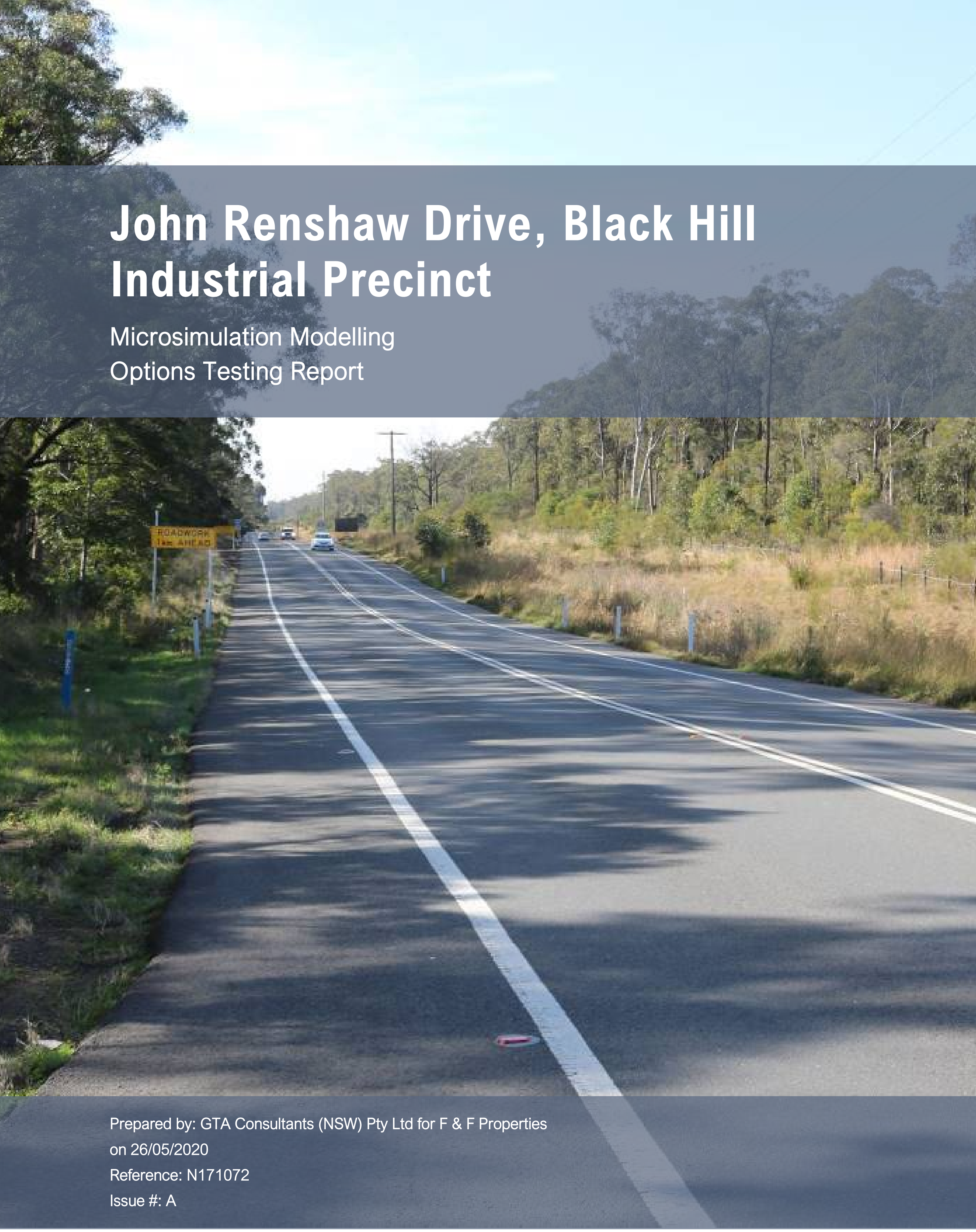

John Renshaw Drive, Black Hill Industrial Precinct

Microsimulation Modelling
Options Testing Report

Prepared by: GTA Consultants (NSW) Pty Ltd for F & F Properties
on 26/05/2020
Reference: N171072
Issue #: A

GTAconsultants

John Renshaw Drive, Black Hill Industrial Precinct

Microsimulation Modelling
Options Testing Report

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Issue #: A

Quality Record

Issue	Date	Description	Prepared By	Checked By	Approved By	Signed
A	26/05/2020	Final	William Finlay	Bryan Li Robert Dus	Rhys Hazell	

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1. EXECUTIVE SUMMARY

F & F Properties engaged GTA Consultants (GTA) to provide traffic and transport advice for the proposed large lot of 200-hectare industrial development on land at DP1057179 on John Renshaw Drive, Black Hill. Extensive engagement with Transport for NSW (TfNSW) has resulted in the need to complete a VISSIM microsimulation model that considers the entire industrial precinct which is made up of the subject site and neighbouring Coal and Allied Land industrial estate development.

This report includes three modelling scenarios, two for the whole precinct and one which only considers the subject site. Option 2B, uses the assumptions provided by the RMS and assesses the traffic impacts based on these assumptions. Option 2A is an alternate assessment of the precinct that adopts numbers that more accurately represents the actual traffic generation rates for each site based on Land and Environment Court proceedings for the adjoining site and TfNSW data. Similarly, the site-specific assessment also adopts these alternate rates, however it only considers the traffic generated by the site.

This assessment clearly identifies the difficulties of predicting the actual traffic flows generated by the precinct and background traffic. As a result it was agreed with TfNSW that ongoing monitoring of traffic at the completion of 25, 50 and 75 per cent of the Gross Floor Area (GFA) should be undertaken to understand the actual traffic being generated by the site, the precinct and that relating to background traffic.

The microsimulation model is as robust as possible and based on sound information available at the time. The site only microsimulation model indicates that with some localised upgrades, the surrounding road network can accommodate traffic generated by the proposed large lot industrial development. Inconsistencies do however remain, and it is clear that the TfNSW preferred assumptions, which we have been asked to adopt, together with several critical elements outside the scope of the model are significantly influencing the outcomes. These outcomes are unfavourably skewed with respect to the proposed large lot industrial development. In this regard, four critical aspects stand out:

- TfNSW preferred background traffic growth
- TfNSW preferred traffic distribution
- TfNSW assumed traffic generation rates
- M1 to Raymond Terrace (M12RT) bypass assumptions and future design uncertainty.

Any one of these aspects are likely to profoundly minimise the traffic impacts associated with the proposed development, noting especially traffic distribution and M12RT bypass assumptions.

The subject site proposes a large lot industrial subdivision that will generate relatively low traffic volumes during the road network peak hours. Heavy vehicles also comprise a larger proportional share of total traffic with 24/7 operations further ‘flattening’ the effects during the peaks. Population growth in the Hunter region west of the site has not been accurately captured in the traffic distribution that has needed to be applied to the model. Planning research appears to indicate that a much more significant proportion of traffic may approach and depart via the west, thereby significantly changing the extent of traffic impact on the road network east of the site, including the M1 / John Renshaw Drive / Weakleys Drive intersection. Should a more even distribution of site generated traffic be split between the east and west there would be up to 200 less vehicles travelling through this intersection and would lessen the extent of works that may be required at the intersection.

With regard to traffic distribution, TfNSW data suggests 80 per cent of trips will approach and depart via the east along John Renshaw Drive and 20 per cent via the west. Recent demographic data and trip times suggest that this is not accurate with the directional split appearing to be more like 55 per cent via the east and 45 per cent via the west. Appendix A includes a briefing note prepared by Barr Property and Planning in this regard.

The assessment of the site and its impact on the surrounding network has been agreed to be modelled in defined stages based on the expected level of GFA development with 25 per cent developed by 2023 increasing to 100 per cent by 2032.

This study recognises that there are already existing constraints in the road network within the study area (and beyond) and note that while TfNSW recently upgraded the M1 / John Renshaw Drive / Weakleys Drive intersection from a roundabout to traffic signals, its own studies conclude that the upgraded intersection would likely fail sometime in the period to 2029 without further mitigating works.

2. INTRODUCTION

2.1. Background and Context

GTA Consultants (GTA) was engaged to provide traffic and transport advice for the proposed large lot industrial development on land on the southern side of John Renshaw Drive, Black Hill. Early engagement with Transport for New South Wales (TfNSW) at the time confirmed the need to complete a microsimulation model assessment to supplement the traffic assessment already completed. As part of these discussions, TfNSW raised the following key items for consideration in the model development:

- Preference to incorporate the neighbouring Coal and Allied Land industrial estate development (Stevens Group adjacent site) thus ensuring a precinct wide model (a detail understood to have previously been excluded from any modelling in the area).
- Availability of the M1 to Raymond Terrace (M12RT) bypass traffic model (prepared for TfNSW).
- Awareness of traffic modelling completed as part of the recent M1 / John Renshaw Drive / Weakleys Drive upgrade project.
- Potential site access arrangements and quantum of intersections along John Renshaw Drive.

One of the key TfNSW requirements was the need to consider the adjacent site in the modelling assessment. Accordingly, the modelling assessment has been completed based on an Industrial Precinct which includes both the subject site and the adjacent site. Also critical to the study is the need to understand the traffic impacts of the subject site in isolation.

While TfNSW preferences are recognised, there remain several areas of contention, notably:

- Trip generation rates for the Industrial Precinct:
  - TfNSW prefers to apply a generic traffic generation rate of 0.4 vehicle trips per 100 square metres to the two sites. Such generic trips rates applied to two distinctly different industrial developments is not considered suitable. As such, two modelling scenarios have been developed:
    - Subject site at 0.185 trips per 100 square metres (based on TfNSW data) and adjacent site at 0.4 trips per 100 square metres (based on Land and Environment Court evidence).
    - Both sites at 0.4 trips per 100 square metres (based on TfNSW preferences).
  - The 0.185 trip rate applied to the subject site is also still considered conservatively high. The 0.185 trips per 100 square metres is the average trip rate of two large industrial precincts in western Sydney (refer to Section 3.3) where the data was collected in early 2012. Already there has been a significant shift in the operational characteristics of large lot industrial developments and heavy freight movement with technological advancements continuing to be a key influence. With 24/7 operation and long-haul freight movement increasingly common in large lot industrial estates, a greater proportion of traffic will increasingly occur outside the road network peak hours. All these factors reduce the traffic impact at peak times.
- Distribution of traffic:
  - TfNSW data suggests 80 per cent of trips will approach and depart via the east along John Renshaw Drive and 20 per cent via the west. Recent demographic data and trip times suggest that this may not accurate with the directional split appearing to be more like 55 per cent via the east and 45 per cent via the east. In this regard, Appendix A includes a briefing note prepared by Barr Property and Planning in this regard.

Following the development of a 2019 Base Year microsimulation model using the VISSIM software package, a series of options have been tested representing the key development stages of the site only assessment, and the two options for the Industrial Precinct. The make-up of these options is the culmination of a mostly collaborative effort between the project team and TfNSW who have a detailed understanding of the precinct and surrounding road network.

This Option Testing Report summarises the key inputs, assumptions and outcomes of the microsimulation modelling assessment. It also follows a detailed draft modelling report issued to TfNSW in November 2019[1] as part of ongoing and proactive engagement to bring about positive outcomes for the precinct.

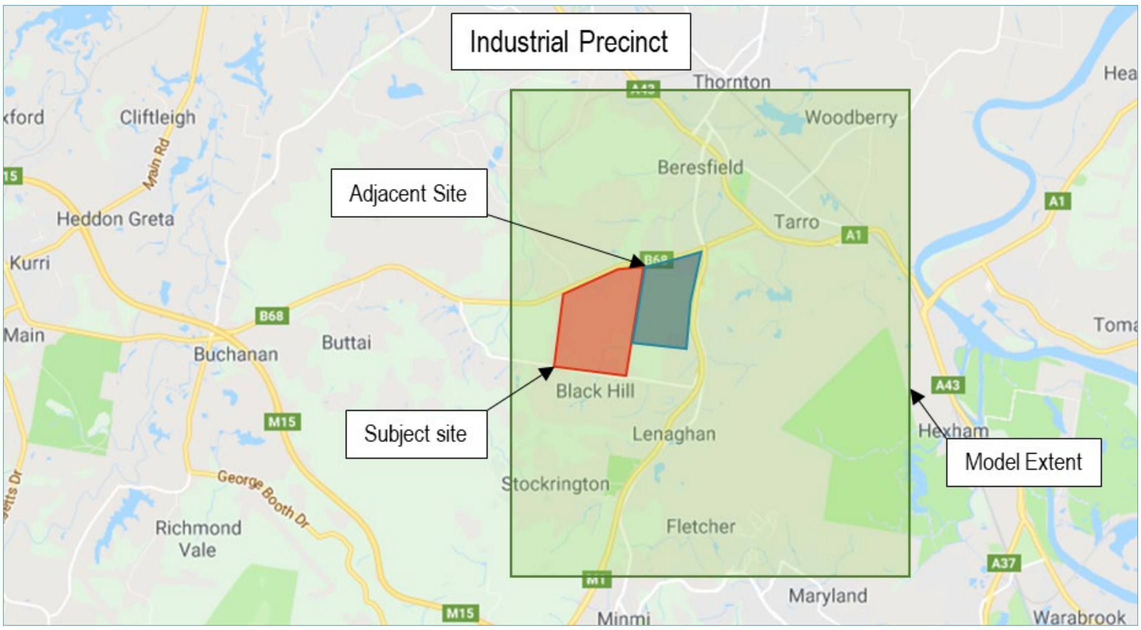
2.2. Study Area

The study area for this modelling assessment is illustrated in Figure 1.1 and indicates the location of the Industrial Precinct comprising both the subject site and the adjacent site. The Industrial Precinct is on John Renshaw Drive in Black Hill and close to the northern end of the M1 Motorway. The key road corridors that surround the Industrial Precinct include:

- Pacific Motorway (M1): north-south motorway that runs along the eastern boundary of the Industrial Precinct.
- John Renshaw Drive: east-west road which runs along the northern boundary of the Industrial Precinct which also provides a connection between the Hunter Expressway (M15) and the Pacific Motorway (M1) / New England Highway (A43).
- Weakleys Drive: north-south continuation of the M1 corridor to connect with the New England Highway (A43).

The M1 / John Renshaw Drive / Weakleys Drive signalised intersection is also centrally located within the study area, immediately north-east of the Industrial Precinct.

Figure 1.1: Study area and model extent



Base image source: Google Maps

[1] John Renshaw Drive, Black Hill Industrial Precinct, Microsimulation Modelling Options Testing Report, GTA Consultants, 19 November 2019.

2.3. References

In preparing this report, reference has been made to the following:

- Traffic Impact Assessment prepared by Intersect Traffic dated August 2018.
- Traffic and Transport Assessment prepared by Arcadis dated May 2018.
- Industrial Subdivision John Renshaw Drive, Black Hill Detailed Review of Transport Assessment prepared by GTA Consultants, dated 26 June 2019.
- other background documents and traffic data as referenced in this report.

2.4. Report Outline

The structure of this report is outlined below:

- Chapter 1: Introduction – overview of the project background and objectives.
- Chapter 2: Option Testing – outline of the options and development scenarios that have been assessed.
- Chapter 3: Future Year Demand – summary of the scenarios and assumptions behind the development of future year traffic demands.
- Chapters 4-6: Operational Assessment Comparison – assessment of Scenario 2A and Scenario 2B.
- Chapter 7: Conclusion – summary of key outcomes and recommendations from the assessment.

2.5. Project Objectives and Summary

The key objectives of this traffic modelling study include:

- Assessing the traffic impacts associated with the proposed development on the surrounding road network. This includes modelling the subject site in isolation and as part of a broader Industrial Precinct.
- Identifying the road network constraints, as well as any additional mitigation works that may be required to support the level of development under the various scenarios.
- Recognising that there are already existing constraints in the road network (particularly the M1 / John Renshaw Drive/ Weakleys Drive intersection) with TfNSW own studies concluding that key intersections are likely to fail in the period to 2029 without further mitigating works (in addition to recent upgrades from a roundabout to traffic signals).
- Communicating uncertainty around traffic in the area generally and extent of variables that will combine to significantly influence TfNSW assumptions.
- Informing the relevant stakeholders (including TfNSW) on the above.

It is important to note that in developing the VISSIM microsimulation model for the precinct it has become increasingly obvious that there remain several mitigating factors that need to be recognised to ensure manageable and agreeable outcomes.

The project team has proactively worked with TfNSW with the outcome being a thoroughly robust microsimulation model that considers a range of development scenarios covering defined future years. While this may be the case, there remains several variables that need to be considered to ensure accuracy with respect to traffic. In this regard the following is noted:

- While the model is robust and based on detailed recent modelling validated and calibrated by TfNSW (completed as part of the M12RT bypass) the original survey data is now ageing and has needed to be growthed to establish 2019 as the base year.

- While reliance on such data for modelling staged future development scenarios is not uncommon, the local and regional area will clearly undergo significant change over the period to 2032. The influencing factors that will prove key to this include:
  - Development of the two sites that make up the Black Hill Industrial Precinct (the subject of this assessment) and the respective adopted (and applicable) traffic generation rates.
  - M12RT bypass and ongoing uncertainty over final alignment and configuration (and hence the extent of benefit it will contribute to local area intersections, including the M1 / John Renshaw Drive / Weakleys Drive signalised intersection).
  - The 1.5 per cent per annum traffic growth rate required by TfNSW may not fully account for future commercial and residential development further to the west (along the Hunter Expressway and Hunter region generally, an area that is expected to undergo significant growth. This will naturally affect traffic distribution and hence the traffic impacts of the Industrial Precinct on the key intersections (refer to Appendix A for further detail).
- Conservatively, a nominal shift in traffic distribution has been applied to more accurately account for greater Hunter region growth to date than that allowed for in the M12RT bypass model. A minor redistribution of traffic to/ from the west along John Renshaw Drive has been applied and amounts to an increase from 20 per cent to 25 per cent. Consistent with our earlier comments, we believe that this should be further increased to 45 per cent.
- Travel time assessments confirm that use of John Renshaw Drive (west of the precinct) and the Hunter Expressway to access the M1 and Newcastle Link Road (rather than John Renshaw Drive (east of the precinct) and the M1) would be more favourable. This is a result of more consistent travel times (especially for heavy vehicles) and time of day impacts, especially during the future years when background traffic growth affects travel times.
- The subject site proposes a large lot industrial subdivision that will generate relatively low traffic volumes during the road network peak hours. Heavy vehicles also comprise a larger proportional share of total traffic with 24/7 operations further ‘flattening’ the effects during the peaks.
- Future operators would limit travel during peak periods, especially should there be congestion on the surrounding road network. This is the case for any Industrial Precinct where consistent travel times for heavy vehicles are critical to operational efficiency.
- As discussed, the microsimulation modelling scenarios include:
  - Site only model with a traffic generation of 0.185 vehicle trips per 100 square metres (refer to detailed assessment included in Appendix B).
  - Precinct Scenario 2A (including traffic generation rates of 0.185 vehicle trips per 100 square metres for the subject site and 0.4 vehicle trips per 100 square metres for the adjacent site).
  - Precinct Scenario 2B (including TfNSW preferred traffic generation rate of 0.4 vehicle trips per 100 square metres for both sites).
- The adjacent Stevens Group site remains subject to ongoing Land and Environment Court proceedings with determination yet to be confirmed at the time of writing. It is understood that intersection traffic modelling completed for that site (as part of the LEC) adopted the traffic generation rate of 0.4 vehicle trips per 100 square metres across the adjacent site. This removes the ability for this model to consider rates more than this (as detailed as part of earlier assessments for that site).
- Background traffic growth rates indicate that the road network (within the bounds of the study area) already shows constraint without the proposed mitigation measures in place. In particular:

  - The M1 / John Renshaw Drive / Weakleys Drive signalised intersection would reach capacity by 2032 (consistent with TfNSW own traffic modelling for this intersection).
  - Congestion north of the New England Highway in Beresfield and Thornton has been by identified by TfNSW with recognition that the microsimulation model is not responsible for addressing such constraint in the upper reaches of the network.
  - The John Renshaw Drive to New England Highway (A1) eastbound merge at the eastern extent of the model also shows signs of congestion.
- The staged development approach (and development scenarios tested in the model itself) allow an understanding the triggers for road network upgrades. Traffic survey data collection associated with these various stages would allow detailed understanding of the actual future traffic generation rates, and if done properly would illustrate any such variations across the two sites that make up the precinct and relative change over time. This would allow for accurate future modelling to be completed, understanding of traffic distribution and traffic apportionment across the two sites.
- The current status of the M12RT bypass alignment and configuration remains relatively unknown and while some details are publicly available, future options testing and modelling status is not able to be confirmed. With congestion evident on the extents of the study area (and outside the responsibility of the Industrial Precinct), there would appear to be obvious benefits with on-ramp and off-ramp locations. For example, an eastbound off-ramp at the Tarro interchange may provide significant benefits to congestion in the network. This includes at the M1 / John Renshaw Drive / Weakleys Drive signalised intersection and New England Highway (A1) eastbound merge.
- It is recognised that large lot Industrial Precincts are unlikely to generate traffic volumes in the future at the same level as they do today (and especially when referencing the adopted traffic generation rates). This is a result of many influencing factors, including technological advancements such as:
  - higher mass limits for heavy vehicles and associated incentives (GPS tracking technology)
  - ongoing trend towards heavy industrial automation
  - autonomous vehicles (including dedicated employee autonomous buses and on-demand buses), and more favourable use of efficient and targeted public transport services
  - commercial drones and their practical application to local / regional deliveries etc.
- Traffic generation rates are expected to further reduce in future years, with modelling scenario 2A considered to reflect a 'worse case' scenario or is at least, highly conservative.

Overall, the microsimulation model is as robust as possible and based on sound information available at the time. Inconsistencies do however remain and it is clear that the TfNSW preferred assumptions, together with several critical elements outside the scope of the model are significantly influencing the outcomes. These outcomes are unfavourably skewed with respect to the proposed large lot industrial development. In this regard, four critical aspects stand out:

- TfNSW preferred background traffic growth
- TfNSW preferred traffic distribution
- TfNSW assumed traffic generation rates
- M12RT bypass assumptions and future design uncertainty.

3. OPTION TESTING

3.1. Overview

Given the significance of the proposed Industrial Precinct and proximity of the site to the planned M12RT bypass, a collaborative effort between the project team and TfNSW has been key with several options developed and scenarios tested as part of the assessment. The following sections outline the key considerations specific to both the subject site and broader Industrial Precinct, as well as other contextual considerations required to inform the development and testing of scenarios.

3.2. Industrial Precinct Staging and Access

3.2.1. Staging

The assessment of the subject site and broader Industrial Precinct and its impact on the surrounding network has been agreed to be modelled in stages based on the expected level of Gross Floor Area (GFA) development on the site. The respective design years at each completion stage are summarised in Table 2.1.

It is important to note that the subject site and adjacent site have needed to be assumed as being developed in unison for the purposes of this assessment.

Table 2.1: Industrial Precinct staging

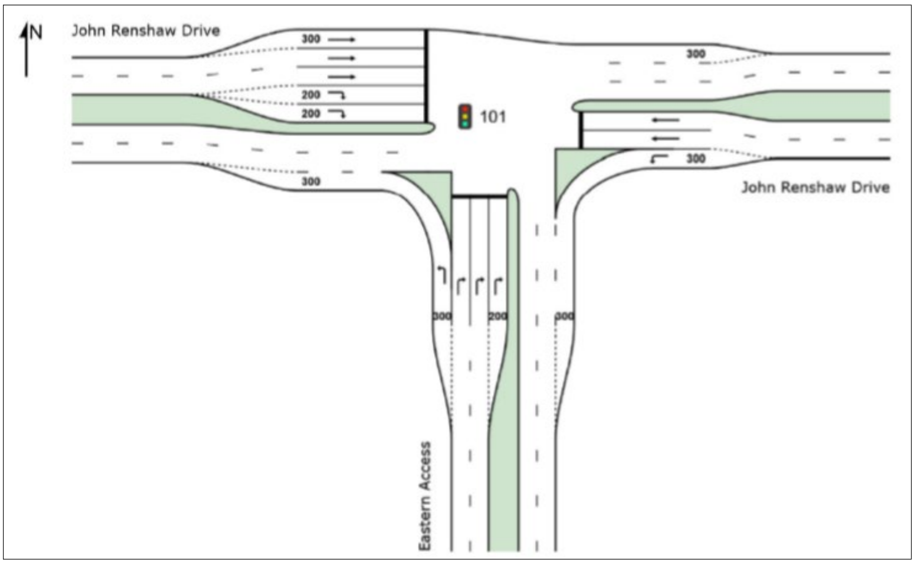
Industrial Precinct Stage	Design Year
25% GFA developed	2023
50% GFA developed	2026
75% GFA developed	2029
100% GFA developed	2032

3.2.2. Access

The development proposal(s) for the Industrial Precinct includes two new signalised intersections on John Renshaw Drive as described below (with approximate locations indicated in Figure 2.6):

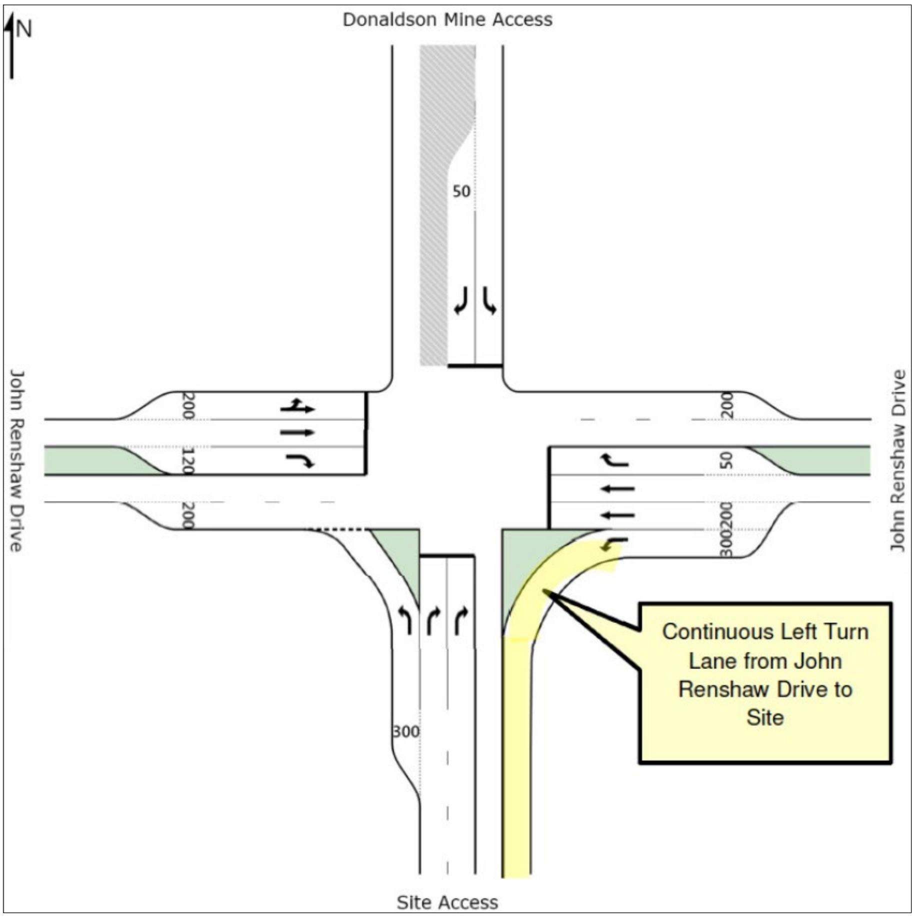
- Central access – signalised T-intersection located at the boundary between the subject site and adjacent site. This central access will facilitate traffic movements for both sites with an indicative layout of the proposed intersection shown in Figure 2.1.
- Western access – located opposite the existing Donaldson Mine access and proposed to be constructed as a four-leg signalised intersection. The indicative layout for this access has been determined from Option 2 in the Traffic and Transport Report for the Black Hill Planning Proposal (Hyder 2013) and shown in Figure 2.2.

Figure 2.1: Proposed central access



Source: Traffic Impact Assessment for Part Lot 1131 In DP 1057179 John Renshaw Drive, Black Hill prepared by Intersect Traffic dated August 2018

Figure 2.2: Proposed western access

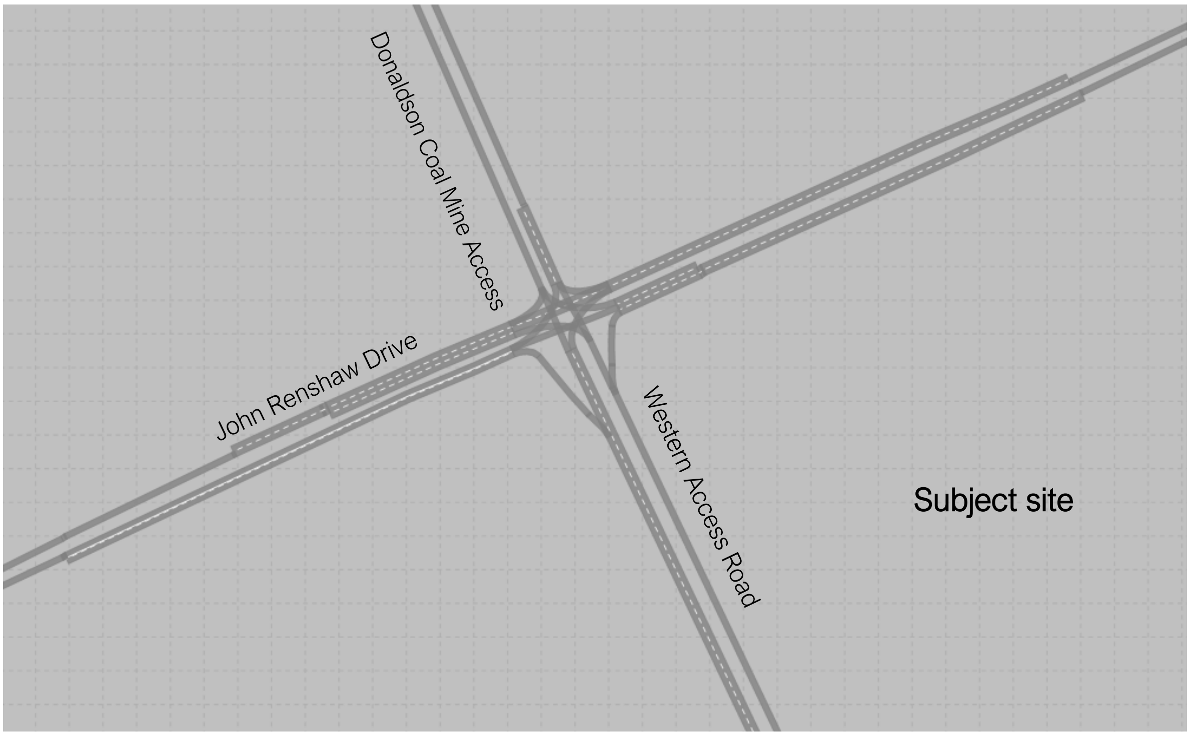


Source: Traffic Impact Assessment for Part Lot 1131 In DP 1057179 John Renshaw Drive, Black Hill prepared by Intersect Traffic dated August 2018

It is noted that Figure 2.1 and Figure 2.2 are considered the 'ultimate' configuration for these access points and may not be required to be developed in full, particularly, during the interim (or early) stages of the Industrial Precinct – subject to more detailed analysis. For the purpose of this assessment, a conservative approach has been undertaken adopting the layouts illustrated in Figure 2.3 and Figure 2.4 which represent a reduced footprint of the intersections.

Figure 2.3: Modelled central access layout

Figure 2.4: Modelled western access layout



In addition to the above, the development proposal for the adjacent site includes an additional left-in / left-out access road on John Renshaw Drive further to the east. For the purposes of this study and in agreement with TfNSW, a conservative assessment has been completed with this access excluded from the model.

3.2.3. Internal Road Network

The subject site comprises approximately 38 large industrial lots ranging in size from 1.8 hectares to 6.3 hectares. The subdivision plan is shown in Figure 2.5 and forms the basis for the internal road network for the model shown in Figure 2.6. The internal road network has been included to distribute vehicles across the multiple site access points and broadly indicate capacity of the internal network to accommodate site traffic.

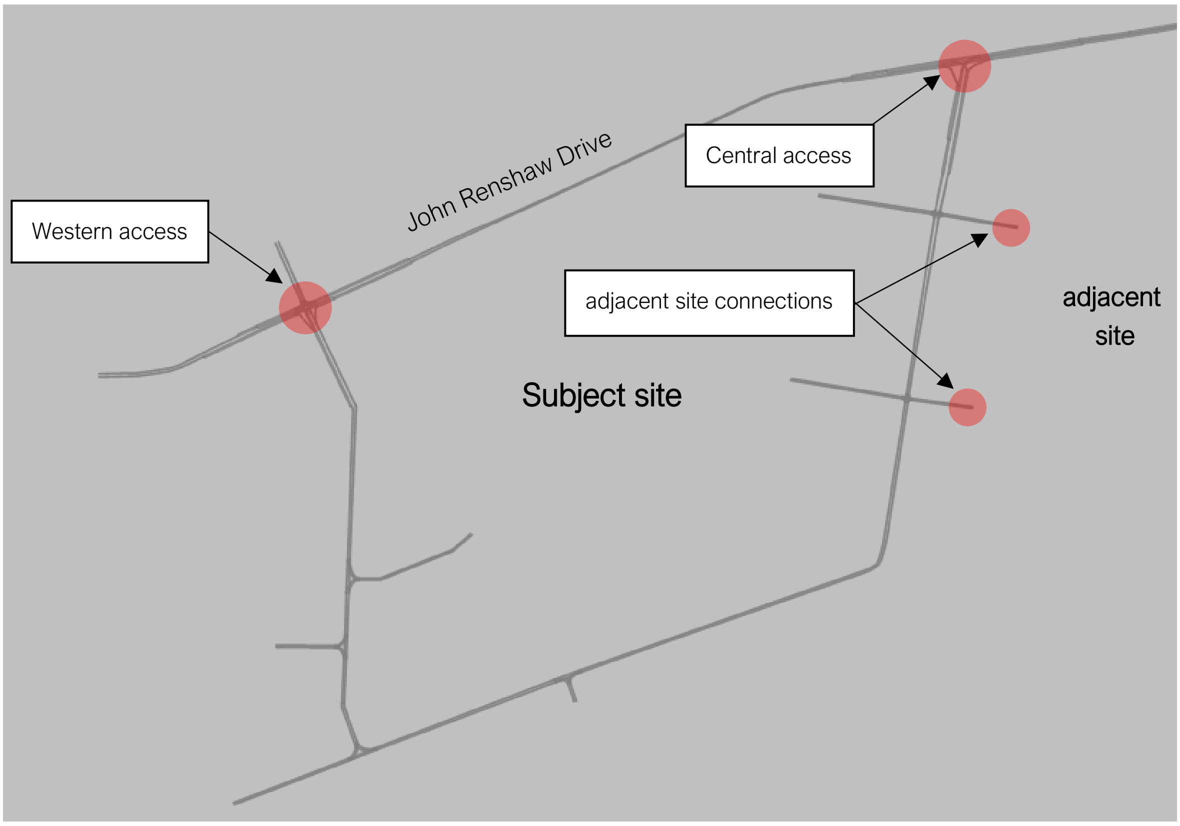
The adjacent site internal road network has not been modelled in as much detail as the subject site. Two connections to the adjacent site have been included to assign trips between the sites and feed into the shared central access.

It is noted that the internal road network operation in this model has not been modelled in detail and further detailed investigation into the road network configuration, intersection layout and controls etc. would need to be completed as part of subsequent work.

Figure 2.5: Subject site subdivision plan

Source: Overall Site Plan, Drawing Reference 239590-CON-001(D) prepared by adw johnson dated 6 June 2018

Figure 2.6: Modelled Industrial Precinct internal road network



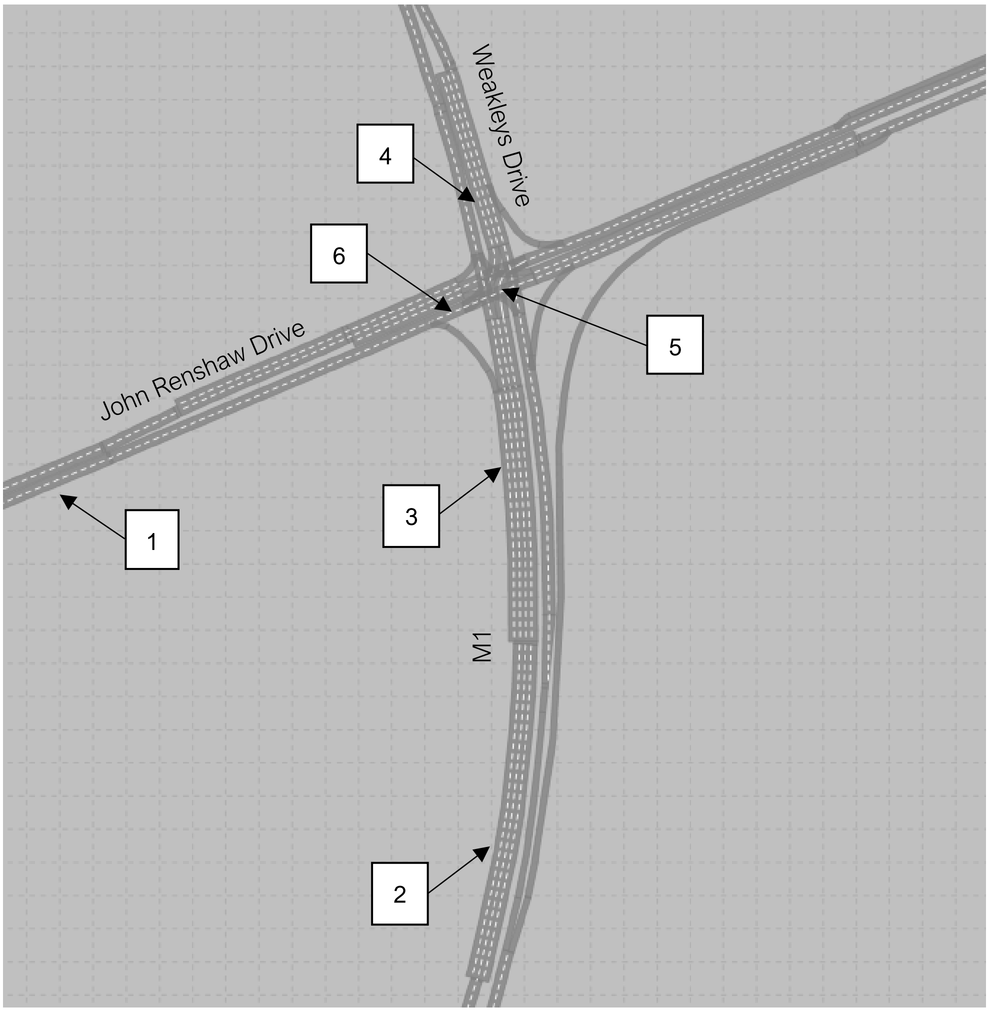
3.3. Road Network Mitigation Options

A preliminary assessment of the road network impacts identified congestion issues for select movements. As such, it was agreed with TfNSW that additional mitigation works could be considered at the M1 / John Renshaw Drive / Weakleys Drive from the 50% GFA developed stage and onwards.

The following outlines the mitigation works recommended at the M1 / John Renshaw Drive / Weakleys Drive intersection, as shown in Figure 2.7 and denoted by the following item numbers:

1. Duplication of John Renshaw Drive between the central Industrial Precinct access and M1 in both directions.
2. Extension of Lane 1 to the start of the right turn lane on the M1 south approach to the M1 / John Renshaw Drive / Weakleys Drive intersection.
3. Addition of left turn slip lane on the M1 south approach to the M1 / John Renshaw Drive / Weakleys Drive intersection.
4. Duplication of right turn onto John Renshaw Drive from Weakleys Drive.
5. Signal phase time redistribution to accommodate future year traffic demands in the various scenarios and development stages.
6. Duplication of right turn onto M1 from John Renshaw Drive (introduced as an additional mitigation feature following a review of the 75% and 100% GFA developed stages).

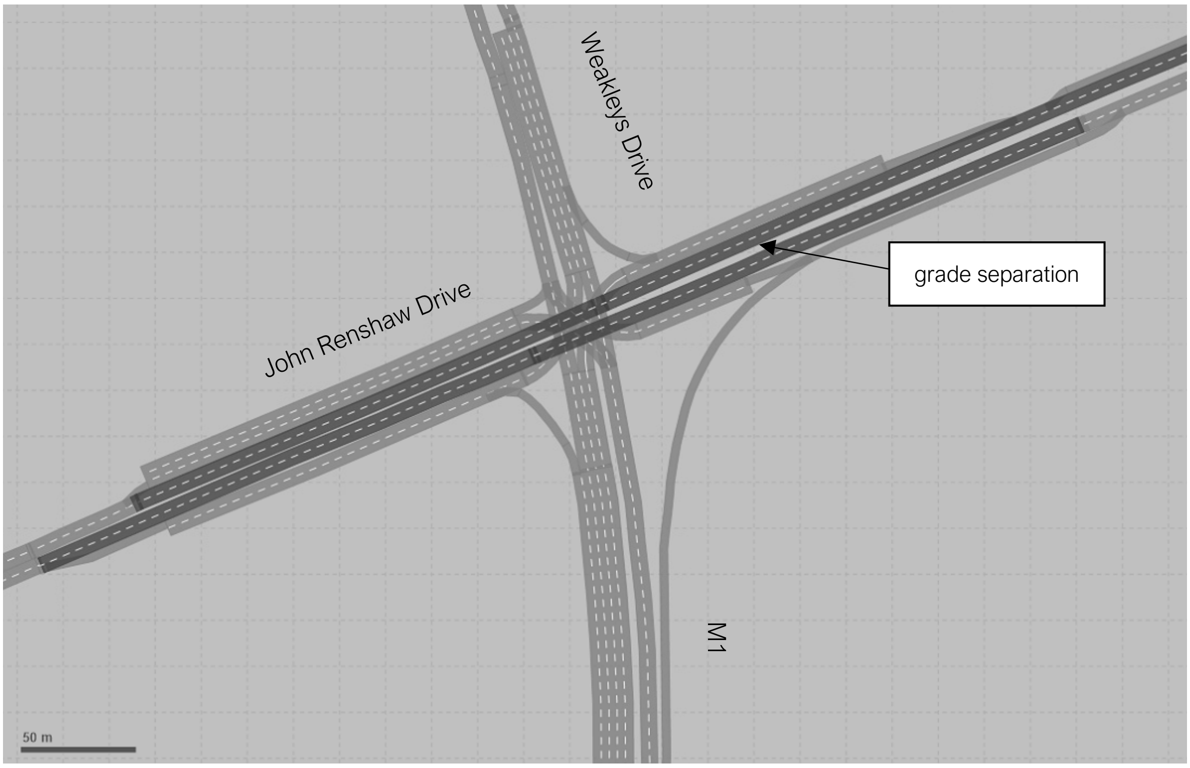
Figure 2.7: Mitigation works modelled for M1 / John Renshaw Drive / Weakleys Drive



Furthermore, following a review of the above assessment, grade separation at the M1 / John Renshaw Drive / Weakleys Drive intersection has been tested under the arrangement shown in Figure 2.8. Such mitigating works are not so much proposed than merely tested to understand not only the benefit but also the implications for other key locations on the periphery of the model (and beyond).

Road network upgrades of this magnitude are tied to several influencing factors rather than a direct link with the proposed Industrial Precinct. These influencing factors include applicable background traffic growth rates, agreement on traffic distribution and final M12RT bypass details (including obvious benefits associated with an eastbound off-ramp at Tarro Interchange). All need to be investigated to ensure all reasonable road upgrades are considered, especially those that present the most benefit to road users and cost benefit for all.

Figure 2.8: Grade Separation modelled for M1 / John Renshaw Drive / Weakleys Drive



3.4. Other Assumptions

As discussed, TfNSW advised that the impacts of the M12RT bypass need to be considered in the modelling assessment. It was agreed that the M12RT bypass was not required to be physically included in the model, rather the future year traffic demands be adjusted to reflect any potential traffic redistribution following its introduction – refer Chapter 3 for further details.

It was also assumed that the M12RT bypass would likely open somewhere between the 50% GFA developed and 75% GFA developed stages of development (between 2026 and 2029).

3.5. Summary of Development Scenarios Tested

Two Industrial Precinct demand scenarios are discussed in this report:

- Precinct Scenario 2A (including traffic generation rates of 0.185 vehicle trips per 100 square metres for the subject site and 0.4 vehicle trips per 100 square metres for the adjacent site)
- Precinct Scenario 2B (including TfNSW preferred traffic generation rate of 0.4 vehicle trips per 100 square metres for both sites).

Further details on future year traffic demands are outlined in Chapter 3. Having consideration to the previous discussion, a summary of the scenarios that were agreed to be assessed in the microsimulation model are detailed in Table 2.2 and Table 2.3.

Table 2.2: Scenario summary – Precinct Scenario 2A

Scenario	Name	Design Year	Precinct Stage	Precinct Access	M12RT Included?	Mitigation Works	Additional Mitigation Work (item 6)	Grade Separation
1	Base	2019	0%	-	No	No	No	No
2	Future Base	2032	0%	-	No	No	No	No
3	25% GFA developed	2023	25%	Central (joint) signalised access	No	No	No	No
4	50% GFA developed	2026	50%	Central (joint) signalised access + western signalised access + internal road network	No	Yes	No	No
5	50% GFA developed	2026	50%	Central (joint) signalised access + western signalised access + internal road network	Yes	Yes	No	No
6	75% GFA developed	2029	75%	Central (joint) signalised access + western signalised access + internal road network	Yes	Yes	Yes	No
7	100% GFA developed	2032	100%	Central (joint) signalised access + western signalised access + internal road network	Yes	Yes	Yes	No
8	100% GFA developed	2032	100%	Central (joint) signalised access + western signalised access + internal road network	Yes	-	-	Yes

Table 2.3: Scenario summary – Precinct Scenario 2B

Scenario	Name	Design Year	Precinct Stage	Precinct Access	M12RT Included?	Mitigation Works	Additional Mitigation Work (item 6)	Grade Separation
1	Base	2019	0%	-	No	No	No	No
2	Future Base	2032	0%	-	No	No	No	No
3	25% GFA developed	2023	25%	Central (joint) signalised access	No	No	No	No
4	50% GFA developed	2026	50%	Central (joint) signalised access + western signalised access + internal road network	No	Yes	No	No
5	50% GFA developed	2026	50%	Central (joint) signalised access + western signalised access + internal road network	Yes	Yes	No	No
6	75% GFA developed	2029	75%	Central (joint) signalised access + western signalised access + internal road network	Yes	Yes	Yes	No
7	100% GFA developed	2032	100%	Central (joint) signalised access + western signalised access + internal road network	Yes	Yes	Yes	No
8	75% GFA developed	2032	100%	Central (joint) signalised access + western signalised access + internal road network	Yes	-	-	Yes
9	100% GFA developed	2032	100%	Central (joint) signalised access + western signalised access + internal road network	Yes	-	-	Yes

4. FUTURE YEAR DEMAND

4.1. Overview

The Industrial Precinct has been assessed for the various scenarios and development stages (based on GFA) and represented by the respective design years. Future traffic demand assumptions have been calculated based on information supplied by TfNSW and supplemented with data from similar developments to accurately inform the future year traffic modelling assessment.

4.2. Background Traffic Growth

As advised by TfNSW in email correspondence dated 6 September 2019, a background traffic growth assumption of 1.5 per cent per annum has been applied to the base model demands up to the respective design years.

In addition (and as indicated above), while the M12RT bypass has not been physically included in the modelling assessment, the expected impact of the M12RT bypass on future year traffic demands has been provided by TfNSW. Table 3.1 outlines the agreed assumptions regarding the reduction (or redistribution) of traffic demand following the implementation of the M12RT bypass.

Table 3.1: M12RT bypass traffic redistribution

Movement	AM Peak Redistribution	PM Peak Redistribution
Northbound right turn at M1 / John Renshaw Drive / Weakleys Drive intersection	**65%** of current or future demands to be redistributed onto the M12RT bypass.	**40%** of current or future demands to be redistributed onto the M12RT bypass.
Southbound left turn at M1 / John Renshaw Drive / Weakleys Drive intersection	**45%** of current or future demands to be redistributed onto the M12RT bypass.	**35%** of current or future demands to be redistributed onto the M12RT bypass.

4.3. Site Traffic Generation and Distribution

In-principle agreement with TfNSW to date has resulted in the Option 2B precinct modelling scenario adopting an average traffic generation rate of 0.4 trips per 100 square metres GFA across the two sites. TfNSW considers this an appropriate mix across the precinct given the broad recognition that the subject site would have a lower traffic generation rate of about 0.2 trips per 100 square metres GFA while the adjacent site was thought to have a higher traffic generation rate of 0.6 trips per 100 square metres. The variance in traffic generation rates between the two sites specifically relates to the size of the individual lots for the subject site being much larger than those detailed in the adjacent site.

While this can be considered appropriate when assessing the precinct, it is also critical to recognise the expected traffic generation associated with each of the sites that make up the precinct. This assists in understanding the impacts of each site, including:

- time of day demand and vehicle type
- apportionment of costs for road network upgrades
- precinct access arrangements
- internal road configuration.

In this regard and as discussed, two scenarios have been assessed regarding site generation for the individual sites within the Industrial Precinct. Given that the adjacent site is currently subject to NSW Land and Environment Court proceedings, the traffic generation rate as detailed in those proceedings (0.4 vehicle trip rate) have been maintained for that site.

However, traffic generation estimates for the subject site have been sourced from rates for other industrial estates referenced in the TfNSW *Guide to Traffic Generating Developments Updated Traffic Surveys – Technical Direction 04a* dated August 2013. The data includes surveys of the Wonderland Business Park in Eastern Creek and the Erskine Park Industrial Estate. The surveys demonstrated the following peak hour generation rates for each industrial estate, based on GFA:

- Wonderland Business Park, Eastern Creek: 0.202 vehicles / hour per 100m2 of GFA.
- Erskine Park Industrial Estate: 0.163 vehicles/ hour per 100m2 of GFA.

These industrial sites are considered similar to the proposed large lot industrial development on the subject site with respect to size and accessibility. The resultant average of these two survey rates is a peak hourly traffic generation rate of 0.185 vehicle trips per 100m2 GFA. Application of these average traffic generation rates to the subject site as part of modelling Scenario 2A is summarised in Table 3.2.

Overall, three modelling scenarios have been tested to understand the traffic impact of the subject site and the Industrial Precinct as a whole. These include the following:

- Scenario 1: Assessment of the subject site only.
  - 0.185 trips per 100 square metres for the subject site.
  - Critical to the study, with a detailed assessment included in Appendix B.
- Scenario 2A: Assessment of both the subject site and adjacent site.
  - 0.185 trips per 100 square metres for the subject site.
  - 0.4 trips per 100 square metres for the adjacent site.
- Scenario 2B: Assessment of both the subject site and adjacent site.
  - 0.4 trips per 100 square metres for the subject site.
  - 0.4 trips per 100 square metres for the adjacent site.

The traffic generation and distribution assumptions for the Industrial Precinct are summarised in the Table 3.2, noting that the distribution assumptions for the precinct have also been estimated by TfNSW and reflect their preferences and assumptions.

Table 3.2: Traffic generation and distribution constants

Type		Precinct Scenario 2A	Precinct Scenario 2B
Trip Generation	AM	subject site: 0.185 per 100m2 GFA [1] adjacent site: 0.38 per 100m2 GFA [2]	both sites: 0.38 per 100m2 GFA [2]
	PM	subject site: 0.185 per 100m2 GFA [1] adjacent site: 0.4 per 100m2 GFA [2]	both sites: 0.4 per 100m2 GFA [2]
Entry / Exit Movements	AM	66.3% / 33.7%	66.3% / 33.7%
	PM	36.3% / 63.7%	36.3% / 63.7%
Heavy Vehicle Percentage	AM	20%	20%
	PM	15.5%	15.5%

Type		Precinct Scenario 2A	Precinct Scenario 2B
AM Trip Distribution (Entry / Exit)	South	30% / 15%	30% / 15%
	West	25% / 25%	25% / 25%
	East	25% / 40%	25% / 40%
	North	20% / 20%	20% / 20%
PM Trip Distribution (Entry / Exit)	South	15% / 30%	15% / 30%
	West	25% / 25%	25% / 25%
	East	40% / 25%	40% / 25%
	North	20% / 20%	20% / 20%
Lot Yield		26% GFA	26% GFA

[1] Based on the average traffic generation rates of the Erskine Park and Eastern Creek industrial sites as referenced in TDT 2013/04a.
[2] Based on TfNSW preferences and the traffic generation rates adopted for the adjacent site as part of Land and Environment Court proceedings.

Table 3.3 summarises the resultant traffic generation of the Industrial Precinct based on these assumptions.

Table 3.3: Industrial Precinct traffic generation

Precinct Scenario	Industrial Precinct	Size (NDA in ha)	Size (GFA in sqm)	Traffic generation estimates (trips / hour)							
				AM				PM			
				25%[1]	50%[1]	75%[1]	100%[1]	25%[1]	50%[1]	75%[1]	100%[1]
2A	subject site	160.3	416,780	193	386	578	771	193	386	578	771
	adjacent site	138.3	359,580	342	683	1,025	1,366	360	719	1,079	1,438
	Total			535	1,069	1,603	2,137	553	1,105	1,657	2,209
2B	subject site	160.3	416,780	396	792	1,188	1,584	417	834	1,250	1,667
	adjacent site	138.3	359,580	342	683	1,025	1,366	360	719	1,079	1,438
	Total			738	1,475	2,213	2,950	776	1,553	2,329	3,105

[1] per cent of GFA developed

In Scenario 2A, the Industrial Precinct at the initial development stage (25% GFA developed) is expected to generate in the order of 550 vehicle movements per hour in the AM and PM peaks. This incrementally builds up to approximately 2,200 vehicle movements per hour in the AM and PM peaks at the full stage (100% GFA developed) of development.

In Scenario 2B, the higher traffic generation rates for the subject site results in higher traffic generation by the Industrial Precinct. At the initial development stage (25% GFA developed) the Industrial Precinct is expected to generate in the order of 750 vehicle movements per hour in the AM and PM peaks. This incrementally builds up to more than 3,000 vehicle movements per hour in the AM and PM peaks at the full stage (100% GFA developed) of development.

The distribution of the Industrial Precinct traffic volumes is included in Appendix C.

4.4. Resultant VISSIM Traffic Demands

The resultant traffic generation for the Industrial Precinct and background traffic growth for each scenario is shown in Figure 3.1 to Figure 3.4.

Figure 3.1: AM peak traffic demands (6am to 9am) – Precinct Scenario 2A

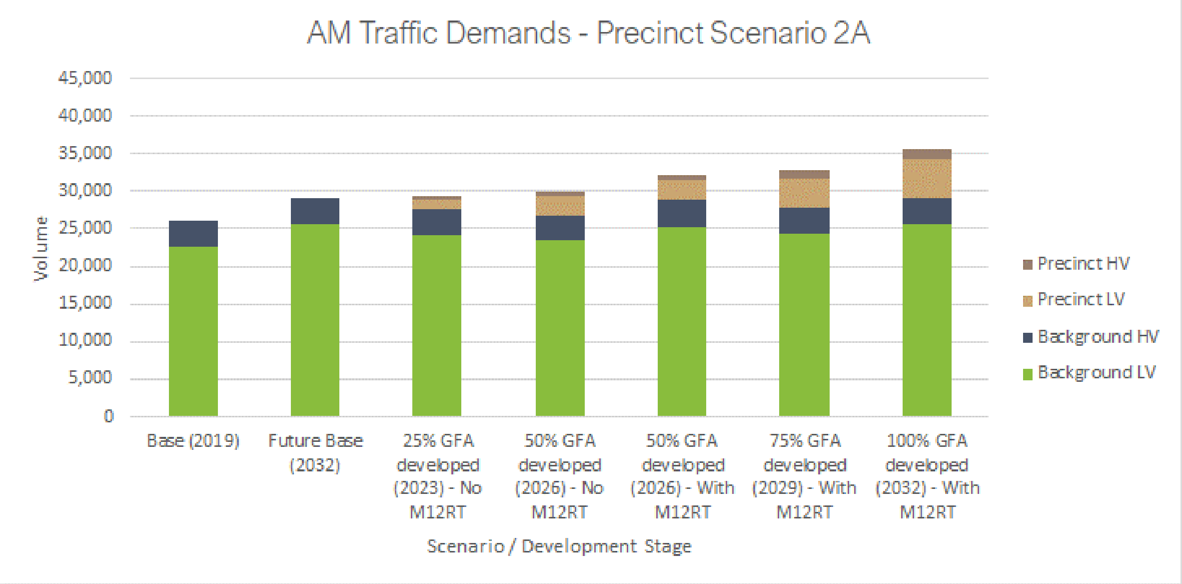


Figure 3.2: PM peak traffic demands (3pm to 6pm) – Precinct Scenario 2A

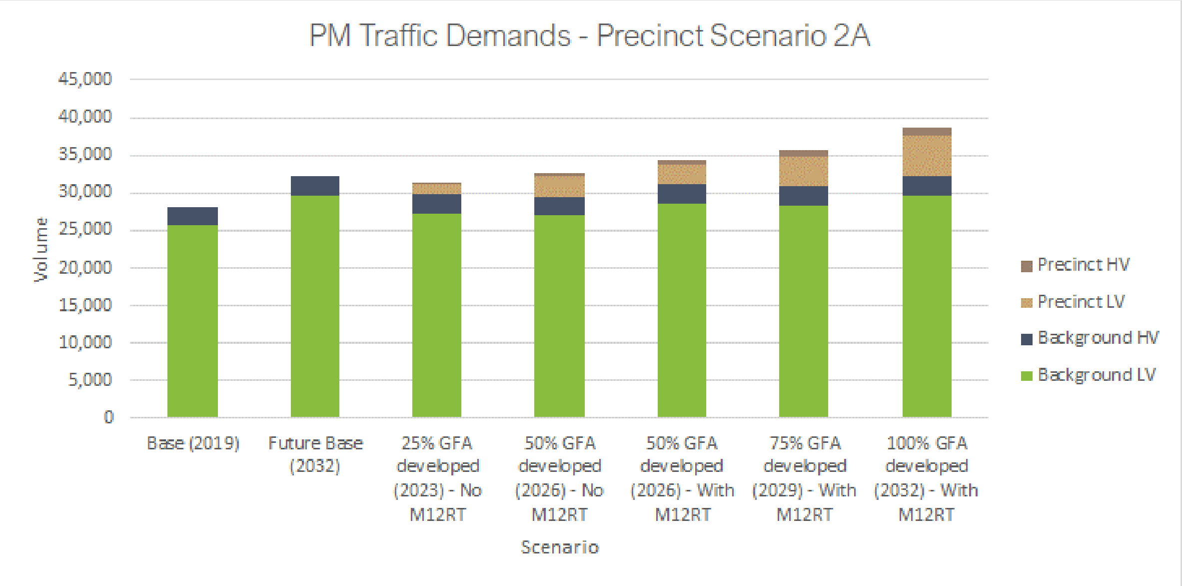


Figure 3.3: AM peak traffic demands (6am to 9am) – Precinct Scenario 2B

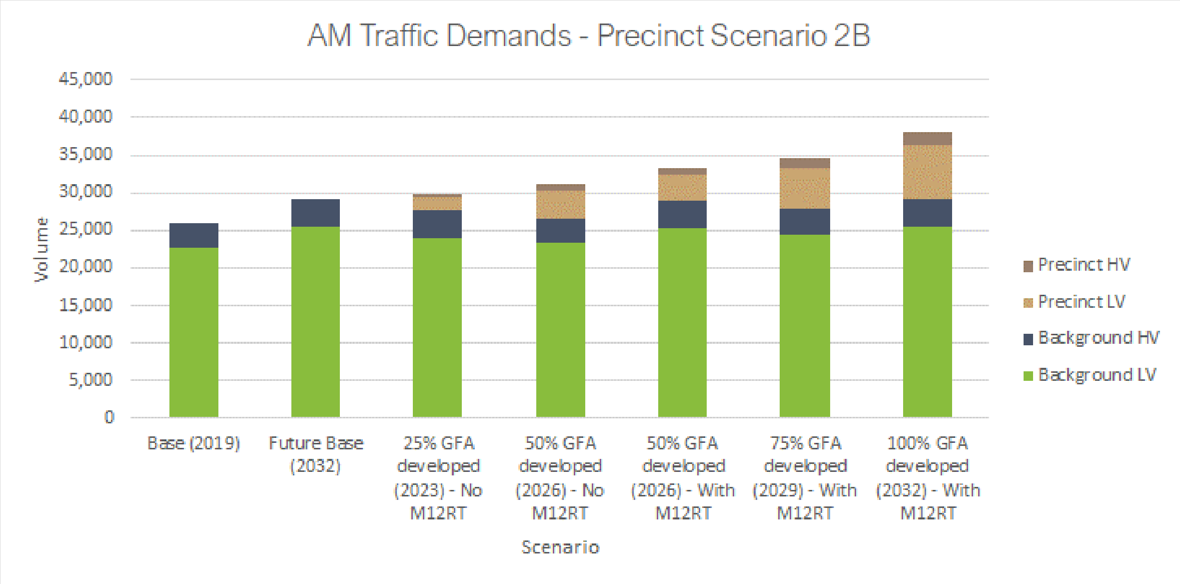
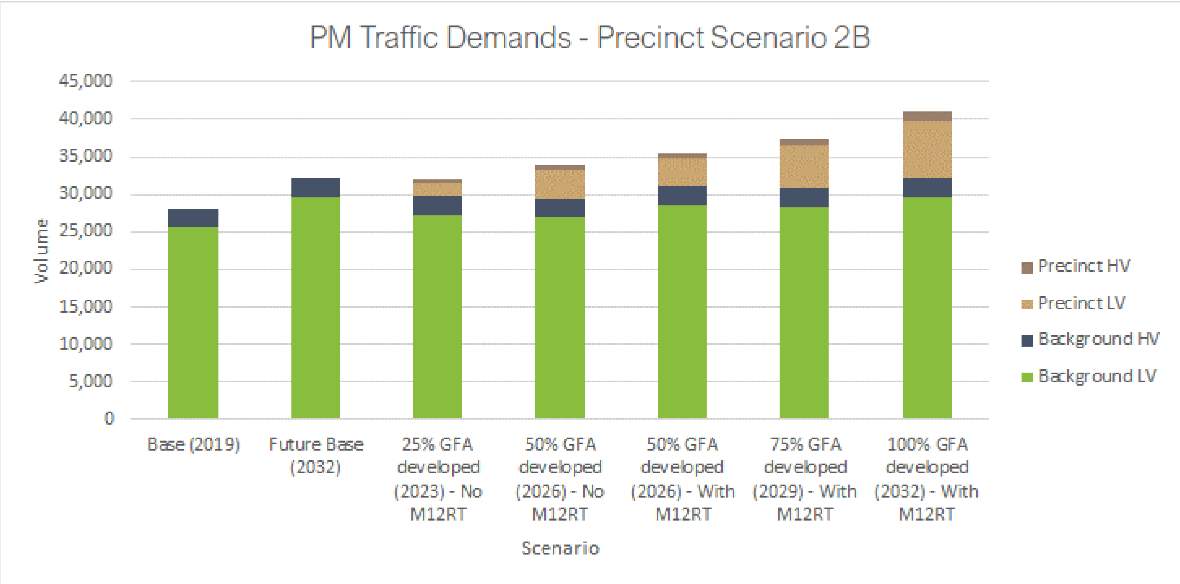


Figure 3.4: PM peak traffic demands (3pm to 6pm) – Precinct Scenario 2B



4.5. Other Assumptions

The following assumptions have been made on the future year demands:

- Industrial Precinct traffic generation has been applied consistently for each of the modelled peak hours. In reality, it is expected that the profile of traffic volumes in and out of the Industrial Precinct may vary according to individual site operations.
- The internal trip distribution within the Industrial Precinct has been assumed based on the total GFA percentage of each lot.

5. OPERATIONAL ASSESSMENT COMPARISON

5.1. Overview

The scenarios described in the previous chapters have been assessed in the VISSIM microsimulation model in order to understand and inform the potential impacts of the Industrial Precinct on the surrounding road network at the various development configurations. This chapter provides a summary of the performance metrics and their purpose in the assessment.

It is noted that the network and intersection performance metrics for each development stage have been reported in the chapters that follow:

- Chapter 5 – Precinct Scenario 2A (reduced rate for the subject site)
- Chapter 6 – Precinct Scenario 2B (common rate for both the subject site and adjacent Stevens Group site).

5.2. Summary of Performance Metrics

5.2.1. Network Performance

Network performance results have been extracted from the model which represent the overall network operating performance across all roads and links in the model network. As such, this enables an understanding of the overall performance impacts of the development stages across the broader road network, including roads and intersections that may not be directly relevant to the Industrial Precinct.

The following key network performance metrics have been extracted from the model for comparative purposes:

- Average delay (in seconds) – average delay for all vehicles in the network.
- Average network speed (in km/h) – average speed of all vehicles in the network.
- Total vehicle kilometres travelled (VKT) – total distance travelled for all vehicles.
- Total vehicle hours travelled (VHT) – total travel time for all vehicles.
- Total Stops – total number of stops experienced by all vehicles.
- Latent demand – number of vehicles unable to enter the model network.
- Total demand – sum of vehicles that have started and completed their journey through the network, as well as latent demand.

5.2.2. Network Average Speed Plots

Average speed plots for the key peak hour in each peak have been illustrated to visualise the general network operation. These are useful in understanding the propagation of queues and delays that are expected on the road network, as well as identifying areas that may experience high levels of congestion.

It is noted that the plots reflect the average speed (in km/h) of all road sections across the reported peak hour and based on the colour scale outlined in Table 4.1.

Table 4.1: Average speed classification

Colour	Definition	Average Speed (km/h)
	Queues formed (standstill and rolling)	0km/h to 10km/h
		10km/h to 20km/h
		20km/h to 30km/h
		30km/h to 40km/h
		40km/h to 50km/h
		50km/h to 60km/h
		60km/h to 80km/h
		80km/h to 100km/h
	Freeflow conditions	Greater than 100km/h

5.2.3. Travel Time

Travel times have been recorded in the model to report on the travel time along key road corridors between the origin and destination locations shown in Figure 4.1. A detailed description of each route is also provided in Table 4.2. The travel time results provide an understanding of where potential increases to delays may occur along these corridors during the reported AM and PM peak hours.

Figure 4.1: Travel time routes

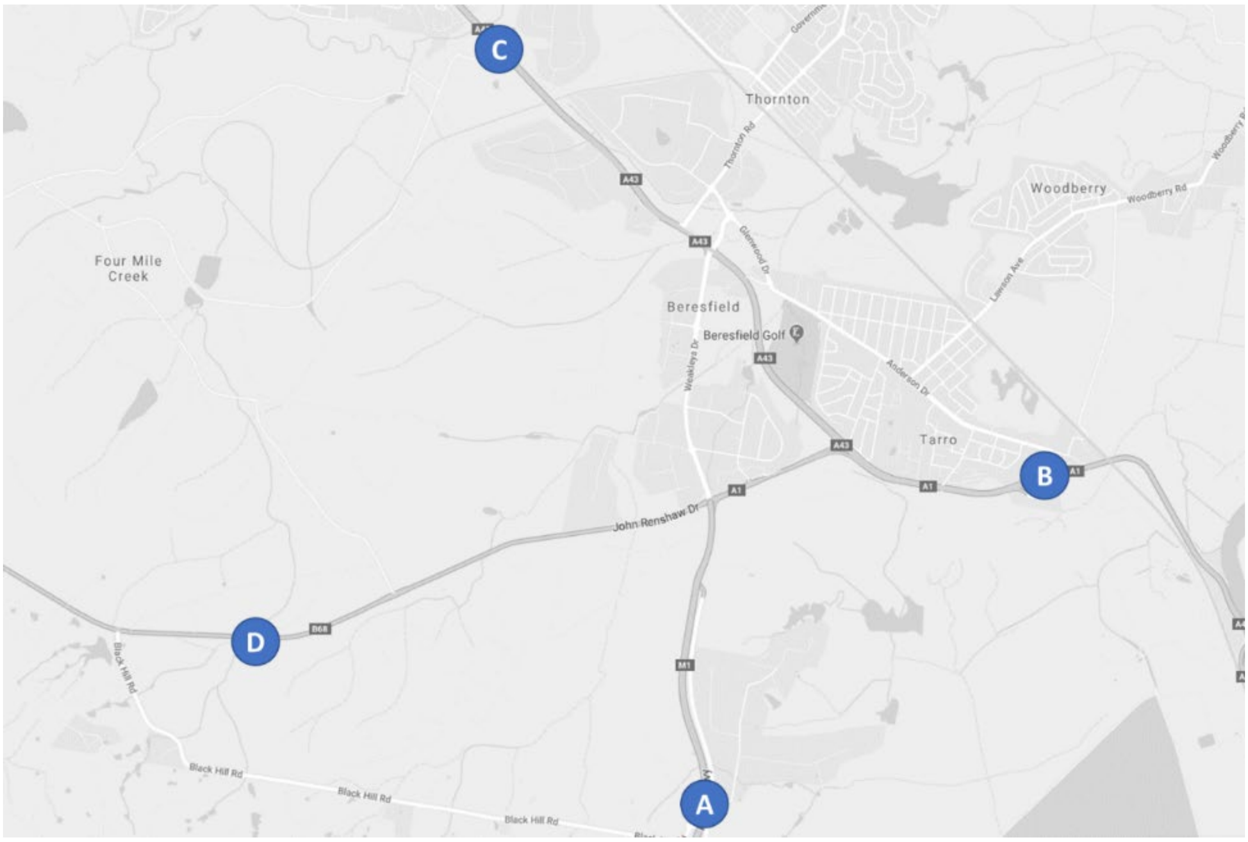


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Table 4.2: Travel time route description

Reporting Description			Full Description
ID	Direction	Description	
A - B	EB	M1 to A1	General eastbound direction from Pacific Motorway (M1) near Black Hill Road interchange to New England Highway (A1) near Tarro Interchange, travelling via John Renshaw Drive.
B - A	WB	A1 to M1	General westbound direction from New England Highway (A1) near Tarro Interchange to Pacific Motorway (M1) near Black Hill Road interchange, travelling via John Renshaw Drive.
A - C	NB	M1 to A43	General northbound direction from Pacific Motorway (M1) near Black Hill Road interchange to New England Highway (A43) near Four Mile Creek, travelling via Weakleys Drive.
C - A	SB	A43 to M1	General southbound direction from New England Highway (A43) near Four Mile Creek to Pacific Motorway (M1) near Black Hill Road interchange, travelling via Weakleys Drive.
D - B	EB	JRD to A1	General eastbound direction from John Renshaw Drive (JRD) near Four Mile Creek to New England Highway (A1) near Tarro Interchange.
B - D	WB	A1 to JRD	General westbound direction from New England Highway (A1) near Tarro Interchange to John Renshaw Drive (JRD) near Four Mile Creek.

It is also noted that the introduction of the double right turn as part of mitigating intersection works for the John Renshaw Drive west approach to the M1 / Weakleys Drive intersection provides immediate benefit to the eastbound through movement due to the additional storage that removes the right turn queuing from the second through lane. Furthermore, the additional right turn lane is able to clear the demand in less time and therefore allows some green time to be redistributed to other critical movements. Hence travel times between John Renshaw Drive and the M1 (A to D, and D to A) would be unlikely to be significantly impacted by development of the Industrial Precinct.

5.2.4. Intersection Performance

The intersection Level of Service (LOS) for key signalised intersections have been extracted from the models for the peak hours. The LOS is based on the average delay for the intersection as per the TfNSW classification which is replicated in Table 4.3.

Table 4.3: Intersection LOS classification

LOS Level	Average Delay (seconds)	
	From	To
A	0	14.5
B	14.5	28.5
C	28.5	42.5
D	42.5	56.5
E	56.5	70.5
F	70.5	9,999

6. PRECINCT SCENARIO 2A MODEL RESULTS

6.1. Overview

To provide some context on the performance of the models, the results from the 2019 Base VISSIM models (Base Case) is also presented in the following sections. The scenario models have been developed from the Base Case model which is calibrated and validated to existing (2019) operating conditions. The 2019 Base Model was initially developed to provide a robust model structure and framework from which future year options could be based upon. Details of the development of the base model and the performance of the network are provided in a technical note, included as Appendix D.

This chapter presents the outcomes from **Precinct Scenario 2A** noting that the 'key network peak hour' has been reported for the AM peak (8am to 9am) and PM peak (5pm to 6pm) with the full results for all peak hours presented in Appendix E to Appendix H.

6.2. Network Performance

The key network performance metrics have been summarised in Table 5.1 and Table 5.2 for the weekday AM and PM peak hours respectively. A definition of each performance metric is provided in Section 4.2.1.

Table 5.1: Precinct Scenario 2A – AM peak network performance results (8am to 9am)

Metric		Base (2019)	No M12RT			With M12RT			
			Future Base (2032)	25% GFA developed (2023)	50% GFA developed (2026)	50% GFA developed (2026)	75% GFA developed (2029)	100% GFA developed (2032)	100% GFA developed (2032) – Grade Separated
Average Delay	Sec	52	144	86	95	169	174	349	275
Average Speed	km/h	68	54	62	60	51	49	35	40
Total VKT	km	68,301	74,972	76,765	75,026	84,564	81,505	88,146	87,948
Total VHT	h	1,001	1,395	1,233	1,257	1,660	1,648	2,506	2,184
Total Stops	no.	7,731	58,617	23,241	22,959	83,463	74,426	314,085	282,647
Latent Demand	no.	0	17	0	0	0	17	429	341
Total Demand	no.	9,365	10,991	10,864	10,918	12,254	12,314	14,458	14,047

Table 5.2: Precinct Scenario 2A – PM peak network performance results (5pm to 6pm)

Metric		Base (2019)	No M12RT			With M12RT			
			Future Base (2032)	25% GFA developed (2023)	50% GFA developed (2026)	50% GFA developed (2026)	75% GFA developed (2029)	100% GFA developed (2032)	100% GFA developed (2032) – Grade Separated
Average Delay	Sec	47	121	69	125	95	242	407	342
Average Speed	km/h	70	58	66	57	61	44	33	36
Total VKT	km	77,198	86,491	84,935	94,242	87,074	93,834	94,350	92,198
Total VHT	h	1,108	1,499	1,293	1,653	1,431	2,129	2,881	2,526
Total Stops	no.	7,125	55,625	15,045	37,011	25,166	263,122	547,487	552,647
Latent Demand	no.	0	0	1	57	0	10	1,569	1,748
Total Demand	no.	10,453	12,140	11,720	13,299	12,357	13,941	16,417	15,940

The network performance results presented in Table 5.1 and Table 5.2 indicate that the overall network operation decreases in performance at each stage which is expected due to the incremental increase in traffic demands. The following summarises the key network performance outcomes:

- The 25% GFA developed stage results in an overall network performance that is marginally lower than the Base (2019) conditions with an average speed decrease in the order of 10% and 5%.
- The introduction of the M12RT at the 50% GFA developed stage results in an overall network performance similar to the 25% GFA developed stage without the M12RT. Should the M12RT not be introduced at the 50% GFA developed stage, the network is still considered to operate at a satisfactory level (and very similar to the Future Base scenario).
- At the later stages of development (75% and 100% GFA developed) in both the AM and PM peaks, network performance metrics decline more noticeably with the average speed decreasing by 42% and 43% in the AM and PM peaks respectively for the 100% GFA developed stage compared to the Future Base. The average delay also increases in the both peaks for the 100% GFA developed stage compared to the Future Base.
- It is noted that visual observations of the model operations (supported by the average speed plots in the following section) indicate that the localised traffic impacts as a result of the Industrial Precinct can be mitigated up until the 75% GFA developed stage by the proposed improvement works in these stages, with wider network constraints skewing the overall network performance (such as John Renshaw Drive to New England Highway A1 merge, New England Highway / Weakleys Drive intersection, etc.).
- The 100% GFA developed stage demonstrates significant queuing and delays throughout the network and at the M1 / John Renshaw Drive / Weakleys Drive intersection indicating that the network is expected to struggle to accommodate the additional traffic demand under the assumptions provided by TfNSW.
- Having consideration to the capacity constraints in the 100% GFA developed stage, an additional option has been included which considers grade separation of John Renshaw Drive from the M1 and Weakleys Drive intersection. This grade separated option can be expected to increase network performance with

increased throughput and efficiencies gained as a result of grade separating key movements at the intersection. However, the network is expected to encounter downstream impacts as a result of the increased throughput which causes other bottlenecks to form at the New England Highway / Weakleys Drive intersection and the New England Highway A1 merge, contributing to the high delays and low network speeds. This confirms that grade separating this intersection is not the sole solution for a range of congestion points that exist in the region. The M12RT bypass also appears to have the ability to alleviate constraints associated with traffic growth over the period to 2032.

6.3. Network Average Speed Plots

The network average speed plots have been illustrated in the following figures based on the conditions set out in Section 4.2.2.

