Transport Modelling to Inform Development Contribution Plan Apportionment

High Wycombe South

DCP

March 2022

Rev 1

city of kalamunda

kctt

Transport Modelling Report DCP
KC00604.000 High Wycombe South

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Author	Marina Kleyweg
Team Members	Jelena Simic / Ana Marijanovic/ Nemanja Marijanovic
Project Manager	Marina Kleyweg
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Prepared by: **KCTT (Trading as KC Traffic and Transport Pty Ltd)**
ABN 35 148 970 727 |
Postal address: **PERTH:** Unit 7, No 10 Whipple Street Balcatta WA 6021 | **BELGRADE**: 23 Hilandarska, Beograd 11000
Phone: 08 9441 2700 |
Website: www.kctt.com.au |

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1 Executive Summary

This report was prepared to summarise findings of a transport model for High Wycombe South Project Area comprising Residential Precinct and TOD Precinct. The transport model was prepared specifically to assist in preparation of Development Contribution Plan. Key road corridors and intersections were assessed. The costs are proposed to be distributed between the precincts in accordance with the transport impact made. Triggers for infrastructure upgrades were determined based on the preliminary assumption of Structure Plan build-out; however, practically they will depend on the uptake in particular areas of the structure plan. The table below summarises the upgrade requirements, land acquisition requirements and impact split per precinct. As discussed further in the report, if the precinct generates 10% or more of projected daily traffic on a road link or an intersection, contributions should be considered.

Upgrades triggered in 2031

Year		Infrastructure Element	BOQ	Current Configuration	Proposed Configuration	Land Acquisition Required	Residential Precinct %	TOD Precinct %	DCP Item
2031	R	Dundas Road (Maida Vale Road - Sorensen Road)	[RD8]	Two-way, one-lane undivided carriageway	Integrator B modified (two-way, one-lane divided carriageway)	No	15.25%	10.16%	Yes
	R	Dundas Road (Berkshire Road - Dundas Road Old)	[RD7]	Two-way, one-lane undivided carriageway	Integrator B modified (two-way, one-lane divided carriageway)	No	0.00%	2.00%	No
	R	Dundas Road (Berkshire Road - Harrison Road)	[RD6]	Two-way, one-lane undivided carriageway	Integrator B modified (two-way, one-lane divided carriageway)	No	7.73%	3.22%	No
	R	TOD Connector (Milner Road - Enterprise Boulevard)	[RD14]	The road doesn't exist at present	* Neighbourhood Connector A (two-way, one-lane divided carriageway)	Yes	0.00%	60.82%	Yes
	R	TOD Connector (Milner Road - Edge of TOD Precinct)	[RD15]	The road doesn't exist at present	* Neighbourhood Connector A (two-way, one-lane divided carriageway)	Yes	69.40%	17.51%	Yes
	R	TOD Connector (Edge of TOD Precinct – Roe Highway)	[RD16]	The road doesn't exist at present	* Neighbourhood Connector A (two-way, one-lane divided carriageway)	Yes	100.00%	0.00%	Yes
	R	Raven Street (Milner Road - Brae Road)	[RD13]	The road doesn't exist at present	* Neighbourhood Connector A (two-way, one-lane divided carriageway)	Yes	100.00%	0.00%	Yes
	I	M01 - Roe Highway / Maida Vale Road	[INT02]	Half - Interchange	Half - Interchange	No	18.85%	14.36%	Yes
	I	M15 - Dundas Road / Old Dundas Road (North)	[INT06]	T-intersection, full movement	Signalised Intersection	No	16.46%	7.85%	Yes
	I	M25 - Dundas Road / Dundas Road (South)*	[-]	T-intersection, full movement	T-intersection, full movement	No	0.00%	2.32%	No

Notes 2031:

- Berkshire Road will trigger the requirement for upgrade to Integrator B carriageway in 2031; however, given that by 2041 it will require more substantial upgrade, it is assigned to a trigger year 2041.
- TOD Connector and Raven Street (south of Milner Road) don't exist at present. Although in 2031 both roads will carry traffic volumes appropriate for an Access Street, we have recommended the construction of the ultimate geometry to avoid unnecessary re-work and disruption to residents and businesses.
- The intersection Dundas Road / Dundas Road (South) does not require upgrading per se; however, the adjustment of the intersection is required once Dundas Road is upgraded.

Upgrades triggered in 2041

Year		Infrastructure Element	BOQ	Current Configuration	Proposed Configuration	Land Acquisition Required	Residential Precinct %	TOD Precinct %	DCP Item
2041	R	Berkshire Road (Roe Highway – Milner Road)	[RD1]	Two-way, one-lane undivided carriageway	Integrator A modified (two-way, two-lane divided carriageway)	Yes	15.96%	8.62%	Yes
	R	Maida Vale Road (Dundas Road - Raven Street)	[RD5]	Two-way, one-lane undivided carriageway	Integrator B modified (two-way, one-lane divided carriageway)	No	47.24%	11.88%	Yes
	R	Maida Vale (Raven Street - Milner Road)	[RD4]	Two-way, one-lane undivided carriageway	Integrator B modified (two-way, one-lane divided carriageway)	No	0.72%	24.06%	Yes
	R	Maida Vale (Milner Road – Roe Highway)	[RD3/3A]	Two-way, one-lane undivided carriageway	Integrator B modified (two-way, one-lane divided carriageway)	No	37.42%	17.25%	Yes
	R	Milner Road (Stewart Road - Maida Vale Road)	[RD10]	Two-way, one-lane undivided carriageway	Integrator B modified (two-way, one-lane divided carriageway)	No	52.67%	17.75%	Yes
	R	Milner Road (Sultana Road West - Stewart Road)	[RD2]	Two-way, one-lane undivided carriageway	Integrator B (two-way, one-lane divided carriageway)	Yes	54.17%	11.34%	Yes
	R	Milner Road (Berkshire Road - Sultana Road West)	[RD9]	Two-way, one-lane undivided carriageway	Integrator B modified (two-way, one-lane divided carriageway)	No	42.06%	14.81%	Yes
	R	Sultana Road West (TOD Connector – Milner Road)	[-]	Two-way, one-lane undivided carriageway	Two-way, one-lane undivided carriageway	No	0.00%	100.00%	Yes
	R	Sultana Road West (Milner Road – Edge of TOD Precinct)	[RD20]	Two-way, one-lane undivided carriageway	Two-way, one-lane undivided carriageway	No	57.75%	12.98%	Yes
	R	Sultana Road West (Edge of TOD Precinct – Cul-de-sac)	[RD20]	Two-way, one-lane undivided carriageway	Two-way, one-lane undivided carriageway	No	100.00%	0.00%	Yes
	R	Stewart Road (Milner Road - Brae Road)	[RD17]	Two-way, one-lane undivided carriageway	Neighbourhood Connector A (two-way, one-lane divided carriageway)	Yes	100.0%	0.00%	Yes
	R	Raven Street (Maida Vale Road - Milner Road)	[RD12]	Two-way, one-lane undivided carriageway	Neighbourhood Connector A (two-way, one-lane divided carriageway)	Yes	64.83%	18.64%	Yes
	R	Enterprise Boulevard(TOD Connector – Maida Vale Road)*	[RD11]	Under construction.	Neighbourhood Connector A (two-way, one-lane divided carriageway)	No	0.00%	100.00%	Yes
	R	Brand Road(TOD Connector – Brae Road)**	[RD19]	Two-way, one-lane undivided carriageway	Two-way, one-lane undivided carriageway	No	100.00%	0.00%	Yes
	I	M02 - Maida Vale Road / Milner Road	[INT01]	T-intersection, full movement	Roundabout	Yes	33.35%	23.20%	Yes
	I	M03 - Milner Road / Stewart Road	[INT18]	T-intersection, full movement	Roundabout	Yes	64.72%	14.74%	Yes
	I	M04 - Milner Road / Raven Street	[INT17]	T-intersection, full movement	Roundabout	Yes	61.43%	17.89%	Yes
	I	M05 - Milner Road / TOD Connector	[INT05]	The intersection doesn't exist at present	Signalised Intersection	Yes	41.24%	16.36%	Yes

Upgrades triggered in 2041									
Year	**Infrastructure Element**		**BOQ**	**Current Configuration**	**Proposed Configuration**	**Land Acquisition Required**	**Residential Precinct %**	**TOD Precinct %**	**DCP Item**
	I	M06 - Milner Road / Berkshire Road /Dundas Road	**[INT15]**	T-intersection, full movement	Roundabout	Yes	17.23%	7.70%	Yes
	I	M07 - Berkshire Road / Roe Highway*	**[-]**	Interchange	Interchange	n/a	2.00%	1.20%	No
	I	M08 - TOD Connector / Brand Road	**[INT16]**	The intersection doesn't exist at present	Four-way, sign controlled	Yes	100.00%	0.00	Yes
	I	M09 - TOD Connector / Brae Road / Raven Street	**[INT14]**	The intersection doesn't exist at present	Four-way, sign controlled, full movement* (roundabout)	Yes	100.00%	0.00%	Yes
	I	M10 - Brae Road / Stewart Road	**[INT09]**	T-intersection, full movement	T-intersection, full movement	No	100.00%	0.00%	Yes
	I	M11 - Milner Road / Sultana Road West	**[INT07]**	Two staggered T-intersection, full movement	Intersection east of Milner Rd to be configured as Left In Left Out Right In	Yes	54.60%	11.53%	Yes
					Sultana Rd West (west of Milner Rd) to be converted to Cul-De-Sac;		0.00%	100.00%	Yes
	I	M12 - Maida Vale Road / Dundas Road / Parking Access*	**[INT14]**	Roundabout	Roundabout	No	21.87%	8.75%	No
	I	M13 - Maida Vale Road / Enterprise Boulevard*	**[INT12]**	T-intersection, full movement	T-intersection, full movement	No	36.91%	17.55%	No
	I	M14 - Maida Vale Road / Raven Street	**[INT13]**	The intersection doesn't exist at present	T-intersection, full movement	Yes	37.82%	19.60%	Yes*
	I	M16 - Maida Vale Road / Newburn Road	**[INT03]**	T-intersection, full movement	Roundabout	Yes	37.72%	22.47%	Yes*
	I	M17 - Maida Vale Road / Butcher Road*	**[-]**	T-intersection, full movement	T-intersection, full movement	No	0.63%	20.91%	Yes*
	I	M18 - Maida Vale Road / Plover Road*	**[-]**	T-intersection, full movement	T-intersection, full movement	No	37.13%	26.04%	Yes*
	I	M19 - Maida Vale Road / Littlefield Road*	**[-]**	T-intersection, full movement	T-intersection, full movement	No	36.52%	25.62%	Yes*
	I	M20 - Milner Road / Nardine Close	**[INT08]**	T-intersection, full movement	Left in Left Out Right In	No	41.57%	11.73%	Yes*
	I	M21 - Berkshire Road / Bonser Road*	**[-]**	T-intersection, full movement	Left in Left Out	No	15.80%	8.50%	Yes*
	I	M22 - Berkshire Road / Ashby Close*	**[-]**	T-intersection, full movement	Left in Left Out	No	13.33%	8.10%	Yes*
	I	M23 - Berkshire Road / Walters Way*	**[-]**	T-intersection, full movement	Left in Left Out	No	14.78%	8.44%	Yes*
	I	M24 - Berkshire Road / Harrison Road*	**[-]**	T-intersection, full movement	Left in Left Out	No	13.65%	8.30%	Yes*

Notes 2041:

- Sections of Maida Vale Road may trigger Neighbourhood Connector A requirement by 2031; however, the upgrade is recommended by 2041. The cross-section was modified to minimise disturbance to the existing residences. Intersection along Maida Vale Road denoted with "*" do not require an upgrade per se, however adjustments will be required to accommodate Maida Vale Road upgrade. The intersection Maida Vale Road / Dundas Road / Parking Access will not require an upgrade; however, adjustment will be required to accommodate upgrade of Maida Vale Road and Dundas Road.
- Similarly, sections of Milner Road may trigger Neighbourhood Connector A requirement by 2031; however, the upgrade is recommended by 2041 in its ultimate configuration – Integrator B. Sections of Milner Road are modified Integrator B to minimise the impact on the existing operating businesses and Poison Gully Creek heritage area.
- Enterprise Boulevard will be constructed as a part of railway works, and no further major upgrades are likely to be required by the end of DCP lifespan. In 2041, Enterprise Boulevard is expected to reach the traffic warranting its configuration.
- The Berkshire Road / Roe Highway interchange may require an upgrade as a result of growing passing traffic; however, the cost for upgrade cannot be apportioned to Residential nor TOD Precincts. Need and Nexus for the upgrade is established at 10% daily traffic contribution. Each of the Precincts contributes less than 10% to the total daily traffic at this intersection. As the traffic contribution is deemed insignificant, no portion of cost for upgrade can be attributed to either precinct.
- The intersection TOD Connector / Brae Road / Raven Street was modelled as a four-way, sign controlled intersection as the traffic demand was fairly low and this configuration retained LOS A for the lifetime of the DCP. Subsequently, preliminary engineering design revealed this configuration cannot be implemented appropriately due to the existing road alignments, therefore the intersection is proposed to be configured as a roundabout. The percentage of traffic and therefore proportional costs remain the same.
- Berkshire Road is likely to require an upgrade to Integrator B in 2031; however, the upgrade is recommended in 2041 to a modified Integrator A configuration. The modification pertains to landtake required to facilitate two lane divided carriageway suitable for RAV vehicles. Intersections along Berkshire Road should be reconfigured as Left In Left Out and will not require land to be acquired in addition to the requirement associated with the road widening.
- Brand Road will require an upgrade at the time when primary school is constructed.

Upgrades triggered in 2050									
Year	**Infrastructure Element**		**BOQ**	**Current Configuration**	**Proposed Configuration**	**Land Acquisition Required**	**Residential Precinct %**	**TOD Precinct %**	**DCP Item**
2050	R	Brae Road (TOD Connector – Roe Highway)	**R18**	Two-way, one-lane undivided carriageway	Neighbourhood Connector B (Two-way, one-lane undivided carriageway)	No	100.00%	0.00%	Yes

Notes 2050:

Brae Road is expected to reach the traffic volume warranting Neighbourhood Connector B configuration in 2050. Practically, it is likely that Brae Road will be progressively upgraded as adjacent land is developed.

2 Background

2.1 Background of the project

The High Wycombe South Project Area (formerly known as Forrestfield North) is within the City of Kalamunda, near the under-construction High Wycombe Railway Station, which is likely to open by mid-2022. West Australian Planning Commission (WAPC) approved District Structure Plan (DSP) for High Wycombe South Project Area on 29 September 2016.

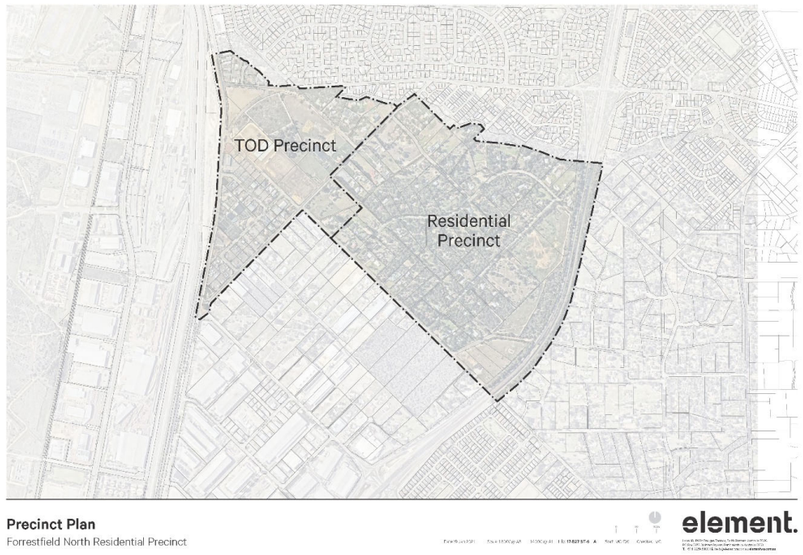

Figure 1 - High Wycombe South Project Area Precincts (TOD and Residential) (source: element WA)

This area includes two major precincts with separate structure plans – Residential Precinct Local Structure Plan (LSP) and Transit-Oriented Development (TOD) Precinct Activity Centre Structure Plan (ACSP). While the Residential Precinct will feature a Primary School, District Open Space, and various residential dwellings, the TOD Precinct will likely feature a mix of commercial and residential uses and a community hub following detailed planning by Development WA. Given that the DSP area is over 200ha, the traffic impact on the surrounding network will be exceptionally high.

The High Wycombe South Residential Precinct LSP was endorsed by WAPC on 27 July 2020. In collaboration with Development WA, the City of Kalamunda and their consultant team are currently preparing the High Wycombe South ACSP. An amendment to the High Wycombe South Residential Precinct Local Structure Plan is being progressed by the City of Kalamunda and is currently being advertised for public comment. The DCP has been prepared to reflect the proposed amendments in the draft LSP.

2.2 Purpose of Modelling and This Report

As major infrastructure upgrades are required to cater for developments of this scale, a robust traffic model must be prepared to assess road network requirements adequately. While KCTT has prepared transport modelling for the Residential Precinct and the District Structure Plan in the past, the purpose of this model is first and foremost to quantify and apportion the impact on the existing network, determine the extent of required upgrades, and allow for the preparation of the Development Contribution Plan.

Modelling prepared for High Wycombe South Residential Precinct LSP focused on the maximum possible build-out. However, to appropriately assess development demand and estimate required infrastructure, modelling for Development Contribution Plan focuses on the most realistic outcome. This model builds on models developed throughout the project, and therefore network and intersection modelling are developed in microsimulation packages.

Modelling is prepared for 2031 (15% of the development completed), 2041 (65% of development completed) and 2050+ (100% of development completed) horizon years. Further to this, the network model was finetuned and developed down to the individual cell level to assess the impact on all internal roads.

This report will outline network and intersection modelling findings and the apportionment of impact for each precinct on each infrastructure element.

2.3 General Structure of This Report

This report will have five (5) main sections.

Section 1 – Background – provides a brief overview of the past activity on this project and the purpose of this modelling and reporting exercise.

Section 2 – Methodology of the Modelling – summarises approaches and methods for data collection and preparation of network and intersection models, as documented in Appendix 1 of this report.

Section 3 – Input Analysis – Outlines key information used for modelling. Appendix 2 of this report provides full documentation on the consideration and selection of data for modelling.

Section 4 – Findings of Network and Intersection Modelling – provides an overview of the anticipated development impact on the infrastructure. A very condensed section provides basic upgrade requirements, estimated timeframe for the upgrade, and land acquisition impact.

Section 5 – Impact on the Cost Apportionment – discusses elements of the SPP 3.6 applicable to this process. Further on, this section provides a summary of each precinct's impact on each road and intersection. Spatial plans are also provided to enable easier correlation of the proposed upgrades and location of the infrastructure elements.

2.4 Scope of Works and Literature

2.4.1 General Scope of Works

The scope of works for this project was defined in a document titled "*Scope of Works*: *Forrestfield North Development Contribution Plan (DCP) – Work Required to Prepare DCP*", prepared by the City of Kalamunda in July 2020. Development WA reviewed this document, and the scope of works was endorsed as outlined below.

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1. **Traffic Modelling and Needs Assessment:**
   a. Traffic modelling to be undertaken to determine assumptions for the traffic distribution of the following:
      i. Background traffic (e.g. existing traffic)
      ii. Development generated traffic (Traffic that has been generated from the High Wycombe South development) – Future population and development projections to determine development generated traffic.
      iii. Traffic generated by attractors to the Precinct (e.g. train station, school).
   b. Based on the outcomes from the modelling, allocate percentages of the three categories listed above to the TOD Precinct, Residential Precinct and outside the DCA. These percentages are to inform apportionment of costings for the DCP.
2. **Community Infrastructure Needs Assessment:**
   a. Determine apportionment of community infrastructure between TOD Precinct, Residential Precinct and outside High Wycombe South (it is noted that some of this work has been done as part of the preparation of the LSPs). Population, development projections and catchments of community infrastructure to inform apportionment.
3. **Infrastructure Concepts:**
   a. Prepare updated concepts for all roads as per Residential precinct LSP and latest TOD precinct ACSP.
   b. Prepare concepts for all drainage areas as per Residential precinct LSP and latest TOD precinct ACSP.
   c. Prepare concepts for all POS as per Residential precinct LSP and latest TOD precinct ACSP.
   d. Prepare concepts for all community infrastructure items as per Residential precinct LSP and latest TOD precinct ACSP. (It is noted that same of this work has been done.)

