

Transport
for NSW

Preliminary M4 East Road Network Performance Plan

April 2023



M4 East Post Opening Study



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Executive Summary

Introduction

WestConnex M4 East (Stage 1b) opened in July 2019. The project involved the construction of 5.5km tunnels with three lanes in each direction between Homebush and Haberfield. The project was delivered to improve connectivity between Western Sydney and the Inner West, and reduce traffic on surface roads by allowing drivers to bypass up to 22 sets of traffic lights along Parramatta Road. The M4 East project was approved by The Department of Planning and Environment (DPE), previously the Department of Planning, Industry and Environment (DPIE), provided that the Conditions of Approval (CoA) are satisfied. As per CoA E36, Transport for NSW (Transport) the road network is required to be reviewed 12 months after opening and this report fulfills that requirement through traffic modelling and analysis.

Background & purpose

The M4 East Road Network Performance Review Plan (M4 East RNPRP) has been prepared by Transport for NSW (Transport) to address Condition E36, which forms part of the Conditions of Approval (CoA) for the M4 East and states the following:

- E36 CoA – Requires the preparation of a RNPRP at 12 months and 5 years after the completion of the M4 East project. This RNPRP addresses the requirement for the 12-month post-opening assessment.

This report is a preliminary report only and potential mitigations to impacts identified have not yet been determined. As such, the potential mitigations section (Section 7) of the report is not currently populated. Once the plan has been completed following further consultation with council, the final Road Network Performance Review Plan will be submitted to DPE and made publicly available.

Assessment scope

This report considers and compares traffic volumes and road user safety metrics before and after the opening of the M4 East project. The comparison identifies the change in traffic patterns and any increases in usage of the surface road network, as well as any significant reduction in safety, highlighting key areas that are deemed to have been highly impacted by the M4 East project.

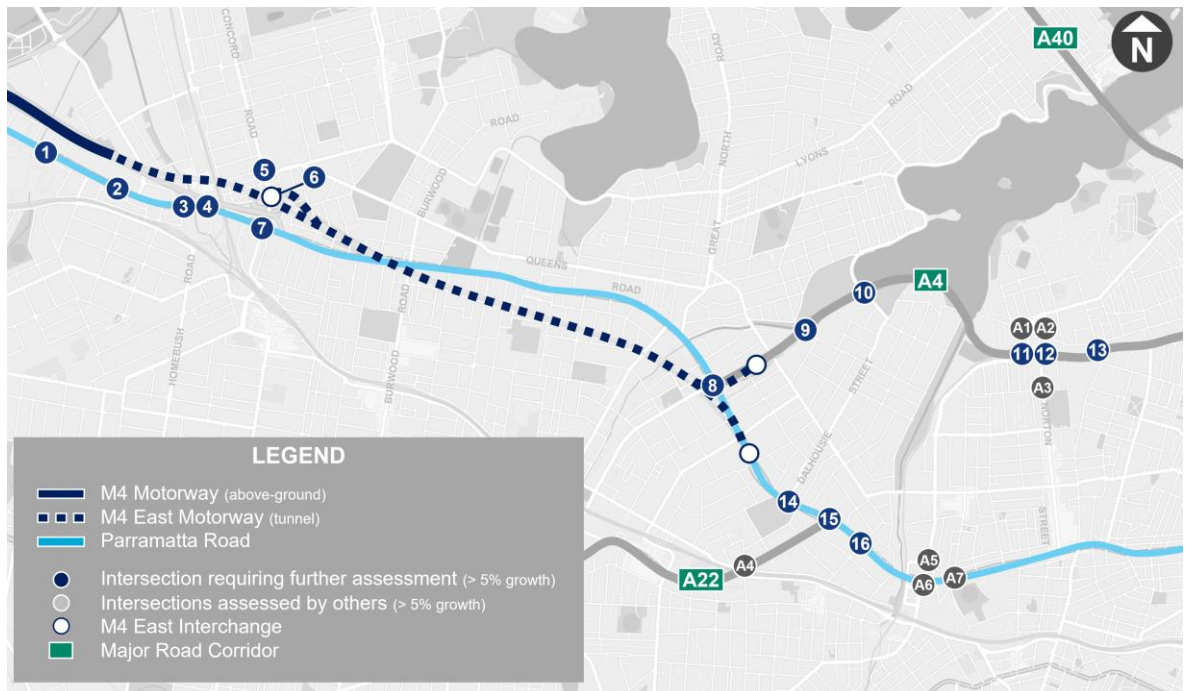
The study area for the M4 East RNPRP extends along key surface road corridors within the study area including Parramatta Road, City-West Link Road/ Dobroyd Parade/ Wattle Street, Concord Road and Homebush Bay Drive.

Summary of assessments

Intersections

Figure E-1 illustrates the intersections within the study area that experienced growth in traffic volumes post-opening (2019 and/or 2020) by greater than five percent of pre-opening volumes (2018).

Figure E - 1 Intersections assessed as part of the M4E RNPRP



- | | |
|--|---------------------------------------|
| 1 Parramatta Road / Potts Street | 13 City-West Link Road / Balmain Road |
| 2 Parramatta Road / Park Road | 14 Parramatta Road / Dalhousie Street |
| 3 Parramatta Road / M4 Motorway On-Ramp | 15 Parramatta Road / Liverpool Street |
| 4 Parramatta Road / George Street / Nipper Street | 16 Parramatta Road / Sloane Street |
| 5 Concord Road / Patterson Street | A1 James Street / Lilyfield Road |
| 6 Concord Road / Sydney Street | A2 Norton Street / Lilyfield Road |
| 7 Parramatta Road / Concord Road / Leicester Avenue | A3 Norton Street / William Street |
| 8 Parramatta Road / Frederick Street / Wattle Street | A4 Hume Highway / Carlton Crescent |
| 9 Dobroyd Parade / Waratah Street | A5 Tebbutt Street / Hathern Street |
| 10 Dobroyd Parade / Timbrell Drive / Mortley Avenue | A6 Parramatta Road / Tebbutt Street |
| 11 City-West Link Road / James Street | A7 Parramatta Road / West Street |
| 12 City-West Link Road / Norton Street | |

Intersection analysis

Intersection performance was assessed at each site identified in Figure E-1 to compare pre-opening (2018) and post-opening (2019 and/or 2020) performance. Most of these intersections experienced a traffic growth of greater than 5 percent in both the 2019 and 2020 post-opening years, with the following exceptions:

- For intersections 2, 3, and 4, the increase in traffic volumes were observed to be less than 5 percent during 2019 and, as such, only the 2020 scenario was reviewed.
- For intersection 13, the increase in traffic volumes were observed to be less than 5 percent during 2020 and, as such, only the 2019 scenario was reviewed.
- Traffic volumes at intersection 8 did not increase more than 5 percent during either post-opening scenarios when compared to pre-opening volumes; however, due to the crash history on Frederick Street, the 2020 scenario was reviewed.

In 2020, during the AM peak, overall performance remained the same or improved from pre-opening at all sites, with the exception of intersections 3, and 9 to 14 where performance degraded. During the PM peak, overall performance remained the same or improved at most intersections, with the exception of intersection 9, 12 and 16 where performance degraded.

Travel time analysis

Analysis of vehicle travel speeds along Parramatta Road was undertaken for both pre-opening and post-opening scenarios. The analysis utilises HERE travel data from Transport for the weekday periods in March 2018 representing pre-opening conditions, and in August 2020 representing post-opening conditions. Travel speeds from September 2019 were also assessed for reference conditions without the impact of the COVID-19 pandemic. The following segments along Parramatta Road were assessed between:

- Potts Street and Concord Road
- Concord Road and Wattle Street
- Wattle Street and Flood Street

The analysis found that travel speeds improved post-opening, particularly between Concord Road and Wattle Street where the M4 East provides a direct alternative route. The analysis indicates travel time savings of between 10 and 20 minutes in each direction across the AM and PM peak periods, between Potts Street and Flood Street.

Bus performance analysis

Analysis of the weekday bus performance along Parramatta Road (between Burwood Road and West Street) was undertaken for both pre-opening and post-opening scenarios. The bus data was assessed for the weekday periods in March 2018 representing pre-opening conditions, and in August 2020 representing post-opening conditions.

Bus travel times and travel speeds generally improved by approximately 1 to 4 minutes during the AM peak (6am to 10am) and PM peak (3pm to 7pm) in both directions on Parramatta Road between pre-opening and post-opening. The reduction in bus travel time is lesser than general traffic due to a shorter segment assessed (noting that there are no standard bus routes that travel west of Burwood Road on Parramatta Road) and bus stopping patterns and dwell times.

Road safety performance

Crash data was reviewed on key road corridors within the study area to assess road safety performance for pre-opening and post-opening. Based on this review, the following key findings were made:

- **Parramatta Road:** 15% overall reduction in crashes between Homebush West and Haberfield; new/increased crash clusters at Dalhousie Street, Sloane Street and between Tebbutt Street/Old Canterbury Road and Flood Street.
- **Frederick Street/ Wattle Street/ City-West Link Road:** Number of crashes remained the same between pre-opening and post-opening, with approximately 38% associated with rear end crashes across the assessed periods.
- **Homebush Bay Drive/ Centenary Drive:** Reduction in crashes from 8 to 3 at the M4 Motorway interchange; the cause of each crash was generally unique.
- **Liverpool Road/ Hume Highway:** Increase from 8 crashes pre-opening to 9 crashes post-opening; most common cause of crashes changed from rear-end (38%) pre-opening to right through and out of control on carriageway (both 22%).

In general, the frequency and type of crashes have remained similar or reduced for the assessed corridors, indicating that, overall, the opening of the M4 East did not significantly impact road safety.

Potential mitigations

This report is a preliminary report only and potential mitigations to impacts identified have not yet been determined. As such, the potential mitigations section (Section 7) of the report is not currently populated. Once the plan has been completed following further consultation with council, the final Road Network Performance Review Plan will be submitted to DPE and made publicly available.

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1. Introduction

1.1 Background

On 11 February 2016, the New South Wales (NSW) Minister for Planning granted approval to the State Significant Infrastructure (SSI) application for the WestConnex M4 East project (“the project”). The infrastructure approval, which is regulated under Section 115ZB of the *Environmental Planning and Assessment Act 1979*, is subject to the Minister’s conditions of approval for the SSI.

The conditions of approval are administered by the NSW Department of Planning and Environment (previously the NSW Department of Planning, Industry and Environment) and delivered by the Proponent – Transport for NSW (previously NSW Roads and Maritime Services).

Part E of the conditions of approval outlines conditions for environmental management, reporting and auditing during operations of the project. Condition E36 lists the requirement for the preparation of a Road Network Performance Review Plan as per the following requirements:

“At both 12 months and 5 years after the commencement of operation of the SSI, or as otherwise agreed to by the Secretary, the Proponent must prepare a Road Network Performance Review Plan in consultation with relevant councils that includes:

- (a) an updated analysis, including modelling of traffic impacts to the adjoining road network (including impacts on local roads and rat-running), as a consequence of the SSI. This must include a review of new information available about potential land use changes, including those associated with the Draft Parramatta Road Urban Transformation Strategy (Transport for NSW, 2015, or as updated), and any traffic changes as a result of other major road projects within the project area;*
- (b) further detailed investigations at the following intersections or sections of the road network:*
 - (i) potential ‘pinch-points’ at the Parramatta Road and Wattle Street Interchanges where merging of tunnel exit traffic and surface traffic would occur,*
 - (ii) Parramatta Road/George Street,*
 - (iii) George Street/Pomeroy Street,*
 - (iv) Parramatta Road/Frederick Street/Wattle Street,*
 - (v) Parramatta Road/Concord Road,*
 - (vi) Concord Road/Patterson Street/Sydney Street,*
 - (vii) the intersection of the Concord Road off-ramps and Parramatta Road, and*
 - (viii) the intersection of the Pomeroy Street on-ramp and Parramatta Road;*
- (c) updated consideration of potential mitigation measures to manage any predicted traffic performance deficiencies, particularly on Parramatta Road and in association with the investigations undertaken within E36(b);*
- (d) details on bus priority measures;*
- (e) the predicted traffic performance improvements from these measures, including any cumulative improvements;*
- (f) justification of why the predicted ‘do minimum’ performance of any intersection on the adjoining road network cannot be maintained (if necessary); and*
- (g) an updated description and proposed timing of potential mitigation measures. The Proponent is responsible for the implementation of the identified measures, if required.*

The Road Network Performance Review Plan must be submitted to the Secretary, Transport for NSW (in relation to impacts on bus services) and to relevant council(s) within 60 days of its completion and made publicly available.

The purpose of the Road Network Performance Review Plan is to optimise road network performance including public transport access and times, and manage the performance impacts of the SSI on the adjoining road network by identifying or confirming mitigation improvements that could be required in areas where traffic performance may be unsatisfactory at time of completion of construction.”

This report is a preliminary report only and potential mitigations to impacts identified have not yet been determined. As such, the potential mitigations section (Section 7) of the report is not currently populated. Once the plan has been completed following further consultation with council, the final Road Network Performance Review Plan will be submitted to DPE and made publicly available.

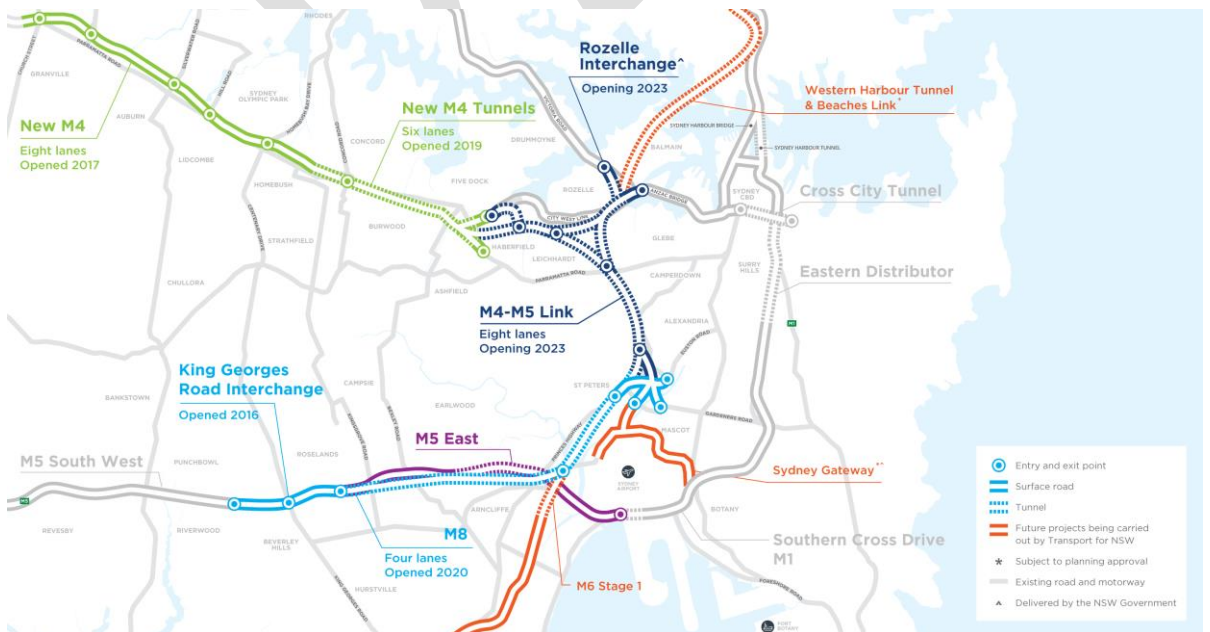
1.2 Overview of the project

1.2.1 WestConnex

WestConnex is a significant investment in Sydney’s road infrastructure by the NSW and Australian governments. It is the largest urban road project currently underway in Australia and comprises a series of interconnected motorways and road upgrades to increase the capacity of the M4 and M5 Motorways and provide a vital underground link between the two motorways.

WestConnex is 33 kilometres in length, which includes capacity improvements on existing motorways as well as new sections of motorway. It aims to better link Sydney’s west with its international gateways and key places of business. WestConnex will act as a catalyst to renew and transform parts of Sydney, creating urban renewal and public transport improvement opportunities. An overview of the WestConnex project is shown in Figure 1-1.

Figure 1-1 Overview of WestConnex



Source: WestConnex (2022)

Efficient and reliable access to and from these gateways supports some of the state's most important economic journeys and is a critical element in sustaining the future productivity and global competitiveness of Sydney and NSW.

With more than two-thirds of WestConnex being built in underground tunnels, the project will ease congestion on surface roads and improve productivity and efficiency for all road users, including buses, freight and light commercial vehicles.