Figure 5.1: AM peak network average speed (8am to 9am) – Future Base (2032)

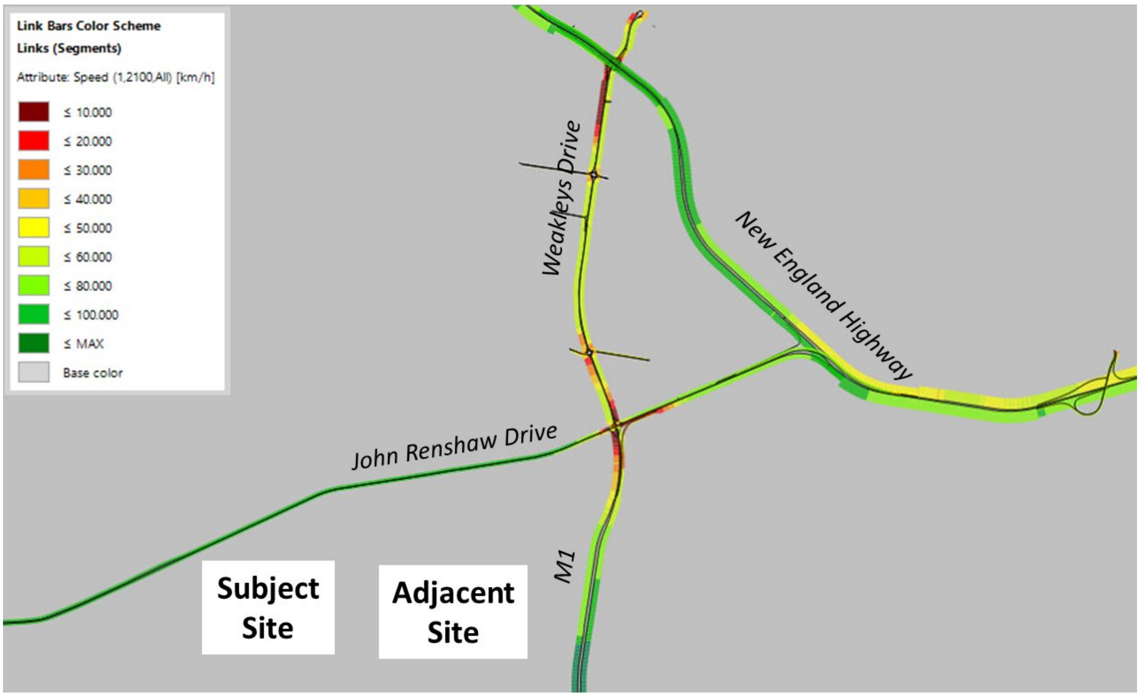

Figure 5.2: AM peak network average speed (8am to 9am) – 25% GFA developed (2023) No M12RT

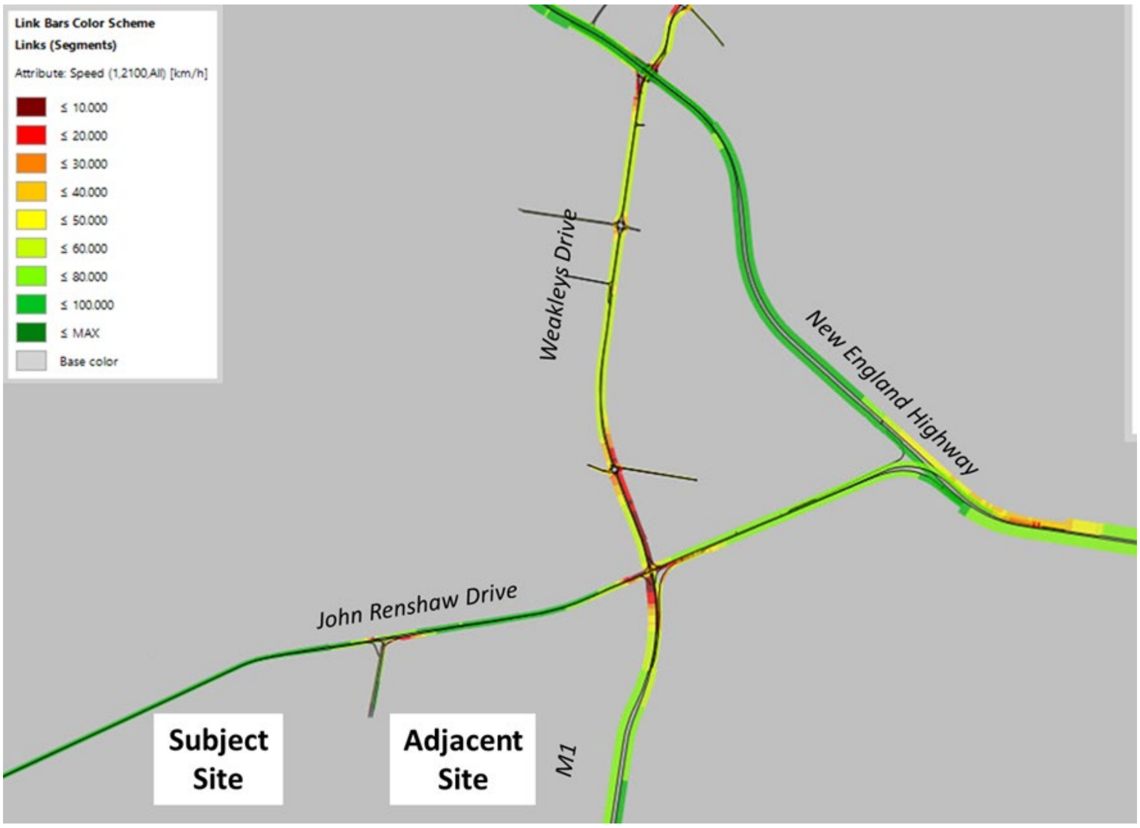

Figure 5.3: AM peak network average speed (8am to 9am) – 50% GFA developed (2023) No M12RT

Figure 5.4: AM peak network average speed (8am to 9am) – 50% GFA developed (2023) With M12RT

Figure 5.5: AM peak network average speed (8am to 9am) – 75% GFA developed (2023) With M12RT

Figure 5.6: AM peak network average speed (8am to 9am) – 100% GFA developed (2023) With M12RT

Figure 5.7: AM peak network average speed (8am to 9am) – 100% GFA developed (2023) With M12RT – Grade Separated

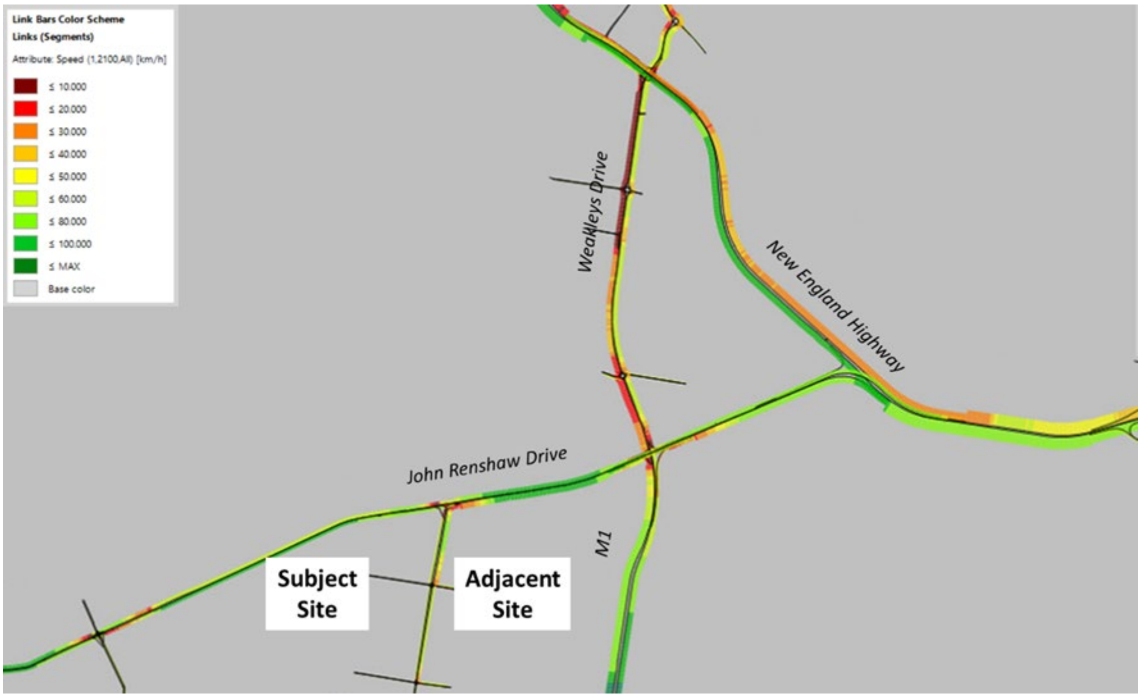

Figure 5.8: PM peak network average speed (5pm to 6pm) – Future Base (2032)

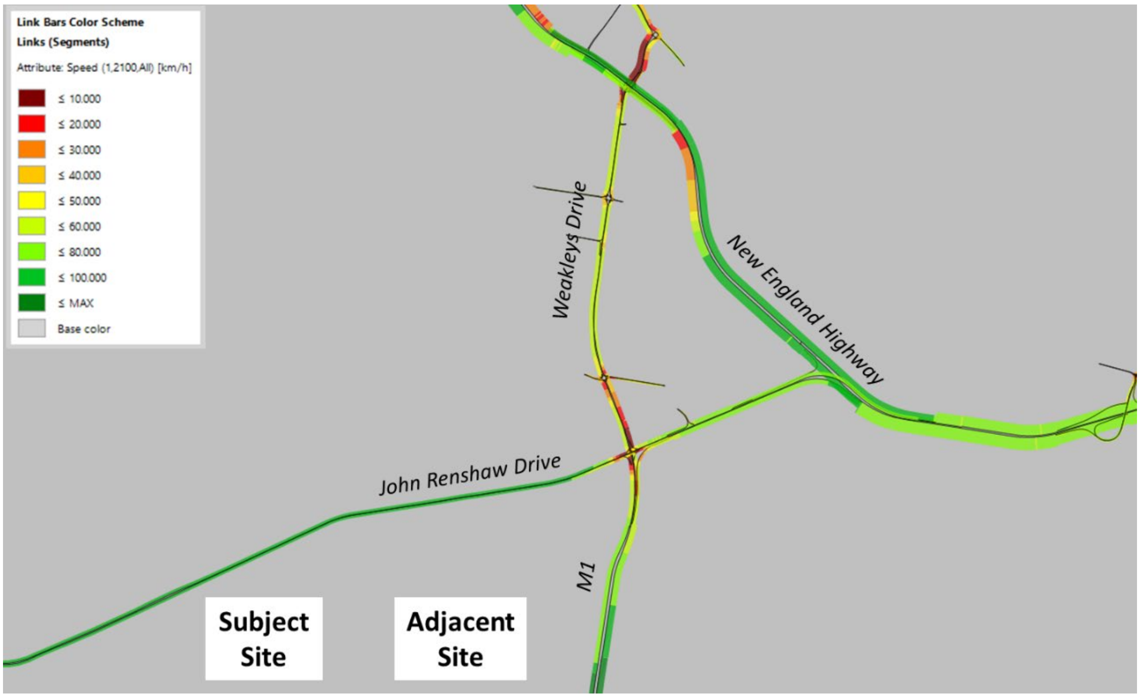

Figure 5.9: PM peak network average speed (5pm to 6pm) – 25% GFA developed (2023) No M12RT

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Figure 5.10:PM peak network average speed (5pm to 6pm) – 50% GFA developed (2023) No M12RT

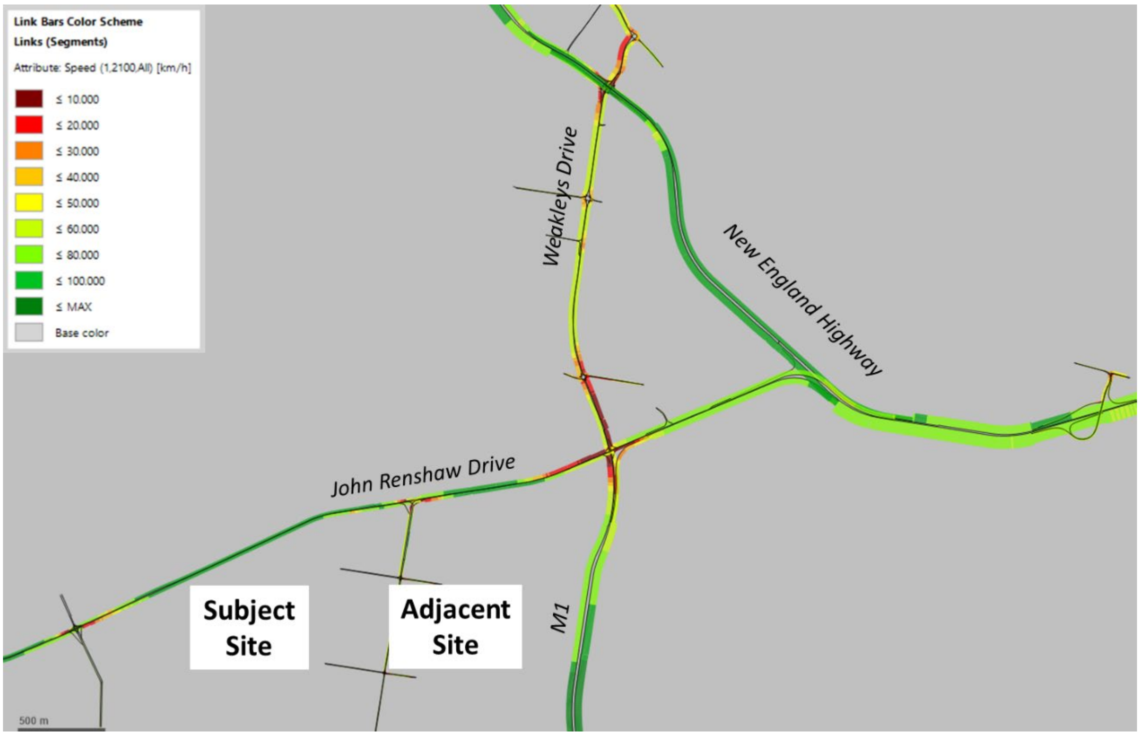


Figure 5.11:PM peak network average speed (5pm to 6pm) – 50% GFA developed (2023) With M12RT

Figure 5.12:PM peak network average speed (5pm to 6pm) – 75% GFA developed (2023) With M12RT

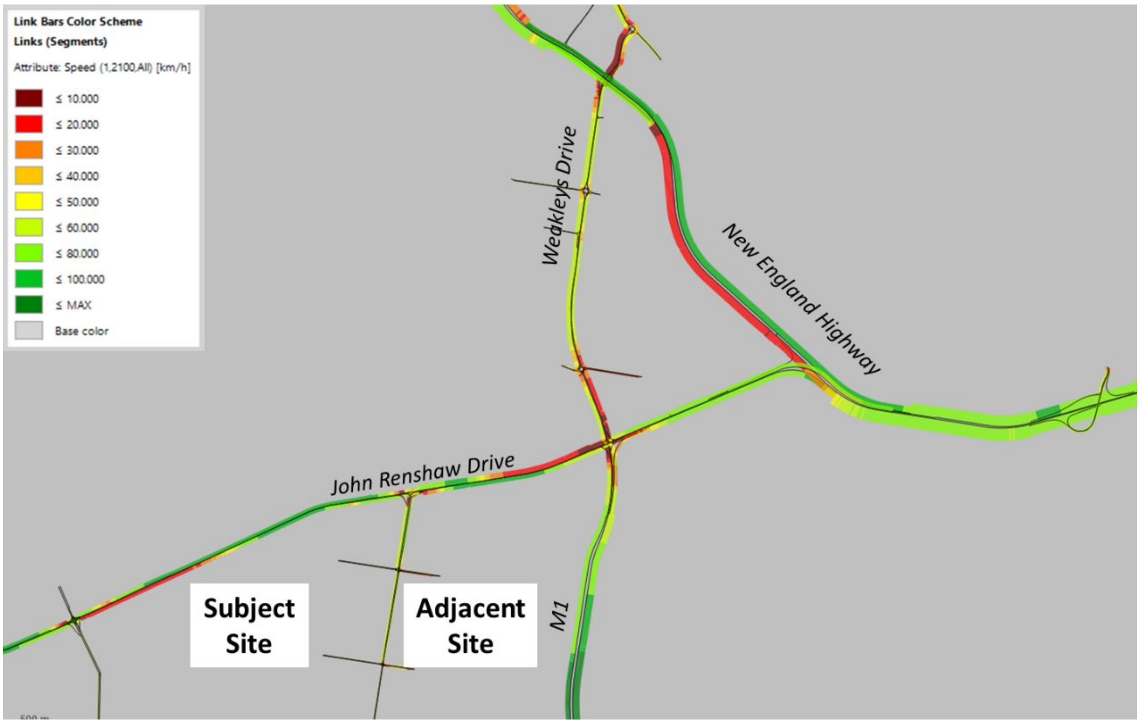


Figure 5.13:PM peak network average speed (5pm to 6pm) – 100% GFA developed (2023) With M12RT

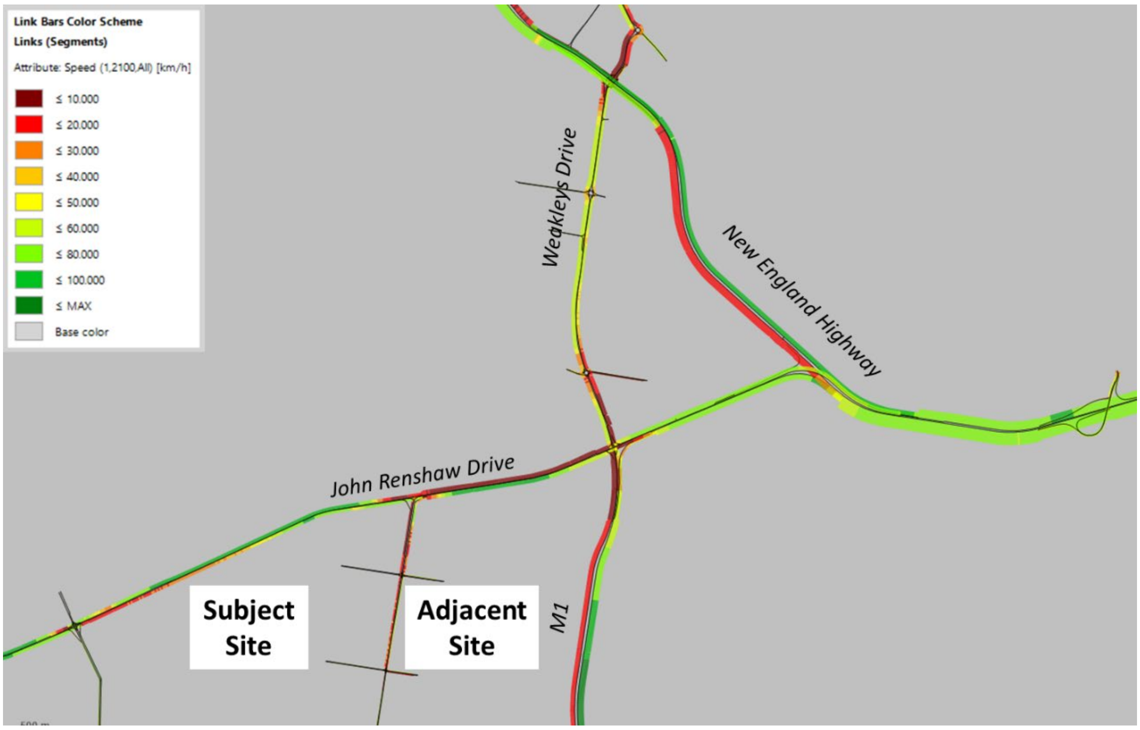
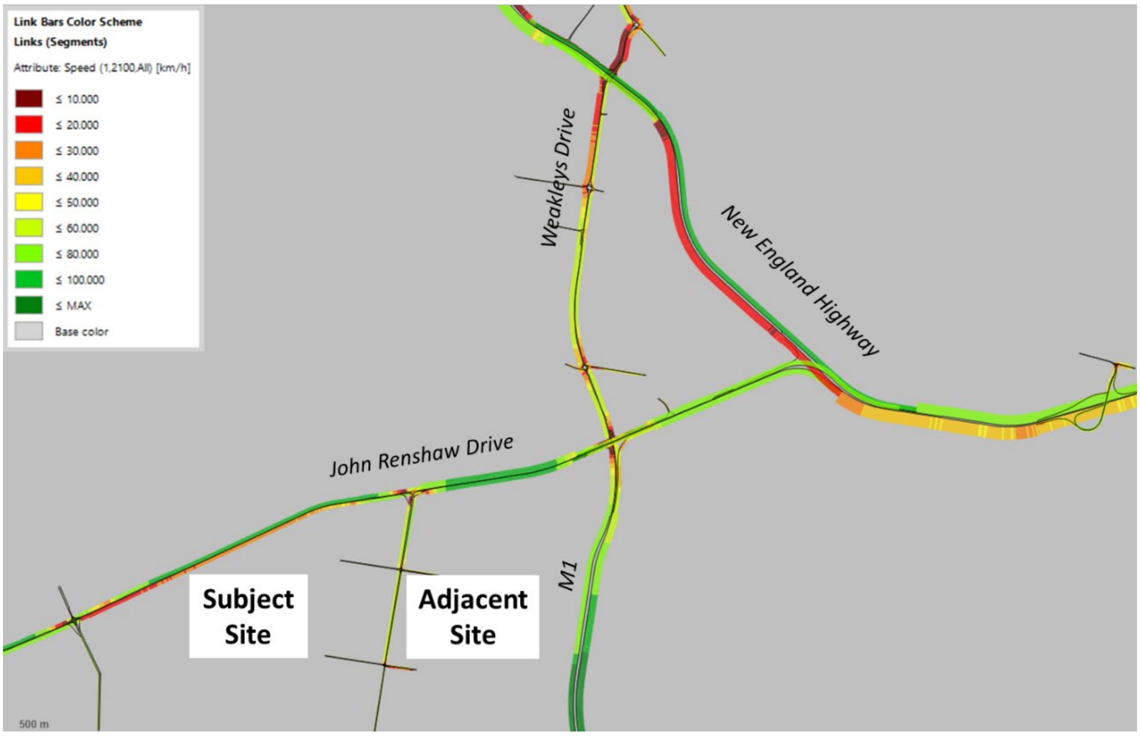


Figure 5.14:PM peak network average speed (5pm to 6pm) – 100% GFA developed (2023) With M12RT – Grade Separated



The average speed plots for the weekday AM and PM peak hours as presented in Figure 5.1 to Figure 5.14 indicate the following key outcomes:

- There is a generally a consistent trend in congestion spots in the network during both the AM and PM peaks which progressively worsens as the development stages grow.
- Congestion has been identified at the M1 / John Renshaw Drive / Weakleys Drive and New England Highway / Weakleys Drive intersections with the critical approaches including:
  - John Renshaw Drive east approach to the M1 / John Renshaw Drive / Weakleys Drive intersection in both AM and PM peaks.
  - Weakleys Drive north approach to the M1 / John Renshaw Drive / Weakleys Drive intersection in both AM and PM peaks.
  - M1 south approach to the M1 / John Renshaw Drive / Weakleys Drive intersection in both AM and PM peaks.
  - Weakleys Drive south approach to the New England Highway / Weakleys Drive intersection in the AM peak.
  - New England Highway eastbound off-ramp to the New England Highway / Weakleys Drive intersection in the PM peak.
- Increased levels of queues and delays can be expected to form on all approaches to the M1 / John Renshaw Drive / Weakleys Drive intersection, particularly in the 75% and 100% GFA developed stages. In the 75% GFA developed stage, the impacts of the queues are generally localised and are not expected to interrupt the performance of the surrounding network. With 100% GFA developed, queues form that extend into the central site access intersection on the west approach, as well as significant queues building up on the M1 south approach.
- In addition, the average speed plots indicate that in various stages, there are some wider disruptions to network performance particularly north of the New England Highway in Beresfield and Thornton and the

John Renshaw Drive to New England Highway (A1) eastbound merge. This is also not dissimilar to the Future Base option.

- The proposed mitigation measures at this intersection are generally able to accommodate the anticipated increase in traffic volumes (background and site generated) up to and including the 75% GFA developed stages.
- The grade separation at the 100% GFA developed stage demonstrates little to no queuing at the John M1 / Renshaw Drive / Weakleys Drive intersection. However, the previously mentioned downstream effects are evident in the average speed plots with increased congestion observed at other key locations including the New England Highway / Weakleys Drive intersection and the New England Highway northbound and eastbound merges.

6.4. Travel Times

Average travel times for the key road corridors identified above have been extracted from the model and summarised below for the weekday AM and PM peak hours respectively (refer to Figure 4.1 and Table 4.1 for travel route details).

Figure 5.15:AM peak travel time in seconds (8am to 9am)

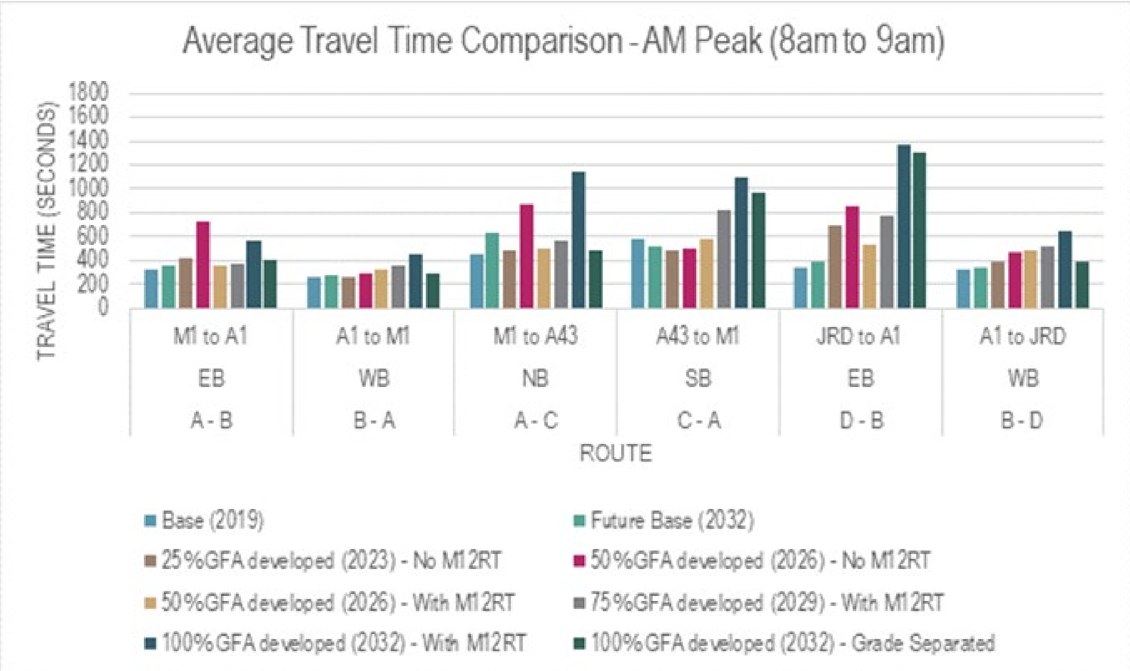
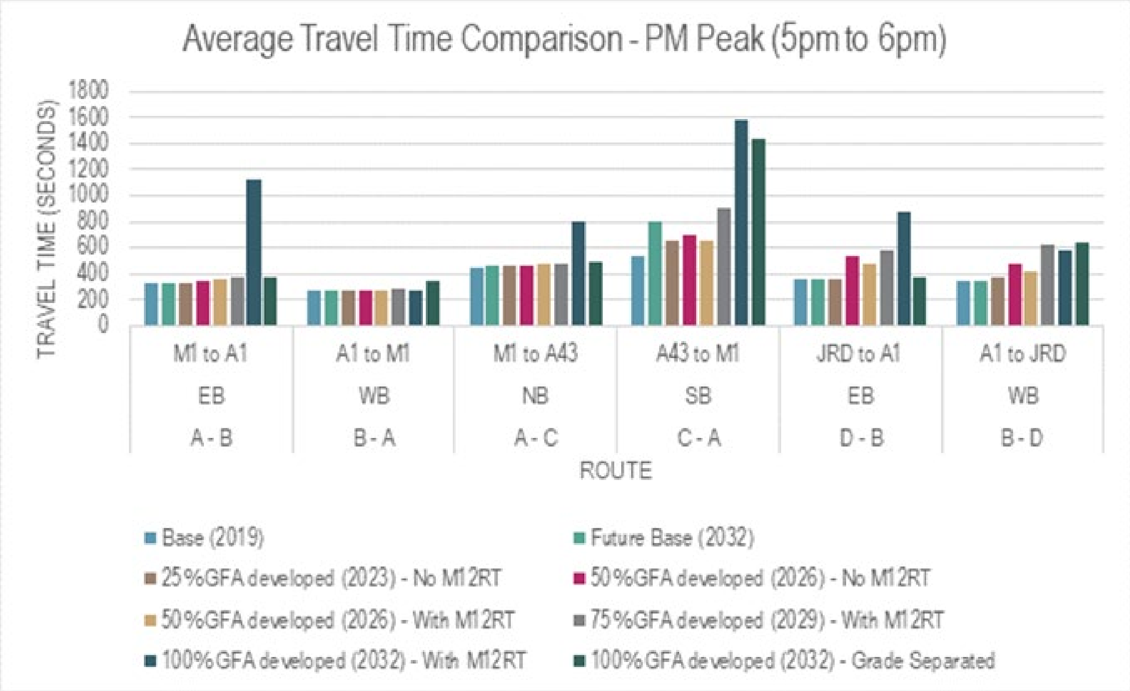


Figure 5.16:PM peak travel time in seconds (5pm to 6pm)



The travel time results presented in the figures above generally indicate the following:

- In both the AM and PM peaks, the majority of routes are able to maintain a reasonable travel time during the early stages of the development.
- The 50% GFA developed stage without the M12RT is expected to result in some increases to travel times during both peaks, most notably along the M1, John Renshaw Drive and New England Highway. However, the introduction of the M12RT at the 50% GFA developed stage results in travel times that are generally consistent with the 25% GFA developed stage.
- During the 75% GFA developed stage, travel times for M1 to A43 in both northbound and southbound directions are expected to experience increases to travel times compared to the previous development stages and generally comparable or slightly above the Future Base.
- Travel times increase during the 100% GFA developed stage with the M1 to A43 northbound and southbound, M1 to A1 eastbound and John Renshaw Drive to A1 eastbound all heavily impacted. The following summarises the notable cause of increased travel times in this stage:
  - In the northbound direction, the capacity constraints at the New England Highway / Weakleys Drive intersection and beyond results in some upstream delays that reduce the efficiency of Weakleys Drive northbound particularly in the AM peak.
  - In the southbound direction, queues and delays are expected on the New England Highway off-ramp to Weakleys Drive which extend beyond the ramp storage length. This is caused by the congestion in the Thornton precinct, in particular at the Weakleys Drive / Glenwood Drive roundabout, which queues back into the New England Highway / Weakleys Drive intersection blocking traffic flow at times during the peak. In addition, the modelling also indicates some increase in queues on the north approach to the M1 / John Renshaw Drive / Weakleys Drive intersection which also increases the travel time experienced along this route.
- The grade separation at the 100% GFA developed stage reduces the travel times for each route, which are most comparable to the Future Base with the exception of only slight reductions expected in the AM

peak for the A43 to M1 route. Southbound delays on this route are still expected on the New England Highway off-ramp to Weakleys Drive which extend beyond the ramp storage length as mentioned above. In addition, the John Renshaw Drive to A1 route is also still expected to experience heavy congestion along John Renshaw Drive resulting in only marginal improvements to travel times in the AM peak.

6.5. Intersection Performance

Intersection level of service (LOS) (based on overall intersection delay) for key intersections in the model have been presented in the figures below for the weekday AM and PM peak hours. A definition of the LOS ranges can be found in Section 4.2.4.

AM Peak Intersection Performance

Figure 5.17: Base – AM Peak

Figure 5.18: Future Base (no M12RT) – AM Peak

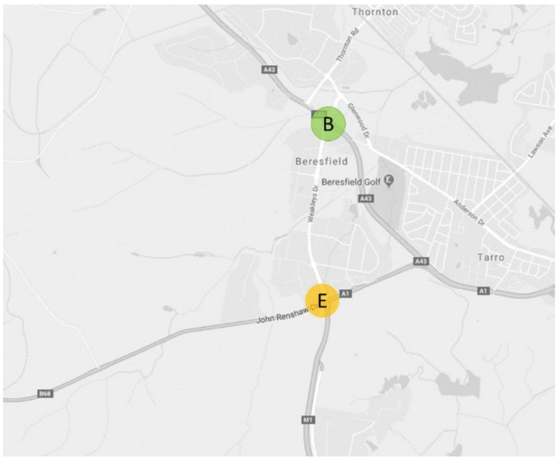


Figure 5.19: Precinct Scenario 2A: 25% GFA Developed (No M12RT) – AM Peak

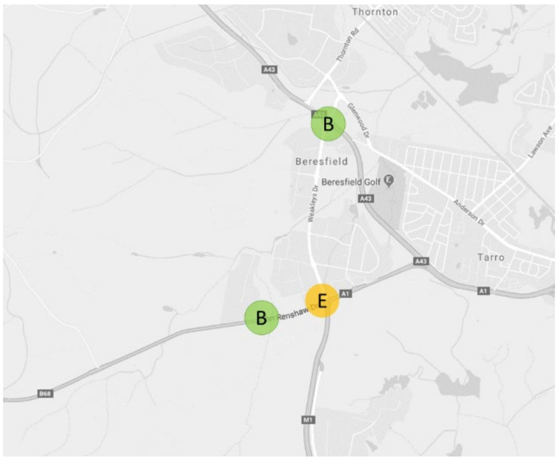
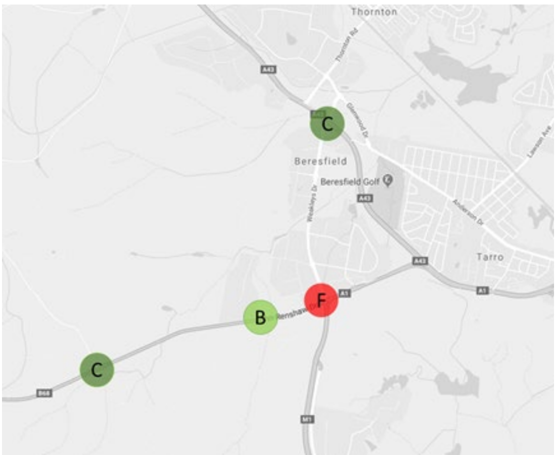


Figure 5.20: Precinct Scenario 2A: 50% GFA Developed (No M12RT) – AM Peak



PRECINCT SCENARIO 2A MODEL RESULTS

Figure 5.21:Precinct Scenario 2A: 50% GFA Developed (With M12RT) – AM Peak

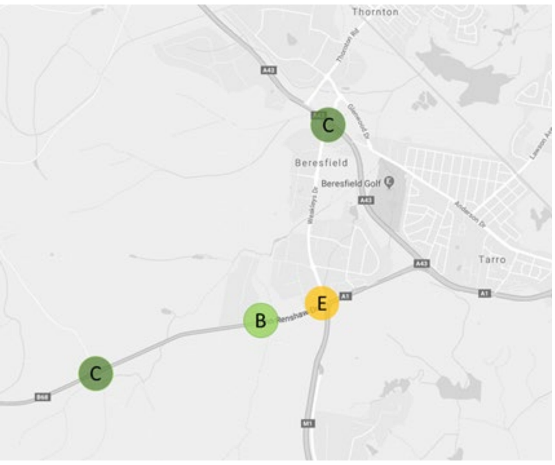
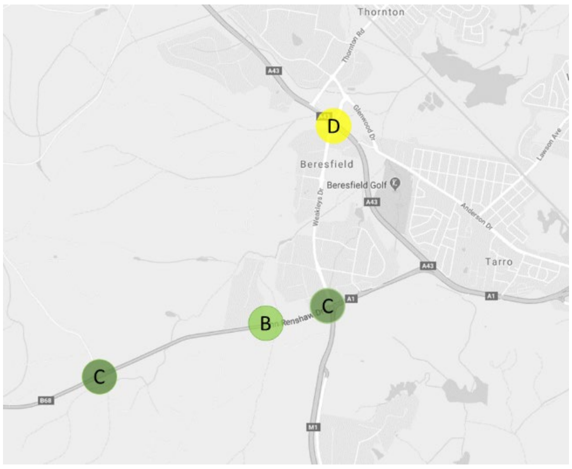


Figure 5.22:Precinct Scenario 2A: 75% GFA Developed (With M12RT) – AM Peak

Figure 5.23:Precinct Scenario 2A: 100% GFA Developed (With M12RT) – AM Peak

Figure 5.24:Precinct Scenario 2A: 100% GFA Developed (With M12RT) – Grade Separated – AM Peak



PM Peak Intersection Performance

Figure 5.25: Base – PM Peak

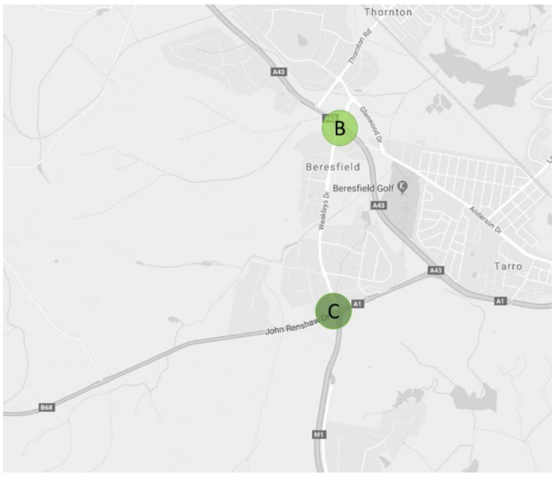


Figure 5.26: Future Base (no M12RT) – PM Peak

Figure 5.27: Precinct Scenario 2A: 25% GFA Developed (No M12RT) – PM Peak

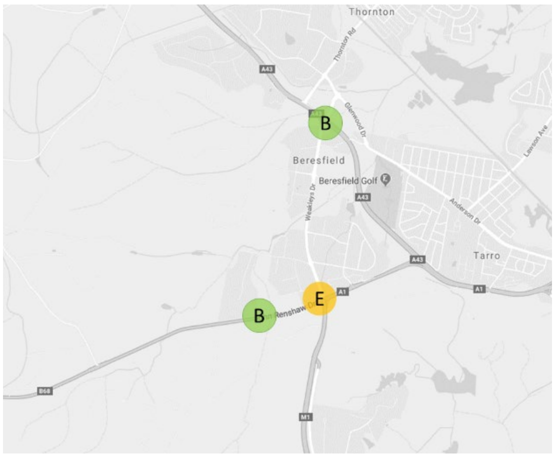


Figure 5.28: Precinct Scenario 2A: 50% GFA Developed (No M12RT) – PM Peak

Figure 5.29: Precinct Scenario 2A: 50% GFA Developed (With M12RT) – PM Peak

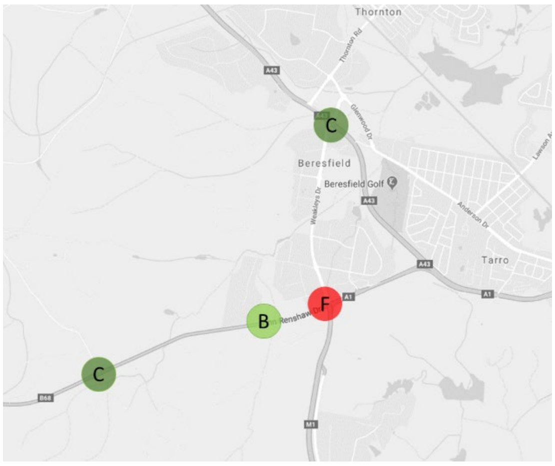


Figure 5.30: Precinct Scenario 2A: 75% GFA Developed (With M12RT) – PM Peak

Figure 5.31:Precinct Scenario 2A: 100% GFA Developed (With M12RT) – PM Peak

Figure 5.32:Precinct Scenario 2A: 100% GFA Developed (With M12RT) – Grade Separated – PM Peak

The intersection performance results generally indicate the following key outcomes:

- The key intersection within the network is the M1 / John Renshaw Drive / Weakleys Drive intersection in both the AM and PM peaks which can be expected to experience increasing delays on the network.
- In both peaks, the M1 / John Renshaw Drive / Weakleys Drive intersection is likely to experience a LOS F when the 50% GFA developed stages are reached. It is noted that the intersection is only marginally above the LOS E to LOS F threshold at 50% and 75% GFA developed stages, and while reasonably high levels of delays can be expected on all approaches, the queue lengths are not expected to impede the performance of the surrounding intersections as indicated by the average speed plots in the previous section. However, the 100% GFA developed stage well exceeds the LOS F threshold with significant delays expected.
- The proposed site access configuration at the eastern and western access points to the subject site can both be expected to operate at a satisfactory level of performance with LOS B to LOS D expected in the AM peak through to the 75% GFA developed stage. During the PM peak the western access experiences a LOS F at the 75% GFA developed stage, the critical approach being the east with the majority of through traffic utilising one lane (on account of the second lane ending 200 metres west of the intersection). It is noted too that the intersection is still only marginally above the LOS E – LOS F threshold.
- The grade separation 100% GFA developed stage demonstrates a significant change to the LOS isolated at the M1 / John Renshaw Drive / Weakleys Drive intersection and the eastern (central) site access. A reduction from LOS F to LOS D and LOS B respectively in the AM peak and a reduction from LOS F to LOS B for both intersections in the PM peak.

6.6. Key Outcomes from Precinct Scenario 2A

A summary of the key outcomes from the Precinct Scenario 2A modelling assessment is as follows:

- The modelling indicates that through to the 75% GFA developed stages the queues and delays formed at the M1 / John Renshaw Drive / Weakleys Drive intersection are considered to be localised and not expected to interrupt the performance of the surrounding network. The proposed mitigation measures at this intersection help to manage the traffic impacts with the intersection performance generally indicating that the intersection is able to accommodate the anticipated increase in traffic volumes (background and site generated) up until at least this stage.

- The western site access point begins to struggle at the 75% GFA developed scenario in the PM peak with significant westbound through traffic causing delays on the east approach. This could be alleviated through extending the length of the second westbound traffic lane further than 200 metres beyond the intersection.
- The 100% GFA developed stage demonstrates queuing and delay across the network indicating that the network would struggle to accommodate the additional demand based on the TfNSW preferred trip distribution parameters.
- The introduction of grade separation at the M1 / John Renshaw Drive / Weakleys Drive intersection increases the operational performance of the immediate area. However, the increased throughput and efficiencies gained in this area causes downstream impacts at the New England Highway / Weakleys Drive intersection and New England Highway eastbound and northbound merge and does not appear to deliver the solutions necessary for the road network generally. Planning for the M12RT bypass would appear to offer opportunities in this regard.
- Travel times along John Renshaw Drive are generally maintained throughout the initial stages of development with significant increases in the 100% GFA developed stages for both peaks. The New England Highway (A43) to M1 route also experiences variable travel times in both peaks during the 100% GFA developed stages due to increase in congestion and queues in the Beresfield and Thornton areas, as well as increase in delays on Weakleys Drive.

7. PRECINCT SCENARIO 2B MODEL RESULTS

7.1. Overview

This chapter presents the outcomes from **Precinct Scenario 2B** noting that the 'key network peak hour' has been reported for the AM peak (8am to 9am) and PM peak (5pm to 6pm) with the full results for all peak hours presented in the tables in Appendix E through Appendix H.

7.2. Network Performance

The key network performance metrics have been summarised in Table 7.1 and Table 7.2 for the weekday AM and PM peak hours respectively. A definition of each performance metric is provided in Section 5.2.1.

Table 7.1: Precinct Scenario 2B – AM peak network performance results (8am to 9am)

Metric		Base (2019)	No M12RT			With M12RT				
			Future Base (2032)	25% GFA developed (2023)	50% GFA developed (2026)	50% GFA developed (2026)	75% GFA developed (2029)	100% GFA developed (2032)	75% GFA developed (2032) – Grade Separated	100% GFA developed (2032) – Grade Separated
Average Delay	Sec	52	144	108	264	108	362	1,022	187	431
Average Speed	km/h	68	54	59	42	58	34	14	48	31
Total VKT	km	68,301	74,972	78,340	85,444	78,297	83,347	62,183	85,672	91,039
Total VHT	h	1,001	1,395	1,331	2,048	1,360	2,423	4,601	1,789	2,979
Total Stops	no.	7,731	58,617	33,044	223,133	31,488	256,122	2,266,522	130,709	850,522
Latent Demand	no.	0	17	0	27	1	152	4,239	141	1,197
Total Demand	no.	9,365	10,991	11,263	12,960	11,467	13,473	17,546	13,154	16,194

Table 7.2: Precinct Scenario 2B – PM peak network performance results (5pm to 6pm)

Metric		Base (2019)	No M12RT			With M12RT				
			Future Base (2032)	25% GFA developed (2023)	50% GFA developed (2026)	50% GFA developed (2026)	75% GFA developed (2029)	100% GFA developed (2032)	75% GFA developed (2032) – Grade Separated	100% GFA developed (2032) – Grade Separated
Average Delay	Sec	47	121	88	372	130	352	567	257	311
Average Speed	km/h	70	58	62	35	56	36	26	42	38
Total VKT	km	77,198	86,491	85,809	93,577	89,940	94,546	92,596	94,201	98,668
Total VHT	h	1,108	1,499	1,373	2,679	1,616	2,613	3,566	2,223	2,584
Total Stops	no.	7,125	55,625	21,925	884,251	38,772	122,182	750,893	366,595	386,248
Latent Demand	no.	0	0	75	82	88	1,691	4,891	737	2,715
Total Demand	no.	10,453	12,140	12,013	14,534	13,059	16,067	20,001	14,981	17,954

The network performance results presented in Table 7.1 and Table 7.2 indicate that the overall network operation decreases in performance at each stage which is expected due to the incremental increase in traffic demands. The following summarise the key outcomes:

- At the 50% No M12RT, 75% and 100% GFA developed stages in both the AM and PM peaks, network performance metrics decline more noticeably with the average speed decreasing by 53% and 55% in the AM and PM peaks respectively for the 100% GFA developed stage compared to the Future Base. Further, the average delay increases by approximately five times in the both peaks for the 100% GFA developed stage compared to the Future Base.
- It is noted that visual observations of the model operations (supported by the average speed plots in the following section) indicate that the localised traffic impacts as a result of the development can be mitigated up until at least the 50% GFA developed stage (likely around 65%) by the proposed improvement works in these stages.
- Significant queuing and delays throughout the network and at the key intersection of M1 / John Renshaw Drive / Weakleys Drive can be expected at the 50% No M12RT, 75%, 100% GFA developed stages indicating that the network is unable to accommodate the additional traffic demand.
- The abovementioned queues have a cumulative impact on the operating performance of the network as follows:
  - Southbound queues on Weakleys Drive extending onto the New England Highway at the 75% GFA developed stage in the AM peak.
  - John Renshaw Drive west approach queues can be expected to impede access to/ from the Industrial Precinct from the 75% GFA developed stage onwards. At the 75% GFA developed stage, the queues extend to the central access point, while at the 100% GFA developed stage queues extend beyond the model extent thus impacting all site access points on John Renshaw Drive.

- Latent demand (vehicles unable to enter the model network) in the model begins to significantly build up in the 75% GFA developed and 100% GFA developed stages suggesting that vehicles are unable to enter the network due to congestion inside the model network.
  - During the AM peak, the majority of latent demand is attributed to the New England Highway southbound due to the heavy southbound congestion on the Weakleys Drive approach to the M1 / John Renshaw Drive / Weakleys Drive intersection. During the 100% GFA developed stage the south approach queues at the M1 / John Renshaw Drive / Weakleys Drive intersection extend beyond the model extent which contribute to the increase in latent demand.
  - During the PM peak, the majority of latent demand is caused by congestion on John Renshaw Drive eastbound on the approach to the M1 / John Renshaw Drive / Weakleys Drive intersection. Queues on John Renshaw Drive extend past the site access points limiting the exiting movement from the Industrial Precinct. Similar to the AM peak, the 100% GFA developed stage demonstrates south approach queues at the M1 / John Renshaw Drive / Weakleys Drive intersection that extend beyond the model extent which also increase the latent demand for this scenario.
- The 75% and 100% GFA developed stages with grade separation show an improvement in overall network performance compared to the associated at grade scenarios. However, while some efficiencies are gained at the M1 / John Renshaw Drive / Weakleys Drive intersection, this effectively pushes the congestion points downstream and applies added pressure to the New England Highway / Weakleys Drive intersection and the New England Highway A1 merge, which contributes to the high delays and low network speeds.

7.3. Network Average Speed Plots

The network average speed plots have been illustrated in the following figures based on the conditions set out in Section 4.2.2.

Figure 6.1: AM peak network average speed (8am to 9am) – Future Base (2032)

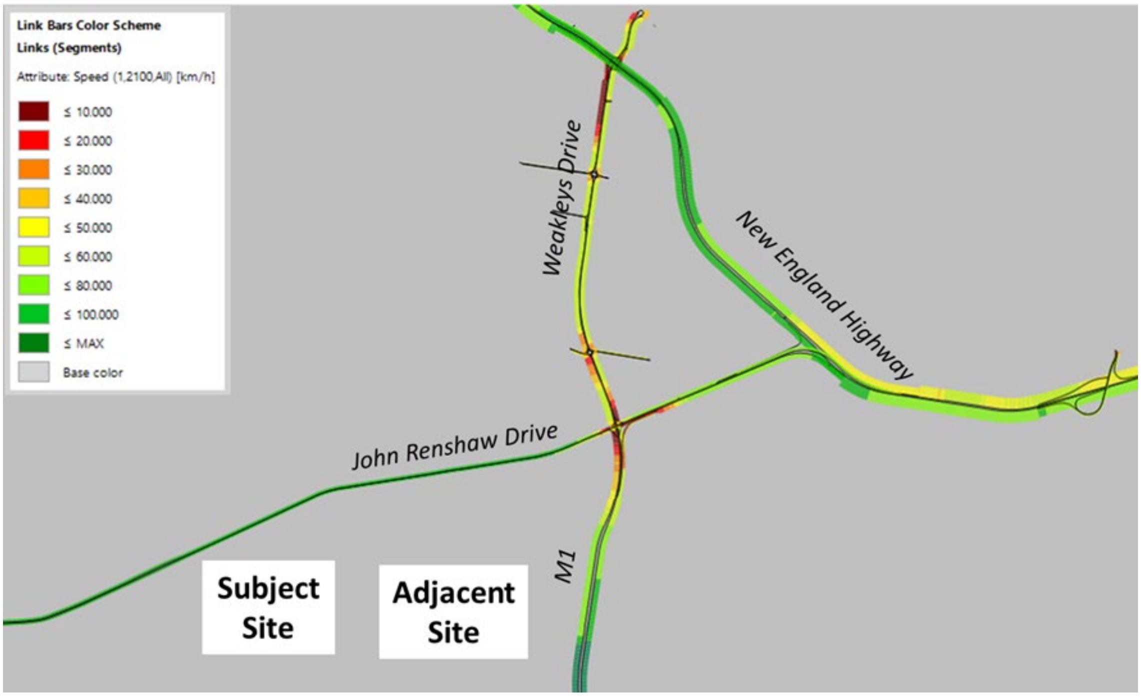


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Figure 6.2: AM peak network average speed (8am to 9am) – 25% GFA developed (2023) No M12RT

Figure 6.3: AM peak network average speed (8am to 9am) – 50% GFA developed (2023) No M12RT

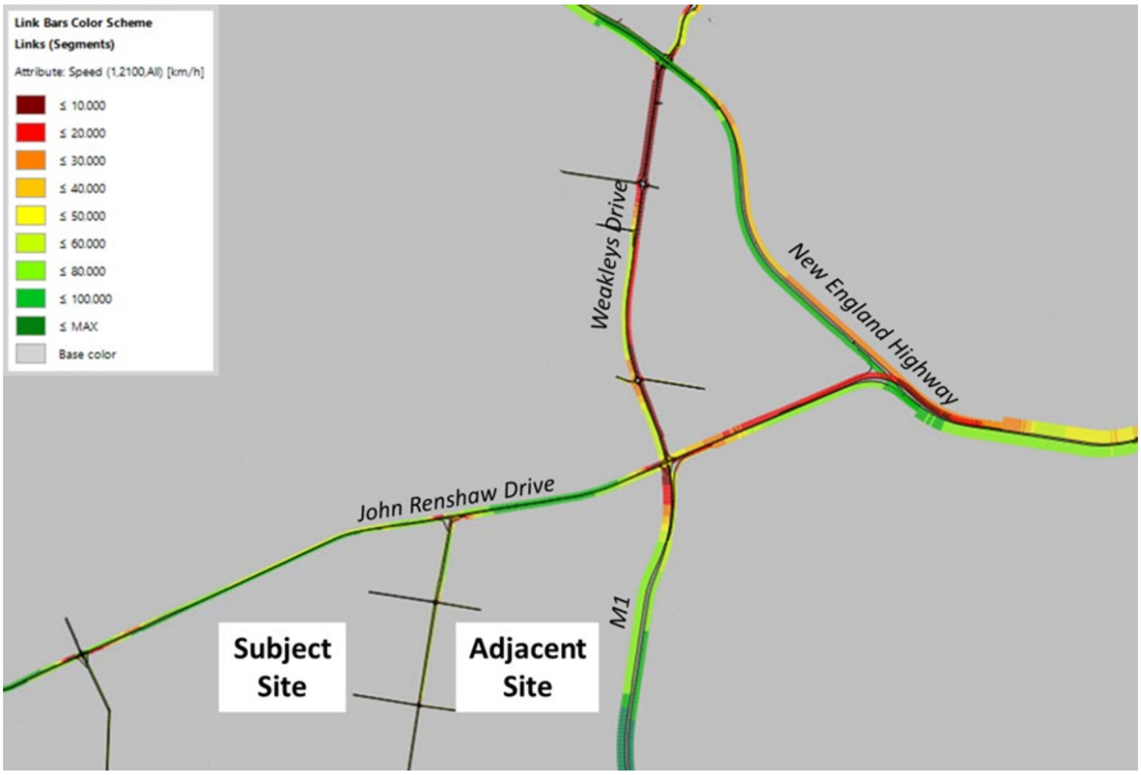


Figure 6.4: AM peak network average speed (8am to 9am) – 50% GFA developed (2023) With M12RT

Figure 6.5: AM peak network average speed (8am to 9am) – 75% GFA developed (2023) With M12RT

Figure 6.6: AM peak network average speed (8am to 9am) – 100% GFA developed (2023) With M12RT

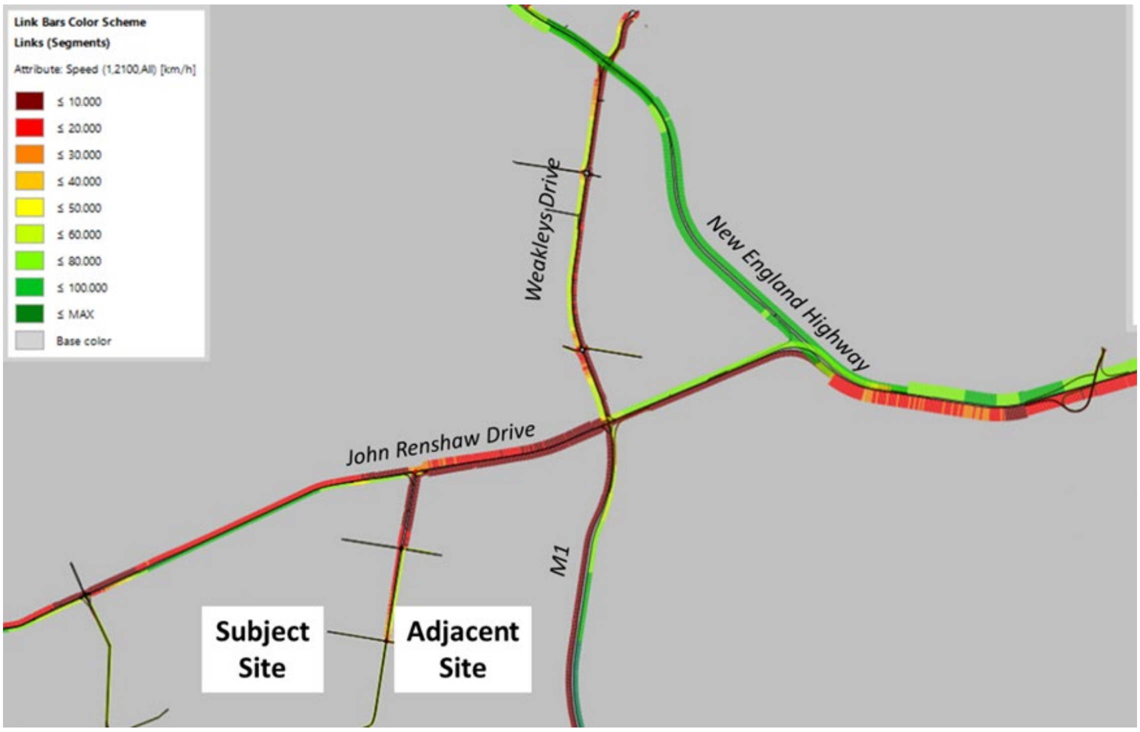


Figure 6.7: AM peak network average speed (8am to 9am) – 75% GFA developed (2023) With M12RT – Grade Separated

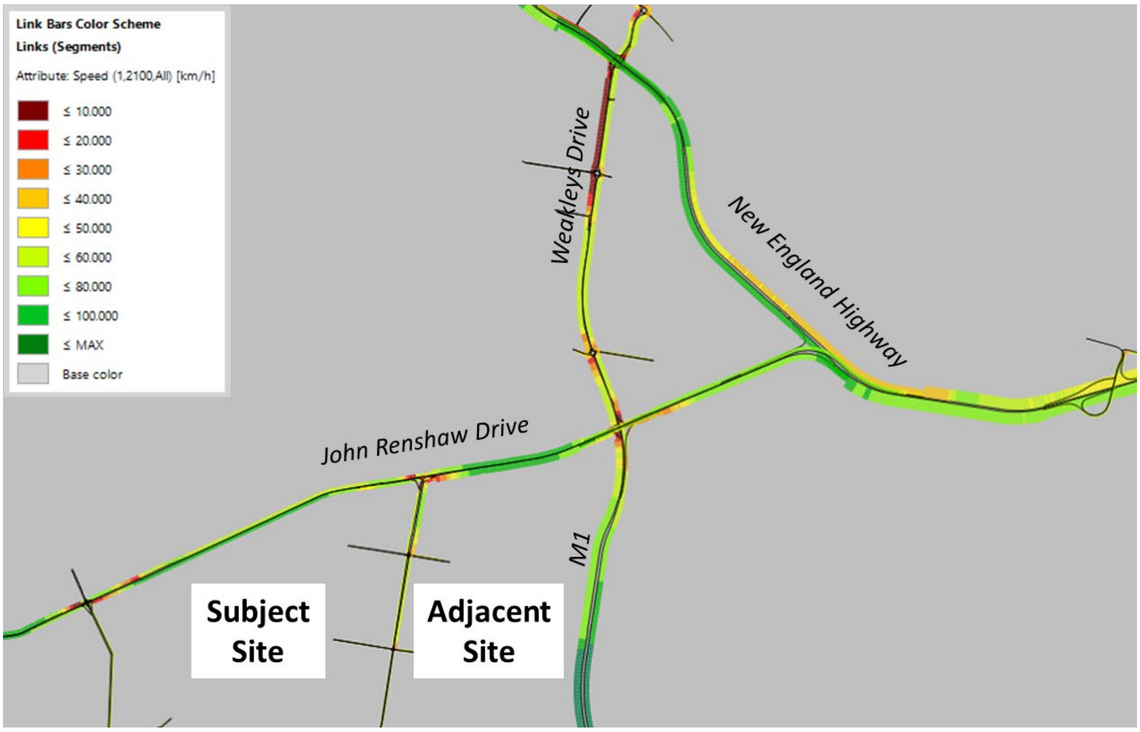


Figure 6.8: AM peak network average speed (8am to 9am) – 100% GFA developed (2023) With M12RT – Grade Separated

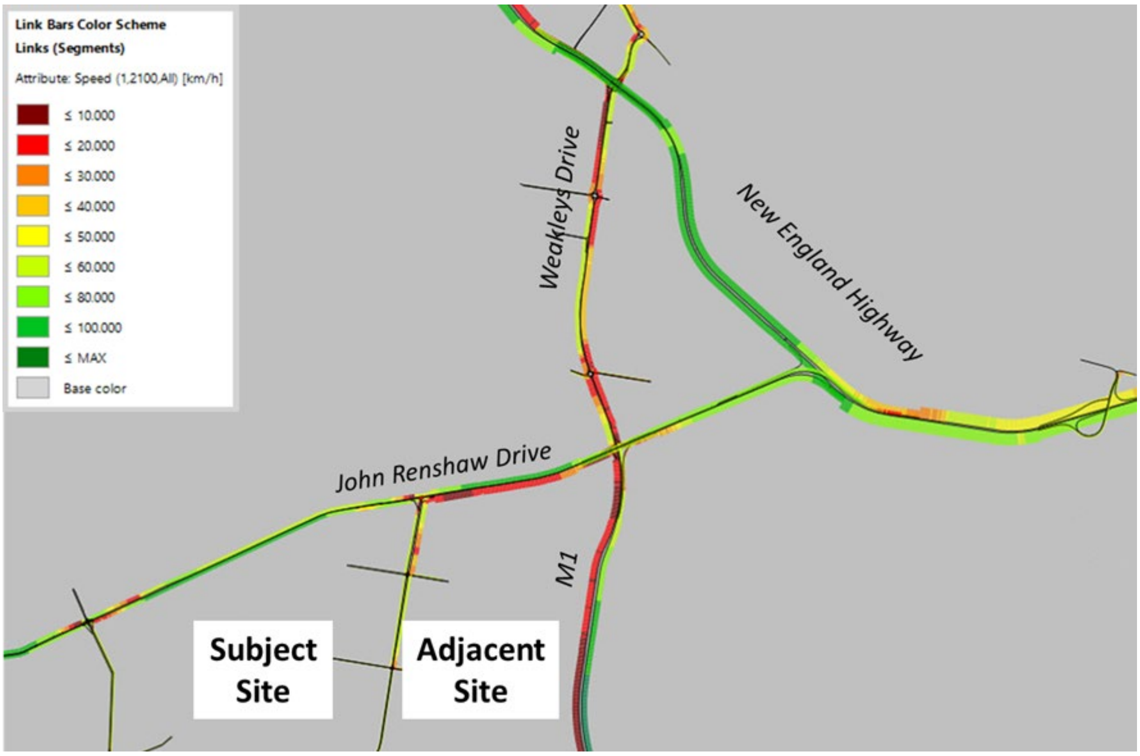


Figure 6.9: PM peak network average speed (5pm to 6pm) – Future Base (2032)

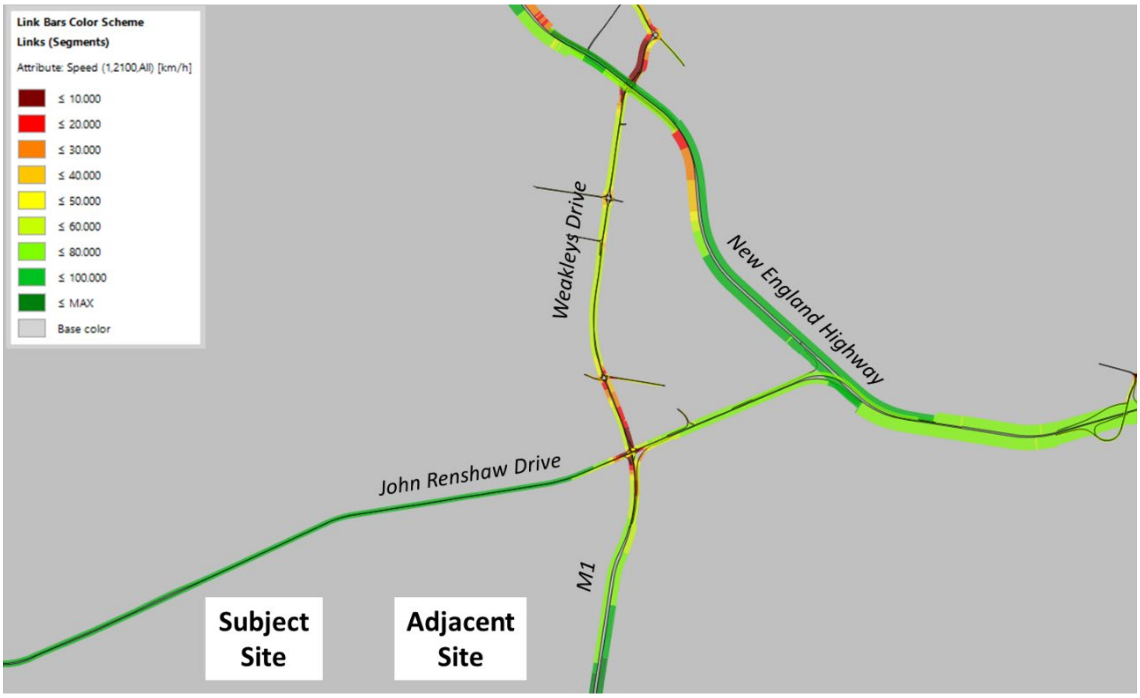


Figure 6.10: PM peak network average speed (5pm to 6pm) – 25% GFA developed (2023) No M12RT

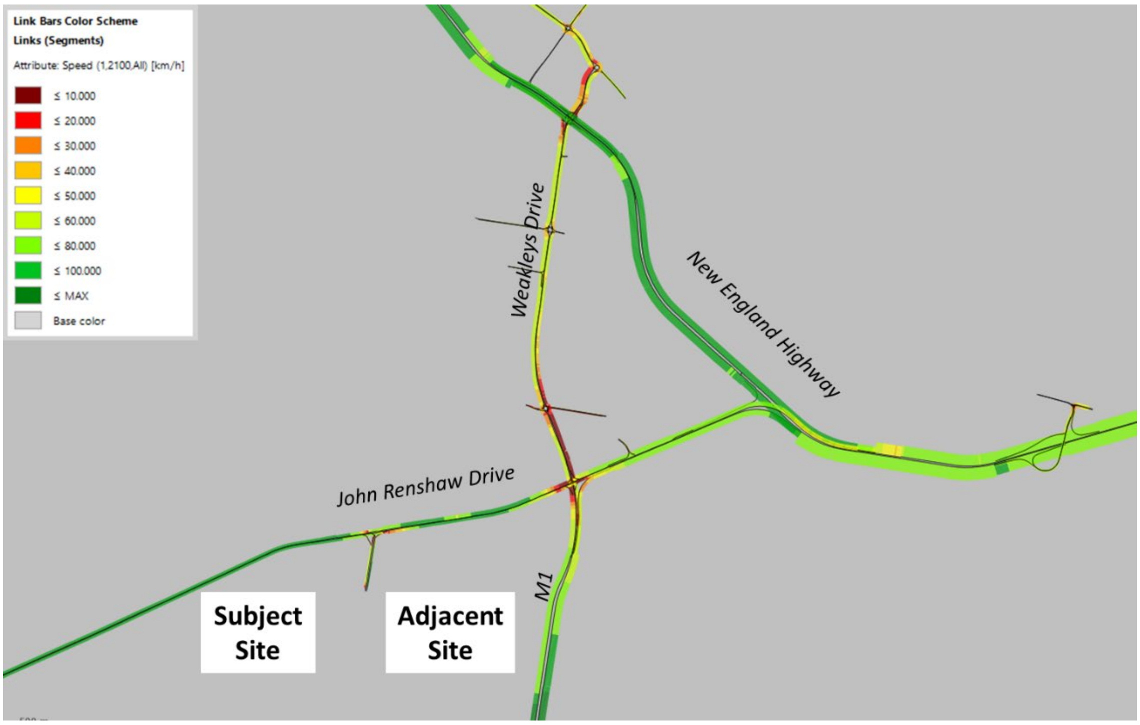


Figure 6.11:PM peak network average speed (5pm to 6pm) – 50% GFA developed (2023) No M12RT

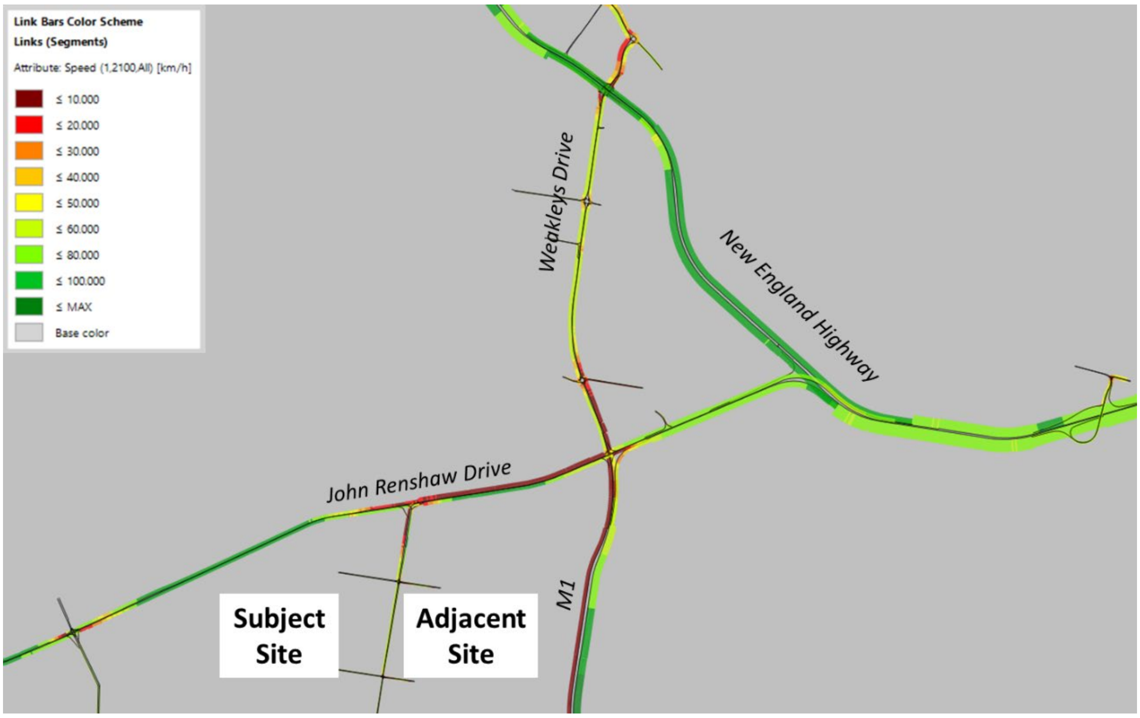


Figure 6.12:PM peak network average speed (5pm to 6pm) – 50% GFA developed (2023) With M12RT

Figure 6.13:PM peak network average speed (5pm to 6pm) – 75% GFA developed (2023) With M12RT

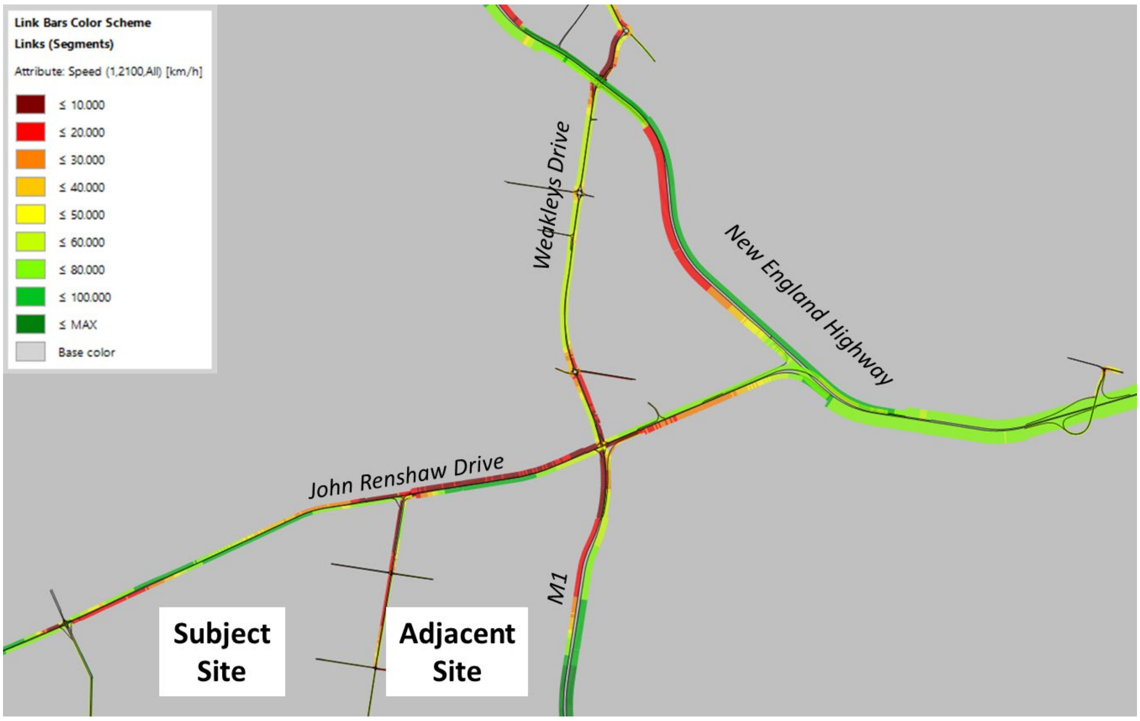


Figure 6.14:PM peak network average speed (5pm to 6pm) – 100% GFA developed (2023) With M12RT

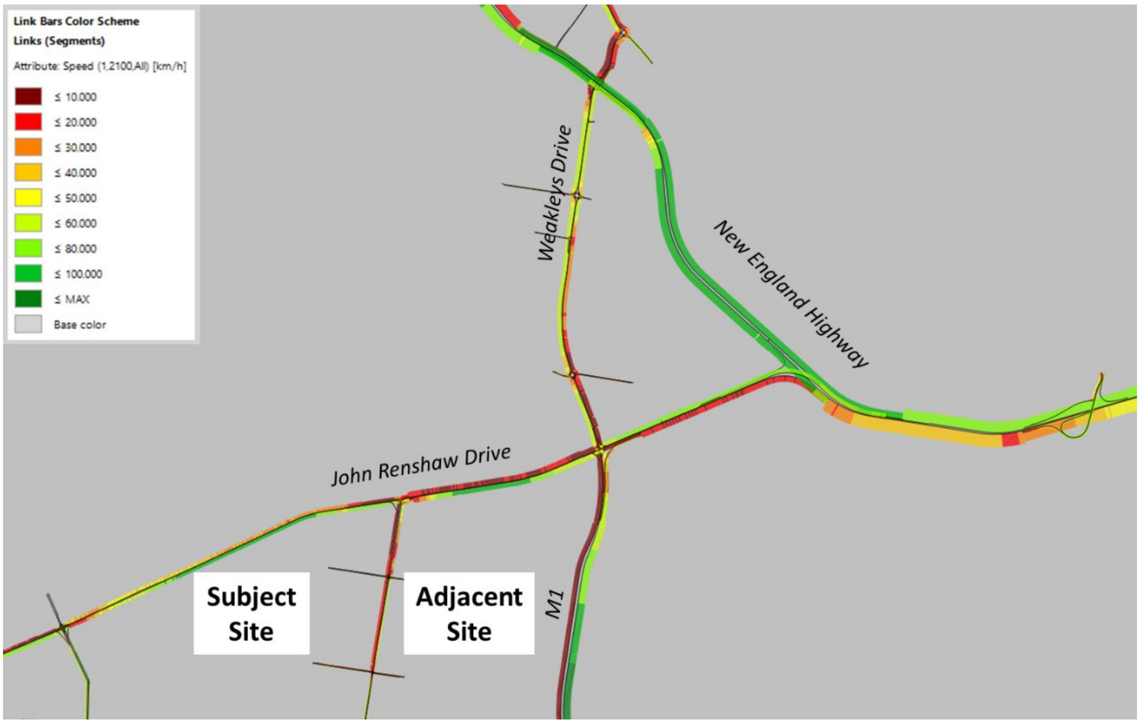
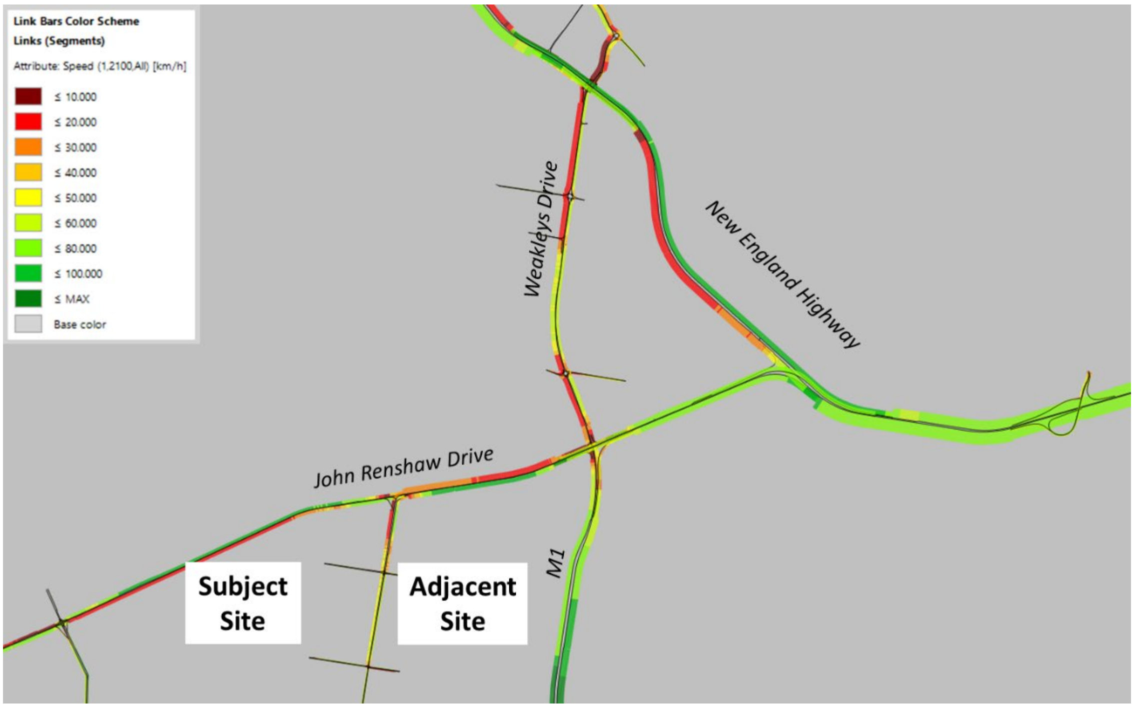


Figure 6.15:PM peak network average speed (5pm to 6pm) – 75% GFA developed (2023) With M12RT – Grade Separated

Figure 6.16:PM peak network average speed (5pm to 6pm) – 100% GFA developed (2023) With M12RT – Grade Separated



The average speed plots for the weekday AM and PM peak hours as presented in Figure 6.1 to Figure 6.16 indicate the following key outcomes:

- There is a generally a consistent trend in congestion spots in the network during both the AM and PM peaks which progressively worsens as the development stages grow.
- The key congestion hotspots have been identified as the M1 / John Renshaw Drive / Weakleys Drive and New England Highway / Weakleys Drive intersections with the critical approaches including:
  - John Renshaw Drive east approach to the M1 / John Renshaw Drive / Weakleys Drive intersection in both AM and PM peaks.
  - Weakleys Drive north approach to the M1 / John Renshaw Drive / Weakleys Drive intersection in both AM and PM peaks.
  - M1 south approach to the M1 / John Renshaw Drive / Weakleys Drive intersection in both AM and PM peaks.
  - Weakleys Drive south approach to the New England Highway / Weakleys Drive intersection in both AM and PM peaks.
  - New England Highway off-ramp (eastbound and westbound) to Weakleys Drive in the AM and PM peaks respectively.
- In the 50% GFA developed stage, the impacts of the queues are localised and are not expected to interrupt the performance of the surrounding network. However, the 50% No M12RT, 75% and 100% GFA developed stages demonstrate eastbound queues on John Renshaw Drive that extend into the central site access point.
- Queues on the M1 south approach to John Renshaw Drive are also expected to increase at the 50% No M12RT, 75% and 100% GFA developed stages progressively worsening as the development increases.
- In addition, the average speed plots indicate that in various scenarios, there are some wider disruptions to network performance particularly north of the New England Highway in Beresfield and Thornton and

the John Renshaw Drive to New England Highway eastbound and northbound merge. These would appear to also be affected by background traffic and existing constraints in that part of the network.

- The proposed mitigation measures at the M1 / John Renshaw Drive / Weakleys Drive intersection are able to accommodate the anticipated increase in traffic volumes (background and site generated) up until at least the 50% GFA developed stage (likely up to around 65% developed).
- The grade separation at the 75% GFA developed stage demonstrates little to no queues at the M1 / John Renshaw Drive / Weakleys Drive intersection. However, further pressure is applied to the New England Highway / Weakleys Drive intersection and the New England Highway northbound and eastbound merges.
- The grade separation at the 100% GFA developed stage demonstrates queuing at the M1 / John Renshaw Drive / Weakleys Drive intersection north approach and east approach right turn. Furthermore, significant pressure is applied to the New England Highway / Weakleys Drive intersection and the New England Highway northbound and eastbound merges.

7.4. Travel Times

Average travel times for the key road corridors identified above have been extracted from the model and summarised below for the weekday AM and PM peak hours.

