Palmerston North City Council

Plan Change 15E: North East Industrial Zone Extension

Intersections Assessment Report

October 2014

Palmerston North City Council

Plan Change 15E: North East Industrial Zone Extension

Intersections Assessment Report

Quality Assurance Statement

Prepared by:

Tom Mabelson

Project Transportation Planner

Reviewed by:

Mark Georgeson

Director

Approved for Issue by:

Mark Georgeson

Director

Status: Final report

Date: 7 October 2014

PO Box 30-721, Lower Hutt 5040
New Zealand

P: +64 4 569 8497

www.tdg.co.nz

Table of Contents

1. Introduction

TDG has been commissioned by Palmerston North City Council (PNCC) to undertake a traffic study to examine the intersection effects of a proposed extension of the North East Industrial Zone (NEIZ), being advanced as Plan Change 15E.

The aim of this report is to provide PNCC with forecast daily and peak traffic generation, distribution and analysis of the key affected intersections. Recommendations will be made of potential intersection improvements to support the growth of the industrial zone to a completed development over a 30 year period.

This will provide an understanding of the future network needs for inclusion in Council's asset management planning.

Plan Change 15E proposes the rezoning of 128 hectares of Rural Zone land to extend the NEIZ to provide large floor plate industrial activities such as logistics, distribution and warehousing businesses. The introduction of development rules and requirements are needed to ensure that a high quality industrial area is developed and that surrounding rural and residential areas are protected.

A number of modifications to traffic related rules relating to the existing NEIZ as well as the proposed extension include the following:

- a reduction in the number of on-site parking spaces and the introduction of new landscaping requirements;
- access controls along Richardsons Line, Setters Line and Roberts Line (full discretionary activity) prior to road upgrades to full industrial standard;
- access controls along Railway Road (non complying activity); and
- the promotion of road connections between the existing NEIZ and extension area.

This Report has been prepared as part of the technical documentation informing the outcomes of the Plan Change.

2. Existing Transport Environment

2.1 Site Location within the Road Network

The existing NEIZ is bounded by Richardsons Line, Roberts Line and Railway Road to the north, south and east of the site respectively. The NEIZ includes a network of internal local roads within the industrial park, namely El Prado Drive, Alderson Drive, Valor Drive and Neil Lane. The main access to the zone is currently provided at the intersection of Railway Road and El Prado Drive.

The proposed NEIZ Extension is an extension of the existing zone to the north of Richardsons Line and to the east of Roberts Line.

The location of the site and the proposed NEIZ extension is shown in **Figure 1**, taken from the Draft NEIZ Extension Structure Plan (Map 7.2).

Plan Change 7 'Roading Hierarchy' has been developed to maintain consistency with the Regional Land Transport Strategy (2010) for the Manawatu – Wanganui Region. Primary roads within the area are designated as follows:

- Railway Road – Major Arterial Road;
- Tremaine Avenue – Major Arterial Road;
- Airport Drive – Minor Arterial Road;
- John F Kennedy Drive – Minor Arterial Road;
- Milson Line – Minor Arterial Road; and
- Roberts Line – Collector Road (between Kelvin Grove Road and Richardsons Line).

The remaining roads within and surrounding the site form part of the Secondary Roading Network. The form, function and layout of roads within the NEIZ and its proposed extension are set out by the Structure Plan and its associated roading cross sections.

2.2 Form and Scale of Existing Intersections

2.2.1 Railway Road / Richardsons Line

The intersection of Railway Road and Richardsons Line is formed by a standard T-intersection arrangement with a protected right turn bay for vehicles turning from Railway Road onto Richardsons Line. There is a short merge lane which can be used to assist in staged right movements from Richardsons Line onto Railway Road, although in practice staged right turns are not made.

This section of Railway Road and Richardsons Line is subject to a speed limit of 100km/hr.

2.2.2 Roberts Line / Richardsons Line

Roberts Line and Richardsons Line meet at a four arm cross roads intersection. This intersection features priority given to traffic travelling north along the Roberts Line approach. The unconventional design assists with the heavier right turn movement from Roberts Line to Richardsons Line (east). The remaining three approaches are stop controlled.

Legend

- Existing Road Alignment
- Road Layout 1
- Road Layout 2
- Road Layout 3
- Road Layout 4
- Future Connection
- Cross Sections (A B)
- Buffer Screen Planting (Ref. Appendix 1)
- Realigned Watercourse
- Flood Protectioin Zone (Ref. Appendix 1)
- Existing Stormwater Channel
- NEIZ Extension
- Existing NEIZ

HUDSON ASSOCIATES
LANDSCAPE ARCHITECTS

PO Box 8823 Havelock North
Ph 06 877-9808
john@hudsonassociates.co.nz
www.hudsonassociates.co.nz

Title

PNCC Sectional District Plan Review

PC 15: NEIZ Extension Structure Plan
Map 7.2

DWG #	*Date*
1136-R2	6-8-2014
Revision # 2	*Client* PNCC

2.2.3 Railway Road / Roberts Line

The intersection of Railway Road and Roberts Line is formed by two T intersections which stagger Roberts Line. Both Roberts Line approaches have a stop control. Whilst there are currently no right turn bays along Railway Road the carriageway is sufficiently wide for through vehicles to safely pass a waiting vehicle.

There is minimal through traffic along Roberts Line, hence the effective operation as two T intersections.

2.2.4 Railway Road / Airport Drive

The intersection of Railway Road and Airport Drive is formed as a three arm roundabout. The roundabout features a segregated left turn slip lane for traffic travelling from Railway Road (south) to Airport Drive (west). Each of the approaches has two lanes, effectively providing an approach lane for each turning movement.

In this location all approaches to the roundabout are subject to a speed limit of 50km/hr.

2.2.5 Railway Road / Tremaine Avenue

The intersection of Railway Road and Tremaine Avenue is formed by a four arm traffic signal controlled intersection. Three lanes are present on all approaches to the intersection including dedicated right turn bays with an additional segregated left turn slip lane for traffic travelling from Tremaine Avenue (west) to Railway Road (north).

The intersection includes pedestrian crossing facilities and is subject to a 50km/hr posted speed limit.

2.2.6 Kairanga Bunnythorpe Road / Roberts Line

Kairanga Bunnythorpe Road and Roberts Line meet at a standard four arm cross roads intersection, with a stop control at the Roberts Line approaches.

All approaches to the intersection are subject to a 100km/hr speed limit.

2.2.7 Airport Drive / Milson Line

The Airport Drive intersection with Milson Line is formed as a four arm roundabout intersection. Approaches to the roundabout are all single lane with the exit arms along Airport Drive and John F Kennedy Drive being two lanes.

All approaches to the intersection are subject to a 50km/hr speed restriction. Footpaths and informal drop kerb pedestrian crossings are included on all legs of the roundabout along with on road cycle lanes along John F Kennedy Drive.

2.2.8 Roberts Line / Kelvin Grove Road

Roberts Line and Kelvin Grove Road meet at a T-intersection with Kelvin Grove Road having priority. A left turn deceleration lane is provided for vehicles turning into Roberts Line.

The Kelvin Grove Road and Roberts Line approaches to the intersection are subject to 70km/hr speed restrictions.

2.2.9 Railway Road / El Prado Drive

El Prado Drive provides the primary access to the current NEIZ and forms a T-intersection with Railway Road. The El Prado Drive approach is subject to give way control with sufficient road width at the approach to accommodate left and right turning vehicles separately.

The intersection includes a right turn bay and channelized left turn deceleration lane to accommodate turning movements from Railway Road. There is a short merge lane which can be used to assist in staged right movements from El Prado Drive onto Railway Road, although again staged turns are not usually made.

Railway Road is subject to a speed limit of 70km/h whilst El Prado Drive is subject to a 50km/h restriction.

3. Planned Local Infrastructure

3.1 Improved Access to the NEIZ

An Initial Investigation Study (2013) has been prepared by MWH to investigate the feasibility of improving Kairanga Bunnythorpe Road and Roberts Line in order to improve access to SH1 and SH3 and reclassify Kairanga Bunnythorpe Road as a State Highway. The initial investigation study identifies that improvements to Kairanga Bunnythorpe Road between Milson Line and Bunnythorpe and to Roberts Line would improve access to and from the industrial zone and the airport from all directions. At present these roads are not practicable for heavy vehicles use due to the limited carriageway width and the weight restriction at Jacks Creek Bridge on Kairanga Bunnythorpe Road.

Improving Kairanga Bunnythorpe Road would increase use by general and commercial traffic and have the particular benefit of providing an alternative route to avoid the centre of Palmerston North. In relation to the NEIZ a proportion of industrial traffic would use Kairanga Bunnythorpe Road rather than routes through the city, providing more direct and efficient access.

3.2 Safety Improvements

The MWH study also identifies a number of safety improvements which are under consideration within the local area of the NEIZ, including:

- SH3/54 intersection – construction of a roundabout, including two circulating lanes;
- SH54/Milson Line – construction of a single lane roundabout;
- SH54 – carriageway widening along KB Road; and
- upgrading the Kairanga Bunnythorpe Road intersection with Roberts Line.

3.3 Local Road Improvements

There are a number of programmes in PNCC's Asset Management Plan related to NEIZ roading which have been allocated funding to support future growth in this area, as follows:

- Programme 1087: Land Purchase and Road Construction; Alderson Drive to Richardsons Line Link (2024/25, $1.7m);
- Programme 1089: Upgrade of Richardsons Line (2018/19, $1.2m and 2022/23, $2.35m);
- Programme 1090: NEIZ Intersection Upgrades (2016/17, $600k; 2022/23, $600k; and 2024/25, $600k); and
- Programme 228: Strategic Roading Package – Upgrade of Roberts Line between Richardsons Line and Railway Road (2017/18 & 2018/19, $3m and 2020/21 & 2021/22, $1.5m).