WestConnex is being delivered in stages. Stage 1, comprising the M4 Widening and the M4 East, and Stage 2, comprising the M8 Motorway are complete and open to traffic. Stage 3, comprising the M4-M5 Link and Rozelle Interchange is currently in delivery. The schedule for WestConnex is indicated in Figure 1-1.

1.2.2 M4 East

The M4 East was delivered to improve connectivity between Western Sydney and Sydney's Inner West.

The key features of the project included the delivery of 5.5 kilometres in tunnels between Homebush and Haberfield, four interchanges, seven new bridge structures, ancillary facilities and buildings, and improvements to the arterial road network, as follows:

- Widening of the existing motorway between Homebush Bay Drive, Homebush and the new M4 East entrance, west of Underwood Road, Homebush, to provide up to 5 lanes in each direction and connect with the widened M4 Motorway;
- Construction of new westbound on-ramp from Parramatta Road, west of George Street, North Strathfield, onto the widened M4 Motorway towards Parramatta;
- Construction of new on-ramp from Concord Road onto the widened M4 Motorway towards Parramatta, and new on/off-ramps to access the M4 East;
- Construction of a new portal for the M4 East on Parramatta Road at Chandos Street, Ashfield;
- Construction of a new portal for the M4 East on Wattle Street at Ramsay Street, Haberfield;
- Provision of intelligent transport systems for motorway operations;
- Provision of road infrastructure and complementary technology services to support the future implementation of smart motorway operations; and
- Provision of tolling infrastructure such as gantries and control systems.

The M4 East project was approved by DPE provided that the Conditions of Approval (CoA) were satisfied. As per CoA E36, the project is required to be reviewed 12 months after opening. The project was opened to traffic on 13 July 2019 and is considered the date of the project opening for the purpose of this report.

1.3 Purpose of this report

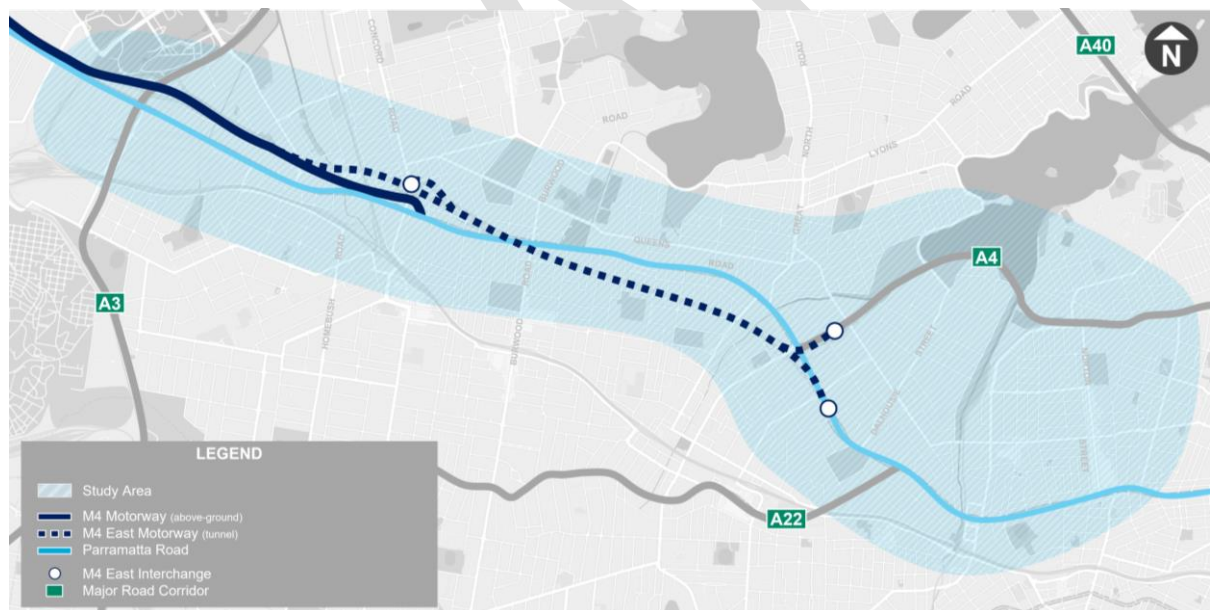
This report assesses the impacts of the project on the performance and safety of the road network 12-months following start of operations on 13 July 2019 (post-opening) with the performance of the road network prior to opening of the project (pre-opening). The report also identifies locations where road network performance and safety on the adjoining road network has been impacted by the M4 East, as well potential mitigation measures to improve impacted locations and support the integration of the M4 East into the broader transport network.

1.4 Extent of this review

The extent of this RNPRP has been identified based on the intersections assessed during the Environmental Impact Statement (EIS) prepared for this project and intersections where safety concerns have been identified. Figure 1-2 illustrates the study area for the M4 East RNPRP. In addition to the M4 Motorway and M4 East, key road corridors within the study area include:

- Parramatta Road
- City-West Link Road/Dobroyd Parade/Wattle Street (A4)
- Concord Road
- Homebush Bay Drive/Centenary Drive (A3)
- Liverpool Road/Hume Highway (A22).

Figure 1-2 M4 East RNPRP study area



1.5 Structure of this report

This plan has been prepared to address the requirements of Condition E36 discussed in Section 1.1. Table 1-1 presents the sections of this document relevant to the E36 conditions of approval.

Table 1-1 Report structure and relevant items addressed from Condition E36

Condition E36 item	Item requirements	Relevant Report Sections
A	<p><i>“an updated analysis, including modelling of traffic impacts to the adjoining road network (including impacts on local roads and rat-running), as a consequence of the SSI. This must include a review of new information available about potential land use changes, including those associated with the Draft Parramatta Road Urban Transformation Strategy (Transport for NSW, 2015, or as updated), and any traffic changes as a result of other major road projects within the project area ”</i></p>	Sections 3 -7
B	<p><i>“further detailed investigations at the following intersections or sections of the road network –</i></p> <ul style="list-style-type: none"> <i>(i) potential ‘pinch-points’ at the Parramatta Road and Wattle Street Interchanges where merging of tunnel exit traffic and surface traffic would occur,</i> <i>(ii) Parramatta Road/George Street,</i> <i>(iii) George Street/Pomeroy Street,</i> <i>(iv) Parramatta Road/Frederick Street/Wattle Street,</i> <i>(v) Parramatta Road/Concord Road,</i> <i>(vi) Concord Road/Patterson Street/Sydney Street,</i> <i>(vii) the intersection of the Concord Road off-ramps and Parramatta Road, and</i> <i>(viii) the intersection of the Pomeroy Street on-ramp and Parramatta Road;</i> 	Section 4
C	<p><i>“updated consideration of potential mitigation measures to manage any predicted traffic performance deficiencies, particularly on Parramatta Road and in association with the investigations undertaken within E36(b)”</i></p>	Section 8
D	<p><i>“details on bus priority measures”</i></p>	Section 5
E	<p><i>“the predicted traffic performance improvements from these measures, including any cumulative improvements”</i></p>	Section 4
F	<p><i>“justification of why the predicted ‘do minimum’ performance of any intersection on the adjoining road network cannot be maintained (if necessary); and”</i></p>	Section 4
G	<p><i>“an updated description and proposed timing of potential mitigation measures. The Proponent is responsible for the implementation of the identified measures, if required.”</i></p>	Section 8

2. Methodology

As outlined in Section 0, this report considers and compares traffic volumes and safety metrics of the network before and after the opening of the M4 East project. The comparison identifies the change in traffic patterns and any increases in usage of the road network as a result of the project.

Traffic volume surveys were performed at a number of sites within the study area which have been compared and analysed to determine the change in traffic volumes between pre-opening and post-opening. A percentage measure has been used to allow comparison of results across the study area.

Anything with a 5% increase or less is considered within normal growth ranges or part of the normal day to day traffic volume variance for this project area. Anything with an observed traffic volume increase of more than 5% was treated as a change and further assessed with traffic modelling software SIDRA, as further discussed in Section 4.1.

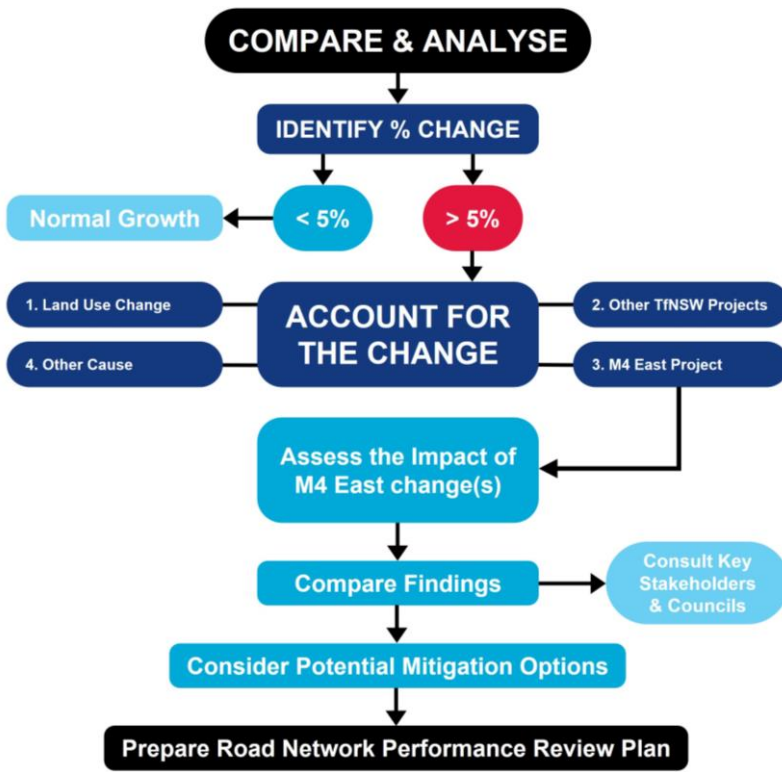
Safety metrics including crash data and observed collisions and near misses were also assessed using data between 2018 and 2020 to determine whether road safety has reduced from the opening of M4 East. Crash data was also reviewed between 2016 and 2018 to determine if the trends during the period assessed were generally consistent with previous years.

The mitigation options were then proposed by considering the benefits of implementing these options in the road network and their alignment with local council improvement works and future road network plans. A summary of potential mitigation options for locations that are impacted by the project is provided in Section 7.

Due to changes in travel behaviours as a result of the COVID-19 pandemic (declared in March 2020), traffic volumes have been reviewed for both 2019 and 2020 to review and determine the associated impacts of the M4 East, with and without the potential impacts of COVID-19. As further discussed in Section 3.3, 2020 traffic volumes were generally higher than 2019, therefore 2020 traffic volumes were selected as the reference for traffic analysis and modelling to provide a more conservative assessment.

Figure 2-1 illustrates the process flow diagram adopted for the post-opening M4 East RNPRP.

Figure 2-1 M4 East Road Network Performance Review Plan methodology



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3. Traffic volume analysis

3.1 Intersections analysed

Table 3-1 presents the intersections where traffic volumes have been analysed for pre-opening and post-opening as part of this review.

Table 3-1 Intersections analysed for the M4 East RNPRP

Primary road: City-West Link Road / Dobroyd Parade		
Balmain Road	James Street	Norton Street
Waratah Street	Timbrell Drive/Mortley Avenue	Ramsay St
Primary road: Concord Road		
Patterson Street	Sydney Street/M4 Off-Ramp	
Primary road: Parramatta Road		
Birnie Avenue	Bland Street	Bold Street*
Bombay Street/Hill Road*	Bridge Street	Broughton Street
Burwood Road	Concord Road/Leicester Avenue	Dalhousie Street
Duck Street/Rawson Street*	Frederick Street/Wattle Street	George Street/Nipper Street
Good Street*	John Street*	Knight Street
Liverpool Road	Marlborough Avenue	Mosely Street
M4 On and Off-Ramp	M4 On-Ramp (Powell's Creek)	Park Road
Potts Street	Shaftesbury Road	Sloane Street
Underwood Road	Wentworth Road	
Primary road: Homebush Bay Drive		
M4 Eastbound On-Ramp	M4 Westbound Off-Ramp	M4 On and Off-Ramps
Primary road: George Street		
Pomeroy Street		

*Intersections are located outside of the RNPRP study area

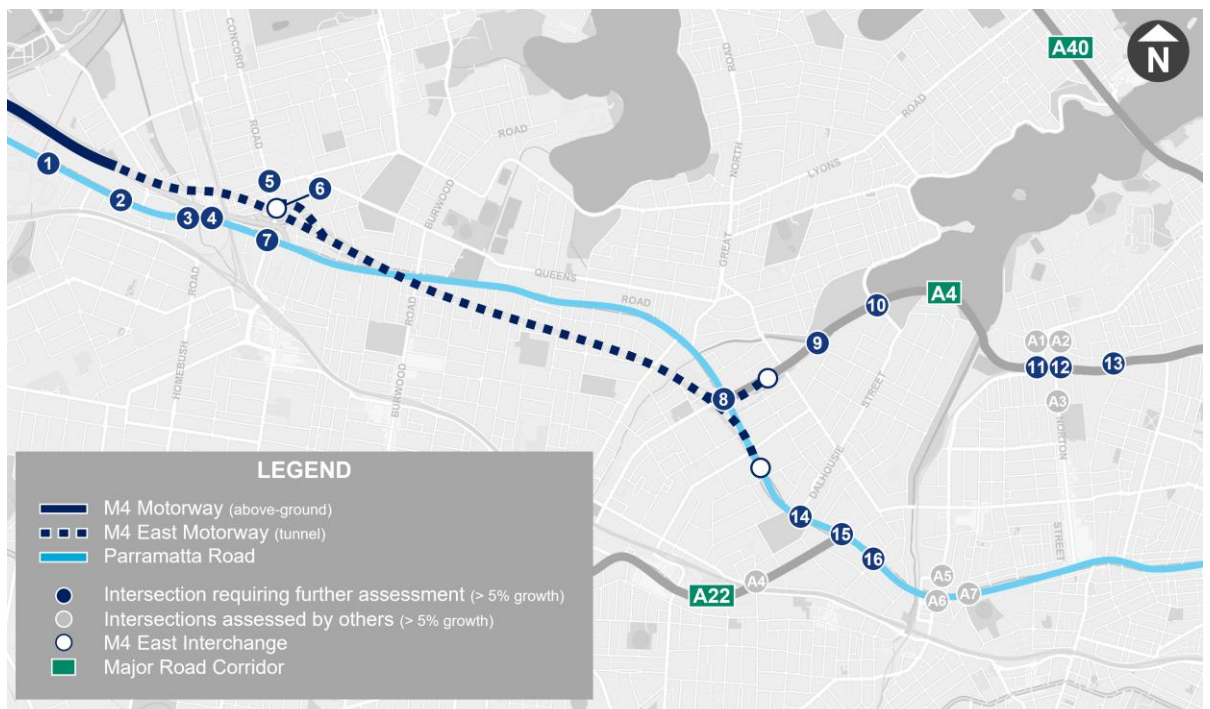
The traffic volume data used for the analysis were based on a combination of traffic surveys and SCATS detector data. The pre-opening baseline surveys were carried out in March 2018. This was done to provide a true representation of the network performance before the M4 East's completion. The post opening surveys used in this analysis were carried out in September 2019 and August 2020.

3.2 Intersections identified for modelling

Figure 3-1 illustrates the intersections within the study area that demonstrated an increase greater than 5% during the AM and/or PM peak hours between pre-opening (2018) and post-opening (2019 and 2020), with the exception of the following:

- Intersections 2, 3 and 4 – over 5% increase was observed between 2018 and 2020 only
- Intersection 8 – less than 5% increase was observed, however, included 2020 for further assessments due to crash history at Frederick Street
- Intersection 13 – over 5% increase was observed between 2018 and 2019 only

Figure 3-1 Intersections identified for traffic modelling



- | | |
|--|--|
| <ul style="list-style-type: none"> 1 Parramatta Road / Potts Road 2 Parramatta Road / Park Road 3 Parramatta Road / M4 Motorway On-Ramp 4 Parramatta Road / George Street / Nipper Street 5 Concord Road / Patterson Street 6 Concord Road / Sydney Street 7 Parramatta Road / Concord Road / Leicester Avenue 8 Parramatta Road / Frederick Street / Wattle Street 9 Dobroyd Parade / Waratah Street 10 Dobroyd Parade / Timbrell Drive / Mortley Avenue 11 City-West Link Road / James Street 12 City-West Link Road / Norton Street | <ul style="list-style-type: none"> 13 City-West Link Road / Balmain Road 14 Parramatta Road / Dalhousie Street 15 Parramatta Road / Liverpool Street 16 Parramatta Road / Sloane Street A1 James Street / Lilyfield Road A2 Norton Street / Lilyfield Road A3 Norton Street / William Street A4 Hume Highway / Carlton Crescent A5 Tebbutt Street / Hathern Street A6 Parramatta Road / Tebbutt Street A7 Parramatta Road / West Street |
|--|--|

3.3 Traffic volume comparison

As noted in Section 2, traffic volumes were reviewed for 2019 and 2020 to assess the impact of the M4 East post-opening, with and without the potential impacts of COVID-19.