Figure 6.17:AM peak travel time in seconds (8am to 9am)

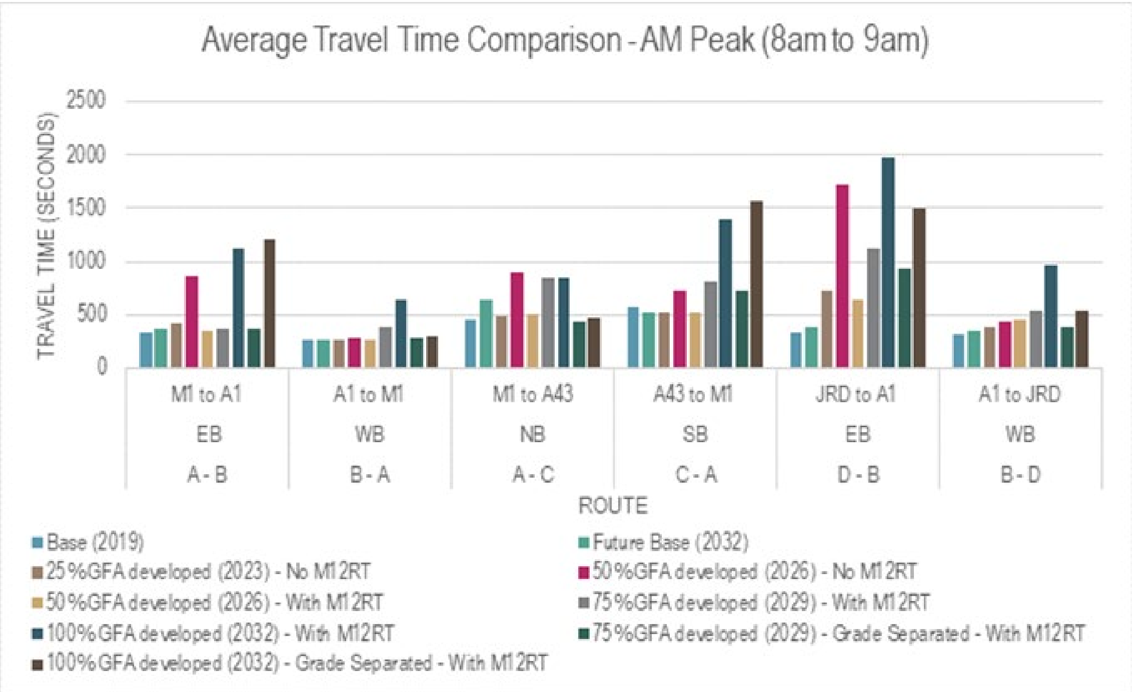
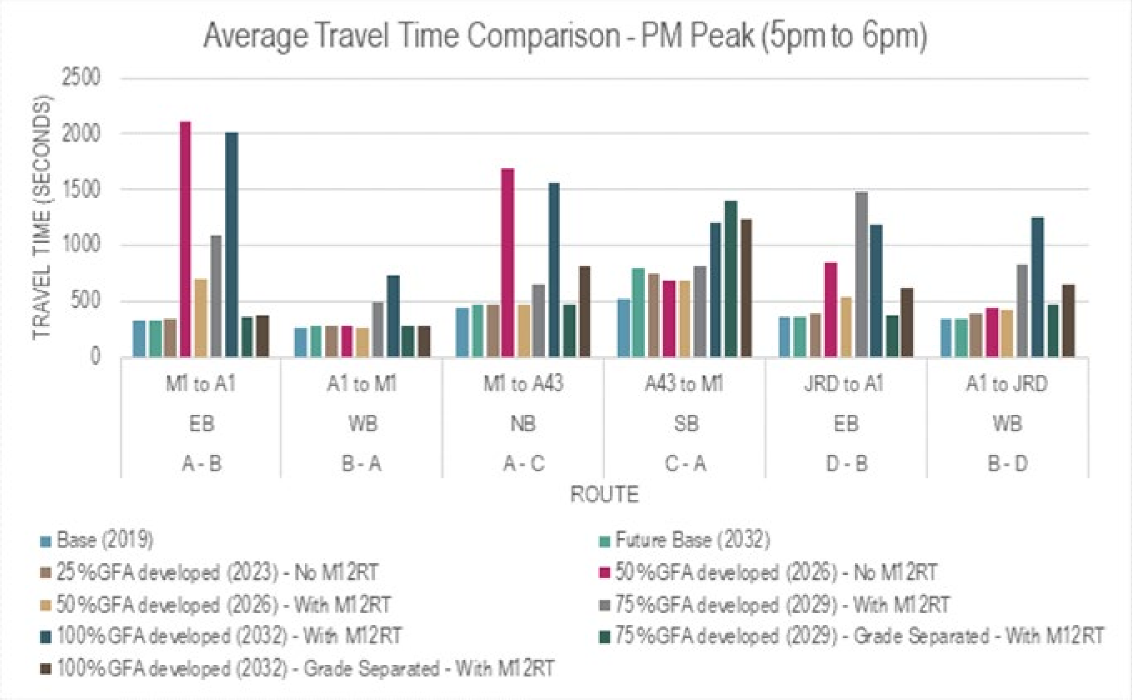


Figure 6.18:PM peak travel time in seconds (5pm to 6pm)



The travel time results presented in the figures above generally indicate the following:

- In both the AM and PM peaks, most routes are able to maintain a reasonable travel time during the early stages of the development.
- The 50% GFA developed stage without the M12RT is expected to result in increases to travel times during both peaks, most notably along the M1, John Renshaw Drive and New England Highway. However, the introduction of the M12RT at the 50% GFA developed stage results in travel times that are somewhat consistent with the 25% GFA developed stage.
- Travel times significantly increase during the 75% GFA developed and continue to worsen in 100% GFA developed stage. Routes M1 to A43 northbound and southbound, M1 to A1 eastbound and John Renshaw Drive to A1 eastbound are all heavily impacted during the scenario. Causes are as follows:
  - In the northbound direction, the capacity constraints at the New England Highway / Weakleys Drive intersection and beyond create results in some upstream delays that reduce the efficiency of Weakleys Drive northbound particularly in the AM peak.
  - In the southbound direction, queues and delays are expected on the New England Highway off ramp to Weakleys Drive which extend beyond the ramp storage length. This is caused by the congestion in the Thornton precinct, in particular at the Weakleys Drive / Glenwood Drive roundabout, which queues back into the New England Highway / Weakleys Drive intersection blocking traffic flow at times during the peak. In addition, the modelling also indicates some increase in queues on the north approach to the M1 / John Renshaw Drive / Weakleys Drive intersection which also increases the travel time experienced along this route.
- The grade separation at the 75% GFA developed stage reduces the travel times for each route, which are most comparable to the Future Base with the exception of only slight reductions in the AM peak for the A43 to M1 route where southbound delays are still expected on the New England Highway off ramp to Weakleys Drive which extend beyond the ramp storage length as discussed above. The John

Renshaw Drive to A1 route is also still expected to experience heavy congestion along John Renshaw Drive due to the merge issues at new England Highway.

- The grade separation at the 100% GFA developed stage reduces travel times on the majority of the routes; however significant congestion remains in the network causing delays in particular to remain on the eastbound and westbound movements on John Renshaw Drive as well as the southbound delays on the New England Highway off ramp to Weakleys Drive.

7.5. Intersection Performance

Intersection LOS (based on overall intersection delay) for key intersections in the model have been presented in the figures below for the weekday AM and PM peak hours. A definition of the LOS ranges can be found in Section 4.2.4.

AM Peak Intersection Performance

Figure 6.19:Base – AM Peak

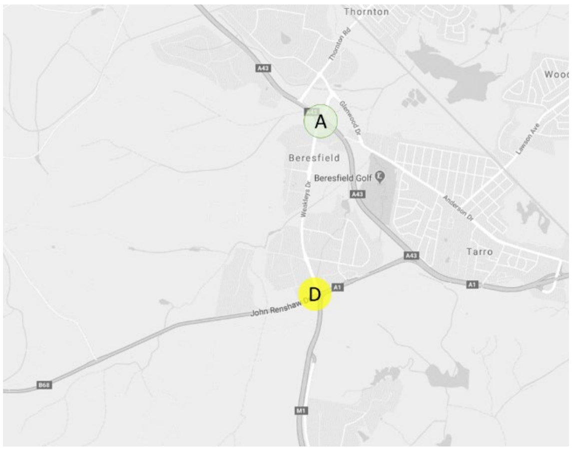


Figure 6.20: Future Base (no M12RT) – AM Peak

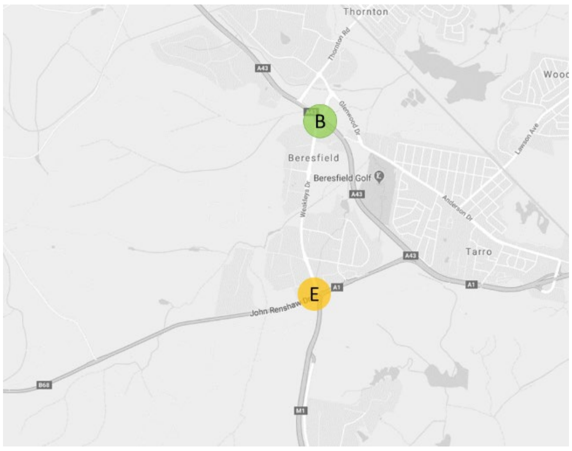


Figure 6.21:Precinct Scenario 2B: 25% GFA Developed (No M12RT) – AM Peak

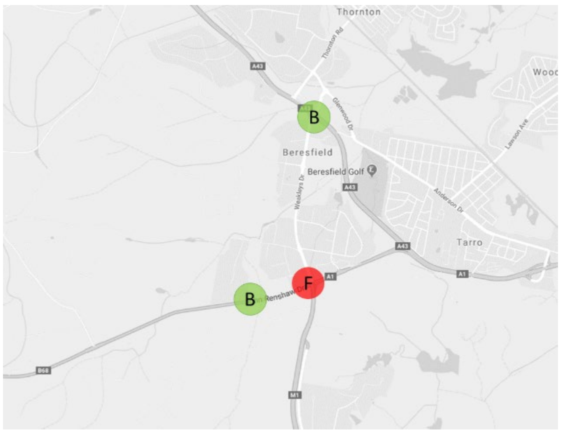
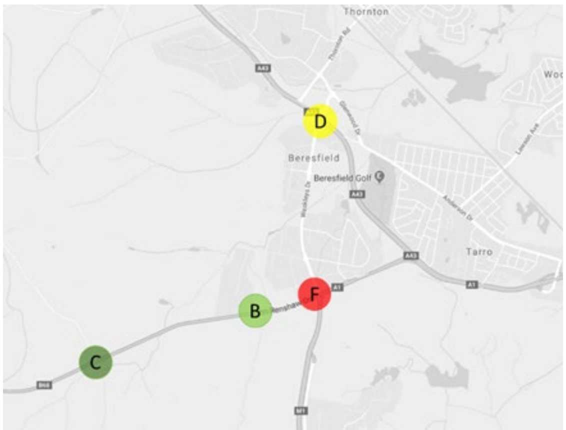


Figure 6.22:Precinct Scenario 2B: 50% GFA Developed (No M12RT) – AM Peak



PRECINCT SCENARIO 2B MODEL RESULTS

Figure 6.23:Precinct Scenario 2B: 50% GFA Developed (With M12RT) – AM Peak

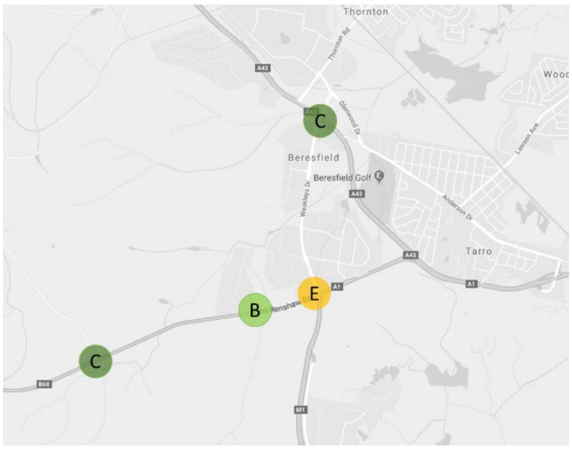


Figure 6.24:Precinct Scenario 2B: 75% GFA Developed (With M12RT) – AM Peak

Figure 6.25:Precinct Scenario 2B: 100% GFA Developed (With M12RT) – AM Peak

Figure 6.26:Precinct Scenario 2B: 75% GFA Developed (With M12RT) – - Grade Separated - AM Peak

Figure 6.27:Precinct Scenario 2B: 100% GFA Developed (With M12RT) – Grade Separated - AM Peak

PM Peak Intersection Performance

Figure 6.28:Base – PM Peak

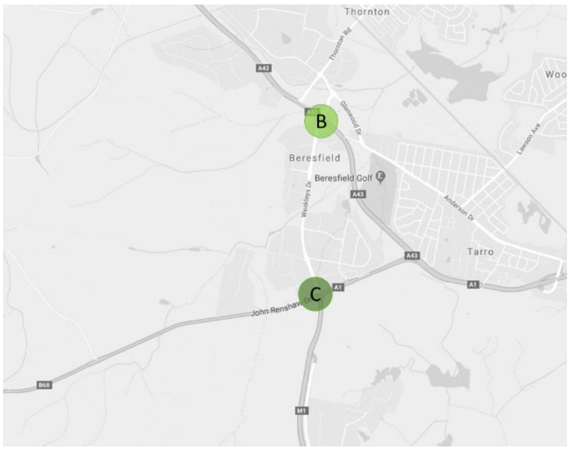


Figure 6.29:Future Base (no M12RT) – PM Peak

Figure 6.30:Precinct Scenario 2B: 25% GFA Developed (No M12RT) – PM Peak

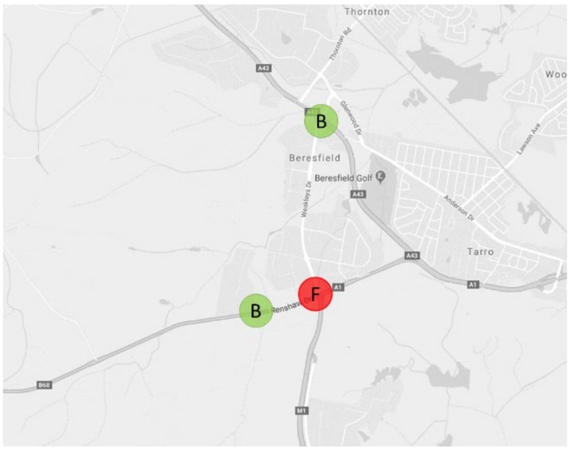
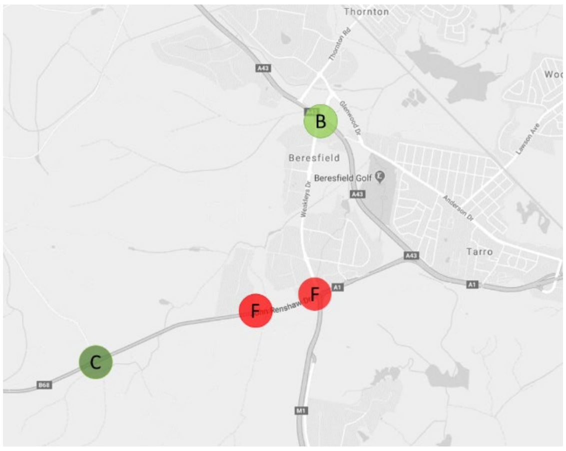


Figure 6.31:Precinct Scenario 2B: 50% GFA Developed (No M12RT) – PM Peak



PRECINCT SCENARIO 2B MODEL RESULTS

Figure 6.32:Precinct Scenario 2B: 50% GFA Developed (With M12RT) – PM Peak

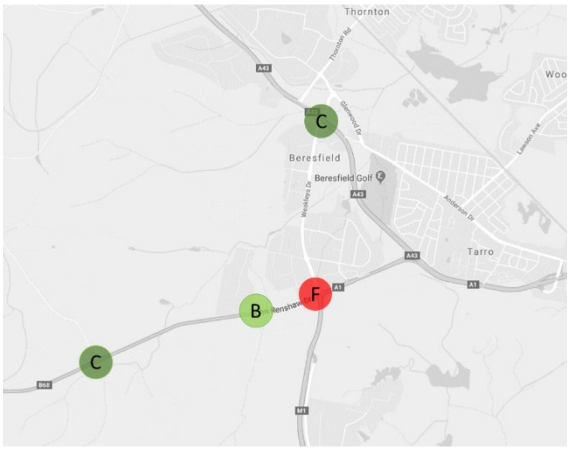


Figure 6.33:Precinct Scenario 2B: 75% GFA Developed (With M12RT) – PM Peak

Figure 6.34:Precinct Scenario 2B: 100% GFA Developed (With M12RT) – PM Peak

Figure 6.35:Precinct Scenario 2B: 75% GFA Developed (With M12RT) – Grade Separated – PM Peak

Figure 6.36:Precinct Scenario 2B: 100% GFA Developed (With M12RT) – Grade Separated – PM Peak

The intersection performance results generally indicate the following key outcomes:

- A general decrease in intersection performance at each stage for both peak periods.
- The M1 / John Renshaw Drive / Weakleys Drive intersection is expected to be at operational capacity by the 50% GFA developed stage (likely realistically around 65%) of the Industrial Precinct in both the AM and PM peaks. However, it is noted that model observations indicate that the queues and delays at this intersection do not appear to have a severe cumulative impact to the rest of the road network and limited to a localised impact. The performance of this intersection deteriorates quite significantly at 75% GFA developed and 100% GFA developed indicating that the forecast demand in these scenarios exceeds the capacity of this intersection. The key movements for the AM and PM peaks are all movements on the M1 south approach, the through and right turns on the Weakleys Drive north approach and the through lanes on the John Renshaw Drive west approach.
- The central access intersection decreases in performance, changing from a LOS B in both AM and PM periods at 50% GFA developed stage to a LOS D and LOS F for the 75% GFA developed stage in the AM and PM peaks respectively. However, it is noted that in the 75% GFA developed and 100% GFA developed stages, the performance of this intersection is mostly affected by eastbound queues on John Renshaw Drive formed at the M1 / John Renshaw Drive / Weakleys Drive intersection.
- The introduction grade separation is able to reduce the LOS at M1 / John Renshaw Drive / Weakleys Drive intersection from LOS F to LOS B at the 75% GFA developed stage for both peaks. The grade separation at the 100% GFA developed stage has less of a benefit reducing from LOS F to LOS E in both peak periods.

7.6. Key Outcomes from Precinct Scenario 2B

A summary of the key outcomes from the Precinct Scenario 2B modelling assessment is as follows:

- The modelling indicates that through to the 50% GFA developed stages (and quite likely around 65%) queuing and delay formed at the M1 / John Renshaw Drive / Weakleys Drive intersection are considered to be localised and are not expected to interrupt the performance of the surrounding network. The proposed mitigation measures at this intersection help to manage the traffic impacts with the intersection performance generally indicating that the intersection can accommodate the anticipated increase in traffic volumes (background and site generated) up until this stage.
- The 50% No M12RT, 75% and 100% GFA developed stage demonstrates a change in queuing and delay across the network indicating that the network is unable to accommodate the increased demand. The site access points to the Industrial Precinct will also start to experience some delays due to capacity constraints, as well as downstream effects which impede the efficiency of the site access points.
- When grade separation is introduced at the M1 / John Renshaw Drive / Weakleys Drive intersection the performance of the immediate area significantly increases. However, further pressure is applied to the New England Highway / Weakleys Drive intersection and New England Highway eastbound and northbound merges indicating it does not appear to deliver the solutions necessary for the road network generally. Planning for the M12RT bypass would appear to offer more obvious opportunities in this regard.

8. CONCLUSION

Based on the analysis and discussions presented within this report, the following conclusions are made:

- The project team has proactively worked with Transport for NSW with the outcome being a thoroughly robust microsimulation model that considers a range of development scenarios covering defined future years for not only the proposed large lot industrial development, but also the adjacent smaller lot industrial development to the east.
- There remain several variables that need to be considered to ensure accuracy with respect to traffic, including:
  - The original TfNSW traffic survey data is ageing and needed to be growthed to establish 2019 as the base year.
  - The local and regional area will clearly undergo significant change over the period to 2032 all of which needs to be captured as part of future planning. There are many influencing factors that affect future traffic conditions, including:
    - M12RT bypass and ongoing uncertainty over final alignment and configuration (and hence the extent of benefit it will contribute to local area intersections, including the M1 / John Renshaw Drive / Weakleys Drive signalised intersection).
    - TfNSW preferred model parameters, including background traffic growth rates, trip generation rates and traffic distribution may not be as accurate as expected.
    - The need to consider impacts associated with both the subject site in isolation and the broader Industrial Precinct.
- Population growth in the Hunter region west of the site may not have been captured in the traffic distribution that has needed to be applied to the model. Planning research appears to indicate that a much more significant proportion of traffic may approach and depart via the west, thereby significantly changing the extent of traffic impact on the road network east of the site, including the M1 / John Renshaw Drive / Weakleys Drive intersection. Should a more even distribution of site generated traffic be split between the east and west there would be up to 200 less vehicles travelling through this intersection and would clearly lessen the extent of works that may be required to the intersection.
- While some efficiencies in the immediate vicinity may be gained with grade separating the M1 / John Renshaw Drive / Weakleys Drive intersection, this would effectively push the congestion points downstream and apply added pressure to the New England Highway / Weakleys Drive intersection and the New England Highway A1 merge, which contributes to the high delays and low network speeds. A more measured approach that considers other potential efficiencies, such as planning for the M12RT bypass is obvious.
- The adjacent Stevens Group site remains subject to ongoing Land and Environment Court proceedings with determination yet to be confirmed at the time of writing. It is understood that intersection traffic modelling completed for that site (as part of the LEC) adopted the traffic generation rate of 0.4 vehicle trips per 100 square metres across the adjacent site. This removes the ability for this model to consider rates more than this.
- Background traffic growth rates indicate that the road network already shows constraint without the proposed mitigation measures in place. This includes the M1 / John Renshaw Drive / Weakleys Drive signalised intersection that would appear to reach capacity by 2032 and consistent with TfNSW own traffic modelling for this intersection. Congestion north of the New England Highway in Beresfield and

Thornton has also been by identified by TfNSW with recognition that the microsimulation model is not responsible for addressing such constraint in the upper reaches of the network. Similarly the John Renshaw Drive to New England Highway (A1) eastbound merge at the eastern extent of the model also shows signs of congestion.

- The staged development approach (and development scenarios tested in the model itself) allow an understanding the triggers for road network upgrades. If done correctly, these surveys would allow updates to modelling to ensure appropriate apportionment of trip rates and distribution.
- It is broadly recognised that large lot Industrial Precincts are unlikely to generate traffic volumes in the future at the same level as they do today. This is reflected in the Scenario 2A traffic generation rates and is a result of many influencing factors, including many technological advancements, 24/7 operations and more favourable use of efficient and targeted public transport services. Traffic generation rates are expected to further reduce in future years, with scenario 2A considered to reflect a 'worse case' scenario or is at least, highly conservative.
- The following observations are made of the precinct modelling scenarios:
  - Precinct Scenario 2A:
    - The model results demonstrate that the network can accommodate the future year traffic demands from both the Industrial Precinct as well as background traffic growth up until at least the 75% GFA developed scenario. While there is a slight decrease in network performance when compared against the Base model, the reductions are generally considered appropriate.
    - The Industrial Precinct traffic demand mixed with background traffic growth impacts the surrounding network at the 100% GFA developed scenario. Significant increases to delays, travel times and queue lengths are expected during this stage in both peaks
    - The introduction of grade separation at the M1 / John Renshaw Drive / Weakleys Drive intersection at the 100% scenario significantly increases the traffic performance within the immediate vicinity; however an increase in pressure is applied to the New England Highway / Weakleys Drive intersection and New England Highway eastbound and northbound merge as a result.
  - Precinct Scenario 2B:
    - The model results demonstrate that the 25% GFA developed and 50% GFA developed (with M12RT) stage scenarios are able to accommodate the future year traffic demands from both the Industrial Precinct as well as background traffic growth. While there is a slight decrease in network performance when compared against the Base model, the reductions are generally considered appropriate.
    - The M1 / John Renshaw Drive / Weakleys Drive intersection is starting to approach capacity at 50% GFA developed stage of the development in both the AM and PM peaks. The Industrial Precinct traffic demand mixed with the background traffic growth heavily impacts the surrounding network from the 50% GFA developed No M12RT and 75% GFA developed stage onwards. Significant increases to delays, travel times and queue lengths are expected during these stages in both peaks.
    - The introduction of grade separation at the M1 / John Renshaw Drive / Weakleys Drive intersection at the 75% and 100% scenario increases the traffic performance within the immediate vicinity; however, an increase in pressure is applied to the New England Highway / Weakleys Drive intersection and New England Highway eastbound and northbound merge as a result.

- Overall, the microsimulation model is as robust as possible and based on sound information available at the time. Inconsistencies do however remain and it is clear that the TfNSW preferred assumptions, together with several critical elements outside the scope of the model are significantly influencing the outcomes. These outcomes are unfavourably skewed with respect to the proposed large lot industrial development. In this regard, four critical aspects stand out:
  - TfNSW preferred background traffic growth
  - TfNSW preferred traffic distribution
  - TfNSW assumed traffic generation rates
  - M12RT bypass assumptions and future design uncertainty.

A. PROJECTED STAFF TRAVEL

A

BARR PROPERTY & PLANNING
Continual Progress

Briefing Note

Job Number:	***16NEW0055***
Project Name:	F & F Properties subdivision Blackhill
Site address:	***John Renshaw Drive Black Hill NSW 2322***
Lot/DP/Plan Number:	Lot 1 Deposited Plan 1260203

Purpose

To identify the plausible residence of employees travelling to site and the direction they will approach the site from, i.e. from the east or west along John Renshaw Drive.

Likely place of residence of workers

The site is expected to generate 1546 jobs in the manufacturing and the transport, postal and warehousing industries. The Economic Impact Assessment (EIA) prepared by Barr Property and Planning (March, 2019) predicted that the drawing areas for the proposed development would include the following statistical areas:

- Newcastle and Lake Macquarie (SA4), this is broken down to Lake Macquarie - East (SA3), Lake Macquarie - West (SA3) and Newcastle (SA3)
- Lower Hunter (SA3)
- Maitland (SA3), and
- Port Stephens (SA3)

These were identified as the "broader region" and are referred to in this report as the potential drawing area for workers on the site.

The Regional Projected Employment Growth to May 2024 estimates the expected employment level for all industries across the SA4 regions (broader statistical areas). The Hunter Valley (excluding Newcastle) SA4 and the Newcastle and Lake Macquarie SA4 encapsulate the broader region identified as the drawing area for workers on the site. The Hunter Valley (excluding Newcastle) is expected to experience a 1.1% decline in the manufacturing industry over the next five years, with the transport, postal and warehousing industry expected to experience a 3.3% growth. The projected growth for the combined industries in the Hunter Valley (excluding Newcastle) is 2.2%, in which the total employment level at May 2024 is estimated to be 14,800 people. However within the Newcastle and Lake Macquarie region both industries are projected to decline as a proportion of total employment, at 0.7% decline in the manufacturing industry and 0.4% decline in the transport, postal and warehouse industry. It is anticipated that the total employment level at May 2024 in these industries for the Newcastle and Lake Macquarie region will be 21,800 people. Accordingly, it is estimated for the broader region that the employment level at May 2024 will be 35,600 people. The proposed development will contribute 4.34% of the total employment in manufacturing, transport, postal and warehousing industries anticipated for the broader region by 2024.

Table 1 below shows the number of residents from each LGA of the broader region who were employed in either the manufacturing industry or the transport, postal and warehousing industry, at the 2016 Census. While we can estimate that most workers at the site will be drawn from these nearby LGAs, it is not possible to predict what proportion of workers will be drawn from each area. For transparency, it has been assumed that the distribution of residences for workers on the site will be equivalent to the distribution of residences for workers within the broader region.

Table 1: Residents working in manufacturing and transport, postal and warehousing industries, ABS TableBuilder 2016 Census Data, Accessed 18 May 2020

Statistical area	Manufacturing	Transport, postal and warehousing	Total number of residents working in manufacturing and transport, postal and warehousing industries	Proportion of broader region workforce in manufacturing and transport, postal and warehousing industries (%)
Newcastle (SA3)	4,259	2,827	7,089	25.89
Lake Macquarie – East (SA3)	3,214	2,069	5,280	19.28
Lake Macquarie – West (SA3)	2,358	1,441	3,799	13.87
Lower Hunter (SA3)	2,459	1,410	3,869	14.13
Maitland (SA3)	2,442	1,481	3,923	14.33
Port Stephens (SA3)	1,905	1,518	3,423	12.50
Total	16,637	10,746	27,383	100

The Newcastle area was the place of residence for the highest proportion (25.89%) of people working in the manufacturing and transport, postal and warehousing industries. This was followed by Lake Macquarie – East (19.28%), Maitland (14.33%), Lower Hunter (14.13%), Lake Macquarie – West (13.87%) and Port Stephens (12.50%).

By applying the proportions established in Table 1 to the anticipated number of jobs to be created on the site (1546 jobs), the place of likely residence of future employees can be estimated, shown in Table 2.

Table 2: Estimated number of employees from each statistical area, collated by author.

Statistical area	Number of employees expected from statistical area
Newcastle (SA3)	400
Lake Macquarie – East (SA3)	298
Lake Macquarie – West (SA3)	214
Lower Hunter (SA3)	218
Maitland (SA3)	222
Port Stephens (SA3)	193
Total	1546

Likely path of travel for workers

Google Maps was used to determine the likely travel route to the site and the direction of approach. Google Maps uses real time traffic data to determine the quickest route to any given location based on traffic density at the time of the request and any possible traffic incidents which may delay travel. There are a number of possible approaches to the site from within the broader region. Accordingly, the route of travel to the site may vary depending on the time of day, levels of traffic during peak periods, accidents, and other factors. Furthermore, it should be noted that personal travel preferences may also influence commuters travel patterns.

The most probable travel routes were ascertained for each statistical area (SA3) based on residence and approximate travel time, and correlated to the approximate percentage of commuters likely to use each route. The assumptions made are outlined below.

- Any vehicle to arrive at the junction between the M1 and M15 would have a 50% chance of taking either direction given the negligible difference in travel time, being a maximum of three minutes at the time of the analysis. At times of heavy traffic at the M1 / John Renshaw Drive intersection, traffic with this option is likely to avoid that intersection and approach the site via the M15 (western approach). At times of light traffic in this area, it is anticipated that traffic facing the option of taking the M1 or the M15 may be equally likely to take either route, resulting in a 50% chance of an eastern or western approach to the site along John Renshaw Drive.
- Accordingly, it was determined that for both the Lake Macquarie East and West SA3 areas, it is likely that 50% of commuters would access John Renshaw Drive via the M1 and 50% would access John Renshaw Drive from the M15. This equates to 50% approaching the site from the east and 50% approaching the site from the west for all commuters of the Lake Macquarie districts.
- For the Newcastle SA3 area it was estimated that 50% of commuters would take a travel route which would approach the M1/M15 junction, with the remaining 50% traveling to the site via Minmi or Hexham. It is, therefore, reasonable to assume that of the 50% of commuters approaching the M1/M15 junction, half are likely to choose the M15 and approach the site from the west, with the remaining half choosing the M1 and approaching the site from the west. For all commuters to the site from the Newcastle SA3, it is therefore assumed that 75% will approach the site from the east and 25% from the west.
- In the Lower Hunter SA3 area, the likely travel route for any commuter that resided in the north east of the statistical area would be to arrive via Tarro and approach the site from the east. All other commuters in the Lower Hunter SA3 would approach the site from the west. Given that the north east area of the Lower Hunter SA3 area comprises approximately 20% of the total statistical area, we have assumed a 1:5 approach ratio, with the remaining 80% approaching from the west.
- There was an equal likelihood of approaching the site from the east or the west for commuters residing in the Maitland SA3 area.
- 100% of commuters would approach the site from the east for the Port Stephens SA3 area.

The likely approach of workers to the site is summarised by statistical area in Table 3.

Table 3: Direction of approach to site, Google Maps, collated by author

Statistical area	Direction of approach	Number of trips approaching from the East	Number of trips approaching from the West
Newcastle (SA3)	75% East, 25% West	300	100
Lake Macquarie – East (SA3)	50% East, 50% West	149	149
Lake Macquarie – West (SA3)	50% East, 50% West	107	107
Lower Hunter (SA3)	20% East, 80% West	44	175
Maitland (SA3)	50% East, 50% West	111	111
Port Stephens (SA3)	100% East	193	0
Total		904	642

Using the estimated percentages of directional approach, it has been calculated that the proposed development will generate 904 inbound trips approaching from the east (58.5%) and 642 inbound trips approaching from the west (41.5%). Accordingly, the same distibution of outbound trips for employees to return home is estimated.

Current journey to work patterns

A substantial percentage of residents work outside of their statistical region of residence. Examination of this proportion assists in understanding the complete picture of the current distribution of workers in the industries, their places of residence and their places of work. This also demonstrates the relative level of mobility of workers. The percentage of people travelling for work, in any industry, outside their statistical region was determined through analysis of the 2016 ABS Census GeoPackage for Commuting Distance to Place of Work. Table 4 provides this detail.

Table 4: Percentage of residents working outside of region, ABS DTW_POW_GeoPackage 2016 Census, Accessed 18 May 2020

Statistical area	Percentage of residents who work out of region
Newcastle (SA3)	41%
Lake Macquarie – East (SA3)	67%
Lake Macquarie – West (SA3)	77%
Lower Hunter (SA3)	74%
Maitland (SA3)	65%
Port Stephens (SA3)	63%

Currently a higher proportion of residents from Lake Macquarie - West and the Lower Hunter travel outside their region for work. For the manufacturing and transport, postal and warehousing industries, travel is likely to be to areas of Western Sydney where jobs in those fields are currently located. It is likely that a number of residents currently leaving their area for work in these industries would prefer to work close to home, and a higher pull from this pool of commuters is considered likely.

Limitations

The information provided is based on a set of assumptions to produce theoretical outcomes. Many factors can result in a variance to the information provided. These include, but are not limited to:

- International trade agreements for the import and export of commodities
- Available industrial lands, and therefore jobs, in Western Sydney, their rate of uptake and development
- Migration rates to the broader region
- New technologies which improve automation in the subject industries
- Type of industry located on the site
- New residential land releases in the broader region

This information brief has not taken into consideration freight traffic generated for each allotment. The number of trucks entering and exiting the site and their directional approach would need to be determined by separate analysis.

Conclusion

It is considered reasonable to assume that workers travelling to the site from Maitland and the Lower Hunter will approach from a combination of east and west directions along John Renshaw Drive. Workers travelling from Port Stephens, Newcastle and Lake Macquarie are likely to approach exclusively from the east. Assuming a distribution of workers' place of residence that represents the existing distribution of workers in the area, this results in a split of trips that is 58.5% (904 workers) from the east and 41.5% (642 workers) from the west. The actual distribution of workers for the site is likely to be influenced by a large number of external factors including the availability of jobs in other areas, location of capital investment, new residential development and migration patterns, and international and domestic trade patterns which drive production.

Prepared by:	*Katrina Walker*
	Project Planner – Social and Economic
Date	*18 May 2020*
Reviewed by:	*Kirsty Tepper*
	Principal Planner – Social and Economic
Date	*19 May 2020*

B. SUBJECT SITE ASSESSMENT REPORT

B

LETTER

Transport Engineering

REF: N171072

DATE: 26 May 2020

F & F Properties
C/- Barr Property and Planning
92 Young Street
CARRINGTON NSW 2294

Attention: Mr Stephen Barr (Director)

Dear Stephen

RE: DP1057179 JOHN RENSHAW DRIVE, BLACK HILL – MICROSIMULATION MODELLING OPTIONS TESTING

Executive Summary

F & F Properties engaged GTA Consultants (GTA) to provide traffic and transport advice for the proposed large lot industrial development on land at DP1057179 on John Renshaw Drive, Black Hill (hereby referred to as the subject site). Extensive engagement with Transport for NSW (TfNSW) has resulted in the need to complete a VISSIM microsimulation model that considers the entire industrial precinct which is made up of the subject site and neighbouring Coal and Allied Land industrial estate development (the adjacent site). The site location and surrounding regional area together with the model extents in shown in Figure 1.

The microsimulation model is as robust as possible and based on sound information available at the time. The *subject site only* model indicates that with some localised upgrades, the surrounding road network can accommodate traffic generated by the proposed large lot industrial development. Inconsistencies do however remain, and it is clear that the TfNSW preferred assumptions, which we have been asked to adopt, together with several critical elements outside the scope of the model are significantly influencing the outcomes. These outcomes are unfavourably skewed with respect to the proposed large lot industrial development. In this regard, four critical aspects stand out:

- TfNSW preferred background traffic growth
- TfNSW preferred traffic distribution
- TfNSW assumed traffic generation rates
- M1 to Raymond Terrace (M12RT) bypass assumptions and future design uncertainty.

Any one of these aspects are likely to profoundly minimise the traffic impacts associated with the proposed development, noting especially traffic distribution and M12RT bypass assumptions.

The subject site proposes a large lot industrial subdivision that will generate relatively low traffic volumes during the road network peak hours. Heavy vehicles also comprise a larger proportional share of total traffic with 24/7 operations further 'flattening' the effects during the peaks.

Population growth in the Hunter region west of the site has not been captured in the traffic distribution that has needed to be applied to the model. Planning research appears to indicate that a much more

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significant proportion of traffic may approach and depart via the west, thereby significantly changing the extent of traffic impact on the road network east of the site, including the M1 / John Renshaw Drive / Weakleys Drive intersection. Should a more even distribution of site generated traffic be split between the east and west there would be up to 200 less vehicles travelling through this intersection and would lessen the extent of works that may be required at the intersection.

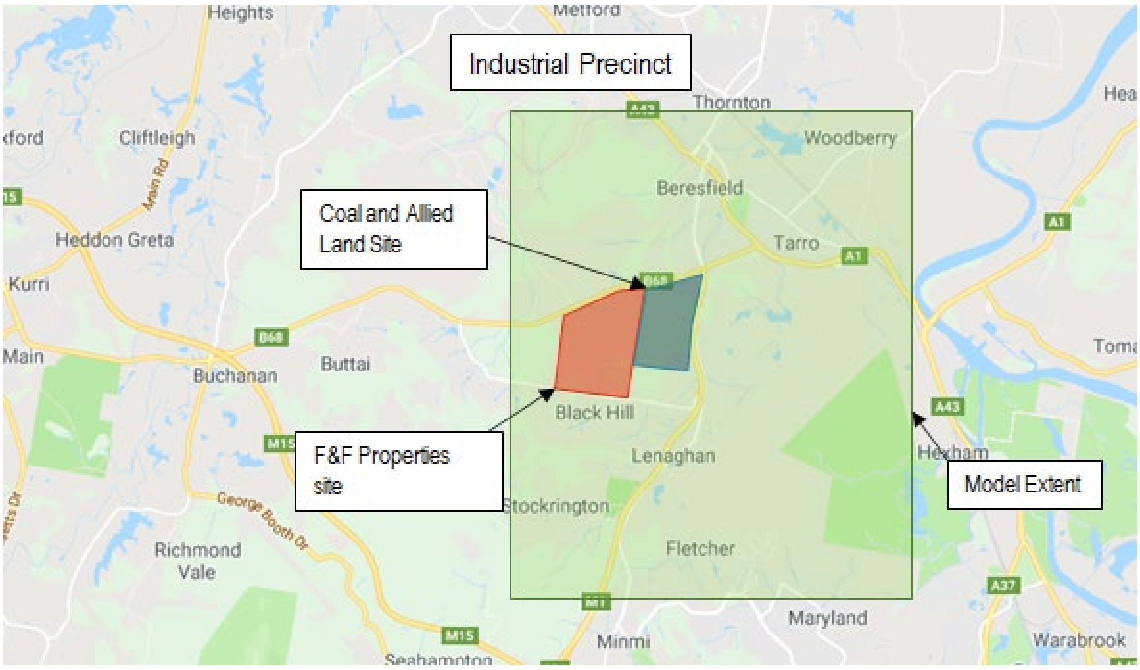
With regard to traffic distribution, TfNSW data suggests 80 per cent of trips will approach and depart via the east along John Renshaw Drive and 20 per cent via the west. Recent demographic data and trip times provided in a research piece by Barr Property and Planning suggest that this is not accurate with the directional split appearing to be more like 55 per cent via the east and 45 per cent via the west.

The assessment of the site and its impact on the surrounding network has been agreed to be modelled in defined stages based on the expected level of GFA development with 25 per cent developed by 2023 increasing to 100 per cent by 2032.

This study recognises that there are already existing constraints in the road network within the study area (and beyond) and note that while TfNSW recently upgraded the M1 / John Renshaw Drive / Weakleys Drive intersection from a roundabout to traffic signals, its own studies conclude that the upgraded intersection would likely fail sometime in the period to 2029 without further mitigating works.

This site-specific study identifies the traffic impacts of the development site in its own right and provides context to the traffic being generated by the subject site. It allows for context when compared with the adjoining site and background traffic growth over the life of the study and the expected delivery of the project over the next 13 years.

Figure 1: Industrial Precinct



Introduction and Overview

This letter has been prepared to outline the microsimulation modelling assessment as a result of the anticipated traffic generation of the ***subject site only***. This letter should also be read in conjunction with the traffic impact assessment of the broader industrial precinct, including analysis and results of the modelling assessment that is detailed in the options testing report prepared by GTA Consultants[1].

In this regard it is important to note that at the time of writing, the adjacent site development application continues to be subject to NSW Land and Environment Court proceedings with formal determination pending.

The project team has proactively worked with TfNSW with the resulting robust microsimulation model considering a range of development scenarios covering defined future years for the subject site. Similar to the Industrial Precinct modelling scenarios, there are several critical variables and TfNSW preferences that need to be highlighted given the extent of impact they have on the modelling outputs. In this regard it is noted that:

- The original TfNSW survey data is ageing and has needed to be growthed to establish 2019 as the base year.
- The local and regional area will undergo significant change over the period to 2032, notably the with the M1 to Raymond Terrace (M12RT) bypass and uncertainty remains over the final alignment and configuration (and hence the extent of benefit it will contribute to local area intersections, including the M1 / John Renshaw Drive / Weakleys Drive signalised intersection).
- The TfNSW preferred 1.5 per cent per annum traffic growth rate may not fully account for future commercial and residential development further to the west along the Hunter Expressway and Hunter region generally, an area that is expected to undergo significant growth. This will significantly affect traffic distribution and the resultant background traffic impacts on key intersections.
- A nominal shift in traffic distribution has been applied to partially account for greater Hunter region growth to date than that allowed for in the M12RT bypass model. A minor redistribution of traffic to/ from the west along John Renshaw Drive has been applied and amounts to an increase from 20 per cent to 25 per cent.
- Travel time assessments confirm that use of John Renshaw Drive (west of the site) and the Hunter Expressway to access the M1 and Newcastle Link Road (rather than John Renshaw Drive east of the site and the M1) would be more favourable. This is a result of more consistent travel times (especially for heavy vehicles) and time of day impacts, especially during the future years when background traffic growth affects travel times.
- The subject site proposes a large lot industrial subdivision that will generate relatively low traffic volumes during the road network peak hours. Heavy vehicles also comprise a larger proportional share of total traffic with 24/7 operations further ‘flattening’ the effects during the peaks.
- It is recognised that large lot industrial sites are unlikely to generate traffic volumes in the future at the same level as they do today. This is a result of many influencing factors, including technological advancements such as:
    - higher mass limits for heavy vehicles and associated incentives (GPS tracking technology)
    - ongoing trend towards heavy industrial automation
    - autonomous vehicles (including dedicated employee autonomous buses and on-demand buses), and more favourable use of efficient and targeted public transport services
    - commercial drones and their practical application to local / regional deliveries etc.

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[1] John Renshaw Drive, Black Hill Industrial Precinct, Microsimulation Modelling Options Testing Report, GTA Consultants, 25 May 2020.

- Traffic generation rates are expected to further reduce in future years and be less than the 0.185 trips per 100 square metres adopted in this assessment. In this regard, this model is considered to a 'worse case' scenario or is at least, highly conservative.

Overview of Options

Given the significance of the industrial precinct and proximity to the planned M1 to Raymond Terrace (M12RT) bypass, a collaborative effort between the project team and TfNSW has been key with several options developed and scenarios tested as part of the assessment.

The same development staging and access arrangements have been retained as part of this subject site only model, with the extent and timing of the road network mitigation varying from that necessary to support the development of the broader industrial precinct. This approach is critical to better define the traffic impacts of the site in isolation and positively responds to uncertainty surrounding the proposed adjacent site development.

The following sections outline the key considerations specific to the site, as well as other contextual considerations required to inform the development and testing of scenarios.

Development Staging

The assessment of the site and its impact on the surrounding network has been agreed to be modelled in defined stages based on the expected level of Gross Floor Area (GFA) development. The respective design years at each completion stage are summarised in Table 1.

Table 1: Subject site staging

Site stage	Design year
25% GFA developed	2023
50% GFA developed	2026
75% GFA developed	2029
100% GFA developed	2032

Site Access Arrangements

It is important to note that traffic modelling associated the subject site only assessment is conservative, especially when considering the proposed site access arrangements and intersection layouts. The adopted intersection layouts as shown in Figure 2 and Figure 3 are consistent with those included in the original DA and the precinct model itself. Such intersection configurations are unlikely to be required to be developed in full, particularly when considering the interim development stages.

Figure 2: Modelled eastern signalised intersection layout

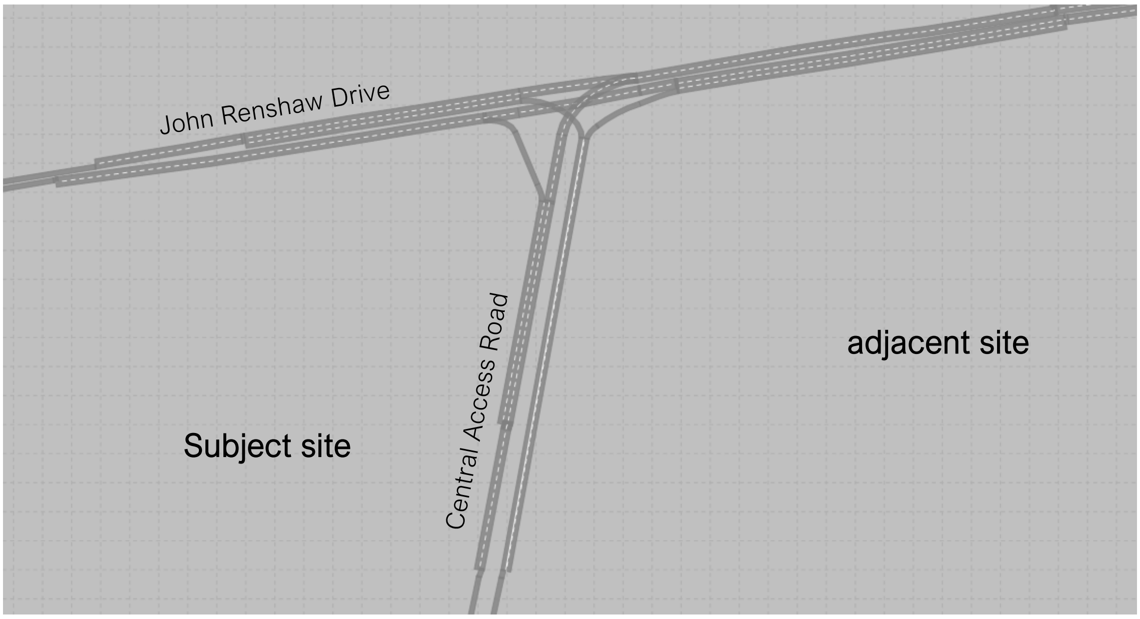
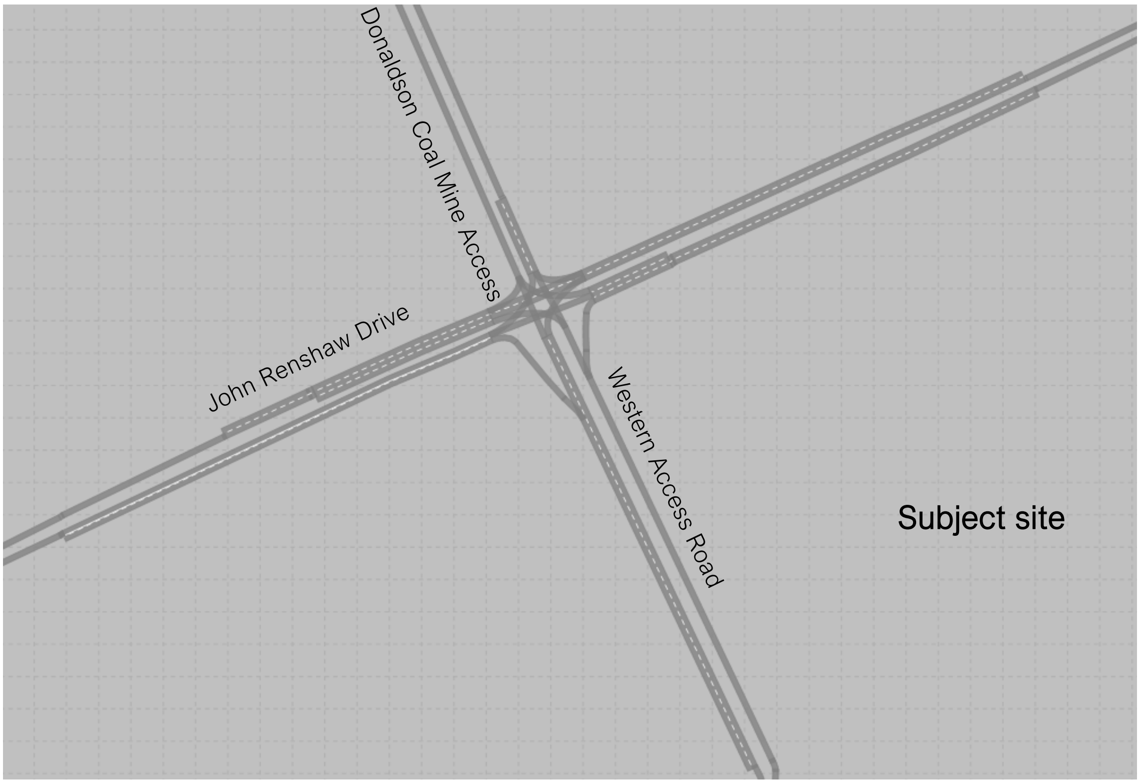


Figure 3: Modelled western signalised intersection layout



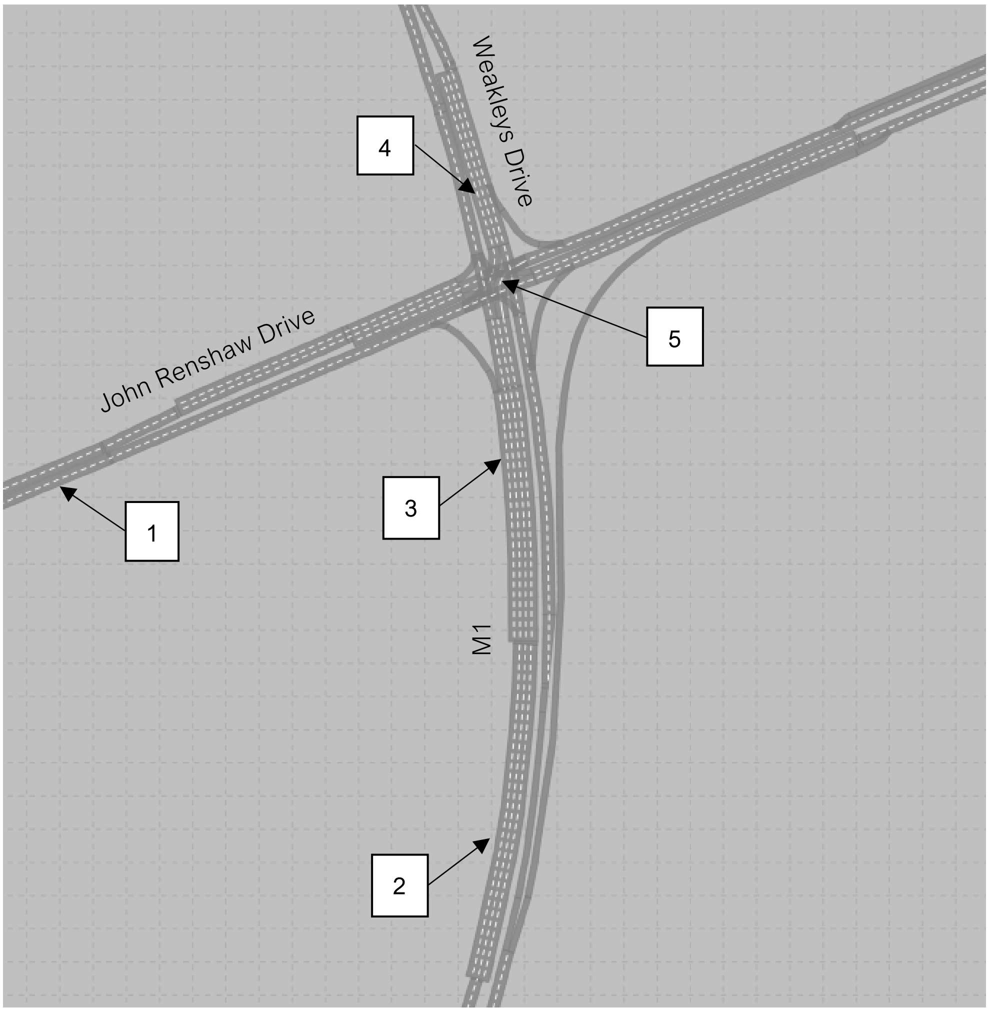
Road Network Mitigation Options

A preliminary assessment of the road network impacts in the industrial precinct model identified congestion for select movements. As such, it was agreed with TfNSW that additional mitigation works could be considered at the M1 / John Renshaw Drive / Weakleys Drive from the 50 per cent GFA developed scenario and onwards.

The following outlines the mitigation works assumed at the M1 / John Renshaw Drive / Weakleys Drive intersection, as shown in Figure 4 and denoted by the following item numbers:

1. Duplication of John Renshaw Drive between the eastern site access and M1 in both directions.
2. Extension of Lane 1 to the start of the right turn lane on the M1 south approach to the M1 / John Renshaw Drive / Weakleys Drive intersection.
3. Addition of left turn slip lane on the M1 south approach to the M1 / John Renshaw Drive / Weakleys Drive intersection.
4. Duplication of right turn onto John Renshaw Drive from Weakleys Drive.
5. Signal phase time redistribution to accommodate future year traffic demands in the various scenarios.

Figure 4: Mitigation works modelled for M1 / John Renshaw Drive / Weakleys Drive



Summary of Scenarios Tested

A summary of the modelling scenarios that were agreed to be assessed as part of the industrial precinct microsimulation model and subsequently also adopted for the purposes of the subject site only model are detailed in Table 2.

Table 2: Scenario summary

Scenario	Name	Design year	Percentage of site developed	F& F Properties Site access	M12RT included?	Mitigation works
1	Base	2019	0%	-	No	No
2	Future Base	2032	0%	-	No	No
3	25% GFA developed	2023	25%	Eastern signalised access	No	No
4	50% GFA developed	2026	50%	Eastern signalised access + western signalised access + internal road network	No	Yes
5	50% GFA developed	2026	50%	Eastern signalised access + western signalised access + internal road network	Yes	Yes
6	75% GFA developed	2029	75%	Eastern signalised access + western signalised access + internal road network	Yes	Yes
7	100% GFA developed	2032	100%	Eastern signalised access + western signalised access + internal road network	Yes	Yes

Future Year Demand

The site has been assessed at the agreed various stages of GFA development and represented by the respective design years. Future traffic demand assumptions have been calculated for each of the respective stages to accurately provide inputs to the model.

Background Traffic Growth

As advised by TfNSW background traffic growth assumptions of 1.5 per cent per annum has been applied to the base model demand up to the respective design years.

In addition, while the M12RT bypass has not been physically included in the modelling assessment, the impact of the M12RT bypass on future year traffic demands has been considered based on information provided by TfNSW. Table 3 outlines the agreed assumptions regarding the reduction (or redistribution) of traffic demand following the implementation of the M12RT bypass.

It was also assumed that the M12RT bypass would likely open somewhere between the 50% GFA developed and 75% GFA developed stage of development (between 2026 and 2029).

Table 3: M12RT bypass traffic redistribution

Movement	AM peak redistribution	PM peak redistribution
Northbound right turn at John Renshaw Drive / M1 / Weakleys Drive intersection	**65%** of current or future demands to be redistributed onto the M12RT bypass.	**40%** of current or future demands to be redistributed onto the M12RT bypass.
Southbound left turn at John Renshaw Drive / M1 / Weakleys Drive intersection	**45%** of current or future demands to be redistributed onto the M12RT bypass.	**35%** of current or future demands to be redistributed onto the M12RT bypass.

Site Traffic Generation and Distribution

Traffic generation estimates for the site have been sourced from rates for other industrial estates referenced in the *Guide to Traffic Generating Developments Updated Traffic Surveys Technical Direction* (TDT 2013/04a). Traffic rates for the Erskine Park and Eastern Creek industrial sites which are considered similar to the proposed development in terms of size and accessibility have an average traffic generation rate of 0.185 trips per 100 square metres. It is noted that this rate represents the average site peak traffic generation rate however has been conservatively applied to the surrounding road network weekday AM and PM peak hours for the purpose of this assessment.

It is noted that industrial land uses, especially large lot industrial sites tend to have their peaks in the 'shoulder' road network peak periods rather than strictly at the same time as the road network peak. This reflects the tendency for large lot industrial sites to mostly operate 24/7, have a greater proportion of heavy vehicles and less concentrated employee demand. Shift changeover periods also tend to be outside typical peak periods with all combining to result in a greater spread of traffic across the day and night.

Nevertheless, the distribution assumptions for the site have also been estimated following ongoing consultation with TfNSW. Table 4 outline these assumptions with [1] slight increase from 20% to 25% to partly reflect greater growth in the Hunter region west of the site

Table 5 summarising the resultant traffic generation of the subject site.

Table 4: Traffic generation and distribution constants

Type		Value
Trip Generation	AM	0.185 per 100m^2 GFA
	PM	0.185 per 100m^2 GFA
Entry / Exit Movements	AM	66.3% / 33.7%
	PM	36.3% / 63.7%
Heavy Vehicle Percentage	AM	20%
	PM	15.5%
AM Trip Distribution (Entry / Exit)	South	30% / 15%
	West	25% / 25% [1]
	East	25% / 40%
	North	20% / 20%
PM Trip Distribution (Entry / Exit)	South	15% / 30%
	West	25% / 25% [1]
	East	40% / 25%
	North	20% / 20%
Lot Yield		26% GFA

[1] slight increase from 20% to 25% to partly reflect greater growth in the Hunter region west of the site

Table 5: Site traffic generation

Size (NDA in ha)	Size (GFA in sqm)	Traffic generation estimates (trips / hour)							
		AM				PM			
		25%[1]	50%[1]	75%[1]	100%[1]	25%[1]	50%[1]	75%[1]	100%[1]
160.3	416,780	193	386	578	771	193	386	578	771

[1] GFA developed

At the initial stage of the development (25% GFA developed), the site is expected to generate in the order of 190 vehicle movements per hour in the AM and PM peak hours. This incrementally builds up to approximately 770 vehicle movements per hour in the AM and PM peak hours at the full stage of development (100% GFA developed).

Operational Assessment Comparison

The modelling scenarios detailed in Table 2 have been assessed in the VISSIM microsimulation model in order to understand and inform the potential impacts of the subject site in isolation on the surrounding road network. Key network and intersection performance metrics for the critical AM and PM peak hours have been reported as indicated in the following sections, with full model results included as attachments to this letter.

Base Model Performance

A 2019 Base Model was initially developed to provide a robust model structure and framework from which future year options could be based upon. Details of the development of the base model and the performance of the network are included in the Microsimulation Modelling Options Testing Report prepared by GTA Consultants.

Assessment of Future Year Scenarios

Network Performance

Network performance results have been extracted from the model which represent the overall network operating performance across all roads and links in the model network. As such, this enables an understanding of the overall performance impacts of the development scenarios and stages across the broader road network, including roads and intersections that may not be directly relevant to the site.

The following key network performance metrics have been extracted from the model for comparative purposes:

- Average delay (in seconds) – average delay for all vehicles in the network.
- Average network speed (in km/h) – average speed of all vehicles in the network.
- Total vehicle kilometres travelled (VKT) – total distance travelled for all vehicles.
- Total vehicle hours travelled (VHT) – total travel time for all vehicles.
- Total Stops – total number of stops experienced by all vehicles.
- Latent demand – number of vehicles unable to enter the model network.
- Total demand – sum of vehicles that have started and completed their journey through the network, as well as latent demand.

Table 6 and Table 7 summarises the network results for the modelled peak periods, with full results included in Attachment 1.

It is also important to note that the staged development approach also ensures that actual traffic generation rates associated with the large lot industrial development will be able to be surveyed to ensure consistency of approach as part of the future year scenario testing. With this in mind, it is critical to recognise that large lot industrial precincts are also unlikely to generate traffic volumes in the future at current levels, with technological advancements (automation, drone use etc.) expected to heavily influence many operational characteristics. Traffic generation rates are expected to further reduce in future years, with this model considered to reflect a 'worse case' scenario or at least considered highly conservative.

Table 6: AM peak network performance results (8am to 9am)

Metric		Base (2019)	No M12RT			With M12RT		
			Future Base (2032)	25% GFA developed (2023)	50% GFA developed (2026)	50% GFA developed (2026)	75% GFA developed (2029)	100% GFA developed (2032)
Average Delay	Sec	58	118	86	136	71	126	194
Average Speed	km/h	67	57	62	55	64	56	48
Total VKT	km	67,755	74,452	74,209	80,831	70,687	75,875	81,593
Total VHT	h	1,011	1,305	1,189	1,466	1,109	1,365	1,706
Total Stops	no.	8,724	48,388	23,603	57,210	13,444	38,140	95,643
Latent Demand	no.	0	56	0	0	0	0	73
Total Demand	no.	9,376	10,849	10,444	11,453	10,133	11,089	12,163

Table 7: PM peak network performance results (5pm to 6pm)

Metric		Base (2019)	No M12RT			With M12RT		
			Future Base (2032)	25% GFA developed (2023)	50% GFA developed (2026)	50% GFA developed (2026)	75% GFA developed (2029)	100% GFA developed (2032)
Average Delay	Sec	47	121	60	87	62	95	202
Average Speed	km/h	70	58	67	63	66	61	48
Total VKT	km	77,198	86,491	82,891	89,245	82,245	87,978	93,418
Total VHT	h	1,108	1,499	1,232	1,418	1,238	1,442	1,937
Total Stops	no.	7,125	55,625	11,387	21,943	11,762	29,421	175,931
Latent Demand	no.	0	0	0	0	0	0	0
Total Demand	no.	10,453	12,140	11,304	12,196	11,452	12,347	13,429

The network performance results presented Table 6 and Table 7 indicate the following key outcomes:

- There is a general decline in network operating performance as the development stages grow in both the AM and PM peaks which can be expected due to the increase in both background and site traffic on the road network.

- The introduction of the M12RT at the 50% GFA developed stage results in an overall network performance similar to the 25% GFA developed stage without the M12RT. Should the M12RT not be introduced at the 50% GFA developed stage, the network is still considered to operate at a satisfactory level, however logically worse than the with M12RT scenario.
- At the later stages of development (75% and 100%) in both the AM and PM peaks, network performance metrics decline more noticeably with key metrics such as average speed and average delay becoming comparable (75%) or worse (100%) than the Future Base in 2032 conditions.
- Notwithstanding, it is noted that visual observations of the model operations (supported by the average speed plots in the following section) indicate that the localised traffic impacts as a result of the subject site can be mitigated by the proposed improvement works in the relevant stages, with wider network constraints impacting the overall network performance (such as John Renshaw Drive to New England Hwy A1 merge, New England Highway / Weakleys Drive intersection and congestion in the Thornton / Beresfield areas etc.).

Network Average Speed Plots

Average speed plots for the critical peak hour in each peak are illustrated in the following figures to visualise the general network operation. These are useful in understanding the propagation of queues and delays that are expected on the road network, as well as identifying areas that may experience high levels of congestion.

It is noted that the plots reflect the average speed (in km/h) of all road sections across the reported peak hour and based on the colour scale outlined in Table 8.

Table 8: Average speed classification

Colour	Definition	Average Speed (km/h)
	Queues formed	0km/h to 10km/h
		10km/h to 20km/h
		20km/h to 30km/h
		30km/h to 40km/h
		40km/h to 50km/h
		50km/h to 60km/h
		60km/h to 80km/h
		80km/h to 100km/h
	Freeflow conditions	Greater than 100km/h

The following average speed plots illustrate an overview of the performance across the entire modelled network. More detailed plots are also included in Attachment 2.

Figure 5: AM peak network average speed (8am to 9am) – Future Base (2032)

Figure 6: AM peak network average speed (8am to 9am) – 25% GFA developed (2023) No M12RT

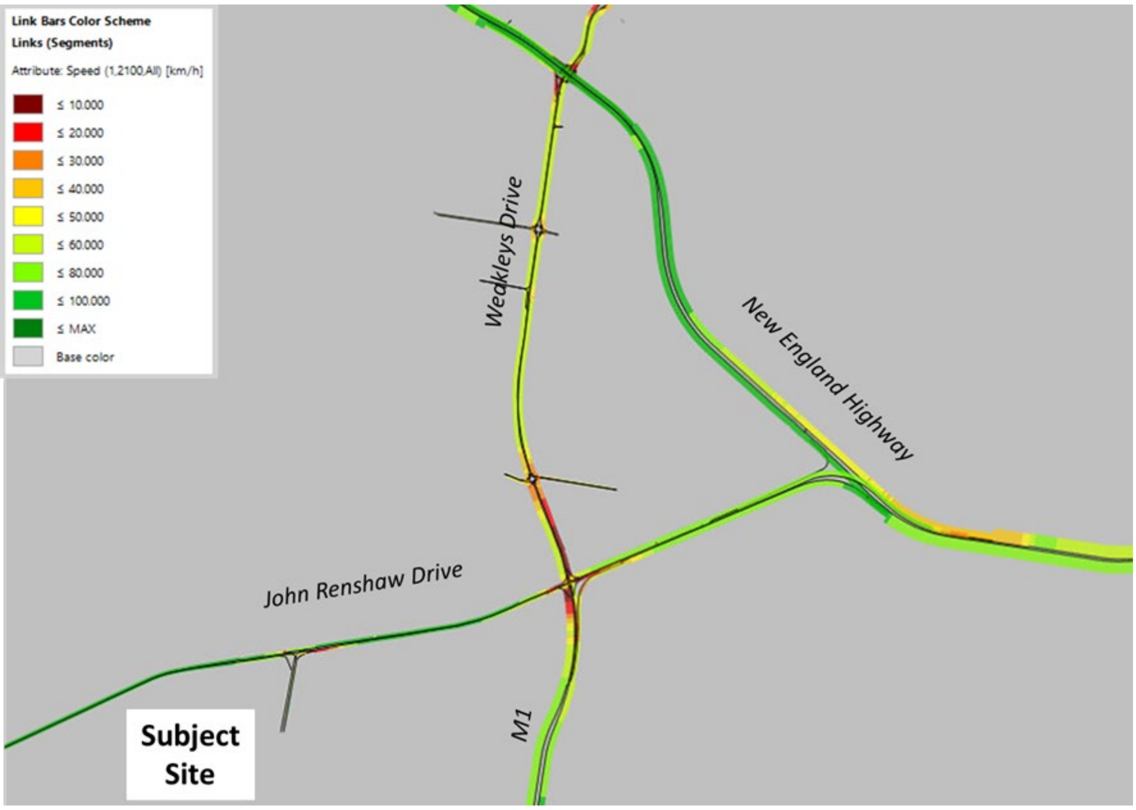


Figure 7: AM peak network average speed (8am to 9am) – 50% GFA developed (2026) No M12RT

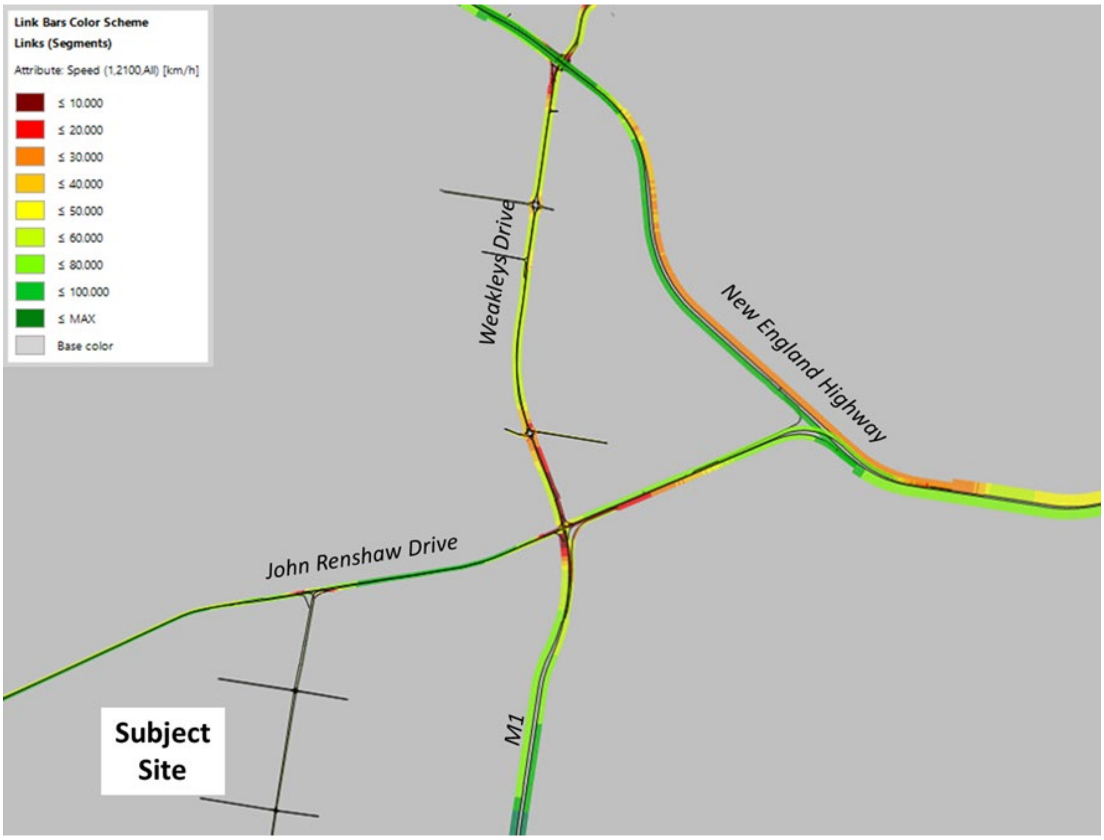


Figure 8: AM peak network average speed (8am to 9am) – 50% GFA developed (2026) With M12RT

Figure 9: AM peak network average speed (8am to 9am) – 75% GFA developed (2029) With M12RT

Figure 10: AM peak network average speed (8am to 9am) – 100% GFA developed (2032) With M12RT

Figure 11: PM peak network average speed (5pm to 6pm) – Future Base (2032)

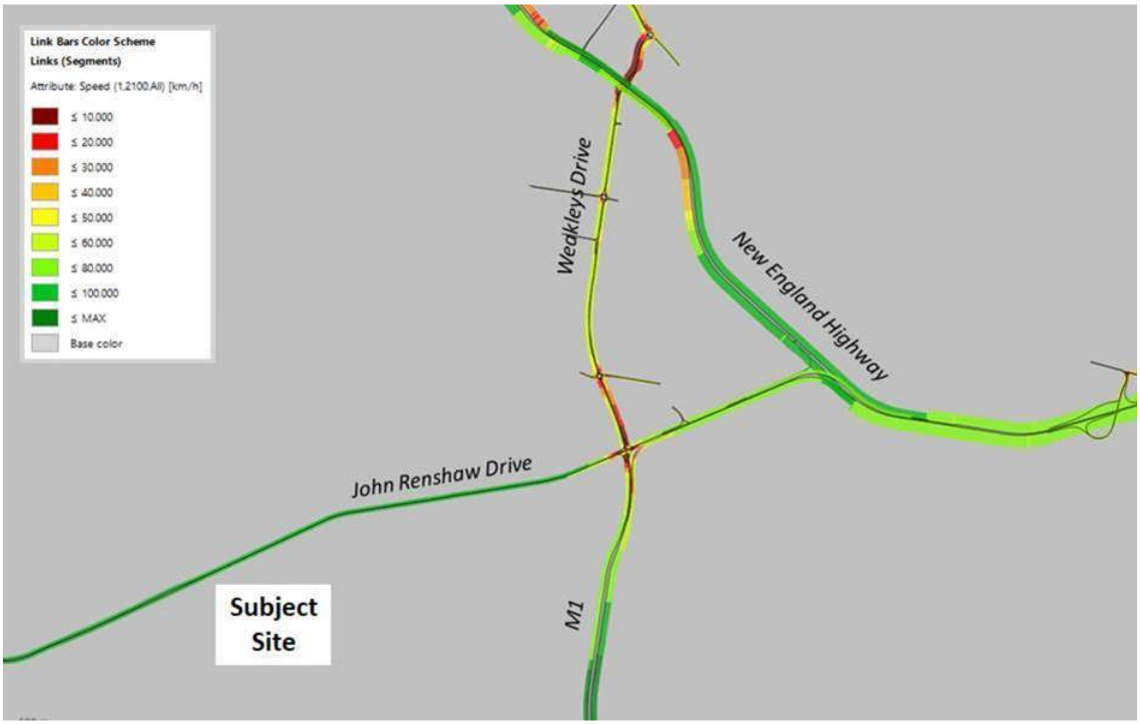


Figure 12: PM peak network average speed (5pm to 6pm) – 25% GFA developed (2023) No M12RT

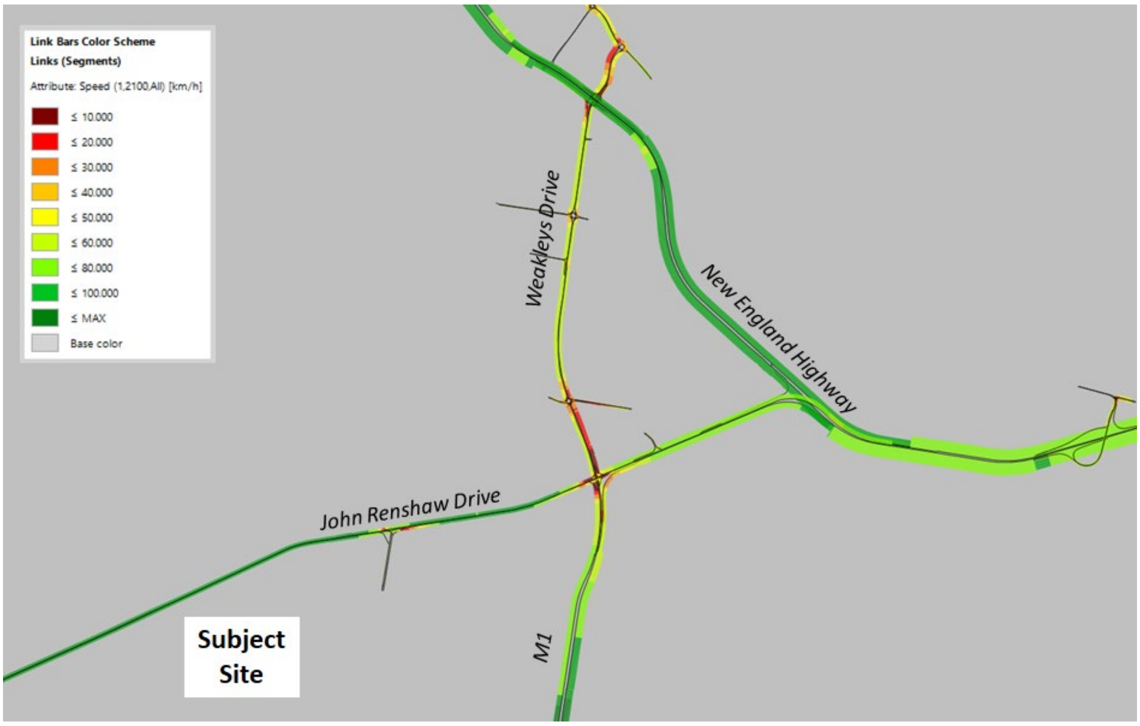


Figure 13: PM peak network average speed (5pm to 6pm) – 50% GFA developed (2026) No M12RT

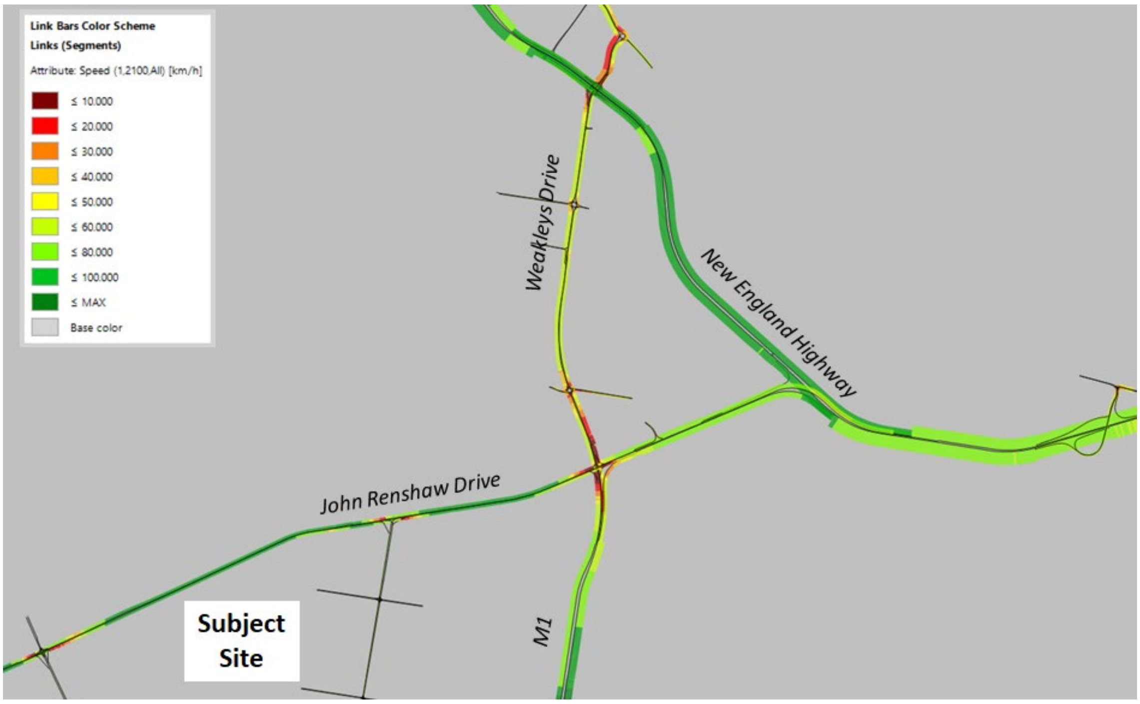


Figure 14: PM peak network average speed (5pm to 6pm) – 50% GFA developed (2026) With M12RT

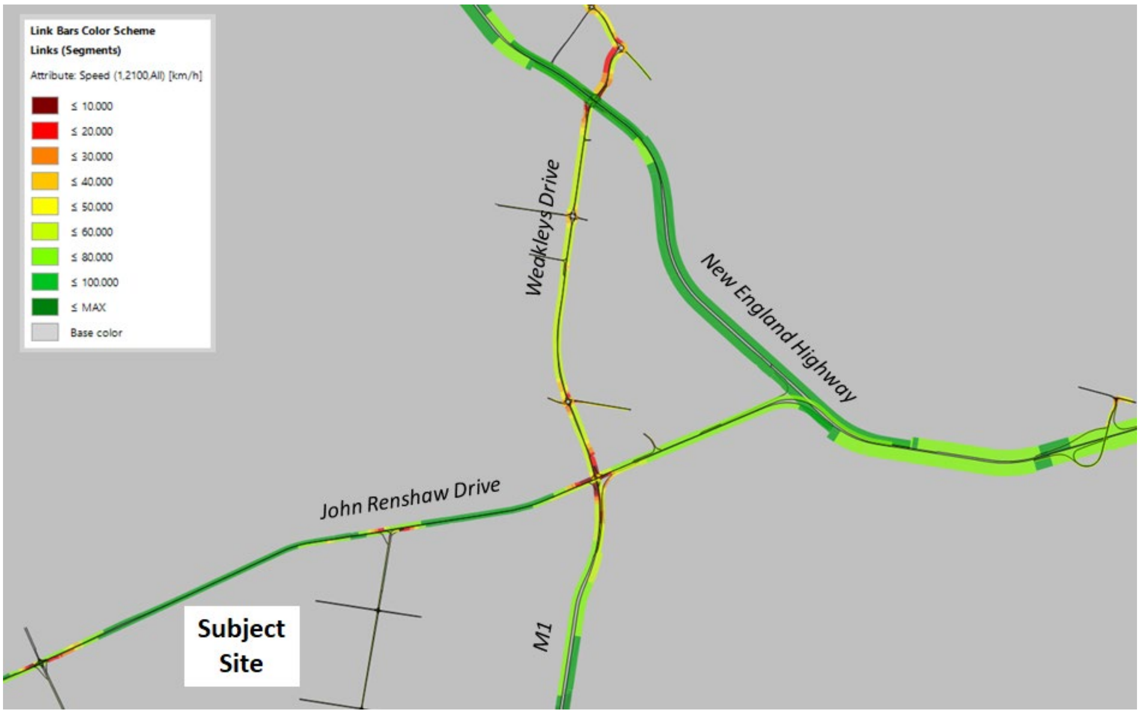


Figure 15: PM peak network average speed (5pm to 6pm) – 75% GFA developed (2029) With M12RT

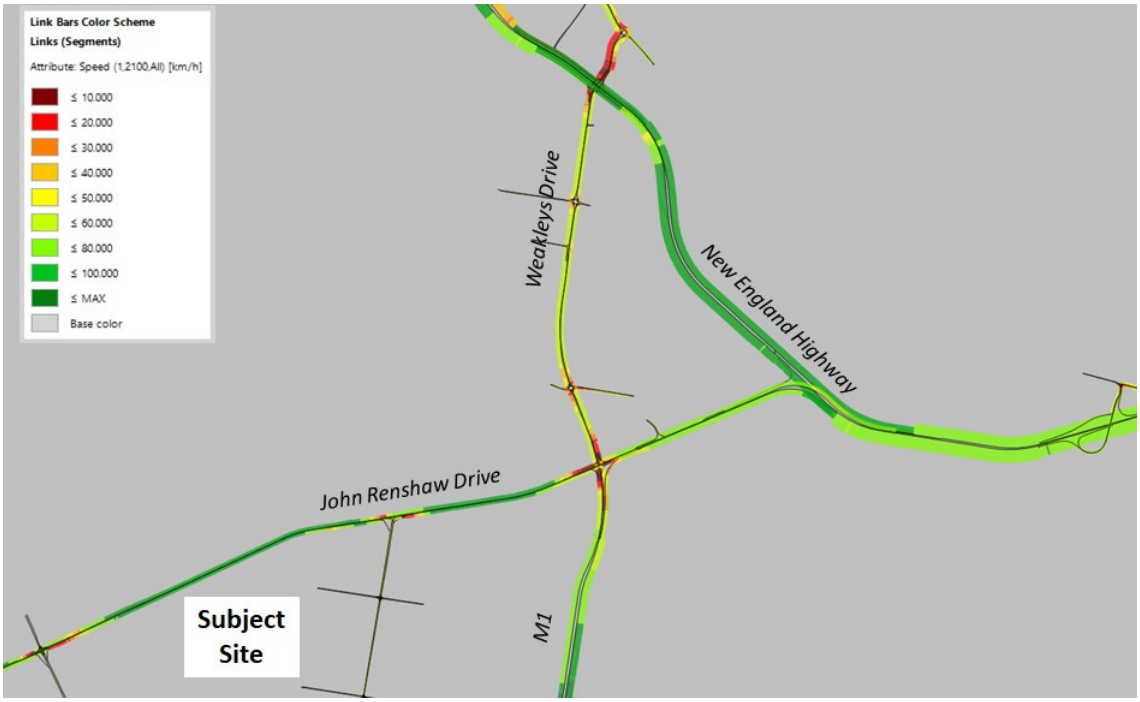
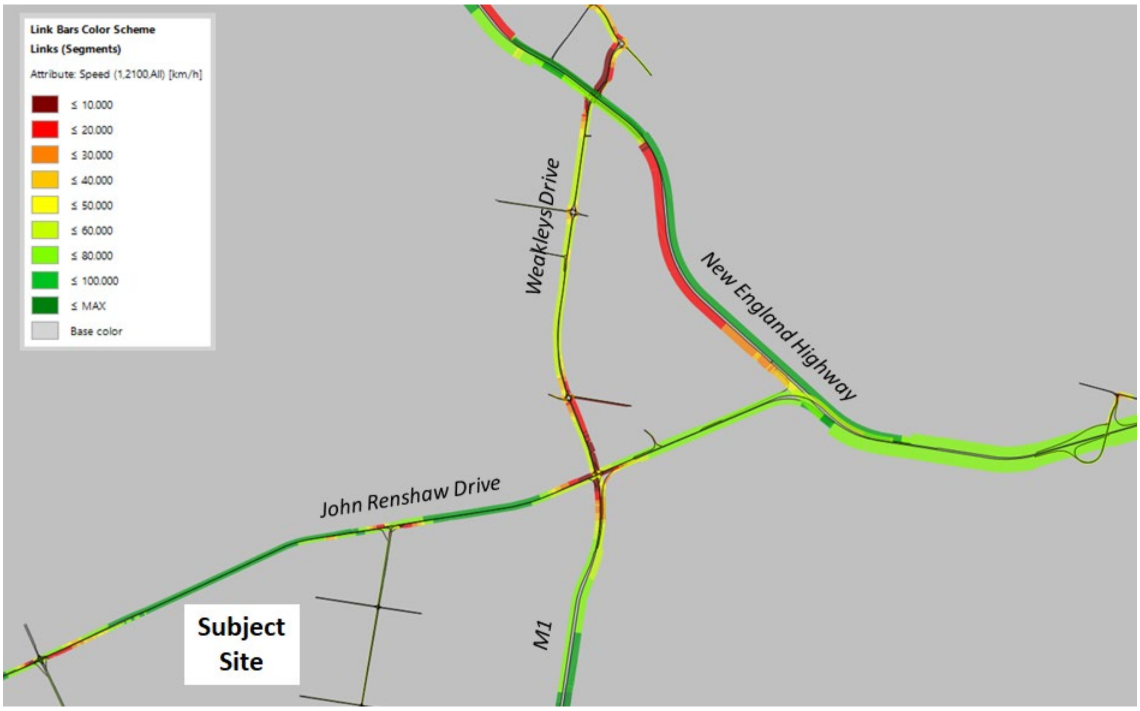


Figure 16: PM peak network average speed (5pm to 6pm) – 100% GFA developed (2032) With M12RT



The average speed plots for the critical AM and PM peak hours as presented in Figure 5 to Figure 16 indicate the following key outcomes:

- There is a generally consistent trend in congestion spots in the network during both the AM and PM peaks which progressively slightly worsens as the development stages grow.

