

TRANSPORT STATEMENT SYDNEY AVENUE PLANNING APPLICATION

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Manchester Airport Ltd

MAG Landside - FI, SA & VCC
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1. Introduction

1.1 Background

Manchester Airport Group (MAG) continues to invest in its airport infrastructure. MAG are close to completion of the Manchester Airport Transformation Programme (MAN-TP), a £1.3bn investment programme that will transform passenger experiences and help attract yet more of the world's leading airlines. The transformation was first announced in 2015 with a 10-year vision to revolutionise the customer experience at the Northern hub and unlock the potential of its two full-length runways. The programme involves an extension, doubling the size of Terminal 2 (T2) and refurbishing the original terminal, including the construction of two new aircraft piers, creation of a state-of-the-art baggage hall, installing next generation scanners in a new security hall, additional retail and food and beverage outlets as well upgrading the airfield and taxiways to cater for next generation aircraft. It also includes the development of the landside road network to allow sufficient capacity and access to the terminal to drop off passengers, pick-up passengers as well as additional car parking.

In review of this landside road network, a traffic modelling exercise has been undertaken to review various parts of the road network and the impacts of increasing traffic numbers in the area following the opening of the full Terminal 2 following the completion of MAN-TP in 2025. This exercise has concluded the need for changes to the road network at the western end of T2. With the existing layout, the Sydney Avenue junction with Thorley Lane is anticipated to be over capacity with queues extending into the West End Roundabout and Palma Avenue, therefore blocking the forecourt exit (see section 7.2.1 below).

An optioneering exercise for solutions was undertaken and the option now progressed is for the closure of the existing short Sydney Avenue and construction of a new link road/carriageway from the western side of the existing West End roundabout and connecting into Thorley Lane via a new signal-controlled junction. The proposed project includes the following: -

- A new carriageway from the West End Roundabout (where Palma Avenue and Sydney Avenue meet) via the existing Staff West Car Park to Thorley Lane (including a 3.0m wide shared footway/cycleway)
- Widening of Thorley Lane to accommodate a signal-controlled junction between the new carriageway and Thorley Lane
- The upgrade of the existing Thorley Lane junction with Runger Lane to a signalised junction.
- Creation of a 3m wide shared footway/cycleway on Thorley Lane.
- Closure of the existing Sydney Avenue carriageway from the West End Roundabout to Thorley Lane and associated retention and realignment of the existing footpaths and cycleway
- Creation of a new exit from the West End Roundabout into the existing Staff West car park

The planning application is limited to seeking planning permission for the creation of a new access from the northern end of the new road to the Thorley Lane carriageway.

The extent of the planning application boundary and the extent of the project boundary are shown on the plan at Appendix A.

1.2 Purpose of this Report

This report will set out the development proposals and their constituent parts. It will then set out the existing situation in terms of transport provision in the vicinity of the development site. Finally, it will present traffic modelling results to demonstrate that the proposed new junction will operate effectively in highway capacity terms.

1.3 Report Structure

This report consists of eight sections including this introduction. The remaining sections are as follows:

- Section 2 outlines the development proposals and their compliance with relevant standards.
- Section 3 sets out the transport infrastructure within the vicinity of the development site.
- Section 4 details the modelling suite that has been used.
- Section 5 sets out the Data that has been collected and used for the modelling.
- Section 6 highlights how the Airport demand has been derived.

- Section 7 details the anticipated impact of the development upon the transport network.
- Section 8 provides conclusions and recommendations.

2. Design Layout and Standards

2.1.1 Design Layout

The principal component of the proposed development is a new link road between the West End Roundabout and Thorley Lane which will replace the stopped up existing Sydney Avenue.

The proposed project covered by this planning application includes the following:

- A new single carriageway (S2 - single lane in each direction) link road from the West End Roundabout (where Palma Avenue and Sydney Avenue meet) via the existing Staff West Car Park to Thorley Lane (including a 3.0m wide shared footway/cycleway). The single carriageway link is to widen to two lanes on the westbound approach to the new junction with Thorley Lane to provide a queuing length of approximately 50m for the right turn onto Thorley Lane.
- Widening of Thorley Lane to accommodate a signal-controlled junction between the new carriageway and Thorley Lane
- The upgrade of the existing Thorley Lane junction with Runger Lane to a signalised junction. The existing junction of Thorley Lane and Runger Lane is located under 100 metres from the proposed new junction. As part of the proposals, this junction will be upgraded from its current priority control to be signal control. The two junctions therefore effectively combine to become a single staggered signalised crossroads.
- Creation of a 3m wide shared footway/cycleway on Thorley Lane with a proposed crossing integrated into the signal controls across the new link road.
- Closure of the existing Sydney Avenue carriageway from the West End Roundabout to Thorley Lane and associated retention and realignment of the existing footpaths and cycleway
- Creation of a new exit from the West End Roundabout into the existing Staff West car park

However, while the project encompasses all the works above, planning permission is only required and being sought for the formation of a means of access from the new road to Thorley Lane. This Transport Statement provides a justification for the entire project's works and is not limited to justifying the new means of access that is the subject of the planning application.

2.1.2 Standards and Specifications

All highway works will be designed and constructed in accordance with the Design Manual for Roads & Bridges (DMRB), Manual for Streets (MFS) and Specification for Highway Works (SHW). The list of design standards below is not exhaustive but has been used in the development of the preliminary design (RIBA3) and will be used as a reference during the development of the detailed design (RIBA4).

<u>Design Standard</u>	<u>Title</u>
DMRB	CD 109 - Highway Link Design
DMRB	CD 127 - Cross-Sections and Headrooms
DMRB	CD 123 - Geometric Design of at-grade Priority and Signal-controlled Junctions
DMRB	CD 116 - Geometric Design of Roundabouts
DfT	Manual for Streets
Manchester City Council	Design for Access 2
DMRB	CD239 – Footway and Cycleway Pavement Design

DfT	Department for Transport: Local Transport Note 2/09 – Pedestrian Guard railing
DMRB	CD 143 – Designing for Walking, Cycling and Horse-Riding
DfT	Provision of Road Restraint Systems for Local Authority Roads
Sustrans	Technical Information Note No. 19 – Segregation of Shared Use Routes
BS EN 1317	Road Restraint Systems (Vehicle and Pedestrian)
TSM	Chapters 2 to 7
DMRB	TA 101 – Traffic Signaling Systems;
LTN 1/98	Installation of Traffic Signals and Associated Equipment;
LTN 2/95	The Design of Pedestrian Crossings
MCHW	Volumes 1 to 3
DMRB	GG119 – Road Safety Audit
DMRB	CD 377 – Requirements for Road Restraint Systems

Construction specifications will be based upon the Specification for Highway Works (SHW) with Contract Specific Appendices produced as required by the design and to the approval of the relevant Highway Authority. Where a proposed design does not comply with the DMRB it shall be treated as a departure from standards.

Within the Manchester City Council boundary, Transport for Greater Manchester Urban Traffic Control will be employed to carry out all aspects of the detailed traffic signal design, installation and procurement of the traffic signal equipment and commissioning. This applies to the Thorley Lane Road junction with the New Link at the northern extent of the scheme which is to be a traffic signal-controlled junction. These signals will be required to communicate with signals present on the West End Roundabout

2.1.2.1 Road Alignment Design

The vertical alignment proposals are based on tying into the existing road network at the various interfaces on the Project.

The alignment design has been developed and assessed using a design speed of 60kph for all new carriageways, in accordance with CD109. This includes assessment of both through visibility and junction visibility.

Reduced speed restrictions are proposed for the scheme to mitigate risks which have been identified. A speed limit of 20mph is proposed across the scheme, with the existing speed limit of 30mph on Runger Lane and Thorley Lane to be retained.

The design of the junctions shall be such that a Ratio of Flow to Capacity (RFC) not exceeding 0.85 (or a positive Practical Reserve Capacity (PRC) for signals) will apply in accordance with DMRB.

2.1.2.2 Agreements for Highways Works

A section 278/38 agreement will be sought with both Manchester City Council and TFGM UTC as required.

2.1.2.3 Design Vehicles

The works will be developed to suit the largest vehicles expected to use the area as follows:

- Proposed link – 15m rigid buses, cars, minibuses, and large saloon cars.
- Upgrade to junction of Thorley Lane and Runger Lane – 16.5m Articulated Vehicles, cars, minibuses, and large saloon cars.

2.2 Highways Safety

Road Safety Audits of design proposals and constructed works are to be undertaken in accordance General Principles and Scheme Governance General information document 'GG 119 Road Safety Audit'.

A Stage 1 Road Safety Audit and response report has already been performed on the preliminary design of the scheme. A copy of this and the associated designer's response can be found at Appendix B and Appendix C respectively.

The following stages of road safety audit shall apply as the project progresses:

- Stage 2: To be undertaken on completion of the detailed design.
- Stage 3: To be undertaken at the completion of construction.
- Stage 4: To be undertaken using 12-months of validated post highway scheme-opening traffic collision data. A Stage 4 road safety audit is not required if there have been no reported traffic collisions.

3. Existing Transport Situation

3.1 Background

This section sets out the current transport network in the vicinity of the development proposals.

3.2 Local Highway Network

3.2.1 West End Roundabout & Sydney Avenue / Thorley Lane Junction

The West End Roundabout is a partially signalised roundabout located to the northwest of the Terminal 2 buildings. It is a key junction in the airport landside network and is currently used by most of the traffic using T2. It is a four-arm roundabout with two circulatory lanes. The Roundabout consists of the following four arms:

- Sydney Avenue.
- Melbourne Avenue.
- Palma Avenue; and
- Atlanta Avenue

Figure 3-1¹ below shows overhead photography illustrating the junction.



Imagery © 2024 Google.

Figure 3-1 West End Roundabout & Sydney Avenue / Thorley Lane

¹ Source: Google Maps. Accessed 07/08/2024

<https://www.google.co.uk/maps/@53.3706745,-2.2844978,138m/data=!3m1!1e3?entry=ttu>

Atlanta Avenue is the exit point from the T2 Departures forecourt and is an exit only arm. There is one set of signals on the roundabout, which operate as three phases. The Palma Avenue arm is conventionally signalled with one set on the approach arm and another on the circulatory arm. A third set controls Atlanta Avenue.

Sydney Avenue is a short section (approximately 40 metres in length) of S1 road running between the West End roundabout and Thorley Lane. At its southern terminus there is a single lane priority-controlled entry to the West End Roundabout. At its northern terminus, it forms a priority control T-junction with Thorley Lane.

Thorley Lane runs from Enterprise Way in the east to the junction of Shay Lane and Roaring Gate Lane in the west. The stretch in the vicinity of the development site is an S2 (single carriageway) road subject to a 30mph speed limit. It forms part of the route from T2 to M56 junction 6 via Runger Lane and to the A555 Manchester Airport Link Road via Enterprise Way and Ringway Road.

Palma Avenue is a key road in the landside network running for approximately 800m from Flag Island to the West End Roundabout. The eastbound carriageway provides access to the authorised vehicle lane at T2 (used by car park & hotel buses, and registered taxis), the T2 East Multi-storey car park and parking for over height vehicles. The westbound carriageway carries traffic from either the T2 departures forecourt or T2 West MSCP back to the M56 via World Way.

Melbourne Avenue is a three-lane road providing access from the West End roundabout to the T2 West Multi-Storey car park. Access is also available to the Little Staff West car park. One lane is used for traffic heading towards the car park, with two lanes used for traffic leaving the car park.

Atlanta Avenue also runs from Flag Island to the Western End roundabout but is also the main departures forecourt for T2. As such it only runs in a southeast to northwest orientation. Only traffic dropping off passengers is permitted to use it and vehicles are subject to a charge of £5.00 for a five-minute stay and £6 for a 10-minute stay. Longer stays are classed as an "overstay" and are subject to a £25.00 charge. Vehicles are not allowed be left unattended.

3.2.2 Thorley Lane / Runger Lane Junction

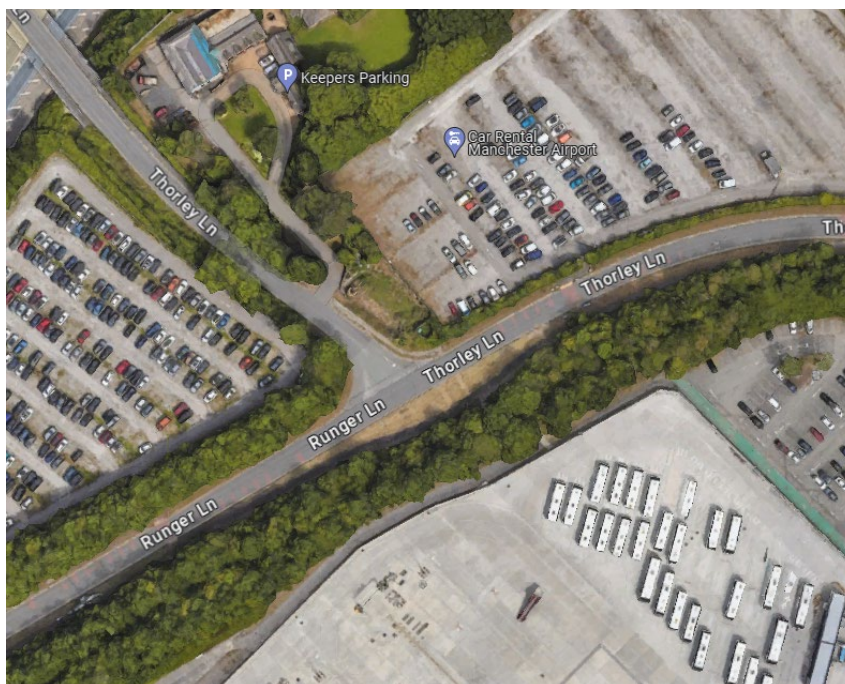
The Thorley Lane / Runger Lane junction priority-controlled junction located to the northwest of the Terminal 2 buildings. It consists of 3 arms

- Thorley Lane (N) – toward Manchester Airport.
- Runger Lane.
- Thorley Lane (W) toward the M56 bridge

Figure 3-2² below shows overhead photography illustrating the junction.

² Source: Google Maps. Accessed 07/08/2024

<https://www.google.co.uk/maps/@53.3706745,-2.2844978,138m/data=!3m1!1e3?entry=ttu>



Imagery © 2024 Google.

Figure 3-2 Thorley Lane / Runger Lane Junction

Runger Lane, and both Thorley Lane arms of the junctions are single carriageway roads subject to a 30mph speed limit.

3.3 Pedestrian and Cycling Facilities

Sydney Avenue has a footway on its eastern side linking into Thorley Lane. Thorley Lane is equipped with a footway on its southern side. The West End Roundabout has a footway around its western perimeter, with uncontrolled crossings across the Melbourne Avenue arm providing onward pedestrian access to T2.

Thorley Lane has a shared footway / cycleway along its southern side. This also forms part of the Manchester Airport orbital cycleway and National Cycle Route 75, as shown in Figure 3-3.

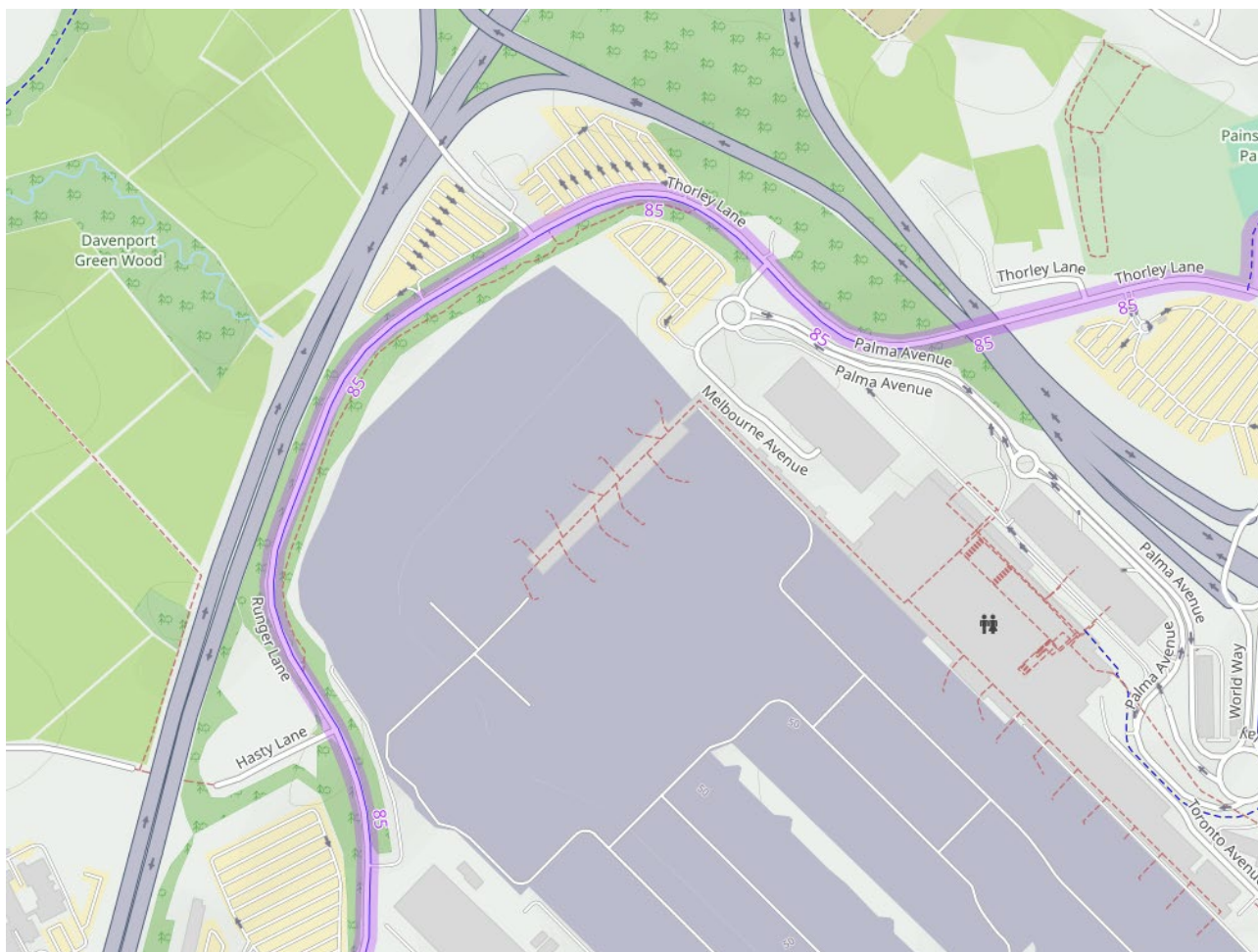


Figure 3-3 Cycle Routes within the vicinity of the site

3.4 Public Transport

3.4.1 Bus Stops and Bus Services

There are bus stops on both sides of Thorley Lane, immediately to the north of the junction with Thorley Lane. The bus services 313, 768 and X5 calls at these stops.

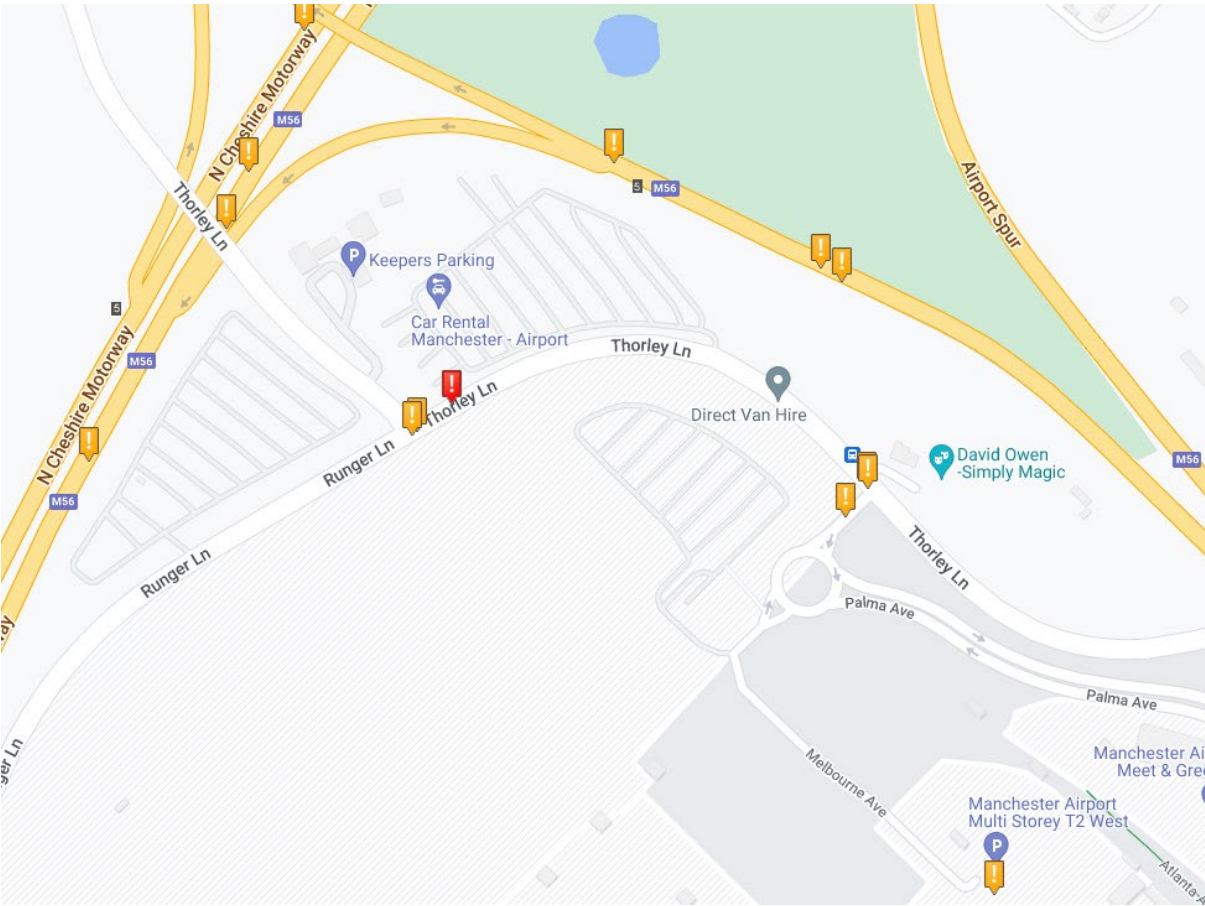
3.4.2 Ground Transport Interchange

The Manchester Airport Ground Transport Interchange provides further public transport including heavy and light rail, bus, and coach services.

3.5 Road Safety

STATS19 data of the five year period 2018 – 2022 has been obtained from the CrashMap³ website for the highway network in the vicinity of the proposed link road. This will provide information on the safety of the west of Manchester Airport at the site of the additional link road. Injury collisions occurring on the nearby highway network are shown in Figure 3-4 below.

³ www.crashmap.co.uk



(Source: www.crashmap.co.uk ©2024, Contains public sector information licensed under the Open Government Licence v3.0)

Figure 3-4 Injury Accident Data

A summary of the injury accidents is shown in Table 3-1 below.

Table 3-1 Injury Accident Summary

Severity	Number of Collisions
Slight	5
Severe	1
Fatal	0
Total	6

As shown in Table 3-1, between Thorley Lane and Palma Avenue roundabout there have a total of 6 collisions. Of the total, five are slight injuries with one serious. There were no fatalities. All the accidents have occurred at junctions, with three at the Sydney Avenue / Thorley Lane junction and three at the Thorley Lane / Runger Lane junction, of which one resulted in a serious injury. However, this level of collisions would not suggest and underlying road safety issue which the proposed link road would exacerbate.

The two junctions are currently priority controlled. The proposals include the installation of traffic signals at the Thorley Lane / Runger Lane junction and the new junction between Thorley Lane and the new link road. The introduction of traffic signals allows better management of conflict and there the level of incidents may decrease because of the development.

4. Modelling Suite

4.1 Modelling Suite

There are four components to the modelling suite used in the assessment of the project. They are as follows:

- Demand Model
- Microsimulation Model
- LinSig Model

The sections below provide further detail regarding each of these models.

4.2 Demand Model

A spreadsheet-based demand model was used to provide demand for the Vissim model. This demand model has been updated by AECOM to reflect the current local conditions. On top of background growth, it takes flight passenger demand and generates corresponding traffic demand by applying factors and splits created from the cordon data (ANPR cameras on key roads in the airport site) and CAA data (taken from passenger surveys undertaken within the terminal) including the following:

- Proportion of journey purpose by flight time
- Proportion of lead time
- Modal splits on accessing the airport
- Number of passengers per vehicle by flight haul
- Primary trips access across the airport site
- Drop off/pick up vehicle splits
- Hourly splits of staff arriving at airport
- Proportion of Sydney Avenue to/from external access points
- Proportion of World Way to/from external access points
- Proportion of Outwood Lane to/from external access points
- Proportion of Ringway Road to/from external access points

4.3 Microsimulation Model

For the original MAN-TP proposals a microsimulation model was developed using PTV Vissim in 2015. Since then, the model has been improved and updated to reflect the evolving MAN-TP. The latest version of the model was produced in 2019 using a combination of online aerial photography and a site visit.

The microsimulation model used has been based on the previous model developed by Jacobs for the previous PP11 work in 2019, known as Model 7. At this point, due to high levels of uncertainty regarding the background data within the model, it was removed from the model. The Vissim model therefore currently only models the T2 landside network in detail. It has subsequently been migrated to operate in PTV Vissim version 2023 Service Pack 14 and is now known as Model 8.

The models have been built to simulate the Airport Peak (05:00 – 06:00), AM peak (08:00 – 09:00) and PM Peak (17:00 – 18:00) for a Thursday in August when passenger demand is predicted (based on flight schedules) to be at its highest.

To producing reliable outputs and for ensuring that the appropriate volumes of traffic are entering and exiting the model, a 15-minute warmup and 15-minute cool down period have been included in the modelling periods.

4.3.1 2023 Traffic Survey and Benchmarking

It is key for every traffic model to reflect the local conditions of the road network. To achieve this, a base model is calibrated and validated to observed data. The base model upon which this work is based is historic. Therefore, to ensure that the model is still fit-for-purpose, a 2023 Present Year Validation" (PYV) exercise has been undertaken for locations on the T2 landside network. The principle was that if a forecast model based on a historic base model produces results, which are consistent with observed data, then the model can be considered reliable. This process has been undertaken using the demand model and microsimulation model for Spring 2023.

To inform the PYV, a set of survey information was required to validate the modelling outputs. For the purposes of the development of this model, the following sources of information and traffic were used:

- Automatic Traffic Counts (ATC) data
- Manual Classified Count (MCC) data

The existing operation of the study area network has been obtained from recent surveys undertaken on site by Nationwide Data Collection (NDC) in March and April 2023.

The traffic survey by NDC collected ATC and MCC data over a 4-day period between Thursday 30th March 2023 and Sunday 2nd April 2023. These surveys covered the 24-hours period across each day, enabling the team to identify the typical AM peak and apply in the Vissim model. The location of these traffic surveys can be observed in Figure 4-1 below.

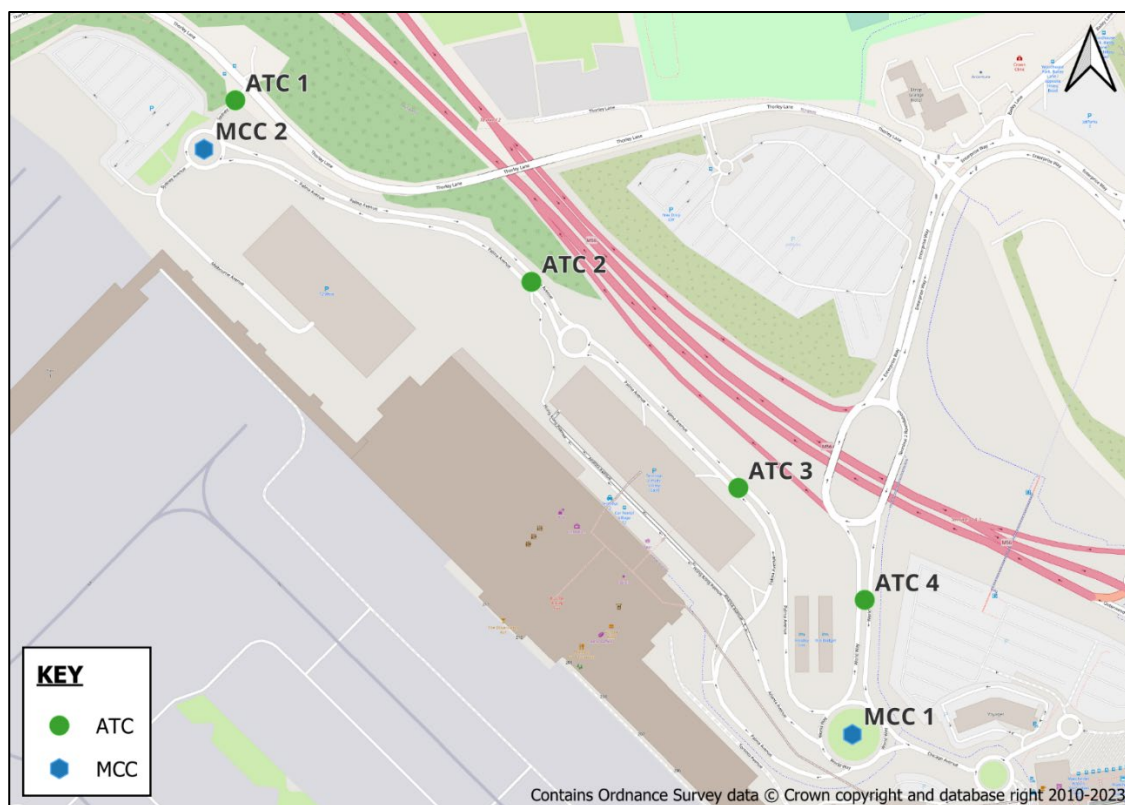


Figure 4-1 Location of 2023 Traffic Surveys

Model benchmarking has been based on guidelines from Transport Analysis Guidance (TAG) and extended using Transport for London (TfL) Modelling Guidelines. TAG Unit M3.14 contains two sets of measures to assess flow calibration and validation, and these are as follows:

⁴ Department for Transport TAG Unit M3.1 – Highway Assignment Modelling (2020) [Online] Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/938864/tag-m3-1-highway-assignment-modelling.pdf [Accessed: August 2024]

- Absolute and percentage differences between modelled flows and observed counts; and
- GEH statistic:

$$GEH = \sqrt{\frac{(M - C)^2}{(M + C)/2}}$$

Where M is the modelled and C is the observed data.

The benchmarking criteria and guidelines to compare modelled and observed data for link flows and turning movements are shown in Table 4-1 below.

Table 4-1 Present Year Validation Criteria

Criteria	Description of Criteria	Guideline
1	Individual flows within 100 veh/h of counts for flows less than 700 veh/h	> 85% of cases
	Individual flows within 15% of counts for flows from 700 to 2,700 veh/h	
	Individual flows within 400 veh/h of counts for flows more than 2,700 veh/h	
2	GEH < 5 for individual flows	> 85% of cases

The GEH statistic is a form of the Chi-squared statistic that incorporates both relative and absolute errors. This means that it is more tolerant of large percentage differences at lower population values, which is particularly useful when analysing traffic flows, where a large difference in a small flow is not necessarily significant, whereas a large difference in a larger flow would be of concern. TAG states that a GEH of less than 5 is favourable.

Table 4-2 below presents a summary of the results to the Present Year Validation Exercise

Table 4-2 Present Year Validation Summary

Time	Link flows		Turning Movements: Flag Roundabout		Turning Movements: West End Roundabout		Pass Rate
	Number of Links	Number of Passes	Number of Movements	Number of Passes	Number of Movements	Number of Passes	
04:30	8	8	16	16	12	12	100%
04:45	8	8	16	16	12	12	100%
05:00	8	8	16	16	12	12	100%
05:15	8	8	16	16	12	12	100%
05:30	8	8	16	16	12	12	100%
05:45	8	8	16	16	12	12	100%
06:00	8	8	16	16	12	12	100%
06:15	8	8	16	16	12	12	100%
06:30	8	8	16	16	12	12	100%
06:45	8	8	16	16	12	12	100%
07:00	8	8	16	16	12	12	100%
07:15	8	8	16	16	12	12	100%
07:30	8	8	16	16	12	12	100%
07:45	8	8	16	16	12	12	100%

Time	Link flows		Turning Movements: Flag Roundabout		Turning Movements: West End Roundabout		Pass Rate
	Number of Links	Number of Passes	Number of Movements	Number of Passes	Number of Movements	Number of Passes	
08:00	8	8	16	16	12	12	100%
08:15	8	8	16	16	12	12	100%

The benchmarking results achieved by the model show that the model produces a reasonable approximation of observed traffic conditions. However, the validation was only undertaken using sites within the airport's landside network. No validation was undertaken for locations on the external highway network.

Full details of the Present Year Validation can be found in Appendix H.

4.4 LinSig Model

A LinSig3 model of the proposed new signalised Thorley Lane / Runger Lane/ New Link Road junction has been produced to assess whether it would operate within its theoretical capacity. A key metric from LinSig is the degree of saturation. Measured as a percentage it is an indication of the operation of a signalised arm of a junction. A value of below 90% suggests the link is operating within its theoretical capacity. Values between 90% and 100% approaching or at theoretical capacity and values over 100% above capacity.

LinSig can only replicate the operation of fixed-time signals, whereas the signals which will be installed will be vehicle actuated and therefore able to better manage queues. LinSig therefore will underestimate the capacity of the junction.

The LinSig model used in the assessment was provided by TfGM on the 26th April 2024. The flows have since been updated using the Vissim model node data and the traffic survey data referenced in Section 5.1.1, for the Airport Peak (05:00 – 06:00), AM peak (08:00 – 09:00) and PM Peak (17:00 – 18:00).

5. Data Collection

5.1.1 July 2024 Traffic Surveys

Traffic surveys were carried out to gain accurate data regarding current traffic volumes within the study area. The traffic surveys include Automatic Number Plate Recognition (ANPR), Speed Survey and Non-Motorised User (NMU) survey. The ANPR and NMU survey covered a 16-hour period (04:00 – 20:00) capturing a Thursday in August 2024. The Speed survey was an Automatic Traffic Count (ATC) carried out over a week in August 2024.

Automatic Number Plate Recognition (ANPR) - ANPR surveys have been recorded using high-definition cameras mounted on street furniture covering all vehicle movements within the proposed ANPR boundary shown in Figure 5-1.

Speed Survey - The speed survey was situated along Thorley Lane (See Figure 5-1) to understand the observed speeds of motorists travelling this route. The Speed survey specifies the Average and 85th percentile speeds which was used to determine speed limit and visibility. The Speed Survey was not used as part of the assessment in this Transport Statement.

Non-Motorised User (NMU) - NMU surveys were conducted on the crossings into Thorley Lane A and B Car parks along Runger Lane and Thorley Lane (See Figure 5-1). The NMU surveys were recorded using high-definition cameras mounted on street furniture, identifying flows of NMUs in both directions. The NMU survey was not used as part of the assessment in this Transport Statement as the pedestrian phases are now called in every cycle of the signal timings.

Figure 5-1 shows the location of the traffic surveys.



Figure 5-1 Overview of traffic survey locations

6. Demand Derivation

6.1 Introduction

This section sets out the various processes undertaken to derive demand data for both background – non airport related traffic and traffic relating to a trip to Terminal 2. Flow diagrams setting out the flows at each stage can be found at Appendices E to G.

6.2 Background Traffic

Background traffic in this context is defined as that which does not have an origin or destination at the airport. The demand is derived from the ANPR Traffic survey data. Several stages are required to process the ANPR data from its raw form to be able to be used within the traffic modelling work. The stages for processing background traffic are shown in Figure 6-1 below.

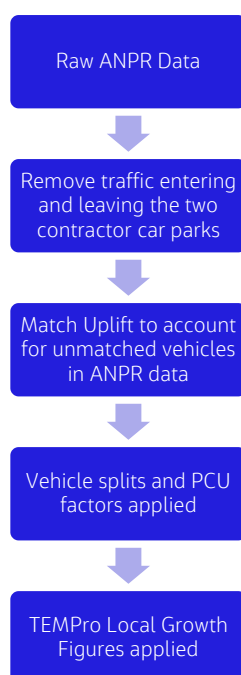


Figure 6-1 Background Traffic Data Processing stages

6.2.1 Match Uplifting

The ANPR data was matched uplifted by 13.77% to account for the number of vehicles that didn't have their number plates matched when entering and leaving the ANPR cordon. Table 6-1 shows the total number of vehicles and the total matched/unmatched number plates captured in the ANPR survey.

Table 6-1 Total Matched Number Plates in ANPR Survey

Total Vehicles	Total Matched Vehicles	Total Matched Percentage	Total Unmatched Percentage
43,112	32,616	86.23%	13.77%

6.2.2 Vehicle Split and PCU Factors

The ANPR data was also used to calculate the percentage vehicle split and produce the PCU factored matrices. Vehicle splits have been derived from the data for Car/LGV, PSV and OGV1/OGV2. PCU values

corresponding these vehicle classes have been applied based on the values contained within the TfL modelling guidelines⁵. Table 6-2 shows the PCU values and the percentage split of the vehicle types.

Table 6-2 Vehicle Splits and PCU values

Vehicle Type	PCU Value	Percentage Split from ANPR data
Cars/LGVs (Light Goods Vehicle)	1	95.26%
Public Service Vehicles (PSV)	2	3.70%
OGV 1 & OGV2 (Heavy Goods Vehicles)	2.3	1.04%

The values in Table 6-2, have been applied to the ANPR data to convert the number of vehicles into PCUs for use in the LinSig model.

6.2.3 TEMPro Growth

Once the ANPR data had been processed and the PCU matrices created, growth factors were applied from TEMPro 8.0 to take demand from 2024 to that which is predicted in 2026 and 2030. The average morning and evening hour (07:00-10:00 & 16:00 – 19:00) growth factors for car drivers between 2024 and the forecast years 2026 and 2030 were extracted for the TEMPro zone E02001097 corresponding to the Manchester Airport area. The TEMPro Core Scenario data set was used to calculate the Local Growth Figures. Table 6-3 TEMPro Growth Factors shows the assessment scenarios and the corresponding Local Growth Figures.

Table 6-3 TEMPro Growth Factors

Assessment Scenarios	TEMPro Time Period Used	Local Growth Figure
2026 Do-something Airport Peak (05:00 – 06:00)	2024 - 2026 Weekday off peak period (0000 - 0659 and 1900 - 2359)	1.0155
2026 Do-something AM Peak (08:00 – 09:00)	2024 – 2026 Weekday AM peak period (07:00 – 09:59)	1.0176
2026 Do-something PM Peak (17:00 – 18:00)	2024 - 2026 Weekday PM peak period (16:00 – 18:59)	1.0171
2030 Do-something Airport Peak (05:00 – 06:00)	2024 - 2030 Weekday off peak period (0000 - 0659 and 1900 - 2359)	1.0605
2030 Do-something AM Peak (08:00 – 09:00)	2024 - 2030 Weekday AM peak period (0700 - 0959)	1.0644
2030 Do-something PM Peak (17:00 – 18:00)	2024 - 2030 Weekday PM peak period (1600 - 1859)	1.0629

⁵ <https://content.tfl.gov.uk/traffic-modelling-guidelines.pdf> Accessed: 09/08/2024

6.3 Airport Demand

Demand for airport traffic is based upon summer flight schedules for 2026 and 2036, for the busiest forecast period of airport operation – the last weekend in August. These flight schedules were input into the demand model with resulting outputs inserted into the Vissim model.

The 2030 demand was derived interpolating between 2026 and 2036 arrival and departure figures, which results in a year-on-year increase of 2.3% of 2026 demand.

The passenger numbers for each demand scenario are presented in Table 6-4 below.

Table 6-4 Flight Schedule Passenger Numbers Summary

Trip Type	2026	2030
Arrival	57,751	63,250
Departure	58,270	63,818
Total	116,021	127,068
Percentage change from 2026		9.5%

As T2 was operational at the time during which the traffic surveys were undertaken, it is reasonable to conclude that a proportion of the traffic recorded was associated with a flight from T2. Many if not all these flights are also contained within the 2026 and 2030 flight schedule. The airport demand which is output from the demand model contains trips for all flights associated with T2, therefore if this demand was simply added to the background demand, then there would be doubling counting of demand associated with flights that operate in 2024 and 2026/2030. To address this the flight schedules for each year have been interrogated to identify an appropriate factor by which to reduce the airport traffic to remove this double counting, this is presented in Table 6-5.

Table 6-5 T2 PAX numbers for 2024, 2026 and 2030

Data Years	T2	Percentage of accounted for traffic in 2024 (%)	Percentage of future year traffic in 2024 (%)
2024	60887		
2026	88322	68.9%	31.1%
2030	97918	62.2%	37.8%

Table 6-5 shows that there is 68.9% of traffic in the 2026 demand that will be accounted for in the trips to T2 in 2024 and 62.2% in 2030. This means that in 2026 and 2030 respectively, there is 31.1 and 37.8% of traffic that is additional unaccounted for traffic. Therefore, these percentages have been applied to the total airport demand and added on top of the background demand.

7. Development Impact

7.1 Assessment scenarios

The following three scenarios have been assessed:

- 2026 Do Minimum Scenario – existing Sydney Avenue
- 2026 Do Something Scenario – proposed new road, closure of existing Sydney Avenue, signalising Runger Lane/Thorley Lane junction
- 2030 Do Something Scenario – proposed new road, closure of existing Sydney Avenue, signalising Runger Lane/Thorley Lane junction

The scenarios have been created by adding the resultant airport demand set out in Section 2.1 to the background demand for the same scenario. Flow diagrams showing the flows in each scenario can be found in Appendix H.

7.2 Modelling Results

7.2.1 2026 Do-minimum – Existing Sydney Avenue

7.2.1.1 Speed

Figure 7-1 below contains a plot of the modelled highway network (including the current alignment of Sydney Avenue), showing the average speed recorded during the AM Peak period of 08:00 – 09:00.

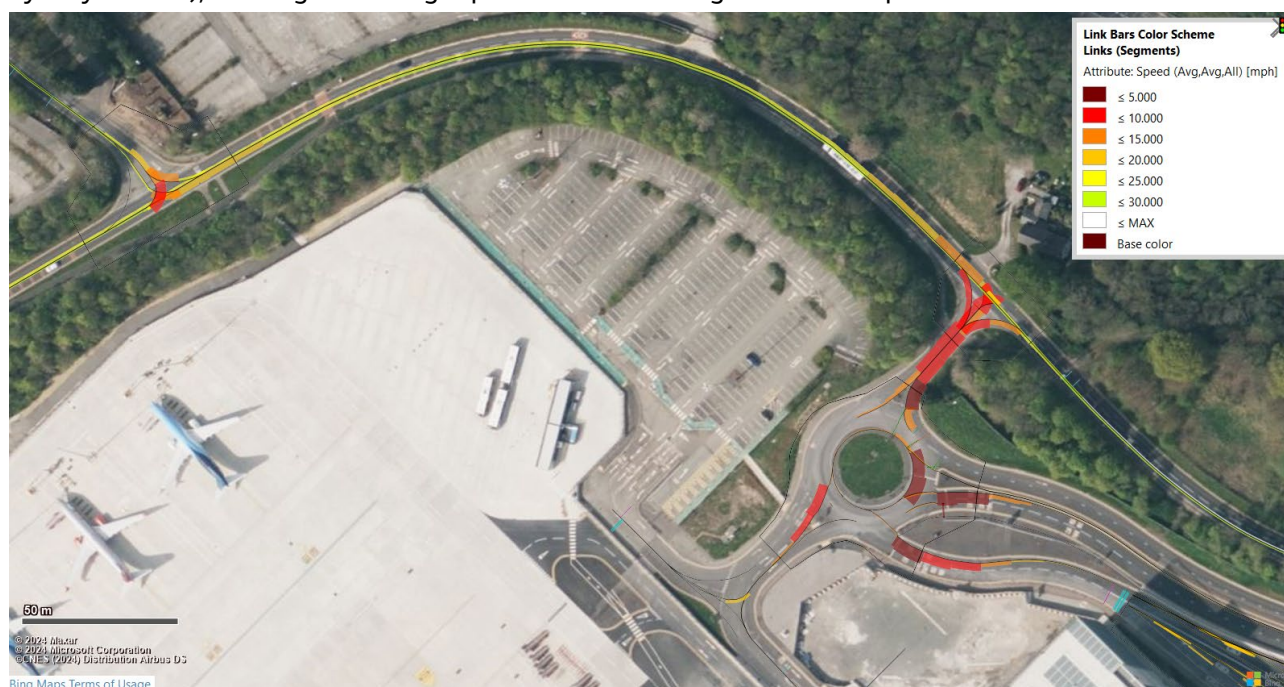


Figure 7-1 Average Modelled Vehicle Speeds – 2026 Do-minimum (08:00 – 09:00)

As can be seen from Figure 7-1, speeds across the morning peak period are typically under 25mph, in many cases under 10mph and some cases under 5mph. This is below what would be expected for roads with a 20mph or 30mph limit, indicating the network is congested.