Figure 3-2 presents a comparison of traffic volumes between 2018, 2019 and 2020 during the AM peak for the intersections identified for further analysis.

Figure 3-2 Comparison of traffic volumes for 2018, 2019 and 2020 – AM peak hour (8-9am)

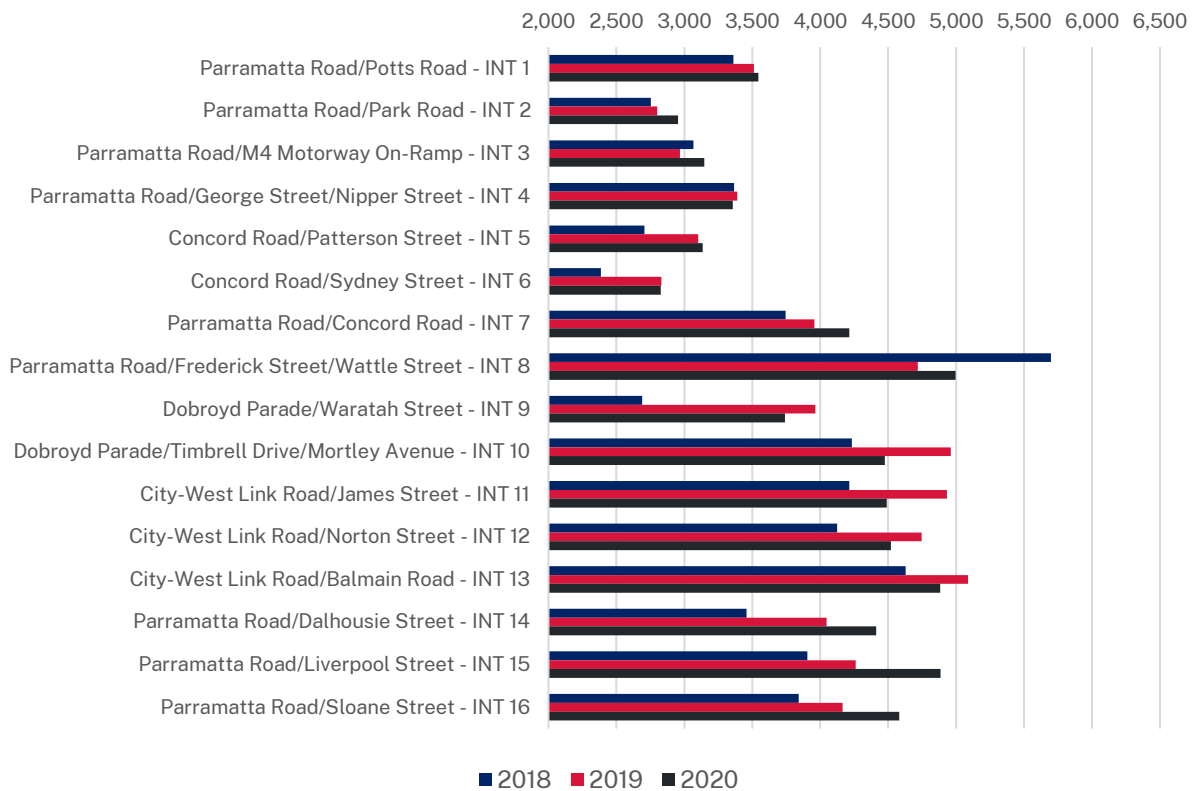
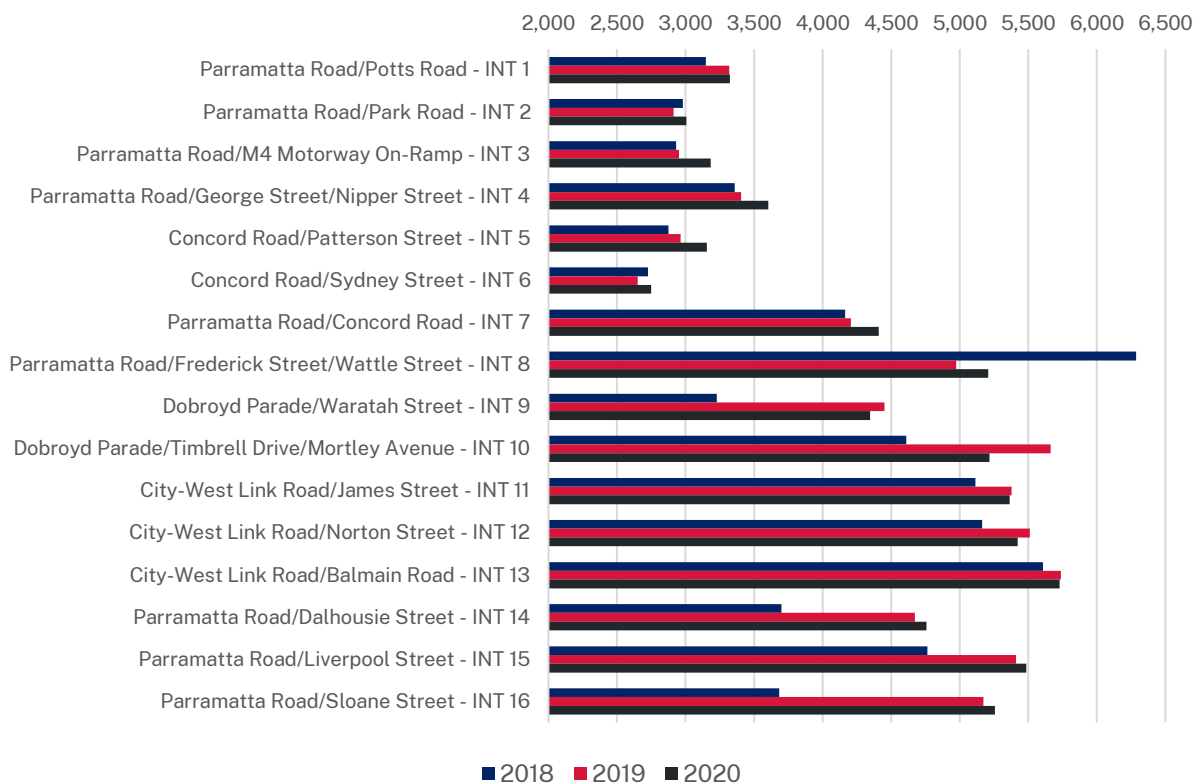


Figure 3-3 presents a comparison of traffic volumes between 2018, 2019 and 2020 during the PM peak for the intersections identified for further analysis.

Figure 3-3 Comparison of traffic volumes for 2018, 2019 and 2020 – PM peak hour (5-6pm)



As illustrated in Figure 3-2 and Figure 3-3, traffic volumes were higher in 2020 for the majority of intersections during the AM and PM peak periods compared to 2019. It is acknowledged that traffic volumes may be higher for 2020 due to changes in travel behaviour as a result of the COVID-19 pandemic, where private vehicle use increased and public transport use decreased. Therefore, the post-opening assessments based on 2020 data were selected to be used as a conservative reference for traffic analysis and modelling in Section 3.4 and Section 4.

In order to assess road network performance without the impacts of COVID-19, intersection assessments were also completed for all sites using 2019 traffic volumes, with the exception of Intersection 13 (as noted in Section 3.2). Intersections 2, 3 and 4 were assessed for 2020 only as traffic volumes did not increase by more than 5% in 2019.

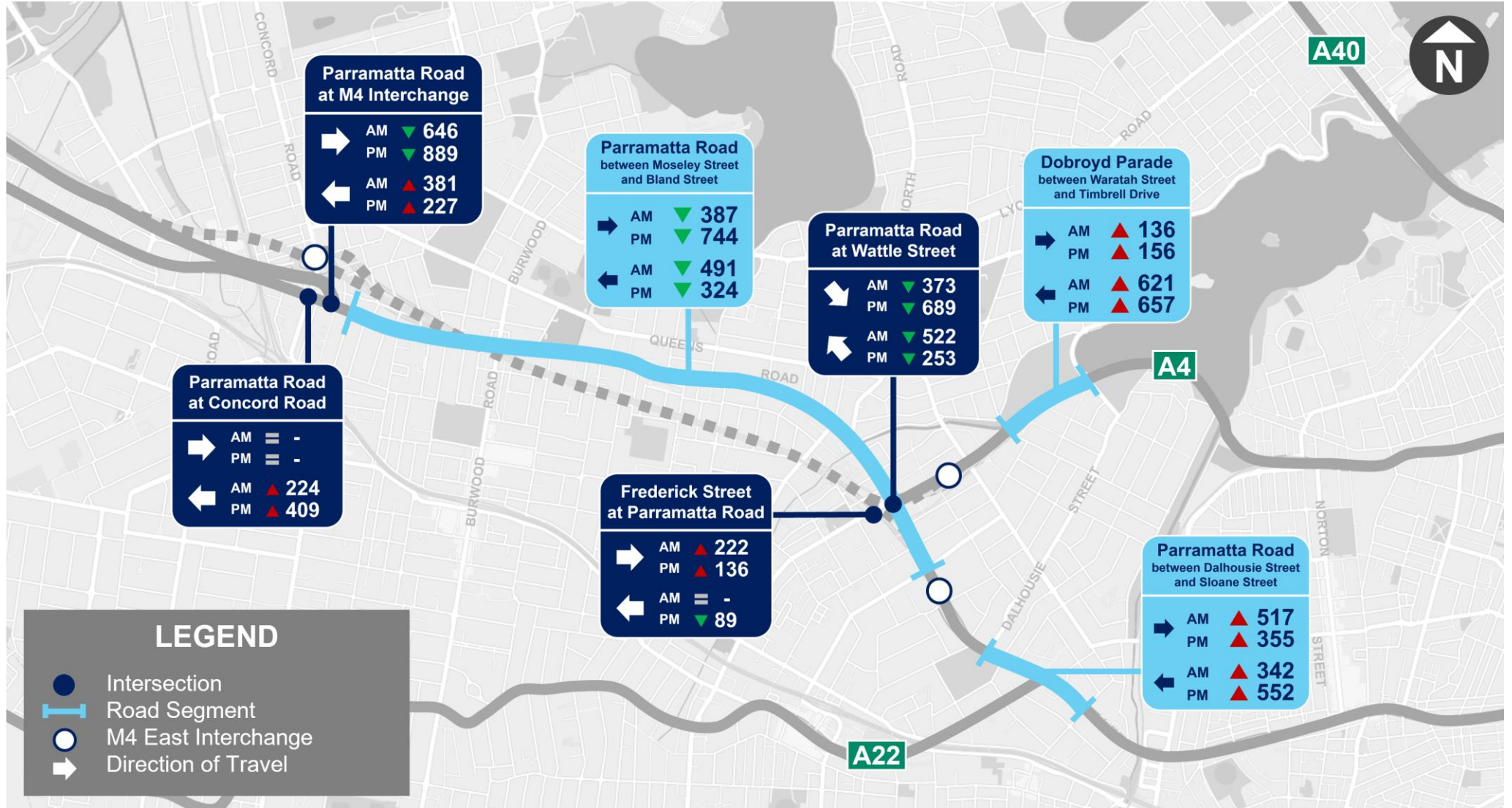
Intersection assessments using 2019 traffic volumes for all sites (excluding Intersections 2, 3, 4, 8 and 13) are included in Appendix A.

3.4 Key observations

Figure 3-4 illustrates the key observations of traffic volumes on key road corridors within the study area between pre-opening (2018) and post-opening (2020) of the M4 East.

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Figure 3-4 Key traffic volume observations between pre-opening and post-opening of M4 East



M4 East Post Opening Study

3.4.1 AM peak (8am to 9am)

Key observations from the comparison of pre-opening (2018) and post-opening (2020) traffic volumes for the AM peak are as follows:

Parramatta Road

- From Mosely Street to Bland Street (eastbound on Parramatta Road between M4 East interchanges) – an average **decrease** of 387 vehicles (18%)
- From Bland Street to Mosely Street (westbound on Parramatta Road between M4 East interchanges) – an average **decrease** of 491 vehicles (24%)
- From Dalhousie Street to Sloane Street (eastbound on Parramatta Road) – an average **increase** of 517 vehicles (29%) during the AM peak due to additional vehicles exiting the M4 East tunnels onto Parramatta Road.
- From Sloane Street to Dalhousie Street (westbound on Parramatta Road) – an average **increase** of 342 vehicles (24%) during the AM peak due to additional vehicles travelling on Parramatta Road to access the M4 East.
- At Concord Road (eastbound on Parramatta Road) – **similar** traffic to pre-opening; heavy vehicles **decreased** by 33 vehicles (33%)
- At Concord Road (westbound on Parramatta Road) – **increase** of 224 vehicles (22%); heavy vehicles **decreased** by 3 vehicles (4%)
- At M4 Motorway Interchange (eastbound on Parramatta Road) – **decrease** of 646 vehicles (28%); heavy vehicles **decreased** by 71 vehicles (31%)
- At M4 Motorway Interchange (westbound on Parramatta Road) – **increase** of 381 vehicles (64%); heavy vehicles **decreased** by 2 vehicles (5%)
- At Wattle Street (eastbound on Parramatta Road) – **decrease** of 373 vehicles (21%); heavy vehicles **decreased** by 57 vehicles (40%)
- At Wattle Street (westbound on Parramatta Road) – **decrease** of 522 vehicles (25%); heavy vehicles **decreased** by 88 vehicles (47%)
- In general, there has been a notable reduction in traffic volumes on Parramatta Road between the M4 East interchanges associated with the opening of the M4 East tunnels which provides an alternative route for drivers. Some increases in traffic volumes are observed for movements into and exiting the tunnel portals and ramps, such as the westbound right turn from Parramatta Road onto Concord Road to enter the eastbound M4 East tunnel on-ramp.

Dobroyd Parade

- From Waratah Street to Timbrell Drive/Mortley Avenue (eastbound on Dobroyd Parade) – an average **increase** by 136 vehicles (9%); heavy vehicles **increased** by 87 vehicles (89%) on average
- From Timbrell Drive/Mortley Avenue to Waratah Street (westbound on Dobroyd Parade) – an average **increase** by 621 vehicles (56%); heavy vehicles **increased** by 51 vehicles (41%) on average

Frederick Street (near southern M4 East interchanges):

- Towards Parramatta Road (northbound on Frederick Street) – **increase** of 222 vehicles (22%); heavy vehicles **increased** by 3 vehicles (5%)
- From Parramatta Road (southbound on Frederick Street) – **similar** traffic to pre-opening; heavy vehicles **decreased** by 4 vehicles (6%)

3.4.2 PM peak (5pm to 6pm)

Key observations from the comparison of pre-opening (2018) and post-opening (2020) traffic volumes for the **PM peak** are as follows:

Parramatta Road

- From Mosely Street to Bland Street (eastbound on Parramatta Road between M4 East interchanges) – an average **decrease** of 744 vehicles (32%)
- From Bland Street to Mosely Street (westbound on Parramatta Road between the M4 East interchanges) – an average **decrease** of 324 vehicles (16%)
- From Dalhousie Street to Sloane Street (eastbound on Parramatta Road) – an average **increase** of 355 vehicles (20%) during the AM peak due to additional vehicles exiting the M4 East tunnels onto Parramatta Road.
- From Sloane Street to Dalhousie Street (westbound on Parramatta Road) – an average **increase** of 552 vehicles (30%) due to additional vehicles travelling on Parramatta Road to access the M4 East.
- At Concord Road (eastbound on Parramatta Road) – **similar** traffic to pre-opening; heavy vehicles **increased** by 6 vehicles (29%).
- At M4 Motorway Interchange (eastbound on Parramatta Road) – **decrease** of 889 vehicles (35%); heavy vehicles **decreased** by 27 vehicles (35%)
- At Wattle Street (eastbound on Parramatta Road) – **decrease** of 689 vehicles (38%); heavy vehicles **decreased** by 17 vehicles (44%)
- At Concord Road (westbound on Parramatta Road) – **increase** of 409 vehicles (42%); heavy vehicles **decreased** by 3 vehicles (6%)
- At M4 Motorway Interchange (westbound on Parramatta Road) – **increase** of 227 vehicles (35%); heavy vehicles **decreased** by 4 vehicles (13%)
- At Wattle Street (westbound on Parramatta Road) – **decrease** of 253 vehicles (12%); heavy vehicles **decreased** by 46 vehicles (44%)

Dobroyd Parade

- Waratah Street to Timbrell Drive/Mortley Avenue (eastbound on Dobroyd Parade) – an average **increase** of 156 vehicles (9%); heavy vehicles **increased** by 13 vehicles (9%) on average
- Timbrell Drive/Mortley Avenue to Waratah Street (westbound on Dobroyd Parade) – an average **increase** of 657 vehicles (48%); heavy vehicles **increased** by 14 vehicles (31%) on average

Frederick Street (near southern M4 East interchanges)

- Towards Parramatta Road (northbound on Frederick Street) – **increase** of 136 vehicles (14%)

- From Parramatta Road (southbound on Frederick Street) – **decrease** of 89 vehicles (8%)

Key observations regarding road safety performance at the intersections assessed within the study area are detailed in Section 6.