- Congestion has been identified as the M1 / John Renshaw Drive / Weakleys Drive intersection with the critical approaches including:
  - John Renshaw Drive east approach in the AM peak
  - Weakleys Drive north approach in both AM and PM peaks.
- While some queues and delays can be expected to form at the M1 / John Renshaw Drive / Weakleys Drive intersection, mostly evident in the 75% and 100% GFA developed stages, the impacts of these queues are localised and are not expected to interrupt the performance of the surrounding network.
- The proposed mitigation measures at this intersection, as identified in the 'Road Network Mitigation Options' section of this letter are able to accommodate the anticipated increase in traffic volumes (background and site generated) in all development stages.
- In addition, the average speed plots indicate that in various scenarios, there are some wider disruptions to network performance particularly north of the New England Highway in Beresfield and Thornton and the John Renshaw Drive to New England Highway eastbound merge. These are also influenced by background traffic growth with delays not significantly different form the Future Base 2032 scenario.
- The average speed along John Renshaw Drive appears to be maintained throughout all stages of development, with some minor delays experienced as a result of the introduction of signalised access points to the site which can be expected.

Travel Times

Travel times have been recorded in the model to report on the travel time for the key road corridors shown in Figure 17 and described in Table 9. The travel time results provide an understanding of where potential increases in delays may occur along these corridors during the reported AM and PM peak hours with the results summarised in Figure 18 and Figure 19. Full results are also included in Attachment 3.

Figure 17: Travel time routes

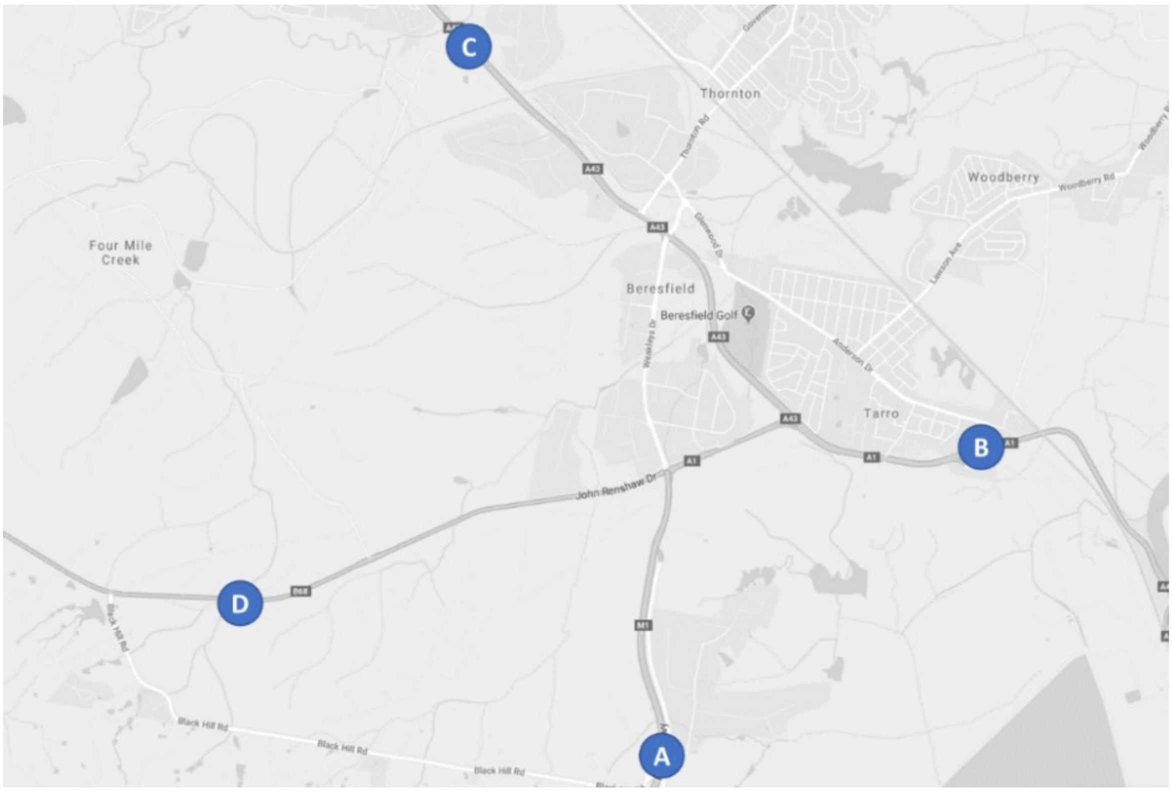


Table 9: Travel time route description

Reporting Description			Full Description
ID	Direction	Description	
A - B	EB	M1 to A1	General eastbound direction from Pacific Motorway (M1) near Black Hill Road interchange to New England Highway (A1) near Tarro Interchange, travelling via John Renshaw Drive.
B - A	WB	A1 to M1	General westbound direction from New England Highway (A1) near Tarro Interchange to Pacific Motorway (M1) near Black Hill Road interchange, travelling via John Renshaw Drive.
A - C	NB	M1 to A43	General northbound direction from Pacific Motorway (M1) near Black Hill Road interchange to New England Highway (A43) near Four Mile Creek, travelling via Weakleys Drive.
C - A	SB	A43 to M1	General southbound direction from New England Highway (A43) near Four Mile Creek to Pacific Motorway (M1) near Black Hill Road interchange, travelling via Weakleys Drive.
D - B	EB	JRD to A1	General eastbound direction from John Renshaw Drive (JRD) near Four Mile Creek to New England Highway (A1) near Tarro Interchange.
B - D	WB	A1 to JRD	General westbound direction from New England Highway (A1) near Tarro Interchange to John Renshaw Drive (JRD) near Four Mile Creek.

Figure 18: AM peak travel time results in seconds (8am to 9am)

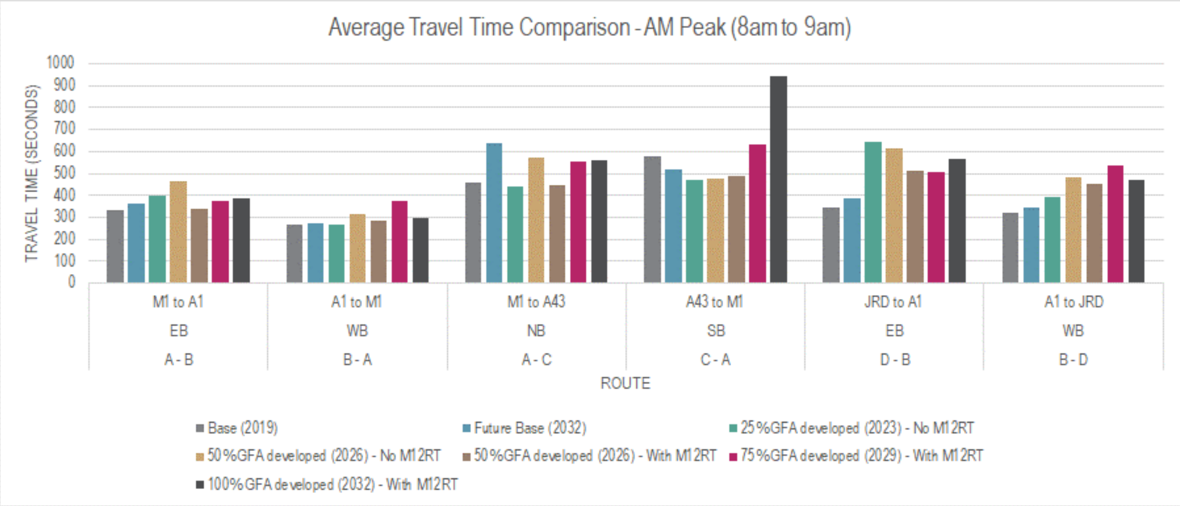
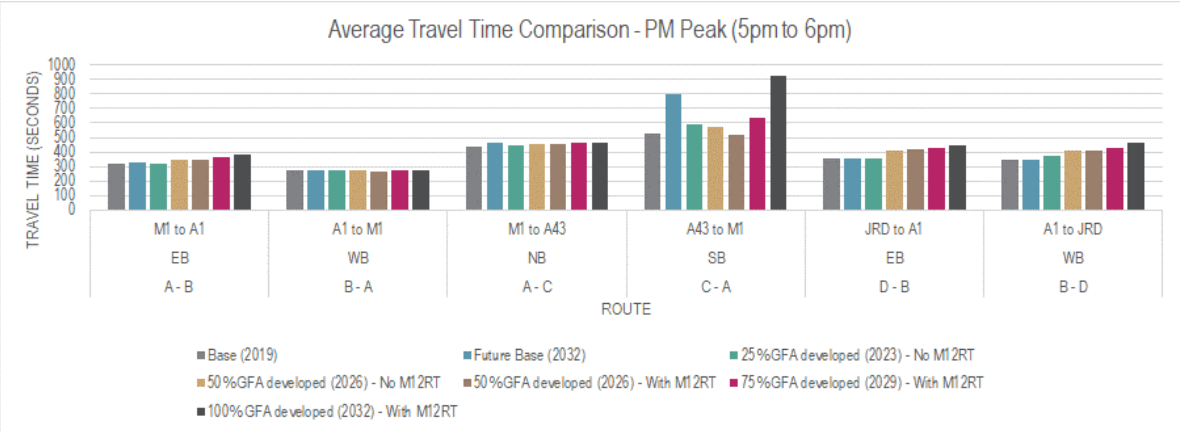


Figure 19: PM peak travel time results in seconds (5pm to 6pm)



The travel time results presented in the figures above generally indicate the following:

- In both the AM and PM peaks, the majority of routes are able to maintain consistent travel times during the early stages of the development.
- The 50% GFA developed stage without the M12RT is expected to result in some increases to travel times during both peaks, most notably along the M1, John Renshaw Drive and New England Highway. However, the introduction of the M12RT at the 50% GFA developed stage results in travel times that are somewhat consistent with the 25% GFA developed stage.
- During the 75% and 100% GFA developed stages, travel times for the Weakleys Drive link between the A43 and M1 are expected to experience increased travel times compared to the previous development stages and generally comparable to or slightly above the Future Base in 2032. This is mostly for the southbound direction. It is noted too that the majority of the delay is at the northern end around the New England Highway with existing background traffic congestion a significant contributor.
    - In the northbound direction, the capacity constraints at the New England Highway / Weakleys Drive intersection and beyond results in some upstream delays that reduce the efficiency of Weakleys Drive northbound throughput particularly in the AM peak.

- In the southbound direction, queues and delays are expected on the New England Highway off ramp to Weakleys Drive which extend beyond the ramp storage length. This is caused by the congestion in the Thornton precinct, in particular at the Weakleys Drive / Glenwood Drive roundabout, which queues back onto the New England Highway / Weakleys Drive intersection blocking traffic flow at select times during the peak hour. In addition, the model also indicates some increase in queues on the north approach to the M1 / John Renshaw Drive / Weakleys Drive intersection which also increases the travel time experienced along this route.

Intersection Performance

The intersection Level of Service (LOS) for key signalised intersections are summarised for critical peak periods in Figure 20 to Figure 33, with full results included in Attachment 4. The LOS is based on the average delay as per the TfNSW classification which is replicated in Table 10.

Table 10: Intersection LOS classification

LOS Level	Average Delay (seconds)	
	From	To
A	0	14.5
B	14.5	28.5
C	28.5	42.5
D	42.5	56.5
E	56.5	70.5
F	70.5	9,999

Figure 20: AM peak (8am – 9am) base

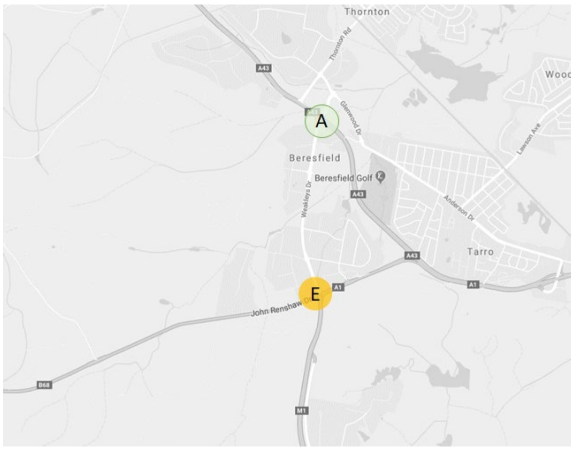


Figure 21: AM peak (8am – 9am) future base

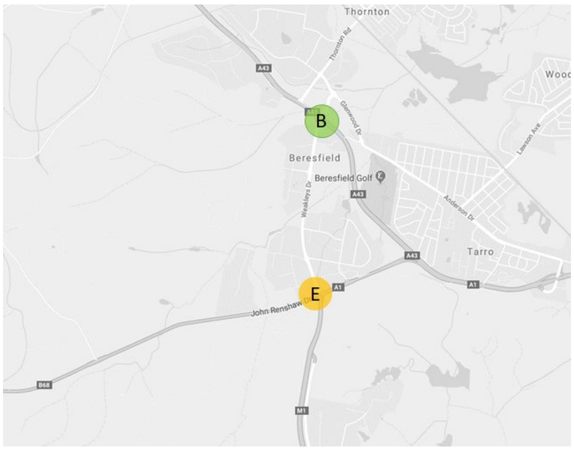


Figure 22: AM peak (8am – 9am) 25% GFA developed no M12RT

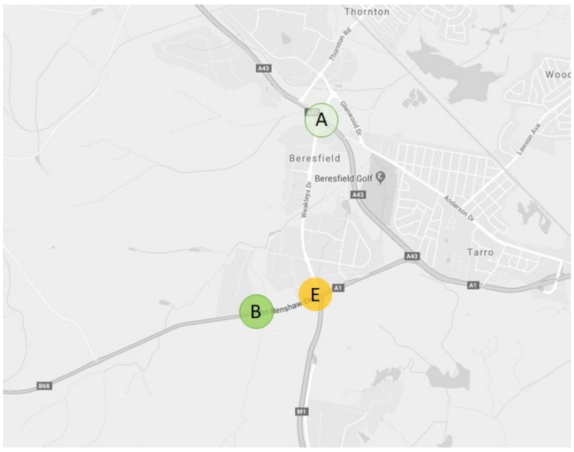


Figure 23: AM Peak (8am – 9am) 50% GFA developed no M12RT

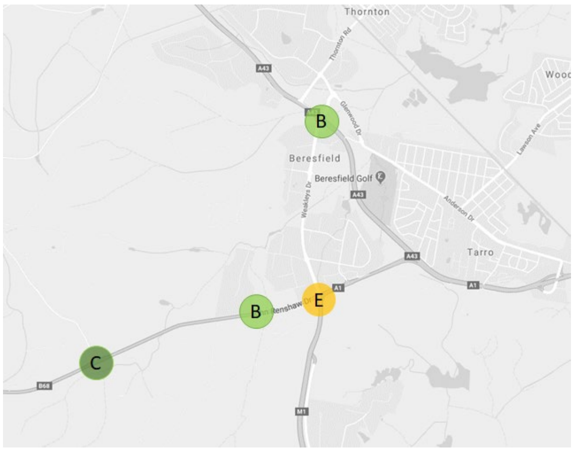


Figure 24: AM peak (8am – 9am) 50% GFA developed with M12RT

Figure 25: AM peak (8am – 9am) 75% GFA developed with M12RT

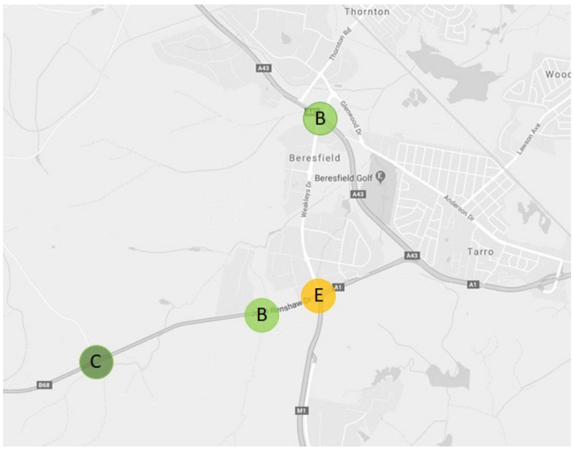


Figure 26: AM peak (8am – 9am) 100% GFA developed with M12RT

Figure 27: PM peak (5pm – 6pm) base

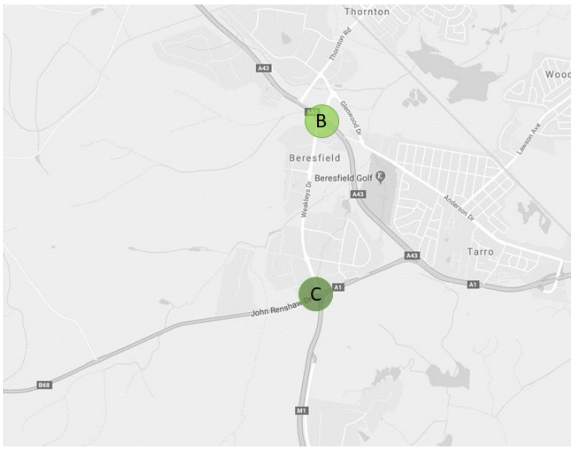


Figure 28: PM peak (5pm – 6pm) future base

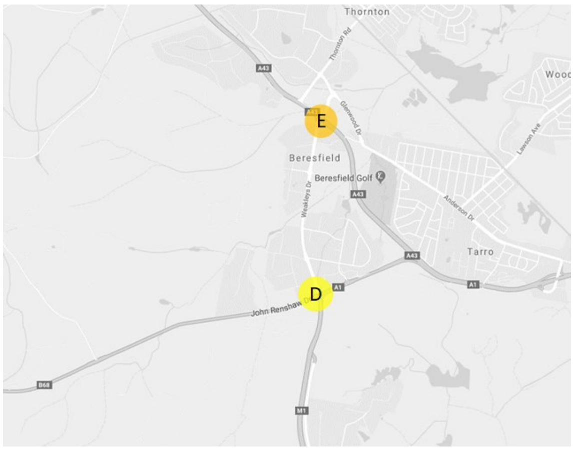


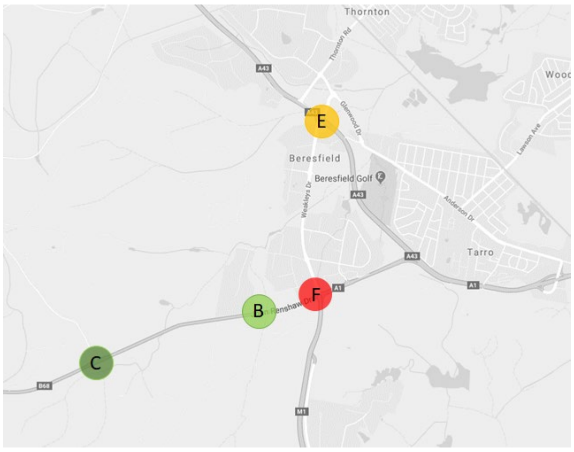
Figure 29: PM peak (5pm – 6pm) 25% GFA developed no M12RT

Figure 30: PM Peak (5pm – 6pm) 50% GFA developed no M12RT

Figure 31: PM peak (5pm – 6pm) 50% GFA developed with M12RT

Figure 32: PM peak (5pm – 6pm) 75% GFA developed with M12RT

Figure 33: PM peak (5pm – 6pm) 100% GFA developed with M12RT



The intersection performance results indicate the following key outcomes:

- The critical intersection within the network is the M1 / John Renshaw Drive / Weakleys Drive intersection in both the AM and PM peaks which can be expected to experience the highest delays on the network.
- In the AM peak, the M1 / John Renshaw Drive / Weakleys Drive intersection can be expected to experience LOS D or LOS E across all stages of the development. This indicates that the intersection can be expected to operate at a satisfactory level of performance and able to accommodate the increase traffic volumes as a result of background traffic growth and development of the subject site only.
- In the PM peak, the M1 / John Renshaw Drive / Weakleys Drive intersection can be expected to experience LOS D over all development stages up to and including 75% GFA developed. However, at 100% GFA developed the intersection is anticipated to operate at capacity with LOS F recorded in the model. It is noted however that the intersection is only marginally above the LOS E to LOS F (delay of 78 seconds) threshold at 100% GFA developed, and while reasonably high delays are anticipated on all approaches, the queue lengths are not expected to impede the performance of the surrounding intersections as confirmed by the average speed plots described above.
- The proposed site access configuration at the eastern and western access points to the subject site can both be expected to operate at a satisfactory level of performance with LOS B and LOS C expected across all the development stages. This confirms that the assumed intersection layouts are more than capable of accommodating the traffic generation expected by the subject site on its own.

Conclusion

Based on the analysis and discussions presented within this letter, the following conclusions are made:

- While a general decline in network performance can be expected as the development stages increase, there are existing broader road network constraints evident in the study area which impact the overall network performance. This includes congestion experienced at the following locations:
  - John Renshaw Drive to New England Hwy A1 merge
  - New England Highway / Weakleys Drive intersection
  - congestion in the Thornton / Beresfield areas.
- There is also a generally a consistent trend in congestion hotspots during both the AM and PM peaks which progressively worsens as the development stages grow. One of the key locations is

the M1 / John Renshaw Drive / Weakleys Drive intersection with the critical approaches being the John Renshaw Drive east approach in the AM peak and Weakleys Drive north approach in both AM and PM peaks.

- Notwithstanding, the queues and delays formed at the M1 / John Renshaw Drive / Weakleys Drive intersection are localised and not expected to interrupt the performance of the surrounding network. The proposed mitigation measures at this intersection help to manage the traffic impacts with the intersection performance generally indicating that the intersection can accommodate the anticipated increase in traffic volumes (background and site generated) in all development stages.
- The M1 / John Renshaw Drive / Weakleys Drive intersection arguably performs better than the Future Base 2032 scenario during all development scenarios including the 75% GFA developed scenario. The 100% GFA developed scenario indicates a marginal decline (from LOS D to LOS E/F) when compared with the Future Base 2032 scenario.
- Travel times along John Renshaw Drive are generally maintained throughout all stages of development. The New England Highway (A43) to M1 route experiences the most variable travel times in both peaks during the 75% and 100% GFA developed scenarios due to an increase in congestion and queues in the Beresfield and Thornton areas, as well as increase in delays on Weakleys Drive. These delays are also significantly influenced by background traffic growth to 2032.

Overall, the site only microsimulation model is robust and based on sound information available at the time. The model indicates that with some localised upgrades, the surrounding road network is able to accommodate traffic generated by the proposed large lot industrial development.

Inconsistencies do however remain and the TfNSW preferred assumptions, together with several critical elements outside the scope of the model significantly influence the model results. In this regard, four critical aspects stand out:

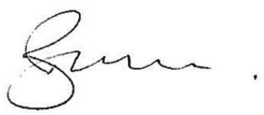
- TfNSW preferred background traffic growth
- TfNSW preferred traffic distribution
- TfNSW assumed traffic generation rates
- M12RT bypass assumptions and future design uncertainty.

Any one of these aspects are likely to profoundly minimise the traffic impacts associated with the proposed development, noting especially traffic distribution and M12RT bypass assumptions.

I trust the above provides the necessary information. Should you have any questions or require any further information, please do not hesitate to contact me on (02) 8448 1800.

Yours sincerely

GTA CONSULTANTS



Rhys Hazell
Director

ATTACHMENT 1

Network Performance Results

JOHN RENSHAW DRIVE, BLACK HILL - TRAFFIC MODELLING
NETWORK PERFORMANCE RESULTS
GTA Ref: N171072
Date: 20/05/25

SITE																						
Metric		AM PEAK																				
		6am to 7am							7am to 8am							8am to 9am						
		Base (2019)	Future Base (2032)	25% Site Stage (2023)	50% Site Stage (2026)	50% Site Stage - No M12RT (2026)	75% Site Stage (2029)	100% Site Stage (2032)	Base (2019)	Future Base (2032)	25% Site Stage (2023)	50% Site Stage (2026)	50% Site Stage - No M12RT (2026)	75% Site Stage (2029)	100% Site Stage (2032)	Base (2019)	Future Base (2032)	25% Site Stage (2023)	50% Site Stage (2026)	50% Site Stage - No M12RT (2026)	75% Site Stage (2029)	100% Site Stage (2032)
Average Delay	Sec	49	57	52	60	70	75	94	55	130	98	70	125	115	167	52	144	83	79	130	118	235
Average Stops	no.	1	1	1	1	1	1	2	1	4	3	1	4	3	7	1	5	2	2	5	3	9
Average Speed	km/h	69	67	69	66	65	64	61	68	56	61	64	57	57	51	68	54	63	62	56	57	44
Average Stop Delay	Sec	23	27	24	29	35	40	50	20	37	24	28	33	40	59	24	62	32	40	47	54	112
Total VKT	km	64,620	68,889	69,736	66,283	74,798	70,257	74,055	79,146	85,147	84,344	82,820	88,990	87,037	91,550	68,301	74,972	74,779	70,664	80,636	76,024	80,125
Total VHT	h	931	1,024	1,016	1,004	1,146	1,106	1,224	1,165	1,520	1,384	1,287	1,568	1,514	1,793	1,001	1,395	1,188	1,133	1,444	1,344	1,825
Total Delay	h	115	148	134	152	193	202	270	163	437	316	225	433	397	616	135	438	241	223	414	364	790
Total Stops	no.	6,166	9,433	7,442	8,700	10,141	11,686	22,410	9,025	53,314	33,007	13,380	55,528	33,901	86,269	7,731	58,617	20,155	16,736	57,072	38,598	107,915
Total Stop Delay	h	54	69	62	74	97	107	143	59	126	78	89	114	137	218	64	190	92	112	150	168	376
Vehicles Active	no.	951	1,070	1,047	1,038	1,154	1,153	1,330	1,181	1,779	1,550	1,360	1,900	1,736	2,120	999	1,322	1,087	1,111	1,366	1,292	1,883
Vehicles Arrived	no.	7,549	8,319	8,193	8,032	8,734	8,520	8,969	9,558	10,343	10,056	10,266	10,530	10,666	11,128	8,366	9,652	9,401	9,028	10,054	9,826	10,239
Latent Delay	h	0	0	0	0	0	0	0	0	27	1	1	12	1	9	0	14	1	0	1	0	15
Latent Demand	no.	0	0	0	0	0	0	0	0	57	18	0	12	2	36	0	17	0	0	0	0	24
Total Demand	no.	8,500	9,389	9,240	9,070	9,888	9,673	10,299	10,739	12,179	11,624	11,626	12,442	12,404	13,284	9,365	10,991	10,488	10,139	11,420	11,118	12,146

SITE																						
Metric		PM PEAK																				
		3pm to 4pm							4pm to 5pm							5pm to 6pm						
		Base (2019)	Future Base (2032)	25% Site Stage (2023)	50% Site Stage (2026)	50% Site Stage - No M12RT (2026)	75% Site Stage (2029)	100% Site Stage (2032)	Base (2019)	Future Base (2032)	25% Site Stage (2023)	50% Site Stage (2026)	50% Site Stage - No M12RT (2026)	75% Site Stage (2029)	100% Site Stage (2032)	Base (2019)	Future Base (2032)	25% Site Stage (2023)	50% Site Stage (2026)	50% Site Stage - No M12RT (2026)	75% Site Stage (2029)	100% Site Stage (2032)
Average Delay	Sec	51	72	59	64	81	86	97	50	93	62	68	91	95	140	47	121	60	62	87	95	202
Average Stops	no.	1	2	1	1	1	2	2	1	2	1	1	2	2	3	1	5	1	1	2	2	13
Average Speed	km/h	69	65	68	66	64	62	61	69	61	67	65	62	61	55	70	58	67	66	63	61	48
Average Stop Delay	Sec	21	27	24	29	35	36	43	22	36	27	32	37	39	70	20	54	27	28	34	43	93
Total VKT	km	75,172	83,395	80,548	79,828	85,184	84,352	88,750	74,886	84,091	80,611	80,057	86,572	85,675	91,048	77,198	86,491	82,891	82,245	89,245	87,978	93,418
Total VHT	h	1,088	1,283	1,192	1,209	1,337	1,352	1,462	1,085	1,370	1,208	1,228	1,399	1,411	1,667	1,108	1,499	1,232	1,238	1,418	1,442	1,937
Total Delay	h	142	230	177	196	261	281	333	144	308	194	214	307	324	512	137	408	189	197	294	327	753
Total Stops	no.	8,254	18,555	9,673	11,910	17,223	22,464	23,667	7,781	24,064	11,640	13,142	20,934	24,774	45,495	7,125	55,625	11,387	11,762	21,943	29,421	175,931
Total Stop Delay	h	59	88	73	88	112	116	147	64	121	84	100	125	134	257	58	183	86	89	115	146	346
Vehicles Active	no.	1,158	1,396	1,239	1,280	1,498	1,421	1,605	1,076	1,426	1,192	1,216	1,405	1,446	1,818	1,048	1,385	1,135	1,149	1,217	1,259	1,710
Vehicles Arrived	no.	8,868	10,087	9,613	9,713	10,087	10,275	10,786	9,265	10,559	9,983	10,163	10,752	10,823	11,386	9,405	10,755	10,169	10,303	10,979	11,088	11,719
Latent Delay	h	0	4	0	0	12	9	20	0	4	0	0	12	2	65	0	0	0	0	9	0	53
Latent Demand	no.	0	21	0	0	39	19	58	0	0	0	0	0	1	43	0	0	0	0	0	0	0
Total Demand	no.	10,026	11,504	10,852	10,993	11,624	11,715	12,449	10,341	11,985	11,175	11,379	12,157	12,270	13,247	10,453	12,140	11,304	11,452	12,196	12,347	13,429

ATTACHMENT 2

Network Average Speed Plots

AM Peak Network Average Speed Plots

Figure 1: AM peak network average speed (6am to 7am) – Future Base (2032)

Figure 2: AM peak network average speed (7am to 8am) – Future Base (2032)

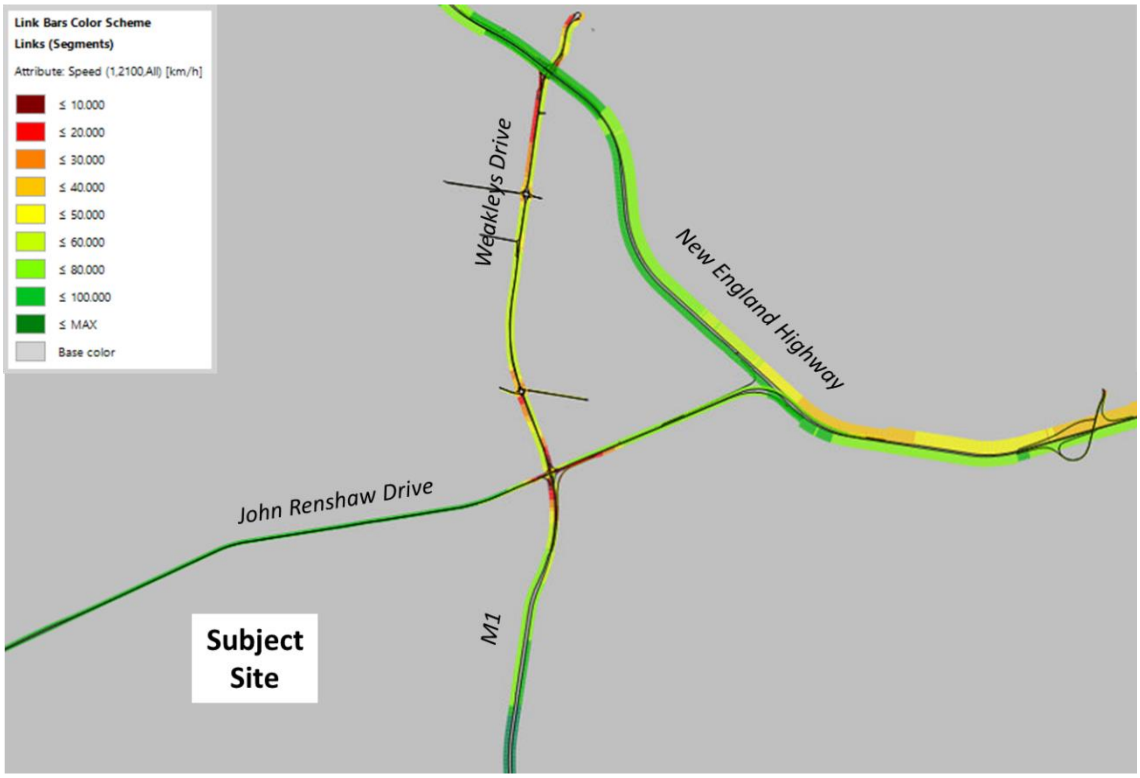


Figure 3: AM peak network average speed (6am to 7am) – 25% GFA developed (2023) No M12RT

Figure 4: AM peak network average speed (7am to 8am) – 25% GFA developed (2023) No M12RT

.

Figure 5: AM peak network average speed (6am to 7am) – 50% GFA developed (2026) No M12RT

Figure 6: AM peak network average speed (7am to 8am) – 50% GFA developed (2026) No M12RT

Figure 7: AM peak network average speed (6am to 7am) – 50% GFA developed (2026) With M12RT

Figure 8: AM peak network average speed (7am to 8am) – 50% GFA developed (2026) With M12RT

Figure 9: AM peak network average speed (6am to 7am) – 75% GFA developed (2029) With M12RT

Figure 10: AM peak network average speed (7am to 8am) – 75% GFA developed (2029) With M12RT

Figure 11: AM peak network average speed (6am to 7am) – 100% GFA developed (2032) With M12RT

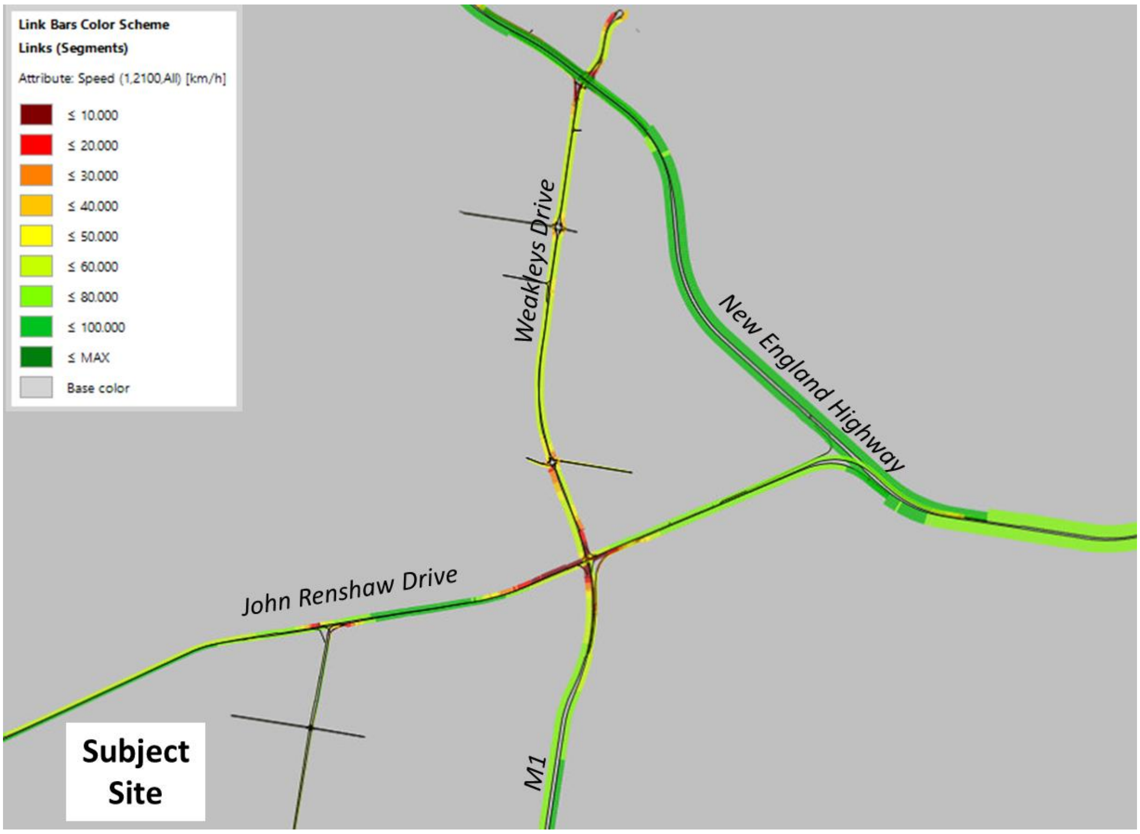
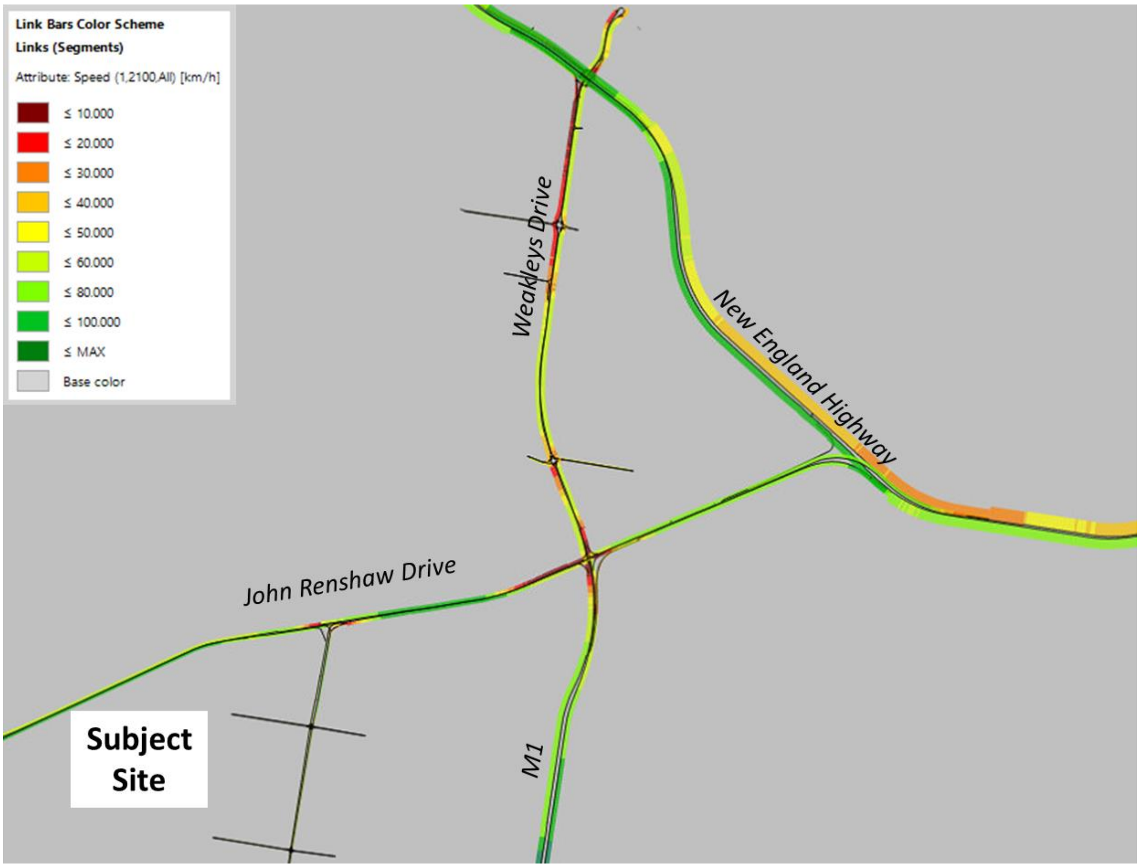


Figure 12: AM peak network average speed (7am to 8am) – 100% GFA developed (2032) With M12RT



PM Peak Hour Network Average Speed Plots

Figure 13: PM peak network average speed (3pm to 4pm) – Future Base (2032)

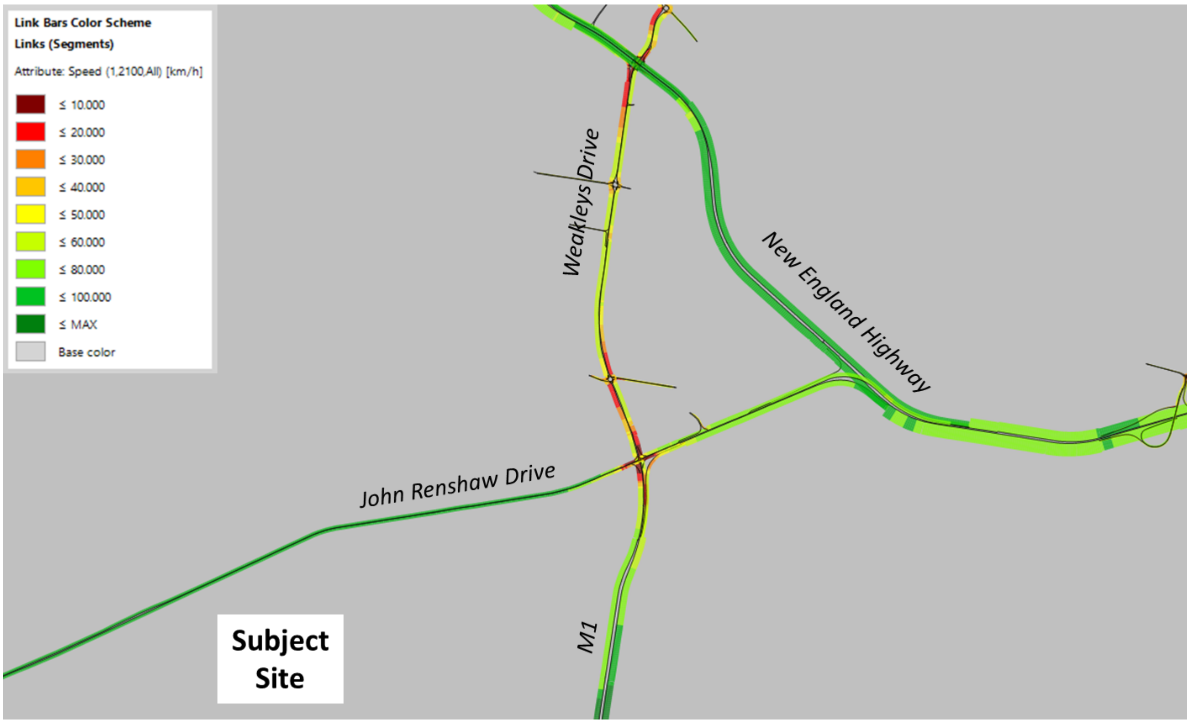


Figure 14: PM peak network average speed (4pm to 5pm) – Future Base (2032)

Figure 15: PM peak network average speed (3pm to 4pm) – 25% GFA developed (2023) No M12RT

Figure 16: PM peak network average speed (4pm to 5pm) – 25% GFA developed (2023) No M12RT

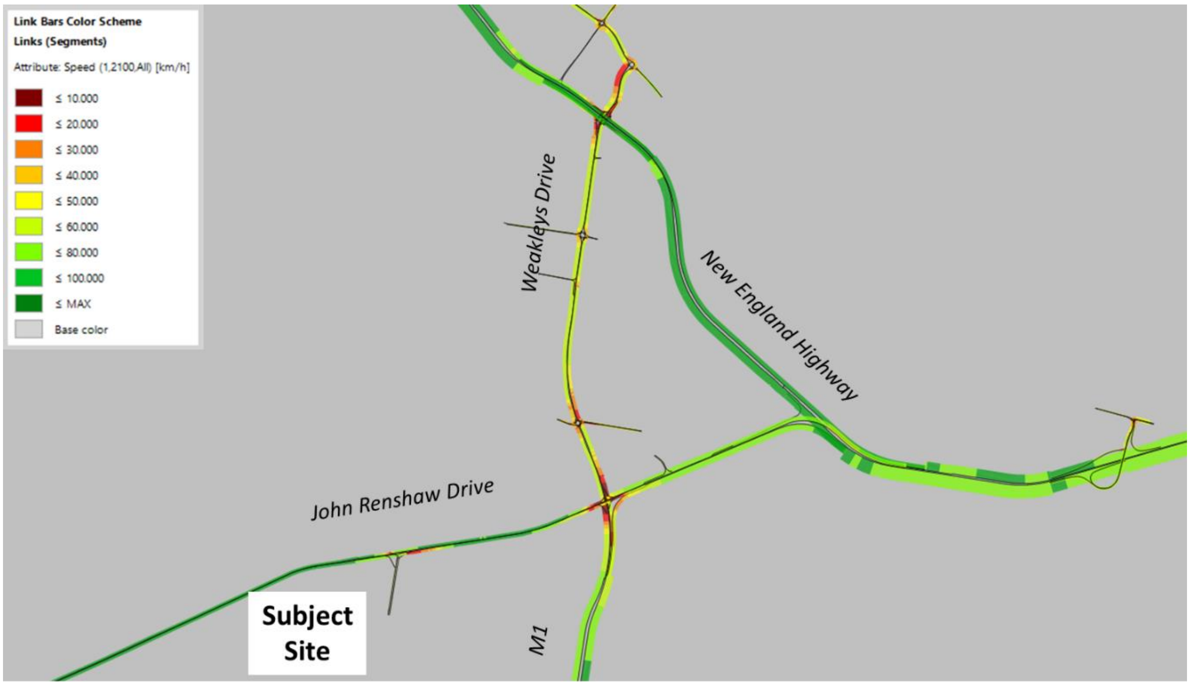


Figure 17: PM peak network average speed (3pm to 4pm) – 50% GFA developed (2026) No M12RT

Figure 18: PM peak network average speed (4pm to 5pm) – 50% GFA developed (2026) No M12RT

Figure 19: PM peak network average speed (3pm to 4pm) – 50% GFA developed (2026) With M12RT

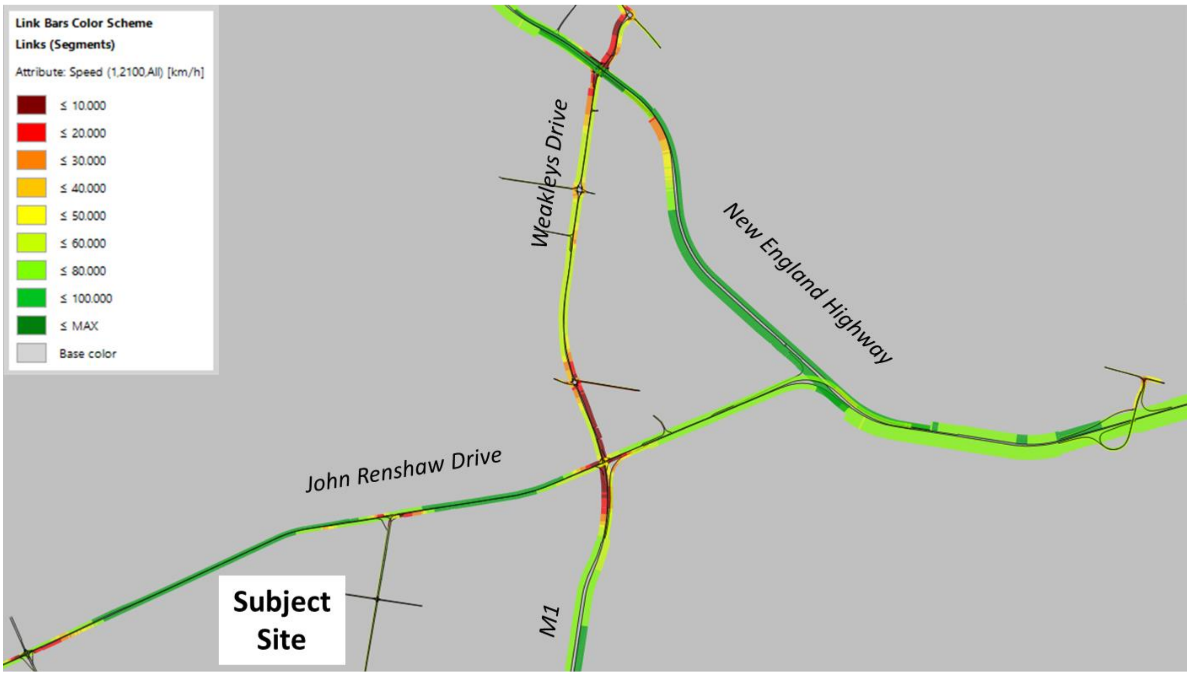
Figure 20: PM peak network average speed (4pm to 5pm) – 50% GFA developed (2026) With M12RT

Figure 21: PM peak network average speed (3pm to 4pm) – 75% GFA developed (2029) With M12RT

Figure 22: PM peak network average speed (4pm to 5pm) – 75% GFA developed (2029) With M12RT

Figure 23: PM peak network average speed (3pm to 4pm) – 100% GFA developed (2032) With M12RT

Figure 24: PM peak network average speed (4pm to 5pm) – 100% GFA developed (2032) With M12RT



ATTACHMENT 3

Travel Time Results

GTAconsultants

JOHN RENSHAW DRIVE, BLACK HILL - TRAFFIC MODELLING
TRAVEL TIME RESULTS
GTA Ref: N171072
Date: 20/05/25

SITE			AM PEAK																				
ROUTE DESCRIPTION			6am to 7am							7am to 8am							8am to 9am						
ID	Direction	Description	Base (2019)	Future Base (2032)	25% Site Stage (2023)	50% Site Stage (2026)	50% Site Stage - No M12RT (2026)	75% Site Stage (2029)	100% Site Stage (2032)	Base (2019)	Future Base (2032)	25% Site Stage (2023)	50% Site Stage (2026)	50% Site Stage - No M12RT (2026)	75% Site Stage (2029)	100% Site Stage (2032)	Base (2019)	Future Base (2032)	25% Site Stage (2023)	50% Site Stage (2026)	50% Site Stage - No M12RT (2026)	75% Site Stage (2029)	100% Site Stage (2032)
A -B (1)	EB	M1 to A1 (1)	169	172	184	181	192	179	175	171	178	169	177	183	180	176	171	175	167	182	176	177	178
A -B (2)	EB	M1 to A1 (2)	69	69	70	68	70	68	67	70	68	68	68	70	67	67	69	68	68	66	69	67	68
A -B (3)	EB	M1 to A1 (3)	90	89	91	89	94	92	93	96	158	174	94	172	147	163	90	112	130	89	148	112	131
TOTAL	**EB**	**M1 to A1**	**328**	**330**	**345**	**338**	**356**	**339**	**335**	**337**	**404**	**411**	**339**	**425**	**394**	**406**	**330**	**355**	**365**	**337**	**393**	**356**	**377**
B - A (1)	WB	A1 to M1 (1)	83	83	83	83	84	83	83	84	84	84	83	84	84	85	83	84	84	84	84	84	115
B - A (2)	WB	A1 to M1 (2)	66	69	67	65	67	66	66	67	66	66	65	67	65	66	66	72	67	78	110	73	274
B - A (3)	WB	A1 to M1 (3)	116	116	117	116	117	115	116	117	116	117	117	118	118	118	117	118	118	117	118	118	118
TOTAL	**WB**	**A1 to M1**	**265**	**268**	**267**	**264**	**268**	**264**	**265**	**268**	**266**	**267**	**265**	**269**	**267**	**269**	**266**	**274**	**269**	**279**	**312**	**275**	**507**
A - C (1)	NB	M1 to A43 (1)	150	160	212	336	364	463	431	152	172	229	327	332	443	504	152	195	220	328	336	363	410
A - C (2)	NB	M1 to A43 (2)	162	166	64	64	65	65	65	168	285	65	65	66	66	66	168	513	65	64	64	65	66
A - C (3)	NB	M1 to A43 (3)	136	137	91	89	94	92	93	139	140	173	94	172	147	163	137	139	130	89	147	112	131
TOTAL	**NB**	**M1 to A43**	**448**	**463**	**367**	**489**	**523**	**620**	**589**	**459**	**597**	**467**	**486**	**570**	**656**	**733**	**457**	**847**	**415**	**481**	**547**	**540**	**607**
C - A (1)	SB	A43 to M1 (1)	169	199	156	147	149	143	156	165	169	156	152	147	150	162	166	180	160	152	150	153	232
C - A (2)	SB	A43 to M1 (2)	239	203	162	161	164	163	176	202	200	182	205	175	261	335	252	199	173	266	188	401	782
C -A (3)	SB	A43 to M1 (3)	132	132	136	137	138	138	137	129	131	140	140	140	140	142	135	138	138	139	139	139	139
TOTAL	**SB**	**A43 to M1**	**540**	**534**	**454**	**445**	**451**	**444**	**469**	**496**	**500**	**478**	**497**	**462**	**551**	**639**	**553**	**517**	**471**	**557**	**477**	**693**	**1153**
D - B (1)	EB	JRD to M1 (1)	197	200	170	189	190	197	423	205	209	165	172	172	174	342	205	209	175	177	198	186	317
D - B (2)	EB	JRD to M1 (2)	65	65	223	191	212	188	204	65	65	205	188	215	191	200	65	65	298	196	305	198	208
D -B (3)	EB	JRD to M1 (3)	90	89	132	130	131	129	132	96	158	127	128	129	128	134	90	112	135	135	137	136	136
TOTAL	**EB**	**JRD to M1**	**352**	**354**	**525**	**510**	**533**	**514**	**759**	**366**	**432**	**497**	**488**	**516**	**493**	**676**	**360**	**386**	**608**	**508**	**640**	**520**	**661**
B - D (1)	WB	M1 to JRD (1)	83	83	83	82	84	83	83	84	84	83	83	84	84	85	83	84	84	83	84	84	114
B - D (2)	WB	M1 to JRD (2)	91	102	96	102	111	106	104	97	100	105	104	112	106	106	95	106	100	131	167	126	349
B - D (3)	WB	M1 to JRD (3)	158	160	195	206	209	210	223	161	160	199	214	211	211	225	157	159	207	212	210	211	226
TOTAL	**WB**	**M1 to JRD**	**332**	**345**	**374**	**390**	**404**	**399**	**410**	**342**	**344**	**387**	**401**	**407**	**401**	**416**	**335**	**349**	**391**	**426**	**461**	**421**	**689**

SITE			PM PEAK																				
ROUTE DESCRIPTION			3pm to 4pm							4pm to 5pm							5pm to 6pm						
ID	Direction	Description	Base (2019)	Future Base (2032)	25% Site Stage (2023)	50% Site Stage (2026)	50% Site Stage - No M12RT (2026)	75% Site Stage (2029)	100% Site Stage (2032)	Base (2019)	Future Base (2032)	25% Site Stage (2023)	50% Site Stage (2026)	50% Site Stage - No M12RT (2026)	75% Site Stage (2029)	100% Site Stage (2032)	Base (2019)	Future Base (2032)	25% Site Stage (2023)	50% Site Stage (2026)	50% Site Stage - No M12RT (2026)	75% Site Stage (2029)	100% Site Stage (2032)
A -B (1)	EB	M1 to A1 (1)	177	174	179	181	174	185	173	164	170	167	188	190	195	293	161	165	158	190	179	202	215
A -B (2)	EB	M1 to A1 (2)	70	69	71	69	71	70	70	70	70	70	70	71	70	71	71	70	70	70	71	70	71
A -B (3)	EB	M1 to A1 (3)	91	91	92	90	92	89	92	91	91	92	89	92	89	92	91	96	91	90	95	94	96
TOTAL	**EB**	**M1 to A1**	**338**	**334**	**342**	**340**	**337**	**344**	**335**	**325**	**331**	**329**	**347**	**353**	**354**	**456**	**323**	**331**	**319**	**350**	**345**	**366**	**382**
B - A (1)	WB	A1 to M1 (1)	86	86	90	86	89	86	87	85	86	86	85	88	86	88	85	90	86	84	87	89	86
B - A (2)	WB	A1 to M1 (2)	73	69	75	69	76	69	70	71	69	71	68	73	69	69	70	68	71	68	72	68	68
B - A (3)	WB	A1 to M1 (3)	117	116	117	117	116	116	117	116	117	116	116	117	117	117	116	116	117	116	117	117	117
TOTAL	**WB**	**A1 to M1**	**276**	**271**	**282**	**272**	**281**	**271**	**274**	**272**	**272**	**273**	**269**	**278**	**272**	**274**	**271**	**274**	**274**	**268**	**276**	**274**	**271**
A - C (1)	NB	M1 to A43 (1)	140	150	146	146	144	146	148	140	149	143	149	143	148	153	141	152	143	147	149	148	147
A - C (2)	NB	M1 to A43 (2)	180	238	178	197	209	194	225	166	188	167	174	177	178	194	162	171	163	167	170	170	176
A - C (3)	NB	M1 to A43 (3)	140	141	139	142	140	142	141	140	143	140	142	142	142	142	138	144	139	140	140	142	145
TOTAL	**NB**	**M1 to A43**	**460**	**529**	**463**	**485**	**493**	**482**	**514**	**446**	**480**	**450**	**465**	**462**	**468**	**489**	**441**	**467**	**445**	**454**	**459**	**460**	**468**
C - A (1)	SB	A43 to M1 (1)	173	174	174	173	175	177	173	188	193	189	197	195	200	196	188	416	186	191	186	303	471
C - A (2)	SB	A43 to M1 (2)	201	238	212	195	252	214	295	199	219	216	206	243	206	367	211	243	274	193	248	198	312
C -A (3)	SB	A43 to M1 (3)	132	138	135	134	138	136	137	130	136	134	133	138	137	138	130	136	134	135	140	136	140
TOTAL	**SB**	**A43 to M1**	**506**	**550**	**521**	**502**	**565**	**527**	**605**	**517**	**548**	**539**	**536**	**576**	**543**	**701**	**529**	**795**	**594**	**519**	**574**	**637**	**923**
D - B (1)	EB	JRD to M1 (1)	212	211	216	243	230	241	263	205	206	216	250	234	249	237	198	195	201	259	244	269	283
D - B (2)	EB	JRD to M1 (2)	66	66	66	65	65	65	66	66	66	66	66	66	65	65	66	66	66	66	66	67	66
D -B (3)	EB	JRD to M1 (3)	91	91	92	90	92	89	92	91	91	92	89	92	89	92	91	96	91	91	95	94	96
TOTAL	**EB**	**JRD to M1**	**369**	**368**	**374**	**398**	**387**	**395**	**421**	**362**	**363**	**374**	**405**	**392**	**403**	**394**	**355**	**357**	**358**	**416**	**405**	**430**	**445**
B - D (1)	WB	M1 to JRD (1)	86	86	90	86	89	86	87	85	87	86	86	88	86	88	85	90	86	84	87	89	86
B - D (2)	WB	M1 to JRD (2)	109	103	113	110	114	120	127	113	110	122	114	119	116	131	96	94	102	108	118	114	132
B - D (3)	WB	M1 to JRD (3)	168	169	195	231	205	235	237	169	170	195	230	220	231	245	162	164	183	221	208	226	245
TOTAL	**WB**	**M1 to JRD**	**363**	**358**	**398**	**427**	**408**	**441**	**451**	**367**	**367**	**403**	**430**	**427**	**433**	**464**	**343**	**348**	**371**	**413**	**413**	**429**	**463**

ATTACHMENT 4

Intersection Performance Results

GTAconsultants

JOHN RENSHAW DRIVE, BLACK HILL - TRAFFIC MODELLING
INTERSECTION PERFORMANCE RESULTS
GTA Ref: N171072
Date: 20/05/25

SITE

AM PEAK

6am to 7am

INTERSECTION	APPROACH	MOVEMENT	Base (2019) Avg Delay (secs)	LOS	Future Base (2032) Avg Delay (secs)	LOS	25% Site Stage (2023) Avg Delay (secs)	LOS	50% Site Stage (2026) Avg Delay (secs)	LOS	50% Site Stage - No M12RT (2026)		75% Site Stage (2029) Avg Delay (secs)	LOS	100% Site Stage (2032) Avg Delay (secs)	LOS
3289 - New England Highway / Weakleys Drive	North	L	10	A	14	A	11	A	13	A	12	A	11	A	14	B
		T	20	B	20	B	19	B	20	B	20	B	18	B	19	B
		R	13	A	16	B	14	A	14	A	15	B	15	B	13	A
	East	L	9	A	11	A	9	A	8	A	8	A	10	A	9	A
		T	0	A	0	A	0	A	0	A	0	A	0	A	0	A
		R	27	B	32	C	28	C	28	C	27	B	32	C	35	C
	South	L	13	A	11	A	12	A	11	A	13	A	10	A	19	B
		T	27	B	34	C	30	C	33	C	26	B	30	C	45	D
		R	18	B	17	B	19	B	27	B	26	B	27	B	20	B
	West	L	2	A	9	A	3	A	11	A	7	A	15	B	98	F
		T	0	A	0	A	0	A	0	A	0	A	0	A	0	A
		R	31	C	59	E	31	C	50	D	50	D	57	E	182	F
	Total		**12**	**A**	**16**	**B**	**12**	**A**	**15**	**B**	**14**	**B**	**16**	**B**	**33**	**C**
4781 - John Renshaw Drive / Weakleys Drive	North	L	52	D	34	C	40	C	23	B	34	C	16	B	31	C
		T	92	F	57	E	80	F	42	C	66	E	39	C	57	E
		R	69	E	67	E	67	E	77	F	70	F	78	F	75	F
	East	L	2	A	2	A	2	A	2	A	3	A	2	A	2	A
		T	29	C	34	C	33	C	40	C	47	D	43	D	42	C
		R	87	F	156	F	61	E	102	F	170	F	148	F	90	F
	South	L	9	A	26	B	16	B	6	A	4	A	6	A	7	A
		T	35	C	47	D	41	C	34	C	34	C	30	C	42	D
		R	54	D	58	E	70	E	68	E	77	F	65	E	61	E
	West	L	37	C	31	C	34	C	57	E	66	E	110	F	98	F
		T	52	D	54	D	56	D	93	F	118	F	203	F	178	F
		R	52	D	54	D	84	F	104	F	120	F	195	F	179	F
	Total		**50**	**D**	**54**	**D**	**50**	**D**	**52**	**D**	**65**	**E**	**73**	**F**	**69**	**E**
Eastern Access (Shared)	East	L	-	-	-	-	1	A	1	A	1	A	2	A	3	A
		T	-	-	-	-	32	C	26	B	25	B	29	C	27	B
	South	L	-	-	-	-	1	A	1	A	1	A	1	A	1	A
		R	-	-	-	-	28	B	17	B	17	B	17	B	17	B
	West	T	-	-	-	-	7	A	17	B	19	B	19	B	18	B
		R	-	-	-	-	17	B	38	C	35	C	33	C	36	C
	Total		**-**	**-**	**-**	**-**	**15**	**B**	**18**	**B**	**19**	**B**	**20**	**B**	**19**	**B**
Western Access	North	L	-	-	-	-	-	-	92	F	92	F	74	F	92	F
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	93	F	93	F	83	F	61	E
	East	L	-	-	-	-	-	-	2	A	1	A	2	A	3	A
		T	-	-	-	-	-	-	21	B	21	B	27	B	26	B
		R	-	-	-	-	-	-	52	D	75	F	87	F	102	F
	South	L	-	-	-	-	-	-	1	A	1	A	1	A	1	A
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	38	C	38	C	51	D	56	E
	West	L	-	-	-	-	-	-	10	A	9	A	29	C	32	C
		T	-	-	-	-	-	-	27	B	28	B	28	B	27	B
		R	-	-	-	-	-	-	76	F	92	F	76	F	80	F
	Total		**-**	**-**	**-**	**-**	**-**	**-**	**27**	**B**	**28**	**B**	**30**	**C**	**31**	**C**

7am to 8am

INTERSECTION	APPROACH	MOVEMENT	Base (2019) Avg Delay (secs)	LOS	Future Base (2032) Avg Delay (secs)	LOS	25% Site Stage (2023) Avg Delay (secs)	LOS	50% Site Stage (2026) Avg Delay (secs)	LOS	50% Site Stage - No M12RT (2026)		75% Site Stage (2029) Avg Delay (secs)	LOS	100% Site Stage (2032) Avg Delay (secs)	LOS
3289 - New England Highway / Weakleys Drive	North	L	11	A	14	A	12	A	12	A	12	A	13	A	13	A
		T	22	B	22	B	20	B	21	B	23	B	21	B	22	B
		R	19	B	23	B	19	B	19	B	22	B	21	B	22	B
	East	L	6	A	6	A	6	A	7	A	6	A	7	A	7	A
		T	0	A	1	A	0	A	1	A	1	A	1	A	1	A
		R	23	B	22	B	23	B	25	B	23	B	25	B	26	B
	South	L	14	A	43	D	24	B	31	C	20	B	41	C	45	D
		T	46	D	101	F	65	E	88	F	60	E	110	F	117	F
		R	29	C	74	F	40	C	52	D	32	C	69	E	93	F
	West	L	3	A	4	A	3	A	4	A	4	A	4	A	44	D
		T	1	A	1	A	1	A	1	A	1	A	1	A	1	A
		R	24	B	27	B	24	B	29	C	30	C	29	C	107	F
	Total		**12**	**A**	**18**	**B**	**14**	**A**	**16**	**B**	**14**	**B**	**19**	**B**	**29**	**C**
4781 - John Renshaw Drive / Weakleys Drive	North	L	25	B	29	C	26	B	19	B	31	C	17	B	27	B
		T	55	D	52	D	54	D	40	C	68	E	40	C	53	D
		R	78	F	69	E	73	F	76	F	80	F	69	E	78	F
	East	L	2	A	1	A	2	A	1	A	2	A	1	A	1	A
		T	35	C	36	C	43	D	43	D	48	D	44	D	46	D
		R	64	E	110	F	68	E	76	F	130	F	104	F	69	E
	South	L	19	B	32	C	26	B	6	A	6	A	7	A	10	A
		T	38	C	58	E	41	C	39	C	32	C	37	C	48	D
		R	57	E	65	E	55	D	63	E	68	E	66	E	62	E
	West	L	37	C	39	C	41	C	57	E	63	E	96	F	126	F
		T	59	E	63	E	70	E	83	F	90	F	184	F	228	F
		R	59	E	63	E	70	E	83	F	91	F	172	F	229	F
	Total		**46**	**D**	**55**	**D**	**47**	**D**	**49**	**D**	**58**	**E**	**68**	**E**	**80**	**F**
Eastern Access (Shared)	East	L	-	-	-	-	1	A	2	A	2	A	2	A	3	A
		T	-	-	-	-	37	C	28	B	29	C	27	B	29	C
	South	L	-	-	-	-	1	A	2	A	1	A	4	A	2	A
		R	-	-	-	-	28	C	16	B	16	B	13	A	16	B
	West	T	-	-	-	-	7	A	17	B	17	B	18	B	19	B
		R	-	-	-	-	22	B	27	B	25	B	28	C	33	C
	Total		**-**	**-**	**-**	**-**	**18**	**B**	**20**	**B**	**20**	**B**	**19**	**B**	**20**	**B**
Western Access	North	L	-	-	-	-	-	-	72	F	72	F	77	F	103	F
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	79	F	79	F	88	F	71	F
	East	L	-	-	-	-	-	-	2	A	2	A	2	A	2	A
		T	-	-	-	-	-	-	25	B	22	B	32	C	25	B
		R	-	-	-	-	-	-	107	F	88	F	88	F	77	F
	South	L	-	-	-	-	-	-	1	A	1	A	1	A	1	A
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	48	D	49	D	54	D	54	D
	West	L	-	-	-	-	-	-	46	D	46	D	24	B	26	B
		T	-	-	-	-	-	-	28	B	29	C	30	C	29	C
		R	-	-	-	-	-	-	78	F	70	E	84	F	92	F
	Total		**-**	**-**	**-**	**-**	**-**	**-**	**29**	**C**	**28**	**B**	**33**	**C**	**32**	**C**

8am to 9am

INTERSECTION	APPROACH	MOVEMENT	Base (2019) Avg Delay (secs)	LOS	Future Base (2032) Avg Delay (secs)	LOS	25% Site Stage (2023) Avg Delay (secs)	LOS	50% Site Stage (2026) Avg Delay (secs)	LOS	50% Site Stage - No M12RT (2026)		75% Site Stage (2029) Avg Delay (secs)	LOS	100% Site Stage (2032) Avg Delay (secs)	LOS
3289 - New England Highway / Weakleys Drive	North	L	7	A	7	A	7	A	8	A	7	A	7	A	11	A
		T	14	B	16	B	15	B	15	B	15	B	14	B	15	B
		R	16	B	18	B	17	B	17	B	16	B	17	B	17	B
	East	L	5	A	6	A	5	A	7	A	5	A	8	A	6	A
		T	0	A	1	A	0	A	1	A	0	A	0	A	0	A
		R	23	B	28	B	23	B	26	B	26	B	26	B	26	B
	South	L	15	B	58	E	16	B	45	D	31	C	59	E	60	E
		T	32	C	132	F	36	C	91	F	73	F	129	F	129	F
		R	23	B	91	F	22	B	59	E	47	D	86	F	95	F
	West	L	3	A	4	A	3	A	4	A	11	A	5	A	77	F
		T	0	A	0	A	0	A	0	A	0	A	0	A	0	A
		R	29	C	41	C	37	C	39	C	60	E	47	D	164	F
	Total		**12**	**A**	**27**	**B**	**13**	**A**	**22**	**B**	**21**	**B**	**28**	**C**	**43**	**D**
4781 - John Renshaw Drive / Weakleys Drive	North	L	71	F	31	C	110	F	25	B	118	F	28	B	40	C
		T	106	F	51	D	137	F	49	D	136	F	51	D	62	E
		R	86	F	74	F	113	F	80	F	113	F	77	F	85	F
	East	L	2	A	2	A	2	A	2	A	2	A	2	A	2	A
		T	34	C	36	C	37	C	49	D	53	D	51	D	55	D
		R	87	F	157	F	86	F	178	F	201	F	163	F	239	F
	South	L	4	A	62	E	27	B	6	A	6	A	6	A	32	C
		T	38	C	77	F	46	D	39	C	35	C	40	C	119	F
		R	56	E	61	E	53	D	69	E	62	E	64	E	63	E
	West	L	38	C	38	C	36	C	63	E	64	E	71	F	131	F
		T	59	E	60	E	62	E	80	F	86	F	113	F	157	F
		R	59	E	60	E	71	F	91	F	86	F	113	F	140	F
	Total		**56**	**D**	**62**	**E**	**63**	**E**	**58**	**E**	**74**	**F**	**62**	**E**	**97**	**F**
Eastern Access (Shared)	East	L	-	-	-	-	1	A	1	A	1	A	2	A	3	A
		T	-	-	-	-	43	D	26	B	24	B	26	B	29	C
	South	L	-	-	-	-	1	A	2	A	3	A	2	A	1	A
		R	-	-	-	-	28	B	17	B	16	B	18	B	19	B
	West	T	-	-	-	-	7	A	17	B	17	B	18	B	17	B
		R	-	-	-	-	23	B	24	B	25	B	44	D	38	C
	Total		**-**	**-**	**-**	**-**	**21**	**B**	**19**	**B**	**18**	**B**	**20**	**B**	**20**	**B**
Western Access	North	L	-	-	-	-	-	-	78	F	78	F	64	E	104	F
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	22	B	22	B	42	D	83	F
	East	L	-	-	-	-	-	-	2	A	2	A	2	A	2	A
		T	-	-	-	-	-	-	25	B	24	B	32	C	26	B
		R	-	-	-	-	-	-	84	F	72	F	94	F	86	F
	South	L	-	-	-	-	-	-	0	A	1	A	1	A	1	A
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	37	C	37	C	47	D	48	D
	West	L	-	-	-	-	-	-	47	D	48	D	19	B	32	C
		T	-	-	-	-	-	-	28	B	27	B	26	B	26	B
		R	-	-	-	-	-	-	78	F	70	F	84	F	78	F
	Total		**-**	**-**	**-**	**-**	**-**	**-**	**28**	**C**	**27**	**B**	**31**	**C**	**31**	**C**

SITE

PM PEAK

3pm to 4pm

INTERSECTION	APPROACH	MOVEMENT	Base (2019) Avg Delay (secs)	LOS	Future Base (2032) Avg Delay (secs)	LOS	25% Site Stage (2023) Avg Delay (secs)	LOS	50% Site Stage (2026) Avg Delay (secs)	LOS	50% Site Stage - No M12Rt (2026)		75% Site Stage (2029) Avg Delay (secs)	LOS	100% Site Stage (2032) Avg Delay (secs)	LOS
3289 - New England Highway / Weakleys Drive	North	L	7	A	8	A	7	A	6	A	7	A	7	A	7	A
		T	22	B	21	B	20	B	24	B	23	B	22	B	23	B
		R	32	C	36	C	31	C	34	C	29	C	34	C	36	C
	East	L	14	B	16	B	15	B	13	A	10	A	16	B	11	A
		T	1	A	1	A	1	A	1	A	1	A	1	A	1	A
		R	39	C	35	C	36	C	36	C	35	C	33	C	34	C
	South	L	19	B	36	C	23	B	33	C	35	C	32	C	39	C
		T	40	C	65	E	47	D	63	E	72	F	63	E	70	E
		R	52	D	58	E	42	C	53	D	55	D	60	E	57	E
	West	L	5	A	5	A	4	A	5	A	5	A	5	A	6	A
		T	0	A	1	A	0	A	0	A	0	A	0	A	0	A
		R	36	C	34	C	36	C	31	C	34	C	34	C	34	C
	Total		**16**	**B**	**20**	**B**	**17**	**B**	**20**	**B**	**21**	**B**	**20**	**B**	**22**	**B**
4781 - John Renshaw Drive / Weakleys Drive	North	L	23	B	19	B	27	B	29	C	66	E	29	C	91	F
		T	44	D	53	D	58	E	52	D	104	F	61	E	133	F
		R	72	F	67	E	70	E	79	F	101	F	85	F	136	F
	East	L	7	A	4	A	8	A	4	A	8	A	4	A	4	A
		T	49	D	43	D	53	D	48	D	53	D	59	E	65	E
		R	73	F	77	F	76	F	78	F	84	F	71	F	79	F
	South	L	11	A	7	A	24	B	6	A	4	A	4	A	8	A
		T	28	C	38	C	34	C	34	C	32	C	35	C	36	C
		R	65	E	61	E	66	E	69	E	62	E	73	E	60	E
	West	L	45	D	46	D	44	D	45	D	38	C	47	D	45	D
		T	65	E	64	E	62	E	51	D	43	D	53	D	72	F
		R	88	F	79	F	74	F	87	F	78	F	81	F	96	F
	Total		**41**	**C**	**44**	**D**	**45**	**D**	**45**	**D**	**52**	**D**	**49**	**D**	**67**	**E**
Eastern Access (Shared)	East	L	-	-	-	-	7	A	3	A	3	A	3	A	4	A
		T	-	-	-	-	35	C	30	C	22	B	31	C	32	C
	South	L	-	-	-	-	1	A	1	A	2	A	2	A	1	A
		R	-	-	-	-	16	B	16	B	16	B	18	B	18	B
	West	T	-	-	-	-	9	A	16	B	17	B	16	B	17	B
		R	-	-	-	-	47	D	28	C	48	D	40	C	36	C
	Total		**-**	**-**	**-**	**-**	**22**	**B**	**22**	**B**	**19**	**B**	**22**	**B**	**22**	**B**
Western Access	North	L	-	-	-	-	-	-	71	F	71	F	83	F	80	F
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	84	F	84	F	74	F	94	F
	East	L	-	-	-	-	-	-	9	A	11	A	10	A	10	A
		T	-	-	-	-	-	-	43	D	31	C	45	D	48	D
		R	-	-	-	-	-	-	105	F	104	F	108	F	128	F
	South	L	-	-	-	-	-	-	0	A	1	A	1	A	1	A
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	45	D	45	D	39	C	43	D
	West	L	-	-	-	-	-	-	21	B	22	B	8	A	28	C
		T	-	-	-	-	-	-	24	B	22	B	21	B	24	B
		R	-	-	-	-	-	-	68	E	68	E	63	E	85	F
	Total		**-**	**-**	**-**	**-**	**-**	**-**	**35**	**C**	**28**	**B**	**34**	**C**	**38**	**C**

