MWH

BUILDING A BETTER WORLD

MOVEMENT NETWORK INFRASTRUCTURE MASTER PLAN

Teviot Road, Greenbank

Prepared for Mirvac

03 March 2017

PLANS AND DOCUMENTS
referred to in the PDA
DEVELOPMENT APPROVAL

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Queensland Government

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QUALITY STATEMENT

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Rev No	Date	Description	Prepared by	Checked by	Reviewed by	Approved by
1	05/02/16	Draft For Comment	Sham Handalage	Ali Syed	Brad Scouller	Brad Scouller
2	28/10/16	Minor amendments	Sarah Atif	Ali Syed	Henry Strachan	Ali Syed
3	03/03/17	Updated 2051 SIDRAs	Sarah Atif	Ali Syed	Henry Strachan	Ali Syed
4	18/04/17	2051 SIDRA Network layout	Sarah Atif	Ali Syed	Henry Strachan	Ali Syed

Mirvac

Teviot Road, Greenbank - Movement Network Infrastructure Master Plan

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1 Introduction

MWH have been commissioned by Mirvac to undertake the technical assessment for the transport 'movement network' for the proposed Teviot Road urban subdivision in Greenbank. The development is located within the state government declared Greater Flagstone Priority Development Area (PDA) and falls under the planning jurisdiction of Economic Development Queensland (EDQ). The site is located within a fragmented portion of the PDA and forms the northernmost developable parcel of land within Greater Flagstone.

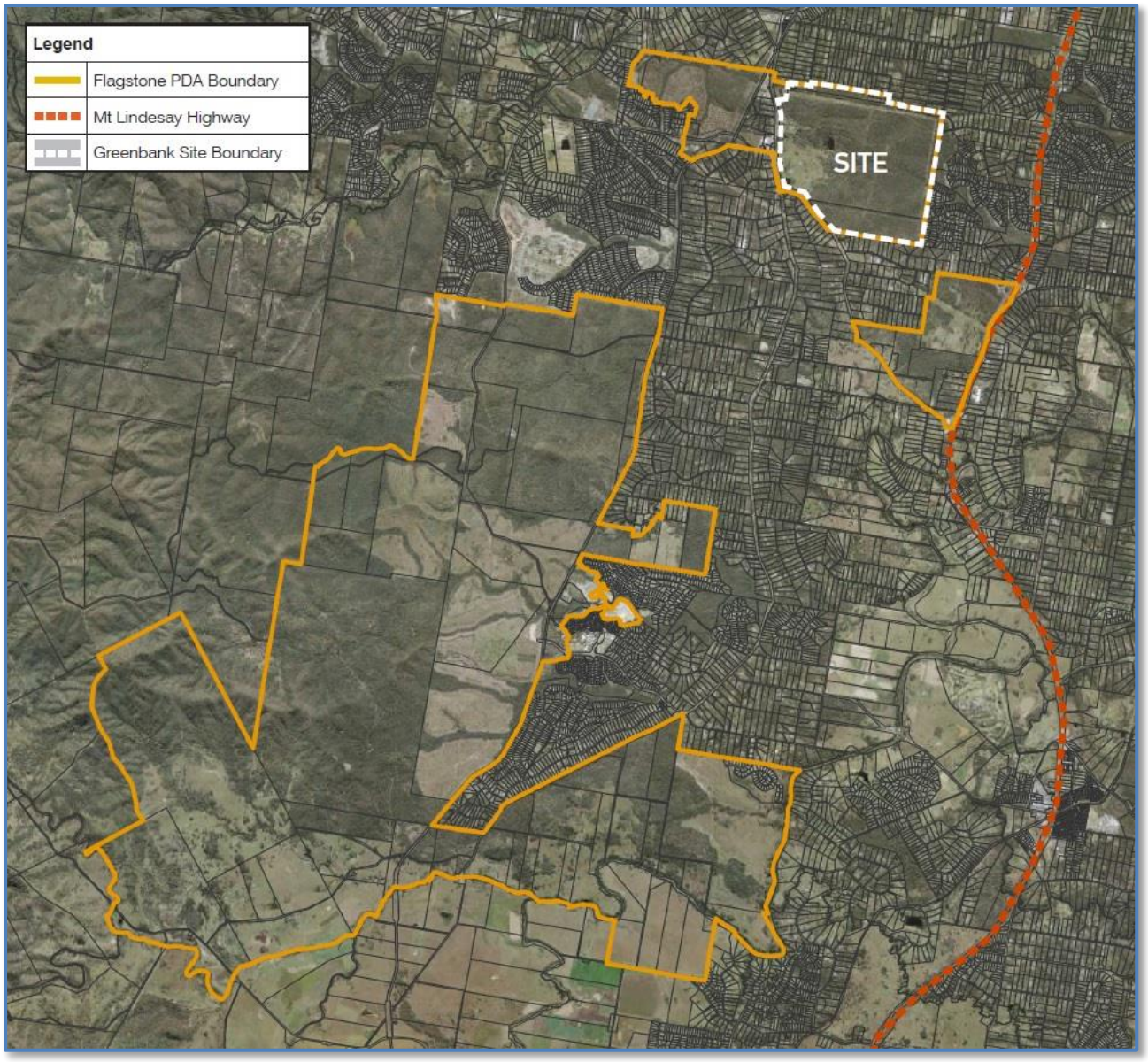

Figure 1-1: Context plan of the development site within the Greater Flagstone PDA.

1.1 Purpose of the Technical Assessment

The purpose of the technical assessment is to prescribe transport network solutions and confirm that these are satisfactory to accommodate the level of demand placed upon them by the development. The technical assessment will investigate the following transport elements.

- **Road Network:** Road network layout, hierarchy, construction profiles and intersections.
- **Public Transport:** Bus compatible routes, bus stop locations and construction typology.
- **Active Transport:** Bicycle and pedestrian network and movement permeability.
- **Parking Provisions:** Adopted rates of parking and proposed provisions.
- **Traffic Assessment:** Forecast of traffic generation and rationale of the proposed road layout.
- **Traffic Impact:** Using a hybrid AIMSUN mesoscopic and microscopic traffic model, the impact of the development upon the external road network and capacity of the proposed network will be validated.

1.2 Site Planning Context

The Greater Flagstone PDA was declared by the Queensland Government in October, 2010 and covers a total area of 7188 hectares. Flanking the interstate railway corridor between Greenbank and Kagaru, when fully developed it is anticipated that the PDA will house a population of 120,000 residents across 50,000 dwellings.

The Mirvac development is located upon a 481ha parcel of land with road frontage to Teviot and Greenbank Roads. It is proposed that a total of 3,350 lots will be provided in addition to a neighbourhood centre, community facility, primary school, regional parkland and sporting facilities and a designated area of conservation parkland. The modelled composition of the development is identified and illustrated below:

- 3,255 standard (urban) residential lots
- 13 interface (semi-rural) residential lots
- 70 'Eco' (semi-rural) residential lots
- A primary school accommodating 1,000 students
- A combined retail and health 'Neighbourhood Centre' and 'Community Facility' comprising of 7,000sqm GFA of retail and 4,000sqm GFA of health facilities.

Note that the modelled composition contemplates 3,338 residential lots (i.e. 12 lots less than current development plans). The impact of this change is considered immaterial to the modelling results.

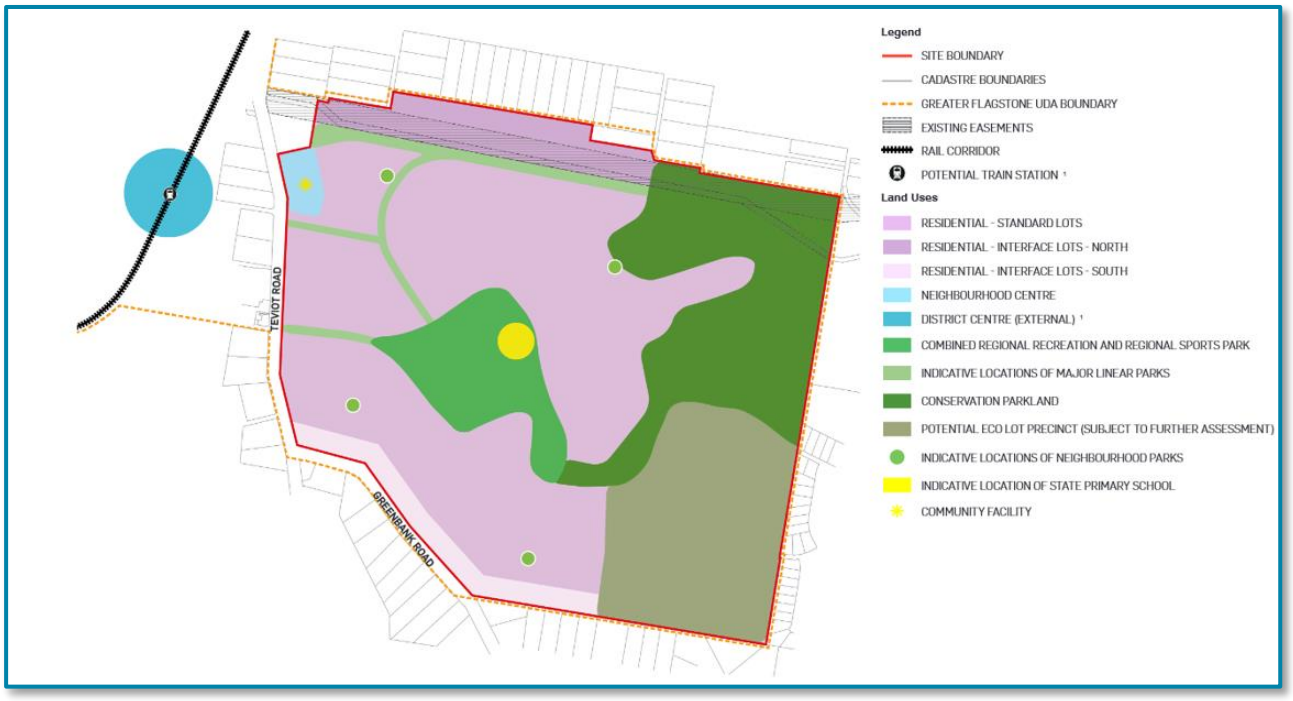

Figure 1-2: Overall context plan for the development.

2 Transport Network Context

The following sections will identify the existing transport networks within context to the development site and the planned improvement initiatives proposed for this infrastructure.

2.1 Existing Transport Networks

2.1.1 Existing Road Network

The development site is located approximately 10km south-west of the Browns Plains Activity Centre and has frontage on the western perimeter to the north-south running Teviot Road as well as along the south-western perimeter with Greenbank Road. The southern, eastern and northern perimeters do not have road frontage, however do have perpendicular access to several rural to semi-rural residential streets.

Regional access to the development site is provided by parallel north-south corridors Teviot Road and Mount Lindesay Highway. Stoney Camp Road (to the north of the site) and Greenbank Road/Crowson Lane (to the south of the site) provide a means of east-west distribution between Teviot Road and the Mount Lindesay Highway.

The junction of Teviot Road and Pub Lane provides access to the semi-rural residential area of New Beith, located 1km west of the development.

Illustrated below is a map of the surrounding road network relevant to the development, followed by a summary of the key roads.

Figure 2-1: Existing road network.

2.1.1.1 Mount Lindesay Highway

Running between Brisbane and the state border, the Mount Lindesay Highway is the primary form of road access to the development between Brisbane and Beaudesert. The corridor is largely grade separated between Browns Plains and Munruben and consists of a 4-lane carriageway from north of the Stoney Camp Road interchange. South of the Crowson Lane interchange, the road transitions into a rural highway typology with at-grade, high speed intersections.

2.1.1.2 Teviot Road

Running parallel to the Mount Lindesay Highway approximately 4km to the west, Teviot Road provides a major local route between the western residential areas of Jimboomba (to the south) and Greenbank (to the north). Teviot Road is a key distributor of traffic, providing links to the Mount Lindesay Highway via Greenbank Road/Crowson Lane and Stoney Camp Road, to Springfield via Springfield-Greenbank Arterial Road and to Browns Plains via Middle Road. Teviot Road is constructed to a 2-lane rural standard.

2.1.1.3 Stoney Camp Road

Stoney Camp Road is a 4km long, 2-lane road providing a key link between Teviot Road and the Mount Lindesay Highway. The road provides frontage to rural properties and is constructed to a rural standard.

2.1.1.4 Greenbank Road/Crowson Lane

Intersecting each other just south of the development site, these roads combine to provide another key link between Teviot Road and the Mount Lindesay Highway. The road provides frontage to rural properties and is constructed to a rural standard.

2.1.1.5 Pub Lane

Pub Lane provides a local connection to the semi-rural residential area of New Beith and provides a logical point of entry to the development site. Pub Lane is a 2-lane, rural standard road.

2.1.2 Existing Public Transport Network

Presently due to the semi-rural to rural nature of the area, there is not the development density to warrant the establishment of an urban public transport network. The Park Ridge Park ‘n’ Ride currently provides the nearest point of access to the bus network, located approximately 8km (by car) from the development site at the Crest Road interchange with Mount Lindesay Highway.

Route 541 currently provides a local service function to the Boronia Heights area (approximately 4km north of the development site). Route 540 provides an hourly service between Beaudesert and Browns Plains and has limited and difficult to access stops along Mount Lindesay Highway. Route P546 provides a peak hour express service to the Brisbane CBD from the Park Ridge Park ‘n’ Ride.

Figure 2-2 shows the relation of the development site to the surrounding public transport network.

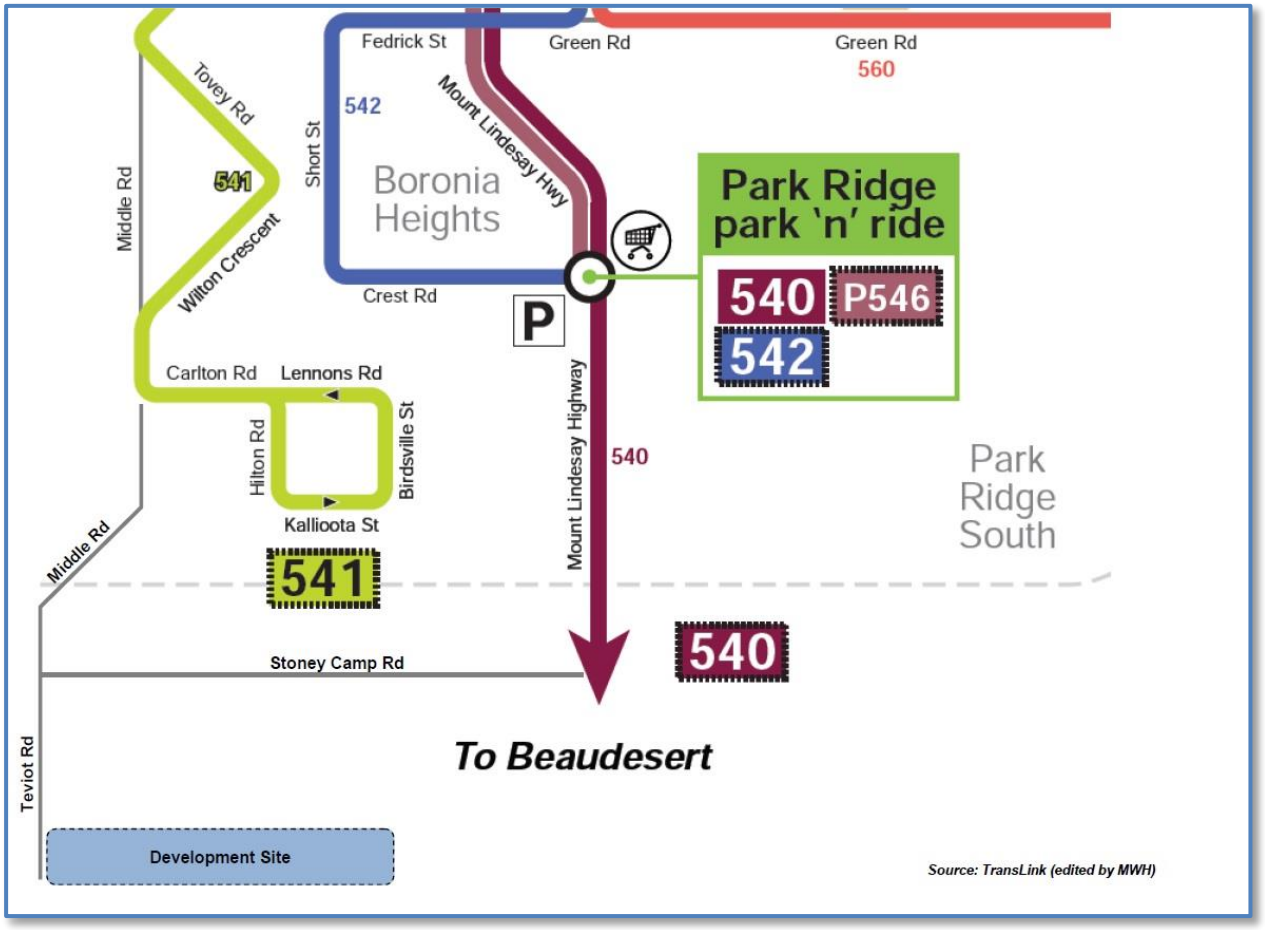

Figure 2-2: Existing public transport network.

2.1.3 Existing Active Transport Network

Again, due to the semi-rural to rural nature of the area, there are no established active transport networks within relevant proximity to the development site. This includes the lack of even basic provisions of paved kerbside footpaths.

2.2 Planned Transport Network Improvements

2.2.1 Road Network Improvements

A review of PDA, Logan City Council and Transport & Main Roads (TMR) transport strategies and infrastructure programs has identified future upgrades to Teviot Road, Mount Lindesay Highway and the establishment of a new east-west arterial corridor between Mount Lindesay Highway and the Pacific Motorway. These improvements are in various stages of progression between strategic planning and programmed construction. They are summarised further below.

2.2.1.1 Mount Lindesay Highway Capacity Upgrade – Planning

TMR have allocated a significant quantity of funding to undertake planning for the upgrade of Mount Lindesay Highway between Stoney Camp Road and Jimboomba during 2016/17. This project would investigate the widening of the highway to 4 lanes where additional capacity is required. Funding for construction is currently unallocated.

2.2.1.2 Mount Lindesay Strategic Transport Network Investigation – Strategic Planning

Focusing on all modes of transport, the roads component of this strategic investigation identifies two key findings of relevance to the development site being:

- Establishment of a major regional road corridor between Beaudesert and Springfield, likely incorporating Teviot Road as part of this corridor.
- Investigation of an east-west arterial corridor between Flagstone and the Pacific Motorway in reflection of increased development and demand for a more direct access to the Gold Coast.

This plan is strategic in nature and currently there is no programmed planning or construction projects that reflect the recommendations of this study.

2.2.1.3 Sub-Regional Road Upgrades – Strategic Planning

Identified by EDQ as being local roads requiring upgrade to support the Greater Flagstone and North Maclean PDAs, most local roads within close proximity to the development site have been identified for future upgrade including; Teviot Road, Stoney Camp Road, Greenbank Road, Crowson Lane and Pub Lane. Such upgrades are identified in the following documents

- *Greater Flagstone Urban Development Area Development Scheme* dated October 2011 (PDA Development Scheme);
- *Infrastructure Charging Offset Plan – Greater Flagstone Priority Development Area* dated July 2013 (ICOP); and
- *Logan Sub-regional Infrastructure Plan (SRIP) version 8* dated 08 April 2016 (SRIP).

2.2.1.4 Crowson Lane Extension – Strategic Planning

An extension of Crowson Lane is proposed between Greenbank Road and Teviot Road to straighten the alignment between Teviot Road and Mount Lindesay Highway. This is currently a concept of strategic traffic modelling for the PDA and it is understood that this is not proposed as an official infrastructure project.

2.2.2 Public Transport Improvements

Strategies for public transport infrastructure are detailed below.

2.2.2.1 Salisbury to Beaudesert Rail Corridor Study - Planning

This study has investigated the implementation of a passenger rail corridor running largely parallel to the interstate railway corridor to facilitate passenger demand within established urban areas in the south of Brisbane and north of Logan City as well as future demand within Greater Flagstone. Station locations proposed as part of the *Salisbury to Beaudesert Review of Environmental Factors (REF)* Study alter to that of the *Greater Flagstone Urban Development Planning Scheme*. In accordance with the Scheme, a station is proposed within 500m of the site in the vicinity of Leanne Court, however this location is not finalised, nor is the project committed for further funding.

2.2.2.2 Mount Lindesay Strategic Transport Network Investigation – Strategic Planning

The public transport component of this project recommends the establishment of regional bus networks on major roads within and external to the PDA. Teviot Road is proposed to form part of the regional bus network between Flagstone and Browns Plains. This study is strategic in nature and there is no current programmed implementation of bus services in addition to the existing TransLink network.

2.2.2.3 Interim Public Transport Service

The PDA Development Scheme requires development to contribute to an interim public transport service for up to 5 years or until the fare box income exceeds 30% of running costs, whichever is sooner. The implementation of this interim service will be further investigated in consultation with relevant stakeholders including Translink and EDQ.

2.2.3 Active Transport Improvements

2.2.3.1 Mount Lindesay Strategic Transport Network Investigation – Strategic Planning

High quality pedestrian and cyclist connections between urban areas are proposed as part of this investigation. Typically these would be provided along regional road corridors. No specific planned or programmed projects have been recommended as part of this study.

2.2.3.2 DILGP Cycle Network Strategy

The Department of Infrastructure, Local Government and Planning (DILGP) is planning a Cycle Network Strategy. While not finalised, it is likely to extend along Teviot Rd and Greenbank Rd and may comprise on/off road cycle tracks and potentially include shared paths. This network is likely to form part of the sub-regional infrastructure network which is intended to be designed and constructed by Logan City Council. Given that strategy work is in progress and designs are currently unavailable, the cycle and pedestrian network arrangements for Teviot Road and Greenbank Road have been largely excluded from the plans and cross sections within this report, although it is noted that the subject road reserves will have sufficient width to accommodate these networks once the strategy has been finalised.

2.2.3.3 Logan Planning Scheme 2015 – Cycle Network

The Logan Planning Scheme 2015 identifies a cycle path network traversing and adjacent to the site. The funding and timing arrangements for this infrastructure are unknown.

Figure 2-3 illustrates the identified primary transport infrastructure improvements planned for the region.

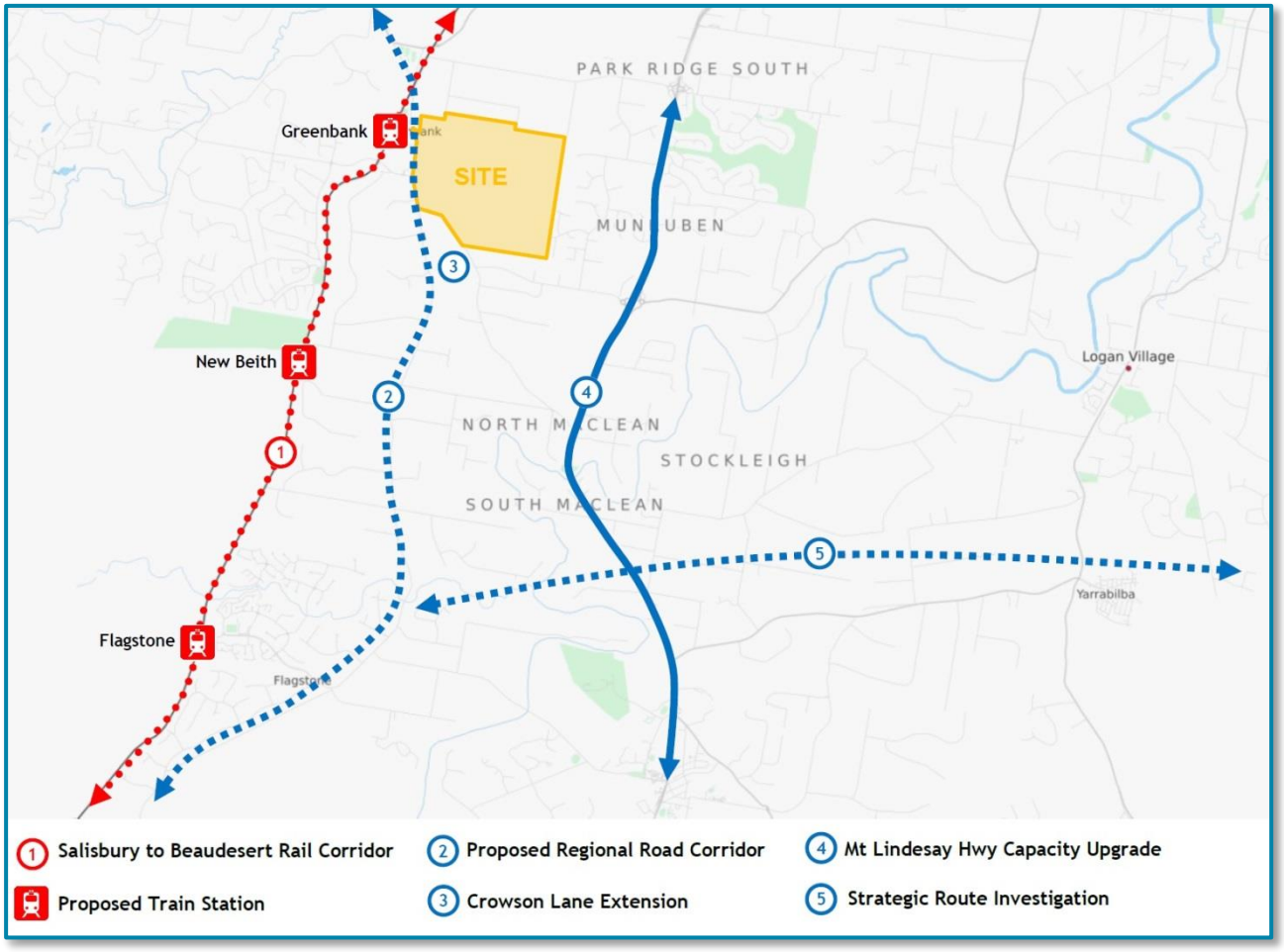

Figure 2-3: Map of identified primary transport improvements.

3 Proposed Movement Network

The proposed movement network incorporates the primary modal function of a vehicle based road network, supported by adequate provisions of accessible public transport infrastructure as well as a connected network of pedestrian and cyclist paths. The below sections will outline the characteristics of the proposed road, public and active transport networks.

3.1 Road Network

Detailed information with respect to traffic demand and network performance is addressed in **Appendix A**

3.1.1 External (Sub-Regional) Network

The site has frontage to two sub-regional roads, being Teviot Road to the west and Greenbank Road to the south.

It is understood that sub-regional road upgrades subject of the PDA are intended to be designed and constructed by Logan City Council through sub-regional infrastructure funding (infrastructure charges). As such, upgrade requirements are considered subject to design and construction by others and have been largely excluded from this document.

However, intersections between these roads and internal roads have been considered, particularly with regard to the Teviot Road arrangement between (and just extending past) Pub Lane and Leanne Court so that slip / merging lane arrangements can be considered holistically.

Mirvac is also considering mounding along the site frontage for acoustic attenuation purposes. Consultation with EDQ indicates that such mounds are generally acceptable and should be designed in accordance with LCC standards.

3.1.2 External (Semi-Rural) Network

The following lower order rural roads adjoin the northern and eastern boundaries of the site:

- Brightwell Street;
- Campbell Road;
- Heathcote Court; and
- Serengetti Drive.

It is proposed that two small catchments of the subject site will connect to these streets (refer Section 3.1.3).

3.1.3 Internal (Municipal) Network

3.1.3.1 Road Hierarchy

The internal network results from a multi-disciplinary and multi-stakeholder urban design development process (including transport modelling) which has been prepared cognisant of:

- the ICOP; and
- *ULDA Guideline No. 06 Street and movement network* dated April 2012 (Guideline 6) (under review at time of drafting this document)

Given that Guideline 6 was under review, the road hierarchy and cross sections were developed in consultation with EDQ.

The proposed road hierarchy is shown in Figure 3-1.

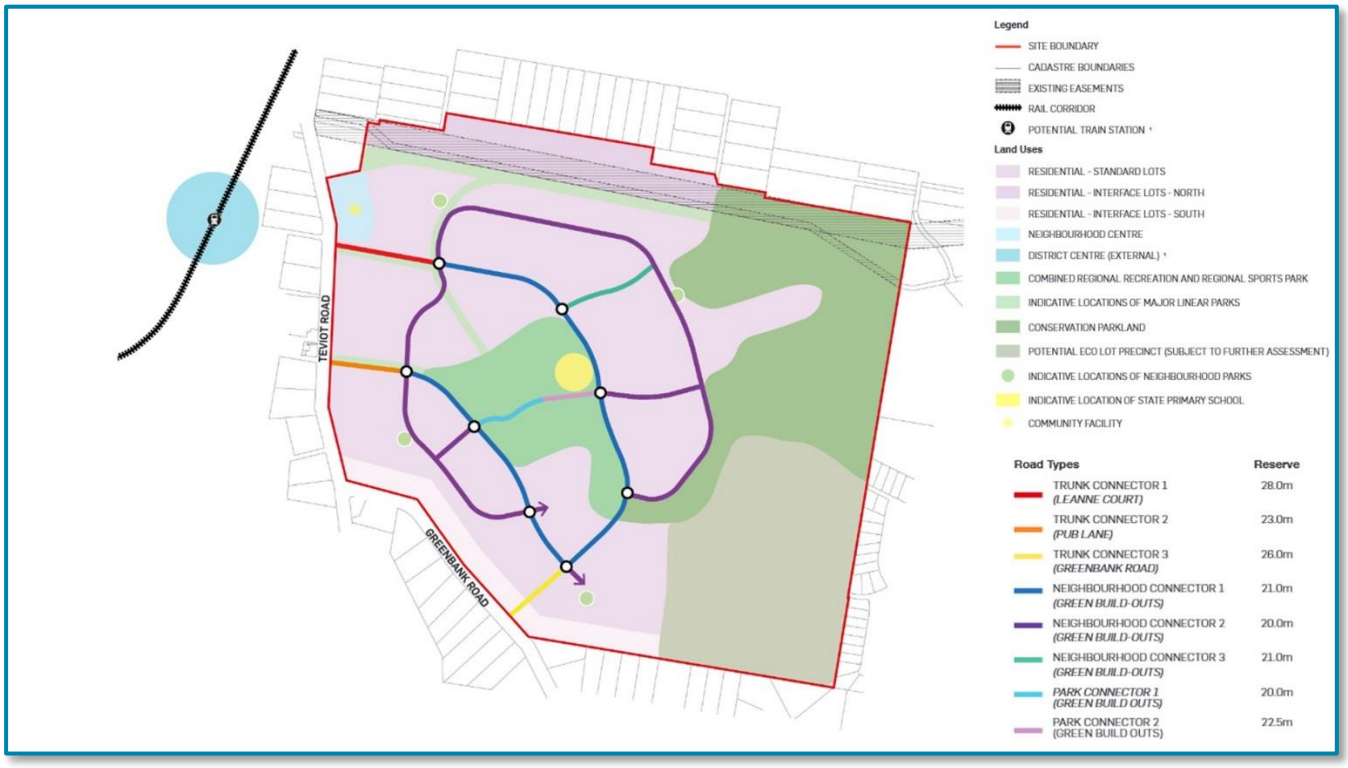

Figure 3-1: Road layout and hierarchy map.

Key features below:

- Three points of access to the external sub-regional network, being:
    - Teviot Road intersection with Leanne Court
    - Teviot Road intersection with Pub Lane
    - Greenbank Road, approximately 450m north-west of Crowson Lane
- Trunk Connectors distribute traffic from the three access points above to the first intersection(s) internal to the subject site.
- Neighbourhood Connectors provide a primary and secondary circuit throughout the site and distribute traffic to tertiary level Access Streets.
- Approximately 13 Residential Interface Lots (North) are proposed to connect to Brightwell Street and Campbell Road to the north.
- Up to 70 Residential Eco Lots are proposed to connect to Heathcote Court and Serengetti Drive to the east.

The ICOP Municipal Road Network Map shows a Trunk Connector traversing the site from the Teviot Road / Pub Lane intersection to Greenbank Road (R106). The proposed internal network varies from ICOP R106 and provides three short sections of Trunk Connector in accordance with desirable traffic outcomes.

3.1.3.2 Cross Sections

For the rural roads (where there is no relevant EDQ standard), the development has adopted either Logan City Council (LCC) standards or has continued the profile of existing adjoining roads where appropriate.

The road profiles described below are generic and may be subject to alteration where appropriate. For example:

- A vegetated sound buffer would not be constructed alongside parkland;
- Vegetated medians may be excluded in some areas to provide visual difference;
- Central medians / road crowns may be raised rather than inverted; and
- Acoustic fences may be excluded subject to acoustic advice.

Such alterations will be addressed in detailed design.

Cross sections for sub-regional Teviot Road and Greenbank Road have been excluded from this report as it is understood that they are intended to be designed and constructed by Logan City Council.

3.1.3.2.1 Trunk Connector

Three Trunk Connector cross sections are proposed within the development, the locations of which are shown in Figure 3-1. Typical cross sections for each of these roads are shown below:

1. Trunk Connector 1 (Leanne Court)

Table 3-1: Trunk Connector 1 Characteristics

Traffic Lanes	Traffic Lane Width	Bicycle Lane Width	Median Width	Verge Width	Vegetated Sound Buffer	Total Reserve Width	Road Speed	Residential Frontage
4	3.5m	N/A	4m	4 m	2m	28m	50km/h	No

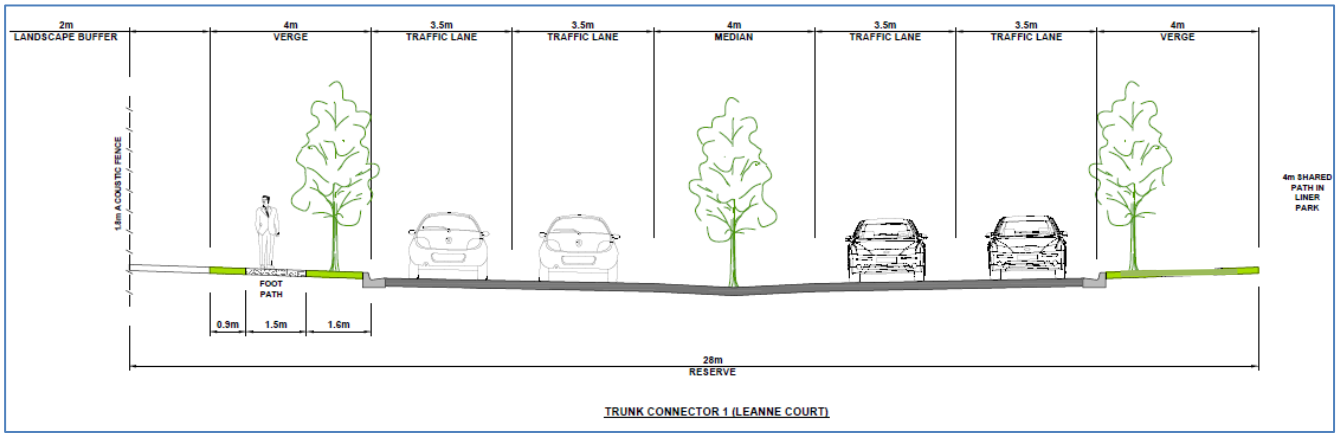

Figure 3-2: Trunk Connector 1 cross section

Notes

- The acoustic fence and landscaped buffer may be excluded where acoustic advice indicates that an acoustic fence is not required.

2. Trunk Connector 2 (Pub Lane)

Table 3-2: Trunk Connector 2 Characteristics

Traffic Lanes	Traffic Lane Width	Bicycle Lane Width	Median Width	Verge Width	Vegetated Sound Buffer	Total Reserve Width	Road Speed	Residential Frontage
2	3.5m	N/A	4m	4 m	2m	23m	50km/h	No

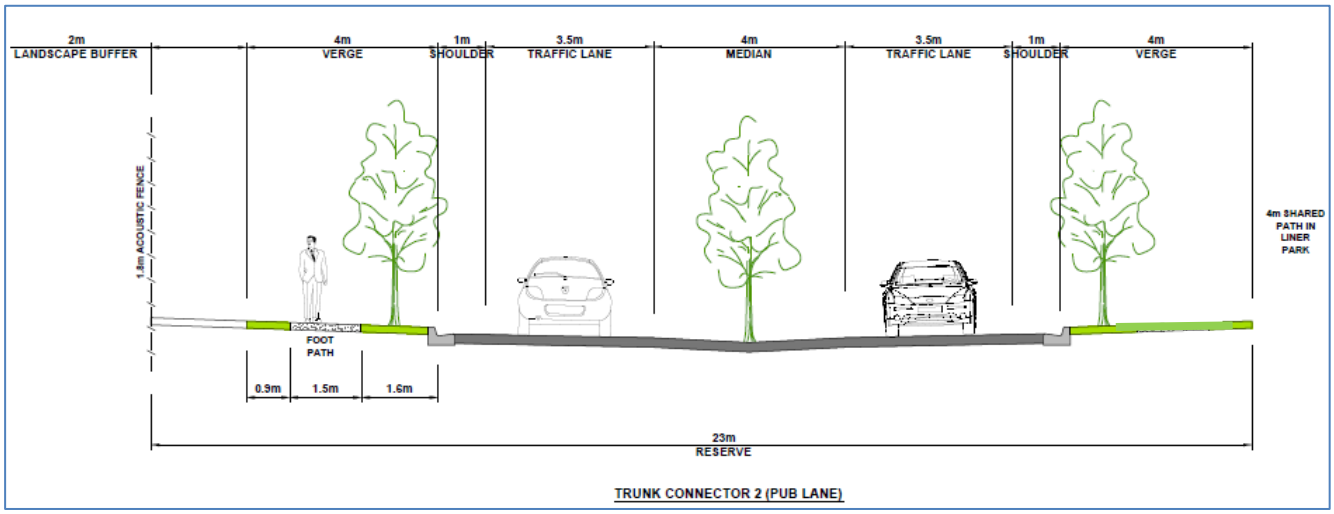

Figure 3-3: Trunk Connector 2 cross section

Notes

- The acoustic fence and landscaped buffer may be excluded where acoustic advice indicates that an acoustic fence is not required.
- Shoulder provided to allow sufficient passing space in the event of the break down

3. Trunk Connector 3 (Greenbank Road)

Table 3-3: Trunk Connector 3 Characteristics

Traffic Lanes	Traffic Lane Width	Bicycle Lane Width	Median Width	Verge Width	Vegetated Sound Buffer	Total Reserve Width	Road Speed	Residential Frontage
2	3.5m	N/A	4m	4 - 5 m	2.m	26m	50km/h	No

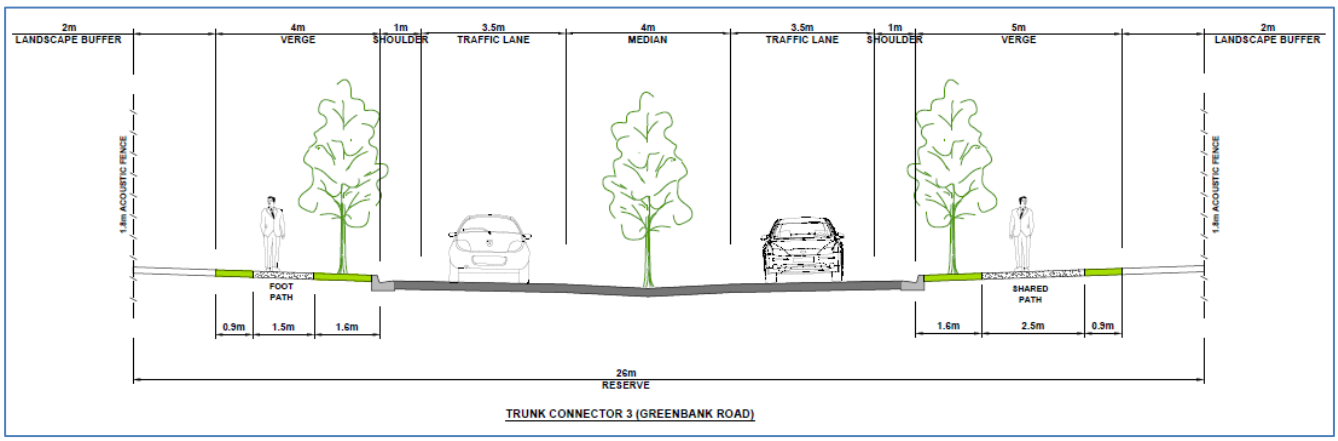

Figure 3-4: Trunk Connector 3 cross section.

Notes

- The acoustic fence and landscaped buffer may be excluded where acoustic advice indicates that an acoustic fence is not required.
- Shoulder provided to allow sufficient passing space in the event of the break down

3.1.3.2.2 Neighbourhood Connector

Neighbourhood Connectors are secondary order roads, distributing traffic from the Trunk Connectors into the residential neighbourhoods. Whilst they have frontage to residential properties, they are wider than typical neighbourhood streets and have designated kerbside parking lanes.