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4. Intersection performance

Using the intersections listed in Section 3.2 of this report, traffic modelling using SIDRA software was undertaken to capture the performance of each of these intersections during pre-opening and post-opening.

It is noted that this modelling exercise is developed based on historical data including SCATS and site understanding. Traffic modelling was undertaken to confirm the extent of network performance impacts since the completion of the M4 East project. Limited calibration data was available as the project base year of 2018 was prior to the commencement of this assessment and limited modelling specific data could be captured or retrieved from this period.

The standard measure of intersection performance is **vehicle delay**. SIDRA determines the average delay that vehicles encounter at the intersection and provides a measure of the **level of service** (LoS). Table 4-1 indicates the criteria that SIDRA adopts in assessing the LoS, in line with Transport’s traffic modelling guidelines.

Table 4-1 Intersection LoS criteria

Level of Service (LoS)	Average delay per vehicle (s/veh)	Traffic signals, roundabouts	Give way and stop sign
A	Less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Near capacity	Near capacity, accident study required
E	57 to 70	At capacity, at signals incidents will cause excessive delays	At capacity, requires other control mode
F	Greater than 70	Extra capacity required	Extreme delay, major treatment required

Signalised intersections generally experience queueing of vehicles due to signal phasing and opposing traffic and/or pedestrian demands. SIDRA provides a queue length for all approaches of an intersection and the movements permitted from each of them (e.g. left turn).

The **Percentile Queue** parameter is used for the percentile queue length value to be included in output reports and displays. The default value is Percentile Queue = **95 %**. The 95th percentile queue length is the value below which 95 per cent of all observed cycle queue lengths fall, or 5 per cent of all observed queue lengths may exceed.

The summary tables present traffic volumes, queue lengths (worst performing approach of each intersection during the pre-opening scenario compared with the performance of the same approach in the post-opening scenario), average delay and Intersection LoS.



Traffic Volumes



Queue Lengths
95th percentile (metres)



Average Delay
(seconds)



Intersection
LoS

4.1 Summary of intersection performance

Table 4-2 presents a summary of the intersection LoS for the AM and PM peak periods during the pre-opening (2018) and post-opening (2020) scenarios.

Table 4-2 Summary of intersection performance

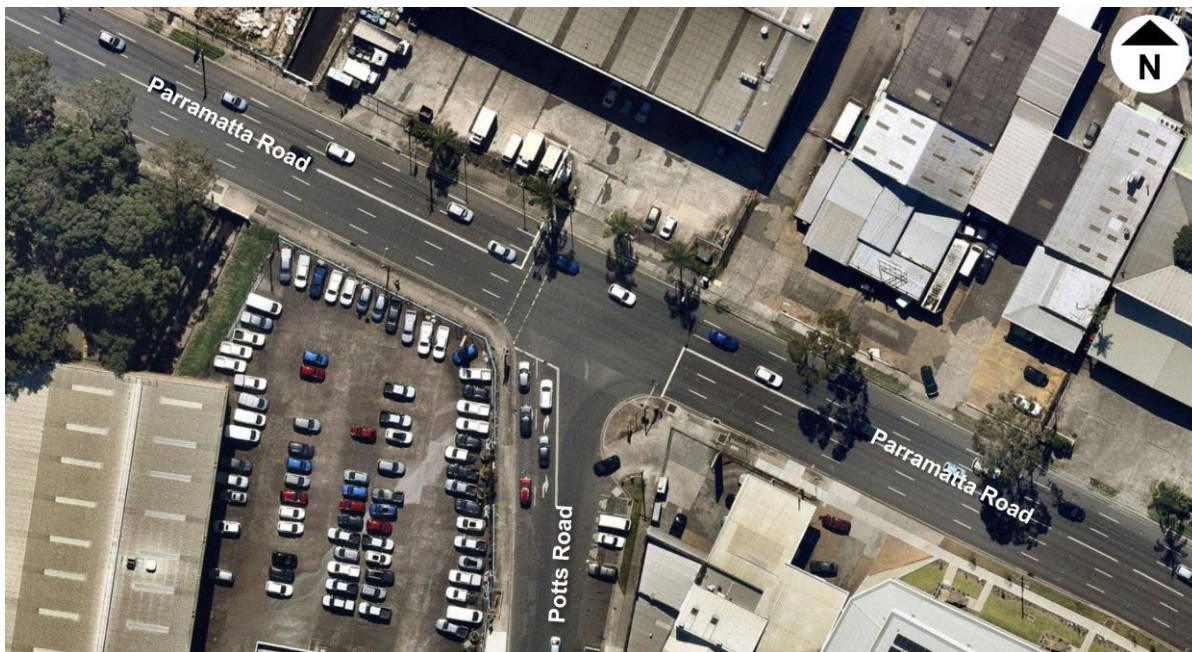
Intersection	AM peak			PM peak		
	Pre	Post	▲▼	Pre	Post	▲▼
1 – Parramatta Road/Potts Street	A	A	≡	A	A	≡
2 – Parramatta Road/Park Road	A	A	≡	A	A	≡
3 – Parramatta Road/M4 Motorway On-Ramp	B	B	≡	A	B	▼
4 – Parramatta Road/George Street/Nipper Street	D	D	≡	E	E	≡
5 – Concord Road/Patterson Road	C	C	≡	D	D	≡
6 – Concord Road/Sydney Road	B	A	▲	B	B	≡
7 – Parramatta Road/Concord Road/Leicester Avenue	E	E	≡	F	F	≡
8 – Parramatta Road/Frederick Street/Wattle Street	E	D	▲	E	E	≡
9 – Dobroyd Parade/Waratah Street	A	B	▼	A	B	▼
10 – Dobroyd Parade/Timbrell Drive/Mortley Avenue	C	F	▼	D	C	▲
11 – City-West Link Road/James Street	C	D	▼	C	C	≡
12 – City-West Link Road/Norton Street	C	C	≡	C	D	▼
13 – City-West Link Road/Balmain Road	C	E	▼	F	F	≡
14 – Parramatta Road/Dalhousie Street	C	C	≡	B	C	▼
15 – Parramatta Road/Liverpool Road	C	C	≡	C	C	≡
16 – Parramatta Road/Sloane Street	A	B	▼	A	B	▼

In general, most intersections experience minor increase in delays and maintain a similar LoS compared to pre-opening. However, it is noted that some intersections on City-West Link Road experience increased delays associated with traffic generation from the M4 East project. Detailed discussion on each intersection is provided in the sections below.

4.2 Intersection 1 – Parramatta Road/Potts Street

This is a three-way signalised intersection between Parramatta Road and Potts Street. Potts Street facilitates access to Paddy’s Markets Flemington for general customers and heavy vehicles. In the eastbound direction, Parramatta Road widens to three lanes on approach to the intersection before narrowing back to two lanes approximately 150 metres from the exit of the intersection. All movements are permitted at this intersection. A pedestrian crossing is provided on the western approach of Parramatta Road. Figure 4-1 illustrates the intersection.

Figure 4-1 Intersection of Parramatta Road/Potts Street



Imagery Source: Nearmap (post-opening)

The layout of this intersection has remained consistent between pre-opening and post-opening. The performance of this intersection has been assessed post-opening for 2020 which saw an overall increase in traffic volumes by approximately 5 percent during the AM peak and 6 percent during the PM peak when compared to pre-opening volumes. No significant land use changes were observed to occur within the surrounding locality of the intersection between pre-opening and post-opening.

Table 4-3 presents a performance summary of this intersection.

Table 4-3 Summary of performance at Parramatta Road/Potts Street

Parramatta Road/Potts Street – 2018 v 2020						
	Pre M4 East (2018)		Post M4 East (2020)		Difference	
	AM	PM	AM	PM	AM	PM
Traffic Volumes	3,537	3,314	3,725	3,499	+188	+185
Queue Length (m) Approach	212.0	233.9	292.3	232.5	+80.3	-1.4
	West	West	West	West		
Average Delay (sec)	9.2	6.1	9.5	6.4	+0.3	+0.3
Intersection LoS	LoS A	LoS A	LoS A	LoS A	=	=

Since the opening of the M4 East, overall performance at this intersection has remained similar during the AM and PM peak periods.

Key changes in performance observed at this intersection are as follows:

- There is minimal increase in queuing and delay at the intersection.
- Road safety remained consistent with 2 crashes occurring at this intersection before and after the opening of the M4 East.

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4.3 Intersection 2 – Parramatta Road/Park Road

This is a three-way signalised intersection between Parramatta Road and Park Road. All movements are permitted at this intersection. Pedestrian crossings are provided on Park Road and the eastern approach of Parramatta Road. Figure 4-2 illustrates the intersection.

Figure 4-2 Intersection of Parramatta Road/Park Road



Imagery Source: Nearmap (post-opening)

The layout of this intersection has remained consistent between pre-opening and post-opening. The performance of this intersection has been assessed post-opening for 2020 which saw an overall increase in traffic volumes by approximately 7 percent during the AM peak and 1 percent during the PM peak when compared to pre-opening volumes. Traffic volumes did not increase more than five percent from pre-opening volumes in 2019. No significant land use changes were observed to occur within the surrounding locality of the intersection between pre-opening and post-opening.

Table 4-4 presents a performance summary of this intersection.

Table 4-4 Summary of performance at Parramatta Road/Park Road

Parramatta Road/Park Road – 2018 v 2020						
	Pre M4 East (2018)		Post M4 East (2020)		Difference	
	AM	PM	AM	PM	AM	PM
Traffic Volumes	2,899	3,137	3,109	3,164	+210	+27
Queue Length (m) Approach	116.6	128.7	118.5	118.9	+1.9	+3.2
	South-East	South-East	South-East	South-East		
Average Delay (sec)	7.9	7.9	7.2	6.9	-0.7	-1.0
Intersection LoS	LoS A	LoS A	LoS A	LoS A	=	=

Since the opening of the M4 East, overall performance at this intersection has remained similar during the AM and PM peak periods.

Key changes in performance observed at this intersection are as follows:

- Average delays have increased on Park Road during the AM peak, due to increased green time on Parramatta Road to facilitate increased traffic volumes as a result of the M4 East. During the PM peak, average delays have marginally decreased on all approaches.
- Vehicle queue lengths have marginally increased on Park Road during the AM peak and marginally decreased on all approaches during the PM peak, despite an increase in traffic volumes on both approaches of Parramatta Road due to traffic signal optimisation.
- Based on a review of crash data for 12 months before and after the opening of the M4 East, no crashes occurred at this intersection pre-opening and 1 crash post-opening.

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4.4 Intersection 3 – Parramatta Road/M4 Motorway On-Ramp (Powell’s Creek)

This is a three-way signalised intersection between Parramatta Road and M4 Motorway on-ramp.

The M4 on-ramp is a one-way access only and the westbound through movement is a continuous flow. All other movements are permitted at this intersection. A pedestrian crossing is provided on the M4 Motorway on-ramp. Figure 4-3 illustrates the intersection.

Figure 4-3 Intersection of Parramatta Road/M4 Motorway On-Ramp (Powell’s Creek)



Imagery Source: Nearmap (post-opening)


The layout of this intersection has remained consistent between pre-opening and post-opening. The performance of this intersection has been assessed post-opening for 2020 which saw an overall increase in traffic volumes by approximately 3 percent during the AM peak and 8 percent during the PM peak when compared to pre-opening volumes. Traffic volumes did not increase more than 5 percent from pre-opening volumes in 2019. No significant land use changes were observed to occur within the surrounding locality of the intersection between pre-opening and post-opening.

Table 4-5 presents a performance summary of this intersection.

Table 4-5 Summary of performance at Parramatta Road/M4 Motorway On-Ramp

Parramatta Road/M4 Motorway On-Ramp – 2018 v 2020						
	Pre M4 East (2018)		Post M4 East (2020)		Difference	
	AM	PM	AM	PM	AM	PM
Traffic Volumes	3,219	3,067	3,300	3,324	+81	+257
Queue Length (m) Approach	236.5	204.3	278.1	197.8	+41.6	-6.5
	West	West	West	West		
Average Delay (sec)	16.5	12.9	24.1	15.3	+7.6	+2.4

Parramatta Road/M4 Motorway On-Ramp – 2018 v 2020

 Intersection LoS	LoS B	LoS A	LoS B	LoS B	=	▼
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Since the opening of the M4 East, overall performance at this intersection has remained similar during the AM peak but marginally degraded during the PM peak.

During the AM peak:

- Overall intersection volumes have increased compared to pre-opening. The westbound through movement on Parramatta Road is a continuous flow, resulting in minimal queue lengths or average delays.
- Average delays and queue lengths for the right turn movement onto the M4 Motorway on-ramp have reduced due to altered traffic signal phasing allowing vehicles to turn right more frequently during each cycle, however queuing is still experienced beyond the turning lane which may impact upon through traffic.
- The altered signal phasing has resulted in an increase in the average delay on the western approach of Parramatta Road, however, queue lengths have slightly decreased.

During the PM peak:

- Both approaches along Parramatta Road have experienced increases in vehicle trips.
- Similar to the AM peak, signal phasing has been altered to allow vehicles to turn right from the eastern approach more frequently onto the M4 on-ramp, allowing a reduction in average delays and queuing.
- Despite the changes to signal phasing, queue lengths and average delays on the western approach have remained similar to pre-opening.
- Queuing between George Street/Nipper Street and the M4 on-ramp has also been observed to occur in both directions during the PM peak. The LoS on both approaches has remained the same as pre-opening.
- The overall intersection performance during the PM peak has degraded slightly from LoS A to LoS B, as it is skewed by the continuous westbound through movement which generally operates with limited delay.

Based on a review of crash data for 12 months before and after the opening of the M4 East, no crashes occurred at this intersection pre-opening or post-opening.

4.5 Intersection 4 – Parramatta Road/George Street/Nipper Street

This is a four-way signalised intersection between Parramatta Road, George Street and Nipper Street. George Street facilitates travel north towards North Strathfield, and Nipper Street facilitates travel south towards Homebush. All movements are permitted at this intersection. Pedestrian crossings are provided on all approaches. Figure 4-4 illustrates the intersection.

Figure 4-4 Intersection of Parramatta Road/George Street/Nipper Street







Imagery Source: Nearthmap (post-opening)

The layout of this intersection has remained consistent between pre-opening and post-opening. The performance of this intersection has been assessed post-opening for 2020 which saw an overall increase in traffic volumes by approximately 6 percent during the AM peak and 7 percent during the PM peak when compared to pre-opening volumes. Traffic volumes did not increase more than 5 percent from pre-opening volumes in 2019. No significant land use changes were observed to occur within the surrounding locality of the intersection between pre-opening and post-opening.

Table 4-6 presents a performance summary of this intersection.

Table 4-6 Summary of performance at Parramatta Road/George Street/Nipper Street

Parramatta Road/George Street/Nipper Street – 2018 v 2020						
	Pre M4 East (2018)		Post M4 East (2020)		Difference	
	AM	PM	AM	PM	AM	PM
 Traffic Volumes	3,530	3,536	3,743	3,792	+213	+256
 Queue Length (m) Approach	362.8	398.0	393.7	511.7	+30.9	+113.7
	West	West	West	West		
 Average Delay (sec)	52.4	59.4	52.9	60.0	+0.5	+0.6
 Intersection LoS	LoS D	LoS E	LoS D	LoS E	=	=

Since the opening of the M4 East, overall performance at this intersection remained similar during the AM and PM peak periods. It is noted that the intersection was operating close to capacity prior to opening, with a LoS E during the PM peak.

Key changes in performance observed at this intersection are as follows:

- Average delays have increased on all approaches during the AM and PM peak periods, with the exception of the western approach of Parramatta Road where the averages delays have decreased. This is likely due to additional green time on Parramatta Road to support additional traffic accessing the M4 East, further east at Concord Road. The LoS has degraded on the eastern approach of Parramatta Road during the PM peak and degraded on Nipper Street and George Street during the AM and PM peak periods.
- Vehicle queue lengths have increased on all approaches during the AM and PM peak periods, with the exception of the western approach of Parramatta Road
- Based on a review of crash data for 12 months before and after the opening of the M4 East, 3 crashes occurred at this intersection pre-opening and 4 crashes post-opening.