There are also a number of local road improvements which are programmed for the near future, including:

- the replacement of Jacks Creek Bridge, in Kairanga Bunnythorpe;

- the replacement of Mangaone Bridge, in approximately 10 years time;
- the upgrading of Roberts Line between Kairanga Bunnythorpe Road and the NEIZ to collector road status;
- widening and strengthening of SH54/Kairanga Bunnythorpe Road as part of a programmed maintenance plan; and
- ad hoc minor road improvements.

The matter of closing Milson Line and part of Richardson Line in regards to the extension of Palmerston North Airport was determined by the Environmental Court in 2009. It had been proposed that road closures were required to extend the airport runway and end safety area. However the Court determined that Milson Line should instead be deviated around the end of the extended runway. Plans of the Milson Line deviation show that Richardsons Line would be closed. It is therefore assumed for the purposes of this assessment that Richardsons Line would be closed at its western extent.

4. Existing Traffic Flows

Traffic volumes on the main roads surrounding the NEIZ have been obtained using 2013 data held by PNCC, as included below in Table 1.

Road	AADT
JF Kennedy Drive (west of Aspiring Avenue and Milson Line)	5,000 vpd
Airport Drive (west of Railway Road)	5,000 vpd
Railway Road (north of El Prado Drive)	6,100 vpd
Railway Road (north of Richardsons Line)	5,300 vpd
Milson Line (south of Airport Drive)	8,200 vpd
Roberts Line	1,000 vpd
Kairanga Bunnythorpe Road (east of Roberts Line)	1,000 vpd

Table 1: Annual Average Daily Traffic (AADT)

Weekday morning and evening peak hour manual turning count surveys have been undertaken in 2014 at the following intersections to assist with analysis of traffic flows and intersection performance for the proposed extension of the NEIZ:

- Railway Road / Richardsons Line;
- Roberts Line / Richardsons Line;
- Railway Road / Roberts Line;
- Railway Road / Airport Drive;
- Railway Road / Tremaine Avenue;
- Kairanga Bunnythorpe Road / Roberts Line;
- Airport Drive / Milson Line;
- Roberts Line / Kelvin Grove Road; and
- Railway Road / El Prado Drive.

The following peak hours have been determined from the traffic flow surveys:

- morning peak – 07:45-08:45; and
- evening peak – 16:30-17:30.

Traffic flow diagrams showing existing traffic volumes during these two peak hours are provided within Appendix A.

Key peak hour traffic flows are summarised within Table 2.

Road	AM Peak Hour			PM Peak Hour		
	NB/EB	SB/WB	Tot	NB/EB	SB/WB	Tot
Railway Road (north of Richardsons Line)	187	469	656	482	189	671
Railway Road (south of Airport Drive)	454	652	1106	721	449	1170
Railway Road (north of Airport Drive)	358	567	925	611	402	1013
Airport Drive (west of Railway Road)	295	306	601	265	328	593
El Prado Drive (north of Railway Road)	190	88	278	55	173	228
Roberts Line (north of Railway Road)	41	63	104	71	55	126
Roberts Line (south of KB Road)	21	39	60	45	18	63
Richardsons Line (west of Railway Road)	0	8	8	5	9	14
Richardsons Line (west of Roberts Line)	50	13	63	19	24	43
KB Road (west of Roberts Line)	48	77	125	93	55	148

Table 2: Peak Hour Traffic Flows

Traffic flows along Railway Road are relatively tidal and to the north of Richardsons Line around 70% of traffic is southbound in the AM peak and northbound in the PM peak. Flows for El Prado Drive have been used as a basis for determining trip rates for the existing NEIZ and its proposed extension.

Existing traffic flow along Kairanga Bunnythorpe Road, Roberts Line and Richardsons Line are particularly low.

5. NEIZ Trip Generation

5.1 Existing Traffic Generation

Traffic generation from the existing site has been calculated based on traffic counts taken at the main entrance to the existing NEIZ via El Prado Drive. These counts along with known occupation of the site at the time of the counts provide an estimation of the traffic being generated.

Table 3 summarises the existing industrial uses currently in operation within the NEIZ.

Activity	Lot Area (m^2)	GFA (m^2)	Site Coverage
Former Leisureplex	12,721	3,893	31%
Allflex	3,733	1,582	43%
Ezibuy	59,109	26,930	46%
Hookers	12,875	2,874	22%
Foodstuffs	98,029	38,623	39%
Flyway	3,265	962	30%
IMP (Distribution)	11,051	3,272	30%
Keegans	5,984	1,731	29%
Budget Plastics	3,886	1,337	34%
Vesta	3,273	1,180	36%
Downers	8,407	1,273	15%
		Average	**32%**

Table 3: Existing site occupation

Based on the El Prado Drive counts, Table 4 summarises the existing daily and peak trip generation calculated per 100m^2 GFA.

Time Period	Arrivals	Departures	Total
AM Peak	0.38	0.12	0.50
PM Peak	0.15	0.35	0.50
Daily	2.43	2.32	4.75

Table 4: Existing Trip Rates (based on El Prado Drive development in 2012)

5.2 Traffic Generating Area

Assessment of the traffic implications on the road network needs to consider the combination of the undeveloped area of the existing NEIZ as well as the proposed extension area to the NEIZ.

The existing NEIZ has 633,982m^2 of developable site area. The proposed extension site area is 1,280,000m^2, of which it is estimated that 70% would be developable. This provides a total developable area of 1,529,982m^2.

As shown within Table 3 around 30% of the developable area would be expected to be built as traffic generating floor area. The total floor area for assessment is therefore estimated to be 458,995m^2, as calculated in Table 5.

Development Area	Total site area	Estimated developable area	Developable Site Area	Site coverage	Proposed Development Floor Area
Proposed extension to NEIZ	1,280,000	70%	896,000	30%	268,800
Existing NEIZ to be developed			633,982	30%	190,195
Total			**1,529,982**	**30%**	**458,995**

Table 5: Traffic Generation Assessment Floor Area

This additional floor area is significant.

5.3 Proposed Traffic Generation

In addition to the NEIZ counts, TDG has a range of traffic count data available for other freight distribution and industrial activities to refer to in assessing the increase in activity within the extended NEIZ.

The Sockburn Industrial Park in Christchurch predominately accommodates freight industries. A review of its daily and peak hour traffic generation rates are summarised in Table 6 including trip rates for 'light' and 'heavy' vehicles, where heavy vehicles are categorised as including all trucks with two or more axles.

Time Period	Vehicle Movements per 100m^2		
	AM Peak	PM Peak	Daily
Light vehicles	0.3	0.3	3.6
Heavy vehicles	0.2	0.1	2.0
Total vehicles	0.5	0.4	5.6

Table 6: Sockburn Industrial Park Trip Rates

These Sockburn rates are similar to those measured at the NEIZ via the El Prado Drive counts. Based on this data and the traffic counts along El Prado Drive which provide an indication of the proportion of light and heavy vehicles, Table 7 summarises the following proposed peak hour trip rates that would apply to development of the existing and extended NEIZ.

Time Period	Vehicle Movements per 100m^2		
	AM Peak	PM Peak	Daily
Light vehicles	0.40	0.45	4.25
Heavy vehicles	0.10	0.05	0.75
Total vehicles	0.50	0.50	5.00

Table 7: Proposed Trip Generation Rates (NEIZ)

While it is acknowledged that the zone will be progressively developed over a long period of perhaps 30 years, such that the traffic activity of future uses will also be added

progressively and indeed may vary from that derived here, it is accepted that the available data presents a reasonable basis for the forecast and assessments provided. It is therefore important that traffic additions and distributions continue to be monitored so that the need for and timing of intersection improvements can be properly verified against the assumptions made for the purpose of this assessment.

The inbound and outbound proportion of traffic has then been based on traffic count data from El Prado Drive. Separate directional splits have been used for light (staff) and heavy (truck) traffic. Staff working patterns predominantly involve inbound trips in the AM peak and outbound trips in the PM peak. Operational traffic associated with the proposed industrial uses at the site is less tidal with trucks arriving and departing more evenly throughout the day, as displayed by the existing data for El Prado Drive. This operational traffic includes all vehicles from vans and couriers (classified as light vehicles) to larger rigid and articulated trucks (classified as heavy vehicles). The directional split to be applied to the new traffic is shown in Table 8.

Time Period	Staff Trips		Operational Trips	
	In	Out	In	Out
AM Peak	85%	15%	65%	35%
PM Peak	15%	85%	35%	65%
Daily	50%	50%	50%	50%

Table 8: Proposed Trip Generation Directional Splits

The resultant traffic generation for the development of 458,995m^2 of new floor area can then be derived as provided in Table 9.

Traffic Type	AM Peak			PM Peak			Daily
	In	Out	Total	In	Out	Total	
Light	1,377	459	1,836	516	1,549	2,065	19,507
Heavy	298	161	459	80	149	229	3,442
Total	1,675	620	2,295	597	1,698	2,295	22,950

Table 9: Proposed Trip Generation

These additional volumes are significant.