7.2.1.2 Queue Lengths

Average and Maximum Queue lengths have been extracted from the model for each end of Sydney Avenue. Table 7-1 below present the results for the Sydney Avenue at the junction with Thorley Lane.

Table 7-1 Queue Lengths at Sydney Avenue Junction with Thorley Lane

Time Period	Average Queue Length (m)	Maximum Queue Length (m)
Airport Peak 05:00 – 06:00	0.59	43.26
AM Peak 08:00 – 09:00	4.77	85.92
PM Peak 17:00 – 18:00	1.34	52.59

As can be seen in Table 7-1 average queue lengths are shorter than the length of Sydney Avenue – approximately 40 metres. However, the maximum queue lengths are longer – up to 85 metres indicating that the queue does stretch back into the West End Roundabout, causing congestion.

Table 7-2 shows the corresponding results for the junction of Sydney Avenue and the West End Roundabout.

Table 7-2 Queue Lengths at Sydney Avenue Junction with West End Roundabout

Time Period	Average Queue Length(m)	Maximum Queue Length (m)
Airport Peak 05:00 – 06:00	2.18	53.17
AM Peak 08:00 – 09:00	7.30	122.04
PM Peak 17:00 – 18:00	5.90	106.21

As can be seen in Table 7-2 average queue lengths are shorter than the length of Sydney Avenue. However, the maximum queue lengths are longer – up to 122 metres, indicated they extend into Thorley Lane and will block through traffic.

7.2.2 Summary

The metrics extracted from the model presented above indicate that the network is experiencing congestion in the AM peak period, with vehicle speeds typically below 25mph on links in the study area. Modelled queue lengths indicate that congestion interferes with other junctions in the study area. Therefore, additional highway capacity is required to accommodate the additional demand generated by MAN-TP.

7.3 2026 Do-something – Proposed New Road, Closure of Existing Sydney Avenue, new signalised Runger Lane/Thorley Lane junction

7.3.1 LinSig Results

The LinSig results for the 2026 Do-something scenario are presented in Table 7-3. Full LinSig result outputs can be found in Appendix I.

Table 7-3 LinSig Results – 2026 Do-something

Junction	Arm	Airport Peak		AM Peak		PM Peak	
		05:00 – 06:00		08:00 – 09:00		17:00 – 18:00	
		Degree of Saturation (%)	Mean Max Queue (pcu)	Degree of Saturation (%)	Mean Max Queue (pcu)	Degree of Saturation (%)	Mean Max Queue (pcu)
Thorley Lane / New Link	Thorley Lane (N)	38.2	6.0	85.6	22.7	66.0	13.4
	New Link	37.0	6.9	73.1	10.9	57.2	8.1

Junction	Arm	Airport Peak		AM Peak		PM Peak	
		05:00 – 06:00		08:00 – 09:00		17:00 – 18:00	
		Degree of Saturation (%)	Mean Max Queue (pcu)	Degree of Saturation (%)	Mean Max Queue (pcu)	Degree of Saturation (%)	Mean Max Queue (pcu)
	Thorley Lane (S)	19.1	0.2	35.5	1.4	35.7	0.6
Thorley Lane / Runger Lane	Thorley Lane (N)	23.4	0.2	56.9	9.1	40.2	2.0
	Runger Lane	26.1	4.4	52.1	11.1	54.9	11.3
	Thorley Lane (W)	38.7	3.0	84.2	14.0	66.6	10.4

The results in Table 7-3 indicate that all arms of the junction will operate within theoretical capacity across all time periods. The following arms, Thorley Lane (N) and Thorley Lane (W), are predicted to operate close to capacity between 08:00 and 09:00 (AM Peak).

As previously noted, these modelling results are based on fixed signal timings, whereas the signals would be able to amend timings to manage queues. In addition, these results are based on the busiest forecast period of airport operation and therefore represent a reasonable worst-case scenario.

7.4 2030 Do-something – proposed new road, closure of existing Sydney Avenue, signalling Runger Lane/Thorley Lane junction

7.4.1 LinSig Results

The LinSig results for the 2030 Do-something scenario are presented in Table 7-4. Full LinSig result outputs can be found in Appendix I.

Junction	Arm	Airport Peak		AM Peak		PM Peak	
		05:00 – 06:00		08:00 – 09:00		17:00 – 18:00	
		Degree of Saturation (%)	Mean Max Queue (pcu)	Degree of Saturation (%)	Mean Max Queue (pcu)	Degree of Saturation (%)	Mean Max Queue (pcu)
Thorley Lane / New Link	Thorley Lane (N)	42.9	6.7	90.4	25.8	69.9	14.4
	New Link	43.8	8.5	84.6	13.2	69.5	9.8
	Thorley Lane (S)	21.5	0.2	38.1	2.2	37.9	0.7
Thorley Lane / Runger Lane	Thorley Lane (N)	25.3	0.2	67.1	10.1	43.1	4.2
	Runger Lane	29.5	5.0	55.2	11.9	58.5	12.2

Junction	Arm	Airport Peak		AM Peak		PM Peak	
		05:00 – 06:00		08:00 – 09:00		17:00 – 18:00	
		Degree of Saturation (%)	Mean Max Queue (pcu)	Degree of Saturation (%)	Mean Max Queue (pcu)	Degree of Saturation (%)	Mean Max Queue (pcu)
	Thorley Lane (W)	41.3	3.3	91.9	16.9	69.8	11.1

Table 7-4 LinSig Results – 2030 Do-something

The results in Table 7-4 show that both junctions are predicted to operate within but approaching capacity, specifically on arms Thorley Lane (N) and Thorley Lane (W) between 08:00 – 09:00 (AM Peak).

As previously noted, these modelling results are based on fixed signal timings, whereas the signals would be able to amend timings to manage queues. In addition, these results are based on the busiest forecast period of airport operation and therefore represent a reasonable worst-case scenario.

7.4.2 Summary

The modelling indicates that the junction will work within theoretical capacity in 2026 but approaching theoretical capacity in the AM Peak (08:00 – 09:00). Likewise, the junction is predicted to operate within theoretical capacity in 2030 Airport peak and PM peak, however, it is slightly over theoretical capacity in the AM Peak (08:00 – 09:00). The arms breaching theoretical capacity in the 2030 AM Peak are Thorley Lane (N) and Thorley Lane (W).

However, LinSig can only model fixed time signals, whereas vehicle actuated signals will be installed which will be able to dynamically control queues. The modelling is also based on the busiest period of airport operation during the school summer holidays for airport traffic and during a neutral period for the background traffic presenting a robust assessment. It is therefore inferred that this assessment represents a reasonable worst-case scenario, and the junction will operate within theoretical capacity for most of the time.

8. Conclusions and Recommendations

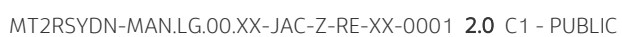
Manchester Airports Group (MAG) is nearing the completion of the Manchester Airport Transformation Programme (MAN-TP), a £1.3bn investment initiative aimed at enhancing passenger experiences and attracting more leading airlines. The project, announced in 2015, includes doubling the size of Terminal 2 (T2), refurbishing the original terminal, constructing two new aircraft piers, creating a state-of-the-art baggage hall, installing next-generation scanners in a new security hall, and upgrading the airfield and taxiways for next-generation aircraft. It also involves developing the landside road network for better terminal access and additional car parking.

A traffic modelling exercise has been conducted to assess the impact of increased traffic following the full opening of T2 in 2025. The study concluded that changes are needed to the road network at the western end of T2. The current layout anticipates the Sydney Avenue junction with Thorley Lane to be over capacity, causing queues extending into the West End Roundabout. The chosen solution is to close the existing short Sydney Avenue and construct a new link road/carriageway from the western side of the existing West End roundabout, connecting into Thorley Lane via a new signal-controlled junction.

Despite the broad extent of works within the project, planning permission is only being sought for the new means of access between the new link road and Thorley Lane.

Further junction modelling of the proposed solution has demonstrated that the junction operates at its theoretical capacity in the assessment year 2026 and slightly over the theoretical capacity in the 2030 AM Peak. Demand is for the busiest time of year in terms of airport operation – August - which is a non-neutral period for background traffic. It therefore represents a reasonable worst-case scenario. Notwithstanding this, the proposed solution represents a significant improvement compared to using the existing Sydney Avenue.

It is therefore concluded that there are no traffic or transport grounds upon which to withhold planning approval.



Appendix B. Stage 1 Road Safety Audit



MAG Landside / Sydney Avenue

Stage 1 Road Safety Audit

MAG42040

04 January 2024

Manchester Airport Group (MAG)



MAG Landside -Sydney Avenue

Project No: MAG42040
Document Title: Stage 1 Road Safety Audit
Document No.: MT2RSYDN-MAN.LG.00.ZZ-JAC-I-RE-XX-0002
Revision: 1.0
Date: 17 January 2024
Client Name: Manchester Airport Limited
Client No: N/A
Project Manager: Nathali Lekam
Author: Barry Smith
File Name: MT2RSYDN-MAN.LG.00.ZZ-JAC-I-RE-XX-0002

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Document history and status

Revision	Date	Description	Author	Checked	Reviewed	Approved
1.0	17.01.2024	Stage 1 RSA	BS	SM	SM	LW

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1. Introduction

Table 1-1 Project details and Introduction

Road Safety Audit (RSA)	
Report Title	MAG Landside - Sydney Avenue Stage 1 RSA
Date	17/01/2024
Document reference and revision	MT2RSYDN-MAN.LG.00.ZZ-JAC-I-RE-XX-0002
Prepared by:	Barry Smith
On behalf of:	Manchester Airport Group (MAG)

Jacobs UK Limited has been commissioned by Manchester Airport Group (MAG) to undertake a Stage 1 Road Safety Audit (RSA) on the proposed changes at Sydney Avenue, Manchester Airport (Landside).

1.1 Background

This report results from a stage1 Road Safety Audit (RSA) carried out at Manchester Airport (Landside) on the 20th December 2023, in accordance with the Design Manual for Roads and Bridges (DMRB) General Principles and Scheme Governance General Information GG 119, Revision 2.

The RSA has been undertaken at the request of John Cross / Nathali Lekam (both Jacobs), on behalf of Manchester Airport Group (MAG) who has approved both the RSA brief and Audit Team. The RSA team (see section 1.5) have accepted the brief.

1.2 General

Highway network to facilitate the recent expansion and development of Terminal 2. New highway alignment and amendments to the existing network. The proposed Sydney Avenue Link is a 200m long section of new single-lane carriageway, designed to replace the existing Sydney Avenue. The proposed Sydney Avenue link is required to provide the resilience for the anticipated increase in the traffic flows, when the expansion of Terminal 2 is completed in April 2025. The link is located to the north-west of Terminal 2.

The Sydney Avenue link to tie-ins on the eastern extends with the West End Roundabout and runs through the existing Staff West car park, joining Thorley Lane and extension of the existing Thorley Lane/Runger Lane junction into a signalled control junction at the western tie-in.

The highway design is to meet the RIBA requirements for Stage 3. This includes the preliminary design of the highway alignment, cross sections, long sections, road restraint and pedestrian guardrail, fencing, kerbs, footways and paved areas, traffic signage and road markings.

The highway design includes the addition of a new link between the West End Roundabout and Thorley Lane, with a signalised junction, and the upgrading of the junction of Thorley Lane and Runger Lane to a signalised junction. In addition to this, a new vehicle entrance to the Staff West car park has been proposed off the West-End Roundabout.

The scheme proposes to upgrade NMU provision on Thorley Lane by the introduction of a 3m wide shared footway/cycleway, which will start at the existing Sydney Ave tie-in with Thorley Lane and run in parallel with the carriageway past the junction of Thorley Lane and Runger Lane. In addition, the Sydney Ave link will have a 3m wide footway/cycleway over the full length, on the southern side.

1.3 Audit Management

The Overseeing organisation will be responsible for ensuring the Road Safety Audit (RSA) response report is completed. The RSA response report shall contain an RSA decision log to include a reiteration of each road safety problem and recommendation made in the RSA report (Appendix C). The RSA response report shall contain a response from the Overseeing Organisation and an RSA action for each problem agreed between the design organisation and Overseeing Organisation. The RSA response report shall be signed by the Overseeing Organisation and design organisation to indicate their agreement on the RSA actions and the RSA response report should be produced and finalised within one month of the issue of the RSA report.

Any other issues including those relating to maintenance which the Terms of Reference exclude from this report but which the Audit Team wishes to draw the attention of the overseeing organisation will be documented in a separate covering letter to this report.

1.4 Terms of Reference of the Audit

The Audit has been undertaken in accordance with the Audit Brief and based on GG 119, Revision 2 (Road Safety Audit) of the National Highway's Design Manual for Roads and Bridges. The Auditors have only examined and reported on the road safety implications of those aspects of the scheme detailed in the drawings/documentation listed in Appendix A. The scheme has not been examined or verified in the compliance of the design to any other criteria. The absence of comments should not be taken to imply compliance.

1.5 Audit Team

Table 1-2 The Audit Team

The Audit Team	Team Leader: Barry Smith BSc (Hons) CMILT MCIHT MSoRSA Dip ASM, Principal Road Safety Engineer (Certificate of Competency in Road Safety Audit gained in 2014).
	Team Member: Stephen McVeigh BSc CMILT MCIHT MSoRSA, Associate Director (Certificate of Competency in Road Safety Audit gained in November 2014).
Audit Observers	N/A
Departures from Standards	N/A
Audit desktop evaluation	Location: Jacobs Office Manchester First Street – December 2023
Site visit	Date: Wednesday 20 th December 2023 Time: 13:30 – 15:00 p.m. Weather: Raining and windy. Traffic conditions: Low volumes Road surface conditions: Wet Comment: N/A
Site visit during the hours of darkness	N/A

Each of the auditors' responses is classified as a 'Problem' that is likely to result in a significant road safety hazard. All comments and recommendations are referenced to the detailed design drawings and the locations have been indicated on the Plan in Appendix B.

Where recommendations are made these do not comprise design decisions, and it remains the responsibility of the Design Team to incorporate any changes into the scheme and consider any interactions between design elements.

1.6 Departures and Relaxations from Standard

The design has been produced in accordance with DMRB. Though the link road will fall under private land DMRB and Manchester City Council standards have also been considered.

The Audit brief received by the RSA team provided staged that there are four departures from DMRB standards.

Departure From Standard 1

Horizontal radius and SSD combination between Ch 0-30m on Thorley Road.

Departure From Standard 2

Standard horizontal alignment and superelevation between Ch 75-105 on new link road.

Departure From Standard 3

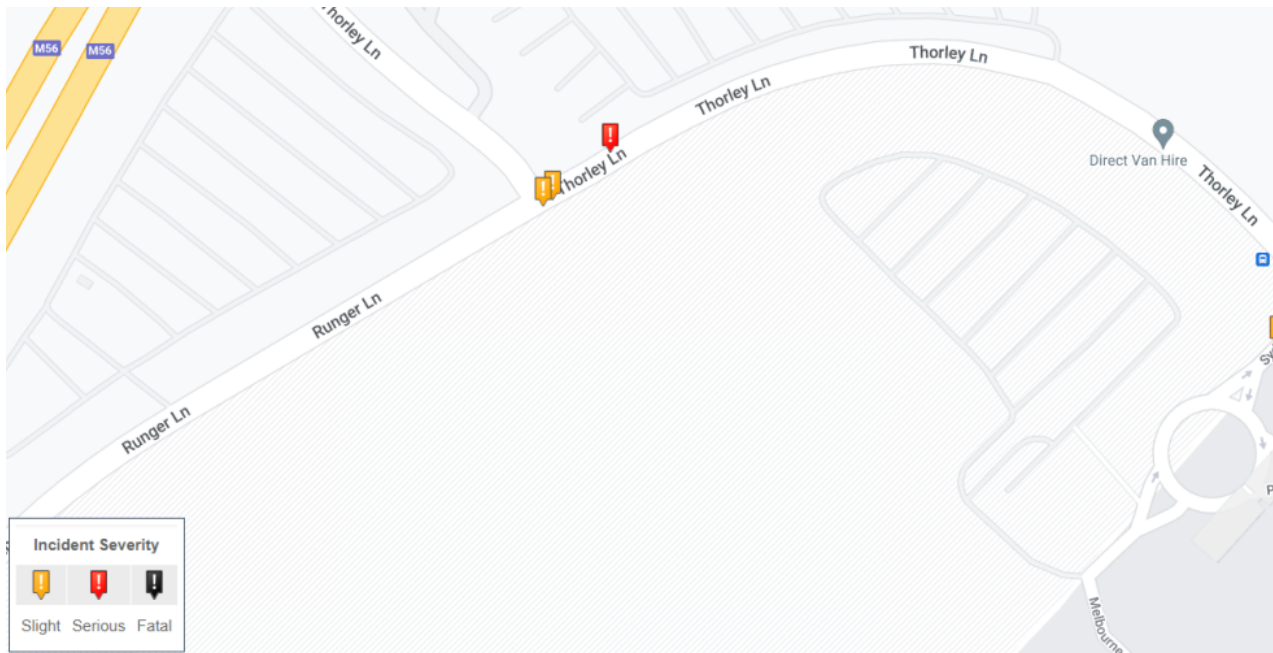
Vertical radius and SSD combination between Ch 165-185 on new link road

Departure From Standard 4

No transition curves are provided along the new link road.

1.7 Collision Data

Collision data in the brief (Doc No. MT2RSYDN-MAN.LG.00.RD-JAC-C-BR-LANDRD-0001) was obtained from CrashMaps from the last 5 years (dates not specified)



The data above is from 6No. incidents with the following information:

Date	Severity	No. of vehicles involved	No. of casualties involved
31/07/2018	Slight	2	2
12/05/2019	Slight	2	1
14/06/2019	Slight	3	2
22/09/2019	Slight	2	1
12/01/2020	Serious	1	1
12/11/2021	Slight	1	1

1.8 Documents Reviewed

Refer to Appendix A 'Audit Brief Documents'.

2. Items Raised at Previous Road Safety Audits

The RSA 1 brief confirmed that no previous Road Safety Audits have been carried out on the current proposals.

3. Items Raised at this Stage 1 Road Safety Audit

3.1 General

3.1.1 PROBLEM A1

Location: West End Roundabout and Thorley Lane

Summary: Lack of Cycle provision and clear direction signage may lead to cycle / pedestrian / vehicle conflicts.

Summary: As shown in Figure 1 below, there are two locations where cyclists are advised to dismount. The first location at the 'West End Roundabout' appears to allow cyclists to cycle across to the refuge (west to east) and then they are required to dismount halfway across the road on the refuge. Cyclists dismounting on the refuge may fall into the path of a vehicle or hit a pedestrian using the refuge. The Audit Team have not been provided with the eastern footway width at this location but from it appears to be a lot narrower than the shared use area on the western side. If a cyclists is allowed to cycle west to east to the refuge they are also likely to continue their journey east on their bike (not dismounting) which will lead to conflict with pedestrians on the eastern footway.

At Thorley Lane, southbound cyclists are advised to dismount if they want to continue their journey west and enter the airport, however, there are no dismount signage provision for northbound cyclists on Thorley Lane turning west into the airport. This creates confusion for cyclists and potential for them to continue their journey on the designated footway leading to the potential for cyclist and pedestrian conflict.

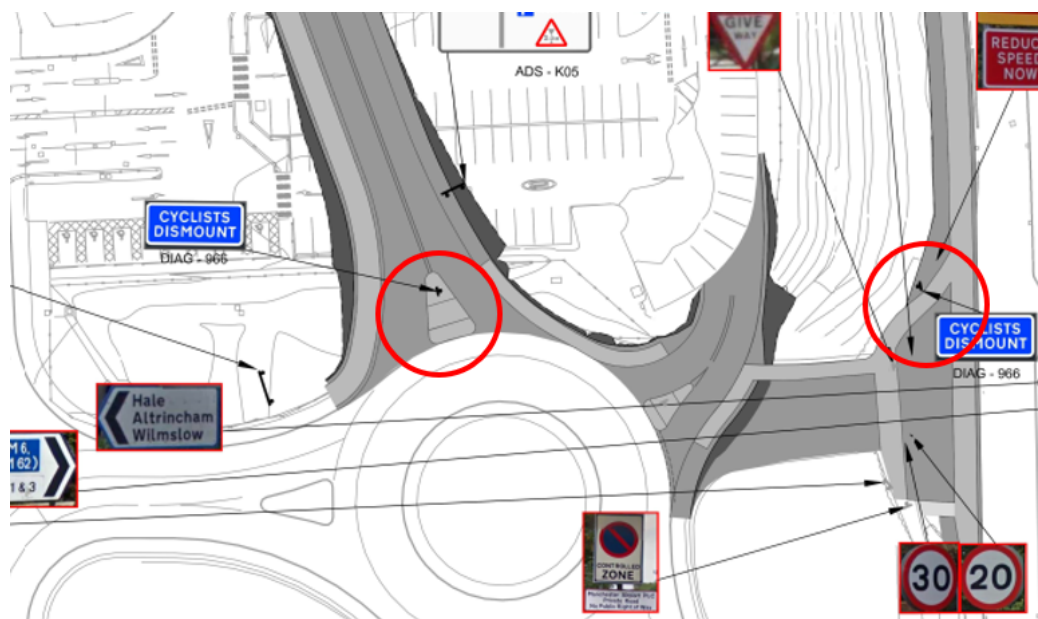


Figure 1 – showing the proposed combined right and left turn arrows

RECOMMENDATION

Provide clear pedestrian and cycle signage within the scheme linking into the areas outside the extents of the scheme ensuring that if cyclists are required to dismount, they can do so in a safe location. Where routes are designated as pedestrian only this should be clearly marked, and alternative cycle routes provided, marked and signed accordingly.

4. Audit Team Statement

We certify that we have examined the documents listed in this report. The examination has been carried out with the sole purpose of identifying any features of the design that could be removed or modified in order to improve the safety of the scheme. The problems identified in this report together with associated safety improvement suggestions that we recommend should be studied for implementation. No member of the audit team has been involved with the scheme design.

We certify that this Road Safety Audit has been carried out in accordance with GG 119, Revision 2.

Signed on behalf of Jacobs

Road Safety Audit Team Leader	
Name:	Barry Smith
Signed:	
Position:	Principal Road Safety Engineer
Organisation:	Jacobs
Address:	First Street, Manchester, M15 4GU
Date	17 th January 2024
Road Safety Audit Team Member	
Name:	Stephen McVeigh
Signed:	
Position:	Associate Director
Organisation:	Jacobs
Address:	First Street, Manchester, M15 4GU
Date	17 th January 2024

Appendix A. Drawings and Documents Provided for Road Safety Audit

Table A.1 – Supplied Documents

Document Number / Reference	Date / Version	Title
MT2RSYDN-MAN.LG.00.RD-JAC-C-BR-LANDRD-0001	18 th December 2023	Road Safety Audit Stage1 Brief

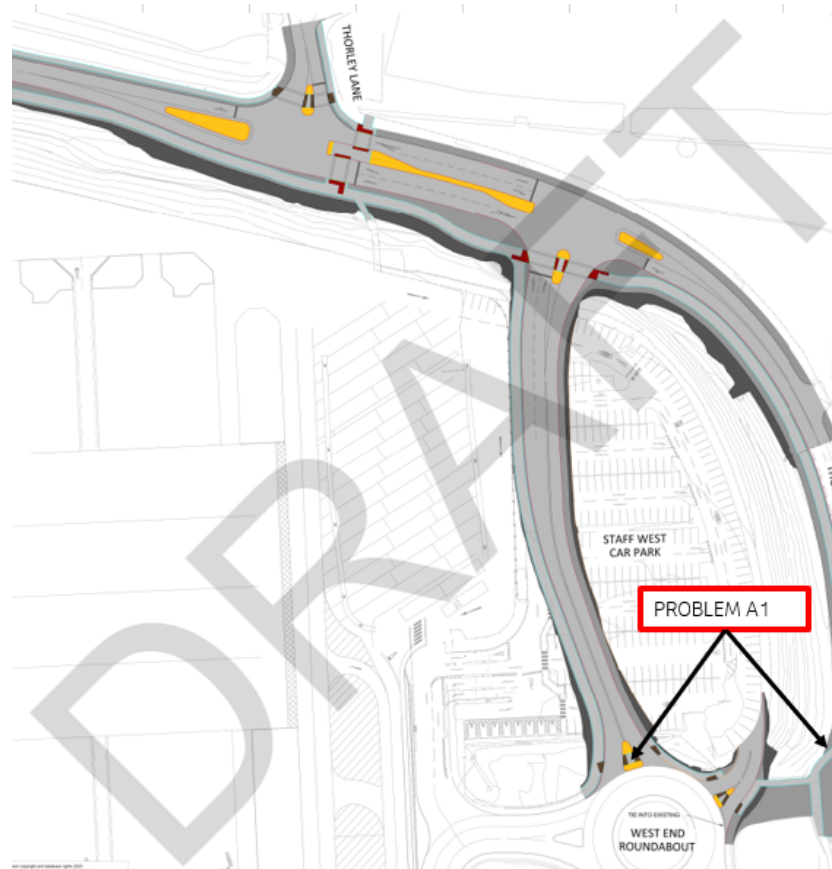
Table A.2 – Supplied Drawings

Drawing Number / Reference	Title
MT2RSYDN-MAN.LG.00.RD-JAC-C-GA-LANDRD-0001	General Arrangement Sheet 1 of 1
MT2RSYDN-MAN.LG.00.RD-JAC-C-GA-LANDRD-0006	Contours and Chainages Sheet 1 of 1
MT2RSYDN-MAN.LG.00.RD-JAC-C-GA-LANDRD-0002 to 0005	Long Section Sheets 1 to 4
MT2RSYDN-MAN.LG.00.RD-JAC-C-GA-LANDRD-0014 to 0021	Cross Section Sheets 1 to 8
MT2RSYDN-MAN.LG.00.RD-JAC-C-GA-PAINT-0001	Road Markings and Signs Sheet 1 of 1
MT2RSYDN-MAN.LG.00.RD-JAC-C-GA-SSIGN-0001	Road Sign Faces Sheet 1 of 1
MT2RSYDN-MAN.LG.00.RD-JAC-C-GA-LANDRD-0007	Fencing Sheet 1 of 1
MT2RSYDN-MAN.LG.00.RD-JAC-C-GA-KERBS-0001	Kerbs Footways and Paved Areas Sheet 1 of 1
MT2RSYDN-MAN.LG.00.RD-JAC-C-GA-LANDRD-0008	Road Restraint and Ped Guardrail Sheet 1 of 1

Table A.3 – Other Drawings

Drawing Number / Reference	Title
MT2RSYDN-MAN.LG.00.RD-JAC-C-RG-LANDRD-0001	Departures and Relaxations Schedule

Appendix B. Problem Location Plan



Appendix C. Safety Audit Feedback Form

Scheme: MAG Landside - Sydney Avenue

Audit Stage: Stage 1

Date Audit Completed: 17/01/2024

Paragraph No. in Report	To Be Completed by the Design Team			To Be Completed by the Audit Team
	Problem accepted (yes/no)	Recommended measure accepted (yes/no)	Alternative measures (describe)	Alternative Measures accepted by Auditors (yes/no)

Signed: Designer

Date:.....

Signed: Audit Team Leader

Date:

Signed: Client

Date:

Appendix C. Stage One Road Safety Audit – Designers Response

STAGE 1 RSA RESPONSE REPORT SYDNEY AVENUE

Document no: MT2RSYDN-MAN.LG.00.RD-JAC-C-RE-LANDRD-0003
Revision no: 1.0

Manchester Airport Ltd

MAG Landside - FI, SA & VCC
26/01/24



STAGE 1 RSA RESPONSE REPORT SYDNEY AVENUE

Client name: Manchester Airport Ltd

Project name: MAG Landside - FI, SA & VCC

Document no: MT2RSYDN-MAN.LG.00.RD-JAC-C-RE-LANDRD-0003

Revision no: 1.0

Date: 26/01/24

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Project manager: Nathali Lekam

Prepared by: Matt Jones

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1.0	26/01/24	FIRST ISSUE	JL	MJ	JC	LW

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1. Project Details

Table 1.1 – Project Details

Report title:	Road Safety Audit Response Report – Manchester Airport Sydney Avenue RSA Stage 1
Date:	26 th January 2024
Document reference and revision:	MT2RSYDN-MAN.LG.00.RD-JAC-C-RE-LANDRD-0003
Prepared by:	Jacobs U.K. Limited
On behalf of:	Manchester Airport Group

Table 1.2 – Authorisation Sheet

Project:	Sydney Avenue
Report title:	Road Safety Audit Response Report – Sydney Avenue
Prepared by:	
Name:	Matt Jones
Position:	Senior Highways Engineer
Signed:	
Organisation:	Jacobs U.K. Limited
Date:	26 th January 2024
Approved by:	
Name:	John Cross
Position:	Principal Highways Engineer
Signed:	
Organisation:	Jacobs U.K. Limited
Date:	26 th January 2024

2. Introduction

The proposed Sydney Avenue Link is a 200m long section of new single-lane carriageway, designed to replace the existing Sydney Avenue. The proposed Sydney Avenue Link is required to provide the resilience for the anticipated increase in the traffic flows, when the expansion of Terminal 2 is completed in April 2025. The link is located to the north-west of Terminal 2

The Sydney Avenue link to tie-ins on the eastern extents of the West End Roundabout and runs through the existing Staff West car park, joining Thorley Lane and extension of the existing Thorley Lane/Runger Lane junction into a signalled control junction at the western tie-in.

The highway design is to meet the RIBA requirements for Stage 3. This includes the preliminary design of the highway alignment, cross sections, long sections, road restraint and pedestrian guardrail, fencing, kerbs, footways and paved areas, traffic signage and road markings.

The highway design includes the addition of a new link between the West End Roundabout and Thorley Lane, with a signalised junction, and the upgrading of the junction of Thorley Lane and Runger Lane to a signalised junction. In addition to this, a new vehicle entrance to the Staff West car park has been proposed off the West-End Roundabout.

The scheme proposes to upgrade NMU provision on Thorley Lane by the introduction of a 3m wide shared footway/cycleway, which will start at the existing Sydney Ave tie-in with Thorley Lane and run in parallel with the carriageway past the junction of Thorley Lane and Runger Lane. In addition, the Sydney Ave link will have a 3m wide footway/cycleway over the full length, on the southern side.

3. Key Personnel

Table 3.1 – Key Personnel

Overseeing Organisation:	Geoff Jones Manchester Airport Group Olympic House, Manchester Airport, Manchester, M90 1QX geoff.jones2@magairports.com
RSA team:	Barry Smith Jacobs U.K. Limited 5 First Street, Manchester, M15 4GU barry.smith1@jacobs.com
Design organisation:	John Cross Jacobs U.K. Limited 5 First Street, Manchester, M15 4GU john.cross2@jacobs.com

4. Road Safety Audit Decision Log

Scheme: Sydney Avenue

Audit Stage: Stage 1 Road Safety Audit

Date Audit Completed: 20th December 2024

RSA ID	RSA Problem	RSA Recommendation	Design Organisation Response	Overseeing Organisation Response	Agreed RSA Action
A1	Location: West End Roundabout and Thorley Lane Summary: Lack of Cycle provision and clear direction signage may lead to cycle / pedestrian / vehicle conflicts. As shown in Figure 1 below, there are two locations where cyclists are advised to dismount. The first location at the 'West End Roundabout' appears to allow cyclists to cycle across to the refuge (west to east) and then they are required to dismount halfway across the road on the refuge. Cyclists dismounting on the refuge may fall into the path of a vehicle or hit a pedestrian using the refuge. The Audit Team have not been provided with the eastern footway width at this location but from it appears to be a lot narrower than the shared use area on the western side. If a cyclists is allowed to cycle west to east to the refuge they are also likely to continue their journey east on their bike (not dismounting) which will lead to conflict with pedestrians on the eastern footway. At Thorley Lane, southbound cyclists are advised to dismount if they want to continue their journey west and enter the airport, however, there are no dismount signage provision for northbound cyclists on Thorley Lane turning west into the airport. This creates confusion for cyclists and potential for them to continue their journey on the designated footway leading to the potential for cyclist and pedestrian conflict.	Provide clear pedestrian and cycle signage within the scheme linking into the areas outside the extents of the scheme ensuring that if cyclists are required to dismount, they can do so in a safe location. Where routes are designated as pedestrian only this should be clearly marked, and alternative cycle routes provided, marked and signed accordingly.	GG119 clause 4.16 Option 1 – accept the RSA problem and recommendation made by the RSA team: Locations of the cycling dismount positions will be reviewed during the detailed design stage, to incorporate the RSA recommendations.		

5. Design Organisation and Overseeing Organisation Statements

Table 5.1 – Design Organisation Statement

On behalf of the design organisation, I certify that: 1) The RSA actions identified in response to the road safety audit problems in this road safety audit have been discussed and agreed with the Overseeing Organisation.	
Name:	John Cross
Signed:	
Position:	Principal Highways Engineer
Organisation:	Jacobs U.K. Limited
Date:	26/01/2024

Table 5.2 – Overseeing Organisation Statement

On behalf of the Overseeing Organisation, I certify that: 1) The RSA actions identified in response to the road safety audit problems in this road safety audit have been discussed and agreed with the design organisation; and, 2) The agreed RSA actions will be progressed.	
Name:	Geoff Jones
Signed:	
Position:	
Organisation:	Manchester Airport Group
Date:	

Appendix A. Stage 1 RSA (MT2RSYDN-MAN.LG.00.ZZ-JAC-I-RE-XX-0002)

Appendix D. 2023 Survey and Benchmarking

2023 T2 Traffic Flows Benchmarking

Document no:
Revision no: Draft

Manchester Airport Group

PP11 Landside Option Study
9 May 2023



2023 T2 Traffic Flows Benchmarking

Client name: Manchester Airport Group
Project name: PP11 Landside Option Study
Client reference: [Client reference] **Project no:** MAG
Document no: [Document number] **Project manager:** Steven Roberts
Revision no: Draft **Prepared by:** Romualdo Garcia
Date: 9 May 2023 **File name:** 2023 T2 Traffic Flows Benchmarking Technical Note.docx
Doc status: [Doc suitability – Delete row if not applicable]

Document history and status

Revision	Date	Description	Author	Checked	Reviewed	Approved
01		First Draft	IK	RGC	JA	SR

Distribution of copies

Revision	Issue approved	Date issued	Issued to	Comments

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1. Introduction

1.1 Background

As part of the PP11 Landside Option Study, Jacobs has been commissioned by Manchester Airport Group (MAG) to develop a micro-simulation model of the Terminal 2 landside road network. The purpose of this modelling task is to understand the performance and operational issues related to the various proposed layout design to accommodate traffic generated by the vehicle demand of Manchester Airport. This report details the validation undertaken to demonstrate that the model reflects conditions and is therefore fit-for-purpose.

This model focus on the landside road network of Manchester Airport Terminal 2 between the elevated World Way Roundabout and Sydney Avenue junction, which are the junctions used by traffic generated from the M56, A6 MARR, Bailey Lane, Runger Lane and Thorley Lane. The study area is presented in Figure 1-1.

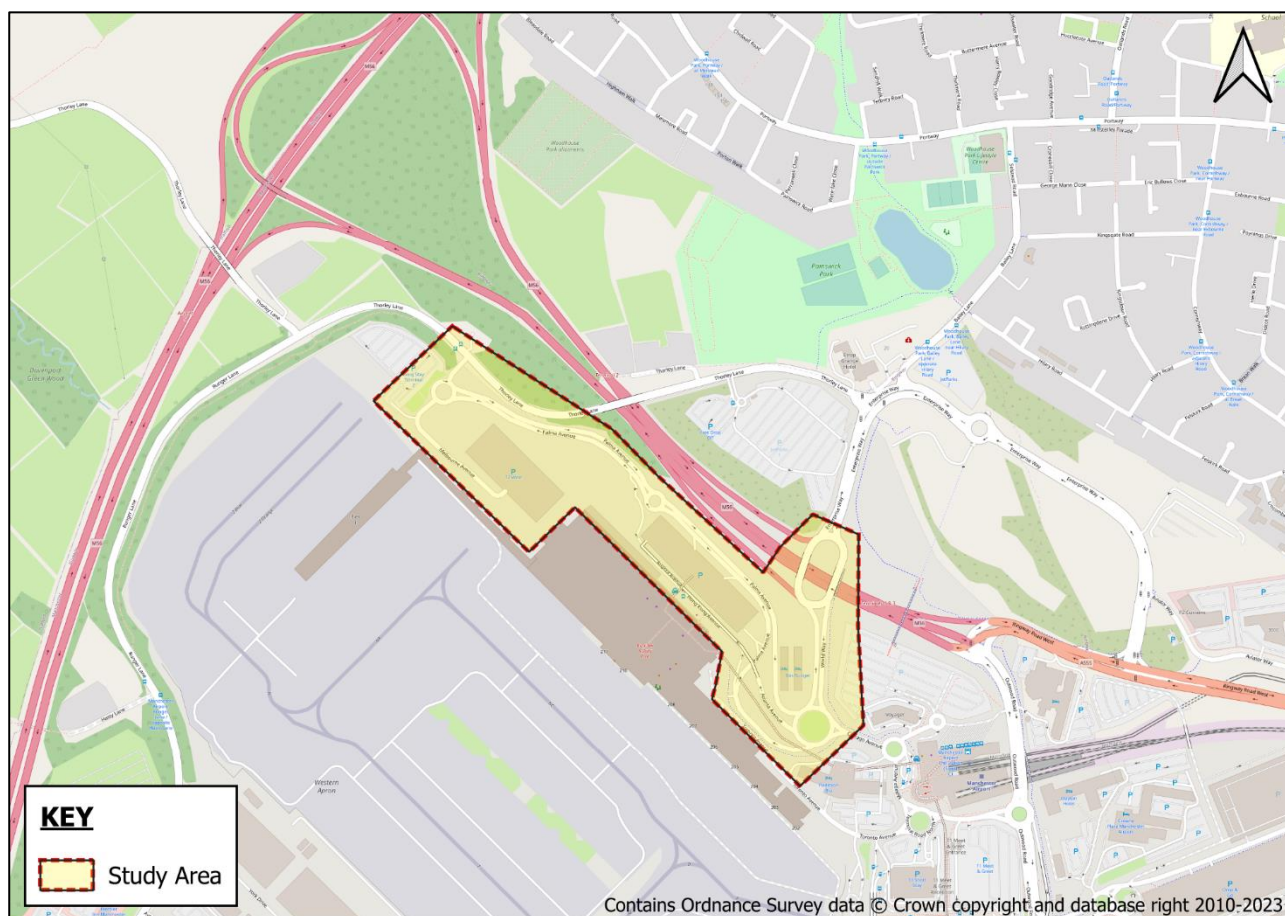


Figure 1-1. Study Area

1.2 Objectives

The objectives of the task are outlined as follows:

1. Coding requirements of the study area to replicate local conditions.
2. Review surveyed traffic data and assign demand within a base model for a peak weekday AM period.
3. Calibrate the base model to traffic flows and validate to available link and turning flow data.

A formal site visit was undertaken to inform the network checking and coding process, however most of the work was desktop based reliant on a combination of overhead photography, mapping data and CAD drawings where available.

1.3 Scope of Report

The remainder of this report is structured into the following sections:

- **Section 2** – Base Model Development
- **Section 3** – Traffic Surveys for Benchmarking
- **Section 4** – Model Benchmarking to observed flows
- **Section 5** – Summary and Conclusion

2. Base Model Development

2.1 Overview

2.1.1 Software Specification

The base model developed by Jacobs has been built using PTV Vissim version 2023 Service Pack 05. Global parameters have been contained within the software and have been kept at default unless otherwise stated in this report.

2.1.2 Base Model

The base model network is based upon the previous model developed in 2019 and updated with current infrastructure (2023) using online aerial photography and supplemented by drawings provided by the Jacobs Highways team and a site visit. Figure 2-1 shows the network coverage of the Terminal 2 Vissim Model.

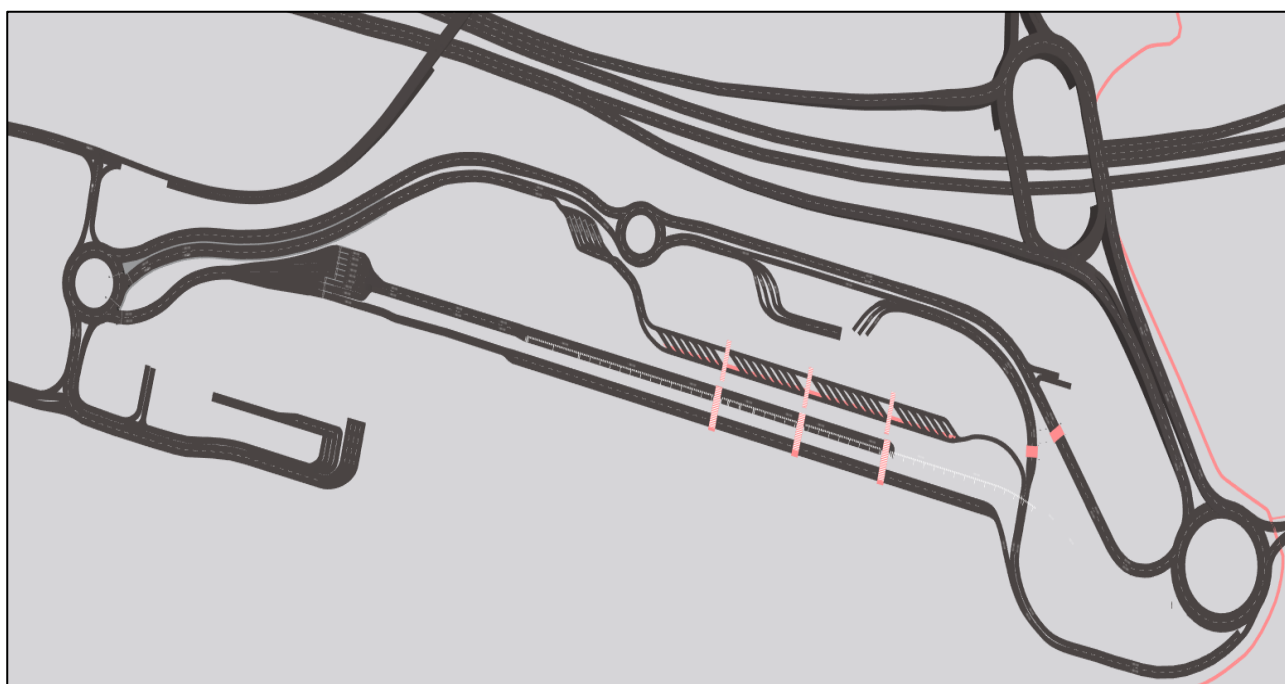


Figure 2-1. Extent of the Base Model

2.2 Model Parameters

This section will cover the model parameters and preliminary data used to develop the base model.

2.2.1 Model Base Year

This model has been built to provide a representation of current traffic conditions for 2023, which is defined as the base year, and provides a reliable starting point and reference for building further forecast models. This year was chosen on the basis that traffic surveys were undertaken in April 2023, and the adoption of this year therefore offered a best fit.

2.2.2 Model time Periods

The base model has been built to simulate the morning peak (AM) between 05:00 and 08:00 for a typical Friday when traffic levels are usually at their highest and result in the longest delays on the network. Analysis of 15-minute period traffic flow profiles was used to determine this AM peak period to be modelled. The modelled

peak periods were identified using 15-minute data from the traffic count surveys undertaken in April 2023. Further details of this traffic count survey are described in Section **Error! Reference source not found.**

For the purpose of producing reliable peak hours and for ensuring that the appropriate volumes of traffic are entering and exiting the model, a 30-minute warmup and 30-minute cool down period have been included in the modelling periods. Therefore, the following time periods have been identified for the AM peak period:

- Warm-up - 04:30 – 05:00
- Peak Hours – 05:00 – 08:00
- Cool down – 08:00 – 08:30

In the case of the warm-up period, this is used to populate the network with traffic prior to the peak hour evaluation period. The cool down period is used in the case of oversaturation. This is used to dissolve any of the queues that may have been created at intersections and need more time to clear.

2.2.3 Zoning Structure

All zones included in the Vissim model (airport sites and external sites, such as the M56 and Runger Lane) were identified following a review with MAG. All zones are origin zones (traffic originates from the zones) and destination zones (traffic travels to the zones). This is to ensure compatibility with the demand model and that the correct traffic flows generated by the demand model are replicated in the Vissim model.

2.2.4 Static Assignment

For each origin to destination journey (inbound and outbound movements to and from the airport site), 1 route choice has been used for each journey.

2.2.5 Junction signal timings

It has been assumed that the traffic signal junctions on the approach roads to the airport are/will be operated under SCOOT or MOVA control to maximise the reduction in traffic congestion around the airport. These forms of control are real time, where the systems assess the traffic flows approaching on each arm of a junction and calculate if extending the green time would be beneficial to disperse queuing.