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4.6 Intersection 5 – Concord Road/Patterson Street

This is a three-way signalised intersection located north of Parramatta Road. Concord Road facilitates travel north towards Rhodes and south towards the M4/M4 East access ramps and further towards North Strathfield, with Patterson Street facilitating travel east towards Five Dock. All movements are permitted at this intersection. Pedestrian crossings are provided on the southern approach of Concord Road and eastern approach of Patterson Street. Figure 4-5 illustrates the intersection.

Figure 4-5 **Intersection of Concord Road/Patterson Street**



Imagery Source: Nearthmap (post-opening)

The layout of this intersection has changed between pre-opening and post-opening with the addition of a right-turn lane from Concord Road (northbound) onto Patterson Street, relocation of the east-west pedestrian crossing to the northern intersection leg, and additional lanes for the new M4/M4 East access ramps to the south. Figure 4-6 illustrates Concord Road/Patterson Street pre-opening of M4 East.

Figure 4-6 **Intersection of Concord Road/Patterson Street prior to opening of M4 East**



Imagery Source: Nearmap (pre-opening)

The performance of this intersection has been assessed post-opening for 2019 and 2020 which saw an overall increase in traffic volumes by approximately 16 percent during the AM peak and 11 percent during the PM peak when compared to pre-opening volumes. No significant land use changes were observed to occur within the surrounding locality of the intersection between pre-opening and post-opening.

Table 4-7 presents a performance summary of this intersection.

Table 4-7 Summary of intersection performance at Concord Road/Patterson Street

Concord Road/Patterson Street – 2018 v 2020						
	Pre M4 East (2018)		Post M4 East (2020)		Difference	
	AM	PM	AM	PM	AM	PM
Traffic Volumes	2,841	3,048	3,299	3,434	+458	+350
Queue Length (m) Approach	166.8	254.2	166.5	169.9	-0.3	-84.3
	South	South	South	South		
Average Delay (sec)	34.0	44.6	33.8	48.4	-0.2	+3.8
Intersection LoS	LoS C	LoS D	LoS C	LoS D	=	=

Since the opening of the M4 East, overall performance at this intersection has been maintained during the AM and PM peaks.

- During the AM peak, average delays have been reduced on both approaches of Concord Road, increasing on Patterson Street. Queue lengths remain relatively similar, with the exception of the northern approach on Concord Road which has increased. The LoS has improved on both approaches of Concord Road from LoS C to LoS B degrading on Patterson Street from LoS C to LoS D.
- During the PM peak, queue lengths have increased on the northern approach of Concord Road and on Patterson Street, reducing on the southern approach of Concord Road which

also experienced a reduction in average delay. The average delay on Patterson Street and the northern approach of Concord Road have increased.

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4.7 Intersection 6 – Concord Road/Sydney Street

This is a three-way signalised intersection between Concord Road, Sydney Street and the on/off-ramps for the M4 and M4 East. Concord Road facilitates travel north towards Rhodes and south towards North Strathfield, with the M4 East facilitating travel east towards Haberfield and the M4 facilitating travel west towards Parramatta. Movement restrictions apply at this intersection. Pedestrian crossings are provided on the southern approach of Concord Road and Sydney Street/M4 off-ramp. Figure 4-7 illustrates the current layout of the intersection.

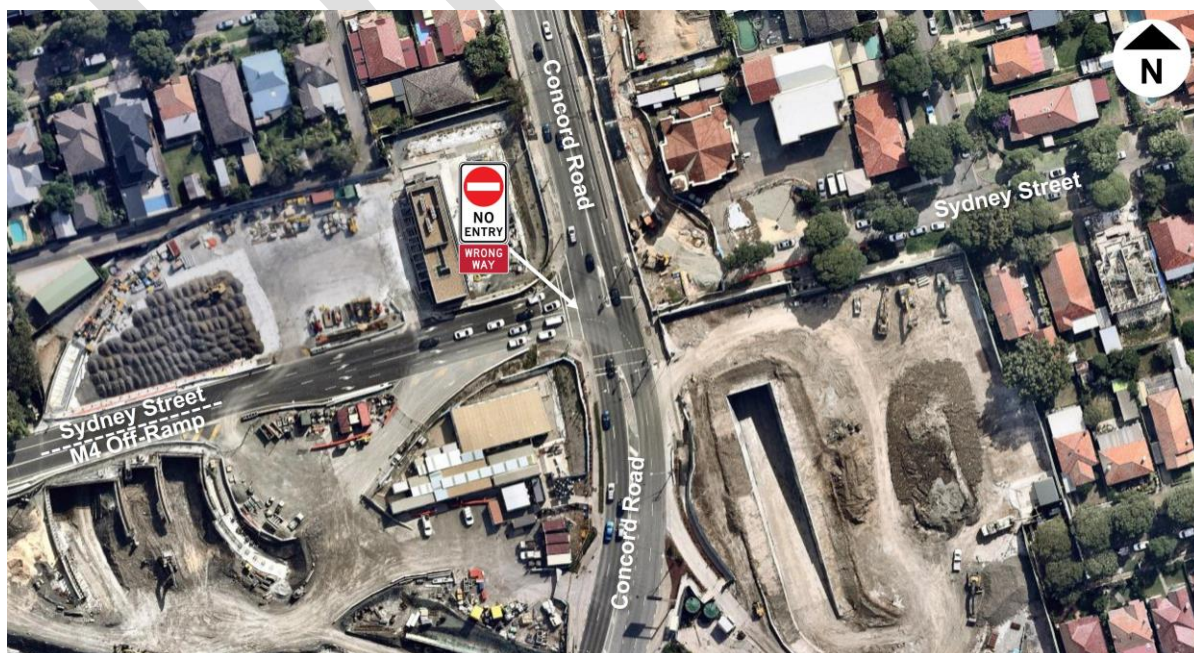
Figure 4-7 Intersection of Concord Road/Sydney Street



Imagery Source: Nearmap (post-opening)

The layout of this intersection has changed between pre-opening and post-opening with the addition of the new M4 and M4 East access ramps. Figure 4-8 illustrates Concord Road/Sydney Street pre-opening of the M4 East.

Figure 4-8 Intersection of Concord Road / Sydney Street prior to opening of M4 East









Imagery Source: Nearmap (pre-opening)

The performance of this intersection has been assessed post-opening for 2019 and 2020 which saw an overall increase in traffic volumes by approximately 68 percent during the AM peak and 4 percent during the PM peak when compared to pre-opening volumes. No significant land use changes were observed to occur within the surrounding locality of the intersection between pre-opening and post-opening.

Table 4-8 presents a performance summary of this intersection.

Table 4-8 Summary of performance at Concord Road/Sydney Street

Concord Road/Sydney Street – 2018 v 2020						
	Pre M4 East (2018)		Post M4 East (2020)		Difference	
	AM	PM	AM	PM	AM	PM
 Traffic Volumes	1,813	2,834	3,049	2,939	+1,236	+105
 Queue Length (m) Approach	92.1	140.3	59.0	71.4	-33.1	-68.9
	North	North	North	North		
 Average Delay (sec)	18.7	21.2	13.5	16.1	-5.2	-5.1
 Intersection LoS	LoS B	LoS B	LoS A	LoS B		

Since the opening of the M4 East, overall performance at this intersection has improved during the AM peak and remained similar during the PM peak.

Key changes in performance observed at this intersection are as follows:

- Average delays have increased on Sydney Street during the AM and PM peak periods. This is likely due to increased green time on Concord Road to accommodate vehicles entering and exiting the M4 East. The LoS of Sydney Street has degraded from LoS C to LoS E during the AM peak and LoS D to LoS E during the PM peak
- Vehicle queue lengths have increased on Sydney Street during the AM peak and the southern approach of Concord Road during the AM and PM peak periods, likely due to the removal of one northbound lane at the intersection to accommodate vehicles exiting the M4 East

4.8 Intersection 7 – Parramatta Road/Concord Road/Leicester Avenue

This is a four-way signalised intersection between Parramatta Road, Concord Road and Leicester Avenue. Parramatta Road facilitates travel east towards Ultimo and west towards Holroyd. Concord Road facilitates travel north towards Rhodes, and Leicester Avenue facilitates travel south towards Strathfield. All movements are permitted at this intersection. Pedestrian crossings are provided on all approaches. Figure 4-9 illustrates the intersection.

Figure 4-9 Intersection of Parramatta Road/Concord Road/Leicester Avenue



Imagery Source: Nearmap (post-opening)

The layout of this intersection has changed between pre-opening and post-opening with an additional right turn lane from Parramatta Road onto Concord Road and the removal of a dedicated left turn lane and reallocation as a right turn lane from Concord Road onto Parramatta Road. Figure 4-10 illustrates Parramatta Road/Concord Road/Leicester Avenue pre-opening of the M4 East.

Figure 4-10 Intersection of Parramatta Road/Concord Road/Leicester Avenue prior to opening of M4 East



Imagery Source: Nearthmap (pre-opening)

The performance of this intersection has been assessed post-opening for 2019 and 2020 which saw an overall increase in traffic volumes by approximately 13 percent during the AM peak and 8 percent during the PM peak when compared to pre-opening volumes. No significant land use changes were observed to occur within the surrounding locality of the intersection between pre-opening and post-opening.

Table A-4-9 presents a performance summary of this intersection.

Table A-4-9 Summary of performance at Parramatta Road/Concord Road/Leicester Avenue

Parramatta Road/Concord Road/Leicester Avenue – 2018 v 2020						
	Pre M4 East (2018)		Post M4 East (2020)		Difference	
	AM	PM	AM	PM	AM	PM
Traffic Volumes	3,918	4,349	4,440	4,706	+522	+357
Queue Length (m)	200.5	369.3	195.7	286.8	-4.8	-82.5
Approach	South	North	South	North		
Average Delay (sec)	59.6	72.7	62.9	76.1	+3.3	+3.4
Intersection LoS	LoS E	LoS F	LoS E	LoS F	=	=

Since the opening of the M4 East, overall performance at this intersection has remained similar during the AM and PM peak periods. It is noted that the intersection was operating close to capacity prior to opening, with a LoS E during the AM peak and LoS F during the PM peak.

Key changes in performance observed at this intersection are as follows:

- Average delays have increased on Concord Road during the AM peak, with the LoS degrading from LoS E to LoS F.

- During the PM peak, average delays have reduced on Concord Road and the eastern approach on Parramatta Road due to phase time optimisation, with average delays increasing on Leicester Avenue and the western approach on Parramatta Road. The western approach on Parramatta Road has degraded from LoS E to LoS F and Leicester Avenue has degraded from LoS D to LoS E.
- Vehicle queue lengths have increased on Leicester Avenue and Concord Road during the AM peak. The northern approach right turn improves due to provision of dual right turn bays by reallocation of the existing through lane to right turn only. Consequently, the through and left turn movements from Concord Road degrade in performance. During the PM peak, all approaches experienced increase in queue lengths, except for Concord Road.
- Based on a review of crash data for 12 months before and after the opening of the M4 East, 1 crash occurred at this intersection pre-opening, with no crashes post-opening.

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4.9 Intersection 8 – Parramatta Road/Frederick Street/Wattle Street

This is a four-way signalised intersection located close to the eastern access and entry ramps of the M4 East. Parramatta Road facilitates travel towards Holroyd in the west and Ultimo in the east. Wattle Street facilitates travel north-east towards Haberfield, and Frederick Street facilitates travel south-west through Ashfield. Movement restrictions apply at this intersection. Pedestrian crossings are provided on Wattle Street, Frederick Street and the southern approach of Parramatta Road. Figure 4-11 illustrates the intersection.

Figure 4-11 Intersection of Parramatta Road/Frederick Street/Wattle Street



Imagery Source: Nearmap (post-opening)

The layout of this intersection has changed between pre-opening and post-opening on the eastern approach. The right turn lanes from Wattle Street onto Parramatta Road have been extended to full length lanes and separated from the through-lanes towards Frederick Street. Figure 4-12 illustrates Parramatta Road/Frederick Street/Wattle Street pre-opening of the M4 East.

Figure 4-12 Intersection of Parramatta Road/Frederick Street/Wattle Street prior to opening of M4 East



Imagery Source: Nearmap (pre-opening)

As described in Section 3.2, the increase in traffic volumes at this intersection during the post-opening scenario (2020) has been observed to be less than 5 percent compared to pre-opening volumes (2018). However, due to the crash history on Frederick Street it has been included in this assessment. Based on a review of available crash data for 12 months before and after the opening of the M4 East, 17 crashes occurred at this intersection pre-opening, with 9 crashes recorded post-opening.

Traffic volumes did not increase more than five percent from pre-opening volumes in 2019. No significant land use changes were observed to occur within the surrounding locality of the intersection between pre-opening and post-opening. Table 4-10 presents a performance summary of this intersection.

Table 4-10 Summary of performance at Parramatta Road/Frederick Street/Wattle Street

Parramatta Road/Frederick Street/Wattle Street – 2018 v 2020						
	Pre M4 East (2018)		Post M4 East (2020)		Difference	
	AM	PM	AM	PM	AM	PM
Traffic Volumes	6,212	6,831	5,333	5,559	-879	-1,272
Queue Length (m) Approach	364.9	419.2	180.8	156.8	-184.1	-262.4
	North-West	North-West	North-West	North-West		
Average Delay (sec)	65.8	59.0	54.5	61.4	-11.3	+2.4
Intersection LoS	LoS E	LoS E	LoS D	LoS E	▲	▬

Since the opening of the M4 East, overall performance at this intersection has improved during the AM peak and remained similar during the PM peak. It is noted that the intersection was operating close to capacity prior to opening, with a LoS E during the AM and PM peak periods.

Key changes in performance observed at this intersection are as follows:

- During the AM peak, average delays have decreased on all approaches. Traffic volumes on all approaches have reduced except for Frederick Street, likely due to vehicles on Parramatta

Road and Wattle Street bypassing this intersection via the M4 East. As Frederick Street does not have direct access to the M4 East and traffic volumes have decreased on all other approaches, additional green time has been allocated to this approach.

- During the PM peak, average delays have increased on Wattle Street and Frederick Street.
- Vehicle queue lengths have decreased on all approaches during the AM peak and increased on Wattle Street and Frederick Street during the PM peak.
- Based on a review of crash data for 12 months before and after the opening of the M4 East, 17 crashes occurred at this intersection pre-opening (three of which involved a pedestrian) and 9 crashes post-opening (none of which involved a pedestrian).

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4.10 Intersection 9 – Dobroyd Parade/Waratah Street

This is a four-way signalised intersection including a temporary access road. Dobroyd Parade facilitates travel north-east towards City-West Link Road and south-west through Haberfield. Waratah Street facilitates travel south-east through Haberfield. The temporary access road facilitates movement of WestConnex construction vehicles. Movement restrictions apply at this intersection. A pedestrian crossing is provided on the eastern approach of Dobroyd Parade. Figure 4-13 illustrates the intersection.

Figure 4-13 Intersection of Dobroyd Parade/Waratah Street



Imagery Source: Nearthmap (post-opening)

The layout of this intersection has changed between pre-opening and post-opening with the addition of a right turn lane from Dobroyd Parade (eastbound) onto Waratah Street and the reconfiguration of the temporary access road on the northern side of the intersection to be used by WestConnex construction vehicles only. Figure 4-14 illustrates Dobroyd Parade/Waratah Street pre-opening of M4 East.

Figure 4-14 Intersection of Dobroyd Parade/Waratah Street prior to opening of M4 East



Imagery Source: Nearmap (pre-opening)

The performance of this intersection has been assessed post-opening for 2019 and 2020 which saw an overall increase in traffic volumes by approximately 29 percent during the AM peak and 36 percent during the PM peak when compared to pre-opening volumes. No significant land use changes were observed to occur within the surrounding locality of the intersection between pre-opening and post-opening.

Table 4-11 presents a performance summary of this intersection.

Table 4-11 Summary of performance at Dobroyd Parade/Waratah Street (2018 v 2020)

Dobroyd Parade/Waratah Street – 2018 v 2020						
	Pre M4 East (2018)		Post M4 East (2020)		Difference	
	AM	PM	AM	PM	AM	PM
Traffic Volumes	2,927	3,419	3,765	4,647	+838	+1,228
Queue Length (m) Approach	217.4	339.2	93.6	109.1	-123.8	-230.1
	South-West	South-West	South-West	South-West		
Average Delay (sec)	12.3	13.4	26.7	15.8	+14.4	+2.4
Intersection LoS	LoS A	LoS A	LoS B	LoS B		

Note: The queue length reported for the south-west approach post-opening in the AM and PM peak is for Dobroyd Parade only; the M4 East off-ramp is separated from Dobroyd Parade at Waratah Street

Since the opening of the M4 East, overall performance at this intersection has degraded during the AM and PM peak periods. It is noted that two lanes on the south-western approach directly exit the M4 East tunnels which are separated from Dobroyd Parade at this intersection.