5.4 Proposed Traffic Distribution

The traffic distribution to and from the NEIZ has been based on routes for light and heavy vehicles to access the site. Two distributions have been identified as follows:

- staff – in the peak hours it is assessed that approximately half of the light traffic trips are associated with staff travel. This traffic has been distributed based on Census data of employee distribution, which demonstrates a relatively local catchment in and around Palmerston North;
- industrial operations – this traffic compromises all heavy vehicles as well as half of the light vehicles which would also be associated with operational activities. Operational traffic has a wider distribution and a preference for inter-regional and longer-haul trucks to use the strategic road network. This traffic distribution has

been informed by the road distributions applying to the Foodstuffs Distribution Centre.

A summary of the distributions is provided below in Tables 10 and 11.

Distribution	Proportion
Palmerston North	35%
SH54 North / Feilding	10%
SH3 West / Sanson, Bulls	25%
SH3 East / SH2	10%
SH56 South	20%

Table 10: Staff Traffic Distribution

Distribution	Proportion
PN North West	27%
PN Central & South	47%
PN East	8%
North and Feilding	13%
Ashhurst	5%

Table 11: Operational Traffic Distribution

It will be clear from these distributions that there is a predominance of local traffic to and from Palmerston North.

5.5 Proposed Traffic Assignment

The NEIZ will include four principal points of access to and from the wider road network, as follows:

- El Prado Drive, from the intersection with Railway Road;
- Roberts Line (south), from the intersection with Railway Road;
- Richardsons Line, from the intersection with Railway Road; and
- Roberts Line (north) from the intersection with Kairanga Bunnythorpe Road.

It is anticipated that access from the west via Richardsons Line would be closed in future as a result of potential works associated with the extension of the Palmerston North Airport runway. Access is also not expected to be provided in future via Setters Line to Kairanga Bunnythorpe Road.

Traffic has been assigned to each of these accesses (intersections) based on the distribution detailed in Tables 11 and 12 and the most likely routes to and from the site. The resulting access assignment for staff and operational traffic is detailed within Tables 12 and 13 below.

Distribution		Access			
		El Prado Drive	Roberts Line (south)	Richardsons Line	Roberts Line (north)
Palmerston North	**27%**	55%	38%	2%	5%
SH54 North / Feilding	**47%**	55%	43%	2%	0%
SH3 West / Sanson, Bulls	**8%**	28%	70%	2%	0%
SH3 East / SH2	**13%**	5%	5%	60%	30%
SH56 South	**5%**	5%	5%	60%	30%

Table 12: Traffic Assignment – Staff

Distribution		Access			
		El Prado Drive	Roberts Line (south)	Richardsons Line	Roberts Line (north)
Palmerston North	**35%**	70%	30%	0%	0%
SH54 North / Feilding	**10%**	5%	5%	45%	45%
SH3 West / Sanson, Bulls	**25%**	5%	0%	0%	95%
SH3 East / SH2	**10%**	5%	0%	65%	30%
SH56 South	**20%**	35%	15%	0%	50%

Table 13: Traffic Assignment – Operational Traffic

Traffic flow diagrams of new traffic generated by NEIZ are provided in Appendix A.

6. Intersection Analysis

6.1 Introduction

The projected growth of the NEIZ is estimated to cover a period of 30 years to full site development and occupation. This assessment has accordingly been undertaken from a 2014 base case and projected development at year 2044, with a background traffic growth of 0.3% per annum also applied.

Detailed intersection assessment has been undertaken using SIDRA Intersection V6 for the following intersections surrounding the NEIZ:

- Railway Road / Richardsons Line;
- Roberts Line / Richardsons Line;
- Railway Road / Roberts Line;
- Railway Road / Airport Drive;
- Railway Road / Tremaine Avenue;
- Kairanga Bunnythorpe Road / Roberts Line;
- Airport Drive / Milson Line; and
- Railway Road / El Prado Drive.

Beyond these intersections, traffic flows associated with the NEIZ become more dispersed across the network, where other influences will primarily determine the need and timing for intersection improvements elsewhere. Therefore, it is not appropriate to assess the traffic effects of this Plan Change on more distant intersections.

6.2 Intersection Traffic Flow Changes

A qualified assessment of traffic additions has been undertaken to demonstrate the percentage change in traffic volumes, as summarised within Tables 14 and 15.

	Existing Flows			Existing + Dev Flows			% Increase		
Intersection	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total
Railway / Tremaine	2056	128	2184	2606	245	2851	+27%	+91%	+31%
Milson / Airport	1267	44	1311	1615	117	1732	+27%	+165%	+32%
Airport / Railway	1230	86	1316	2336	301	2637	+90%	+250%	+100%
Railway / El Prado	835	77	912	1964	294	2258	+135%	+282%	+148%
Railway / Roberts	747	46	793	1249	113	1362	+67%	+145%	+72%
Roberts / Kelvin Grove	466	23	489	526	23	549	+13%	+0%	+12%
Roberts / Richardsons	87	6	93	930	234	1164	+969%	+3801%	+1151%
Railway / Richardsons	627	37	664	868	92	960	+38%	+149%	+45%
KB / Roberts	169	6	175	610	195	805	+261%	+3156%	+360%

Table 14: Additional Traffic at Intersections - AM Peak

	Existing Flows			Existing + Dev Flows			% Increase		
Intersection	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total
Railway / Tremaine	2202	130	2332	2821	189	3010	+28%	+45%	+29%
Milson / Airport	1348	44	1392	1739	80	1820	+29%	+83%	+31%
Airport / Railway	1330	58	1388	2575	165	2740	+94%	+185%	+97%
Railway / El Prado	879	53	932	2150	161	2311	+145%	+205%	+148%
Railway / Roberts	834	27	861	1396	60	1456	+67%	+123%	+69%
Roberts / Kelvin Grove	491	20	511	555	20	575	+13%	+0%	+12%
Roberts / Richardsons	116	7	123	1064	121	1185	+817%	+1629%	+864%
Railway / Richardsons	661	19	680	932	47	979	+41%	+145%	+44%
KB / Roberts	191	5	196	687	100	786	+260%	+1893%	+301%

Table 15: Additional Traffic at Intersections - PM Peak

As can be seen from the tables above, the percentage increase at most intersections is significant. However, some intersections experience very low existing traffic volumes and can accommodate NEIZ traffic well, whilst others will come under increasing pressure and require improvements.

6.3 Sidra Intersection Analysis

SIDRA Intersection V6 analyses intersection capacities and vehicle delays, giving an indication of expected intersection performance. It calculates a number of performance indicators, including:

- degree of saturation (ratio of demand to capacity);
- 95th percentile queue length, defining 95% of the time queues will be less than this;
- average delay (seconds/vehicle), defining delay to the typical motorist; and
- level of service (LOS), based on the above delay to motorists, graded from A (no or minimal delays) to F (extreme delays).

The assessed traffic flows have been based on the traffic generation, distribution and assignment detailed within Section 5.

6.3.1 Railway Road / Richardsons Line

A summary of the expected future performance of the Railway Road / Richardsons Line intersection is provided within Tables 16 and 17 for the AM and PM peak hours.

Approach	Turn	Railway Road / Richardsons Line – AM Peak			
		DoS (v/c)	Average Delay (sec)	Level of Service	95% Back of Queue (vehs)
Railway (south)	L	0.129	7.8	LOS A	0.0
	T	0.129	0.0	LOS A	0.0
Railway (north)	T	0.293	0.0	LOS A	0.0
	R	0.142	9.3	LOS A	0.7
Richardsons (west)	L	0.092	11.9	LOS B	0.4
	R	0.021	20.4	LOS C	0.1
All Vehicles		**2.8 seconds delay**			

Table 16: Railway Road / Richardsons Line Intersection Performance with Development – AM Peak

Approach	Turn	Railway Road / Richardsons Line – PM Peak			
		DoS (v/c)	Average Delay (sec)	Level of Service	95% Back of Queue (vehs)
Railway (south)	L	0.301	7.9	LOS A	0.0
	T	0.301	0.0	LOS A	0.0
Railway (north)	T	0.120	0.0	LOS A	0.0
	R	0.113	10.8	LOS B	0.5
Richardsons (west)	L	0.259	14.4	LOS B	1.1
	R	0.040	18.9	LOS C	0.1
All Vehicles		**3.6 seconds delay**			

Table 17: Railway Road / Richardsons Line Intersection Performance with Development – PM Peak

The intersection, in its current layout, is expected to operate with a future LOS C for the right turn movement from Richardsons Line into Railway Road. This level of delay (an average of around 20 seconds) is considered to be acceptable.

6.3.2 Roberts Line / Richardsons Line

A summary of the expected future performance of the Roberts Line / Richardsons Line intersection is provided within Tables 18 and 19 for the AM and PM peak hours.