Three Neighbourhood Connector cross sections are proposed within the development, the locations of which are shown in Figure 3-1. Typical cross sections for each of these roads are shown below:

1. Neighbourhood Connector 1

Table 3-4: Neighbourhood Connector 1 Characteristics

Traffic Lanes	Traffic Lane Width	Parking Lane	Median Width	Verge Width	Vegetated Sound Buffer	Total Reserve Width	Road Speed	Residential Frontage
2	3.5m	2.5m	N/A	4 - 5m	N/A	21m	50km/h	Yes

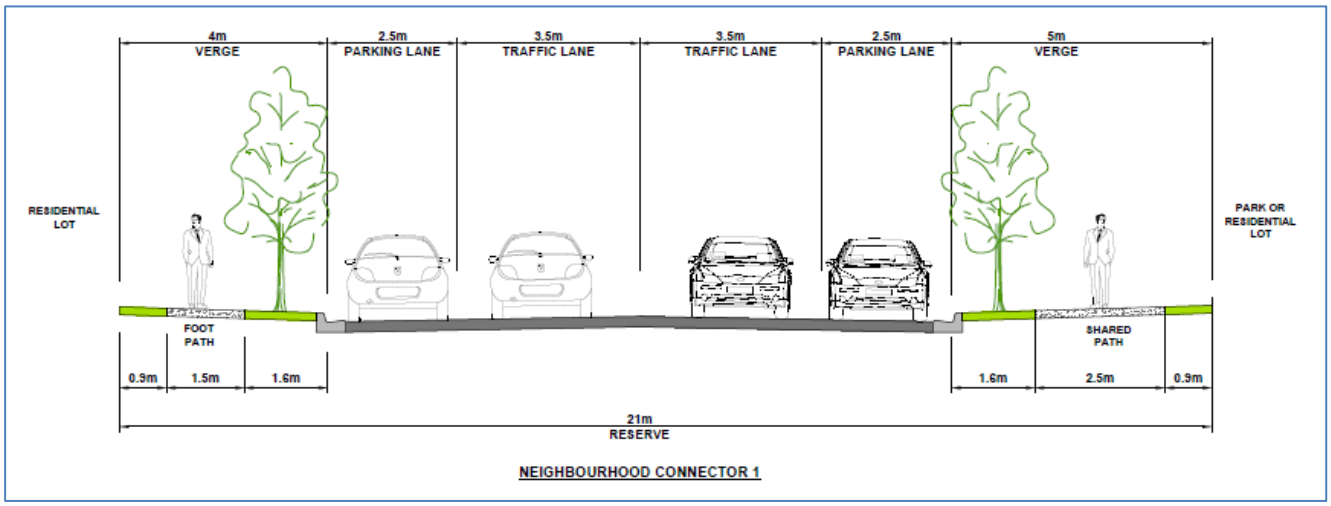

Figure 3-5: Neighbourhood Connector 1 cross section.

Notes

- Parking lanes include 1.5m wide green build outs

2. Neighbourhood Connector 2

Table 3-5: Neighbourhood Connector 2 Characteristics

Traffic Lanes	Traffic Lane Width	Parking Lane	Median Width	Verge Width	Vegetated Sound Buffer	Total Reserve Width	Road Speed	Residential Frontage
2	3.5m	2.5m	N/A	4m	N/A	20m	50km/h	Yes

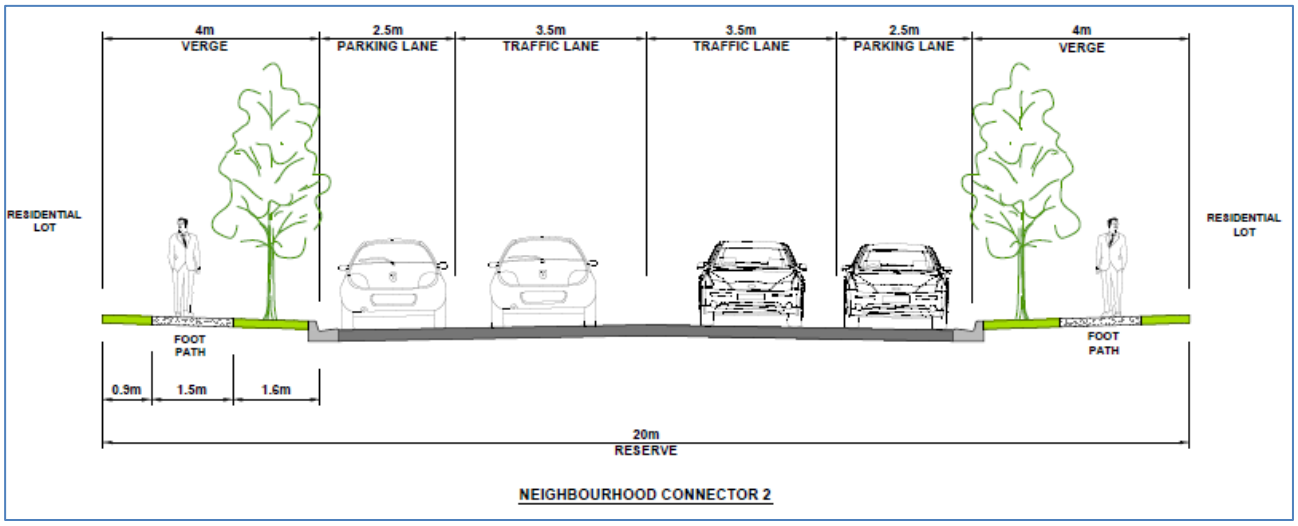

Figure 3-6: Neighbourhood Connector 2 cross section.

Notes

- Parking lanes include 1.5m wide green build outs

3. Neighbourhood Connector 3

Table 3-6: Neighbourhood Connector 3 Characteristics

Traffic Lanes	Traffic Lane Width	Parking Lane	Median Width	Verge Width	Vegetated Sound Buffer	Total Reserve Width	Road Speed	Residential Frontage
2	3.5m	2.5m	N/A	4-5m	N/A	21m	50km/h	Yes

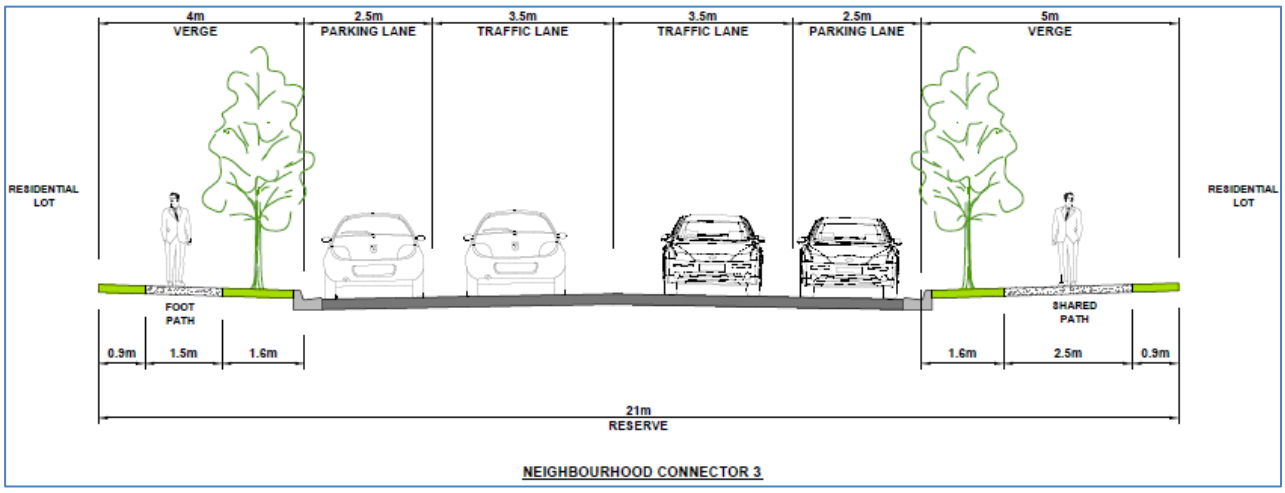

Figure 3-7: Neighbourhood Connector 3 cross section.

Notes

- Parking lanes include 1.5m wide green build outs

3.1.3.2.3 Park Connectors

Two Park Connector cross sections are proposed within the development, the locations of which are shown in Figure 3-1. Typical cross sections for each of these roads are shown below:

1. Park Connector 1

Table 3-7: Neighbourhood Park Connector 1 Characteristics

Traffic Lanes	Traffic Lane Width	Parking Lane	Median Width	Verge Width	Total Reserve Width	Road Speed	Residential Frontage
2	3.5m	2.5	N/A	4m	20m	50km/h	N/A

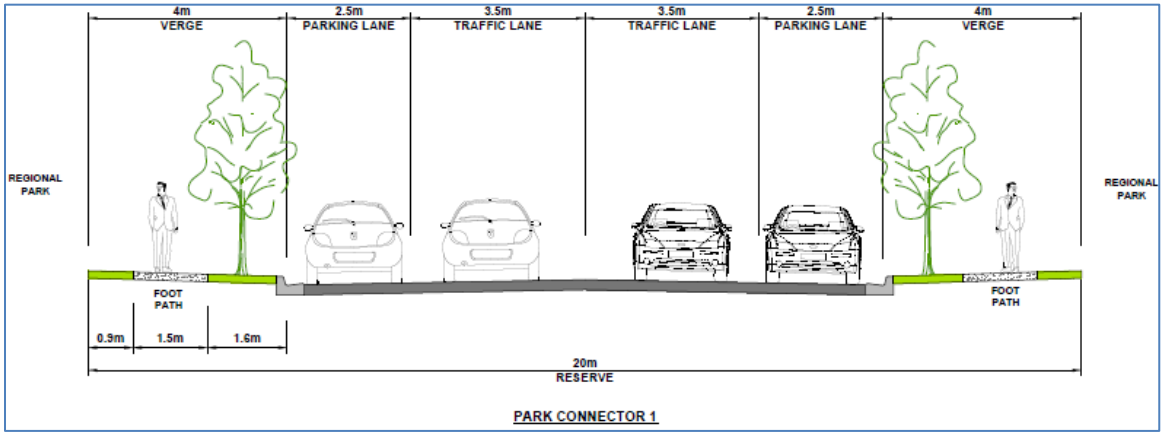

Figure 3-8: Park Connector 1 cross section.

Notes

- Footpaths may be deleted where paths provided in adjacent park
- Parking lanes include 1.5m wide green build outs
- Road reserve may be widened to provide for perpendicular and / or angle parking

2. Park Connector 2

Table 3-8: Park Connector 2 Characteristics

Traffic Lanes	Traffic Lane Width	Parking Lane	Median Width	Verge Width	Parking Lane Width	Total Reserve Width	Road Speed	Residential Frontage
2	3.5m	2.5	N/A	4-6.5m	2.5m	22.5m	50km/h	N/A

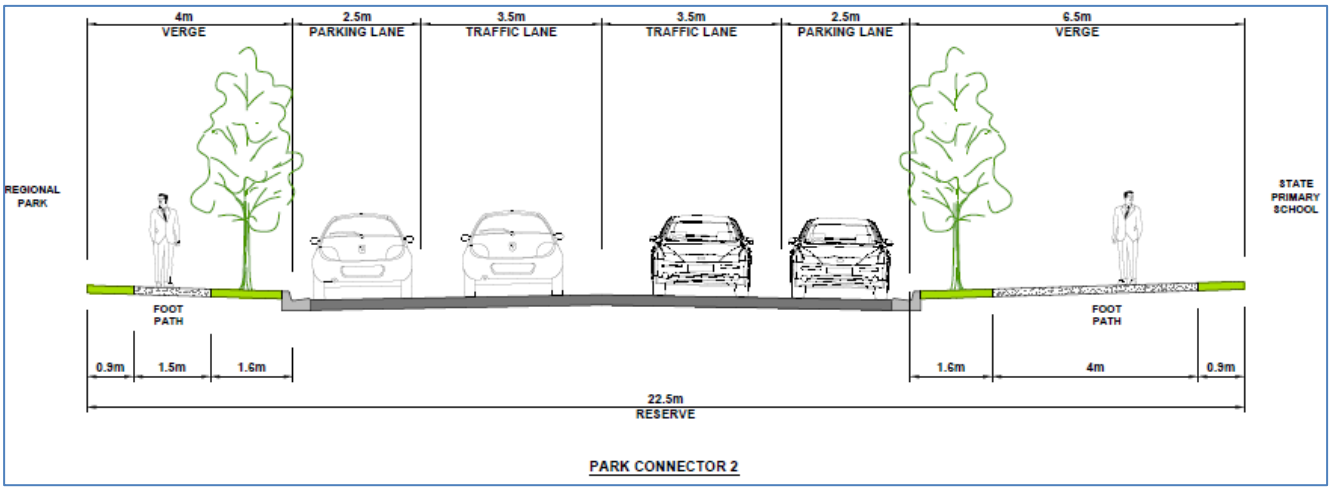

Figure 3-9: Park Connector 2 cross section.

Notes

- Footpaths may be deleted where paths provided in adjacent park
- Parking lanes include 1.5m wide green build outs
- Road reserve may be widened to provide for perpendicular and / or angle parking

3.1.3.2.4 Access Street (Typical)

Access Streets with a 7.5m road carriageway are the predominant profile for tertiary level neighbourhood streets. Due to their width, kerbside parking can be accommodated whilst still allowing for a flow of light traffic.

Table 3-9: Access Street (Typical) Characteristics

Traffic Lanes	Traffic Lane Width	Parking Lane	Median Width	Verge Width	Parking Lane Width	Total Reserve Width	Road Speed	Residential Frontage
2	3.75	Kerbside	N/A	4m	N/A	15.5m	</= 50km/h	Yes

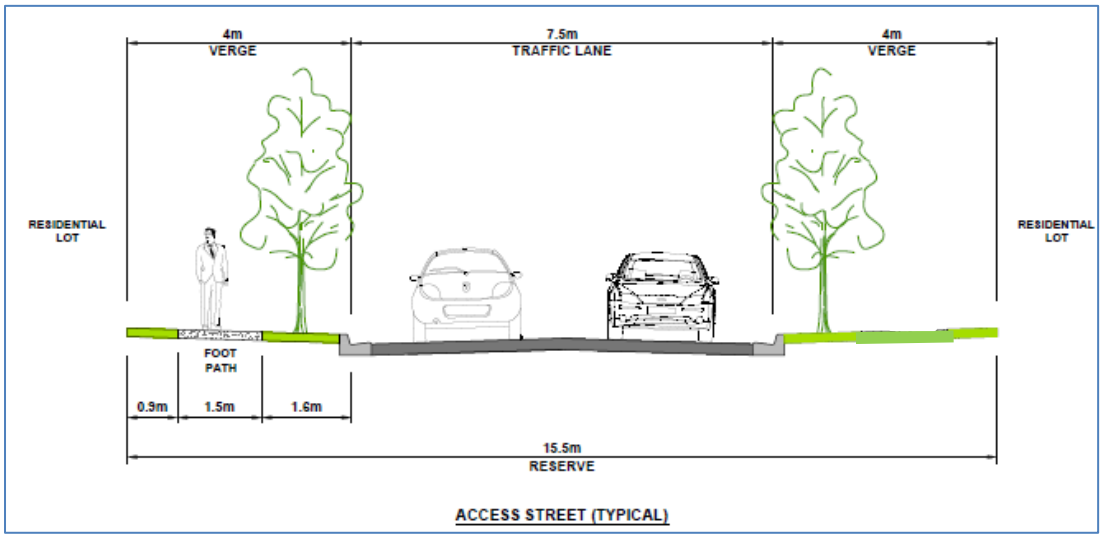

Figure 3-10: Access Street (Typical) cross section

3.1.3.2.5 Access Street (Park)

Access Streets (Park) are specified for a minority of streets where adjoining park space.

Table 3-10: Access Street (Park) Characteristics

Traffic Lanes	Traffic Lane Width	Median Width	Verge Width	Parking Lane Width	Total Reserve Width	Road Speed	Residential Frontage
2	2.75m	N/A	2.2 – 4m	2.3	14.0m	</= 50km/h	Yes

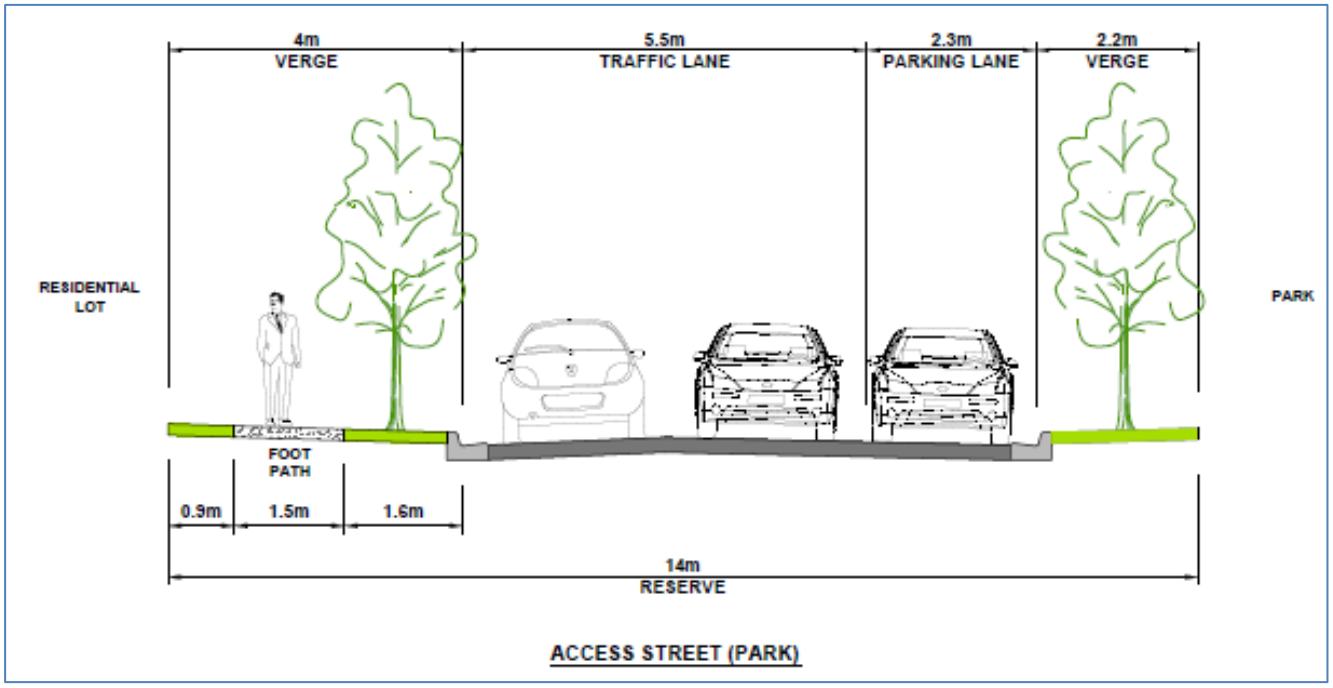

Figure 3-11: Access Street (Park) cross section

Notes

- Foot path may be deleted where a path is provided within the park

3.1.3.2.6 Rural Access Street

Rural Access Streets are proposed for the rural networks associated with the northern interface and eco lots. The street profile has been developed based on a continuation of the existing road profiles.

Table 3-11: Rural Access Street Characteristics

Traffic Lanes	Traffic Lane Width	Bicycle Lane Width	Median Width	Verge Width	Parking Lane Width	Total Reserve Width	Road Speed	Residential Frontage
2	3.5m	N/A	N/A	6.5m	N/A	20m	50km/h	Yes

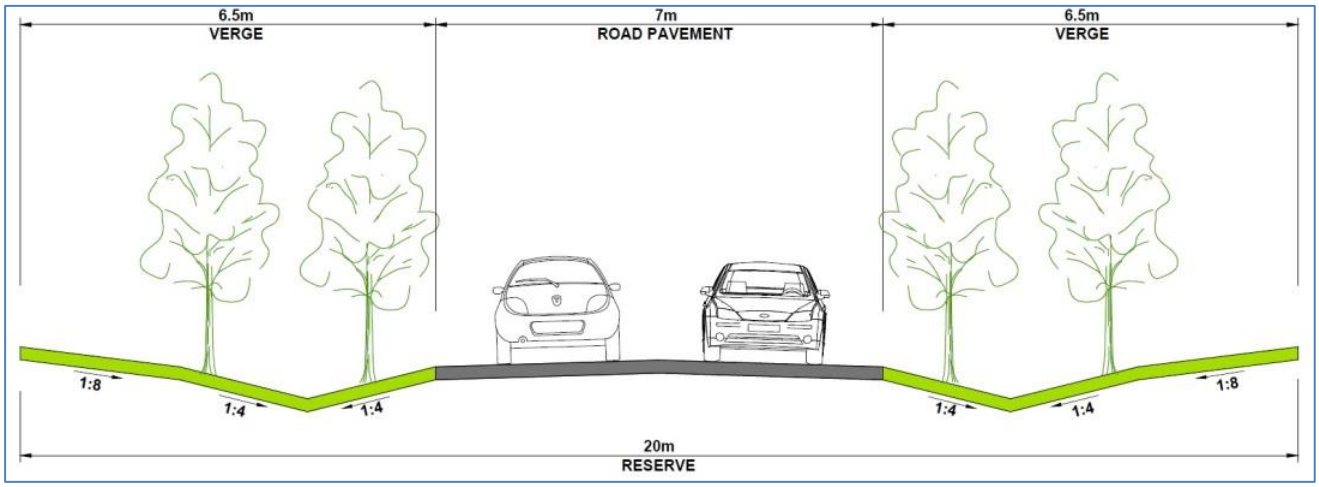

Figure 3-12: Rural Access Street cross section.

3.2 Public Transport Network

Due to the lack of existing public transport networks in the area and the absence of detailed network planning for future bus routes, the public transport network has been developed to allow for future flexibility to implement bus routes as demand warrants. Figure 3-13 shows the ultimate bus network, bus stop locations and catchment accessibility within 400m of a bus stop. The bus stop requirements and locations will be refined progressively in consultation with relevant stakeholders.

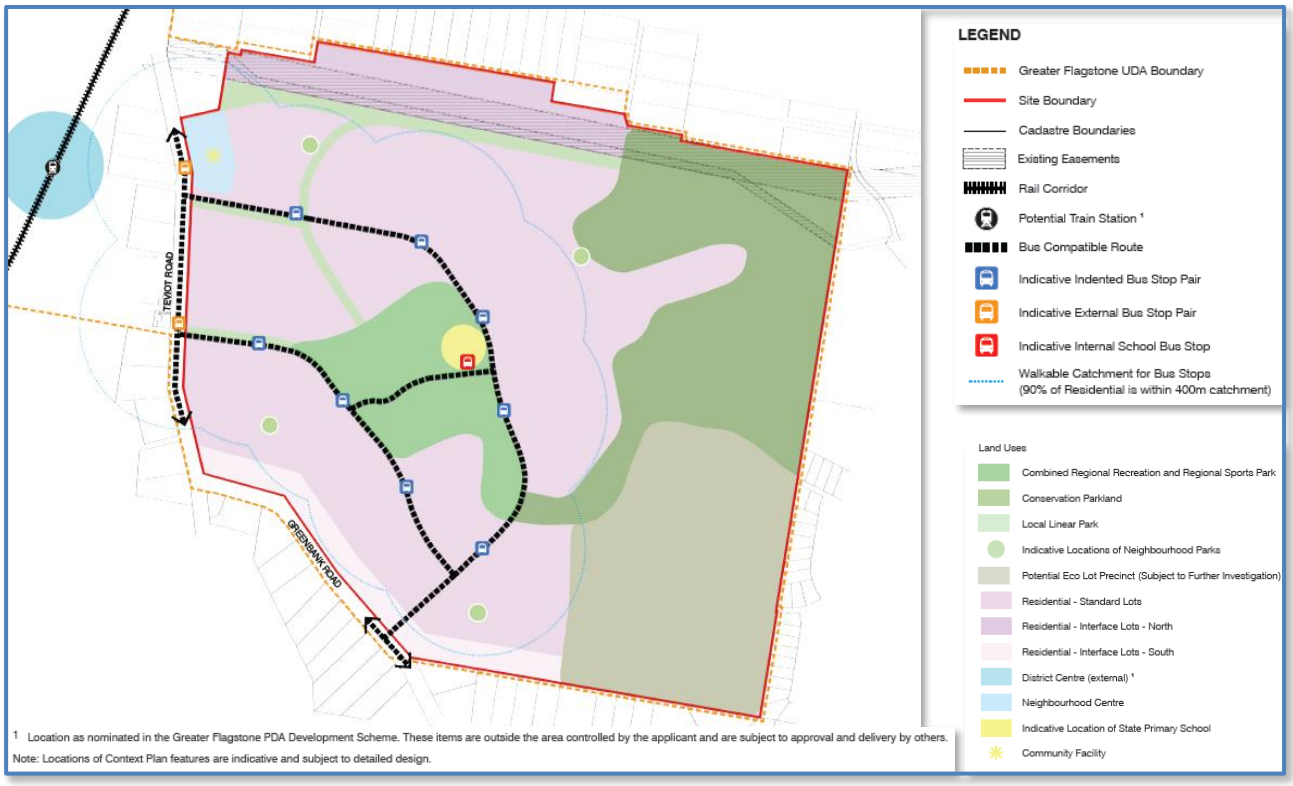

Figure 3-13: Ultimate public transport network.

3.2.1 Bus Compatible Routes

As identified in Figure 3-13, ultimate bus compatible routes have been designated to utilise the Trunk Connectors, Neighbourhood Park Connector and a single Neighbourhood Connector. These route alignments have been selected to achieve the following objectives:

- Allow for ultimate flexibility in the alignment and type of bus service provided;
- Reduce circuitous alignments and 'double-backing' (driving back on already driven routes);
- Maximise catchment accessibility to a bus stop in order to achieve EDQ's objective of providing 90% catchment accessibility within 400m of a bus stop.
- Where for bus scheduling efficiencies (reducing frequent stops) the development cannot achieve 400m bus stop access for 90% of all residents, cycle routes can be introduced to service 90% plus of the catchment within easy access to a key bus stop.

The designated roads have appropriate road profiles to accommodate bus manoeuvrability as they have sufficient pavement widths and traffic lanes which are unimpeded by on street parking. Essentially, any Trunk or Neighbourhood Connector is capable of accommodating bus services, however any future bus services to utilise routes other than those in demonstrated in Figure 3-13 would not have bus stop infrastructure provisions.

3.2.2 Bus Stop Infrastructure & Catchment Accessibility

Placement of bus stops within the development has been undertaken in accordance with the Bus Stop Infrastructure chapter of TransLink's *Public Transport Infrastructure Manual (PTIM) 2015*. The characteristics outlined below describe the particulars of the proposed bus stop infrastructure on-site and are generally in alignment with the PTIM's bus stop planning principles.

- 9 bus stop pairs (18 in total) are proposed within the development's internal road network.
- 2 bus stop pairs (4 in total) are proposed external to the development on Teviot Road.
- A single bus stop is shown within the school. This is to be delivered as part of the school's construction (by others) and is not proposed to be an urban bus stop.
- All bus stops on Trunk Connectors will be indented, however will not require property setbacks as the verge and landscaping space will be utilised to accommodate the bus stop hardstand.
- All bus stops on Neighbourhood Connectors will not be indented, rather utilise the parking lane and require 0.5m from the adjacent traffic lane.
- All inbound (waiting) bus stops within the internal road network will be 'Regular Stops', providing a hardstand, seat, rubbish bin and TGSI tactiles and will be provided at outbound stops.
- Bus stops on Teviot Road will be 'Intermediate Stops' providing a hardstand, bus shelter, rubbish bin and TGSI tactiles.
- The bus stops have been positioned to maximise pedestrian accessibility, being located adjacent to intersecting streets and/or mid-block pedestrian thoroughfares.
- All bus stops will be located within 50m from a pedestrian refuge crossing at Trunk Connectors.
- The refuge island will improve the connectivity to the regional parks and will also help to access the bus stops more safely. To meet the council's guidelines, the refuge islands should be a minimum of 1.5 m wide in width. Additionally EDQ advise that refuge islands are generally not required for the Neighbourhood Connectors.
- Detailed design as part of the subsequent ROL applications will determine site specific details i.e. distances to intersections etc – in accordance with the PTIM and overarching Traffic Regulations.

3.2.3 Network Integration

The integration of the site as part of the public transport network will mature over the life of the development and surrounding greater PDA. The progressive steps of network integration are outlined below:

- It is acknowledged that the PDA Development Scheme requires development to contribute to an interim public transport service for up to 5 years or until the fare box income exceeds 30% of running costs, whichever is sooner, and it is understood that EDQ will likely require commencement of this subsidised service prior to occupation of the 200th residential lot.
- The first lots (0-199) will not have access to any service and access to the network will be reliant upon park 'n' ride – of which two facilities are located within 10km of the development.
- From occupation of the 200th lot, it is envisaged that the subsidised public transport service will extend into the site and connect to the abovementioned park'n'ride facilities.
- As viable demand emerges, it is anticipated that access to the greater network would be enabled through interchange at Browns Plains Bus Station.
- As the Flagstone Town Centre develops, a north-south bus spine would develop along Teviot Road.
- Ultimately, the potential implementation of passenger rail along the interstate corridor would provide a catalyst for strong public transport demand between Flagstone and Brisbane.

The preliminary strategy above will be progressively refined through engagement and collaboration with relevant stakeholders.

3.3 Active Transport Network

This development will be the catalyst for the first active transport infrastructure within the surrounding Greenbank area, proposing a connected network of shared pedestrian / cycle paths, parkland recreational paths as well as mid-block permeability links. Figure 3-14 demonstrates the ultimate active transport network within the site.

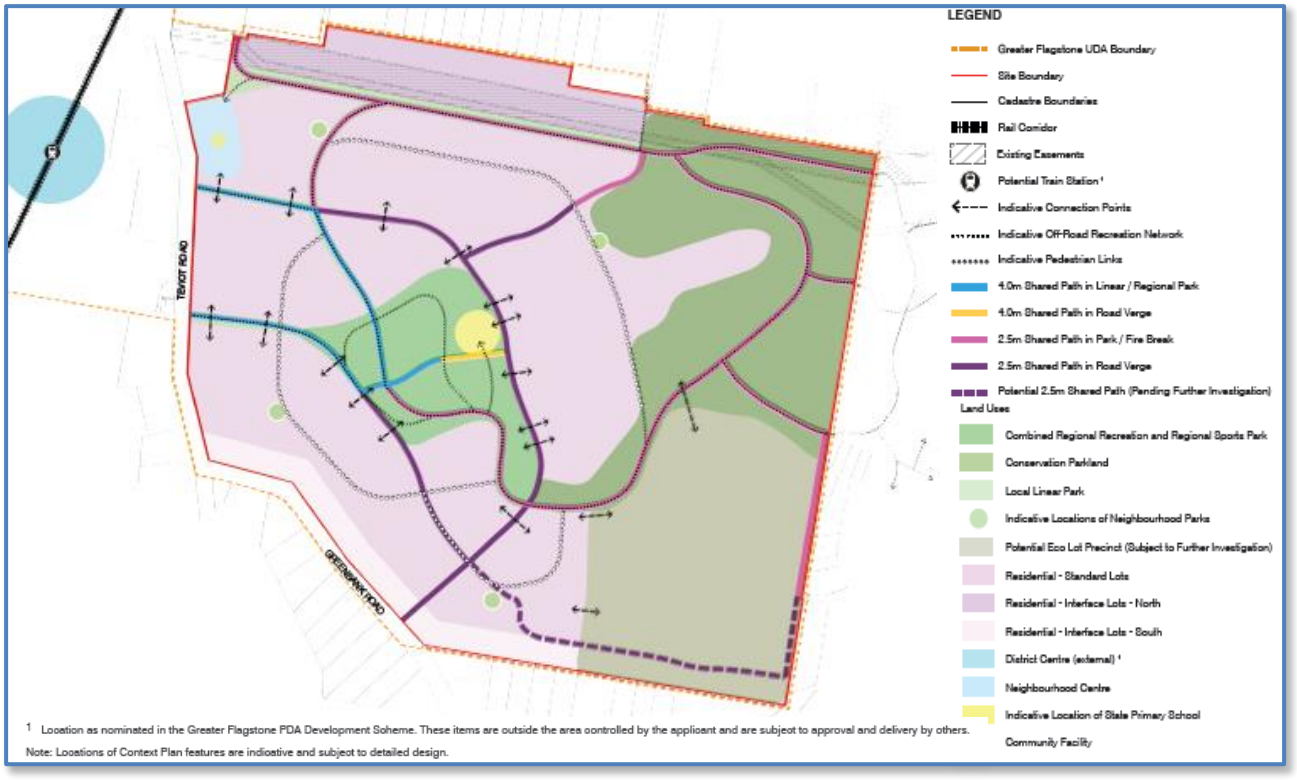

Figure 3-14: Ultimate Active Transport Network

3.3.1 Off-Road Shared Paths

The pedestrian / cycle network has been determined in consultation with EDQ and cognisant of the planned Logan City Council Cycle Network.

The internal network reflects a strong preference for off-road shared paths instead of on road cycle lanes. These paths aim to capture both pedestrians and cyclists in providing both a commuting and recreational function. The internal shared path network connects to the planned LCC cycle network adjacent to the site and has been prepared in consultation with EDQ cognisant of the DILGP planned Cycle Strategy (refer Section 2.2.3.2). The proposed hierarchy and path typologies are shown in Figure 3-15 below. The arrangement provides connectivity between key internal and external destinations such as existing and planned parks, conservation parkland, schools, retail centres, community centres and the potential future rail station. Such connectivity provides permeable site boundaries and promotes pedestrian and cycle movements throughout the estate and the surrounding community.

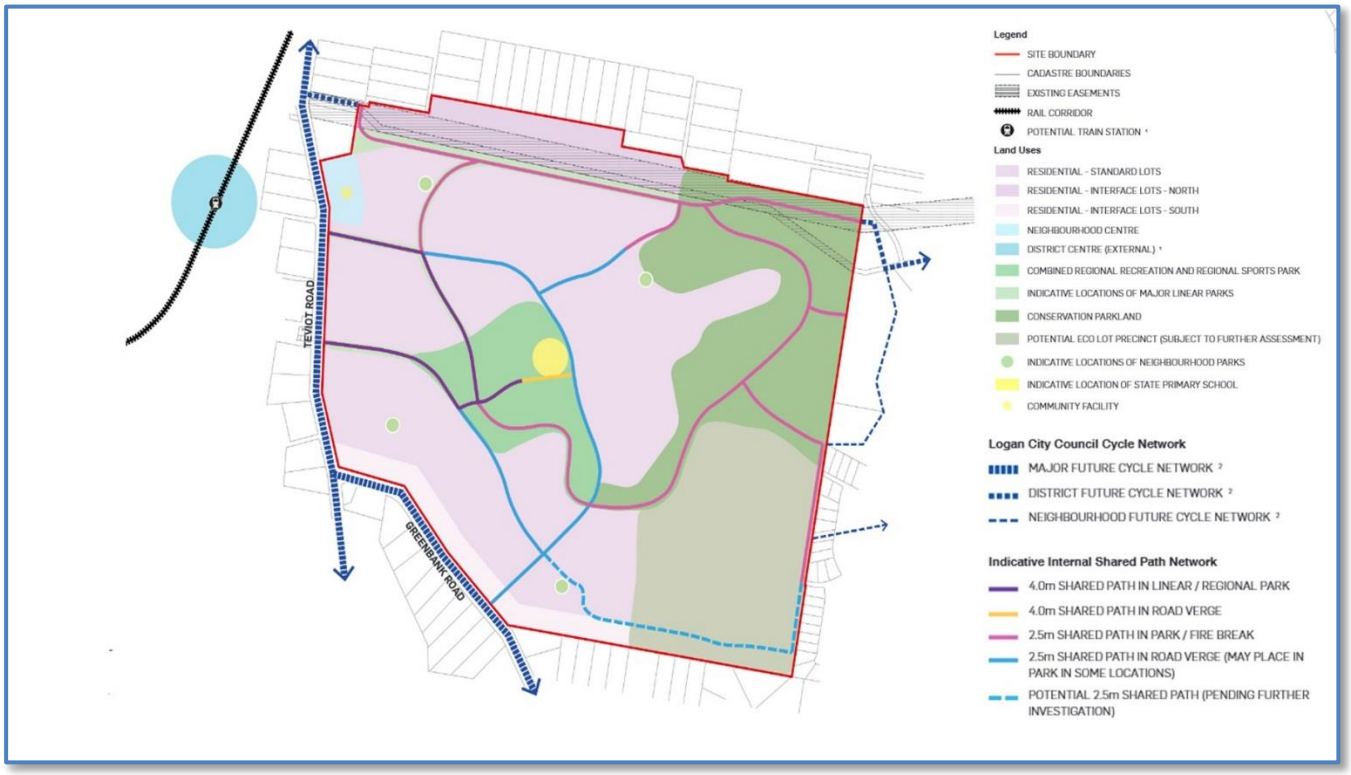

Figure 3-15: Shared Path Network

3.3.2 Footpaths

In accordance with *PDA Guideline No. 1 Residential 30* dated May 2015, footpaths or shared paths will be provided on all urban roads within the development. Refer cross sections in Section 3.1.3.2.1.

3.3.3 Permeability

The Plan of Development (PoD) has been designed as such to eliminate dead-ends and reduce linear block length to less than 200m. In addition to this, a series of mid-block pedestrian links have been provided to provide greater accessibility to bus stops and parklands as well as to provide legible lines-of-sight between blocks.

3.3.4 Supporting Infrastructure

End of trip (EOT) facilities are not required as part of the development due to the lack of land uses that would generate demand for such a facility. Infrastructure to facilitate greater attraction to the recreational

network will be provided as part of the parklands implementation. This includes items such as covered rest areas, drinking fountains and points of interest.

3.4 Parking Provisions

The provision of parking within the development is applicable to the relevant land uses proposed as part of the PoD. The applicable land uses are as follows:

- Residential dwellings
- Outdoor recreation (court & field sports)
- Education (State primary school)
- Retail
- Health

Table 3-12 identifies applicable parking provisions per land use. These provisions have been obtained from multiple sources including:

- *EDQ Residential 30 PDA Guideline No.1* – for residential parking provisions
- *Logan City Council Planning Scheme – Part 9 Development Codes – 9.4.7 Servicing, Access & Parking Code* – for school, recreation, retail and health vehicle parking provisions
- *Cycling Aspects of Austroads Guidelines* – for bicycle parking provisions
- Technical Note 128, Selection and Design of Cycle Tracks

Table 3-12: Parking provision rates

Land Use	Vehicle Parking Provision	Bicycle Parking Provision
Residential	1 covered space and 1 visitor space per dwelling (within the property boundary); plus 0.5 on-street parking space 5.0m in length - in front of dwelling (clear of driveways) or dedicated as part of formalised parking.	N/A
Outdoor Recreation	15 spaces per field; 4 spaces per court;	Unspecified – Appropriate provisions will be made
Education	To be provided within the school site by others	To be provided within the school site by others
Retail (Shopping Centre)	1 space per 20sqm GFA	1 space per 300sqm GFA for employees; plus 1 visitor space per 500sqm GFA over 1000sqm GFA
Health Facility	1 space per 10sqm GFA	1 space per 400sqm GFA for employees; plus 1 visitor space per 200sqm GFA

The provision of wide 7.5m residential streets will enable on-street parking for residential dwellings. Additionally, the two on-site parking spaces required for residential lots will help to reduce on-street parking and enable safer and easier movement of vehicles, pedestrians and cyclists.

The provision of on-street parking is also provided along the Neighbourhood Park Connector to contribute to parking for the district recreational park and primary school, although it is noted that parking spaces will also be provided within each of these areas.

4 Traffic Assessment

This section of the report addresses the traffic component of the development and will assess the following aspects:

- **Traffic demand** – based on trips generated by the development's land uses
- **Traffic capacity** – of the proposed internal roads and external network intersections
- **Traffic impact** – to determine the impact of the traffic generated and identify works contributions to mitigate this impact.

4.1 Traffic Demand

As the development has three segregated networks, assessment of the trip generations will be made in accordance with the land use demand of these networks. The urban network is the largest and will form the base of the traffic modelling assessment. The remaining two networks are relatively small rural networks and as such, will only be subject to desktop assessment. The networks and their composition are identified below.

- Eco lots rural network (70 lots)
- Northern interface lots network (13 lots)
- Urban network (3,255 standard lots, 1,000 student primary school, 7,000sqm GFA retail & 4,000sqm GFA health)

For trip rate calculations, MWH have reviewed the widely adopted *RMS Guide to Traffic Generating Developments* and the *TMR Road Planning & Design Manual (RPDM).* For residential vehicle trip rates, MWH have determined a trip rate of 7 trips per day (as opposed to RMS's 9 trips) as a more realistic, yet conservative approach in distinguishing between vehicle trips and active and/or public transport trips. This rate is consistent with the LCC trip generation rates and will be adopted as part of the traffic demand calculations.

4.1.1 Eco Residential Lots Network

Although subject to further investigation, the proposed eco lots network comprises of 70 rural residential allotments which gain access via Serengetti Drive and Heathcote Court. As Heathcote Court is only accessed via Serengetti Drive, the total demand of trips generated by this network will be absorbed by Serengetti Drive east of the Heathcote Court intersection. The traffic generation for the eco lots network is identified in Table 4-1below.