Key changes in performance observed at this intersection are as follows:

- Average delays have increased on all approaches during the AM peak with additional vehicles entering and exiting the M4 East.

- During the PM peak, the average delay has increased on the north-eastern approach on Dobroyd Parade. The LoS for Waratah Street has improved from a LoS F to LoS E due to a slight increase in green time. The north-eastern approach on Dobroyd Parade degraded from a LoS A to LoS B due to a reallocation of green time to the south-western approach to accommodate vehicles exiting the M4 East onto Dobroyd Parade. The western approach on Dobroyd Parade remained at LoS A due to the increased capacity.
- Vehicle queue lengths have increased on most approaches during the AM peak with additional vehicles entering and exiting the M4 East. Site observations have indicated that the queues on the south-west approach along Dobroyd Parade often extend into the M4 East tunnel portal. This is primarily due to queues from the Dobroyd Parade/Timbrell Drive/Mortley Avenue intersection extending to this intersection, resulting in reduced downstream capacity for the northbound through movements. During the PM, queue lengths have increased on most approaches, likely due to increased demand generated by the M4 East interchange immediately south-west of this intersection, except for the south-western approach on Dobroyd Parade
- Based on a review of crash data for 12 months before and after the opening of the M4 East, 1 crash occurred at this intersection pre-opening and 2 crashes post-opening.
- There have been record of several vehicles colliding with the pedestrian fence in the centre median of this intersection. Since the pedestrian crossing is in two phases, pedestrians regularly situated nearby the pedestrian fence in the centre median. This has caused for concern and further assessment as outlined in Section 6.

4.11 Intersection 10 – Dobroyd Parade/Timbrell Drive/Mortley Avenue

This is a four-way signalised intersection located north-east of the M4 East ramps and the intersection at Dobroyd Parade/Waratah Street. Dobroyd Parade facilitates travel towards City-West Link Road in the east and west through Haberfield. Timbrell Drive facilitates travel north towards Rodd Point. Mortley Avenue facilitates travel south through Haberfield. Movement restrictions apply at this intersection. Pedestrian crossings are provided on Timbrell Drive, Mortley Avenue and the western approach of Dobroyd Parade. Figure 4-15 illustrates the intersection.

Figure 4-15 Intersection of Dobroyd Parade/Timbrell Drive/Mortley Avenue



Imagery Source: Nearmap (post-opening)

The layout of this intersection has changed between pre-opening and post-opening through the provision of an additional eastbound through lane on Dobroyd Parade. Figure 4-16 illustrates Dobroyd Parade/Timbrell Drive/Mortley Avenue pre-opening of M4 East.

Figure 4-16 Intersection of Dobroyd Parade/Timbrell Drive/Mortley Avenue prior to opening of M4 East



Imagery Source: Nearthmap (pre-opening)

The performance of this intersection has been assessed post-opening for 2019 and 2020 which saw an overall increase in traffic volumes by approximately 6 percent during the AM peak and 20 percent during the PM peak when compared to pre-opening volumes. No significant land use changes were observed to occur within the surrounding locality of the intersection between pre-opening and post-opening.

Table 4-12 presents a performance summary of this intersection.

Table 4-12 Summary of performance at Dobroyd Parade/Timbrell Drive/Mortley Avenue

Dobroyd Parade/Timbrell Drive/Mortley Avenue – 2018 v 2020						
	Pre M4 East (2018)		Post M4 East (2020)		Difference	
	AM	PM	AM	PM	AM	PM
Traffic Volumes	4,471	4,721	4,732	5,662	+261	+941
Queue Length (m) Approach	341.2	460.0	517.4	290.2	+176.2	-169.8
	South-West	South-West	South-West	South-West		
Average Delay (sec)	39.5	51.7	72.5	41.7	+33.0	-10.0
Intersection LoS	LoS C	LoS D	LoS F	LoS C	▼	▲

Since the opening of the M4 East, overall performance at this intersection has degraded during the AM peak and improved during the PM peak.

Key changes in performance observed at this intersection are as follows:

- Average delays have increased on Timbrell Drive and the south-western approach of Dobroyd Parade during the AM peak. The LoS has degraded on these two approaches.

- During the PM peak, average delays have increased on Timbrell Drive and the south-eastern approach of Dobroyd Parade. The LoS for the south-western approach on Dobroyd Parade has improved from LoS F to LoS C through the provision of an additional approach lane
- Vehicle queue lengths have increased on the south-western approach on Dobroyd Parade during the AM peak. Site observations have indicated that queues often extend along this approach into the Dobroyd Parade/Waratah Street intersection. This is primarily due to downstream queuing, green time for right turn from Timbrell Drive towards Dobroyd Parade, and pedestrian movements at this intersection.
- During the PM peak, queue lengths have increased on Timbrell Drive and the south-eastern approach of Dobroyd Parade. There has been a significant increase in queue length on the north-eastern approach of Dobroyd Parade. This may be due to additional vehicles travelling on Dobroyd Parade towards the M4 East
- Based on a review of crash data for 12 months before and after the opening of the M4 East, 2 crashes occurred at this intersection pre-opening, increasing to 4 crashes post-opening.

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4.12 Intersection 11 – City-West Link Road/James Street

This is a four-way signalised intersection connecting the suburbs of Leichhardt, Lilyfield and Rozelle. City-West Link Road facilitates travel east towards the Sydney CBD and west towards Haberfield, Parramatta Road and the M4 East access ramps. James Street facilitates travel north through Lilyfield and south towards Leichhardt. Movement restrictions apply at this intersection. Pedestrian crossings are provided on both approaches of James Street and the western approach of City-West Link Road. Figure 4-17 illustrates the intersection.

Figure 4-17 Intersection of City-West Link Road/James Street



Imagery Source: Nearthmap (post-opening)

The layout of this intersection has remained consistent between pre-opening and post-opening of the M4 East. The performance of this intersection has been assessed post-opening for 2019 and 2020 which saw an overall increase in traffic volumes by approximately 3 percent during the AM peak and 8 percent during the PM peak when compared to pre-opening volumes. No significant land use changes were observed to occur within the surrounding locality of the intersection between pre-opening and post-opening.

Table 4-13 presents a performance summary of this intersection.

Table 4-13 Summary of performance at City-West Link Road/James Street

City-West Link Road/James Street – 2018 v 2020						
	Pre M4 East (2018)		Post M4 East (2020)		Difference	
	AM	PM	AM	PM	AM	PM
Traffic Volumes	4,531	5,353	4,655	5,791	+124	+438
Queue Length (m) Approach	206.8	218.3	109.4	467.4	-97.4	+249.1
	South	East	South	East		
Average Delay (sec)	31.0	33.3	51.9	36.3	+20.9	+3.0
Intersection LoS	LoS C	LoS C	LoS D	LoS C	▼	▬

Since the opening of the M4 East, overall performance at this intersection has degraded during the AM peak and remained similar during the PM peak.

Key changes in performance observed at this intersection are as follows:

- Average delays have marginally increased on the northern approach of James Street and significantly increased on the western approach of City-West Link Road during the AM peak. The LoS on the western approach of City-West Link Road degraded from LoS B to LoS F. This significant reduction in performance is likely due to increased demand on City-West Link Road from the M4 East. Green time has been reallocated from James Street to City-West Link Road, reducing the number of vehicles passing through the intersection from James Street.
- During the PM peak, average delays have reduced on James Street and increased on City-West Link. Similar to the AM peak, green time has been reallocated from James Street to City-West Link Road.
- Vehicle queue lengths have increased on City-West Link Road during the PM peak
- Based on a review of crash data for 12 months before and after the opening of the M4 East, 2 crashes occurred at this intersection pre-opening and post-opening.

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4.13 Intersection 12 – City-West Link Road/Norton Street

This is a four-way signalised intersection located immediately east of the intersection at City-West Link Road/James Street (Intersection 11). City-West Link Road facilitates travel east towards the Sydney CBD and west towards Haberfield. Norton Street facilitates travel north through Lilyfield and south towards Leichhardt. Movement restrictions apply at this intersection. Pedestrian crossings are provided on all approaches. Figure 4-18 illustrates the intersection.

Figure 4-18 Intersection of City-West Link Road/Norton Street



Imagery Source: Nearthmap (post-opening)

The layout of this intersection has remained consistent between pre-opening and post-opening. The performance of this intersection has been assessed post-opening for 2019 and 2020 which saw an overall increase in traffic volumes by approximately 7 percent during the AM peak and 5 percent during the PM peak when compared to pre-opening volumes. No significant land use changes were observed to occur within the surrounding locality of the intersection between pre-opening and post-opening.

Table 4-14 presents a performance summary of this intersection.

Table 4-14 Summary of performance at City-West Link Road/Norton Street

City-West Link Road/Norton Street – 2018 v 2020						
	Pre M4 East (2018)		Post M4 East (2020)		Difference	
	AM	PM	AM	PM	AM	PM
Traffic Volumes	4,469	5,395	4,792	5,672	+323	+277
Queue Length (m) Approach	214.5	355.9	216.7	615.6	+2.2	+259.7
	North	South	North	South		
Average Delay (sec)	29.9	32.2	31.4	53.5	+1.5	+21.3
Intersection LoS	LoS C	LoS C	LoS C	LoS D	=	▼

Since the opening of the M4 East, overall performance at this intersection has remained similar during the AM peak but degraded during the PM peak.

Key changes in performance observed at this intersection are as follows:

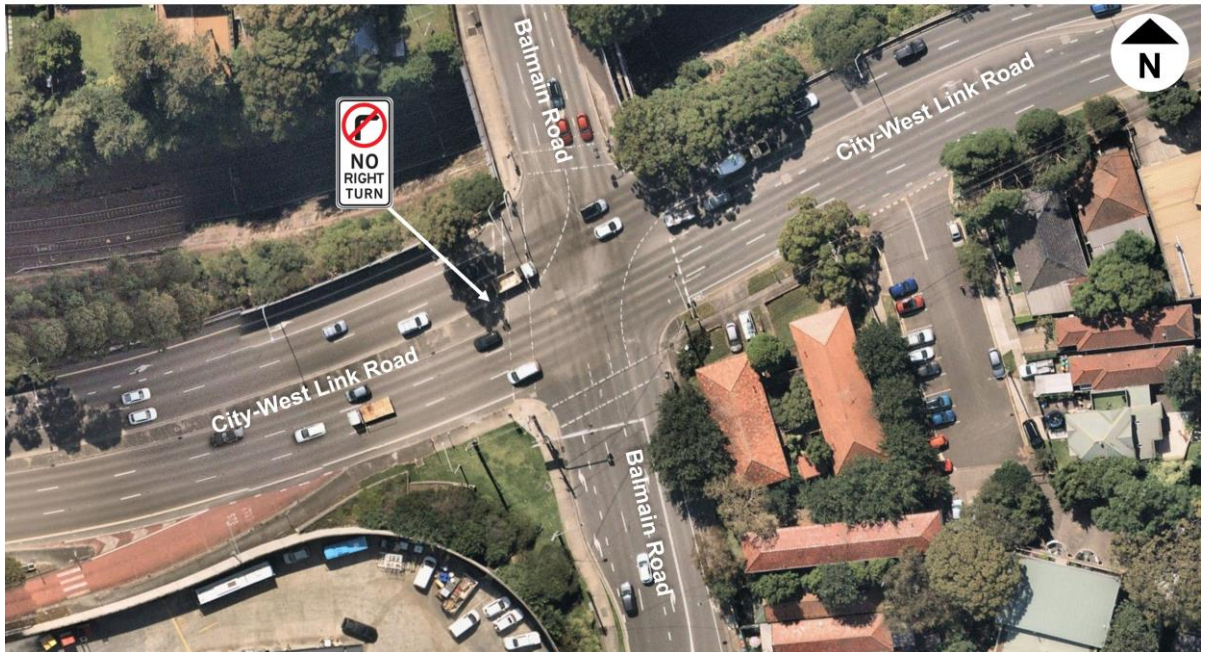
- Average delays have increased on Norton Street during the AM peak. This is likely due to green time reallocation from Norton Street to City-West Link Road to accommodate additional traffic generation from the M4 East. During the PM peak, average delays have increased on the south-eastern approach of City-West Link Road. The LoS for this approach has degraded from LoS C to LoS F, which may be due to additional vehicles using this approach to access the M4 East further west on Dobroyd Parade
- Vehicle queue lengths have increased on Norton Street during the AM peak. During the PM peak, queue lengths have increased on all approaches, with the exception of the north-western approach of City-West Link Road, and a significant increase was observed on the south-eastern approach of City-West Link Road.
- Based on a review of crash data for 12 months before and after the opening of the M4 East, 1 crash occurred at this intersection pre-opening and post-opening.

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4.14 Intersection 13 – City-West Link Road/Balmain Road

This is a four-way signalised intersection connecting the suburbs of Leichhardt, Lilyfield and Rozelle. City-West Link Road facilitates travel east towards the Sydney CBD and west towards Haberfield, Parramatta Road and the M4 East access ramps. Balmain Road facilitates travel north through Lilyfield and south towards Leichardt and Parramatta Road. Movement restrictions apply at this intersection. Pedestrian crossings are provided on both approaches of Balmain Road and the western approach of City-West Link Road. Figure 4-19 illustrates the intersection.

Figure 4-19 Intersection of City-West Link Road/Balmain Road









Imagery Source: Nearmap (post-opening)

The layout of this intersection has remained consistent between pre-opening and post-opening. The performance of this intersection has been assessed post-opening for 2019 which saw an overall increase in traffic volumes by approximately 14 percent during the AM peak and 2 percent during the PM peak when compared to pre-opening volumes. Traffic volumes did not increase more than 5 percent from pre-opening volumes in 2020. New warehouses were constructed between pre-opening and post-opening to the east of the intersection, near Catherine Street, however this land use change would be anticipated to have a minimal impact on the performance of this intersection.

Table 4-15 presents a performance summary of this intersection.

Table 4-15 Summary of performance at City-West Link Road/Balmain Road (2018 v 2019)

City-West Link Road/Balmain Road – 2018 v 2019						
	Pre M4 East (2018)		Post M4 East (2019)		Difference	
	AM	PM	AM	PM	AM	PM
 Traffic Volumes	4,680	5,926	5,357	6,041	+677	+115
 Queue Length (m) Approach	367.0	771.6	826.9	872.1	+459.9	+100.5
	West	West	West	West		
 Average Delay (sec)	32.9	65.2	64.6	78.6	+31.7	+13.4
 Intersection LoS	LoS C	LoS F	LoS E	LoS F		

Since the opening of the M4 East, overall performance at this intersection has degraded during the AM peak but remained similar during the PM peak. It is noted that the intersection was operating at capacity prior to opening during the PM peak with LoS F.

Key changes in performance observed at this intersection are as follows:

- Average delays have increased on Balmain Road during the AM peak. This is due to increased green time on both approaches of City-West Link Road to accommodate additional traffic generation from the M4 East.
- Vehicle queue lengths have increased on Balmain Road during the AM peak. During the PM peak, queue lengths have increased on the northern approach of Balmain Road and both approaches of City-West Link Road
- Based on a review of available crash data for 12 months before and after the opening of the M4 East, 3 crashes occurred at this intersection pre-opening, with 2 crashes recorded post-opening.

4.15 Intersection 14 – Parramatta Road/Dalhousie Street

This is a three-way signalised intersection located just east of the M4 East access ramps to/from Parramatta Road in Ashfield. Parramatta Road facilitates travel towards Holroyd in the west and Ultimo in the east. Dalhousie Street facilitates travel north into Haberfield. All movements are permitted at this intersection. Pedestrian crossings are provided on all approaches. Figure 4-20 illustrates the intersection.