Note:
Drainage:
Assumptions will need to be made in relation to concept plans for the drainage areas in the TOD precinct based on the best information currently available. These assumptions will need to be reviewed once further information in relation to environmental and drainage investigations are made available through the investigations being undertaken by DevelopmentWA.
Community infrastructure:
Assumptions will need to be made in relation to concept plans for community infrastructure in the TOD precinct based on the best information currently available. These assumptions will need to be reviewed once further information is made available through the investigations being undertaken by METRONET.

4. **Cost estimates:**
   a. Prepare cost estimates for all roads as per updated concepts.
   b. Prepare cost estimates for drainage as per updated concepts.
   c. Prepare cost estimates for POS as per updated concepts.
   d. Prepare cost estimates for community infrastructure as per updated concepts. (It is noted that some of this work has been done. Community Hub Project for the TOD Precinct to help inform this item).
   e. Cost estimates for 2 year maintenance period of POS to be included.
   f. Cost estimates relating to works required to be undertaken as part of the Strategic Conservation Management Plan and reasonably included in a DCP (POS Management Plan, demolition of buildings etc.)
   g. Land acquisition requirements and cost estimates.

5. **Technical Report**

Prepare a report which collates the technical information generated from the above, plus any relevant information already prepared. Report to address the following:

1. How the technical information prepared addresses the provisions of State Planning Policy 3.6.
2. Establish the identification and justification of need and nexus where the relationship between the need for infrastructure and the new development is clearly established.
3. Determine apportionment of infrastructure costs to the Residential Precinct, TOD Precinct and outside the DCA.
4. Establish projected rate of development to help inform a project plan to determine timing of funds being received and infrastructure being delivered.

Methodology discussed in this report pertains to deliverable No 1 (Traffic Modelling and Needs Assessment). The findings of deliverable No 1 will be directly fed to deliverables No 3 and No4.

2.4.2 Additional Literature and Sources Used

Documents:

- Forrestfield North – District Structure Plan
- Forrestfield North – Residential Precinct Structure Plan, July 2020
- Transport Impact Assessment Guidelines (set), WAPC 2016
- Operational Modelling Guidelines, MRWA 2021
- Transport Modelling Guidelines for Activity Centre Structure Plans, DoT 2016
- Australian Transport Assessment and Planning Guidelines, ATAP 2016
- NSW RTA Guidelines to Traffic Generating Developments, NSW RTA 2002 (updated in 2013)
- Forrestfield North Development Contribution Plan - Yield Analysis, Surrounding Development Projections, City of Kalamunda, April 2021
- Forrestfield Station Multi-Storey Car Park, Traffic Impact Assessment, Aurecon (PTA), September 2019
- ROM24 Model Plots provided by MRWA in December 2020 and in 2016 for purposes of DSP modelling
- ROM24 Model Link volume plots provided by MRWA in July 2021
- MLUFS population projections, provided to KCTT in December 2020
- High Wycombe Station Precinct Retail & Commercial Assessment, Urbis (development WA), April 2021
- High Wycombe Station Access Strategy, GHD (PTA), April 2021
- State Planning Policy 3.6 – Infrastructure Contributions, WAPC, April 2021

Sources

- City of Kalamunda Community ID
- Australian Bureau of Statistics
- Main Roads WA Portal

2.4.3 Glossary of Abbreviations

- AADT (Average Annual Daily Traffic)
- Precinct Activity Centre Structure Plan (ACSP)
- AS (Access Street – Liveable Neighbourhoods)
- DOS (District Open Space)
- DoT (Department of Transport)
- DPLH (Department of Planning, Lands and Heritage)
- DSP (District Structure Plan)
- FFN (Forrestfield North)
- GEH (Goodness of fit measure)
- HWS (High Wycombe South)
- IA (Integrator A – Liveable Neighbourhoods)
- IB (Integrator B – Liveable Neighbourhoods)
- LSP (Local Structure Plan)
- MLUFS (Metropolitan Land Use Forecasting System)
- MRWA (Main Roads Western Australia)
- NCA / NCB (Neighbourhood Connector A /B – Liveable Neighbourhoods)
- OMG (Operational Modelling Guidelines)
- PTA (Public Transportation Authority)
- ROM24 (Regional Operational Model)
- TOD (Transit Oriented Development)
- STEM (Strategic Transport Evaluation Model)
- VPD (Vehicles Per Day)
- VPH (Vehicles Per Hour)

3 Methodology of the Modelling

3.1 Overview

KCTT prepared a document "*Methodology for Transport Modelling to Inform Development Contribution Plan Apportionment Analysis*" in February 2021 for the City of Kalamunda and the stakeholder group outlining the process and the sequence of all actions related to the transport modelling. This document is provided as in Appendix 1 of this report.

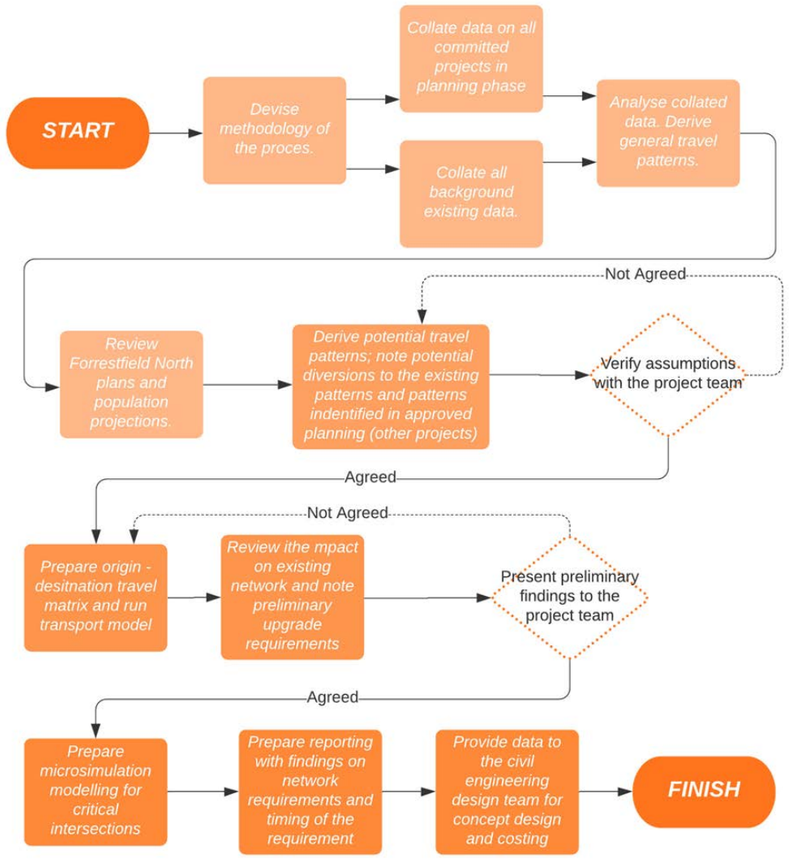

Figure 2 - Transport Modelling Methodology - Process Overview

This document was peer-reviewed by an independent entity. The City of Kalamunda endorsed the subsequent revision of the report.

3.2 Methodology of Data Collation

Data intended to be used as input are collated from various sources. Main Roads Western Australia (MRWA) have provided Regional Operational Model (ROM) plots for various horizon years showing forecasted traffic for main transport routes.

This was supplemented by projections of dwelling yields from the Metropolitan Land Use Forecasting System (MLUFS).

Current traffic counts were obtained (where available) from the City of Kalamunda for local roads and from the MRWA traffic map and traffic portal for State infrastructure. Current road classification and speed limits were obtained from the MRWA portal, while various population data were obtained from the City of Kalamunda's Community ID website.

Current intersection and road configuration were obtained from aerial imagery supplied by Nearmaps.

3.3 Methodology of Traffic Modelling

Network models were prepared in Q-Paramics as this is the software used for modelling High Wycombe South since District Structure Plan preparation. Intersection modelling was completed in SIDRA Intersection software.

Models were generally prepared in accordance with Operational Modelling Guidelines, prepared by MRWA. Where guidelines could not be followed, MRWA were informed, and instruction was received on how to proceed.

3.4 Consultation With External Stakeholders

KCTT contacted various State authorities to confirm basic assumptions and methodology on essential modelling items in establishing methodology. The status of responses is provided in the table below:

Table 1 – Status Liaison Activities (State Government Agencies)

	Traffic Generation Rates	Transport Mode Share	ROM Model Calibration	Model Validation
Main Roads WA				
Department of Planning, Lands and Heritage				
Public Transport Authority				
Department of Transport				

Legend:

Response still outstanding	Authority has no comment / information	Authority not contacted as it has no jurisdiction	Authority provided appropriate comments

Department of Planning, Lands and Heritage (DPLH) and Public Transportation Authority (PTA) confirmed they have no comment to make on assumptions they were presented with.

4 Input Analysis

4.1 Overview

Given the scope of the model, input for modelling was analysed in a separate technical report. The Input Analysis Report is provided as an appendix of this report. This section will outline only the most important parameters used in the modelling. For further detail please refer to Appendix 2 of this report.

4.2 Existing Traffic on Network and Network Configuration

Data on the existing traffic on the network was collated via Main Roads WA and the City of Kalamunda, inclusive of current daily volumes, peak volumes, the composition of vehicles on the network (Austroads classification). In addition to this, data was collected on road hierarchy, speed limit, RAV networks and general network configuration.

There is no meaningful data on pedestrian and cycling traffic; however, given that the existing infrastructure is poorly developed at present, minimal activity is anticipated.

Data on bus traffic was collated from PTA schedules and referenced against other data collected.

4.2.1 Currently Available Traffic Count Data

The table below outlines currently available traffic count data on key roads within and in the vicinity of the High Wycombe South Project Area.

Table 2 - Current Traffic Counts

Road	Location	VPD	Heavy Vehicles	Year	Source
Roe Highway	North of Berkshire Road	43,557	16.6%	2016	MRWA
	South of Berkshire Road	58,806	15.5%	2018	MRWA
	North of Maida Vale Road	44,657	12.7%	2019	MRWA
Milner Road	South of Raven Street	1,537	9.2%	2018	City of Kalamunda
	Northeast from Stewart Road	1,807	9.4%	2018	City of Kalamunda
	Southwest of Sultana Road West	2,397	14.1%	2018	City of Kalamunda
	South of Eureka Street	3,864	19.3%	2019	City of Kalamunda
Maida Vale Road	East from Milner Road	3,711	8.0%	2018	City of Kalamunda
	West from Milner Road	3,062	7.3%	2018	City of Kalamunda
	East of Dundas Road	2,430	7.0%	2018	City of Kalamunda
	West of Butcher Road	1,994	9.1%	2019	City of Kalamunda
Maida Vale Road	East of Plover Road	8,851	7.6%	2019	City of Kalamunda
	West of Jaeger Court	3,870	8.3	2020	City of Kalamunda
Dundas Road	South of Maida Vale Road	4,770	19.4%	2017	MRWA
	North of Maida Vale Road	5,697	12.3%	2018	City of Kalamunda
	North of Berkshire Road	4,267	19.4%	2018	City of Kalamunda
	South of Kapok Court	5,953	11.5%	2020	City of Kalamunda
	North of Daddow Road	3,794	36.7%	2020	MRWA
Berkshire Road	West of Roe Highway	4,199	23.0%	2016	MRWA
	West of Roe Highway	6,531	26%	2020	MRWA
	East of Milner Road	5,054	15.9%	2016	City of Kalamunda

Most roads in the vicinity of High Wycombe South Project Area have a high percentage of heavy vehicles. This is not surprising given the industrial land use near the subject area.

4.2.2 Existing Bus Routes

The table below outlines currently available bus routes in the vicinity of the High Wycombe South Project Area. Lack of connection and inaccessibility are the main reasons that High Wycombe South Project Area residents are not using public transportation services.

Table 3 - Current public transport availability

Route	Road	Peak frequency	Approximate daily (workday) number of vehicles per direction
294	Maida Vale Road	40 minutes	28
296	Maida Vale Road	15 minutes	15
298	Maida Vale Road	30 minutes	3

It is anticipated that bus feeder routes will be introduced, enhancing the availability of public transport for residents.

4.3 Traffic Generation / Attraction Rates

There is a limited source of West Australian based traffic generation rates. We have used rates from WAPC Transport Assessment Guidelines for Developments where applicable. Unavailable rates were supplemented by the rates provided in the NSW RTA Guide to Traffic Generating Developments as the most relevant, Australian based reference document. Rates that were not available in either of these documents were referenced from ITE Trip Generation Rates Handbook. Some of the traffic generation rates were adjusted to suit local conditions. Where these adjustments were applied, an explanation was provided. In many instances, the WAPC Guidelines Volume 5 (Technical Handbook) offers an hourly traffic generation rate without a daily traffic generation rate. In those instances, daily rates were sourced from the other two reference documents.

Table 4 – Vehicular traffic generation / attraction rates per land use

Land Use	Value (vehicular trips per unit)	Period	Split (In / Out)	Source	Note
Residential – Low density (R20 and less)	10 / dwelling	daily	50/50		
	0.8 / dwelling	AM / PM peak	AM 25/75 PM 67/33	WAPC TAGD	
Residential Medium density (R30-R40)	8 / dwelling	daily	50/50	NSW RTA GTGD	
	0.8 / dwelling	AM / PM peak	AM 25/75 PM 67/33	WAPC TAGD	
Residential Medium Density (R50-R60)	6.5 / dwelling	daily	50/50	NSW RTA GTGD	
	0.65 / dwelling	AM / PM peak	AM 25/75 PM 67/33	WAPC TAGD	
Residential High Density (R80)	5.5 / dwelling	daily	50/50	NSW RTA GTGD	
	0.55 / dwelling	AM / PM peak	AM 25/75 PM 67/33	WAPC TAGD	
Residential High Density (R100 and more)	5 / dwelling	daily	50/50	NSW RTA GTGD	
	0.5 / dwelling	AM / PM peak	AM 25/75 PM 67/33	WAPC TAGD	
Shopping	121/100m2	Daily	50/50	NSW RTA GTGD	
	AM – 2.5/100m^2 PM – 10/100m^2	AM / PM peak	AM 80/20 PM 50/50		
Showroom Shopping	17/100m^2	Daily	50/50	NSW RTA GTGD	
	2.7/100m^2	AM / PM peak	PM 50/50		
Primary School	2 / person	daily	50/50	Derived from hourly peak rate and the nature of the use	
	1/ person	AM / PM peak	50/50	WAPC TAGD	
Childcare Centre	4 / child + 1/employee	Daily	50/50	Derived from experience	
	0.8 / child 0.7 / child	AM / PM peak	50/50	Adjusted rate from NSW RTA GTGD	
Office and Commercial	10 / 100m^2 GFA	daily	50/50	NSW RTA GTGD	
	2 / 100m^2 GFA	AM / PM peak	AM 80/20 PM 20/80	WAPC TAGD	
Warehouse	4 / 100m^{2}GFA	daily	50/50	NSW RTA GTGD	
	0.5 / 100m^{2}GFA	AM / PM peak	AM 80/20 PM 20/80		
Factory	5 / 100m^2 GFA	daily	50/50	NSW RTA GTGD	
	1 / 100m^2 GFA	AM / PM peak	AM 80/20 PM 20/80		
Light Industry	4.6 / 100m^2 GFA	daily	50/50	This rate was derived as an average of Warehouse and Factory Rates	
	0.7 / 100m^2 GFA	AM / PM peak	AM 80/20 PM 20/80		
District Open Space	71.33 / playing field	Daily	50/50	ITE CTGR	
Aquatic Facility	1.5 / person	Daily	50/50	This rate was derived as per the description below.	
	0.15 / person	AM/PM peak	AM 70/30 PM 30/70		
Railway Station – Kiss and Ride	4,000	Daily	50/50	PTA Transport Assessment for High Wycombe Station	
	1,000 (ultra-peak hour)	AM/PM peak	50/50		
Railway Station – Public parking	2 / bay	Daily	50/50	This rate was derived based on the nature of parking (all day transit parking) and under the assumption that peak hour distribution will be like kiss and drop off facility	

4.4 Anticipated Changes in High Wycombe South Project Area and Vicinity

High Wycombe South Project Area comprises two distinct areas whose development will be guided by separate structure plans: Residential Precinct and Transit-Oriented Development (TOD) precinct. At present, Residential Precinct features larger residential lots intended for rural residential use. At the same time, the TOD precinct has been a worksite for the construction of the High Wycombe Railway Station.

Given that the latest Census (2016) recorded 313 dwellings in the High Wycombe South Project Area, by 2050 population will increase significantly as per the schedule below:

Table 5 - Population and Dwelling Forecasts - High Wycombe South Project Area (source: element WA)

		Year 2031	Year 2041	Year 2050+
TOD Precinct	Dwellings	69	508	508
	Population	151	1,359	1,359
Residential Precinct	Dwellings	340	1,594	2,417
	Population	850	3,948	5,998

Many different factors will dictate the rate of development in the coming years. For purposes of modelling, the following rates were assumed:

Table 6 - Estimated Rate of Build-Out (source: City of Kalamunda/Development WA)

	2031	2041	2050+
Rate of Buildout	15%	65%	100%

The rate of development may vary over the development cells depending on the interest. For purposes of this report, a uniform build-out is assumed across all cells.

4.4.1 High Wycombe South Project Area – Residential Land Use

The residential Precinct of the High Wycombe South Project Area will be developed over seven (7) development cells. Transit-Oriented Development (TOD) Precinct will be developed over six (6) development cells; however, residential land use will feature only in two (2) cells.

The anticipated number of dwellings for each cell is shown in the table below:

Table 7 - Dwelling Forecasts – High Wycombe South Project Area (source: element WA)

Residential Precinct		TOD Precinct	
Cell Number	**No Dwellings**	**Cell Number**	**No Dwellings**
1	55	1A	0
2	44	1B	301
3	261	1C	0
4	226	1D	0
5	352	1E	0
6&7	842	2	207
8	637		
Total	**2,417**	**Total**	**508**

Figure 3 - TOD Precinct Plan (source: element WA)

Figure 4 - Residential Precinct Plan (source: element WA)

Following traffic generation was developed for the residential component.

Table 8 - Traffic Generation - Residential Land Use

	2031		2041		2050+	
Zone	**Daily Traffic (VPD)**	**Peak Traffic (VPH)**	**Daily Traffic (VPD)**	**Peak Traffic (VPH)**	**Daily Traffic (VPD)**	**Peak Traffic (VPH)**
9 (Cell 1)	66	7	288	29	440	44
10 (Cell 2)	53	5	232	23	352	35
11 (Cell 3)	313	31	1,360	136	2,088	209
12 (Cell 4)	270	27	1,168	117	1,800	180
13 (Cell 5)	422	42	1,832	183	2,816	282
14 (Cell 6)	774	77	3,353	335	5,158	516
15 (Cell 7)	606	61	2,625	263	4,039	404
16 (TOD Residential)	171	17	1,139	74	1,139	114
18 (1B HWS station)	226	23	1,505	98	1,505	151
	2,900	**290**	**13,502**	**1,257**	**19,336**	**1,934**

4.4.2 Non-Residential Land Use

Besides residential land use, High Wycombe South Project Area will feature a number of non-residential uses. TOD Precinct will have a number of non-residential land uses to support new transit node. Current estimates are as follows:

Table 9 – Commercial Land Use in TOD Precinct (source: City of Kalamunda/Development WA)

Year	2030	2040	2050
Retail	1,100 m^2 (32)	5,160 m^2 (152)	5,160 m^2 (152)
Commercial		450 m^2 (18)	1,200 m^2 (48)
Medical		450 m^2 (5)	1,200 m^2 (14)
Childcare	400 m^2 (12)	1,250 m^2 (36)	1,250 m^2 (36)
Showroom Retail	-	2,500 m^2 (32)	2,500 m^2 (32)
Total	**1,500 m^2 (44)**	**9,810 m^2 (243)**	**11,310 m^2 (282)**

As we weren't provided with the breakdown per development cell, the following breakdown was assumed:

Table 10 - Distribution of Non-Residential Land Uses Across TOD Development Cells

Cell Number	Food Retail	Non-Food Retail	Showroom Retail	Medical	Childcare	Commercial
1A	0	0	100%	0	0	0
1B	100%	50%	0	100%	70%	0
1C	0	0	0	0	0	0
1D	0	0	0	0	0	0
1E	0	50%	0	0	0	100%
2	0	0	0	0	30%	0

For purposes of this report, it was assumed that the nominated Retail floor space would comprise 70% "Food Retail" and 30% of "Non-food Retail". It was assumed that the Showroom Retail would be predominantly situated in Cell 1A, gradually replacing light industry activities. The majority of other non-residential land uses will be situated in Cell 1B, abutting main internal transit corridors. Cell 2 is expected to be a predominantly residential cell.