2.2.6 Speed limits

A 20-mph speed limit has been used for the road network between Sydney Avenue and Chicago Avenue, and the existing speed limits for the remainder of the road network have been used.

2.2.7 Public Transport (PT) Lines and Stops

All bus services operating within the study area during the modelled period have been coded into the model. Information on the PT lines, service frequency, and bus stop locations have been collected from bus operators via bus timetable information contained on the operators' websites.

2.2.8 Demand Model Assumptions

A spreadsheet-based demand model was used to feed the 2019 Vissim model. This demand model has been updated to reflect the current local conditions. It generates traffic demand, factors and splits created from the cordon data (ANPR cameras on key roads in the airport site) and CAA data (taken from barriers across the airport site), including the following:

- Proportion of journey purpose by flight time
- Proportion of lead time
- Modal splits on accessing the airport
- Number of passengers per vehicle by flight haul

- Primary trips access across the airport site
- Drop off/pick up vehicle splits
- Hourly splits of staff arriving at airport
- Proportion of Sydney Avenue to/from external access points
- Proportion of World Way to/from external access points
- Proportion of Outwood Lane to/from external access points
- Proportion of Ringway Road to/from external access points

Several movements were fixed and were not included in the demand model. These movements have been hard coded into the Vissim model based on the current situation (2023) and include the following:

- M&G Shadowmoss Car Storage to Car Pickup (T1, T2 and T3) – 40 vehicles an hour
- M&G A1 MSCP Car Storage to Car Pick Up (T1 and T2) – 22 vehicles an hour
- Terminal 1 M&G Car Drop Off to Car Storage (Shadowmoss and A1 MSCP) – 22 vehicles an hour;
- Terminal 2 M&G Car Drop Off to Car Storage (Shadowmoss and A1 MSCP) – 20 vehicles an hour;
- Terminal 3 M&G Car Drop Off to Car Storage (Shadowmoss) – 20 vehicles an hour;
- Staff buses to Amazon depot – 1 vehicle every 10 min in each direction.
- T2 West MSCP outbound traffic – increase based on April 2023 Traffic Surveys demand.

The remaining assumptions have been maintained as per 2019 Vissim model. It is worth noting that the extent of the changes made to the road network and the improvements made to the Vissim coding parameters mean that the 2019 model has been fully replaced with a modified model. The overall assumptions made in the 2019 model development thus, cannot be compared with the assumptions made during the construction of the new Vissim models as this would not be a comparison of the same situation.

2.2.9 Evaluation features

Evaluation features such as node polygons and data collection points have been coded into the model to extract the data needed for calibration and validation.

2.2.10 Simulation Resolution

Simulation Resolution is the number of time steps, or how often vehicles are moved, and their positions recalculated, in a simulation second. TfL Traffic Modelling Guidelines¹ states that “Simulation resolution should be set to the default of 5 steps per simulation second”. Therefore, a resolution of 5-time steps per simulation second has been used in the model. This means that driver decisions are assessed 5 times every second. The base models have been created with this resolution and this will be maintained throughout later modelled scenarios for consistency.

¹ Transport for London Traffic Modelling Guideline (2021) [Online] Available from: <https://content.tfl.gov.uk/traffic-modelling-guidelines.pdf> [Accessed: May 2023]

3. Traffic Surveys for Benchmarking

It is key for every traffic model to reflect the local conditions of the road network; therefore a set of survey information is required to validate the modelling outputs. For the purposes of the development of this model, the following sources of information and traffic were used:

- Automatic Traffic Counts (ATC) data
- Manual Classified Count (MCC) data

The existing operation of the study area network has been obtained from recent observations during various site visits (March and April 2023), from review of the traffic count data, and from the review of the Google live traffic data.

ATC and MCC data have been obtained from Traffic Surveys undertaken during a 4-day period between Thursday 30th March and Sunday 2nd April 2023. These surveys covered the 24-hours period across each day, enabling to identify the typical AM peak and apply in the Vissim model. The location of these traffic surveys can be observed in Figure 3-1 below.

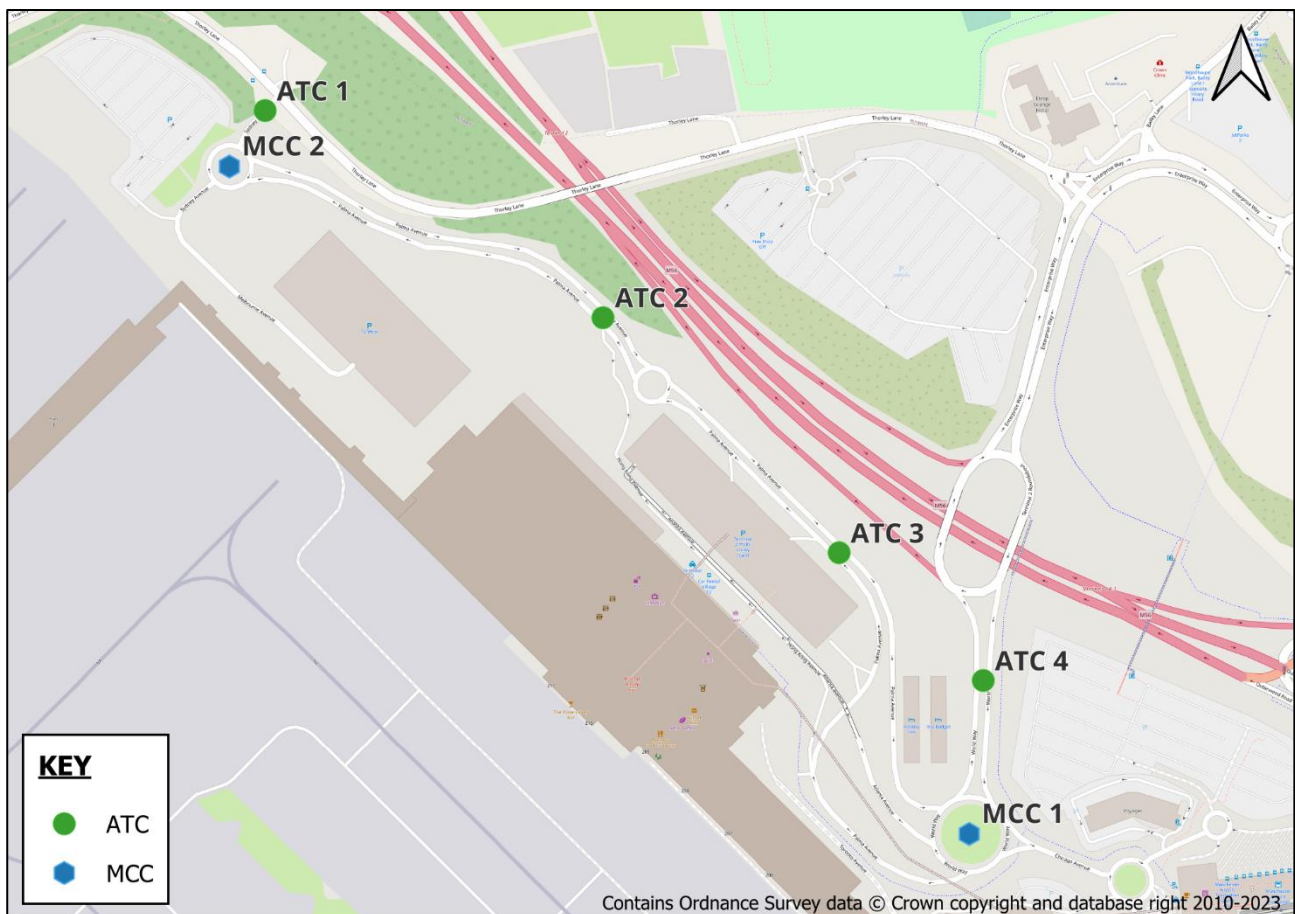


Figure 3-1. Location of traffic surveys.

4. Model Benchmarking to observed flows

Once the base model set-up was completed, checks were undertaken to identify any coding and operational errors, as well as verifying whether the model's performance accurately reflects the actual conditions on the network. The model checking process included the following tasks:

- Checking the software error messages and warnings;
- Checking the lists of network objects individually;
- Addressing any issues with vehicle static routings; and
- Running the model simulation and checking the network objects' performance.
- Addressing the issue related to abnormal vehicular operations.

4.1 Model Calibration

Model calibration involves a number of techniques to alter driver behaviour such that the model reflects network conditions as closely as possible. The techniques and associated assumptions have been covered in the earlier sections of this report. Calibration of the model is discussed in this section, which includes the following:

- Speed limits, speed distributions and reduced speed areas
- Vehicle priorities and associated gap acceptance
- Signal control logic and timings
- Static routing coding;
- Lane change and emergency stop distances
- Lane utilisation

In order to facilitate calibration some alterations to the network were made. Bespoke desired speed decisions have been used at all arms and circulatory links of the study area. Most of the reduced speed areas have been introduced in the model due to narrow road widths and sharp bends. Some gap times and headway priorities have been adjusted from Vissim default values during calibration as required, to reflect site conditions based on site observations and video data.

An accepted method of reducing potential bias in model results is to run several simulations, using a range of random seeds and to present mean results from across the runs. Modelled flows are averaged over five seed values and the results are presented as a mean of all five simulation runs. Figure 4- 1 presents the basic settings of model runs during extraction of results.

Simulation parameters

General Meso

Comment: Manchester Airport April 2023 AM

Period: 14400 s Simulation seconds

Start time: 04:30:00

Start date: 12/05/2023

Simulation resolution: 5 Time step(s) / simulation second

Random Seed: 57

Number of runs: 5

Random seed increment: 5

Dynamic assignment volume increment: 0.00 %

Simulation speed: ☒ Factor: 62.5 ☐ Maximum

☐ Retrospective synchronization

☐ Break at: 0 s Simulation seconds

Number of cores: use all cores

OK Cancel

Figure 4-1 Adopted Simulation Parameters

4.2 Benchmarking Criteria

Model benchmarking has been based on guidelines from Transport Analysis Guidance (TAG) and extended using Transport for London (TfL) Modelling Guidelines. TAG Unit M3.1² contains two sets of measures to assess flow calibration and validation, and these are as follows:

- Absolute and percentage differences between modelled flows and observed counts; and
- GEH statistic:

$$GEH = \sqrt{\frac{(M - C)^2}{(M + C)/2}}$$

Where M is the modelled and C is the observed data.

The benchmarking criteria and guidelines to compare modelled and observed data for link flows and turning movements are shown in Table 4-1 below.

² Department for Transport TAG Unit M3.1 – Highway Assignment Modelling (2020) [Online] Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/938864/tag-m3-1-highway-assignment-modelling.pdf [Accessed: May 2022]

Criteria	Description of Criteria	Guideline
1	Individual flows within 100 veh/h of counts for flows less than 700 veh/h	> 85% of cases
	Individual flows within 15% of counts for flows from 700 to 2,700 veh/h	
	Individual flows within 400 veh/h of counts for flows more than 2,700 veh/h	
2	GEH < 5 for individual flows	> 85% of cases

Table 4-1 Link flows and Turning Movement Calibration Criteria

The GEH statistic is a form of the Chi-squared statistic that incorporates both relative and absolute errors. This means that it is more tolerant of large percentage differences at lower population values, which is particularly useful when analysing traffic flows where a large difference in a small flow is not necessarily significant, whereas a large difference in a larger flow would be of concern. The TfL guidance states that a GEH of less than 5 is favourable.

Due to the turning count data being used within the construction of the demand matrices, it is no longer an independent dataset for use in validation, therefore the comparison between modelled and observed flows is part of the calibration process.

4.3 2023 Benchmarking

4.3.1 Link Flows

Bi-directional links flows have been obtained from ATC data provided by Traffic Surveys at the four locations showed in Section 3 and benchmarked using the criteria described in the previous section. Observed links flows from traffic surveys have been average across the 4-day period surveyed in order to obtain a representative AM peak period (05:00 to 08:00) and be compared against modelled data collection results.

4.3.1.1 Sydney Avenue (ATC 1)

Sydney Avenue forms the main connexion of vehicular movements to/from Manchester Airport with M56 Junction 6 via Runger Lane, Thorley Lane, Bailey Lane and in a smaller scale with Manchester Airport Relief Road. Figure 4-2 shows the location of the ATC at Sydney Avenue Northbound direction.



Figure 4-2. Sydney Avenue Northbound ATC

Table 4-2 depicts the benchmarking figures and WebTAG criteria assessment. As can be seen 100% of the cases passes the first WebTAG criteria and 92% of cases passes the second WebTAG criteria. Therefore, it can be considered that the model is representative of the link flows surveyed at Sydney Avenue Northbound.

Time	Observed Flow	Modelled Flow	Absolute Difference	% Difference	WebTAG Criteria 1	GEH	WebTAG Criteria 2	Passes at least 1 criterion
05:00	74	57	17	23%	Pass	2	Pass	Pass
05:15	77	65	12	16%	Pass	1	Pass	Pass
05:30	88	79	9	10%	Pass	1	Pass	Pass
05:45	76	69	7	9%	Pass	1	Pass	Pass
06:00	80	78	2	3%	Pass	0	Pass	Pass
06:15	72	47	25	35%	Pass	3	Pass	Pass
06:30	56	54	2	4%	Pass	0	Pass	Pass
06:45	81	56	25	31%	Pass	3	Pass	Pass
07:00	57	77	20	35%	Pass	2	Pass	Pass
07:15	91	66	25	27%	Pass	3	Pass	Pass
07:30	85	66	19	22%	Pass	2	Pass	Pass
07:45	127	72	55	43%	Pass	6	Fail	Pass

Table 4-2. Sydney Avenue Northbound – Benchmarking

Figure 4-3 shows the location of the ATC at Sydney Avenue Southbound direction.



Figure 4-3. Sydney Avenue Southbound ATC.

Table 4-3 shows the benchmarking figures and WebTAG criteria assessment. As can be seen 100% of the cases passes the first WebTAG criteria and 92% of cases passes the second WebTAG criteria. Therefore, it can be considered that the model is representative of the link flows surveyed at Sydney Avenue Southbound.

Time	Observed Flow	Modelled Flow	Absolute Difference	% Difference	WebTAG Criteria 1	GEH	WebTAG Criteria 2	Passes at least 1 criterion
05:00	43	36	7	16%	Pass	1	Pass	Pass
05:15	34	41	7	21%	Pass	1	Pass	Pass
05:30	38	42	4	11%	Pass	1	Pass	Pass
05:45	36	42	6	17%	Pass	1	Pass	Pass
06:00	48	34	14	29%	Pass	2	Pass	Pass
06:15	38	35	3	8%	Pass	0	Pass	Pass
06:30	56	37	19	34%	Pass	3	Pass	Pass

Time	Observed Flow	Modelled Flow	Absolute Difference	% Difference	WebTAG Criteria 1	GEH	WebTAG Criteria 2	Passes at least 1 criterion
06:45	41	36	5	12%	Pass	1	Pass	Pass
07:00	61	34	27	44%	Pass	4	Pass	Pass
07:15	60	32	28	47%	Pass	4	Pass	Pass
07:30	59	36	23	39%	Pass	3	Pass	Pass
07:45	79	36	43	54%	Pass	6	Fail	Pass

Table 4-3. Sydney Avenue Southbound - Benchmarking

4.3.1.2 Palma Avenue – West of Terminal 2 MSCP exit (ATC 2)

Palma Avenue links Flag junction with Sydney Avenue junction and acts as the entry and exit for Terminal 2 MSCP vehicular movements. This survey was located after the exit of the Terminal 2 East MSCP. Figure 4-4 shows the location of the ATC at Palma Avenue (West of Terminal 2 MSCP exit) Westbound direction.



Figure 4-4. Palma Avenue Westbound ATC - West of Terminal 2 MSCP exit

Table 4-4 shows the benchmarking figures and WebTAG criteria assessment. As can be seen 100% of the cases passes the first WebTAG criteria and 92% of cases passes the second WebTAG criteria. Therefore, it can be considered that the model is representative of the link flows surveyed at Palma Avenue West of Terminal 2 MSCP exit Westbound.

Time	Observed Flow	Modelled Flow	Absolute Difference	% Difference	WebTAG Criteria 1	GEH	WebTAG Criteria 2	Passes at least 1 criterion
05:00	38	41	3	8%	Pass	0	Pass	Pass
05:15	31	36	5	16%	Pass	1	Pass	Pass
05:30	44	43	1	2%	Pass	0	Pass	Pass
05:45	37	41	4	11%	Pass	1	Pass	Pass
06:00	38	46	8	21%	Pass	1	Pass	Pass
06:15	35	38	3	9%	Pass	0	Pass	Pass
06:30	52	36	16	31%	Pass	2	Pass	Pass
06:45	58	36	22	38%	Pass	3	Pass	Pass
07:00	83	52	31	37%	Pass	4	Pass	Pass
07:15	80	68	12	15%	Pass	1	Pass	Pass

Time	Observed Flow	Modelled Flow	Absolute Difference	% Difference	WebTAG Criteria 1	GEH	WebTAG Criteria 2	Passes at least 1 criterion
07:30	104	51	53	51%	Pass	6	Fail	Pass
07:45	93	60	33	35%	Pass	4	Pass	Pass

Table 4-4. Palma Avenue Westbound - West of Terminal 2 MSCP exit – Benchmarking

Figure 4-5 shows the location of the ATC at Palma Avenue (West of Terminal 2 MSCP exit) Eastbound direction.



Figure 4-5. Palma Avenue Eastbound ATC - West of Terminal 2 MSCP exit

Table 4-5 depicts the benchmarking figures and WebTAG criteria assessment. As can be seen, all cases passes both criteria, therefore it can be considered that the model is representative of the link flows surveyed at Palma Avenue West of Terminal 2 MSCP exit Eastbound.

Time	Observed Flow	Modelled Flow	Absolute Difference	% Difference	WebTAG Criteria 1	GEH	WebTAG Criteria 2	Passes at least 1 criterion
05:00	82	90	8	10%	Pass	1	Pass	Pass
05:15	80	127	47	59%	Pass	5	Pass	Pass
05:30	76	122	46	61%	Pass	5	Pass	Pass
05:45	88	122	34	39%	Pass	3	Pass	Pass
06:00	90	103	13	14%	Pass	1	Pass	Pass
06:15	83	84	1	1%	Pass	0	Pass	Pass
06:30	82	83	1	1%	Pass	0	Pass	Pass
06:45	89	84	5	6%	Pass	1	Pass	Pass
07:00	104	104	0	0%	Pass	0	Pass	Pass
07:15	90	85	5	6%	Pass	1	Pass	Pass
07:30	115	86	29	25%	Pass	3	Pass	Pass
07:45	160	105	55	34%	Pass	5	Pass	Pass

Table 4-5. Palma Avenue Eastbound - West of Terminal 2 MSCP exit – Benchmarking

4.3.1.3 Palma Avenue – East of Terminal 2 MSCP entry (ATC 3)

The section of Palma Avenue covered by this survey was located before the entry of the Terminal 2 East MSCP. Figure 4-6 shows the location of the ATC at Palma Avenue (East of Terminal 2 MSCP entry) Westbound direction.



Figure 4-6. Palma Avenue East of Terminal 2 MSCP entry - Westbound ATC.

Table 4-6 shows the benchmarking figures and WebTAG criteria assessment. As can be seen, all cases passes both criteria, therefore it can be considered that the model is representative of the link flows surveyed at Palma Avenue (East of Terminal 2 MSCP entry) Westbound.

Time	Observed Flow	Modelled Flow	Absolute Difference	% Difference	WebTAG Criteria 1	GEH	WebTAG Criteria 2	Passes at least 1 criterion
05:00	68	77	9	13%	Pass	1	Pass	Pass
05:15	66	73	7	11%	Pass	1	Pass	Pass
05:30	68	82	14	21%	Pass	2	Pass	Pass
05:45	85	77	8	9%	Pass	1	Pass	Pass
06:00	78	77	1	1%	Pass	0	Pass	Pass
06:15	61	72	11	18%	Pass	1	Pass	Pass
06:30	70	67	3	4%	Pass	0	Pass	Pass
06:45	97	69	28	29%	Pass	3	Pass	Pass
07:00	98	79	19	19%	Pass	2	Pass	Pass
07:15	116	91	25	22%	Pass	2	Pass	Pass
07:30	126	79	47	37%	Pass	5	Pass	Pass
07:45	105	85	20	19%	Pass	2	Pass	Pass

Table 4-6. Palma Avenue Westbound - East of Terminal 2 MSCP entry – Benchmarking

Figure 4-7 shows the location of the ATC at Palma Avenue (East of Terminal 2 MSCP entry) Eastbound direction.



Figure 4-7. Palma Avenue East of Terminal 2 MSCP entry - Westbound ATC.

Table 4-7 depicts the benchmarking figures and WebTAG criteria assessment. As can be seen 100% of the cases passes the first WebTAG criteria and 92% of cases passes the second WebTAG criteria. Therefore, it can be considered that the model is representative of the link flows surveyed at Palma Avenue (East of Terminal 2 MSCP entry) Eastbound direction.

Time	Observed Flow	Modelled Flow	Absolute Difference	% Difference	WebTAG Criteria 1	GEH	WebTAG Criteria 2	Passes at least 1 criterion
05:00	101	109	8	8%	Pass	1	Pass	Pass
05:15	110	147	37	34%	Pass	3	Pass	Pass
05:30	107	143	36	34%	Pass	3	Pass	Pass
05:45	100	144	44	44%	Pass	4	Pass	Pass
06:00	105	122	17	16%	Pass	2	Pass	Pass
06:15	100	111	11	11%	Pass	1	Pass	Pass
06:30	109	106	3	3%	Pass	0	Pass	Pass
06:45	106	104	2	2%	Pass	0	Pass	Pass
07:00	122	130	8	7%	Pass	1	Pass	Pass
07:15	148	113	35	24%	Pass	3	Pass	Pass
07:30	189	112	77	41%	Pass	6	Fail	Pass
07:45	194	132	62	32%	Pass	5	Pass	Pass

Table 4-7. Palma Avenue Eastbound - East of Terminal 2 MSCP entry - Benchmarking

4.3.1.4 World Way (ATC 4)

World Way forms the main connexion of vehicular movements to/from Manchester Airport with M56 Junction 5, and Manchester Airport Relief Road or Bailey Lane via Enterprise Way. Figure 4-8 shows the location of the ATC at World Way Southbound direction.



Figure 4-8. World Way - Southbound ATC

Table 4-8 depicts the benchmarking figures and WebTAG criteria assessment. As can be seen 100% of the cases passes the first WebTAG criteria and 75% of cases passes the second WebTAG criteria. Therefore, it can be considered that the model is representative of the link flows surveyed at World Way Southbound.

Time	Observed Flow	Modelled Flow	Absolute Difference	% Difference	WebTAG Criteria 1	GEH	WebTAG Criteria 2	Passes at least 1 criterion
05:00	122	53	69	57%	Pass	7	Fail	Pass
05:15	150	52	98	65%	Pass	10	Fail	Pass
05:30	125	193	68	54%	Pass	5	Fail	Pass
05:45	145	204	59	41%	Pass	4	Pass	Pass
06:00	148	203	55	37%	Pass	4	Pass	Pass
06:15	174	207	33	19%	Pass	2	Pass	Pass
06:30	126	144	18	14%	Pass	2	Pass	Pass
06:45	131	132	1	1%	Pass	0	Pass	Pass
07:00	130	129	1	1%	Pass	0	Pass	Pass
07:15	175	124	51	29%	Pass	4	Pass	Pass
07:30	164	117	47	29%	Pass	4	Pass	Pass
07:45	166	120	46	28%	Pass	4	Pass	Pass

Table 4-8. World Way Southbound Benchmark.

Figure 4-9 below shows the location of the ATC at World Way Northbound direction.



Figure 4-9. World Way - Northbound ATC.

Table 4-9 shows the benchmarking figures and WebTAG criteria assessment. As can be seen 100% of the cases passes the first WebTAG criteria and 83% of cases passes the second WebTAG criteria. Therefore, it can be considered that the model is representative of the link flows surveyed at World Way Northbound.

Time	Observed Flow	Modelled Flow	Absolute Difference	% Difference	WebTAG Criteria 1	GEH	WebTAG Criteria 2	Passes at least 1 criterion
05:00	125	193	68	54%	Pass	5	Fail	Pass
05:15	145	204	59	41%	Pass	4	Pass	Pass
05:30	148	203	55	37%	Pass	4	Pass	Pass
05:45	174	207	33	19%	Pass	2	Pass	Pass
06:00	126	144	18	14%	Pass	2	Pass	Pass
06:15	131	132	1	1%	Pass	0	Pass	Pass
06:30	130	129	1	1%	Pass	0	Pass	Pass
06:45	175	124	51	29%	Pass	4	Pass	Pass
07:00	164	117	47	29%	Pass	4	Pass	Pass
07:15	166	120	46	28%	Pass	4	Pass	Pass
07:30	175	117	58	33%	Pass	5	Pass	Pass
07:45	187	114	73	39%	Pass	6	Fail	Pass

Table 4-9. World Way Northbound Benchmark.

4.3.2 Turning Movements

Inbound and outbound turning flows per arm have been obtained from MCC data provided by Traffic Surveys at the two junctions showed in Section 3 and benchmarked using the criteria described in the previous section. Observed turning flows from traffic surveys have been average across the 4-day period surveyed in order to obtain a representative AM peak period (05:00 to 08:00) and be compared against modelled data collection results.

4.3.2.1 Flag Roundabout (MCC 1)

Flag Roundabout is a 4-arm priority controlled at-grade roundabout which provides access onto World Way to the north, Chicago Avenue to the east and to the Palma Avenue and Atlanta Avenue to the west. Figure 4-2 shows the location of Flag Roundabout.

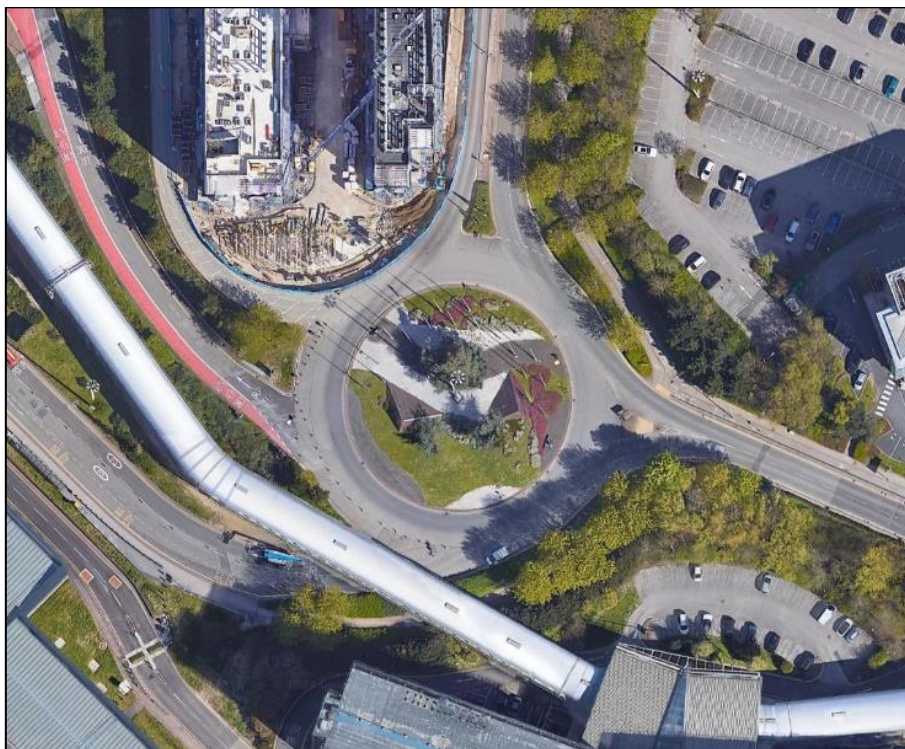


Figure 4-10. Flag Roundabout

4.3.2.1.1 World Way turning flows

Table 4-10 shows the benchmarking figures and WebTAG criteria assessment for World Way inbound and outbound flows. As can be seen, for both directions 100% of the cases passes the first WebTAG criteria, however 67% and 75% of cases passes the second WebTAG criteria for the inbound and outbound directions respectively. Therefore, it can be considered that the model is representative of the turning flows surveyed at World Way.

Time	Observed Flow	Modelled Flow	Absolute Difference	% Difference	WebTAG Criteria 1	GEH	WebTAG Criteria 2	Passes at least 1 criterion
World Way – Inbound								
05:00	125	188	63	50%	Pass	5	Fail	Pass
05:15	127	203	76	60%	Pass	6	Fail	Pass
05:30	147	204	57	39%	Pass	4	Pass	Pass
05:45	165	208	43	26%	Pass	3	Pass	Pass
06:00	126	144	18	14%	Pass	2	Pass	Pass
06:15	127	133	6	5%	Pass	1	Pass	Pass
06:30	126	130	4	3%	Pass	0	Pass	Pass
06:45	180	123	57	32%	Pass	5	Pass	Pass
07:00	160	120	40	25%	Pass	3	Pass	Pass
07:15	161	119	42	26%	Pass	4	Pass	Pass
07:30	177	115	62	35%	Pass	5	Fail	Pass
07:45	187	116	71	38%	Pass	6	Fail	Pass
World Way – Outbound								
05:00	101	101	0	0%	Pass	0	Pass	Pass
05:15	92	142	50	54%	Pass	5	Pass	Pass
05:30	70	134	64	91%	Pass	6	Fail	Pass
05:45	103	141	38	37%	Pass	3	Pass	Pass

Time	Observed Flow	Modelled Flow	Absolute Difference	% Difference	WebTAG Criteria 1	GEH	WebTAG Criteria 2	Passes at least 1 criterion
06:00	79	143	64	81%	Pass	6	Fail	Pass
06:15	92	120	28	30%	Pass	3	Pass	Pass
06:30	79	117	38	48%	Pass	4	Pass	Pass
06:45	117	118	1	1%	Pass	0	Pass	Pass
07:00	127	147	20	16%	Pass	2	Pass	Pass
07:15	112	133	21	19%	Pass	2	Pass	Pass
07:30	125	126	1	1%	Pass	0	Pass	Pass
07:45	150	143	7	5%	Pass	1	Pass	Pass

Table 4-10. World Way – Benchmarking

4.3.2.1.2 Chicago Avenue turning flows

Table 4-11 shows the benchmarking figures and WebTAG criteria assessment for Chicago Avenue inbound and outbound flows. As can be seen, for both directions 100% of the cases passes the first WebTAG criteria, however 75% and 83% of cases passes the second WebTAG criteria for the inbound and outbound directions respectively. Therefore, it can be considered that the model is representative of the turning flows surveyed at Chicago Avenue.

Time	Observed Flow	Modelled Flow	Absolute Difference	% Difference	WebTAG Criteria 1	GEH	WebTAG Criteria 2	Passes at least 1 criterion
Chicago Avenue – Inbound								
05:00	60	40	20	33%	Pass	3	Pass	Pass
05:15	66	33	33	50%	Pass	5	Pass	Pass
05:30	64	42	22	34%	Pass	3	Pass	Pass
05:45	60	33	27	45%	Pass	4	Pass	Pass
06:00	56	66	10	18%	Pass	1	Pass	Pass
06:15	79	53	26	33%	Pass	3	Pass	Pass
06:30	83	56	27	33%	Pass	3	Pass	Pass
06:45	104	50	54	52%	Pass	6	Fail	Pass
07:00	93	53	40	43%	Pass	5	Pass	Pass
07:15	84	49	35	42%	Pass	4	Pass	Pass
07:30	116	49	67	58%	Pass	7	Fail	Pass
07:45	104	42	62	60%	Pass	7	Fail	Pass
Chicago Avenue – Outbound								
05:00	45	33	12	27%	Pass	2	Pass	Pass
05:15	38	36	2	5%	Pass	0	Pass	Pass
05:30	47	45	2	4%	Pass	0	Pass	Pass
05:45	41	37	4	10%	Pass	1	Pass	Pass
06:00	37	31	6	16%	Pass	1	Pass	Pass
06:15	63	42	21	33%	Pass	3	Pass	Pass
06:30	62	40	22	35%	Pass	3	Pass	Pass
06:45	65	35	30	46%	Pass	4	Pass	Pass
07:00	62	33	29	47%	Pass	4	Pass	Pass
07:15	52	29	23	44%	Pass	4	Pass	Pass
07:30	84	33	51	61%	Pass	7	Fail	Pass
07:45	72	30	42	58%	Pass	6	Fail	Pass

Table 4-11. Chicago Avenue – Benchmarking

4.3.2.1.3 Palma Avenue turning flows

Table 4-12 shows the benchmarking figures and WebTAG criteria assessment for Palma Avenue inbound and outbound flows. As can be seen, for both directions 100% of the cases passes the first WebTAG criteria, however 75% and 83% of cases passes the second WebTAG criteria for the inbound and outbound directions respectively. Therefore, it can be considered that the model is representative of the turning flows surveyed at Palma Avenue.

Time	Observed Flow	Modelled Flow	Absolute Difference	% Difference	WebTAG Criteria 1	GEH	WebTAG Criteria 2	Passes at least 1 criterion
Palma Avenue – Inbound								
05:00	112	119	7	6%	Pass	1	Pass	Pass
05:15	79	161	82	104%	Pass	7	Fail	Pass
05:30	87	163	76	87%	Pass	7	Fail	Pass
05:45	102	161	59	58%	Pass	5	Fail	Pass
06:00	98	141	43	44%	Pass	4	Pass	Pass
06:15	88	132	44	50%	Pass	4	Pass	Pass
06:30	85	122	37	44%	Pass	4	Pass	Pass
06:45	86	124	38	44%	Pass	4	Pass	Pass
07:00	118	151	33	28%	Pass	3	Pass	Pass
07:15	104	131	27	26%	Pass	2	Pass	Pass
07:30	129	130	1	1%	Pass	0	Pass	Pass
07:45	161	151	10	6%	Pass	1	Pass	Pass
Palma Avenue – Outbound								
05:00	79	96	17	22%	Pass	2	Pass	Pass
05:15	75	83	8	11%	Pass	1	Pass	Pass
05:30	90	99	9	10%	Pass	1	Pass	Pass
05:45	97	87	10	10%	Pass	1	Pass	Pass
06:00	92	92	0	0%	Pass	0	Pass	Pass
06:15	68	80	12	18%	Pass	1	Pass	Pass
06:30	87	85	2	2%	Pass	0	Pass	Pass
06:45	126	74	52	41%	Pass	5	Fail	Pass
07:00	126	95	31	25%	Pass	3	Pass	Pass
07:15	124	100	24	19%	Pass	2	Pass	Pass
07:30	156	93	63	40%	Pass	6	Fail	Pass
07:45	140	94	46	33%	Pass	4	Pass	Pass

Table 4-12. Palma Avenue – Benchmarking

4.3.2.1.4 Atlanta Avenue turning flows

Table 4-13 shows the benchmarking figures and WebTAG criteria assessment for Atlanta Avenue outbound (entry ramp to Terminal 2 Drop-off forecourt). As can be seen, for both directions 100% of the cases passes the first WebTAG criteria, and 83% of cases passes the second WebTAG criteria. Therefore, it can be considered that the model is representative of the turning flows surveyed at Atlanta Avenue.

Time	Observed Flow	Modelled Flow	Absolute Difference	% Difference	WebTAG Criteria 1	GEH	WebTAG Criteria 2	Passes at least 1 criterion
World Way – Outbound								
05:00	72	117	45	63%	Pass	5	Pass	Pass

Time	Observed Flow	Modelled Flow	Absolute Difference	% Difference	WebTAG Criteria 1	GEH	WebTAG Criteria 2	Passes at least 1 criterion
05:15	67	136	69	103%	Pass	7	Fail	Pass
05:30	91	131	40	44%	Pass	4	Pass	Pass
05:45	86	137	51	59%	Pass	5	Pass	Pass
06:00	72	85	13	18%	Pass	1	Pass	Pass
06:15	71	76	5	7%	Pass	1	Pass	Pass
06:30	66	66	0	0%	Pass	0	Pass	Pass
06:45	62	70	8	13%	Pass	1	Pass	Pass
07:00	56	49	7	13%	Pass	1	Pass	Pass
07:15	61	37	24	39%	Pass	3	Pass	Pass
07:30	57	42	15	26%	Pass	2	Pass	Pass
07:45	90	42	48	53%	Pass	6	Fail	Pass

Table 4-13. Atalanta Avenue – Benchmarking

4.3.2.2 West End Roundabout (MCC 2)

West End Roundabout is a 4-arm signal controlled at-grade roundabout which provides access onto Sydney Avenue to the north, Palma Avenue Chicago to the east and to Terminal 2 drop-off barrier plaza and Melbourne Avenue to the south. Figure 4-2 shows the location of West End Roundabout.

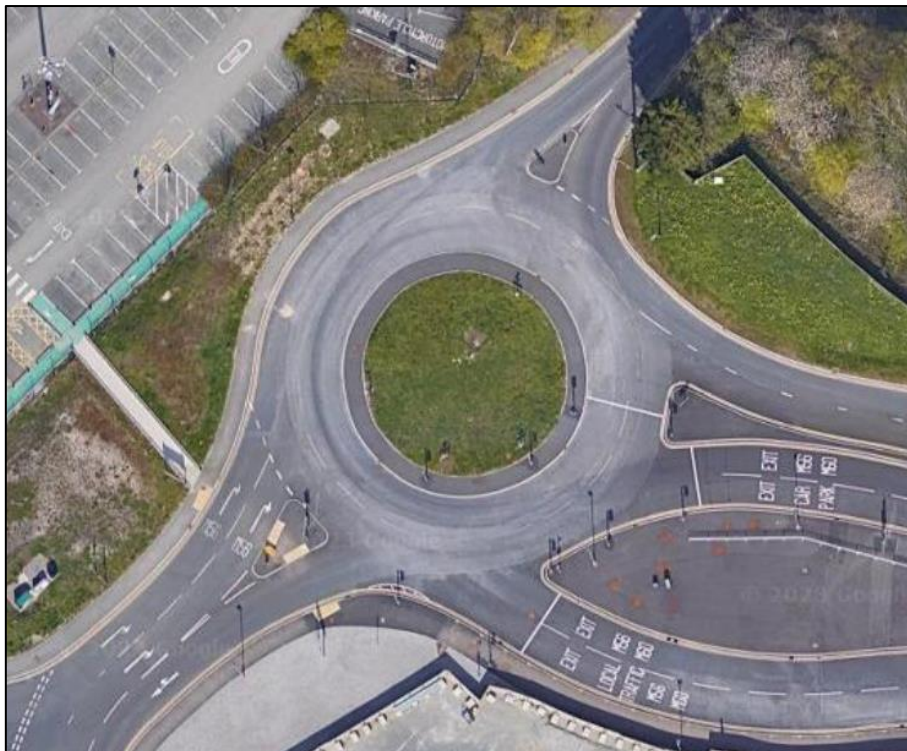


Figure 4-11. West End Roundabout

4.3.2.2.1 Sydney Avenue turning flows

Table 4-14 shows the benchmarking figures and WebTAG criteria assessment for World Way inbound and outbound flows. As can be seen, for both directions 100% of the cases passes the first WebTAG criteria, however

92% of cases passes the second WebTAG criteria for both the inbound and outbound directions. Therefore, it can be considered that the model is representative of the turning flows surveyed at Sydney Avenue.

Time	Observed Flow	Modelled Flow	Absolute Difference	% Difference	WebTAG Criteria 1	GEH	WebTAG Criteria 2	Passes at least 1 criterion
Sydney Avenue – Inbound								
05:00	39	13	26	67%	Pass	5	Fail	Pass
05:15	32	11	21	66%	Pass	5	Pass	Pass
05:30	44	35	9	20%	Pass	1	Pass	Pass
05:45	35	41	6	17%	Pass	1	Pass	Pass
06:00	44	44	0	0%	Pass	0	Pass	Pass
06:15	38	42	4	11%	Pass	1	Pass	Pass
06:30	51	32	19	37%	Pass	3	Pass	Pass
06:45	38	36	2	5%	Pass	0	Pass	Pass
07:00	51	37	14	27%	Pass	2	Pass	Pass
07:15	44	37	7	16%	Pass	1	Pass	Pass
07:30	53	33	20	38%	Pass	3	Pass	Pass
07:45	60	30	30	50%	Pass	4	Pass	Pass
Sydney Avenue – Outbound								
05:00	12	6	6	50%	Pass	2	Pass	Pass
05:15	26	2	24	92%	Pass	6	Fail	Pass
05:30	29	11	18	62%	Pass	4	Pass	Pass
05:45	21	8	13	62%	Pass	3	Pass	Pass
06:00	26	15	11	42%	Pass	2	Pass	Pass
06:15	22	6	16	73%	Pass	4	Pass	Pass
06:30	30	24	6	20%	Pass	1	Pass	Pass
06:45	19	13	6	32%	Pass	2	Pass	Pass
07:00	23	14	9	39%	Pass	2	Pass	Pass
07:15	32	23	9	28%	Pass	2	Pass	Pass
07:30	30	43	13	43%	Pass	2	Pass	Pass
07:45	48	45	3	6%	Pass	0	Pass	Pass

Table 4-14. Sydney Avenue – Benchmarking

4.3.2.2.2 Palma Avenue turning flows

Table 4-15 shows the benchmarking figures and WebTAG criteria assessment for Palma Avenue inbound and outbound flows. As can be seen, for both directions 100% of the cases passes the first WebTAG criteria, however 91% and 100% of cases passes the second WebTAG criteria for the inbound and outbound directions respectively. Therefore, it can be considered that the model is representative of the turning flows surveyed at Palma Avenue.

Time	Observed Flow	Modelled Flow	Absolute Difference	% Difference	WebTAG Criteria 1	GEH	WebTAG Criteria 2	Passes at least 1 criterion
Palma Avenue – Inbound								
05:00	22	16	6	27%	Pass	1	Pass	Pass
05:15	53	22	31	58%	Pass	5	Fail	Pass
05:30	37	38	1	3%	Pass	0	Pass	Pass
05:45	30	37	7	23%	Pass	1	Pass	Pass
06:00	36	43	7	19%	Pass	1	Pass	Pass
06:15	40	41	1	3%	Pass	0	Pass	Pass

Time	Observed Flow	Modelled Flow	Absolute Difference	% Difference	WebTAG Criteria 1	GEH	WebTAG Criteria 2	Passes at least 1 criterion
06:30	42	48	6	14%	Pass	1	Pass	Pass
06:45	40	36	4	10%	Pass	1	Pass	Pass
07:00	45	35	10	22%	Pass	2	Pass	Pass
07:15	64	36	28	44%	Pass	4	Pass	Pass
07:30	72	51	21	29%	Pass	3	Pass	Pass
07:45	78	65	13	17%	Pass	2	Pass	Pass
Palma Avenue – Outbound								
05:00	30	17	13	43%	Pass	3	Pass	Pass
05:15	30	23	7	23%	Pass	1	Pass	Pass
05:30	46	47	1	2%	Pass	0	Pass	Pass
05:45	21	41	20	95%	Pass	4	Pass	Pass
06:00	24	38	14	58%	Pass	3	Pass	Pass
06:15	28	38	10	36%	Pass	2	Pass	Pass
06:30	38	36	2	5%	Pass	0	Pass	Pass
06:45	32	35	3	9%	Pass	1	Pass	Pass
07:00	40	37	3	8%	Pass	0	Pass	Pass
07:15	41	42	1	2%	Pass	0	Pass	Pass
07:30	49	69	20	41%	Pass	3	Pass	Pass
07:45	49	58	9	18%	Pass	1	Pass	Pass

Table 4-15. Palma Avenue – Benchmarking

4.3.2.2.3 Terminal 2 drop-off forecourt barrier plaza turning flows

Table 4-16 shows the benchmarking figures and WebTAG criteria assessment for Terminal 2 drop-off forecourt barrier plaza inbound flows. As can be seen, for both directions 100% of the cases passes the first WebTAG criteria, however 83% of cases passes the second WebTAG criteria. Therefore, it can be considered that the model is representative of the turning flows surveyed at Terminal 2 drop-off forecourt barrier plaza.

Time	Observed Flow	Modelled Flow	Absolute Difference	% Difference	WebTAG Criteria 1	GEH	WebTAG Criteria 2	Passes at least 1 criterion
Terminal 2 drop-off forecourt barrier plaza – Inbound								
05:00	88	18	70	80%	Pass	10	Fail	Pass
05:15	97	7	90	93%	Pass	12	Fail	Pass
05:30	75	96	21	28%	Pass	2	Pass	Pass
05:45	98	141	43	44%	Pass	4	Pass	Pass
06:00	96	150	54	56%	Pass	5	Pass	Pass
06:15	108	141	33	31%	Pass	3	Pass	Pass
06:30	97	122	25	26%	Pass	2	Pass	Pass
06:45	102	80	22	22%	Pass	2	Pass	Pass
07:00	74	85	11	15%	Pass	1	Pass	Pass
07:15	84	76	8	10%	Pass	1	Pass	Pass
07:30	68	71	3	4%	Pass	0	Pass	Pass
07:45	76	47	29	38%	Pass	4	Pass	Pass

Table 4-16. Terminal 2 drop-off forecourt barrier plaza – Benchmarking

4.3.2.2.4 Melbourne Avenue turning flows

Table 4-17 shows the benchmarking figures and WebTAG criteria assessment for Melbourne Avenue. As can be seen, for both directions 100% of the cases passes the first WebTAG criteria, however 91% and 100% of cases passes the second WebTAG criteria for the inbound and outbound directions respectively. Therefore, it can be considered that the model is representative of the turning flows surveyed at Melbourne Avenue.