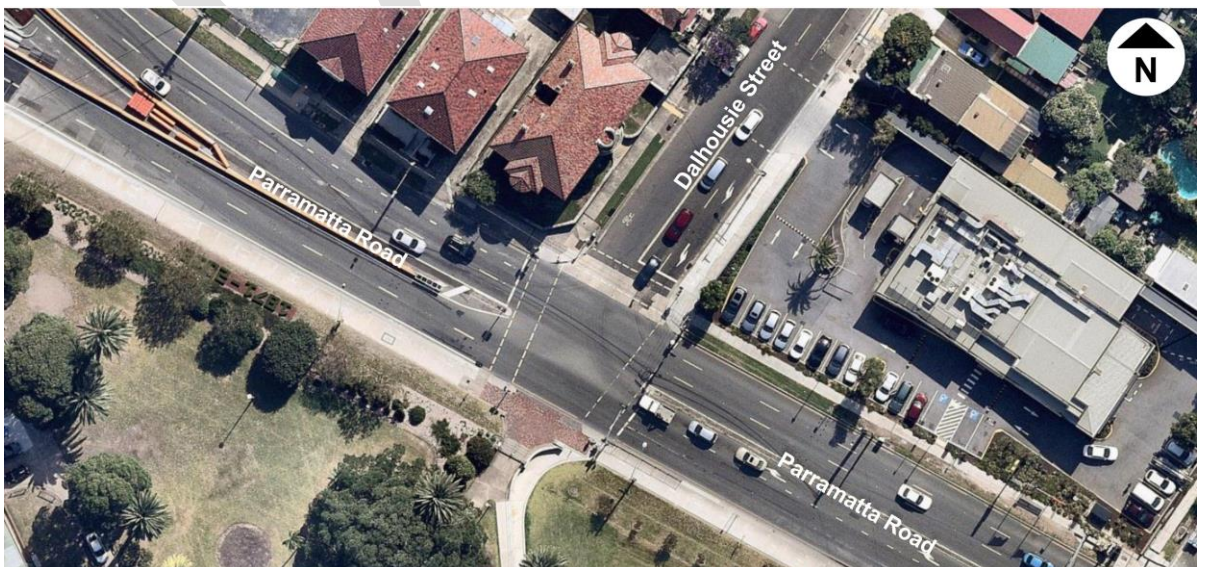
Figure 4-20 Intersection of Parramatta Road/Dalhousie Street



Imagery Source: Nearmap (post-opening)

The layout of this intersection has changed between pre-opening and post-opening on the eastern approach with the left through-lane marked for Parramatta Road or M4 East, and right through-lane marked for the M4 East only. On the western approach, the left through-lane has also been extended to a full-length lane, noting vehicles exit directly into the middle and right through-lanes immediately west of the intersection. Figure 4-21 illustrates Parramatta Road/Dalhousie Street pre-opening of M4 East for reference.

Figure 4-21 Intersection of Parramatta Road/Dalhousie Street prior to opening of M4 East







Imagery Source: Nearmap (pre-opening)

The performance of this intersection has been assessed post-opening for 2019 and 2020 which saw an overall increase in traffic volumes by approximately 26 percent during the AM peak and 33 percent during the PM peak when compared to pre-opening volumes. No significant land use changes were observed to occur within the surrounding locality of the intersection

Table 4-16 presents a performance summary of this intersection.

Table 4-16 Summary of performance at Parramatta Road/Dalhousie Street

Parramatta Road/Dalhousie Street – 2018 v 2020						
	Pre M4 East (2018)		Post M4 East (2020)		Difference	
	AM	PM	AM	PM	AM	PM
 Traffic Volumes	3,754	3,848	4,727	5,107	+973	+1,259
 Queue Length (m) Approach	334.7	319.4	426.6	525.6	+91.9	+206.2
	North-West	North-West	North-West	North-West		
 Average Delay (sec)	29.2	26.3	37.3	38.0	+8.1	+11.7
 Intersection LoS	LoS C	LoS B	LoS C	LoS C	=	▼

Since the opening of the M4 East, overall performance at this intersection has remained similar during the AM peak but reduced during the PM peak.

Key changes in performance observed at this intersection are as follows:

- Average delays have increased on all approaches during the AM peak due to notable increases in traffic volumes, likely due to additional vehicles using Parramatta Road to access the M4 East immediately north-west of this intersection.
- Signal cycle lengths have been adjusted to provide additional green time for Parramatta Road which provides direct access to the M4 East. The LoS on the north-west approach of Parramatta Road has reduced from LoS C to LoS D.
- During the PM peak, average delays have increased on all approaches. The north-west approach of Parramatta Road has degraded from LoS B to C, while Dalhousie Street has degraded from LoS C to E.
- Vehicle queue lengths have increased on all approaches during the AM and PM peak periods. Site observations have indicated that the queues on the north-west approach along Parramatta Road often extend into the M4 East tunnel portal. This is likely due to queuing back to Dalhousie Street from the right-turn lane at Parramatta Road/Liverpool Road intersection. This has been observed to occur during the AM and PM peaks, resulting in reduced downstream capacity for the eastbound through movements, thereby resulting in queues extending until the tunnel portals.
- Based on a review of crash data for 12 months before and after the opening of the M4 East, no crashes occurred at this intersection pre-opening. Five crashes were recorded post-opening.
- Based on observations, there have been several near misses reported between vehicles exiting the M4 East tunnel portals and pedestrians crossing at Dalhousie Street to and from Ashfield Park. There is low visibility of drivers exiting the tunnel (unable to see the pedestrian crossing beyond the crest in the road), coupled with the proximity of the pedestrian crossing to the tunnel portal exits has caused concerns for pedestrian safety at this intersection.

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4.16 Intersection 15 – Parramatta Road/Liverpool Road

This is a three-way signalised intersection connecting the A22 (also known as Hume Highway) with Parramatta Road. Parramatta Road facilitates travel north-west towards Holroyd and south-east towards Ultimo. Liverpool Street (Hume Highway) facilitates travel towards Liverpool and is a key west-east connection. All movements are permitted at this intersection. Pedestrian crossings are provided on Liverpool Road and the western approach of Parramatta Road. Figure 4-22 illustrates the intersection.

Figure 4-22 Intersection of Parramatta Road/Liverpool Road



Imagery Source: Nearthmap (post-opening)

The layout of this intersection has remained consistent between pre-opening and post-opening. The performance of this intersection has been assessed post-opening for 2019 and 2020 which saw an overall increase in traffic volumes by approximately 20 percent during the AM peak and 18 percent during the PM peak when compared to pre-opening volumes. No significant land use changes were observed to occur within the surrounding locality of the intersection

Table 4-17 presents a performance summary of the existing site.

Table 4-17 Summary of performance at Parramatta Road/Liverpool Road

Parramatta Road/Liverpool Road – 2018 v 2020						
	Pre M4 East (2018)		Post M4 East (2020)		Difference	
	AM	PM	AM	PM	AM	PM
Traffic Volumes	4,211	4,889	5,058	5,778	+847	+889
Queue Length (m) Approach	286.3	305.3	402.3	363.5	+116.0	+58.2
	South-East	South-East	South-East	South-East		
Average Delay (sec)	29.2	32.1	40.5	31.0	+11.3	-1.1
Intersection LoS	LoS C	LoS C	LoS C	LoS C	=	=

Since the opening of the M4 East, overall performance at this intersection has remained similar during the AM and PM peak periods.

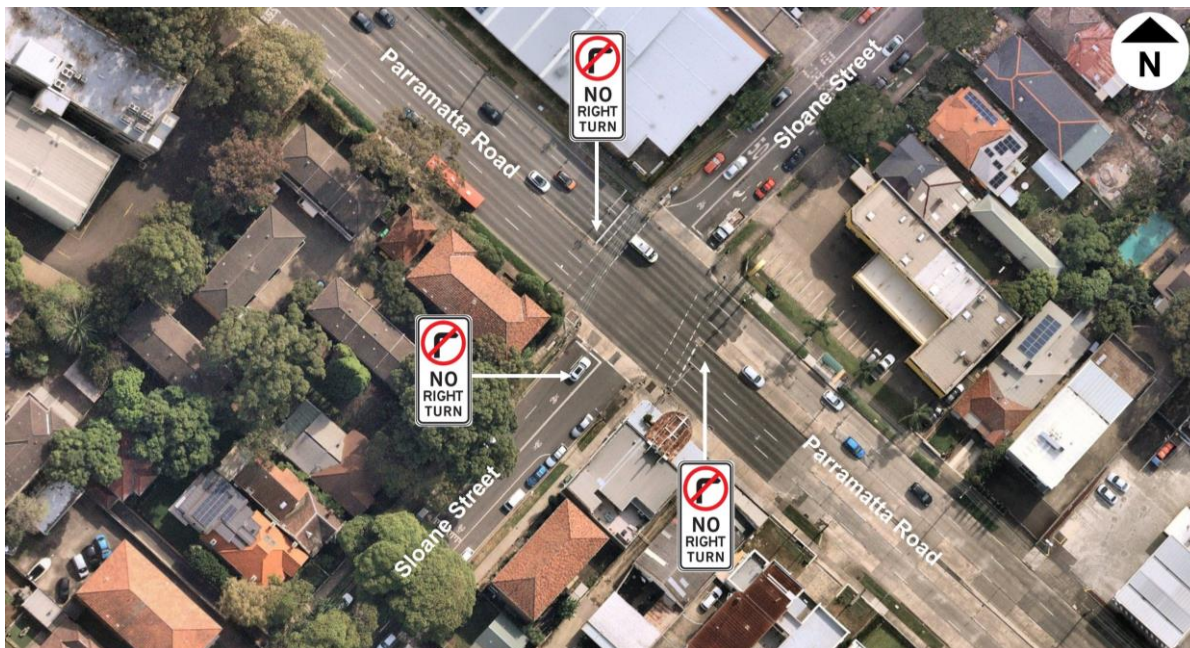
Key changes in performance observed at this intersection are as follows:

- Average delays have increased on all approaches during the AM peak. Additional green time is provided to Parramatta Road at Dalhousie Street (Intersection 14) further north to accommodate additional vehicles entering and exiting the M4 East, however green time and signal timing for vehicles on Parramatta Road at Liverpool Street has remained relatively similar to pre-opening conditions. Despite this, the LoS has remained the same on the western approach of Parramatta Road with LoS B, degrading from LoS B to LoS C on the eastern approach.
- It is noted that the right-turn movement from Parramatta Road onto Liverpool Road experiences considerable delays, worsening post-opening of the M4 East. Liverpool Road has also degraded from LoS E to LoS F with left turning vehicles more than doubling; this is likely due to vehicles using Parramatta Road to access the M4 East entrance further north-west.
- Vehicle queue lengths have increased on all approaches during the AM peak.
- During the PM peak, average delays have decreased on the eastern approach due to a reallocation of green time to Parramatta Road, whilst slightly increasing on the western approach. The LoS on the western approach of Parramatta Road degraded from LoS B to LoS C. Liverpool Street maintains a LoS E due to a decrease in right-turning vehicles while vehicles turning left towards the M4 East increased.
- During the PM peak, queue lengths have increased on both approaches of Parramatta Road and Liverpool Road.
- Site observations have also indicated that during the AM and PM peaks, right turn vehicles on the western approach of Parramatta Road often overflow into the through lanes resulting in longer queues and reduced capacity for the eastbound through vehicles along Parramatta Road, resulting in the safety issue of through-moving vehicles weaving across.
- Based on a review of crash data for 12 months before and after the opening of the M4 East, 2 crashes occurred at this intersection pre-opening and post-opening.

4.17 Intersection 16 – Parramatta Road/Sloane Street

This is a four-way signalised intersection located just east of Parramatta Road/Liverpool Street. Parramatta Road facilitates travel north-west towards Holroyd and south-east towards Ultimo. Sloane Street facilitates travel north-east towards Haberfield and south-west towards Summer Hill. Movement restrictions apply at this intersection. Pedestrian crossings are provided on all approaches. Figure 4-23 illustrates the intersection.

Figure 4-23 Intersection of Parramatta Road/Sloane Street



Imagery Source: Nearmap (post-opening)

The layout of this intersection has remained consistent between pre-opening and post-opening. The performance of this intersection has been assessed post-opening for 2019 and 2020 which saw an overall increase in traffic volumes by approximately 16 percent during the AM peak and 21 percent during the PM peak when compared to pre-opening volumes. No significant land use changes were observed to occur within the surrounding locality of the intersection between pre-opening and post-opening.

Table 4-18 presents a performance summary of this intersection.

Table 4-18 Summary of performance at Parramatta Road/Sloane Street

Parramatta Road/Sloane Street – 2018 v 2020						
	Pre M4 East (2018)		Post M4 East (2020)		Difference	
	AM	PM	AM	PM	AM	PM
Traffic Volumes	4,145	4,682	4,809	5,666	+664	+984
Queue Length (m) Approach	170.6	137.1	179.0	139.1	+8.4	+2.0
	North-West	North-West	North-West	North-West		
Average Delay (sec)	13.6	13.4	15.1	14.6	+1.5	+1.2
Intersection LoS	LoS A	LoS A	LoS B	LoS B		

Since the opening of the M4 East, overall performance at this intersection has marginally degraded during the AM and PM peak periods.

Key changes in performance observed at this intersection are as follows:

- During the AM peak, average delays have increased on all approaches. The LoS on the south-western approach on Sloane Street degraded from LoS E to LoS F due to increased priority for Parramatta Road to support additional traffic generation from the M4 East.
- During the PM peak, average delays have increased on all approaches, except for the north-west approach on Parramatta Road. The LoS for both approaches of Sloane Street has degraded due to increased priority of Parramatta Road to support traffic generated by the M4 East
- Vehicle queue lengths have increased on all approaches during the AM and PM peak periods, with the exception of the north-west approach on Parramatta Road which only increased during the PM peak
- Based on a review of crash data for 12 months before and after the opening of the M4 East, 2 crashes occurred at this intersection pre-opening, with 4 crashes recorded post-opening.

4.18 Additional intersections

Traffic analysis was undertaken for additional intersections within Haberfield, Ashfield and Leichardt to assess potential locations requiring interventions or upgrades. A total of 11 intersections were assessed using the same assessment criteria detailed in Section 3.2. These are:

- Paramatta Road / Tebbutt Street
- Paramatta Road / West Street / Flood Street
- Tebbutt Street / Hathern Street
- Ramsay Street / Wattle Street
- James Street / Lilyfield Road
- Lilyfield Road / Norton Street
- Darley Road / Charles Street
- William Street / Charles Street
- Norton Street / William Street
- Lilyfield Road / Balmain Road
- Hume Highway / Carlton Cres

Of the 11 intersections assessed, 7 intersections saw overall increases in traffic volumes greater than 5% of pre-opening volumes in either 2019 or 2020, all of which are located within the study area for the M4 East RNPRP (as discussed in Section 3.2):

- James Street/ Lilyfield Road (A1)
- Norton Street/ Lilyfield Road (A2)
- Norton Street/ William Street (A3)
- Hume Highway/ Carlton Crescent (A4)

- Tebbutt Street/ Hathern Street (A5)
- Parramatta Road/ Tebbutt Street (A6)
- Parramatta Road/ West Street (A7)

Key findings during the AM peak include:

- Average delays reduced or remained similar to pre-opening levels at all sites during both 2019 and 2020, with the exception of James Street/ Lilyfield Road where the average delay increased.
- Queue lengths increased at Tebbutt Street/ Hathern Street and James Street Lilyfield Road in 2019, reducing or remaining similar to pre-opening at the remaining sites.
- In 2020, queue lengths reduced or remained similar to pre-opening at all sites.

Key findings during the PM peak include;

- Average delays decreased or remained the same or similar at all sites in both 2019 and 2020, with the exception of Parramatta Road/ Tebbutt Street where average delay increased.
- Queue lengths increased Parramatta Road/ West Street in both 2019 and 2020
- Queue lengths reduced or remained similar to pre-opening at all other sites for both years.

DRAFT

5. Travel time performance

5.1 General traffic

Analysis of vehicle travel speeds along Parramatta Road was undertaken for both pre-opening and post-opening scenarios. Travel time data was sourced from HERE technologies, which provides GPS based movement metrics for the weekday periods in March 2018 representing pre-opening conditions, and in August 2020 representing post-opening conditions.