Community facilities in TOD Precinct may feature an aquatic centre with two areas (indoor and outdoor), a water-play recreational area and a gym if constructed at this scale. If constructed at the aforementioned scale, the community facility is anticipated to attract approximately 450,000 visitors per annum when fully established.

The Residential Precinct will feature a District Open Space and a Primary School.

4.4.3 Traffic Generation / Attraction – Non-Residential Uses

Retail land use is expected to start developing in 2031 and be fully developed by 2041. While no further development is expected for retail land use between 2041 and 2050, the population in the area is expected to grow significantly, and therefore the proportion of internal trips will increase.

The table below focuses on the PM peak as the higher peak. For a full detailed analysis, please see Network Modelling Report.

Table 11 - Retail Land Use - Traffic Attraction / Generation

Zone	2031				2041				2050+			
	Total VPD	Total PM VPH	External VPD	External PM VPH	Total VPD	Total PM VPH	External VPD	External PM VPH	Total VPD	Total PM VPH	External VPD	External PM VPH
17 (1a)	0	0	0	0	500	100	425	85	500	100	400	80
18 (1b)	551	46	385	32	4,371	361	2,841	235	4,371	361	2,404	199
19 (1c)	0	0	0	0	0	0	0	0	0	0	0	0
20 (1d)	0	0	0	0	0	0	0	0	0	0	0	0
21 (1e)	39	0	35	8	310	100	263	62	310	100	248	62
Total	**590**	**46**	**420**	**40**	**5,181**	**561**	**3,529**	**382**	**5,181**	**561**	**3,052**	**341**

Childcare and Medical land uses are expected to increase in the period 2031-2050 iteratively; however, the percentage of external trips is expected to be higher than the percentage of internal trips on a daily basis throughout the period.

Table 12 – Medical and Childcare Use Land Use - Traffic Attraction / Generation

Zone 18 (1b)	2031				2041				2050+			
	Total VPD	Total AM VPH	External VPD	External AM VPH	Total VPD	Total AM VPH	External VPD	External AM VPH	Total VPD	Total AM VPH	External VPD	External AM VPH
Medical	234	35	211	32	234	35	176	26	528	79	396	59
Childcare	176	32	158	29	550	100	413	75	550	100	413	75
Total	**410**	**67**	**369**	**61**	**784**	**135**	**589**	**101**	**1,078**	**179**	**809**	**134**

High Wycombe Railway Station is expected to be opened in mid 2022. For modelling purposes, it is assumed that it will reach its full capacity when it comes to vehicular attraction by 2041. While the patronage is expected to grow to 2050, the growth in the High Wycombe South Project Area population will increase the percentage of walking and cycling arrivals.

Table 13 – High Wycombe Railway Station - Traffic Attraction / Generation

20 (1C HWS station)	2031				2041				2050+			
	Total VPD	Total AM VPH	External VPD	External AM VPH	Total VPD	Total AM VPH	External VPD	External AM VPH	Total VPD	Total AM VPH	External VPD	External AM VPH
Kiss'n'Ride	2,948	643	2,358	590	4,000	1,000	3,200	800	4,000	1,000	3,200	800
Park and Ride	1,170	541	1,416	496	2,400	840	1,920	672	2,400	840	1,920	672
Total	**4,118**	**1,184**	**3,774**	**1,086**	**6,400**	**1,840**	**5,120**	**1,472**	**6,400**	**1,840**	**5,120**	**1,472**

Commercial land use is expected to be fully developed in 2050, and throughout the study period, it is anticipated that vehicular traffic attracted to this land use will be mostly external.

Table 14 - Commercial Use Land Use - Traffic Attraction / Generation

Zone	2041				2050+			
	TOTAL VPD	TOTAL VPH	External VPD	External AM VPH	TOTAL VPD	TOTAL VPH	External VPD	External AM VPH
21 (1E)	45	9	43	9	120	24	114	23

Should the community site be constructed at the envisioned scale, the facility is not expected to become operational before 2041 and is not likely to reach operational peak immediately. The facility is expected become operational by 2041; however, it is not likely to reach an operational peak immediately.

Table 15 – Community Land Use - Traffic Attraction/Generation

Zone	2041				2050+			
	TOTAL VPD	TOTAL VPH	External VPD	External AM VPH	TOTAL VPD	TOTAL VPH	External VPD	External AM VPH
18 (1B)	942	94	754	75	1884	188	1507	150

Primary School is expected to open by 2041; however, it will reach its full capacity by 2050. Most of the trips associated with this land use will be internal to the project area.

Table 16 – Primary School - Traffic Attraction / Generation

Zone	2041				2050+			
	TOTAL VPD	TOTAL VPH	External VPD	External AM VPH	TOTAL VPD	TOTAL VPH	External VPD	External AM VPH
22 (Primary School)	600	300	120	60	1080	540	216	108

High Wycombe South Industrial Zone is expected to be fully operational by 2031.

Table 17 - High Wycombe South Industrial Zone - Vehicular Traffic Attraction / Generation

Zone	Total Area (m^2)	Equivalent Area (m^2)	VPD	VPH
23	241,366	48,273	2,414	483
24	154,967	30,993	1,550	310
25	174,543	34,909	1,745	349
26	83,945	16,789	839	168
	654,821	**130,964**	**6,548**	**1,310**

As the City of Kalamunda is looking to meet its projected population targets and associated physical and social infrastructure requirements, changes in the vicinity of the High Wycombe South Project Area are inevitable. These were reviewed, and the impact on the subject area was assessed.

4.5 Regional Operational Model (ROM) and Metropolitan Land Use Forecasting System MLUFS) Data

In December 2020, KCTT received the following ROM plots from MRWA:

- 41696_LVP_All Day_Y16 Forrestfield DCP_MLUFS140
- 41696_LVP_All Day_Y16 Forrestfield DCP_TUE
- 41696_LVP_All Day_Y21 Forrestfield DCP_MLUFS140
- 41696_LVP_All Day_Y21 Forrestfield DCP_TUE
- 41696_LVP_All Day_Y26 Forrestfield DCP_MLUFS140
- 41696_LVP_All Day_Y31 Forrestfield DCP_MLUFS140
- 41696_LVP_All Day_Y36 Forrestfield DCP_MLUFS140
- 41696_LVP_All Day_Y36 Forrestfield DCP_TUE
- 41696_LVP_All Day_Y41 Forrestfield DCP_MLUFS140
- 41696_LVP_All Day_Y41 Forrestfield DCP_TUE
- 41696_Validation_Y16 Forrestfield DCP_MLUFS140
- 41696_Validation_Y16 Forrestfield DCP_TUE
- 41696_ZBP_Forrestfield DCP_MLUFS140 (*schedule of zones*)
- 41696_ZBP_Forrestfield DCP_TUE (*schedule of zones*)

KCTT have been supplied with two distinct sets of ROM plots based on different population scenarios.

One set is based on the MLUFS land-use model and hereon will be referred to as "ROM Scenario 1". The other scenario was prepared to examine the impact of the Tonkin Highway extension and hereon will be referred to as "ROM Scenario 2". ROM Scenario 2 also shows slight variations in population assumptions to ROM Scenario 1.

The map of zones for each scenario was used to correlate existing statistical data and the number of dwellings to determine the population growth anticipated by the State Government.

KCTT received population scenarios for the 2041 horizon year only as a part of this package.

In-network modelling, KCTT relied predominantly on the "ROM Scenario 1".

In July 2021, KCTT received additional link volume plots for sections of Dundas Road and Berkshire Road. We only received link plots for 2041. These plots were used to derive passing traffic on Dundas Road and Berkshire Road.

5 Findings of Network and Intersection Modelling

5.1 Network Configuration

The table below outlines the requirement for upgrades on each section of the network. The table shows anticipated vehicles per day (VPD) on the link, Liveable Neighbourhoods classification (LN), applicable road reservation width required (RR) and whether the land acquisition is necessary. The current size of the road reservation was sourced from Nearmap in June 2021. The critical information in the table below is when the upgrade of a particular link is required and whether this upgrade requires additional land acquisition. Details of modelling, conclusions and apportionment are provided in Appendix 3 of this report.

Liveable Neighbourhoods classify streets based on the function and volume of vehicular traffic. This classification is generally used as a reference for planning purposes. Once the road is constructed and functional, the Liveable Neighbourhoods classification is replaced by the Main Road WA classification. However, for comparison purposes, the table below will outline Liveable Neighbourhoods equivalent road class on existing roads, based on the current traffic counts.

The reference in the brackets pertains to the infrastructure element in the associated Bill of Quantities.

Table 18 - Timing of Upgrades - Road Network

Road	BOQ	Section	RR Current	LN category Current	2031				2041				2050			
					VPD	LN	RR	Land Acquisition	VPD	LN	RR	Land Acquisition	VPD	LN	RR	Land Acquisition
Berkshire Road	[RD1]	W of Roe Hwy	20m	NCA	16,500	IB	25.2m (20m)	No	21,900	IA	35.6m*(25m)	Yes	25,843	IA	35.6m*(25m)	No
	[-]	E of Roe Hwy	20m	NCA	17,900		25.2m (20m)	No	25,600		35.6m	Yes	31,805		35.6m	No
	[RD1]	S of Milner Rd	30m	NCA	15,700		25.2m (20m)	No	21,000		35.6m*(25m)	Yes	24,915		35.6m*(25m)	No
Dundas Road	[RD6]	S of Berkshire Rd	Varies	NCA	11,100	IB	25.2m (20m)	No	13,400	IB	25.2m (20m)	No	15,200	IB	25.2m (20m)	No
	[RD7]	SW of Old Dundas Rd	Varies	NCA	10,500		25.2m (20m)	No	11,700		25.2m (20m)	No	13,700		25.2m (20m)	No
	[RD8]	N of Old Dundas Rd	Varies	NCA	12,500		25.2m (20m)	No	16,600		25.2m (20m)	No	20,000	IA (IB)	25.2m (20m)	No
Maida Vale Road	[RD5]	E of Enterprise Blvd	25m	AS/NCB	3,400	NCA	24.4m (20m)	No	6,200	NCA	25.2m (20m)	No	7,700	IB	25.2m (20m)	No
	[RD4]	E of Raven St	20m	AS/NCB	2,900	NCB	19.4m	No	4,300	NCA	24.4m (20m)	No	4,500	NCA	24.4m (20m)	No
	[RD3/3A]	E of Milner Rd	20m	AS/NCB	6,600	NCA	24.4m (20m)	No	11,400	IB	25.2m (20m)	No	13,100	IB	25.2m (20m)	No
Milner Road	[RD10]	S of Maida Vale Rd	20m	AS	4,000	NCA	24.4m (20m)	No	7,800	IB	25.2m (20m)	No	9,300	IB	25.2m (20m)	No
	[RD2]	S of TOD Connector	20m	AS	4,100		24.4m	Yes	7,000		25.2m	Yes	8,200		25.2m	No
	[RD9]	N of Berkshire Rd	20m	AS	7,000		24.4m (20m)	No	11,500		25.2m (20m)	No	13,000		25.2m (20m)	No
TOD Connector	[RD15]	E of Milner Rd	n.a.	n.a.	1,500	AS	<20m	Yes	5,200	NCA	24.4m	Yes	6,500	NCA	24.4m	No
	[RD14]	S of Enterprise Blvd	n.a.	n.a.	700		<20m	Yes	2,000	AS	<20m (24.4m)	Yes	2,400	AS	<20m (24.4m)	No
	[RD16]	S of TOD Precinct	n.a.	n.a.	800		<20m	Yes	3,100	NCA	24.4m	Yes	4,600	NCA	24.4m	No

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Road	BOQ	Section	RR Current	LN category Current	2031				2041				2050			
					VPD	LN	RR	Land Acquisition	VPD	LN	RR	Land Acquisition	VPD	LN	RR	Land Acquisition
Sultana Road West	[-]	W of Milner Rd	20m	AS	500	AS	<20m	No	1,400	AS	<20m	No	1,600	AS	<20m	No
	[RD20]	E of Milner Rd	20m	AS	800	AS	<20m	No	1,600	AS	<20m	No	1,900	AS	<20m	No
		E of TOD Precinct	20m	AS	452	AS	<20m	No	1,300	AS	<20m	No	1,700	AS	<20m	No
Stewart Road	[RD17]	E of Milner Rd	20m	AS	800	AS	<20m	No	3,400	NCA	24.4m	Yes	4,800	NCA	24.4m	No
Raven Street	[RD12]	S of Maida Vale Rd	20m	AS	700	AS	<20m	No	4,400	NCA	24.4m	Yes	5,700	NCA	24.4m	No
	[RD13]	S of Milner Rd	n.a.	n.a.	1,100	AS	<20m	Yes	4,100	NCA	24.4m	Yes	6,000	NCA	24.4m	No
Enterprise Boulevard	[RD11]	W of Maida Vale Rd	20m	AS	1,900	AS	<20m	No	3,500	NCA*	24.4m (20m)	No	3,700	NCA	24.4m (20m)	No
		N of TOD Connector	20m	n.a	700	AS	<20m	No	1,700	NCA*	20m	No	2,000	NCA*	20m	No
Brand Road	[RD19]	N of TOD Connector	20m	AS	300	AS	<20m	No	1,400	AS	<20m	No	2,100	AS	20m	No
Brae Road	[R18]	E of TOD Connector	20m	AS	500	AS	<20m	No	1,900	AS	<20m	No	2,600	NCB	19.4m	No
Newburn Road	[-]	N of Maida Vale Rd	25.5m	AS	4,200	NCA	24.4m	No	5,700	NCA	24.4m	No	6,600	NCA	24.4m	No

The anticipated traffic volumes indicate that Berkshire Road should be upgraded to an Integrator A configuration. Given that the Liveable Neighbourhoods guideline generally applies to the residential areas, the nominal cross-section should be modified to cater for industrial traffic. On-street parking is not deemed appropriate on Berkshire Road west of Roe Highway, given this road will carry RAV vehicles. Further to this, a generously sized shared path is a safer cycling option than on-road cycle paths, given the quantum of RAV vehicles and the possible presence of Over-Size Over Mass vehicles on this route. Therefore, we believe that a road reservation of 25m is appropriate for this section of Berkshire Road.

Dundas Road is servicing an industrial area for most of its length; therefore, an adjusted Integrator B cross-section is suggested.

Milner Road and Maida Vale Road require Integrator B as an ultimate configuration. Although the interim Neighbourhood Connector A configuration will suffice, it is recommended that both roads are upgraded to the ultimate configuration when traffic volumes meet warrants. These two configurations have only minor differences; however, reconstruction of the road will cause unnecessary disturbance and cost.

TOD Connector is a new local distributor servicing the High Wycombe South Project Area. The ultimate configuration for this road is Neighbourhood Connector A; therefore, the land for the ultimate road configuration will be acquired initially.

Enterprise Boulevard is under construction as a part of Railway Station works. It will be constructed to a Neighbourhood Connector A standard. Actual future traffic counts on this road will depend on the design of the access points for commercial and community facilities in TOD Precinct.

Brand Road will be upgraded by 2041 to an urban standard, although its formal classification will not change (Access Street). This upgrade is directly related to the construction of the Primary School and District Open Space and is likely to occur concurrently to construction of these two community facilities.

Portions of existing roads (Brae Road and Brand Road west of TOD Connector and Sultana Road West south of Brand Road) will become subdivisional roads, and the responsibility for upgrade will be with a developer.

5.2 Intersection Configuration

The table below outlines the requirement for upgrades on some of the key intersections on the network. The table below shows starting and the ultimate configuration of the intersection, expected contribution per precinct, the timing of the upgrade and whether the land acquisition is necessary. The current size of the road reservation was sourced from Nearmap in July 2021. The requirement for land acquisition was assessed for intersections independently of the adjoining road link; therefore, it reflects the requirement for the land acquisition in addition to land acquisition for the widening of road links. The impact of each precinct was assessed for AM and PM peaks independently. The values below reflect the average impact of both peak times. Details of modelling, conclusions and apportionment are provided in Appendix 4 of this report. The reference in the brackets pertains to the infrastructure element in the associated Bill of Quantities.

Table 19 - Timing of Upgrades - Intersections

Intersection	BOQ	Starting Configuration	Ultimate Configuration	Residential Precinct %	TOD Precinct %	Year of Upgrade	Land Acquisition Required?
M01. Roe Highway / Maida Vale Road	[INT02]	Half interchange	Half Interchange	18.85%	14.36%	2031	No
M02. Maida Vale Road / Milner Road	[INT01]	T-intersection full movement	Roundabout	33.35%	23.20%	2041	Yes
M03. Milner Road / Stewart Road	[INT18]	T-intersection full movement	Roundabout	64.72%	14.74%	2041	Yes
M04. Milner Road / Raven Street	[INT17]	T-intersection full movement	Roundabout	61.43%	17.89%	2041	Yes
M05. Milner Road / TOD Connector	[INT05]	The intersection doesn't exist	Signals	41.24%	16.36%	2041	Yes
M06. Milner Road / Berkshire Road / Dundas Road	[INT15]	T-intersection full movement	Roundabout	17.23%	7.70%	2031/2041	Yes
M07. Berkshire Road / Roe Highway	[-]	Grade separated interchange	Grade separated interchange	2.00%	1.20%	2041	No
M08. TOD Connector / Brand Road	[INT16]	The intersection doesn't exist	Four-way, sign controlled	100.00%	0.00%	2041	Yes
M09. TOD Connector / Brae Road / Raven Street	[INT14]	The intersection doesn't exist	Full movement 4-way intersection	100.00%	0.00%	2041	Yes
M10. Brae Road / Stewart Road	[INT09]	T-intersection full movement	T-intersection full movement	100.00%	0.00%	2041	Yes
M11. Milner Road / Sultana Road West	[INT07]	Two staggered T-intersections - full movement	Section east of Milner Rd to be converted to a LILORI	54.60%	11.53%	2041	No *
			Section west of Milner Rd to be converted to Cul-de-Sac	0.00%	100.00%		
M12. Maida Vale Road / Dundas Road / Parking Access	[INT14]	Roundabout	Roundabout	21.87%	8.75%	2041	No
M13. Maida Vale Road / Enterprise Boulevard*	[INT12]	T-intersection full movement	T-intersection full movement	36.91%	17.55%	2041	No
M14. Maida Vale Road / Raven Street	[INT13]	The intersection doesn't exist	T-intersection full movement	37.82%	19.60%	2041	Yes
M15. (old Dundas Road) / Dundas Road	[INT06]	T-intersection full movement	Signals	16.46%	7.85%	2031	No
M16. Maida Vale Road / Newburn Road	[INT03]	T-intersection full movement	Roundabout	37.72%	22.47%	2041	Yes
M17. Maida Vale Road / Butcher Road	[-]	T-intersection full movement	T-intersection full movement	0.63%	20.91%	2041	No
M18. Maida Vale Road / Plover Road	[-]	T-intersection full movement	T-intersection full movement	37.13%	26.04%	2041	No
M19. Maida Vale Road / Littlefield Road	[-]	T-intersection full movement	T-intersection full movement	36.52%	25.62%	2041	No
M20. Milner Road / Nardine Close	[INT08]	T-intersection	Left in Left Out Right In	41.57%	11.73%	2041	No
M21. Berkshire Road / Bonser Road	[-]	T-intersection full movement	Left In Left Out	15.80%	8.50%	2041	No *
M22. Berkshire Road / Ashby Close	[-]	T-intersection full movement	Left In Left Out	13.33%	8.10%	2041*	No *
M23. Berkshire Road / Walters Way	[-]	T-intersection full movement	Left In Left Out	14.78%	8.44%	2041*	No *
M24. Berkshire Road / Harrison Road	[-]	T-intersection full movement	Left In Left Out	13.65%	8.30%	2041*	No *
M25. Dundas Road / Dundas Road (south)*	[-]	T-intersection full movement	T-intersection full movement	0.00%	2.32%	2041*	No

6 Impact on Cost Apportionment

6.1 Basis of the Apportionment (State Planning Policy 3.6)

In April 2021 Department of Planning, Lands and Heritage adopted the revised State Planning Policy 3.6: Infrastructure Contributions. Section 6 of this document outlines the following fundamental principles for application:

a) Need and the nexus: The need for the infrastructure must be clearly demonstrated (need), and the connection between the development and the demand created should be clearly established (nexus).

b) Transparency: Both the method for calculating the infrastructure contribution and the manner in which it is applied should be clear, transparent, and simple to understand and administer.

c) Equity: Infrastructure contributions should be levied equitably from identified stakeholders within a contribution area, based on the relative contribution to need.

d) Certainty: The scope, timing, and priority for delivering infrastructure items, and the cost of infrastructure contributions and methods of accounting for escalation, should be clearly identified.

e) Efficiency: Contribution should be justified on a whole-of-life capital cost basis consistent with maintaining financial discipline on service providers by precluding the over-recovery of costs.

f) Consistency: The system for infrastructure contributions for apportioning, collecting and spending contributions should be consistent, efficient and transparent.

g) Accountable: That there is accountability in the manner in which infrastructure contributions are determined, collected and expended

h) Right of consultation and review: Landowners and developers have the right to be consulted on the manner in which development contributions are determined and the opportunity to seek a review by an independent third party regarding the calculation of costs, and return of funds.