Table 4-1: Eco Lots Network Traffic Generation

Land Use	Quantity	Daily Rate	Daily Traffic	Peak Hour Rate	Peak Hour Traffic
Residential	70 lots	7 trips per dwelling*	490 vpd	0.85 trips per dwelling	60 trips

* Table 4.2.2.2 – Planned density and planned demand rate for a trunk infrastructure (Logan Planning Scheme 2015 Version 2.1)

4.1.2 Northern Residential Interface Lots Network

The northern interface lots network comprises of 13 rural residential lots and will gain access via Brightwell and Campbell Streets. The traffic generation for the northern interface lots network is identified in Table 4-2 below.

Table 4-2: Northern Interface Lots Network Traffic Generation

Land Use	Quantity	Daily Rate	Daily Traffic	Peak Hour Rate	Peak Hour Traffic
Residential	13 lots	7 trips per dwelling	91 vpd	0.85 trips per dwelling	11 trips

4.1.3 Urban Network

The urban network is the largest and most significant traffic network to be assessed, accounting for 97% of the overall development's residential lot yield. In addition to this, it also comprises of a primary school and neighbourhood retail and health centre. The forecasted traffic generation of the urban network is identified in Table 4-3.

Table 4-3: Urban Network AM Peak Traffic Generation

Land Use	Qty	Daily Rate	Daily Traffic	RMS Rates	Peak Hour Trip Generation
Urban Network (Residential)	3255	7 trips per dwelling	22785	*0.85	^2075
School Precinct	1000 Students	N/A	N/A	**0.2vph/student	200
Neighbourhood Centre	4000m^2 (Medical)	N/A	N/A	***10.4/ 100m^2 (Medical)	416
	7000 m^2 (Retail)	N/A	N/A	****12.3/ 100m^2 (Retail)	^^301

Source:

*****RTA Guide to traffic generating developments- Section 3.3*

******School Travel, Department of Transport and Main Roads, Mode share by Region/ School Travel*

*******RTA Guide to traffic generating developments, extended hours medical centres, Section 3.11.2*

********RTA Guide to traffic generating developments, Shopping Centres, Section 3.6.1*

^ *For above the calculations for residential precincts, it has assumed that 75% of the generated trips will exit the development area during AM Peak and 25% will be the internal trips.*

^^*For above the calculations for retail centre, it is assumed that retail centre will be operating at 35 % of its capacity in AM Peak. (Reference: RMS, "Technical Direction For traffic, safety and transport practitioners", August 2013, Appendix F3-Peak Network Hour*

For further details, please refer to MIRVAC Traffic Modelling Report

Table 4-4: Urban Network PM Peak Traffic Generation

Land Use	Qty	Daily Rate	Daily Traffic	RMS Rates	Peak Hour Trip Generation
Residential Lots	3255	7 trips per dwelling	22785	*0.85	2075
School Precinct	1000 Students	N/A	N/A	**0.042vph/student	42
Neighbourhood Centre	4000m^2 (Medical)	N/A	N/A	***10.4/ 100m^2 (Medical)	^250
	7000 m^2 (Retail)	N/A	N/A	****12.3/ 100m^2 (Retail)	^^560

Source:

**RTA Guide to traffic generating developments, Residential Section 3.3*
***For the above calculation for the school precincts, the school trip generation rate in PM peak has been assumed from another study carried out by MWH in Queensland*
****RTA Guide to traffic generating developments, extended hours medical centres, Section 3.11.2*
*****RTA Guide to traffic generating developments, Shopping Centres, Section 3.6.1*

^For above the calculations for medical centre, it is assumed that medical centre will be operating at 60 % of its capacity in PM peak as the services will be continuing till late at night.

^^For above the calculations for retail centre, it is assumed that the retail centre will be operating at 65 % of its capacity in PM peak. (Reference: RMS, "Technical Direction For traffic, safety and transport practitioners", August 2013, Appendix F3-Peak Network Hour Vehicle Trips Percentage in AM and PM)
For further details, please refer to MIRVAC Traffic Modelling Report

4.2 Traffic Capacity and Traffic Impact Assessment

Outcomes of the traffic modelling are addressed in **Appendix A** and traffic impact assessments will be provided as separate reports for the various application areas within the subject site.

4.3 2051 SIDRA Intersection Analysis

2051 intersection layouts have been considered for the following intersections to ensure that sufficient road reserve is provided within the subject to accommodate future upgrades:

- Teviot Road / Leanne Court/ HOR 2 Intersection
- Teviot Road / Shopping Centre Intersection
- Teviot Road / Pub Lane / HOR 1 Intersection
- Teviot Road / Greenbank Road Intersection
- Greenbank Road / HOR 1 Intersection

The traffic generation assumptions are detailed within **Appendix G** of 2051 Sidra technical note. Additionally, the conceptual 2051 intersection layouts are shown within **Appendix B** of this report.

4.4 2051 Average Weekday Traffic

The 2051 Average Weekday Traffic (AWT) sourced from VLC Zenith model for 2051 is shown in **Appendix C**.

Appendix A Traffic Modelling Report

Mirvac Greenbank Site – Detailed Traffic Modelling

Prepared for Mirvac

07/11/2016

QUALITY STATEMENT

PROJECT MANAGER	PROJECT TECHNICAL LEAD
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CHECKED BY		
Ali Syed	.....	04/11/2016
REVIEWED BY		
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APPROVED FOR ISSUE BY		
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REVISION SCHEDULE

Rev No.	Date	Description	Signature or Typed Name (documentation on file)			
			Prepared by	Checked by	Reviewed by	Approved by

Mirvac

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APPENDICES

1 Introduction

MWH has been commissioned by Mirvac to undertake technical assessment and traffic modelling for its development project located at 138 Teviot Road, Greenbank Queensland (Lot 9 on S312355, Lot 205 on RP845844 and Lot 434 on RP845844). The subject site is within the Greater Flagstone Priority Development Area which falls under the planning jurisdiction of Economic Development Queensland (EDQ). The project is anticipated to yield approximately 3,338 lots in addition to a neighbourhood retail and health centre, primary school, regional parkland and sporting facilities and a designated area of environmental conservation. Development of the subject site is anticipated to be complete by 2031.

The location of the subject site in relation to the PDA is shown in **Figure 1-1** and **Table 1-1** represents key intersections within the study area.

Figure 1-1: Location of Mirvac Site

Table 1-1: Key Intersections within the Base Model

Intersection Number	Intersection Name	Intersection Type
1	Stoney Camp Road / Mount Lindesay Highway East	Roundabout
2	Stoney Camp Road / Mount Lindesay Highway West	Roundabout
3	Mount Lindesay Highway & Kooringal Road	Priority Controlled
4	Stoney Camp Road / Andall Road	Priority Controlled
5	Stoney Camp Road / Teviot Road	Priority Controlled
6	Teviot Road / Middle Road	Priority Controlled
7	Teviot Road / Pub Lane	Signal Controlled

Intersection Number	Intersection Name	Intersection Type
8	Teviot Road / Greenbank Road	Priority Controlled
9	Greenbank Road / Crowson Lane	Priority Controlled
10	Crowson Lane / Greenhill Road	Priority Controlled
11	Crowson Lane / Mount Lindesay Highway West	Roundabout
12	Crowson Lane / Mount Lindesay Highway East	Roundabout

2 Objective

The objectives of this study are as follows:

- Develop a base year model which is calibrated and validated to 2015 traffic data
- Develop the following future year models (2031) using 2031 matrices provided by VLC:
  - 2031 base case without development of the Mirvac site (2031 Do Nothing Model);
  - 2031 rectified base case without development of the Mirvac site (2031 Do Nothing Model (Rectified)); and
  - 2031 development case with development of the Mirvac site (2031 Do Something Model).
- Identify capacity issues throughout the network for the current and future year.
- Document the modelling process including base model development, calibration and validation.
- Document the key findings of this study

The purpose of the various 2031 models is to provide a clear understanding of network upgrades that would be required by 2031 if the subject site was not developed, and then assesses the additional upgrades that result from the traffic generated by the Mirvac site.

3 Data Sources

3.1 Introduction

This section describes the data that was collected to inform the development of trip matrices and calibration/validation of the Base 2015 model. This includes a description of the location and type of traffic surveys that were commissioned in November 2015 as part of the study, and details of other data that was provided to MWH to assist with the development of the model. This section summarises the data used for developing the base and future models.

3.2 Traffic Counts

Classified intersection counts were undertaken starting 12AM Thursday, 5th of November 2015 for 24 hours in 15 minute increments at the locations shown **Figure 3-1** and in listed in **Table 3-1**. This data set was used to inform the development of trip matrices and to support model calibration procedures.

Figure 3-1: Intersection Count Locations

Table 3-1: List of Intersection Count Locations

Intersection Number	Intersection Name	Intersection Type
1	Stoney Camp Road / Mount Lindesay Highway East	Roundabout
2	Stoney Camp Road / Mount Lindesay Highway West	Roundabout
3	Mount Lindesay Highway & Kooringal Road	Priority Controlled
4	Stoney Camp Road / Andall Road	Priority Controlled
5	Stoney Camp Road / Teviot Road	Priority Controlled
6	Teviot Road / Middle Road	Priority Controlled
7	Teviot Road / Pub Lane	Signal Controlled

Intersection Number	Intersection Name	Intersection Type
8	Teviot Road / Greenbank Road	Priority Controlled
9	Greenbank Road / Crowson Lane	Priority Controlled
10	Crowson Lane / Greenhill Road	Priority Controlled
11	Crowson Lane / Mount Lindesay Highway West	Roundabout
12	Crowson Lane / Mount Lindesay Highway East	Roundabout

The peak hours were found to be as follows:

- AM Peak: 8-9 AM
- PM Peak: 4-5 PM

Trip balancing was performed for both lights and heavy vehicles to ensure that the model would match the observed data. The intersection at Teviot Road / Shopping Centre north of the Teviot Road / Pub Lane intersection was found to be significant enough to warrant modelling. As such, it was added as the 13th intersection.

Traffic counts were not collected on the Mount Lindesay Highway so data was instead obtained from the Department of Transport and Main Roads (TMR), being hourly averages over five weeks from Monday 26th of October 2015 to Sunday 29th of November. The Thursday 8-9AM volumes and Thursday 4-5PM volumes were used for the AM and PM peak respectively.

3.3 Travel Times

Travel times were obtained from TomTom for the purposes of validating the model. The data was an average from Tuesday 6th October 2015 to Thursday 10th December 2015 for both 8-9AM and 4-5PM. However, only the northbound data was available from Greenbank Road South of Crowson Lane to Middle Road East of Teviot Road as shown in **Figure 3-2**.

Figure 3-2 Travel Time Data Location

4 Base 2015 Model Development Methodology

This section explains the methodology adopted to develop the 2015 transport model of the study as well as any deviations from standard modelling procedures and the associated reasoning. The model calibration and validation criteria set out in DMRB have guided the model development methodology. The modelled periods represent the AM (8:00- 9:00) and PM (4:00 – 5:00) peak periods for a typical neutral weekday. The modelled periods include the peak hours and 30 minute warm-up and cool-down periods.

Table 4-1: Summary of the model specifications.

Model Development	Specifications
Time Periods	• Weekday AM (8:00- 9:00) • Weekday PM (4:00 – 5:00)
Simulation Area	• Study area shown in **Figure 4-1**
Link Speeds	• Mt Lindesay Highway (Speed = 90KM/hr) • Teviot Rd (Speed = 70KM/hr) • Stoney Camp Rd (Speed = 70KM/hr) • Crowson Lane (Speed = 80KM/hr)
Model Calibration	Model Calibrated to Classified Intersection Counts
Model Validation	Model Validated to Travel Time Surveys

4.1 Modelling Software

Simulation modelling software AIMSUN has been used as it offers accurate traffic modelling with detail sufficient for the purposes of this study.

The version of AIMSUN used for this project was version 8.1.1 which was the latest available at the time. **Table 4-2** represents the model specifications used in the AIMSUN model.

Table 4-2: AIMSUN Model Specifications

Model Development	Specifications
Time Periods	• Weekday AM (8:00- 9:00) • Weekday PM (4:00 – 5:00)
Warm Up/ Cool down Periods	30 minute time intervals • AM (7:30-8:00, 9:00-9:30) • PM (3:30-4:00, 5:00-5:30)
Assignment	Dynamic User Equilibrium (DUE)
Vehicular Classes	Light and Heavies
Signal Controllers	Fixed
Seed Matrix	28, 560, 2849, 7771 and 86524

4.2 Network Coding

Aerial photography images from Nearmaps were sourced to provide a suitable overlay for developing the model network. These aerial photographs were also cross-checked with on-site observations to confirm the accuracy of the model network configuration. Road network distances within the model have been checked and coded in proper scale. Aerial photographs were used as the basis for the positioning of kerbs and stop lines. Adjustments were made to confirm that vehicle progression along links is realistic. The base model geometry was generated over the scaled background including actual number of lanes, lane widths, lane closures, turn restrictions, speed zones and traffic control measures.

Only one intersection was signalised: Teviot Road / Pub Lane, the signal phasings were based on the SIDRA assessment undertaken by MWH previously. In total there were 18 zone centroids in the model network. The location of these centroids can be seen in **Figure 4-1.**

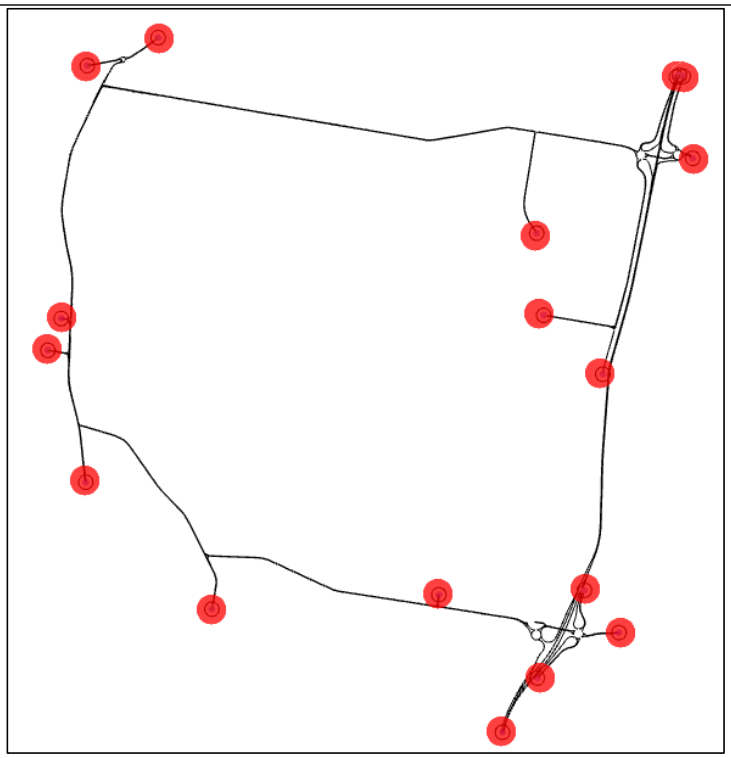


Figure 4-1 Base Model Centroid Locations

4.3 Demand Matrices

The traffic demand within the study area is in the form of an Origin-Destination matrix developed using intersection turning counts. Zones represent the origins and destinations of all trips in the study area. A list of centroids locations within the model is shown in **Figure 4-1.**

The intersection turning counts were analysed to assess the peak period traffic profiles within the study area. The analysis showed a range of markedly different profiles at key locations which on average did not show a significantly 'peaked' hourly profile. Therefore, and for consistency with forecast scenarios, a flat profile was adopted for each peak period.

Based on a review of existing classified count data at the locations presented in **Figure 3-1**, this model includes a simple but appropriate assumption on vehicle composition. In the AM peak, the model is being split by light (94%) and heavy (6%) vehicle classifications whereas in PM peak, the model is split by light (93%) and heavy (7%) respectively.

'LinSig's matrix estimation tool' was used to establish a set of matrices based on the traffic counts (refer **Figure 4-2**).

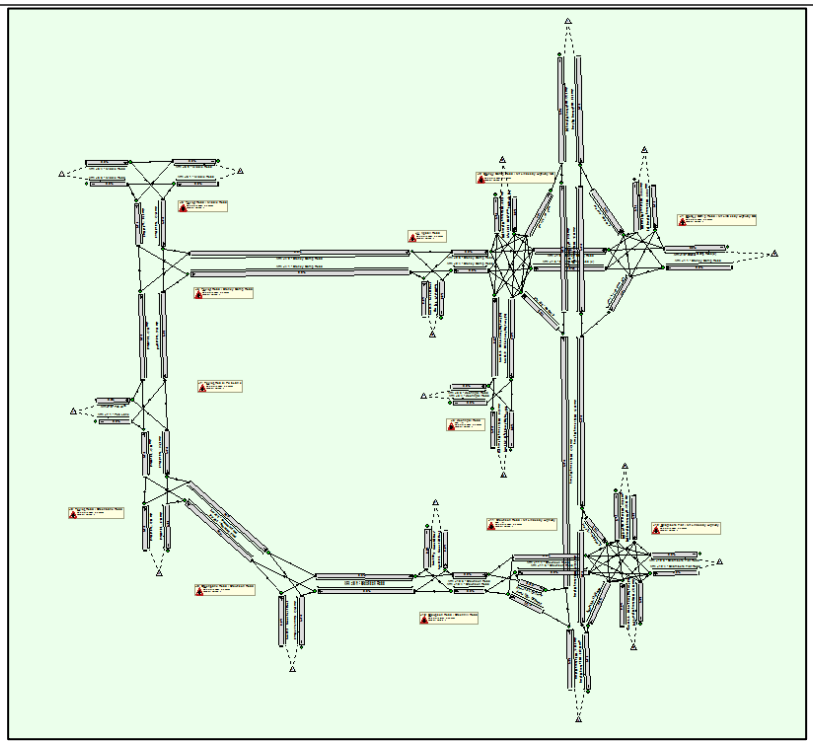


Figure 4-2 LinSig Model (for initial OD estimation)

Demand matrices were generated separately for AM / PM and Light Vehicles / Heavy Vehicles resulting in 4 demand matrices in total. The OD matrices were then imported into AIMSUN for each case.

4.4 Model Calibration and Validation

The model calibration process confirms whether the developed model adequately aligns with the observed data in terms of traffic survey counts. Model validation serves as confirmation that the model represents the current traffic condition and journey patterns in the study area. A model must fulfil the criteria for the calibration and validation to give realistic results. The model calibration and validation data is derived from an average of five random seeds.

4.5 Model Calibration:

The base year model was calibrated against a set of survey data for each hour of the model except warm-up and cool-down periods. Model calibration is the process that adjusts model parameters to adequately reflect the observed traffic behaviour and conditions in the study area. The calibration guidelines were based on the *Traffic Modelling Guidelines* developed by RMS which are very similar to TMR SATURN Modelling guidelines.

On any given road network, traffic volumes will vary from day to day, and from location to location. The GEH statistic is used to confirm the statistical accuracy and significance of any deviations between the observed and modelled traffic flow values. The GEH statistic provides a more reliable comparison between these flow values compared to relative and absolute measures, which can be distorted by virtue of scale.

As a result, the purpose of the calibration criterion is to provide a satisfactory correlation between the observed and modelled traffic flow volumes at all key intersections. The calibration criterion for traffic models is a minimum of 85% of intersection GEH values must be less than 5. The GEH compares the difference between the observed traffic flows and modelled traffic flows through the following formulae:

$$\mathrm{GEH} = \sqrt{\frac{(\mathrm{V_O} - \mathrm{V_M})^2}{0.5(\mathrm{V_O} + \mathrm{V_M})}}$$

- V_O = Observed traffic flow (vehicles / hour)
- V_M = Modelled traffic flow (vehicles / hour)

Table 4-3 documents the RMS criteria used to calibrate the model.

Table 4-3: RMS Calibration Criteria

Indicator/ Measure	Description of Criteria		Acceptability Criteria
	Link	Turn	
GEH	GEH < 5 for individual flows	GEH < 8 for individual flows	85% of all cases (preferably > 95% on key locations
Scatter Plot	Coefficient of Determination R^2 > 0.9	Coefficient of Determination R^2 > 0.9	Over all observations

4.6 Model Stability

In accordance with best practice and the Roads and Maritime Services Guidelines, the model stability was assessed using the RMS' recommended seed values of 28, 560, 2849, 7771 and 86524 to ensure the robustness of the models. In addition, 28 was determined as the median seed number for validation of the model. Model stability was determined based on the current number of vehicles in the network.

The assessment shows that the base model presents stable operation with limited variation between the model runs with differing simulation seeds.

The calibration and validation results for each scenario presented in this report are based upon the mean simulation model run, which is considered to provide a good representation of the average model operation. The following seed values are used for each peak period:

- AM Peak 28
- PM Peak 28

The model calibration process was undertaken for each hour of the AM and PM peak period models. **Section 4.7** documents the results of the model calibration process.

4.7 Model Calibration Results

The modelled intersection flows provide a good fit with survey data at most locations and the level of calibration achieved for the AM and PM Peak models are considered appropriate. Summaries of the calibration results for each peak period are provided in **Appendix A**

RMS Guidelines require that at least 85% of individual turn volumes should pass the criteria of GEH equal or less than 5.0. **Table 4-4** represents results that indicate that more than 85% of the links are satisfying the GEH criteria in both Peaks.

Table 4-4: Intersection Volumes Calibration Results Summary

Peak Periods	No of Comparisons	Pass	Fail	% Passing GEH Criteria
AM Peak	62	62	0	100%
PM Peak	62	62	0	100%

Refer to **Appendix B** for R-Squared graphs for both AM and PM peak periods which represent a good fit with values of 0.98 and 0.98 respectively.

4.8 Model Validation

Upon calibration of the model, a separate data set is required to be used to validate the model. This is an important comparison since journey times can affect driver route choice through the model and therefore have a significant impact on traffic volumes, congestion and delays. The data set chosen for the model validation process was the comparison between observed and modelled travel times on key routes in the network. As detailed in **Section 3.3**, there is one travel time route chosen for the validation process. This route passes through almost the entire length of the model area.

- Greenbank Road South of Crowson Lane to Middle Road East of Teviot Road (Northbound)

Table 4-5: RMS Validation Criteria

Travel Time Target Validation Criteria (RMS Guideline)
Average modelled journey time to be within 15 % or minute (whichever is greater) of average observed journey time for full length of route.

Table 4-6 summarises the comparison of observed and modelled travel times and the validation test outcomes.

Table 4-6: Travel Time Calibration Results

Peak Period	Routes	Surveyed Travel Time (sec)	Modelled Travel Time (sec)	Diff (sec)	Check
AM	Greenbank/Crownson Intersection to Middle Road Intersection	279	275	4	pass
PM	Greenbank/Crownson Intersection to Middle Road Intersection	269	284	15	pass

DMRB criteria for journey time validation states that 85% of modelled routes should achieve acceptable tolerance levels in comparison to observed data. **Table 4-7** shows that 100 percent of journey time routes pass the DMRB model acceptability criteria by being within 15% or one minute of the observed journey times

Table 4-7: Journey Time Validation Results Summary

Peak Periods	No of Comparisons	Pass	Fail	% Passing GEH Criteria
AM Peak	1	1	0	100%
PM Peak	1	1	0	100%

4.9 Summary of 2015 Base Model Calibration and Validation

The Base 2015 models for AM and PM peaks have been successfully calibrated against the intersection volumes which in turn represents a good correlation between observed and modelled values as described in **Section 4.5**. The AM and PM model are further validated through travel time surveys for the major arterial (mentioned in **Section 4.8)**. In all cases, Base 2015 Models (AM and PM) pass the calibration and validation criteria provided by RMS which shows that this model can act as a good candidate for the future forecast traffic volumes and scenarios.

5 Future 2031 Model Development

5.1 2031 Scenarios

Three 2031 model scenarios have been developed as follows:

- 2031 base case without development of the Mirvac site (2031 Do Nothing Model);
- 2031 rectified base case without development of the Mirvac site (2031 Do Nothing Model (Rectified)); and
- 2031 development case with development of the Mirvac site (2031 Do Something Model).

The purpose of the various 2031 models is to provide a clear understanding of network upgrades that would be required by 2031 if the subject site was not developed, and then assesses the additional upgrades that result from the traffic generated by the Mirvac development.

The 2031 Do Nothing Model identifies parts of the network that are already below an acceptable level of service in 2031 without the influence of the Mirvac site (i.e. assumes that the Mirvac site has not been developed).

The 2031 Do Nothing Model (Rectified) includes network upgrades to the 2031 Do Nothing Model to achieve acceptable levels of service for all relevant parts of the network. This model also assumes that the Mirvac site has not been developed.

The 2031 Do Something Model assumes that the Mirvac development is complete, and that the network has been upgraded in accordance with the 2031 Do Nothing Model (Rectified). Requirements for further upgrades based on the influence of the Mirvac development are assessed in this scenario.

The 2031 Do Something model seeks to provide:

- A tool to assess the operational impact of physical changes to the Mirvac development road network based on concept designs
- A tool to assess the operational impact of other adjoining roads due to Mirvac development.
- Evidence to stakeholders on the performance of the new Mirvac development and to provide sufficient information for the purposes of decision making.

5.1.1 Demand Matrices

The 2031 traffic flows were obtained from an extracted cordon out of 2031 Zenith Model (2031 Base model (VLC reference 'Run132'), completed on 12/3/2016) developed by VLC. This was then imported directly into the AIMSUN model. The Do-Nothing and Do-Nothing (Rectified) scenarios utilise the VLC matrices without Zone 1280 and 1281 assuming that there won't be any development traffic loaded on the network within these scenarios.

5.1.2 Level of Service Criteria

For all three scenarios, the respective networks were coded and the level of service for the signalised intersections were determined using the average delay over the intersection recommended in HCM 2010

(Exhibit 18-4). The thresholds for intersection level of service (LOS) are summarised in **Table 5-1**. For roundabouts and priority intersections, the worst movement is used to represent the intersection LOS.

Table 5-1: HCM 2010 LOS Criteria

Level of Service	Control Delay (Sec/veh)	
	Signalised Intersections	Unsignalised Intersections
LOS A	d <= 10	d <= 10
LOS B	10 < d <= 20	10 < d <= 15
LOS C	20 < d <= 35	15 < d <= 25
LOS D	35 < d <= 55	25 < d <= 35
LOS E	55 < d <= 80	35 < d <= 50
LOS F	d> 80	d> 50

5.2 2031 Do Nothing Model

5.2.1 Network

The 2031 Do-Nothing scenario represents the existing transport network under 2031 demand conditions assuming that the Mirvac development is not in place and that no network upgrades have occurred since the 2015 Base Case. **Figure 5-1** below shows the 2031 Do-Nothing network.

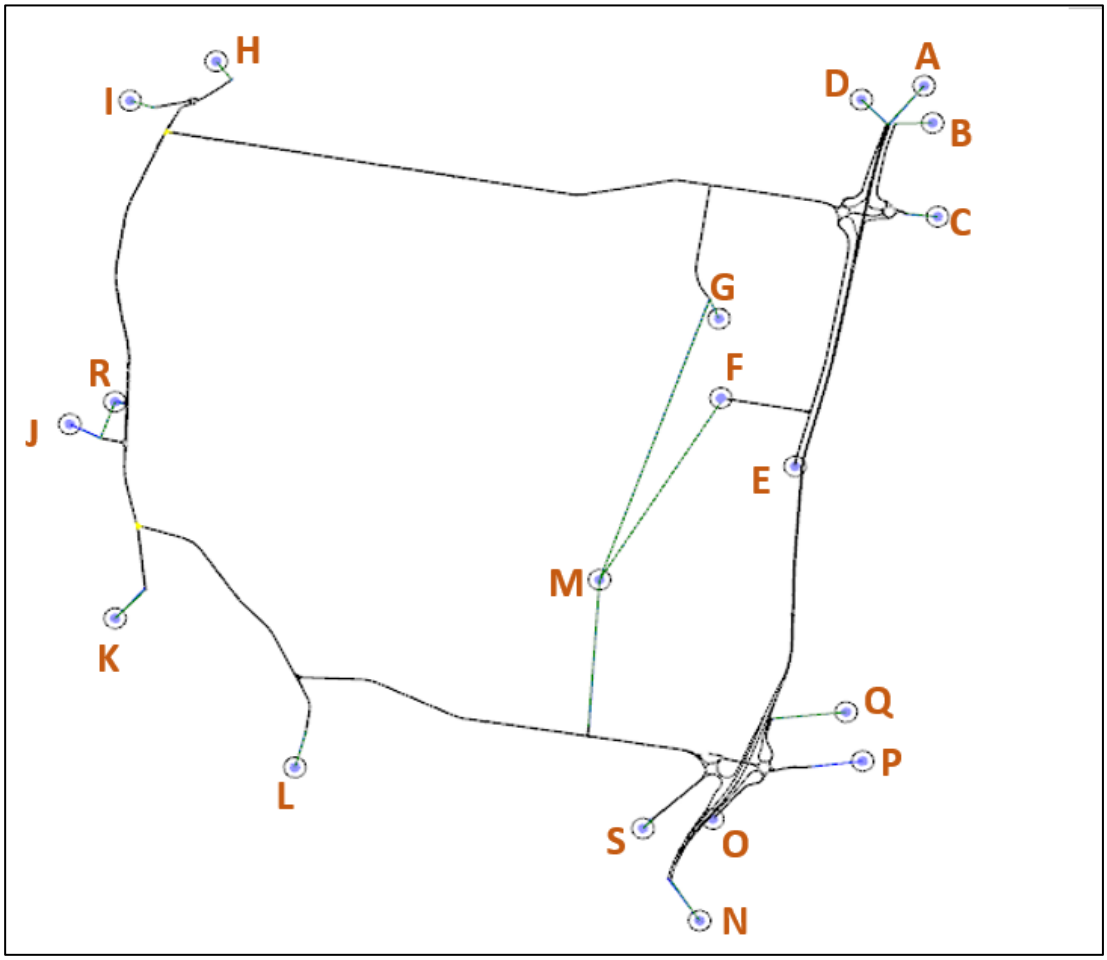


Figure 5-1: 2031 Do-Nothing Network

5.2.2 Intersection Performance

Table 5-2 provides a summary of performance measures for the Do-Nothing scenario.

Table 5-2: 2031 Do Nothing Intersection Performance Measures

Intersection	Intersection Control Type	2031 Do Nothing			
		AM Peak		PM Peak	
		Delay	LOS	Delay	LOS
Teviot Road / Middle Road	Roundabout	50.9	F	55.1	F
Stoney Camp Road/Mount Lindesay Highway Northbound	Roundabout	15.0	C	13.1	B
Teviot Road/ Stoney Camp Road	Priority	5.3	A	181.4	F
Tevoit Road/ Greenbank Shopping Centre	Priority	5.2	A	1.5	A
Teviot Road / Pub Lane	Signal	20.2	C	18.0	B
Teviot Road / Greenbank Road	Priority	14.8	B	65.9	F
Greenbank Road / Crowson Lane	Priority	4.0	A	5.3	A
Stoney Camp Eastern Roundabout	Roundabout	4.2	A	10.5	B
Crowson Lane Roundabout West	Roundabout	8.7	A	7.4	A
Crowson Lane Roundabout East	Roundabout	17.2	C	35.1	E

* LOS for un-signalised priority-controlled intersection is based on the worst affected movement.

The network experiences delays and queues under the 2031 AM and PM peak Do-Nothing scenario. A detailed summary of the performance of each study intersection is provided below:

1. Teviot Road / Middle Road Roundabout – This roundabout operates at LOS 'F' during both the 2031 Do-Nothing AM and PM peak periods.
2. Stoney Camp Road/Mount Lindesay Highway Northbound – This roundabout operates at LOS 'C' and LOS 'B' during the 2031 Do-Nothing AM and PM peak periods. The eastbound approach of this roundabout experiences delays with queues extending back to the Stoney Camp Road / Andall Road intersection.
3. Teviot Road / Stoney Camp Road – This intersection operates at LOS 'A' and 'F' during the 2031 Do-Nothing AM and PM peak periods, respectively. The westbound left turn from Stoney Camp Road is the worst affected movement at this intersection and causes the intersection to fail.
4. Teviot Road / Greenbank Shopping Centre – This intersection operates at LOS 'A' during both the 2031 Do-Nothing AM and PM peak periods.
5. Teviot Road / Pub Lane – This intersection operates at LOS 'C' and 'B' during the 2031 Do-Nothing AM and PM peak periods, respectively.
6. Teviot Road / Greenbank Road – This intersection operates at LOS 'B' and 'F' during the 2031 Do-Nothing AM and PM peak periods, respectively. The westbound approach of Greenbank Road is the worst affected movement at this intersection and causes the intersection to fail.
7. Greenbank Road / Crowson Lane - This intersection operates at LOS 'A' during both the 2031 Do-Nothing AM and PM peak periods.
8. Stoney Camp Roundabout (East) - This roundabout operates at LOS 'A' and LOS 'B' during the 2031 Do-Nothing AM and PM peak periods.
9. Crowson Lane / Mount Lindesay Highway Northbound - This roundabout operates at LOS 'A' during both the 2031 Do-Nothing AM and PM peak periods.
10. Crowson Lane / Mount Lindesay Highway Southbound - This roundabout operates at LOS 'C' and LOS 'E' during the 2031 Do-Nothing AM and PM peak periods.

5.3 2031 Do Nothing Model (Rectified)

5.3.1 Network Layout

The network layout for the 2031 Do Nothing Model (Rectified) is as per the 2031 Do Nothing Model (refer **Section 5.2.1**)

5.3.2 Network Upgrades

This iteration of the model includes network upgrades required to rectify level of service deficiencies identified in the 2031 Do Nothing Model (refer **Section 5.2.2**)

The 2031 Do Nothing (Rectified) scenario represents the existing transport network with the following improvements under 2031 demand conditions assuming that the Mirvac development is not in place.

1. Conversion of the Middle Road / Teviot Road roundabout into a three arm signalised intersection as shown in **Figure 5-2.**

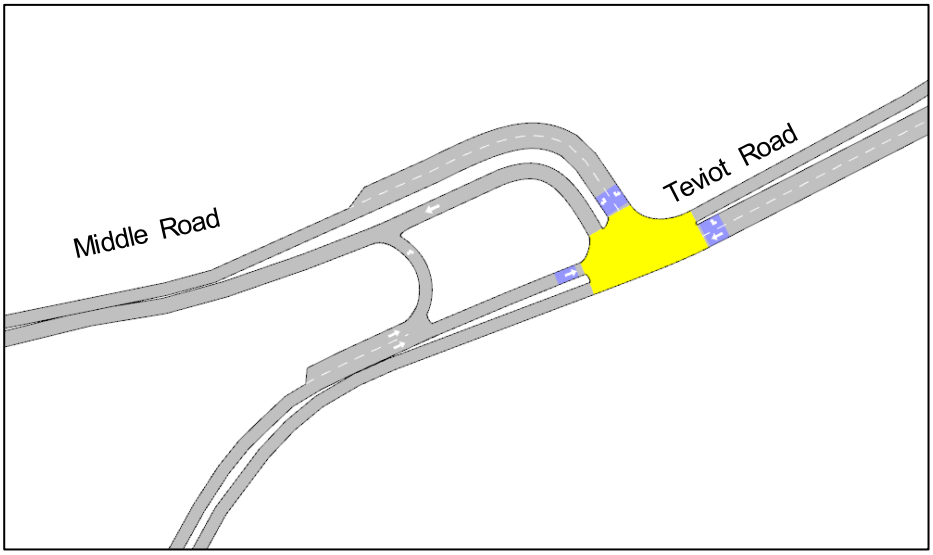


Figure 5-2: 2031 Middle Road / Teviot Road Signalised Intersection

2. Widening the Stoney Camp Road / Mount Lindesay Highway roundabout to provide two circulating lanes as shown in **Figure 5-3.**

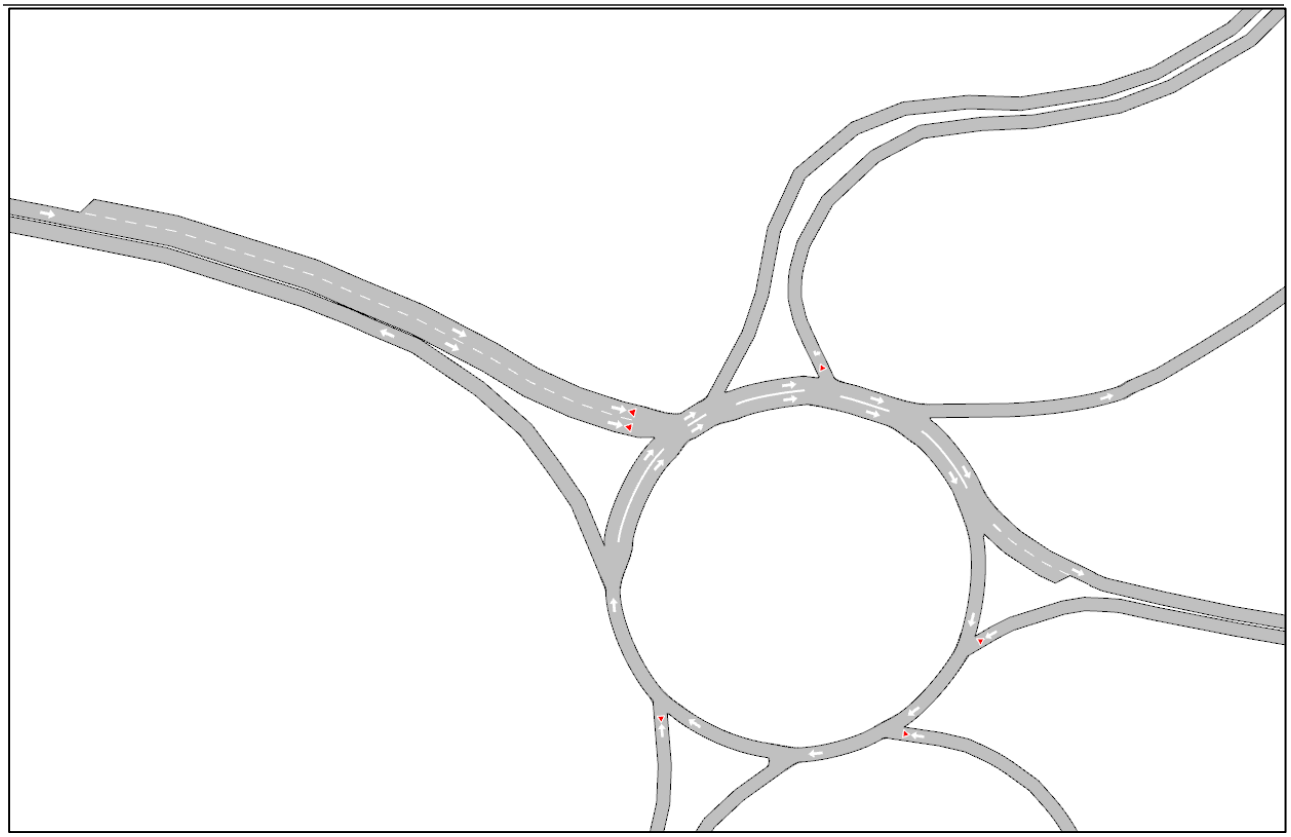


Figure 5-3: 2031 Stoney Camp Road /Mount Lindesay Highway Roundabout

3. Widening of the southbound direction of Teviot Road to provide two southbound through lanes at the Stoney Camp Road / Teviot Road intersection to as shown in **Figure 5-4.** This improvement also assumes signalisation of this intersection.