4pm to 5pm

INTERSECTION	APPROACH	MOVEMENT	Base (2019) Avg Delay (secs)	LOS	Future Base (2032) Avg Delay (secs)	LOS	25% Site Stage (2023) Avg Delay (secs)	LOS	50% Site Stage (2026) Avg Delay (secs)	LOS	50% Site Stage - No M12Rt (2026)		75% Site Stage (2029) Avg Delay (secs)	LOS	100% Site Stage (2032) Avg Delay (secs)	LOS
3289 - New England Highway / Weakleys Drive	North	L	4	A	8	A	4	A	5	A	5	A	5	A	7	A
		T	15	B	18	B	13	A	18	B	16	B	17	B	17	B
		R	55	D	71	F	52	D	55	D	62	E	62	E	63	E
	East	L	31	C	49	D	33	C	26	B	29	C	24	B	39	C
		T	1	A	1	A	1	A	1	A	1	A	1	A	2	A
		R	64	E	199	F	62	E	64	E	78	F	153	F	237	F
	South	L	14	B	20	B	15	B	19	B	19	B	18	B	26	B
		T	30	C	64	E	34	C	34	C	41	C	63	E	74	F
		R	69	E	68	E	54	D	63	E	69	E	73	F	57	E
	West	L	8	A	72	F	15	B	17	B	24	B	48	D	91	F
		T	0	A	0	A	0	A	0	A	0	A	1	A	1	A
		R	50	D	55	D	51	D	55	D	53	D	58	E	57	E
	Total		**22**	**B**	**43**	**D**	**22**	**B**	**24**	**B**	**26**	**B**	**37**	**C**	**48**	**D**
4781 - John Renshaw Drive / Weakleys Drive	North	L	20	B	44	D	20	B	34	C	70	E	29	C	153	F
		T	45	D	64	E	57	E	56	E	103	F	56	E	184	F
		R	68	E	80	F	79	F	84	F	97	F	76	F	172	F
	East	L	6	A	4	A	6	A	3	A	7	A	4	A	4	A
		T	54	D	51	D	62	E	53	D	58	E	55	D	70	E
		R	61	E	70	E	68	E	63	E	74	F	65	E	82	F
	South	L	0	A	0	A	8	A	7	A	4	A	6	A	13	A
		T	27	C	38	C	30	C	36	C	31	C	36	C	41	C
		R	51	D	57	E	54	D	75	F	77	F	82	F	180	F
	West	L	44	D	33	C	33	C	39	C	30	C	36	C	33	C
		T	58	E	59	E	60	E	52	D	44	D	52	D	44	D
		R	72	F	83	F	73	F	81	F	83	F	86	F	89	F
	Total		**39**	**C**	**47**	**D**	**44**	**D**	**48**	**D**	**56**	**E**	**60**	**E**	**92**	**F**
Eastern Access (Shared)	East	L	-	-	-	-	7	A	4	A	4	A	6	A	5	A
		T	-	-	-	-	36	C	33	C	25	B	38	C	36	C
	South	L	-	-	-	-	0	A	2	A	4	A	3	A	2	A
		R	-	-	-	-	26	B	18	B	18	B	17	B	17	B
	West	T	-	-	-	-	10	A	17	B	15	B	16	B	17	B
		R	-	-	-	-	37	C	36	C	49	D	38	C	46	D
	Total		**-**	**-**	**-**	**-**	**23**	**B**	**24**	**B**	**20**	**B**	**25**	**B**	**24**	**B**
Western Access	North	L	-	-	-	-	-	-	62	F	62	F	60	F	81	F
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	41	E	41	E	96	F	73	F
	East	L	-	-	-	-	-	-	10	A	12	A	11	A	15	B
		T	-	-	-	-	-	-	40	C	42	C	34	C	54	D
		R	-	-	-	-	-	-	126	F	130	F	105	F	129	F
	South	L	-	-	-	-	-	-	1	A	1	A	1	A	1	A
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	46	D	46	D	47	D	49	D
	West	L	-	-	-	-	-	-	26	B	26	B	17	B	19	B
		T	-	-	-	-	-	-	23	B	24	B	25	B	25	B
		R	-	-	-	-	-	-	75	F	74	F	78	F	77	F
	Total		**-**	**-**	**-**	**-**	**-**	**-**	**34**	**C**	**35**	**C**	**32**	**C**	**41**	**C**

5pm to 6pm

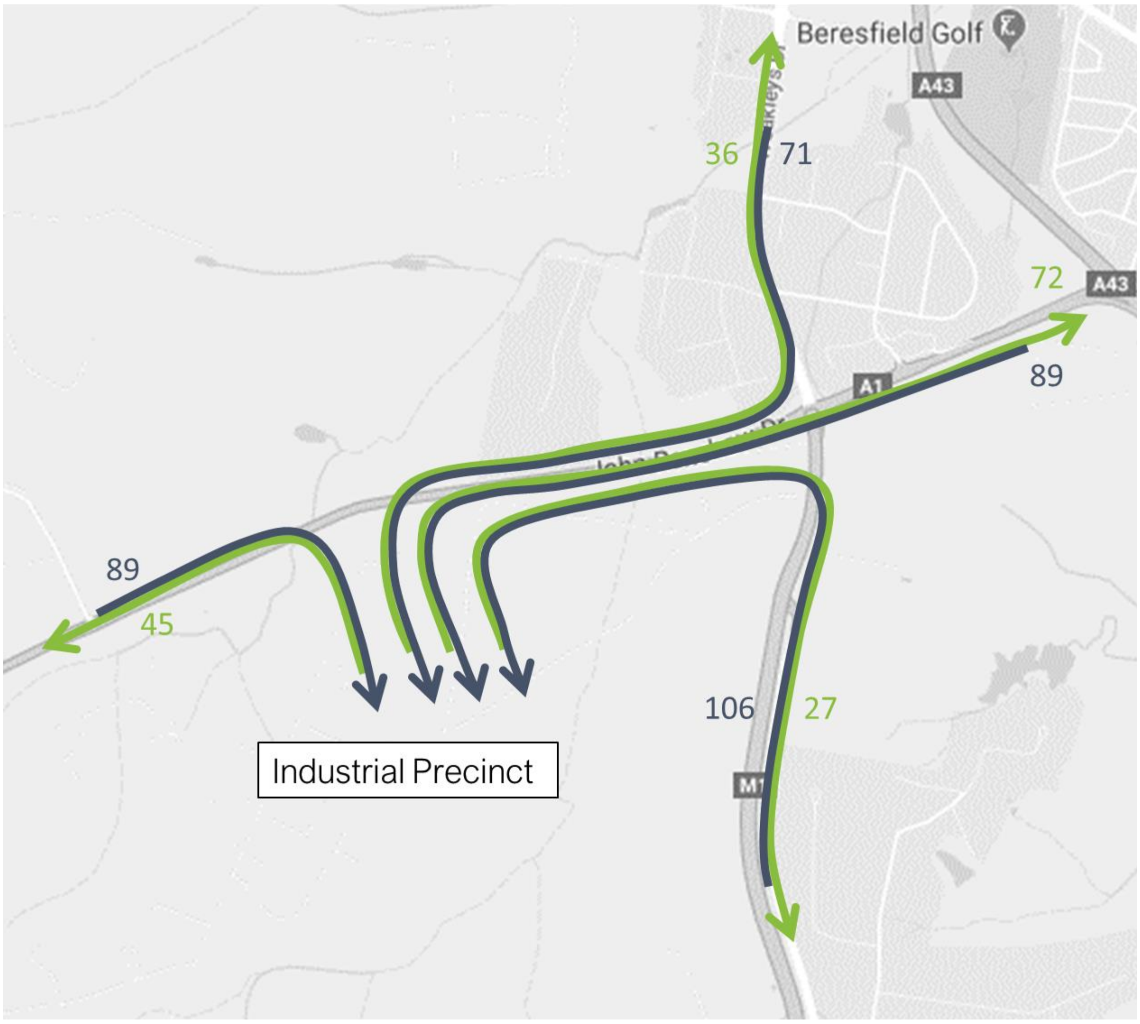
INTERSECTION	APPROACH	MOVEMENT	Base (2019) Avg Delay (secs)	LOS	Future Base (2032) Avg Delay (secs)	LOS	25% Site Stage (2023) Avg Delay (secs)	LOS	50% Site Stage (2026) Avg Delay (secs)	LOS	50% Site Stage - No M12Rt (2026)		75% Site Stage (2029) Avg Delay (secs)	LOS	100% Site Stage (2032) Avg Delay (secs)	LOS
3289 - New England Highway / Weakleys Drive	North	L	3	A	11	A	6	A	4	A	4	A	8	A	12	A
		T	14	A	27	B	16	B	15	B	18	B	20	B	27	B
		R	68	E	104	F	76	F	75	F	69	E	84	F	104	F
	East	L	22	B	280	F	14	A	17	B	18	B	109	F	303	F
		T	1	A	3	A	1	A	1	A	1	A	2	A	4	A
		R	57	E	316	F	55	D	58	E	67	E	173	F	380	F
	South	L	12	A	14	B	12	A	15	B	14	A	15	B	18	B
		T	27	B	76	F	28	B	34	C	40	C	63	E	82	F
		R	72	F	71	F	67	E	67	E	70	E	58	E	67	E
	West	L	7	A	293	F	8	A	11	A	18	B	200	F	342	F
		T	0	A	1	A	1	A	1	A	1	A	1	A	1	A
		R	51	D	47	D	47	D	48	D	44	D	52	D	45	D
	Total		**18**	**B**	**60**	**E**	**18**	**B**	**19**	**B**	**20**	**B**	**42**	**D**	**66**	**E**
4781 - John Renshaw Drive / Weakleys Drive	North	L	31	C	70	E	95	F	31	C	74	E	28	B	103	F
		T	62	E	99	F	125	F	49	D	109	F	50	D	138	F
		R	67	E	82	F	117	F	77	F	104	F	72	F	136	F
	East	L	5	A	4	A	6	A	3	A	6	A	4	A	4	A
		T	36	C	35	C	42	C	47	D	57	E	54	D	71	E
		R	60	E	55	D	66	E	69	E	70	E	65	E	69	E
	South	L	8	A	21	B	8	A	5	A	5	A	7	A	6	A
		T	29	C	31	C	31	C	35	C	36	C	36	C	35	C
		R	52	D	52	D	45	D	77	F	67	E	88	F	102	F
	West	L	25	B	28	B	36	C	42	C	29	C	49	D	50	D
		T	50	D	47	D	46	D	60	E	47	D	71	F	81	F
		R	80	F	70	E	70	E	90	F	81	F	115	F	123	F
	Total		**39**	**C**	**51**	**D**	**54**	**D**	**46**	**D**	**56**	**E**	**51**	**D**	**78**	**E**
Eastern Access (Shared)	East	L	-	-	-	-	5	A	2	A	3	A	3	A	5	A
		T	-	-	-	-	26	B	29	C	22	B	29	C	34	C
	South	L	-	-	-	-	1	A	2	A	4	A	3	A	5	A
		R	-	-	-	-	24	B	16	B	17	B	17	B	18	B
	West	T	-	-	-	-	9	A	18	B	17	B	17	B	20	B
		R	-	-	-	-	35	C	39	C	34	C	31	C	40	C
	Total		**-**	**-**	**-**	**-**	**17**	**B**	**21**	**B**	**19**	**B**	**21**	**B**	**24**	**B**
Western Access	North	L	-	-	-	-	-	-	62	E	62	E	68	F	75	F
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	60	E	60	E	85	F	55	D
	East	L	-	-	-	-	-	-	6	A	9	A	11	A	20	B
		T	-	-	-	-	-	-	34	C	36	C	39	C	56	D
		R	-	-	-	-	-	-	103	F	85	F	99	F	123	F
	South	L	-	-	-	-	-	-	0	A	0	A	1	A	1	A
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	46	D	46	D	41	C	43	D
	West	L	-	-	-	-	-	-	33	C	33	C	28	B	14	B
		T	-	-	-	-	-	-	25	B	25	B	26	B	25	B
		R	-	-	-	-	-	-	77	F	58	E	100	F	88	F
	Total		**-**	**-**	**-**	**-**	**-**	**-**	**30**	**C**	**31**	**C**	**34**	**C**	**41**	**C**

C. INDUSTRIAL PRECINCT TRAFFIC DISTRIBUTION

C

APPENDIX: INDUSTRIAL PRECINCT TRAFFIC DISTRIBUTION

Figure B.1: AM Peak 25% Scenario Industrial Precinct Traffic Generation Distribution – Precinct 2A



APPENDIX: INDUSTRIAL PRECINCT TRAFFIC DISTRIBUTION

Figure B.2: AM Peak 50% Scenario Industrial Precinct Traffic Generation Distribution – Precinct 2A

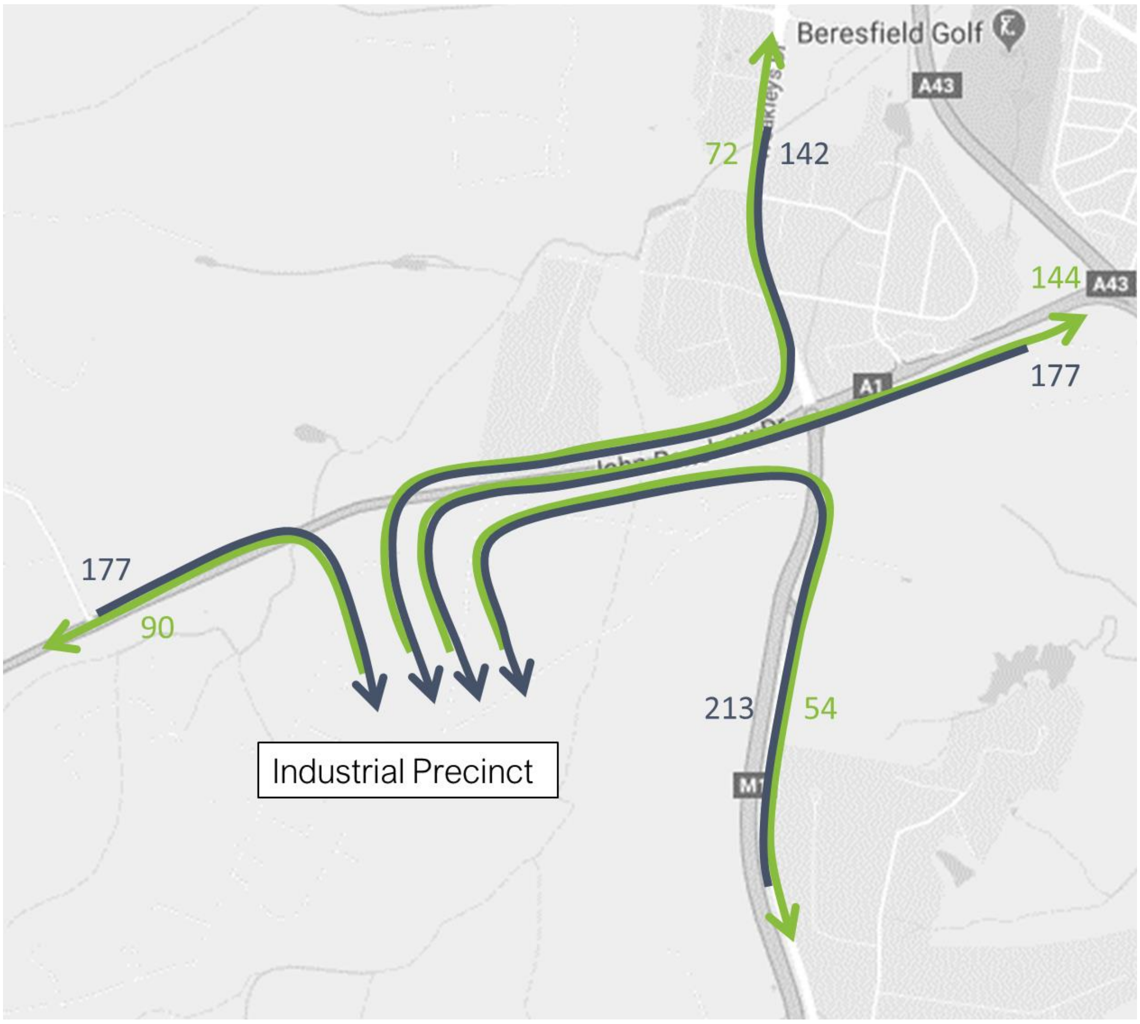


Figure B.3: AM Peak 75% Scenario Industrial Precinct Traffic Generation Distribution – Precinct 2A

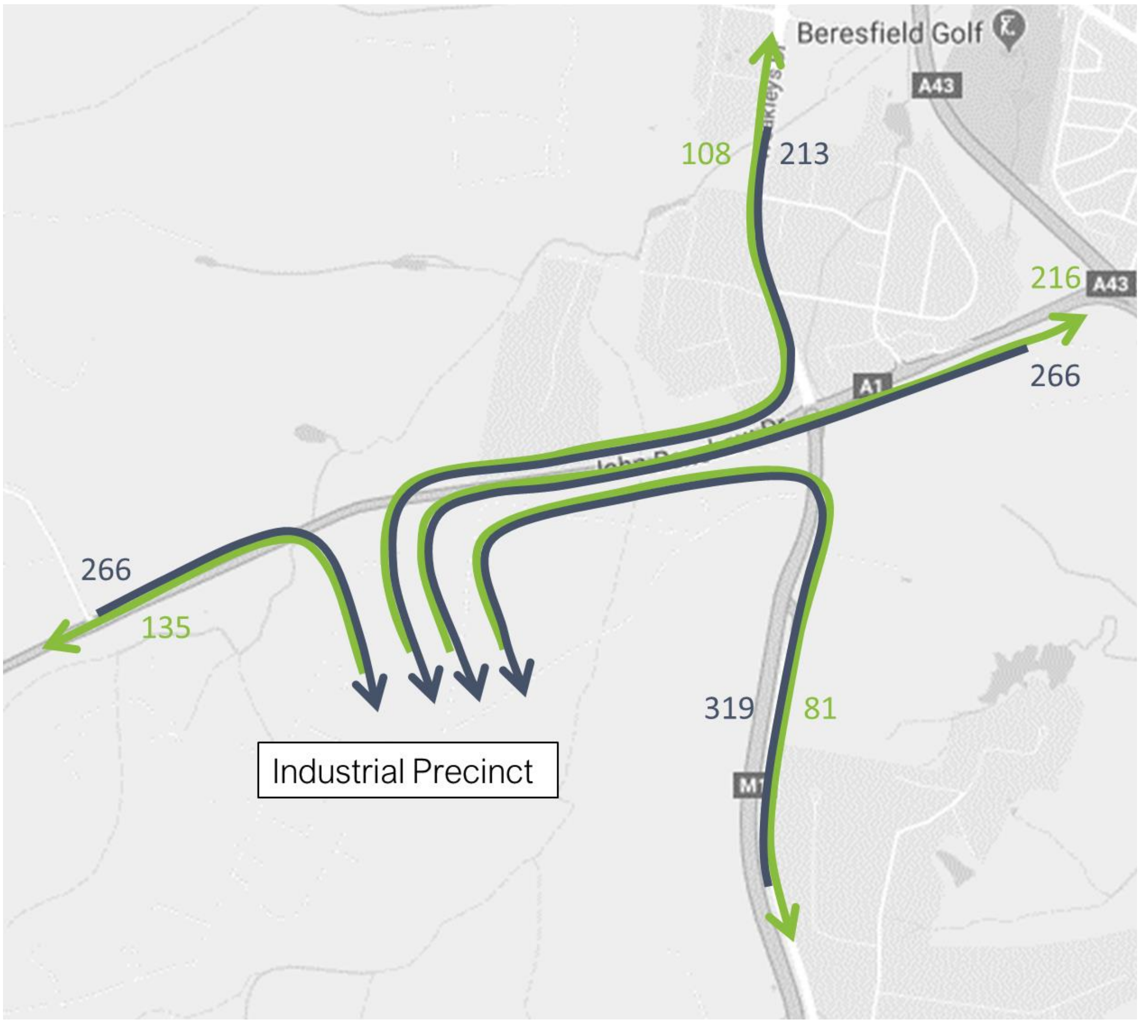
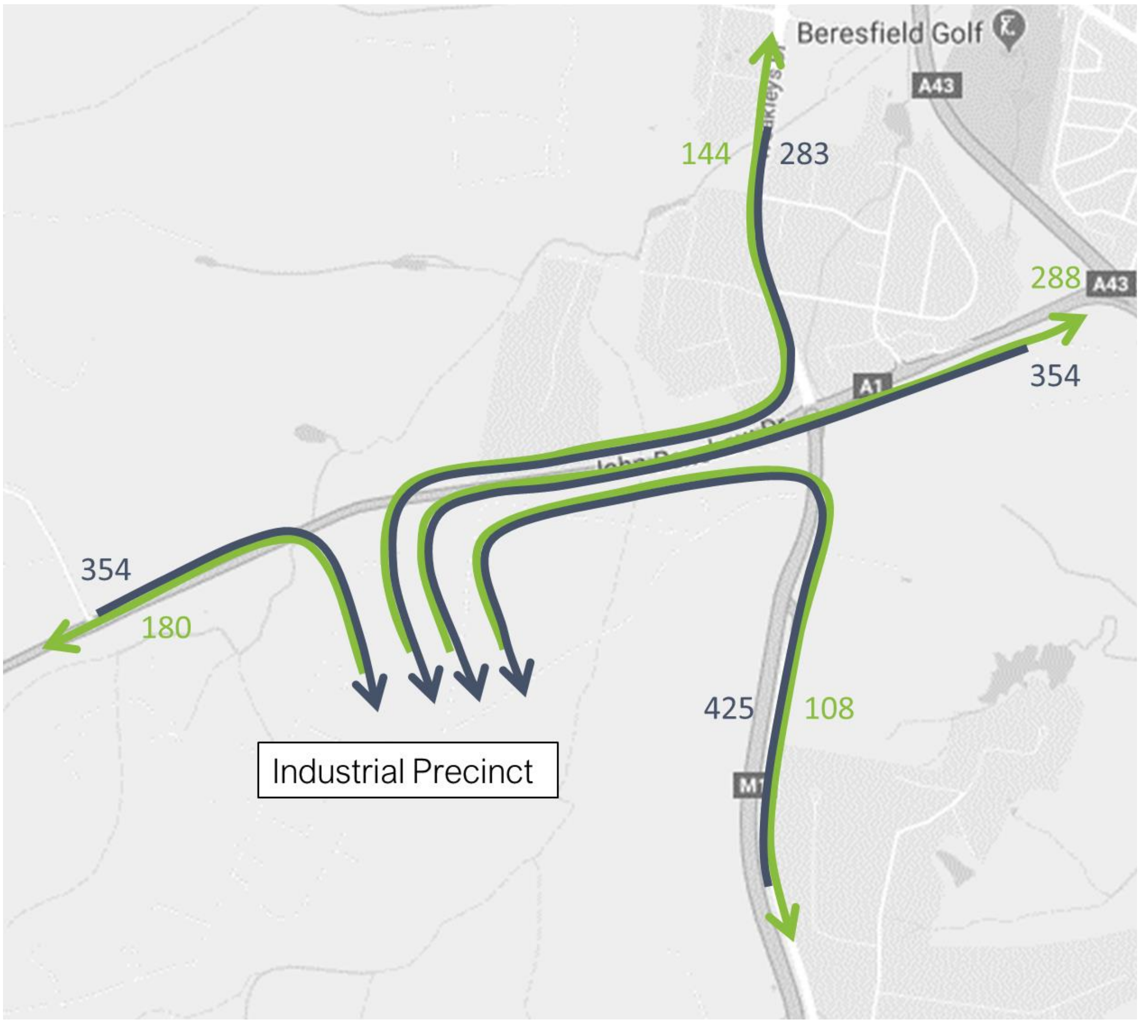


Figure B.4: AM Peak 100% Scenario Industrial Precinct Traffic Generation Distribution – Precinct 2A



APPENDIX: INDUSTRIAL PRECINCT TRAFFIC DISTRIBUTION

Figure B.5: PM Peak 25% Scenario Industrial Precinct Traffic Generation Distribution – Precinct 2A

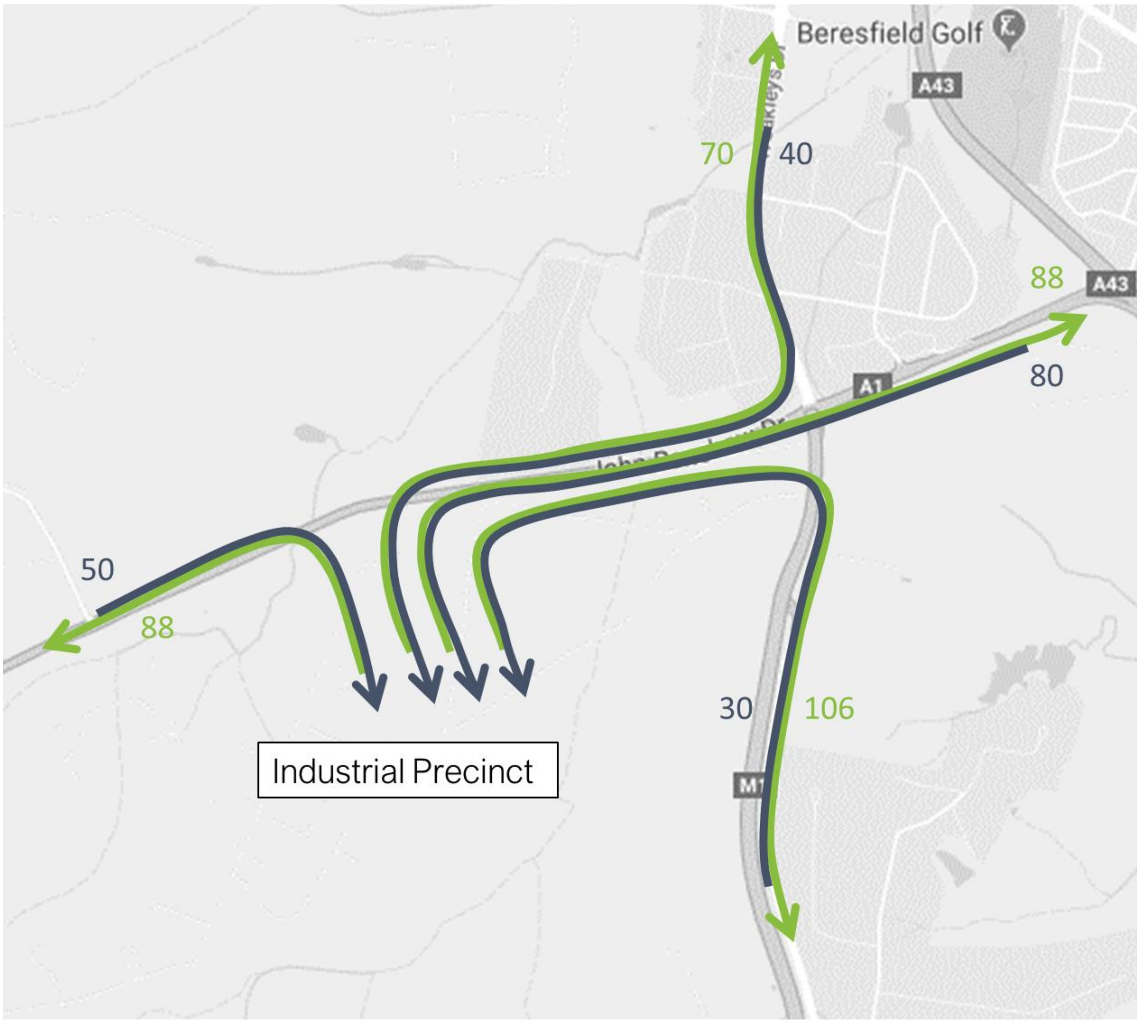


Figure B.6: PM Peak 50% Scenario Industrial Precinct Traffic Generation Distribution – Precinct 2A

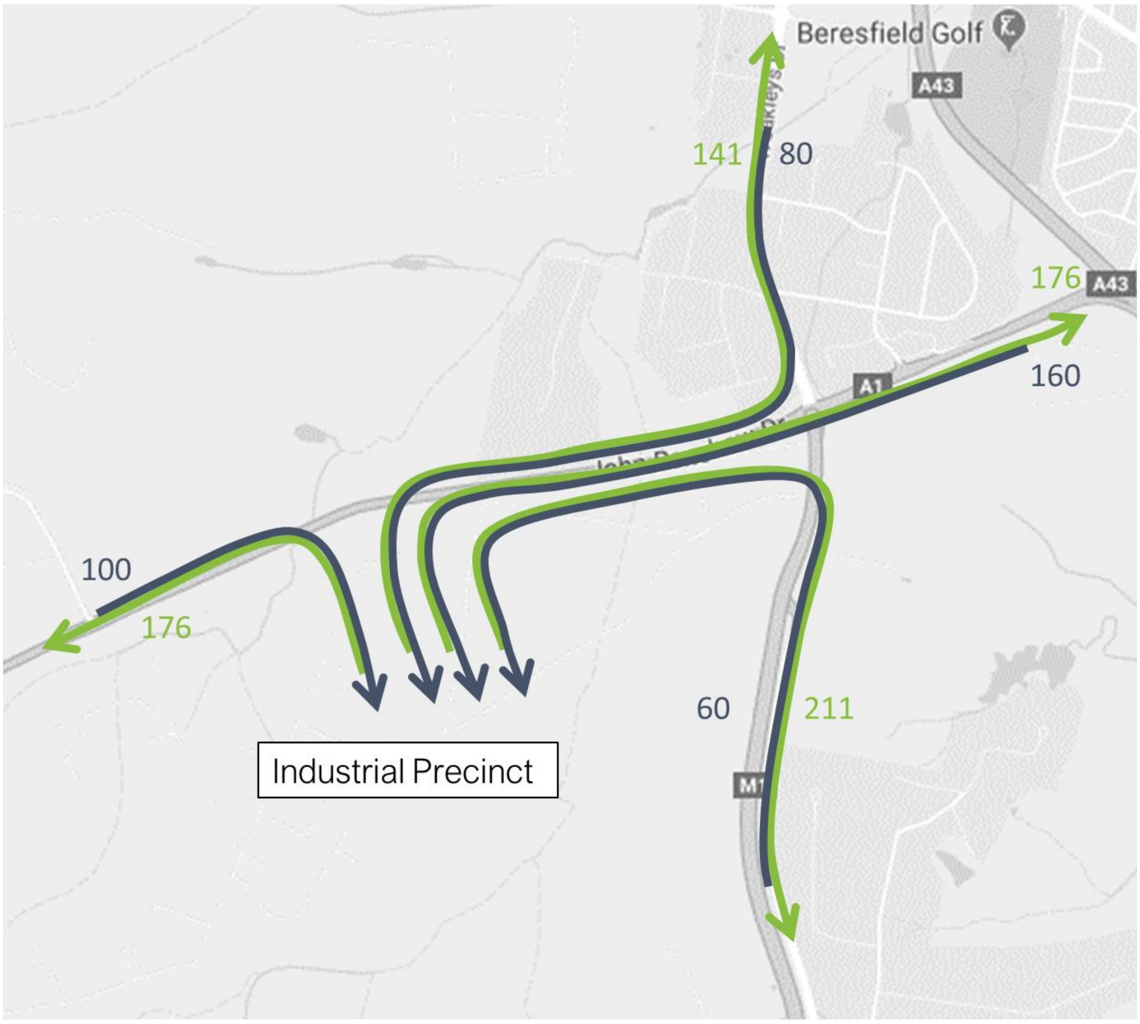


Figure B.7: PM Peak 75% Scenario Industrial Precinct Traffic Generation Distribution – Precinct 2A

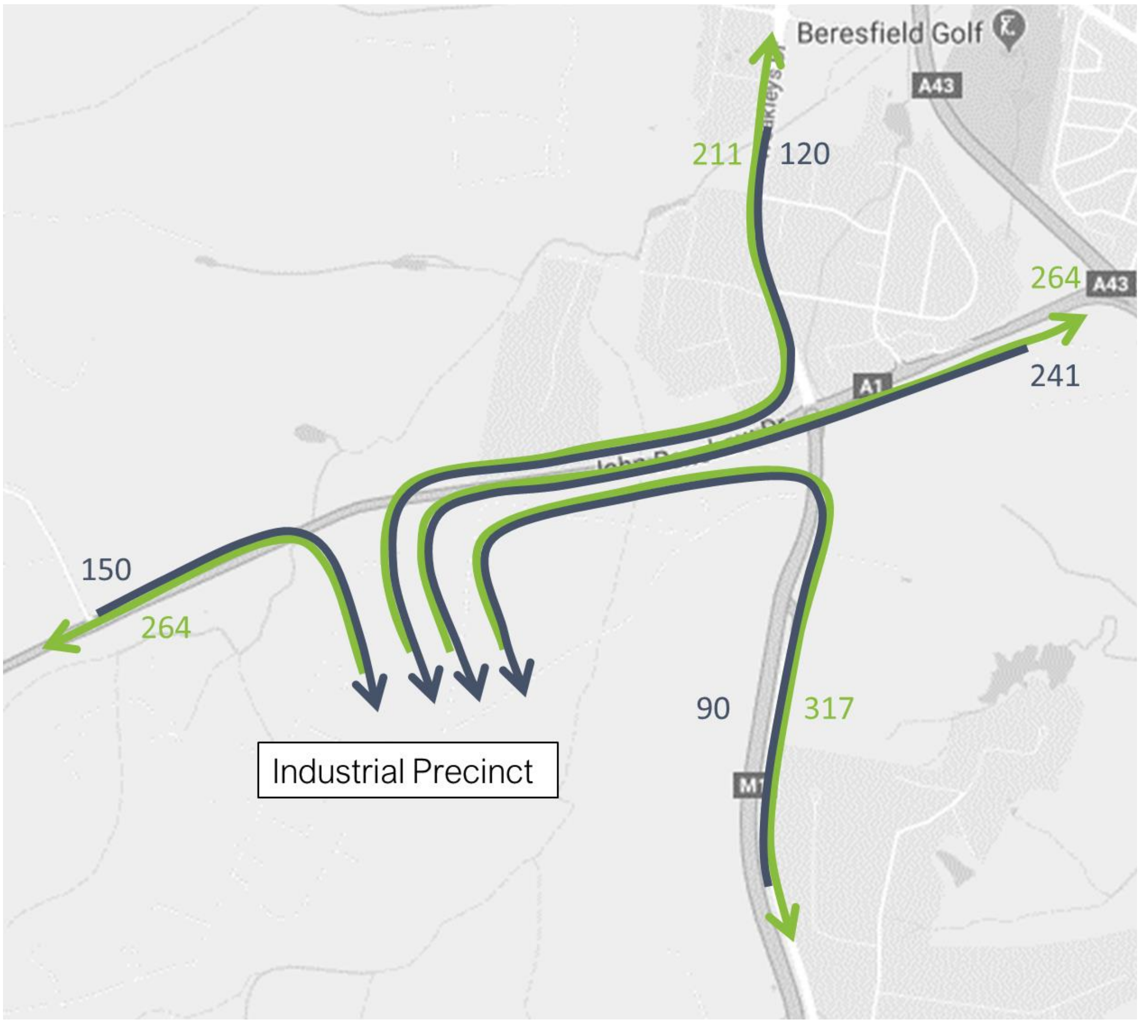


Figure B.8: AM Peak 100% Scenario Industrial Precinct Traffic Generation Distribution – Precinct 2A

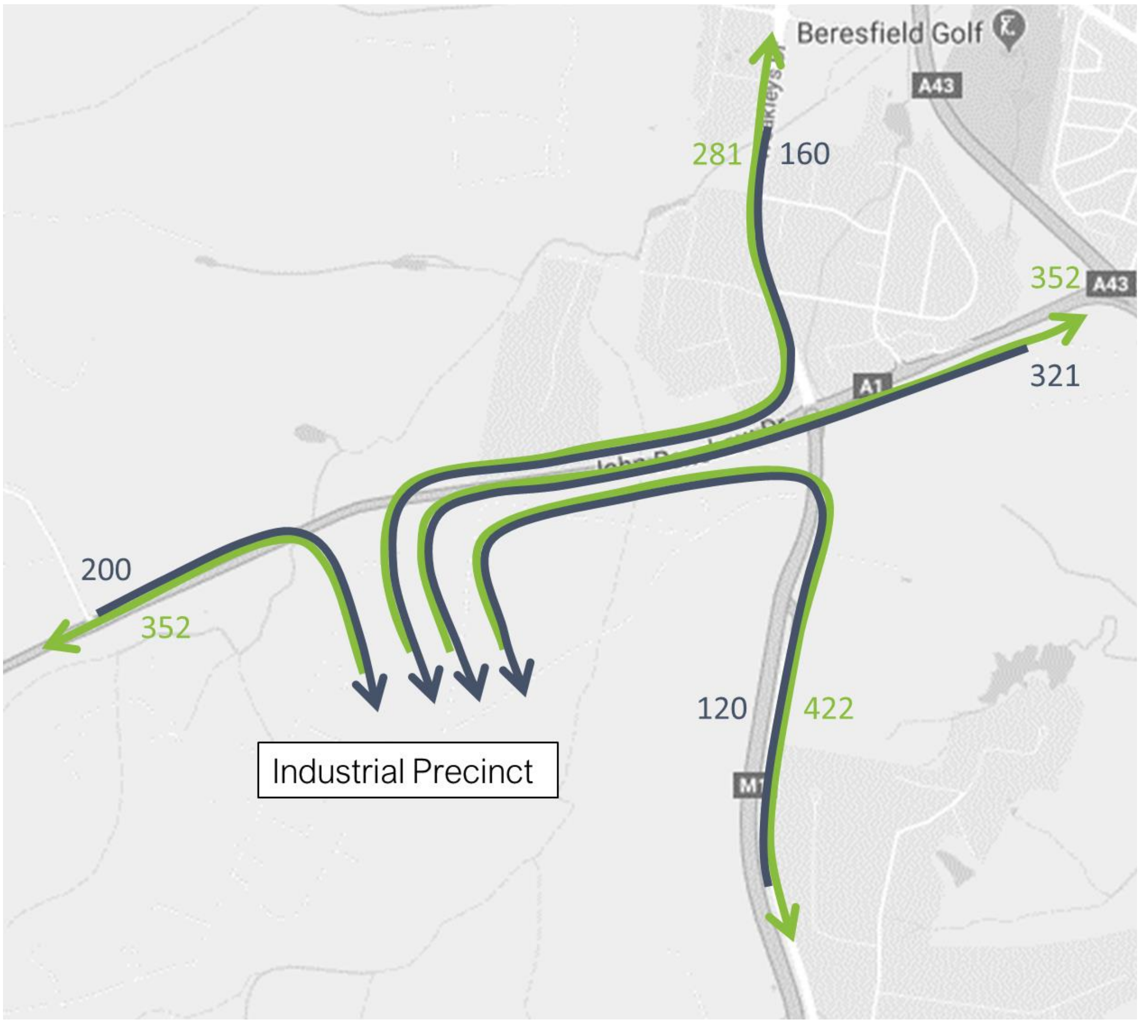


Figure B.9: AM Peak 25% Scenario Industrial Precinct Traffic Generation Distribution – Precinct 2B

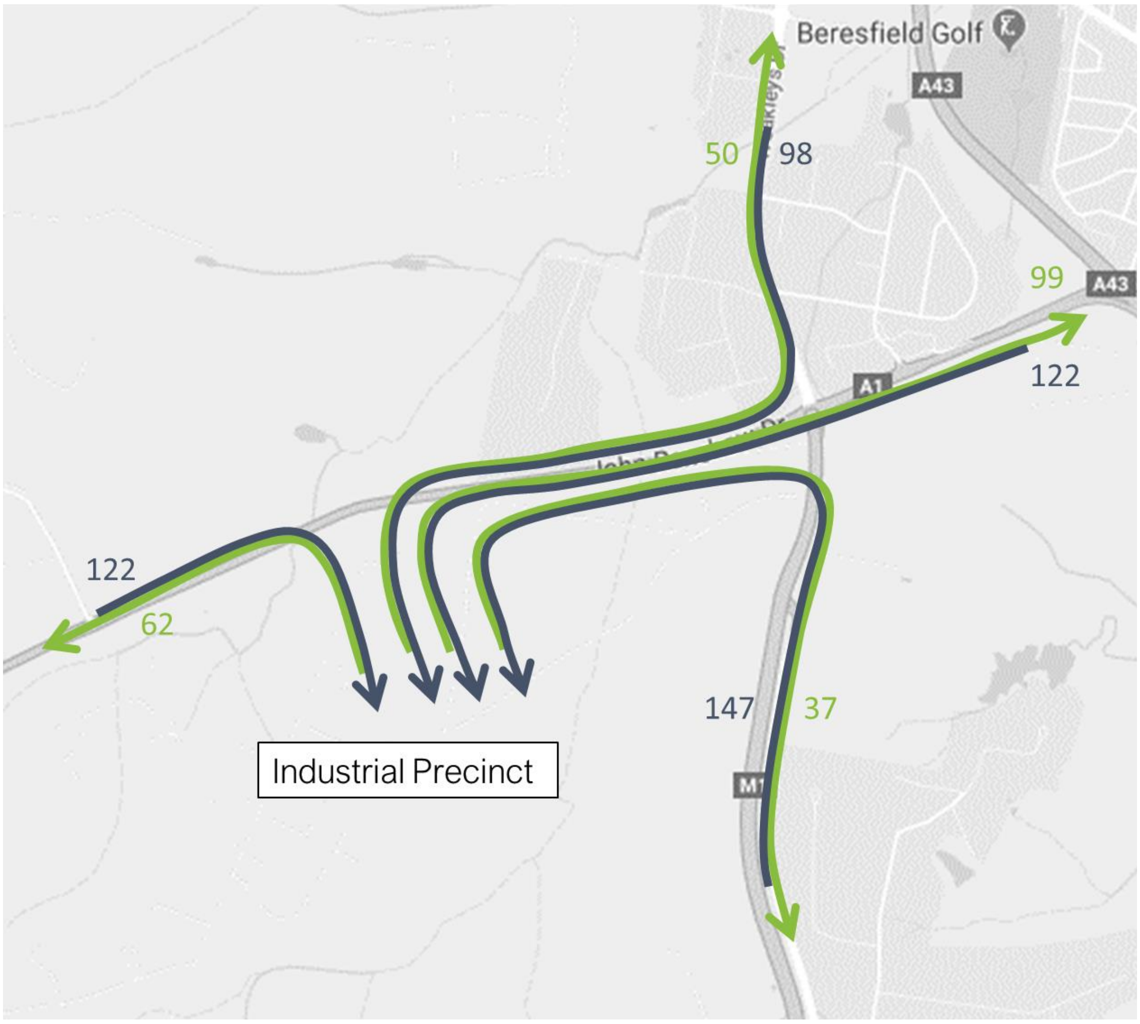


Figure B.10: AM Peak 50% Scenario Industrial Precinct Traffic Generation Distribution – Precinct 2B

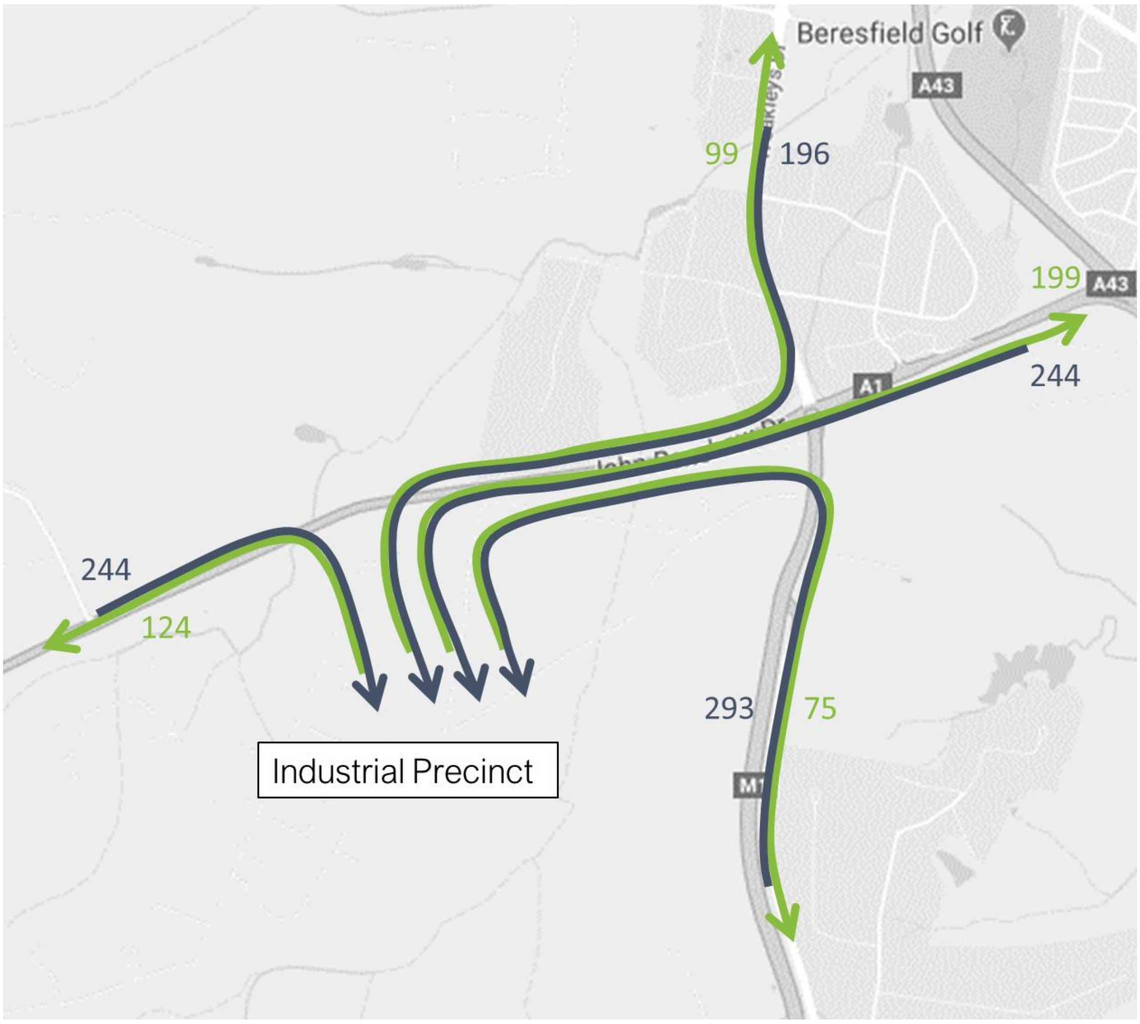


Figure B.11: AM Peak 75% Scenario Industrial Precinct Traffic Generation Distribution – Precinct 2B

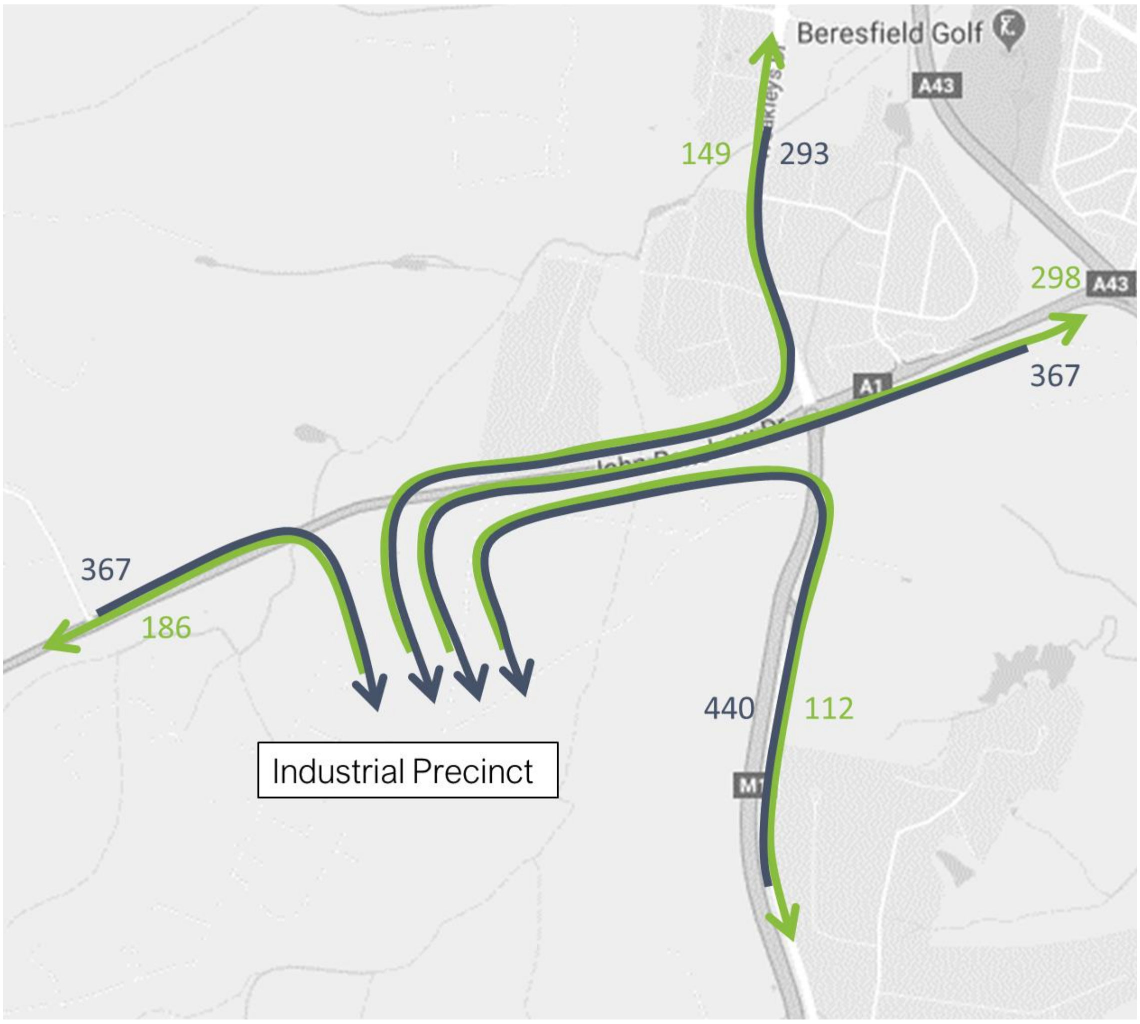


Figure B.12: AM Peak 100% Scenario Industrial Precinct Traffic Generation Distribution – Precinct 2B

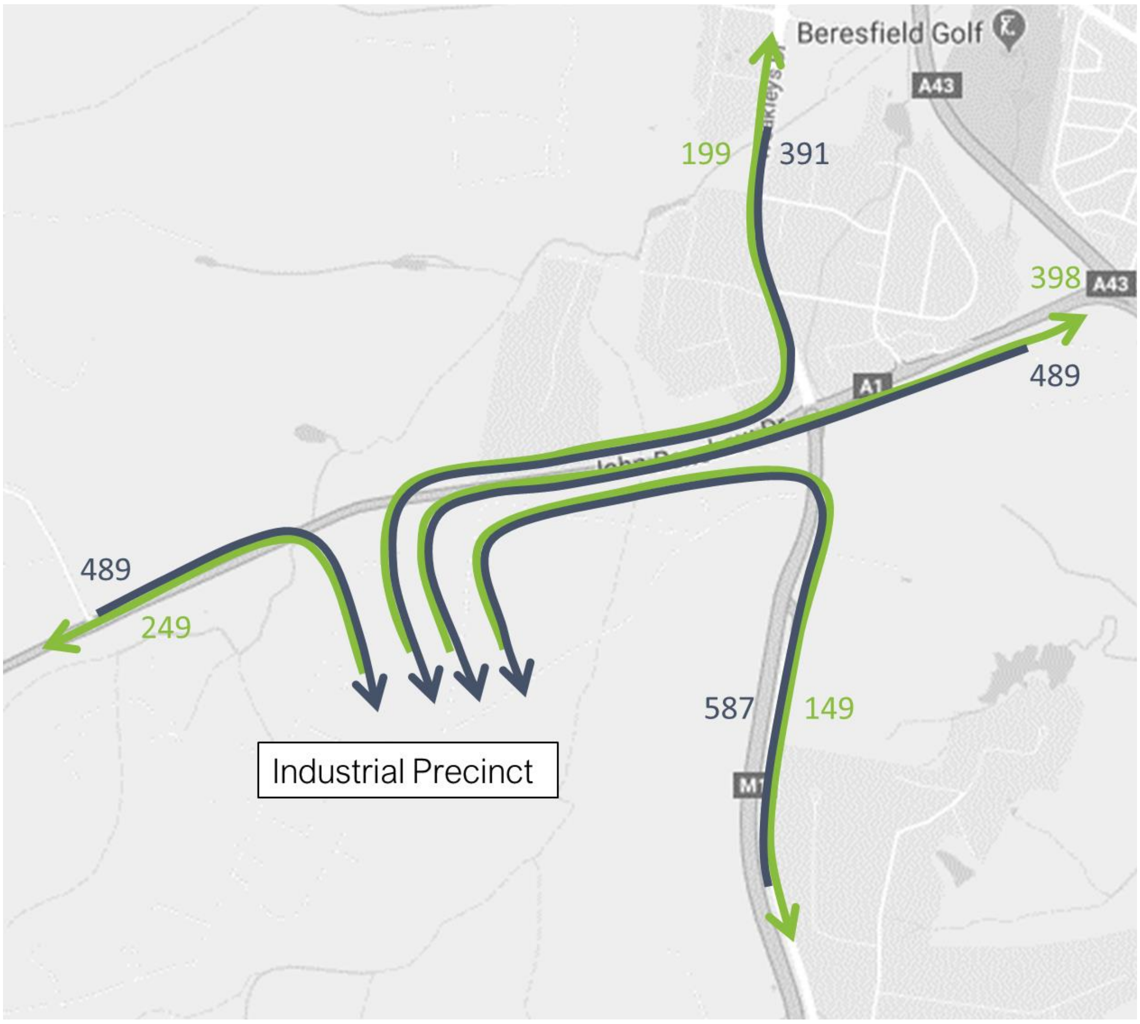


Figure B.13: PM Peak 25% Scenario Industrial Precinct Traffic Generation Distribution – Precinct 2B

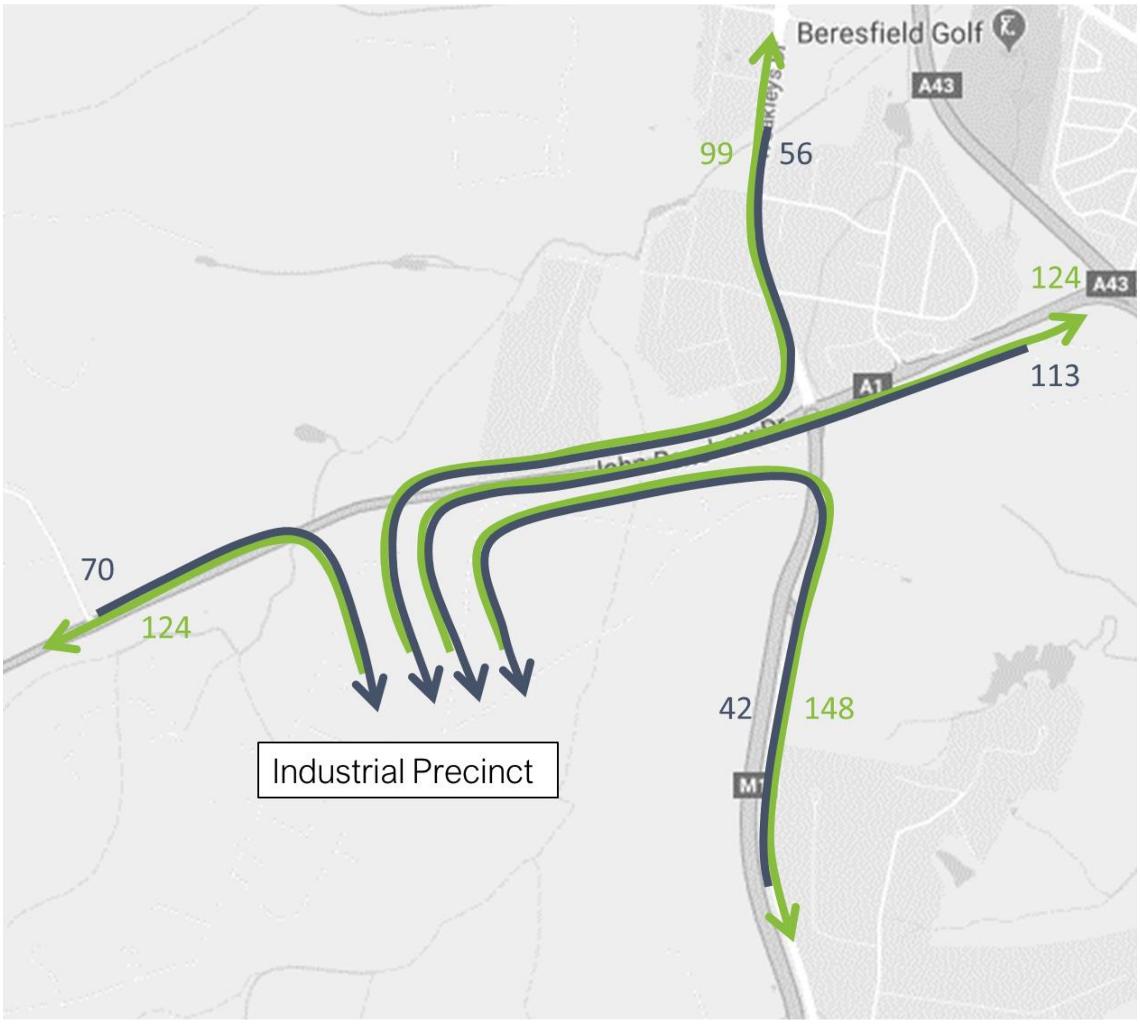


Figure B.14: PM Peak 50% Scenario Industrial Precinct Traffic Generation Distribution – Precinct 2B

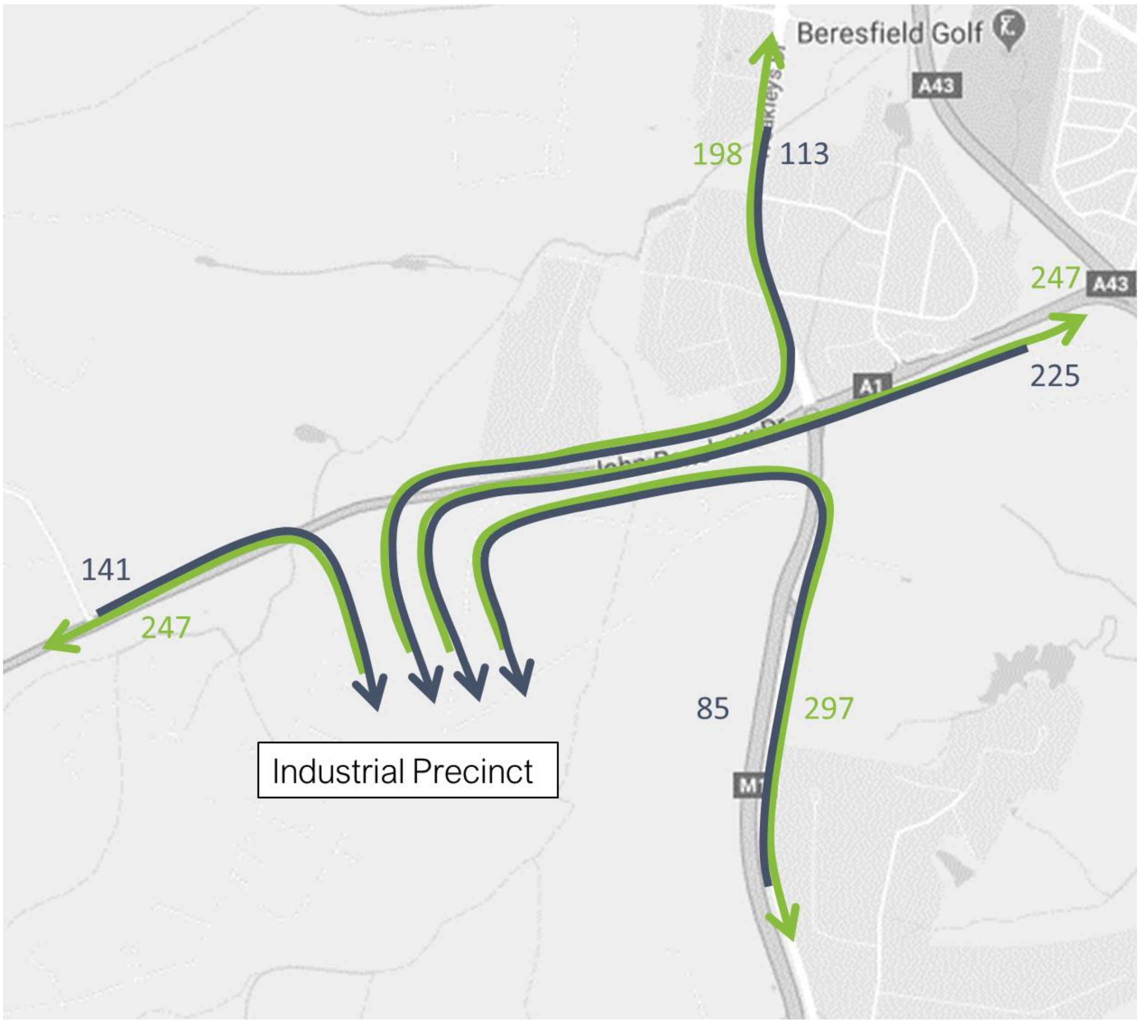


Figure B.15: PM Peak 75% Scenario Industrial Precinct Traffic Generation Distribution – Precinct 2B

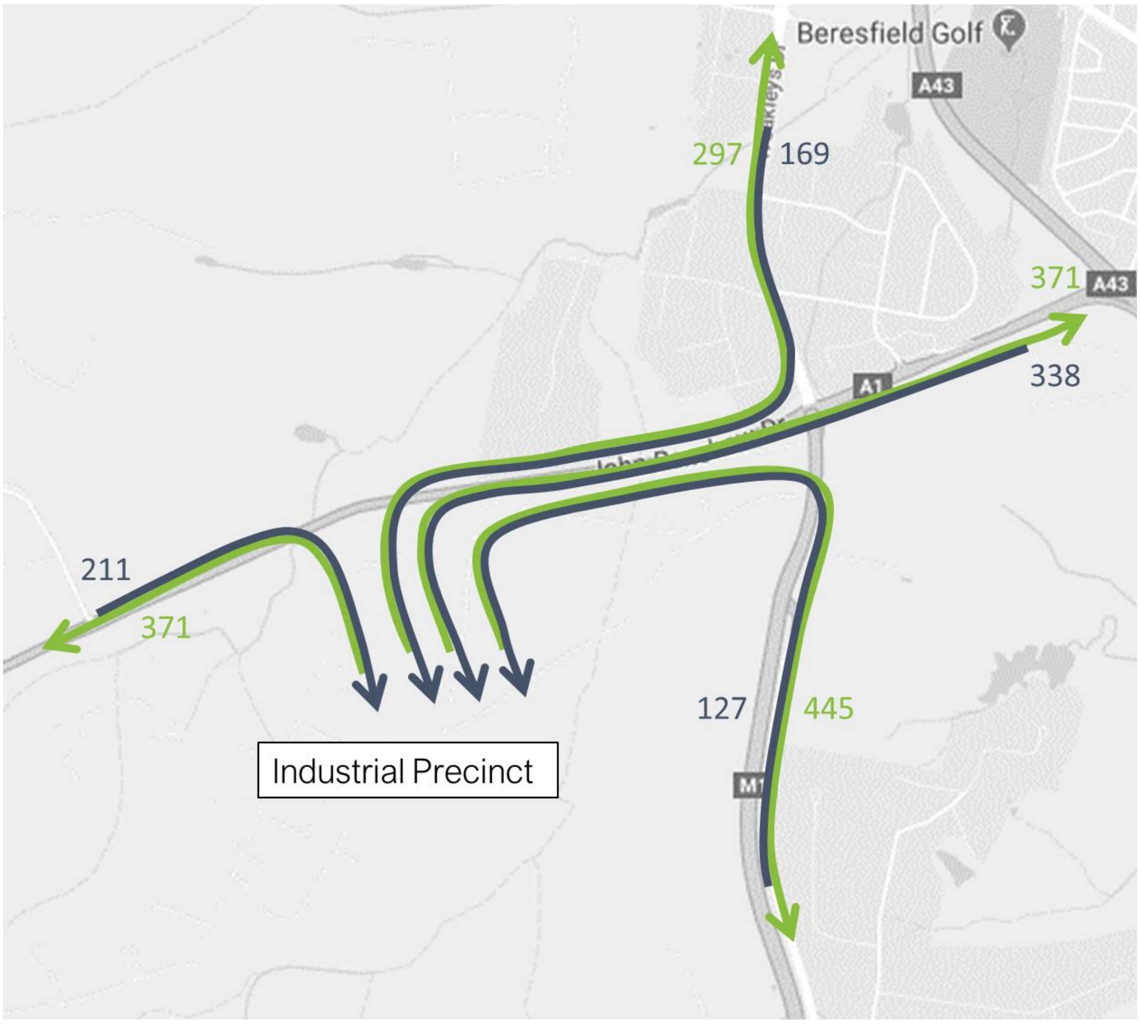
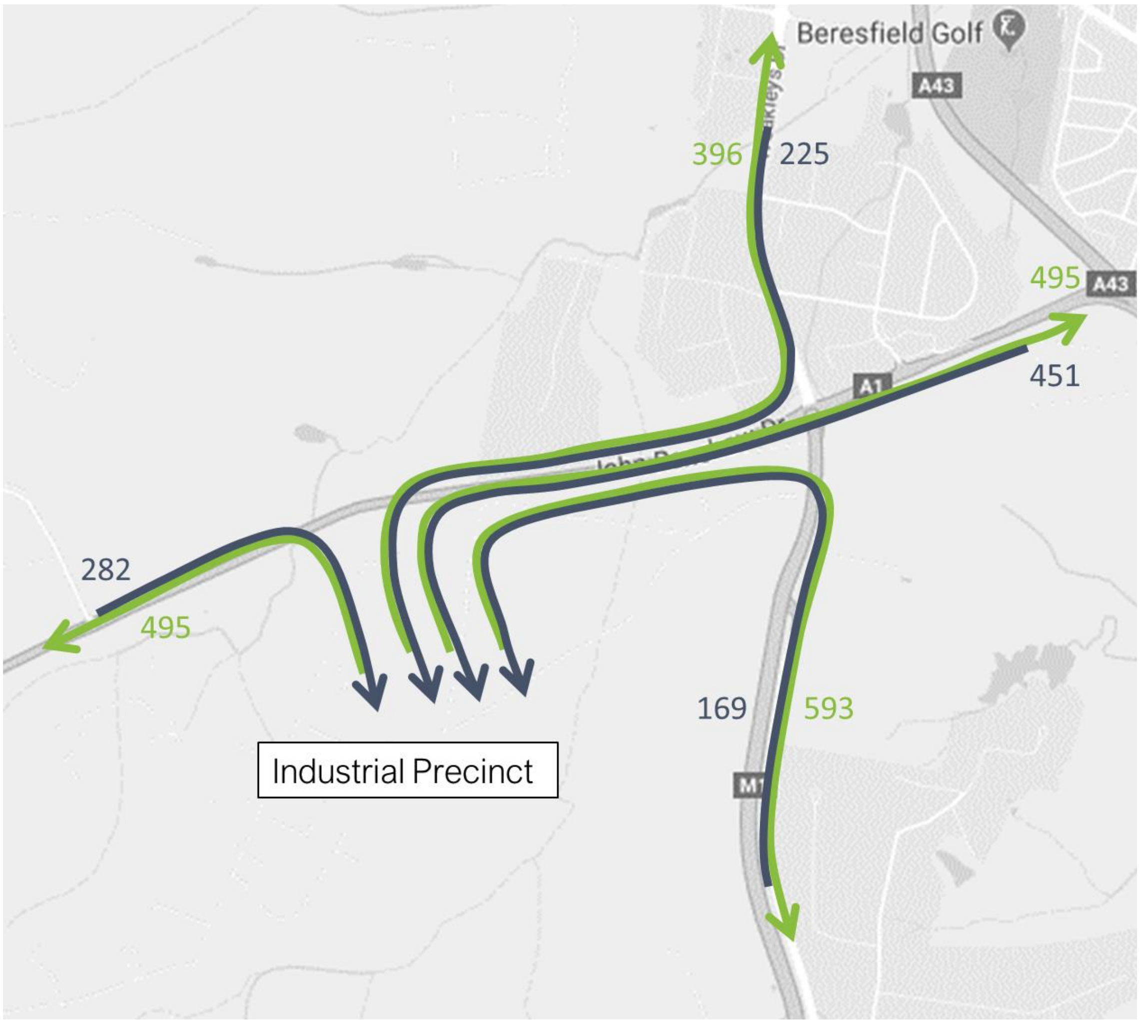


Figure B.16: AM Peak 100% Scenario Industrial Precinct Traffic Generation Distribution – Precinct 2B



D. BASE MODEL DEVELOPMENT REPORT

D

TECHNICAL NOTE

Transport Analytics

DRAFT

Project Code:	N171072	**Project Name:**	John Renshaw Drive, Black Hill
Dept:	Operational Modelling		
Date:	29 November 2019	**Version No.**	1
Author:	William Finlay		
Reviewer:	Bryan Li		
SUBJECT:	**2019 BASE YEAR MODEL DEVELOPMENT**		
Page 1 of	8 (plus Appendix A)		

1. Introduction

1.1 Project Background

GTA Consultants (GTA) has been assisting the project team with the traffic related impacts associated with the proposed large lot industrial development on land located at John Renshaw Drive, Black Hill. The project team have regularly consulted with key stakeholders including Roads and Maritime Services (Roads and Maritime) and Cessnock City Council. Roads and Maritime have subsequently requested that a microsimulation model be developed to supplement the traffic assessment, as well as raising the following key items for consideration in the model development:

- incorporate the neighbouring Coal and Allied Land industrial estate development.
- availability of the M1 to Raymond Terrace traffic model (prepared for Roads and Maritime).
- traffic modelling completed as part of the recent John Renshaw Drive / Weakleys Drive / M1 upgrade project.
- potential site access arrangements and quantum of intersections along John Renshaw Drive.

GTA has now completed the development of the base microsimulation model with this document summarising the model development methodology and its appropriateness to use as a reference for future year investigations.

1.2 Model Scope

The 2017 base year VISSIM model developed by Roads and Maritime was provided to GTA to use as a starting point for this assessment. As agreed, the calibrated and validated 2017 base year model has been truncated to capture the required extents for this assessment – i.e. cropping the model to the east of the Tarro Interchange (refer Figure 1).

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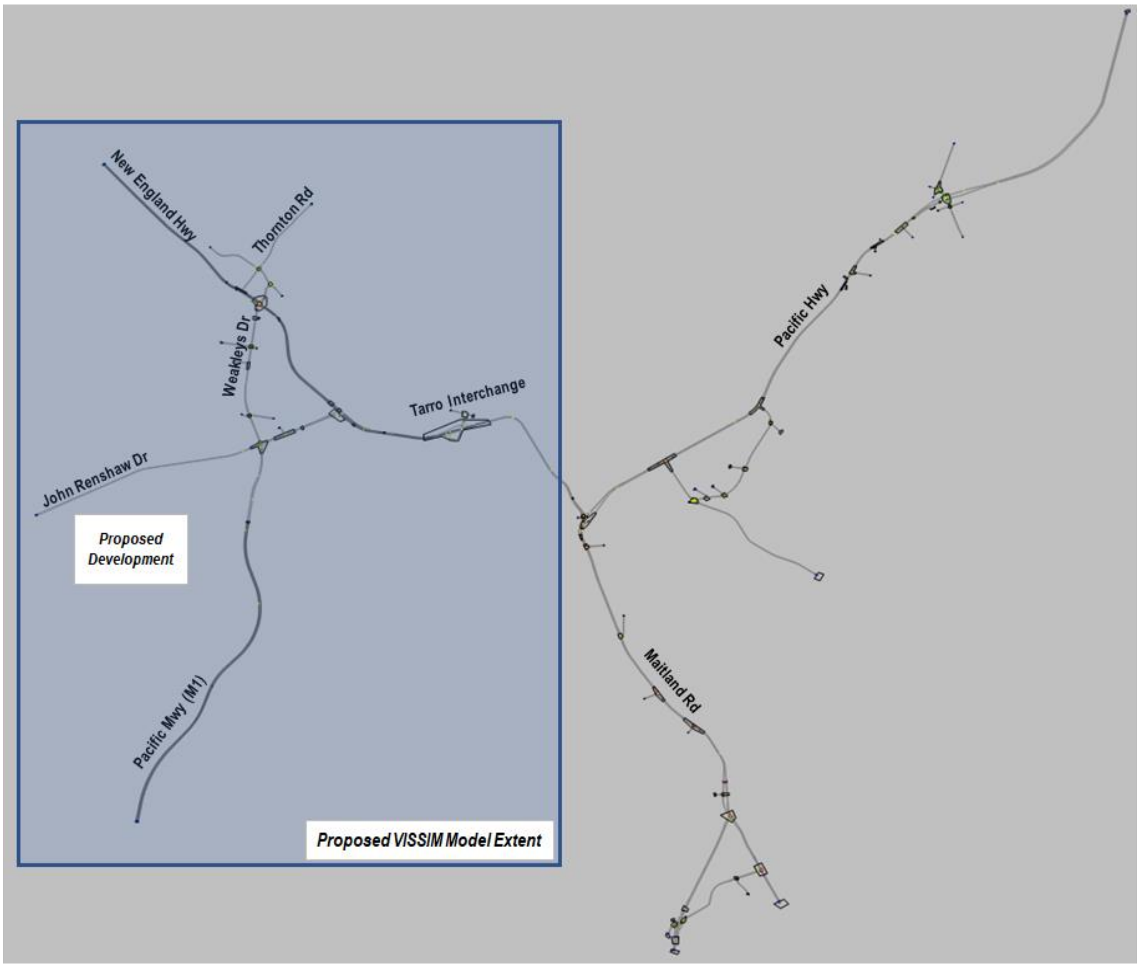
Figure 1: Roads and Maritime 2017 VISSIM Model Extent and Truncated Section for this assessment



The truncated section of the model has been updated to reflect 2019 road network and traffic conditions and will be referred to as the 2019 base year VISSIM model.

It is noted that the 2017 base year VISSIM model was calibrated and validated to an appropriate standard for Roads and Maritime. As such, it has been agreed that the model update to reflect 2019 road network and traffic conditions did not require a full calibration and validation exercise. Notwithstanding, a high level comparison of key metrics (e.g. turn volumes) has been undertaken and presented in Section 4 to demonstrate the suitability of the 2019 base year VISSIM model.

2. SCATS Data Analysis

SCATS data has been obtained from Roads and Maritime to initially assist with understanding the traffic volume changes between 2017 and 2019 at signalised intersections within the truncated model section – i.e. New England Highway / Weakleys Drive. It is noted that the John Renshaw Drive / Weakleys Drive intersection was recently converted to a signalised intersection (previously a roundabout), and as such could not be included in the comparison.

SCATS traffic volume data at the New England Highway / Weakleys Drive intersection for September 2017 and September 2019 has been analysed and graphically illustrated in Figure 2.

Figure 2: SCATS Average Weekday 2017–2019 Comparison for New England Highway / Weakleys Drive Intersection

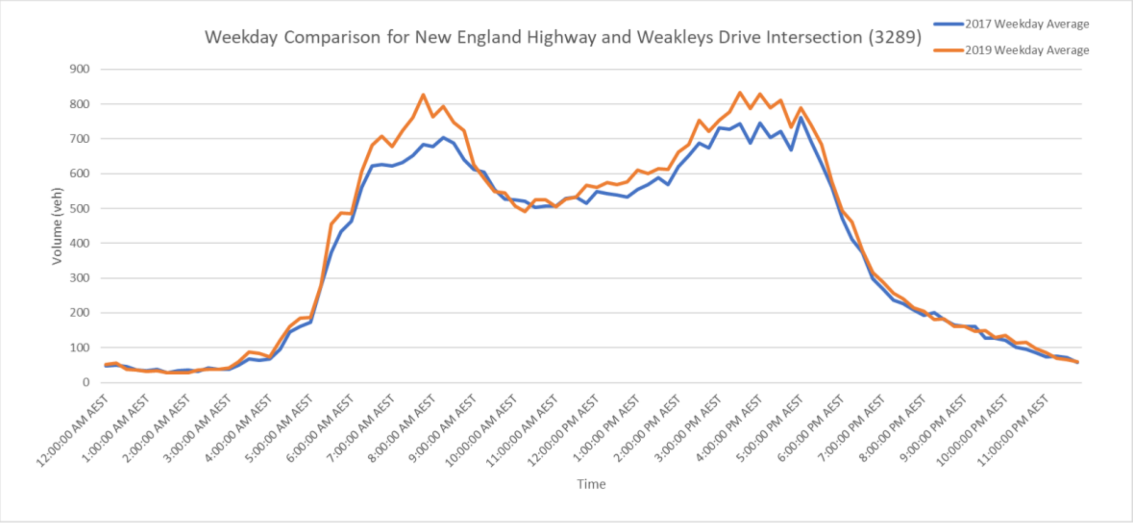


Figure 2 indicates that the total volume at the intersection from 2017 to 2019 increases by approximately 7%, with 12% and 9% increases in the AM peak (6:00 – 9:00am) and PM peak (3:00 – 6:00pm) respectively. Based on the above analysis, the 2017 calibrated and validated model and its inputs were considered suitable to inform the 2019 model as a starting point.

In addition to the above, the SCATS data has also been used to assist with the coding of signalised intersections in the 2019 base year VISSIM model. The data provides information on the following parameters which were analysed to either update of develop new signal controls in the model (refer Section 3.4):

- phasing
- detector locations and numbers
- signal groups
- cycle and phase times
- pedestrian walk times and activation.

3. Base Model Development Methodology

3.1 Software Version

The model has been developed using the VISSIM software (PTV Vision) version 10.00-06. The original software version was retained for consistency, noting that different software versions can, at times, result in slight differences in model outputs.

3.2 Model Network Coding

As mentioned previously, the 2017 base year VISSIM model has been adopted as the starting point for this assessment. The model network has been reviewed against latest Nearmap aerial imagery (2019) to ensure that the modelling assessment incorporates any changes to the road network within the study area between 2017 and 2019.

The main difference between 2017 and 2019 is the intersection configuration of the John Renshaw Drive / Weakleys Drive intersection. This intersection has been converted to a signalised intersection (from a roundabout) in the 2019 base year VISSIM model, with the appropriate lane geometries coded based on the latest aerial imagery.

3.3 Traffic Demand Development

The origin-destination (OD) traffic demand matrices from the 2017 base year VISSIM model were adjusted to reflect the truncated network by creating a new zone at the southern New England Highway boundary. The new zone simulates the north and south bound traffic generated from the original model network that has been removed as part of this assessment.

Given the marginal changes in traffic volumes observed in the network (refer Figure 2), an initial model simulation was undertaken to compare the 2017 traffic demands against 2019 SCATS volumes at the New England Highway / Weakleys Drive and John Renshaw Drive / Weakleys Drive intersections. The results of this initial assessment resulted in the requirement to undertake some minor traffic demand adjustment to better reflect 2019 traffic conditions.

These adjustments were limited to applying scaling factors to origin or destination trip ends, thus maintaining the trip distribution proportions. In addition, some minor OD redistribution was required to ensure a better correlation in modelled traffic volumes with the observed data for key movements.

3.4 Signals

The new signals at the John Renshaw Drive / Weakleys Drive intersection was coded using PTV VisVAP (dynamic) signal control, consistent with the coding of existing signalised intersections within the model. In this regard, signals will be responsive to model demands and call and extend phases as they would under SCATS operation.

Settings for cycle time, phase minimums and phase maximums were fixed for each one hour interval based on the SCATS signal timing data obtained from Roads and Maritime. However, gapping and extending phases are demand dependent.

4. 2019 Base Year Model Suitability

4.1 Model Stability

In order to demonstrate the stability of the model, an assessment of the model over five seeds has been undertaken based on the Vehicle Hours Travelled (VHT), or Total Travel Time, network performance metric. The following sections summarises the model stability analysis with descriptive statistical results for each of the modelled peak also presented.