Approach	Turn	Roberts Line / Richardsons Line - AM Peak			
		DoS (v/c)	Average Delay (sec)	Level of Service	95% Back of Queue (vehs)
Roberts Line (south)	L	0.213	8.2	LOS A	0.0
	T	0.213	0.0	LOS A	0.0
	R	0.213	7.8	LOS A	0.0
Richardsons Line (east)	L	0.466	17.7	LOS C	2.6
	T	0.466	16.5	LOS C	2.6
	R	0.466	18.3	LOS C	2.6
Roberts Line (north)	L	0.578	14.5	LOS B	4.8
	T	0.578	13.1	LOS B	4.8
	R	0.578	14.1	LOS B	4.8
Richardsons Line (west)	L	0.288	12.5	LOS B	1.2
	T	0.288	10.7	LOS B	1.2
	R	0.288	11.6	LOS B	1.2
All Vehicles		**11.3 seconds delay**			

Table 18: Roberts Line / Richardsons Line Intersection Performance with Development – AM Peak

Approach	Turn	Roberts Line / Richardsons Line - PM Peak			
		DoS (v/c)	Average Delay (sec)	Level of Service	95% Back of Queue (vehs)
Roberts Line (south)	L	0.204	8.0	LOS A	0.0
	T	0.204	0.0	LOS A	0.0
	R	0.204	7.6	LOS A	0.0
Richardsons Line (east)	L	0.551	17.7	LOS C	3.5
	T	0.551	16.4	LOS C	3.5
	R	0.551	17.5	LOS C	3.5
Roberts Line (north)	L	0.401	10.9	LOS B	2.2
	T	0.401	9.7	LOS A	2.2
	R	0.401	10.6	LOS B	2.2
Richardsons Line (west)	L	0.419	13.7	LOS B	2.3
	T	0.419	12.4	LOS B	2.3
	R	0.419	13.1	LOS B	2.3
All Vehicles		**10.4 seconds delay**			

Table 19: Roberts Line / Richardsons Line Intersection Performance with Development – PM Peak

The intersection, in its current form and layout, is expected to perform relatively well in both peak hours with a LOS C and maximum delays of up to 18 seconds, which equates to queues of 4-5 vehicles. Whilst this performance is acceptable it is likely that some improvements will be required at the intersection. The current layout is unconventional with a single approach having priority and the remaining three approaches giving way. The function of both Roberts Line and Richardsons Line would change with the development of NEIZ leading to higher traffic flows and a lower speed environment. It is therefore anticipated that upgrades to the intersection would be necessary for traffic function and safety reasons.

6.3.3 Railway Road / Roberts Line

A summary of the expected future performance of the Railway Road / Roberts Line intersection is provided within Tables 20 and 21 for the AM and PM peak hours.

Approach	Turn	Railway Road / Roberts Line - AM Peak			
		DoS (v/c)	Average Delay (sec)	Level of Service	95% Back of Queue (vehs)
Railway (south)	L	0.338	8.2	LOS A	0.0
	T	0.338	0.0	LOS A	0.0
Railway (north)	T	0.302	5.5	LOS A	3.9
	R	0.302	12.5	LOS B	3.9
Roberts (west)	L	1.209	241.0	LOS F	36.1
	R	1.209	240.3	LOS F	36.1
All Vehicles		**49 seconds delay**			

Table 20: Railway Road / Roberts Line Intersection Performance with Development – AM Peak

Approach	Turn	Railway Road / Roberts Line - PM Peak			
		DoS (v/c)	Average Delay (sec)	Level of Service	95% Back of Queue (vehs)
Railway (south)	L	0.444	8.0	LOS A	0.0
	T	0.444	0.1	LOS A	0.0
Railway (north)	T	0.151	6.7	LOS A	1.7
	R	0.151	13.1	LOS B	1.7
Roberts (west)	L	1.920	864.4	LOS F	139.9
	R	1.920	863.8	LOS F	139.9
All Vehicles		**249 seconds delay**			

Table 21: Railway Road / Roberts Line Intersection Performance with Development – PM Peak

With the scale of increased development proposed, the level of service at the Railway Road / Roberts Line intersection would deteriorate. During the peak hours the left and right turn movements out of Roberts Line would experience LOS F with significant delays and queues. With the development of the NEIZ a significant volume of traffic would be anticipated to use the intersection. Improvements will be required.

6.3.4 Railway Road / Airport Drive

A summary of the expected future performance of the Railway Road / Airport Drive intersection is provided within Tables 22 and 23 for the AM and PM peak hours.

Approach	Turn	Railway Road /Airport Drive - AM Peak			
		DoS (v/c)	Average Delay (sec)	Level of Service	95% Back of Queue (vehs)
Railway (south)	L	0.127	4.0	LOS A	0.0
	T	0.607	12.5	LOS B	6.1
Railway (north)	T	0.553	5.2	LOS A	5.7
	R	0.334	11.0	LOS B	2.5
Airport (west)	L	0.729	14.7	LOS B	10.9
	R	0.343	13.5	LOS B	2.6
All Vehicles		**10.1 seconds delay**			

Table 22: Railway Road / Airport Drive Intersection Performance with Development – AM Peak

Approach	Turn	Railway Road /Airport Drive - PM Peak			
		DoS (v/c)	Average Delay (sec)	Level of Service	95% Back of Queue (vehs)
Railway (south)	L	0.133	4.0	LOS A	0.0
	T	0.772	18.9	LOS B	12.6
Railway (north)	T	0.542	5.0	LOS A	5.7
	R	0.490	10.8	LOS B	4.6
Airport (west)	L	0.538	9.3	LOS A	5.9
	R	0.350	14.1	LOS B	2.8
All Vehicles		**10.9 seconds delay**			

Table 23: Railway Road / Airport Drive Intersection Performance with Development – PM Peak

The Airport Drive / Railway Road intersection has been recently constructed and currently operates with a LOS A. In future additional traffic is expected to result in the intersection operating at LOS B with 10-11 seconds average intersection delay in both peak hours. This LOS is considered to be acceptable.

6.3.5 Railway Road / Tremaine Avenue

A summary of the expected future performance of the Railway Road / Tremaine Avenue intersection is provided within Tables 24 and 25 for the AM and PM peak hours.

This intersection has been modelled based on a double diamond overlap phasing with filtered right turns.

Approach	Turn	Railway Road / Tremaine Avenue - AM Peak			
		DoS (v/c)	Average Delay (sec)	Level of Service	95% Back of Queue (vehs)
Vogel (south)	L	0.752	50.1	LOS C	12.9
	T	0.752	44.4	LOS C	13.3
	R	0.271	23.7	LOS A	2.7
Tremaine (east)	L	0.814	47.9	LOS C	20.1
	T	0.814	41.9	LOS C	20.1
	R	0.671	38.1	LOS B	8.4
Railway (north)	L	0.554	34.0	LOS A	14.0
	T	0.554	27.1	LOS A	14.0
	R	0.865	37.9	LOS C	13.6
Tremaine (west)	L	0.431	12.0	LOS A	6.5
	T	0.424	32.9	LOS A	7.8
	R	0.53	33.8	LOS A	3.7
All Vehicles		**34.6 seconds delay**			

Table 24: Railway Road / Tremaine Avenue Intersection Performance with Development – AM Peak

Approach	Turn	Railway Road / Tremaine Avenue - PM Peak			
		DoS (v/c)	Average Delay (sec)	Level of Service	95% Back of Queue (vehs)
Vogel (south)	L	0.7	47.4	LOS B	12.5
	T	0.7	41.8	LOS B	12.6
	R	0.42	24.5	LOS A	4.1
Tremaine (east)	L	0.624	45.8	LOS B	10.5
	T	0.624	40.3	LOS B	10.5
	R	0.722	35.1	LOS C	8.5
Railway (north)	L	0.469	32.3	LOS A	11.4
	T	0.469	26.6	LOS A	11.8
	R	0.752	28.4	LOS C	13.1
Tremaine (west)	L	0.266	11.5	LOS A	4.7
	T	0.717	41.8	LOS C	12.8
	R	0.425	31.1	LOS A	4.9
All Vehicles		**33.4 seconds delay**			

Table 25: Railway Road / Tremaine Avenue Intersection Performance with Development – PM Peak

It is anticipated that the intersection will operate with a LOS C in future with average delays of 34 and 35 seconds in the AM and PM peak hours. The intersection has been upgraded to a signalised intersection in recent years and is expected to accommodate forecast future traffic flows without resulting in significant increases in delay.

6.3.6 Kairanga Bunnythorpe Road / Roberts Line

A summary of the expected future performance of the Kairanga Bunnythorpe Road / Roberts Line intersection is provided within Tables 26 and 27 for the AM and PM peak hours.

Approach	Turn	Kairanga Bunnythorpe Road / Roberts Line – AM Peak			
		DoS (v/c)	Average Delay (sec)	Level of Service	95% Back of Queue (vehs)
Roberts Line (south)	L	0.329	13.8	LOS B	1.4
	T	0.329	11.6	LOS B	1.4
	R	0.329	12.5	LOS B	1.4
KB (east)	L	0.113	8.5	LOS A	0.6
	T	0.113	0.1	LOS A	0.6
	R	0.113	7.5	LOS A	0.6
Roberts Line (north)	L	0.047	13.9	LOS B	0.2
	T	0.047	13.4	LOS B	0.2
	R	0.047	13.2	LOS B	0.2
KB (west)	L	0.296	9.0	LOS A	1.7
	T	0.296	1.2	LOS A	1.7
	R	0.296	9.4	LOS A	1.7
All Vehicles		**9.3 seconds delay**			

Table 26: Kairanga Bunnythorpe / Roberts Line Intersection Performance with Development – AM Peak

Approach	Turn	Kairanga Bunnythorpe Road / Roberts Line – PM Peak			
		DoS (v/c)	Average Delay (sec)	Level of Service	95% Back of Queue (vehs)
Roberts Line (south)	L	0.468	12.4	LOS B	2.9
	T	0.468	10.9	LOS B	2.9
	R	0.468	11.3	LOS B	2.9
KB (east)	L	0.060	8.4	LOS A	0.3
	T	0.060	0.3	LOS A	0.3
	R	0.060	7.7	LOS A	0.3
Roberts Line (north)	L	0.018	12.1	LOS B	0.1
	T	0.018	11.6	LOS B	0.1
	R	0.018	11.4	LOS B	0.1
KB (west)	L	0.170	8.3	LOS A	0.9
	T	0.170	0.5	LOS A	0.9
	R	0.170	8.3	LOS A	0.9
All Vehicles		**9.0 seconds delay**			

Table 27: Kairanga Bunnythorpe / Roberts Line Intersection Performance with Development – PM Peak

The intersection is expected to operate well within capacity with the Roberts Line side roads experiencing LOS B and delays of less than 15 seconds. Development of the NEIZ would add small delays to the Kairanga Bunnythorpe approaches which do not currently have right turn bays; therefore through traffic can be delayed by turning traffic. It is envisaged this road will be upgraded to a State Highway accommodating strategic traffic around Palmerston North. Considering the upgrade of KB, anticipated growth in traffic flows and potential safety concerns it will be necessary to provide some improvements to the intersection, to be coordinated with the upgrade of Kairanga Bunnythorpe Road.