This report considers the road infrastructure required to cater for the estimated vehicular volumes. Appropriate cycling and pedestrian infrastructure were considered in developing appropriate road cross-sections.

All of the infrastructure items discussed in this report can be considered "Development Infrastructure" as defined in Section 6.3, clause a) of SPP 3.6. and are listed as items 8-12 in Schedule 1 of the SPP 3.6.

Findings of this report will be utilised to apportion the construction cost of all movement infrastructure (inclusive of roads, intersections, cycling paths and shared paths).

6.2 Addressing Key Principles of SPP 3.6

The table below outlines how relevant SPP 3.6 principles were addressed in deriving cost apportionment for road infrastructure.

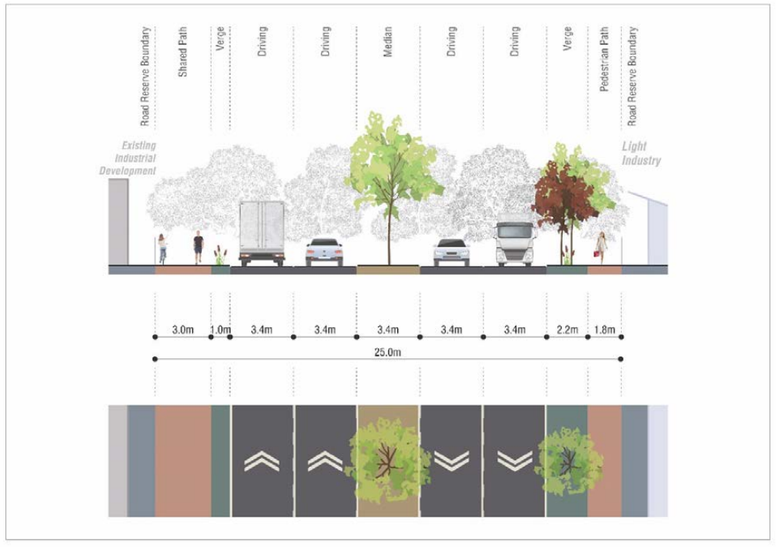
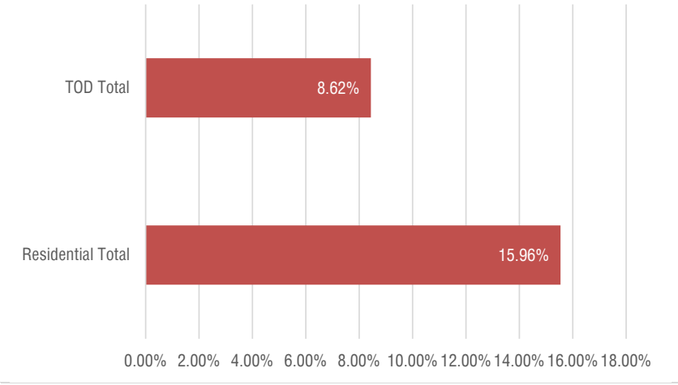
Table 20 - Addressing SPP 3.6 Principles

Principles	Addressing the principle
a) Need and the nexus	A significant increase in population and commercial floor space will generate and attract high vehicular traffic. Current infrastructure may not have sufficient capacity to service the increase in traffic without significant delays and/or safety risk; therefore, it is essential to determine where upgrades may be required to accommodate the increase in traffic. A minimum threshold for establishing the need and nexus was set at 10% of traffic contribution; therefore, if a precinct contributes 10% or more of projected daily traffic in the ultimate scenario, it is deemed sufficient to trigger the requirement for cost apportionment. This threshold ensures that only the roads that are likely to have significant traffic increases due to this development will be a DCP item, funded and apportioned according to traffic modelling, through the DCP. Conversely, roads and intersections in the broader network that are likely to experience only minor increases in traffic and that are unlikely to require upgrades are not a DCP item Extensive network and intersection modelling clearly delineated where the introduction of the new infrastructure or upgrade of the existing infrastructure is a consequence of development within the Residential and Transit-Oriented Development Precincts. The proportion of passing traffic, traffic not originating or terminating in the High Wycombe South Project Area, has been separated to apportion costs in the DCP.
b) Transparency	While the method of modelling and apportionment was quite complex, the basic principles will be set out in this report in a straightforward and easy-to-follow manner . The model was set up so the volume of traffic generated or attracted by each precinct is clearly identifiable on every intersection and road link. Passing traffic is also identified, as the cost proportional to the impact of this traffic component cannot be attributed to the DCP. Traffic associated with the High Wycombe Railway Station, originating outside of the High Wycombe South Project Area, was deemed "passing traffic" in this assessment, as the road network surrounding the station will be constructed to cater for the traffic attracted by the railway station. Key terminology: - Passing traffic – traffic not originating nor terminating in the High Wycombe South Project Area. ***Example One:*** *Resident of High Wycombe (North) travelling to work in Forrestfield Industrial Area via Maida Vale Road, Milner Road or Dundas Road.* ***Example Two:*** *Resident of Forrestfield accessing Railway Station via Berkshire Road > Milner Road > TOD Connector.* - Reciprocal traffic / reciprocity in traffic generation and attraction – traffic originating in one precinct and terminating in the other precinct within the High Wycombe South Project Area. ***Example One:*** *Residents of the Residential Precinct travelling for shopping or recreation to TOD Precinct.* ***Example Two:*** *Residents of TOD Precinct taking their children to the primary school in the Residential Precinct.*
c) Equity *(Continued on the following page)*	The cost for the infrastructure will be apportioned according to: - the results of traffic modelling in the precinct, - the need generated by the future development, - the party benefiting from the infrastructure. Two key categories have been adopted in this report for the purposes of apportionment within the High Wycombe South Project Area: TOD Precinct and Residential Precinct. While there is some reciprocity in the traffic generation and attraction between two precincts, this portion of traffic is minor. Reciprocal traffic has been apportioned according to the location of the infrastructure and the key beneficiary. For example, any reciprocal traffic modelled on the section of the TOD Connector located within the TOD Precinct will be apportioned to the TOD Precinct. The basic principles of the apportionment can be summarised as follows: - If the precinct (TOD Precinct or Residential Precinct) contributes more than 10% of daily traffic on an intersection or a road section, the DCP contribution is required. If the precinct contributes less than 10% of daily traffic, it is not deemed sufficient to trigger the upgrade requirement; therefore, the contribution is not required. ***Example:*** *If in the ultimate scenario (horizon year 2050) 25% of the traffic on a road section or an intersection comes from the Residential Precinct, then 25% of the cost for the upgrade will be apportioned to the Residential Precinct. If approximately 35% of daily traffic on the same infrastructure element is attracted by TOD Precinct (and is not originating in the Residential Precinct), then 35% of the cost for the upgrade will be apportioned to the TOD Precinct. As the remaining 40% of daily traffic in this example is deemed passing traffic and cannot be attributed to either precinct, 40% of the cost for the upgrade cannot be attributed to DCP and this portion of cost will have to be funded through an alternate mechanism.*

Principles	Addressing the principle
	- If a road or an intersection is deemed necessary for functioning of one of the Precincts, regardless of the presence of the other Precinct, the cost will be apportioned to the Precinct where the access is necessary. ***Example One**: Raven Street between Milner Road and Brae Road. This road link provides Residential Precinct with an access to a higher order network (Milner Road > Maida Vale Road or Berkshire Road). While some of the residents of TOD Precinct may travel on this road, the road is required to service the Residential Precinct even if the TOD Precinct is not constructed. Therefore, the cost for construction should be allocated fully to the Residential Precinct.* ***Example Two**: TOD Connector between Milner Road and Enterprise Boulevard. While the residents of the Residential Precinct will likely travel on this link to access future commercial and community services within the TOD Precinct, should the TOD Precinct not proceed the residents will travel elsewhere to access these services and will use other road links. Therefore, this section of TOD Connector is essential for future commercial and community services within the TOD Precinct but is optional for the Residential Precinct, and the cost for the upgrade should be apportioned to the TOD Precinct fully.* **Exception:** Raven Street between Milner Road and Maida Vale Road and Raven Street / Maida Vale Road intersection. The modelling showed that the residents of the Residential Precinct are likely to use this link as a shortcut to access Maida Vale Road and Dundas Road northbound, not to access services in TOD Precinct; therefore, cost is apportioned to each precinct proportionally to the daily traffic contributed.
d) Certainty	It is envisaged that both precincts will be fully built out by 2050. Modelling was completed for 2031, 2041 and 2050+ horizon years to determine when infrastructure upgrades might be required. Each of the horizon years is associated with the proportional build out of the Project Area, so 2031 corresponds with an approximate 15% build out, 2041 corresponds with 65% buildout while 2050 corresponds with the completion of structure plans (100% buildout). Although general assumptions on the build-out rate are discussed in this report, the actual build-out rate will depend on many factors (such as the general real estate market, the interest of developers in this particular area, other opportunities in the Perth Metro area etc.)
e) Efficiency	The proposed upgrades have been designed to accommodate increased traffic demand but also to provide an appropriate balance between vehicular traffic, public transport, cycling and walking. Furthermore, the proposed infrastructure upgrades seek to minimally disrupt existing residences and businesses as land acquisition requirements are minimised wherever possible. Some of the infrastructure elements are proposed to be modified compared to Liveable Neighbourhoods to be accommodated within the existing road reservation and/or for vehicular and pedestrian safety. The modelling shows that some road links may trigger iterative upgrades (Maida Vale Road, Berkshire Road, Milner Road). Iterative upgrades would add unnecessary cost to DCP and the disruption to the community may cause angst which could be avoided. Therefore, to minimise abortive road upgrades and costs. it is proposed to construct the ultimate configuration once it is close to trigger, rather than iterative road upgrades every several years.
f) Consistency	The advice on potential upgrades predominantly relies on Liveable Neighbourhoods 2009. General recommendations by the guideline are, on occasion, locally modified to take into account site constraints and vehicular/pedestrian safety.
g) Accountable	These two principles pertain to the administration of the DCP, which is outside the scope of this report.
h) Right of consultation and review	

6.3 Key Network Links

The table below shows the summary of proposed upgrades and the contribution per precinct. For purposes of this report, traffic attracted by the railway station precinct was assessed as "passing traffic". For details, please refer the Appendix 3 of this report (Network Modelling Report).

<table>
<tr><th>Road</th><th>Section [BOQ]</th><th>2050 Volumes (VPD)</th><th>Configuration</th><th>Contribution per Precinct</th></tr>
<tr><td rowspan="2">Berkshire Road</td><td>Roe Highway – Walters Way [RD1]</td><td>25,900</td><td rowspan="2"> 
</td><td rowspan="2"> 
</td></tr>
<tr><td>Walters Way – Milner Road [RD1]</td><td>25,000</td></tr>
</table>

Berkshire Road will trigger a requirement for an upgrade to Integrator B configuration by 2031. To minimise cost and disturbance for the existing businesses, it is recommended that the road is upgraded straight to Integrator A closer to 2041. Alternatively, the Integrator B configuration can be implemented in 2031 within the existing road reservation, with additional traffic lanes added in 2041 once the land is acquired for widening.

Note: The modelling showed negligible difference in contributions for each precinct in these two segments of Berkshire Road. For simplicity, the values were averaged for the entire length, as per table below:

	Roe Hwy-Walters Way	Walters Wy-Milner Road	Average Berkshire Road
Residential Precinct	15.54%	16.37%	15.96%
TOD Precinct	8.44%	8.79%	8.62%

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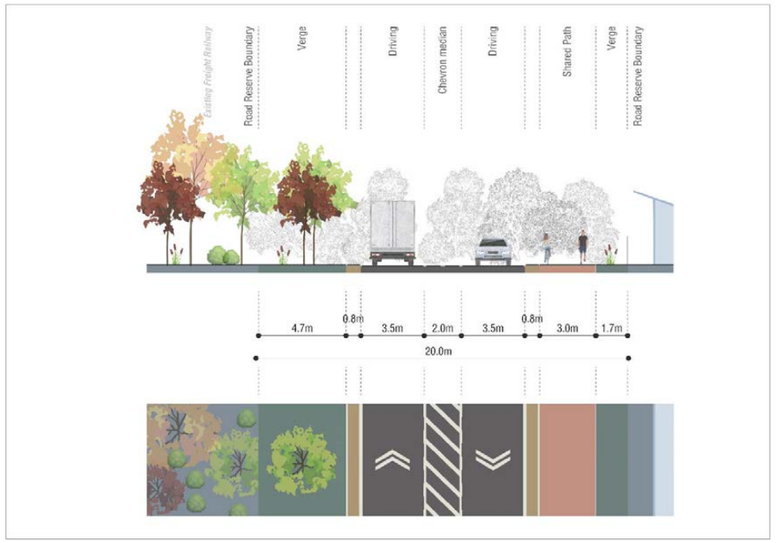
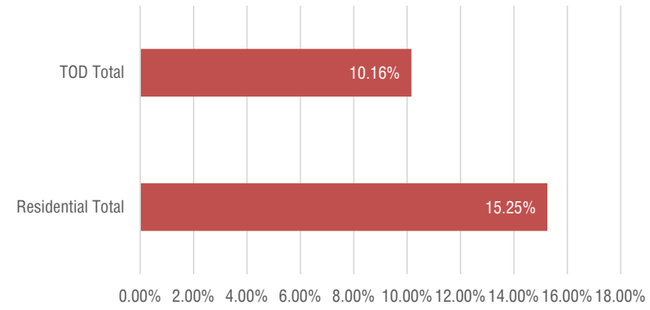
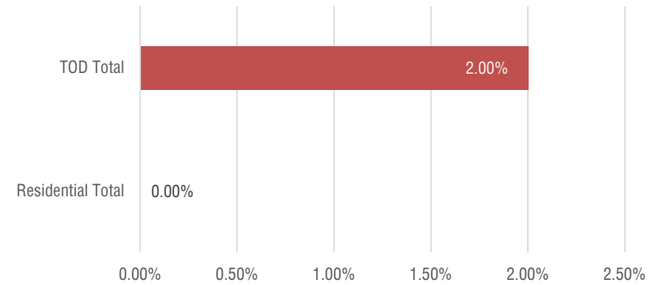
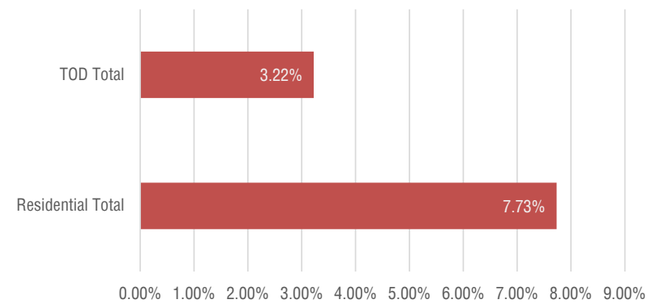
Road	Section [BOQ]	2050 Volumes (VPD)	Configuration	Contribution per Precinct
Dundas Road	Maida Vale Road - Sorensen Road [RD8]	20,000		
	Berkshire Road - Dundas Road Old (north of the railway station)) [RD7]	13,700		
	Berkshire Road - Harrison Road [RD6]	15,200	Dundas Road, north of the realignment, in 2050, may carry traffic volumes approaching the threshold for an Integrator A upgrade (dual lanes in each direction). Given that any forecast of passing traffic for a 30-year timeframe is unreliable, this configuration should not be considered for DCP purposes.	

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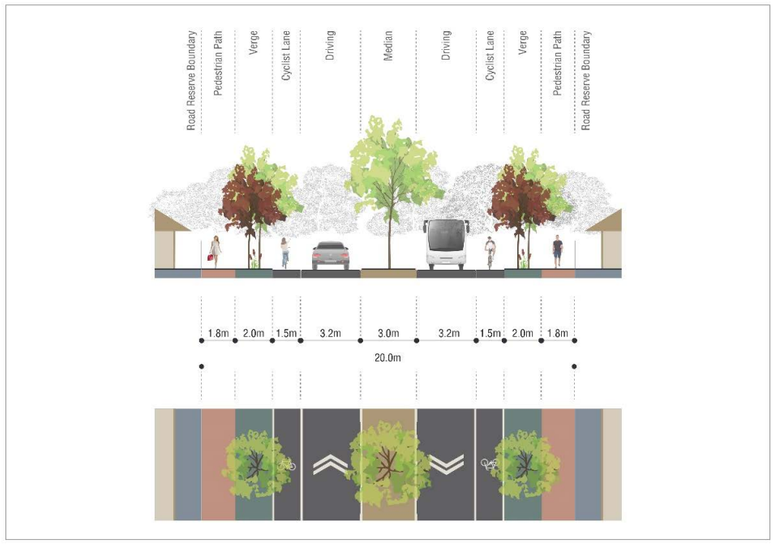
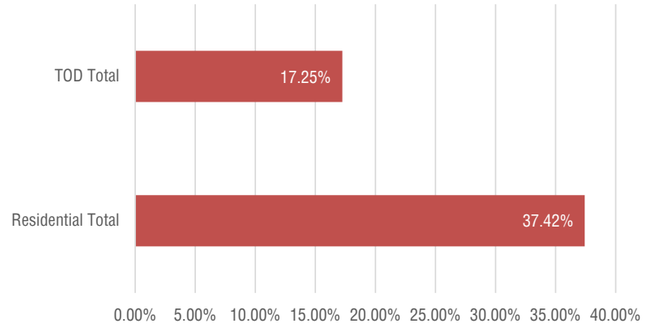
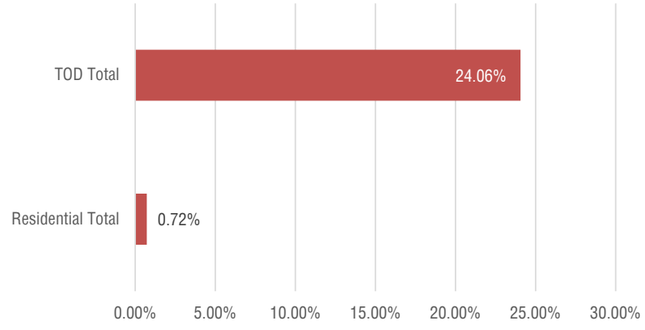
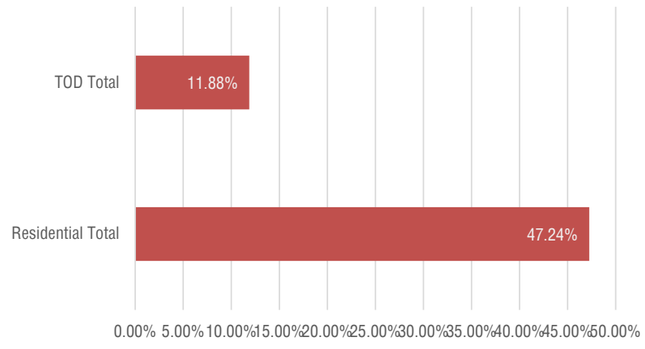
Road	Section [BOQ]	2050 Volumes (VPD)	Configuration	Contribution per Precinct
Maida Vale Road	Milner Road – Roe Highway [RD3/3A]	13,000		
	Raven Street - Milner Road [RD4]	4,200		
	Dundas Road - Raven Street [RD5]	7,800	As previously discussed, Maida Vale Road proposed upgrade was developed to minimise the impact on the existing residences.	

