghs Rd, Robinsons Rd, Ballam Rd, Larcomb Rd [Paige Pl]	9.9
							From East: Robinsons Rd, Larcombs Rd [Paige Pl] || Weedons Rd, Selwyn Rd, Waterholes Rd, Lacombs Rd [Paige Pl]	N/A		From East: Robinsons Rd, Larcombs Rd [Paige Pl] (unchanged) || Weedons Rd, Selwyn Rd, Waterholes Rd, Lacombs Rd [Paige Pl] (unchanged)	N/A
Lot 33, DP 363037	Lucy Ann Giles	144		-			From West: Weedons Ross Rd, MSR northbound, Larcombs Rd [Paige Pl] || Curraghs Rd, MSR southbound, Larcombs Rd [Paige Pl]	3.9 II 5.9		From West: Weedons Ross Rd, Weedons Rd, Selwyn Rd, Waterholes Rd, Larcombs Rd [Paige Pl] || Curraghs Rd, Robinsons Rd, Bellam Rd, Larcombs Rd [Paige Pl]	12.4 || 9.0
							To North: [Paige Pl] Larcombs Rd, MSR northbound	5.6		To North: [Paige Pl] Larcombs Rd, Berketts Rd, MSR southbound, Weedons I/C, MSR northbound	10.0
RS 12193 PT RS 5107	Larcomb Properties Ltd	143		-	Via Larcombs Rd		To South: [Paige Pl] Larcombs Rd, MSR southbound	4.2	Via Larcombs Rd	To South: [Paige Pl] Larcombs Rd, Berketts Rd, MSR southbound	6.0
							To East: [Paige Pl] Larcombs Rd, MSR southbound, Weedons Rd || [Paige Pl] Larcombs Rd, Robinsons Rd	10.0 || N/A		To East: [Paige Pl] Larcombs Rd, Berketts Rd, MSR southbound, Weedons I/C, Weedons Rd || [Paige Pl] Larcombs Rd, Robinsons Rd (unchanged)	12.1 || N/A
							To West: [Paige Pl] Larcombs Rd, MSR southbound, Weedons Ross Rd || [Paige Pl] Larcombs Rd, MSR northbound, Curraghs Rd	3.9 II 5.1		To West: [Paige Pl] Larcombs Rd, Berketts Rd, MSR southbound, Weedons I/C, Weedons Ross Rd || [Paige Pl] Larcombs Rd, Bellam Rd, Robinsons Rd, Curraghs Rd	6.4 || 6.0