6.3.7 Airport Drive / Milson Line

A summary of the expected future performance of the Airport Drive / Milson Line intersection is provided within Tables 28 and 29 for the AM and PM peak hours.

Approach	Turn	Airport Drive / Milson Line - AM Peak			
		DoS (v/c)	Average Delay (sec)	Level of Service	95% Back of Queue (vehs)
Milson (south)	L	0.345	6.4	LOS A	2.2
	T	0.345	6.3	LOS A	2.2
	R	0.345	10.3	LOS B	2.2
Airport (east)	L	0.725	14.2	LOS B	8.8
	T	0.725	14.3	LOS B	8.8
	R	0.725	18.3	LOS B	8.8
Milson (north)	L	0.758	13.8	LOS B	9.7
	T	0.758	13.8	LOS B	9.7
	R	0.758	17.8	LOS B	9.7
JFK (west)	L	0.549	5.3	LOS A	4.4
	T	0.549	5.4	LOS A	4.4
	R	0.549	9.3	LOS A	4.4
All Vehicles		**11.0 seconds delay**			

Table 28: Airport Drive / Milson Line Intersection Performance with Development – AM Peak

Approach	Turn	Airport Drive / Milson Line - PM Peak			
		DoS (v/c)	Average Delay (sec)	Level of Service	95% Back of Queue (vehs)
Milson (south)	L	0.701	12.2	LOS B	7.6
	T	0.701	12.2	LOS B	7.6
	R	0.701	16.2	LOS B	7.6
Airport (east)	L	0.701	8.4	LOS A	8.3
	T	0.701	8.5	LOS A	8.3
	R	0.701	12.4	LOS B	8.3
Milson (north)	L	0.388	5.8	LOS A	2.6
	T	0.388	5.8	LOS A	2.6
	R	0.388	9.8	LOS A	2.6
JFK (west)	L	0.618	9.5	LOS A	6.1
	T	0.618	9.5	LOS A	6.1
	R	0.618	13.5	LOS B	6.1
All Vehicles		**9.7 seconds delay**			

Table 29: Airport Drive / Milson Line Intersection Performance with Development – PM Peak

The Airport Drive / Milson Line intersection is expected to operate well within capacity in future with LOS B and short delays. No improvements are therefore required.

6.3.8 Railway Road / El Prado Drive

A summary of the expected future performance of the Railway Road / El Prado Drive intersection is provided within Tables 30 and 31 for the AM and PM peak hours.

Approach	Turn	Railway Road / El Prado Drive - AM Peak			
		DoS (v/c)	Average Delay (sec)	Level of Service	95% Back of Queue (vehs)
Railway (south)	L	0.428	6.9	LOS A	0.0
	T	0.295	0.0	LOS A	0.0
Railway (north)	T	0.371	2.3	LOS A	0.0
	R	0.079	8.8	LOS A	0.3
El Prado	L	0.057	8.9	LOS A	0.2
	R	8.747	7074.5	LOS F	231
All Vehicles		**1,097 seconds delay**			

Table 30: Railway Road / El Prado Drive Intersection Performance with Development – AM Peak

Approach	Turn	Railway Road / El Prado Drive - PM Peak			
		DoS (v/c)	Average Delay (sec)	Level of Service	95% Back of Queue (vehs)
Railway (south)	L	0.204	6.8	LOS A	0.0
	T	0.378	0.1	LOS A	0.0
Railway (north)	T	0.326	2.3	LOS A	0.0
	R	0.031	9.7	LOS A	0.1
El Prado	L	0.132	10.1	LOS B	0.5
	R	9.746	7935.0	LOS F	426
All Vehicles		**2,267 seconds delay**			

Table 31: Railway Road / El Prado Drive Intersection Performance with Development – PM Peak

The intersection currently operates with a LOS C during the peak hours. As traffic growth increases, the right turn out from El Prado Drive onto Railway Road will come under significant pressure. A LOS F and significant queueing is forecast. Capacity improvements are therefore required.

7. Proposed Intersection Modifications

7.1.1 Introduction

As the NEIZ is extended, several roads will provide access to the NEIZ including Roberts Line and Richardsons Line. As such the function of these roads will change from rural roads with low volumes to provide access to industrial sites with higher traffic flows and greater volumes of heavy vehicles. It is therefore appropriate to review the form of these intersections, not only from the perspective of performance, but also in terms of their new function and associated lower traffic speeds.

Changes to the existing road environment are anticipated, as well as the introduction of new internal access roads, as summarised within Table 32. Each of the roads would have a total road reserve width of 20m.

Road	Location	Speed	Road geometry
Richardsons Line	West of Roberts Line	60km/h	■ Carriageway – 8.4m ■ Foot/cyclepath – 1 x 3.0m
Richardsons Line	Between Roberts Line and Railway Road	40km/h	■ Carriageway – 9.5m ■ Foot/cyclepath – 1 x 3.0m
Roberts Line	Between Richardsons Line and KB Road	80km/h	■ Carriageway – 10.5m ■ Footpath – 1 x 1.5m
Internal access roads		40km/h	■ Carriageway – 7.5m ■ Footpath – 2 x 1.5m

Table 32: Proposed Road Layout

Intersection improvements are recommended below on the basis of improving intersection performance where necessary and in consideration of the future road network and its changing function.

As summarised in Section 3.3, it is noted that PNCC's Asset Management Plan Programme 1090 includes an allocation of funding for NEIZ intersection improvements.

7.1.2 Railway Road / Richardsons Line

No improvements are expected to be required at this intersection.

7.1.3 Roberts Line / Richardsons Line

As noted in Section 6.3.2 the function of the Roberts Line / Richardsons Line is expected to change in future as a central intersection within the industrial zone, accommodating higher traffic flows, including more heavy vehicles, at lower speeds. The existing layout of the intersection is relatively unconventional and it is considered necessary to improve the intersection in terms of safety and to minimise any potential delays.

As a cross roads intersection with similar traffic flows on each approach it is considered a roundabout would be an appropriate layout. Initial capacity testing has been undertaken for a roundabout with a 20m island diameter, two lane approaches and a single circulating lane. This would achieve a performance of LOS A with average delays across the intersection of 8-9 seconds in both the AM and PM peak hours.

It is therefore recommended that sufficient space be provided for the future modification of the intersection to become a roundabout.

7.1.4 Railway Road / Roberts Line

As a key access route between Palmerston North and the NEIZ it is envisaged that traffic flows will increase substantially at this intersection in future. In particular, the increase in the right turn volumes onto Railway Road would result in significant delay based on the current intersection layout. The west and east sides of Roberts Line are positioned opposite each other on Railway Road and it would be beneficial to stagger the two T intersections by relocating the western intersection further north.

Tests for a new tee intersection have been undertaken based on additional capacity with a right turn bay and a staged right turn exit lane along Railway Road. This is anticipated to operate sufficiently in the AM peak with LOS B. However, in the PM peak there is a significantly higher right turn out volume (370 light + 20 heavy vehicles), which results in LOS F with 130 seconds delay and 35 vehicle queues, based on a fully developed NEIZ. Therefore, whilst an enhanced T intersection would be sufficient in the interim, a roundabout option may be necessary in the future, depending on the level and timing of added traffic.

A roundabout with a 20m island diameter, two approach lanes and a single circulating lane has been assessed as a future alternative to provide sufficient capacity in both peak hours. An average LOS A is expected with 8-9 seconds average delays and queues of up to 4 vehicles. The right turn movements would experience LOS B and delays of around 14-15 seconds.

7.1.5 Railway Road / Airport Drive

No intersection improvements are considered to be required.

7.1.6 Railway Road / Tremaine Avenue

No intersection improvements are considered to be required.

7.1.7 Kairanga Bunnythorpe Road / Roberts Line

As noted within Section 6.3.6 the intersection is not expected to have capacity issues in future. However it is recommended that some safety improvements are undertaken by providing turning bays for vehicles along Kairanga Bunnythorpe Road and avoiding through traffic being slowed along a high speed upgraded route. The provision of turning bays would also improve the performance of the intersection.

It is noted that safety improvements are already under consideration for this intersection and it is expected that Kairanga Bunnythorpe Road will be widened and strengthened to become a key strategic route. The upgrade should also provide for these intersection improvements at Roberts Line.