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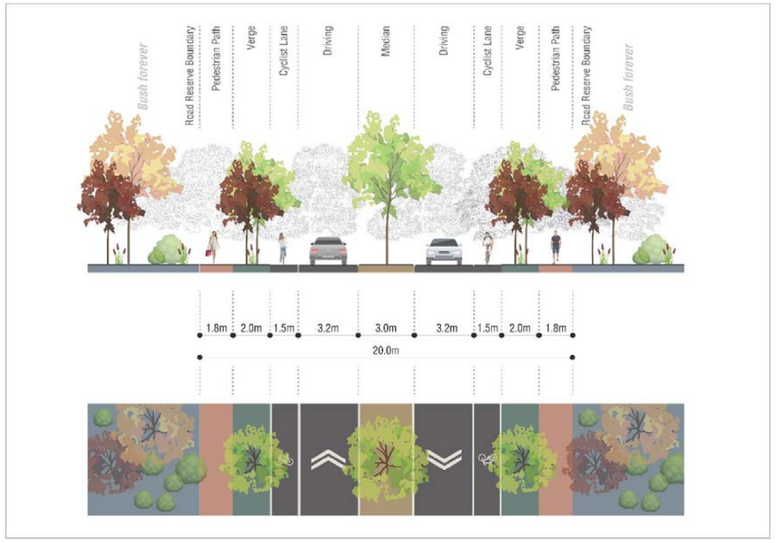
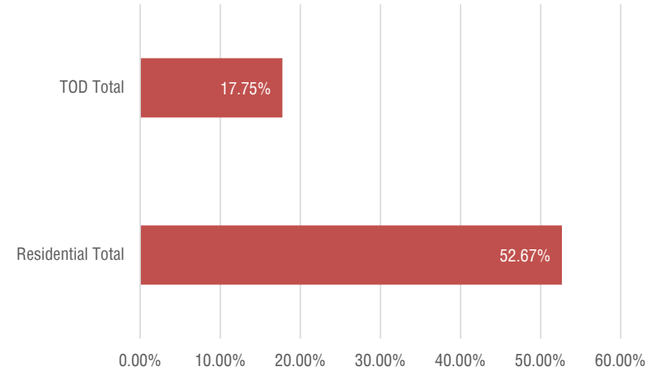
Road	Section [BOQ]	2050 Volumes (VPD)	Configuration	Contribution per Precinct
Milner Road	Stewart Road - Maida Vale Road [RD10]	10,000		

Milner Road traverses Poison Gully Creek at this point. This cross-section was derived to minimise the impact on heritage areas and the existing residences.

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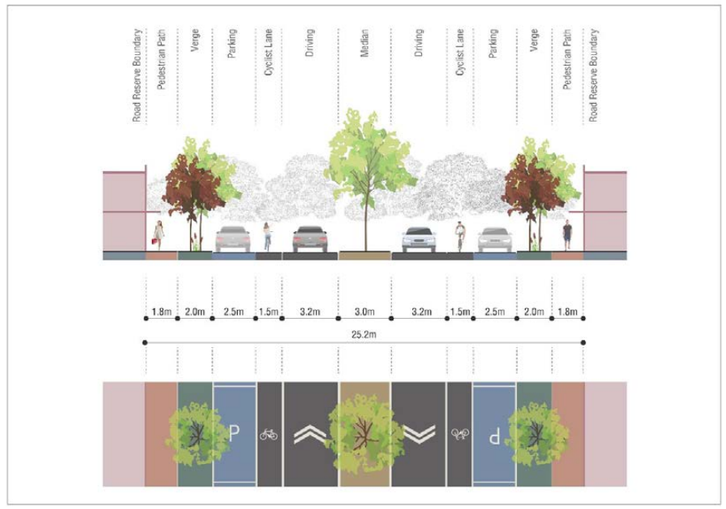
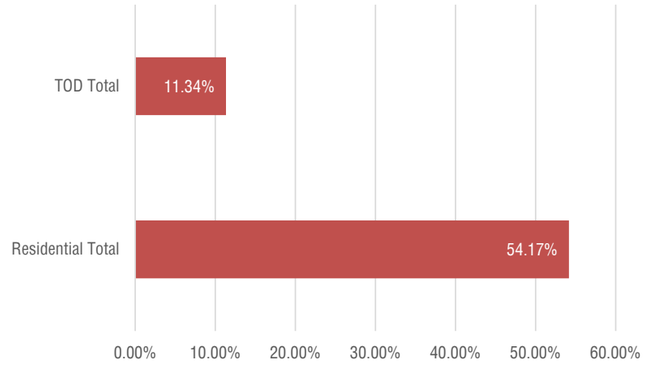
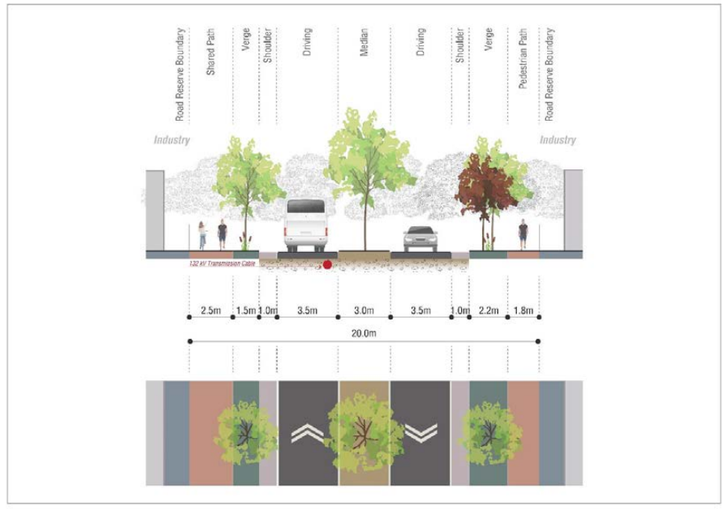
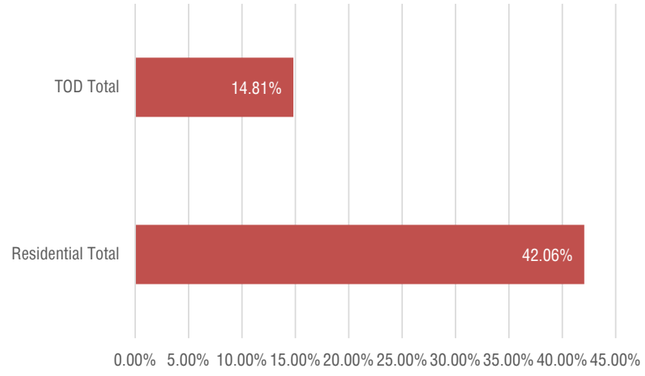
Road	Section [BOQ]	2050 Volumes (VPD)	Configuration	Contribution per Precinct
Milner Road	Sultana Road West - Stewart Road [RD2]	9,700		
	Berkshire Road - Sultana Road West [RD9]	13,000		

This section of Milner Road is modified to minimise the disturbance to the existing businesses. The presence of an HV underground transmission line dictates the options for upgrade.

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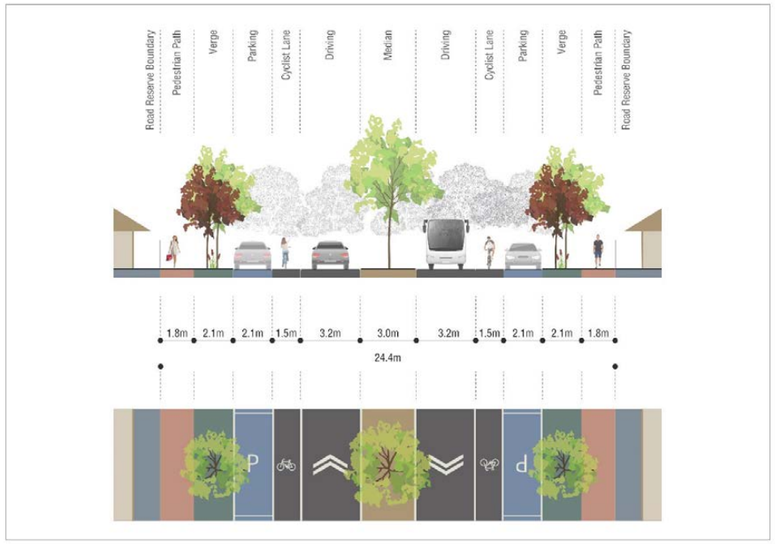
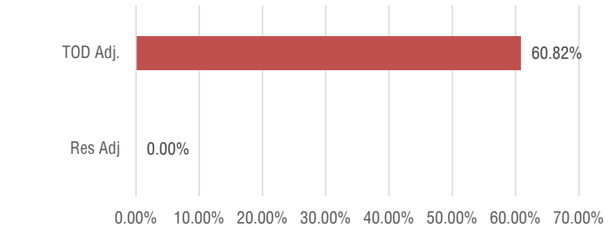
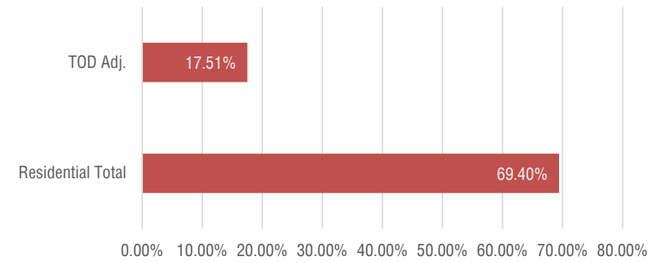
Road	Section [BOQ]	2050 Volumes (VPD)	Configuration	Contribution per Precinct
TOD Connector	Milner Road - Enterprise Boulevard/Ibis Place [RD14]	2,400		 Traffic attracted by the railway station, originating outside of the project area, was assessed as passing traffic.
	Milner Road - Edge of TOD Precinct [RD15]	6,400		 The percentage of traffic for TOD Precinct was recalculated to exclude reciprocal traffic.
	Edge of TOD Precinct – Roe Highway [RD16]	3,700		100% Residential Precinct

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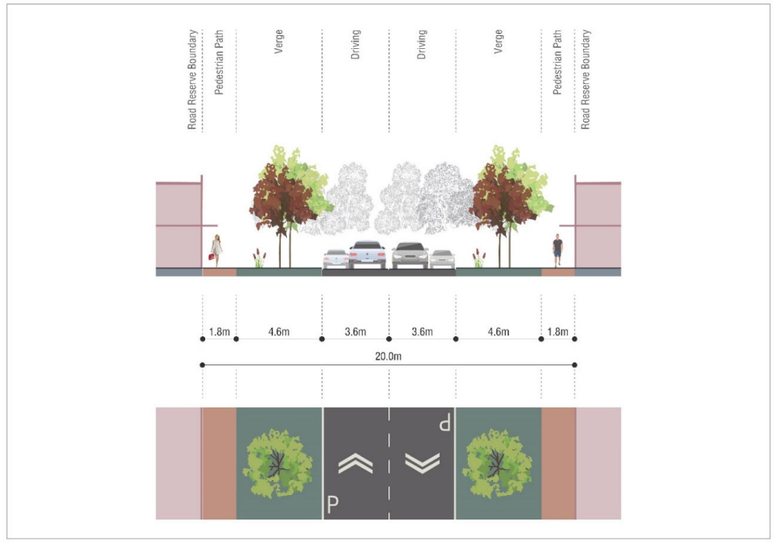
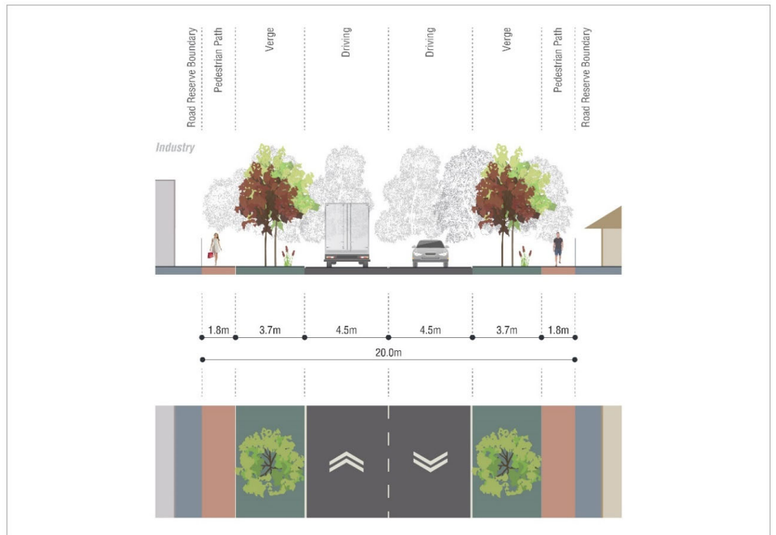
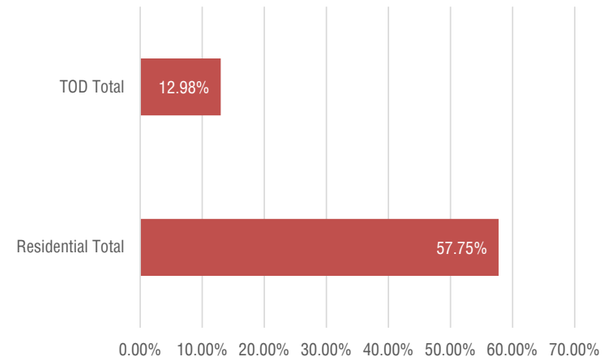
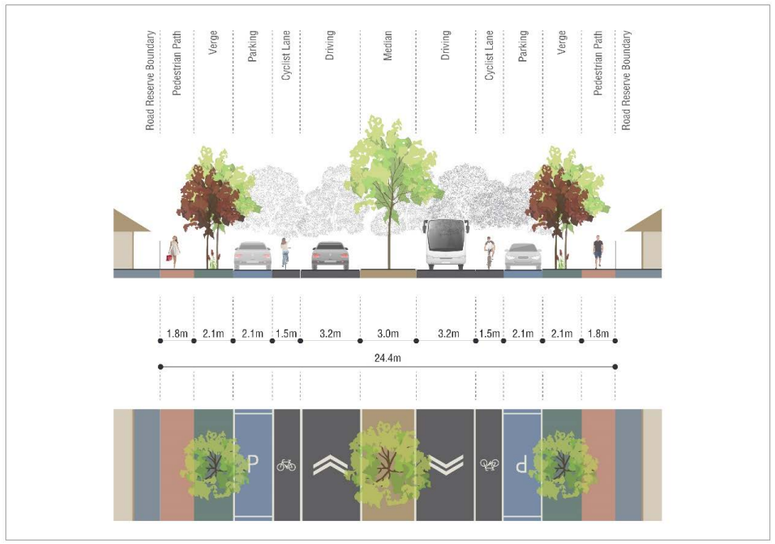
Road	Section [BOQ]	2050 Volumes (VPD)	Configuration	Contribution per Precinct
Sultana Road West	TOD Connector – Milner Road [-]	<1,500		100% TOD Precinct (this road is constructed as a part of railway station works and is not likely to require an upgrade)
	Milner Road – Edge of TOD Precinct & Edge of TOD Precinct – Cul-de-sac [RD20]	1,900		Milner Road – Edge of TOD Precinct:  It is expected that this road will be brought to an urban standard as the development progresses. Edge of TOD Precinct – Cul-de-sac 100% Residential Precinct

Road	Section [BOQ]	2050 Volumes (VPD)	Configuration	Contribution per Precinct
Stewart Road	Milner Road – Brae Road [RD17]	4,700		100% Residential Precinct

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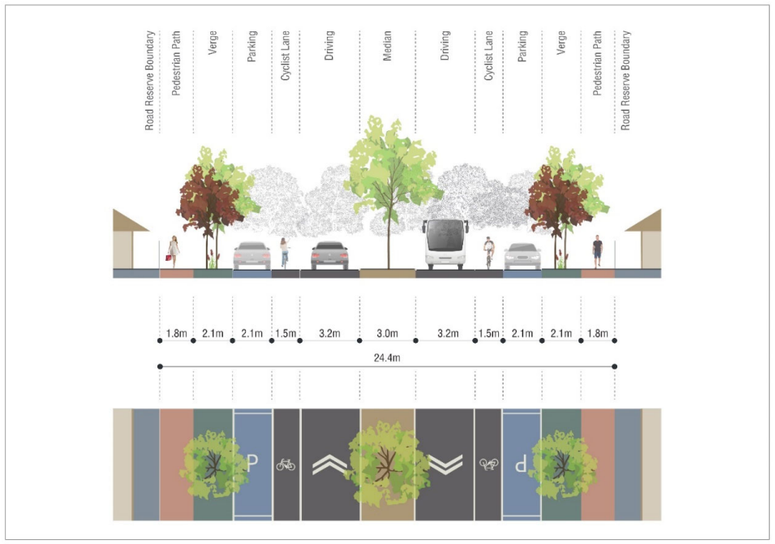
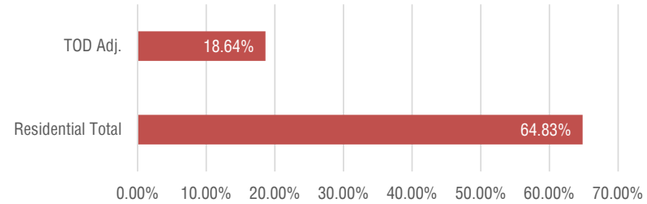
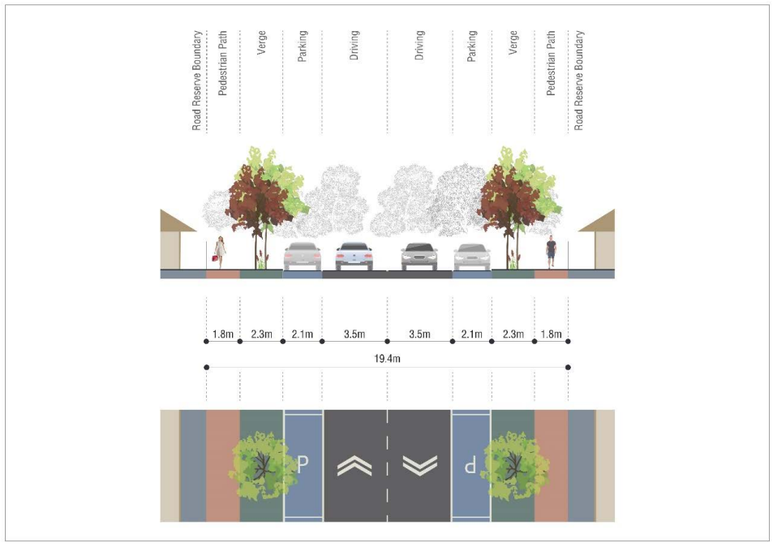
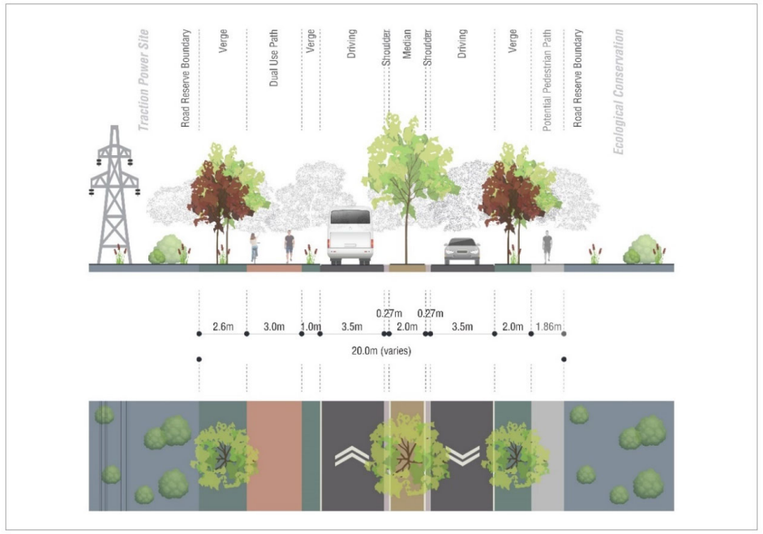
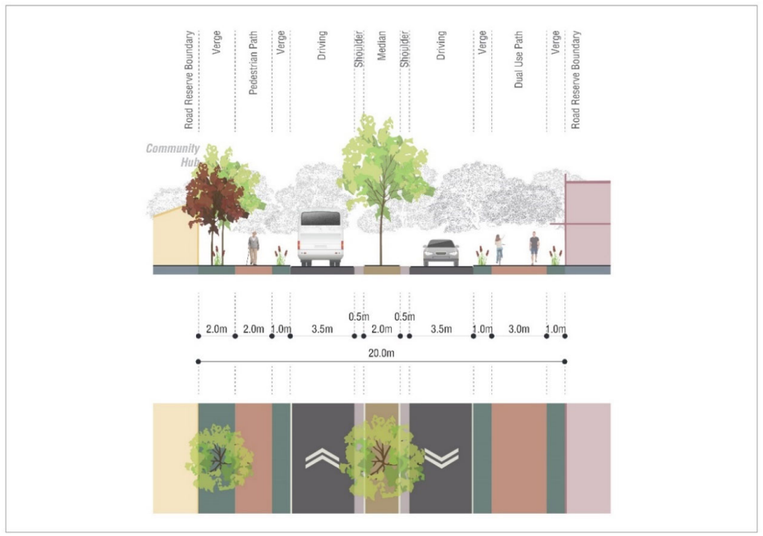
Road	Section [BOQ]	2050 Volumes (VPD)	Configuration	Contribution per Precinct
Raven Street	Maida Vale Road - Millner Road [RD12]	5,700		 The percentage of traffic for TOD Precinct was recalculated to exclude reciprocal traffic.
	Milner Road - Brae Road [RD13]	6,000		100% Residential Precinct
Brae Road	TOD Connector – Brand Road [RD18]	2,600		100% Residential Precinct *NOTE: Section of Brae Road southwest of TOD Connector (to be renamed as Brae Street) will be an Access Street. As this road will become a standard subdivisional road, the responsibility for upgrade (bringing the road up to an urban road standard) is directly with the developer. This is not a DCP item.