Larcombs Rd to Berketts Rd

Legal Description	Owner	Ref	Total Purchase by NZTA?	Legal Access to MSR?	Current Access to Property	Change to Access?	Pre CSM2 Routing	Pre CSM2 Routing Distance [KM]	Post CSM2 Access?	Post CSM2 Routing	Post CSM2 Routing Distance [KM]
RES 955	Selwyn District Council	142		1	Via Larcombs Rd	No change	All movements possible from Larcombs Rd and Larcombs Rd/MSR intersection	4.2 (3.7)	Access via Larcombs Rd - Larcombs Rd restricted to Left In only from MSR southbound	From North: MSR southbound, Larcombs Rd (, ROW)	4.2 (4.4)
								2.8 (3.0)		From South: MSR northbound, Weedons I/C, Weedons Rd, Selwyn Rd, Waterholes Rd, Larcombs Rd (, ROW)	12.7 (13.0)
								2.6 (2.7) || 4.5 (4.0)		From West: Weedons Ross Rd, Weedons Rd, Selwyn Rd, Waterholes Rd, Larcombs Rd (, ROW) || Curraghs Rd, Robinsons Rd, Bellam Rd, Larcombs Rd (, ROW)	11.9 || 5.6
		141		2	Via MSR	No access to MSR	All movements possible from MSR access points	4.4 (4.9)	ROW from Larcombs Rd	From East: Robinsons Rd, Larcombs Rd (, ROW)	4.4 (4.6)
								4.2 (3.6)		To North: (ROW,) Larcombs Rd, Berketts Rd, MSR southbound, Weedons I/C, MSR northbound || (ROW,) Larcombs Rd, Waterholes Rd, MSR northbound	9.4 (9.7)
								2.8 (3.0)		To South: (ROW,) Larcombs Rd, Berketts Rd, MSR southbound	5.9 (6.1)
		140		1				2.6 (2.7) || 4.5 (4.0)		To West: (ROW,) Larcombs Rd, Bellam Rd, Robinsons Rd, Curraghs Rd || (ROW,) Larcombs Rd, Berketts Rd, MSR southbound, Weedons I/C, Weedons Ross Rd	5.8 (6.1) || 6.2 (6.5)
								4.4 (4.9) || 8.6 (8.9)		To East: (ROW,) Larcombs Rd, Robinsons Rd || (ROW,) Larcombs Rd, Berketts Rd, MSR southbound, Weedons I/C, Weedons Rd	4.4 (4.6) || 12.2 (12.4)
		139		-	Via Berketts Rd	Berketts Rd restricted to Left In/Left Out	From North: MSR southbound, Berketts Rd	N/A	Access via Berketts Rd - Berketts Rd restricted to Left In/Left Out	From North: MSR southbound, Berketts Rd (no change)	N/A
							From South: MSR northbound, Berketts Rd	3.9		From South: MSR northbound, Weedons I/C, Weedons Ross Rd, Jones Rd, Curraghs Rd, Robinsons Rd, Berketts Dr, Berketts Rd	7.9
							From East: Robinsons Rd, Larcombs Rd, Berketts Rd || Weedons Rd, MSR northbound	N/A || 9.6		From East: Robinsons Rd, Larcombs Rd, Berketts Rd (unchanged) || Weedons Rd, Selwyn Rd, Waterholes Rd, Lacombs Rd, Berketts Rd	N/A || 10.4
							From West: Weedons Ross Rd, MSR northbound, Berketts Rd || Curraghs Rd, MSR southbound, Berketts Rd	3.7 II 3.5		From West: Weedons Ross Rd, Joness Rd, Robinsons Rd, Berketts Dr, Berketts Rd || Curraghs Rd, Robinsons Rd, Berketts Dr, Berketts Rd	7.0 II 3.9
							To North: Berketts Rd, MSR northbound	3.2		To North: Berketts Rd, Larcombs Rd, Waterholes Rd, MSR northbound || Berketts Rd, MSR southbound, Weedons I/C, MSR northbound	5.5 II 8.0
							To South: Berketts Rd, MSR southbound	N/A		To South: Berketts Rd, MSR southbound (unchanged)	N/A
							To East: Berketts Rd, MSR southbound, Weedons Rd || Berketts Rd, Larcombs Rd, Robinsons Rd	9.6 || N/A		To East: Berketts Rd, MSR southbound, Weedons I/C, Weedons Rd || Berketts Rd, Larcombs Rd, Robinsons Rd (no changed)	10.0 || N/A
							To West: MSR southbound, Weedons Ross Rd || MSR northbound, Curraghs Rd	3.6 II 3.5		To West: Berketts Rd, MSR southbound, Weedons I/C, Weedons Ross Rd || Berketts Rd, Berketts Dr, Robinsons Rd, Curraghs Rd	4.2 II 3.9