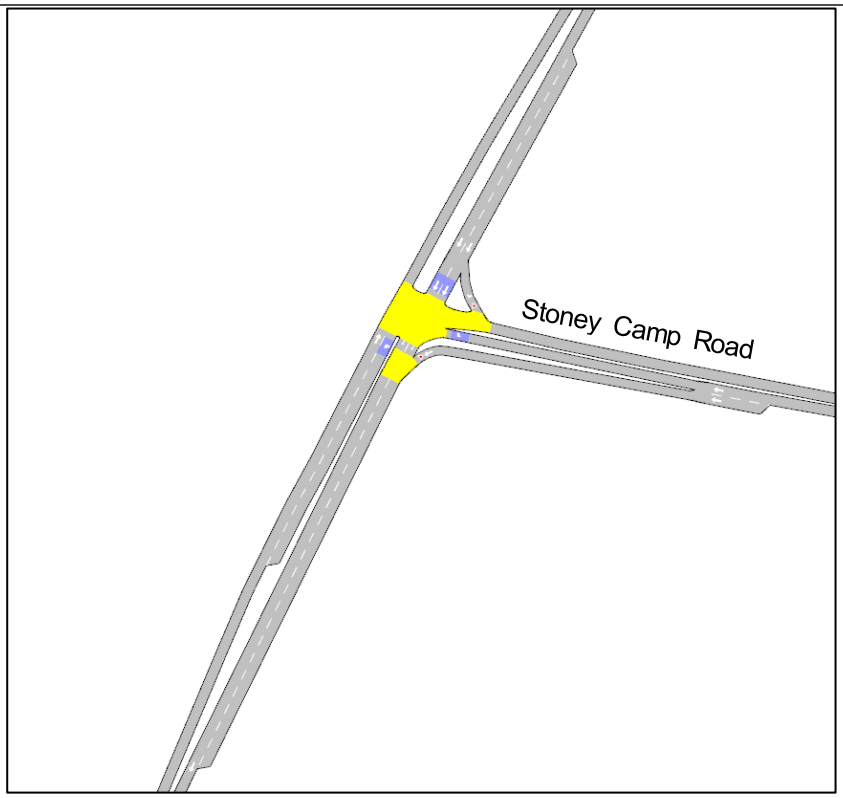


Figure 5-4: 2031 Stoney Camp Road / Teviot Road Improvements

4. Widening Teviot Road to provide two through lanes between Pub Lane and Leanne Court as shown in **Figure 5-5.**

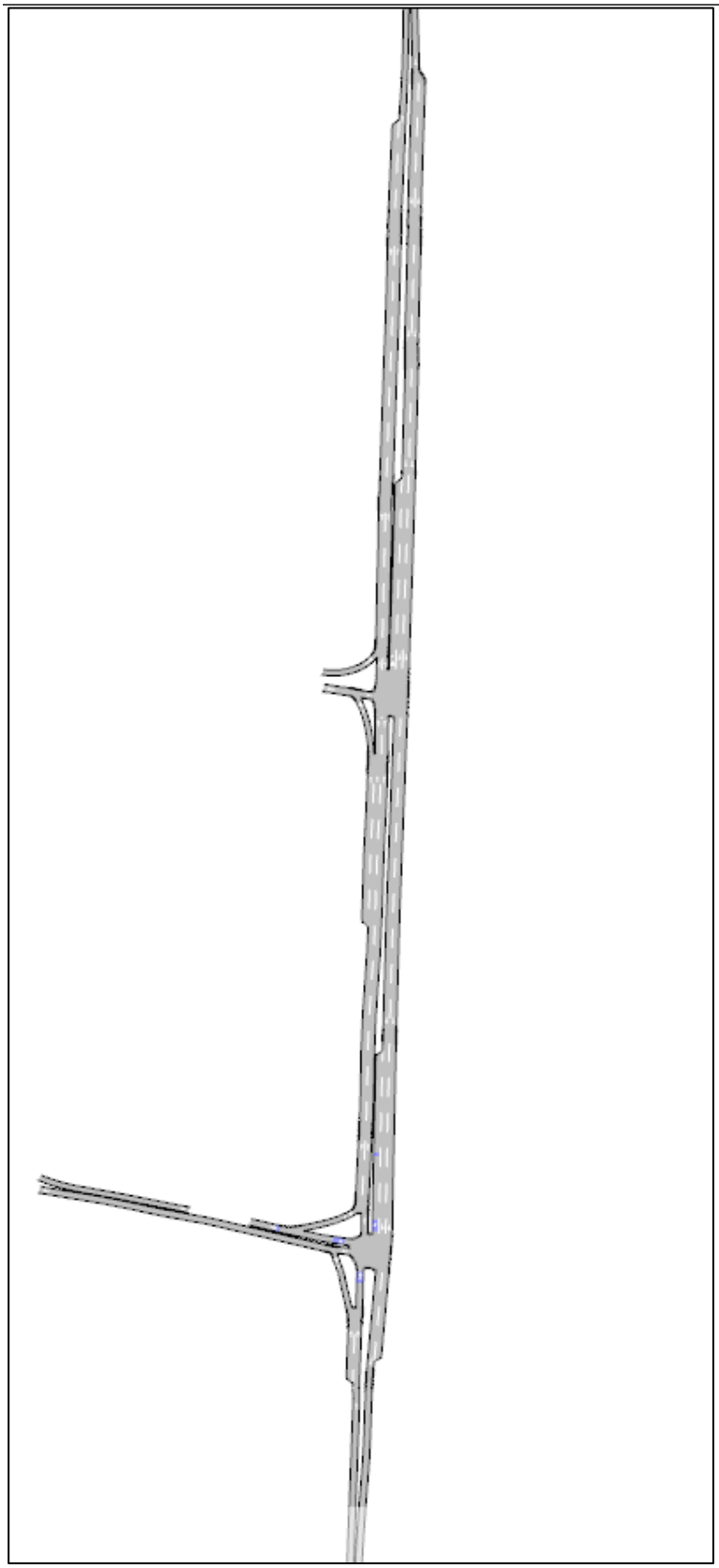


Figure 5-5: 2031 Teviot Road Improvements

5. Additional right turn bay of 100 m at Greenbank Road and 25 m at Teviot Road (NB direction) as shown in **Figure 5-6.**

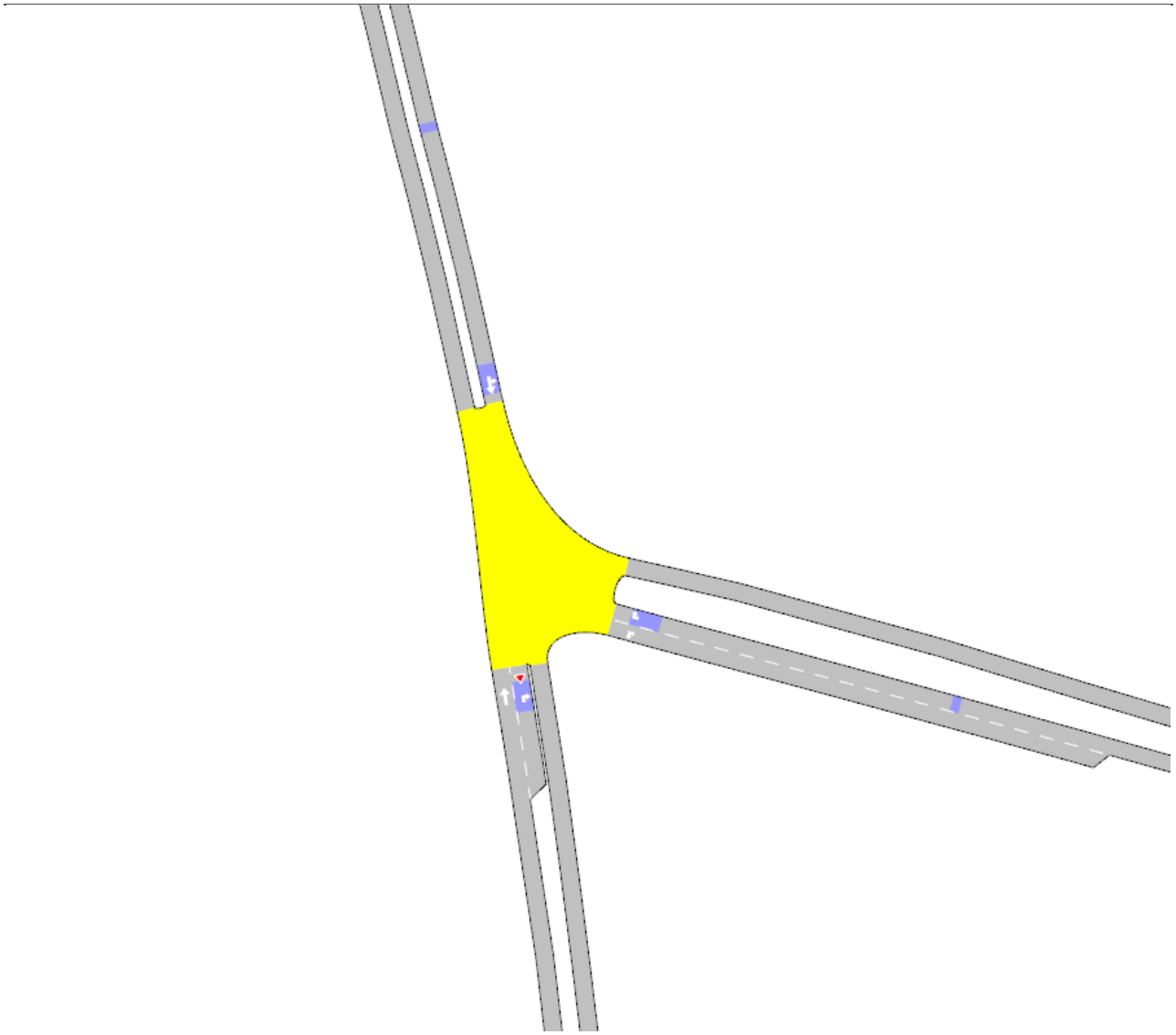


Figure 5-6: 2031 Teviot Road / Greenbank Road Intersection upgrade

5.3.3 Intersection Performance

Table 5-3 provides a summary of performance measures for the Do Nothing (Rectified) scenario

Table 5-3: 2031 Do Nothing (Rectified) Intersection Performance Measures

Intersection	Intersection Control Type	2031 Do Minimum			
		AM Peak		PM Peak	
		Delay	LOS	Delay	LOS
Teviot Road / Middle Road	Signal	9.7	A	26.8	C
Stoney Camp Road/Mount Lindesay Highway Northbound	Roundabout	9.2	A	18.5	C
Teviot Road/ Stoney Camp Road	Signal	4.4	A	8.2	A
Tevoit Road/ Greenbank Shopping Centre	Priority	4.9	A	11.9	B
Teviot Road / Pub Lane	Signal	9.7	A	29.6	C
Teviot Road / Greenbank Road	Signal	19.4	B	33.6	C
Greenbank Road / Crowson Lane	Priority	2.7	A	7.5	A
Stoney Camp Eastern Roundabout	Roundabout	4.3	A	11.4	B
Crowson Lane Roundabout West	Roundabout	7.2	A	10.4	B
Crowson Lane Roundabout East	Roundabout	11.0	B	33.5	D

* LOS for unsignalised priority-controlled intersection is based on the worst affected movement.

Table 5-3 depicts that the network operates better compared to 2031 Do Nothing Model due to network improvements proposed as part of the Do Nothing (Rectified) scenario and detailed in **Section 5.3.2**. A detailed summary of the performance of each study intersection is provided below:

1. Teviot Road / Middle Road – This intersection operates at LOS 'A' and LOS 'C' during the 2031 Do Nothing (Rectified) AM and PM peak periods, respectively, assuming reconfiguration of the roundabout into a signalised T-intersection.
2. Stoney Camp Road/Mount Lindesay Highway Northbound – This roundabout operates at LOS 'A' and LOS 'C' during the 2031 Do Nothing (Rectified) AM and PM peak periods, assuming provision of two eastbound approach lanes and two circulating lanes for the northern half of the roundabout.
3. Teviot Road / Stoney Camp Road – This intersection operates at LOS 'A' during both the 2031 Do Nothing (Rectified) AM and PM peak periods assuming signalisation of this intersection.
4. Teviot Road / Greenbank Shopping Centre – This intersection operates at LOS 'A' and LOS 'B' during the 2031 Do Nothing (Rectified) AM and PM peak periods, respectively.
5. Teviot Road / Pub Lane – This intersection operates at LOS 'A' and 'C' during the 2031 Do Nothing (Rectified) AM and PM peak periods, respectively.
6. Teviot Road / Greenbank Road – This intersection operates at LOS 'B' and LOS 'C' during the 2031 Do Nothing (Rectified) AM and PM peak periods, respectively, assuming widening of the westbound approach to provide a left turn bay and a right turn lane.
7. Greenbank Road / Crowson Lane - This intersection operates at LOS 'A' during both the 2031 Do-Nothing (Rectified) AM and PM peak periods.
8. Stoney Camp Roundabout (East) - This roundabout operates at LOS 'A' and LOS 'B' during the 2031 Do-Nothing (Rectified) AM and PM peak periods.
9. Crowson Lane / Mount Lindesay Highway Northbound - This roundabout operates at LOS 'A' and LOS 'B' during the 2031 Do-Nothing (Rectified) AM and PM peak periods, respectively.
10. Crowson Lane / Mount Lindesay Highway Southbound - This roundabout operates at LOS 'B' and LOS 'D' during the 2031 Do-Nothing (Rectified) AM and PM peak periods.

5.4 2031 Do Something Model

5.4.1 Demand Matrices

The 2031 traffic demand matrices were obtained from an extracted cordon out of 2031 Zenith Model (2031 Base model (VLC reference 'Run132') completed on 12/3/2016) developed by VLC. This was then imported directly into the AIMSUN model. Assumptions made during the demand matrices development process through VLC matrices are detailed below:

- Several of the centroids provided in VLC matrices were merged together in order to maintain consistency among 2015 base model and 2031 future model shown in **Appendix C**.
- The VLC matrices provided to MWH were based upon 2 hour peak hour traffic. However, they are converted into 1 hour by multiplying with 0.53. The factor was derived from observed count data within the study area.
- There is an additional centroid in future 2031 VLC model named as "S" which represents the future industrial development in North Maclean as anticipated in 2031.
- For the assessment of future year with Mirvac development in 2031, MWH has updated the two existing centroids named as "U" and "T" within 2031 VLC matrices with the latest information provided by Mirvac as detailed in in **Section 5.4.2**. However, the distribution of these centroids are taken from 2031 VLC matrices.
- Heavy vehicle percentage of Mirvac centroids U and T is taken from the 2031 VLC model.

5.4.2 Mirvac Development 2031

The following **Figure 5-7** shows the strategic layout of the structure plan of high level estimation of each of the marked-up areas which have been used to forecast the traffic movement within development. The proposed composition of the development is identified and illustrated below:

- 3,255 standard (urban) residential lots
- 13 interface (semi-rural) residential lots
- 70 'eco' (semi-rural) residential lots
- A primary school accommodating 1000 students
- A combined retail and health 'Neighbourhood Centre' comprising of 7000sqm of retail and 4000sqm of health facilities.

Note that the development layout in **Figure 5-7** varies slightly from the current proposal, although this variance is considered immaterial as the catchments are unaffected and variance in anticipated development yield is 12 residential lots (increased from the modelled 3,338 lots to 3,350 lots).

Teviot Road and Greenbank Road provide points of access from the internal urban network to the external sub-regional road network. Eco Lots and Northern Interface Lots comprising of semi-rural residential allotments gain access from the existing external road network and do not have an internal connection to the internal Urban Network. They are connected to external roads through Serengetti Drive & Heathcote Court and Campbell Road & Brightwell Street respectively. The roads hierarchy within the Urban Network is primarily based on trunk and Neighbourhood connector road types which consist of traffic lane widths of 3.5 metres.

Regional access to the development site is provided by parallel north-south corridors Teviot Road and Mount Lindesay Highway. Stoney Camp Road (to the north of the site) and Greenbank Road/Crowson Lane (to the south of the site) provide a means of east-west distribution between Teviot Road and the Mount Lindesay Highway.

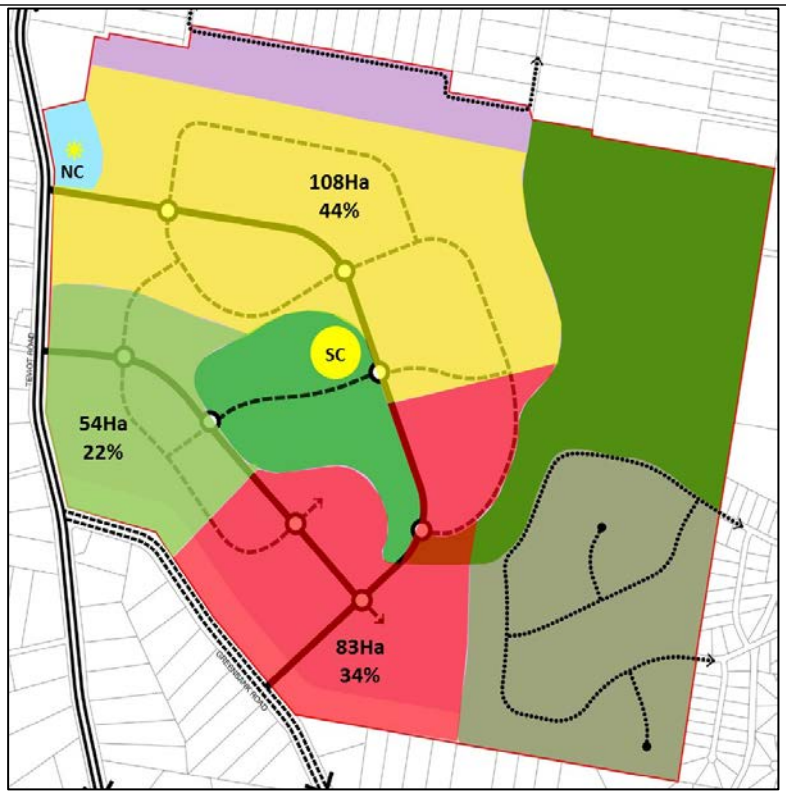


Figure 5-7: Potential Road Layout Overview

5.4.3 Network Layout

The 2031 Do-Something Model scenario represents the Mirvac development along with other planned developments in the area. **Figure 5-8** shows the proposed year 2031 road network assuming construction of the Mirvac development. Access to the proposed development is provided via two access points along Teviot Road, and one along Greenbank Road.

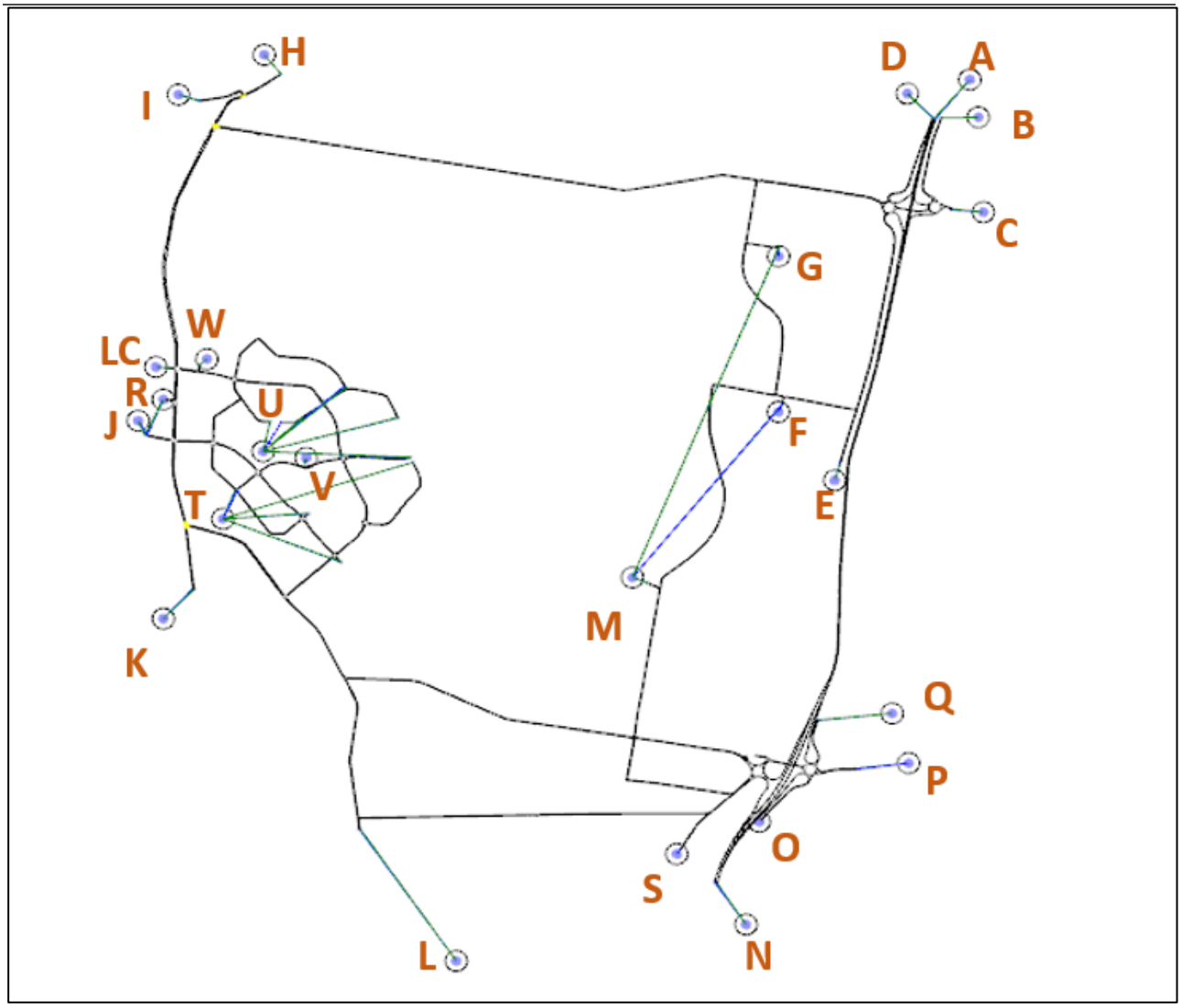


Figure 5-8: 2031 Network with Mirvac Development

5.4.4 Network Upgrades

The following upgrades have been proposed as part of the Do-Something scenario in addition to those proposed under the 2031 Do-Nothing (Rectified) scenario. A summary of upgrades proposed is provided below:

1. **Teviot Road / Middle Road Intersection**: Widening Teviot Road to provide two northbound through lanes. This upgrade will require provision of a 60m long departure lane to accommodate the two through lanes as shown in **Figure 5-9.**

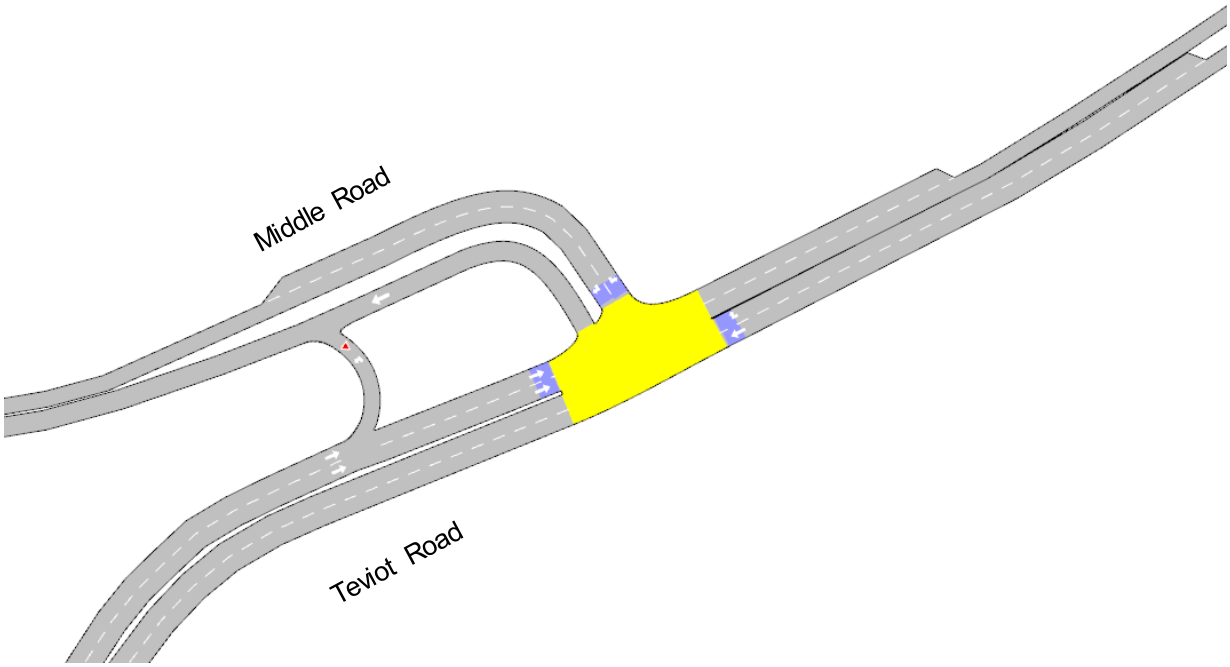


Figure 5-9: Teviot Road / Middle Road

2. **Teviot Road / Stoney Camp Road Intersection**: Upgrading the northbound approach of Teviot Road to provide an additional through lane and upgrading the westbound approach of Stoney Camp Road to provide a 245m left turn bay (compared to 115m proposed in the Do-Nothing (Rectified) scenario as shown in **Figure 5-10**. Additionally, it is recommended that the southbound approach be upgraded by converting the kerb-side lane into a full lane extending between Stoney Camp Road and Middle Road.

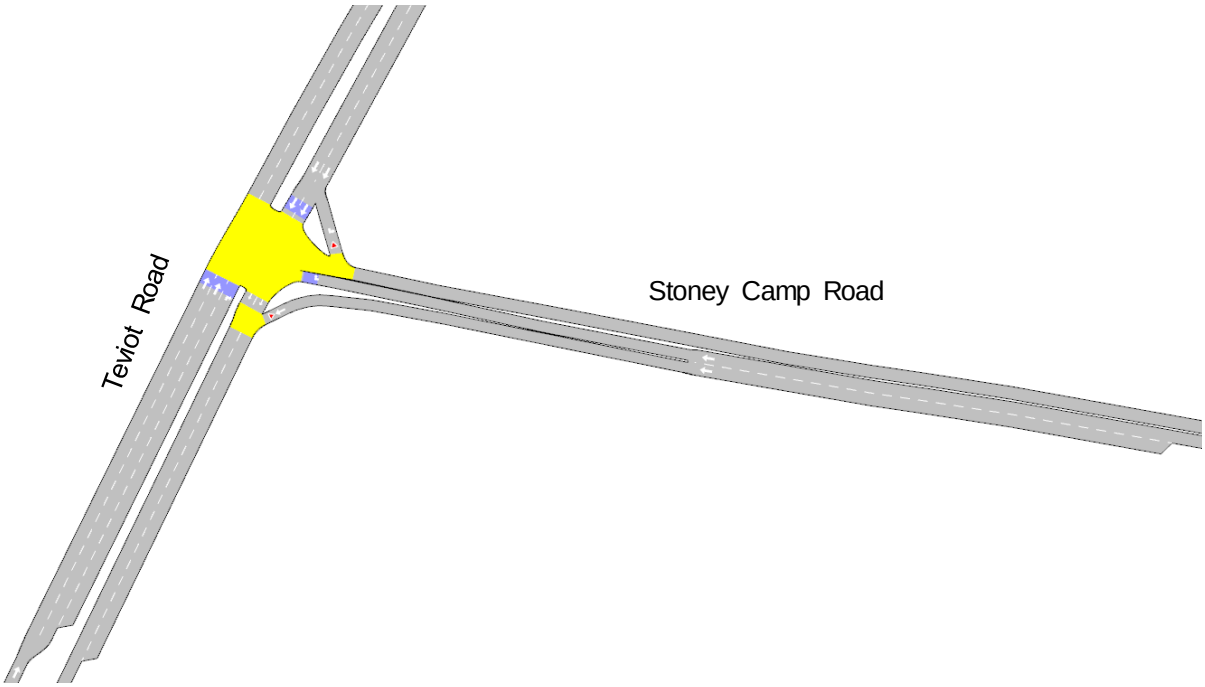


Figure 5-10: Teviot Road / Stoney Camp Road

3. **Teviot Road / Leanne Court / MIRVAC High Order Road 2:** Upgrading the Leanne Court / Teviot Road intersection from a priority-controlled T-intersection to a signal controlled four-legged intersection as shown in **Figure 5-11.**

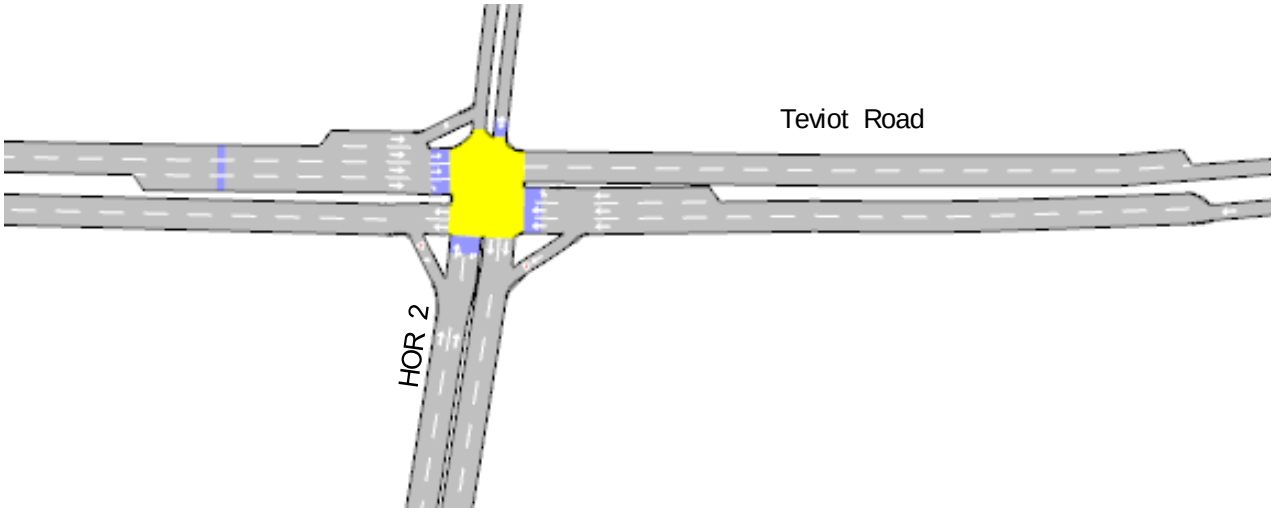


Figure 5-11: Teviot Road / Leanne Court / MIRVAC HOR 2

4. **Teviot Road / Pub Lane / MIRVAC High Order Road 1 (HOR 1):** Upgrading the Pub Lane / Teviot Road intersection from a T-intersection to a signal controlled four-legged intersection as shown in **Figure 5-12.**

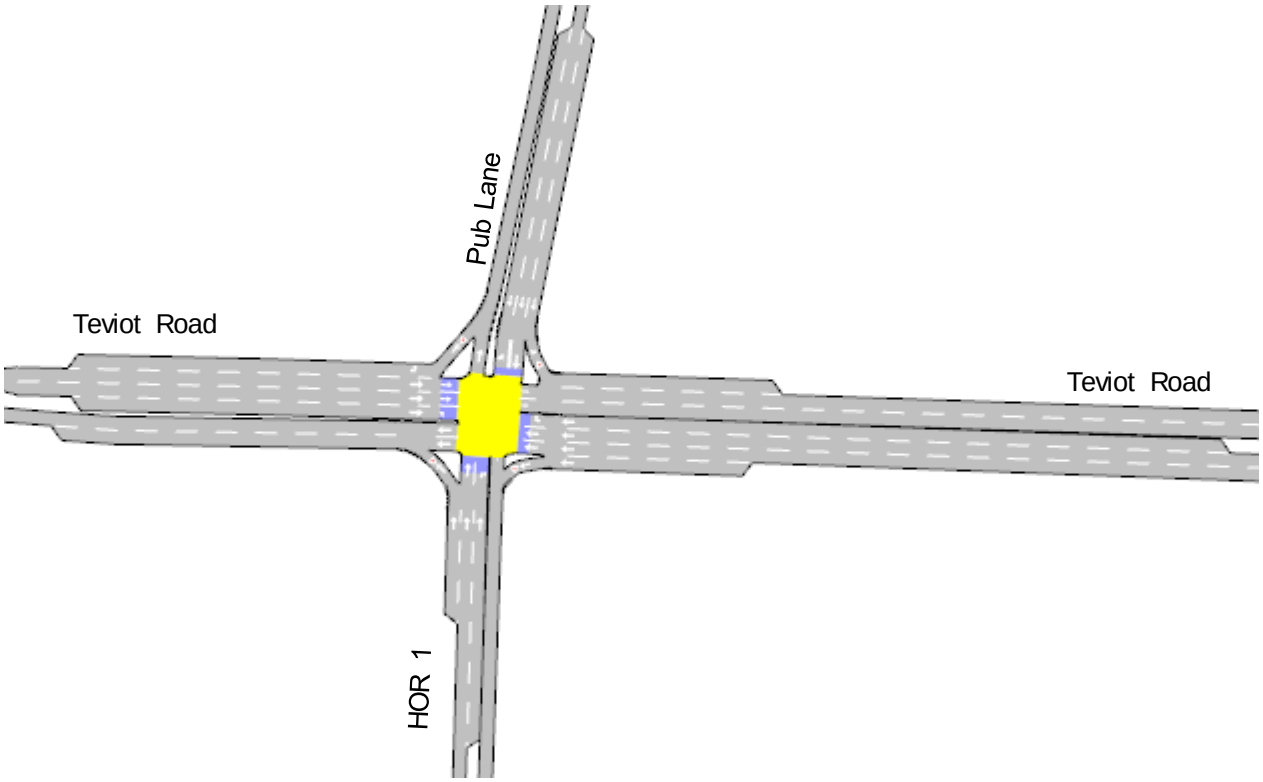


Figure 5-12: Teviot Road / Pub Lane / MIRVAC HOR 1

5. **Teviot Road / Greenbank Road:** Reconfiguring the westbound approach to provide one exclusive left turn lane and one left/right shared lane. This upgrade will require provision of a 75m long departure lane to accommodate dual right turns from the westbound approach of

Greenbank Road as shown in **Figure 5-13.** Additionally, a southbound left turn lane has also been proposed as part of the Do-Something scenario.

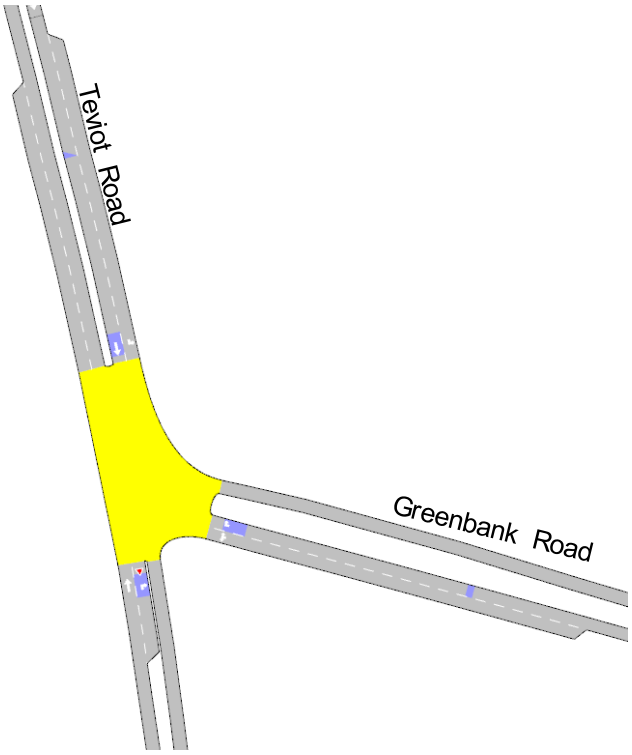


Figure 5-13: Teviot Road / Greenbank Road

6. **Greenbank Road / MIRVAC HOR 1:** Construction of a priority controlled T-intersection to connect the MIRVAC HOR 1 with Greenbank Road as shown in **Figure 5-14.**

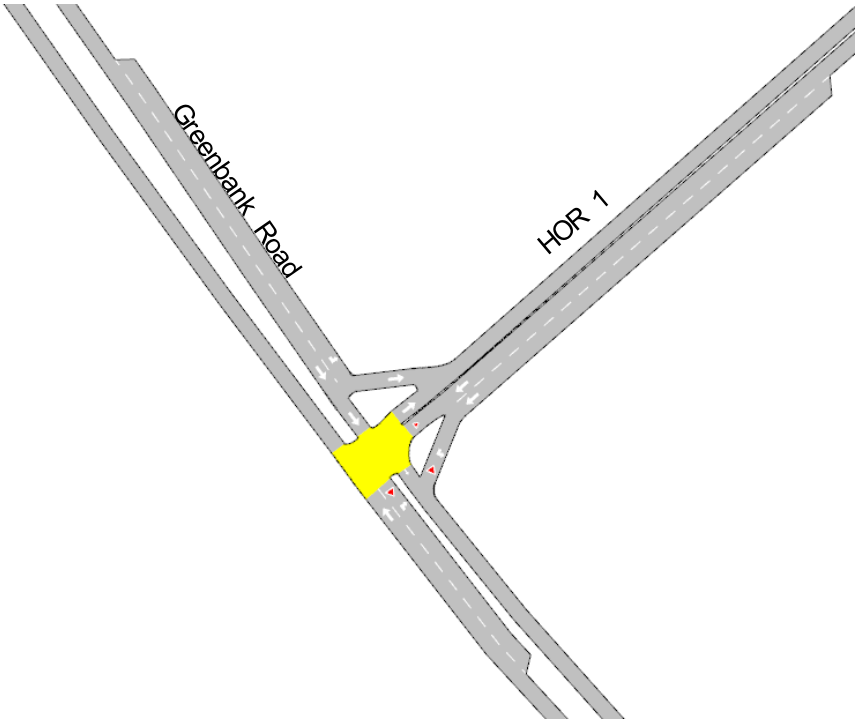


Figure 5-14: Greenbank Road / MIRVAC HOR 1

5.4.5 Trip Generation / Allocation

5.4.5.1 Trip Allocations

Table 5-4 summarises the trip allocations undertaken for each of different subdivision of Urban Network, Northern Lots and Eco Lots as shown in different colour codes in **Figure 5-7**.

Table 5-4: Peak Hour Trip Generation

Area	Qty	RMS Rates	Assumed Distribution of Lots	Total Peak Hour Residential Trips	Trips Exiting the Development	Internal Trips
Yellow	3255	0.85	44% of Urban Network (Residential)	1217	913	304
Light Green			22% of Urban Network (Residential)	609	457	152
Pink			34% of Urban Network (Residential)	941	706	235
Purple	13	0.85	100% of Northern Lots (Residential)	13	8	-
Grey	70	0.85	100% of Eco Lots (Residential)	70	45	-

Note: According to RTA guidelines, it has assumed that 75% generated trips will exit the development area during peak and 25% will be the internal trips

5.4.5.2 Trip Generation AM Peak

Productions and attractions for Mirvac Development in AM peak has been calculated based upon ITE trip generation rate percentages as listed in **Table 5-5.**

Table 5-5: Mirvac Development Trip Generation AM Peak

Land Use	Qty	RMS Rates	Peak Hour Trip Generation	Operating Capacity	Productions	Attractions
Urban Network (Residential)	3255	*0.85	^2075	100%	1619	457
School Precinct	1000 Students	**0.2vph/student	200	100%	90	110
Neighbourhood Centre	4000m^2 (Medical)	***10.4/ 100m^2 (Medical)	416	100%	154	262
	7000 m^2 (Retail)	****12.3/ 100m^2 (Retail)	^^301	35%	115	187
Northern Interface Lots (Residential)	13	*0.85	8	100%	6	2
Eco Lots (Residential)	70	*0.85	45	100%	35	10

Source:

*****RTA Guide to traffic generating developments- Section 3.3*

*** School Travel, Department of Transport and Main Roads, Mode share by Region/ School Travel*

****RTA Guide to traffic generating developments, extended hours medical centres, Section 3.11.2*

*****RTA Guide to traffic generating developments, Shopping Centres, Section 3.6.1*

^For above the calculations for residential precincts, it has assumed that 75% of the generated trips will exit the development area during AM Peak and 25% will be the internal trips.*

^^For above the calculations for retail centre, it is assumed that retail centre will be operating at 35 % of its capacity in AM Peak. (Reference: RMS, "Technical Direction For traffic, safety and transport practitioners", August 2013, Appendix F3-Peak Network Hour*

The distribution split (IN & OUT) in the AM and PM peaks are shown in **Table 5-6**

Table 5-6: ITE Trip Generations Percentage-AM Peak

ITE Trip Generations Percentage		
Landuse	As	Ps
	AM Out	AM In
Residential	78%	22%
Elementary School	45%	55%
Hospital	37%	63%
Shopping Centre	38%	62%

Source: ITE Trip Generation Rates-9th Edition

5.4.5.3 Trip Generation PM Peak

Productions and attractions for Mirvac Development in the PM peak have been calculated based upon ITE trip generation rate percentages as listed in **Table 5-8**

Table 5-7: Mirvac Development Trip Generation PM Peak

Land Use	Qty	RMS Rates	Peak Hour Trip Generation	Operating Capacity	Productions	Attractions
Residential Lots	3255	0.85	2075	100%	726	1349
School Precinct	1000 Students	*0.042vph/student	42	100%	21	20
Neighbourhood Centre	4000m^2 (Medical)	10.4/ 100m^2 (Medical)	^250	60%	155	95
	7000 m^2 (Retail)	12.3/ 100m^2 (Retail)	^^560	65%	291	269
Northern Interface Lots (Residential)	13	0.85	8	100%	3	5
Eco Lots (Residential)	70	0.85	45	100%	16	29

*RTA Guide to traffic generating developments, Residential Section 3.3

**For the above calculation for the school precincts, the school trip generation rate in PM peak has been assumed from another study carried out by MWH in Queensland

***RTA Guide to traffic generating developments, Extended hours medical centres, Section 3.11.2

****RTA Guide to traffic generating developments, Shopping Centres, Section 3.6.1

^For above the calculations for medical centre, it is assumed that medical centre will be operating at 60 % of its capacity in PM peak as the services will be continuing till late at night.