Road	Section [BOQ]	2050 Volumes (VPD)	Configuration	Contribution per Precinct
Enterprise Boulevard (former Ibis Place)	TOD Connector – Maida Vale Road (East of Maida Vale Road, abutting TEC) [RD11]	3,600		100% TOD Precinct This road will be constructed mainly as a part of railway station works. Once community facility is in place, a shared path will be required on the south side of road reservation.
	TOD Connector – Maida Vale Road (North of TOD Connector, abutting Community Facility) [RD11]	2,000		

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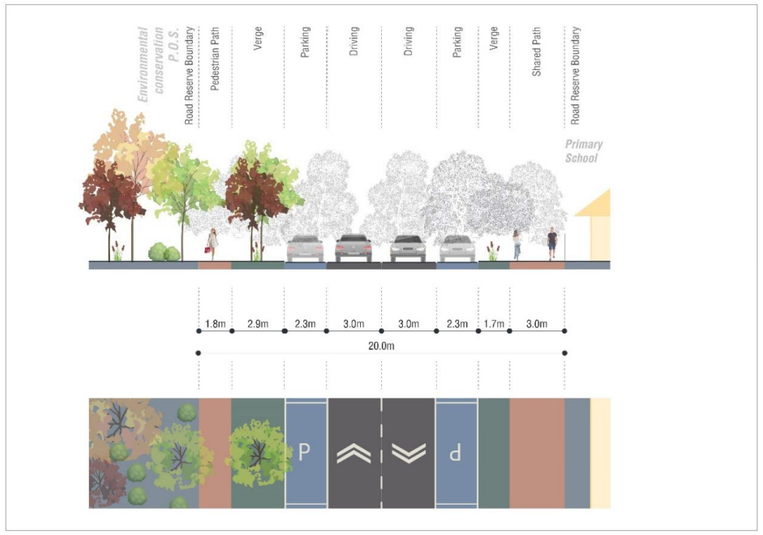
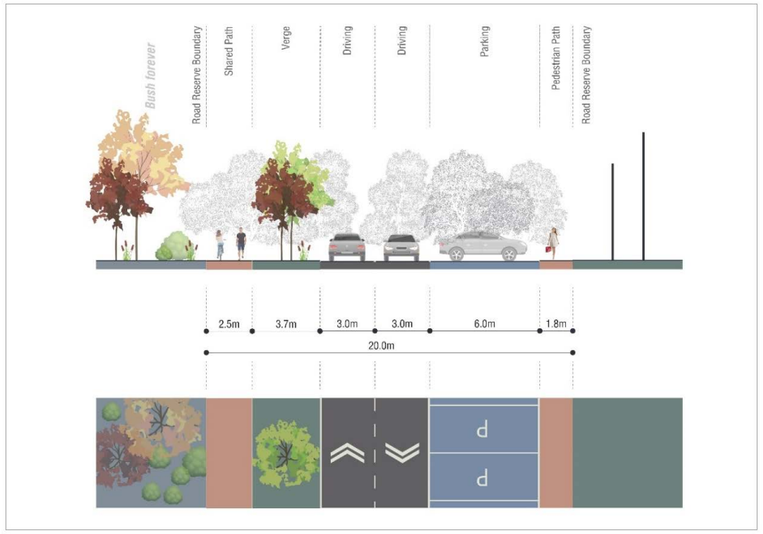
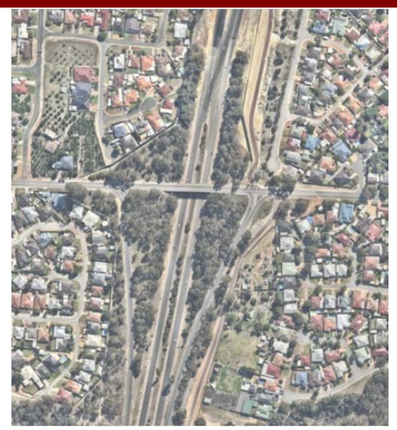
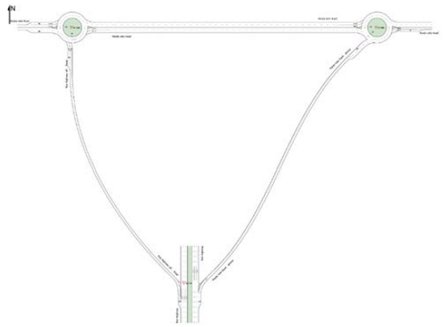
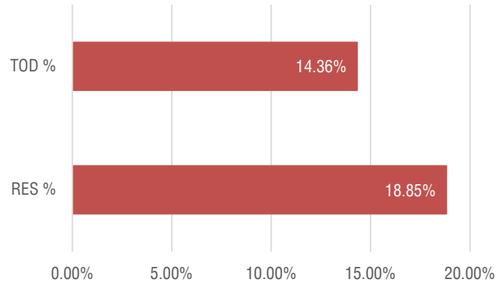
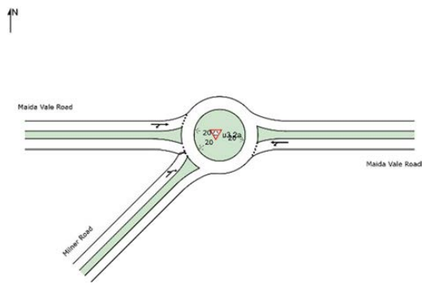
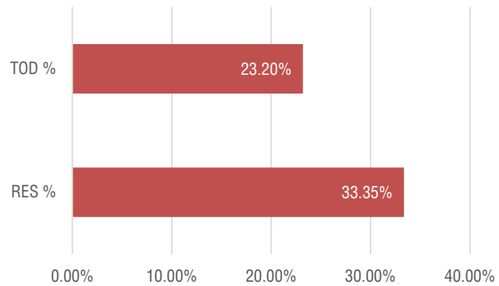
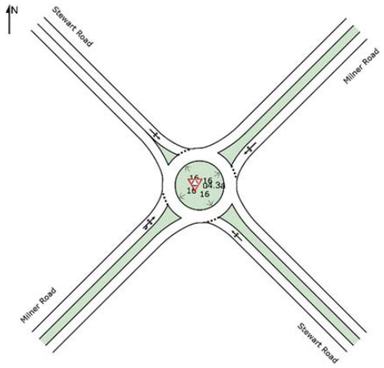
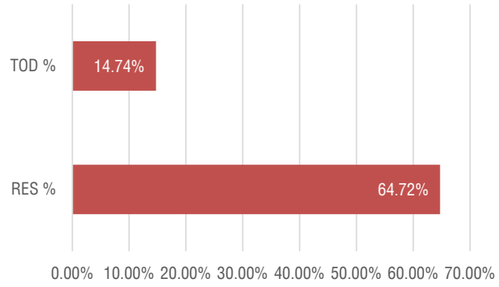
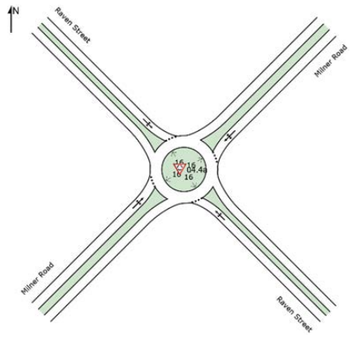
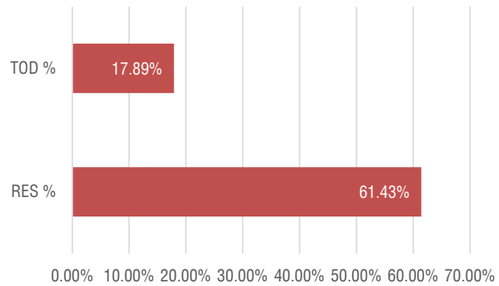
Road	Section [BOQ]	2050 Volumes (VPD)	Configuration	Contribution per Precinct
Brand Road	TOD Connector – Brae Road [RD19]	2,000		100% Residential Precinct This road is expected to be upgraded at the time when the primary school and the district open space are constructed. Two cross-sections show possible options for road configuration which would cater the best for the adjoining facilities. *<u>NOTE:</u> Section of Brand Road southwest of TOD Connector will be an Access Street. As this road will become a standard subdivisional road, the responsibility for upgrade (bringing the road up to an urban road standard) is directly with the developer. This is not DCP item.
	TOD Connector – Brae Road (Variation along the Primary School Site) [RD19]	2,000		

6.4 Key Intersections

The table below shows the summary of proposed upgrades and the contribution per precinct. For details, please refer the Appendix 4 of this report (Intersection Modelling Report)

Intersection [BOQ]	Current Configuration	Upgrade Requirements (Ultimate Configuration)	Precincts Contribution
M01. Roe Highway / Maida Vale Road [INT 02]	 Half interchange	 Half Interchange	
M02. Maida Vale Road / Milner Road [INT 01]	 T-intersection full movement	 Roundabout after upgrade	

Intersection [BOQ]	Current Configuration	Upgrade Requirements (Ultimate Configuration)	Precincts Contribution
M03. Milner Road / Stewart Road [INT 16]	 T-intersection full movement	 Roundabout	
M04. Milner Road / Raven Street [INT 12]	 T-intersection full movement	 Roundabout	

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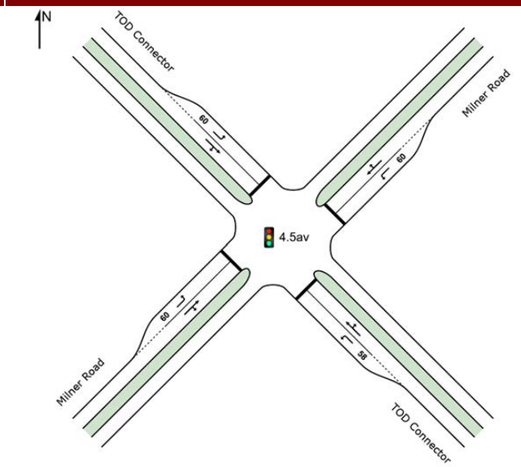
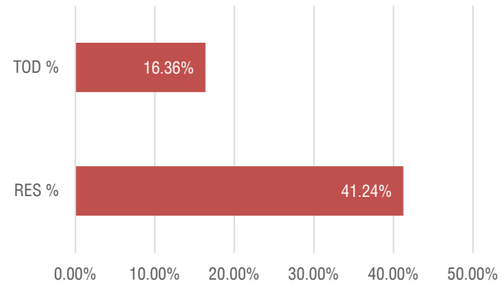
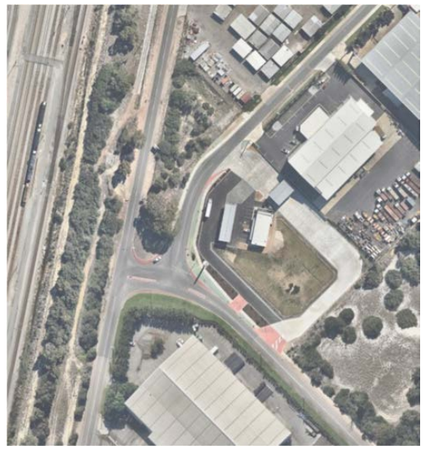
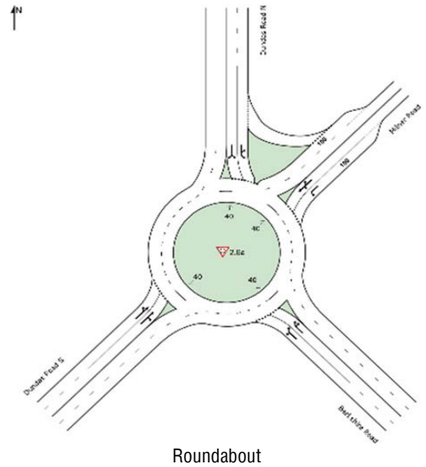
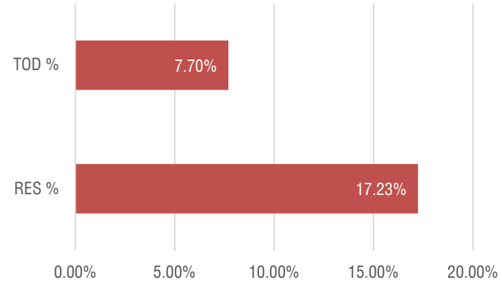
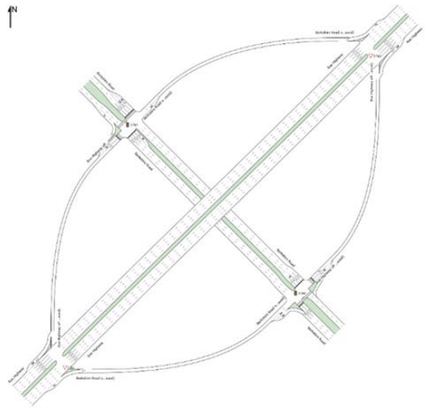
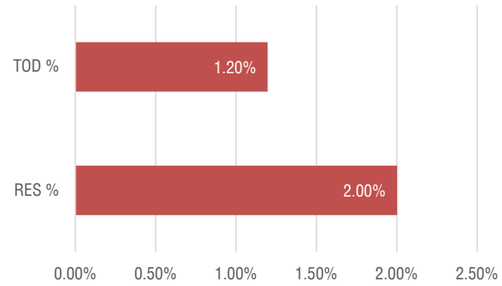
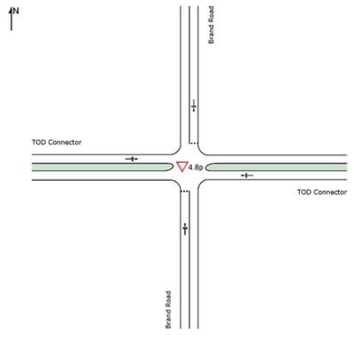
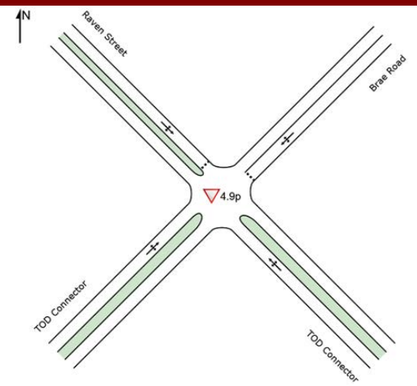
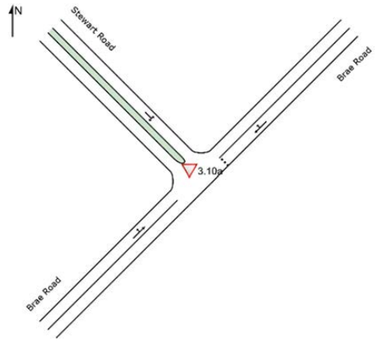
Intersection [BOQ]	Current Configuration	Upgrade Requirements (Ultimate Configuration)	Precincts Contribution
M05. Milner Road / TOD Connector [INT 05]	Intersection doesn't exist at present. Possibly it might be constructed as a sign-controlled intersection initially.	 Signalised intersection	
M06. Milner Road / Berkshire Road / Dundas Road [INT 15]	 T-intersection full movement	 Roundabout	

Intersection [BOQ]	Current Configuration	Upgrade Requirements (Ultimate Configuration)	Precincts Contribution
M07. Berkshire Road / Roe Highway [-]	 Grade separated interchange	 Grade separated interchange	 While this interchange may require an upgrade in future, this will be due to the growth of passing traffic, not due to the traffic from the Project Area. Therefore, it is excluded from DCP.
M08. TOD Connector / Brand Road [INT 16]	Intersection doesn't exist at present.	 Four-way, sign controlled	100% Residential Precinct

Intersection [BOQ]	Current Configuration	Upgrade Requirements (Ultimate Configuration)	Precincts Contribution
M09. TOD Connector / Brae Road / Raven Street [INT 14]	Intersection doesn't exist at present.	 T-intersection full movement Note: civil design investigation showed that due to the geometry of existing roads, safer intersection configuration is a roundabout. This does not change traffic distribution on precinct apportionment. As sign controlled intersection had a LOS A, roundabout will maintain LOS A.	100% Residential Precinct
M10. Brae Road / Stewart Road [INT 09]	 T-intersection full movement	 T-intersection full movement	100% Residential Precinct

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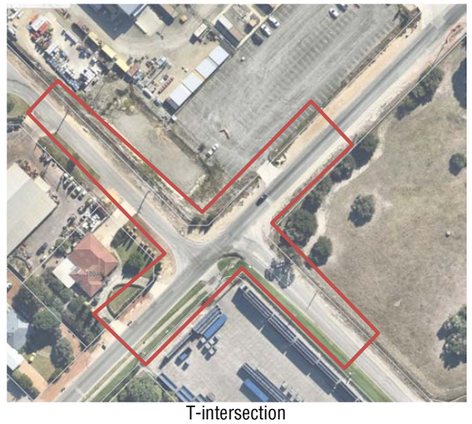
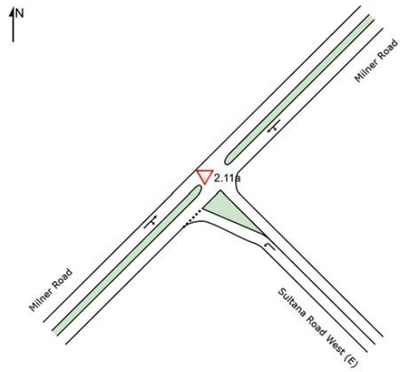
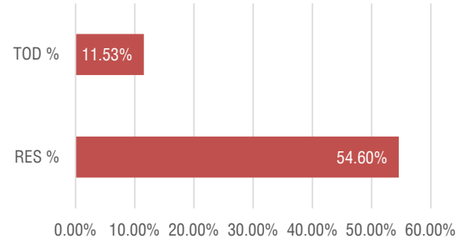
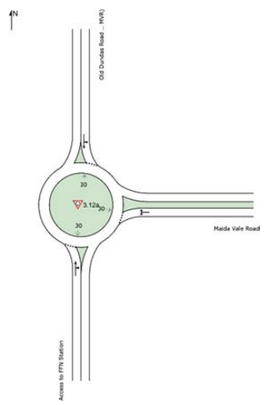
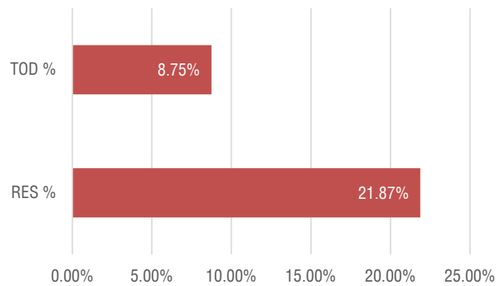
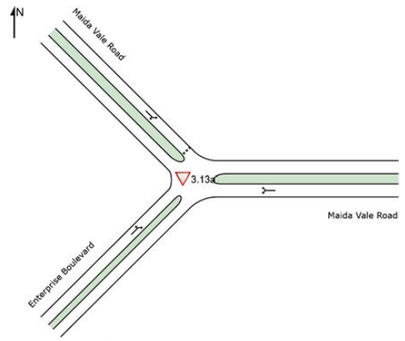
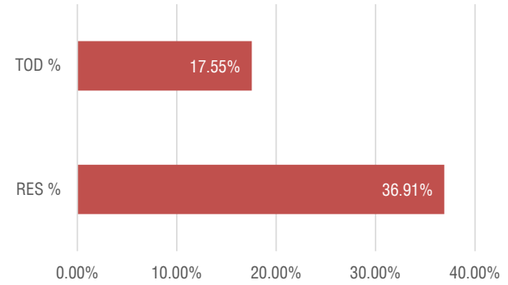
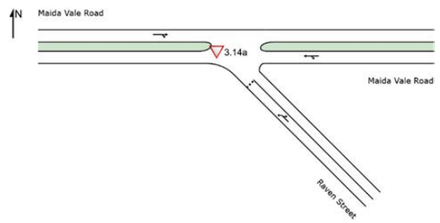
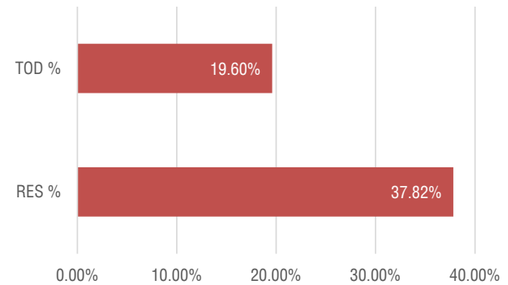
Intersection [BOQ]	Current Configuration	Upgrade Requirements (Ultimate Configuration)	Precincts Contribution
M11. Milner Road / Sultana Road West [INT 07]	 T-intersection	 Left In Left Out Right In	
M12. Maida Vale Road / Dundas Road / Parking Access [INT 14]	Intersection is in construction.	 Roundabout	 This intersection is constructed as a part of the railway works and <u>will not require an upgrade</u> by 2050.