Berketts Rd to Robinsons Rd

Legal Description	Owner	Ref	Total Purchase by NZTA?	Legal Access to MSR?	Current Access to Property	Change to Access?	Pre CSM2 Routing	Pre CSM2 Routing Distance [KM]	Post CSM2 Access?	Post CSM2 Routing	Post CSM2 Routing Distance [KM]
Lot 1 , DP 418409	David Lewis Mitchell Sara Louise Mitchell Timpany Walton Trustess Limited	138		1	MSR or via Berketts Rd	No access to MSR	From North: MSR southbound	2.2	Via Berketts Dr off Berketts Rd or Robinsons Rd	From North: MSR southbound, Berketts Rd, Berketts Dr	4.2
	Kauri Stables Ltd	137		1	MSR or via Berketts Rd		From South: MSR northbound	4.5		From South: MSR northbound, Weedons I/C, Weedons Ross Rd, Jones Rd, Curraghs Rd, Robinsons Rd, Berketts Dr	4.9
		136		-	Via Berketts Dr		From East: Robinsons Rd, MSR southbound || Weedons Rd, MSR northbound	4.5 || 10.3		From East: Robinsons Rd, Berketts Dr || Weedons Rd, Selwyn Rd, Waterholes Rd, Lacombs Rd, Berketts Rd, Berketts Dr	3.8 || 11.0
		135		1 (Shared)	MSR		From West: Weedons Ross Rd, MSR northbound || Curraghs Rd, MSR southbound	4.3 || 2.5		From West: Weedons Ross Rd, Joness Rd, Robinsons Rd, Berketts Dr || Curraghs Rd, Robinsons Rd, Berketts Dr	6.1 || 2.9
		132		1 (Shared)	MSR		To North: MSR northbound	2.2		To North: Berketts Dr, Robinsons Rd, Curraghs Rd, Jones Rd, Dawsons Rd, MSR northbound || Berketts Dr, Berketts Rd, MSR southbound, Weedons I/C, MSR northbound	2.9 || 8.4
							To South: MSR southbound	4.5		To South: Berketts Dr, Berketts Rd, MSR southbound	4.9
		131		1	MSR		To East: MSR southbound, Weedons Rd || MSR southbound, Berketts Rd, Larcombs Rd, Robinsons Rd	10.3 || 5.0		To East: Berketts Dr, Berketts Rd, MSR southbound, Weedons I/C, Weedons Rd || Berketts Dr, Robinsons Rd	10.8 || 3.8
		130		4	MSR		To West: MSR southbound, Weedons Ross Rd || MSR northbound, Curraghs Rd	4.3 || 2.5		To West: Berketts Dr, Berketts Rd, MSR southbound, Weedons I/C, Weedons Ross Rd || Berketts Dr, Robinsons Rd, Curraghs Rd	5.2 || 2.9
Pt Lot 2, DP 82599	Godfried Maria Louise van Tulder Sandra Kay van Tulder Philip Robert Haunui Royal	129	Yes	-							

Robinsons Rd to Waterholes Rd

Legal Description	Owner	Ref	Total Purchase by NZTA?	Legal Access to MSR?	Current Access to Property	Change to Access?	Pre CSM2 Routing	Pre CSM2 Routing Distance [KM]	Post CSM2 Access?	Post CSM2 Routing	Post CSM2 Routing Distance [KM]
Lot 1, DP 307449	Geoffrey James Hall White Kathriene Dora White Phillip Roth	128	Yes								
Lot 1, DP 55499	Murray John Mannall Susanne Madeline Mannall Jennifer Joy Flett	1			MSR	No access to MSR - all access off road connecting new Robinsons Rd roundabout with MSR southbound off-slip	From North: MSR southbound	1.3	Access to Robinsons Rd via ROW and MSR southbound off-slip road	From North: MSR southbound, MSR southbound off-slip, ROW	1.6
							From South: MSR northbound	5.7		From South: MSR northbound, Weedons I/C, Weedons Ross Rd, Jones Rd, Curraghs Rd, Robinsons Rd, MSR southbound off-slip road, ROW	6.2
							From East: Robinsons Rd, MSR northbound	4		From East: Robinsons Rd, MSR southbound off-slip road, ROW	3.6
Lot 2, DP 55499	Peters Stables Limited	4			Shared driveway with 1 off MSR		From West: Curraghs Rd, MSR northbound	2		From West: Curraghs Rd, Robinsons Rd, MSR southbound off-slip road, ROW	2.1
							To North: MSR northbound	1.5		To North: ROW, MSR southbound off-slip road, Robinsons Rd, Curraghs Rd, Jones Rd, Dawsons Rd, MSR northbound	2.1
Lot 3, DP 55499	Jonathan Stewart Armstrong Erin Mary Armstrong	3					To South: MSR southbound	5.6		To South: ROW, MSR southbound off-slip road, Robinsons Rd, Curraghs Rd, Jones Rd, Weedons Ross Rd, Weedons I/C, MSR southbound	6.5
							To East: MSR southbound, Robinsons Rd	4		To East: ROW, MSR southbound off-slip road, Robinsons Rd	3.6
							To West: MSR southbound, Curraghs Rd	2		To West: ROW, MSR southbound off-slip road, Robinsons Rd, Curraghs Rd	2.1
Lot 2, DP 81942	NZTA (Ex Clark)	2	Yes								
Lot 3, DP 81942	NZTA (Ex Clark)	5	Yes								
Lot 1, DP 81942	NZTA (Ex Clark)	6	Yes								
Lot 10, DP 50079	NZTA (Ex Kim)	7	Yes								
Lot 1, DP 20502	John Stewart Wilson Susan Margaret Wilson	8a	Yes								
Lot 1, DP 20502	John Stewart Wilson Susan Margaret Wilson	8b	Yes								
Lot 9, DP 50079	NZTA (Ex Clark)	9	Yes								
Lot 8, DP 50079	NZTA (Ex Clark)	10	Yes								
Lot 7, DP 50079	NZTA (Ex Clark)	10a	Yes								
Lot 3, DP 306932	Paterson Poultry Limited	11			Waterholes Rd	No change		N/A	Waterholes Rd		N/A
Lot 1 , DP 20355	Wendy Shao Ping Gan	122	Yes								
Pt RS 38039	John David Boyland Robin Annette Boylan	173			Waterholes Rd	No change		N/A	Waterholes Rd		N/A