Weekday AM Peak

Figure 3: Weekday AM Peak (6am – 9am) – VHT Comparison

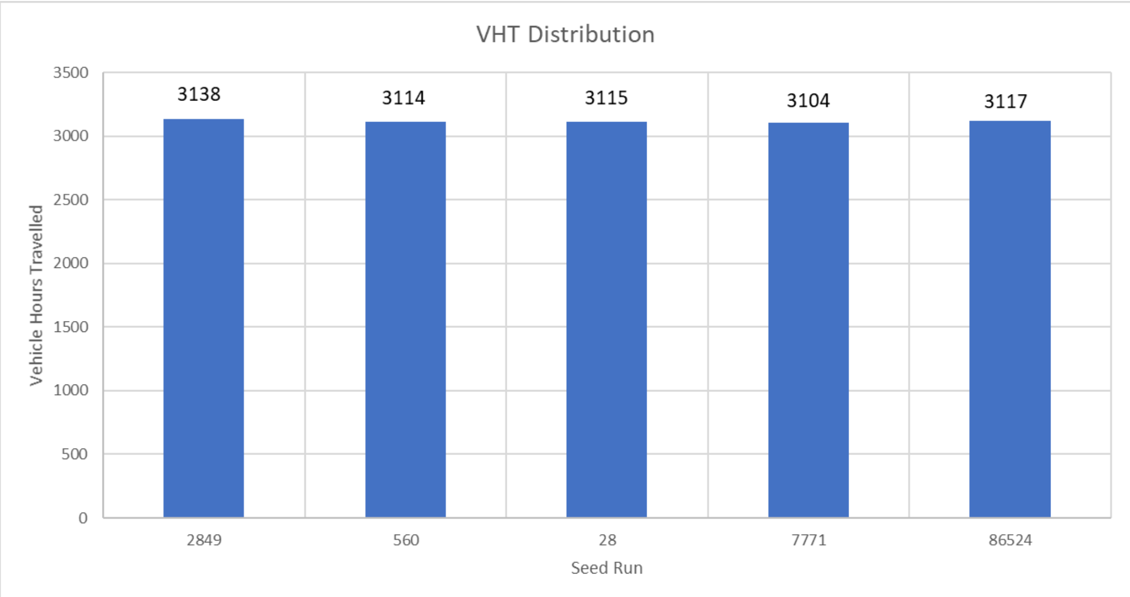


Table 1: Weekday AM Peak (6am – 9am) – Descriptive Statistical Results for VHT

Statistic	Results
Number of runs (n)	5
Mean (ẋ)	3,117
Median (m)	3,115
Standard Deviation (σ)	12.28
Range	33.48
Minimum	3,104
Maximum	3,138
Confidence Level	95%
α	0.05
t-statistic (t)	2.78
CI Half Width	15.25
Upper Confidence Limit	3,133
Lower Confidence Limit	3,102

The results of the model stability analysis for the weekday AM peak illustrates some variation in the VHT results without large shifts in value which is in line with a typical variation in day-to-day traffic volumes. A median seed value of '28' has been identified for the weekday AM peak model. This will be the single seed run to take forward for reporting purposes, as well as for adoption in future year models.

Weekday PM Peak

Figure 4: Weekday PM Peak (3pm – 6pm) – VHT Comparison

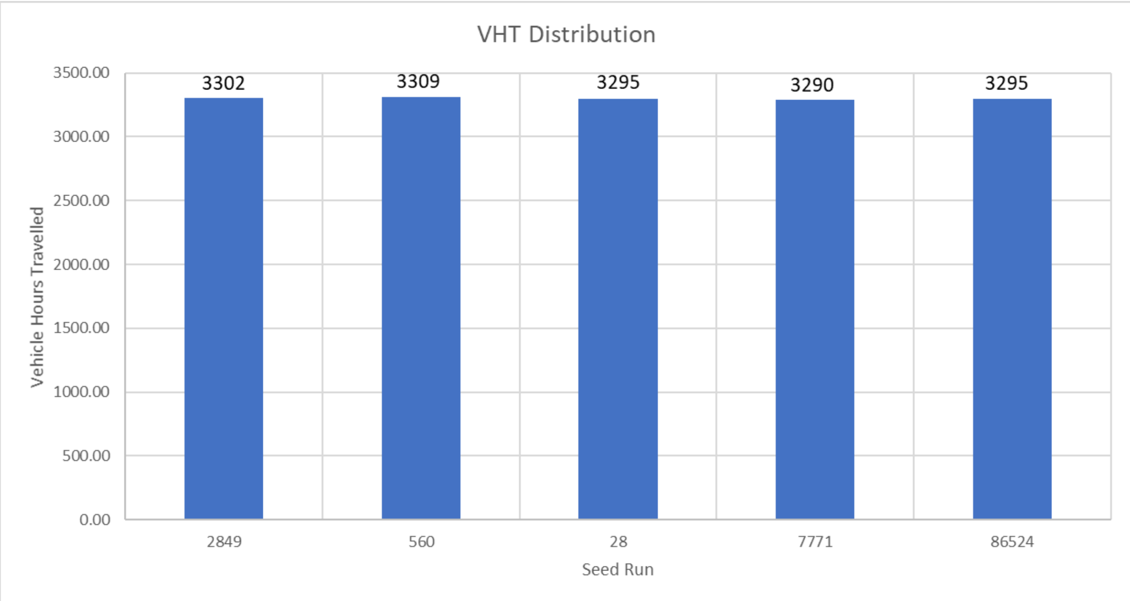


Table 2: Weekday PM Peak (3pm – 6pm) – Descriptive Statistical Results for VHT

Statistic	Results
Number of runs (n)	5
Mean (ẋ)	3,299
Median (m)	3,295
Standard Deviation (σ)	7.42
Range	18.72
Minimum	3,291
Maximum	3,310
Confidence Level	95%
α	0.05
t-statistic (t)	2.78
CI Half Width	9.21
Upper Confidence Limit	3,308
Lower Confidence Limit	3,289

The results of the model stability analysis for the weekday PM peak illustrate some variation in the VHT results without large shifts in value which is in line with a typical variation in day-to-day traffic volumes. A median seed value of '86524' has been identified for the weekday PM peak model. This will be the single seed run to take forward for reporting purposes, as well as for adoption in future year models.

4.2 Model Turn Volume Comparison

A summary of the comparison of modelled turn flows against the 2019 SCATS data has been undertaken based on the criteria specified in the Roads and Maritime Traffic Modelling Guidelines (2013). The network wide criteria has been adopted for turn volume comparison which is summarised below:

- 85% of individual link or turn volumes to have a GEH ≤ 5
- All individual link and turn volumes to have a GEH ≤ 10
- R^2 value > 0.9.

Table 3 and the figures below outline the results of the turn volume comparison. The tables in Appendix A provide the comparison of the individual turn movements.

Table 3: GEH Results Summary

Peak	Time	Measure and Criteria		
		85 % of Turn Counts	All Turn Counts	R^2 value
		GEH ≤ 5	GEH ≤ 10	> 0.9
Weekday AM Peak	6am to 7am	91%	100%	0.93
	7am to 8am	100%	100%	0.96
	8am to 9am	95%	100%	0.96
Weekday PM Peak	3pm to 4pm	95%	100%	0.97
	4pm to 5pm	95%	100%	0.93
	5pm to 6pm	86%	100%	0.98

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Figure 5: Weekday AM Peak (6am – 7am) – Modelled vs Observed Plot

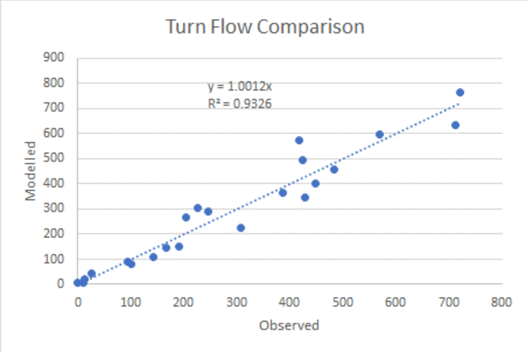

Figure 6: Weekday AM Peak (7am – 8am) – Modelled vs Observed Plot

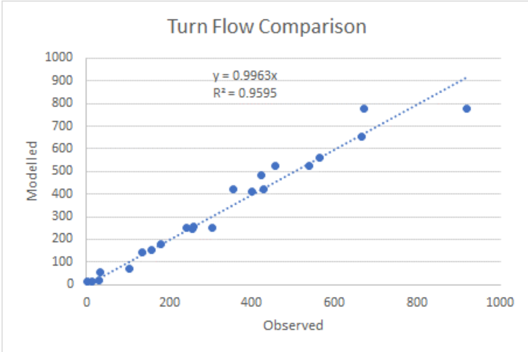

Figure 7: Weekday AM Peak (8am – 9am) – Scatter Plot for VHT

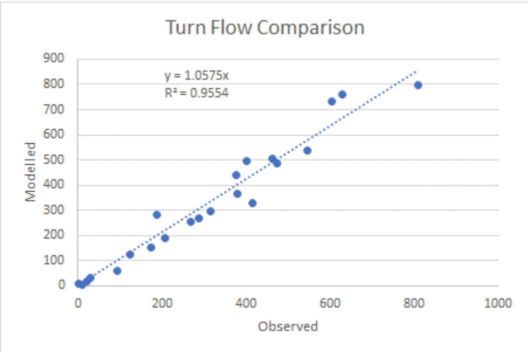

Figure 8: Weekday PM Peak (3pm – 4pm) – Modelled vs Observed Plot

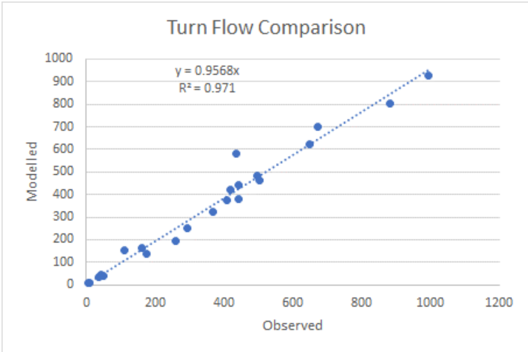

Figure 9: Weekday PM Peak (4pm – 5pm) – Modelled vs Observed Plot

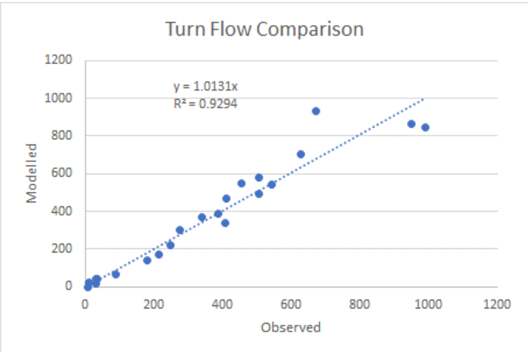

Figure 10: Weekday PM Peak (5pm – 6pm) – Modelled vs Observed Plot

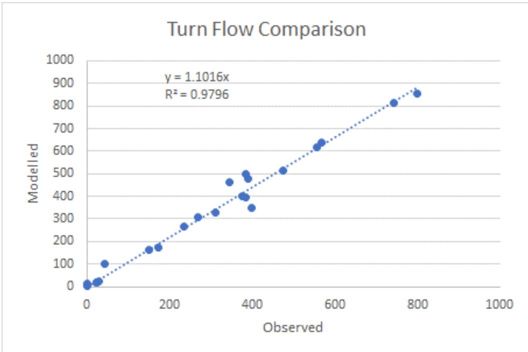

Table 3 indicates that the turn flow calibration criteria is being met for all peak periods with more than 85% of turns having a GEH ≤ 5 for all peak hours, and all turns having a GEH ≤ 10.

Figure 5 to Figure 10 illustrate a close correlation between modelled and observed counts for all peak hours, as well as R^2 value greater than 0.9 which meets the criteria specified in the Roads and Maritime Traffic Modelling Guidelines.

The above comparison indicates that the model has appropriately replicated the traffic conditions in 2019 at key intersections.

4.3 Visual Observations

A review of model operation indicates that the model generally performs in line with current operations and is able to replicate the following key observations at the newly signalised intersection of John Renshaw Drive / Weakleys Drive:

- Minimal queues on the John Renshaw Drive approaches to the New England Highway, with queues able to clear the intersection within the allocated 'E' phase.

- Heavy right turn movement from Weakleys Drive to John Renshaw Drive (south to east), however queues for this movement are generally able to clear the intersection with the allocated 'G' phase.
- Weakleys Drive southbound queues generally require two cycles to clear the intersection.

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5. Existing Network Performance

Network performance metrics provide an understanding of the overall operating performance of the model network. Table 4 and Table 5 summarise the key network performance metrics for the Weekday AM and PM peak models respectively.

Table 4: Network Performance Results – Weekday AM Peak

Network Metric	6:00am to 7:00am	7:00am to 8:00am	8:00am to 9:00am
Average Delay (seconds)	49	60	58
Average speed (km/h)	69.1	67.0	67.1
Total VKT (km)	64,145	78,800	67,755
Total VHT (h)	928	1,176	1,011
Total delay (seconds)	419,496	639,454	542,095
Total number of stops (number)	6,315	9,657	8,724
Latent demand (number)	0	0	0

Table 5: Network Performance Results – Weekday PM Peak

Network Metric	3:00am to 4:00am	4:00am to 5:00am	5:00am to 6:00am
Average Delay (seconds)	51	50	47
Average speed (km/h)	69.0	69.0	70.0
Total VKT (km)	75,172	74,886	77,198
Total VHT (h)	1,088	1,085	1,108
Total delay (seconds)	512,224	517,633	494,612
Total number of stops (number)	8,254	7,781	7,125
Latent demand (number)	0	0	0

Table 4 and Table 5 generally indicate that the operating performance across the entire model network is generally consistent between the AM and PM peaks, with the PM peak recording marginally higher speeds and reduced delays than the AM peak. There are zero unreleased trips (latent demand) which suggests that the model extents are suitable and captures the network appropriate level of network demand.

6. Summary

Based on the above analysis and discussion, the 2019 base year VISSIM model has been developed consistent with the requirements and expectations of Roads and Maritime. The turn volume comparison at key intersections within the network indicated a high level of correlation between modelled and observed counts. As such, it is considered that the 2019 base year VISSIM model is suitable for its intended purpose – i.e. to assess the relative impacts of the proposed development and surrounding infrastructure and land use upgrades.

APPENDIX A

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Turn Volume Comparison Results

Table A-1: AM Peak Turn Volume GEH Results

Time	Intersection	Approach	Movement	Observed	Modelled	Abs Diff	Rel Diff	GEH
6am to 7am	3289 - New England Highway / Weakleys Drive	North	L	448	402	-46	-10%	2.2
			T	430	344	-86	-20%	4.4
			R	166	148	-18	-11%	1.4
		East	L	101	80	-21	-21%	2.2
			T	0	802	802	-	-
			R	226	306	80	35%	4.9
		South	L	246	290	44	18%	2.7
			T	387	363	-24	-6%	1.2
			R	12	20	8	67%	2.0
		West	L	95	90	-5	-5%	0.5
			T	0	1073	1073	-	-
			R	424	496	72	17%	3.4
	4781 - John Renshaw Drive / Weakleys Drive	North	L	26	42	16	62%	2.7
			T	570	595	25	4%	1.0
			R	143	111	-32	-22%	2.8
		East	L	417	572	155	37%	7.0
			T	307	225	-82	-27%	5.0
			R	204	268	64	31%	4.2
		South	L	10	5	-5	-50%	1.8
			T	713	634	-79	-11%	3.0
			R	721	764	43	6%	1.6
		West	L	191	152	-39	-20%	3.0
			T	484	456	-28	-6%	1.3
			R	0	5	5	-	3.2
7am to 8am	3289 - New England Highway / Weakleys Drive	North	L	564	562	-2	0%	0.1
			T	423	485	62	15%	2.9
			R	241	249	8	3%	0.5
		East	L	103	73	-30	-29%	3.2
			T	0	1199	1199	-	-
			R	260	255	-5	-2%	0.3
		South	L	355	421	66	19%	3.4
			T	456	525	69	15%	3.1
			R	31	20	-11	-35%	2.2
		West	L	135	141	6	4%	0.5
			T	0	1889	1889	-	-
			R	539	526	-13	-2%	0.6

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Time	Intersection	Approach	Movement	Observed	Modelled	Abs Diff	Rel Diff	GEH
	4781 - John Renshaw Drive / Weakleys Drive	North	L	33	54	21	64%	3.2
			T	666	655	-11	-2%	0.4
			R	158	152	-6	-4%	0.5
		East	L	428	420	-8	-2%	0.4
			T	304	250	-54	-18%	3.2
			R	256	247	-9	-4%	0.6
		South	L	13	15	2	15%	0.5
			T	918	776	-142	-15%	4.9
			R	672	780	108	16%	4.0
		West	L	181	181	0	0%	0.0
			T	401	409	8	2%	0.4
			R	2	16	14	700%	4.7
8am to 9am	3289 - New England Highway / Weakleys Drive	North	L	416	330	-86	-21%	4.5
			T	401	494	93	23%	4.4
			R	379	367	-12	-3%	0.6
		East	L	94	60	-34	-36%	3.9
			T	0	1017	1017	-	-
			R	269	256	-13	-5%	0.8
		South	L	377	439	62	16%	3.1
			T	475	487	12	3%	0.5
			R	22	19	-3	-14%	0.7
		West	L	175	152	-23	-13%	1.8
			T	0	982	982	-	-
			R	464	506	42	9%	1.9
	4781 - John Renshaw Drive / Weakleys Drive	North	L	29	31	2	7%	0.4
			T	604	731	127	21%	4.9
			R	123	126	3	2%	0.3
		East	L	547	538	-9	-2%	0.4
			T	287	268	-19	-7%	1.1
			R	189	283	94	50%	6.1
		South	L	10	5	-5	-50%	1.8
			T	809	796	-13	-2%	0.5
			R	630	761	131	21%	5.0
		West	L	207	191	-16	-8%	1.1
			T	315	296	-19	-6%	1.1
			R	3	10	7	233%	2.7

Table A-2: PM Peak Turn Volume GEH Results

Time	Intersection	Approach	Movement	Observed	Modelled	Abs Diff	Rel Diff	GEH
3pm to 4pm	3289 - New England Highway / Weakleys Drive	North	L	293	251	-42	-14%	2.5
			T	444	382	-62	-14%	3.1
			R	420	418	-2	0%	0.1
		East	L	43	58	15	35%	2.1
			T	0	1205	1205	-	-
			R	410	375	-35	-9%	1.8
		South	L	436	581	145	33%	6.4
			T	498	480	-18	-4%	0.8
			R	48	36	-12	-25%	1.9
		West	L	260	194	-66	-25%	4.4
			T	0	976	976	-	-
			R	444	443	-1	0%	0.0
	4781 - John Renshaw Drive / Weakleys Drive	North	L	36	36	0	0%	0.0
			T	883	795	-88	-10%	3.0
			R	175	143	-32	-18%	2.5
		East	L	993	926	-67	-7%	2.2
			T	505	460	-45	-9%	2.0
			R	109	143	34	31%	3.0
		South	L	5	6	1	20%	0.4
			T	673	701	28	4%	1.1
			R	650	624	-26	-4%	1.0
		West	L	162	161	-1	-1%	0.1
			T	369	326	-43	-12%	2.3
			R	10	10	0	0%	0.0
4pm to 5pm	3289 - New England Highway / Weakleys Drive	North	L	274	303	29	11%	1.7
			T	406	340	-66	-16%	3.4
			R	387	393	6	2%	0.3
		East	L	31	14	-17	-55%	3.6
			T	0	1250	1250	-	-
			R	455	550	95	21%	4.2
		South	L	504	581	77	15%	3.3
			T	543	540	-3	-1%	0.1
			R	34	45	11	32%	1.8
		West	L	249	221	-28	-11%	1.8
			T	0	686	686	-	-
			R	412	464	52	13%	2.5

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Time	Intersection	Approach	Movement	Observed	Modelled	Abs Diff	Rel Diff	GEH
	4781 - John Renshaw Drive / Weakleys Drive	North	L	31	39	8	26%	1.4
			T	991	863	-128	-13%	4.2
			R	216	166	-50	-23%	3.6
		East	L	950	866	-84	-9%	2.8
			T	506	489	-17	-3%	0.8
			R	88	67	-21	-24%	2.4
		South	L	9	0	-9	-100%	4.2
			T	627	709	82	13%	3.2
			R	673	740	67	10%	2.5
		West	L	181	142	-39	-22%	3.1
			T	339	367	28	8%	1.5
			R	10	20	10	100%	2.6
5pm to 6pm	3289 - New England Highway / Weakleys Drive	North	L	269	307	38	14%	2.2
			T	312	326	14	4%	0.8
			R	386	398	12	3%	0.6
		East	L	24	26	2	8%	0.4
			T	0	1416	1416	-	-
			R	389	476	87	22%	4.2
		South	L	475	512	37	8%	1.7
			T	384	502	118	31%	5.6
			R	29	25	-4	-14%	0.8
		West	L	235	264	29	12%	1.8
			T	0	1250	1250	-	-
			R	399	350	-49	-12%	2.5
	4781 - John Renshaw Drive / Weakleys Drive	North	L	22	18	-4	-18%	0.9
			T	800	849	49	6%	1.7
			R	174	174	0	0%	0.0
		East	L	743	815	72	10%	2.6
			T	376	403	27	7%	1.4
			R	44	96	52	118%	6.2
		South	L	2	1	-1	-50%	0.8
			T	558	611	53	9%	2.2
			R	569	618	49	9%	2.0
		West	L	150	162	12	8%	1.0
			T	345	466	121	35%	6.0
			R	2	12	10	500%	3.8

E. TRAFFIC MODEL RESULTS – NETWORK PERFORMANCE

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APPENDIX: PRECINCT 2A - NETWORK PERFORMANCE SUMMARY

JOHN RENSHAW DRIVE, BLACK HILL - TRAFFIC MODELLING
NETWORK PERFORMANCE RESULTS
GTA Ref: N171072
Date: 20/05/21

PRECINCT

AM PEAK

Metric		6am to 7am							
		Base (2019)	Future Base (2032)	25% Precinct Stage (2023)	50% Precinct Stage (2026)	50% Precinct Stage - No M12RT (2026)	75% Precinct Stage (2029)	100% Precinct Stage (2032)	100% Precinct Stage - Grade Separated (2032)
Average Delay	Sec	49	57	59	72	83	87	141	102
Average Stops	no.	1	1	1	1	1	2	6	5
Average Speed	km/h	69	67	67	64	63	61	53	59
Average Stop Delay	Sec	23	27	29	37	44	46	72	41
Total VKT	km	64,620	68,889	71,409	70,327	78,696	76,339	80,191	81,638
Total VHT	h	931	1,024	1,061	1,103	1,252	1,249	1,500	1,388
Total Delay	h	115	148	157	196	245	261	460	332
Total Stops	no.	6,166	9,433	8,909	11,243	13,006	17,339	68,015	53,041
Total Stop Delay	h	54	69	77	101	130	137	233	134
Vehicles Active	no.	951	1,070	1,091	1,154	1,294	1,338	1,805	1,599
Vehicles Arrived	no.	7,549	8,319	8,488	8,634	9,333	9,429	9,927	10,112
Latent Delay	h	0	0	0	0	0	0	15	4
Latent Demand	no.	0	0	0	0	0	0	34	15
Total Demand	no.	8,500	9,389	9,579	9,788	10,627	10,767	11,766	11,726

Metric		7am to 8am							
		Base (2019)	Future Base (2032)	25% Precinct Stage (2023)	50% Precinct Stage (2026)	50% Precinct Stage - No M12RT (2026)	75% Precinct Stage (2029)	100% Precinct Stage (2032)	100% Precinct Stage - Grade Separated (2032)
Average Delay	Sec	55	130	93	79	142	136	262	195
Average Stops	no.	1	4	2	1	6	3	11	10
Average Speed	km/h	68	56	62	62	54	54	42	48
Average Stop Delay	Sec	20	37	28	32	45	56	108	53
Total VKT	km	79,146	85,147	86,679	87,320	93,624	93,649	97,264	98,354
Total VHT	h	1,165	1,520	1,409	1,398	1,720	1,721	2,329	2,064
Total Delay	h	163	437	311	275	523	513	1,072	796
Total Stops	no.	9,025	53,314	28,510	17,070	74,759	46,232	158,761	139,625
Total Stop Delay	h	59	126	93	111	165	213	441	218
Vehicles Active	no.	1,181	1,779	1,532	1,460	2,068	1,897	2,677	2,453
Vehicles Arrived	no.	9,558	10,343	10,458	10,981	11,211	11,695	12,057	12,243
Latent Delay	h	0	27	0	1	2	8	262	194
Latent Demand	no.	0	57	1	1	1	28	430	242
Total Demand	no.	10,739	12,179	11,991	12,442	13,280	13,620	15,164	14,938

Metric		8am to 9am							
		Base (2019)	Future Base (2032)	25% Precinct Stage (2023)	50% Precinct Stage (2026)	50% Precinct Stage - No M12RT (2026)	75% Precinct Stage (2029)	100% Precinct Stage (2032)	100% Precinct Stage - Grade Separated (2032)
Average Delay	Sec	52	144	86	95	169	174	349	275
Average Stops	no.	1	5	2	2	7	6	22	21
Average Speed	km/h	68	54	62	60	51	49	35	40
Average Stop Delay	Sec	24	62	37	50	70	89	152	94
Total VKT	km	68,301	74,972	76,765	75,026	84,564	81,505	88,146	87,948
Total VHT	h	1,001	1,395	1,233	1,257	1,660	1,648	2,506	2,184
Total Delay	h	135	438	259	288	576	593	1,361	1,045
Total Stops	no.	7,731	58,617	23,241	22,959	83,463	74,426	314,085	282,647
Total Stop Delay	h	64	190	112	151	238	304	591	356
Vehicles Active	no.	999	1,322	1,178	1,212	1,537	1,685	2,420	2,109
Vehicles Arrived	no.	8,366	9,652	9,686	9,706	10,717	10,612	11,609	11,597
Latent Delay	h	0	14	0	0	0	17	240	195
Latent Demand	no.	0	17	0	0	0	17	429	341
Total Demand	no.	9,365	10,991	10,864	10,918	12,254	12,314	14,458	14,047

PRECINCT

PM PEAK

Metric		3pm to 4pm							
		Base (2019)	Future Base (2032)	25% Precinct Stage (2023)	50% Precinct Stage (2026)	50% Precinct Stage - No M12RT (2026)	75% Precinct Stage (2029)	100% Precinct Stage (2032)	100% Precinct Stage - Grade Separated (2032)
Average Delay	Sec	51	72	73	80	91	104	131	95
Average Stops	no.	1	2	1	1	2	2	3	2
Average Speed	km/h	69	65	65	63	62	59	56	61
Average Stop Delay	Sec	21	27	28	38	39	49	64	37
Total VKT	km	75,172	83,395	82,018	83,918	88,783	90,060	93,811	95,191
Total VHT	h	1,088	1,283	1,261	1,329	1,437	1,520	1,690	1,571
Total Delay	h	142	230	227	260	310	371	491	357
Total Stops	no.	8,254	18,555	15,170	16,411	21,227	27,409	43,671	32,039
Total Stop Delay	h	59	88	89	125	134	175	241	138
Vehicles Active	no.	1,158	1,396	1,363	1,461	1,596	1,730	1,951	1,718
Vehicles Arrived	no.	8,868	10,087	9,855	10,296	10,673	11,070	11,525	11,774
Latent Delay	h	0	4	3	1	38	11	164	165
Latent Demand	no.	0	21	10	0	126	45	471	436
Total Demand	no.	10,026	11,504	11,228	11,757	12,395	12,845	13,947	13,928

Metric		4pm to 5pm							
		Base (2019)	Future Base (2032)	25% Precinct Stage (2023)	50% Precinct Stage (2026)	50% Precinct Stage - No M12RT (2026)	75% Precinct Stage (2029)	100% Precinct Stage (2032)	100% Precinct Stage - Grade Separated (2032)
Average Delay	Sec	50	93	80	95	119	160	234	159
Average Stops	no.	1	2	1	2	2	5	9	6
Average Speed	km/h	69	61	64	60	57	52	44	52
Average Stop Delay	Sec	22	36	35	47	58	79	126	75
Total VKT	km	74,886	84,091	83,100	84,600	89,682	92,096	95,413	96,881
Total VHT	h	1,085	1,370	1,307	1,401	1,563	1,782	2,160	1,868
Total Delay	h	144	308	260	324	426	607	944	633
Total Stops	no.	7,781	24,064	17,264	24,047	31,880	74,758	127,999	91,398
Total Stop Delay	h	64	121	113	159	208	301	507	299
Vehicles Active	no.	1,076	1,426	1,247	1,402	1,619	1,938	2,489	2,140
Vehicles Arrived	no.	9,265	10,559	10,418	10,864	11,260	11,733	12,030	12,241
Latent Delay	h	0	4	1	0	160	33	712	616
Latent Demand	no.	0	0	0	0	169	2	912	782
Total Demand	no.	10,341	11,985	11,665	12,266	13,048	13,673	15,431	15,163

Metric		5pm to 6pm							
		Base (2019)	Future Base (2032)	25% Precinct Stage (2023)	50% Precinct Stage (2026)	50% Precinct Stage - No M12RT (2026)	75% Precinct Stage (2029)	100% Precinct Stage (2032)	100% Precinct Stage - Grade Separated (2032)
Average Delay	Sec	47	121	69	95	125	242	407	342
Average Stops	no.	1	5	1	2	3	19	37	39
Average Speed	km/h	70	58	66	61	57	44	33	36
Average Stop Delay	Sec	20	54	33	48	60	115	202	146
Total VKT	km	77,198	86,491	84,935	87,074	94,242	93,834	94,350	92,198
Total VHT	h	1,108	1,499	1,293	1,431	1,653	2,129	2,881	2,526
Total Delay	h	137	408	223	325	462	935	1,677	1,349
Total Stops	no.	7,125	55,625	15,045	25,166	37,011	263,122	547,487	552,647
Total Stop Delay	h	58	183	106	163	221	445	834	574
Vehicles Active	no.	1,048	1,385	1,194	1,242	1,552	2,008	2,781	2,263
Vehicles Arrived	no.	9,405	10,755	10,525	11,115	11,690	11,923	12,067	11,929
Latent Delay	h	0	0	0	1	203	16	1,167	1,204
Latent Demand	no.	0	0	1	0	57	10	1,569	1,748
Total Demand	no.	10,453	12,140	11,720	12,357	13,299	13,941	16,417	15,940

APPENDIX: PRECINCT 2A - NETWORK TRAVEL TIME

JOHN RENSHAW DRIVE, BLACK HILL - TRAFFIC MODELLING
TRAVEL TIME RESULTS
GTA Ref: N171072
Date: 20/05/21

PRECINCT — ROUTE DESCRIPTION — AM PEAK — 6am to 7am

ID	Direction	Description	Base (2019)	Future Base (2032)	25% Precinct Stage (2023)	50% Precinct Stage (2026)	50% Precinct Stage - No M12RT (2026)	75% Precinct Stage (2029)	100% Precinct Stage (2032)	100% Precinct Stage - Grade Separated (2032)
A -B (1)	EB	M1 to A1 (1)	169	172	187	176	211	180	178	179
A -B (2)	EB	M1 to A1 (2)	69	69	69	69	69	68	69	73
A -B (3)	EB	M1 to A1 (3)	90	89	93	93	95	94	94	87
TOTAL	**EB**	**M1 to A1**	**328**	**330**	**349**	**338**	**375**	**342**	**341**	**339**
B - A (1)	WB	A1 to M1 (1)	83	83	84	83	85	84	84	84
B - A (2)	WB	A1 to M1 (2)	66	69	68	66	67	65	69	81
B - A (3)	WB	A1 to M1 (3)	116	116	117	116	116	116	117	117
TOTAL	**WB**	**A1 to M1**	**265**	**268**	**269**	**265**	**268**	**265**	**270**	**282**
A - C (1)	NB	M1 to A43 (1)	150	160	219	412	437	422	556	259
A - C (2)	NB	M1 to A43 (2)	162	166	65	65	65	65	66	62
A - C (3)	NB	M1 to A43 (3)	136	137	93	93	95	94	94	87
TOTAL	**NB**	**M1 to A43**	**448**	**463**	**377**	**570**	**597**	**581**	**716**	**408**
C - A (1)	SB	A43 to M1 (1)	169	199	170	153	150	159	167	133
C - A (2)	SB	A43 to M1 (2)	239	203	161	165	167	164	173	169
C -A (3)	SB	A43 to M1 (3)	132	132	136	137	137	137	138	139
TOTAL	**SB**	**A43 to M1**	**540**	**534**	**467**	**455**	**454**	**460**	**478**	**441**
D - B (1)	EB	JRD to M1 (1)	197	200	172	201	250	318	569	571
D - B (2)	EB	JRD to M1 (2)	65	65	267	196	231	203	209	171
D -B (3)	EB	JRD to M1 (3)	90	89	130	130	136	132	131	124
TOTAL	**EB**	**JRD to M1**	**352**	**354**	**569**	**527**	**617**	**653**	**909**	**866**
B - D (1)	WB	M1 to JRD (1)	83	83	83	83	85	83	84	84
B - D (2)	WB	M1 to JRD (2)	91	102	100	110	107	103	113	67
B - D (3)	WB	M1 to JRD (3)	158	160	200	217	233	209	247	229
TOTAL	**WB**	**M1 to JRD**	**332**	**345**	**383**	**410**	**425**	**395**	**444**	**380**

AM PEAK — 7am to 8am

ID	Direction	Description	Base (2019)	Future Base (2032)	25% Precinct Stage (2023)	50% Precinct Stage (2026)	50% Precinct Stage - No M12RT (2026)	75% Precinct Stage (2029)	100% Precinct Stage (2032)	100% Precinct Stage - Grade Separated (2032)
A -B (1)	EB	M1 to A1 (1)	171	178	173	175	213	179	190	180
A -B (2)	EB	M1 to A1 (2)	70	68	69	67	91	67	68	72
A -B (3)	EB	M1 to A1 (3)	96	158	160	103	274	134	156	156
TOTAL	**EB**	**M1 to A1**	**337**	**404**	**402**	**345**	**578**	**380**	**414**	**408**
B - A (1)	WB	A1 to M1 (1)	84	84	84	83	86	85	85	85
B - A (2)	WB	A1 to M1 (2)	67	66	67	66	67	66	68	69
B - A (3)	WB	A1 to M1 (3)	117	116	118	117	118	118	117	117
TOTAL	**WB**	**A1 to M1**	**268**	**266**	**269**	**266**	**271**	**269**	**270**	**271**
A - C (1)	NB	M1 to A43 (1)	152	172	240	347	468	412	872	263
A - C (2)	NB	M1 to A43 (2)	168	285	65	66	82	65	65	62
A - C (3)	NB	M1 to A43 (3)	139	140	160	103	274	133	155	156
TOTAL	**NB**	**M1 to A43**	**459**	**597**	**465**	**516**	**824**	**610**	**1092**	**481**
C - A (1)	SB	A43 to M1 (1)	165	169	163	158	156	173	279	136
C - A (2)	SB	A43 to M1 (2)	202	200	199	234	197	345	263	329
C -A (3)	SB	A43 to M1 (3)	129	131	139	140	140	140	141	141
TOTAL	**SB**	**A43 to M1**	**496**	**500**	**501**	**532**	**493**	**658**	**683**	**606**
D - B (1)	EB	JRD to M1 (1)	205	209	171	176	181	374	707	650
D - B (2)	EB	JRD to M1 (2)	65	65	221	197	263	203	307	202
D -B (3)	EB	JRD to M1 (3)	96	158	130	127	134	129	132	122
TOTAL	**EB**	**JRD to M1**	**366**	**432**	**522**	**500**	**578**	**706**	**1146**	**974**
B - D (1)	WB	M1 to JRD (1)	84	84	84	83	86	85	85	85
B - D (2)	WB	M1 to JRD (2)	97	100	107	112	107	104	113	63
B - D (3)	WB	M1 to JRD (3)	161	160	205	223	240	216	256	246
TOTAL	**WB**	**M1 to JRD**	**342**	**344**	**396**	**418**	**433**	**405**	**454**	**394**

AM PEAK — 8am to 9am

ID	Direction	Description	Base (2019)	Future Base (2032)	25% Precinct Stage (2023)	50% Precinct Stage (2026)	50% Precinct Stage - No M12RT (2026)	75% Precinct Stage (2029)	100% Precinct Stage (2032)	100% Precinct Stage - Grade Separated (2032)
A -B (1)	EB	M1 to A1 (1)	171	175	167	181	196	177	329	179
A -B (2)	EB	M1 to A1 (2)	69	68	68	67	240	67	68	72
A -B (3)	EB	M1 to A1 (3)	90	112	135	91	292	109	151	135
TOTAL	**EB**	**M1 to A1**	**330**	**355**	**370**	**339**	**728**	**353**	**548**	**386**
B - A (1)	WB	A1 to M1 (1)	83	84	84	84	86	85	85	85
B - A (2)	WB	A1 to M1 (2)	66	72	67	73	93	74	111	95
B - A (3)	WB	A1 to M1 (3)	117	118	117	117	117	117	117	117
TOTAL	**WB**	**A1 to M1**	**266**	**274**	**268**	**274**	**296**	**276**	**313**	**297**
A - C (1)	NB	M1 to A43 (1)	152	195	236	327	343	357	860	259
A - C (2)	NB	M1 to A43 (2)	168	513	65	65	234	65	66	62
A - C (3)	NB	M1 to A43 (3)	137	139	135	91	292	109	151	135
TOTAL	**NB**	**M1 to A43**	**457**	**847**	**436**	**483**	**869**	**531**	**1077**	**456**
C - A (1)	SB	A43 to M1 (1)	166	180	170	160	155	199	465	139
C - A (2)	SB	A43 to M1 (2)	252	199	174	315	213	609	389	633
C -A (3)	SB	A43 to M1 (3)	135	138	138	139	139	140	140	139
TOTAL	**SB**	**A43 to M1**	**553**	**517**	**482**	**614**	**507**	**948**	**994**	**911**
D - B (1)	EB	JRD to M1 (1)	205	209	184	288	243	413	952	914
D - B (2)	EB	JRD to M1 (2)	65	65	330	195	470	219	277	175
D -B (3)	EB	JRD to M1 (3)	90	112	135	135	136	136	134	126
TOTAL	**EB**	**JRD to M1**	**360**	**386**	**649**	**618**	**849**	**768**	**1363**	**1215**
B - D (1)	WB	M1 to JRD (1)	83	84	84	84	85	85	85	85
B - D (2)	WB	M1 to JRD (2)	95	106	101	130	148	123	167	73
B - D (3)	WB	M1 to JRD (3)	157	159	203	221	238	213	248	237
TOTAL	**WB**	**M1 to JRD**	**335**	**349**	**388**	**435**	**471**	**421**	**500**	**395**

PRECINCT — ROUTE DESCRIPTION — PM PEAK — 3pm to 4pm

ID	Direction	Description	Base (2019)	Future Base (2032)	25% Precinct Stage (2023)	50% Precinct Stage (2026)	50% Precinct Stage - No M12RT (2026)	75% Precinct Stage (2029)	100% Precinct Stage (2032)	100% Precinct Stage - Grade Separated (2032)
A -B (1)	EB	M1 to A1 (1)	177	174	175	187	178	183	181	170
A -B (2)	EB	M1 to A1 (2)	70	69	71	69	71	70	70	93
A -B (3)	EB	M1 to A1 (3)	91	91	91	90	94	96	94	90
TOTAL	**EB**	**M1 to A1**	**338**	**334**	**337**	**346**	**343**	**349**	**345**	**353**
B - A (1)	WB	A1 to M1 (1)	86	86	87	86	90	88	88	88
B - A (2)	WB	A1 to M1 (2)	73	69	72	69	74	69	69	70
B - A (3)	WB	A1 to M1 (3)	117	116	117	117	117	117	117	117
TOTAL	**WB**	**A1 to M1**	**276**	**271**	**276**	**272**	**281**	**274**	**274**	**275**
A - C (1)	NB	M1 to A43 (1)	140	150	153	155	146	153	160	128
A - C (2)	NB	M1 to A43 (2)	180	238	187	217	206	271	284	292
A - C (3)	NB	M1 to A43 (3)	140	141	140	141	140	141	142	142
TOTAL	**NB**	**M1 to A43**	**460**	**529**	**480**	**513**	**492**	**565**	**586**	**562**
C - A (1)	SB	A43 to M1 (1)	173	174	173	179	176	177	176	175
C - A (2)	SB	A43 to M1 (2)	201	238	222	256	229	234	361	190
C -A (3)	SB	A43 to M1 (3)	132	138	136	136	136	137	135	131
TOTAL	**SB**	**A43 to M1**	**506**	**550**	**531**	**571**	**541**	**548**	**672**	**496**
D - B (1)	EB	JRD to M1 (1)	212	211	216	250	285	327	340	208
D - B (2)	EB	JRD to M1 (2)	66	66	66	65	66	67	66	63
D -B (3)	EB	JRD to M1 (3)	91	91	91	90	94	96	94	90
TOTAL	**EB**	**JRD to M1**	**369**	**368**	**373**	**405**	**445**	**490**	**500**	**361**
B - D (1)	WB	M1 to JRD (1)	86	86	87	86	90	88	88	88
B - D (2)	WB	M1 to JRD (2)	109	103	118	118	168	132	125	62
B - D (3)	WB	M1 to JRD (3)	168	169	197	223	202	221	234	246
TOTAL	**WB**	**M1 to JRD**	**363**	**358**	**402**	**427**	**460**	**441**	**447**	**396**

PM PEAK — 4pm to 5pm

ID	Direction	Description	Base (2019)	Future Base (2032)	25% Precinct Stage (2023)	50% Precinct Stage (2026)	50% Precinct Stage - No M12RT (2026)	75% Precinct Stage (2029)	100% Precinct Stage (2032)	100% Precinct Stage - Grade Separated (2032)
A -B (1)	EB	M1 to A1 (1)	164	170	167	188	195	199	522	183
A -B (2)	EB	M1 to A1 (2)	70	70	70	70	71	71	70	103
A -B (3)	EB	M1 to A1 (3)	91	91	92	90	92	91	93	89
TOTAL	**EB**	**M1 to A1**	**325**	**331**	**329**	**348**	**358**	**361**	**685**	**375**
B - A (1)	WB	A1 to M1 (1)	85	86	94	86	88	91	89	89
B - A (2)	WB	A1 to M1 (2)	71	69	71	68	72	71	69	69
B - A (3)	WB	A1 to M1 (3)	116	117	117	117	117	117	117	117
TOTAL	**WB**	**A1 to M1**	**272**	**272**	**282**	**271**	**277**	**279**	**275**	**275**
A - C (1)	NB	M1 to A43 (1)	140	149	152	157	148	157	252	130
A - C (2)	NB	M1 to A43 (2)	166	188	171	215	182	263	309	400
A - C (3)	NB	M1 to A43 (3)	140	143	141	142	142	142	141	141
TOTAL	**NB**	**M1 to A43**	**446**	**480**	**464**	**514**	**472**	**562**	**702**	**671**
C - A (1)	SB	A43 to M1 (1)	188	193	190	201	198	220	313	232
C - A (2)	SB	A43 to M1 (2)	199	219	266	275	349	269	495	192
C -A (3)	SB	A43 to M1 (3)	130	136	134	137	137	137	137	131
TOTAL	**SB**	**A43 to M1**	**517**	**548**	**590**	**613**	**684**	**626**	**945**	**555**
D - B (1)	EB	JRD to M1 (1)	205	206	214	245	348	356	483	213
D - B (2)	EB	JRD to M1 (2)	66	66	66	66	66	65	66	65
D -B (3)	EB	JRD to M1 (3)	91	91	92	90	92	91	93	89
TOTAL	**EB**	**JRD to M1**	**362**	**363**	**372**	**401**	**506**	**512**	**642**	**367**
B - D (1)	WB	M1 to JRD (1)	85	87	94	86	88	91	89	89
B - D (2)	WB	M1 to JRD (2)	113	110	141	119	171	178	147	62
B - D (3)	WB	M1 to JRD (3)	169	170	198	238	215	287	336	399
TOTAL	**WB**	**M1 to JRD**	**367**	**367**	**433**	**443**	**474**	**556**	**572**	**550**

PM PEAK — 5pm to 6pm

ID	Direction	Description	Base (2019)	Future Base (2032)	25% Precinct Stage (2023)	50% Precinct Stage (2026)	50% Precinct Stage - No M12RT (2026)	75% Precinct Stage (2029)	100% Precinct Stage (2032)	100% Precinct Stage - Grade Separated (2032)
A -B (1)	EB	M1 to A1 (1)	161	165	160	200	182	201	957	183
A -B (2)	EB	M1 to A1 (2)	71	70	70	70	71	70	71	95
A -B (3)	EB	M1 to A1 (3)	91	96	92	93	96	95	95	91
TOTAL	**EB**	**M1 to A1**	**323**	**331**	**322**	**363**	**349**	**366**	**1123**	**369**
B - A (1)	WB	A1 to M1 (1)	85	90	85	85	87	92	91	157
B - A (2)	WB	A1 to M1 (2)	70	68	70	68	72	69	69	68
B - A (3)	WB	A1 to M1 (3)	116	116	117	116	117	117	117	117
TOTAL	**WB**	**A1 to M1**	**271**	**274**	**272**	**269**	**276**	**278**	**277**	**342**
A - C (1)	NB	M1 to A43 (1)	141	152	148	158	148	154	479	132
A - C (2)	NB	M1 to A43 (2)	162	171	167	171	168	177	183	199
A - C (3)	NB	M1 to A43 (3)	138	144	140	141	141	147	145	154
TOTAL	**NB**	**M1 to A43**	**441**	**467**	**455**	**470**	**457**	**478**	**807**	**485**
C - A (1)	SB	A43 to M1 (1)	188	416	187	240	190	481	1075	1125
C - A (2)	SB	A43 to M1 (2)	211	243	333	276	364	287	362	180
C -A (3)	SB	A43 to M1 (3)	130	136	132	137	138	137	139	130
TOTAL	**SB**	**A43 to M1**	**529**	**795**	**652**	**653**	**692**	**905**	**1576**	**1435**
D - B (1)	EB	JRD to M1 (1)	198	195	205	314	370	412	715	214
D - B (2)	EB	JRD to M1 (2)	66	66	66	66	66	67	67	64
D -B (3)	EB	JRD to M1 (3)	91	96	93	93	96	95	95	91
TOTAL	**EB**	**JRD to M1**	**355**	**357**	**364**	**473**	**532**	**574**	**877**	**369**
B - D (1)	WB	M1 to JRD (1)	85	90	85	85	87	92	91	157
B - D (2)	WB	M1 to JRD (2)	96	94	109	113	179	145	144	61
B - D (3)	WB	M1 to JRD (3)	162	164	186	213	208	380	349	414
TOTAL	**WB**	**M1 to JRD**	**343**	**348**	**380**	**411**	**474**	**617**	**584**	**632**

F. TRAFFIC MODEL RESULTS – TRAVEL TIMES

1. Precinct 2A
2. Precinct 2B

F

APPENDIX: PRECINCT 2B - NETWORK TRAVEL TIME

GTAconsultants

JOHN RENSHAW DRIVE, BLACK HILL - TRAFFIC MODELLING
TRAVEL TIME RESULTS
GTA Ref: N171072
Date: 20/05/21

PRECINCT — ROUTE DESCRIPTION — AM PEAK

AM PEAK – 6am to 7am

ID	Direction	Description	Base (2019)	Future Base (2032)	25% Precinct Stage (2023)	50% Precinct Stage (2026)	50% Precinct Stage - No M12RT (2026)	75% Precinct Stage (2029)	100% Precinct Stage (2032)	75% Precinct Stage - Grade Separated (2032)	100% Precinct Stage - Grade Separated (2032)
A -B (1)	EB	M1 to A1 (1)	169	172	179	181	193	178	181	180	179
A -B (2)	EB	M1 to A1 (2)	69	69	69	68	70	69	68	74	75
A -B (3)	EB	M1 to A1 (3)	90	89	93	91	100	94	93	90	90
TOTAL	EB	M1 to A1	328	330	341	340	363	341	342	344	344
B - A (1)	WB	A1 to M1 (1)	83	83	84	84	84	84	85	84	85
B - A (2)	WB	A1 to M1 (2)	66	69	68	67	68	67	69	80	90
B - A (3)	WB	A1 to M1 (3)	116	116	117	116	117	116	116	116	116
TOTAL	WB	A1 to M1	265	268	269	267	269	267	270	280	291
A - C (1)	NB	M1 to A43 (1)	150	160	218	326	374	615	713	260	266
A - C (2)	NB	M1 to A43 (2)	162	166	65	65	65	66	66	63	63
A - C (3)	NB	M1 to A43 (3)	136	137	93	91	100	94	93	90	90
TOTAL	NB	M1 to A43	448	463	376	482	539	775	872	413	419
C - A (1)	SB	A43 to M1 (1)	169	199	177	159	159	168	194	131	136
C - A (2)	SB	A43 to M1 (2)	239	203	161	166	168	170	176	162	172
C -A (3)	SB	A43 to M1 (3)	132	132	136	138	137	138	138	138	139
TOTAL	SB	A43 to M1	540	534	474	463	464	476	508	431	447
D - B (1)	EB	JRD to M1 (1)	197	200	180	248	285	376	669	434	616
D - B (2)	EB	JRD to M1 (2)	65	65	246	205	343	210	221	167	179
D -B (3)	EB	JRD to M1 (3)	90	89	131	130	132	130	130	122	123
TOTAL	EB	JRD to M1	352	354	557	583	760	716	1020	723	918
B - D (1)	WB	M1 to JRD (1)	83	83	84	83	84	84	85	84	85
B - D (2)	WB	M1 to JRD (2)	91	102	99	109	112	105	115	67	72
B - D (3)	WB	M1 to JRD (3)	158	160	201	218	221	208	253	221	317
TOTAL	WB	M1 to JRD	332	345	384	410	417	397	453	372	474

AM PEAK – 7am to 8am

ID	Direction	Description	Base (2019)	Future Base (2032)	25% Precinct Stage (2023)	50% Precinct Stage (2026)	50% Precinct Stage - No M12RT (2026)	75% Precinct Stage (2029)	100% Precinct Stage (2032)	75% Precinct Stage - Grade Separated (2032)	100% Precinct Stage - Grade Separated (2032)
A -B (1)	EB	M1 to A1 (1)	171	178	174	176	182	181	481	183	329
A -B (2)	EB	M1 to A1 (2)	70	68	69	67	74	68	69	72	72
A -B (3)	EB	M1 to A1 (3)	96	158	188	122	261	162	96	139	151
TOTAL	EB	M1 to A1	337	404	431	365	517	411	646	394	552
B - A (1)	WB	A1 to M1 (1)	84	84	84	83	85	85	86	85	85
B - A (2)	WB	A1 to M1 (2)	67	66	67	67	67	66	161	69	74
B - A (3)	WB	A1 to M1 (3)	117	116	117	117	117	117	117	117	117
TOTAL	WB	A1 to M1	268	266	268	267	269	268	364	271	276
A - C (1)	NB	M1 to A43 (1)	152	172	264	325	328	895	1242	262	272
A - C (2)	NB	M1 to A43 (2)	168	285	65	65	68	65	66	63	62
A - C (3)	NB	M1 to A43 (3)	139	140	188	122	260	162	96	139	150
TOTAL	NB	M1 to A43	459	597	517	512	656	1122	1404	464	484
C - A (1)	SB	A43 to M1 (1)	165	169	165	174	162	212	559	133	396
C - A (2)	SB	A43 to M1 (2)	202	200	191	247	230	230	189	291	227
C -A (3)	SB	A43 to M1 (3)	129	131	140	140	140	140	141	140	141
TOTAL	SB	A43 to M1	496	500	496	561	532	582	889	564	764
D - B (1)	EB	JRD to M1 (1)	205	209	169	222	218	408	1040	570	891
D - B (2)	EB	JRD to M1 (2)	65	65	207	205	598	245	564	186	469
D -B (3)	EB	JRD to M1 (3)	96	158	129	129	131	128	124	121	119
TOTAL	EB	JRD to M1	366	432	505	556	947	781	1728	877	1479
B - D (1)	WB	M1 to JRD (1)	84	84	83	83	84	85	86	85	85
B - D (2)	WB	M1 to JRD (2)	97	100	111	108	116	109	292	63	65
B - D (3)	WB	M1 to JRD (3)	161	160	203	227	225	228	493	240	396
TOTAL	WB	M1 to JRD	342	344	397	418	425	422	871	388	546

AM PEAK – 8am to 9am

ID	Direction	Description	Base (2019)	Future Base (2032)	25% Precinct Stage (2023)	50% Precinct Stage (2026)	50% Precinct Stage - No M12RT (2026)	75% Precinct Stage (2029)	100% Precinct Stage (2032)	75% Precinct Stage - Grade Separated (2032)	100% Precinct Stage - Grade Separated (2032)
A -B (1)	EB	M1 to A1 (1)	171	175	182	179	177	482	2099	174	966
A -B (2)	EB	M1 to A1 (2)	69	68	69	67	136	67	68	71	73
A -B (3)	EB	M1 to A1 (3)	90	112	147	99	325	126	95	134	147
TOTAL	EB	M1 to A1	330	355	398	345	638	675	2262	379	1186
B - A (1)	WB	A1 to M1 (1)	83	84	85	84	86	85	453	85	86
B - A (2)	WB	A1 to M1 (2)	66	72	68	66	69	197	545	81	112
B - A (3)	WB	A1 to M1 (3)	117	118	117	117	118	118	118	117	118
TOTAL	WB	A1 to M1	266	274	270	267	273	400	1116	283	316
A - C (1)	NB	M1 to A43 (1)	152	195	236	328	335	880	1457	259	266
A - C (2)	NB	M1 to A43 (2)	168	513	65	65	115	66	66	62	62
A - C (3)	NB	M1 to A43 (3)	137	139	147	99	325	126	95	134	147
TOTAL	NB	M1 to A43	457	847	448	492	775	1072	1618	455	475
C - A (1)	SB	A43 to M1 (1)	166	180	242	175	166	653	2405	138	1057
C - A (2)	SB	A43 to M1 (2)	252	199	171	358	267	254	165	554	371
C -A (3)	SB	A43 to M1 (3)	135	138	139	139	139	140	138	140	140
TOTAL	SB	A43 to M1	553	517	552	672	572	1047	2708	832	1568
D - B (1)	EB	JRD to M1 (1)	205	209	181	288	459	543	2003	690	1175
D - B (2)	EB	JRD to M1 (2)	65	65	350	228	926	551	1050	180	533
D -B (3)	EB	JRD to M1 (3)	90	112	134	135	132	133	124	125	128
TOTAL	EB	JRD to M1	360	386	665	651	1517	1227	3177	995	1836
B - D (1)	WB	M1 to JRD (1)	83	84	84	84	86	85	452	85	85
B - D (2)	WB	M1 to JRD (2)	95	106	102	106	105	302	761	65	82
B - D (3)	WB	M1 to JRD (3)	157	159	205	220	218	456	817	224	406
TOTAL	WB	M1 to JRD	335	349	391	410	409	843	2030	374	573

PRECINCT — ROUTE DESCRIPTION — PM PEAK

PM PEAK – 3pm to 4pm

ID	Direction	Description	Base (2019)	Future Base (2032)	25% Precinct Stage (2023)	50% Precinct Stage (2026)	50% Precinct Stage - No M12RT (2026)	75% Precinct Stage (2029)	100% Precinct Stage (2032)	75% Precinct Stage - Grade Separated (2032)	100% Precinct Stage - Grade Separated (2032)
A -B (1)	EB	M1 to A1 (1)	177	174	176	211	481	228	260	174	173
A -B (2)	EB	M1 to A1 (2)	70	69	70	70	70	69	70	92	93
A -B (3)	EB	M1 to A1 (3)	91	91	93	95	92	91	90	91	90
TOTAL	EB	M1 to A1	338	334	339	376	643	388	420	357	356
B - A (1)	WB	A1 to M1 (1)	86	86	87	87	89	87	90	87	87
B - A (2)	WB	A1 to M1 (2)	73	69	73	69	74	79	147	69	69
B - A (3)	WB	A1 to M1 (3)	117	116	117	117	117	117	117	117	117
TOTAL	WB	A1 to M1	276	271	277	273	280	283	354	273	273
A - C (1)	NB	M1 to A43 (1)	140	150	158	161	204	171	176	131	131
A - C (2)	NB	M1 to A43 (2)	180	238	184	224	223	208	240	325	368
A - C (3)	NB	M1 to A43 (3)	140	141	140	141	141	142	141	142	141
TOTAL	NB	M1 to A43	460	529	482	526	568	521	557	598	640
C - A (1)	SB	A43 to M1 (1)	173	174	172	176	178	179	175	178	175
C - A (2)	SB	A43 to M1 (2)	201	238	236	242	269	366	428	181	193
C -A (3)	SB	A43 to M1 (3)	132	138	136	137	136	134	134	129	135
TOTAL	SB	A43 to M1	506	550	544	555	583	679	737	488	503
D - B (1)	EB	JRD to M1 (1)	212	211	218	318	288	562	740	206	253
D - B (2)	EB	JRD to M1 (2)	66	66	67	65	66	65	65	64	64
D -B (3)	EB	JRD to M1 (3)	91	91	93	95	92	91	90	91	90
TOTAL	EB	JRD to M1	369	368	378	478	446	718	895	361	407
B - D (1)	WB	M1 to JRD (1)	86	86	87	87	89	87	90	87	87
B - D (2)	WB	M1 to JRD (2)	109	103	118	142	137	200	292	62	62
B - D (3)	WB	M1 to JRD (3)	168	169	199	232	215	226	225	245	235
TOTAL	WB	M1 to JRD	363	358	404	461	441	513	607	394	384

PM PEAK – 4pm to 5pm

ID	Direction	Description	Base (2019)	Future Base (2032)	25% Precinct Stage (2023)	50% Precinct Stage (2026)	50% Precinct Stage - No M12RT (2026)	75% Precinct Stage (2029)	100% Precinct Stage (2032)	75% Precinct Stage - Grade Separated (2032)	100% Precinct Stage - Grade Separated (2032)
A -B (1)	EB	M1 to A1 (1)	164	170	168	353	1274	568	850	181	189
A -B (2)	EB	M1 to A1 (2)	70	70	71	70	70	70	70	98	103
A -B (3)	EB	M1 to A1 (3)	91	91	92	92	89	89	90	92	92
TOTAL	EB	M1 to A1	325	331	331	515	1433	727	1010	371	384
B - A (1)	WB	A1 to M1 (1)	85	86	87	86	98	87	259	87	88
B - A (2)	WB	A1 to M1 (2)	71	69	71	69	72	139	277	69	69
B - A (3)	WB	A1 to M1 (3)	116	117	116	117	117	117	118	117	117
TOTAL	WB	A1 to M1	272	272	274	272	287	343	654	273	274
A - C (1)	NB	M1 to A43 (1)	140	149	159	168	866	208	458	132	150
A - C (2)	NB	M1 to A43 (2)	166	188	173	191	185	187	235	498	607
A - C (3)	NB	M1 to A43 (3)	140	143	141	143	142	143	142	144	143
TOTAL	NB	M1 to A43	446	480	473	502	1193	538	835	774	900
C - A (1)	SB	A43 to M1 (1)	188	193	192	204	196	212	261	243	282
C - A (2)	SB	A43 to M1 (2)	199	219	253	353	351	464	682	181	194
C -A (3)	SB	A43 to M1 (3)	130	136	135	135	136	135	135	134	132
TOTAL	SB	A43 to M1	517	548	580	692	683	811	1078	558	608
D - B (1)	EB	JRD to M1 (1)	205	206	214	340	502	959	1050	212	533
D - B (2)	EB	JRD to M1 (2)	66	66	66	65	65	65	65	64	65
D -B (3)	EB	JRD to M1 (3)	91	91	92	92	89	89	91	92	92
TOTAL	EB	JRD to M1	362	363	372	497	656	1113	1206	368	690
B - D (1)	WB	M1 to JRD (1)	85	87	87	86	98	87	259	87	88
B - D (2)	WB	M1 to JRD (2)	113	110	174	132	145	319	514	62	62
B - D (3)	WB	M1 to JRD (3)	169	170	199	245	228	237	277	304	387
TOTAL	WB	M1 to JRD	367	367	460	463	471	643	1050	453	537

PM PEAK – 5pm to 6pm

ID	Direction	Description	Base (2019)	Future Base (2032)	25% Precinct Stage (2023)	50% Precinct Stage (2026)	50% Precinct Stage - No M12RT (2026)	75% Precinct Stage (2029)	100% Precinct Stage (2032)	75% Precinct Stage - Grade Separated (2032)	100% Precinct Stage - Grade Separated (2032)
A -B (1)	EB	M1 to A1 (1)	161	165	161	533	1940	919	1848	175	184
A -B (2)	EB	M1 to A1 (2)	71	70	70	71	70	71	71	95	96
A -B (3)	EB	M1 to A1 (3)	91	96	115	94	95	93	93	93	91
TOTAL	EB	M1 to A1	323	331	346	698	2105	1083	2012	363	371
B - A (1)	WB	A1 to M1 (1)	85	90	86	85	92	107	306	87	87
B - A (2)	WB	A1 to M1 (2)	70	68	71	68	70	266	311	68	68
B - A (3)	WB	A1 to M1 (3)	116	116	116	117	117	118	118	117	117
TOTAL	WB	A1 to M1	271	274	273	270	279	491	735	272	272
A - C (1)	NB	M1 to A43 (1)	141	152	157	166	1385	341	1254	130	135
A - C (2)	NB	M1 to A43 (2)	162	171	169	168	163	172	166	196	531
A - C (3)	NB	M1 to A43 (3)	138	144	140	141	141	141	141	146	152
TOTAL	NB	M1 to A43	441	467	466	475	1689	654	1561	472	818
C - A (1)	SB	A43 to M1 (1)	188	416	187	190	190	196	229	1100	915
C - A (2)	SB	A43 to M1 (2)	211	243	433	363	364	487	841	177	182
C -A (3)	SB	A43 to M1 (3)	130	136	133	137	137	137	136	128	137
TOTAL	SB	A43 to M1	529	795	753	690	691	820	1206	1405	1234
D - B (1)	EB	JRD to M1 (1)	198	195	214	387	678	1316	1036	218	457
D - B (2)	EB	JRD to M1 (2)	66	66	66	65	66	66	65	65	65
D -B (3)	EB	JRD to M1 (3)	91	96	115	94	95	93	93	93	91
TOTAL	EB	JRD to M1	355	357	395	546	839	1475	1194	376	613
B - D (1)	WB	M1 to JRD (1)	85	90	86	86	92	107	306	87	87
B - D (2)	WB	M1 to JRD (2)	96	94	118	120	133	475	540	62	62
B - D (3)	WB	M1 to JRD (3)	162	164	189	220	214	242	414	332	508
TOTAL	WB	M1 to JRD	343	348	393	426	439	824	1260	481	657

APPENDIX: PRECINCT 2B - NETWORK PERFORMANCE SUMMARY

JOHN RENSHAW DRIVE, BLACK HILL - TRAFFIC MODELLING
NETWORK PERFORMANCE RESULTS
GTA Ref: N171072
Date: 20/05/21

PRECINCT — **AM PEAK** — 6am to 7am

Metric		Base (2019)	Future Base (2032)	25% Precinct Stage (2023)	50% Precinct Stage (2026)	50% Precinct Stage - No M12RT (2026)	75% Precinct Stage (2029)	100% Precinct Stage (2032)	75% Precinct Stage - Grade Separated (2032)	100% Precinct Stage - Grade Separated (2032)
Average Delay	Sec	49	57	60	72	92	120	188	90	157
Average Stops	no.	1	1	1	1	2	2	9	2	11
Average Speed	km/h	69	67	67	64	61	56	48	61	52
Average Stop Delay	Sec	23	27	29	36	50	67	97	42	65
Total VKT	km	64,620	68,889	72,600	72,916	81,098	79,447	83,003	79,204	81,784
Total VHT	h	931	1,024	1,082	1,148	1,325	1,413	1,728	1,309	1,583
Total Delay	h	115	148	163	204	282	381	650	282	522
Total Stops	no.	6,166	9,433	9,279	12,810	17,376	28,469	115,395	25,654	135,811
Total Stop Delay	h	54	69	78	101	153	214	338	130	218
Vehicles Active	no.	951	1,070	1,112	1,235	1,421	1,594	2,252	1,460	1,875
Vehicles Arrived	no.	7,549	8,319	8,680	8,967	9,610	9,827	10,219	9,787	10,094
Latent Delay	h	0	0	0	0	0	0	47	58	219
Latent Demand	no.	0	0	0	0	0	0	156	147	637
Total Demand	no.	8,500	9,389	9,792	10,202	11,031	11,421	12,627	11,394	12,606

AM PEAK — 7am to 8am

Metric		Base (2019)	Future Base (2032)	25% Precinct Stage (2023)	50% Precinct Stage (2026)	50% Precinct Stage - No M12RT (2026)	75% Precinct Stage (2029)	100% Precinct Stage (2032)	75% Precinct Stage - Grade Separated (2032)	100% Precinct Stage - Grade Separated (2032)
Average Delay	Sec	55	130	110	97	188	216	459	163	283
Average Stops	no.	1	4	4	2	8	7	40	6	23
Average Speed	km/h	68	56	59	60	49	46	29	51	40
Average Stop Delay	Sec	20	37	30	37	66	98	250	54	111
Total VKT	km	79,146	85,147	87,100	90,267	95,683	97,004	89,516	95,963	94,147
Total VHT	h	1,165	1,520	1,474	1,513	1,948	2,120	3,066	1,872	2,356
Total Delay	h	163	437	371	347	721	863	1,907	634	1,141
Total Stops	no.	9,025	53,314	45,115	24,238	112,235	96,114	593,345	83,862	338,905
Total Stop Delay	h	59	126	101	131	253	393	1,038	212	449
Vehicles Active	no.	1,181	1,779	1,673	1,608	2,363	2,377	3,839	2,070	2,867
Vehicles Arrived	no.	9,558	10,343	10,515	11,316	11,435	12,030	11,128	11,941	11,633
Latent Delay	h	0	27	2	1	1	21	893	316	1,590
Latent Demand	no.	0	57	17	1	13	98	1,588	508	2,166
Total Demand	no.	10,739	12,179	12,205	12,925	13,811	14,505	16,555	14,519	16,666

AM PEAK — 8am to 9am

Metric		Base (2019)	Future Base (2032)	25% Precinct Stage (2023)	50% Precinct Stage (2026)	50% Precinct Stage - No M12RT (2026)	75% Precinct Stage (2029)	100% Precinct Stage (2032)	75% Precinct Stage - Grade Separated (2032)	100% Precinct Stage - Grade Separated (2032)
Average Delay	Sec	52	144	108	108	264	362	1,022	187	431
Average Stops	no.	1	5	3	3	17	19	170	10	57
Average Speed	km/h	68	54	59	58	42	34	14	48	31
Average Stop Delay	Sec	24	62	44	54	115	195	601	72	142
Total VKT	km	68,301	74,972	78,340	78,297	85,444	83,347	62,183	85,672	91,039
Total VHT	h	1,001	1,395	1,331	1,360	2,048	2,423	4,601	1,789	2,979
Total Delay	h	135	438	337	344	948	1,340	3,778	677	1,794
Total Stops	no.	7,731	58,617	33,044	31,488	223,133	256,122	2,266,522	130,709	850,522
Total Stop Delay	h	64	190	139	172	414	722	2,220	259	590
Vehicles Active	no.	999	1,322	1,273	1,298	2,110	2,526	4,999	1,773	3,020
Vehicles Arrived	no.	8,366	9,652	9,990	10,168	10,823	10,795	8,308	11,240	11,977
Latent Delay	h	0	14	1	0	13	117	2,408	88	979
Latent Demand	no.	0	17	0	1	27	152	4,239	141	1,197
Total Demand	no.	9,365	10,991	11,263	11,467	12,960	13,473	17,546	13,154	16,194

PRECINCT — **PM PEAK** — 3pm to 4pm

Metric		Base (2019)	Future Base (2032)	25% Precinct Stage (2023)	50% Precinct Stage (2026)	50% Precinct Stage - No M12RT (2026)	75% Precinct Stage (2029)	100% Precinct Stage (2032)	75% Precinct Stage - Grade Separated (2032)	100% Precinct Stage - Grade Separated (2032)
Average Delay	Sec	51	72	76	89	119	161	230	99	114
Average Stops	no.	1	2	1	2	2	4	5	2	3
Average Speed	km/h	69	65	64	61	58	52	45	60	58
Average Stop Delay	Sec	21	27	30	45	59	89	143	40	47
Total VKT	km	75,172	83,395	83,001	86,644	90,526	90,811	93,440	93,573	98,959
Total VHT	h	1,088	1,283	1,289	1,411	1,570	1,752	2,091	1,561	1,716
Total Delay	h	142	230	241	304	420	589	893	365	449
Total Stops	no.	8,254	18,555	15,707	19,866	29,917	51,004	74,800	32,409	44,490
Total Stop Delay	h	59	88	96	152	210	327	556	149	185
Vehicles Active	no.	1,158	1,396	1,406	1,576	1,867	2,102	2,721	1,828	1,942
Vehicles Arrived	no.	8,868	10,087	10,039	10,654	10,874	11,093	11,275	11,490	12,208
Latent Delay	h	0	4	9	1	56	102	342	77	314
Latent Demand	no.	0	21	16	0	132	359	927	228	746
Total Demand	no.	10,026	11,504	11,461	12,230	12,873	13,554	14,923	13,546	14,896

PM PEAK — 4pm to 5pm

Metric		Base (2019)	Future Base (2032)	25% Precinct Stage (2023)	50% Precinct Stage (2026)	50% Precinct Stage - No M12RT (2026)	75% Precinct Stage (2029)	100% Precinct Stage (2032)	75% Precinct Stage - Grade Separated (2032)	100% Precinct Stage - Grade Separated (2032)
Average Delay	Sec	50	93	85	126	254	272	422	150	208
Average Stops	no.	1	2	2	3	29	7	21	4	7
Average Speed	km/h	69	61	63	56	43	41	31	53	47
Average Stop Delay	Sec	22	36	36	69	118	170	247	67	99
Total VKT	km	74,886	84,091	84,392	87,096	89,460	91,613	90,425	96,139	99,442
Total VHT	h	1,085	1,370	1,346	1,559	2,094	2,232	2,896	1,821	2,134
Total Delay	h	144	308	282	447	960	1,061	1,741	592	861
Total Stops	no.	7,781	24,064	18,249	33,074	400,983	92,429	305,216	63,710	103,184
Total Stop Delay	h	64	121	120	245	447	662	1,017	266	411
Vehicles Active	no.	1,076	1,426	1,319	1,624	2,425	2,436	3,381	1,921	2,359
Vehicles Arrived	no.	9,265	10,559	10,621	11,168	11,191	11,628	11,468	12,312	12,570
Latent Delay	h	0	4	4	3	169	642	1,797	314	1,236
Latent Demand	no.	0	0	0	28	146	968	2,713	394	1,675
Total Demand	no.	10,341	11,985	11,940	12,820	13,762	15,032	17,562	14,627	16,604

PM PEAK — 5pm to 6pm

Metric		Base (2019)	Future Base (2032)	25% Precinct Stage (2023)	50% Precinct Stage (2026)	50% Precinct Stage - No M12RT (2026)	75% Precinct Stage (2029)	100% Precinct Stage (2032)	75% Precinct Stage - Grade Separated (2032)	100% Precinct Stage - Grade Separated (2032)
Average Delay	Sec	47	121	88	130	372	352	567	257	311
Average Stops	no.	1	5	2	3	61	8	50	26	25
Average Speed	km/h	70	58	62	56	35	36	26	42	38
Average Stop Delay	Sec	20	54	45	70	149	227	300	110	139
Total VKT	km	77,198	86,491	85,809	89,940	93,577	94,546	92,596	94,201	98,668
Total VHT	h	1,108	1,499	1,373	1,616	2,679	2,613	3,566	2,223	2,584
Total Delay	h	137	408	292	469	1,491	1,407	2,382	1,018	1,318
Total Stops	no.	7,125	55,625	21,925	38,772	884,251	122,182	750,893	366,595	386,248
Total Stop Delay	h	58	183	150	254	599	905	1,257	434	590
Vehicles Active	no.	1,048	1,385	1,271	1,517	2,733	2,590	3,446	2,156	2,510
Vehicles Arrived	no.	9,405	10,755	10,667	11,454	11,719	11,786	11,664	12,088	12,729
Latent Delay	h	0	0	45	79	173	1,347	3,920	515	2,202
Latent Demand	no.	0	0	75	88	82	1,691	4,891	737	2,715
Total Demand	no.	10,453	12,140	12,013	13,059	14,534	16,067	20,001	14,981	17,954

G. TRAFFIC MODEL RESULTS – INTERSECTION PERFORMANCE

1. Precinct 2A
2. Precinct 2B

G

APPENDIX: PRECINCT 2A - NETWORK INTERSECTION

JOHN RENSHAW DRIVE, BLACK HILL - TRAFFIC MODELLING
INTERSECTION PERFORMANCE RESULTS
GTA Ref: N171072
Date: 20/05/21

PRECINCT – SITE DETAILS – AM PEAK

6am to 7am

Intersection	Approach	Movement	Base (2019) Avg Delay (secs)	LOS	Future Base (2032) Avg Delay (secs)	LOS	25% Precinct Stage (2023) Avg Delay (secs)	LOS	50% Precinct Stage (2026) Avg Delay (secs)	LOS	50% Precinct Stage - No M12RT (2026) Avg Delay (secs)	LOS	75% Precinct Stage (2029) Avg Delay (secs)	LOS	100% Precinct Stage (2032) Avg Delay (secs)	LOS	100% Precinct Stage - Grade Separated (2032) Avg Delay (secs)	LOS
3289 - New England Highway / Weakleys Drive	North	L	10	A	14	A	12	A	11	A	13	A	11	A	13	A	13	A
		T	20	B	20	B	20	B	19	B	22	B	22	B	24	B	20	B
		R	13	A	16	B	15	B	15	B	13	A	15	B	13	A	13	A
	East	L	9	A	11	A	6	A	9	A	10	A	7	A	12	A	13	A
		T	0	A	0	A	0	A	0	A	0	A	0	A	0	A	0	A
		R	27	B	32	C	26	B	29	C	33	C	31	C	32	C	34	C
	South	L	13	A	11	A	11	A	14	B	13	A	11	A	17	B	16	B
		T	27	B	34	C	27	B	31	C	38	C	31	C	38	C	38	C
		R	18	B	17	B	17	B	28	C	23	B	13	C	19	C	21	C
	West	L	2	A	9	A	3	A	16	B	42	C	76	F	109	F	102	F
		T	0	A	0	A	0	A	0	A	0	A	0	A	0	A	0	A
		R	31	C	59	E	33	C	62	E	107	F	146	F	196	F	191	F
	Total		12	A	16	B	12	A	17	B	24	B	28	C	35	C	34	C
4781 - John Renshaw Drive / Weakleys Drive	North	L	52	D	34	C	82	F	21	B	44	D	27	B	37	C	8	C
		T	92	F	57	E	114	F	49	D	84	F	55	D	61	E	22	E
		R	69	E	67	E	94	F	78	F	83	F	76	F	79	F	74	F
	East	L	2	A	2	A	2	A	1	A	3	A	1	A	2	A	9	A
		T	29	C	34	C	37	C	47	D	42	C	41	D	43	D	0	D
		R	87	F	156	F	56	E	123	F	145	F	110	F	132	F	77	F
	South	L	9	A	26	B	30	C	8	A	6	A	12	A	19	B	10	B
		T	35	C	47	D	56	D	40	C	35	C	46	D	53	D	19	D
		R	54	D	58	E	72	F	62	E	96	F	66	E	64	E	65	E
	West	L	37	C	31	C	41	C	85	F	93	F	91	F	114	F	22	F
		T	52	D	54	D	61	E	155	F	175	F	153	F	172	F	1	F
		R	52	D	54	D	72	F	152	F	169	F	168	F	184	F	77	F
	Total		50	D	54	D	60	E	67	E	77	F	69	F	76	F	25	F
Eastern Access (Shared)	East	L	-	-	-	-	2	A	3	A	3	A	6	A	12	A	15	A
		T	-	-	-	-	34	C	27	B	27	B	29	C	30	C	33	C
	South	L	-	-	-	-	1	A	2	A	1	A	2	A	1	A	2	A
		R	-	-	-	-	26	B	18	B	18	B	19	B	28	B	29	B
	West	T	-	-	-	-	7	A	19	B	17	B	20	B	19	B	19	B
		R	-	-	-	-	21	B	49	D	49	D	82	F	35	F	34	F
	Total		-	-	-	-	15	B	18	B	18	B	21	B	21	C	22	C
Western Access	North	L	-	-	-	-	-	-	119	F	119	F	87	F	72	F	72	F
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	66	E	66	E	66	E	72	F	72	F
	East	L	-	-	-	-	-	-	2	A	1	A	2	A	3	A	3	A
		T	-	-	-	-	-	-	21	B	34	C	25	B	40	C	30	C
		R	-	-	-	-	-	-	70	E	78	F	89	F	87	F	83	F
	South	L	-	-	-	-	-	-	1	A	1	A	1	A	1	A	1	A
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	62	E	51	D	43	D	50	C	60	C
	West	L	-	-	-	-	-	-	17	B	16	B	51	D	31	C	31	C
		T	-	-	-	-	-	-	29	C	28	B	29	C	30	C	30	C
		R	-	-	-	-	-	-	70	E	89	F	96	F	59	F	58	F
	Total		-	-	-	-	-	-	29	C	33	C	31	C	34	C	32	C

AM PEAK 7am to 8am

Intersection	Approach	Movement	Base (2019) Avg Delay (secs)	LOS	Future Base (2032) Avg Delay (secs)	LOS	25% Precinct Stage (2023) Avg Delay (secs)	LOS	50% Precinct Stage (2026) Avg Delay (secs)	LOS	50% Precinct Stage - No M12RT (2026) Avg Delay (secs)	LOS	75% Precinct Stage (2029) Avg Delay (secs)	LOS	100% Precinct Stage (2032) Avg Delay (secs)	LOS	100% Precinct Stage - Grade Separated (2032) Avg Delay (secs)	LOS
3289 - New England Highway / Weakleys Drive	North	L	11	A	14	A	10	A	11	A	11	A	12	A	12	A	11	A
		T	22	B	22	B	20	B	21	B	23	B	24	B	24	B	22	B
		R	19	B	23	B	21	B	20	B	24	B	21	B	20	B	22	B
	East	L	6	A	6	A	5	A	6	A	5	A	6	A	6	A	6	A
		T	0	A	1	A	0	A	0	A	1	A	1	A	1	A	1	A
		R	23	B	22	B	25	B	23	B	23	B	25	B	25	B	24	B
	South	L	14	A	43	D	37	C	41	C	29	C	52	D	44	D	43	D
		T	46	D	101	F	94	F	106	F	76	F	123	F	106	F	107	F
		R	29	C	74	F	55	D	74	F	47	D	82	F	75	F	84	F
	West	L	3	A	4	A	3	A	5	A	7	A	69	E	73	F	66	E
		T	1	A	1	A	1	A	1	A	1	A	1	A	1	A	2	A
		R	24	B	27	B	27	B	33	C	38	C	139	F	136	F	131	F
	Total		12	A	18	B	18	B	19	B	17	B	34	C	34	C	33	C
4781 - John Renshaw Drive / Weakleys Drive	North	L	25	B	29	C	36	C	20	B	79	F	22	B	80	F	26	B
		T	55	D	52	D	72	F	44	D	113	F	50	D	115	F	34	C
		R	78	F	69	E	72	F	72	F	88	F	73	F	136	F	107	F
	East	L	2	A	1	A	2	A	1	A	2	A	1	A	1	A	2	A
		T	35	C	36	C	45	D	50	D	43	D	42	D	47	D	0	A
		R	64	E	110	F	71	F	95	F	141	F	76	F	123	F	68	E
	South	L	19	B	32	C	29	C	10	A	7	A	14	B	62	E	11	A
		T	38	C	58	E	49	D	44	D	41	C	60	E	130	F	21	B
		R	57	E	65	E	58	E	62	E	99	F	64	E	66	E	66	E
	West	L	37	C	39	C	45	D	56	E	97	F	79	F	114	F	22	B
		T	59	E	63	E	80	F	100	F	205	F	144	F	182	F	2	A
		R	59	E	63	E	68	E	97	F	216	F	156	F	203	F	71	F
	Total		46	D	55	D	54	D	56	D	89	F	67	E	108	F	30	C
Eastern Access (Shared)	East	L	-	-	-	-	2	A	5	A	4	A	8	A	19	B	15	B
		T	-	-	-	-	39	C	29	C	28	C	27	B	33	C	32	C
	South	L	-	-	-	-	1	A	2	A	1	A	2	A	9	A	2	A
		R	-	-	-	-	27	B	16	B	15	B	18	B	179	F	27	B
	West	T	-	-	-	-	7	A	18	B	16	B	23	B	108	F	18	B
		R	-	-	-	-	20	B	59	E	50	D	178	F	53	D	42	D
	Total		-	-	-	-	17	B	20	B	18	B	29	C	67	E	23	B
Western Access	North	L	-	-	-	-	-	-	94	F	94	F	68	E	71	F	71	F
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	56	E	56	E	56	D	84	F	84	F
	East	L	-	-	-	-	-	-	2	A	0	A	3	A	4	A	3	A
		T	-	-	-	-	-	-	26	B	35	C	32	C	42	C	37	C
		R	-	-	-	-	-	-	76	F	105	F	81	F	99	F	96	F
	South	L	-	-	-	-	-	-	1	A	1	A	1	A	1	A	1	A
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	57	E	57	E	49	D	57	E	46	D
	West	L	-	-	-	-	-	-	32	C	32	C	53	D	23	B	23	B
		T	-	-	-	-	-	-	28	C	29	C	31	C	31	C	30	C
		R	-	-	-	-	-	-	60	E	68	E	84	F	65	E	62	E
	Total		-	-	-	-	-	-	29	C	33	C	33	C	35	C	33	C