Intersection [BOQ]	Current Configuration	Upgrade Requirements (Ultimate Configuration)	Precincts Contribution
M13. Maida Vale Road / Enterprise Boulevard [INT 12]	 T-intersection full movement	 T-intersection full movement	 This intersection is constructed as a part of the railway works. Adjustment may be required when Maida Vale Road is upgraded.
M14. Maida Vale Road / Raven Street [INT 13]	 Intersection doesn't exist at present	 T-intersection full movement	

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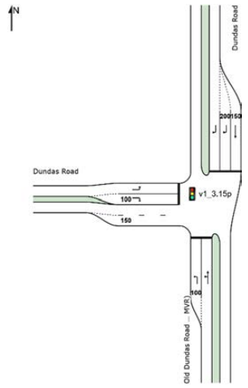
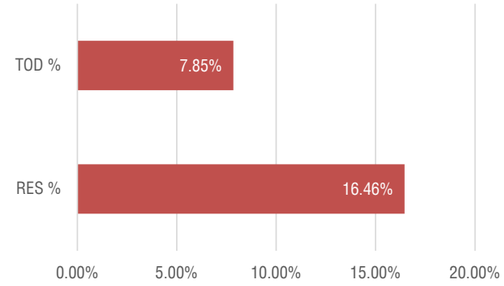
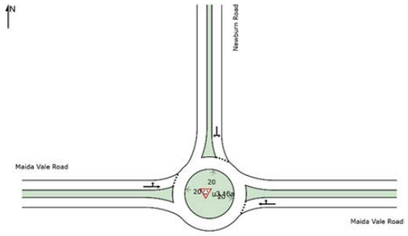
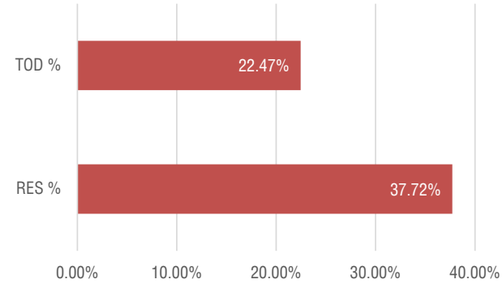
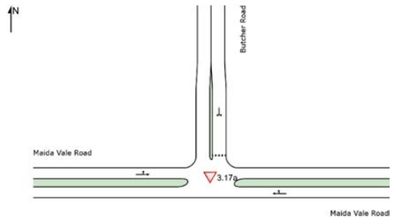
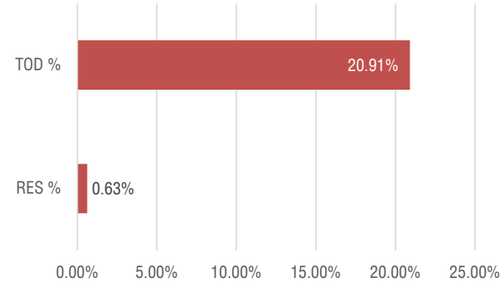
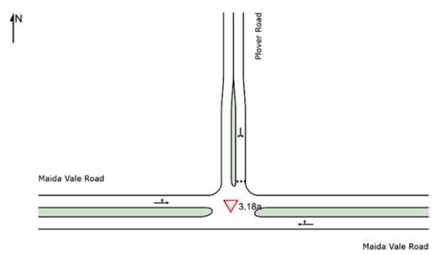
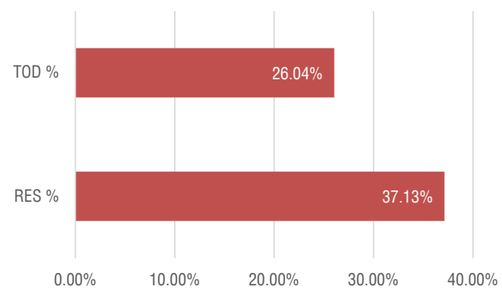
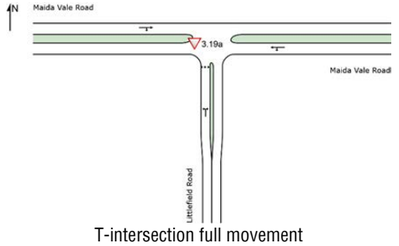
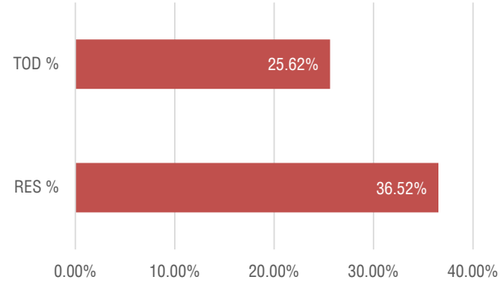
Intersection [BOQ]	Current Configuration	Upgrade Requirements (Ultimate Configuration)	Precincts Contribution
M15. Maida Vale Road (old Dundas Road) / Dundas Road [INT06]	 T-intersection full movement	 Signals	
M16. Maida Vale Road / Newburn Road [INT 03]	 T-intersection full movement	 Roundabout	
M17. Maida Vale Road / Butcher Road [-]	 T-intersection full movement	 T-intersection full movement	

Intersection [BOQ]	Current Configuration	Upgrade Requirements (Ultimate Configuration)	Precincts Contribution
M18. Maida Vale Road / Plover Road [-]	 T-intersection full movement	 T-intersection full movement	
M19, Maida Vale Road / Littlefield Road [-]	 T-intersection full movement	 T-intersection full movement	

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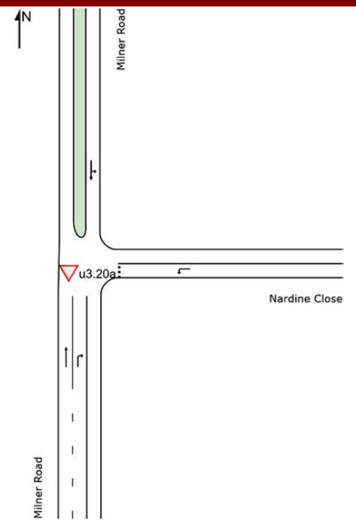
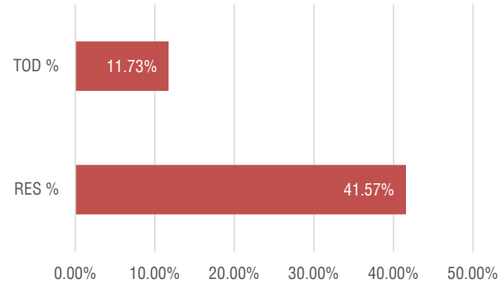
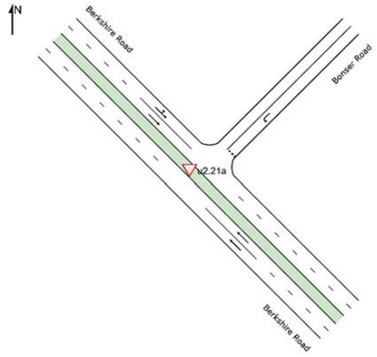
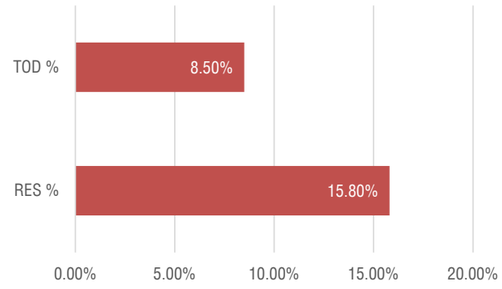
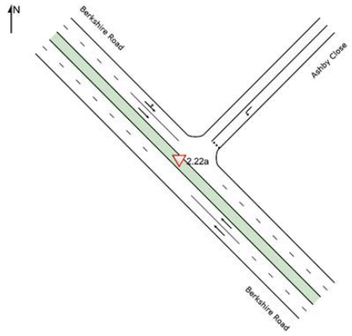
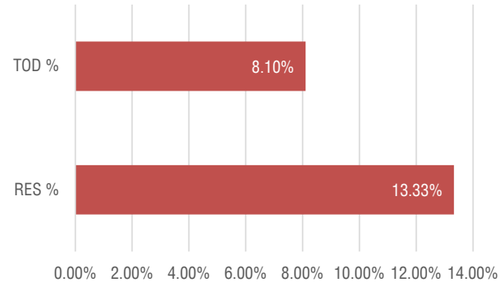
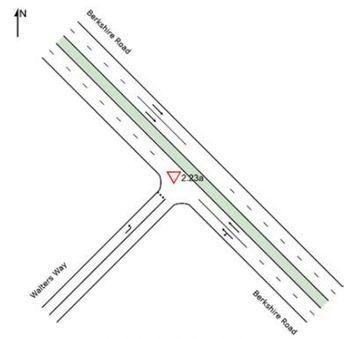
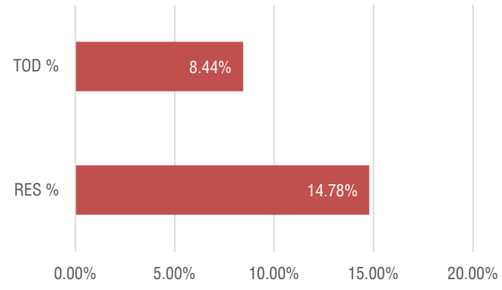
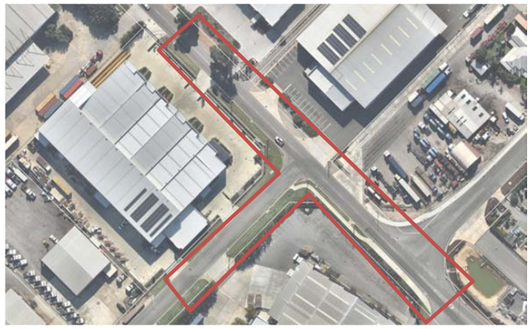
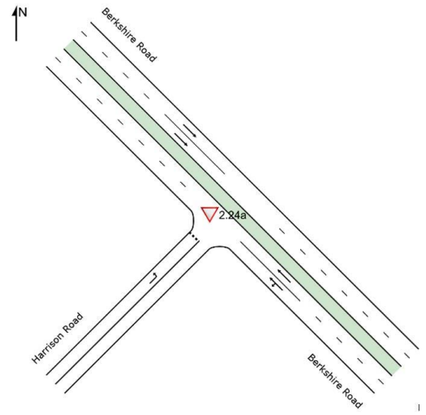
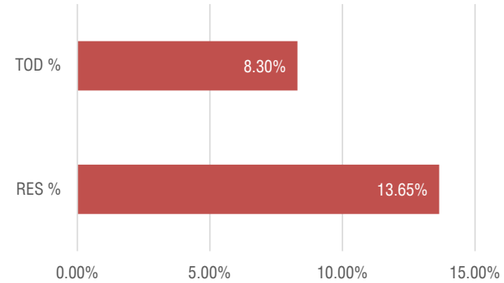
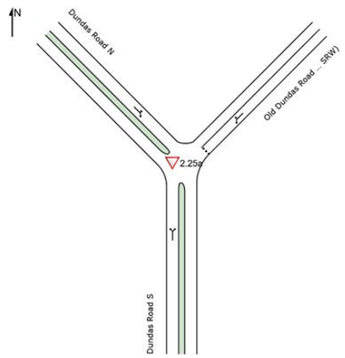
Intersection [BOQ]	Current Configuration	Upgrade Requirements (Ultimate Configuration)	Precincts Contribution
M20. Milner Road / Nardine Close [INT 08]	 T-intersection	 Left In Left Out Right In	
M21. Berkshire Road / Bonser Road [-]	 T-intersection full movement	 Left In Left Out Only	

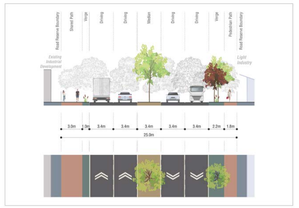
Intersection [BOQ]	Current Configuration	Upgrade Requirements (Ultimate Configuration)	Precincts Contribution
M22. Berkshire Road / Ashby Close [-]	 T-intersection full movement	 Left In Left Out Only	
M23. Berkshire Road / Walters Way [-]	 T-intersection full movement	 Left In Left Out Only	

Intersection [BOQ]	Current Configuration	Upgrade Requirements (Ultimate Configuration)	Precincts Contribution
M24. Berkshire Road / Harrison Road [-]	 T-intersection full movement	 Left In Left Out Only	
M25. Dundas Road / Dundas Road (old alignment) [-]	 T-intersection full movement	 T-intersection full movement	This intersection is being constructed as a part of the railway works. It will not require an upgrade by 2050, apart for adjustment to accommodate the upgrade of Dundas Road.

Berkshire Road

Distributor B > Integrator A (modified)

segment :		Precincts Contribution:		RR widening required	Year of Upgrade
	[RD1] Milner Road - Roe Highway	• Residential Precinct	15.96%	✓	2041
		• TOD Precinct	8.62%		

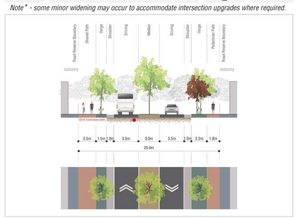


Milner Road

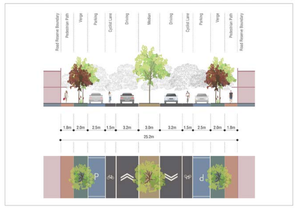
Local Distributor > Integrator B (modified)

segment :		Precincts Contribution:		RR widening required	Year of Upgrade
	[RD9] Berkshire Road - Sultana Road West	• Residential Precinct	42.06%	✗*	2041
		• TOD Precinct	14.81%		

Note* - some minor widening may occur to accommodate intersection upgrades where required.

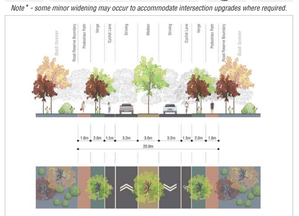


segment :		Precincts Contribution:		RR widening required	Year of Upgrade
	[RD2] Sultana Road West - Stewart Road	• Residential Precinct	54.17%	✓	2041
		• TOD Precinct	11.34%		



segment :		Precincts Contribution:		RR widening required	Year of Upgrade
	[RD10] Stewart Road - Maida Vale Road	• Residential Precinct	52.67%	✗*	2041
		• TOD Precinct	17.75%		

Note* - some minor widening may occur to accommodate intersection upgrades where required.



Dundas Road

Distributor B > Integrator B (modified)

segment :		Precincts Contribution:		RR widening required	Year of Upgrade
	[RD6] Berkshire Road - Harrison Road	• Residential Precinct	7.73%	✗*	2031
		• TOD Precinct	3.22%		
	[RD7] Berkshire Road - Dundas Road Old	• Residential Precinct	0.00%	✗*	2031
		• TOD Precinct	2.00%		
	[RD8] Maida Vale Road - Sorensen Road	• Residential Precinct	15.25%	✗*	2031
		• TOD Precinct	10.16%		

Note* - some minor widening may occur to accommodate intersection upgrades where required.

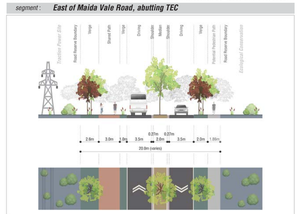
Enterprise Boulevard (former Ibis Place)

Access Street >Neighbourhood Connector A

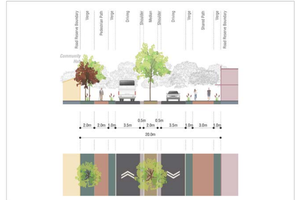
segment :		Precincts Contribution:		RR widening required	Year of Upgrade
	[RD11] TOD Connector – Maida Vale Road	• Residential Precinct	0.00%	✗*	2041
		• TOD Precinct	100.00%		

Note* - some minor widening may occur to accommodate intersection upgrades where required.

segment : **East of Maida Vale Road, abutting TEC**



segment : **North of TOD Connector, abutting Community Facility**



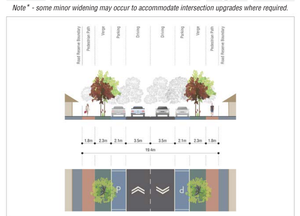
Note: Enterprise Boulevard is constructed to an appropriate standard as a part of railway station works. In future shared path will be added on the southern side of road reservation.

Brae Road

Access Street > Neighbourhood Connector B

segment :		Precincts Contribution:		RR widening required	Year of Upgrade
	[RD18] TOD Connector – Brand Road	• Residential Precinct	100.00%	✗*	2050
		• TOD Precinct	0.00%		

Note* - some minor widening may occur to accommodate intersection upgrades where required.

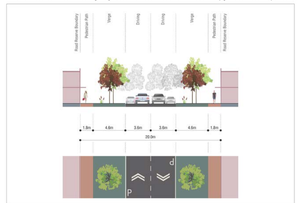


Sultana Road West

Access Street > Access Street (urban standard)

segment :		Precincts Contribution:		RR widening required	Year of Upgrade
	[-] TOD Connector – Milner Road	• Residential Precinct	0.00%	✗*	2041
		• TOD Precinct	100.00%		

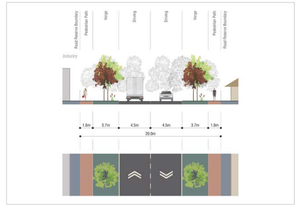
Note* - some minor widening may occur to accommodate intersection upgrades where required.



Note: Sultana Road West in this section is constructed to an appropriate standard as a part of railway station works.

segment :		Precincts Contribution:		RR widening required	Year of Upgrade
	[RD28] Milner Road – Edge of TOD Precinct	• Residential Precinct	57.75%	✗*	2041
		• TOD Precinct	12.98%		
	[RD20] Edge of TOD Precinct – Cul-de-sac	• Residential Precinct	100.00%	✗*	2041
		• TOD Precinct	0.00 %		

Note* - some minor widening may occur to accommodate intersection upgrades where required.

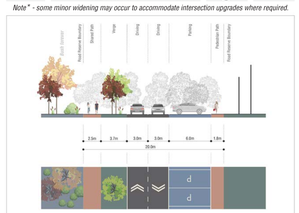


Brand Road

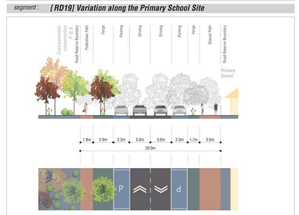
Access Street > Access Street (urban standard)

segment :		Precincts Contribution:		RR widening required	Year of Upgrade
	[RD19] TOD Connector – Brae Road	• Residential Precinct	100.00%	✗*	2041
		• TOD Precinct	0.00%		

Note* - some minor widening may occur to accommodate intersection upgrades where required.



segment : **[RD19] Variation along the Primary School Site**

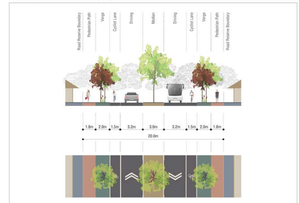


Maida Vale Road

Distributor B > Integrator B (modified)

segment :		Precincts Contribution:		RR widening required	Year of Upgrade
	[RD3;3A] Milner Road – Roe Highway	• Residential Precinct	37.42%	✗*	2041
		• TOD Precinct	17.25%		
	[RD4] Raven Street - Milner Road	• Residential Precinct	0.72%	✗*	2041
		• TOD Precinct	24.06%		
	[RD5] Dundas Road - Raven Street	• Residential Precinct	47.24%	✗*	2041
		• TOD Precinct	11.88%		

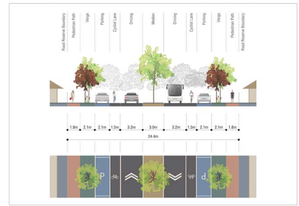
Note* - some minor widening may occur to accommodate intersection upgrades where required.