Time	Observed Flow	Modelled Flow	Absolute Difference	% Difference	WebTAG Criteria 1	GEH	WebTAG Criteria 2	Passes at least 1 criterion
Melbourne Avenue – Inbound								
05:00	9	8	1	11%	Pass	0	Pass	Pass
05:15	21	17	4	19%	Pass	1	Pass	Pass
05:30	29	23	6	21%	Pass	1	Pass	Pass
05:45	14	15	1	7%	Pass	0	Pass	Pass
06:00	11	10	1	9%	Pass	0	Pass	Pass
06:15	12	10	2	17%	Pass	1	Pass	Pass
06:30	18	17	1	6%	Pass	0	Pass	Pass
06:45	9	10	1	11%	Pass	0	Pass	Pass
07:00	8	10	2	25%	Pass	1	Pass	Pass
07:15	24	23	1	4%	Pass	0	Pass	Pass
07:30	25	75	50	200%	Pass	7	Fail	Pass
07:45	47	71	24	51%	Pass	3	Pass	Pass
Melbourne Avenue – Outbound								
05:00	28	14	14	50%	Pass	3	Pass	Pass
05:15	50	25	25	50%	Pass	4	Pass	Pass
05:30	35	38	3	9%	Pass	0	Pass	Pass
05:45	37	44	7	19%	Pass	1	Pass	Pass
06:00	41	44	3	7%	Pass	0	Pass	Pass
06:15	40	49	9	23%	Pass	1	Pass	Pass
06:30	43	37	6	14%	Pass	1	Pass	Pass
06:45	36	34	2	6%	Pass	0	Pass	Pass
07:00	41	31	10	24%	Pass	2	Pass	Pass
07:15	59	31	28	47%	Pass	4	Pass	Pass
07:30	71	47	24	34%	Pass	3	Pass	Pass
07:45	88	63	25	28%	Pass	3	Pass	Pass

Table 4-17. Melbourne Avenue – Benchmarking

5. Summary and Conclusion

This report details the benchmarking of the April 2023 Vissim Base model against observed traffic surveys flows for the Manchester Airport Terminal 2.

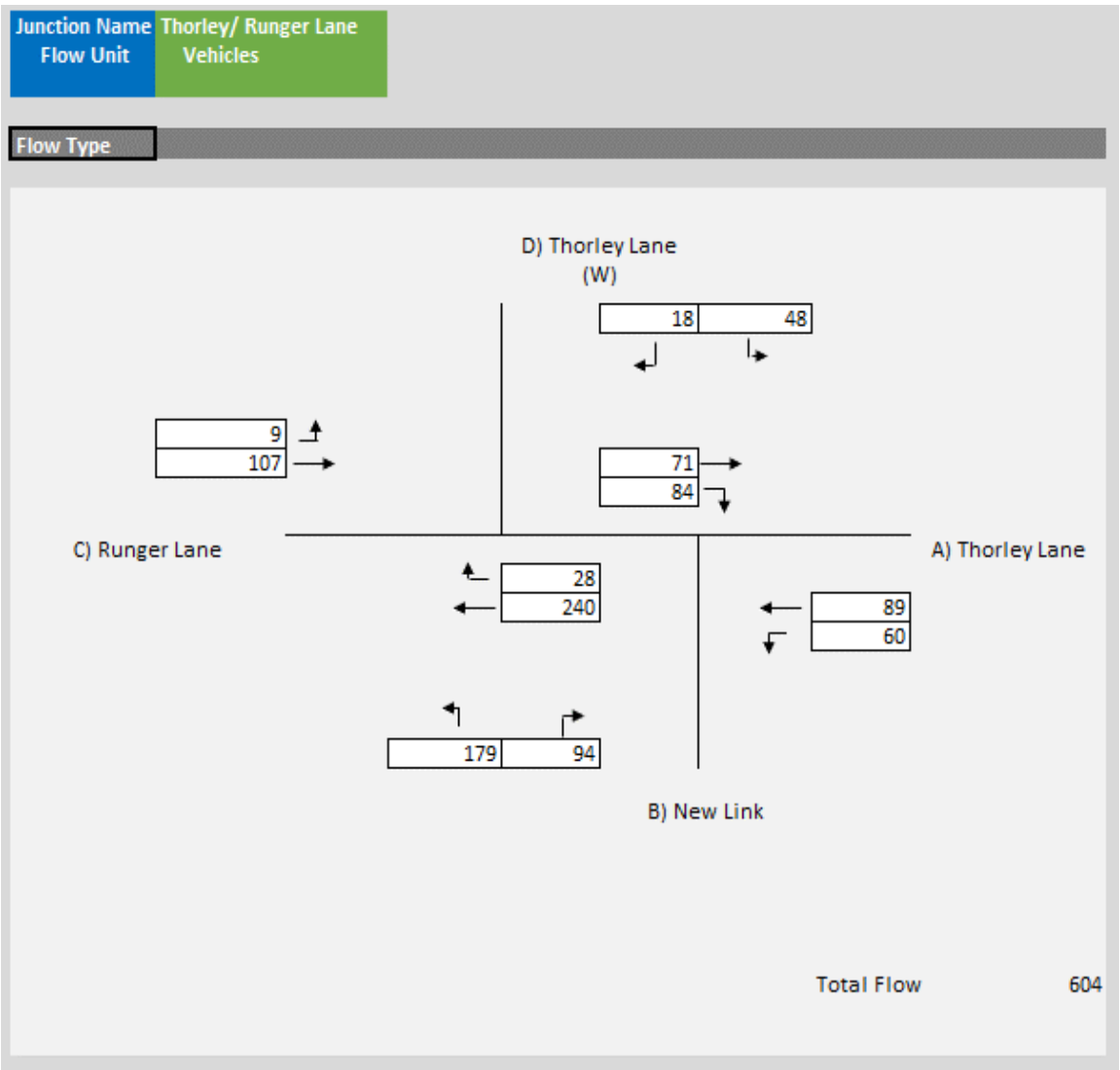
The benchmarking results achieved by the model show that they offer a reliable approximation of observed baseline conditions on site.

Modelled traffic flows are shown to meet the standards required by the Transport Analysis Guidance (TAG) when compared to traffic turning count data at the junction.

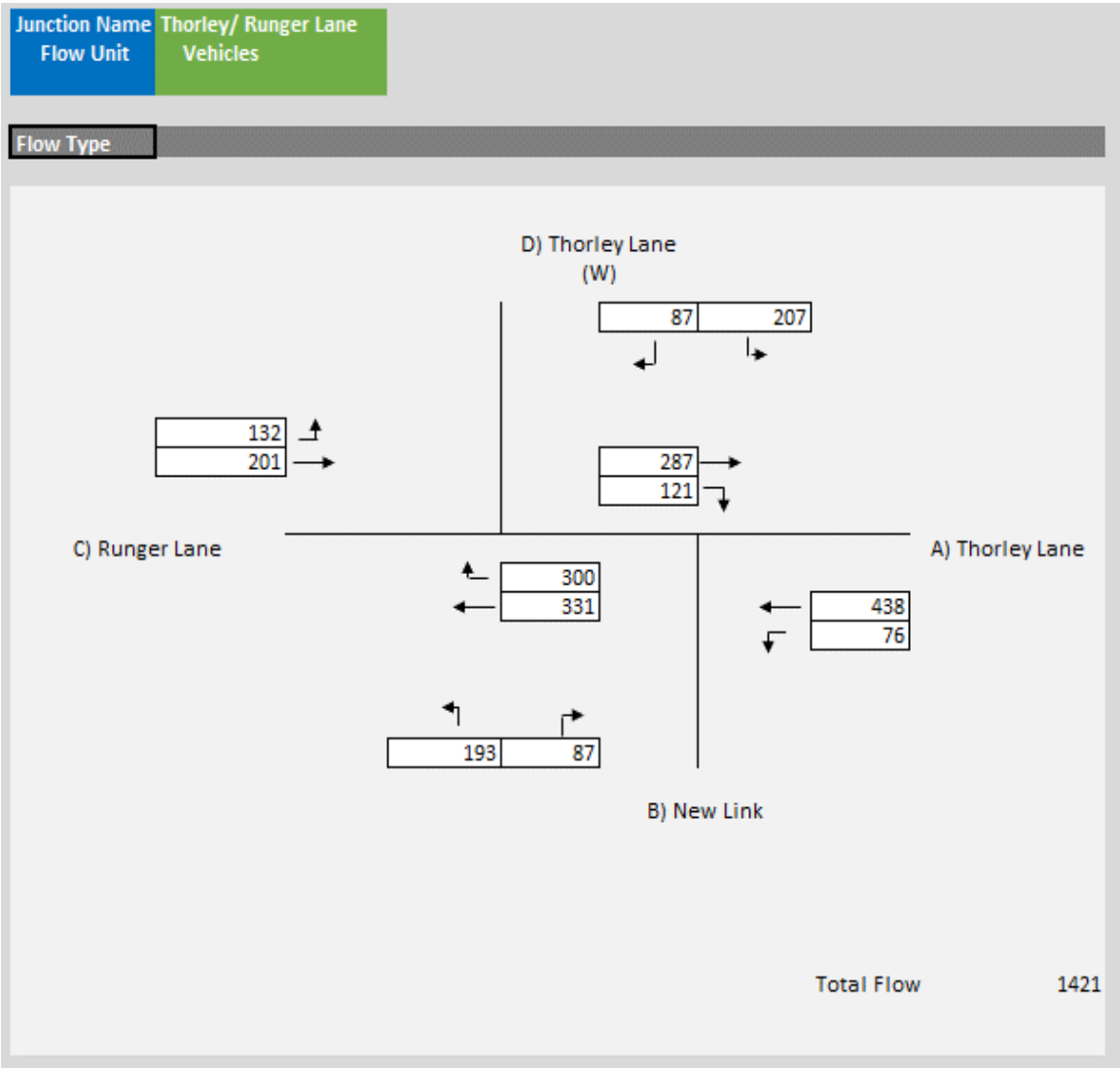
It is considered that the April 2023 Vissim Base model updated by Jacobs and described in this report can be used in evaluating the likely changes in operating conditions arising from the proposed new layouts of the Manchester Airport Terminal 2.

Appendix E. ANPR Data Process Flow Diagrams

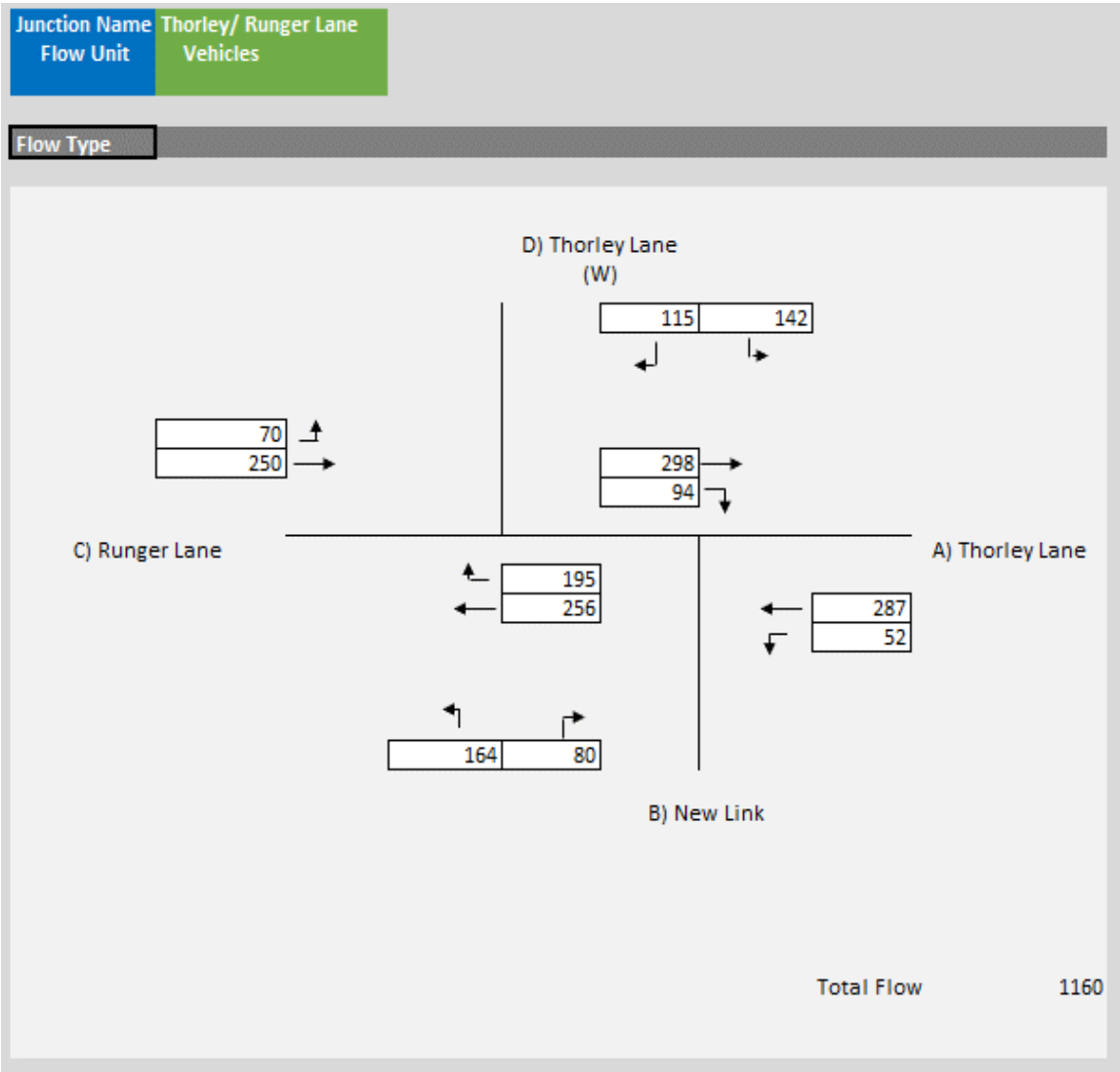
2024 ANPR Raw Count: Airport Peak



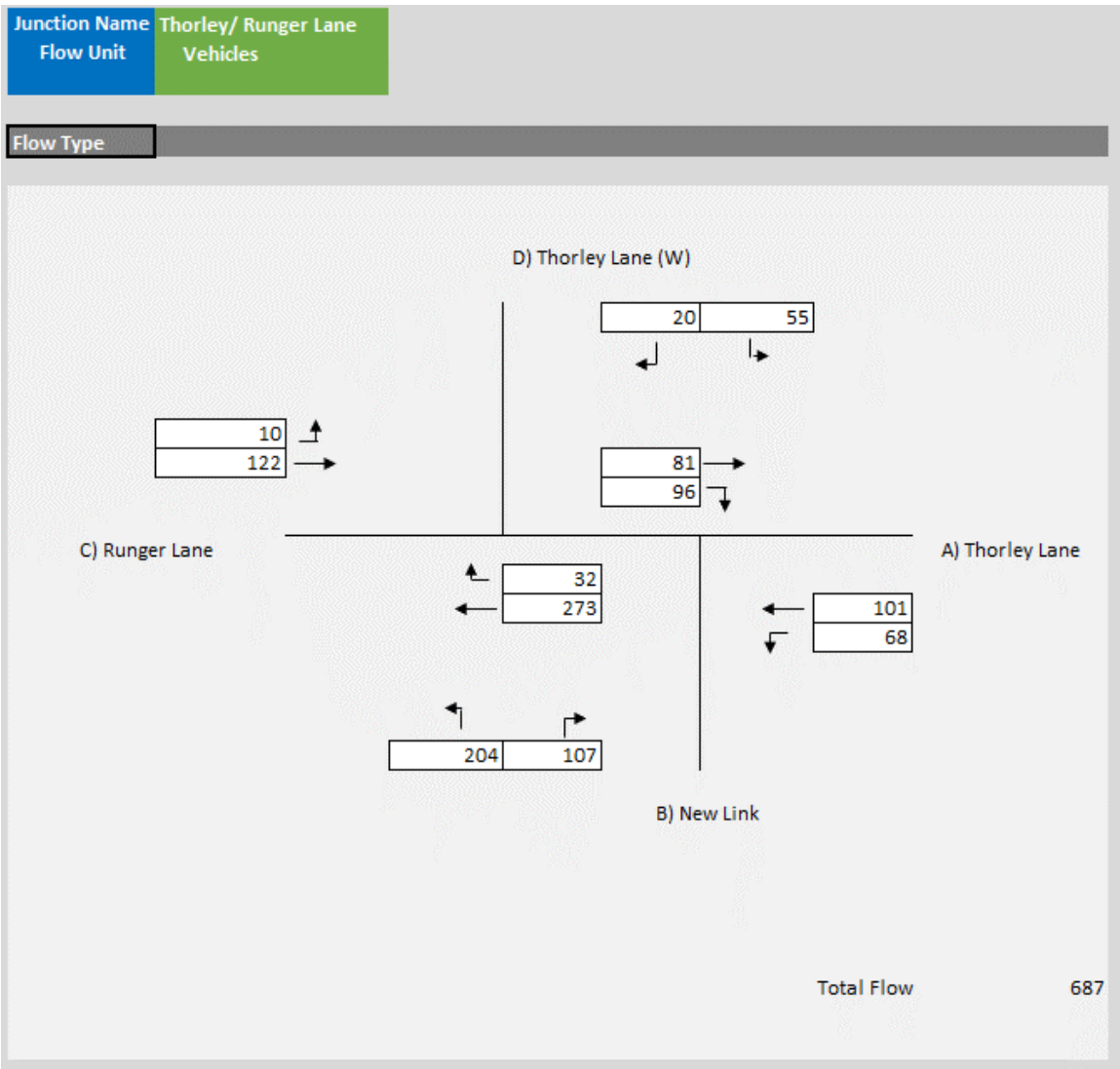
2024 ANPR Raw Count: AM Peak



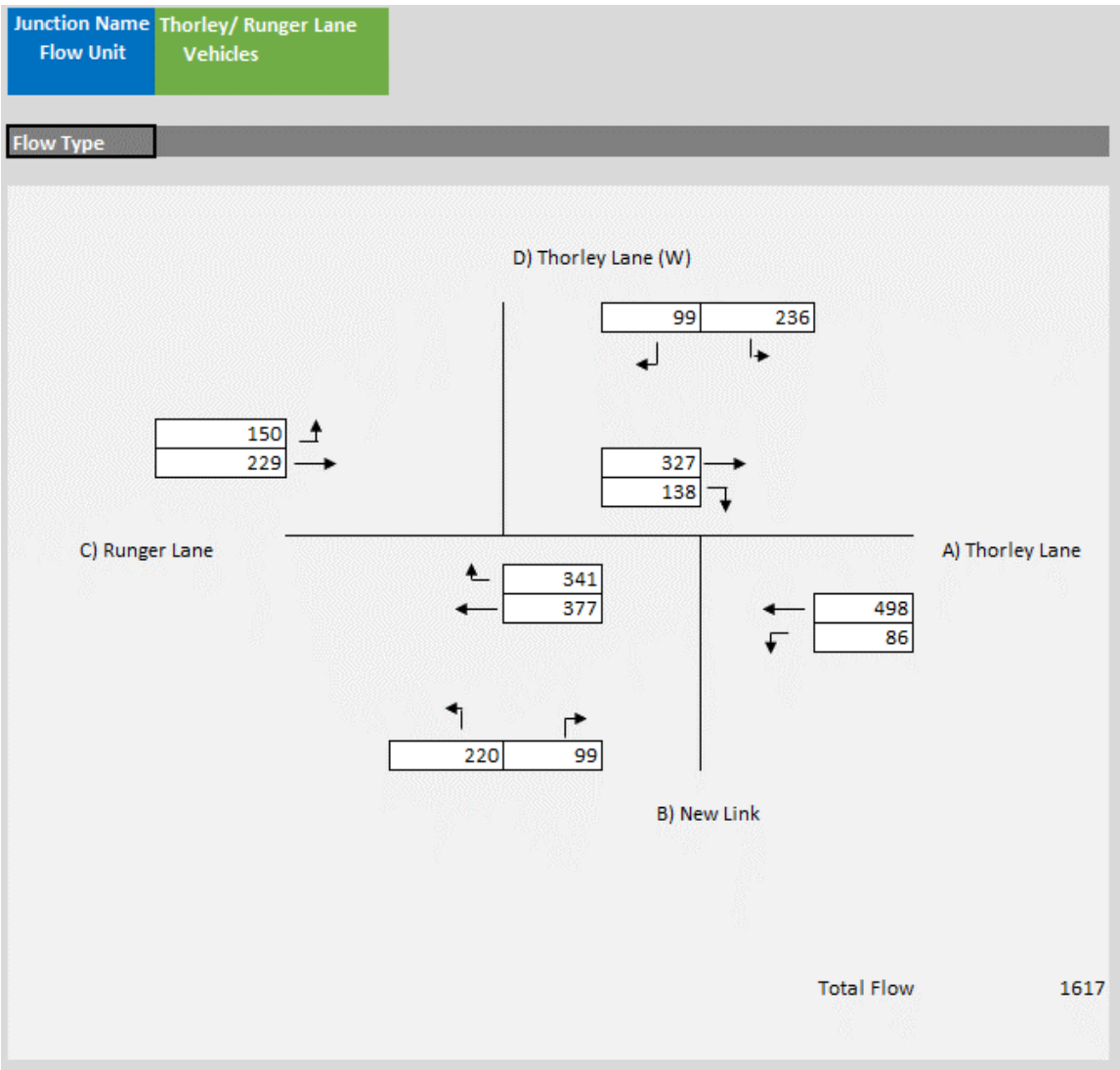
2024 ANPR Raw Count: PM Peak



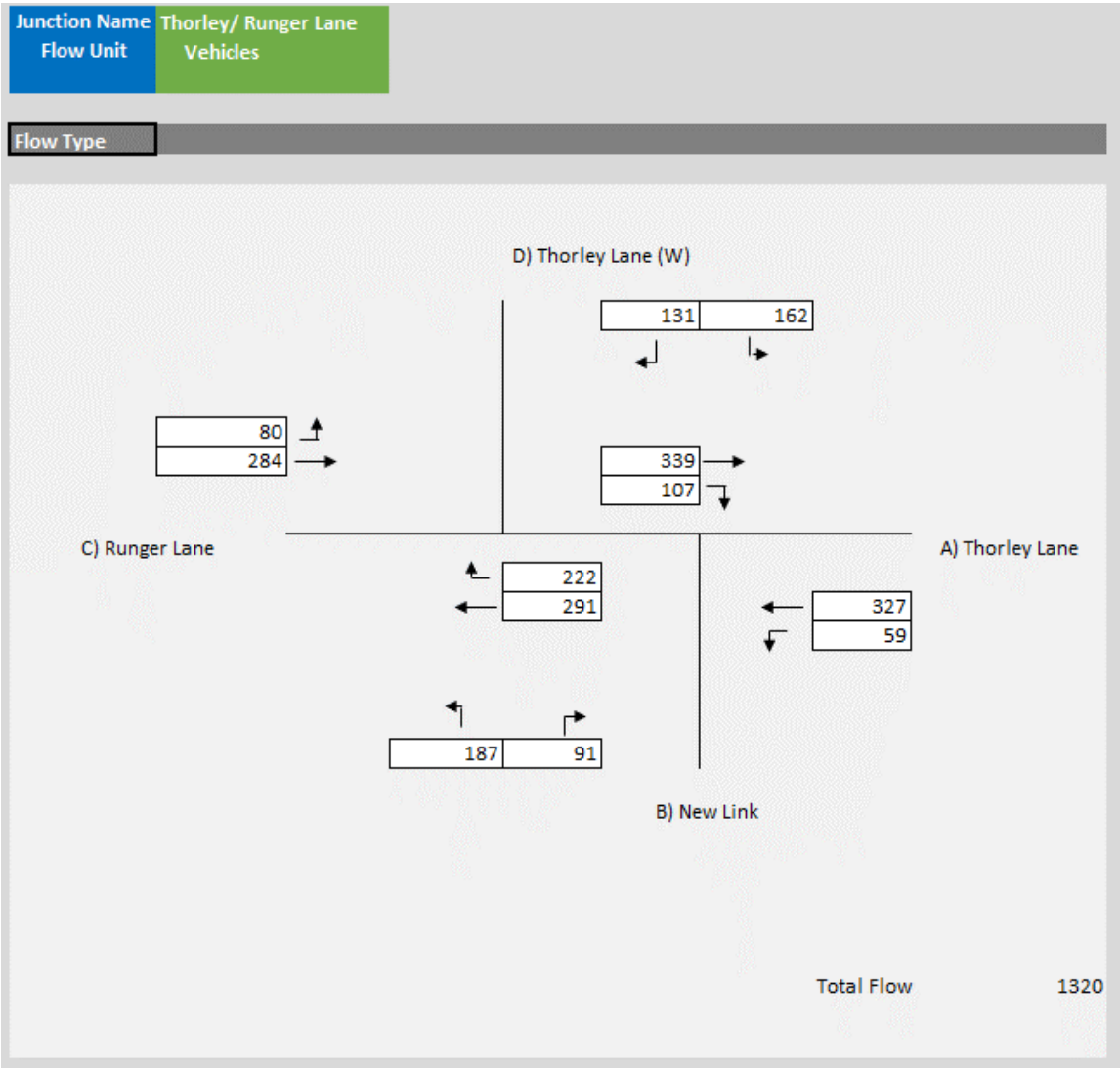
2024 ANPR 13.77% Matched Uplift: Airport Peak



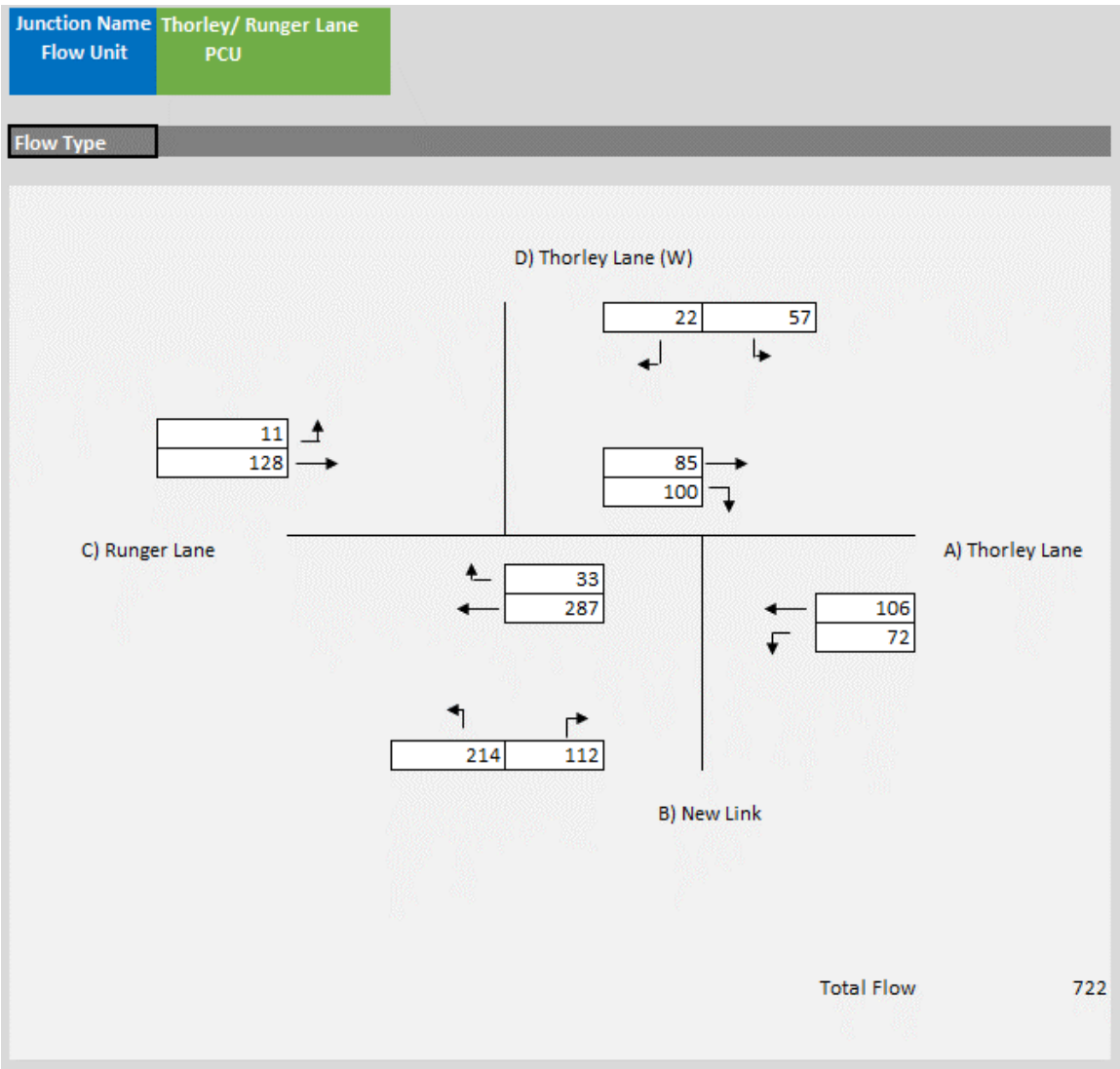
2024 ANPR 13.77% Matched Uplift: AM Peak



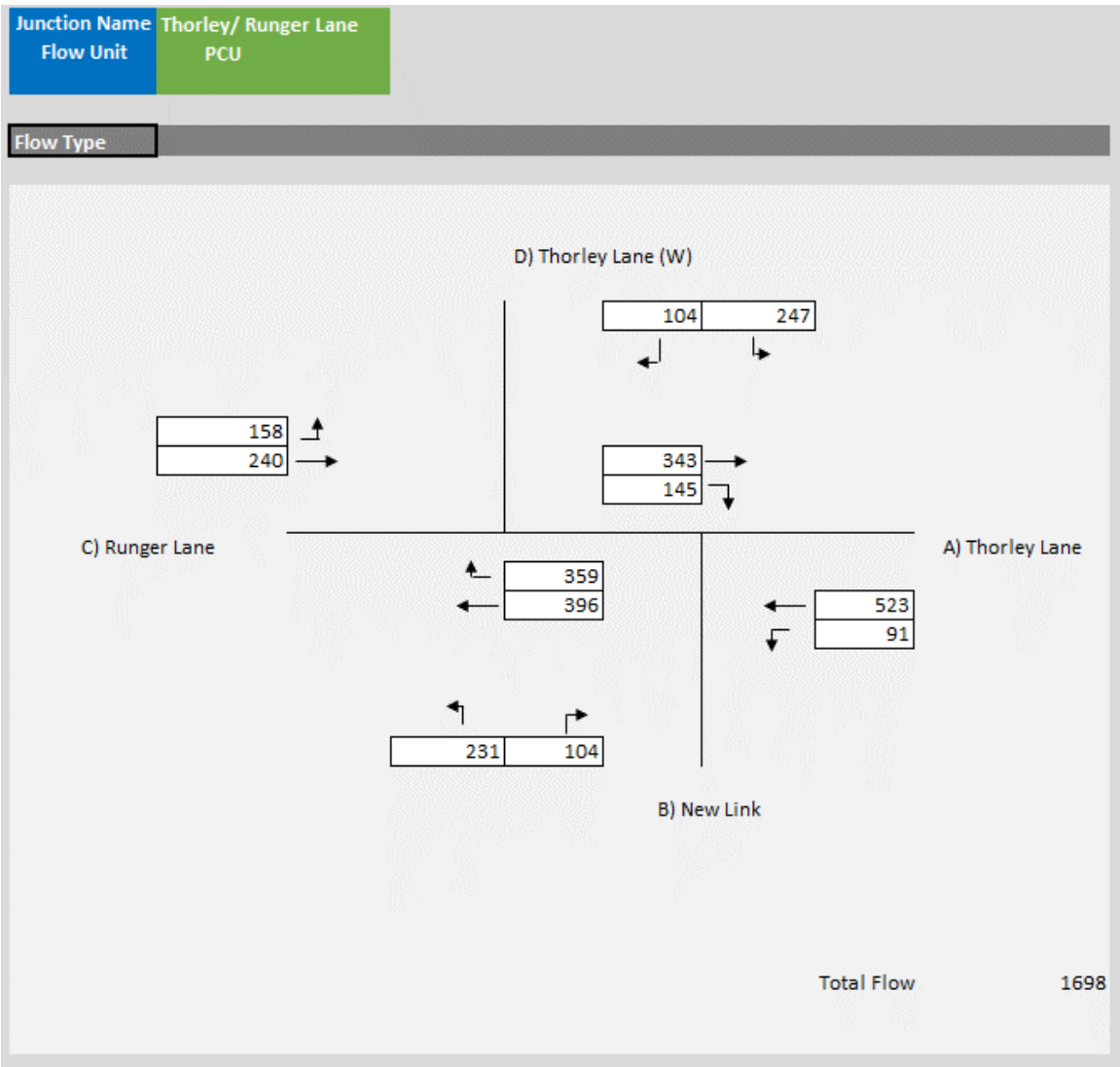
2024 ANPR 13.77% Matched Uplift: PM Peak