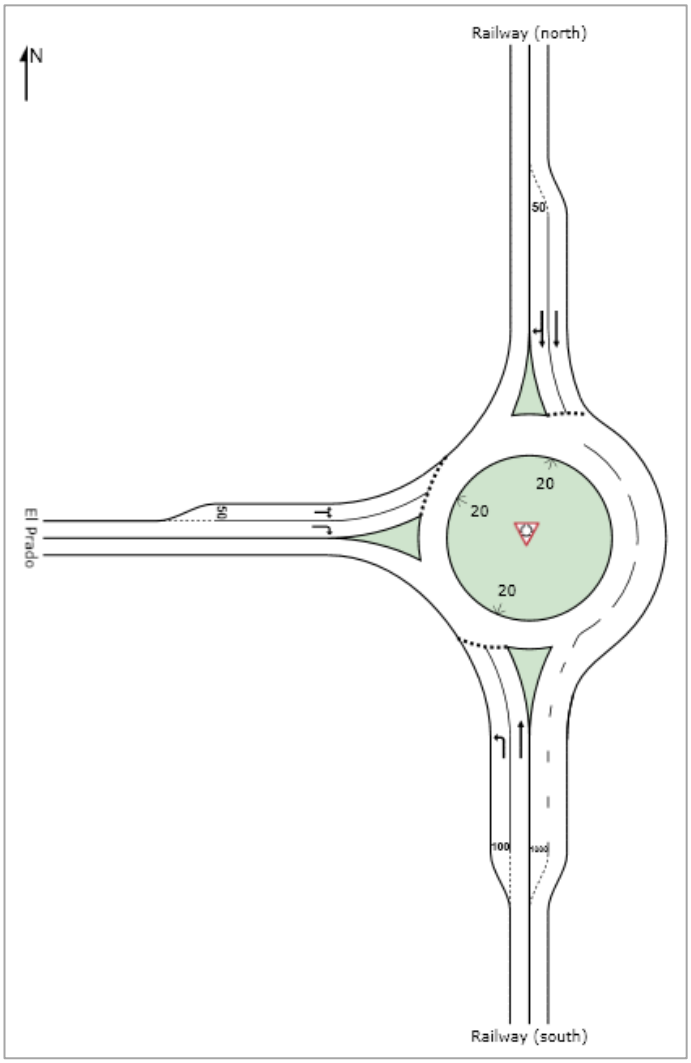
7.1.8 Airport Drive / Milson Line

No intersection improvements are considered to be required.

7.1.9 Railway Road / El Prado Drive

The El Prado Drive / Railway Road intersection is expected to accommodate significant volumes of traffic between Palmerston North and the NEIZ in the future. This results in worsening levels of service. The future traffic volumes require consideration of a roundabout option as a tee intersection has been tested to be insufficient.

A roundabout with the following design has been assessed to provide an overall LOS B with average delays of 8 and 11 seconds in the AM and PM peak hours respectively.



8. Conclusions

TDG has been commissioned by Palmerston North City Council (PNCC) to undertake a traffic study to examine the intersection effects of a proposed extension of the North East Industrial Zone (NEIZ).

Plan Change 15E proposes the rezoning of 128 hectares of Rural Zone land to extend the NEIZ to provide large floor plate industrial activities

The site is located north of Palmerston North Airport, with the main access currently provided at the intersection of Railway Road and El Prado Drive. The proposed NEIZ Extension widens the existing zone to the north of Richardsons Line and to the east of Roberts Line.

The traffic generation and distribution of the fully developed NEIZ have been estimated based on existing surveys and travel behaviour. These traffic volumes have then been assessed on the local road network to identify where infrastructure improvements may be required and what form these may take. It is also envisaged that the character of many local roads will change from rural lightly trafficked high speed roads to busier low speed access roads.

The following intersections have been identified for improvement, with suggested intersection forms for the fully developed NEIZ scenario:

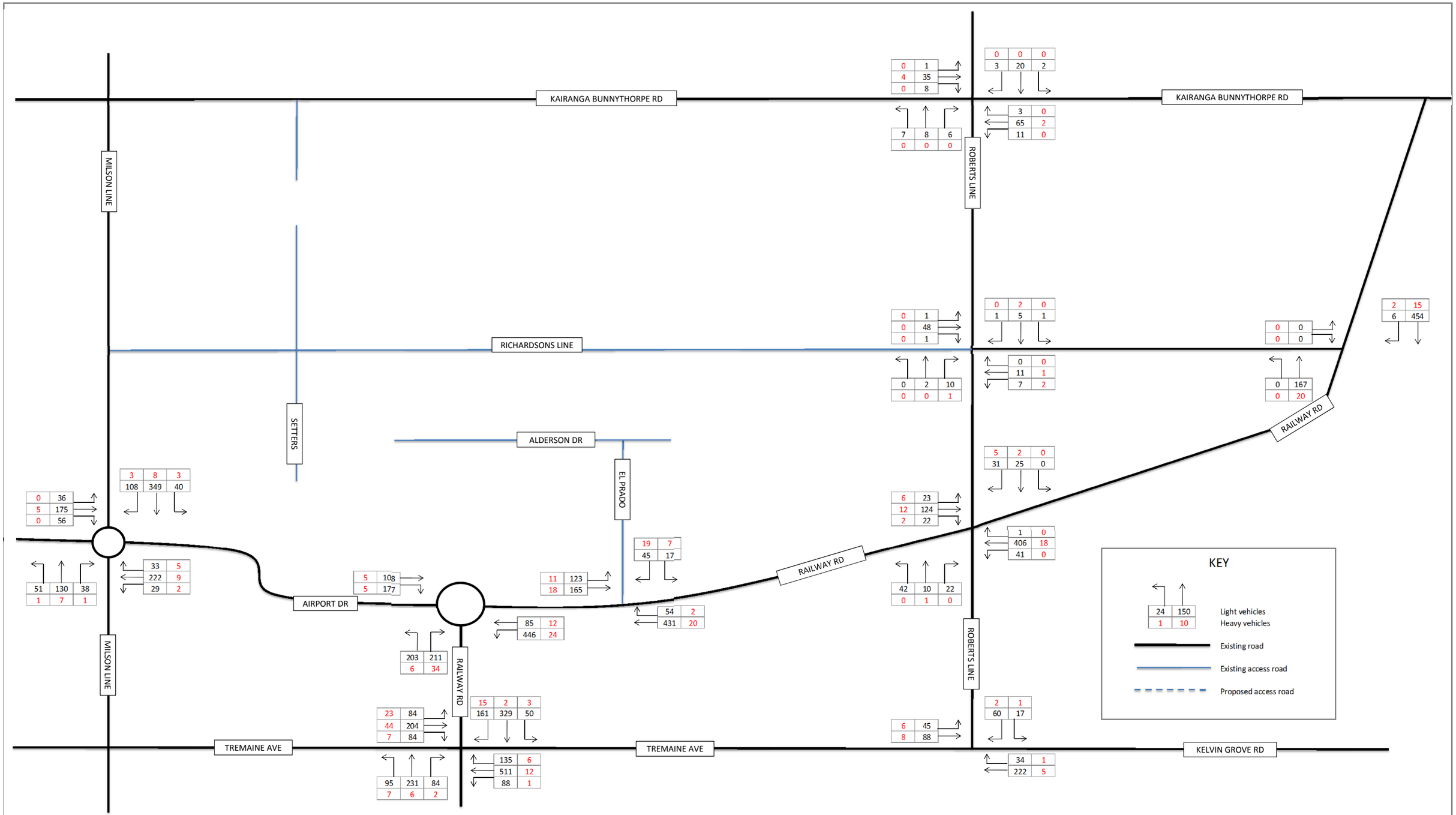
- Roberts Line / Richardsons Line – Improvements required due to change in road function and potential safety issues. Roundabout identified as potential intersection form;
- Railway Road / Roberts Line – Improvements required due to worsening intersection performance. An offset T intersection is identified as an appropriate interim form, with a roundabout possibly being needed once the NEIZ is fully developed;
- Kairanga Bunnythorpe Road / Roberts Line – Improvements required due to change in road function and potential safety issues. Upgraded intersection with turning bays identified as potential improvements; and
- El Prado Drive / Railway Road – Improvements required due to worsening intersection performance. Roundabout identified as potential intersection form.

These improvements are provided for by Programme 1090 in PNCC's Asset Management Plan.