Access to Property – CSM2 Alignment

Waterholes Road/Hamptons Road

Owner	Legal Description	Ref	Total Purchase by NZTA?	Current Access to Property	Change to Access?	Pre CSM2 Routing	Pre CSM2 Routing Distance	Post CSM2 Access?	Post CSM2 Routing	Post CSM2 Routing Distance
NZTA (Ex Kimm)	Lot 2, DP 26707	12	Yes							
NZTA (Ex Heald)	Lot 1, DP 26707	13	Yes							
NZTA (Ex Wadsworth)	Lot 1, DP 408618	16	Yes							
NZTA (Ex RLM)	Lot 3, DP 408618	19	Yes							
	Lot 2, DP 408618	18		Hamptons Rd	No change	All movements possible from access points	N/A	No Change	No change to pre-CSM2 routings	N/A
John Ronald Tate Gaylene Elizabeth Tate	Lot 2, DP 341197	15	Yes							
John Ronald Tate Gaylene Elizabeth Tate	Lot 1, DP 341197	17	Yes							

Trents Road

Owner	Legal Description	Ref	Total Purchase by NZTA?	Current Access to Property	Change to Access?	Pre CSM2 Routing	Pre CSM2 Routing Distance	Post CSM2 Access?	Post CSM2 Routing	Post CSM2 Routing Distance
John Alexander Shanks Susan Annette Shanks Landsay John Dick Micael Christopher Robinson	Lot 2 , DP 19955	21		Via Trents Rd	No Change	All movements possible from access point	N/A	Via Trents Rd	All movements possible from access point	N/A
NZTA (Ex Nyhan)	Lot 1, DP 19955	20	Yes							
Phillip George Clarke Margarete Frances Clarke	Lot 1, DP 23731	60	Yes							

Blakes Road

Owner	Legal Description	Ref	Total Purchase by NZTA?	Current Access to Property	Change to Access?	Pre CSM2 Routing	Pre CSM2 Routing Distance	Post CSM2 Access?	Post CSM2 Routing	Post CSM2 Routing Distance
NZTA (Ex Williams)	Lot 1, DP 322541	22	Yes							
NZTA (Ex O Connor)	Lot 2, DP 340332	23	Yes							
NZTA (Ex Williams)	Lot 1, DP 340332	24	Yes							
Vaughan Graeme Morrison Belinda Ann Morrison Clio Trustee Services Limited	Lot 3, DP 307041	59	Yes							
Toolshed Investments Limited	Lot 2, DP 307041	25	Yes							
Warren Allen Hastings Julie Hastings Grant Rae Trustee Limited	Lot 2, DP 58229	27		Via Blakes Rd	Blakes Rd severed on either side of motorway alignment	From and To South & East: Blakes Rd to Blakes/Shands intersection	N/A	Blakes Rd severed to west of these properties - all access now via Blakes Rd off Shands Rd	From and To South & East: Blakes Rd to Blakes/Shands intersection (no change)	N/A
						From North: MSR southbound, Trents Rd, Blakes Rd || Shands Rd, Blakes Rd	2.6 || N/A		From North: MSR southbound, Trents Rd, Shands Rd, Blakes Rd || Shands Rd, Blakes Rd (no change)	6.3 || N/A
						From West: Kirk Rd, Trents Rd, Blakes Rd	2.7		From West: Kirk Rd, Trents Rd, Shands Rd, Blakes Rd	6.4
						To North: Blakes Rd, Trents Rd, MSR northbound || Blakes Rd, Shands Rd	2.5 II 3.8		To North: Blakes Rd, Shands Rd, Trents Rd, MSR northbound || Blakes Rd, Shands Rd	6.3 II 3.8
						To West: Blakes Rd, Trents Rd, Kirk Rd	2.7		To West: Blakes Rd, Shands Rd, Trents Rd, Kirk Rd	6.4