^^For above the calculations for retail centre, it is assumed that the retail centre will be operating at 65 % of its capacity in PM peak. (Reference: RMS, "Technical Direction For traffic, safety and transport practitioners", August 2013, Appendix F3-Peak Network Hour Vehicle Trips Percentage in AM and PM)

Table 5-8: ITE Trip Generations Percentage-PM Peak

ITE Trip Generations Percentage		
Landuse	As	Ps
	AM Out	AM In
Residential	35%	65%
Elementary School	51%	49%
Hospital	62%	38%
Shopping Centre	52%	48%

Source: *ITE Trip Generation Rates-9th Edition*

5.4.6 Intersection Performance

Table 5-9 provides a summary of performance measures for the Do-Something scenario.

Table 5-9: 2031 Do Something Intersection Performance Measures

Intersection	Intersection Control Type	2031 Do Something			
		AM Peak		PM Peak	
		Delay	LOS	Delay	LOS
Teviot Road / Middle Road	Signal	16.9	B	24.0	C
Stoney Camp Road/Mount Lindesay Highway Northbound	Roundabout	26.3	D	28.4	D
Teviot Road/ Stoney Camp Road	Signal	16.2	B	17.6	B
Teviot Road/ Leanne Court	Signal	11.3	B	12.9	B
Tevoit Road/ Greenbank Shopping Centre	Priority	14.9	B	3.7	A
Teviot Road / Pub Lane	Signal	9.9	A	17.0	B
Teviot Road / Greenbank Road	Signal	26.4	C	35.7	D
Greenbank Road / Crowson Lane	Priority	21.3	C	14.3	B
Stoney Camp Eastern Roundabout	Roundabout	6.5	A	24.4	C
Crowson Lane Roundabout West	Roundabout	11.1	B	10.8	B
Crowson Lane Roundabout East	Roundabout	9.7	A	27.5	D
Greenbank Road / High Order Road 1	Signal	4	A	4	A

* LOS for unsignalised priority-controlled intersection is based on the worst affected movement.

A detailed summary of the performance of each study intersection is provided below:

1. Teviot Road / Middle Road Roundabout – This roundabout operates at LOS 'B' and LOS 'C' and experiences delays around 20 seconds during both the 2031 Do-Something AM and PM peak periods.
2. Stoney Camp Road/Mount Lindesay Highway Northbound – This roundabout operates at LOS 'D' during both the 2031 Do-Something AM and PM peak periods.
3. Teviot Road / Stoney Camp Road – This intersection operates at LOS 'B' during the 2031 Do-Something AM and PM peak periods.
4. Teviot Road / Leanne Court / Mirvac Primary *Access (HOR 2)* – This intersection operates at LOS 'B' during both the 2031 Do-Something AM and PM peak periods.
5. Teviot Road / Greenbank Shopping Centre – This intersection operates at LOS 'B' and LOS 'A' during the 2031 Do-Something AM and PM peak periods, respectively.
6. Teviot Road / Pub Lane – This intersection operates at LOS 'A' and 'B' during the 2031 Do-Something AM and PM peak periods, respectively.
7. Teviot Road / Greenbank Road – This intersection operates at LOS 'C' and LOS 'D' during both the 2031 Do-Something AM and PM peak periods, respectively.

8. Greenbank Road / Crowson Lane - This intersection operates at LOS 'C' and LOS 'B' during both the 2031 Do-Something AM and PM peak periods, respectively.
9. Stoney Camp Roundabout (East) - This roundabout operates at LOS 'A' and LOS 'C' during the 2031 Do-Something AM and PM peak periods.
10. Crowson Lane / Mount Lindesay Highway Northbound - This roundabout operates at LOS 'B' during the 2031 Do-Something AM and PM peak periods.
11. Crowson Lane / Mount Lindesay Highway Southbound - This roundabout operates at LOS 'A' and LOS 'D' during the 2031 Do-Something AM and PM peak periods, respectively.
12. Greenbank Road / High Order Road 1 - This intersection operates at LOS 'A' during both the 2031 Do-Something AM and PM peak periods, respectively.

6 Summary and Conclusion

This report documents the findings of an AIMSUN simulation modelling study which assesses the transport infrastructure requirements under 2031 traffic conditions with and without the proposed Mirvac development.

The Roads and Maritime Services' Modelling Guidelines (2013) document was used as the reference to calibrate the AIMSUN model. Calibration was split into three main categories, network verification, demand calibration, and travel times. The network verification step involved editing the original AIMSUN network provided to MWH to match existing road geometry. Demand calibration was conducted through an iterative process to ensure traffic assignments are within the required threshold compared to observed traffic volumes.

Roads and Maritime's recommended volume and travel time validation targets were used to validate the AM and PM peak models.

The Base 2015 AM and PM Peak models have been successfully calibrated and validated.

The calibrated and validated models were then used to model 2031 Do-Nothing, Do Nothing (Rectified) and Do-Something scenarios.

The 2031 Do-Nothing scenario represents the existing transport network under 2031 demand conditions assuming that the Mirvac development is not in place. The future year demand causes congestion at several intersections. The intersections of Teviot Road / Middle Road, Teviot Road / Stoney Camp Road, and Teviot Road / Greenbank Road operates at LOS 'F' in at least one peak period. The level of congestion creates queues rendering the network operating in saturated conditions.

The 2031 Do Nothing (Rectified) scenario represents the existing transport network with the following improvements under 2031 demand conditions assuming that the Mirvac development is not in place.

1. Conversion of the Middle Road / Teviot Road roundabout into a three arm signalised intersection,
2. Widening the Stoney Camp Road / Mount Lindesay Highway roundabout to provide two circulating lanes,
3. Widening of the southbound direction of Teviot Road to provide two southbound through lanes at the Stoney Camp Road / Teviot Road intersection,
4. Widening Teviot Road to provide two through lanes between Pub Lane and Leanne Court, and
5. Signalisation of the Teviot Road / Greenbank Road intersection, and provision of a northbound right turn bay.

The above mentioned improvements significantly improve traffic operations at study area intersections resulting in all intersections operating at LOS 'C' or better under 2031 AM and PM demand conditions.

Further improvements compared to the 2031 Do Nothing (Rectified) scenario are outlined below:

1. Widening of Teviot Road to provide two northbound through lanes at the Teviot Road / Middle Road intersection. This upgrade will require provision of a 60m long departure lane to accommodate the two through lanes.
2. Teviot Road / Stoney Camp Road intersection - Upgrading the northbound approach of Teviot Road to provide an additional through lane and upgrading the westbound approach of Stoney Camp Road to provide a 245m left turn bay (compared to 115m proposed in the Do-Nothing (Rectified) scenario. Additionally, it is recommended that the southbound approach be upgraded by converting the kerb-side lane into a full lane extending between Stoney Camp Road and Middle Road.
3. Upgrading the Leanne Court / Teviot Road intersection from a priority-controlled T-intersection to a signal controlled four-legged intersection.
4. Upgrading the Pub Lane / Teviot Road intersection from a T-intersection to a signal controlled four arm intersection.
5. Reconfiguring the westbound approach at the Teviot Road / Greenbank Road intersection to provide one exclusive left turn lane and one left/right shared lane. This upgrade will require provision of a 75m long departure lane to accommodate dual right turns from the westbound approach of Greenbank Road. Additionally, a southbound left turn lane has also been proposed as part of the Do-Something scenario.

6. Construction of a priority controlled T-intersection to connect the Mirvac HOR 1 with Greenbank Road

The Do-Something scenario consists of the Mirvac development and assumes additional infrastructure improvements to mitigate the impacts of traffic generated by the Mirvac development. All intersections operate at LoS 'D' or better under the 2031 Do-Something scenario.

Appendices

Appendix A Model Calibration Results

2015 Traffic Volumes Calibration Results for AM Peak

Link No	Link	Approach	Direction	2015 Observed	2015 Modelled	GEH	Check
1	Crownson Ln	East of Greenhill Rd	WB	148	152	0.326599	pass
2	Crownson Ln	East of Greenhill Rd	EB	162	213	3.724513	pass
3	Greenhill Rd	Greenhill Rd	NB	45	57	1.680336	pass
4	Greenhill Rd	Greenhill Rd	SB	56	80	2.910428	pass
5	Crownson Ln	East of Greenbank Rd	WB	140	133	0.599145	pass
6	Crownson Ln	East of Greenbank Rd	EB	126	177	4.143467	pass
7	Greenbank Rd	South of Crownson Lane	NB	27	30	0.561951	pass
8	Greenbank Rd	South of Crownson Lane	SB	16	17	0.246183	pass
9	Greenbank Rd	East of Teviot Rd	WB	152	137	1.247835	pass
10	Greenbank Rd	East of Teviot Rd	EB	123	176	4.334662	pass
11	Teviot Rd	South of Greenbank Rd	NB	359	373	0.731792	pass
12	Teviot Rd	South of Greenbank Rd	SB	186	192	0.436436	pass
13	Teviot Rd	South of Pub Ln	NB	484	467	0.779603	pass
14	Teviot Rd	South of Pub Ln	SB	282	337	3.126312	pass
15	Pub Ln	West of Teviot Rd	WB	181	177	0.298974	pass
16	Pub Ln	West of Teviot Rd	EB	430	473	2.023669	pass
17	Teviot Rd	North of Pub Ln	NB	696	726	1.125088	pass
18	Teviot Rd	North of Pub Ln	SB	245	304	3.561073	pass
19	Shopping Centre	West of Teviot Rd	WB	118	74	4.490731	pass
20	Shopping Centre	West of Teviot Rd	EB	111	80	3.172196	pass
21	Teviot Rd	South of Stoney Camp Rd	NB	807	787	0.708436	pass
22	Teviot Rd	South of Stoney Camp Rd	SB	363	353	0.528516	pass
23	Teviot Rd	North of Stoney Camp Rd	NB	769	773	0.144056	pass
24	Teviot Rd	North of Stoney Camp Rd	SB	394	368	1.33202	pass
25	Middle Rd	West of Teviot Rd	WB	579	574	0.208243	pass
26	Middle Rd	West of Teviot Rd	EB	592	603	0.450012	pass
27	Middle Rd	East of Teviot Rd	WB	359	359	0	pass
28	Middle Rd	East of Teviot Rd	EB	747	783	1.301583	pass
29	Stoney Camp Rd	East of Teviot Rd	WB	154	181	2.086202	pass
30	Stoney Camp Rd	East of Teviot Rd	EB	223	201	1.510966	pass
31	Stoney Camp Rd	East of Andall Rd	WB	152	187	2.688334	pass
32	Stoney Camp Rd	East of Andall Rd	EB	260	208	3.399346	pass
33	Kooringal Rd	West of Mt Lindesay Hwy	WB	21	15	1.414214	pass
34	Kooringal Rd	West of Mt Lindesay Hwy	EB	80	87	0.766046	pass
35	Mount Lindesay Highway (S)	South of Kooringal Rd	NB	31	27	0.742781	pass
36	Mount Lindesay Highway (S)	South of Kooringal Rd	SB	9	7	0.707107	pass
37	Mount Lindesay Highway (S)	South of Stoney Camp Rd (W)	NB	110	111	0.09513	pass
38	Mount Lindesay Highway (S)	South of Stoney Camp Rd (W)	SB	29	21	1.6	pass
39	Mount Lindesay Highway (N)	North of Stoney Camp Rd (W)	NB	17	13	1.032796	pass

40	Mount Lindesay Highway (N)	North of Stoney Camp Rd (W)	SB	38	28	1.740777	pass
41	Stoney Camp Rd	East of Western Roundabout	WB	314	373	3.183381	pass
42	Stoney Camp Rd	East of Western Roundabout	EB	236	200	2.438228	pass
43	NB On Ramp	North of Stoney Camp Rd	NB	373	377	0.206559	pass
44	NB Off Ramp	South of Stoney Camp Rd	NB	85	78	0.775388	pass
45	SB On Ramp	South of Stoney Camp Rd	SB	78	59	2.295664	pass
46	SB Off Ramp	North of Stoney Camp Rd	SB	119	159	3.392756	pass
47	Mount Lindesay Highway (N)	North of Stoney Camp Rd (E)	NB	258	229	1.85844	pass
48	Mount Lindesay Highway (N)	North of Stoney Camp Rd (E)	SB	135	140	0.426401	pass
49	Mount Lindesay Highway (S) / Granger	East of Eastern Roundabout	WB	282	284	0.118888	pass
50	Mount Lindesay Highway (S) / Granger	East of Eastern Roundabout	EB	122	117	0.457389	pass
51	Mount Lindesay Highway (N)	Eastern Roundabout	NB	23	34	2.060489	pass
52	Mount Lindesay Highway (N)	Eastern Roundabout	SB	36	28	1.414214	pass
53	Mount Lindesay Highway (S)	Eastern Roundabout	NB	9	7	0.707107	pass
54	Mount Lindesay Highway (S)	Eastern Roundabout	SB	56	61	0.65372	pass
55	Chambers Flat Road	Eastern Roundabout	WB	115	129	1.2675	pass
56	Chambers Flat Road	Eastern Roundabout	EB	68	78	1.170411	pass
57	NB On Ramp	North of Crownson Lane	NB	84	102	1.866513	pass
58	NB Off Ramp	South of Crownson Lane	NB	145	167	1.76141	pass
59	SB On Ramp	South of Crownson Lane	SB	205	190	1.067352	pass
60	SB Off Ramp	North of Crownson Lane	SB	117	81	3.618136	pass
61	Crownson Ln	Between Roundabouts	WB	107	110	0.288009	pass
62	Crownson Ln	Between Roundabouts	EB	182	231	3.409856	pass

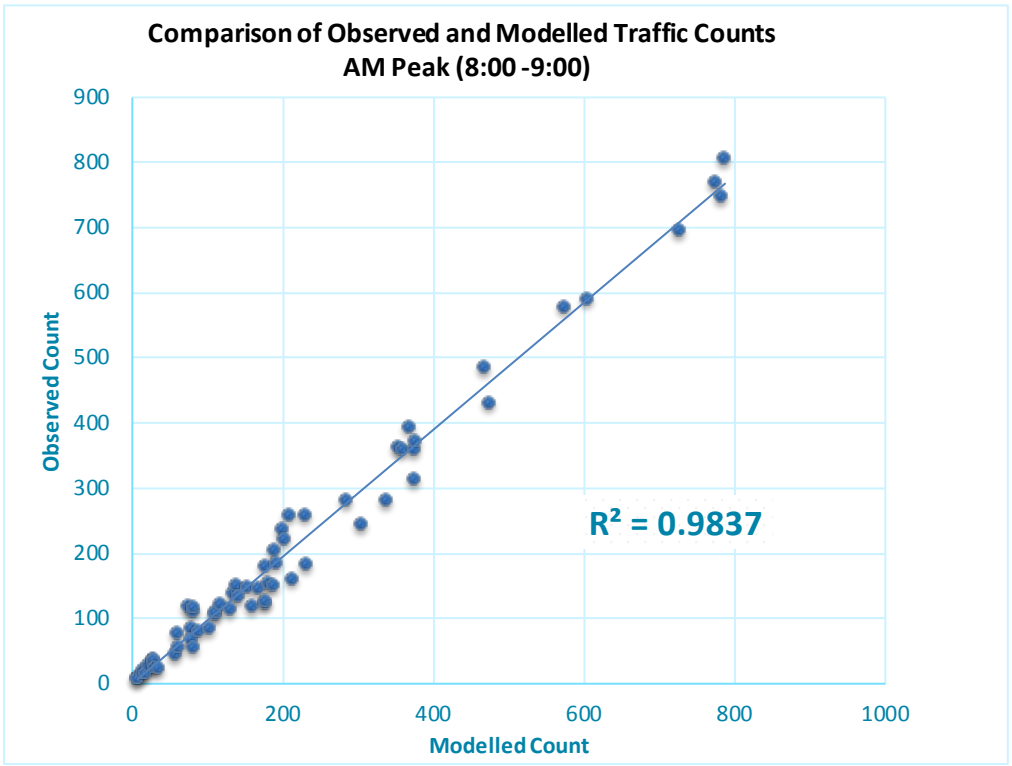
2015 Traffic Volumes Calibration Results for PM Peak

Link No	Link	Approach	Direction	2015 Observed	2015 Modelled	GEH	Check
1	Crownson Ln	East of Greenhill Rd	WB	167	209	3.063165	pass
2	Crownson Ln	East of Greenhill Rd	EB	175	197	1.613118	pass
3	Greenhill Rd	Greenhill Rd	NB	57	61	0.520756	pass
4	Greenhill Rd	Greenhill Rd	SB	46	38	1.234427	pass
5	Crownson Ln	East of Greenbank Rd	WB	133	181	3.830817	pass
6	Crownson Ln	East of Greenbank Rd	EB	155	194	2.952344	pass
7	Greenbank Rd	South of Crownson Lane	NB	10	8	0.666667	pass
8	Greenbank Rd	South of Crownson Lane	SB	40	48	1.206045	pass
9	Greenbank Rd	East of Teviot Rd	WB	131	164	2.717177	pass
10	Greenbank Rd	East of Teviot Rd	EB	181	218	2.619572	pass
11	Teviot Rd	South of Greenbank Rd	NB	248	225	1.495589	pass
12	Teviot Rd	South of Greenbank Rd	SB	388	412	1.2	pass
13	Teviot Rd	South of Pub Ln	NB	352	352	0	pass
14	Teviot Rd	South of Pub Ln	SB	542	601	2.467993	pass
15	Pub Ln	West of Teviot Rd	WB	385	411	1.303262	pass
16	Pub Ln	West of Teviot Rd	EB	335	412	3.984239	pass
17	Teviot Rd	North of Pub Ln	NB	367	437	3.491283	pass

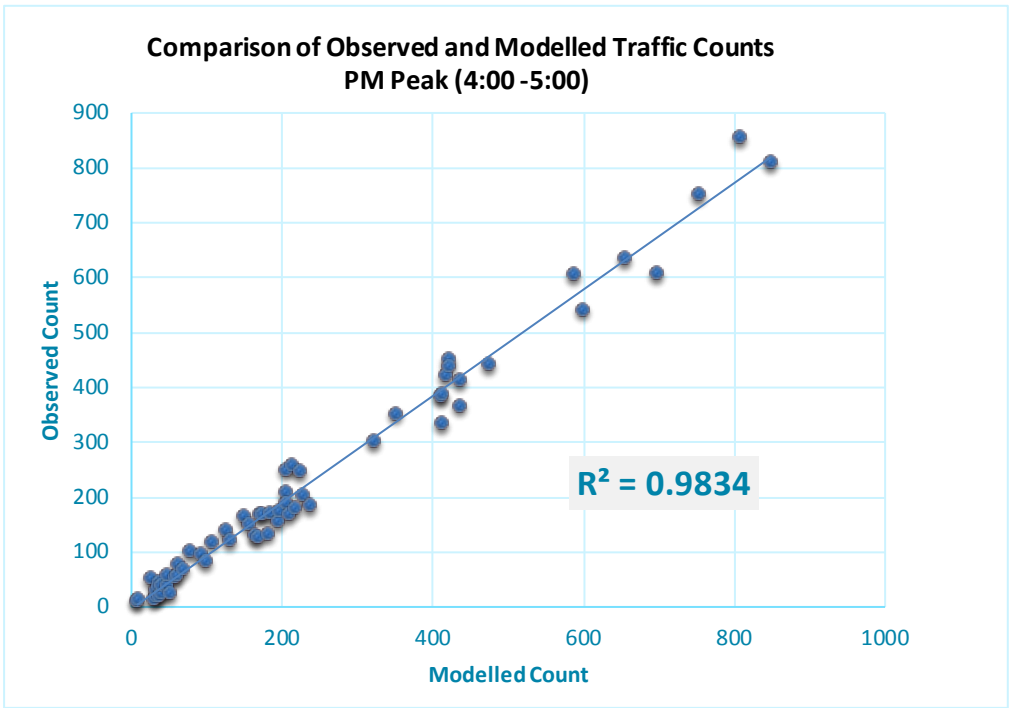
18	Teviot Rd	North of Pub Ln	SB	607	697	3.524672	pass
19	Shopping Centre	West of Teviot Rd	WB	249	205	2.920383	pass
20	Shopping Centre	West of Teviot Rd	EB	83	98	1.576765	pass
21	Teviot Rd	South of Stoney Camp Rd	NB	450	421	1.389645	pass
22	Teviot Rd	South of Stoney Camp Rd	SB	856	808	1.664101	pass
23	Teviot Rd	North of Stoney Camp Rd	NB	441	475	1.588716	pass
24	Teviot Rd	North of Stoney Camp Rd	SB	810	848	1.319795	pass
25	Middle Rd	West of Teviot Rd	WB	605	587	0.737309	pass
26	Middle Rd	West of Teviot Rd	EB	635	655	0.787499	pass
27	Middle Rd	East of Teviot Rd	WB	752	752	0	pass
28	Middle Rd	East of Teviot Rd	EB	413	437	1.164171	pass
29	Stoney Camp Rd	East of Teviot Rd	WB	209	205	0.278019	pass
30	Stoney Camp Rd	East of Teviot Rd	EB	172	184	0.899438	pass
31	Stoney Camp Rd	East of Andall Rd	WB	258	214	2.864156	pass
32	Stoney Camp Rd	East of Andall Rd	EB	168	170	0.153846	pass
33	Kooringal Rd	West of Mt Lindesay Hwy	WB	68	69	0.120824	pass
34	Kooringal Rd	West of Mt Lindesay Hwy	EB	20	38	3.342516	pass
35	Mount Lindesay Highway (S)	South of Kooringal Rd	NB	13	10	0.884652	pass
36	Mount Lindesay Highway (S)	South of Kooringal Rd	SB	54	58	0.534522	pass
37	Mount Lindesay Highway (S)	South of Stoney Camp Rd (W)	NB	33	47	2.213594	pass
38	Mount Lindesay Highway (S)	South of Stoney Camp Rd (W)	SB	122	130	0.712697	pass
39	Mount Lindesay Highway (N)	North of Stoney Camp Rd (W)	NB	24	53	4.673773	pass
40	Mount Lindesay Highway (N)	North of Stoney Camp Rd (W)	SB	38	36	0.328798	pass
41	Stoney Camp Rd	East of Western Roundabout	WB	439	422	0.819337	pass
42	Stoney Camp Rd	East of Western Roundabout	EB	164	150	1.117322	pass
43	NB On Ramp	North of Stoney Camp Rd	NB	168	172	0.306786	pass
44	NB Off Ramp	South of Stoney Camp Rd	NB	58	48	1.373606	pass
45	SB On Ramp	South of Stoney Camp Rd	SB	78	62	1.912366	pass
46	SB Off Ramp	North of Stoney Camp Rd	SB	422	417	0.24412	pass
47	Mount Lindesay Highway (N)	North of Stoney Camp Rd (E)	NB	95	93	0.206284	pass
48	Mount Lindesay Highway (N)	North of Stoney Camp Rd (E)	SB	139	127	1.040532	pass
49	Mount Lindesay Highway (S) / Granger	East of Eastern Roundabout	WB	188	205	1.21274	pass
50	Mount Lindesay Highway (S) / Granger	East of Eastern Roundabout	EB	301	321	1.134096	pass
51	Mount Lindesay Highway (N)	Eastern Roundabout	NB	25	40	2.631174	pass
52	Mount Lindesay Highway (N)	Eastern Roundabout	SB	19	32	2.574384	pass
53	Mount Lindesay Highway (S)	Eastern Roundabout	NB	40	40	0	pass
54	Mount Lindesay Highway (S)	Eastern Roundabout	SB	13	30	3.666314	pass
55	Chambers Flat Road	Eastern Roundabout	WB	151	157	0.483494	pass
56	Chambers Flat Road	Eastern Roundabout	EB	102	77	2.642582	pass
57	NB On Ramp	North of Crownson Lane	NB	50	27	3.706786	pass
58	NB Off Ramp	South of Crownson Lane	NB	126	168	3.464102	pass
59	SB On Ramp	South of Crownson Lane	SB	185	237	3.579828	pass
60	SB Off Ramp	North of Crownson Lane	SB	31	32	0.178174	pass
61	Crownson Ln	Between Roundabouts	WB	119	108	1.032511	pass
62	Crownson Ln	Between Roundabouts	EB	203	229	1.769076	pass

Appendix B Correlation Analysis

Comparison of Observed and Modelled Traffic Flows- AM Peak



Comparison of Observed and Modelled Traffic Flows- PM Peak



Appendix C Merging of Centroids

2031 MWH AIMSUN Centroids	2031 VLC Cordon Points	Percentage Distribution
A	113881+90085	100%
B	90089	100%
C	90090	100%
D	108503	100%
E	1284	30%
F	1290	30%
	1284	70%
G	3064	100%
	1274	100%
	1296	100%
H	109351	100%
I	101206	100%
J	231531	100%
K	116582	100%
L	98155	100%
M	136870	100%
	1283	100%
	1282	100%
	1290	70%
N	121558+121559	100%
O	35058	100%
P	113921	100%
Q	608814	100%
R	1278	100%
S	136864	100%
T	1280	100%
U	1281	100%
V (School Zone)	1280	-
W (NC)	1281	-
LC (Residential Access)	-	-

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Appendix B 2051 SIDRA Intersection Analysis

Mirvac Development Application

2051 SIDRA Intersection Analysis

1 Purpose

The purpose of this technical note is to advise about the ultimate intersection analysis layout arrangements for the following intersections in 2051.

1. Teviot Road /Leanne Court/ HOR 2 Intersection
2. Teviot Road /Shopping Centre Intersection
3. Teviot Road /Pub Lane/ HOR 1 Intersection
4. Teviot Road / Greenbank Road Intersection
5. Greenbank Road /HOR1 Intersection

It should be noted that these SIDRA layouts will form the basis for the 2051 ultimate intersection design layouts. The proposed layouts has been changed to accommodate separated cycle lanes as directed by EDQ.

2 Assumptions

The SIDRA intersection analysis for the all intersections is based on the 2051 traffic demand volumes provided by VLC (model no 15-039, Run #93:#110) as shown in Appendix A. Additionally, during the development process of the 2051 traffic diagram, agreed necessary adjustments have been made as noted in the meeting minutes provided under Appendix H of this note. They are detailed below:

1. **Smaller Size of Neighbourhood Centre:**

VLC has assumed a relatively smaller size of neighbourhood centre (6,800 sqm) within their modelling assessment which resulted in the under estimation of the neighbourhood centre trips. VLC has advised MWH to calculate the number of trips based on the revised Mirvac Neighbourhood Centre (11,000 sqm) size and to add the additional generated trips to the VLC turning counts.

The additional neighbourhood centre trips have been calculated based on the difference in GFAs as shown in Appendix G. These additional trips have been added at Leanne Court Intersection and distributed throughout the network as shown in Appendix C.

2. Catch Trade Trips:

The VLC Zenith model disregards the ‘catch trade’ trips to/ from the Greenbank Shopping Centre and the Mirvac Neighbourhood Centre. This is due to ‘catch trade’ trips under reported in the household travel survey which are the basis for the VLC model. VLC has advised MWH to readjust the trips between Leanne Court intersection and the Pub Lane intersection to accommodate catch trade movements as well as make proportionate reductions along through movements on Teviot road.

VLC has recommended to use a catch trade trip percentage of 10% in the AM peak period and 30 % in the PM peak period. The catch trade trips at the Greenbank Shopping Centre and the Mirvac Neighbourhood Centre have been calculated based on the percentages provided by VLC. The appropriate adjustments have been made along all the through vehicular volumes along Teviot road as shown in Appendix D.

3. PT Access Vehicular Trips:

VLC has also directed MWH to include public transport access demand volumes as vehicular trips to the VLC turning movement counts as shown in Appendix B.

The 2 hours PT trips volumes were converted into 1 hour by multiplying it with the 0.53 factor as shown in Appendix E.

3 2051 SIDRA Intersection Analysis

SIDRA 7.0 traffic modelling software was used to undertake the intersection assessments. SIDRA is an advance micro analytical traffic evaluation tool that employs lane-by-lane and vehicle drive cycle models.

In analysing intersection performance, Degree of Saturation (DOS) is used to measure the ratio of traffic flow compared to capacity.

For priority controlled intersections (un-signalised), a DOS in excess of 80% is considered to be over capacity. Roundabouts are considered over capacity at 85% DOS and signalised intersections are considered over capacity at 90% DOS. (Austroads Traffic Management Part 3 2013, Page 32)

Cycle times were kept consistent for the AM and PM peak periods to allow for signal coordination. A cycle time of 80 seconds were analysed for the AM peak period and 150 seconds for the PM peak period. The signal phasing timings for all the intersections for both peak periods are presented within Appendix I.

3.1 2051 Teviot Road / Leanne Ct/ HOR 2 Intersection

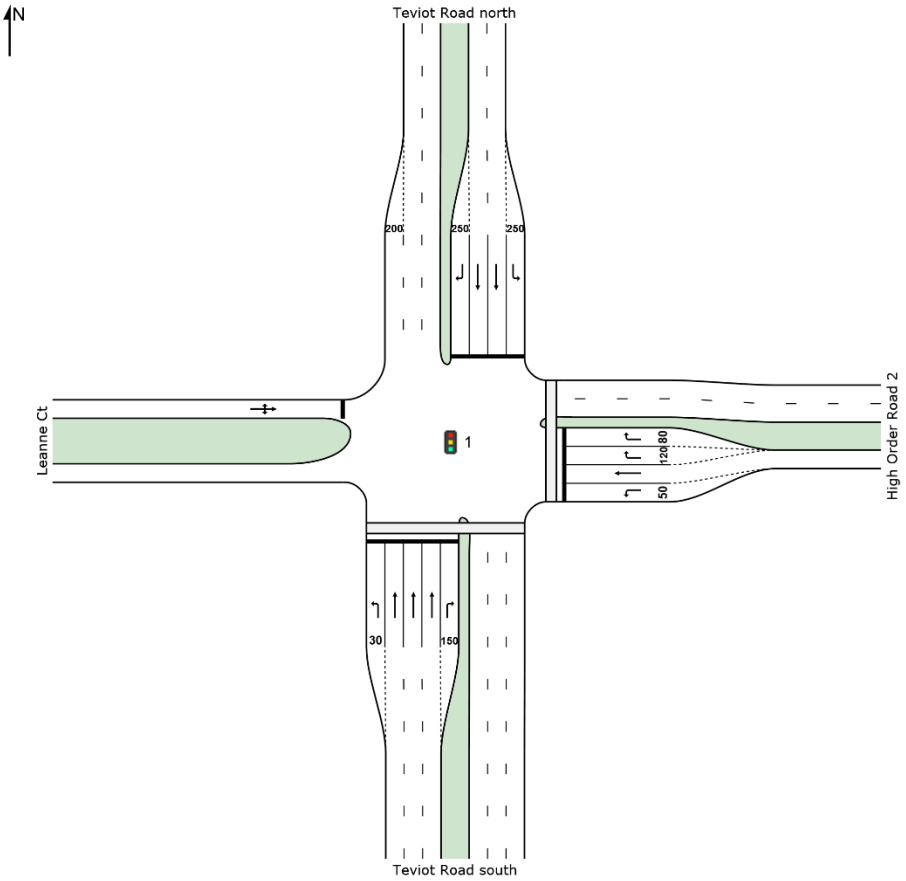


Figure 3-1: Teviot Road / Leanne Ct /HOR 2 Intersection Layout

Figure 3-1 shows the intersection layout and Table 3-1 presents the intersection results for the AM and PM peak period. The phasing summary for this intersection is presented in Appendix I of this report.

Table 3-1 – Movement Summary Teviot Road / Leanne Ct /HOR 2 Intersection

Movement Performance - Vehicles													
Mov ID	OD Mov	Demand Flows		Deg.	Average	Level of Service	Back of Queue	Demand Flows		Deg.	Average	Level of Service	Back of Queue
		Total	HV	Satn.	Delay			Total	HV	Satn.	Delay		
		veh/h	%	v/c	sec		m	veh/h	%	v/c	sec		m
South													
1	L2	1	0.0	0.001	22.1	LOS A	0.2	8	0.0	0.021	56.5	LOS A	3.2
2	T1	1756	3.6	0.785	28.4	LOS C	156.1	784	5.1	0.667	61.5	LOS B	129.9
3	R2	146	1.4	0.449	39.6	LOS A	37.4	180	1.1	0.468	63.0	LOS A	82.0
Approach		1903	3.5	0.785	29.3	LOS C	156.1	972	4.3	0.667	61.8	LOS B	129.9
East													
4	L2	186	1.1	0.320	20.1	LOS A	31.8	180	1.1	0.857	84.2	LOS C	100.7
5	T1	14	0.0	0.052	32.9	LOS A	3.4	22	0.0	0.099	64.6	LOS A	10.2
6	R2	424	1.9	0.833	47.7	LOS C	65.8	238	2.9	0.571	74.1	LOS A	60.7
Approach		624	1.6	0.833	39.1	LOS C	65.8	440	2.0	0.857	77.8	LOS C	100.7

North													
7	L2	181	5.5	0.259	24.5	LOS A	35.4	493	1.2	0.516	31.9	LOS A	165.7
8	T1	602	8.3	0.416	21.8	LOS A	64.7	1793	2.3	0.900	45.1	LOS C	457.8
9	R2	48	0.0	0.146	37.2	LOS A	11.4	41	7.3	0.045	25.5	LOS A	10.8
Approach		831	7.2	0.416	23.3	LOS A	64.7	2327	2.1	0.900	42.0	LOS C	457.8
West													
10	L2	38	13.2	0.355	42.4	LOS A	16.5	15	0.0	0.731	93.1	LOS C	16.2
11	T1	17	0.0	0.355	38.7	LOS A	16.5	12	0.0	0.731	89.4	LOS C	16.2
12	R2	1	0.0	0.355	42.4	LOS A	16.5	1	0.0	0.731	93.0	LOS C	16.2
Approach		56	8.9	0.355	41.3	LOS A	16.5	28	0.0	0.731	91.5	LOS C	16.2
All Vehicles		3414	4.1	0.833	29.8	LOS C	156.1	3767	2.7	0.900	51.6	LOS C	457.8

The SIDRA results suggest that the intersection will be operating within acceptable limits on all approaches with the maximum DOS of 83% (eastern approach) and 90% (northern approach) in AM and PM peak respectively. The phasing summary for this intersection is presented in Appendix I of this report.

3.2 2051 Teviot Road / Greenbank Shopping Centre Intersection

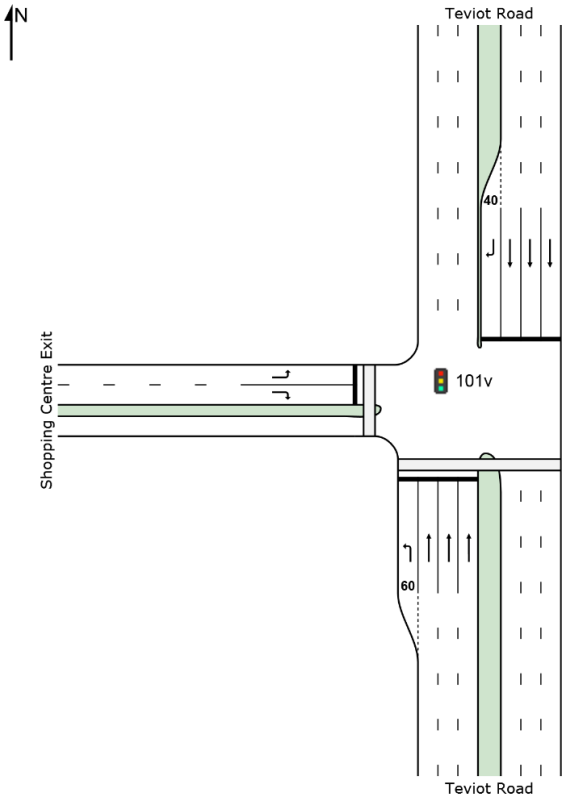


Figure 3-2: Teviot Road / Greenbank Shopping Centre Intersection Layout

Figure 3-2 shows the intersection layout and Table 3-2 presents the intersection results for the AM and PM peak period respectively.

Table 3-2– Movement Summary Teviot Road / Greenbank Shopping Centre Intersection

Movement Performance - Vehicles													
Mov ID	OD Mov	Demand Flows		Deg.	Average	Level of Service	Back of Queue	Demand Flows		Deg.	Average	Level of Service	Back of Queue
		Total	HV	Satn.	Delay			Total	HV	Satn.	Delay		
		veh/h	%	v/c	sec		m	veh/h	%	v/c	sec		m
South													
1	L2	5	0.0	0.006	17.2	LOS A	0.7	49	4.3	0.037	11.6	LOS A	7.1
2	T1	1981	3.5	0.722	18.1	LOS C	149.0	880	4.5	0.211	6.9	LOS A	48.9
Approach		1986	3.4	0.722	18.1	LOS C	149.0	929	4.5	0.211	7.2	LOS A	48.9
North													
8	T1	698	7.1	0.260	13.5	LOS A	40.3	2025	2.2	0.490	9.0	LOS A	148.9
9	R2	132	4.0	0.321	34.2	LOS A	31.8	52	0.0	0.344	78.1	LOS A	25.8
Approach		829	6.6	0.321	16.8	LOS A	40.3	2077	2.2	0.490	10.7	LOS A	148.9
West													
10	L2	20	0.0	0.142	42.5	LOS A	5.4	141	3.0	0.823	82.3	LOS C	79.1
12	R2	42	7.5	0.315	43.7	LOS A	12.5	5	0.0	0.030	70.0	LOS A	2.5
Approach		62	5.1	0.315	43.3	LOS A	12.5	146	2.9	0.823	81.8	LOS C	79.1
All Vehicles		2878	4.4	0.722	18.3	LOS C	149.0	3153	2.9	0.823	13.0	LOS C	148.9

The SIDRA results show that the intersection will continue to operate within acceptable limits on all approaches with the maximum DOS of 72 % (southern approach) and 82 % (western approach) in AM and PM peak respectively. The phasing summary for this intersection is presented in Appendix I of this report.

3.3 2051 Teviot Road / Pub Lane/ HOR 1 Intersection

The Teviot Road / Pub Lane intersection / High Order Road 1 intersection has been analysed with the proposed arrangement as shown in Figure 3-3 below.

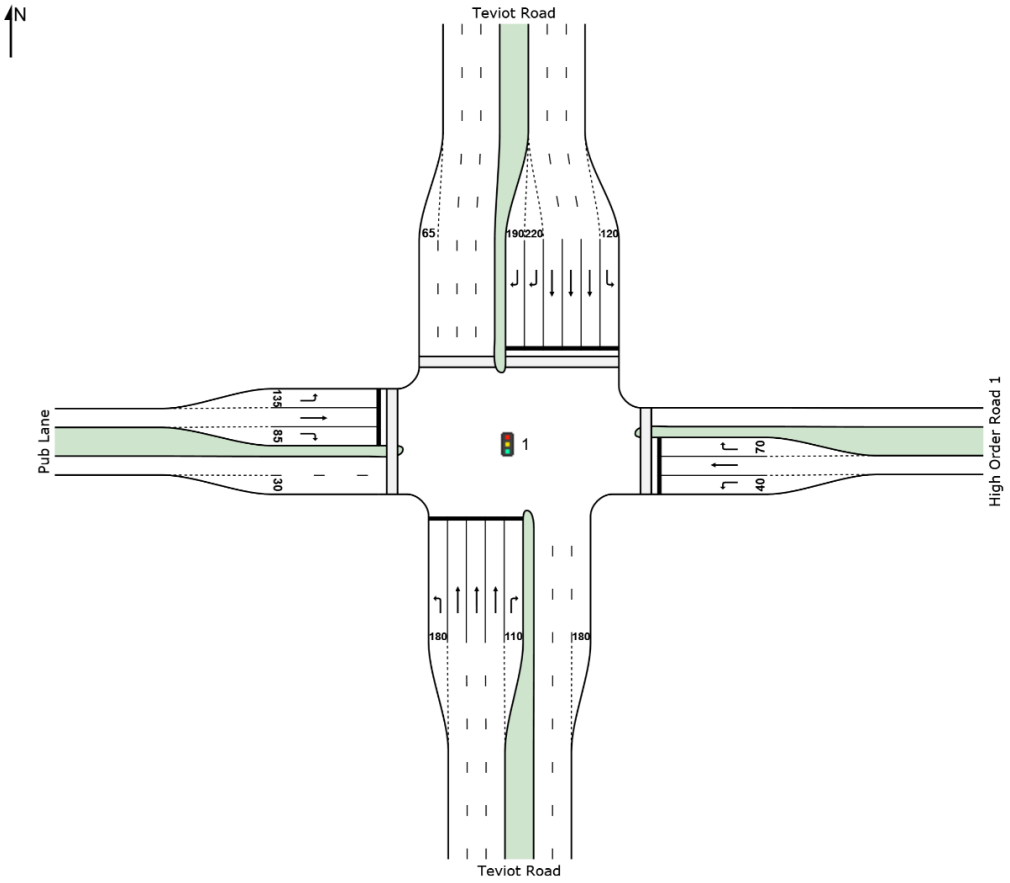


Figure 3-3: 2051 Teviot Road / Pub Lane /HOR1 Intersection

Table 3-3 presents the intersection results for the AM and PM peak period respectively.