8am to 9am

Intersection	Approach	Movement	Base (2019) Avg Delay (secs)	LOS	Future Base (2032) Avg Delay (secs)	LOS	25% Precinct Stage (2023) Avg Delay (secs)	LOS	50% Precinct Stage (2026) Avg Delay (secs)	LOS	50% Precinct Stage - No M12RT (2026) Avg Delay (secs)	LOS	75% Precinct Stage (2029) Avg Delay (secs)	LOS	100% Precinct Stage (2032) Avg Delay (secs)	LOS	100% Precinct Stage - Grade Separated (2032) Avg Delay (secs)	LOS
3289 - New England Highway / Weakleys Drive	North	L	7	A	7	A	7	A	6	A	7	A	7	A	8	A	10	A
		T	14	B	16	B	15	B	16	B	15	B	15	B	17	B	15	B
		R	16	B	18	B	18	B	17	B	20	B	16	B	18	B	16	B
	East	L	5	A	6	A	6	A	6	A	6	A	9	A	6	A	7	A
		T	0	A	1	A	0	A	0	A	0	A	0	A	1	A	1	A
		R	23	B	28	B	26	B	27	B	24	B	28	C	26	B	27	B
	South	L	15	B	58	E	21	B	62	E	38	C	56	D	55	D	55	D
		T	32	C	132	F	53	D	129	F	93	F	124	F	104	F	126	F
		R	23	B	91	F	31	C	88	F	71	F	75	F	65	E	98	F
	West	L	3	A	4	A	6	A	66	E	37	C	88	F	103	F	104	F
		T	0	A	0	A	0	A	0	A	0	A	0	A	1	A	26	B
		R	29	C	41	C	46	D	147	F	105	F	180	F	199	F	197	F
	Total		12	A	27	B	17	B	41	C	30	C	44	D	44	D	51	D
4781 - John Renshaw Drive / Weakleys Drive	North	L	71	F	31	C	113	F	21	B	132	F	48	D	92	F	16	B
		T	106	F	51	D	136	F	49	D	164	F	75	F	106	F	24	B
		R	86	F	74	F	128	F	80	F	131	F	93	F	128	F	83	F
	East	L	2	A	2	A	2	A	2	A	3	A	2	A	2	A	15	B
		T	34	C	36	C	39	C	54	D	55	D	47	D	52	D	0	A
		R	87	F	157	F	84	F	180	F	188	F	168	F	162	F	93	F
	South	L	4	A	62	E	32	C	9	A	7	A	21	B	90	F	11	A
		T	38	C	77	F	54	D	47	D	39	C	86	F	163	F	28	C
		R	56	E	61	E	52	D	67	E	83	F	63	E	65	E	65	E
	West	L	38	C	38	C	39	C	59	E	47	D	53	D	109	F	75	F
		T	59	E	60	E	77	F	74	F	96	F	90	F	174	F	1	A
		R	59	E	60	E	81	F	84	F	96	F	115	F	199	F	92	F
	Total		56	D	62	E	66	E	59	E	80	F	72	F	115	F	33	C
Eastern Access (Shared)	East	L	-	-	-	-	2	A	4	A	4	A	7	A	15	B	18	B
		T	-	-	-	-	38	C	27	B	27	B	27	B	30	C	30	C
	South	L	-	-	-	-	1	A	2	A	1	A	2	A	22	B	3	A
		R	-	-	-	-	29	C	16	B	16	B	18	B	261	F	28	C
	West	T	-	-	-	-	7	A	19	B	17	B	28	B	80	F	19	B
		R	-	-	-	-	21	B	58	E	55	D	287	F	46	D	39	C
	Total		-	-	-	-	18	B	19	B	18	B	38	C	75	F	23	B
Western Access	North	L	-	-	-	-	-	-	59	E	59	E	65	E	91	F	91	F
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	71	F	71	F	54	D	63	E	63	E
	East	L	-	-	-	-	-	-	3	A	0	A	2	A	3	A	3	A
		T	-	-	-	-	-	-	27	B	38	C	32	C	42	D	36	C
		R	-	-	-	-	-	-	75	F	97	F	95	F	104	F	96	F
	South	L	-	-	-	-	-	-	1	A	1	A	1	A	1	A	1	A
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	37	C	37	C	44	D	65	E	61	E
	West	L	-	-	-	-	-	-	59	E	59	E	22	B	12	A	12	A
		T	-	-	-	-	-	-	28	C	27	B	27	B	29	C	28	C
		R	-	-	-	-	-	-	75	F	79	F	74	F	54	D	53	D
	Total		-	-	-	-	-	-	29	C	32	C	31	C	35	C	33	C

PRECINCT – SITE DETAILS – PM PEAK

3pm to 4pm

Intersection	Approach	Movement	Base (2019) Avg Delay (secs)	LOS	Future Base (2032) Avg Delay (secs)	LOS	25% Precinct Stage (2023) Avg Delay (secs)	LOS	50% Precinct Stage (2026) Avg Delay (secs)	LOS	50% Precinct Stage - No M12Rt (2026) Avg Delay (secs)	LOS	75% Precinct Stage (2029) Avg Delay (secs)	LOS	100% Precinct Stage (2032) Avg Delay (secs)	LOS	100% Precinct Stage - Grade Separated (2032) Avg Delay (secs)	LOS
3289 - New England Highway / Weakleys Drive	North	L	7	A	8	A	7	A	8	A	7	A	8	A	9	A	8	A
		T	22	B	21	B	20	B	22	B	23	B	23	B	24	B	23	B
		R	32	C	36	C	33	C	34	C	32	C	34	C	37	C	36	C
	East	L	14	B	16	B	13	A	17	B	15	B	15	B	14	B	15	B
		T	1	A	1	A	1	A	1	A	1	A	1	A	1	A	1	A
		R	39	C	35	C	35	C	35	C	35	C	38	C	35	C	36	C
	South	L	19	B	36	C	28	C	35	C	38	C	40	C	47	D	45	D
		T	40	C	65	E	57	E	69	E	73	F	73	F	76	F	77	F
		R	52	D	58	E	52	D	58	E	67	E	71	F	73	F	63	E
	West	L	5	A	5	A	5	A	5	A	5	A	6	A	7	A	7	A
		T	0	A	1	A	0	A	0	A	0	A	0	A	0	A	0	A
		R	36	C	34	C	35	C	36	C	34	C	33	C	36	C	35	C
	Total		16	B	20	B	19	B	21	B	22	B	23	B	24	B	24	B
4781 - John Renshaw Drive / Weakleys Drive	North	L	23	B	19	B	37	C	73	F	46	D	49	D	108	F	13	A
		T	44	D	53	D	69	E	107	F	79	F	84	F	150	F	33	C
		R	72	F	67	E	78	F	115	F	85	F	97	F	145	F	74	F
	East	L	7	A	4	A	7	A	4	A	8	A	4	A	4	A	4	A
		T	49	D	43	D	58	E	57	E	107	F	70	F	64	E	0	A
		R	73	F	77	F	71	F	78	F	84	F	72	F	79	F	75	F
	South	L	11	A	7	A	17	B	10	A	7	A	10	A	9	A	4	A
		T	28	C	38	C	42	C	43	D	34	C	41	C	48	D	16	B
		R	65	E	61	E	62	E	74	F	65	E	70	E	69	E	60	E
	West	L	45	D	46	D	38	C	38	C	55	D	109	F	104	F	11	A
		T	65	E	64	E	59	E	56	D	93	F	131	F	136	F	6	A
		R	88	F	79	F	88	F	91	F	125	F	166	F	174	F	72	F
	Total		41	C	44	D	48	D	61	E	62	E	75	F	88	F	24	B
Eastern Access (Shared)	East	L	-	-	-	-	7	A	4	A	4	A	6	A	6	A	7	A
		T	-	-	-	-	34	C	31	C	0	A	32	C	33	C	31	C
	South	L	-	-	-	-	1	A	3	A	3	A	3	A	2	A	2	A
		R	-	-	-	-	21	B	17	B	17	B	19	B	20	B	20	B
	West	T	-	-	-	-	10	A	18	B	17	B	19	B	19	B	18	B
		R	-	-	-	-	35	C	39	C	43	D	56	E	133	F	104	F
	Total		-	-	-	-	20	B	20	B	17	B	21	B	24	B	23	B
Western Access	North	L	-	-	-	-	-	-	63	E	63	E	89	F	73	F	73	F
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	77	F	77	F	66	E	64	E	64	E
	East	L	-	-	-	-	-	-	19	B	4	A	13	A	14	A	24	B
		T	-	-	-	-	-	-	40	C	23	B	37	C	47	D	58	E
		R	-	-	-	-	-	-	104	F	97	F	106	F	150	F	106	F
	South	L	-	-	-	-	-	-	1	A	1	A	1	A	1	A	1	A
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	43	D	43	D	45	D	48	D	48	D
	West	L	-	-	-	-	-	-	50	D	50	D	29	C	19	B	19	B
		T	-	-	-	-	-	-	24	B	22	B	22	B	25	B	25	B
		R	-	-	-	-	-	-	97	F	84	F	91	F	83	F	89	F
	Total		-	-	-	-	-	-	33	C	24	B	32	C	37	C	42	C

PM PEAK 4pm to 5pm

Intersection	Approach	Movement	Base (2019) Avg Delay (secs)	LOS	Future Base (2032) Avg Delay (secs)	LOS	25% Precinct Stage (2023) Avg Delay (secs)	LOS	50% Precinct Stage (2026) Avg Delay (secs)	LOS	50% Precinct Stage - No M12Rt (2026) Avg Delay (secs)	LOS	75% Precinct Stage (2029) Avg Delay (secs)	LOS	100% Precinct Stage (2032) Avg Delay (secs)	LOS	100% Precinct Stage - Grade Separated (2032) Avg Delay (secs)	LOS
3289 - New England Highway / Weakleys Drive	North	L	4	A	8	A	5	A	5	A	7	A	6	A	8	A	10	A
		T	15	B	18	B	14	B	17	B	18	B	18	B	19	B	20	B
		R	55	D	71	F	54	D	55	D	69	E	63	E	78	F	76	F
	East	L	31	C	49	D	17	B	44	D	32	C	54	D	49	D	48	D
		T	1	A	1	A	1	A	1	A	1	A	2	A	2	A	1	A
		R	64	E	199	F	73	F	121	F	60	E	302	F	264	F	261	F
	South	L	14	B	20	B	18	B	26	B	21	B	31	C	32	C	36	C
		T	30	C	64	E	32	C	72	F	38	C	90	F	91	F	94	F
		R	69	E	68	E	63	E	72	F	66	E	84	F	77	F	95	F
	West	L	8	A	72	F	14	B	53	D	19	B	91	F	246	F	186	F
		T	0	A	0	A	0	A	0	A	0	A	0	A	0	A	0	A
		R	50	D	55	D	52	D	58	E	56	D	75	F	78	F	63	E
	Total		22	B	43	D	24	B	36	C	25	B	56	E	60	E	57	E
4781 - John Renshaw Drive / Weakleys Drive	North	L	20	B	44	D	66	E	91	F	146	F	89	F	156	F	25	B
		T	45	D	64	E	106	F	125	F	184	F	122	F	186	F	35	C
		R	68	E	80	F	104	F	121	F	158	F	113	F	174	F	76	F
	East	L	6	A	4	A	6	A	4	A	7	A	4	A	4	A	4	A
		T	54	D	51	D	82	F	58	E	110	F	111	F	85	F	0	A
		R	61	E	70	F	69	E	78	F	60	E	70	E	69	E	76	F
	South	L	0	A	0	A	20	B	7	A	7	A	10	A	97	F	4	A
		T	27	B	38	C	40	C	45	D	36	C	45	D	125	F	17	B
		R	51	D	57	E	54	D	76	F	82	F	86	F	405	F	74	F
	West	L	44	D	33	C	29	C	29	C	105	F	117	F	232	F	11	A
		T	58	E	59	E	56	D	47	D	151	F	151	F	274	F	6	A
		R	79	F	83	F	76	F	86	F	237	F	197	F	326	F	81	F
	Total		39	C	47	D	57	E	64	E	100	F	96	F	182	F	28	C
Eastern Access (Shared)	East	L	-	-	-	-	7	A	5	A	6	A	6	A	8	A	9	A
		T	-	-	-	-	33	C	36	C	0	A	33	C	39	C	32	C
	South	L	-	-	-	-	1	A	2	A	3	A	3	A	4	A	2	A
		R	-	-	-	-	25	B	18	B	19	B	19	B	19	B	19	B
	West	T	-	-	-	-	10	A	18	B	17	B	19	B	21	B	20	B
		R	-	-	-	-	35	C	49	D	46	D	54	D	118	F	115	F
	Total		-	-	-	-	21	B	23	B	20	B	22	B	26	B	24	B
Western Access	North	L	-	-	-	-	-	-	72	F	72	F	68	E	82	F	82	F
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	78	F	78	F	70	F	66	E	66	E
	East	L	-	-	-	-	-	-	16	B	9	A	63	E	90	F	154	F
		T	-	-	-	-	-	-	50	D	34	C	98	F	140	F	195	F
		R	-	-	-	-	-	-	109	F	88	F	165	F	206	F	237	F
	South	L	-	-	-	-	-	-	1	A	1	A	1	A	1	A	1	A
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	36	C	35	C	38	C	51	D	51	D
	West	L	-	-	-	-	-	-	26	B	26	B	26	B	37	C	37	C
		T	-	-	-	-	-	-	23	B	24	B	26	B	26	B	26	B
		R	-	-	-	-	-	-	85	F	79	F	80	F	79	F	80	F
	Total		-	-	-	-	-	-	38	C	30	C	63	E	80	F	106	F

5pm to 6pm

Intersection	Approach	Movement	Base (2019) Avg Delay (secs)	LOS	Future Base (2032) Avg Delay (secs)	LOS	25% Precinct Stage (2023) Avg Delay (secs)	LOS	50% Precinct Stage (2026) Avg Delay (secs)	LOS	50% Precinct Stage - No M12Rt (2026) Avg Delay (secs)	LOS	75% Precinct Stage (2029) Avg Delay (secs)	LOS	100% Precinct Stage (2032) Avg Delay (secs)	LOS	100% Precinct Stage - Grade Separated (2032) Avg Delay (secs)	LOS
3289 - New England Highway / Weakleys Drive	North	L	3	A	11	A	4	A	4	A	6	A	9	A	22	B	22	B
		T	14	A	27	B	15	B	16	B	18	B	21	B	39	C	38	C
		R	68	E	104	F	67	E	70	E	75	F	86	F	125	F	140	F
	East	L	22	B	280	F	18	B	50	D	41	C	311	F	289	F	298	F
		T	1	A	3	A	1	A	1	A	1	A	5	A	4	A	5	A
		R	57	E	316	F	55	D	134	F	80	F	404	F	371	F	414	F
	South	L	12	A	14	B	14	B	15	B	13	A	20	B	22	B	25	B
		T	27	B	76	F	28	B	69	E	45	D	83	F	89	F	96	F
		R	72	F	71	F	61	E	79	F	74	F	68	E	72	F	78	F
	West	L	7	A	293	F	9	A	170	F	35	C	318	F	448	F	434	F
		T	0	A	1	A	1	A	1	A	0	A	1	A	1	A	1	A
		R	51	D	47	D	48	D	48	D	48	D	50	D	64	E	50	D
	Total		18	B	60	E	18	B	35	C	23	B	67	E	76	F	81	F
4781 - John Renshaw Drive / Weakleys Drive	North	L	31	C	70	E	152	F	107	F	155	F	106	F	128	F	11	A
		T	62	E	99	F	169	F	141	F	190	F	119	F	168	F	29	C
		R	67	E	82	F	151	F	139	F	175	F	125	F	160	F	75	F
	East	L	5	A	4	A	5	A	3	A	6	A	3	A	3	A	4	A
		T	36	C	35	C	49	D	52	D	115	F	80	F	80	F	0	A
		R	60	E	55	D	58	E	64	E	68	E	70	E	71	F	74	F
	South	L	8	A	21	B	9	A	7	A	8	A	10	A	162	F	4	A
		T	29	C	40	C	35	C	46	D	36	C	42	D	210	F	19	B
		R	47	D	52	D	47	D	87	F	69	E	88	F	673	F	72	F
	West	L	25	B	28	B	35	C	67	E	114	F	176	F	364	F	9	A
		T	50	D	47	D	49	D	108	F	166	F	205	F	419	F	5	A
		R	80	F	83	F	64	E	168	F	232	F	244	F	450	F	75	F
	Total		39	C	51	D	65	E	84	F	106	F	108	F	244	F	26	B
Eastern Access (Shared)	East	L	-	-	-	-	6	A	4	A	5	A	7	A	6	A	8	A
		T	-	-	-	-	26	B	30	C	0	A	36	C	32	C	31	C
	South	L	-	-	-	-	1	A	3	A	3	A	2	A	38	C	2	A
		R	-	-	-	-	24	B	18	B	19	B	19	B	262	F	20	B
	West	T	-	-	-	-	10	A	18	B	18	B	19	B	94	F	21	B
		R	-	-	-	-	38	C	44	D	43	D	58	E	96	F	100	F
	Total		-	-	-	-	17	B	20	B	19	B	22	B	90	F	23	B
Western Access	North	L	-	-	-	-	-	-	57	E	57	E	63	E	71	F	71	F
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	56	D	56	D	39	C	77	F	77	F
	East	L	-	-	-	-	-	-	5	A	9	A	147	F	99	F	119	F
		T	-	-	-	-	-	-	34	C	32	C	189	F	153	F	173	F
		R	-	-	-	-	-	-	96	F	82	F	266	F	197	F	229	F
	South	L	-	-	-	-	-	-	0	A	1	A	1	A	1	A	1	A
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	40	C	38	C	40	C	46	D	46	D
	West	L	-	-	-	-	-	-	48	D	47	D	20	B	13	A	13	A
		T	-	-	-	-	-	-	25	B	25	B	26	B	27	B	27	B
		R	-	-	-	-	-	-	72	F	79	F	98	F	126	F	119	F
	Total		-	-	-	-	-	-	30	C	30	C	102	F	84	F	92	F

APPENDIX: PRECINCT 2B - NETWORK INTERSECTION

JOHN RENSHAW DRIVE, BLACK HILL - TRAFFIC MODELLING
INTERSECTION PERFORMANCE RESULTS
GTA Ref: N171072
Date: 20/05/21

PRECINCT – SITE DETAILS – AM PEAK – 6am to 7am

INTERSECTION	APPROACH	MOVEMENT	Base (2019) Avg Delay (secs)	Base (2019) LOS	Future Base (2032) Avg Delay (secs)	Future Base (2032) LOS	25% Precinct Stage (2023) Avg Delay (secs)	25% Precinct Stage (2023) LOS	50% Precinct Stage (2026) Avg Delay (secs)	50% Precinct Stage (2026) LOS	50% Precinct Stage - No M12RT (2026) Avg Delay (secs)	50% Precinct Stage - No M12RT (2026) LOS	75% Precinct Stage (2029) Avg Delay (secs)	75% Precinct Stage (2029) LOS	100% Precinct Stage (2032) Avg Delay (secs)	100% Precinct Stage (2032) LOS	75% Precinct Stage - Grade Separated (2032) Avg Delay (secs)	75% Precinct Stage - Grade Separated (2032) LOS	100% Precinct Stage - Grade Separated (2032) Avg Delay (secs)	100% Precinct Stage - Grade Separated (2032) LOS
3289 - New England Highway / Weakleys Drive	North	L	10	A	14	A	12	A	11	A	13	A	13	A	13	A	13	A	13	A
		T	20	B	20	B	20	B	21	B	22	B	22	B	21	B	20	B	24	B
		R	13	A	16	B	14	A	14	B	14	B	14	A	13	A	13	B	13	A
	East	L	9	A	11	A	9	A	7	A	8	A	8	A	20	B	12	A	15	A
		T	0	A	0	A	0	A	0	A	0	A	0	A	0	A	0	A	0	A
		R	27	B	32	C	28	C	29	C	27	B	26	B	46	D	32	C	45	C
	South	L	13	A	11	A	11	A	14	B	13	A	15	B	18	B	14	A	19	B
		T	27	B	34	C	30	C	35	C	31	C	37	C	37	C	30	C	41	C
		R	18	B	17	B	21	B	26	B	18	B	22	B	23	B	16	C	19	C
	West	L	2	A	9	A	5	A	45	D	75	F	85	F	109	F	88	F	109	F
		T	0	A	0	A	0	A	0	A	0	A	0	A	0	A	0	A	0	A
		R	31	C	59	E	41	C	103	F	140	F	162	F	192	F	172	F	191	F
	Total		12	A	16	B	14	A	23	B	28	B	31	C	36	C	32	C	36	C
4781 - John Renshaw Drive / Weakleys Drive	North	L	52	D	34	C	62	E	25	B	115	F	35	C	42	D	6	B	10	C
		T	92	F	57	E	100	F	58	E	155	F	60	E	70	E	21	D	25	E
		R	69	E	67	E	77	F	80	F	119	F	82	F	86	F	78	F	79	F
	East	L	2	A	2	A	3	A	2	A	2	A	2	A	2	A	9	A	12	A
		T	29	C	34	C	35	C	46	D	47	D	42	C	48	D	0	D	0	D
		R	87	F	156	F	61	E	98	F	90	F	113	F	125	F	77	F	81	F
	South	L	9	A	26	B	31	C	9	A	9	A	18	B	72	F	8	A	13	B
		T	35	C	47	D	62	E	45	D	44	D	54	D	79	F	17	D	21	D
		R	54	D	58	E	64	E	66	E	78	F	63	E	66	E	66	E	64	E
	West	L	37	C	31	C	36	C	47	D	64	E	101	F	108	F	16	F	22	F
		T	52	D	54	D	61	E	72	F	124	F	172	F	185	F	1	F	2	F
		R	52	D	54	D	61	E	72	F	124	F	187	F	207	F	68	F	75	F
	Total		50	D	54	D	56	E	54	D	76	F	74	F	87	F	24	F	26	F
Eastern Access (Shared)	East	L	-	-	-	-	3	A	6	A	5	A	14	A	0	A	12	A	77	A
		T	-	-	-	-	33	C	27	B	30	C	29	C	32	C	31	C	73	C
	South	L	-	-	-	-	1	A	2	A	2	A	2	A	12	A	1	A	3	A
		R	-	-	-	-	29	C	19	B	19	B	39	C	101	F	32	B	36	B
	West	T	-	-	-	-	7	A	19	B	18	B	25	B	80	F	18	B	19	B
		R	-	-	-	-	19	B	76	F	70	F	35	C	52	D	34	F	41	F
	Total		-	-	-	-	15	B	20	B	20	B	25	B	45	D	22	B	50	C
Western Access	North	L	-	-	-	-	-	-	66	E	66	E	72	F	80	F	72	F	80	F
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	55	D	55	D	63	E	77	F	63	E	77	F
	East	L	-	-	-	-	-	-	2	A	2	A	3	A	5	A	3	A	6	A
		T	-	-	-	-	-	-	22	B	23	B	23	B	36	C	31	B	34	C
		R	-	-	-	-	-	-	68	E	86	F	74	F	90	F	91	F	91	F
	South	L	-	-	-	-	-	-	1	A	1	A	1	A	1	A	1	A	1	A
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	47	D	44	D	58	E	73	F	59	D	69	C
	West	L	-	-	-	-	-	-	15	B	30	C	35	C	28	B	35	D	28	C
		T	-	-	-	-	-	-	30	C	29	C	31	C	32	C	31	C	33	C
		R	-	-	-	-	-	-	88	F	114	F	64	E	83	F	65	F	91	F
	Total		-	-	-	-	-	-	29	C	31	C	31	C	38	C	33	C	38	C

AM PEAK – 7am to 8am

INTERSECTION	APPROACH	MOVEMENT	Base (2019) Avg Delay (secs)	Base (2019) LOS	Future Base (2032) Avg Delay (secs)	Future Base (2032) LOS	25% Precinct Stage (2023) Avg Delay (secs)	25% Precinct Stage (2023) LOS	50% Precinct Stage (2026) Avg Delay (secs)	50% Precinct Stage (2026) LOS	50% Precinct Stage - No M12RT (2026) Avg Delay (secs)	50% Precinct Stage - No M12RT (2026) LOS	75% Precinct Stage (2029) Avg Delay (secs)	75% Precinct Stage (2029) LOS	100% Precinct Stage (2032) Avg Delay (secs)	100% Precinct Stage (2032) LOS	75% Precinct Stage - Grade Separated (2032) Avg Delay (secs)	75% Precinct Stage - Grade Separated (2032) LOS	100% Precinct Stage - Grade Separated (2032) Avg Delay (secs)	100% Precinct Stage - Grade Separated (2032) LOS
3289 - New England Highway / Weakleys Drive	North	L	11	A	14	A	12	A	11	A	12	A	10	A	11	A	11	A	12	A
		T	22	B	22	B	20	B	23	B	21	B	22	B	38	C	23	B	26	B
		R	19	B	23	B	18	B	22	B	21	B	21	B	20	B	20	B	22	B
	East	L	6	A	6	A	5	A	6	A	6	A	6	A	23	B	6	A	11	A
		T	0	A	1	A	0	A	0	A	0	A	1	A	1	A	1	A	1	A
		R	23	B	22	B	24	B	25	B	21	B	24	B	25	B	22	B	24	B
	South	L	14	A	43	D	26	B	40	C	36	C	39	C	27	B	48	D	38	C
		T	46	D	101	F	68	E	111	F	94	F	92	F	73	F	110	F	97	F
		R	29	C	74	F	45	D	82	F	63	E	56	E	46	D	58	E	66	E
	West	L	3	A	4	A	3	A	20	B	21	B	62	E	94	F	68	E	77	F
		T	1	A	1	A	1	A	1	A	1	A	1	A	0	A	1	A	0	A
		R	24	B	27	B	26	B	69	E	65	E	121	F	191	F	133	F	156	F
	Total		12	A	18	B	15	B	24	B	22	B	30	C	36	C	33	C	35	C
4781 - John Renshaw Drive / Weakleys Drive	North	L	25	B	29	C	32	C	30	C	148	F	60	E	97	F	22	B	70	E
		T	55	D	52	D	60	E	55	D	181	F	86	F	118	F	30	C	72	F
		R	78	F	69	E	70	E	76	F	144	F	108	F	232	F	102	F	185	F
	East	L	2	A	1	A	2	A	1	A	2	A	1	A	1	A	3	A	5	A
		T	35	C	36	C	49	D	46	D	53	D	47	D	141	F	0	A	0	A
		R	64	E	110	F	73	F	66	E	74	F	77	F	97	F	72	F	68	E
	South	L	19	B	32	C	27	B	14	B	13	A	42	D	278	F	11	A	146	F
		T	38	C	58	E	50	D	60	E	47	D	96	F	167	F	19	B	89	F
		R	57	E	65	E	60	E	62	E	67	E	65	E	68	E	69	E	65	E
	West	L	37	C	39	C	43	D	43	D	49	D	115	F	101	F	22	B	23	B
		T	59	E	63	E	106	F	71	F	83	F	181	F	180	F	1	A	2	A
		R	59	E	63	E	106	F	71	F	83	F	203	F	189	F	65	E	77	F
	Total		46	D	55	D	56	E	54	D	75	F	91	F	148	F	29	C	61	E
Eastern Access (Shared)	East	L	-	-	-	-	3	A	5	A	7	A	14	B	0	A	17	B	90	F
		T	-	-	-	-	39	C	30	C	34	C	31	C	94	F	32	C	84	F
	South	L	-	-	-	-	1	A	2	A	3	A	56	E	96	F	2	A	4	A
		R	-	-	-	-	30	C	17	B	16	B	354	F	464	F	31	C	36	C
	West	T	-	-	-	-	7	A	20	B	19	B	112	F	226	F	19	B	21	B
		R	-	-	-	-	24	B	67	E	66	E	44	D	123	F	35	C	55	D
	Total		-	-	-	-	17	B	21	B	21	B	90	F	205	F	24	B	58	E
Western Access	North	L	-	-	-	-	-	-	66	E	66	E	69	E	85	F	69	E	76	F
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	40	C	40	C	77	F	80	F	77	F	80	F
	East	L	-	-	-	-	-	-	2	A	2	A	5	A	4	A	5	A	4	A
		T	-	-	-	-	-	-	26	B	23	B	36	C	34	C	41	C	37	C
		R	-	-	-	-	-	-	77	F	96	F	85	F	73	F	84	F	71	F
	South	L	-	-	-	-	-	-	1	A	1	A	1	A	1	A	1	A	1	A
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	48	D	48	D	58	E	92	F	60	E	68	E
	West	L	-	-	-	-	-	-	32	C	31	C	21	B	37	C	21	B	32	C
		T	-	-	-	-	-	-	31	C	30	C	33	C	59	E	33	C	33	C
		R	-	-	-	-	-	-	105	F	78	F	70	E	81	F	70	E	81	F
	Total		-	-	-	-	-	-	32	C	29	C	34	C	51	D	36	C	37	C

AM PEAK – 8am to 9am

INTERSECTION	APPROACH	MOVEMENT	Base (2019) Avg Delay (secs)	Base (2019) LOS	Future Base (2032) Avg Delay (secs)	Future Base (2032) LOS	25% Precinct Stage (2023) Avg Delay (secs)	25% Precinct Stage (2023) LOS	50% Precinct Stage (2026) Avg Delay (secs)	50% Precinct Stage (2026) LOS	50% Precinct Stage - No M12RT (2026) Avg Delay (secs)	50% Precinct Stage - No M12RT (2026) LOS	75% Precinct Stage (2029) Avg Delay (secs)	75% Precinct Stage (2029) LOS	100% Precinct Stage (2032) Avg Delay (secs)	100% Precinct Stage (2032) LOS	75% Precinct Stage - Grade Separated (2032) Avg Delay (secs)	75% Precinct Stage - Grade Separated (2032) LOS	100% Precinct Stage - Grade Separated (2032) Avg Delay (secs)	100% Precinct Stage - Grade Separated (2032) LOS
3289 - New England Highway / Weakleys Drive	North	L	7	A	7	A	8	A	7	A	8	A	8	A	40	C	8	A	7	A
		T	14	B	16	B	17	B	16	B	58	E	22	B	168	F	18	B	23	B
		R	16	B	18	B	17	B	17	B	18	B	18	B	54	D	17	B	18	B
	East	L	5	A	6	A	5	A	6	A	42	D	14	B	104	F	6	A	12	A
		T	0	A	1	A	0	A	0	A	0	A	1	A	1	A	0	A	1	A
		R	23	B	28	B	27	B	25	B	27	B	27	B	23	B	24	B	25	B
	South	L	15	B	58	E	17	B	56	E	54	D	41	C	12	A	55	D	57	E
		T	32	C	132	F	41	C	122	F	112	F	94	F	30	C	117	F	124	F
		R	23	B	91	F	21	B	75	F	75	F	56	E	22	B	84	F	81	F
	West	L	3	A	4	A	4	A	67	E	141	F	102	F	415	F	103	F	125	F
		T	0	A	0	A	0	A	0	A	1	A	0	A	0	A	0	A	0	A
		R	29	C	41	C	43	D	141	F	266	F	206	F	647	F	197	F	224	F
	Total		12	A	27	B	15	B	40	C	52	D	42	D	71	F	47	D	47	D
4781 - John Renshaw Drive / Weakleys Drive	North	L	71	F	31	C	117	F	48	D	161	F	94	F	118	F	15	B	59	E
		T	106	F	51	D	145	F	73	F	206	F	116	F	145	F	27	B	65	E
		R	86	F	74	F	128	F	94	F	157	F	193	F	356	F	92	F	167	F
	East	L	2	A	2	A	2	A	2	A	3	A	2	A	2	A	10	A	21	B
		T	34	C	36	C	40	C	42	C	42	D	118	F	278	F	0	A	0	A
		R	87	F	157	F	88	F	132	F	110	F	145	F	84	F	81	F	100	F
	South	L	4	A	62	E	67	E	11	A	12	A	160	F	605	F	11	A	159	F
		T	38	C	77	F	98	F	61	E	51	D	173	F	302	F	24	B	102	F
		R	56	E	61	E	55	D	65	E	61	E	70	F	69	E	60	E	67	E
	West	L	38	C	38	C	39	C	53	D	56	E	114	F	97	F	30	C	35	C
		T	59	E	60	E	76	F	67	E	83	F	181	F	172	F	2	A	2	A
		R	59	E	60	E	76	F	67	E	83	F	204	F	197	F	70	F	76	F
	Total		56	D	62	E	77	F	61	E	77	F	136	F	205	F	29	C	67	E
Eastern Access (Shared)	East	L	-	-	-	-	3	A	5	A	5	A	116	F	0	A	13	A	84	F
		T	-	-	-	-	40	C	27	B	27	B	95	F	149	F	30	C	88	F
	South	L	-	-	-	-	1	A	3	A	2	A	68	E	78	F	3	A	3	A
		R	-	-	-	-	32	C	17	B	18	B	352	F	329	F	30	C	34	C
	West	T	-	-	-	-	7	A	20	B	19	B	86	F	150	F	18	B	18	B
		R	-	-	-	-	20	B	66	E	60	E	110	F	341	F	33	C	56	D
	Total		-	-	-	-	18	B	20	B	19	B	140	F	220	F	22	B	58	E
Western Access	North	L	-	-	-	-	-	-	65	E	65	E	78	F	112	F	78	F	71	F
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	61	E	61	E	87	F	57	E	87	F	57	E
	East	L	-	-	-	-	-	-	2	A	3	A	4	A	5	A	4	A	6	A
		T	-	-	-	-	-	-	25	B	25	B	40	C	38	C	34	C	43	D
		R	-	-	-	-	-	-	82	F	76	F	86	F	68	E	103	F	112	F
	South	L	-	-	-	-	-	-	1	A	1	A	1	A	1	A	1	A	1	A
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	43	D	40	C	63	E	143	F	57	E	63	E
	West	L	-	-	-	-	-	-	38	C	38	C	26	B	139	F	26	B	38	C
		T	-	-	-	-	-	-	29	C	28	C	30	C	162	F	30	C	32	C
		R	-	-	-	-	-	-	127	F	110	F	65	E	117	F	65	E	88	F
	Total		-	-	-	-	-	-	32	C	31	C	35	C	104	F	33	C	39	C

PRECINCT – SITE DETAILS – PM PEAK – 3pm to 4pm

INTERSECTION	APPROACH	MOVEMENT	Base (2019) Avg Delay (secs)	Base (2019) LOS	Future Base (2032) Avg Delay (secs)	Future Base (2032) LOS	25% Precinct Stage (2023) Avg Delay (secs)	25% Precinct Stage (2023) LOS	50% Precinct Stage (2026) Avg Delay (secs)	50% Precinct Stage (2026) LOS	50% Precinct Stage - No M12Rt (2026) Avg Delay (secs)	50% Precinct Stage - No M12Rt (2026) LOS	75% Precinct Stage (2029) Avg Delay (secs)	75% Precinct Stage (2029) LOS	100% Precinct Stage (2032) Avg Delay (secs)	100% Precinct Stage (2032) LOS	75% Precinct Stage - Grade Separated (2032) Avg Delay (secs)	75% Precinct Stage - Grade Separated (2032) LOS	100% Precinct Stage - Grade Separated (2032) Avg Delay (secs)	100% Precinct Stage - Grade Separated (2032) LOS
3289 - New England Highway / Weakleys Drive	North	L	7	A	8	A	7	A	7	A	7	A	7	A	7	A	7	A	8	A
		T	22	B	21	B	20	B	22	B	23	B	22	B	24	B	22	B	23	B
		R	32	C	36	C	34	C	37	C	33	C	34	C	35	C	34	C	35	C
	East	L	14	B	16	B	17	B	18	B	14	B	18	B	14	B	18	B	12	A
		T	1	A	1	A	1	A	1	A	1	A	1	A	1	A	1	A	1	A
		R	39	C	35	C	36	C	35	C	34	C	36	C	35	C	35	C	35	C
	South	L	19	B	36	C	25	B	38	C	40	C	36	C	41	C	45	D	47	D
		T	40	C	65	E	53	D	70	E	78	F	67	E	75	F	76	F	72	F
		R	52	D	58	E	42	D	64	E	70	E	64	E	64	E	69	E	68	E
	West	L	5	A	5	A	5	A	6	A	5	A	7	A	8	A	6	A	9	A
		T	0	A	1	A	0	A	0	A	1	A	0	A	1	A	0	A	1	A
		R	36	C	34	C	35	C	33	C	35	C	35	C	35	C	35	C	36	C
	Total		16	B	20	B	19	B	22	B	23	B	22	B	23	B	23	B	24	B
4781 - John Renshaw Drive / Weakleys Drive	North	L	23	B	19	B	52	D	55	D	87	F	129	F	114	F	7	A	12	A
		T	44	D	53	D	84	F	93	F	121	F	166	F	153	F	28	C	36	C
		R	72	F	67	E	94	F	99	F	118	F	166	F	152	F	71	F	73	F
	East	L	7	A	4	A	7	A	4	A	7	A	4	A	5	A	4	A	4	A
		T	49	D	43	D	60	E	80	F	75	F	123	F	131	F	0	A	0	A
		R	73	F	77	F	66	E	76	F	69	E	68	E	54	D	77	F	75	F
	South	L	11	A	7	A	22	B	11	A	42	D	12	A	11	A	4	A	5	A
		T	28	C	38	C	46	D	50	D	91	F	59	E	64	E	19	B	18	B
		R	65	E	61	E	64	E	99	F	369	F	116	F	148	F	63	E	62	E
	West	L	45	D	46	D	41	C	74	F	55	D	278	F	353	F	13	A	29	C
		T	65	E	64	E	61	E	115	F	90	F	321	F	393	F	9	A	7	A
		R	88	F	79	F	88	F	180	F	134	F	393	F	467	F	67	E	81	F
	Total		41	C	44	D	53	D	78	F	106	F	149	F	164	F	24	B	28	B
Eastern Access (Shared)	East	L	-	-	-	-	7	A	6	A	6	A	7	A	14	A	8	A	11	A
		T	-	-	-	-	35	C	34	C	0	A	34	C	34	C	31	C	31	C
	South	L	-	-	-	-	1	A	3	A	3	A	19	B	54	D	2	A	3	A
		R	-	-	-	-	23	B	20	B	19	B	129	F	230	F	21	B	21	B
	West	T	-	-	-	-	9	A	17	B	17	B	51	D	198	F	18	B	18	B
		R	-	-	-	-	46	D	38	C	50	D	65	E	175	F	60	E	89	F
	Total		-	-	-	-	21	B	21	B	19	B	56	E	122	F	21	B	23	B
Western Access	North	L	-	-	-	-	-	-	76	F	76	F	69	E	72	F	69	E	72	F
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	62	E	62	E	69	E	88	F	69	E	88	F
	East	L	-	-	-	-	-	-	11	A	7	A	8	A	8	A	24	B	20	B
		T	-	-	-	-	-	-	45	D	35	C	37	C	40	C	56	E	49	D
		R	-	-	-	-	-	-	93	F	101	F	104	F	114	F	122	F	119	F
	South	L	-	-	-	-	-	-	1	A	1	A	1	A	1	A	1	A	1	A
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	44	D	43	D	54	D	54	D	57	E	54	D
	West	L	-	-	-	-	-	-	16	B	17	B	28	C	53	D	28	C	103	F
		T	-	-	-	-	-	-	24	B	22	B	24	B	36	C	24	B	74	F
		R	-	-	-	-	-	-	93	F	86	F	220	F	310	F	233	F	429	F
	Total		-	-	-	-	-	-	35	C	30	C	39	C	50	D	48	D	70	F

PM PEAK – 4pm to 5pm

INTERSECTION	APPROACH	MOVEMENT	Base (2019) Avg Delay (secs)	Base (2019) LOS	Future Base (2032) Avg Delay (secs)	Future Base (2032) LOS	25% Precinct Stage (2023) Avg Delay (secs)	25% Precinct Stage (2023) LOS	50% Precinct Stage (2026) Avg Delay (secs)	50% Precinct Stage (2026) LOS	50% Precinct Stage - No M12Rt (2026) Avg Delay (secs)	50% Precinct Stage - No M12Rt (2026) LOS	75% Precinct Stage (2029) Avg Delay (secs)	75% Precinct Stage (2029) LOS	100% Precinct Stage (2032) Avg Delay (secs)	100% Precinct Stage (2032) LOS	75% Precinct Stage - Grade Separated (2032) Avg Delay (secs)	75% Precinct Stage - Grade Separated (2032) LOS	100% Precinct Stage - Grade Separated (2032) Avg Delay (secs)	100% Precinct Stage - Grade Separated (2032) LOS
3289 - New England Highway / Weakleys Drive	North	L	4	A	8	A	4	A	5	A	7	A	5	A	14	A	6	A	8	A
		T	15	B	18	B	15	B	17	B	19	B	17	B	22	B	17	B	18	B
		R	55	D	71	F	54	D	54	D	71	F	62	E	79	F	60	E	68	E
	East	L	31	C	49	D	16	B	43	D	36	C	22	B	49	D	24	B	35	C
		T	1	A	1	A	1	A	1	A	1	A	1	A	1	A	2	A	1	A
		R	64	E	199	F	67	E	119	F	76	F	98	F	140	F	234	F	133	F
	South	L	14	B	20	B	17	B	24	B	23	B	25	B	26	B	34	C	38	C
		T	30	C	64	E	32	C	69	E	38	C	62	E	75	F	91	F	89	F
		R	69	E	68	E	63	E	70	E	70	F	67	E	70	F	75	F	85	F
	West	L	8	A	72	F	16	B	67	E	15	B	52	D	109	F	153	F	114	F
		T	0	A	0	A	0	A	0	A	0	A	0	A	0	A	0	A	0	A
		R	50	D	55	D	54	D	60	E	54	D	67	E	109	F	89	F	105	F
	Total		22	B	43	D	23	B	35	C	27	B	33	C	48	D	54	D	47	D
4781 - John Renshaw Drive / Weakleys Drive	North	L	20	B	44	D	60	E	152	F	151	F	157	F	135	F	26	B	23	B
		T	45	D	64	E	94	F	186	F	190	F	190	F	183	F	37	C	37	C
		R	68	E	80	F	96	F	183	F	190	F	190	F	187	F	76	F	79	F
	East	L	6	A	4	A	6	A	4	A	6	A	5	A	4	A	4	A	4	A
		T	54	D	51	D	114	F	71	F	84	F	145	F	144	F	0	A	0	A
		R	61	E	70	F	75	F	69	E	66	E	47	D	43	D	70	E	91	F
	South	L	0	A	0	A	19	B	11	A	292	F	36	C	172	F	4	A	5	A
		T	27	B	38	C	46	D	57	E	325	F	96	F	214	F	21	B	46	D
		R	51	D	57	E	55	D	240	F	857	F	455	F	670	F	71	F	89	F
	West	L	44	D	33	C	29	C	106	F	258	F	403	F	399	F	14	A	361	F
		T	58	E	59	E	56	E	142	F	302	F	444	F	454	F	8	A	217	F
		R	79	F	83	F	80	F	232	F	389	F	544	F	570	F	76	F	391	F
	Total		39	C	47	D	60	E	121	F	251	F	223	F	264	F	27	B	77	F
Eastern Access (Shared)	East	L	-	-	-	-	7	A	7	A	6	A	8	A	98	F	9	A	11	A
		T	-	-	-	-	33	C	36	C	0	A	36	C	83	F	33	C	36	C
	South	L	-	-	-	-	1	A	2	A	3	A	95	F	135	F	3	A	5	A
		R	-	-	-	-	28	B	18	B	19	B	391	F	450	F	21	B	75	F
	West	T	-	-	-	-	10	A	18	B	19	B	362	F	255	F	19	B	48	D
		R	-	-	-	-	42	C	57	E	54	D	247	F	363	F	68	E	68	E
	Total		-	-	-	-	21	B	22	B	21	B	192	F	203	F	23	B	42	D
Western Access	North	L	-	-	-	-	-	-	47	D	47	D	96	F	73	F	96	F	73	F
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	47	D	47	D	51	D	74	F	51	D	74	F
	East	L	-	-	-	-	-	-	19	B	16	B	12	A	12	A	68	E	144	F
		T	-	-	-	-	-	-	55	D	46	D	47	D	44	D	114	F	179	F
		R	-	-	-	-	-	-	155	F	92	F	118	F	120	F	168	F	242	F
	South	L	-	-	-	-	-	-	1	A	1	A	1	A	1	A	1	A	1	A
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	46	D	46	D	49	D	49	D	50	D	50	D
	West	L	-	-	-	-	-	-	15	B	12	A	23	B	110	F	23	B	105	F
		T	-	-	-	-	-	-	24	B	27	B	26	B	168	F	26	B	177	F
		R	-	-	-	-	-	-	84	F	93	F	122	F	727	F	131	F	765	F
	Total		-	-	-	-	-	-	40	C	37	C	40	C	109	F	70	E	168	F

PM PEAK – 5pm to 6pm

INTERSECTION	APPROACH	MOVEMENT	Base (2019) Avg Delay (secs)	Base (2019) LOS	Future Base (2032) Avg Delay (secs)	Future Base (2032) LOS	25% Precinct Stage (2023) Avg Delay (secs)	25% Precinct Stage (2023) LOS	50% Precinct Stage (2026) Avg Delay (secs)	50% Precinct Stage (2026) LOS	50% Precinct Stage - No M12Rt (2026) Avg Delay (secs)	50% Precinct Stage - No M12Rt (2026) LOS	75% Precinct Stage (2029) Avg Delay (secs)	75% Precinct Stage (2029) LOS	100% Precinct Stage (2032) Avg Delay (secs)	100% Precinct Stage (2032) LOS	75% Precinct Stage - Grade Separated (2032) Avg Delay (secs)	75% Precinct Stage - Grade Separated (2032) LOS	100% Precinct Stage - Grade Separated (2032) Avg Delay (secs)	100% Precinct Stage - Grade Separated (2032) LOS
3289 - New England Highway / Weakleys Drive	North	L	3	A	11	A	5	A	5	A	5	A	5	A	8	A	7	A	9	A
		T	14	A	27	B	17	B	18	B	20	B	20	B	32	C	21	B	26	B
		R	68	E	104	F	69	E	73	F	80	F	70	F	91	F	90	F	101	F
	East	L	22	B	280	F	22	B	53	D	36	C	71	F	55	D	325	F	336	F
		T	1	A	3	A	1	A	1	A	1	A	1	A	1	A	4	A	4	A
		R	57	E	316	F	58	E	119	F	57	E	150	F	57	E	424	F	422	F
	South	L	12	A	14	B	13	A	13	A	12	A	15	B	16	B	23	B	36	C
		T	27	B	76	F	33	C	60	E	33	C	76	F	37	C	92	F	107	F
		R	72	F	71	F	64	E	70	E	81	F	62	E	62	E	80	F	93	F
	West	L	7	A	293	F	9	A	72	F	13	A	157	F	29	C	523	F	424	F
		T	0	A	1	A	1	A	1	A	1	A	1	A	1	A	1	A	1	A
		R	51	D	47	D	48	D	47	D	47	D	50	D	81	F	65	E	62	E
	Total		18	B	60	E	19	B	29	C	20	B	37	C	27	B	76	F	76	F
4781 - John Renshaw Drive / Weakleys Drive	North	L	31	C	70	E	183	F	155	F	160	F	160	F	149	F	10	A	7	A
		T	62	E	99	F	218	F	190	F	193	F	189	F	186	F	28	B	28	B
		R	67	E	82	F	188	F	190	F	182	F	188	F	185	F	81	F	82	F
	East	L	5	A	4	A	6	A	3	A	5	A	4	A	5	A	3	A	3	A
		T	36	C	35	C	58	E	59	E	72	F	142	F	148	F	0	A	0	A
		R	60	E	55	D	59	E	73	F	63	E	44	D	47	D	69	E	64	E
	South	L	8	A	21	B	18	B	9	A	304	F	169	F	259	F	3	A	4	A
		T	29	C	40	C	44	D	54	D	345	F	216	F	316	F	18	B	25	B
		R	47	D	52	D	48	D	420	F	896	F	795	F	956	F	64	E	70	F
	West	L	25	B	28	B	31	C	140	F	366	F	412	F	385	F	14	B	185	F
		T	50	D	47	D	56	D	184	F	399	F	470	F	445	F	10	A	129	F
		R	80	F	83	F	71	F	261	F	475	F	531	F	541	F	71	F	306	F
	Total		39	C	51	D	77	F	149	F	282	F	277	F	307	F	24	B	60	E
Eastern Access (Shared)	East	L	-	-	-	-	6	A	6	A	5	A	64	E	334	F	8	A	9	A
		T	-	-	-	-	28	C	33	C	0	A	54	D	212	F	30	C	33	C
	South	L	-	-	-	-	1	A	3	A	10	A	131	F	113	F	3	A	10	A
		R	-	-	-	-	25	B	19	B	142	F	557	F	570	F	21	B	88	F
	West	T	-	-	-	-	10	A	18	B	109	F	381	F	273	F	19	B	42	C
		R	-	-	-	-	41	C	37	C	56	E	315	F	394	F	61	E	82	F
	Total		-	-	-	-	18	B	21	B	75	F	248	F	324	F	21	B	46	D
Western Access	North	L	-	-	-	-	-	-	76	F	76	F	116	F	94	F	76	F	94	F
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	70	F	70	F	39	C	67	E	39	C	67	E
	East	L	-	-	-	-	-	-	7	A	11	A	9	A	15	B	96	F	183	F
		T	-	-	-	-	-	-	36	C	36	C	41	C	46	D	143	F	226	F
		R	-	-	-	-	-	-	103	F	100	F	130	F	113	F	196	F	299	F
	South	L	-	-	-	-	-	-	1	A	1	A	59	E	1	A	1	A	1	A
		T	-	-	-	-	-	-	0	A	0	A	0	A	0	A	0	A	0	A
		R	-	-	-	-	-	-	47	D	47	D	294	F	52	D	48	D	51	D
	West	L	-	-	-	-	-	-	6	A	5	A	77	F	120	F	6	A	98	F
		T	-	-	-	-	-	-	27	B	26	B	118	F	151	F	29	C	150	F
		R	-	-	-	-	-	-	107	F	93	F	280	F	701	F	222	F	671	F
	Total		-	-	-	-	-	-	34	C	33	C	105	F	110	F	84	F	177	F

H. TRAFFIC MODEL RESULTS – AVERAGE SPEED PLOTS

1. Precinct 2A
2. Precinct 2B

H

APPENDIX: PRECINT 2A – NETWORK AVERAGE SPEED PLOTS

Recorded AM Peak Hour Average Speed Plots

Figure H.1: AM peak network average speed (6am to 7am) – Future Base (2032)

Figure H.2: AM peak network average speed (7am to 8am) – Future Base (2032)

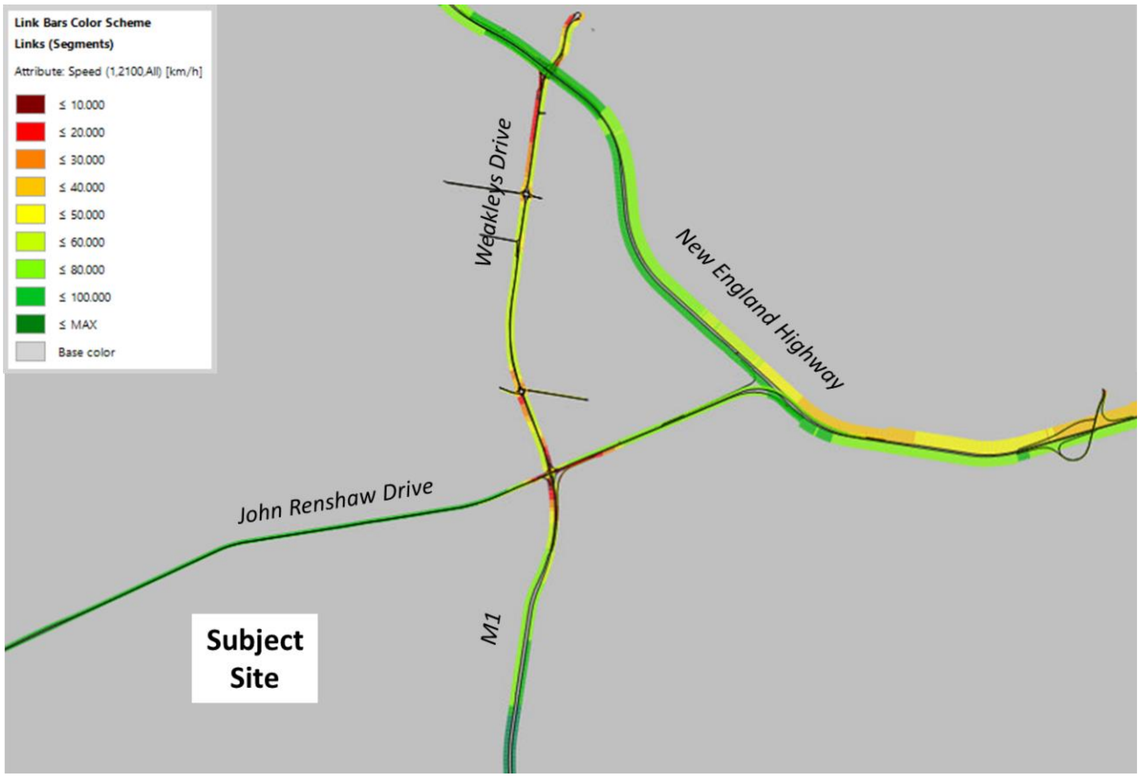

Figure H.3: AM peak network average speed (6am to 7am) – 25% GFA developed (2023) No M12RT

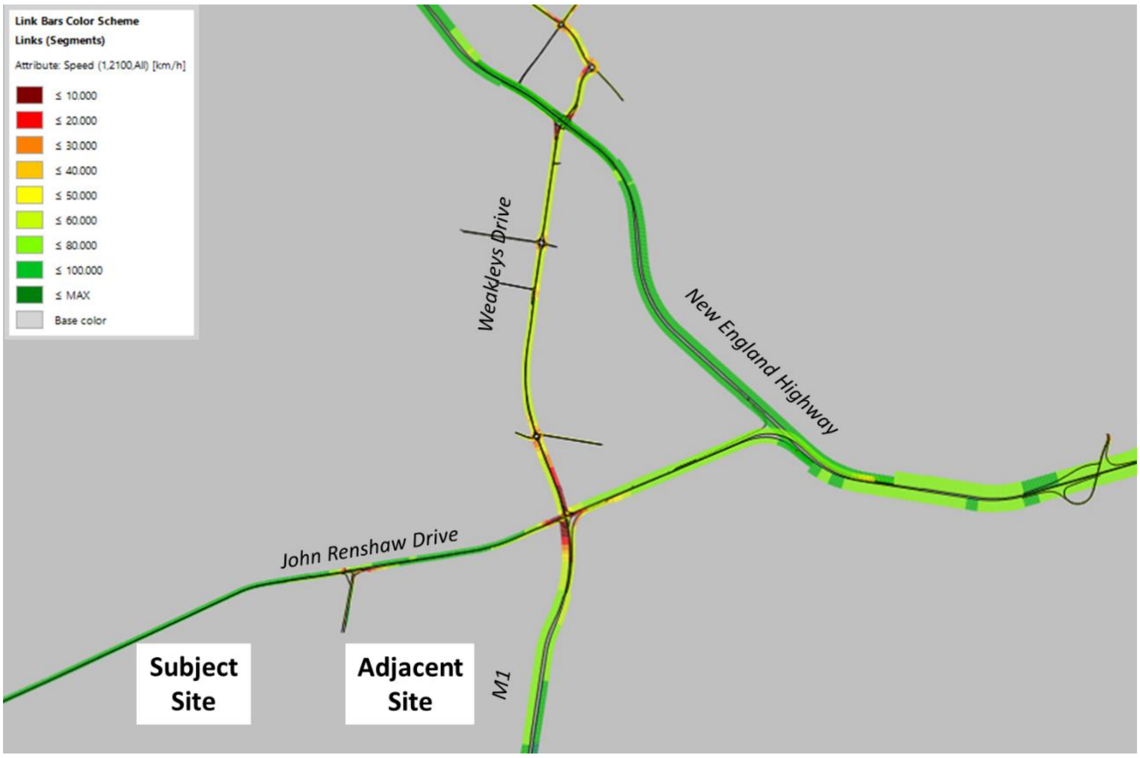

Figure H.4: AM peak network average speed (7am to 8am) – 25% GFA developed (2023) No M12RT

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Figure H.5: AM peak network average speed (6am to 7am) – 50% GFA developed (2026) No M12RT

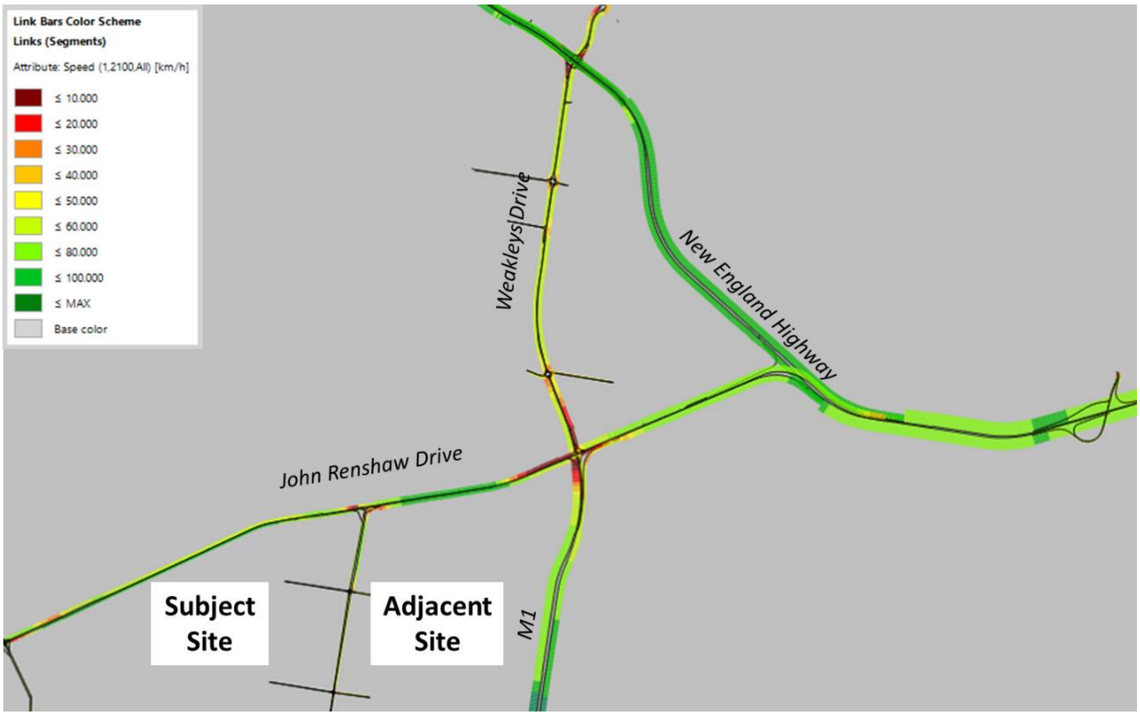


Figure H.6: AM peak network average speed (7am to 8am) – 50% GFA developed (2026) No M12RT

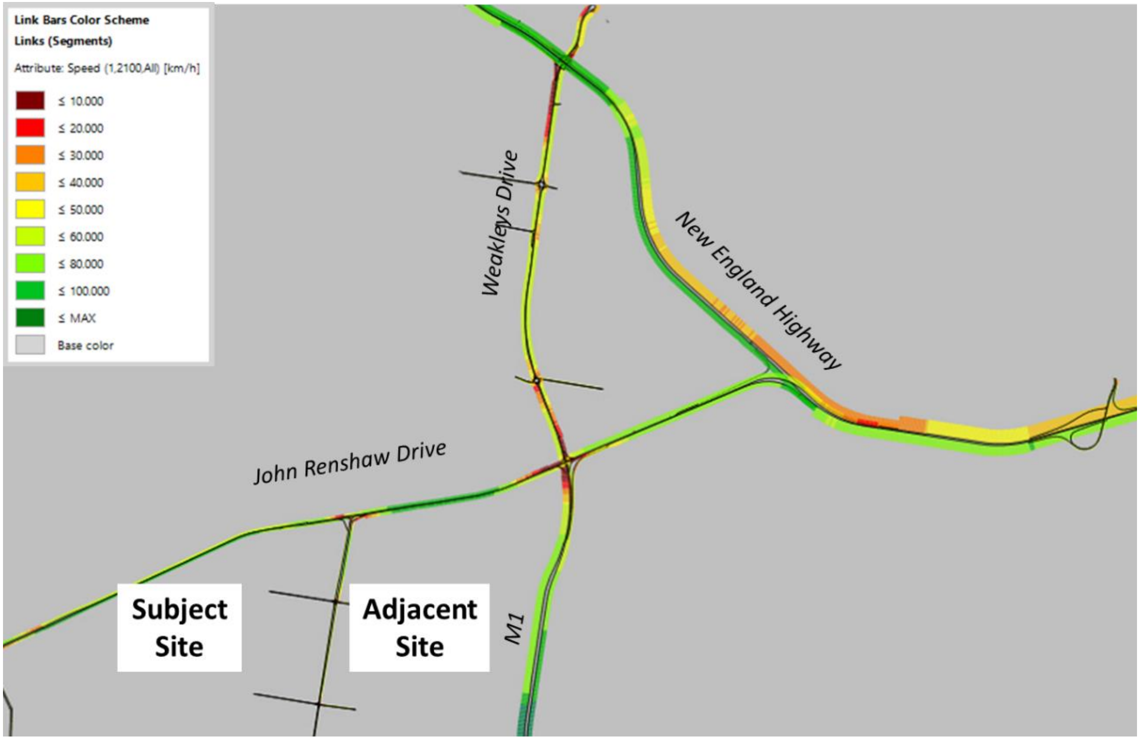


Figure H.7: AM peak network average speed (6am to 7am) – 50% GFA developed (2026) With M12RT

Figure H.8: AM peak network average speed (7am to 8am) – 50% GFA developed (2026) With M12RT

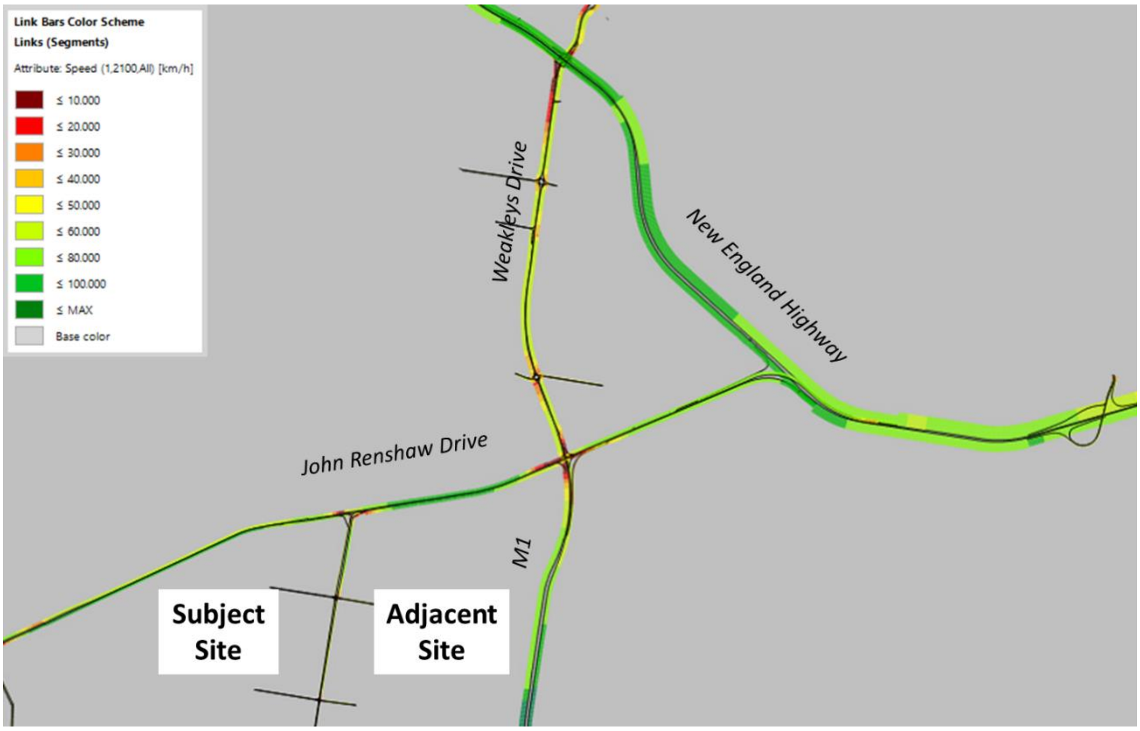


Figure H.9: AM peak network average speed (6am to 7am) – 75% GFA developed (2029) With M12RT

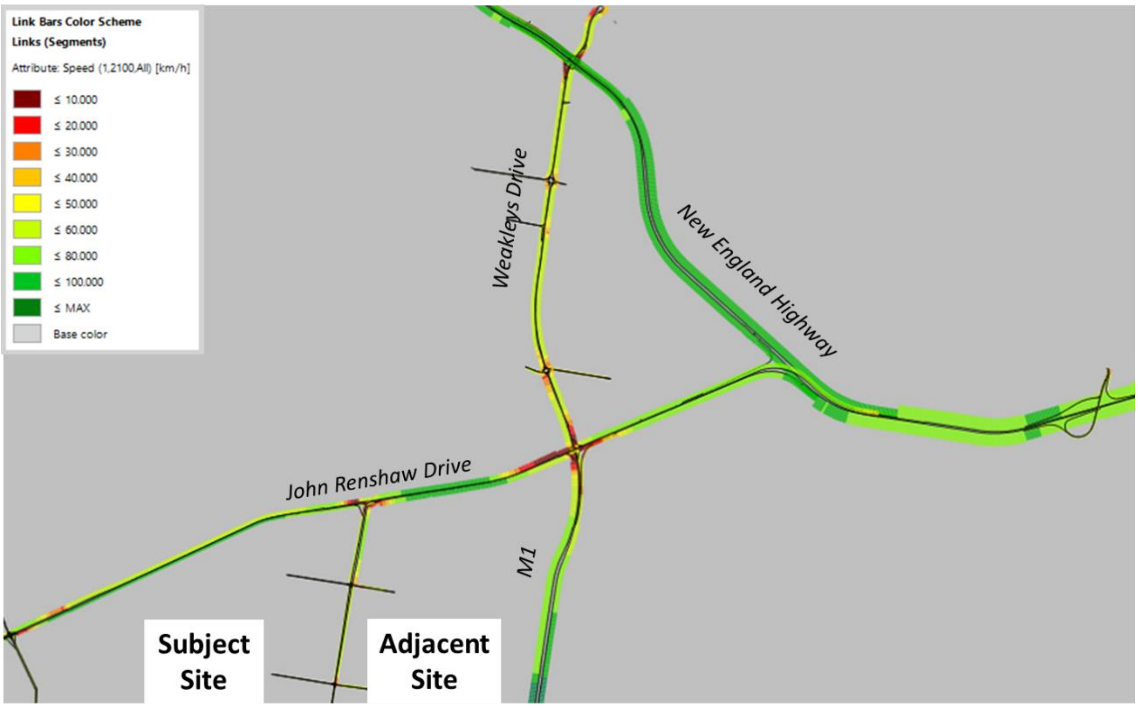


Figure H.10: AM peak network average speed (7am to 8am) – 75% GFA developed (2029) With M12RT

Figure H.11: AM peak network average speed (6am to 7am) – 100% GFA developed (2032) With M12RT

Figure H.12: AM peak network average speed (7am to 8am) – 100% GFA developed (2032) With M12RT

Figure H.13: AM peak network average speed (6am to 7am) – 100% GFA developed (2032) – Grade Separated With M12RT

Figure H.14: AM peak network average speed (7am to 8am) – 100% GFA developed (2032) – Grade Separated With M12RT

Recorded PM Peak Hour Average Speed Plots

Figure H.15: PM peak network average speed (3pm to 4pm) – Future Base (2032)

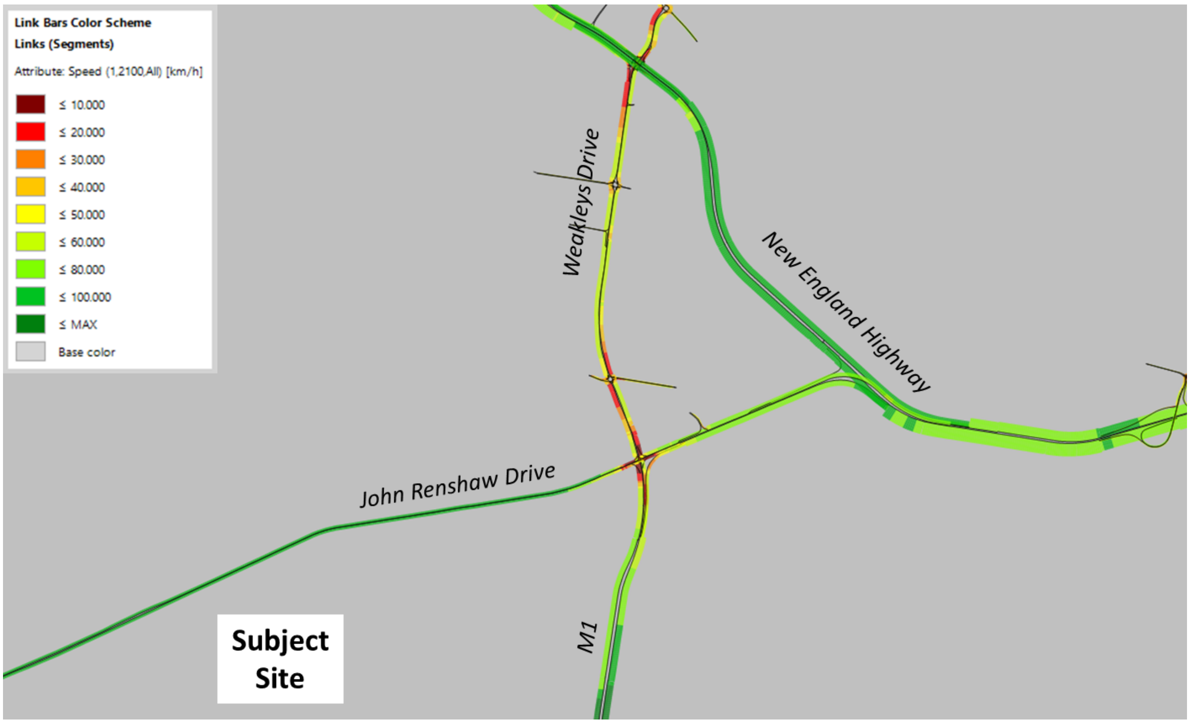


Figure H.16: PM peak network average speed (4pm to 5pm) – Future Base (2032)

Figure H.17: PM peak network average speed (3pm to 4pm) – 25% GFA developed (2023) No M12RT

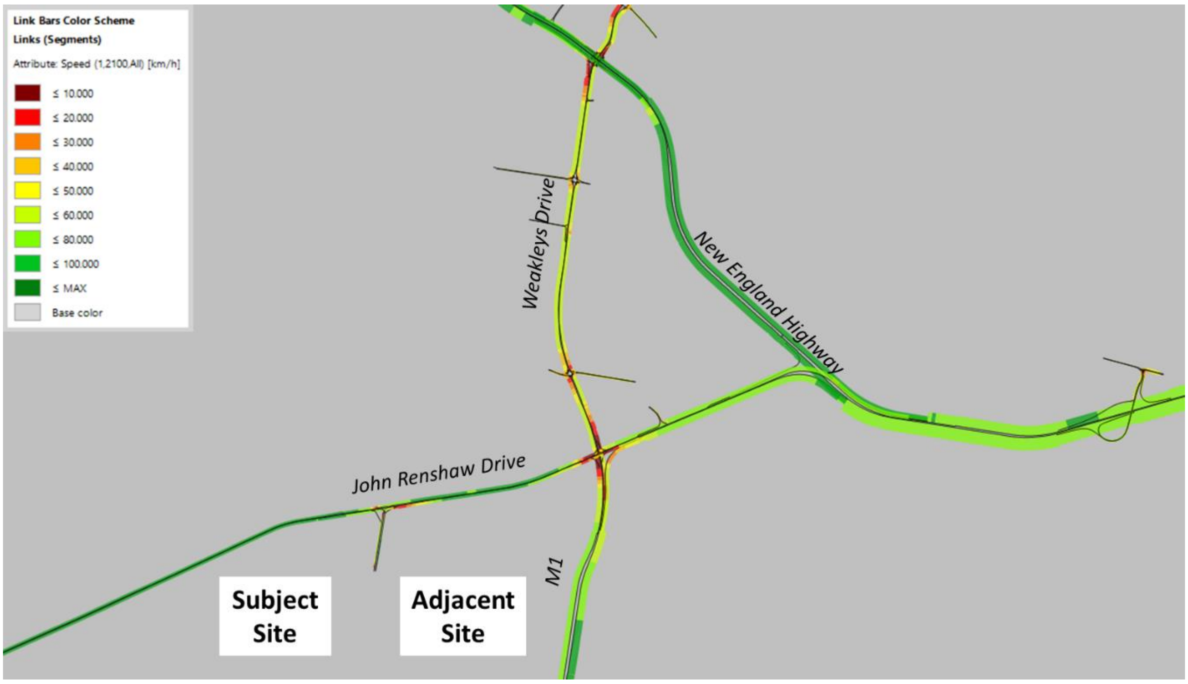


Figure H.18: PM peak network average speed (4pm to 5pm) – 25% GFA developed (2023) No M12RT

Figure H.19: PM peak network average speed (3pm to 4pm) – 50% GFA developed (2026) No M12RT

Figure H.20: PM peak network average speed (4pm to 5pm) – 50% GFA developed (2026) No M12RT

Figure H.21: PM peak network average speed (3pm to 4pm) – 50% GFA developed (2026) With M12RT

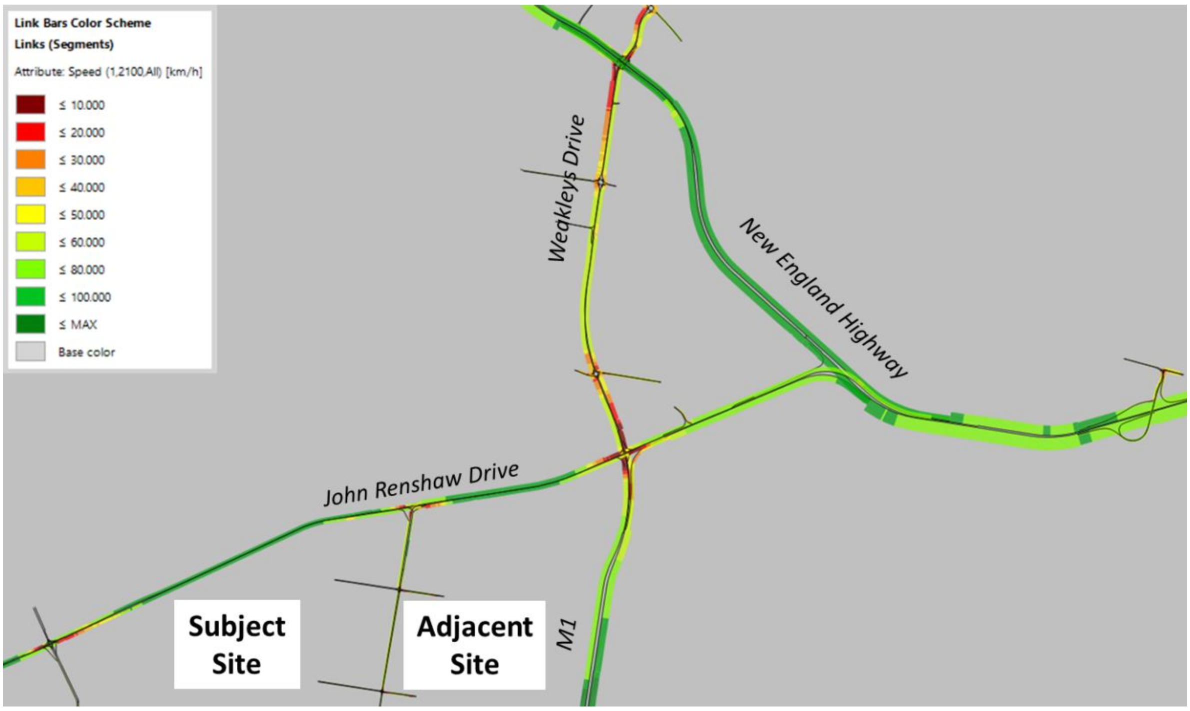


Figure H.22: PM peak network average speed (4pm to 5pm) – 50% GFA developed (2026) With M12RT

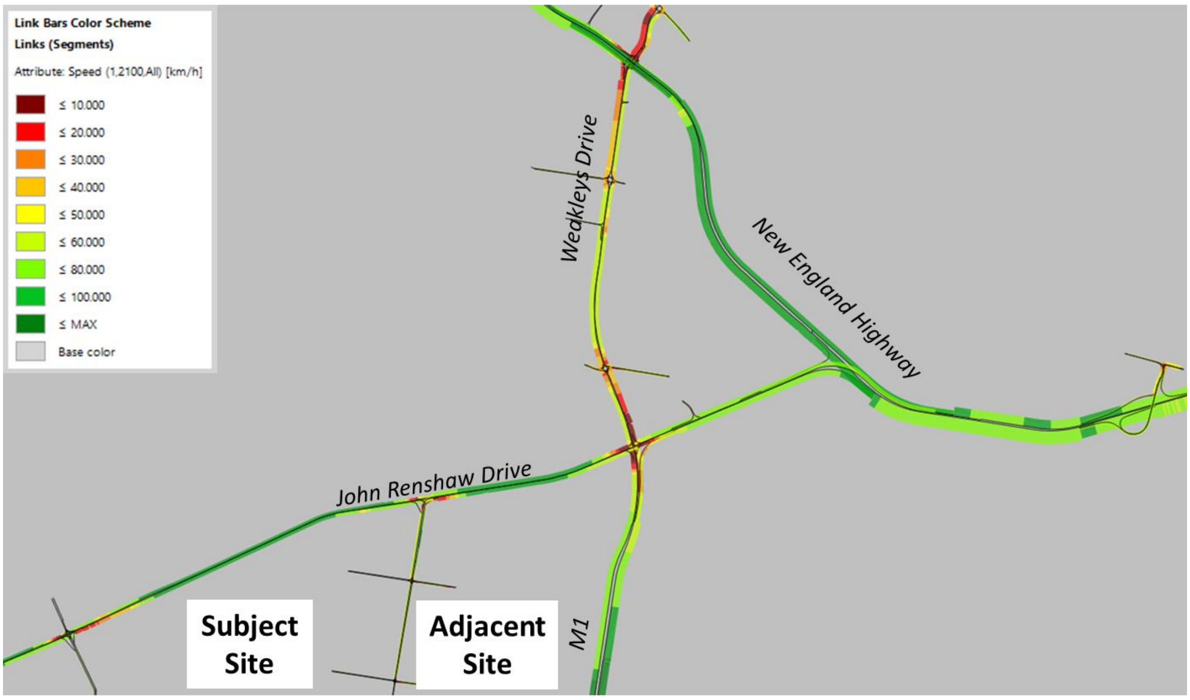


Figure H.23: PM peak network average speed (3pm to 4pm) – 75% GFA developed (2029) With M12RT