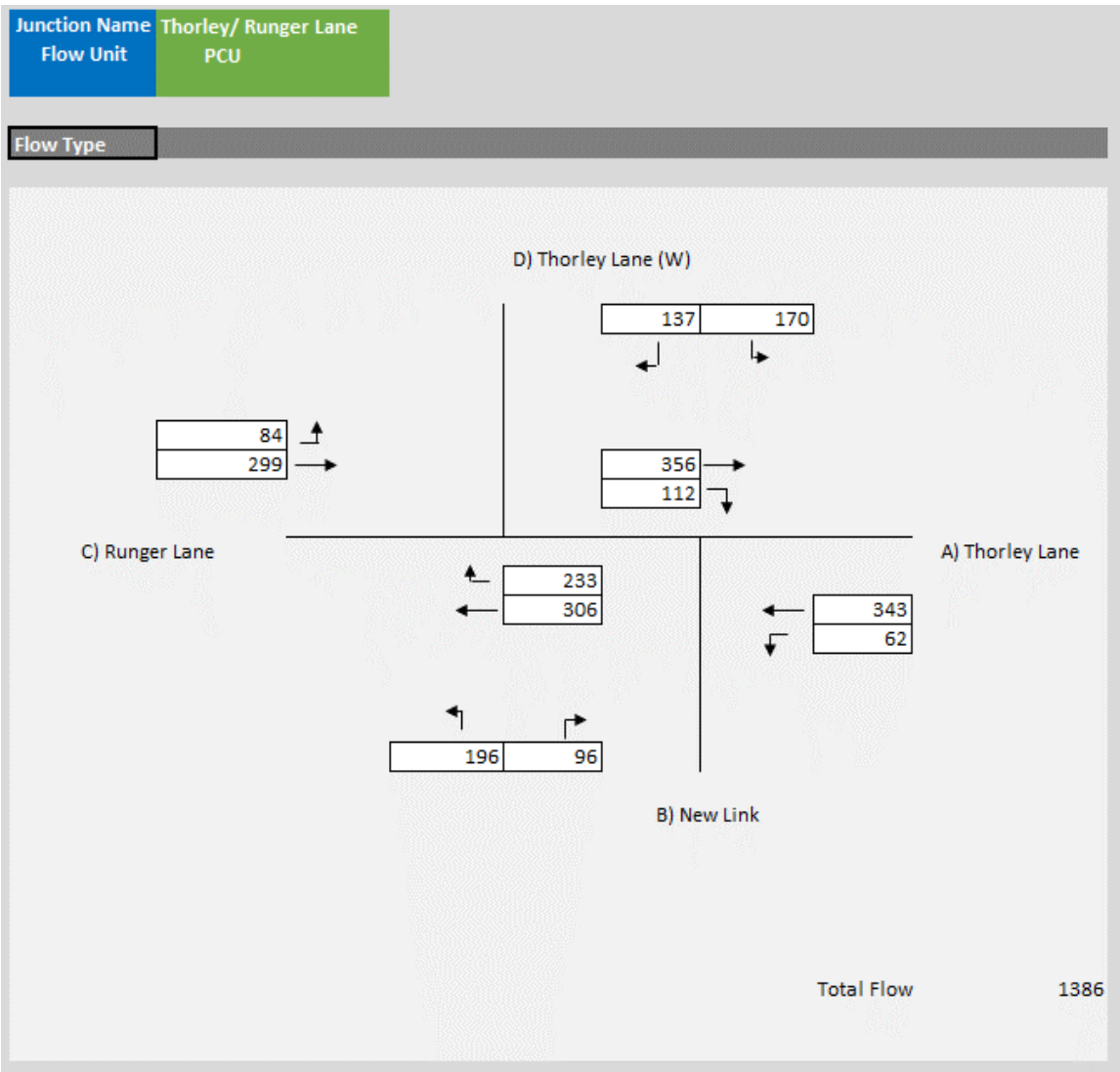
2024 ANPR PCU Converted: Airport Peak



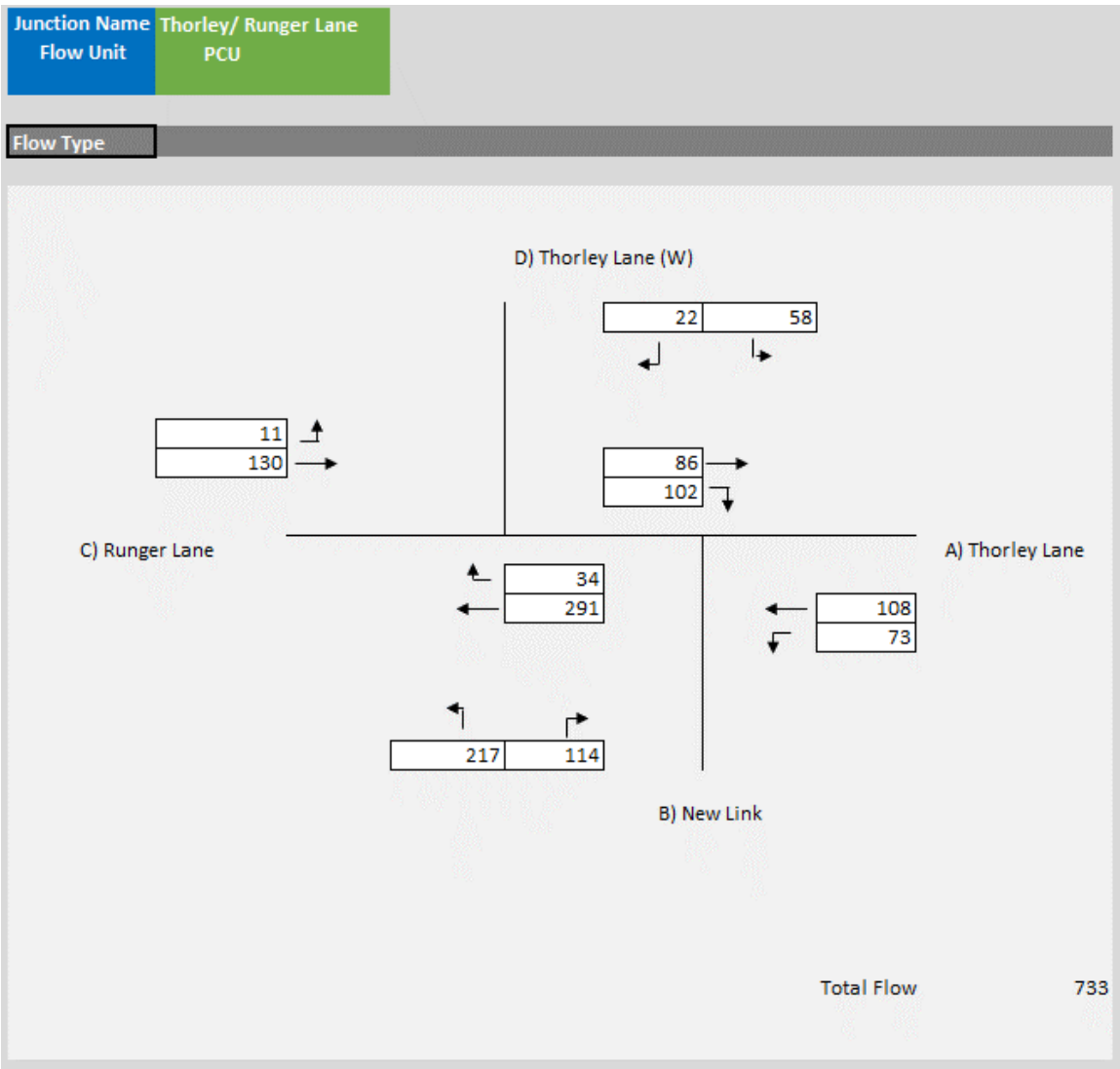
2024 ANPR PCU Converted: AM Peak



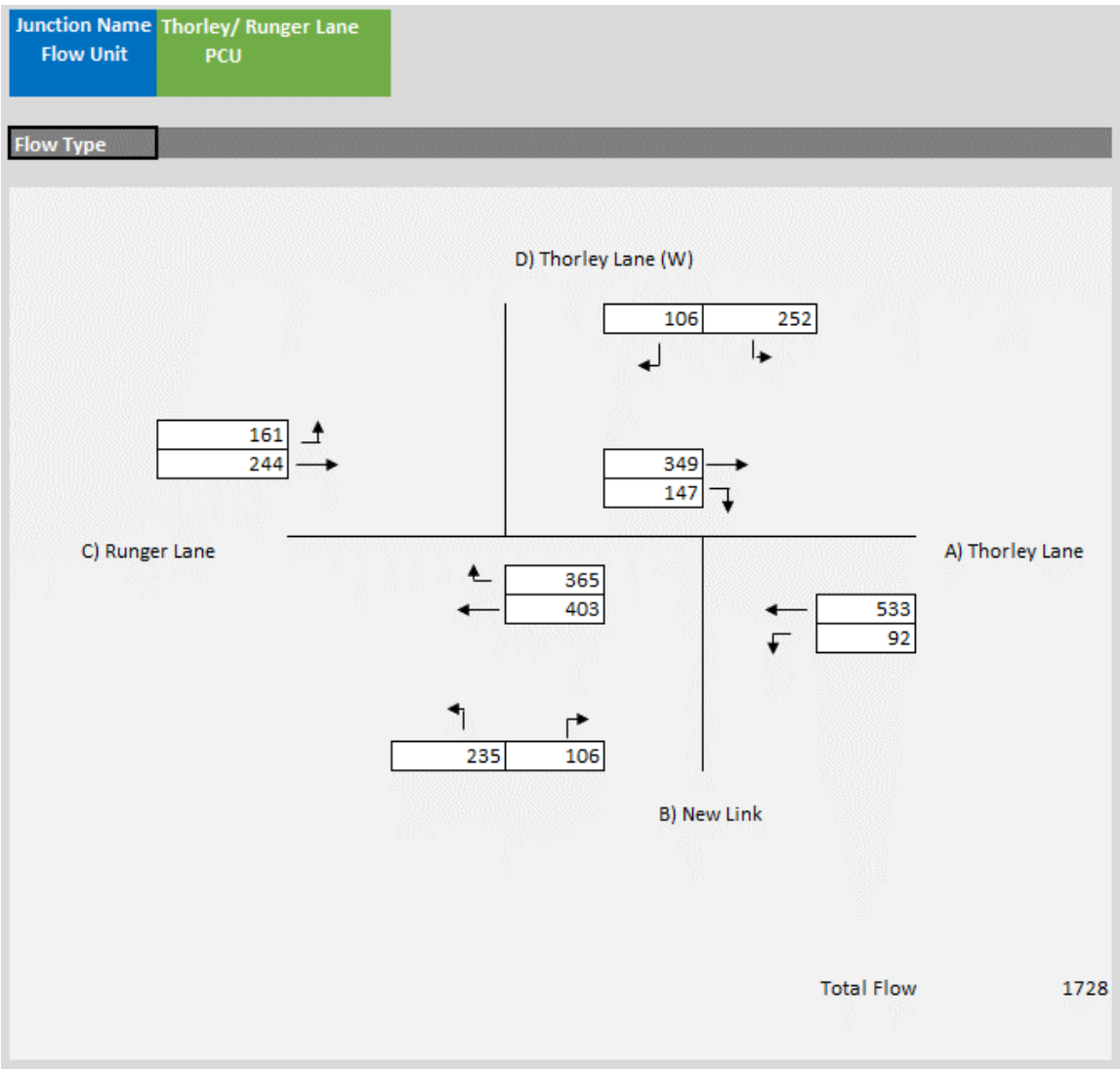
2024 ANPR PCU Converted: PM Peak



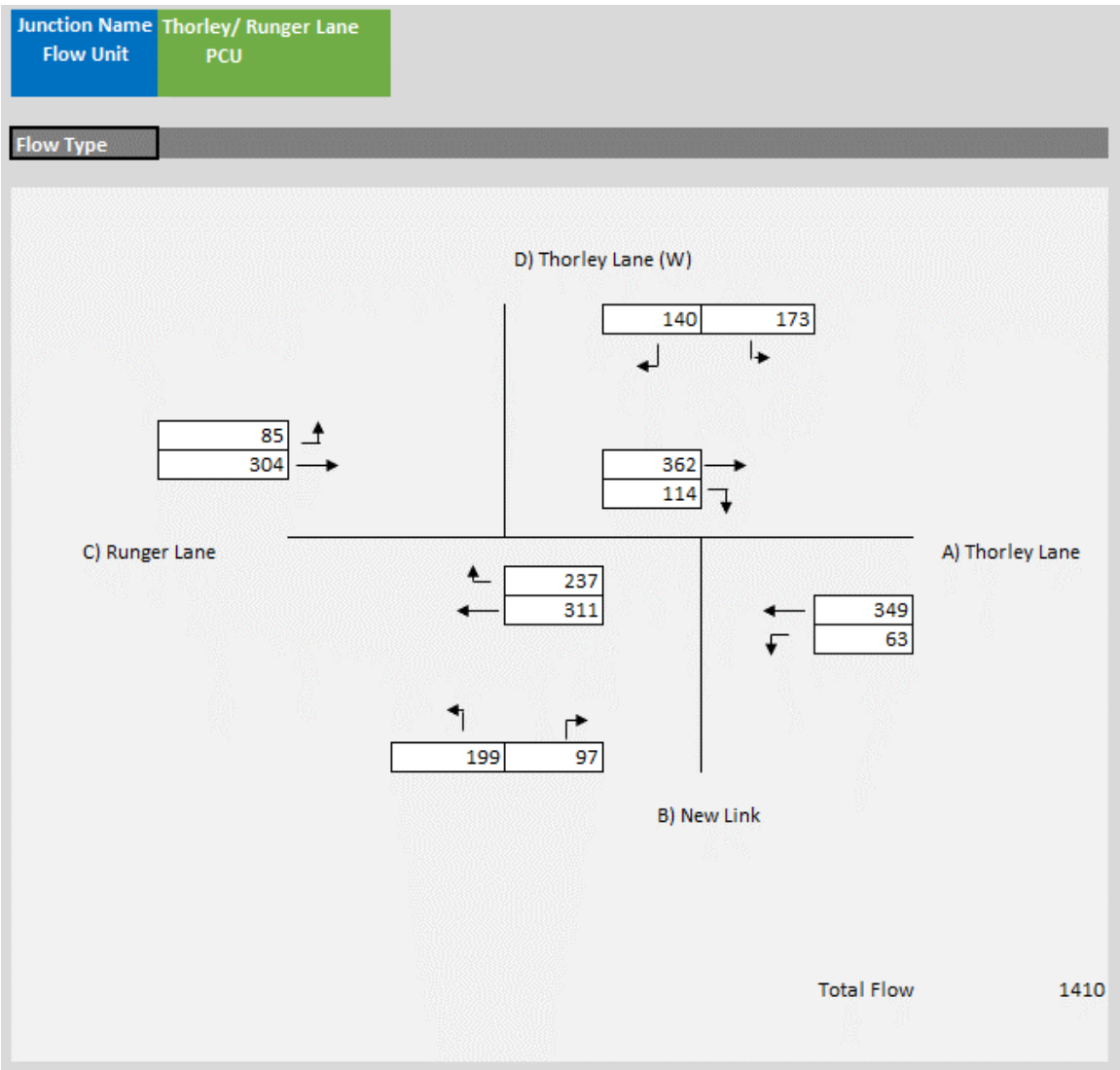
2024 – 2026 ANPR TEMPro: Airport Peak



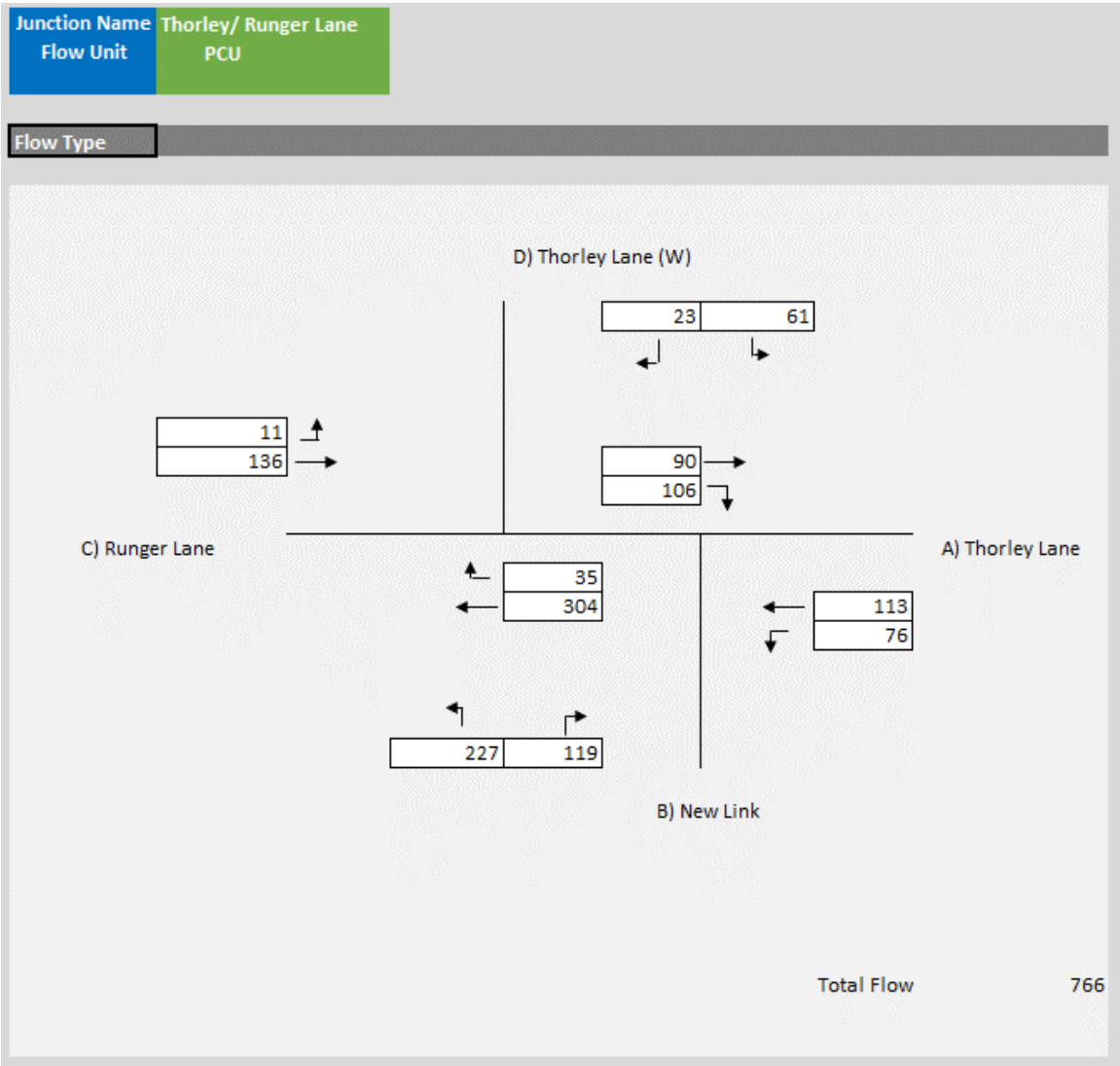
2024 – 2026 ANPR TEMPro: AM Peak



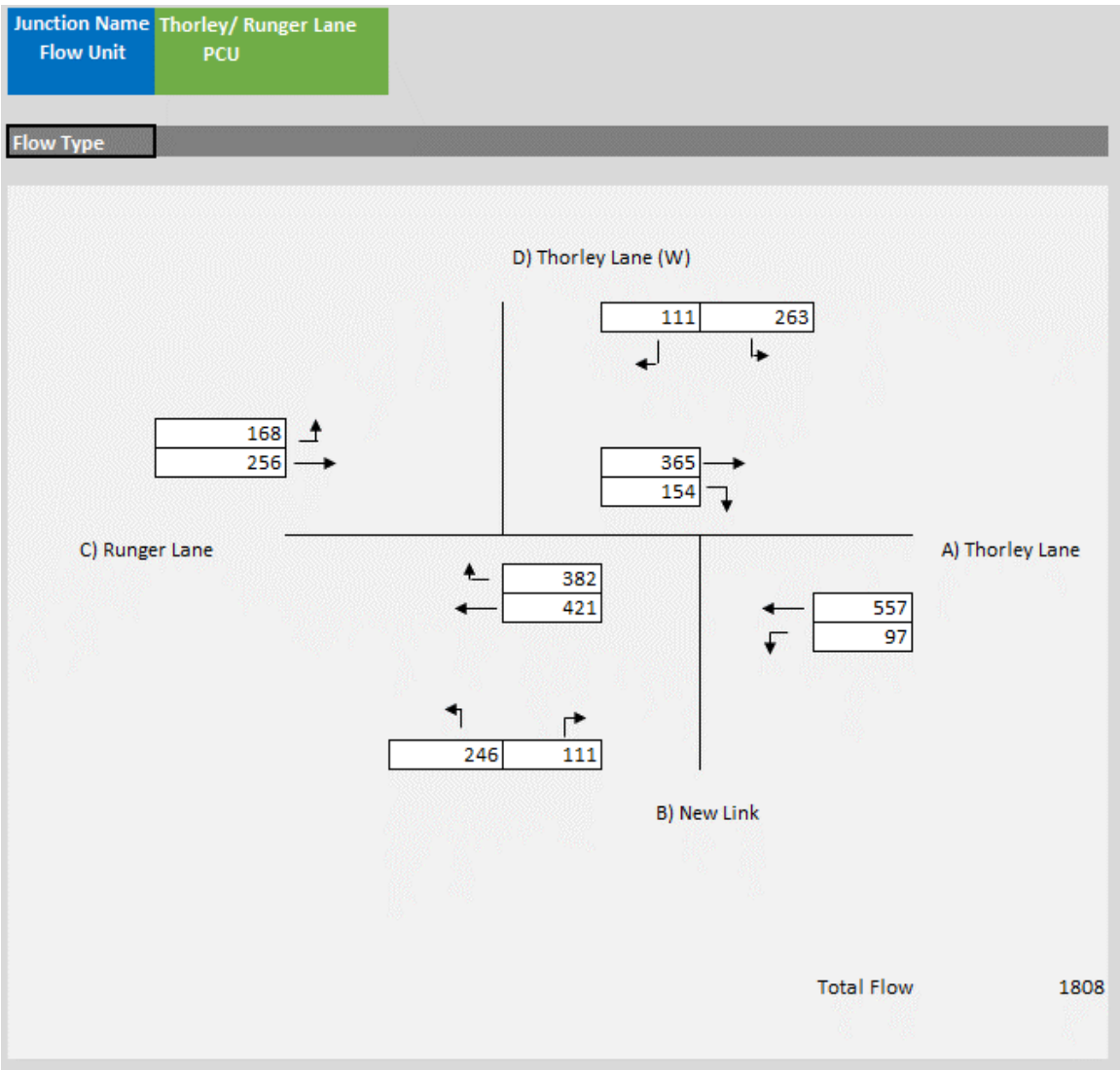
2024 – 2026 ANPR TEMPro: PM Peak



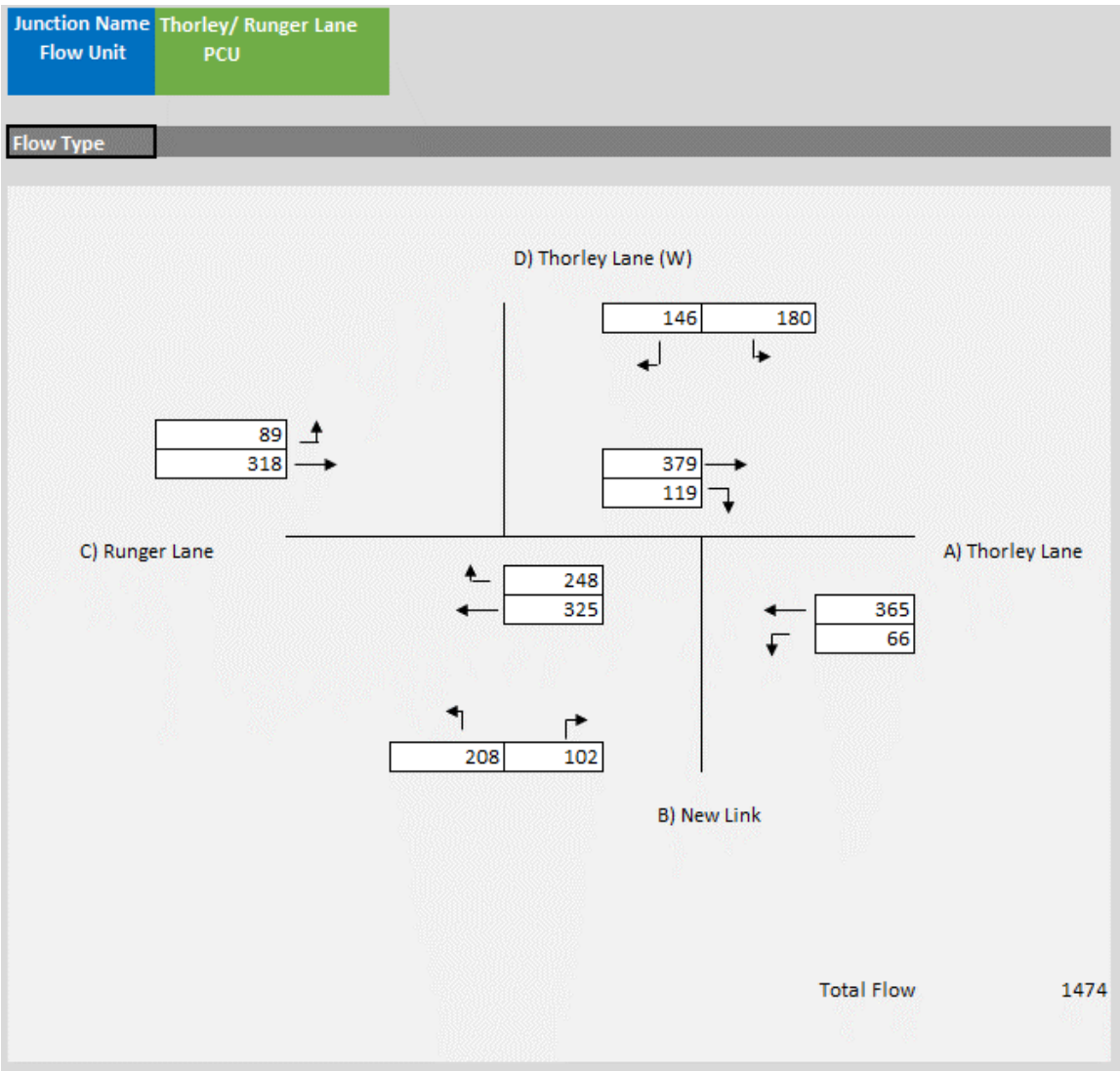
2024 – 2030 ANPR TEMPro: Airport Peak



2024 – 2030 ANPR TEMPro: AM Peak

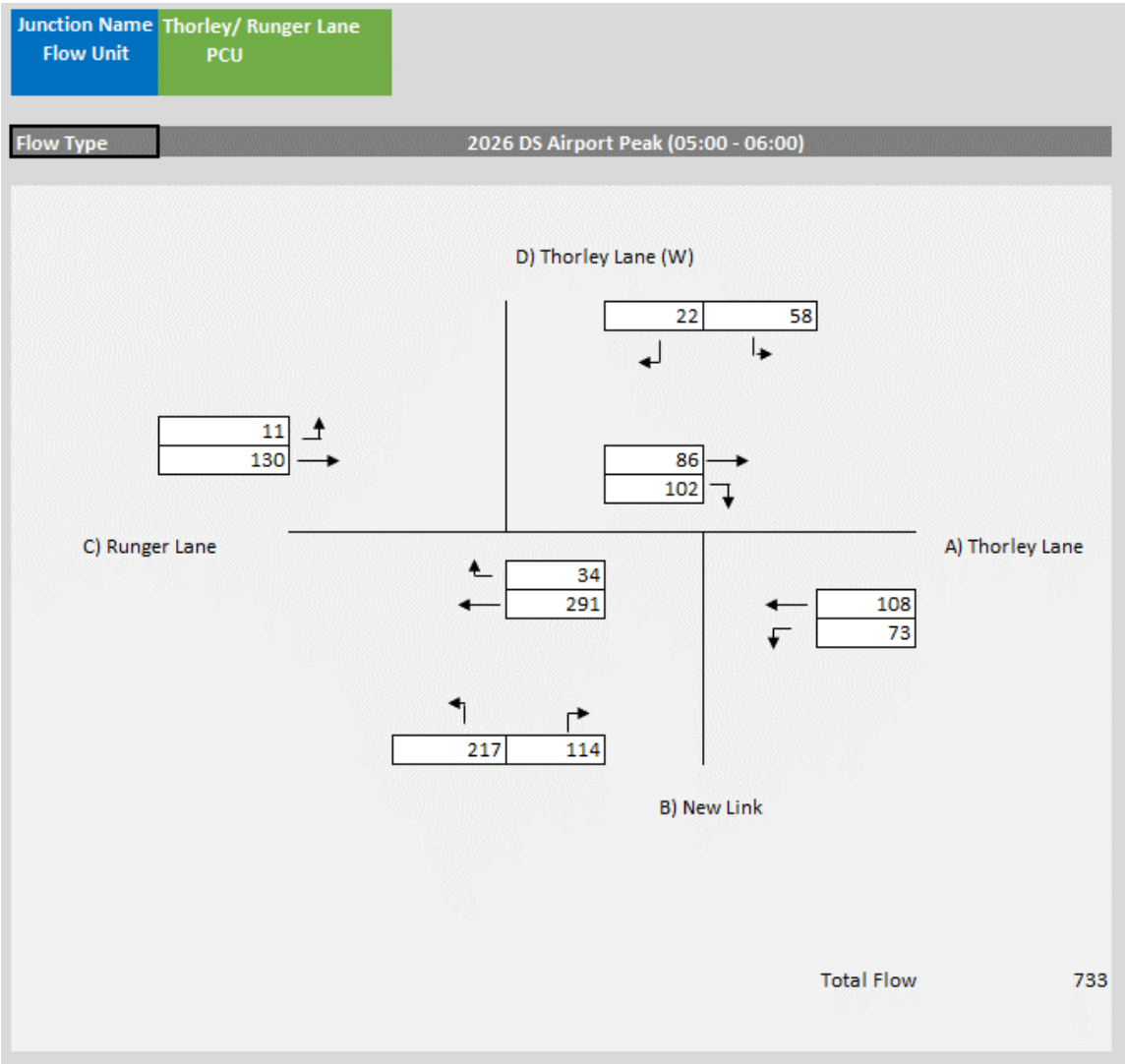


2024 – 2030 ANPR TEMPro: PM Peak

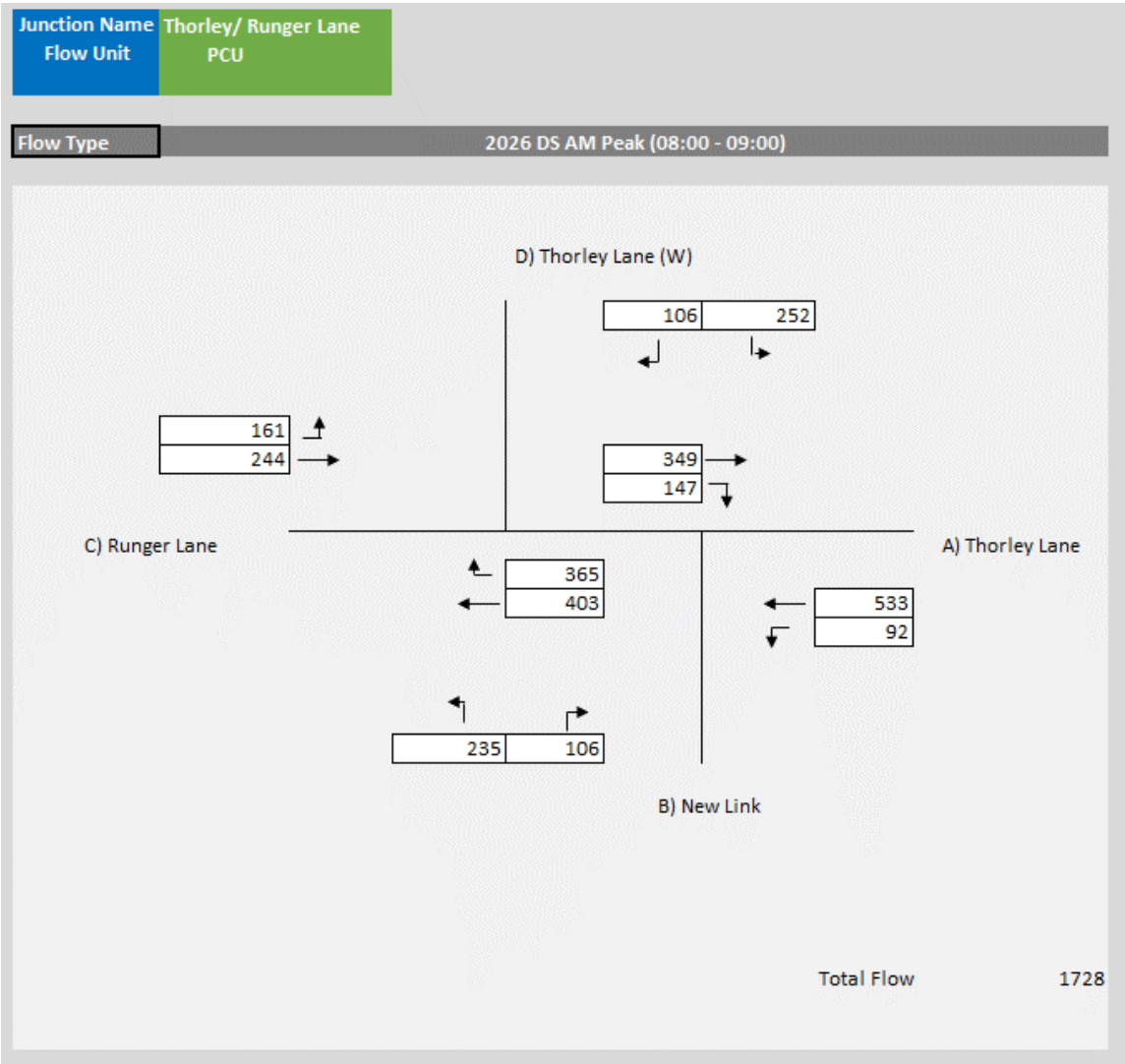


Appendix F. Background Traffic Flow Diagrams

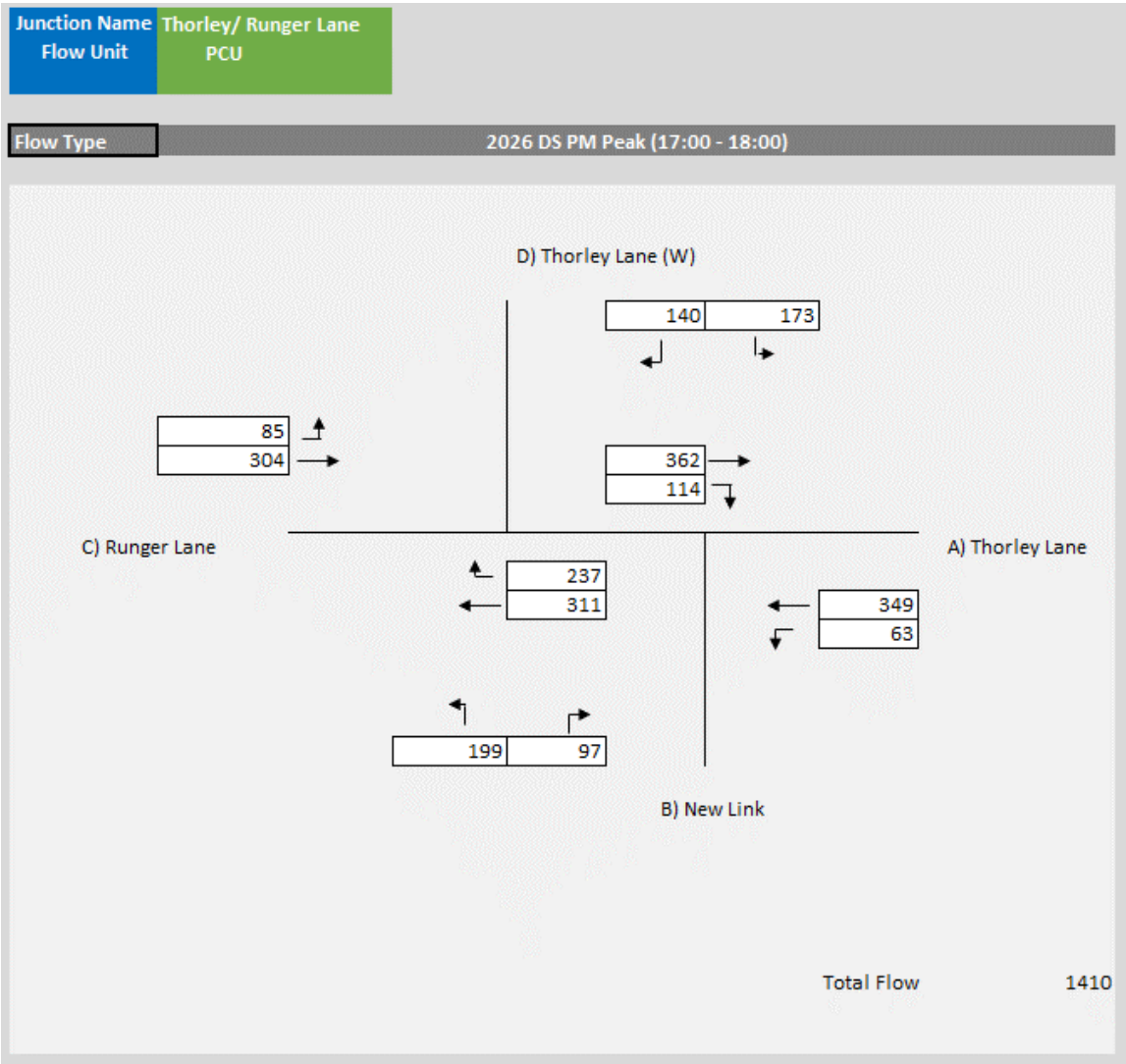
2026 Background Traffic: Airport Peak



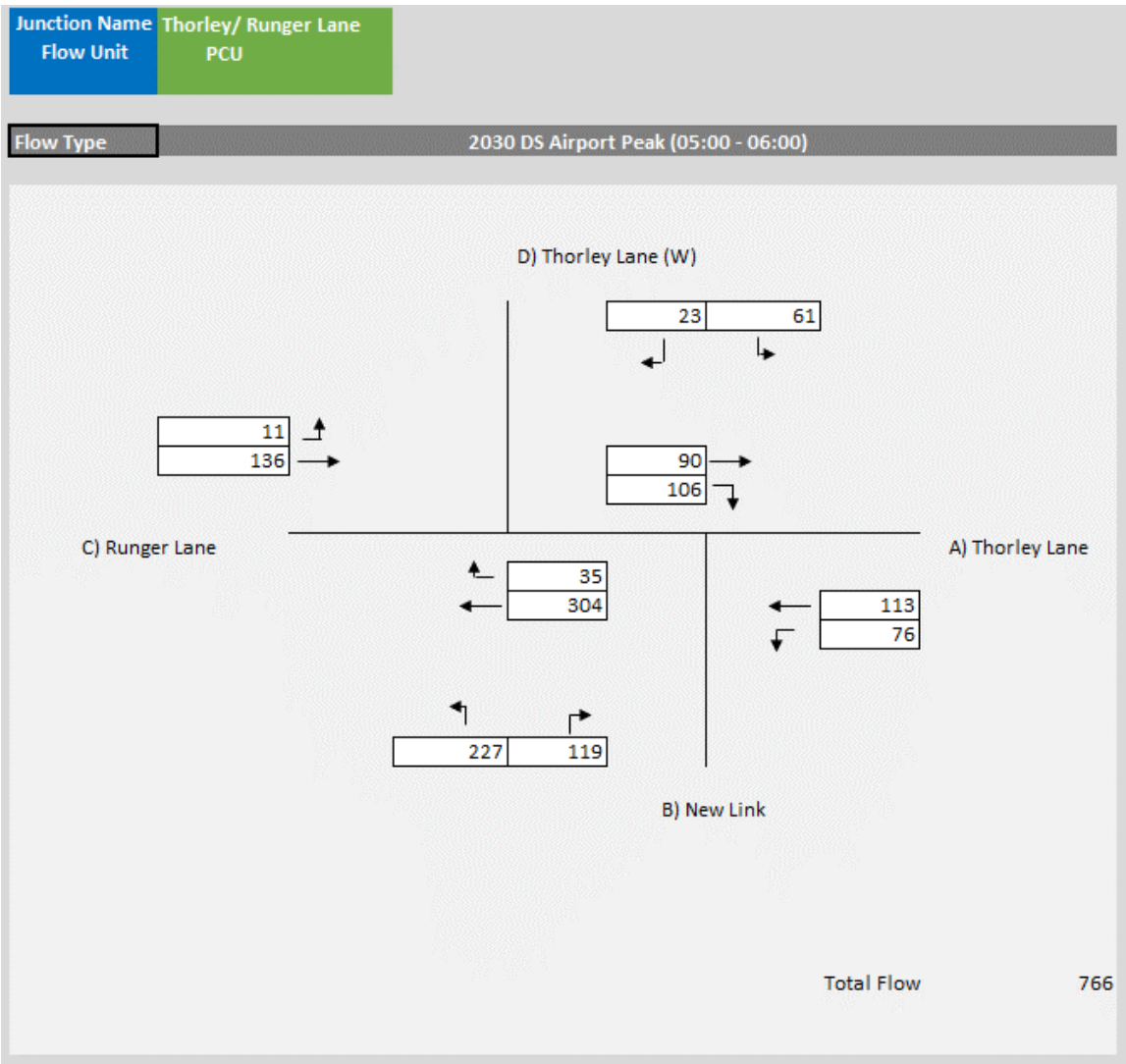
2026 Background Traffic: AM Peak



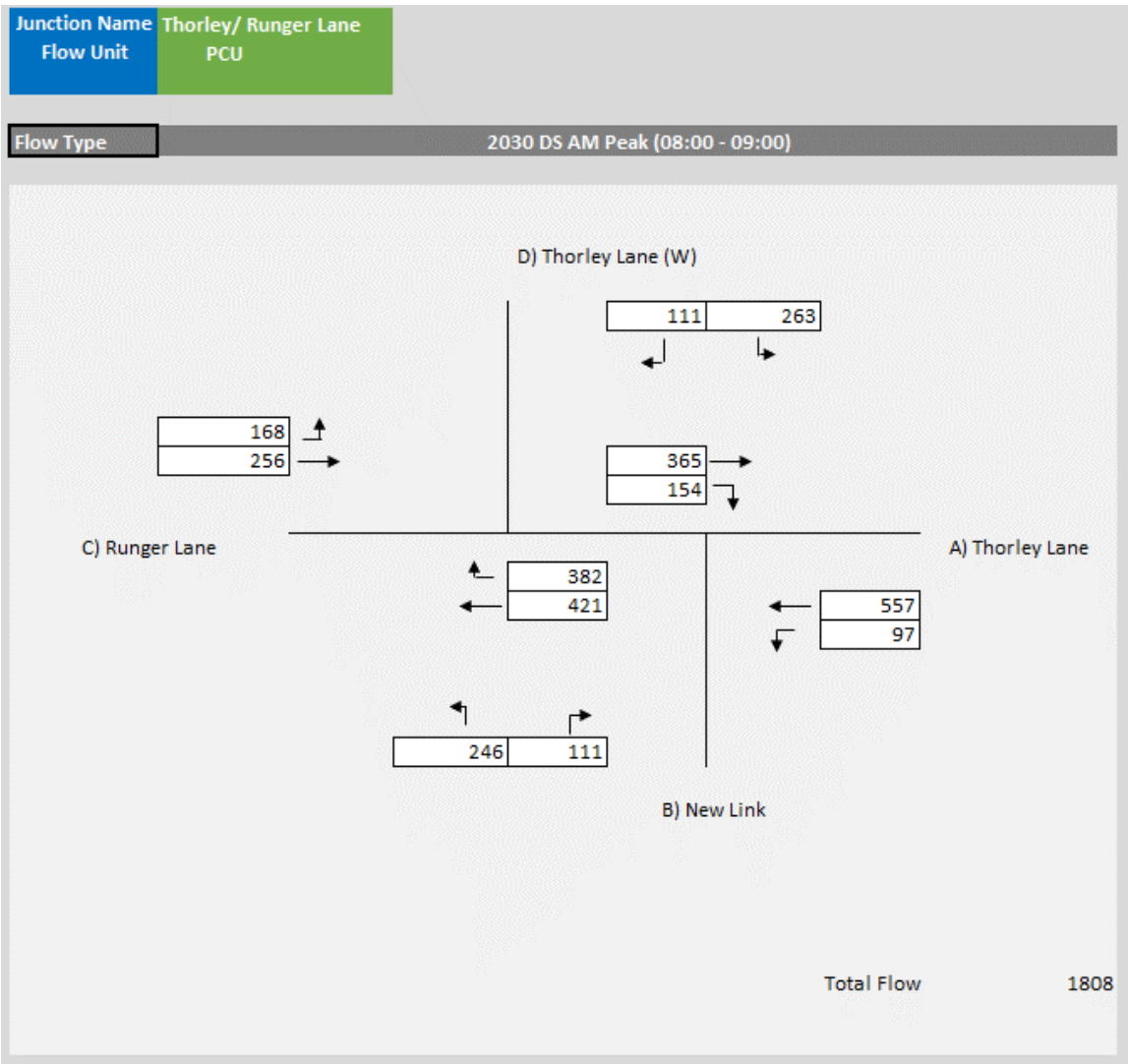
2026 Background Traffic: PM Peak



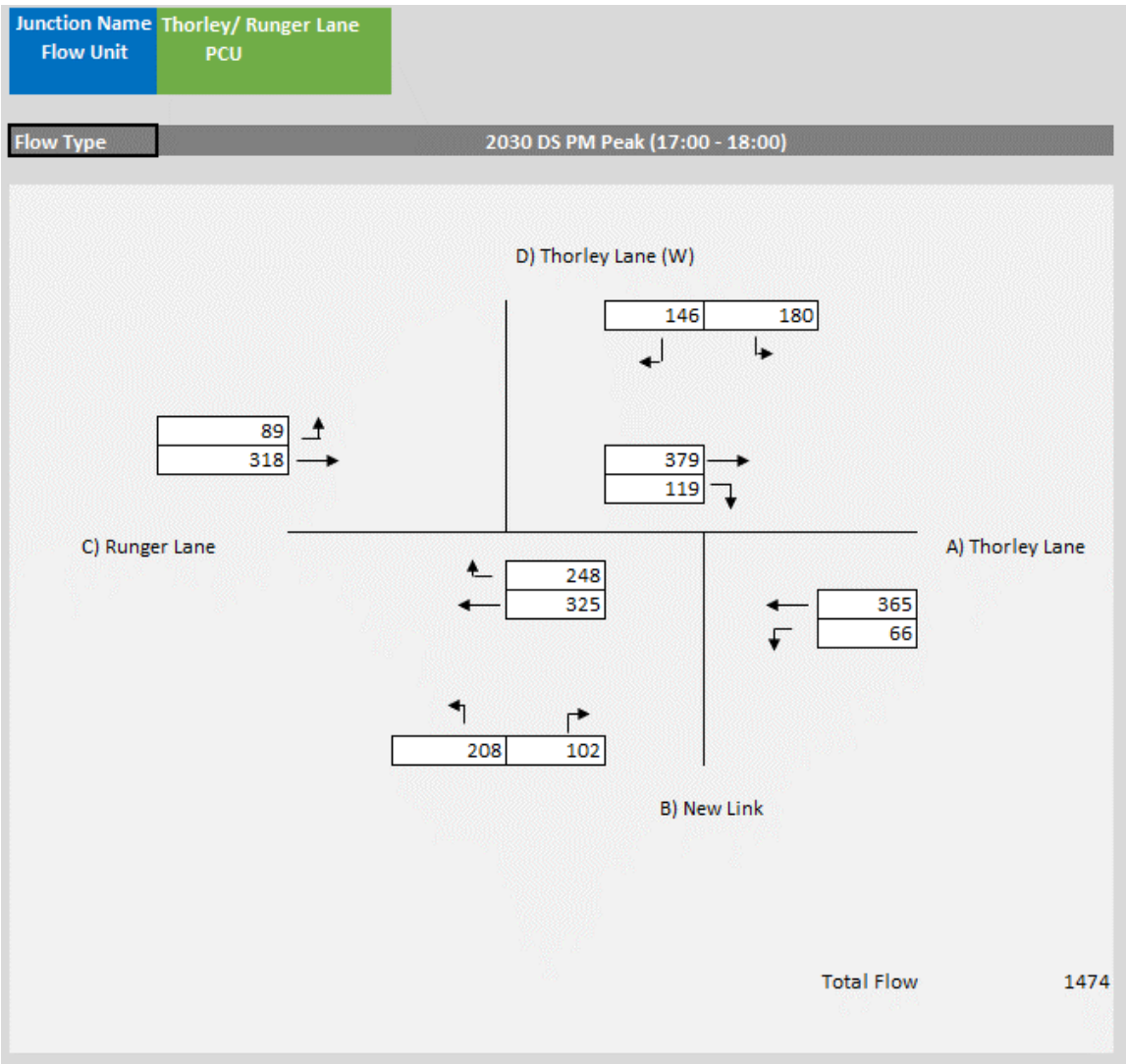
2030 Background Traffic: Airport Peak



2030 Background Traffic: AM Peak

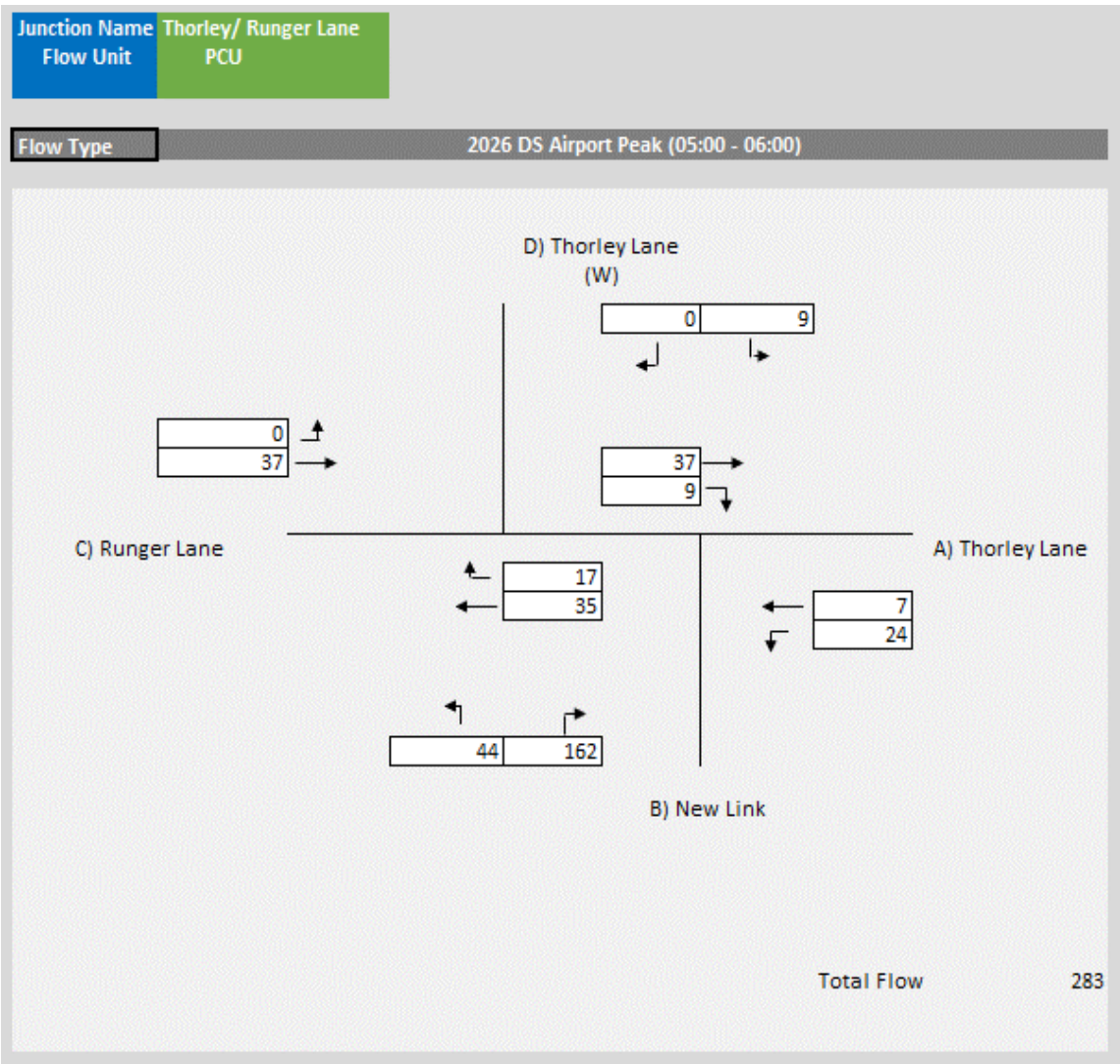


2030 Background Traffic: PM Peak

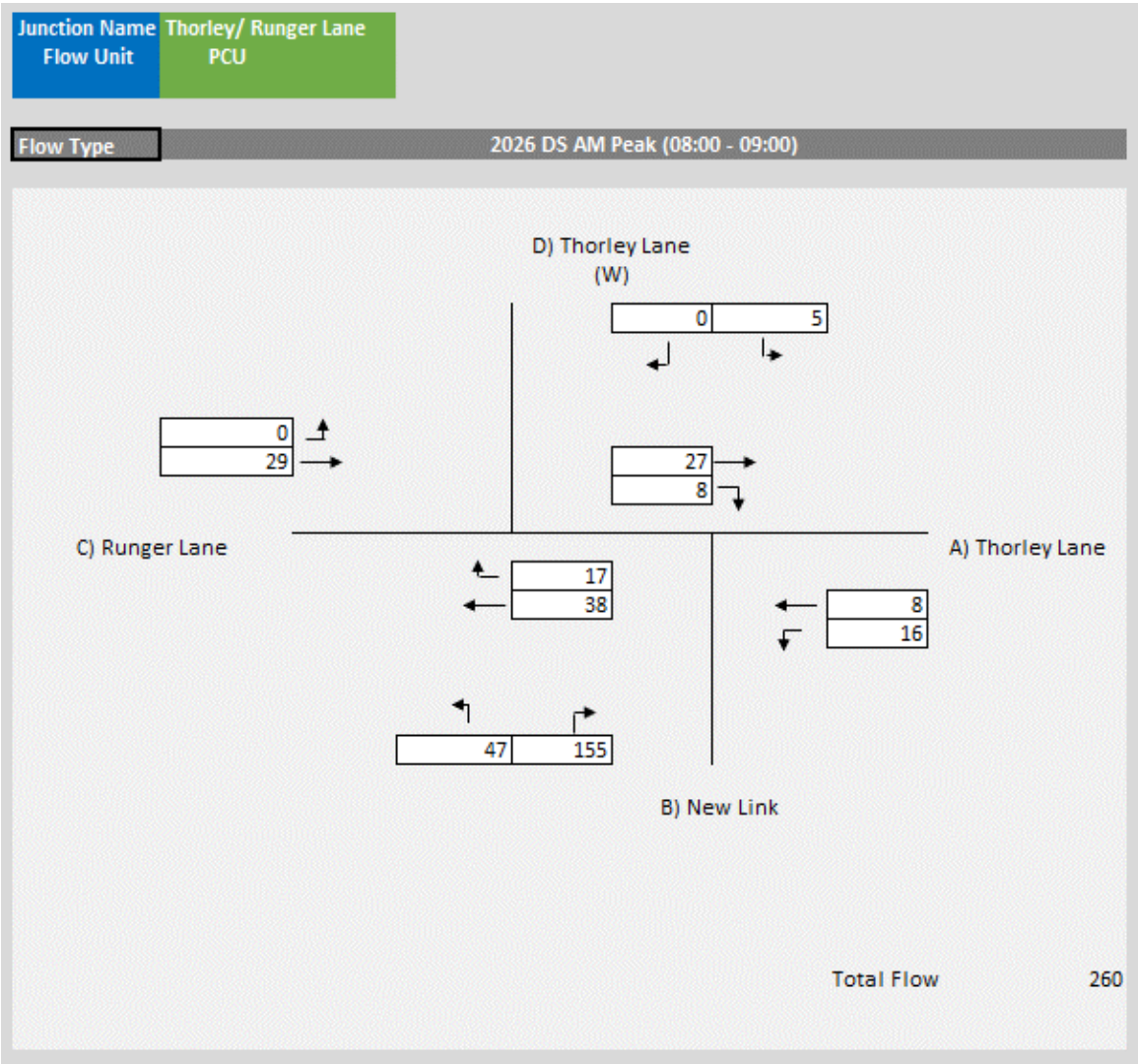


Appendix G. Airport Traffic Flow Diagrams

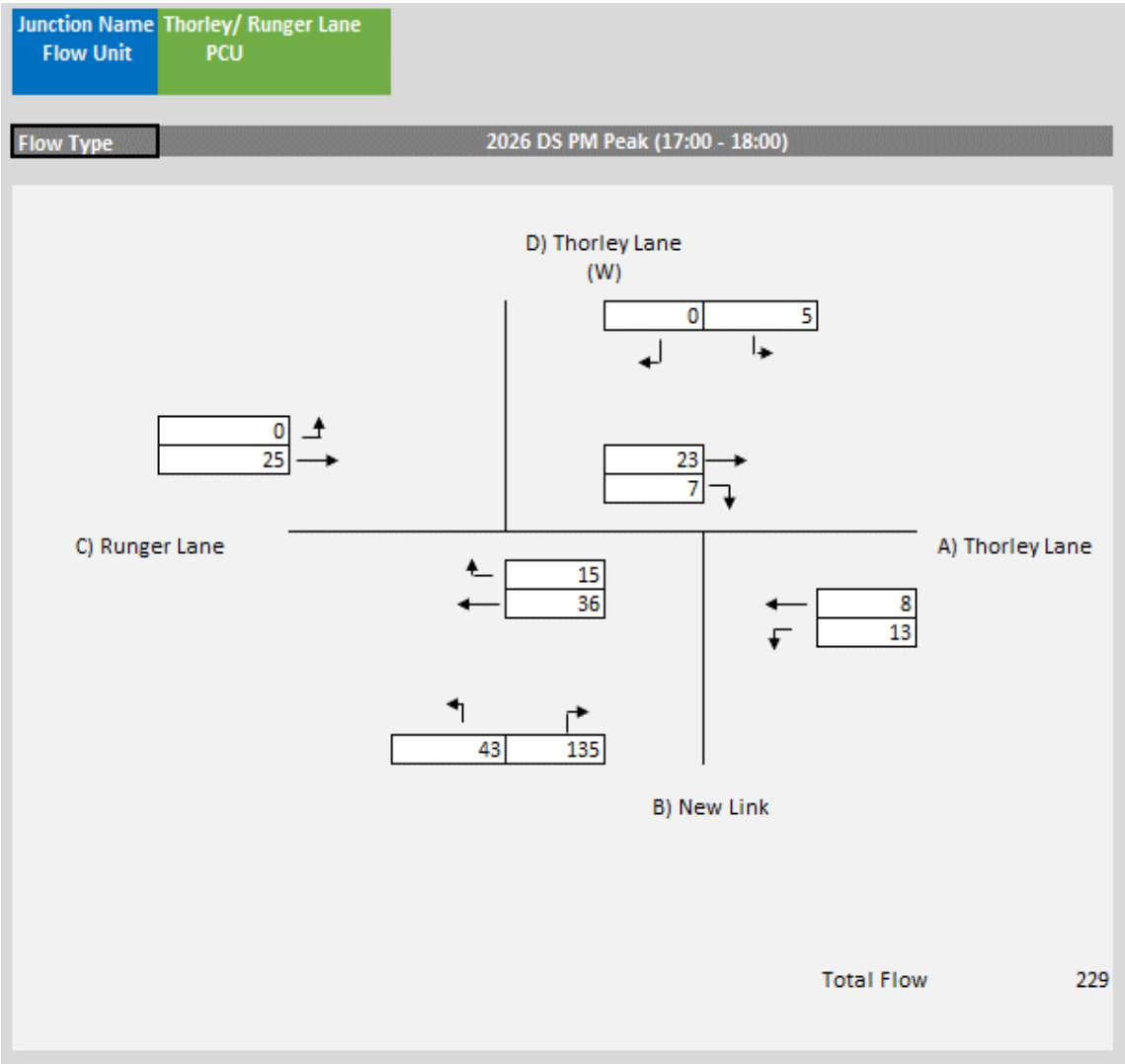
2026 Airport Traffic: Airport Peak



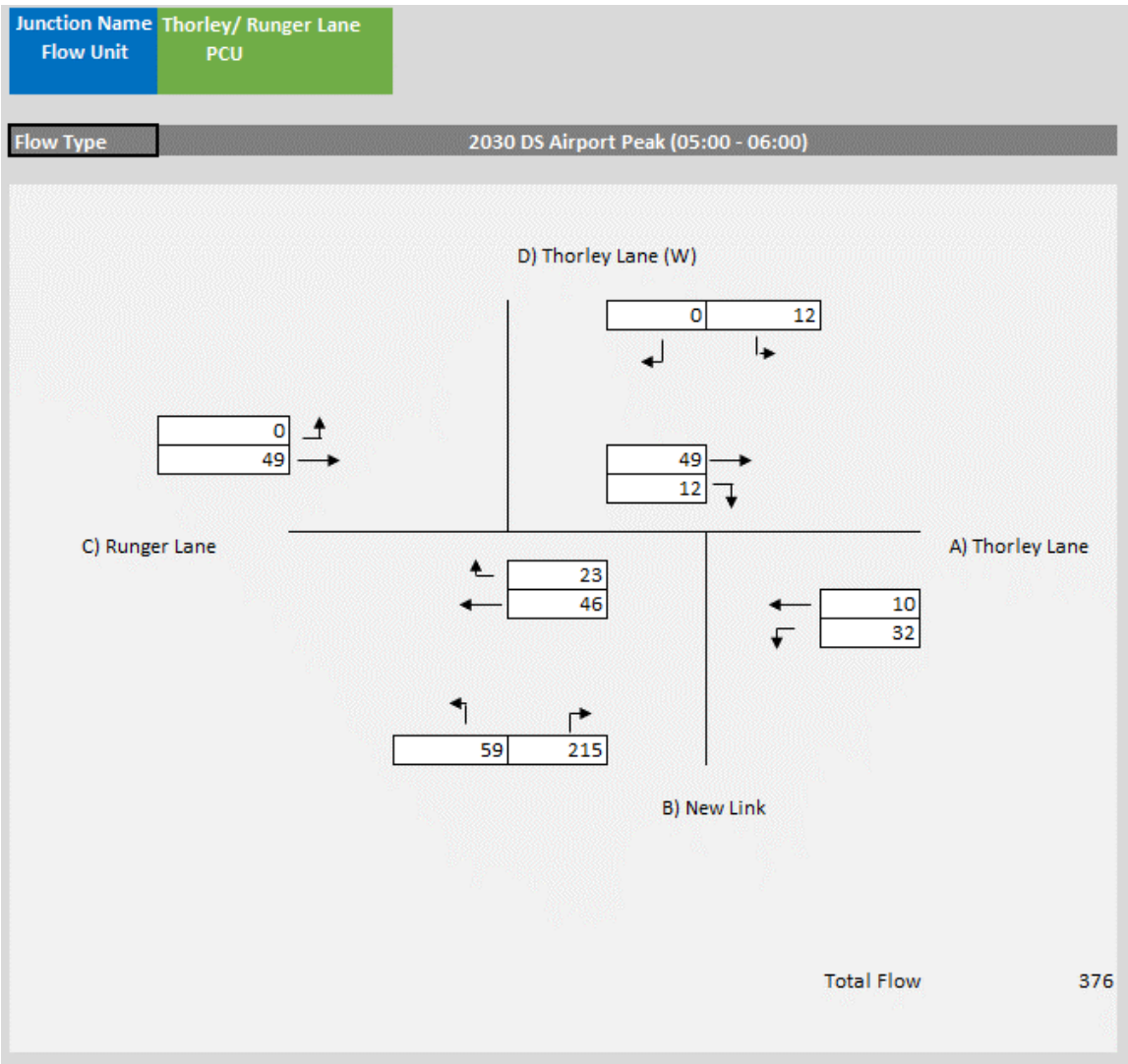
2026 Airport Traffic: AM Peak



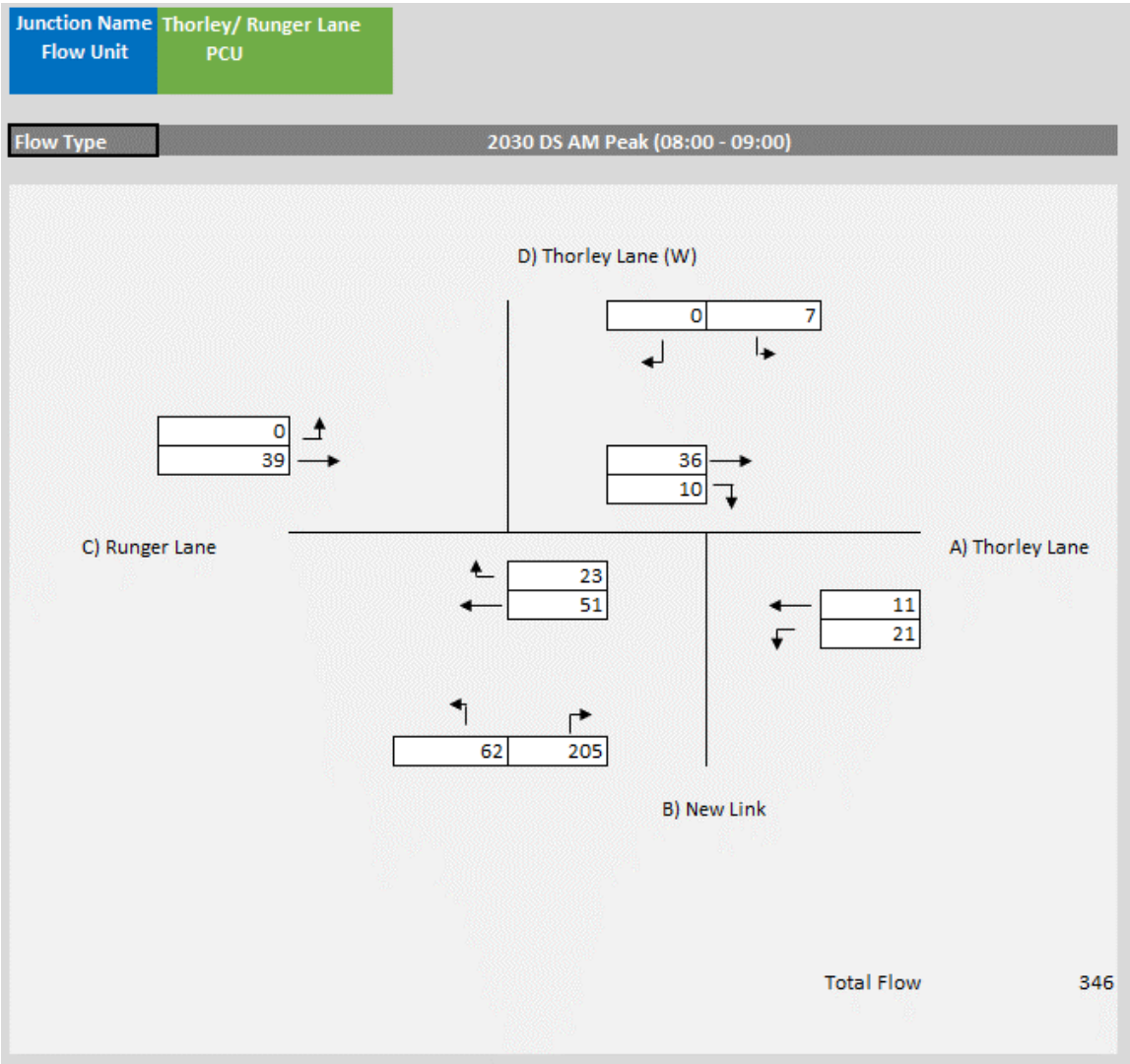
2026 Airport Traffic: PM Peak



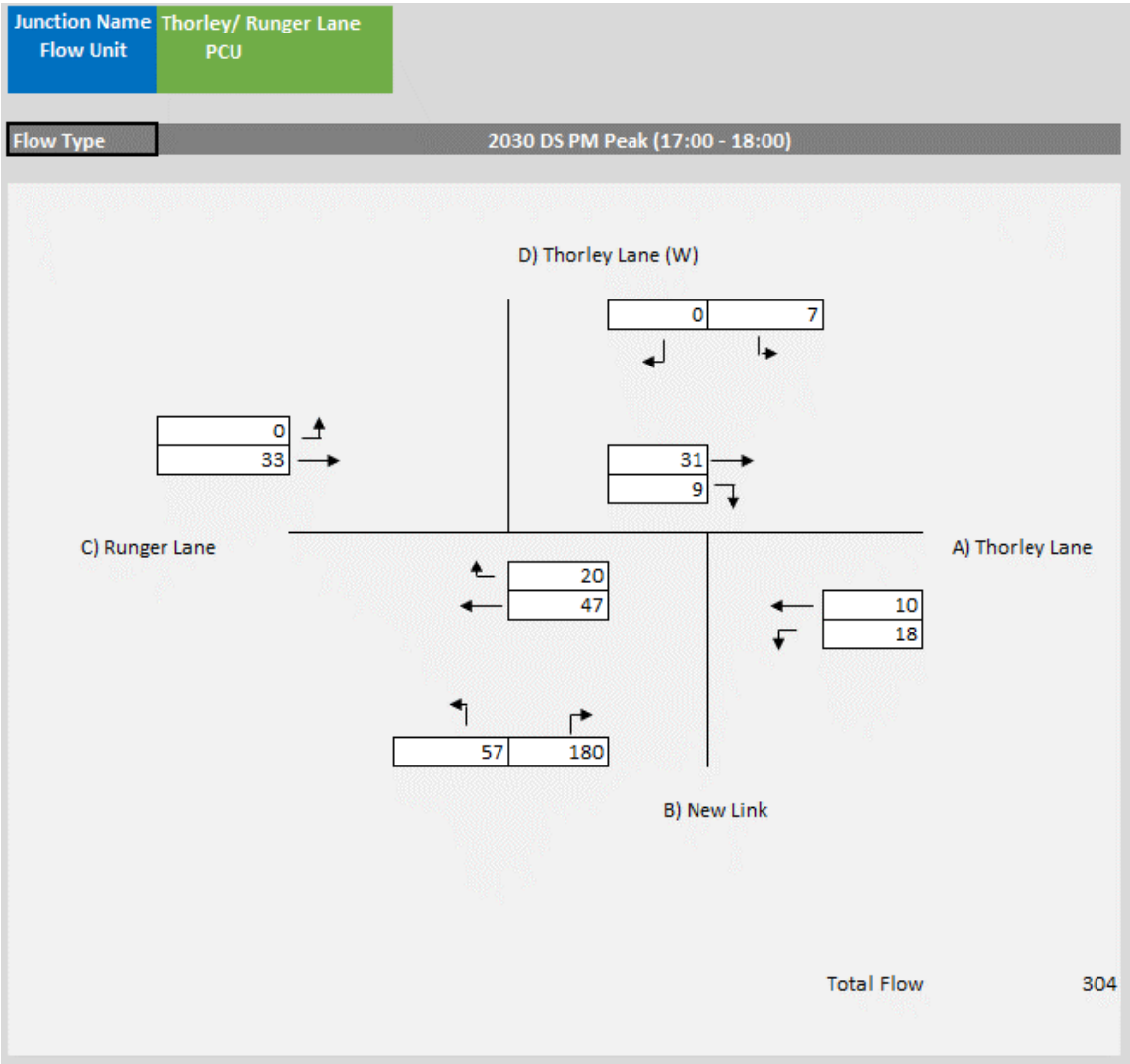