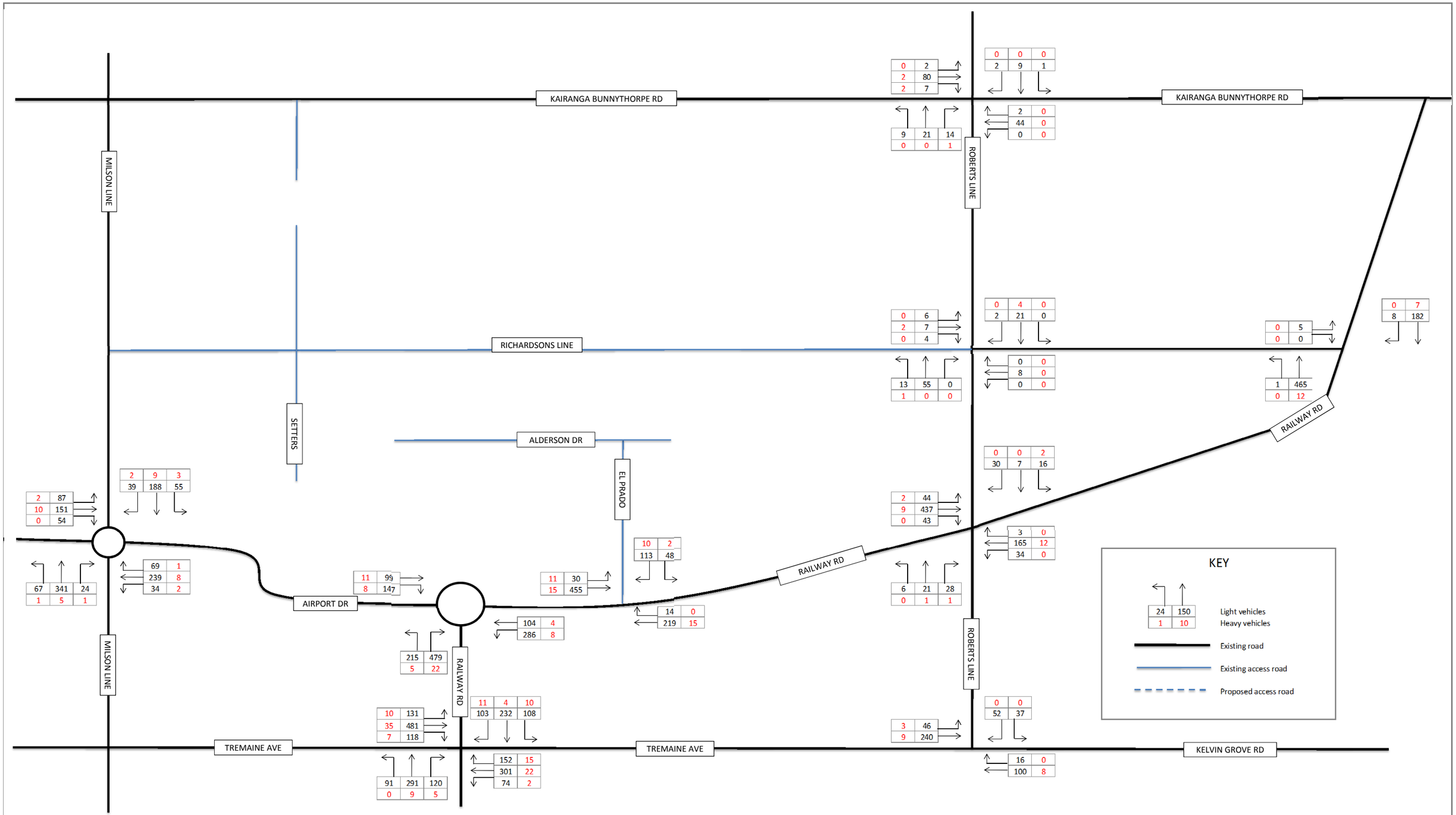
Traffic Design Group Ltd

Appendix A

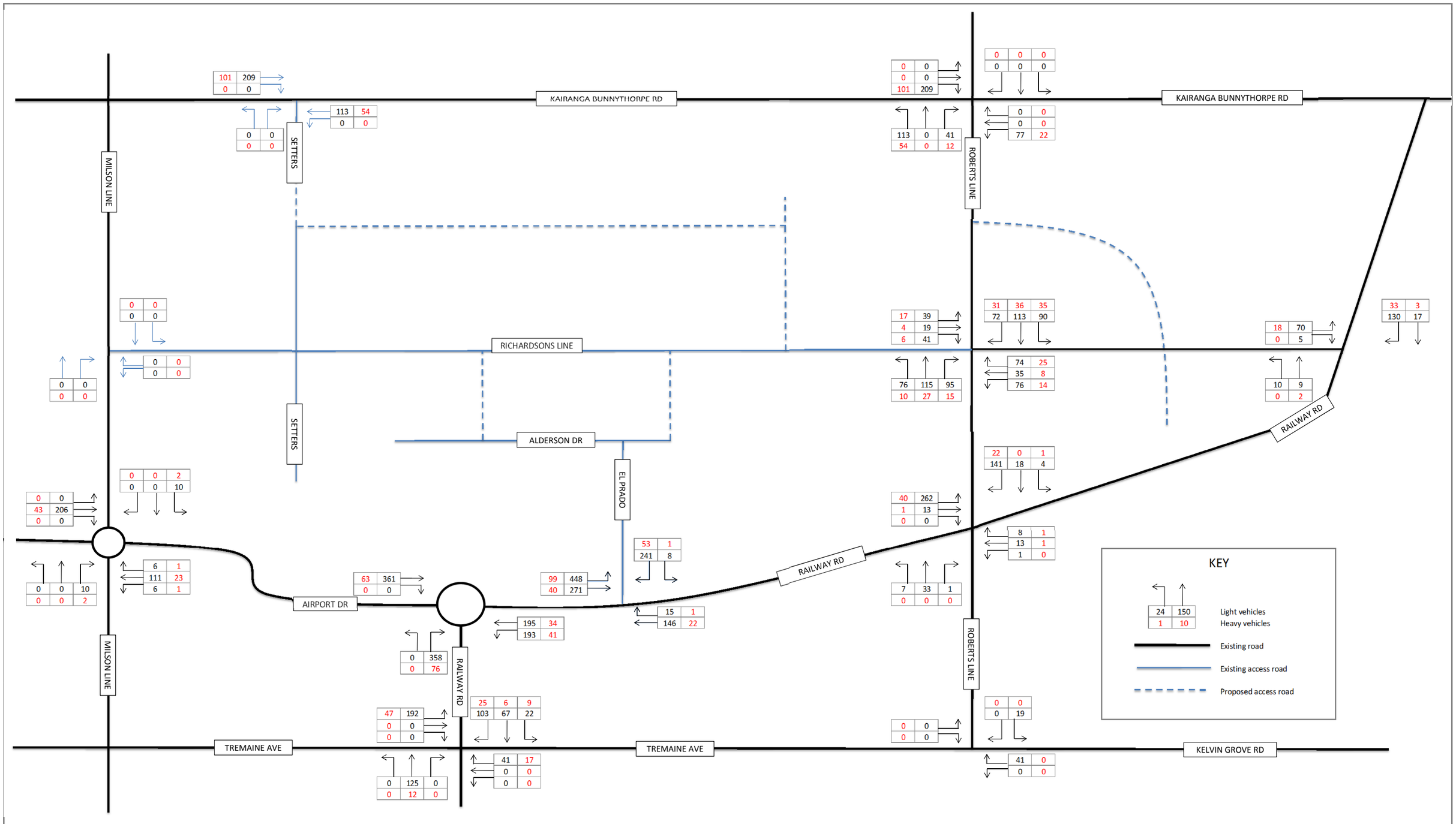
Traffic Flow Diagrams



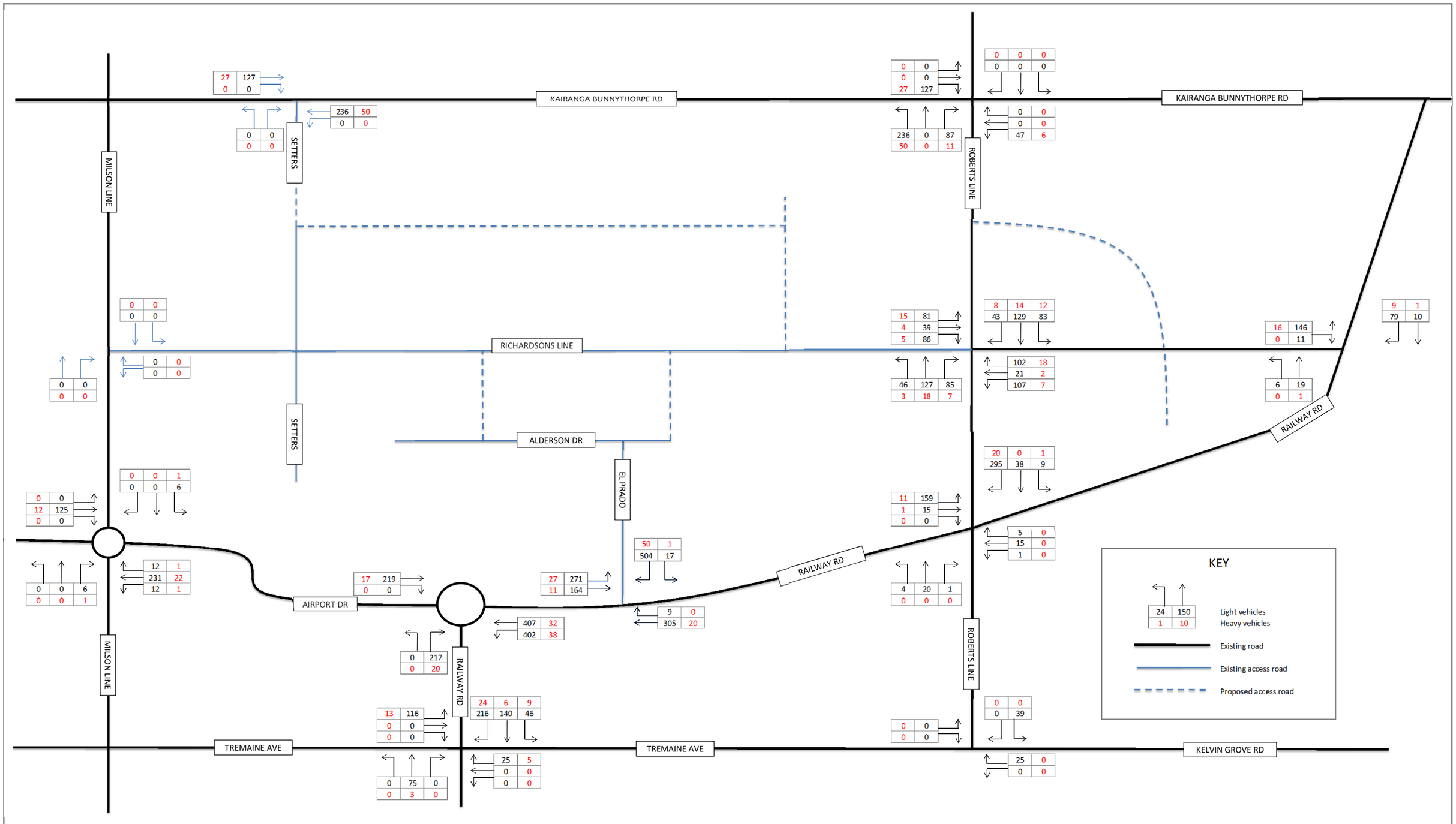
PALMERSTON NORTH - NORTH EAST INDUSTRIAL ZONE	EXISTING TRAFFIC FLOWS - AM PEAK (07:45-08:45)	FIGURE A1