Figure H.24: PM peak network average speed (4pm to 5pm) – 75% GFA developed (2029) With M12RT

Figure H.25: PM peak network average speed (3pm to 4pm) – 100% GFA developed (2032) With M12RT

Figure H.26: PM peak network average speed (4pm to 5pm) – 100% GFA developed (2032) With M12RT

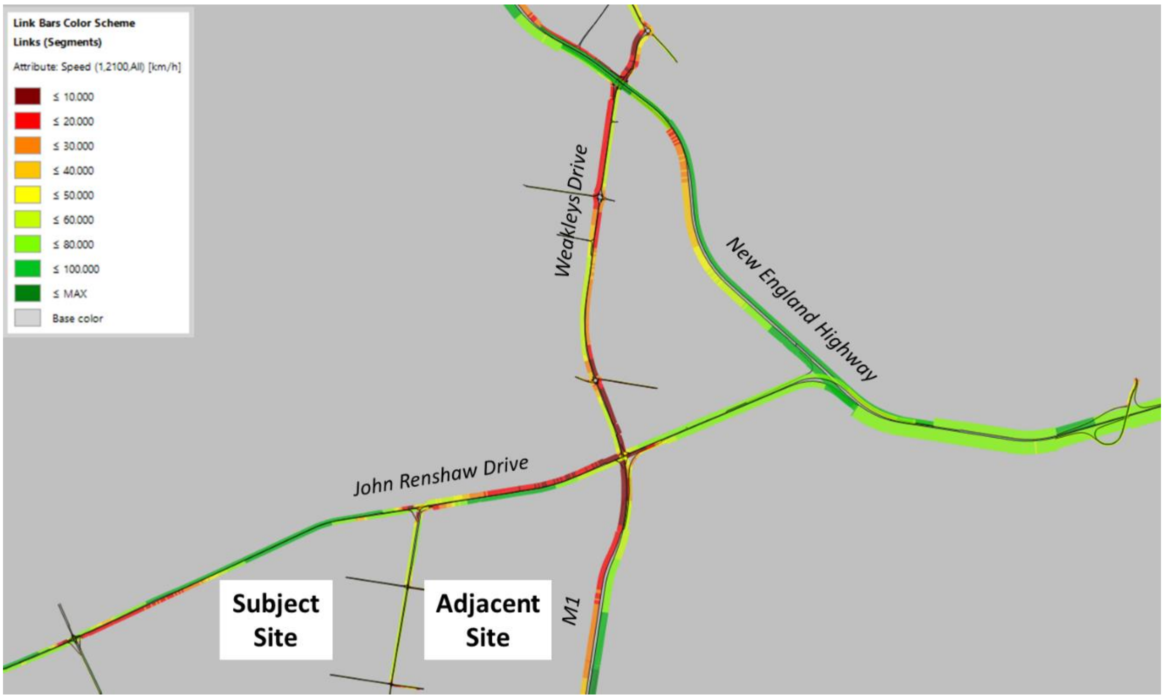
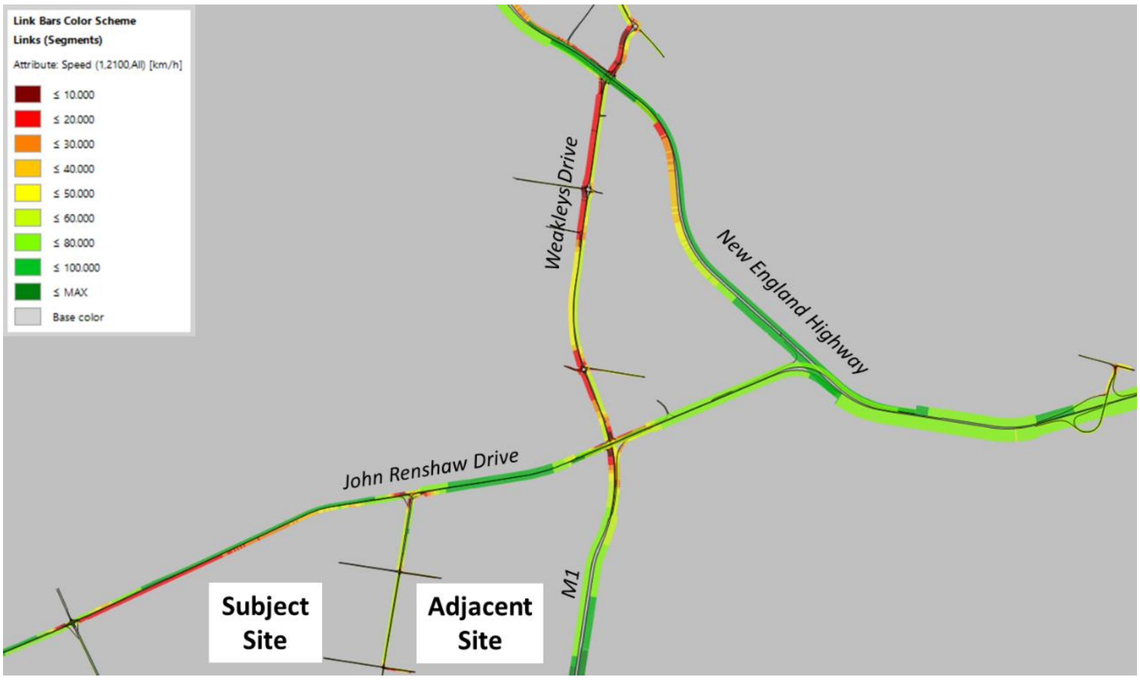


Figure H.27: PM peak network average speed (3pm to 4pm) – 100% GFA developed (2032) - Grade Separated With M12RT

Figure H.28: PM peak network average speed (4pm to 5pm) – 100% GFA developed (2032) – Grade Separated With M12RT

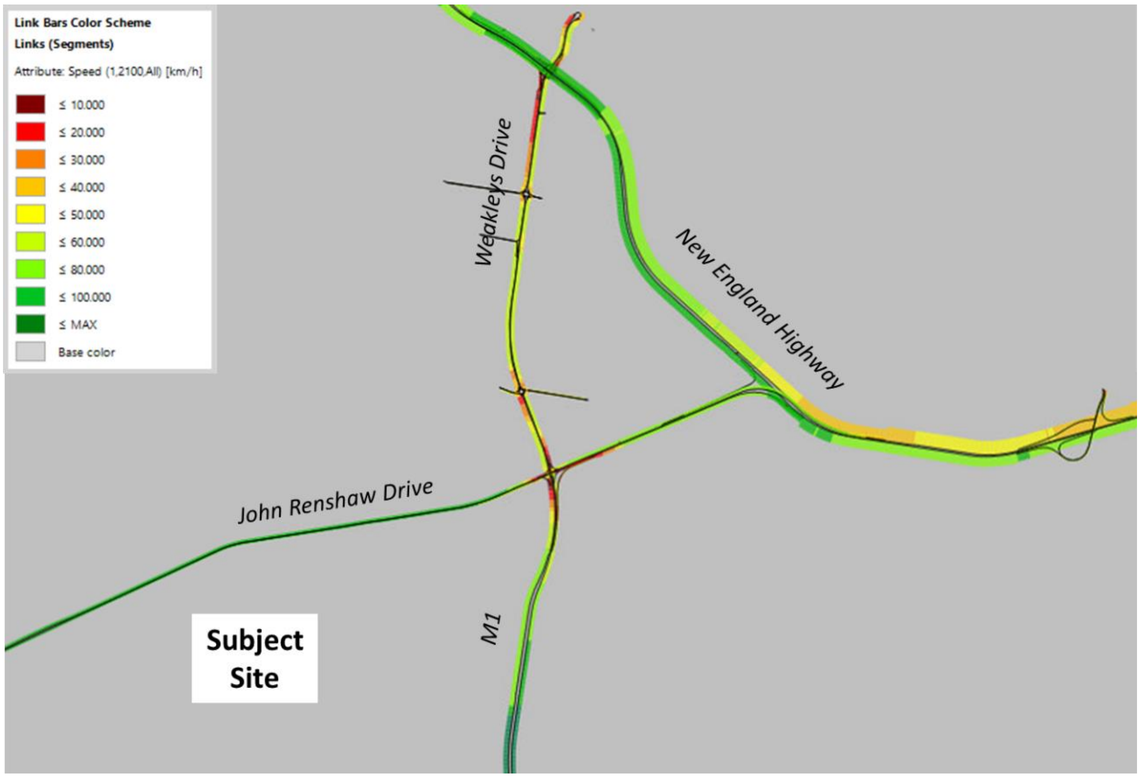


APPENDIX: PRECINT 2B – NETWORK AVERAGE SPEED PLOTS

Precinct 2B – Recorded AM Peak Hour Average Speed Plots

Figure H.29: AM peak network average speed (6am to 7am) – Future Base (2032)

Figure H.30: AM peak network average speed (7am to 8am) – Future Base (2032)



APPENDIX: PRECINT 2B – NETWORK AVERAGE SPEED PLOTS

Figure H.31: AM peak network average speed (6am to 7am) – 25% GFA developed (2023) No M12RT

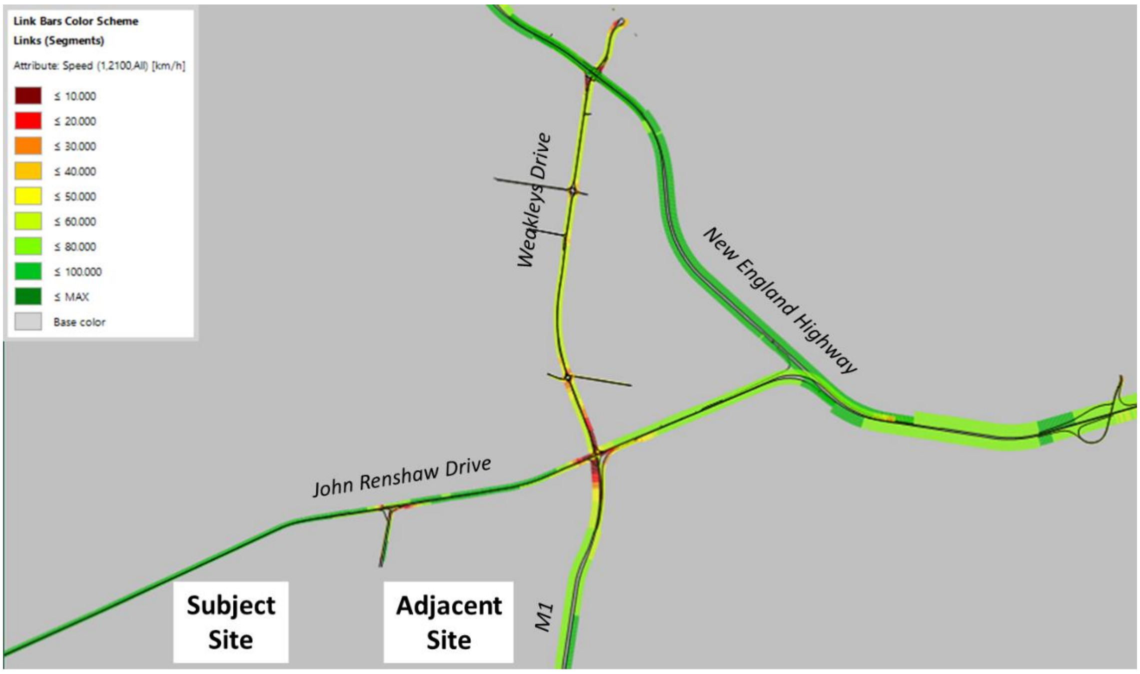
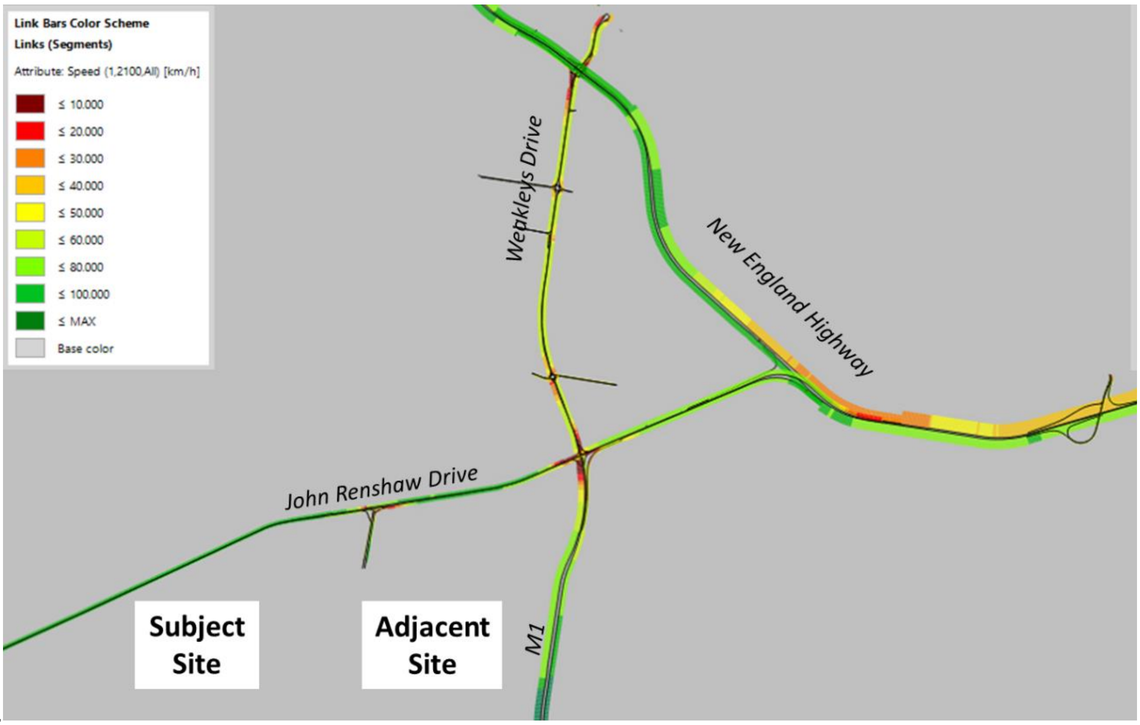


Figure H.32: AM peak network average speed (7am to 8am) – 25% GFA developed (2023) No M12RT



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APPENDIX: PRECINT 2B – NETWORK AVERAGE SPEED PLOTS

Figure H.33: AM peak network average speed (6am to 7am) – 50% GFA developed (2026) No M12RT

Figure H.34: AM peak network average speed (7am to 8am) – 50% GFA developed (2026) No M12RT

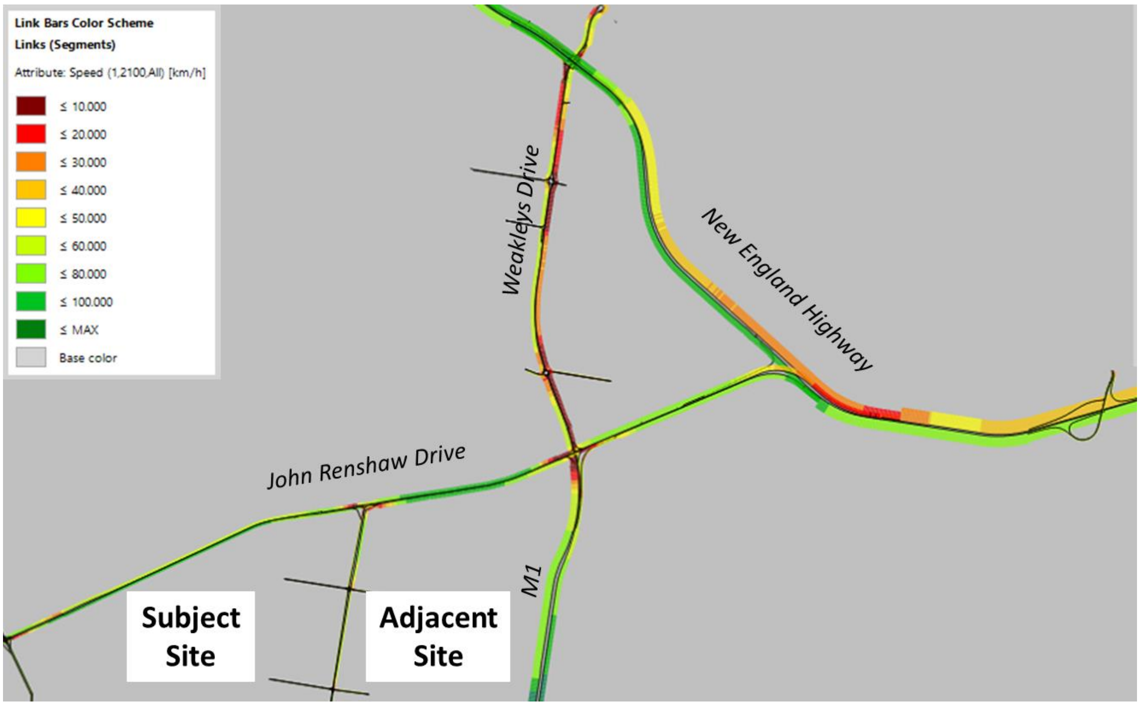


Figure H. 35: AM peak network average speed (6am to 7am) – 50% GFA developed (2026) With M12RT

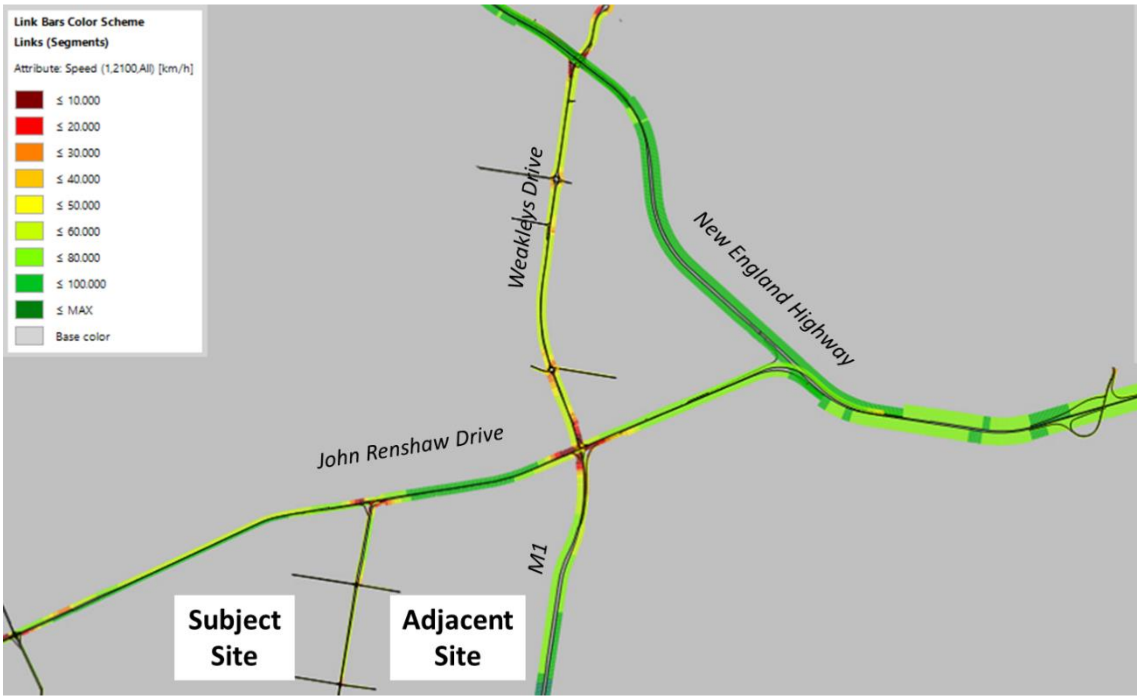
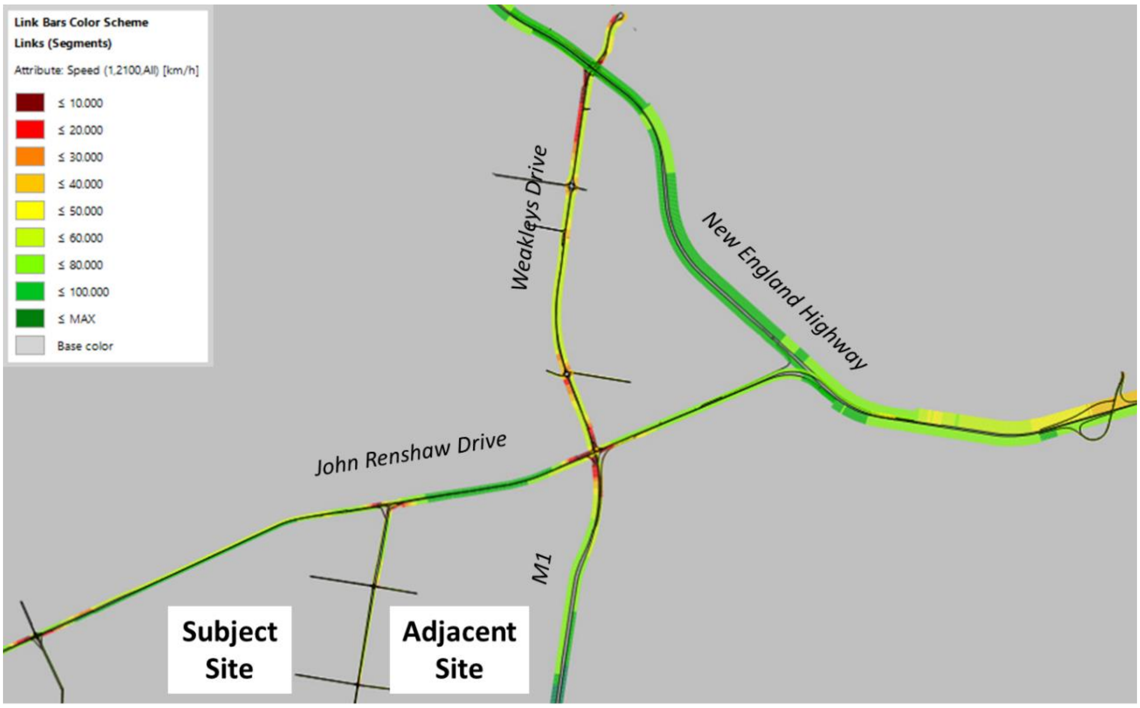


Figure H.36: AM peak network average speed (7am to 8am) – 50% GFA developed (2026) With M12RT



APPENDIX: PRECINT 2B – NETWORK AVERAGE SPEED PLOTS

Figure H.37: AM peak network average speed (6am to 7am) – 75% GFA developed (2029) With M12RT

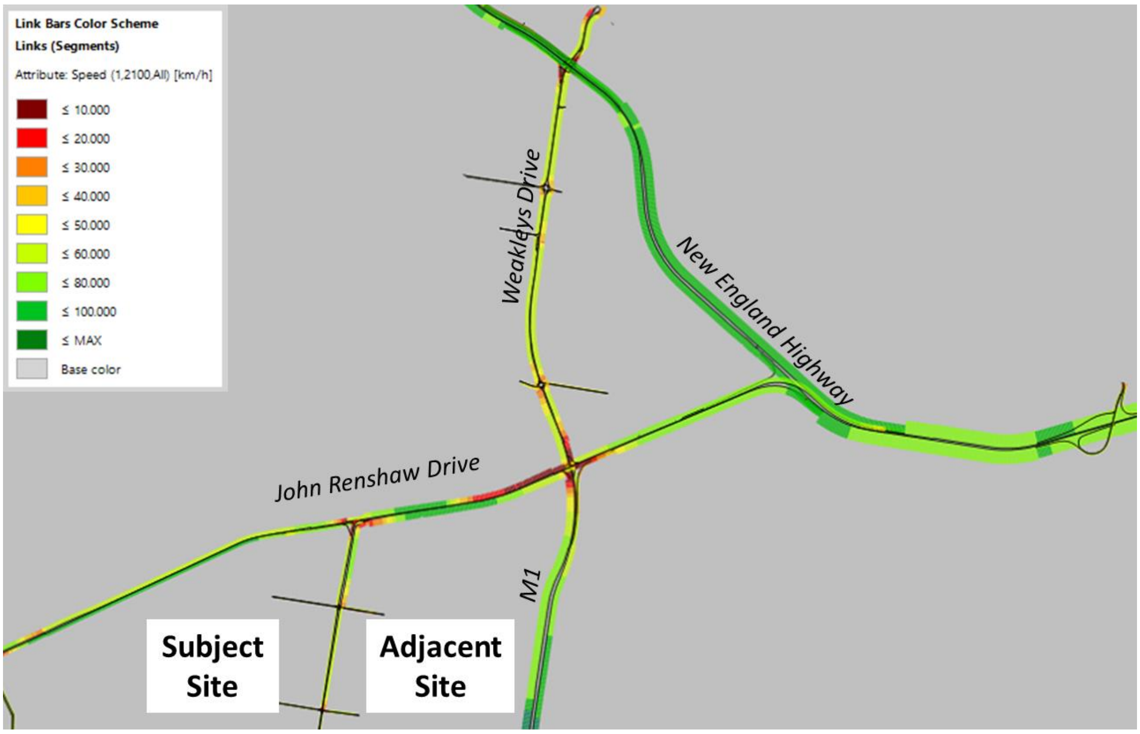
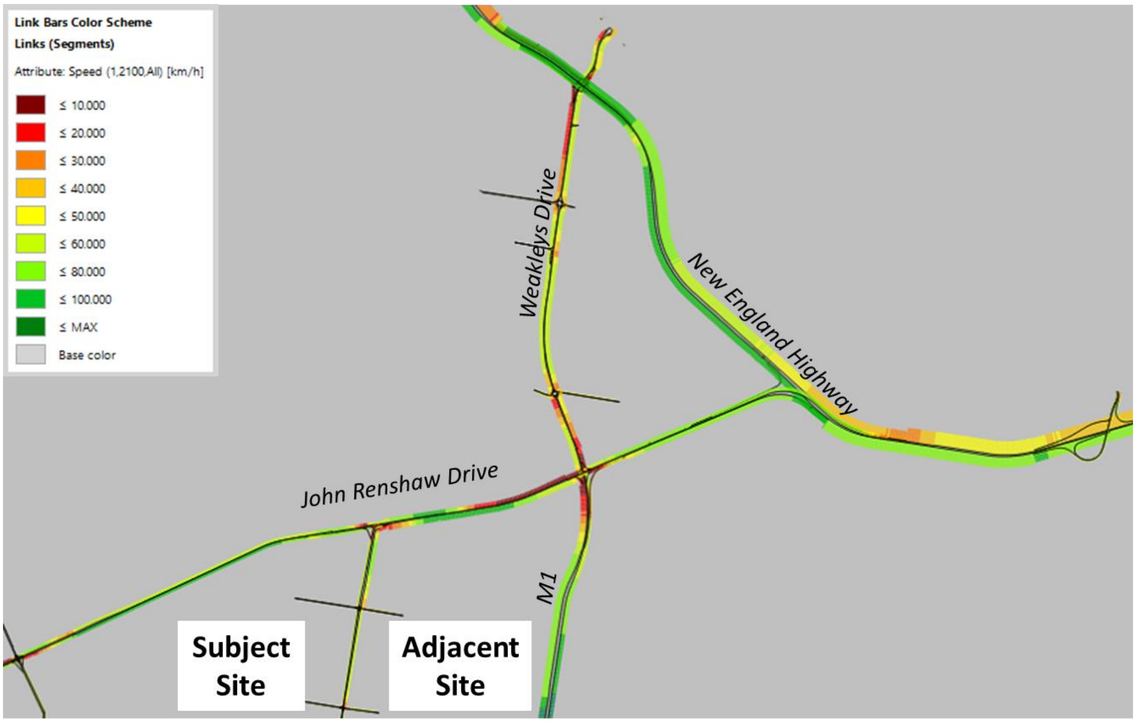


Figure H.38: AM peak network average speed (7am to 8am) – 75% GFA developed (2029) With M12RT



APPENDIX: PRECINT 2B – NETWORK AVERAGE SPEED PLOTS

Figure H.39: AM peak network average speed (6am to 7am) – 100% GFA developed (2032) With M12RT

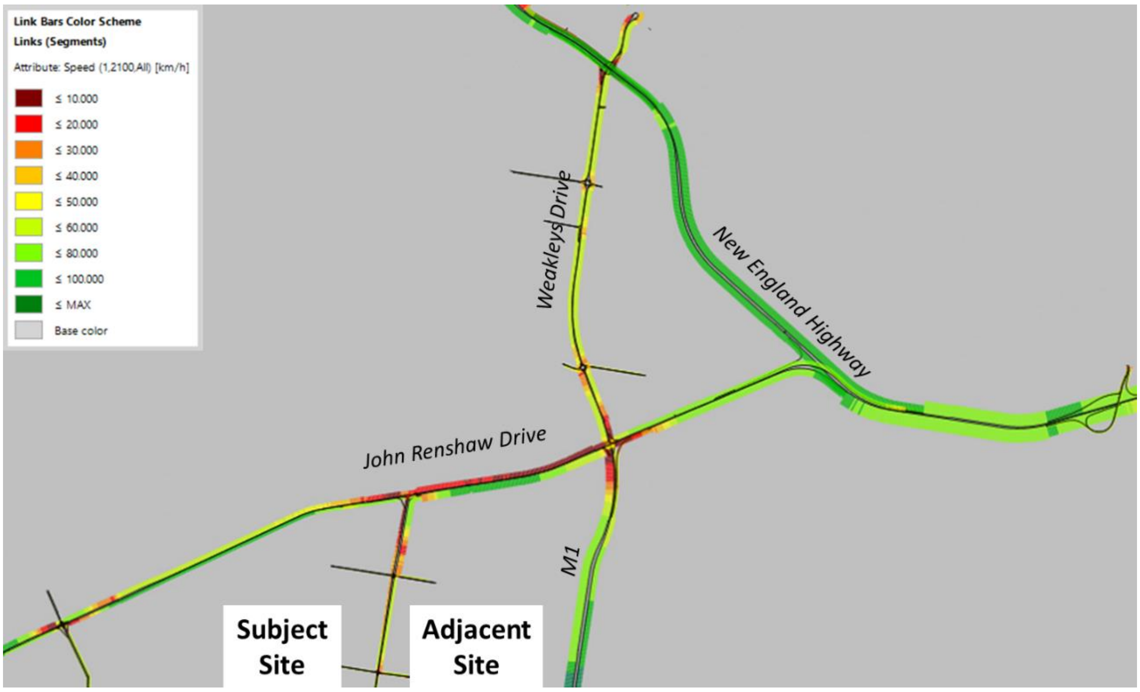
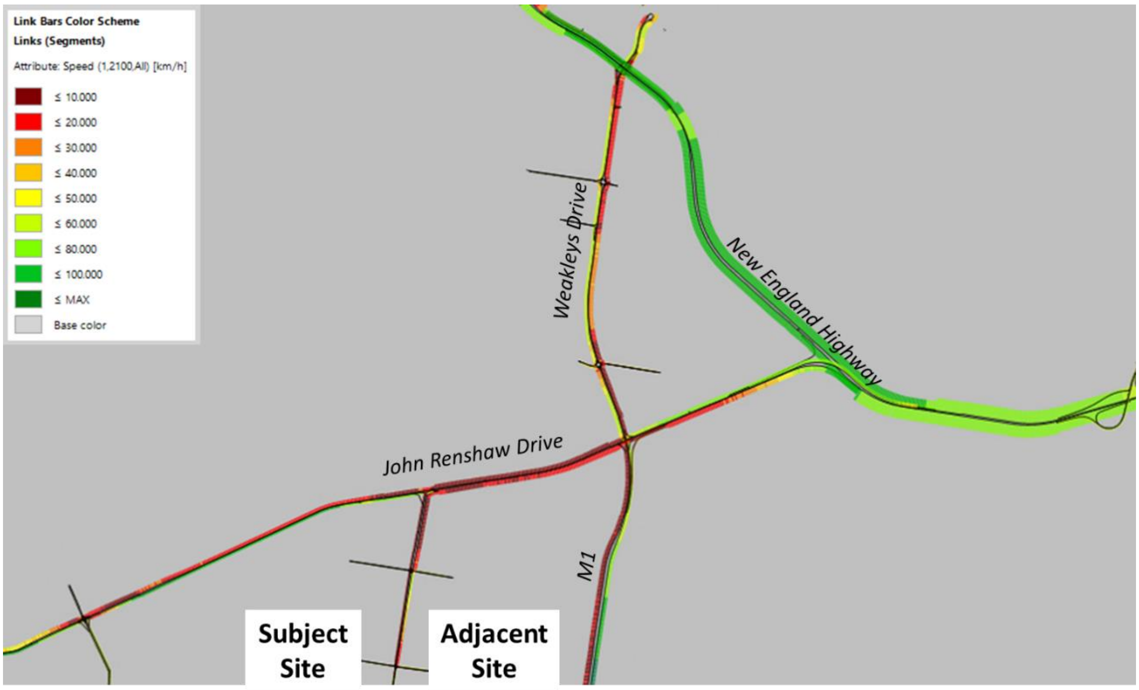


Figure H.40: AM peak network average speed (7am to 8am) – 100% GFA developed (2032) With M12RT



APPENDIX: PRECINT 2B – NETWORK AVERAGE SPEED PLOTS

Figure H.41: AM peak network average speed (6am to 7am) – 75% GFA developed (2032) – Grade Separated With M12RT

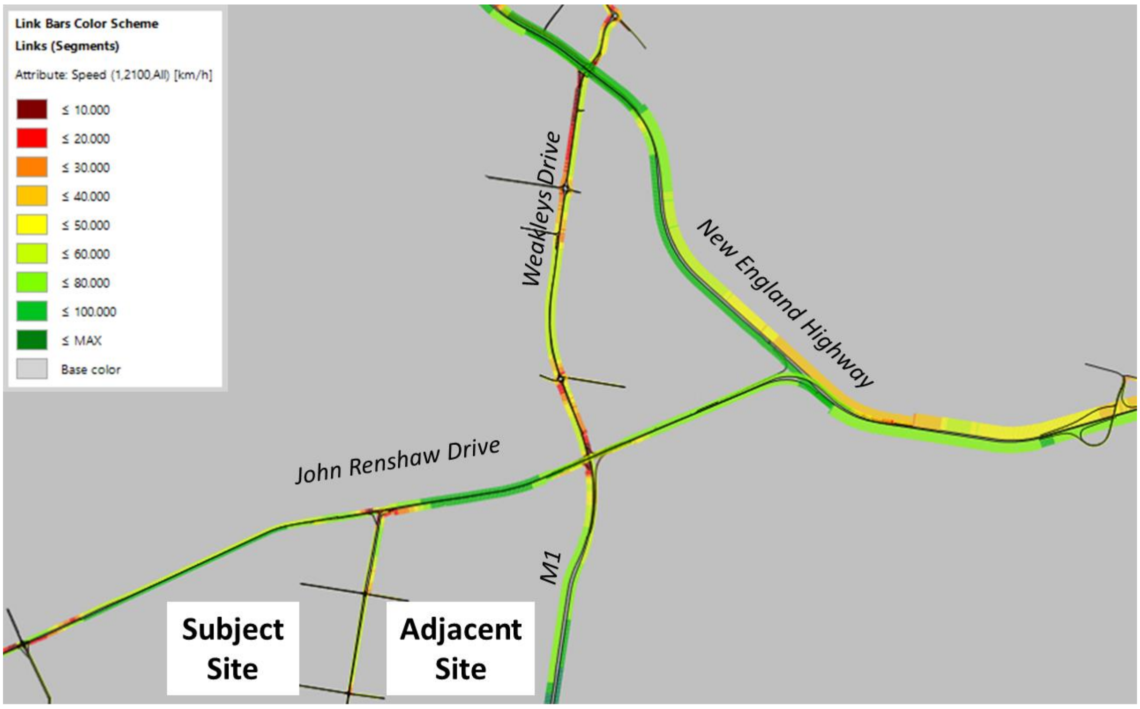
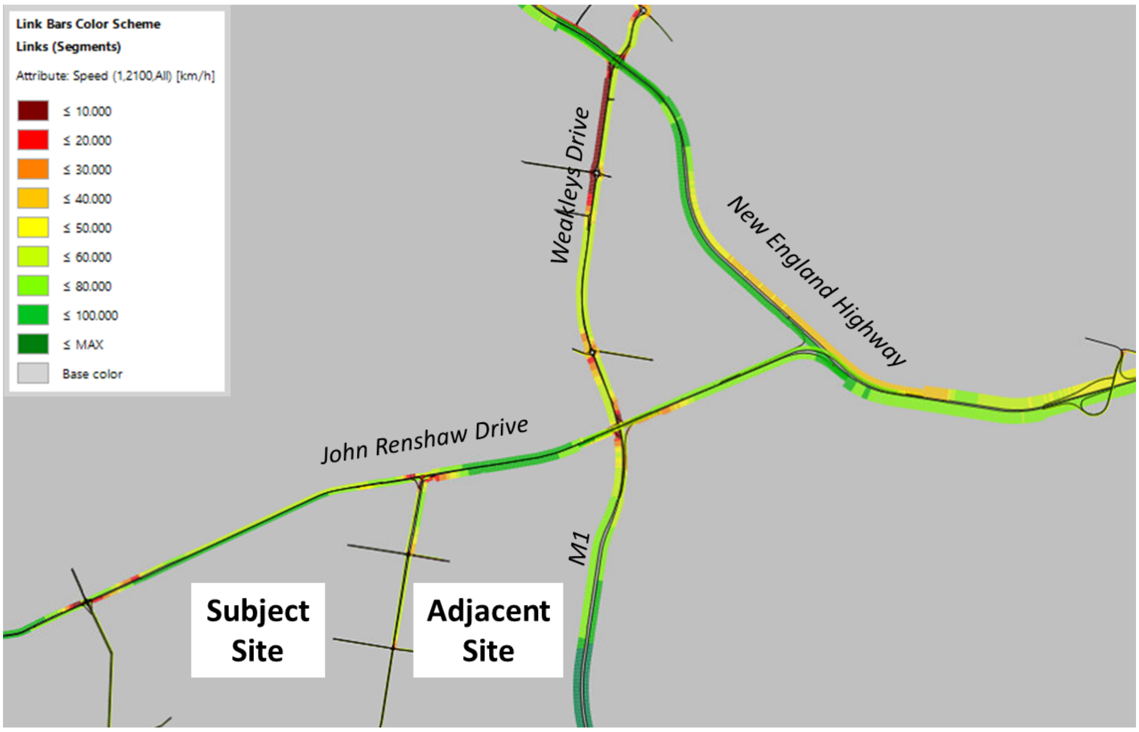


Figure H.42: AM peak network average speed (7am to 8am) – 75% GFA developed (2032) – Grade Separated With M12RT



APPENDIX: PRECINT 2B – NETWORK AVERAGE SPEED PLOTS

Figure H.43: AM peak network average speed (6am to 7am) – 100% GFA developed (2032) – Grade Separated With M12RT

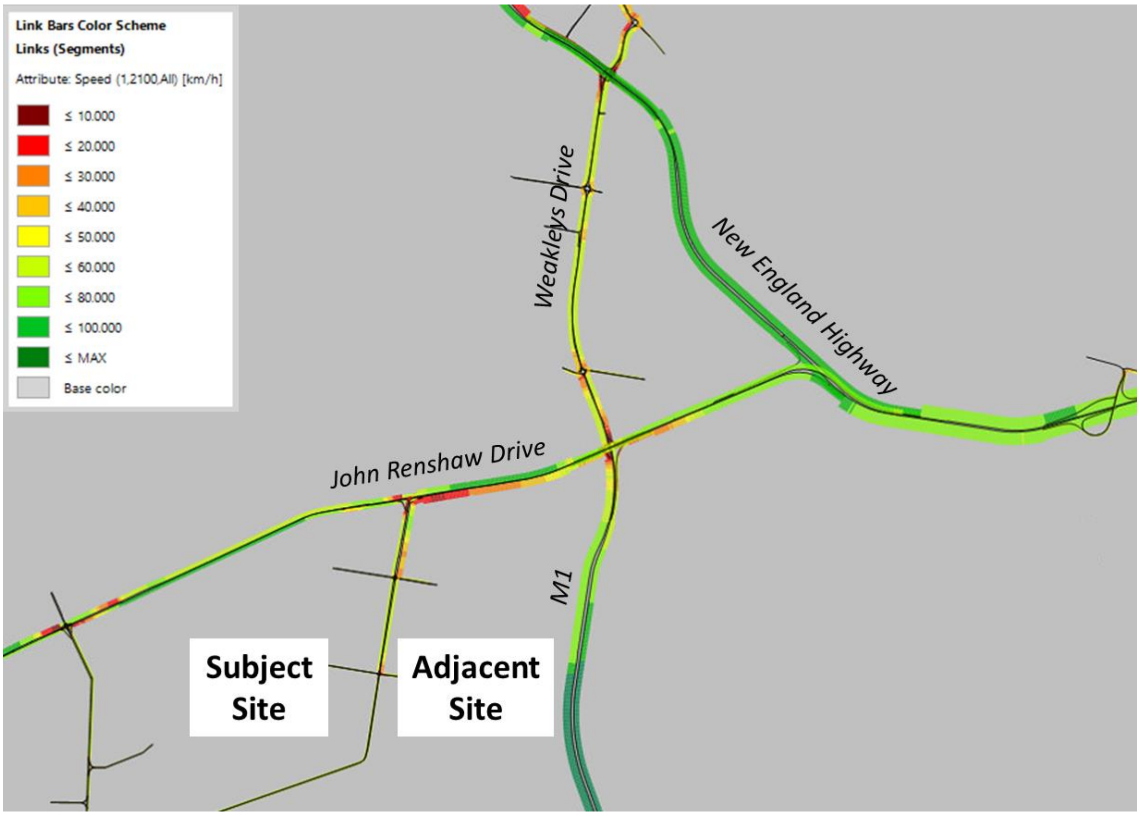
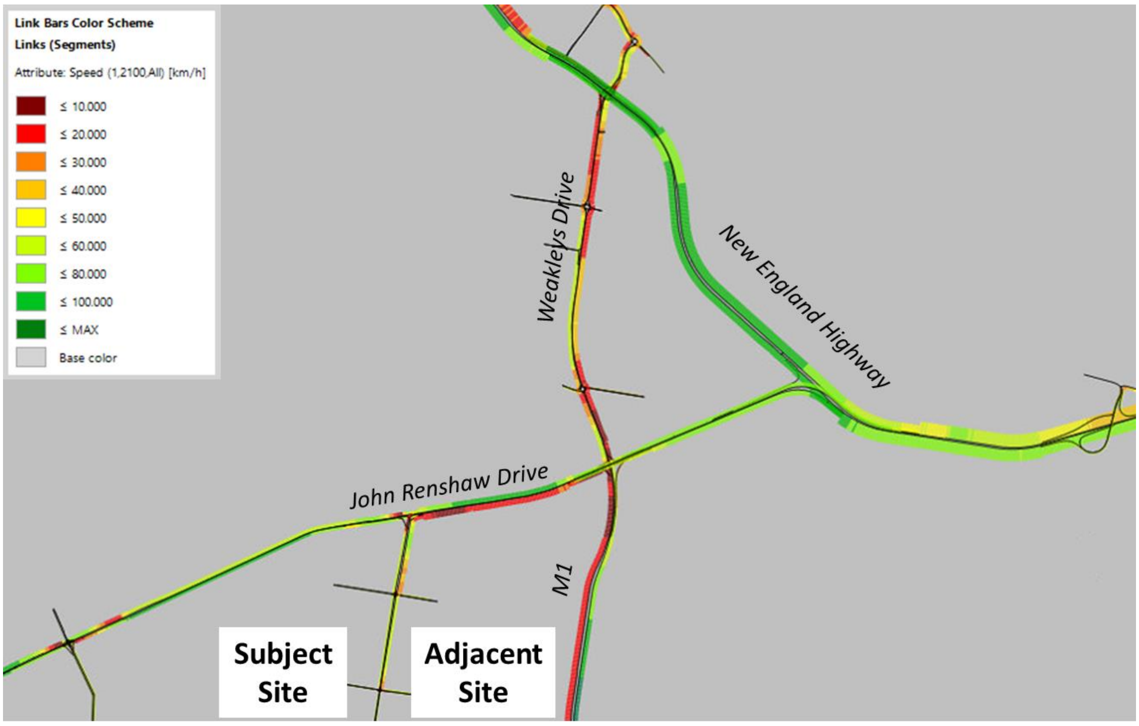


Figure H.44: AM peak network average speed (7am to 8am) – 100% GFA developed (2032) – Grade Separated With M12RT



APPENDIX: PRECINT 2B – NETWORK AVERAGE SPEED PLOTS

Recorded PM Peak Hour Average Speed Plots

Figure H.45: PM peak network average speed (3pm to 4pm) – Future Base (2032)

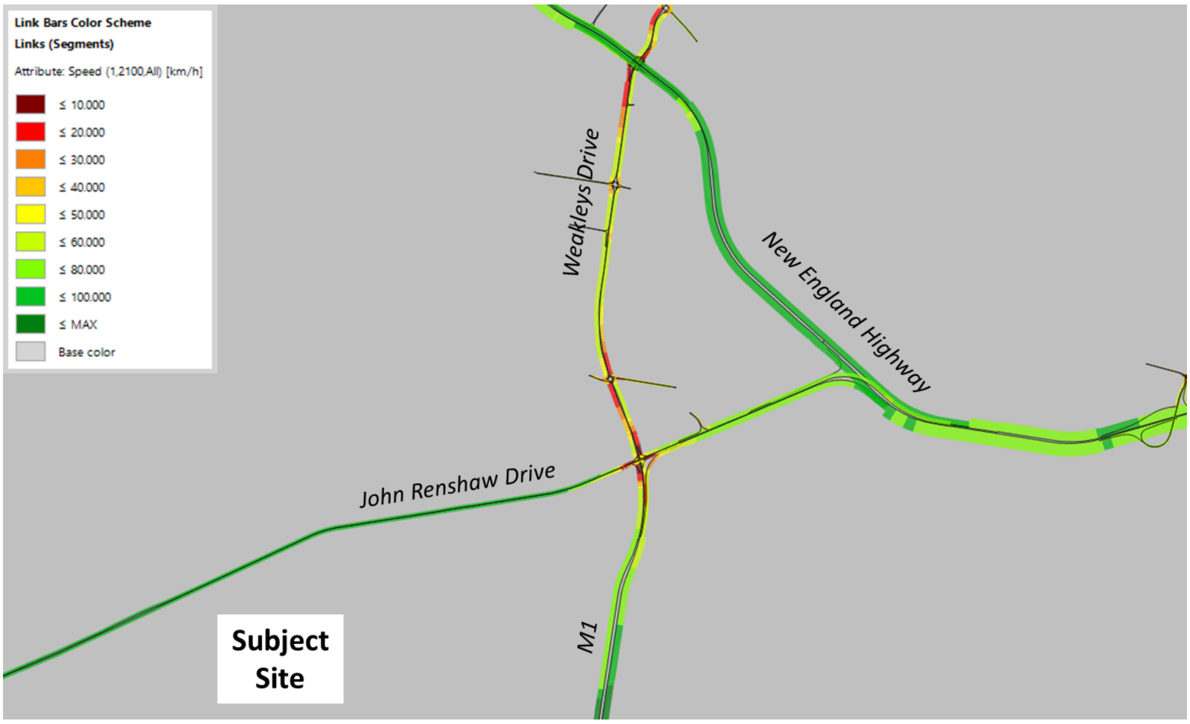


Figure H.46: PM peak network average speed (4pm to 5pm) – Future Base (2032)

APPENDIX: PRECINT 2B – NETWORK AVERAGE SPEED PLOTS

Figure H.47: PM peak network average speed (3pm to 4pm) – 25% GFA developed (2023) No M12RT

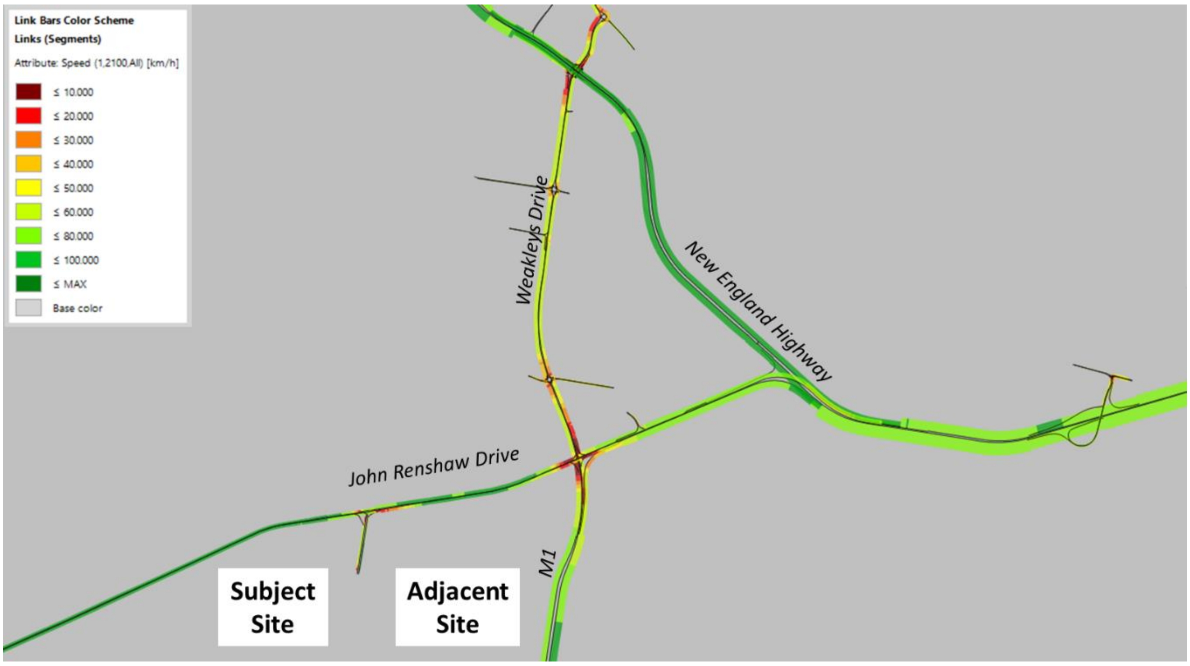
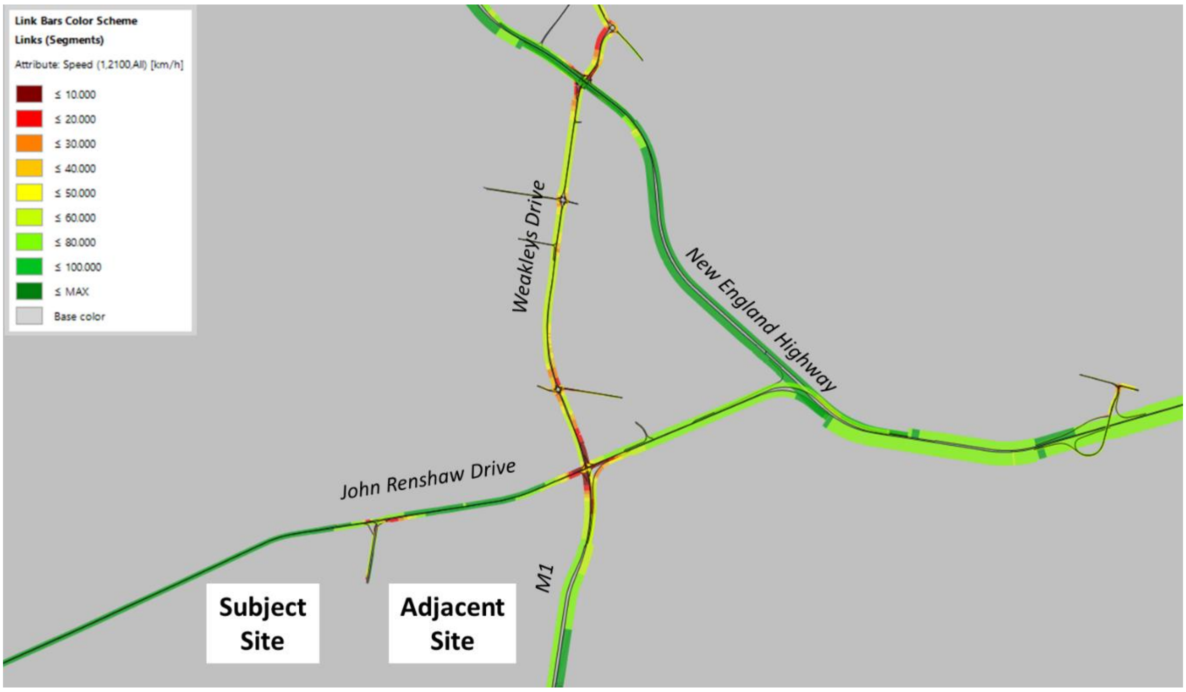


Figure H.48: PM peak network average speed (4pm to 5pm) – 25% GFA developed (2023) No M12RT



APPENDIX: PRECINT 2B – NETWORK AVERAGE SPEED PLOTS

Figure H.49: PM peak network average speed (3pm to 4pm) – 50% GFA developed (2026) No M12RT

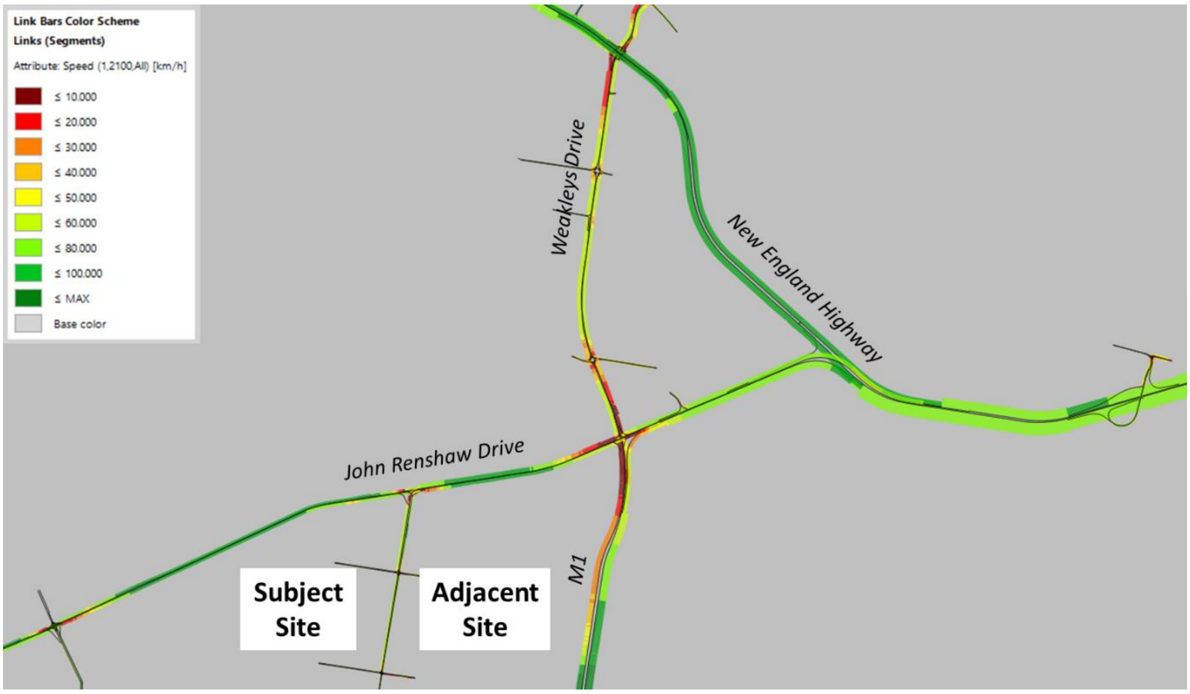
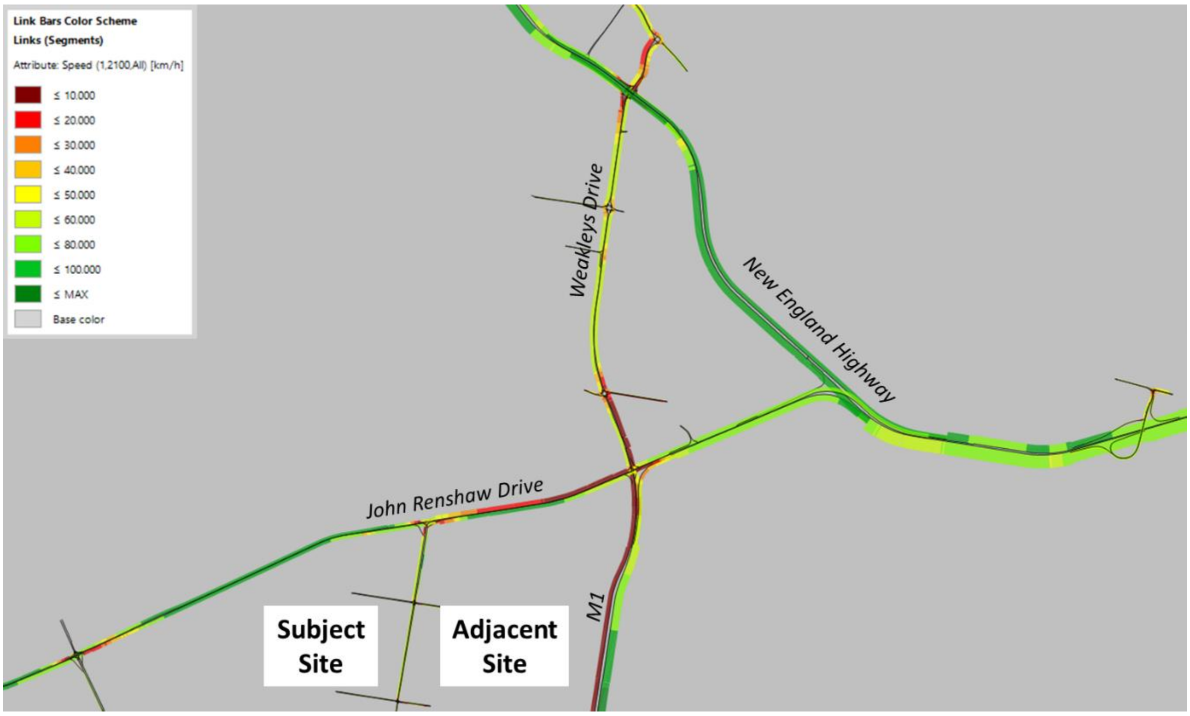


Figure H.50: PM peak network average speed (4pm to 5pm) – 50% GFA developed (2026) No M12RT



APPENDIX: PRECINT 2B – NETWORK AVERAGE SPEED PLOTS

Figure H.51: PM peak network average speed (3pm to 4pm) – 50% GFA developed (2026) With M12RT

Figure H.52: PM peak network average speed (4pm to 5pm) – 50% GFA developed (2026) With M12RT

APPENDIX: PRECINT 2B – NETWORK AVERAGE SPEED PLOTS

Figure H.53: PM peak network average speed (3pm to 4pm) – 75% GFA developed (2029) With M12RT

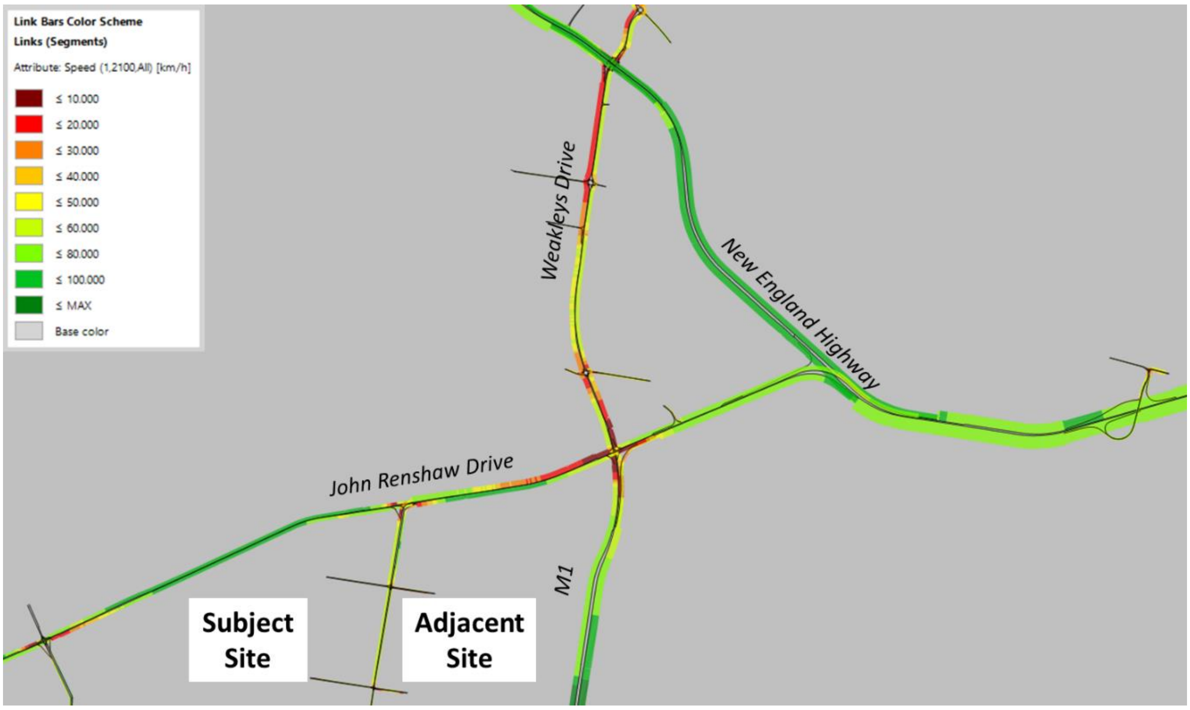
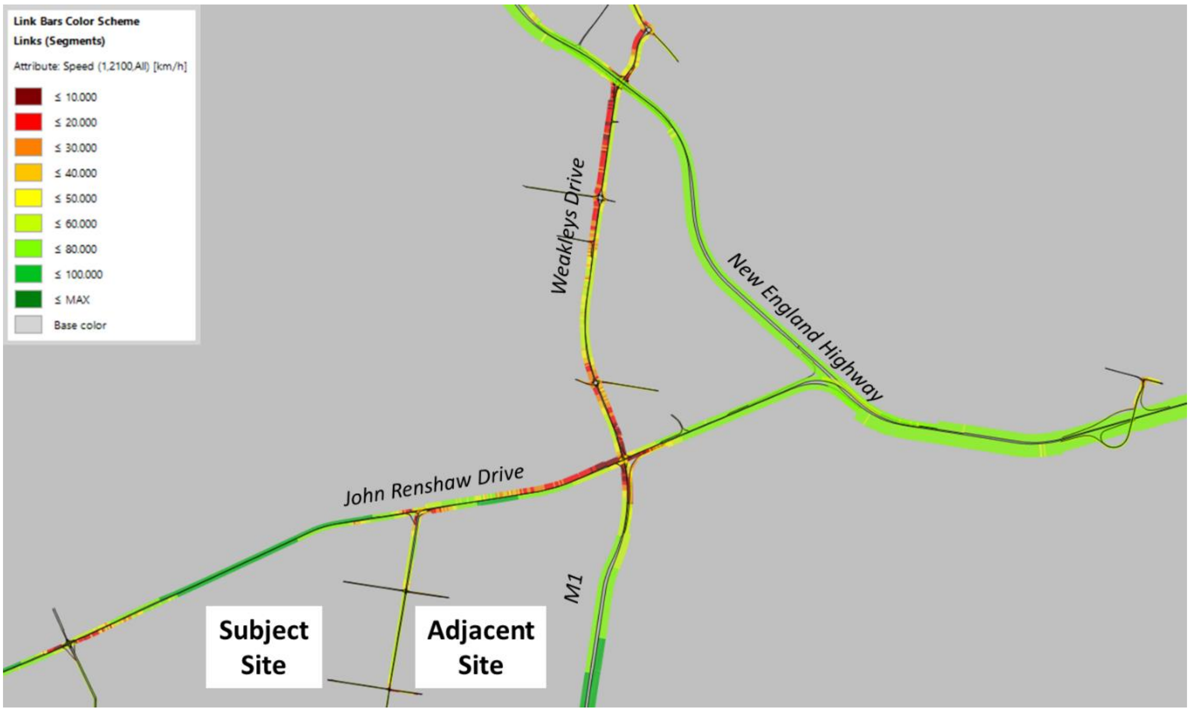


Figure H.54: PM peak network average speed (4pm to 5pm) – 75% GFA developed (2029) With M12RT



APPENDIX: PRECINT 2B – NETWORK AVERAGE SPEED PLOTS

Figure H.55: PM peak network average speed (3pm to 4pm) – 100% GFA developed (2032) With M12RT

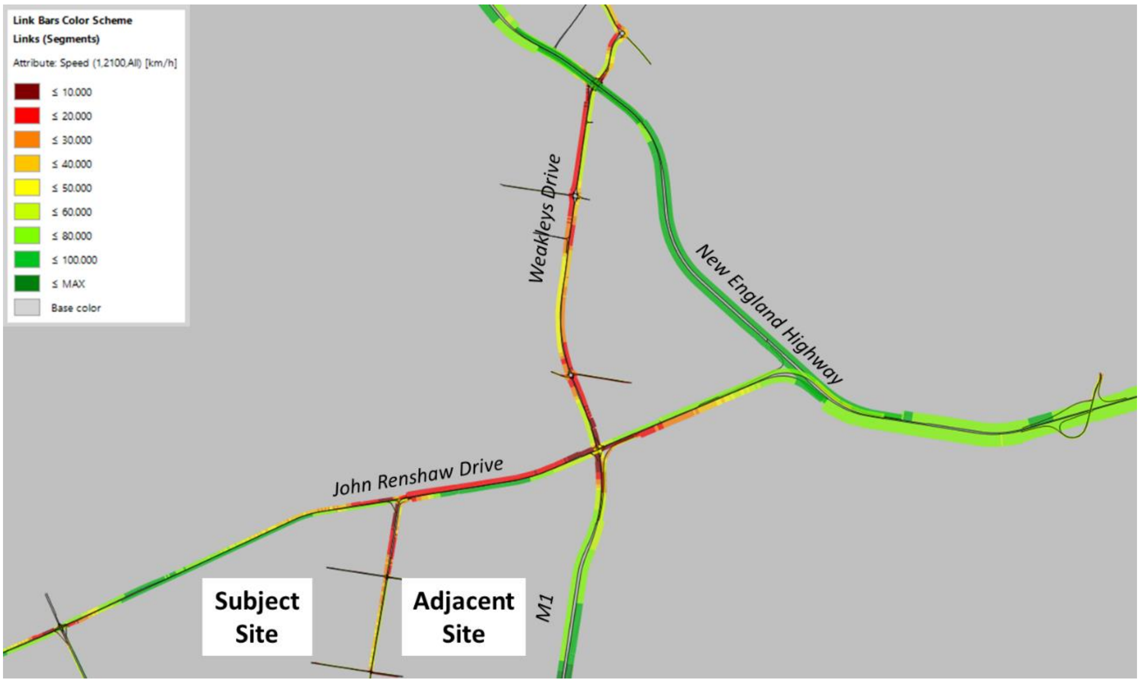
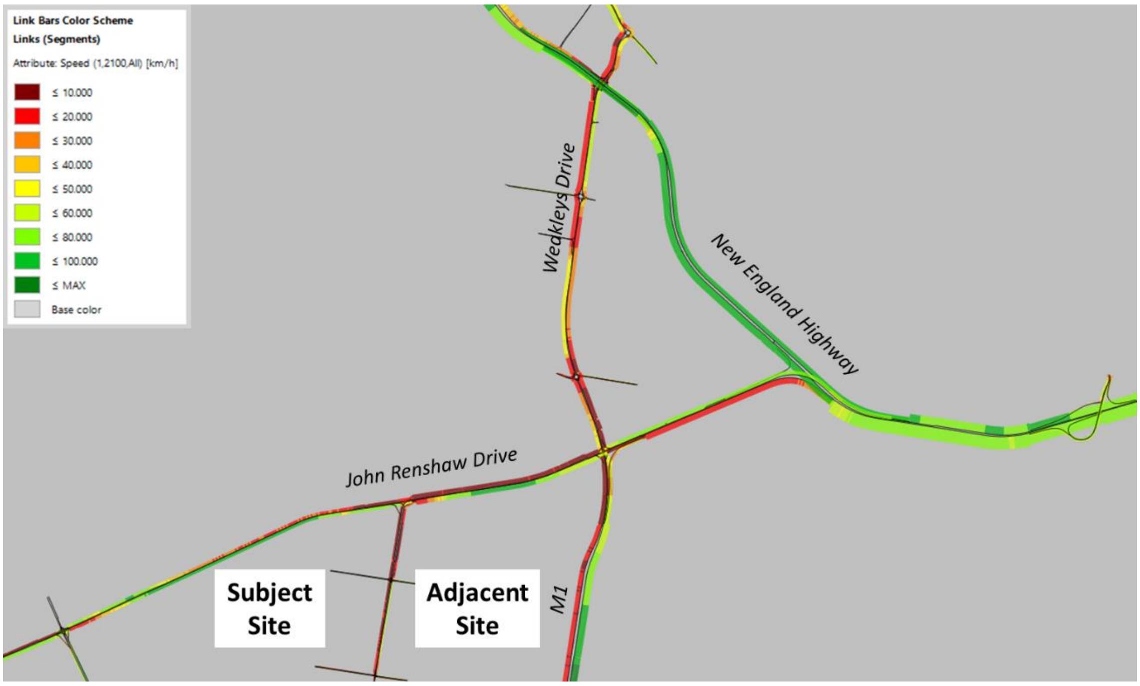


Figure H.56: PM peak network average speed (4pm to 5pm) – 100% GFA developed (2032) With M12RT



APPENDIX: PRECINT 2B – NETWORK AVERAGE SPEED PLOTS

Figure H.57: PM peak network average speed (3pm to 4pm) – 75% GFA developed (2032) – Grade Separated With M12RT

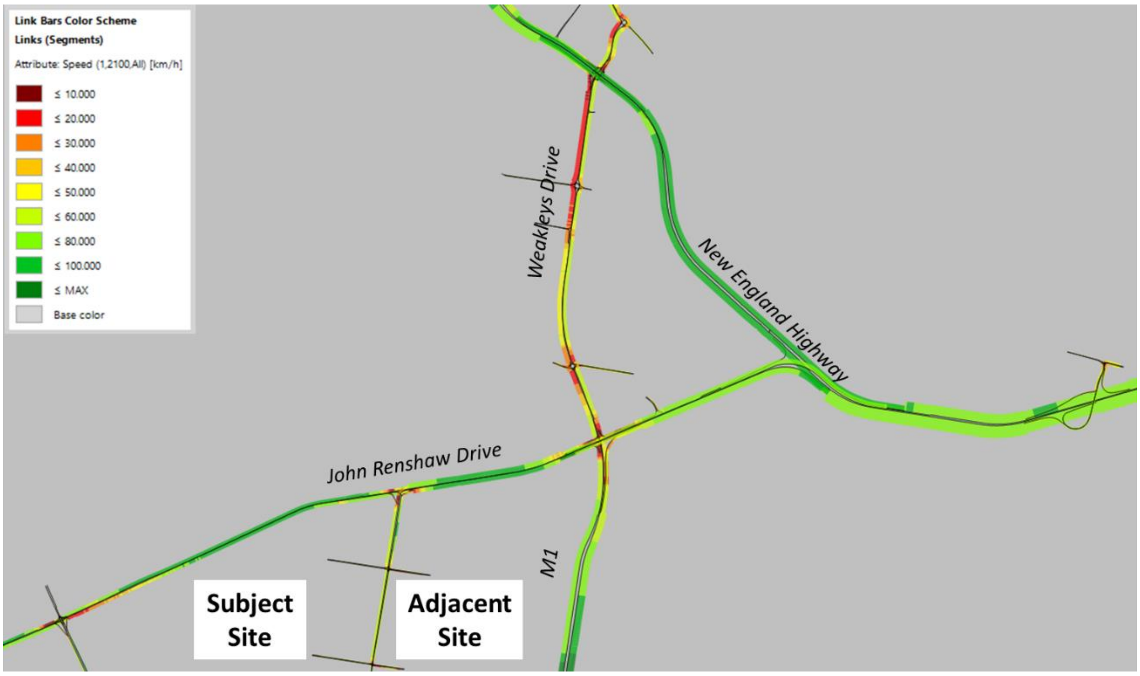
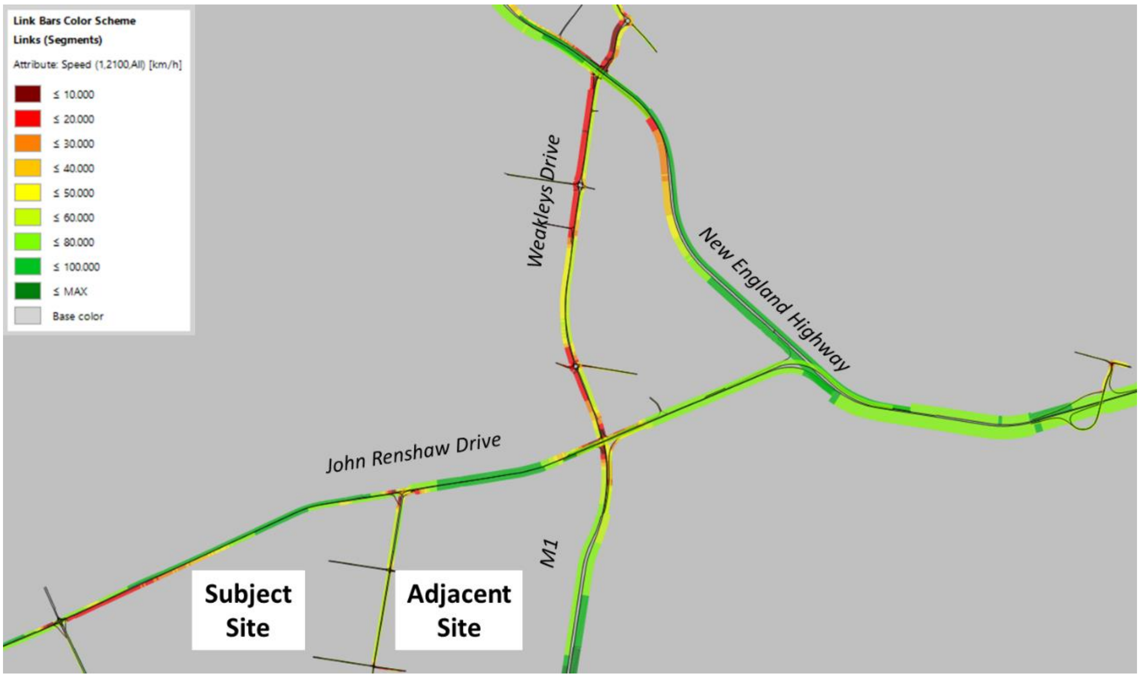


Figure H.58: PM peak network average speed (4pm to 5pm) – 75% GFA developed (2032) – Grade Separated With M12RT



APPENDIX: PRECINT 2B – NETWORK AVERAGE SPEED PLOTS

Figure H.59: PM peak network average speed (3pm to 4pm) – 100% GFA developed (2032) - Grade Separated With M12RT

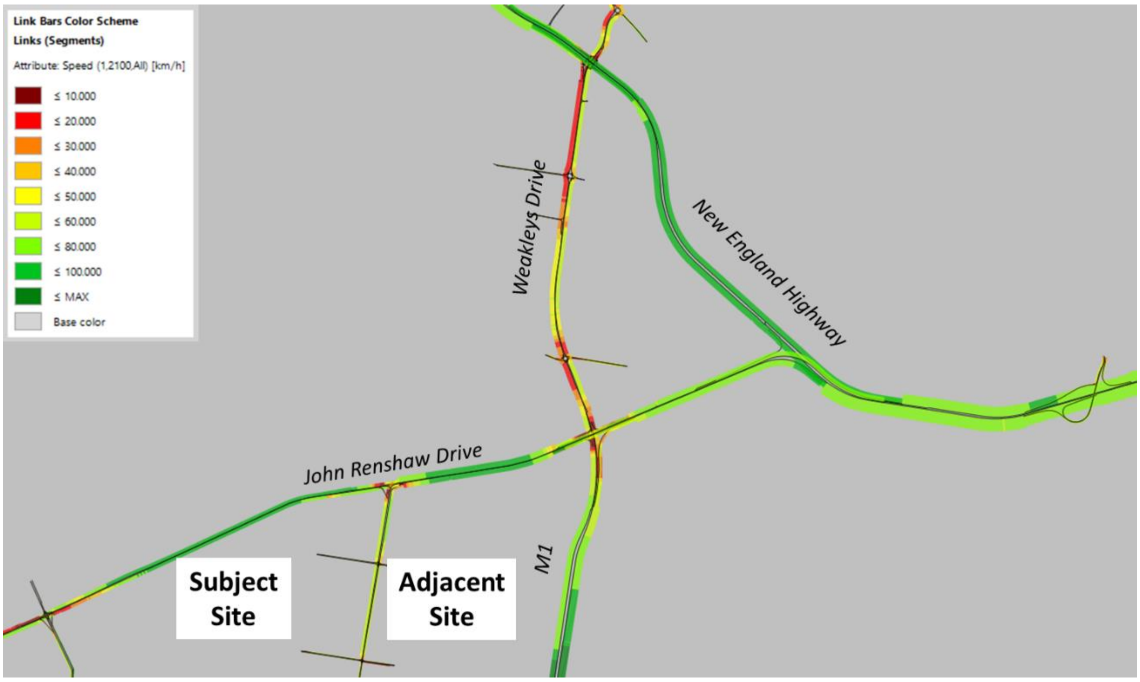
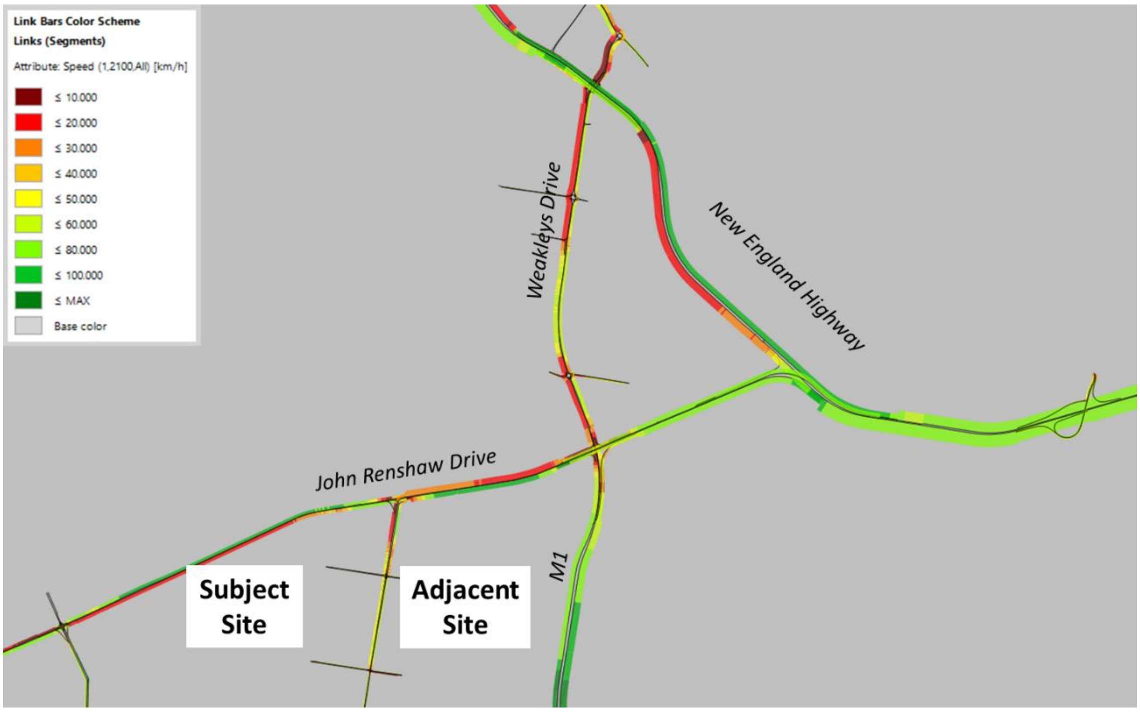


Figure H.60: PM peak network average speed (4pm to 5pm) – 100% GFA developed (2032) – Grade Separated With M12RT



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