Table 3-3: Movement Summary Teviot Road / Pub Lane /HOR 1 Intersection

Movement Performance - Vehicles													
Mov ID	OD Mov	Demand Flows		Deg.	Average	Level of Service	Back of Queue	Demand Flows		Deg.	Average	Level of Service	Back of Queue
		Total	HV	Satn.	Delay			Total	HV	Satn.	Delay		
		veh/h	%	v/c	sec		m	veh/h	%	v/c	sec		m
South													
1	L2	280	2.1	0.332	21.7	LOS A	50.4	320	1.9	0.491	47.4	LOS A	129.7
2	T1	855	4.1	0.759	33.6	LOS C	100.5	456	5.9	0.508	58.9	LOS A	91.5
3	R2	54	1.9	0.255	43.2	LOS A	14.4	61	0.0	0.076	33.9	LOS A	18.3
Approach		1189	3.5	0.759	31.2	LOS C	100.5	837	3.9	0.508	52.7	LOS A	129.7
East													
4	L2	85	0	0.119	23.1	LOS A	15.2	37	0.0	0.036	21.9	LOS A	8.5
5	T1	125	0	0.333	31.1	LOS A	30.4	92	1.1	0.534	72.8	LOS A	47.0
6	R2	233	0.9	0.763	43.2	LOS C	67.3	127	2.4	0.884	91.9	LOS C	74.6
Approach		443	0.5	0.763	35.9	LOS C	67.3	256	1.6	0.884	74.9	LOS C	74.6
North													
7	L2	119	3.4	0.16	14.9	LOS A	11.5	217	0.9	0.453	36.6	LOS A	67.4
8	T1	379	9.5	0.279	28.4	LOS A	31.1	1014	2.8	0.890	76.3	LOS C	194.1
9	R2	205	4.9	0.773	47.6	LOS C	49.4	698	1.9	0.691	42.4	LOS B	228.8
Approach		703	7.1	0.773	31.7	LOS C	49.4	1929	2.2	0.890	59.6	LOS C	228.8

West													
10	L2	798	3.4	0.7	16.9	LOS C	151.8	300	3.0	0.223	12.9	LOS A	51.0
11	T1	120	0	0.369	33.2	LOS A	30.2	113	0.0	0.368	61.8	LOS A	52.3
12	R2	164	3	0.541	40.1	LOS A	44	249	1.6	0.862	81.6	LOS C	139.0
Approach		1082	3	0.7	22.2	LOS C	151.8	662	2.0	0.862	47.1	LOS C	139.0
All Vehicles		3417	3.7	0.773	29.1	LOS C	151.8	3684	2.5	0.890	56.8	LOS C	228.8

The SIDRA results show that the intersection will continue to operate within acceptable limits on all approaches with the maximum DOS of 77 % (northern approach) and 89 % (northern approach) in AM and PM peak respectively. The phasing summary for this intersection is presented in Appendix I of this report.

3.4 2051 Teviot Road / Greenbank Road Intersection

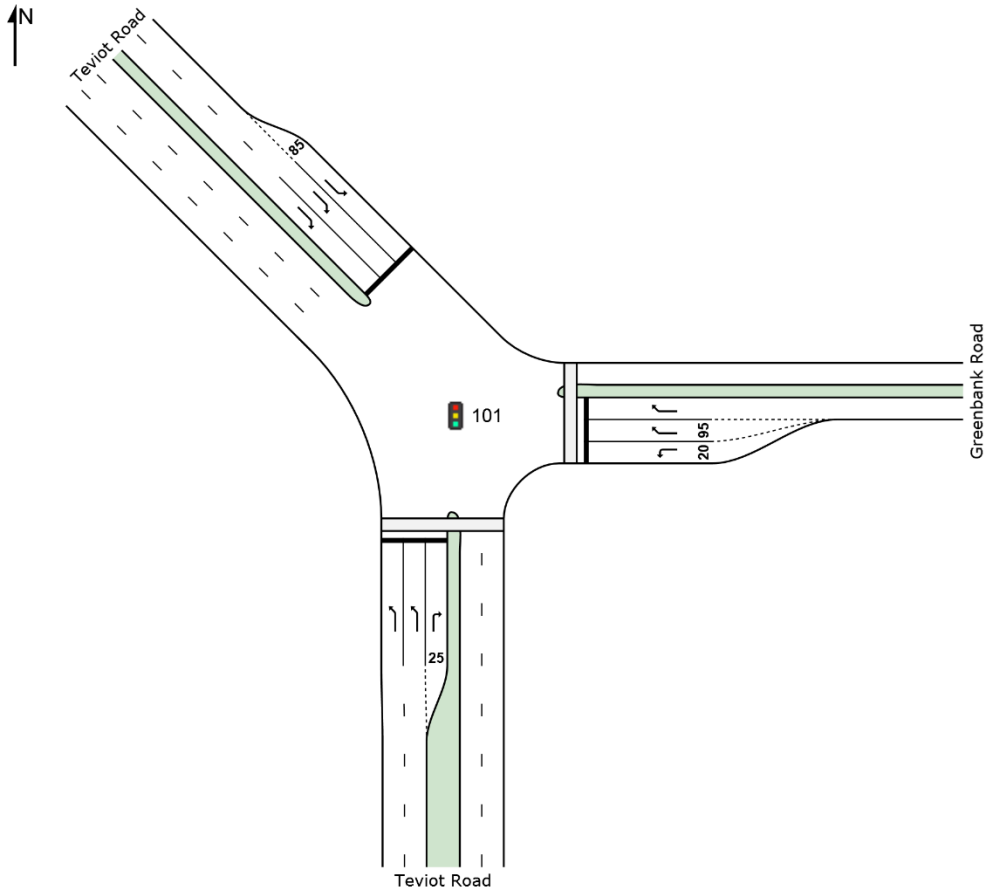


Figure 3-4: Teviot Road /Greenbank Intersection Layout

Figure 3-4 shows the intersection layout and Table 3-4 presents the intersection results for the AM and PM peak period respectively.

Table 3-4 – Movement Summary Teviot Road /Greenbank Intersection

Movement Performance - Vehicles													
Mov ID	OD Mov	Demand Flows		Deg.	Average	Level of Service	Back of Queue	Demand Flows		Deg.	Average	Level of Service	Back of Queue
		Total	HV	Satn.	Delay			Total	HV	Satn.	Delay		
		veh/h	%	v/c	sec		m	veh/h	%	v/c	sec		m
South													
1a	L1	979	2.9	0.356	8.0	LOS A	47.7	505	4.2	0.177	9.7	LOS A	36.0
3	R2	303	3.1	0.599	21.2	LOS A	56.1	1	0.0	0.004	61.4	LOS A	0.4
Approach		1282	3.0	0.599	11.2	LOS A	56.1	506	4.2	0.177	9.8	LOS A	36.0
East													
4	L2	1	0.0	0.004	38.7	LOS A	0.3	113	1.9	0.561	66.8	LOS A	52.9
6a	R1	274	5.8	0.590	42.2	LOS A	39.3	375	3.7	0.726	70.3	LOS C	113.1
Approach		275	5.7	0.590	42.2	LOS A	39.3	487	3.2	0.726	69.5	LOS C	113.1
NorthWest													
27a	L1	199	8.5	0.273	22.1	LOS A	39.4	207	4.1	0.145	9.7	LOS A	28.7
29a	R1	463	5.9	0.555	34.9	LOS A	60.5	1162	2.3	0.568	26.6	LOS A	199.6
Approach		662	6.7	0.555	31.1	LOS A	60.5	1369	2.5	0.568	24.0	LOS A	199.6
All Vehicles		2219	4.4	0.599	20.9	LOS A	60.5	2363	3.0	0.726	30.3	LOS C	199.6

The SIDRA results of the intersection analysis undertaken shows that the intersection will operate within acceptable limits on all approaches with a maximum DOS of 59% (southern approach) and 72% (eastern approach) during both AM and PM peak traffic conditions. The phasing summary for this intersection is presented in Appendix I of this report.

3.5 2051 Greenbank Road / High Order Road 1 Intersection

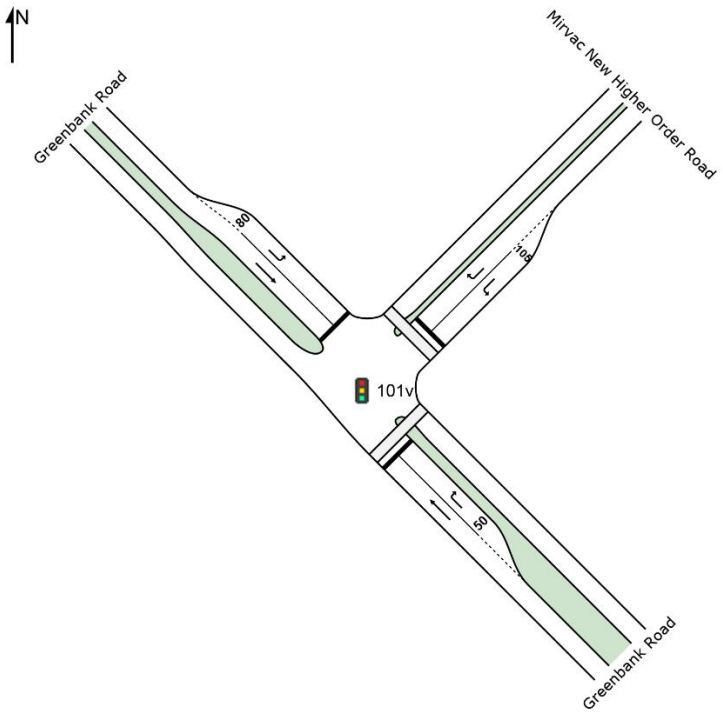


Figure 3-5: 2051 Greenbank Road / High Order Road 1 Intersection Layout

Figure 3-5 shows the intersection layout and Table 3-5 presents the intersection results for Greenbank Road / High Order Road 1 Intersection in AM and PM peak period respectively.

Table 3-5 – Movement Summary Greenbank Road / High Order Road 1 Intersection

Movement Performance - Vehicles													
Mov ID	OD Mov	Demand Flows		Deg.	Average	Level of Service	Back of Queue	Demand Flows		Deg.	Average	Level of Service	Back of Queue
		Total	HV	Satn.	Delay			Total	HV	Satn.	Delay		
		veh/h	%	v/c	sec		m	veh/h	%	v/c	sec		m
SouthEast													
22	T1	274	5.8	0.195	3.4	LOS A	23.7	487	3.2	0.296	2.2	LOS A	48.8
23	R2	89	3.5	0.217	33.3	LOS A	20.9	258	1.2	0.274	27.8	LOS A	74.8
Approach		363	5.2	0.217	10.8	LOS A	23.7	745	2.5	0.296	11.1	LOS A	74.8
NorthEast													
24	L2	241	1.7	0.578	36.1	LOS A	61.3	82	2.6	0.088	25.6	LOS A	21.6
26	R2	1	0.0	0.005	39.8	LOS A	0.3	1	0.0	0.008	75.0	LOS A	0.5
Approach		242	1.7	0.578	36.2	LOS A	61.3	83	2.5	0.088	26.2	LOS A	21.6
NorthWest													
27	L2	1	0.0	0.001	18.8	LOS A	0.2	1	0.0	0.002	43.0	LOS A	0.4
28	T1	502	5.2	0.602	18.6	LOS B	110.0	207	4.1	0.352	43.0	LOS A	84.5
Approach		503	5.2	0.602	18.6	LOS B	110.0	208	4.0	0.352	43.0	LOS A	84.5
All Vehicles		1108	4.5	0.602	19.9	LOS B	110.0	1037	2.8	0.352	18.7	LOS A	84.5

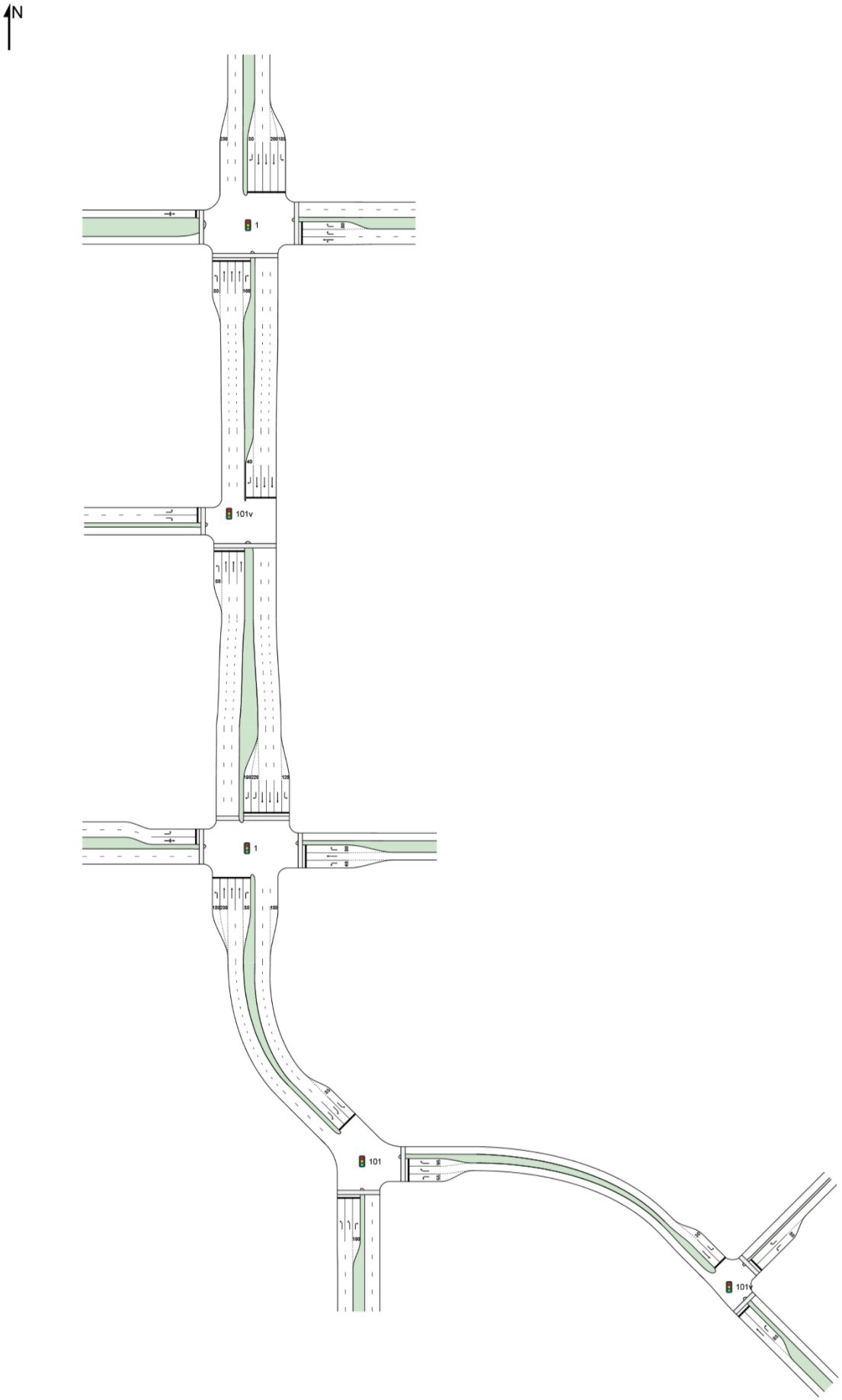
The SIDRA results of the intersection analysis undertaken shows that the intersection will operate within acceptable limits on all approaches with a maximum DOS of 60% and 35% on north-western approaches for the AM peak and PM peak periods. The phasing summary for this intersection is presented in Appendix I of this report.

REVISION SCHEDULE

Rev	Date	Description	Prepared	Reviewed	Approved
1	03/03/2017	Final	Sarah Atif	Henry Strachan	Ali Syed

2051 SIDRA Network

SITES IN NETWORK	
Site ID	**Site Name**
1	2051-Leanne Ct Intersection_AM
101v	2051-Shopping Centre Intersection_AM
1	2051-Pub Lane Intersection_AM
101	2051-Greenbank/ Teviot Road Intersection_AM
101v	2051-Greenbank Road/ Mirvac New HOR Intersection_AM

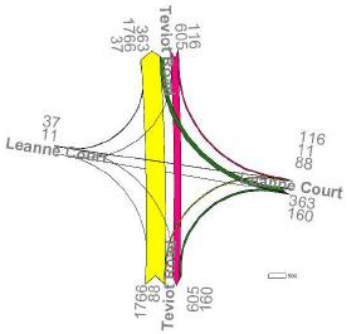

N
1
101v
1
101
101

Appendices

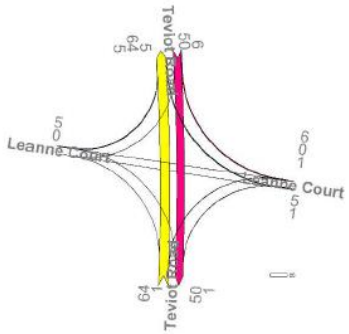
Appendix A: VLC Turning Movement Counts (1 Hour)

Teviot Road/ Leanne Court Intersection

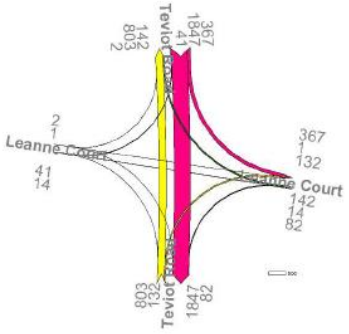
Intersection 2 (nodenr 25521): Teviot Rd / Leanne Ct (2051 Mirvac - Full SRIP)



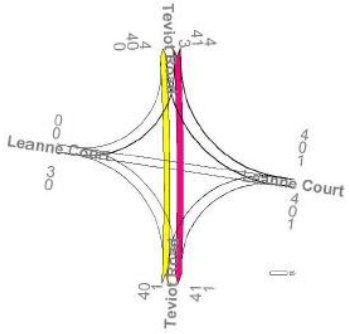
Total Vehicles: AM Peak 1 Hour



Goods Vehicles: AM Peak 1 Hour



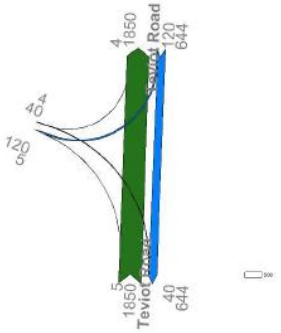
Total Vehicles: PM Peak 1 Hour



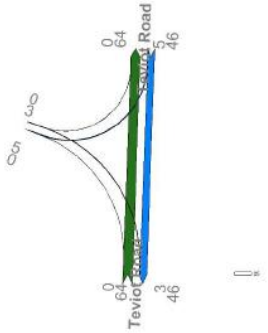
Goods Vehicles: PM Peak 1 Hour

Teviot Road/ Greenbank Shopping Centre Intersection

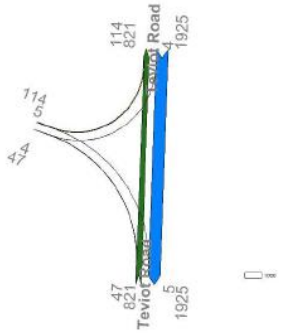
Intersection 7 (nodenr 31641): Teviot Rd / Greenbank Shopping Center (2051 Mirvac - Full SRIP)



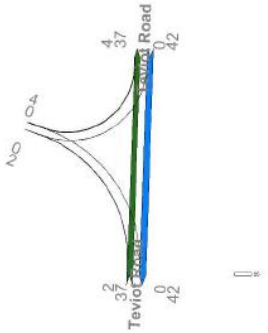
Total Vehicles: AM Peak 1 Hour



Goods Vehicles: AM Peak 1 Hour



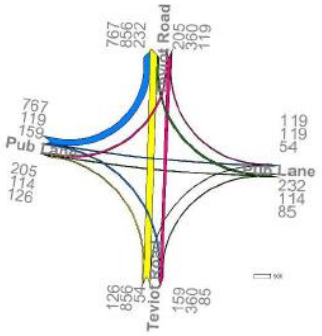
Total Vehicles: PM Peak 1 Hour



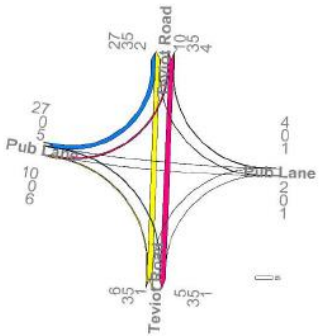
Goods Vehicles: PM Peak 1 Hour

Teviot Road/ Pub Lane Intersection

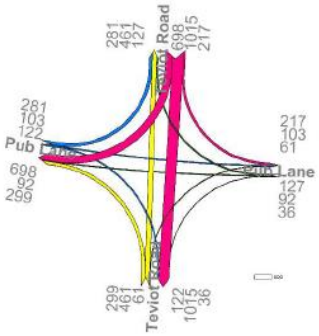
Intersection 1 (nodenr 11193): Teviot Rd / Pub Lane (2051 Mirvac - Full SRIP)



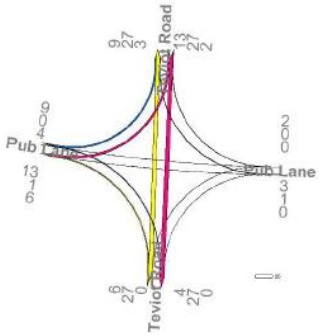
Total Vehicles: AM Peak 1 Hour



Goods Vehicles: AM Peak 1 Hour



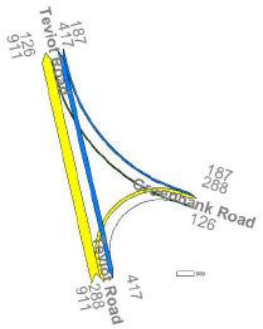
Total Vehicles: PM Peak 1 Hour



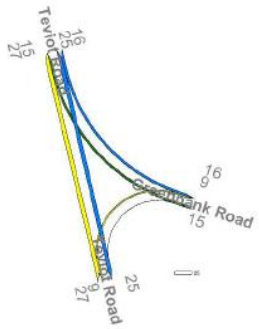
Goods Vehicles: PM Peak 1 Hour

Teviot Road/ Greenbank Road Intersection

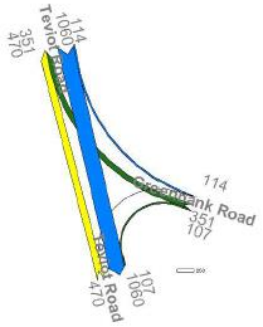
Intersection 3 (nodenr 11194): Teviot Rd / Greenbank Rd (2051 Mirvac - Full SRIP)



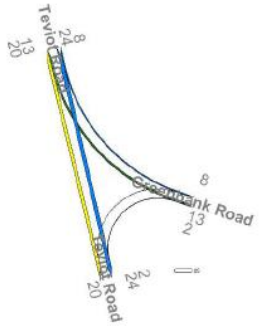
Total Vehicles: AM Peak 1 Hour



Goods Vehicles: AM Peak 1 Hour



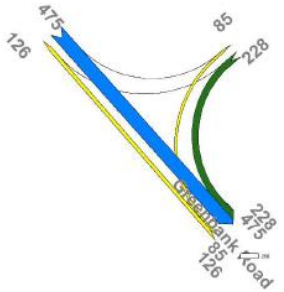
Total Vehicles: PM Peak 1 Hour



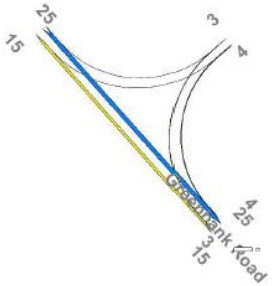
Goods Vehicles: PM Peak 1 Hour

Greenbank Road/ Mirvac HOR 1 Intersection

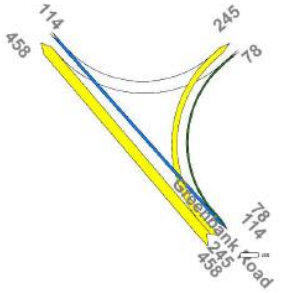
Intersection 8 (nodenr 36319): Greenbank Rd (2051 Mirvac - Full SRIP)



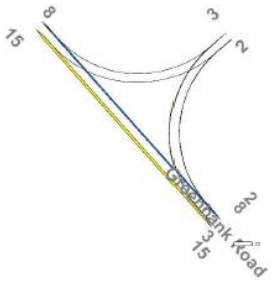
Total Vehicles: AM Peak 1 Hour



Goods Vehicles: AM Peak 1 Hour



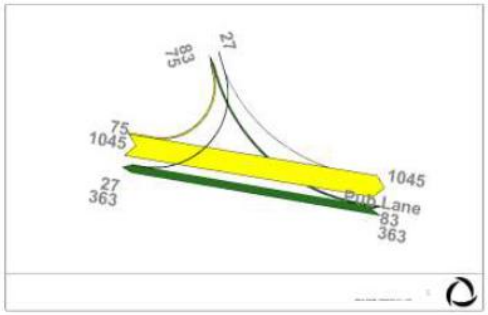
Total Vehicles: PM Peak 1 Hour



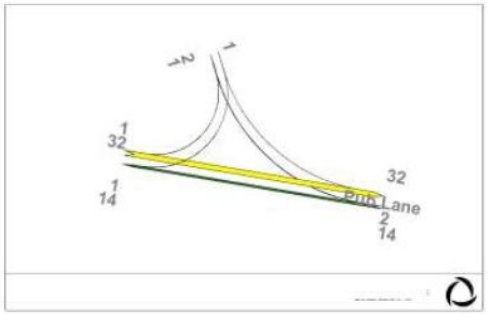
Goods Vehicles: PM Peak 1 Hour

Shopping Centre Access at Pub Lane Intersection

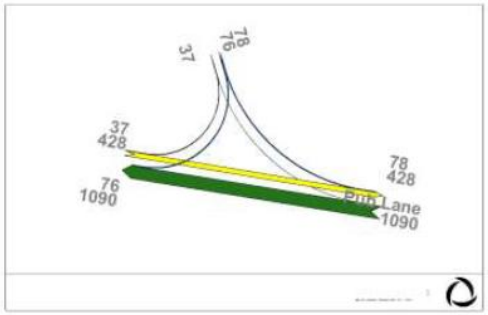
Intersection 9 (nodenr 31597): Pub Lane (2051 Mirvac - Full SRIP)



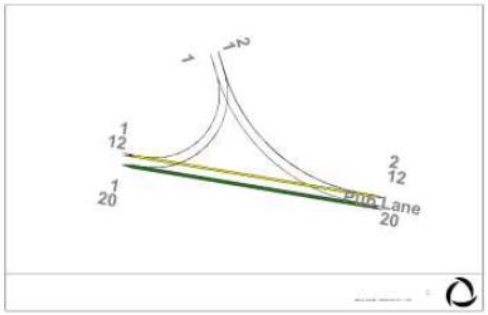
Total Vehicles: AM Peak 1 Hour



Goods Vehicles: AM Peak 1 Hour

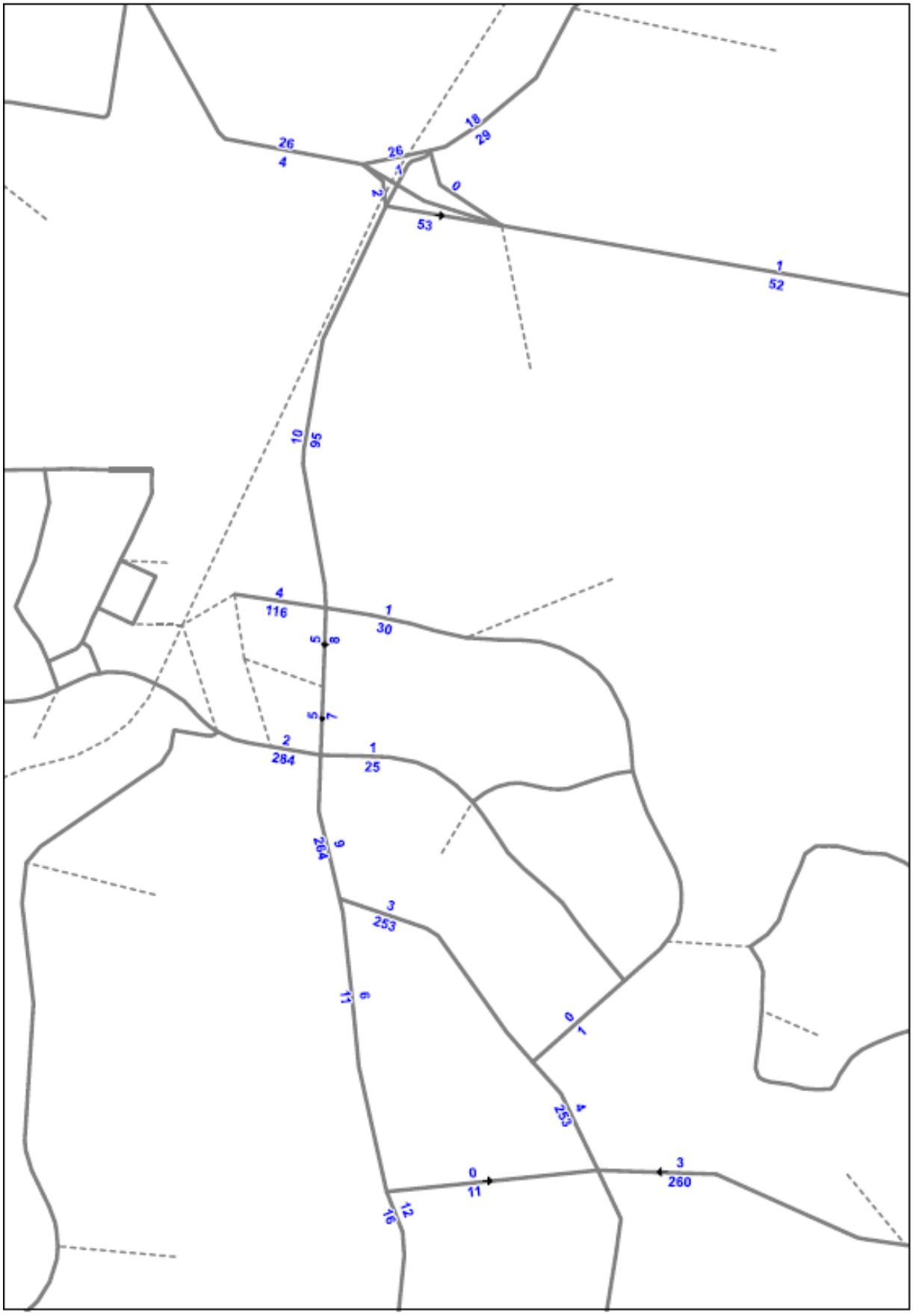


Total Vehicles: PM Peak 1 Hour

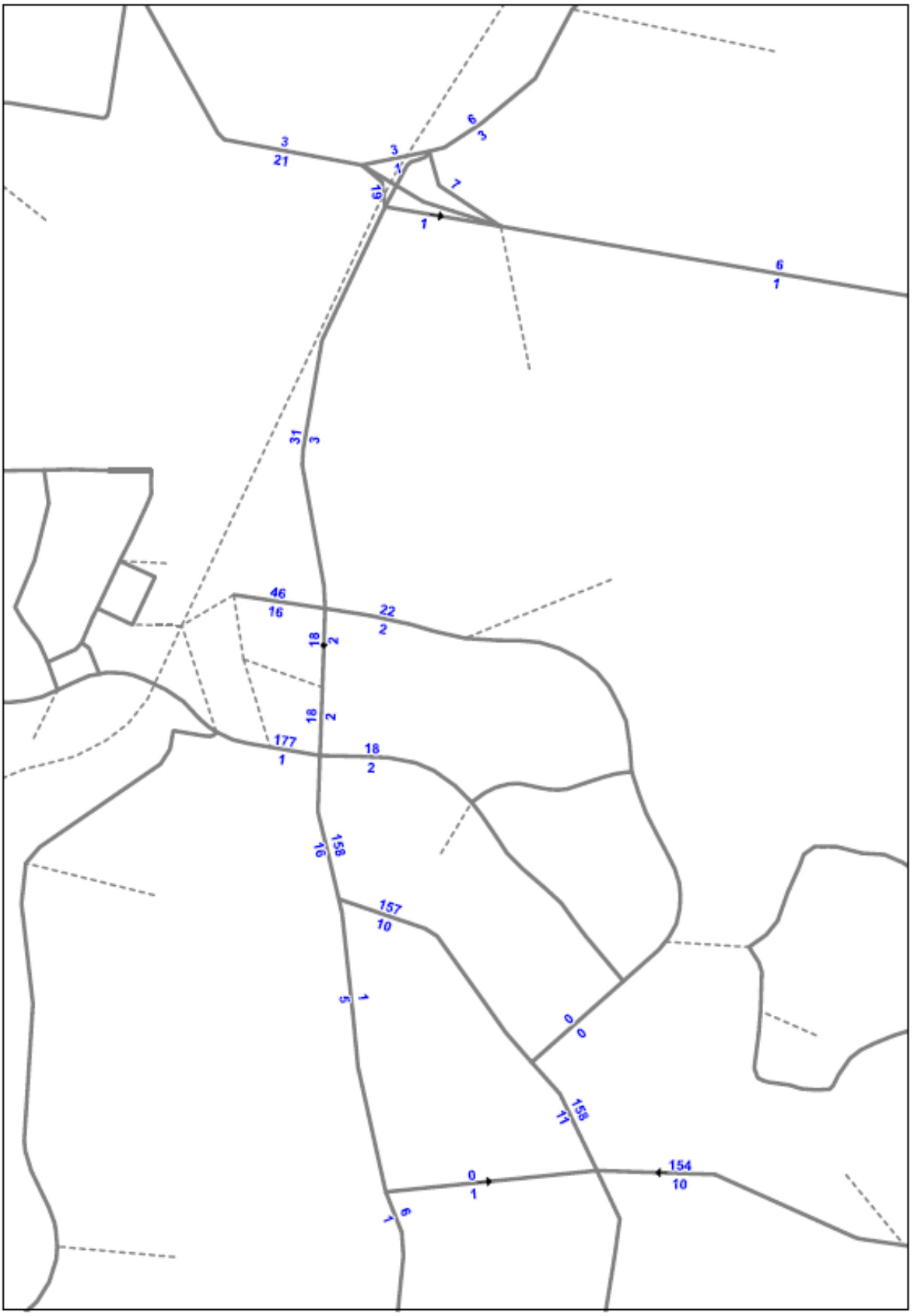


Goods Vehicles: PM Peak 1 Hour

Appendix B: PT Vehicular Access Volumes (2 Hours)



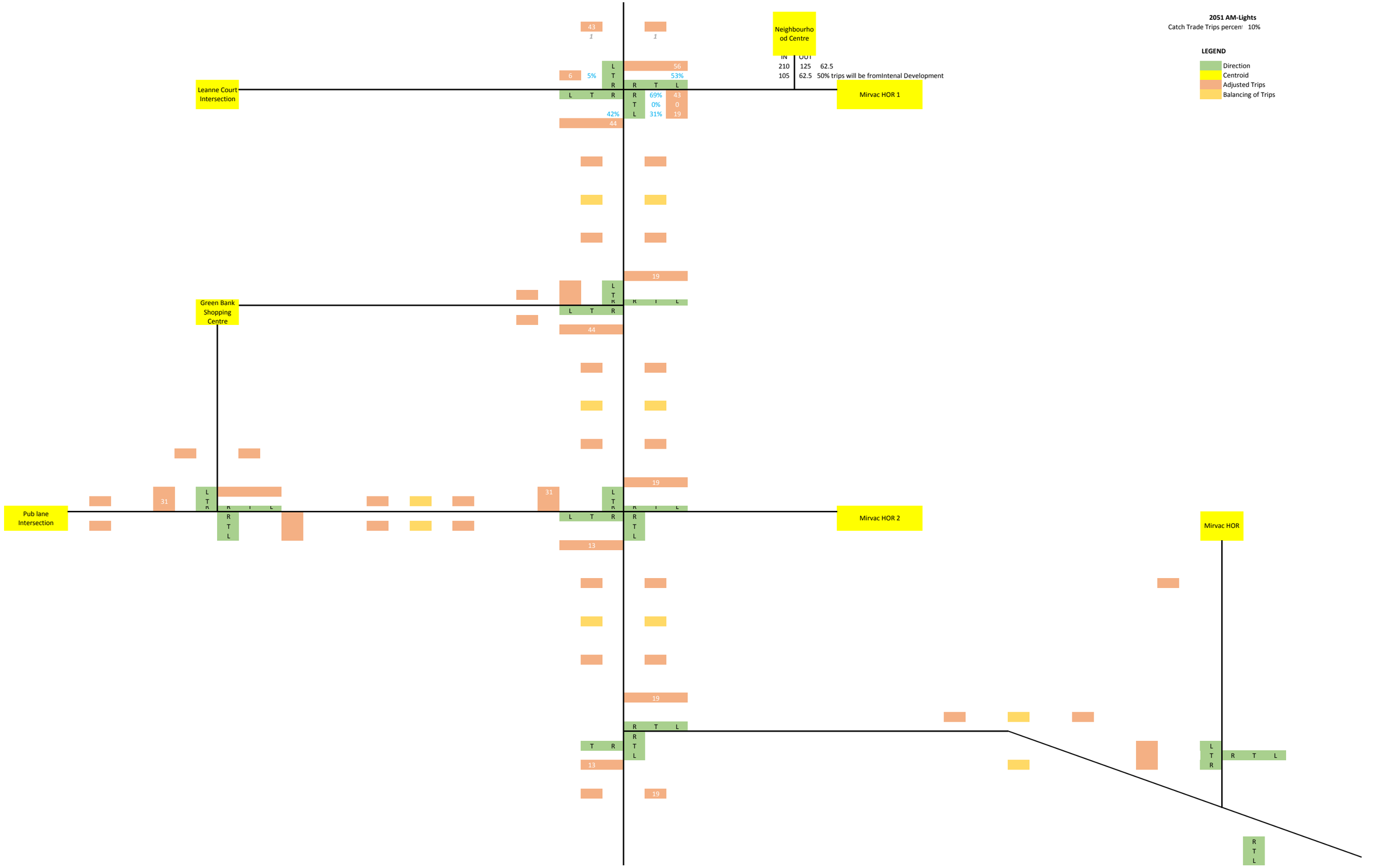
PT Park'n'Ride Access Demands (AM 2 hours), 2051 (Full SRIP)



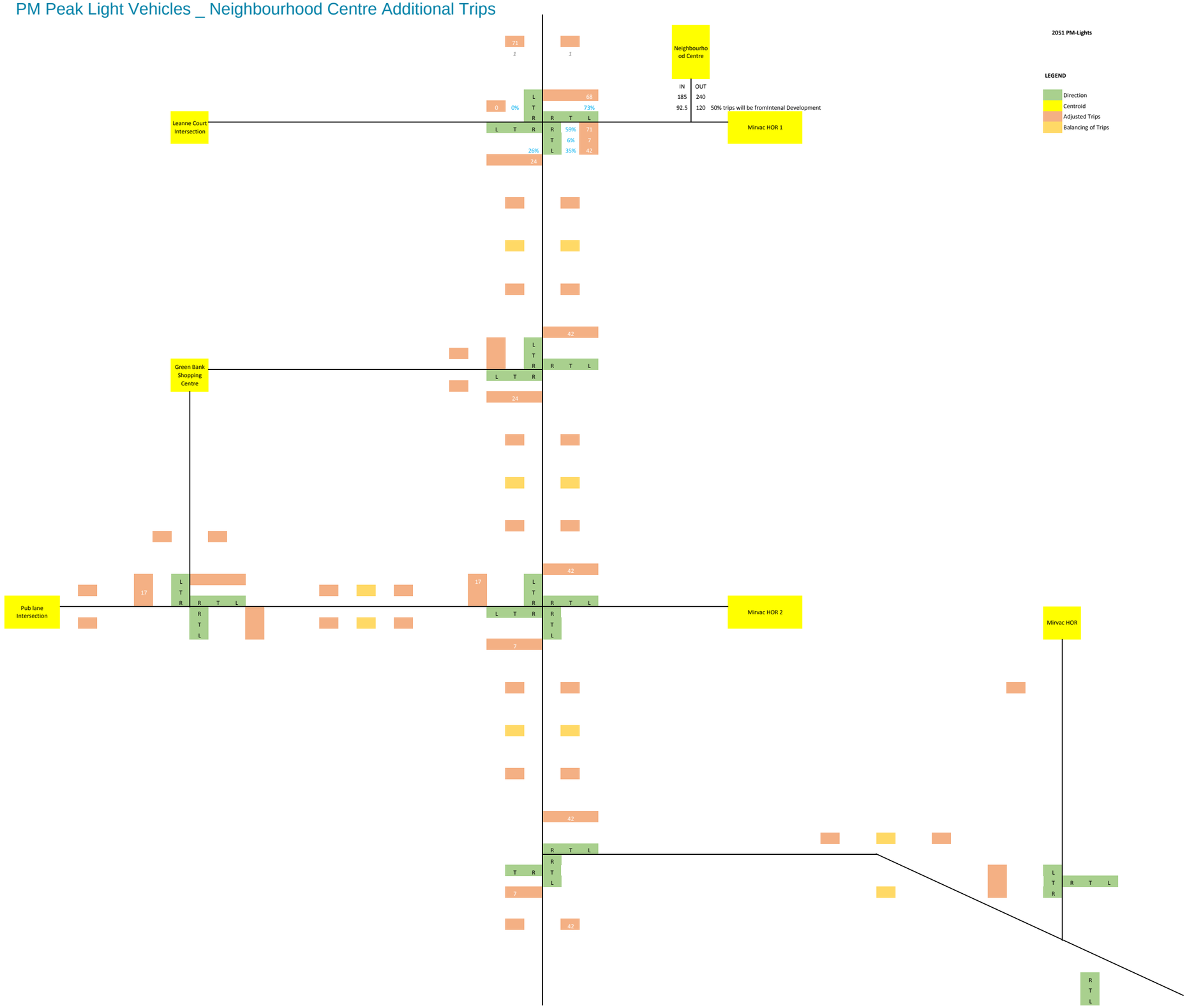
PT Park'n'Ride Access Demands (PM 2 hours), 2051 (Full SRIP)