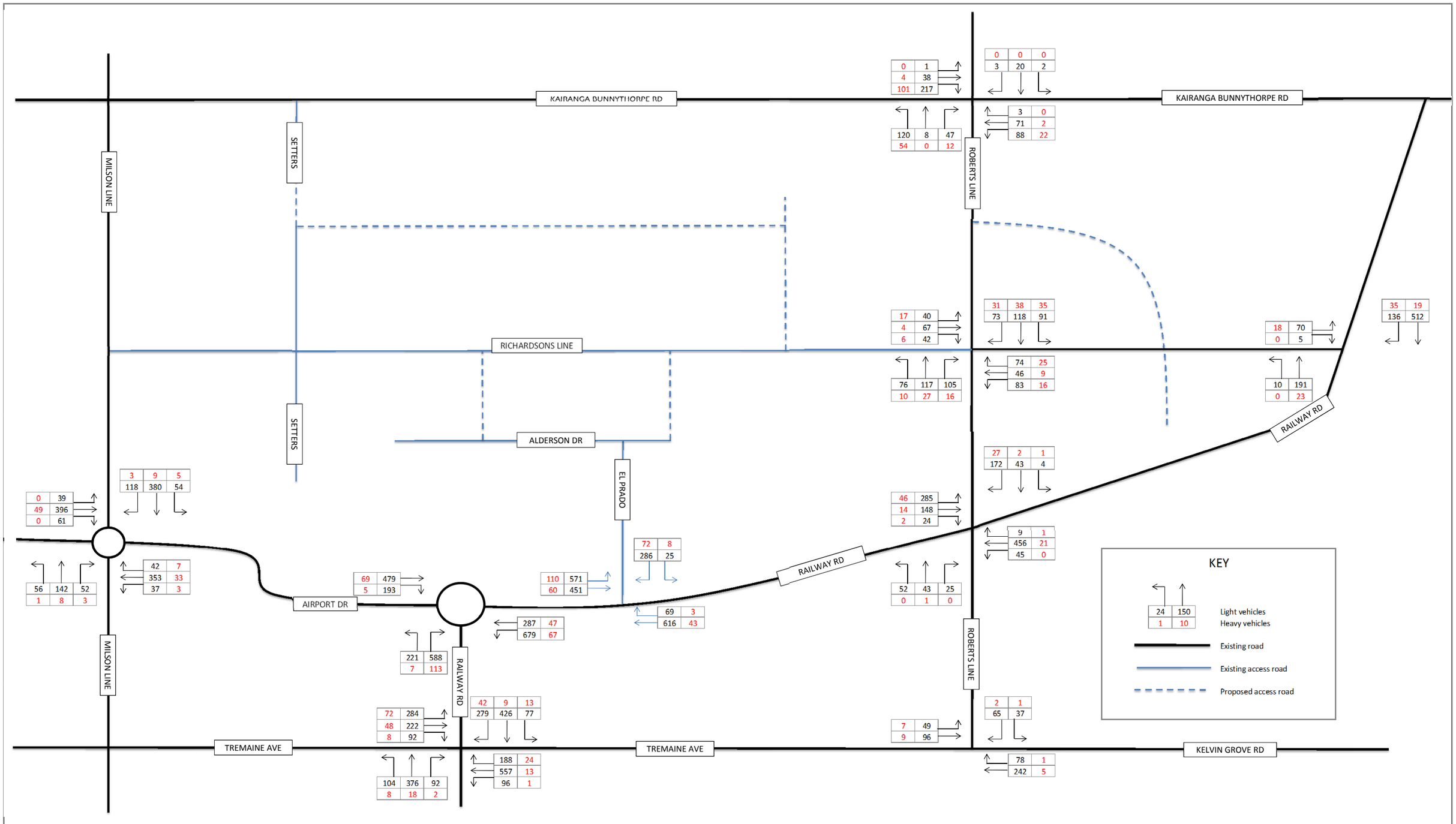
PALMERSTON NORTH NORTH EAST INDUSTRIAL ZONE	EXISTING TRAFFIC FLOWS - PM PEAK (16:30-17:30)	FIGURE A2



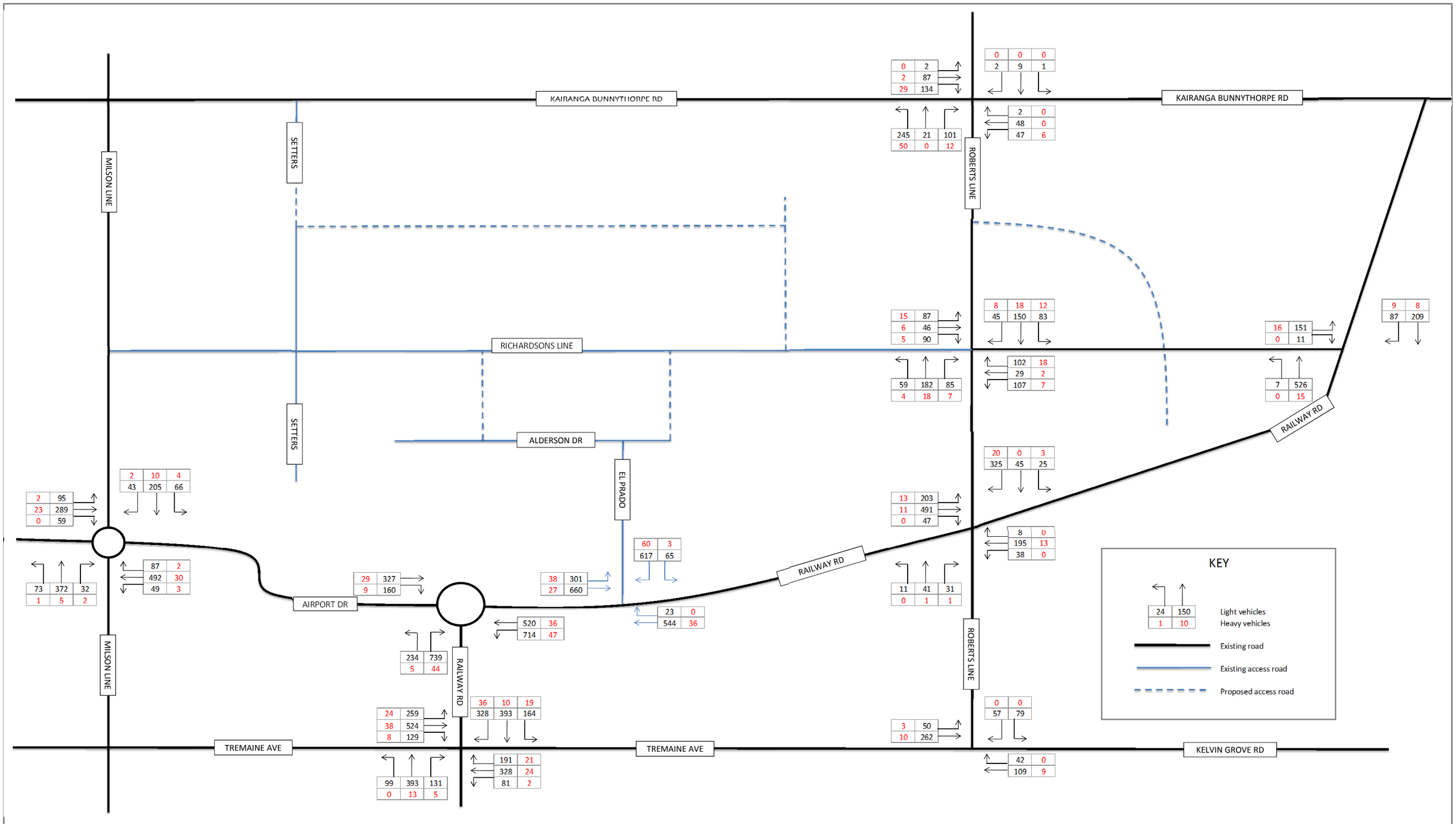
PALMERSTON NORTH - NORTH EAST INDUSTRIAL ZONE	NEIZ TRAFFIC FLOWS - AM PEAK	FIGURE A3



PALMERSTON NORTH - NORTH EAST INDUSTRIAL ZONE	NEIZ TRAFFIC FLOWS - PM PEAK	FIGURE A4



PALMERSTON NORTH NORTH EAST INDUSTRIAL ZONE	FUTUE BASELINE + DEVELOPMENT TRAFFIC FLOWS - AM PEAK (07:45-08:45)	FIGURE A5



PALMERSTON NORTH NORTH EAST INDUSTRIAL ZONE	FUTURE BASELINE + DEVELOPMENT TRAFFIC FLOWS - PM PEAK (16:30-17:30)	FIGURE A6