Shands Road

Owner	Legal Description	Ref	Total Purchase by NZTA?	Current Access to Property	Change to Access?	Pre CSM2 Routing	Pre CSM2 Routing Distance	Post CSM2 Access?	Post CSM2 Routing	Post CSM2 Routing Distance
Chelandry Farms Limited	Lot 1, DP 310929	31		Via Shands Rd	No change	No change to access routings	N/A	Via Shands Rd	No change to access routings	N/A
Chelandry Farms Limited	Lot 2, DP 310929	32								
Tegel Foods Limited	Lot 1, DP 53738	34	Yes							
Foddercube Products Nth Canty Limited	Lot 2, DP 24365	38	Yes							
Benjamin William McAlpine Tothill Sally Jean Tothill	Lot 1, DP 24365	39	Yes							

Marshs Road

Owner	Legal Description	Ref	Total Purchase by NZTA?	Current Access to Property	Change to Access?	Pre CSM2 Routing	Pre CSM2 Routing Distance	Post CSM2 Access?	Post CSM2 Routing	Post CSM2 Routing Distance
Kevin Lawrence Williams Bonnie Ann Williams	Not specified, RS 2836	58		Via Marshs Rd	No change	No change to access routings	N/A	Via Marshs Rd	No change to access routings	N/A
Kevin Lawrence Williams Bonnie Ann Williams	0, RS 2705	29								
Kevin Lawrence Williams Bonnie Ann Williams	Lot 1, DP 54254	33								
Noel Lindsay Moore	Lot 2, DP 64487	65								
NZTA	Lot 1, DP 19825	66	Yes							
Tegel Foods Limited	Lot 1, DP 53739	41	Yes							
Micheal Stuart Peters Anne Felicia Peters	Lot 2 , DP 402608	183		Via Marshs Rd	Access routed to eastern end of Marshs Rd bridge structure	No change to access routings	N/A	Via Marshs Rd	No change to access routings	N/A
Barrie Leonard Houghton Janice Ann Houghton	Lot 1, DP 57203	40								
Calder Stewart Industries Limited	Lot 1, DP 397092	44	Yes							
Preshes Investments Limited	Lot 2, DP 397092	45	Yes							
Calder Stewart Industries Limited	Lot 2, DP 49203	42 - NW		Via Sir James Wattie Dr onto Shands Rd	No change	No change to access routings	N/A	Via Sir James Wattie Drive onto Shands Rd	No change to access routings	N/A
		42 - SE			Alignment severs access to Sir James Wattie Dr - access will be off Marshs Rd	From North: Shands Rd, Sir James Wattie Dr	1.0	Via Marshs Rd	From North: Shands Rd, Marshs Rd	1.4
						From South: Shands Rd, Sir James Wattie Dr	1.3		From South: Shands Rd, Marshs Rd	1.1
						From West: Marshs Rd, Shands Rd, Sir James Wattie Dr	1.3		From West: Marshs Rd	1.1
						From East: Halswell Junction Rd, Shands Rd, Sir James Wattie Dr	3.7		From East:Halswell Junction Rd, Springs Rd, Marshs Rd	2.0
						To North: Sir James Wattie Dr, Shands Rd	1.0		To North: Marshs Rd, Shands Rd	1.4
						To South: Sir James Wattie Dr, Shands Rd	1.3		To South: Marshs Rd, Shands Rd	1.1
						To West: Sir James Wattie Dr, Shands Rd, Marshs Rd	1.3		To West: Marshs Rd	1.1
						To East: Sir James Wattie Dr, Shands Rd, Halswell Junction Rd	3.7		To East: Marshs Rd, Springs Rd, Halswell Junction Rd	2.0