Appendix C: Neighbourhood Centre Additional Trips

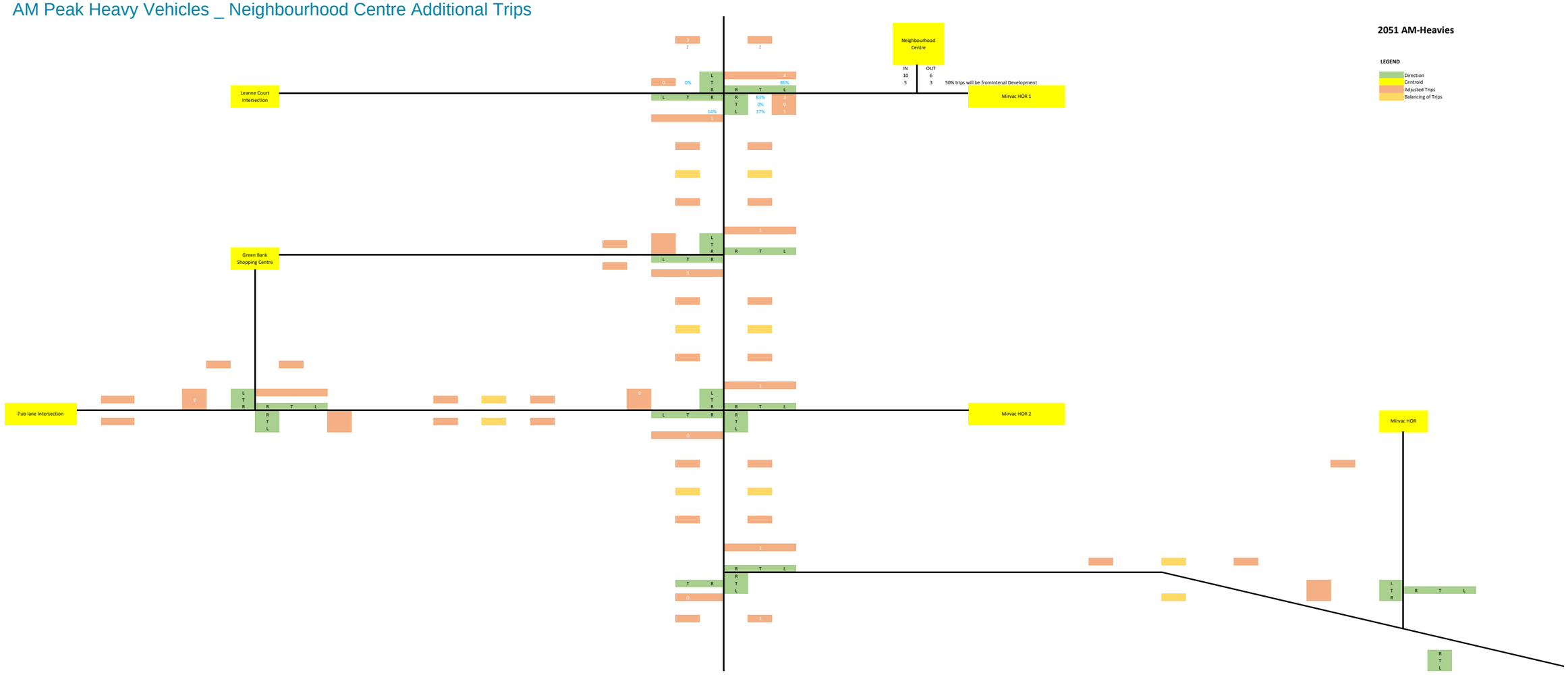
AM Peak Light Vehicles _ Neighbourhood Centre Additional Trips



PM Peak Light Vehicles _ Neighbourhood Centre Additional Trips



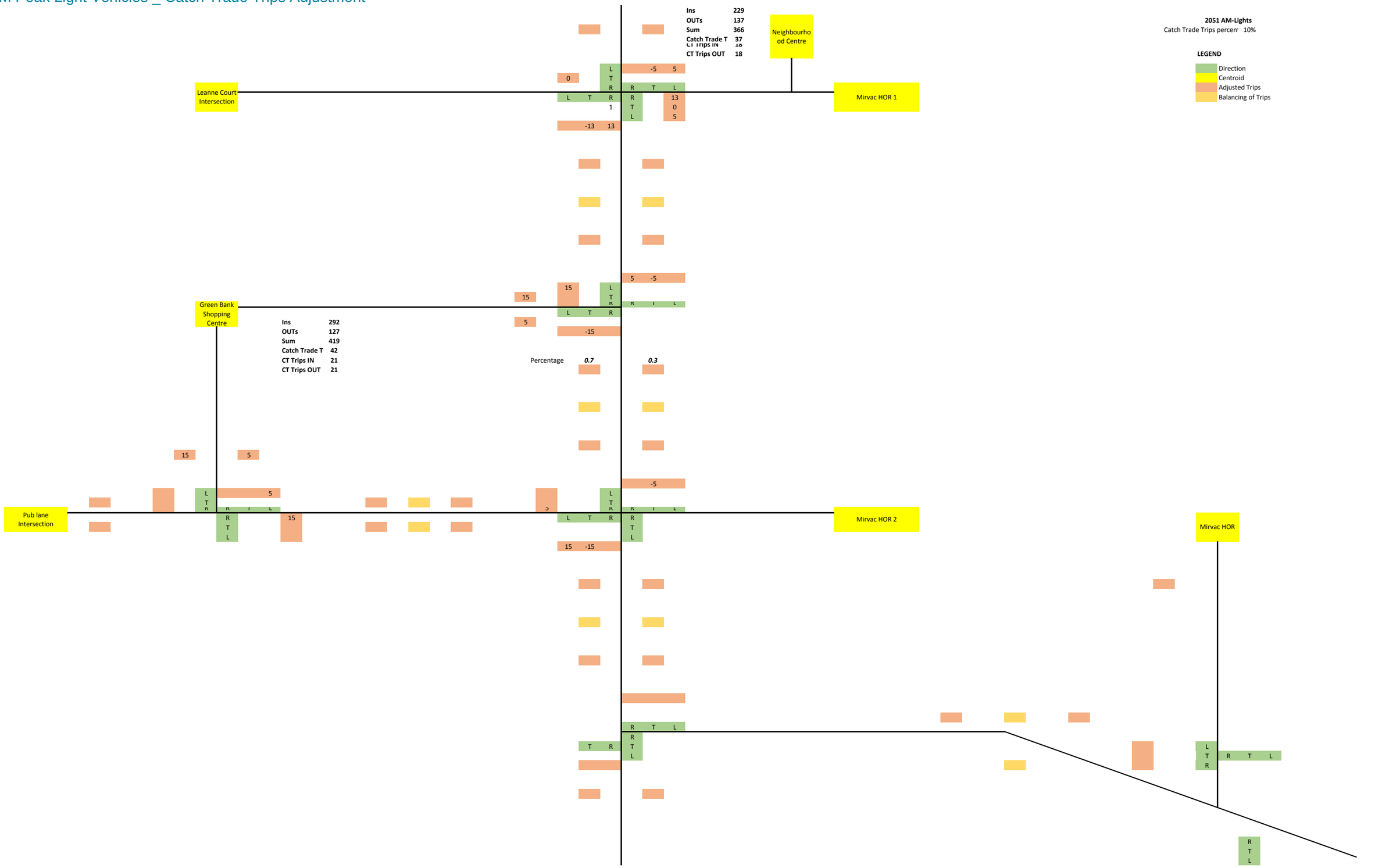
AM Peak Heavy Vehicles _ Neighbourhood Centre Additional Trips



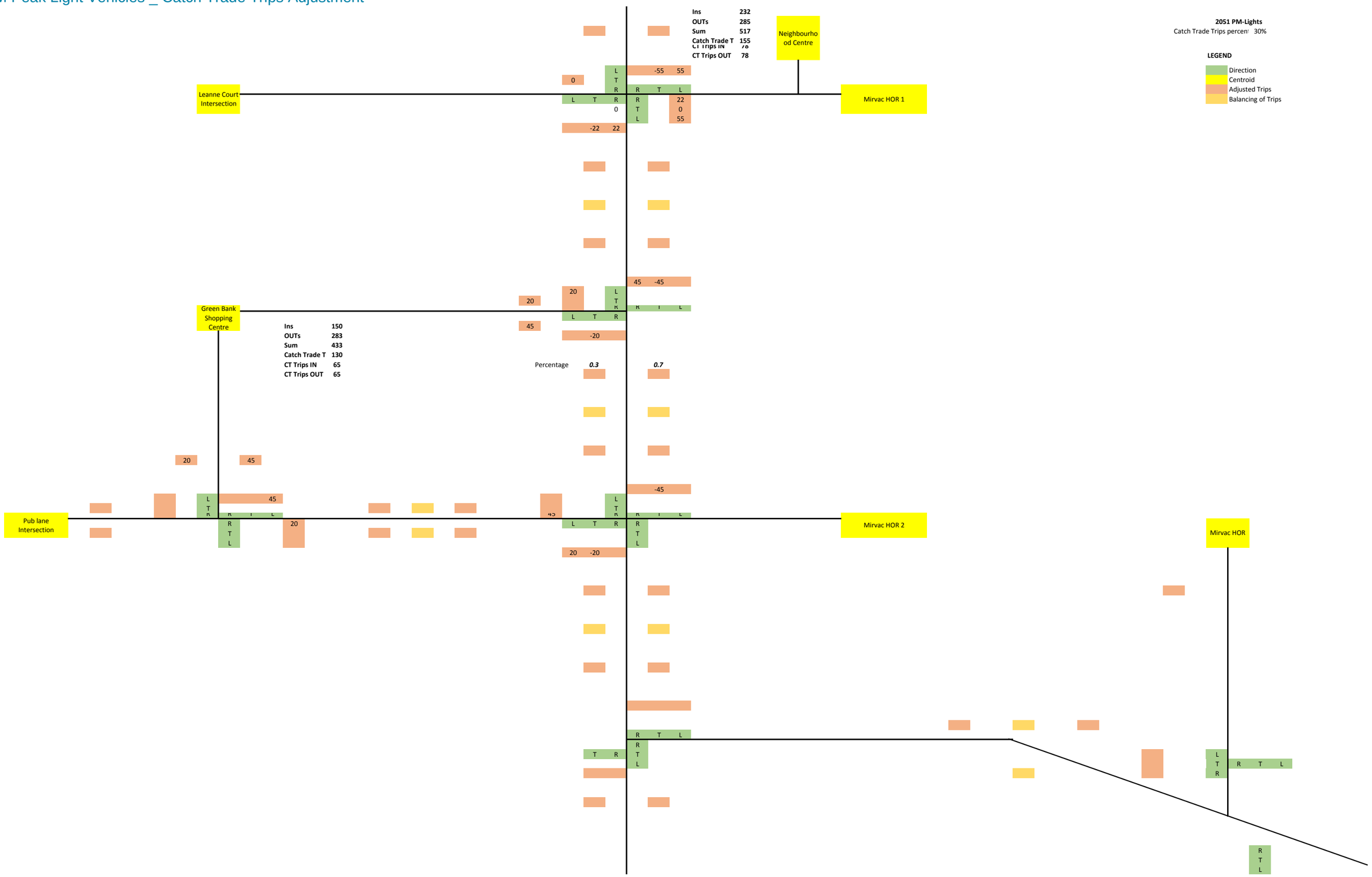
PM Peak Heavy Vehicles _ Neighbourhood Centre Additional Trips

Appendix D: Catch Trade Trips Adjustment

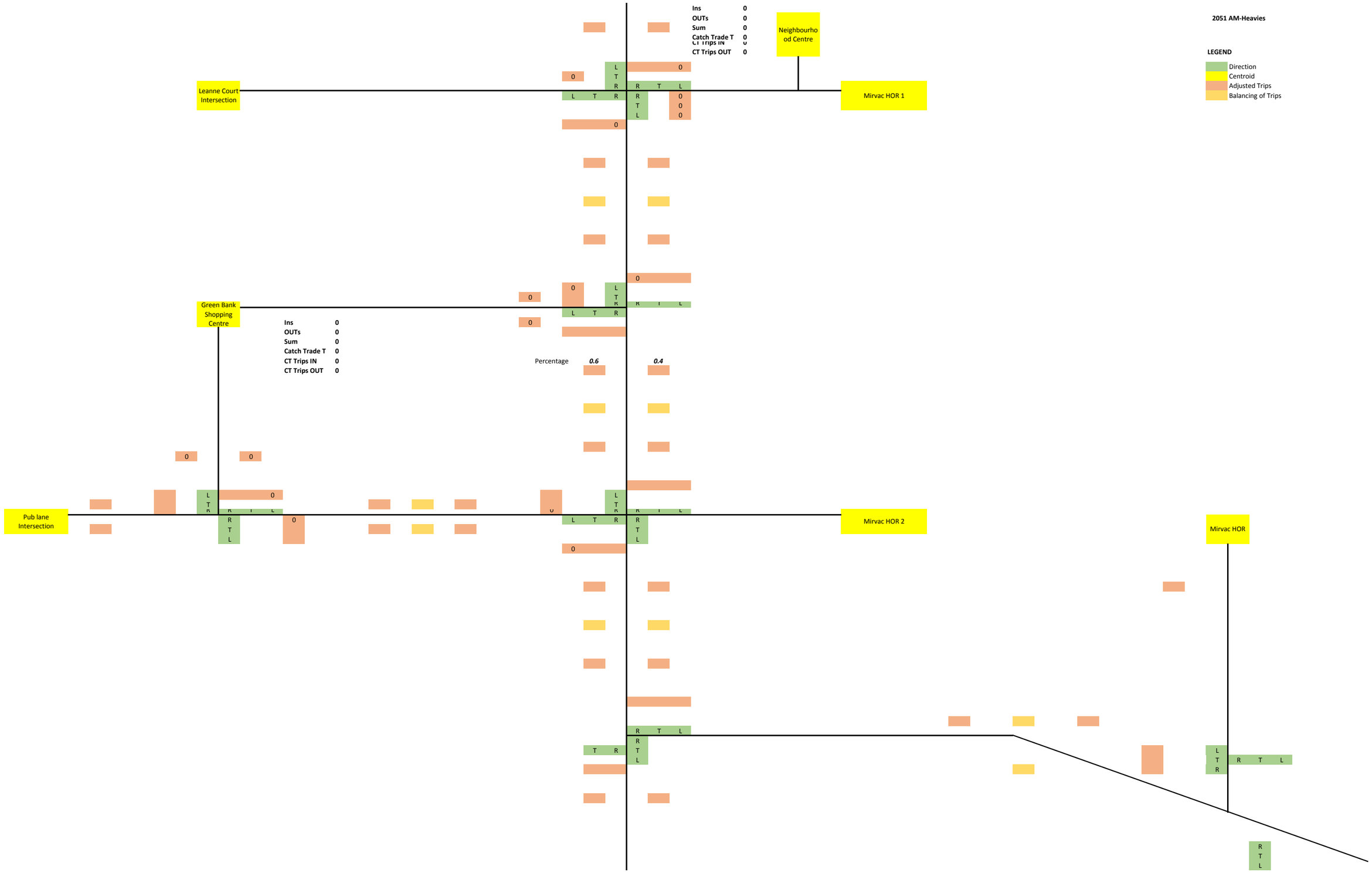
AM Peak Light Vehicles _ Catch Trade Trips Adjustment



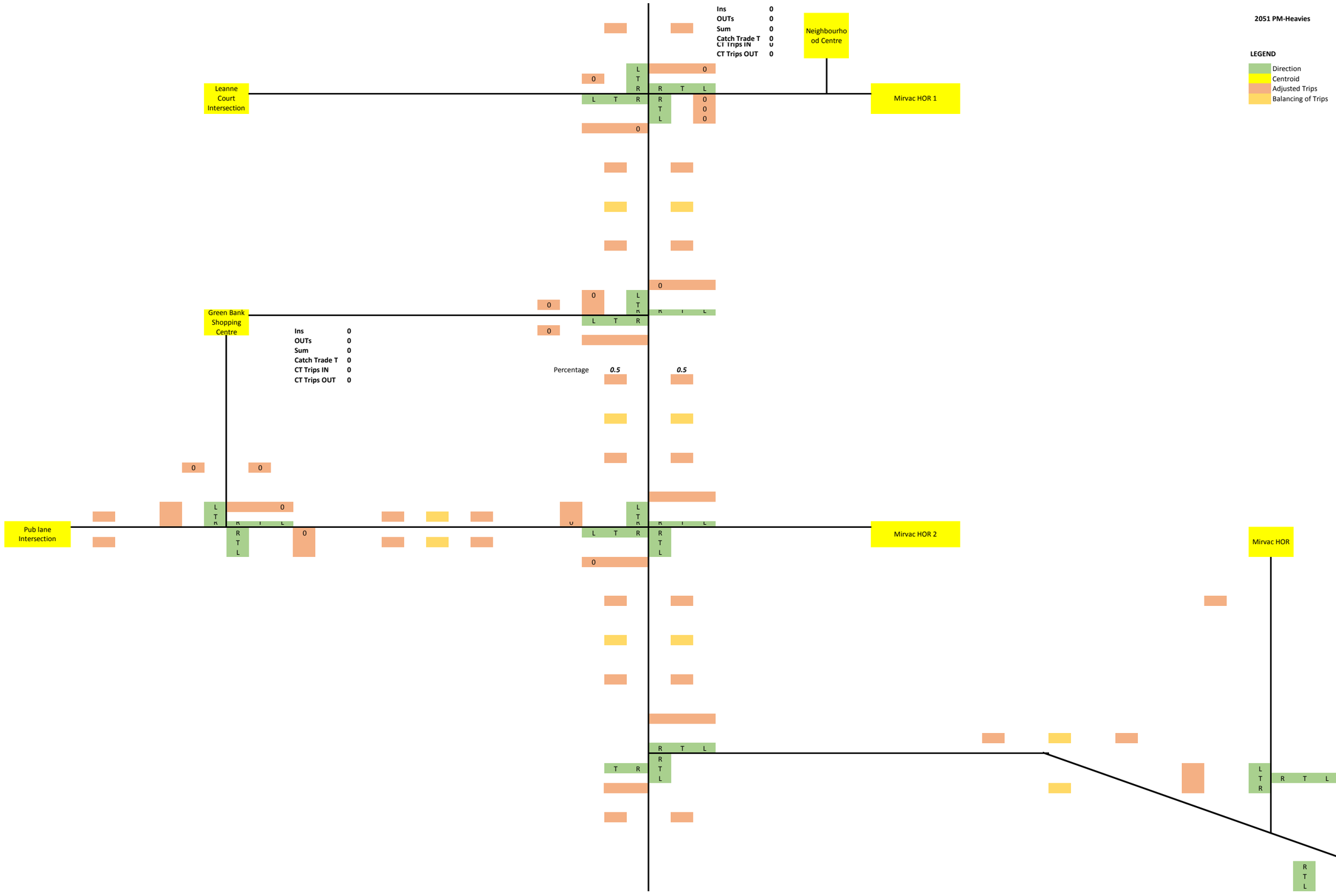
PM Peak Light Vehicles _ Catch Trade Trips Adjustment



AM Peak Heavy Vehicles _ Catch Trade Trips Adjustment

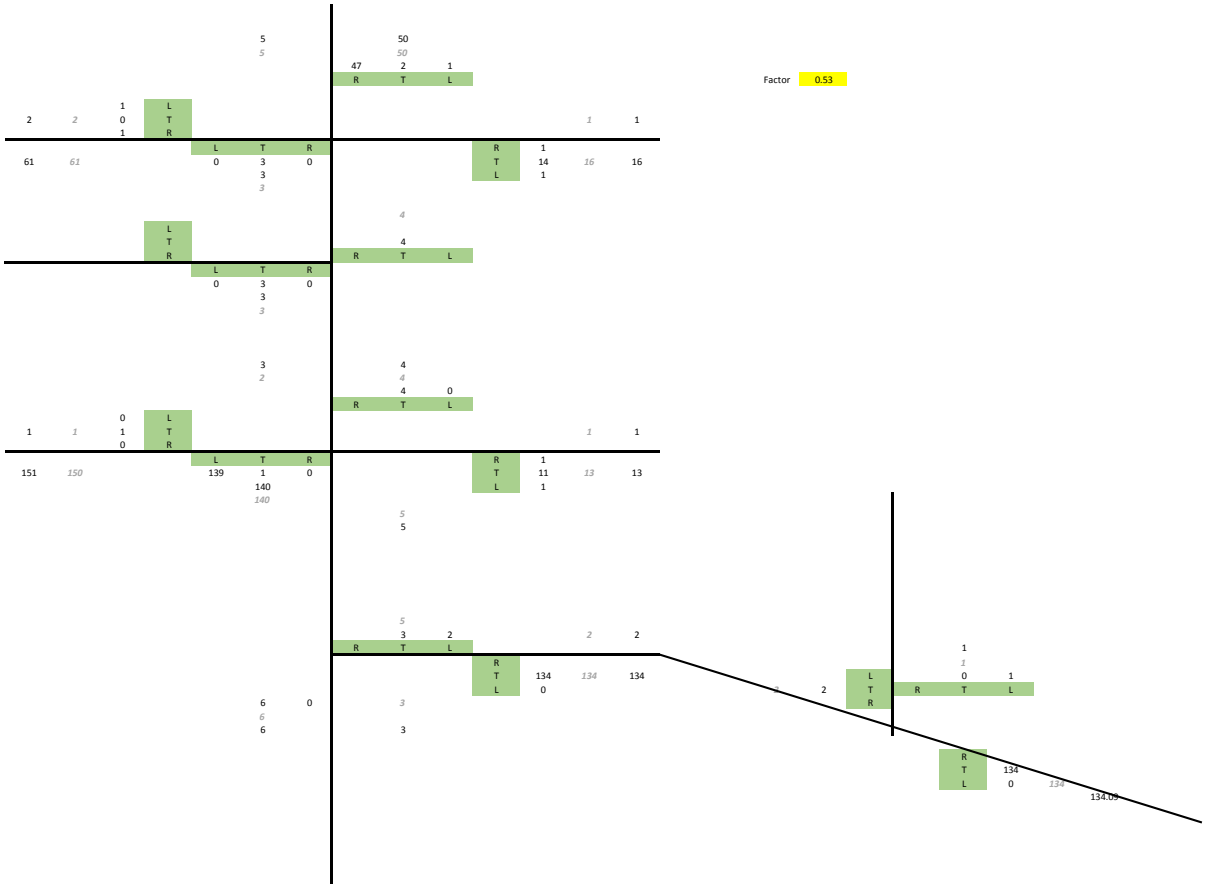


PM Peak Heavy Vehicles _ Catch Trade Trips Adjustment

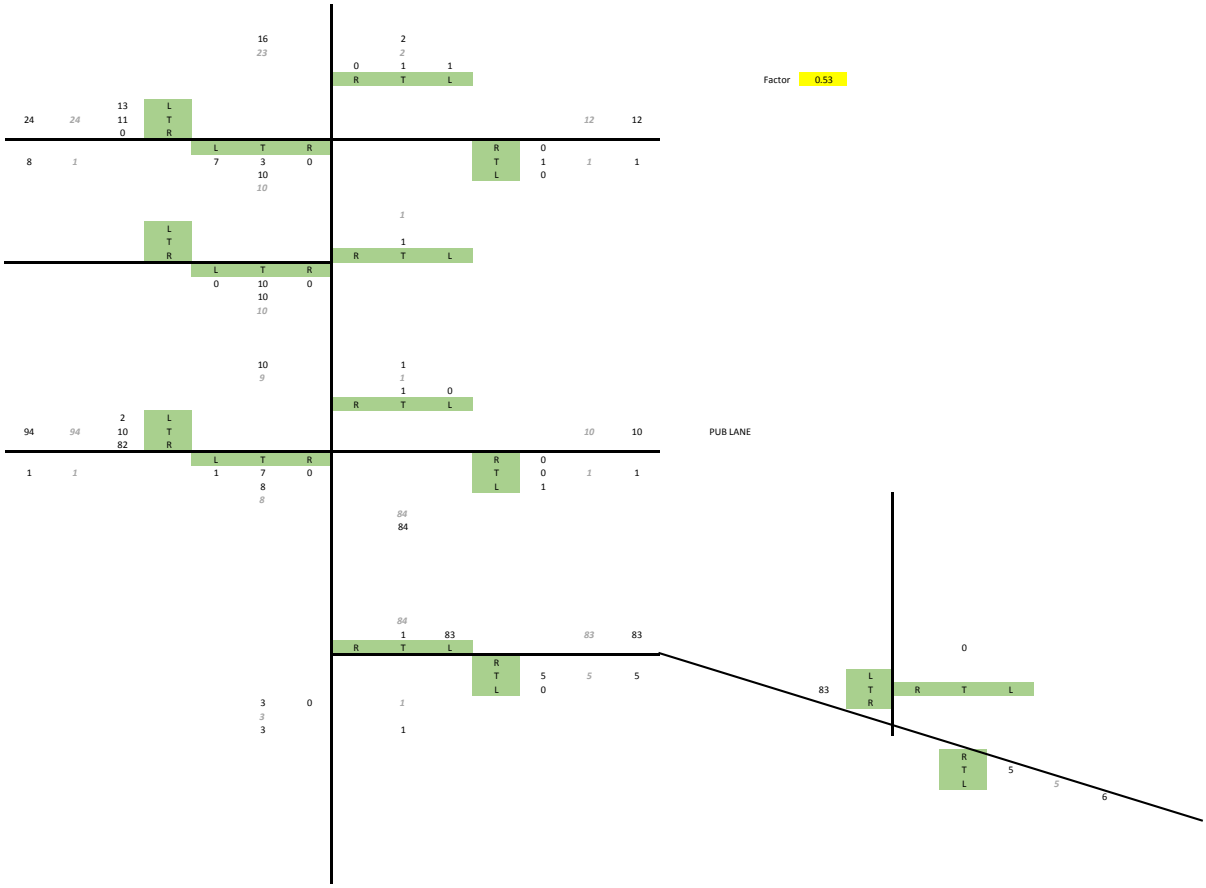


Appendix E: Traffic Stick Diagrams _ PT Vehicular Access Volumes (1 Hour)

AM Peak _ PT Access Volume

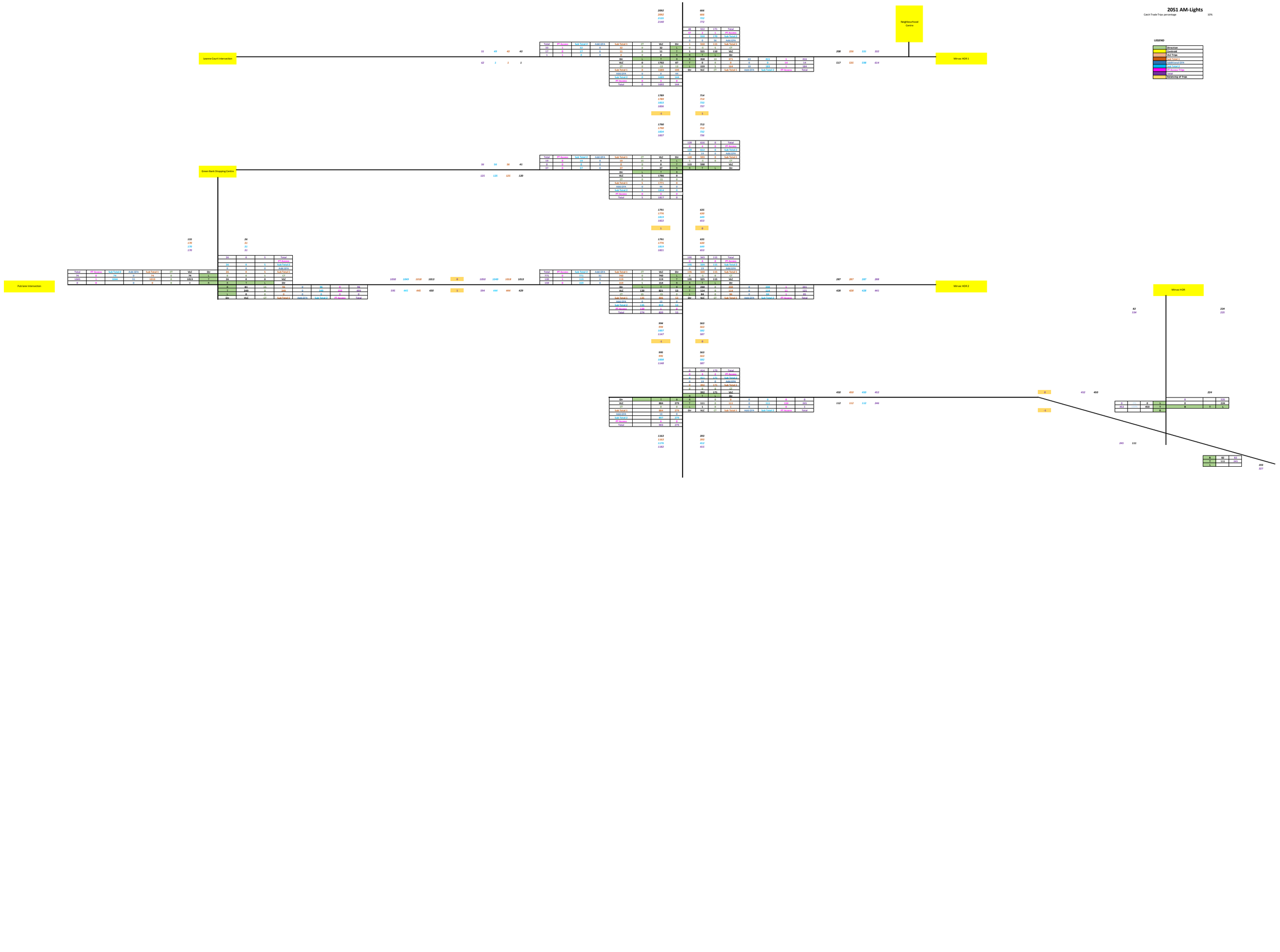


PM Peak _ PT Access Volume



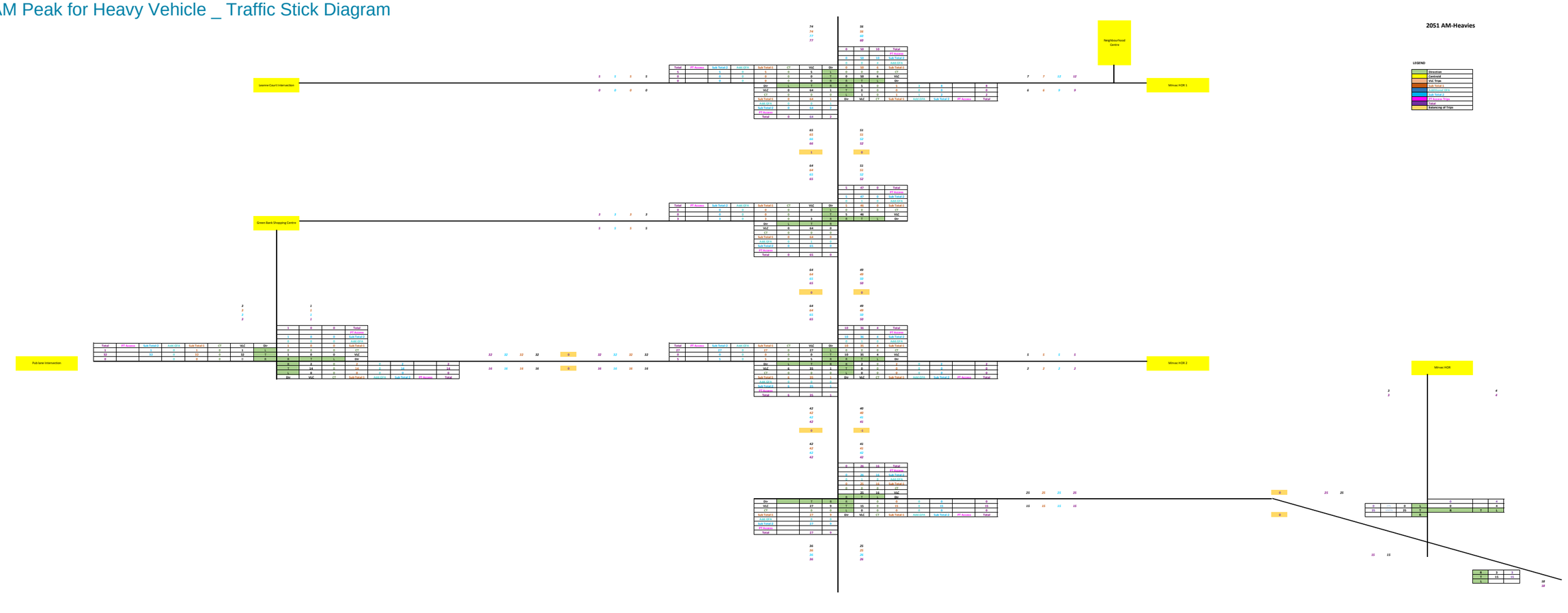
Appendix F: Traffic Stick Diagrams

AM Peak for Light Vehicle _ Traffic Stick Diagrams

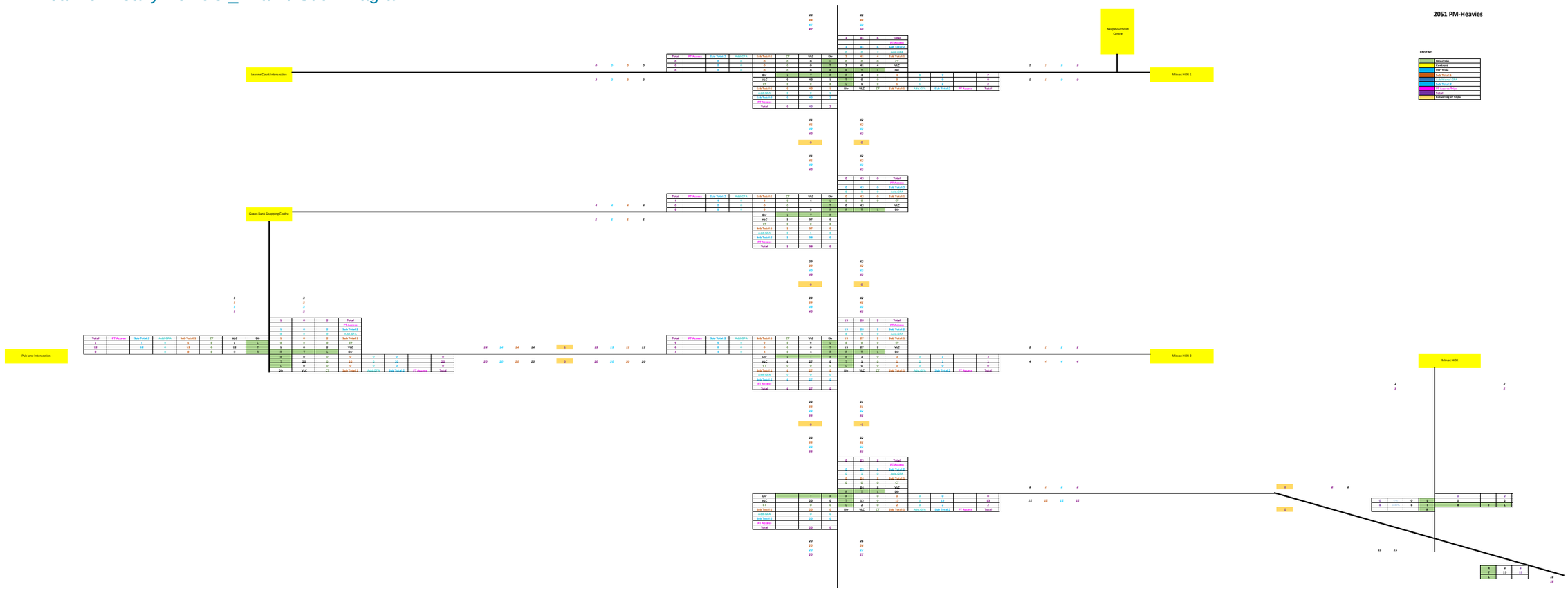


PM Peak for Light Vehicle _ Traffic Stick Diagram

AM Peak for Heavy Vehicle _ Traffic Stick Diagram



PM Peak for Heavy Vehicle _ Traffic Stick Diagram



Appendix G: Peak Hour Trips Estimation

AM Peak

	Land Use	Qty	RMS Rates 100/m 2	Peak Hour Trips Generatio n	Operating Capacity	Productions	Attractions
Mirvac Neighbourhood Centre (MWH)	Community Facility (Medical)	4000	10.4	416	100%	154	262
	Neighbourhood Centre (Retail)	7000	12.3	301	35%	115	187
	Total	**11000**		**717**		**268**	**449**
Mirvac Neighbourhood Centre (VLC)	Community Facility (Medical)	1800	10.4	187	100%	69	118
	Neighbourhood Centre (Retail)	4000	12.3	172	35%	65	107
	Neighbourhood Centre (Commercial)	1000	2.0	7	35%	3	4
	Total	**6800**		**366**		**137**	**229**
Difference in GFA	-						
	-						
	Total	**4200**		**351**		**131**	**220**
	LIGHTS					125	210
	HEAVIES					**6**	**10**

Description/I TE Code	ITE Vehicle Trip Generation Rates	
	Ps	**As**
	AM Out	**AM In**
Hospital 610	37%	63%
Shopping Center 820 Rate	38%	62%

- 10.4 veh/ hr/ 100 m2 has been used for Medical facility in AM peak based on RTA, Guide to Traffic Generating Developments, Version 2.2, October 2002
- 12.3 veh/ hr/ 100 m2 has been used for Retail facility in AM peak based on RTA, Guide to Traffic Generating Developments, Ver sion 2.2, October 2002
- 2.0 veh/ hr/ 100 m2 has been used for Commercial facility in AM peak based on RTA, Guide to Traffic Generating Developments, Version 2.2, October 2002
- Operating Capacity of 35% have been assumed for Retail/ Commercial in AM peak based on "Technical Direction For traffic, safety and transport practitioners", August 2013, Appendix F3-Peak Network Hour Vehicle Trips Percentage.

PM Peak

	Land Use	Qty	RMS Rates 100/m 2	Peak Hour Trips Generatio n	Operating Capacity	Productions	Attractions
Mirvac Neighbourhoo d Centre (MWH)	Community Facility (Medical)	4000	8.8	352	100%	218	134
	Neighbourhood Centre (Retail)	7000	12.3	603	70%	313	289
	Total	**11000**		**955**		**532**	**423**
Mirvac Neighbourhoo d Centre (VLC)	Community Facility (Medical)	1800	8.8	158	100%	98	60
	Neighbourhood Centre (Retail)	4000	12.3	344	70%	179	165
	Neighbourhood Centre (Commercial)	1000	2.0	14	70%	7	7
	Total	**6800**		**517**		**285**	**232**
Difference in GFA							
	-	-	-	-	-	-	-
	Total	**4200**		**438**		**247**	**191**
	LIGHTS					240	185
	HEAVIES					7	6

Description/ITE Code	ITE Vehicle Trip Generation Rates	
	Ps	**As**
	PM Out	**PM In**
Hospital 610	62%	38%
Shopping Center 820 Rate	52%	48%

- 8.8 veh/ hr/ 100 m2 has been used for Medical facility in PM peak based on RTA, Guide to Traffic Generating Developments, Version 2.2, October 2002
- 12.3 veh/ hr/ 100 m2 has been used for Retail facility in PM peak based on RTA, Guide to Traffic Generating Deve lopments, Version 2.2, October 2002
- 2.0 veh/ hr/ 100 m2 has been used for Commercial facility in PM peak based on RTA, Guide to Traffic Generating Developments, Version 2.2, October 2002
- Operating Capacity of 70% have been assumed for Retail/ Commercial in PM peak based on "Technical Direction For traffic, safety and transport practitioners", August 2013, Appendix F3-Peak Network Hour Vehicle Trips Percentage.