2030 Airport Traffic: Airport Peak



2030 Airport Traffic: AM Peak

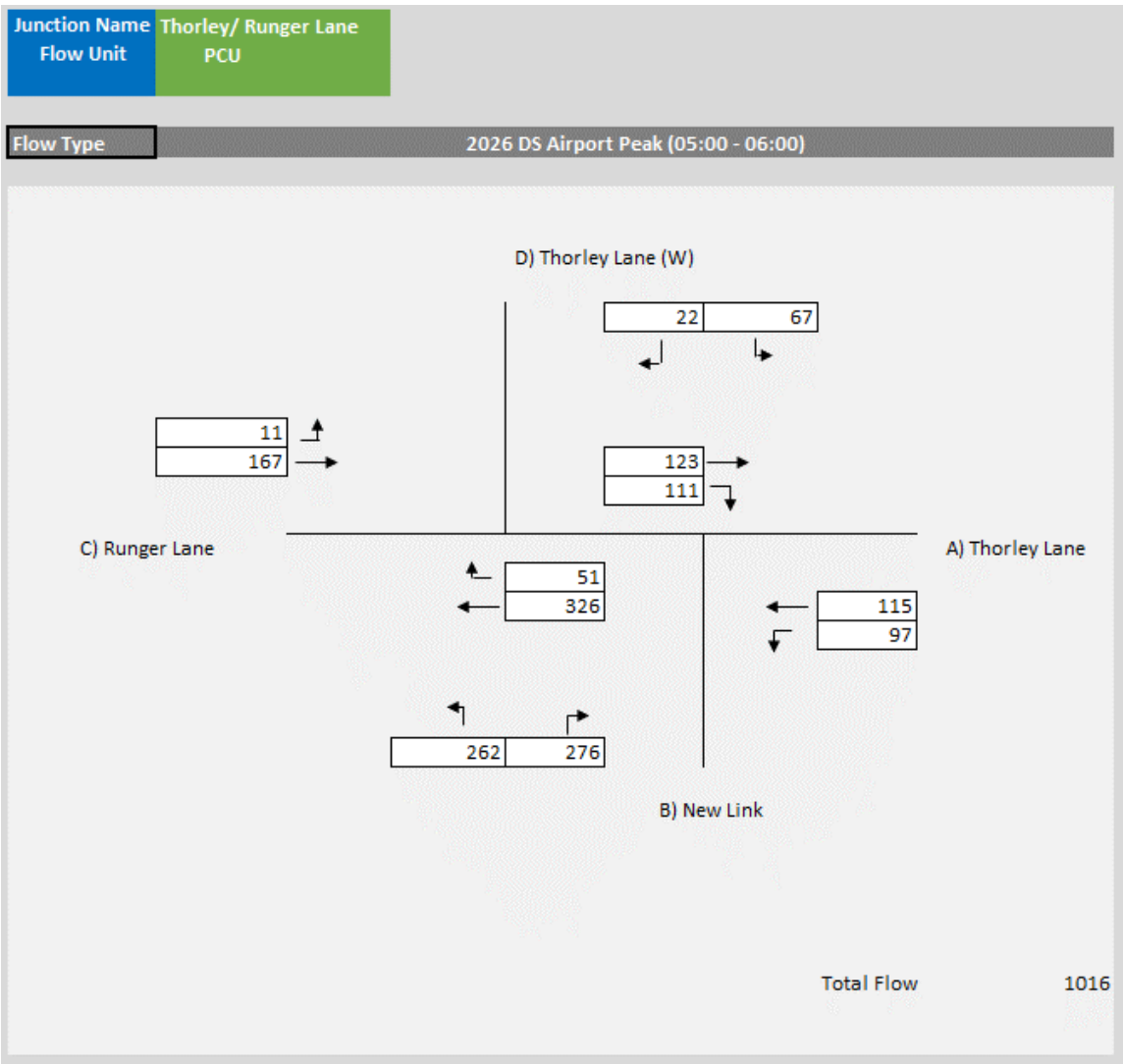


2030 Airport Traffic: PM Peak

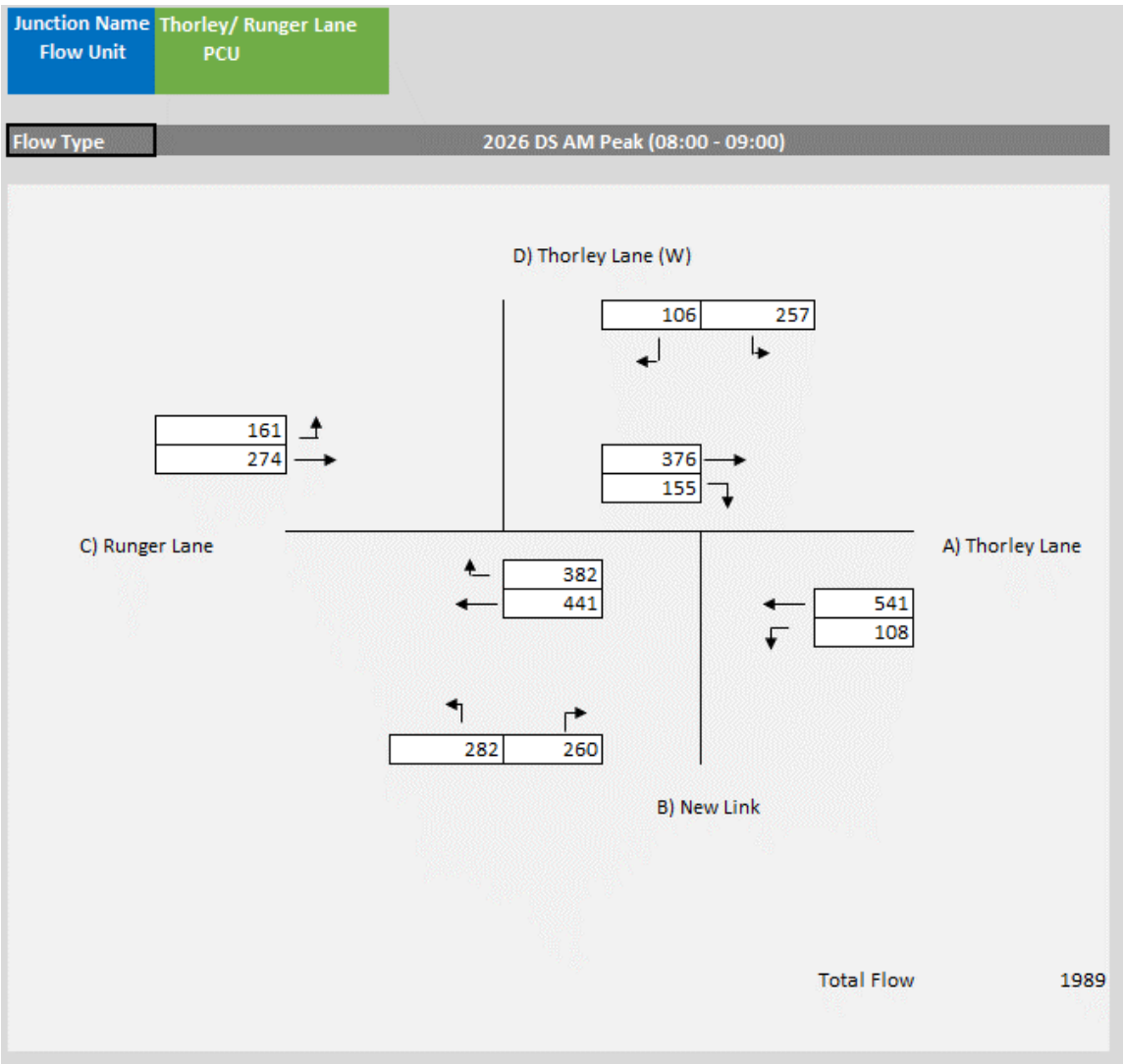


Appendix H. Combined Traffic Flow Diagrams

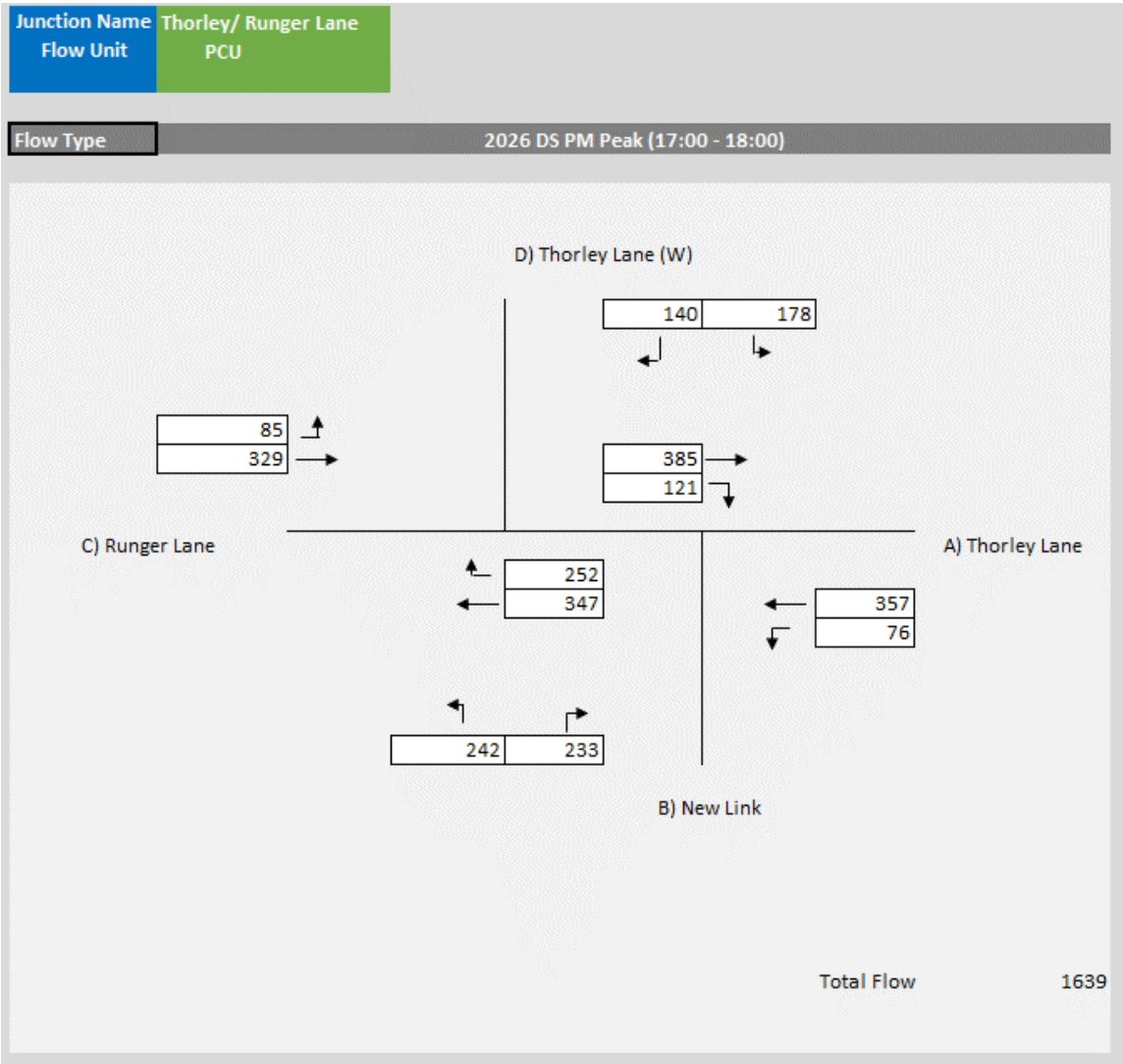
2026 Combined Traffic: Airport Peak



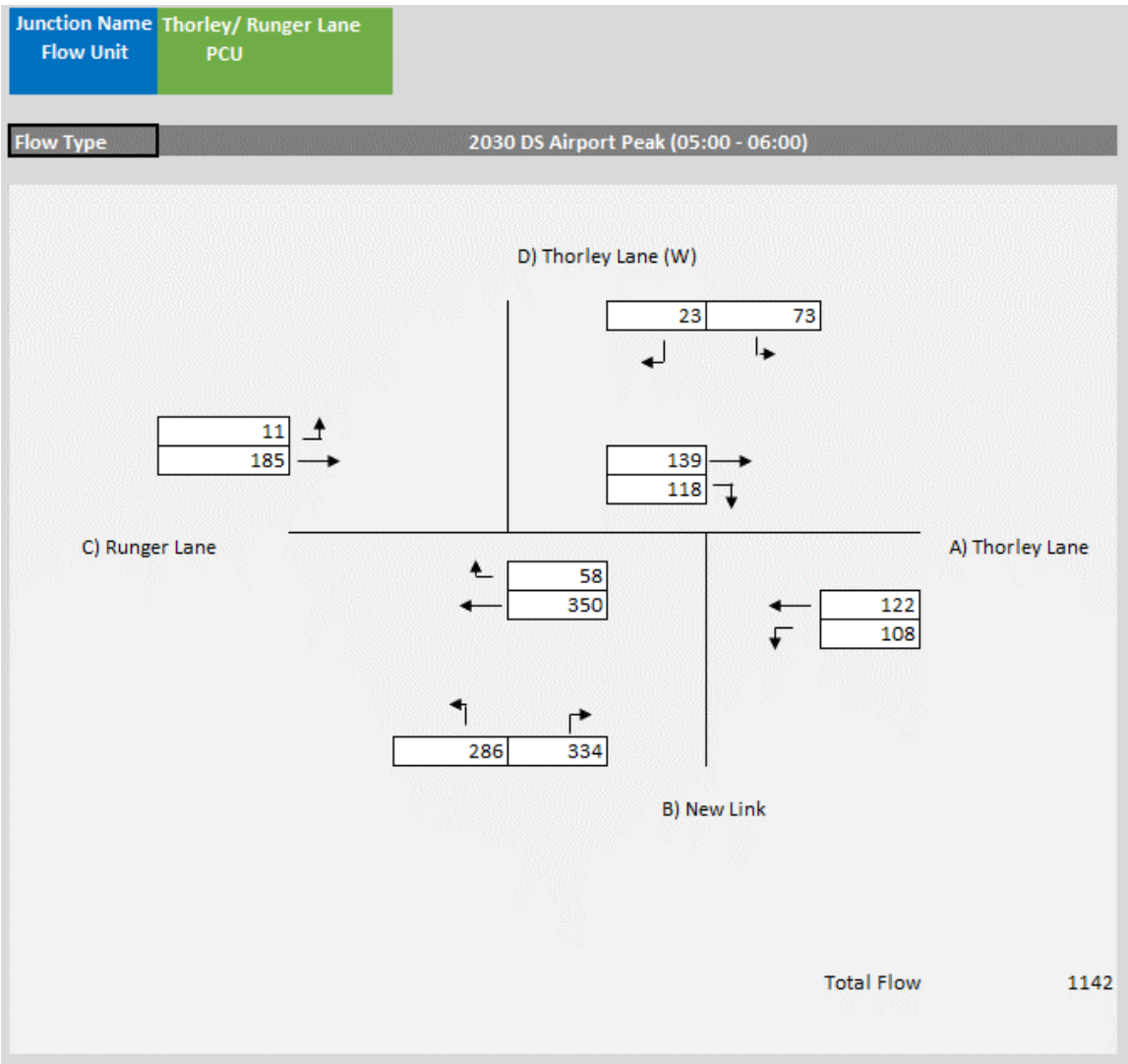
2026 Combined Traffic: AM Peak



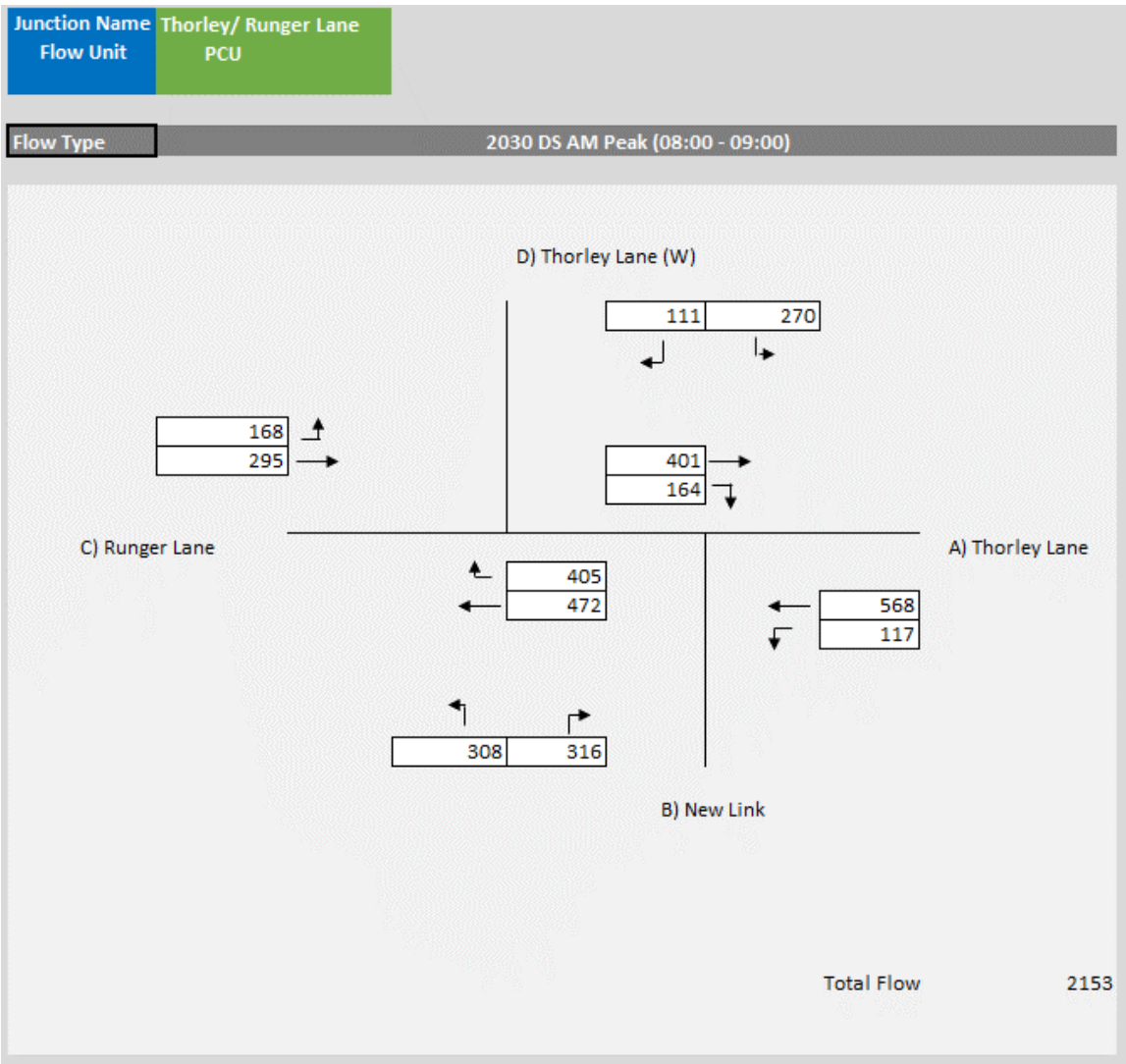
2026 Combined Traffic: PM Peak



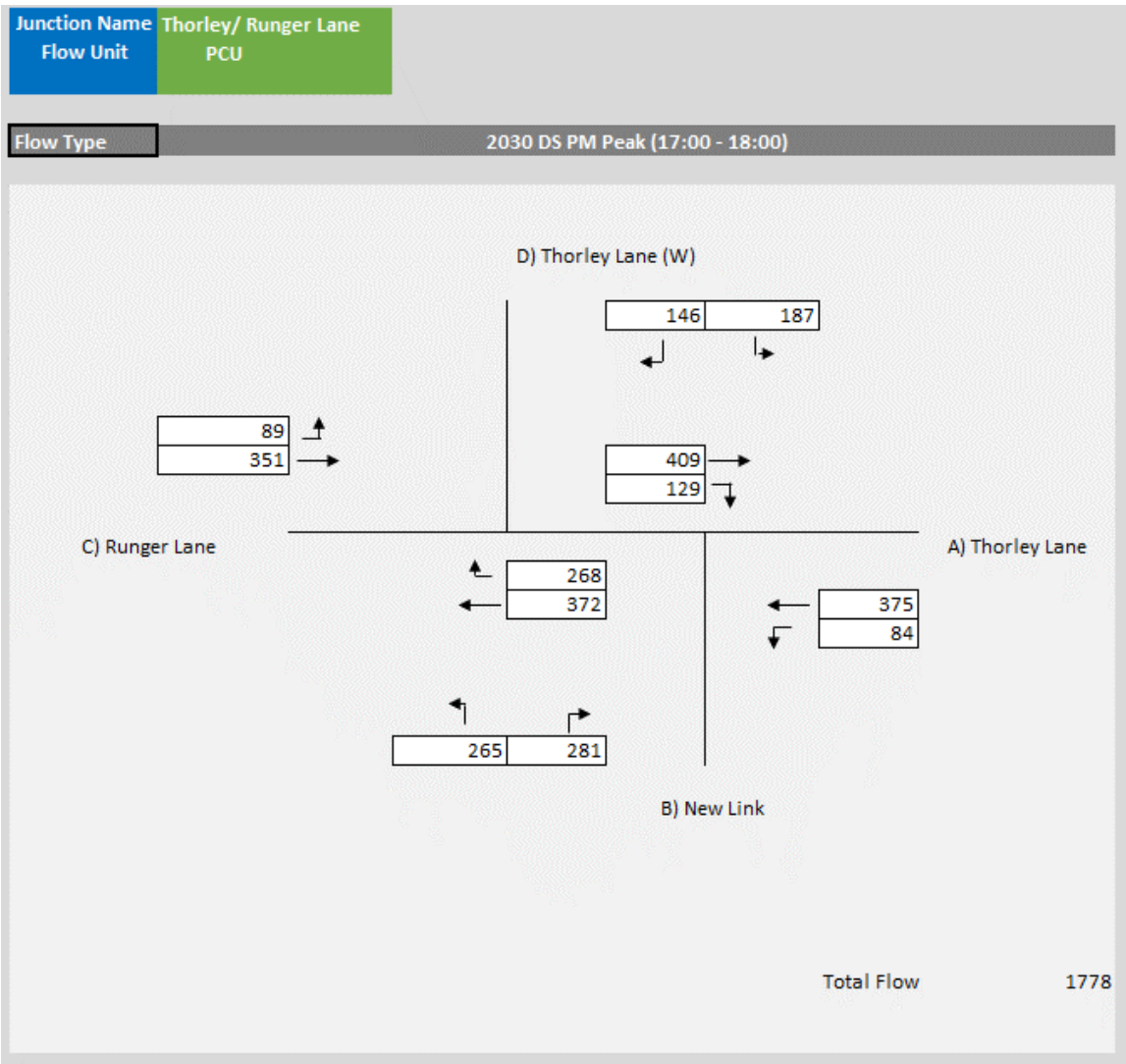
2030 Combined Traffic: Airport Peak



2030 Combined Traffic: AM Peak



2030 Combined Traffic: PM Peak

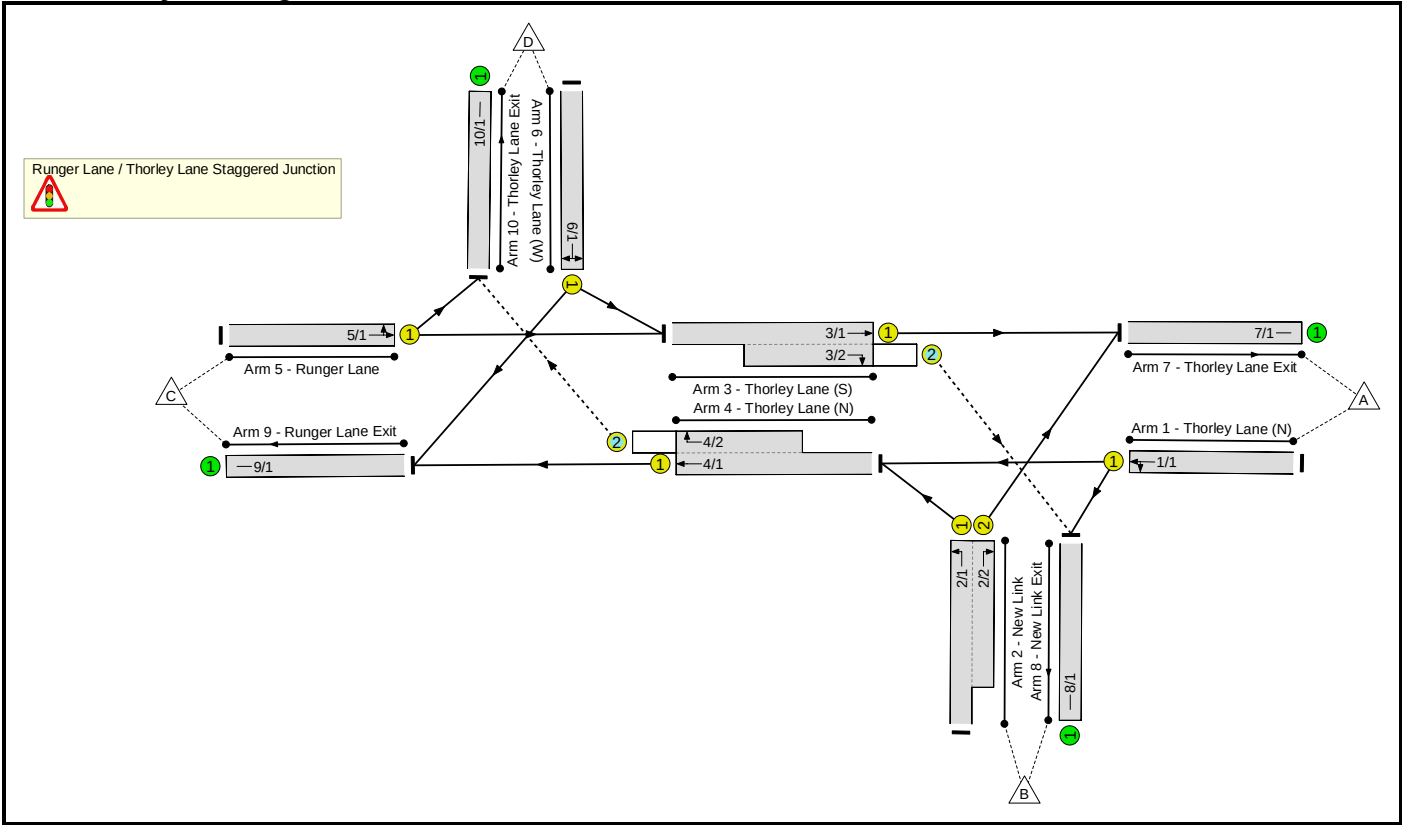


Appendix I. LinSig Outputs

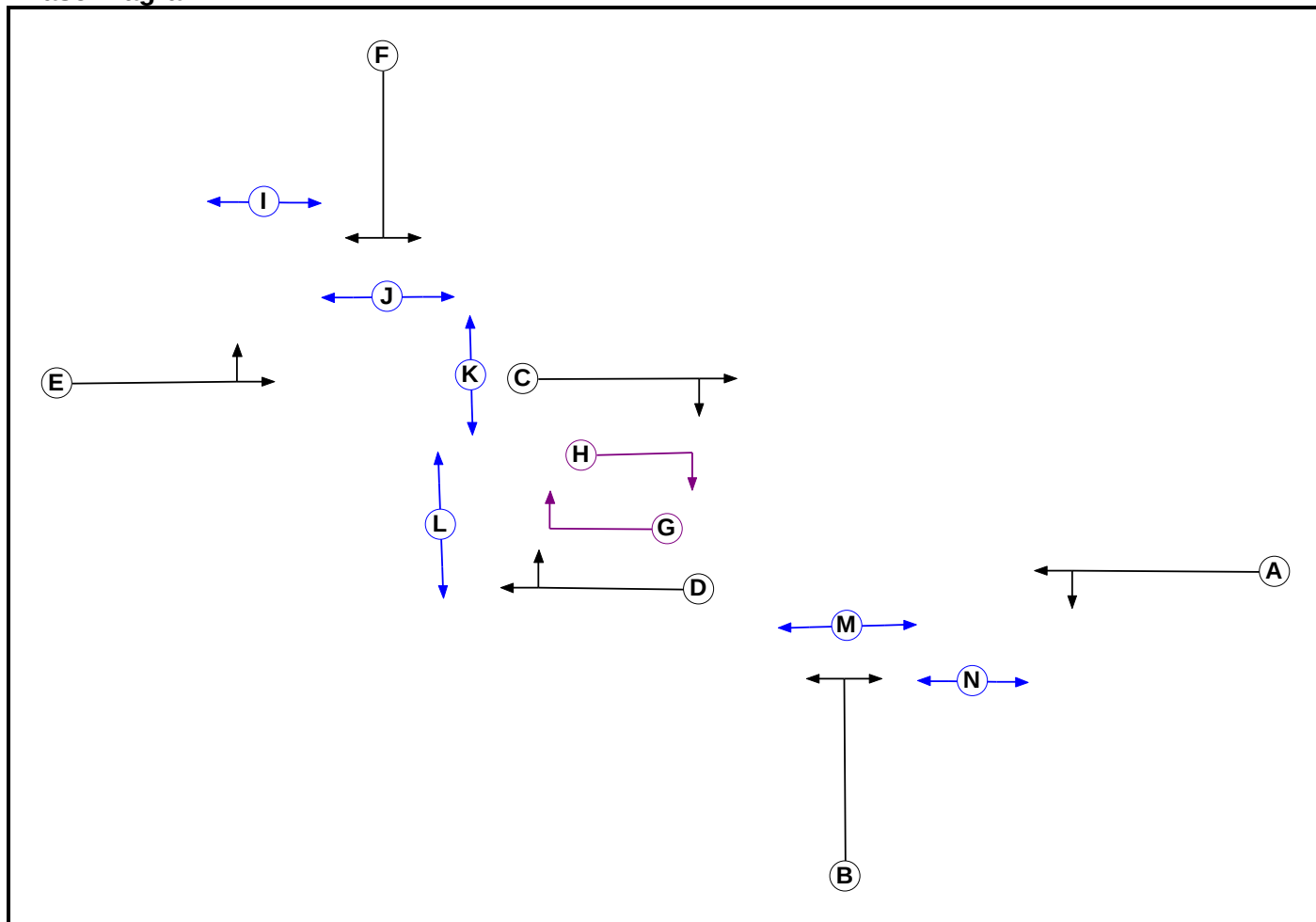
User and Project Details

Project:	Manchester Airport Transformation Programme
Title:	New Sydney Avenue Junction
Location:	Manchester Airport
Client:	Manchester Airports Group
Design Layout Ref:	30334-RPS-SI-XX-M2-H-0800-Revised for Linsig
Date Started:	24/07/24
Model Purpose:	TfGM Review of Jacobs Submission 26/06/24 Reviewed by Ed Coventry This review is not an endorsement of the proposed layout or the assumed forecast demands. The appropriate TfGM departments should be consulted on these aspects of the modelling. Updated by Jacobs in July 2024 with revised flows data.
Checked By:	Ed Coventry (TfGM) Jon Addy (Jacobs)
Checked By Date:	26/06/24
Additional detail:	Updated by Simon Knox (Jacobs)
File name:	Runger Lane_Thorley Lane_Staggered_LinSig3.lsg3x
Author:	Ed Coventry
Company:	TfGM
Address:	2 Piccadilly Place