Springs Road

Owner	Legal Description	Ref	Total Purchase by NZTA?	Current Access to Property	Change to Access?	Pre CSM2 Routing	Pre CSM2 Routing Distance	Post CSM2 Access?	Post CSM2 Routing	Post CSM2 Routing Distance
Shands Road Industrial Park	Lot 2, DP 61408	47	Yes							
Kovan Limited	Lot 2, DP 82095	48	Yes							
NZTA(Ex Carter)	Pt, RS 1480	49	Yes							
NZTA Historic Purchase.	Pt, RS 1480	50	Yes							
NZTA Historic Purchase.	Pt Lot 1, DP 8509	51	Yes							
NZTA Historic Purchase.	Pt, RS 2426	52	Yes							
Fodder Cube Products North Canterbury Limited	Lot 1, DP 53489	76		Springs Road	No Change	All movements possible from access point	N/A	No Change	All movements possible from access point	N/A
Ying ho Chen Kwei Fen Hsueh	Pt Lot 1, DP 34236	177								

John Paterson Dr

Owner	Legal Description	Ref	Total Purchase by NZTA?	Current Access to Property	Change to Access?	Pre CSM2 Routing	Pre CSM2 Routing Distance	Post CSM2 Access?	Post CSM2 Routing	Post CSM2 Routing Distance
Richard John Sissons Carolyn Beverley Sissons	Lot 1, DP 318764	54	Yes							
Grant Phillip England Halie Sharleen Kellaway	Lot 8, DP 318764	67		John Paterson Dr (connecting to Springs Rd)	John Paterson Dr extended to join Halswell Junction Rd at CSM westbound off-ramp roundabout, existing connection to Springs Rd closed	From North: Springs Rd southbound, John Paterson Dr	1.5	Realigned John Paterson Dr (connecting to Halswell Junction Rd)	From North: Springs Rd southbound, Halswell Junction Rd, John Paterson Dr	2
		A1				From South: Springs Rd northbound, John Paterson Dr	1.8		From South: Springs Rd northbound, Halswell Junction Rd, John Paterson Dr	3
		A2				From East: Halswell Junction Rd, Springs Rd southbound, John Paterson Dr	2.8		From East: Halswell Junction Rd, John Paterson Dr	1.9
		A3				From West: Halswell Junction Rd, Springs Rd southbound, John Paterson Dr || Marshs Rd, Springs Rd northbound, John Paterson Dr	2.4 II 2.9		From West: Halswell Junction Rd, John Paterson Dr || Marshs Rd, Springs Rd northbound, Halswell Junction Rd, John Paterson Dr	2.9 II 4.0
		A4				To North: John Paterson Dr, Springs Rd northbound	1.6		To North: John Paterson Dr, Halswell Junction Rd, Springs Rd	2
Martin Richard Harcourt Aiko Harcourt Peter Ian Cullen	Lot 4, DP 318764	178				To South: John Paterson Dr, Springs Rd southbound	1.8		To South: John Paterson Dr, Halswell Junction Rd, Springs Rd	3
						To East: John Paterson Dr, Springs Rd northbound, Halswell Junction Rd	2.8		To East: John Paterson Dr, Halswell Junction Rd	1.9
Neil Morton Sword Philipa Sword William Leslie Brown	Lot 5, DP 318764	185				To West: John Paterson Dr, Springs Rd northbound, Halswell Junction Rd || John Paterson Dr, Springs Rd southbound, Marshs Rd	2.4 II 2.9		To West: John Paterson Dr, Halswell Junction Rd || John Paterson Dr, Halswell Junction Rd, Springs Rd, Marshs Rd	2.9 II 4.0

Halswell Junction Road

Owner	Legal Description	Ref	Total Purchase by NZTA?	Current Access to Property	Change to Access?	Pre CSM2 Routing	Pre CSM2 Routing Distance	Post CSM2 Access?	Post CSM2 Routing	Post CSM2 Routing Distance
NZTA Historic Purchase.	Lot 1, DP 303635	53	Yes							
Meadow Mushrooms	Lot 6, DP 45957	55	Yes							
Mee Lai Lee Bak Cheong Lee	Pt Lot 1, DP 42549	72	Yes							
Fulton Hogan Land Development	Lots 1 and 2, DP 3256	179		Halswell Junction Road	No Access to Halswell Junction Rd	All movements possible from access point	N/A	Access to rerouted John Paterson Dr	All movements possible from roundabout where realigned John Paterson Dr joins Halswell Junction Rd	N/A
John Gregory Keith Olive	Lot 1, DP 60678	71								