Appendix H: Meeting Minutes

MWH
BUILDING A BETTER WORLD

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Meeting Minutes

Meeting Name	Mirvac Greenbank Development 2031 AIMSUN modelling and 2051 SIDRA modelling – Way Forward		
Meeting Venue	Level 5,200 Mary Street, Brisbane		
Date Of Meeting	25th January 2017	Time Of Meeting	14:15 – 16:15
Chairperson	Robert Kwok	Recorder	Sarah Atif

Project Details

Client Name	Mark Clancy,
Project Name	Mirvac Greenbank Development
Project Number	83502923

Attendees

Robert Kwok (EDQ)
Gary Hunter (VLC)
Ali Syed (MWH)
Sarah Atif (MWH)

Item	Details	Mutual Decision between EDQ, VLC and MWH	Outstanding Action
1.	**Background**		
	The purpose of this meeting was to discuss a way forward for Mirvac Greenbank Development 2031 AIMSUN and 2051 SIDRA modelling. The following were discussed in detail: • Feedback received on 2031 AIMSUN modelling from VLC (Email sent by EDQ on 20 December, 2016) • Adjustments to VLC 2051 turning counts to develop Ultimate SIDRA layouts.		
2.	**VLC Technical Note 1: Peer Review of Modelling and Assessments (VLC_15-039-01_TN1_MWHreview_v1 (3))undertaken by MWH**		
	Vehicular Trip Rate: • VLC considered that the vehicular trip rate assumed for the school (0.2vph/student) in the AM peak was low.	• MWH clarified that the rate is same as provided within Department of Main Roads, Roads Planning and Design Manual, Chapter 3, table 3.9	• It was mutually agreed that information reference will be included within the report and is deemed acceptable for the purpose of this assessment

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	Neighbourhood Centre Peak Hour Traffic Assumption: • VLC considered the 'percentage of maximum 1 hour traffic' assumed by MWH for both the medical centre (60%) and the retail centre (65%) in the PM peak hour were low.	• MWH clarified that the assumption for retail centre operating at 65% in PM peak is based on RMS guidelines, "Technical Direction For traffic, safety and transport practitioners", August 2013, Appendix F3-Peak Network Hour Vehicle Trips Percentage in AM and PM. • MWH explained 60% traffic percentage (operating capacity) assumption for medical centre based on the previous knowledge of projects.	MWH will use 35% and 70% for 2051 estimated volumes in AM and PM peak VLC request better substantiation, if the RTA rate for PM peak (=8.8veh/hr/100m2) is to be ignored. It's been agreed that MWH will use this rate for 2051 estimated volumes
	Development Traffic Distribution: • VLC recommended MWH to reconsider trip distribution pattern for 4 internal zones within the Greenbank Development.	• MWH/EDQ clarified that ultimate intersection layouts will be based on the 2051 turning volumes provided by VLC whereas 2031 MWH AIMSUN modelling assessment will only provide an overview of network performance in 2031.	• EDQ clarified to VLC that there will be an opportunity in the next 5-10 years to review these layouts based on updated modelling. This will be stated within the traffic modelling report.
3.	**2051 Ultimate SIDRAs**		
	• VLC noted two major issues related to VLC 2051 turning counts prior to do 2051 Ultimate SIDRA layouts as stated below. 1. Underestimation of trips at Neighbourhood Centre due to reduced size (6,800 sqm)	• VLC, MWH and EDQ mutually agreed with the following methodology to adjust this trips within VLC 2051 traffic counts:	• MWH will prepare traffic stick diagrams based on the adjustment methodology as advised by VLC. The traffic stick diagrams will be sent to VLC for confirmation prior to SIDRA analysis.

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	2. Reporting of reduced trips coming out of Greenbank Shopping Centre and Neighbourhood Centre due to 'catch trade' trips.	• Add Neighbourhood Centre additional trips to VLC 2051 traffic volumes for Teviot Rd/Leanne Court intersection.	• It is noted that the data for estimating loss of trips due to 'catch trade' trips at Greenbank Shopping Centre and Neighbourhood Centre is unavailable within RTA guidelines, "Guide to Traffic Generating Developments" (October, 2012, Section 3.6.1 and 5.7.1) and Department of Main Roads Road Planning and Design Manual (December 2005). VLC subsequently identified alternative sources of 'verification' of the 40%.
4.	**Other**		
	Pedestrian Movement • VLC identified that there will be high pedestrian movements near the shopping centre therefore there might be a need to signalise left turn at intersections next to shopping centre.	• EDQ advised MWH to undertake sensitivity analysis on these intersections considering DTMR Technical Note 128, "Selection and Design of Cycle Tracks", May 2015	• Results will be provided after the assessment.
	Exclusive Lanes • VLC and EDQ inquired about modelling of exclusive turning lanes instead of using shared lanes along Teviot Road.	• MWH advised VLC and EDQ that this will be addressed as the part of assessment.	NIL

Appendix I: Signal Phasing Arrangements

PHASING SUMMARY

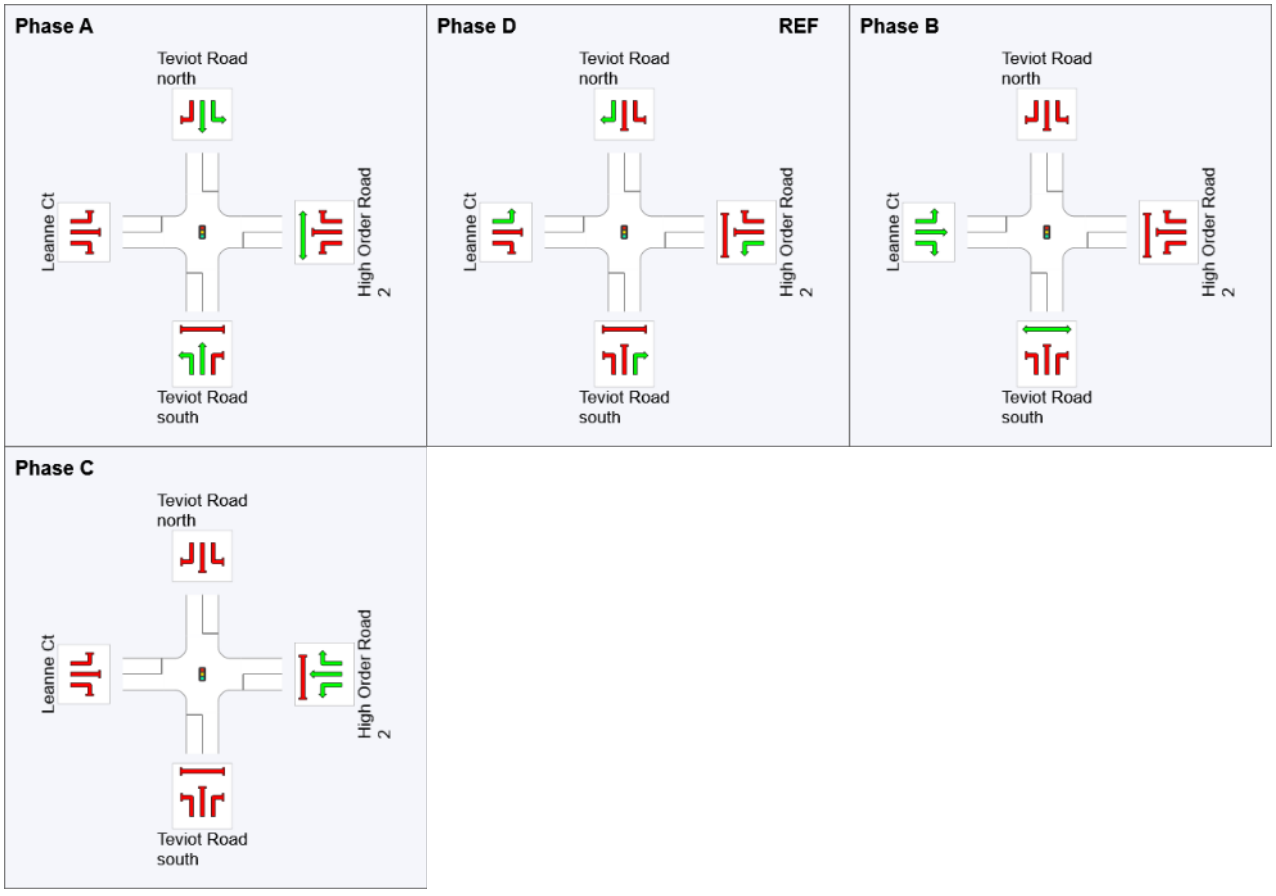
Site: 1 [2051-Leanne Ct Intersection_AM]

Access 3
Signals - Fixed Time Isolated Cycle Time = 80 seconds (User-Given Phase Times)

Phase Times specified by the user
Sequence: Split Phasing
Reference Phase: Phase D
Input Sequence: A, D, B, C
Output Sequence: A, D, B, C

Phase Timing Results

Phase	A	D	B	C
Phase Change Time (sec)	43	0	20	26
Green Time (sec)	31	14	3	11
Yellow Time (sec)	4	4	4	4
All-Red Time (sec)	2	2	2	2
Phase Time (sec)	37	20	6	17
Phase Split	46 %	25 %	8 %	21 %



REF: Reference Phase
VAR: Variable Phase

PHASING SUMMARY

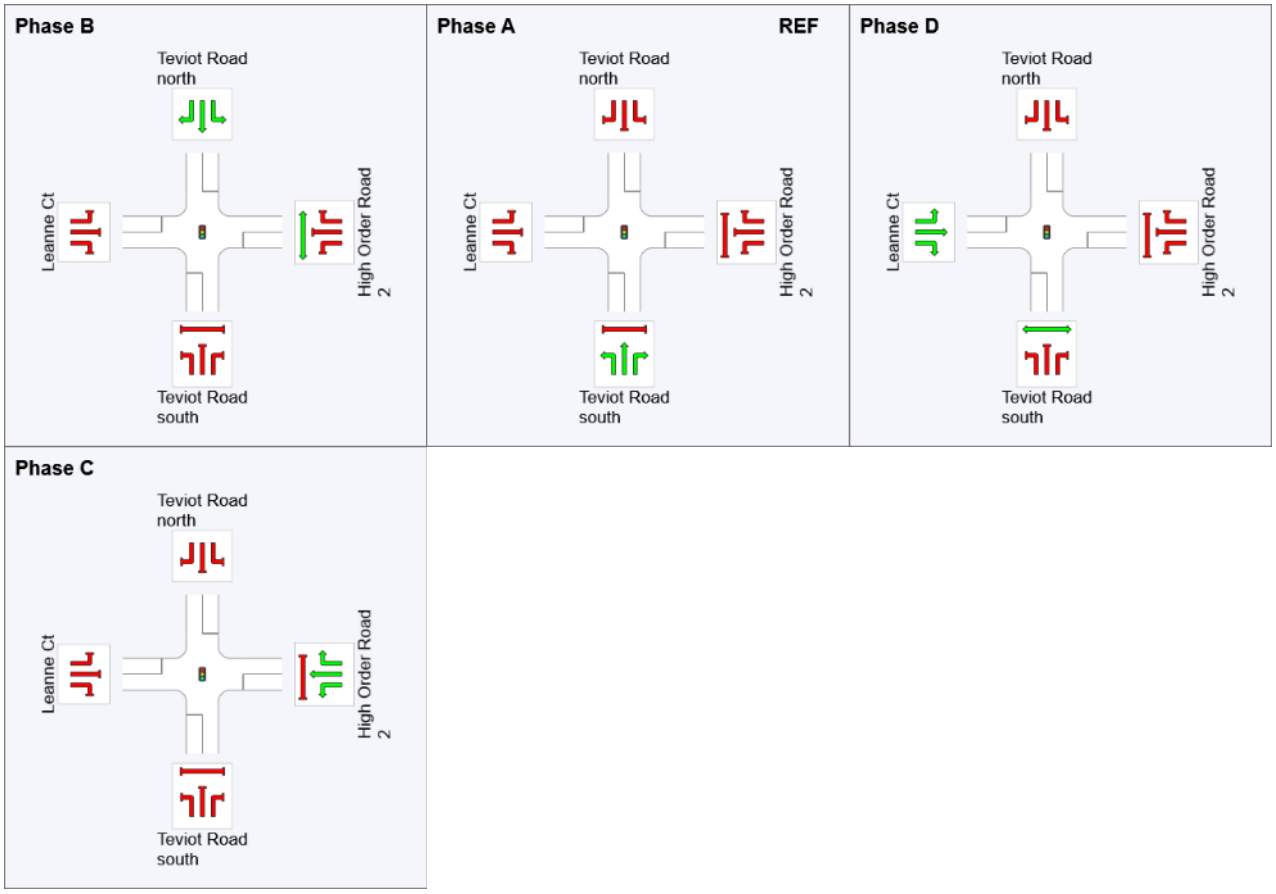
Site: 1 [2051-Leanne Ct Intersection_PM]

Access 3
Signals - Fixed Time Isolated Cycle Time = 150 seconds (User-Given Phase Times)

Phase Times specified by the user
Sequence: Split Phasing
Reference Phase: Phase A
Input Sequence: B, A, D, C
Output Sequence: B, A, D, C

Phase Timing Results

Phase	B	A	D	C
Phase Change Time (sec)	67	0	37	44
Green Time (sec)	77	31	3	17
Yellow Time (sec)	4	4	4	4
All-Red Time (sec)	2	2	2	2
Phase Time (sec)	83	37	7	23
Phase Split	55 %	25 %	5 %	15 %



REF: Reference Phase
VAR: Variable Phase

PHASING SUMMARY

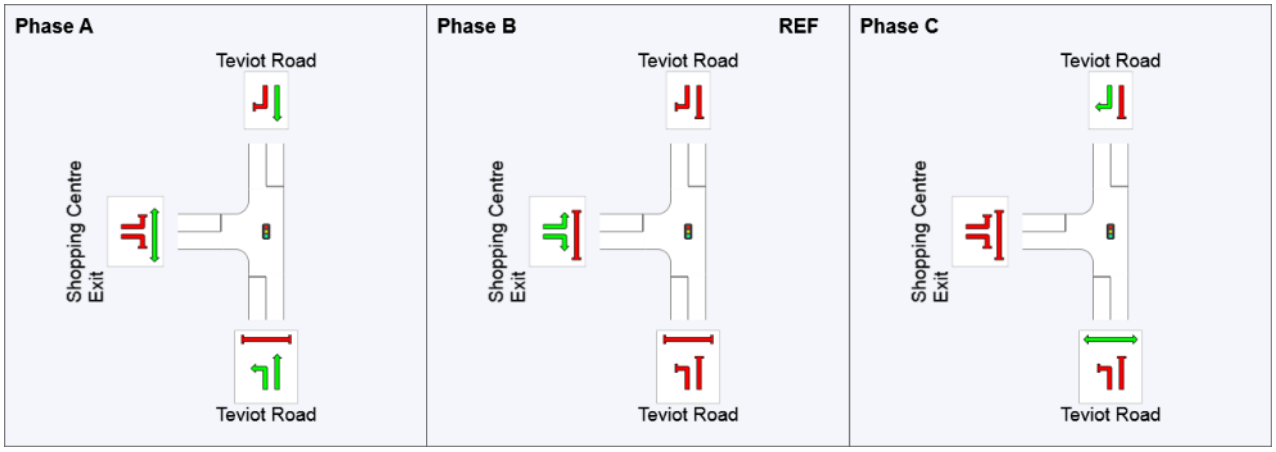
Site: 101v [2051-Shopping Centre Intersection- AM]

New Site
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Optimum Cycle Time - Minimum Degree of Saturation)

Phase Times determined by the program
Sequence: Opposed Turns
Reference Phase: Phase B
Input Sequence: A, B, C
Output Sequence: A, B, C

Phase Timing Results

Phase	A	B	C
Phase Change Time (sec)	36	0	12
Green Time (sec)	38	6	18
Yellow Time (sec)	4	4	4
All-Red Time (sec)	2	2	2
Phase Time (sec)	44	12	24
Phase Split	55 %	15 %	30 %



REF: Reference Phase
VAR: Variable Phase

PHASING SUMMARY

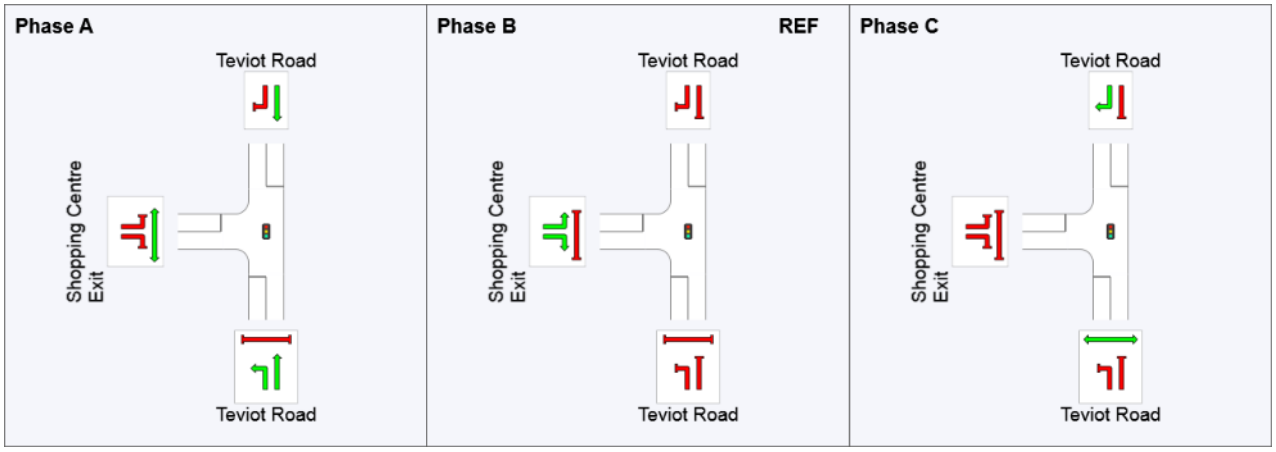
Site: 101v [2051-Shopping Centre Intersection- PM]

New Site
Signals - Fixed Time Isolated Cycle Time = 150 seconds (User-Given Phase Times)

Phase Times specified by the user
Sequence: Opposed Turns
Reference Phase: Phase B
Input Sequence: A, B, C
Output Sequence: A, B, C

Phase Timing Results

Phase	A	B	C
Phase Change Time (sec)	35	0	20
Green Time (sec)	109	14	12
Yellow Time (sec)	4	4	4
All-Red Time (sec)	2	2	2
Phase Time (sec)	115	20	15
Phase Split	77 %	13 %	10 %



REF: Reference Phase
VAR: Variable Phase

PHASING SUMMARY

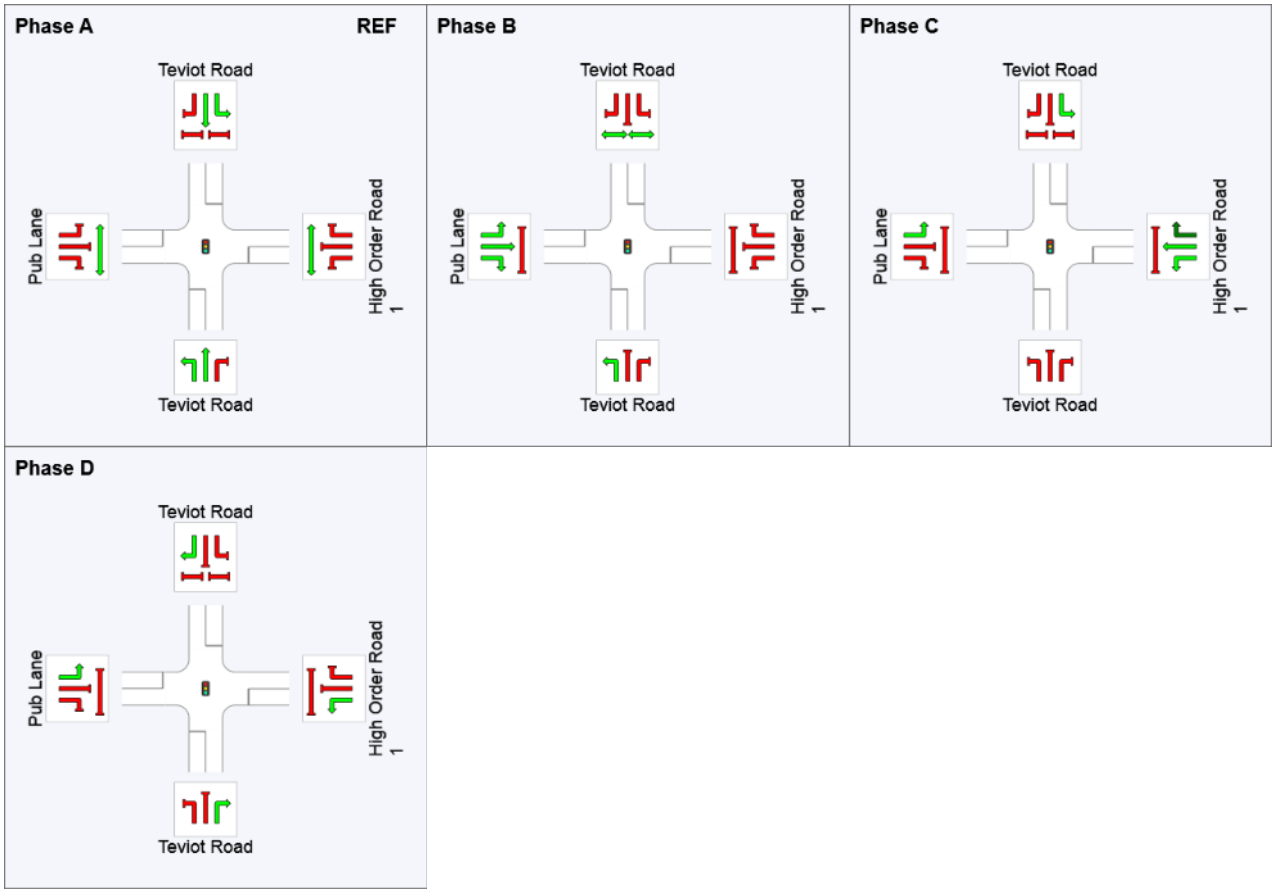
Site: 1 [2051-Pub Lane Intersection_AM]

Existing Site
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Optimum Cycle Time - Minimum Degree of Saturation)

Phase Times determined by the program
Sequence: Split Phasing
Reference Phase: Phase A
Input Sequence: A, B, C, D
Output Sequence: A, B, C, D

Phase Timing Results

Phase	A	B	C	D
Phase Change Time (sec)	0	25	44	65
Green Time (sec)	19	13	15	9
Yellow Time (sec)	4	4	4	4
All-Red Time (sec)	2	2	2	2
Phase Time (sec)	25	19	21	15
Phase Split	31 %	24 %	26 %	19 %



REF: Reference Phase
VAR: Variable Phase

PHASING SUMMARY

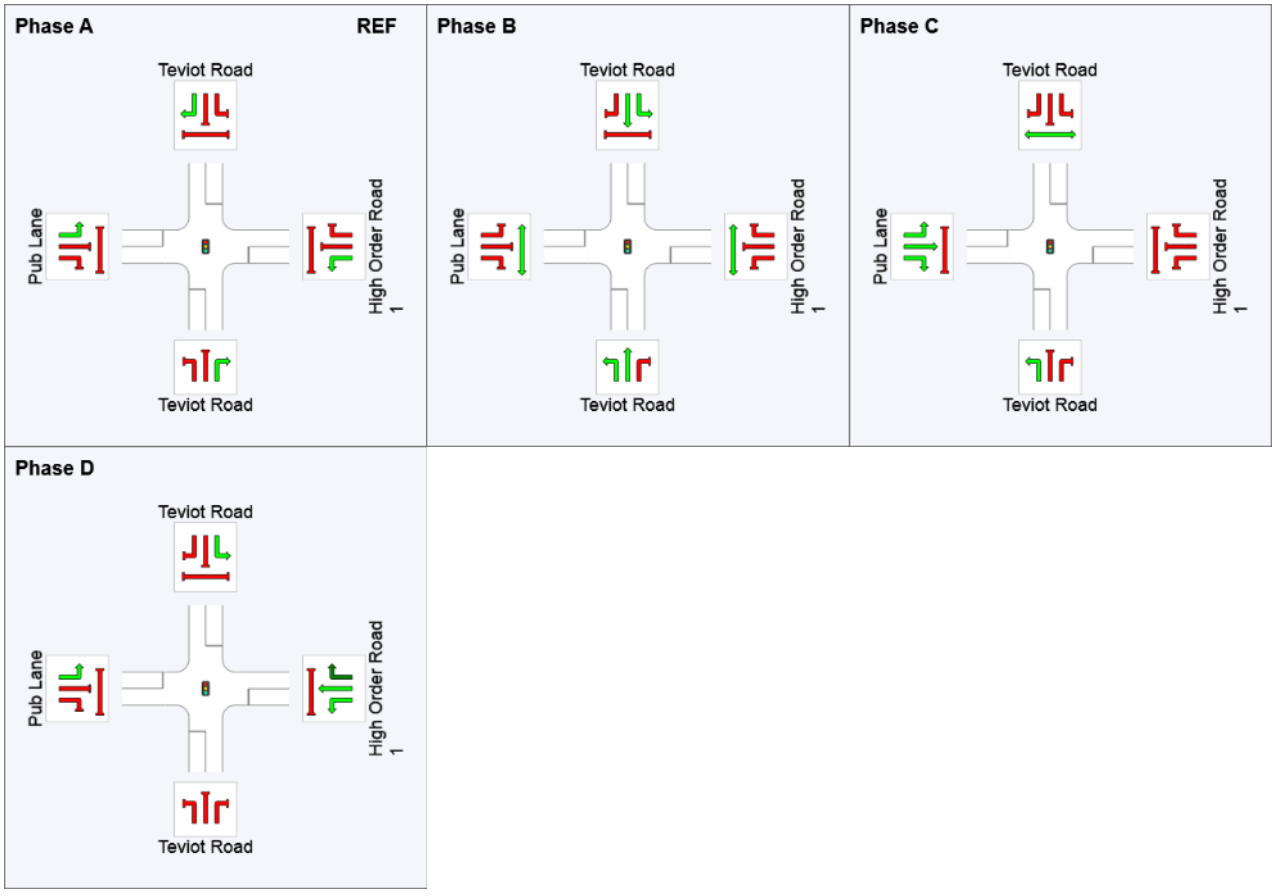
Site: 1 [2051-Pub Lane Intersection_PM]

Existing Site
Signals - Fixed Time Isolated Cycle Time = 150 seconds (User-Given Phase Times)

Phase Times specified by the user
Sequence: Split Phasing
Reference Phase: Phase A
Input Sequence: A, B, C, D
Output Sequence: A, B, C, D

Phase Timing Results

Phase	A	B	C	D
Phase Change Time (sec)	0	69	104	131
Green Time (sec)	63	29	23	13
Yellow Time (sec)	4	4	4	4
All-Red Time (sec)	2	2	2	2
Phase Time (sec)	69	35	27	19
Phase Split	46 %	23 %	18 %	13 %



REF: Reference Phase
VAR: Variable Phase

PHASING SUMMARY

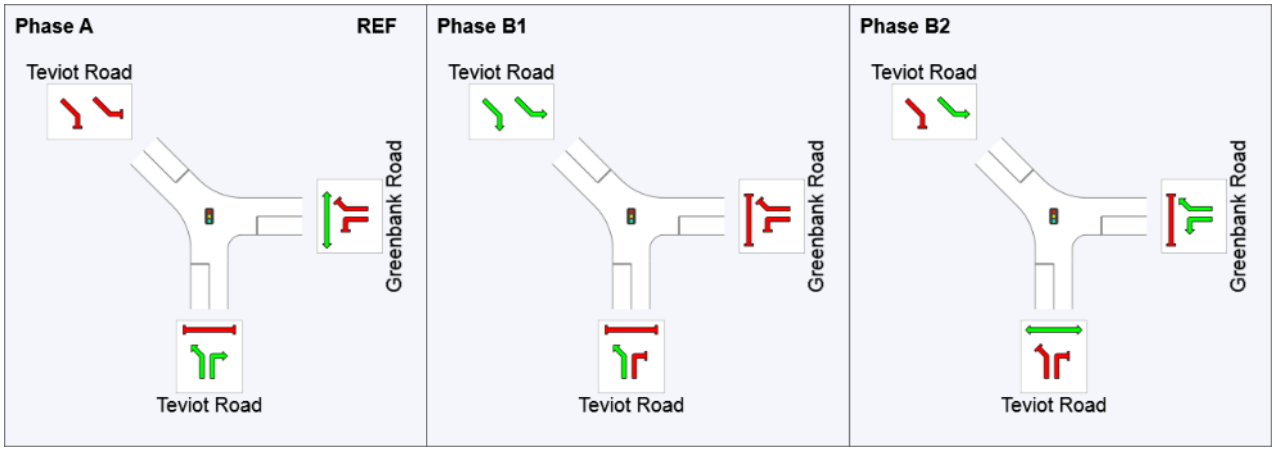
Site: 101 [2051-Greenbank/ Teviot Road Intersection_AM]

New Site
Signals - Fixed Time Isolated Cycle Time = 80 seconds (User-Given Phase Times)

Phase Times specified by the user
Sequence: Variable Phasing
Reference Phase: Phase A
Input Sequence: A, B1, B2
Output Sequence: A, B1, B2

Phase Timing Results

Phase	A	B1	B2
Phase Change Time (sec)	0	42	66
Green Time (sec)	36	18	10
Yellow Time (sec)	4	4	4
All-Red Time (sec)	2	2	2
Phase Time (sec)	42	24	14
Phase Split	53 %	30 %	18 %



REF: Reference Phase
VAR: Variable Phase

PHASING SUMMARY

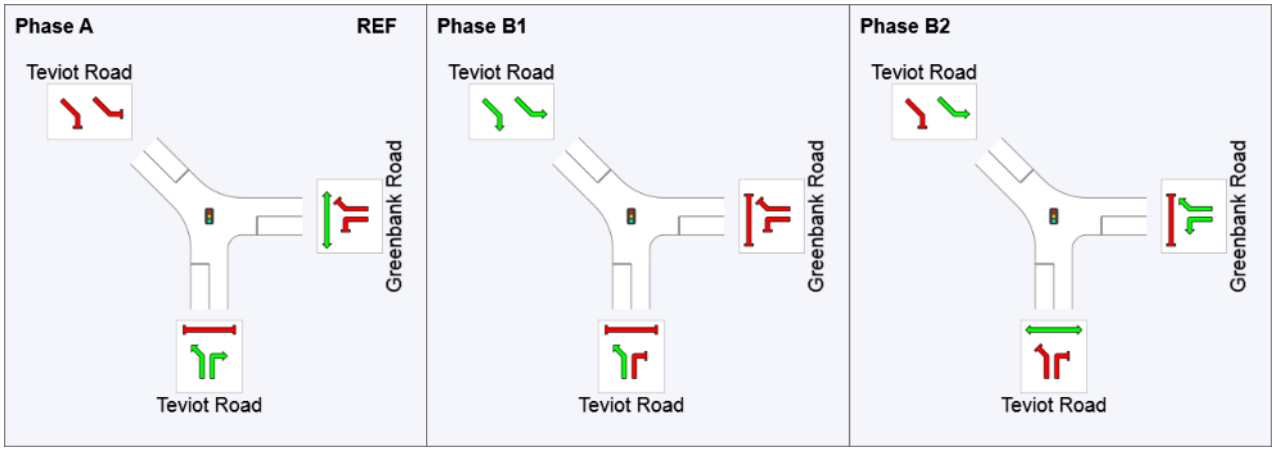
Site: 101 [2051-Greenbank/ Teviot Road Intersection_PM]

New Site
Signals - Fixed Time Isolated Cycle Time = 150 seconds (User-Given Phase Times)

Phase Times specified by the user
Sequence: Variable Phasing
Reference Phase: Phase A
Input Sequence: A, B1, B2
Output Sequence: A, B1, B2

Phase Timing Results

Phase	A	B1	B2
Phase Change Time (sec)	0	30	120
Green Time (sec)	24	84	24
Yellow Time (sec)	4	4	4
All-Red Time (sec)	2	2	2
Phase Time (sec)	30	90	30
Phase Split	20 %	60 %	20 %



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class Running	Other Movement Class Stopped
Mixed Running & Stopped Movement Classes	
Undetected Movement	Phase Transition Applied

PHASING SUMMARY

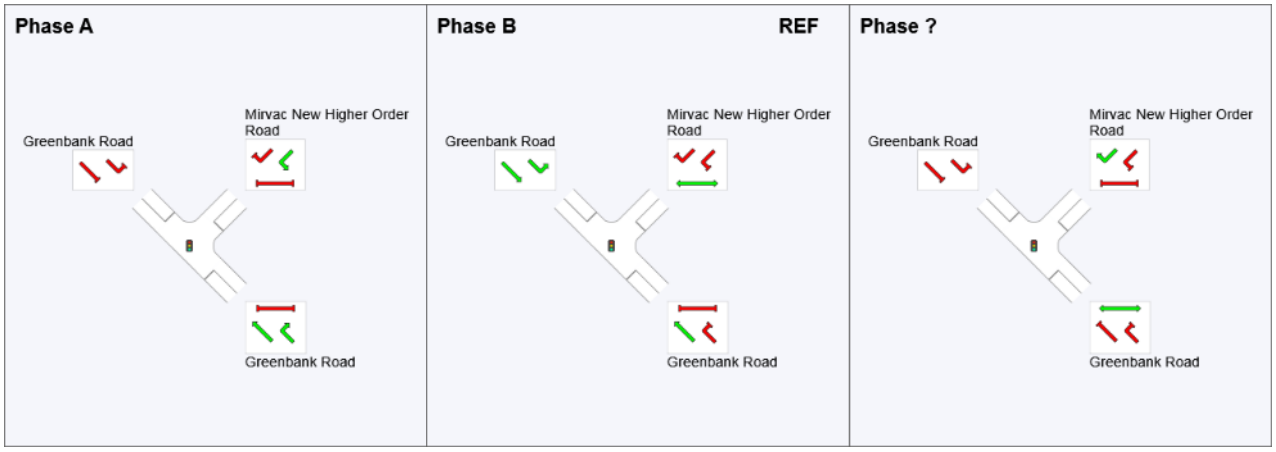
Site: 101v [2051-Greenbank Road/ Mirvac New HOR Intersection_AM]

New Site
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Optimum Cycle Time - Minimum Degree of Saturation)

Phase Times determined by the program
Sequence: Opposed Turns
Reference Phase: Phase B
Input Sequence: A, B, ?
Output Sequence: A, B, ?

Phase Timing Results

Phase	A	B	?
Phase Change Time (sec)	56	0	41
Green Time (sec)	18	35	9
Yellow Time (sec)	4	4	4
All-Red Time (sec)	2	2	2
Phase Time (sec)	24	41	15
Phase Split	30 %	51 %	19 %



REF: Reference Phase
VAR: Variable Phase

Normal Movement		Permitted/Opposed	
Slip/Bypass-Lane Movement		Opposed Slip/Bypass-Lane	
Stopped Movement		Turn On Red	
Other Movement Class Running		Other Movement Class Stopped	
Mixed Running & Stopped Movement Classes			
Undetected Movement		Phase Transition Applied	

PHASING SUMMARY

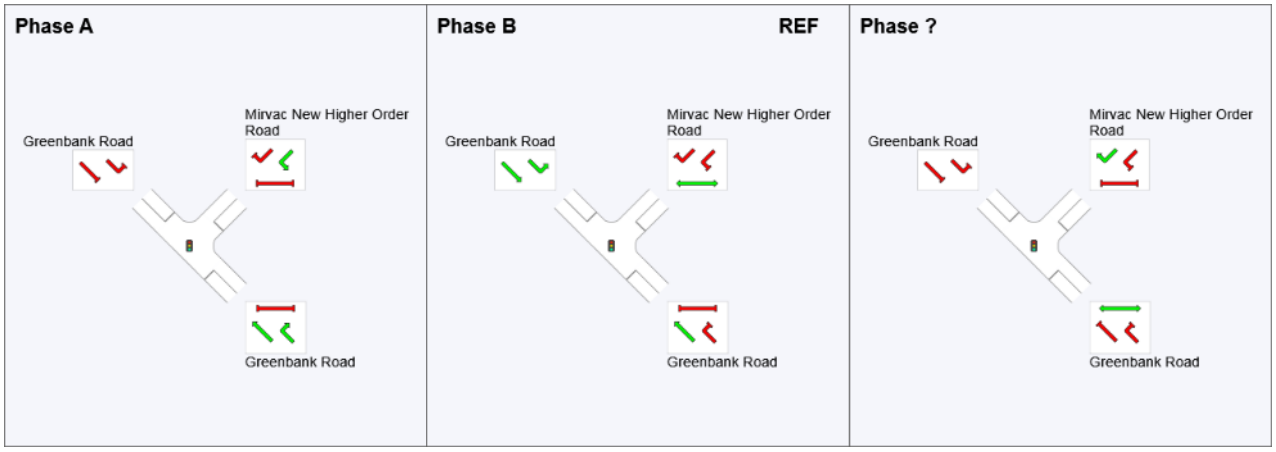
Site: 101v [2051-Greenbank Road/ Mirvac New HOR Intersection_PM]

New Site
Signals - Fixed Time Isolated Cycle Time = 150 seconds (User-Given Phase Times)

Phase Times specified by the user
Sequence: Opposed Turns
Reference Phase: Phase B
Input Sequence: A, B, ?
Output Sequence: A, B, ?

Phase Timing Results

Phase	A	B	?
Phase Change Time (sec)	68	0	52
Green Time (sec)	76	46	11
Yellow Time (sec)	4	4	4
All-Red Time (sec)	2	2	2
Phase Time (sec)	82	52	16
Phase Split	55 %	35 %	11 %



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class Running	Other Movement Class Stopped
Mixed Running & Stopped Movement Classes	
Undetected Movement	Phase Transition Applied

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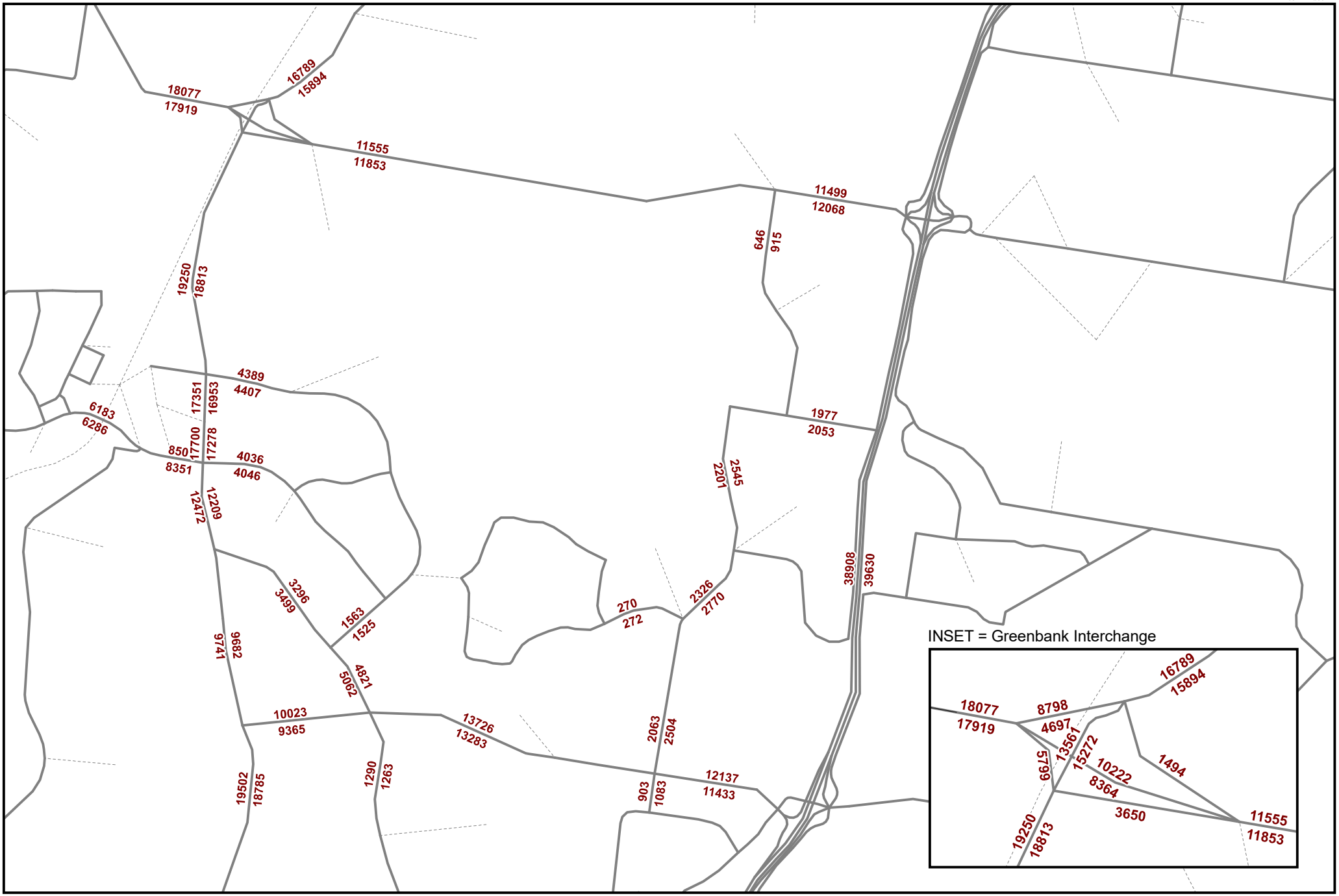
Appendix C Average Weekday Traffic



Forecast Average Weekday Traffic, 2051 (with Full SRIP)