Network Layout Diagram



Phase Diagram



Phase Input Data

Phase Name	Phase Type	Stage Stream	Assoc. Phase	Street Min	Cont Min
A	Traffic	1		-9999	7
B	Traffic	1		-9999	7
C	Traffic	1		-9999	7
D	Traffic	1		-9999	7
E	Traffic	1		-9999	7
F	Traffic	1		-9999	7
G	Ind. Arrow	1	D	-9999	4
H	Ind. Arrow	1	C	-9999	4
I	Pedestrian	1		-9999	5
J	Pedestrian	1		-9999	6
K	Pedestrian	1		-9999	5
L	Pedestrian	1		-9999	5
M	Pedestrian	1		-9999	6
N	Pedestrian	1		-9999	5

Phase Intergreens Matrix

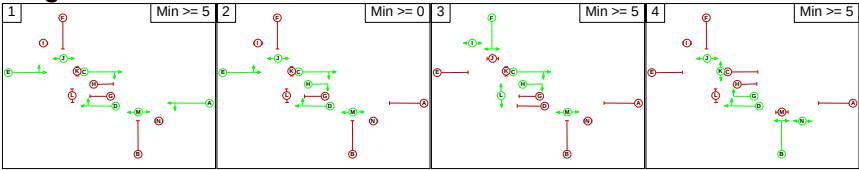
		Starting Phase													
Terminating Phase		A	B	C	D	E	F	G	H	I	J	K	L	M	N
	A		7	-	-	-	-	-	5	-	-	-	-	-	8
	B	7		7	-	-	-	-	7	-	-	-	-	5	-
	C	-	5		-	-	-	-	-	-	-	-	-	-	11
	D	-	-	-		-	6	-	-	11	-	-	6	-	-
	E	-	-	-	-		7	5	-	7	-	10	-	-	-
	F	-	-	-	6	6		6	-	-	5	8	-	-	-
	G	-	-	-	-	4	6		-	11	-	-	6	-	-
	H	5	5	-	-	-	-	-		-	-	-	-	-	11
	I	-	-	-	7	7	-	7	-		-	-	-	-	-
	J	-	-	-	-	-	8	-	-	-		-	-	-	-
	K	-	-	-	-	5	5	-	-	-	-		-	-	-
	L	-	-	-	6	-	-	6	-	-	-	-		-	-
	M	-	9	-	-	-	-	-	-	-	-	-	-		-
	N	6	-	6	-	-	-	-	6	-	-	-	-	-	

Phases in Stage

Stream	Stage No.	Phases in Stage
1	1	A C D E J M
1	2	C D E H J M
1	3	C F H I L M
1	4	B D G J K N

Stage Diagram

Stage Stream: 1



Phase Delays

Stage Stream: 1

Term. Stage	Start Stage	Phase	Type	Value	Cont value
2	3	D	Losing	1	1
2	3	E	Losing	1	1
3	4	F	Losing	1	1
4	1	N	Losing	1	1

Prohibited Stage Change
Stage Stream: 1

From Stage	To Stage				
		1	2	3	4
	1			5	11
	2	5		12	11
	3	7	7		11
	4	7	7	11	

Full Input Data And Results

Give-Way Lane Input Data

Junction: Runger Lane / Thorley Lane Staggered Junction											
Lane	Movement	Max Flow when Giving Way (PCU/Hr)	Min Flow when Giving Way (PCU/Hr)	Opposing Lane	Opp. Lane Coeff.	Opp. Mvmnts.	Right Turn Storage (PCU)	Non-Blocking Storage (PCU)	RTF	Right Turn Move up (s)	Max Turns in Intergreen (PCU)
3/2 (Thorley Lane (S))	8/1 (Right)	1439	0	1/1	1.09	All	3.00	-	0.50	3	3.00
4/2 (Thorley Lane (N))	10/1 (Right)	1439	0	5/1	1.09	All	3.00	-	0.50	3	3.00

Full Input Data And Results

Lane Input Data

Junction: Runger Lane / Thorley Lane Staggered Junction												
Lane	Lane Type	Phases	Start Disp.	End Disp.	Physical Length (PCU)	Sat Flow Type	Def User Saturation Flow (PCU/Hr)	Lane Width (m)	Gradient	Nearside Lane	Turns	Turning Radius (m)
1/1 (Thorley Lane (N))	U	A	2	3	60.0	Geom	-	4.50	0.00	Y	Arm 4 Ahead	Inf
											Arm 8 Left	12.56
2/1 (New Link)	U	B	2	3	60.0	Geom	-	3.66	0.00	Y	Arm 4 Left	15.00
2/2 (New Link)	U	B	2	3	30.4	Geom	-	3.76	0.00	N	Arm 7 Right	16.00
3/1 (Thorley Lane (S))	U	C	2	3	18.1	Geom	-	3.67	0.00	Y	Arm 7 Ahead	Inf
3/2 (Thorley Lane (S))	O	C H	2	3	8.9	Geom	-	3.65	0.00	N	Arm 8 Right	16.73
4/1 (Thorley Lane (N))	U	D	2	3	16.7	Geom	-	3.80	0.00	Y	Arm 9 Ahead	Inf
4/2 (Thorley Lane (N))	O	D G	2	3	8.7	Geom	-	3.65	0.00	N	Arm 10 Right	13.59
5/1 (Runger Lane)	U	E	2	3	60.0	Geom	-	3.49	0.00	Y	Arm 3 Ahead	Inf
											Arm 10 Left	15.27
6/1 (Thorley Lane (W))	U	F	2	3	60.0	Geom	-	3.79	0.00	Y	Arm 3 Left	17.00
											Arm 9 Right	21.90
7/1 (Thorley Lane Exit)	U		2	3	1.0	Inf	-	-	-	-	-	-
8/1 (New Link Exit)	U		2	3	1.0	Inf	-	-	-	-	-	-
9/1 (Runger Lane Exit)	U		2	3	1.0	Geom	-	3.63	0.00	Y		
10/1 (Thorley Lane Exit)	U		2	3	1.0	Inf	-	-	-	-	-	-

Traffic Flow Groups

Flow Group	Start Time	End Time	Duration	Formula
7: '2026 Airport Peak Combined'	05:00	06:00	01:00	F1 + F2
8: '2026 AM Peak Combined'	08:00	09:00	01:00	F3 + F4
9: '2026 PM Peak Combined'	17:00	18:00	01:00	F5 + F6
16: '2030 Airport Peak Combined'	05:00	06:00	01:00	F10 + F11
17: '2030 AM Peak Combined'	08:00	09:00	01:00	F12 + F13
18: '2030 PM Peak Combined'	17:00	18:00	01:00	F14 + F15

Scenario 1: '2026 - Airport Peak' (FG7: '2026 Airport Peak Combined', Plan 1: 'Network Control Plan 1')

Traffic Flows, Desired

Desired Flow :

	Destination					
		A	B	C	D	Tot.
Origin	A	0	97	98	17	212
	B	276	0	228	34	538
	C	82	85	0	11	178
	D	41	26	22	0	89
	Tot.	399	208	348	62	1017

Traffic Lane Flows

Lane	Scenario 1: 2026 - Airport Peak
Junction: Runger Lane / Thorley Lane Staggered Junction	
1/1	212
2/1 (with short)	538(In) 262(Out)
2/2 (short)	276
3/1 (with short)	234(In) 123(Out)
3/2 (short)	111
4/1 (with short)	377(In) 326(Out)
4/2 (short)	51
5/1	178
6/1	89
7/1	399
8/1	208
9/1	348
10/1	62

Lane Saturation Flows

Junction: Runger Lane / Thorley Lane Staggered Junction								
Lane	Lane Width (m)	Gradient	Nearside Lane	Allowed Turns	Turning Radius (m)	Turning Prop.	Sat Flow (PCU/Hr)	Flared Sat Flow (PCU/Hr)
1/1 (Thorley Lane (N))	4.50	0.00	Y	Arm 4 Ahead	Inf	54.2 %	1958	1958
				Arm 8 Left	12.56	45.8 %		
2/1 (New Link)	3.66	0.00	Y	Arm 4 Left	15.00	100.0 %	1801	1801
2/2 (New Link)	3.76	0.00	N	Arm 7 Right	16.00	100.0 %	1948	1948
3/1 (Thorley Lane (S))	3.67	0.00	Y	Arm 7 Ahead	Inf	100.0 %	1982	1982
3/2 (Thorley Lane (S))	3.65	0.00	N	Arm 8 Right	16.73	100.0 %	1946	1946
4/1 (Thorley Lane (N))	3.80	0.00	Y	Arm 9 Ahead	Inf	100.0 %	1995	1995
4/2 (Thorley Lane (N))	3.65	0.00	N	Arm 10 Right	13.59	100.0 %	1909	1909
5/1 (Runger Lane)	3.49	0.00	Y	Arm 3 Ahead	Inf	93.8 %	1952	1952
				Arm 10 Left	15.27	6.2 %		
6/1 (Thorley Lane (W))	3.79	0.00	Y	Arm 3 Left	17.00	75.3 %	1841	1841
				Arm 9 Right	21.90	24.7 %		
7/1 (Thorley Lane Exit Lane 1)	Infinite Saturation Flow						Inf	Inf
8/1 (New Link Exit Lane 1)	Infinite Saturation Flow						Inf	Inf
9/1 (Runger Lane Exit)	3.63	0.00	Y				1978	1978
10/1 (Thorley Lane Exit Lane 1)	Infinite Saturation Flow						Inf	Inf

Scenario 2: '2026 - AM Peak' (FG8: '2026 AM Peak Combined', Plan 1: 'Network Control Plan 1')

Traffic Flows, Desired

Desired Flow :

	Destination					
	A	B	C	D	Tot.	
Origin	A	0	108	196	346	650
	B	261	0	246	36	543
	C	145	130	0	161	436
	D	231	25	106	0	362
	Tot.	637	263	548	543	1991

Traffic Lane Flows

Lane	Scenario 2: 2026 - AM Peak
Junction: Runger Lane / Thorley Lane Staggered Junction	
1/1	650
2/1 (with short)	543(In) 282(Out)
2/2 (short)	261
3/1 (with short)	531(In) 376(Out)
3/2 (short)	155
4/1 (with short)	824(In) 442(Out)
4/2 (short)	382
5/1	436
6/1	362
7/1	637
8/1	263
9/1	548
10/1	543

Lane Saturation Flows

Junction: Runger Lane / Thorley Lane Staggered Junction								
Lane	Lane Width (m)	Gradient	Nearside Lane	Allowed Turns	Turning Radius (m)	Turning Prop.	Sat Flow (PCU/Hr)	Flared Sat Flow (PCU/Hr)
1/1 (Thorley Lane (N))	4.50	0.00	Y	Arm 4 Ahead	Inf	83.4 %	2025	2025
				Arm 8 Left	12.56	16.6 %		
2/1 (New Link)	3.66	0.00	Y	Arm 4 Left	15.00	100.0 %	1801	1801
2/2 (New Link)	3.76	0.00	N	Arm 7 Right	16.00	100.0 %	1948	1948
3/1 (Thorley Lane (S))	3.67	0.00	Y	Arm 7 Ahead	Inf	100.0 %	1982	1982
3/2 (Thorley Lane (S))	3.65	0.00	N	Arm 8 Right	16.73	100.0 %	1946	1946
4/1 (Thorley Lane (N))	3.80	0.00	Y	Arm 9 Ahead	Inf	100.0 %	1995	1995
4/2 (Thorley Lane (N))	3.65	0.00	N	Arm 10 Right	13.59	100.0 %	1909	1909
5/1 (Runger Lane)	3.49	0.00	Y	Arm 3 Ahead	Inf	63.1 %	1895	1895
				Arm 10 Left	15.27	36.9 %		
6/1 (Thorley Lane (W))	3.79	0.00	Y	Arm 3 Left	17.00	70.7 %	1842	1842
				Arm 9 Right	21.90	29.3 %		
7/1 (Thorley Lane Exit Lane 1)	Infinite Saturation Flow						Inf	Inf
8/1 (New Link Exit Lane 1)	Infinite Saturation Flow						Inf	Inf
9/1 (Runger Lane Exit)	3.63	0.00	Y				1978	1978
10/1 (Thorley Lane Exit Lane 1)	Infinite Saturation Flow						Inf	Inf

Scenario 3: '2026 - PM Peak' (FG9: '2026 PM Peak Combined', Plan 1: 'Network Control Plan 1')

Traffic Flows, Desired

Desired Flow :

	Destination					
	A	B	C	D	Tot.	
Origin	A	0	77	141	216	434
	B	232	0	205	36	473
	C	231	98	0	85	414
	D	155	23	140	0	318
	Tot.	618	198	486	337	1639

Traffic Lane Flows

Lane	Scenario 3: 2026 - PM Peak
Junction: Runger Lane / Thorley Lane Staggered Junction	
1/1	434
2/1 (with short)	473(In) 241(Out)
2/2 (short)	232
3/1 (with short)	507(In) 386(Out)
3/2 (short)	121
4/1 (with short)	598(In) 346(Out)
4/2 (short)	252
5/1	414
6/1	318
7/1	618
8/1	198
9/1	486
10/1	337

Lane Saturation Flows

Junction: Runger Lane / Thorley Lane Staggered Junction								
Lane	Lane Width (m)	Gradient	Nearside Lane	Allowed Turns	Turning Radius (m)	Turning Prop.	Sat Flow (PCU/Hr)	Flared Sat Flow (PCU/Hr)
1/1 (Thorley Lane (N))	4.50	0.00	Y	Arm 4 Ahead	Inf	82.3 %	2022	2022
				Arm 8 Left	12.56	17.7 %		
2/1 (New Link)	3.66	0.00	Y	Arm 4 Left	15.00	100.0 %	1801	1801
2/2 (New Link)	3.76	0.00	N	Arm 7 Right	16.00	100.0 %	1948	1948
3/1 (Thorley Lane (S))	3.67	0.00	Y	Arm 7 Ahead	Inf	100.0 %	1982	1982
3/2 (Thorley Lane (S))	3.65	0.00	N	Arm 8 Right	16.73	100.0 %	1946	1946
4/1 (Thorley Lane (N))	3.80	0.00	Y	Arm 9 Ahead	Inf	100.0 %	1995	1995
4/2 (Thorley Lane (N))	3.65	0.00	N	Arm 10 Right	13.59	100.0 %	1909	1909
5/1 (Runger Lane)	3.49	0.00	Y	Arm 3 Ahead	Inf	79.5 %	1925	1925
				Arm 10 Left	15.27	20.5 %		
6/1 (Thorley Lane (W))	3.79	0.00	Y	Arm 3 Left	17.00	56.0 %	1847	1847
				Arm 9 Right	21.90	44.0 %		
7/1 (Thorley Lane Exit Lane 1)	Infinite Saturation Flow						Inf	Inf
8/1 (New Link Exit Lane 1)	Infinite Saturation Flow						Inf	Inf
9/1 (Runger Lane Exit)	3.63	0.00	Y				1978	1978
10/1 (Thorley Lane Exit Lane 1)	Infinite Saturation Flow						Inf	Inf

Scenario 4: '2030 - Airport Peak' (FG16: '2030 Airport Peak Combined', Plan 1: 'Network Control Plan 1')**Traffic Flows, Desired****Desired Flow :**

	Destination					
	A	B	C	D	Tot.	
Origin	A	0	108	105	18	231
	B	334	0	246	40	620
	C	95	91	0	11	197
	D	45	27	23	0	95
	Tot.	474	226	374	69	1143

Traffic Lane Flows

Lane	Scenario 4: 2030 - Airport Peak
Junction: Runger Lane / Thorley Lane Staggered Junction	
1/1	231
2/1 (with short)	620(In) 286(Out)
2/2 (short)	334
3/1 (with short)	258(In) 140(Out)
3/2 (short)	118
4/1 (with short)	409(In) 351(Out)
4/2 (short)	58
5/1	197
6/1	95
7/1	474
8/1	226
9/1	374
10/1	69

Lane Saturation Flows

Junction: Runger Lane / Thorley Lane Staggered Junction								
Lane	Lane Width (m)	Gradient	Nearside Lane	Allowed Turns	Turning Radius (m)	Turning Prop.	Sat Flow (PCU/Hr)	Flared Sat Flow (PCU/Hr)
1/1 (Thorley Lane (N))	4.50	0.00	Y	Arm 4 Ahead	Inf	53.2 %	1956	1956
				Arm 8 Left	12.56	46.8 %		
2/1 (New Link)	3.66	0.00	Y	Arm 4 Left	15.00	100.0 %	1801	1801
2/2 (New Link)	3.76	0.00	N	Arm 7 Right	16.00	100.0 %	1948	1948
3/1 (Thorley Lane (S))	3.67	0.00	Y	Arm 7 Ahead	Inf	100.0 %	1982	1982
3/2 (Thorley Lane (S))	3.65	0.00	N	Arm 8 Right	16.73	100.0 %	1946	1946
4/1 (Thorley Lane (N))	3.80	0.00	Y	Arm 9 Ahead	Inf	100.0 %	1995	1995
4/2 (Thorley Lane (N))	3.65	0.00	N	Arm 10 Right	13.59	100.0 %	1909	1909
5/1 (Runger Lane)	3.49	0.00	Y	Arm 3 Ahead	Inf	94.4 %	1953	1953
				Arm 10 Left	15.27	5.6 %		
6/1 (Thorley Lane (W))	3.79	0.00	Y	Arm 3 Left	17.00	75.8 %	1840	1840
				Arm 9 Right	21.90	24.2 %		
7/1 (Thorley Lane Exit Lane 1)	Infinite Saturation Flow						Inf	Inf
8/1 (New Link Exit Lane 1)	Infinite Saturation Flow						Inf	Inf
9/1 (Runger Lane Exit)	3.63	0.00	Y				1978	1978
10/1 (Thorley Lane Exit Lane 1)	Infinite Saturation Flow						Inf	Inf

Scenario 5: '2030 - AM Peak' (FG17: '2030 AM Peak Combined', Plan 1: 'Network Control Plan 1')**Traffic Flows, Desired****Desired Flow :**

	Destination					
Origin	A	0	118	205	363	686
	B	316	0	266	42	624
	C	157	137	0	168	462
	D	244	26	111	0	381
	Tot.	717	281	582	573	2153

Traffic Lane Flows

Lane	Scenario 5: 2030 - AM Peak
Junction: Runger Lane / Thorley Lane Staggered Junction	
1/1	686
2/1 (with short)	624(In) 308(Out)
2/2 (short)	316
3/1 (with short)	564(In) 401(Out)
3/2 (short)	163
4/1 (with short)	876(In) 471(Out)
4/2 (short)	405
5/1	462
6/1	381
7/1	717
8/1	281
9/1	582
10/1	573

Lane Saturation Flows

Junction: Runger Lane / Thorley Lane Staggered Junction									
Lane	Lane Width (m)	Gradient	Nearside Lane	Allowed Turns	Turning Radius (m)	Turning Prop.	Sat Flow (PCU/Hr)	Flared Sat Flow (PCU/Hr)	
1/1 (Thorley Lane (N))	4.50	0.00	Y	Arm 4 Ahead	Inf	82.8 %	2023	2023	
				Arm 8 Left	12.56	17.2 %			
2/1 (New Link)	3.66	0.00	Y	Arm 4 Left	15.00	100.0 %	1801	1801	
2/2 (New Link)	3.76	0.00	N	Arm 7 Right	16.00	100.0 %	1948	1948	
3/1 (Thorley Lane (S))	3.67	0.00	Y	Arm 7 Ahead	Inf	100.0 %	1982	1982	
3/2 (Thorley Lane (S))	3.65	0.00	N	Arm 8 Right	16.73	100.0 %	1946	1946	
4/1 (Thorley Lane (N))	3.80	0.00	Y	Arm 9 Ahead	Inf	100.0 %	1995	1995	
4/2 (Thorley Lane (N))	3.65	0.00	N	Arm 10 Right	13.59	100.0 %	1909	1909	
5/1 (Runger Lane)	3.49	0.00	Y	Arm 3 Ahead	Inf	63.6 %	1896	1896	
				Arm 10 Left	15.27	36.4 %			
6/1 (Thorley Lane (W))	3.79	0.00	Y	Arm 3 Left	17.00	70.9 %	1842	1842	
				Arm 9 Right	21.90	29.1 %			
7/1 (Thorley Lane Exit Lane 1)	Infinite Saturation Flow						Inf	Inf	
8/1 (New Link Exit Lane 1)	Infinite Saturation Flow						Inf	Inf	
9/1 (Runger Lane Exit)	3.63	0.00	Y				1978	1978	
10/1 (Thorley Lane Exit Lane 1)	Infinite Saturation Flow						Inf	Inf	

Scenario 6: '2030 - PM Peak' (FG18: '2030 PM Peak Combined', Plan 1: 'Network Control Plan 1')

Traffic Flows, Desired

Desired Flow :

	Destination					
	A	B	C	D	Tot.	
Origin	A	0	85	149	225	459
	B	282	0	223	41	546
	C	247	105	0	89	441
	D	163	24	146	0	333
	Tot.	692	214	518	355	1779

Traffic Lane Flows

Lane	Scenario 6: 2030 - PM Peak
Junction: Runger Lane / Thorley Lane Staggered Junction	
1/1	459
2/1 (with short)	546(In) 264(Out)
2/2 (short)	282
3/1 (with short)	539(In) 410(Out)
3/2 (short)	129
4/1 (with short)	638(In) 372(Out)
4/2 (short)	266
5/1	441
6/1	333
7/1	692
8/1	214
9/1	518
10/1	355

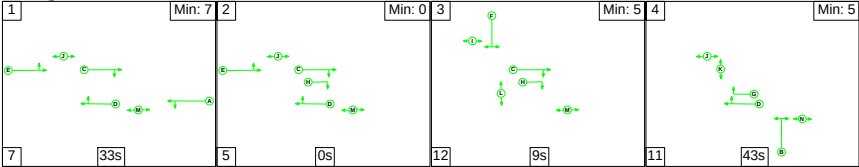
Lane Saturation Flows

Junction: Runger Lane / Thorley Lane Staggered Junction								
Lane	Lane Width (m)	Gradient	Nearside Lane	Allowed Turns	Turning Radius (m)	Turning Prop.	Sat Flow (PCU/Hr)	Flared Sat Flow (PCU/Hr)
1/1 (Thorley Lane (N))	4.50	0.00	Y	Arm 4 Ahead	Inf	81.5 %	2020	2020
				Arm 8 Left	12.56	18.5 %		
2/1 (New Link)	3.66	0.00	Y	Arm 4 Left	15.00	100.0 %	1801	1801
2/2 (New Link)	3.76	0.00	N	Arm 7 Right	16.00	100.0 %	1948	1948
3/1 (Thorley Lane (S))	3.67	0.00	Y	Arm 7 Ahead	Inf	100.0 %	1982	1982
3/2 (Thorley Lane (S))	3.65	0.00	N	Arm 8 Right	16.73	100.0 %	1946	1946
4/1 (Thorley Lane (N))	3.80	0.00	Y	Arm 9 Ahead	Inf	100.0 %	1995	1995
4/2 (Thorley Lane (N))	3.65	0.00	N	Arm 10 Right	13.59	100.0 %	1909	1909
5/1 (Runger Lane)	3.49	0.00	Y	Arm 3 Ahead	Inf	79.8 %	1926	1926
				Arm 10 Left	15.27	20.2 %		
6/1 (Thorley Lane (W))	3.79	0.00	Y	Arm 3 Left	17.00	56.2 %	1847	1847
				Arm 9 Right	21.90	43.8 %		
7/1 (Thorley Lane Exit Lane 1)	Infinite Saturation Flow						Inf	Inf
8/1 (New Link Exit Lane 1)	Infinite Saturation Flow						Inf	Inf
9/1 (Runger Lane Exit)	3.63	0.00	Y				1978	1978
10/1 (Thorley Lane Exit Lane 1)	Infinite Saturation Flow						Inf	Inf

Scenario 1: '2026 - Airport Peak' (FG7: '2026 Airport Peak Combined', Plan 1: 'Network Control Plan 1')

Stage Sequence Diagram

Stage Stream: 1

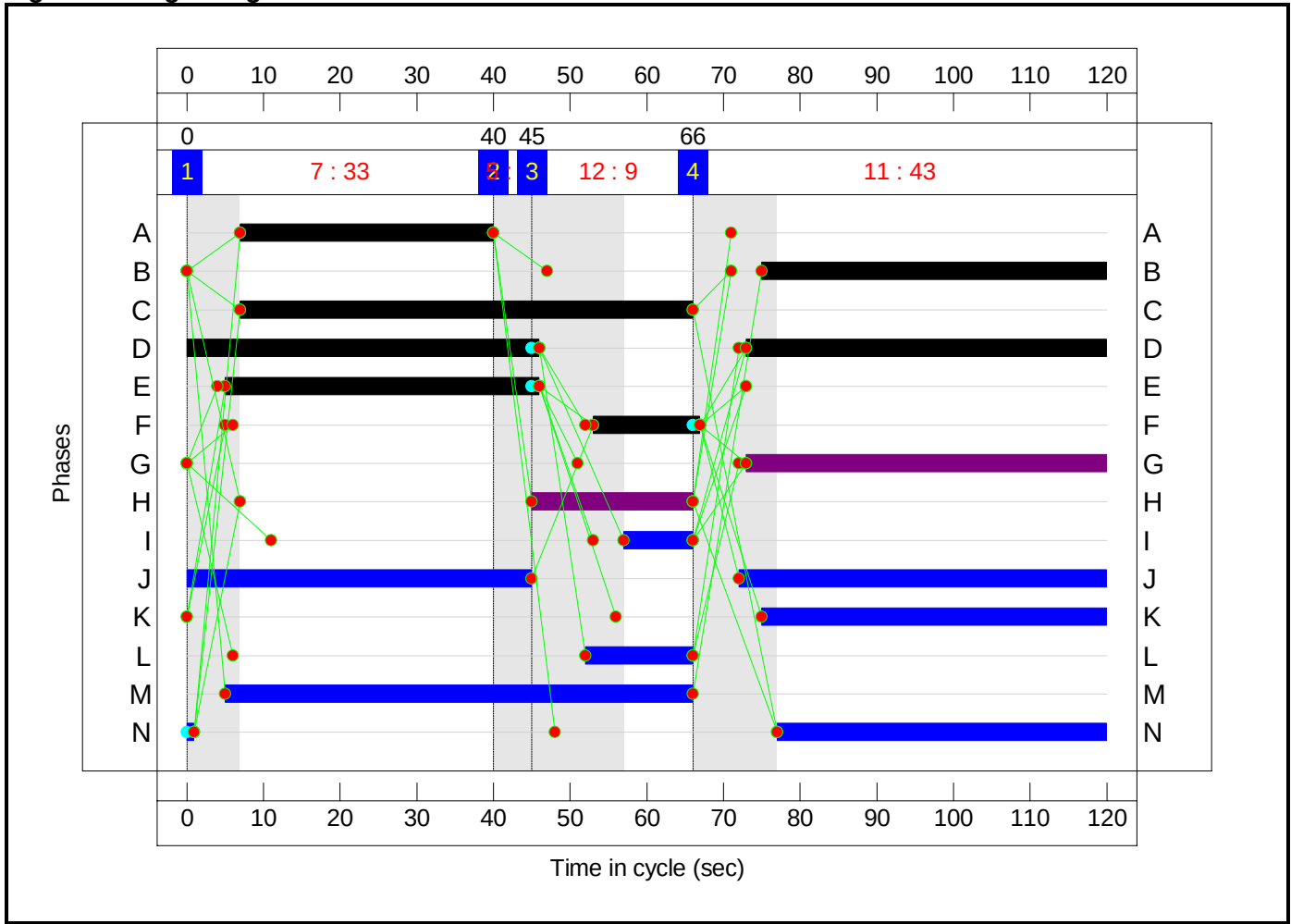


Stage Timings

Stage Stream: 1

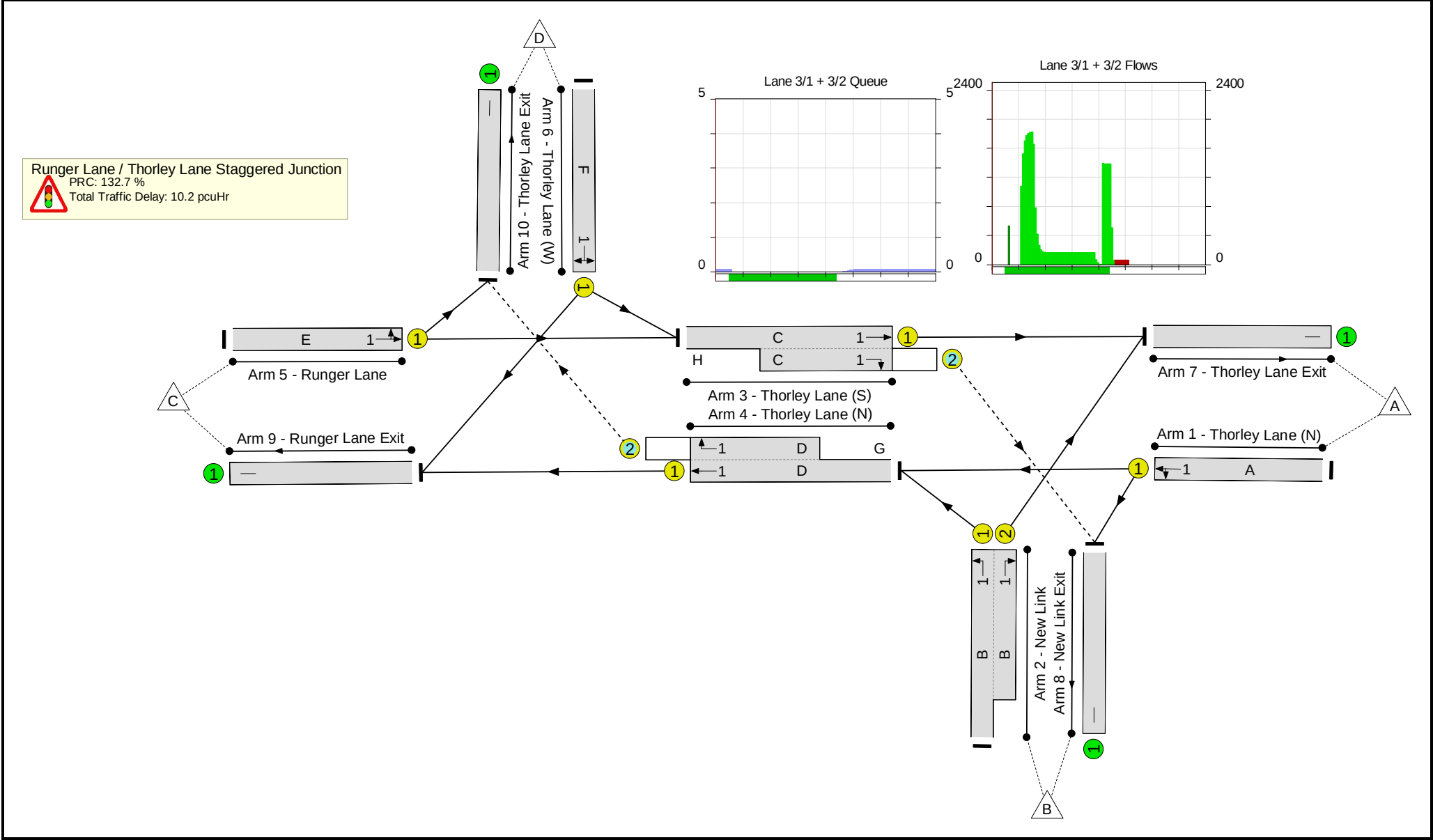
Stage	1	2	3	4
Duration	33	0	9	43
Change Point	0	40	45	66

Signal Timings Diagram



Full Input Data And Results

Network Layout Diagram



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network: New Sydney Avenue Junction	-	-	N/A	-	-		-	-	-	-	-	-	38.7%
Runger Lane / Thorley Lane Staggered Junction	-	-	N/A	-	-		-	-	-	-	-	-	38.7%
1/1	Thorley Lane (N) Ahead Left	U	1	N/A	A		1	33	-	212	1958	555	38.2%
2/1+2/2	New Link Left Right	U	1	N/A	B		1	45	-	538	1801:1948	690+747	37.9 : 37.0%
3/1+3/2	Thorley Lane (S) Ahead Right	U+O	1	N/A	C	H	1	59	21	234	1982:1946	645+582	19.1 : 19.1%
4/1+4/2	Thorley Lane (N) Ahead Right	U+O	1	N/A	D	G	1	93	47	377	1995:1909	1395+218	23.4 : 23.4%
5/1	Runger Lane Ahead Left	U	1	N/A	E		1	41	-	178	1952	683	26.1%
6/1	Thorley Lane (W) Left Right	U	1	N/A	F		1	14	-	89	1841	230	38.7%
7/1	Thorley Lane Exit	U	N/A	N/A	-		-	-	-	399	Inf	Inf	0.0%
8/1	New Link Exit	U	N/A	N/A	-		-	-	-	208	Inf	Inf	0.0%
9/1	Runger Lane Exit	U	N/A	N/A	-		-	-	-	348	1978	1978	17.6%
10/1	Thorley Lane Exit	U	N/A	N/A	-		-	-	-	62	Inf	Inf	0.0%

Full Input Data And Results

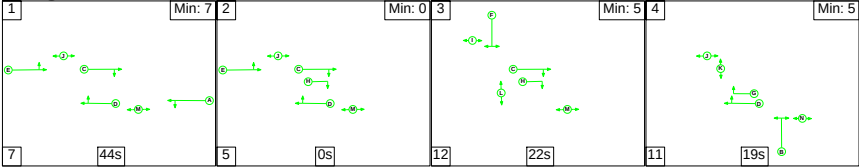
Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network: New Sydney Avenue Junction	-	-	93	63	6	8.7	1.5	0.0	10.2	-	-	-	-
Runger Lane / Thorley Lane Staggered Junction	-	-	93	63	6	8.7	1.5	0.0	10.2	-	-	-	-
1/1	212	212	-	-	-	2.0	0.3	-	2.3	39.8	5.7	0.3	6.0
2/1+2/2	538	538	-	-	-	4.0	0.3	-	4.3	28.6	6.6	0.3	6.9
3/1+3/2	234	234	75	30	6	0.1	0.1	0.0	0.2	3.3	0.1	0.1	0.2
4/1+4/2	377	377	18	33	0	0.0	0.2	0.0	0.2	1.7	0.1	0.2	0.2
5/1	178	178	-	-	-	1.4	0.2	-	1.6	31.5	4.2	0.2	4.4
6/1	89	89	-	-	-	1.2	0.3	-	1.5	61.0	2.7	0.3	3.0
7/1	399	399	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
8/1	208	208	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
9/1	348	348	-	-	-	0.0	0.1	-	0.1	1.1	0.0	0.1	0.1
10/1	62	62	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
C1 Stream: 1 PRC for Signalled Lanes (%): 132.7 Total Delay for Signalled Lanes (pcuHr): 10.08 Cycle Time (s): 120 PRC Over All Lanes (%): 132.7 Total Delay Over All Lanes(pcuHr): 10.18													

Full Input Data And Results

Scenario 2: '2026 - AM Peak' (FG8: '2026 AM Peak Combined', Plan 1: 'Network Control Plan 1')

Stage Sequence Diagram

Stage Stream: 1

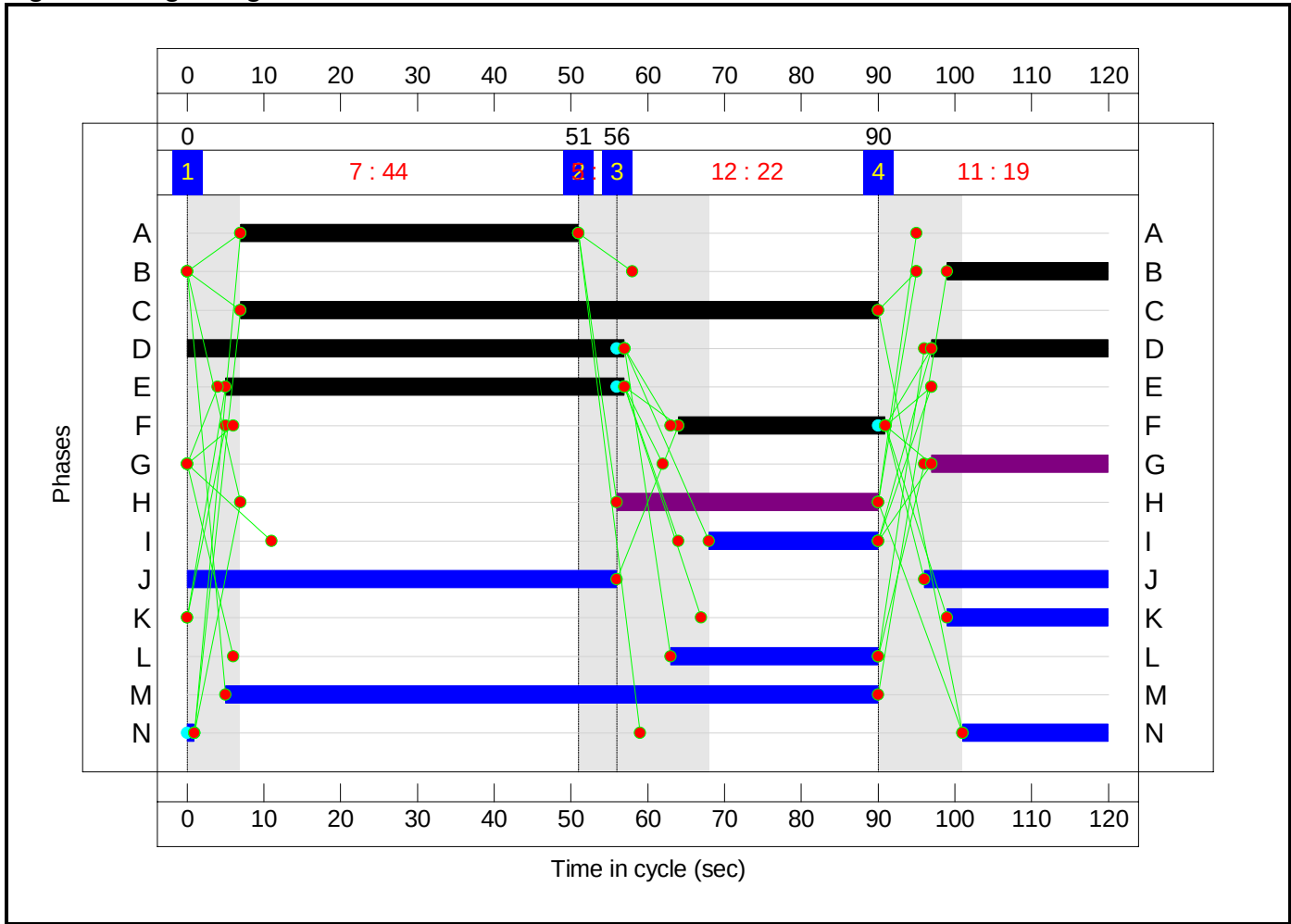


Stage Timings

Stage Stream: 1

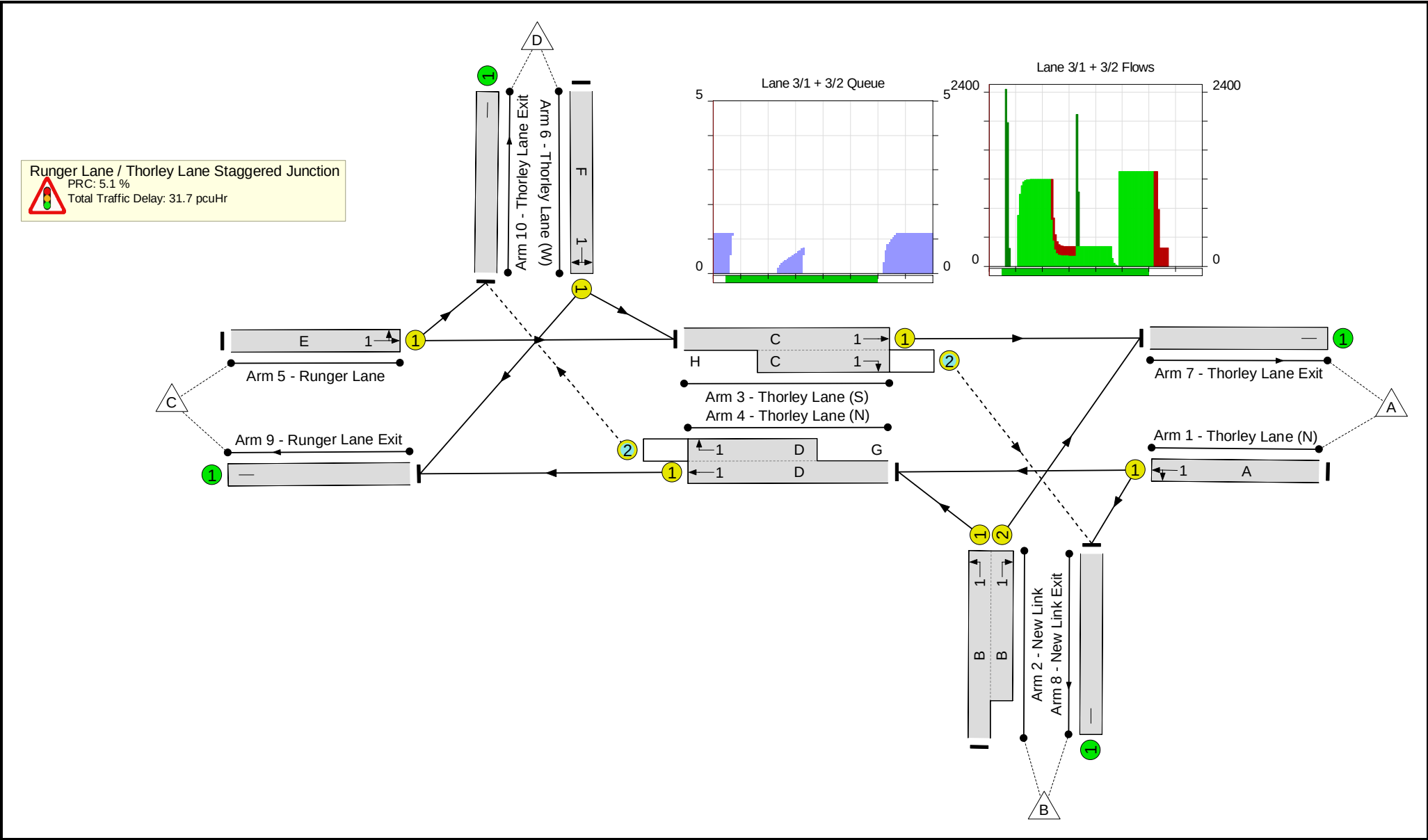
Stage	1	2	3	4
Duration	44	0	22	19
Change Point	0	51	56	90