Stewart Road

Access Street > Neighbourhood Connector A

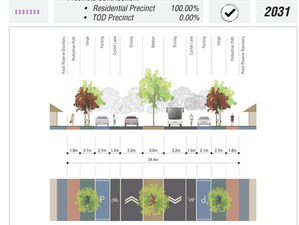
segment :		Precincts Contribution:		RR widening required	Year of Upgrade
	[RD17] Milner Road - Brae Road	• Residential Precinct	100.00%	✓	2041
		• TOD Precinct	0.00%		



Raven Street

Access Street / New road > Neighbourhood Connector A

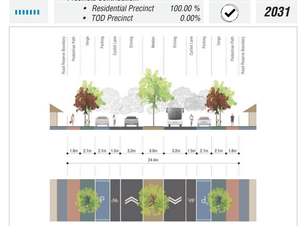
segment :		Precincts Contribution:		RR widening required	Year of Upgrade
	[RD12] Maida Vale Road - Milner Road	• Residential Precinct	64.83%	✓	2041
		• TOD Precinct	18.64%		
	[RD13] Milner Road - Brae Road	• Residential Precinct	100.00%	✓	2031
		• TOD Precinct	0.00%		



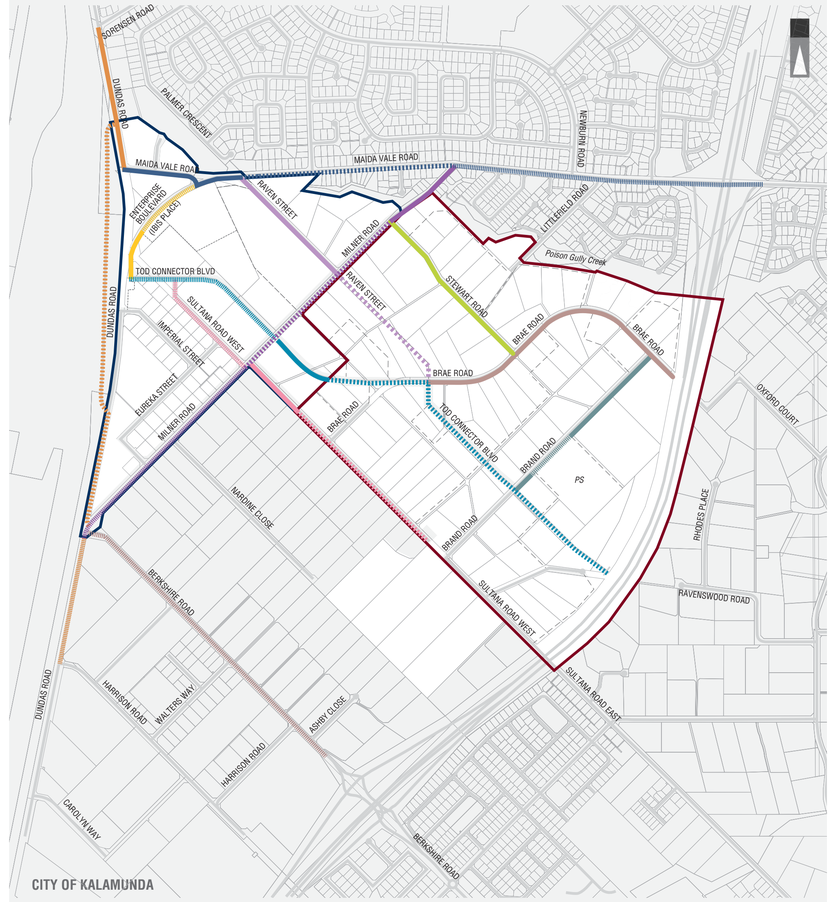
TOD Connector

New road > Neighbourhood Connector A

segment :		Precincts Contribution:		RR widening required	Year of Upgrade
	[RD14] Milner Road - Enterprise Boulevard	• Residential Precinct	0.00%	✓	2031
		• TOD Precinct	60.82%		
	[RD15] Milner Road - Edge of TOD Precinct	• Residential Precinct	69.40%	✓	2031
		• TOD Precinct	17.51%		
	[RD16] Edge of TOD Precinct – Roe Highway	• Residential Precinct	100.00 %	✓	2031
		• TOD Precinct	0.00%		



HIGH WYCOMBE SOUTH - TOD & RESIDENTIAL PRECINCTS



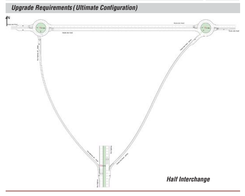
Plan of upgrades and apportionment
- Roads

kctt
www.kctt.com.au

M01. Roe Highway / Maida Vale Road | (INT 02)

Current Configuration	Precincts Contribution:		Year of Upgrade
Half interchange	• Residential Precinct	18.85%	2031
	• TOD Precinct	14.36%	

Upgrade Requirements (Ultimate Configuration)

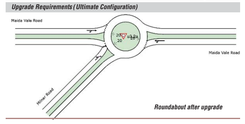


Half Interchange

M02. Maida Vale Road / Milner Road | (INT 01)

Current Configuration	Precincts Contribution:		Year of Upgrade
T-intersection full movement (Roundabout after upgrade)	• Residential Precinct	33.35%	2041
	• TOD Precinct	23.20%	

Upgrade Requirements (Ultimate Configuration)

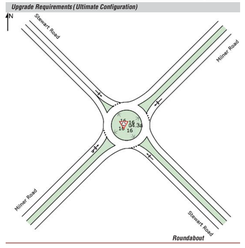


Roundabout after upgrade

M03. Milner Road / Stewart Road | (INT 18)

Current Configuration	Precincts Contribution:		Year of Upgrade
T-intersection full movement (Roundabout after upgrade)	• Residential Precinct	64.72%	2041
	• TOD Precinct	14.74%	

Upgrade Requirements (Ultimate Configuration)

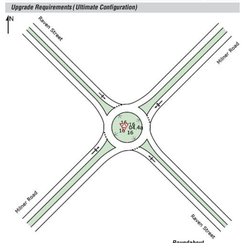


Roundabout

M04. Milner Road / Raven Street | (INT 17)

Current Configuration	Precincts Contribution:		Year of Upgrade
T-intersection full movement (Roundabout after upgrade)	• Residential Precinct	61.43%	2041
	• TOD Precinct	17.89%	

Upgrade Requirements (Ultimate Configuration)

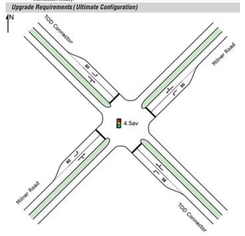


Roundabout

M05. Milner Road / TOD Connector | (INT 05)

Current Configuration	Precincts Contribution:		Year of Upgrade
Intersection doesn't exist at present. Possibly it might be constructed as a sign-controlled intersection initially.	• Residential Precinct	41.24%	2041
	• TOD Precinct	16.36%	

Upgrade Requirements (Ultimate Configuration)

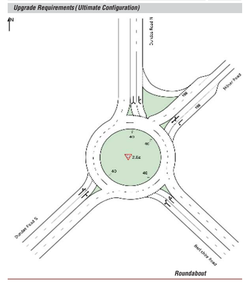


Signalised intersection

M06. Milner Road / Berkshire Road / Dundas Road | (INT 15)

Current Configuration	Precincts Contribution:		Year of Upgrade
T-intersection full movement	• Residential Precinct	17.23%	2031/41
	• TOD Precinct	12.58%	

Upgrade Requirements (Ultimate Configuration)

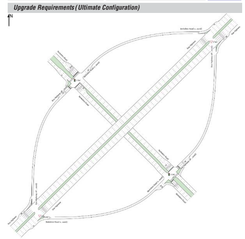


Roundabout

M07. Berkshire Road / Roe Highway

Current Configuration	Precincts Contribution:		Year of Upgrade
Grade separated interchange	• Residential Precinct	2.00%	-
	• TOD Precinct	1.20%	

Upgrade Requirements (Ultimate Configuration)



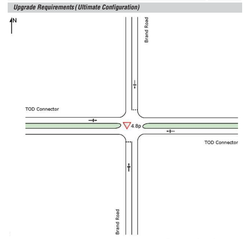
Note: While this interchange may require an upgrade in future, this will be due to the growth of passing traffic, not due to the traffic from the Project Area. Therefore, it is excluded from DCP.

Grade separated interchange

M08. TOD Connector / Brand Road | (INT 16)

Current Configuration	Precincts Contribution:		Year of Upgrade
Intersection doesn't exist at present.	• Residential Precinct	100.00%	2041
	• TOD Precinct	0.00%	

Upgrade Requirements (Ultimate Configuration)

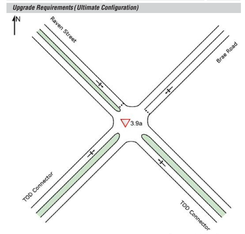


Four-way intersection

M09. TOD Connector / Brae Road / Raven Street | (INT 14)

Current Configuration	Precincts Contribution:		Year of Upgrade
Intersection doesn't exist at present.	• Residential Precinct	100.00%	2031
	• TOD Precinct	0.00%	

Upgrade Requirements (Ultimate Configuration)

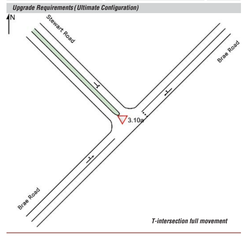


Four-way intersection

M10. Brae Road / Stewart Road | (INT 09)

Current Configuration	Precincts Contribution:		Year of Upgrade
T-intersection full movement	• Residential Precinct	100.00%	2041
	• TOD Precinct	0.00%	

Upgrade Requirements (Ultimate Configuration)

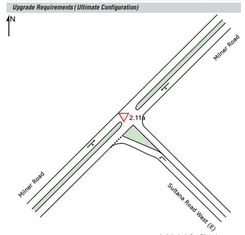


T-intersection full movement

M11. Milner Road / Sultana Road West | (INT 07)

Current Configuration	Precincts Contribution:		Year of Upgrade
T-intersection	• Residential Precinct	54.60%	2041
	• TOD Precinct	11.53%	

Upgrade Requirements (Ultimate Configuration)

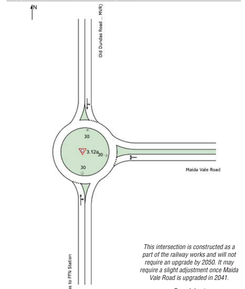


Left In Left Out Right In

M12. Maida Vale Road / Dundas Road / Parking Access | (INT 04)

Current Configuration	Precincts Contribution:		Year of Upgrade
Intersection is in construction.	• Residential Precinct	16.46%	2041*
	• TOD Precinct	7.85%	

Upgrade Requirements (Ultimate Configuration)



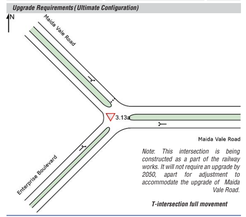
This intersection is constructed as a part of the railway works and will not require an upgrade by 2050. It may require a slight adjustment once Maida Vale Road is upgraded in 2041.

Roundabout

M13. Maida Vale Road / Enterprise Boulevard | (INT 12)

Current Configuration	Precincts Contribution:		Year of Upgrade
T-intersection full movement	• Residential Precinct	36.91%	2041*
	• TOD Precinct	17.55%	

Upgrade Requirements (Ultimate Configuration)



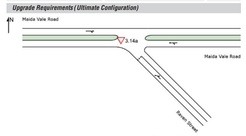
Note: This intersection is being constructed as a part of the railway works. It will not require an upgrade by 2050, apart for adjustment to accommodate the upgrade of Maida Vale Road.

T-intersection full movement

M14. Maida Vale Road / Raven Street | (INT 13)

Current Configuration	Precincts Contribution:		Year of Upgrade
Intersection doesn't exist at present	• Residential Precinct	37.82%	2041
	• TOD Precinct	19.60%	

Upgrade Requirements (Ultimate Configuration)

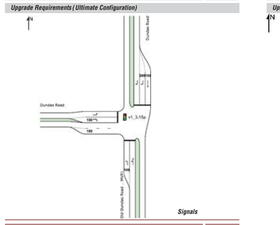


T-intersection full movement

M15. Maida Vale Road (old Dundas Road) / Dundas Road

Current Configuration	Precincts Contribution:		Year of Upgrade
T-intersection full movement	• Residential Precinct	16.46%	2031
	• TOD Precinct	7.85%	

Upgrade Requirements (Ultimate Configuration)

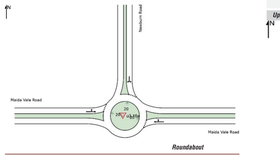


Signals

M16. Maida Vale Road / Newburn Road | (INT 03)

Current Configuration	Precincts Contribution:		Year of Upgrade
T-intersection full movement	• Residential Precinct	37.72%	2041
	• TOD Precinct	22.47%	

Upgrade Requirements (Ultimate Configuration)

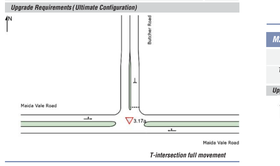


Roundabout

M17. Maida Vale Road / Butcher Road

Current Configuration	Precincts Contribution:		Year of Upgrade
T-intersection full movement	• Residential Precinct	n/a (1.63%)	2041
	• TOD Precinct	20.91%	

Upgrade Requirements (Ultimate Configuration)

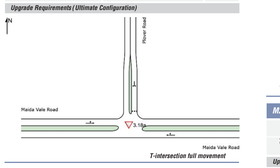


T-intersection full movement

M18. Maida Vale Road / Plover Road

Current Configuration	Precincts Contribution:		Year of Upgrade
T-intersection full movement	• Residential Precinct	37.13%	2041
	• TOD Precinct	26.04%	

Upgrade Requirements (Ultimate Configuration)

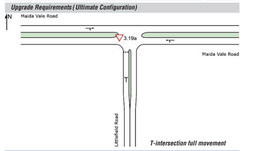


T-intersection full movement

M19. Maida Vale Road / Littlefield Road

Current Configuration	Precincts Contribution:		Year of Upgrade
T-intersection full movement	• Residential Precinct	36.52%	2041
	• TOD Precinct	25.62%	

Upgrade Requirements (Ultimate Configuration)

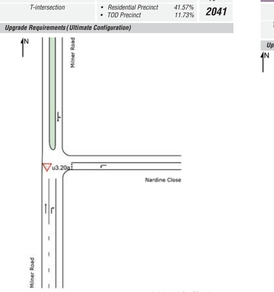


T-intersection full movement

M20. Milner Road / Nardine Close | (INT 08)

Current Configuration	Precincts Contribution:		Year of Upgrade
T-intersection	• Residential Precinct	41.57%	2041
	• TOD Precinct	11.73%	

Upgrade Requirements (Ultimate Configuration)



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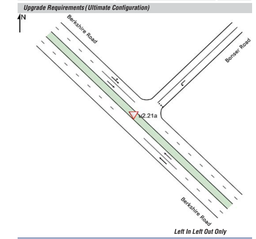
M21. Berkshire Road / Bonser Road

Current Configuration	Precincts Contribution:		Year of Upgrade
T-intersection full movement	• Residential Precinct	15.80%	2041
	• TOD Precinct	8.50%	

Upgrade Requirements (Ultimate Configuration)



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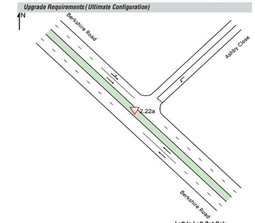
M22. Berkshire Road / Ashby Close

Current Configuration	Precincts Contribution:		Year of Upgrade
T-intersection full movement	• Residential Precinct	13.33%	2041*
	• TOD Precinct	8.10%	

Upgrade Requirements (Ultimate Configuration)



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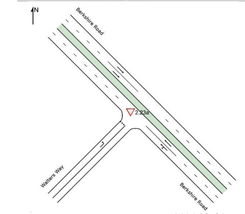
M23. Berkshire Road / Walters Way

Current Configuration	Precincts Contribution:		Year of Upgrade
T-intersection full movement	• Residential Precinct	14.78%	2041*
	• TOD Precinct	8.44%	

Upgrade Requirements (Ultimate Configuration)



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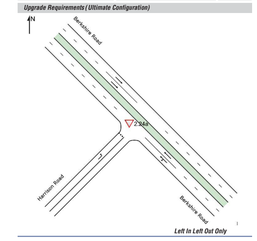
M24. Berkshire Road / Harrison Road

Current Configuration	Precincts Contribution:		Year of Upgrade
T-intersection full movement	• Residential Precinct	13.65%	2041*
	• TOD Precinct	8.30%	

Upgrade Requirements (Ultimate Configuration)



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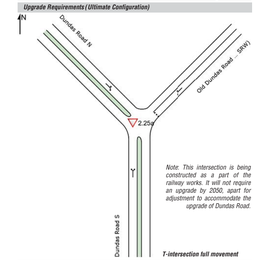
M25. Dundas Road / Dundas Road (old alignment) | (INT 06)

Current Configuration	Precincts Contribution:		Year of Upgrade
T-intersection full movement	• Residential Precinct	n/a	2041*
	• TOD Precinct	2.32%	

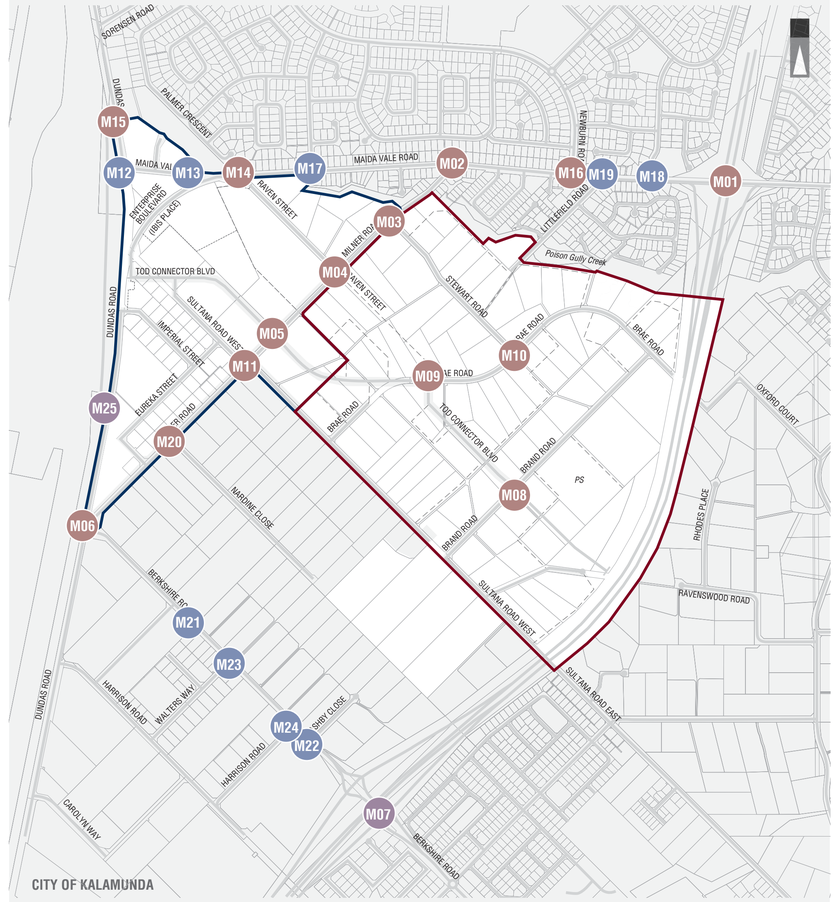
Upgrade Requirements (Ultimate Configuration)



Note: This intersection is being constructed as a part of the railway works. It will not require an upgrade by 2050, apart for adjustment to accommodate the upgrade of Dundas Road.

T-intersection full movement

HIGH WYCOMBE SOUTH - TOD & RESIDENTIAL PRECINCTS



CITY OF KALAMUNDA

RESIDENTIAL PRECINCT BOUNDARY

TOD PRECINCT BOUNDARY

INTERSECTIONS MAY REQUIRE KERB ADJUSTMENT ONCE ADJACENT ROADS ARE UPGRADED. INCLUDED IN DCP

INTERSECTIONS REQUIRING UPGRADE AND INCLUDED IN DCP

INTERSECTIONS MAY REQUIRE UPGRADE OR ADJUSTMENT IN FUTURE. NOT INCLUDED IN DCP.

Plan of upgrades and apportionment - Intersections

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