Signal Timings Diagram



Full Input Data And Results

Network Layout Diagram



Full Input Data And Results

Network Results

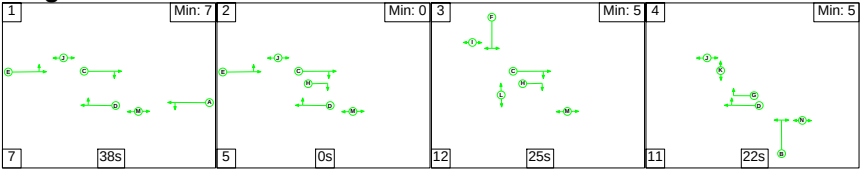
Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network: New Sydney Avenue Junction	-	-	N/A	-	-		-	-	-	-	-	-	85.6%
Runger Lane / Thorley Lane Staggered Junction	-	-	N/A	-	-		-	-	-	-	-	-	85.6%
1/1	Thorley Lane (N) Ahead Left	U	1	N/A	A		1	44	-	650	2025	759	85.6%
2/1+2/2	New Link Left Right	U	1	N/A	B		1	21	-	543	1801:1948	330+357	85.4 : 73.1%
3/1+3/2	Thorley Lane (S) Ahead Right	U+O	1	N/A	C	H	1	83	34	531	1982:1946	1060+437	35.5 : 35.5%
4/1+4/2	Thorley Lane (N) Ahead Right	U+O	1	N/A	D	G	1	80	23	824	1995:1909	777+671	56.9 : 56.9%
5/1	Runger Lane Ahead Left	U	1	N/A	E		1	52	-	436	1895	837	52.1%
6/1	Thorley Lane (W) Left Right	U	1	N/A	F		1	27	-	362	1842	430	84.2%
7/1	Thorley Lane Exit	U	N/A	N/A	-		-	-	-	637	Inf	Inf	0.0%
8/1	New Link Exit	U	N/A	N/A	-		-	-	-	263	Inf	Inf	0.0%
9/1	Runger Lane Exit	U	N/A	N/A	-		-	-	-	548	1978	1978	27.7%
10/1	Thorley Lane Exit	U	N/A	N/A	-		-	-	-	543	Inf	Inf	0.0%

Full Input Data And Results

Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network: New Sydney Avenue Junction	-	-	320	140	77	21.5	8.8	1.4	31.7	-	-	-	-
Runger Lane / Thorley Lane Staggered Junction	-	-	320	140	77	21.5	8.8	1.4	31.7	-	-	-	-
1/1	650	650	-	-	-	6.2	2.8	-	9.1	50.2	19.9	2.8	22.7
2/1+2/2	543	543	-	-	-	7.1	1.8	-	8.9	59.0	9.1	1.8	10.9
3/1+3/2	531	531	55	97	3	0.4	0.3	0.7	1.4	9.4	1.2	0.3	1.4
4/1+4/2	824	824	265	43	74	0.4	0.7	0.7	1.8	7.7	8.4	0.7	9.1
5/1	436	436	-	-	-	2.9	0.5	-	3.5	28.8	10.5	0.5	11.1
6/1	362	362	-	-	-	4.4	2.5	-	6.9	68.6	11.5	2.5	14.0
7/1	637	637	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
8/1	263	263	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
9/1	548	548	-	-	-	0.0	0.2	-	0.2	1.3	0.0	0.2	0.2
10/1	543	543	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
C1 Stream: 1 PRC for Signalised Lanes (%): 5.1 Total Delay for Signalised Lanes (pcuHr): 31.49 Cycle Time (s): 120 PRC Over All Lanes (%): 5.1 Total Delay Over All Lanes(pcuHr): 31.68													

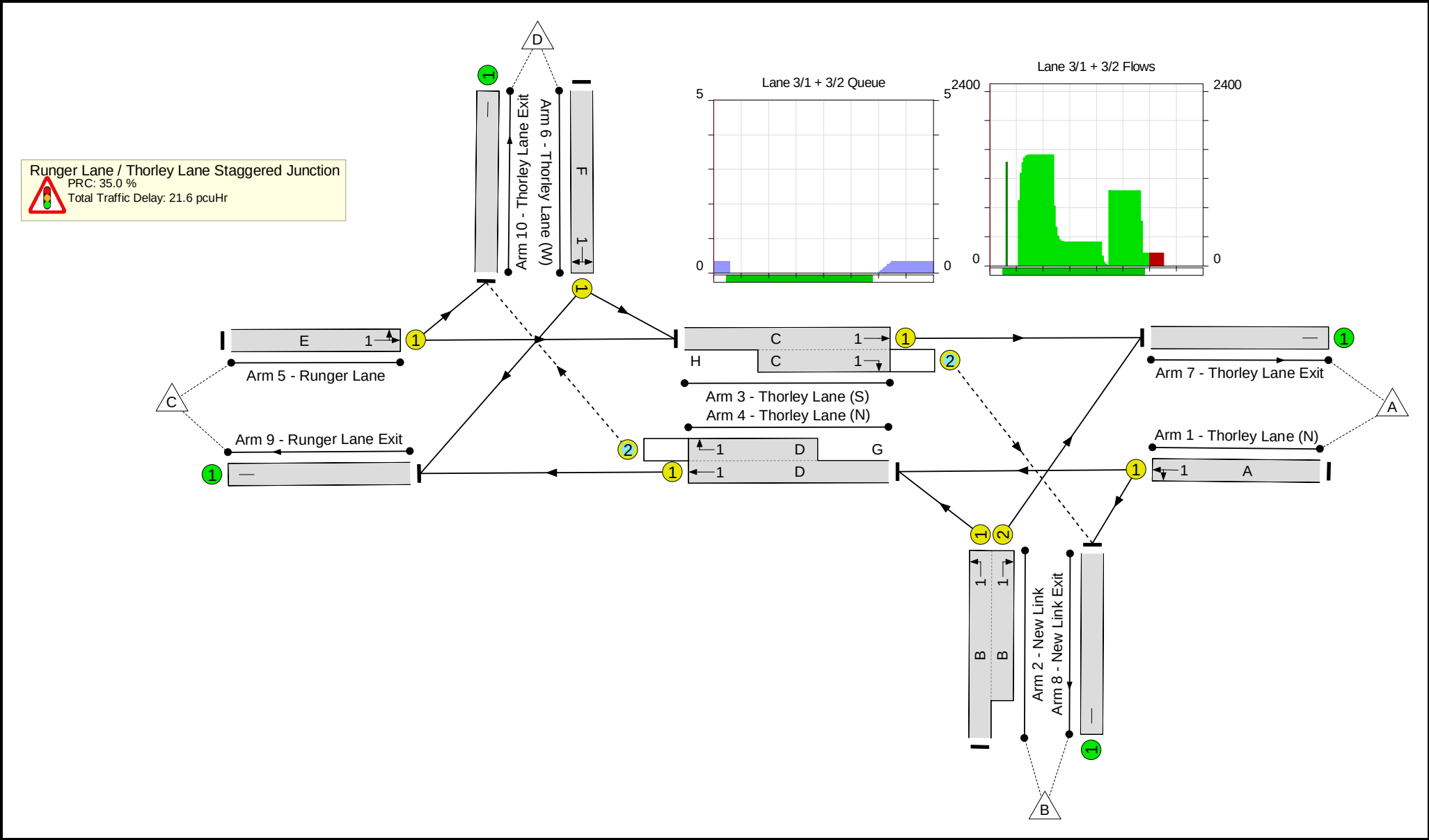
Stage Sequence Diagram

Stage Stream: 1



Full Input Data And Results

Network Layout Diagram



Full Input Data And Results

Network Results

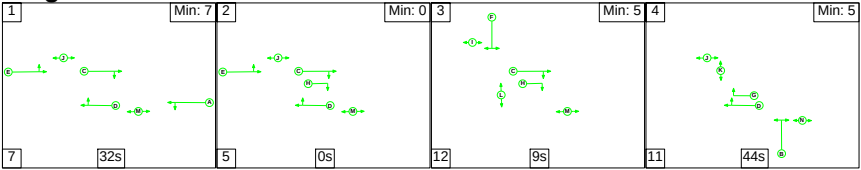
Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network: New Sydney Avenue Junction	-	-	N/A	-	-		-	-	-	-	-	-	66.6%
Runger Lane / Thorley Lane Staggered Junction	-	-	N/A	-	-		-	-	-	-	-	-	66.6%
1/1	Thorley Lane (N) Ahead Left	U	1	N/A	A		1	38	-	434	2022	657	66.0%
2/1+2/2	New Link Left Right	U	1	N/A	B		1	24	-	473	1801:1948	375+406	64.2 : 57.2%
3/1+3/2	Thorley Lane (S) Ahead Right	U+O	1	N/A	C	H	1	80	37	507	1982:1946	1082+339	35.7 : 35.7%
4/1+4/2	Thorley Lane (N) Ahead Right	U+O	1	N/A	D	G	1	77	26	598	1995:1909	860+626	40.2 : 40.2%
5/1	Runger Lane Ahead Left	U	1	N/A	E		1	46	-	414	1925	754	54.9%
6/1	Thorley Lane (W) Left Right	U	1	N/A	F		1	30	-	318	1847	477	66.6%
7/1	Thorley Lane Exit	U	N/A	N/A	-		-	-	-	618	Inf	Inf	0.0%
8/1	New Link Exit	U	N/A	N/A	-		-	-	-	198	Inf	Inf	0.0%
9/1	Runger Lane Exit	U	N/A	N/A	-		-	-	-	486	1978	1978	24.6%
10/1	Thorley Lane Exit	U	N/A	N/A	-		-	-	-	337	Inf	Inf	0.0%

Full Input Data And Results

Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network: New Sydney Avenue Junction	-	-	295	75	2	16.9	4.1	0.6	21.6	-	-	-	-
Runger Lane / Thorley Lane Staggered Junction	-	-	295	75	2	16.9	4.1	0.6	21.6	-	-	-	-
1/1	434	434	-	-	-	4.2	1.0	-	5.2	42.8	12.4	1.0	13.4
2/1+2/2	473	473	-	-	-	5.7	0.8	-	6.4	48.9	7.3	0.8	8.1
3/1+3/2	507	507	86	35	1	0.1	0.3	0.2	0.6	4.1	0.3	0.3	0.6
4/1+4/2	598	598	209	41	2	0.1	0.3	0.4	0.9	5.3	1.7	0.3	2.0
5/1	414	414	-	-	-	3.3	0.6	-	3.9	33.6	10.7	0.6	11.3
6/1	318	318	-	-	-	3.5	1.0	-	4.5	51.0	9.5	1.0	10.4
7/1	618	618	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
8/1	198	198	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
9/1	486	486	-	-	-	0.0	0.2	-	0.2	1.2	0.0	0.2	0.2
10/1	337	337	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
C1 Stream: 1 PRC for Signalled Lanes (%): 35.0 Total Delay for Signalled Lanes (pcuHr): 21.41 Cycle Time (s): 120 PRC Over All Lanes (%): 35.0 Total Delay Over All Lanes(pcuHr): 21.57													

Stage Sequence Diagram

Stage Stream: 1

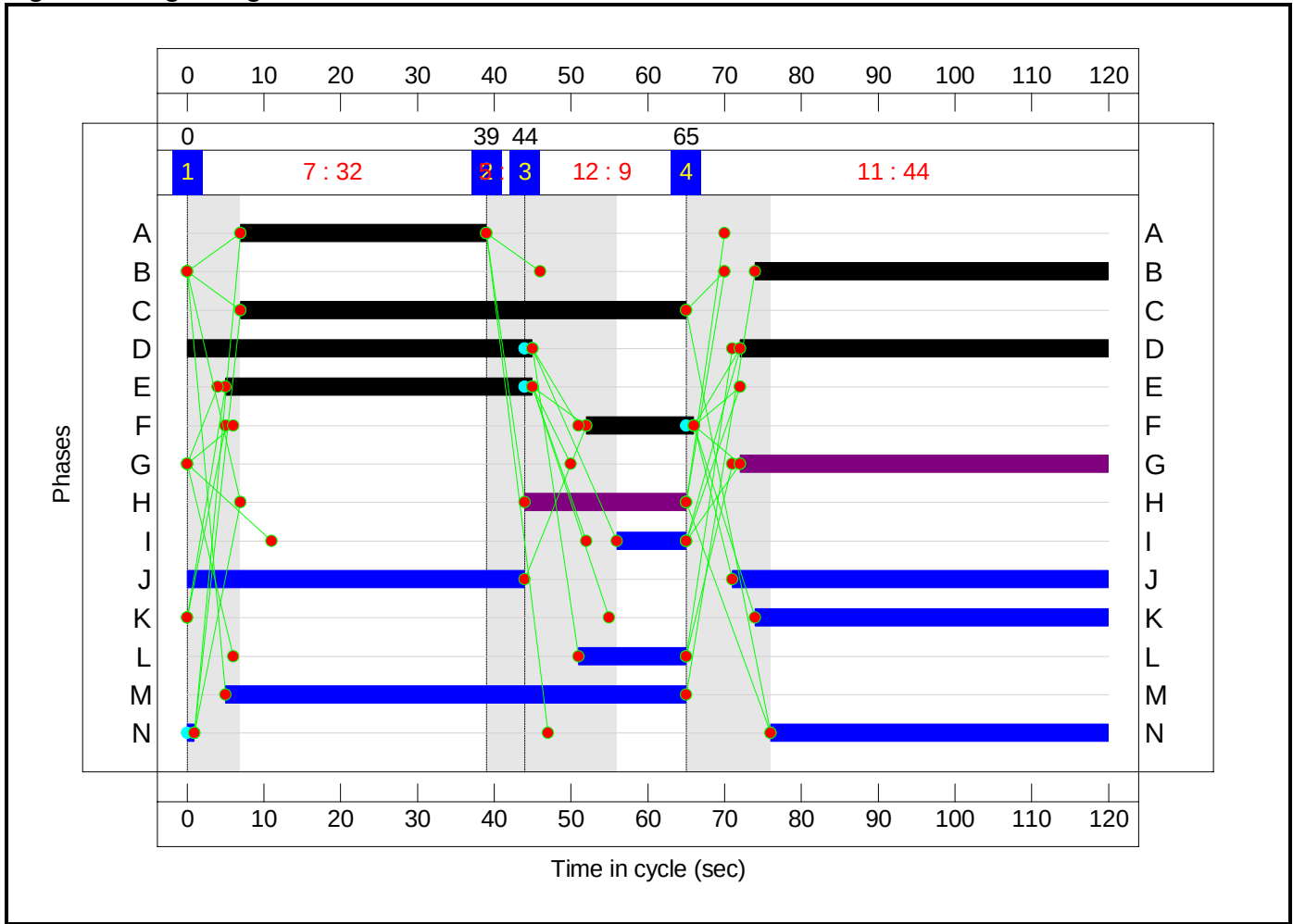


Stage Timings

Stage Stream: 1

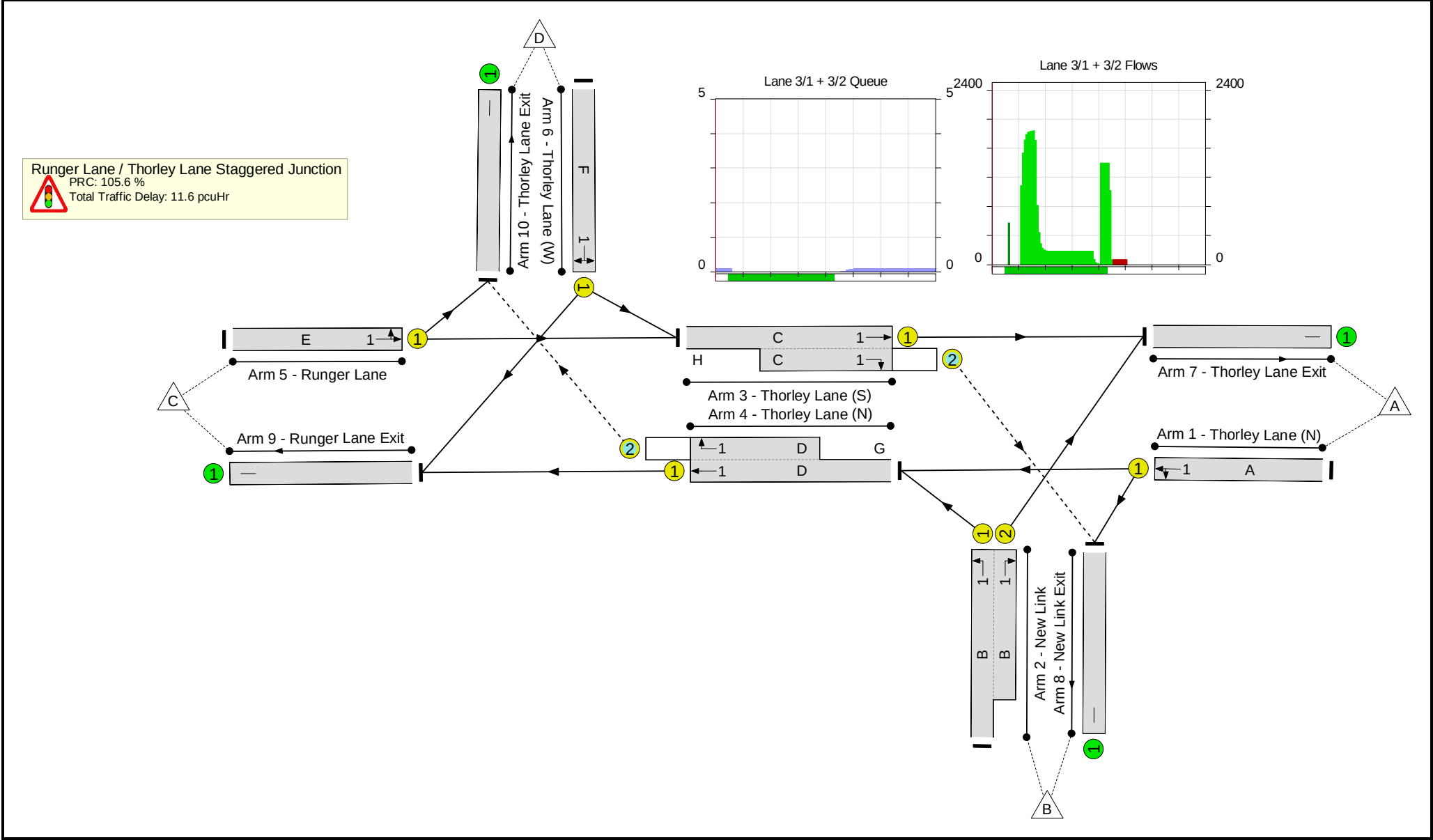
Stage	1	2	3	4
Duration	32	0	9	44
Change Point	0	39	44	65

Signal Timings Diagram



Full Input Data And Results

Network Layout Diagram



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network: New Sydney Avenue Junction	-	-	N/A	-	-		-	-	-	-	-	-	43.8%
Runger Lane / Thorley Lane Staggered Junction	-	-	N/A	-	-		-	-	-	-	-	-	43.8%
1/1	Thorley Lane (N) Ahead Left	U	1	N/A	A		1	32	-	231	1956	538	42.9%
2/1+2/2	New Link Left Right	U	1	N/A	B		1	46	-	620	1801:1948	705+763	40.5 : 43.8%
3/1+3/2	Thorley Lane (S) Ahead Right	U+O	1	N/A	C	H	1	58	21	258	1982:1946	651+548	21.5 : 21.5%
4/1+4/2	Thorley Lane (N) Ahead Right	U+O	1	N/A	D	G	1	93	48	409	1995:1909	1386+229	25.3 : 25.3%
5/1	Runger Lane Ahead Left	U	1	N/A	E		1	40	-	197	1953	667	29.5%
6/1	Thorley Lane (W) Left Right	U	1	N/A	F		1	14	-	95	1840	230	41.3%
7/1	Thorley Lane Exit	U	N/A	N/A	-		-	-	-	474	Inf	Inf	0.0%
8/1	New Link Exit	U	N/A	N/A	-		-	-	-	226	Inf	Inf	0.0%
9/1	Runger Lane Exit	U	N/A	N/A	-		-	-	-	374	1978	1978	18.9%
10/1	Thorley Lane Exit	U	N/A	N/A	-		-	-	-	69	Inf	Inf	0.0%

Full Input Data And Results

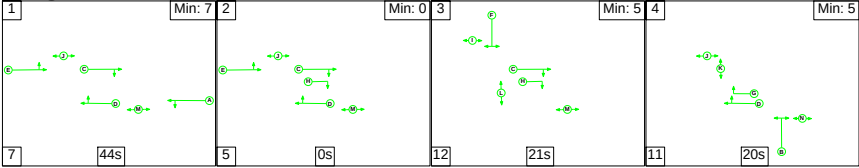
Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network: New Sydney Avenue Junction	-	-	99	69	8	9.8	1.7	0.1	11.6	-	-	-	-
Runger Lane / Thorley Lane Staggered Junction	-	-	99	69	8	9.8	1.7	0.1	11.6	-	-	-	-
1/1	231	231	-	-	-	2.3	0.4	-	2.7	41.6	6.3	0.4	6.7
2/1+2/2	620	620	-	-	-	4.6	0.4	-	4.9	28.7	8.2	0.4	8.5
3/1+3/2	258	258	80	30	8	0.1	0.1	0.1	0.3	3.7	0.1	0.1	0.2
4/1+4/2	409	409	19	39	0	0.0	0.2	0.0	0.2	1.7	0.1	0.2	0.2
5/1	197	197	-	-	-	1.6	0.2	-	1.8	32.8	4.8	0.2	5.0
6/1	95	95	-	-	-	1.3	0.4	-	1.6	61.7	2.9	0.4	3.3
7/1	474	474	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
8/1	226	226	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
9/1	374	374	-	-	-	0.0	0.1	-	0.1	1.1	0.0	0.1	0.1
10/1	69	69	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
C1 Stream: 1 PRC for Signalled Lanes (%): 105.6 Total Delay for Signalled Lanes (pcuHr): 11.50 Cycle Time (s): 120 PRC Over All Lanes (%): 105.6 Total Delay Over All Lanes(pcuHr): 11.62													

Full Input Data And Results

Scenario 5: '2030 - AM Peak' (FG17: '2030 AM Peak Combined', Plan 1: 'Network Control Plan 1')

Stage Sequence Diagram

Stage Stream: 1

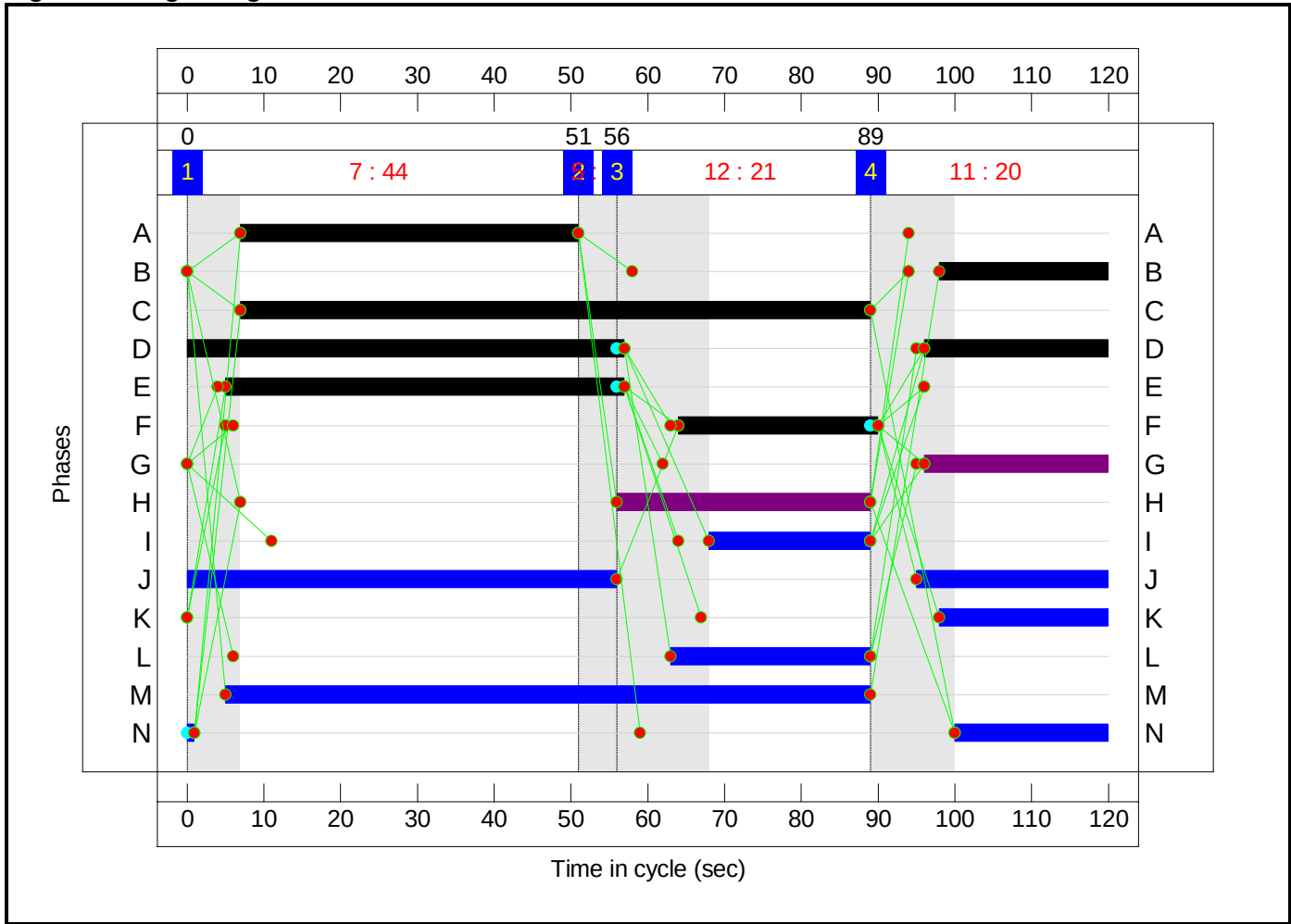


Stage Timings

Stage Stream: 1

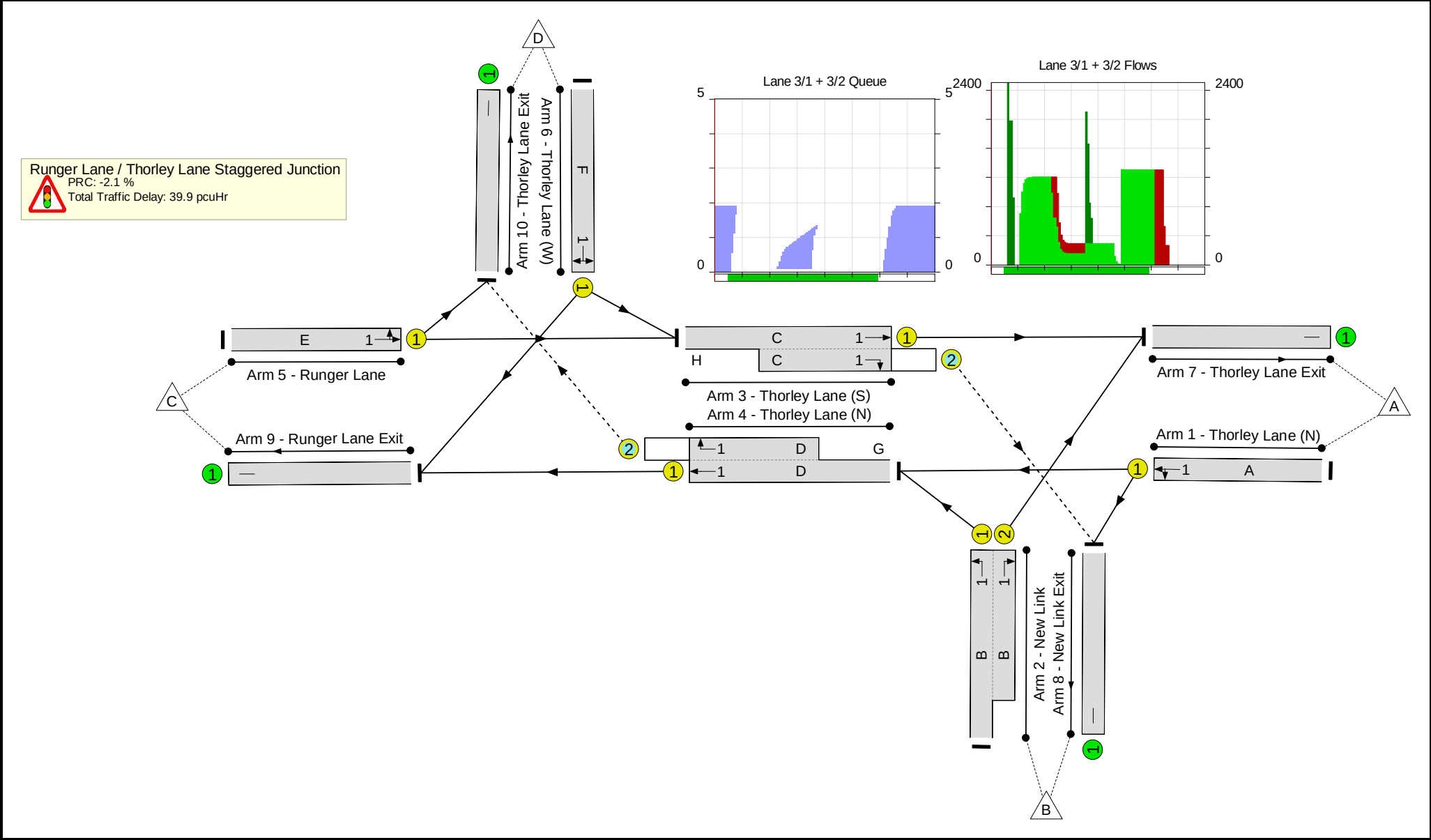
Stage	1	2	3	4
Duration	44	0	21	20
Change Point	0	51	56	89

Signal Timings Diagram



Full Input Data And Results

Network Layout Diagram



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network: New Sydney Avenue Junction	-	-	N/A	-	-		-	-	-	-	-	-	91.9%
Runger Lane / Thorley Lane Staggered Junction	-	-	N/A	-	-		-	-	-	-	-	-	91.9%
1/1	Thorley Lane (N) Ahead Left	U	1	N/A	A		1	44	-	686	2023	759	90.4%
2/1+2/2	New Link Left Right	U	1	N/A	B		1	22	-	624	1801:1948	345+373	89.2 : 84.6%
3/1+3/2	Thorley Lane (S) Ahead Right	U+O	1	N/A	C	H	1	82	33	564	1982:1946	1051+427	38.1 : 38.1%
4/1+4/2	Thorley Lane (N) Ahead Right	U+O	1	N/A	D	G	1	81	24	876	1995:1909	763+656	61.7 : 61.7%
5/1	Runger Lane Ahead Left	U	1	N/A	E		1	52	-	462	1896	837	55.2%
6/1	Thorley Lane (W) Left Right	U	1	N/A	F		1	26	-	381	1842	414	91.9%
7/1	Thorley Lane Exit	U	N/A	N/A	-		-	-	-	717	Inf	Inf	0.0%
8/1	New Link Exit	U	N/A	N/A	-		-	-	-	281	Inf	Inf	0.0%
9/1	Runger Lane Exit	U	N/A	N/A	-		-	-	-	582	1978	1978	29.4%
10/1	Thorley Lane Exit	U	N/A	N/A	-		-	-	-	573	Inf	Inf	0.0%

Full Input Data And Results

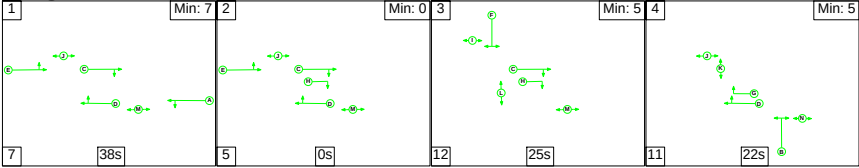
Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network: New Sydney Avenue Junction	-	-	276	214	78	24.6	13.8	1.5	39.9	-	-	-	-
Runger Lane / Thorley Lane Staggered Junction	-	-	276	214	78	24.6	13.8	1.5	39.9	-	-	-	-
1/1	686	686	-	-	-	6.8	4.2	-	11.0	57.7	21.5	4.2	25.8
2/1+2/2	624	624	-	-	-	8.2	3.1	-	11.3	64.9	10.1	3.1	13.2
3/1+3/2	564	564	35	125	3	0.8	0.3	0.7	1.8	11.5	1.9	0.3	2.2
4/1+4/2	876	876	242	89	74	1.0	0.8	0.8	2.6	10.6	9.3	0.8	10.1
5/1	462	462	-	-	-	3.2	0.6	-	3.8	29.5	11.3	0.6	11.9
6/1	381	381	-	-	-	4.8	4.5	-	9.3	87.9	12.4	4.5	16.9
7/1	717	717	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
8/1	281	281	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
9/1	582	582	-	-	-	0.0	0.2	-	0.2	1.3	0.0	0.2	0.2
10/1	573	573	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
C1 Stream: 1 PRC for Signalled Lanes (%): -2.1 Total Delay for Signalled Lanes (pcuHr): 39.71 Cycle Time (s): 120 PRC Over All Lanes (%): -2.1 Total Delay Over All Lanes(pcuHr): 39.91													

Full Input Data And Results

Scenario 6: '2030 - PM Peak' (FG18: '2030 PM Peak Combined', Plan 1: 'Network Control Plan 1')

Stage Sequence Diagram

Stage Stream: 1

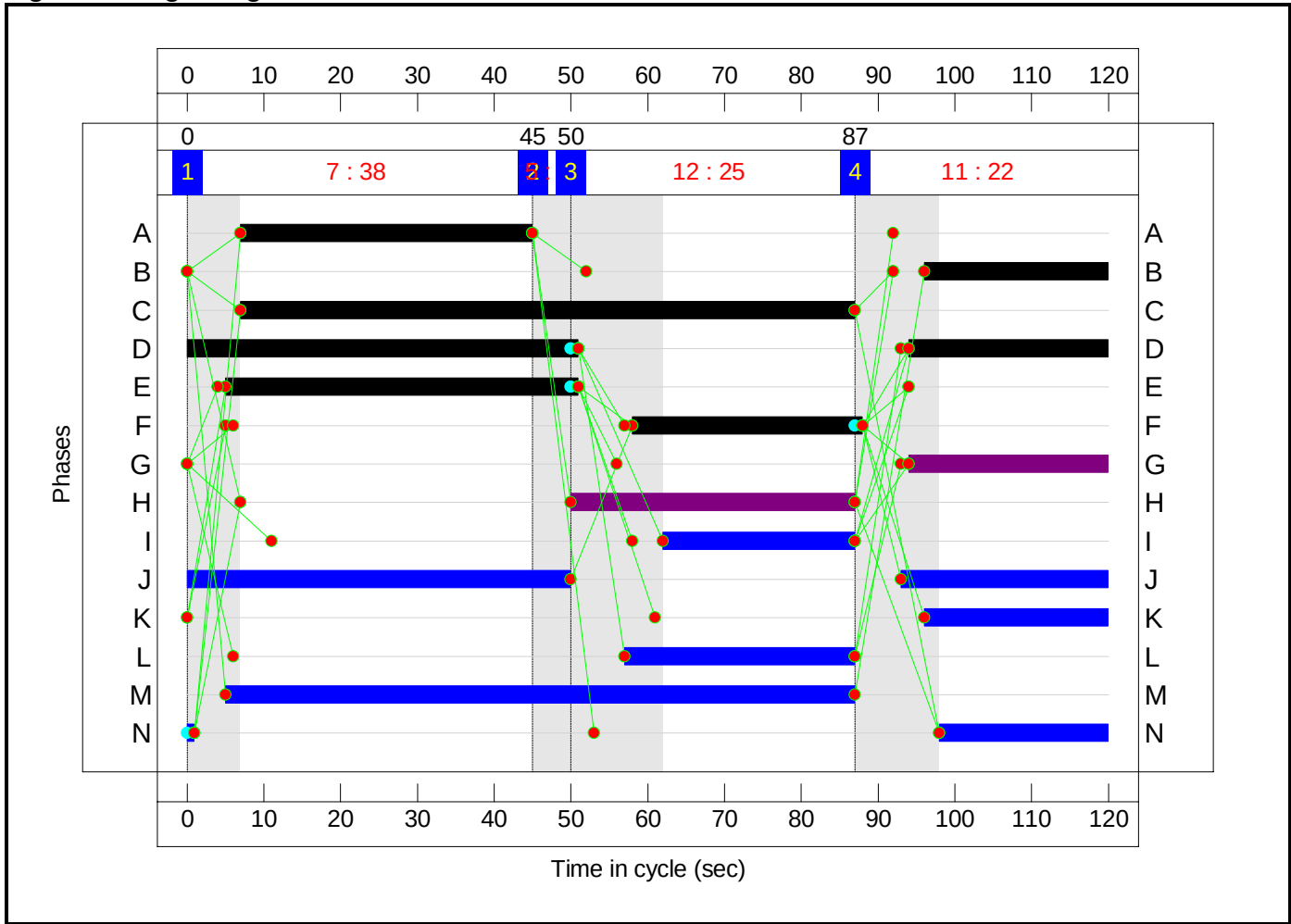


Stage Timings

Stage Stream: 1

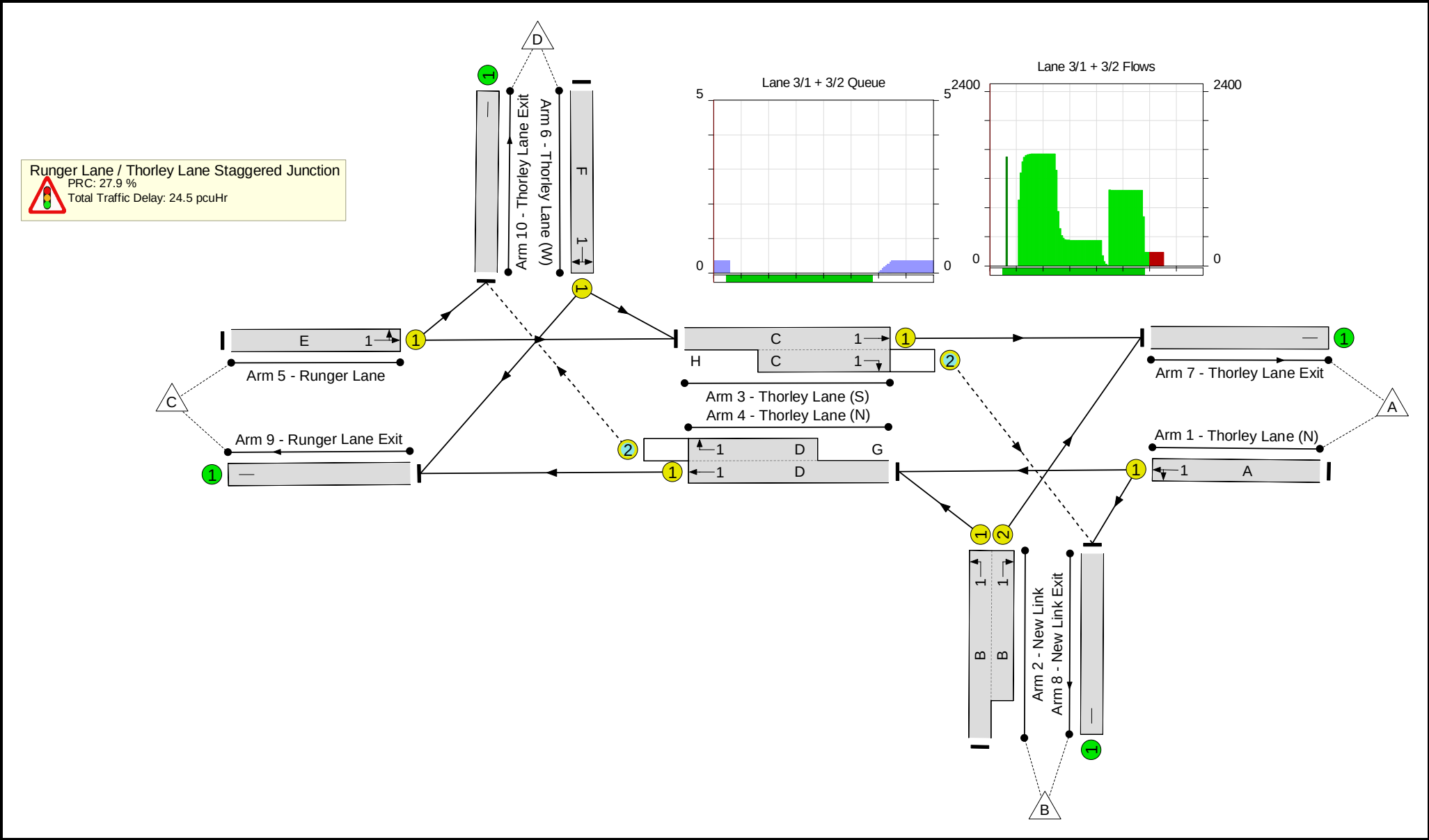
Stage	1	2	3	4
Duration	38	0	25	22
Change Point	0	45	50	87

Signal Timings Diagram



Full Input Data And Results

Network Layout Diagram



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network: New Sydney Avenue Junction	-	-	N/A	-	-		-	-	-	-	-	-	70.4%
Runger Lane / Thorley Lane Staggered Junction	-	-	N/A	-	-		-	-	-	-	-	-	70.4%
1/1	Thorley Lane (N) Ahead Left	U	1	N/A	A		1	38	-	459	2020	656	69.9%
2/1+2/2	New Link Left Right	U	1	N/A	B		1	24	-	546	1801:1948	375+406	70.4 : 69.5%
3/1+3/2	Thorley Lane (S) Ahead Right	U+O	1	N/A	C	H	1	80	37	539	1982:1946	1082+340	37.9 : 37.9%
4/1+4/2	Thorley Lane (N) Ahead Right	U+O	1	N/A	D	G	1	77	26	638	1995:1909	864+618	43.1 : 43.1%
5/1	Runger Lane Ahead Left	U	1	N/A	E		1	46	-	441	1926	754	58.5%
6/1	Thorley Lane (W) Left Right	U	1	N/A	F		1	30	-	333	1847	477	69.8%
7/1	Thorley Lane Exit	U	N/A	N/A	-		-	-	-	692	Inf	Inf	0.0%
8/1	New Link Exit	U	N/A	N/A	-		-	-	-	214	Inf	Inf	0.0%
9/1	Runger Lane Exit	U	N/A	N/A	-		-	-	-	518	1978	1978	26.2%
10/1	Thorley Lane Exit	U	N/A	N/A	-		-	-	-	355	Inf	Inf	0.0%

Full Input Data And Results

Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network: New Sydney Avenue Junction	-	-	292	82	21	18.8	5.0	0.8	24.5	-	-	-	-
Runger Lane / Thorley Lane Staggered Junction	-	-	292	82	21	18.8	5.0	0.8	24.5	-	-	-	-
1/1	459	459	-	-	-	4.5	1.1	-	5.7	44.4	13.3	1.1	14.4
2/1+2/2	546	546	-	-	-	6.7	1.2	-	7.8	51.6	8.7	1.2	9.8
3/1+3/2	539	539	92	36	1	0.1	0.3	0.2	0.7	4.5	0.4	0.3	0.7
4/1+4/2	638	638	200	46	20	0.2	0.4	0.5	1.1	6.1	3.9	0.4	4.2
5/1	441	441	-	-	-	3.5	0.7	-	4.2	34.5	11.5	0.7	12.2
6/1	333	333	-	-	-	3.7	1.1	-	4.9	52.6	10.0	1.1	11.1
7/1	692	692	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
8/1	214	214	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
9/1	518	518	-	-	-	0.0	0.2	-	0.2	1.2	0.0	0.2	0.2
10/1	355	355	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
C1 Stream: 1 PRC for Signalled Lanes (%): 27.9 Total Delay for Signalled Lanes (pcuHr): 24.33 Cycle Time (s): 120 PRC Over All Lanes (%): 27.9 Total Delay Over All Lanes(pcuHr): 24.51													