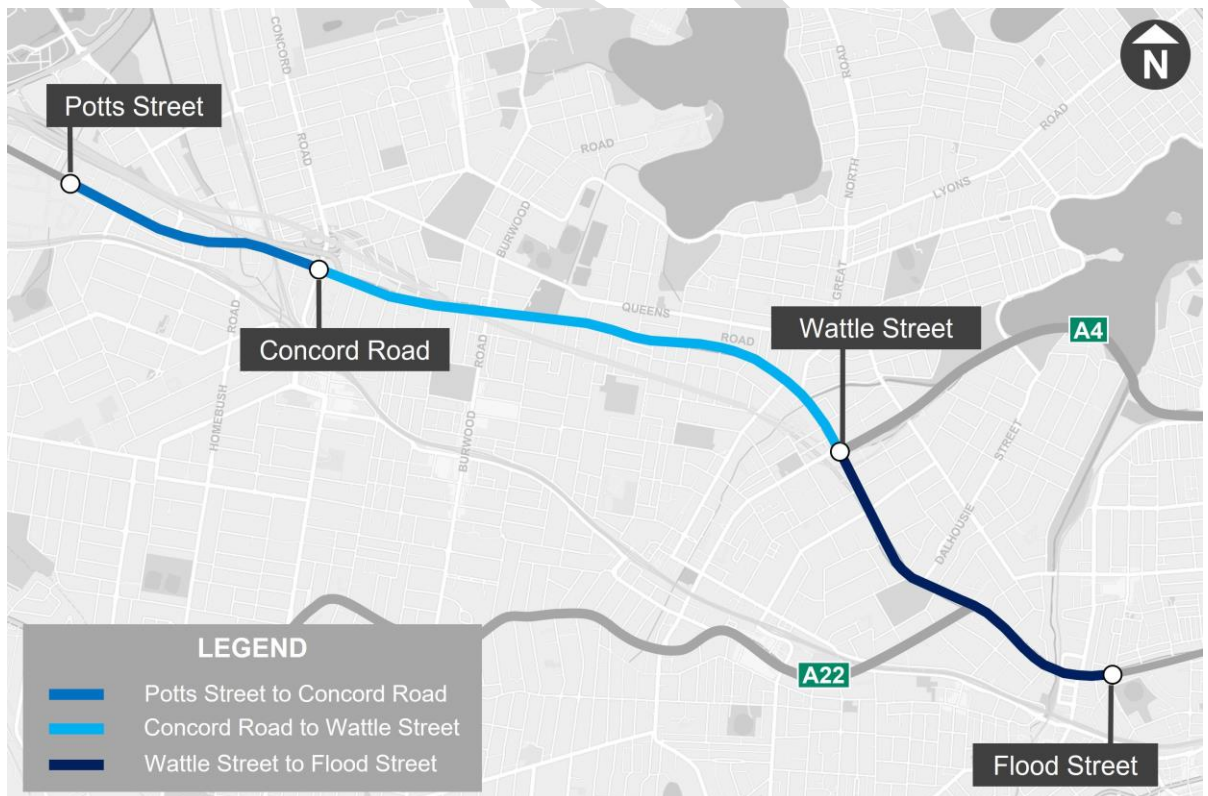
Travel times on Parramatta Road were assessed in three segments, between Potts Street and Flood Street, encompassing the extent of the M4 East RNPRP as presented in Figure 5-1. The assessed travel time data is reflective of typical traffic conditions experienced by vehicles on the corridor including cars, heavy vehicles and buses.

The following segments of Parramatta Road were assessed between:

- Potts Street and Concord Road
- Concord Road and Wattle Street
- Wattle Street and Flood Street

Travel speeds from September 2019 were also assessed for reference conditions without the impact of the COVID-19 pandemic and is provided in Appendix C.

Figure 5-1 Assessed travel time segments

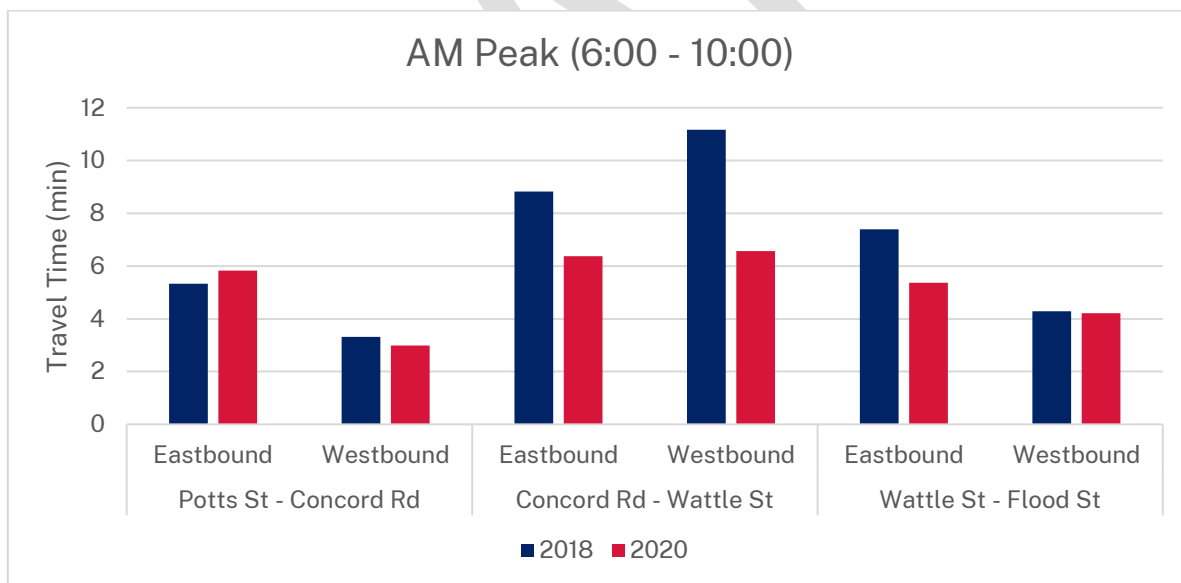


5.1.1 Parramatta Road - AM Peak

Figure 5-2 presents a comparison of the pre-opening and post-opening average travel time during a typical weekday morning (6-10am) in both directions on Parramatta Road between Potts Street and Flood Street. The key observations are noted below:

- Overall, travel times reduced on Parramatta Road by approximately 11 minutes in the eastbound direction and 9 minutes westbound, for the full assessed length of the corridor, between Potts Street and Flood Street. This is likely due to the opening of the M4 East, which has resulted in reduction in traffic volumes on the corridor by providing a faster competing route for drivers.
- Travel times on the western segment, between Potts Street and Concord Road remain relatively similar between 2018 and 2020 in the westbound direction. However, travel times increased by approximately 3 minutes in the eastbound direction post opening.
- Substantial decrease in travel time between Concord Road and Wattle Street of approximately 8 minutes eastbound and 16 minutes westbound.
- In the eastern segment, between Wattle Street and Flood Street, travel time decrease by approximately 6 minutes in the eastbound direction, while increasing by 6 minutes westbound. The increase in travel time in the westbound direction largely occurs between Flood Street and the tunnel portals and is likely due to increased eastbound right turning traffic from Parramatta Road onto Liverpool Road. This in turn, reduce the amount of phase time allocated to the opposing westbound movement on Parramatta Road at the Liverpool Road intersection.

Figure 5-2 Average travel times on Parramatta Road in the AM peak



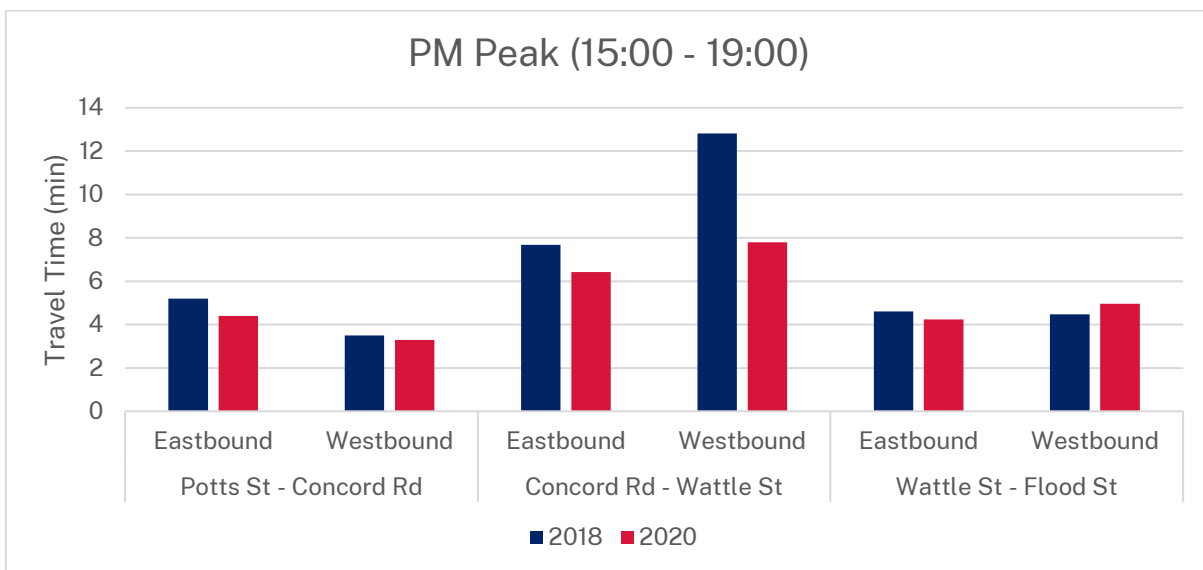
5.1.2 Parramatta Road - PM Peak

Figure 5-3 presents a comparison of the pre-opening and post-opening average travel time during a typical weekday afternoon/evening in both directions on Parramatta Road between Potts Street and Flood Street. They key observations are noted below:

- A total travel time reduction of approximately 8 minutes in the eastbound direction and 23 minutes in the westbound direction, noting that the westbound is the peak direction of travel in the evening associated with return to home journeys.
- The section between Concord Road and Wattle Street in the westbound direction experienced the largest reduction in travel time, likely due to the opening of the M4 East which provide an alternative route for motorists.

- The eastern segment between Wattle Street and Flood Street experienced an increase in travel time of approximately 5 minutes similar to the AM peak, in both directions.

Figure 5-3 Average travel times on Parramatta Road in the PM peak



5.2 Bus performance analysis

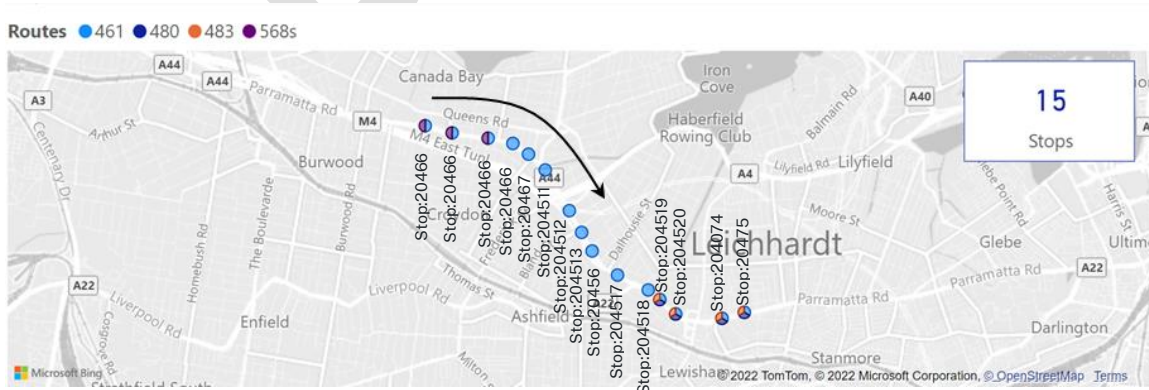
Analysis of bus performance along Parramatta Road was undertaken to determine the potential impacts due to the opening of the M4 East. Bus travel time data was analysed for the weekday periods in March 2018 representing pre-opening conditions, and in August 2020 representing post-opening conditions. Bus travel time from September 2019 were also assessed for reference conditions without the impact of the COVID-19 pandemic.

Travel times are presented for the segments between individual bus stops in each direction on Parramatta Road during the AM and PM peak periods. A comparison of 2018 and 2019 travel times is provided in Appendix D.

5.2.1 Parramatta Road – Eastbound

Figure 5-4 illustrates the eastbound bus stop locations within the study area, between Burwood Road and Norton Street. There are no bus routes that travel west of Burwood Road on Parramatta Road within the RNPRP study area, except for Night Ride replacement services.

Figure 5-4 Eastbound bus stop locations and bus routes on Parramatta Road

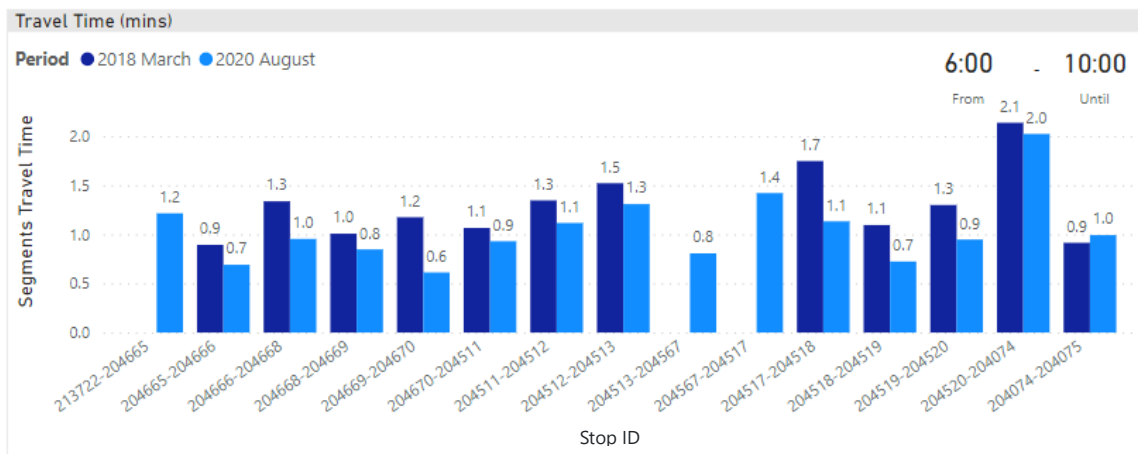


Note: Bus travel times and travel speeds are presented from west to east

Figure 5-5 presents a comparison of the pre-opening and post-opening bus travel times in the eastbound direction along Parramatta Road during the AM peak between 6am and 10am. The

assessments indicate that eastbound bus travel times during the AM peak have generally improved across most segments, indicating improve performance through the corridor. Travel time savings are generally with the range of 5 to 35 seconds (0.1 to 0.6 minutes) per segment, with a travel time saving of approximately 3 minutes and 20 seconds across the assessed stops.

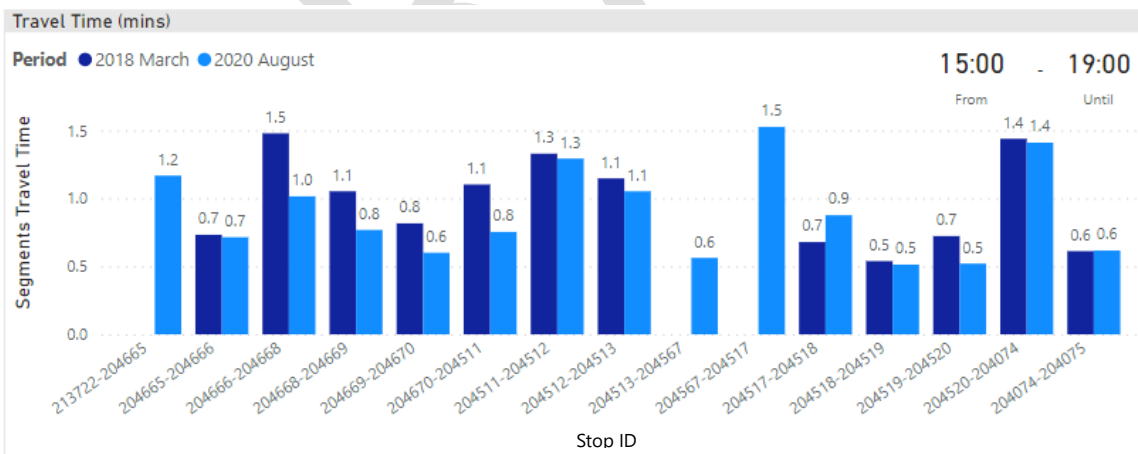
Figure 5-5 Comparison of eastbound bus travel times on Parramatta Road (AM peak)



Note: Travel time data was missing or incomplete on three-segments assessed in 2018. Average changes in travel time were taken from segments with 2018 and 2020 data only.

Figure 5-6 presents a comparison of the pre-opening and post-opening bus travel times in the eastbound direction along Parramatta Road during the PM peak between 6am and 10am. The assessments indicate that eastbound bus travel times during the PM peak have generally improved slightly across most stops, with stop-to-stop travel time savings of approximately of 10 to 30 seconds. In total, travel times have reduced by approximately 1 minute and 20 seconds across the assessed stops, with a larger proportion of travel time savings experienced on the western section of the corridor, west of Liverpool Road.

Figure 5-6 Comparison of eastbound bus travel times on Parramatta Road (PM peak)



Note: Travel time data was missing or incomplete on three-segments assessed in 2018. Average changes in travel time were taken from segments with 2018 and 2020 data only.

5.2.2 Parramatta Road – Westbound

Figure 5-7 illustrates the bus stop locations and bus routes using the westbound segments assessed, between Burwood Road and Norton Street. As noted previously, there are currently no bus routes that travel west of Burwood Road on Parramatta Road within the RNPRP study area, except for Night Ride replacement services.

Figure 5-7 Westbound bus stop locations and bus routes on Parramatta Road

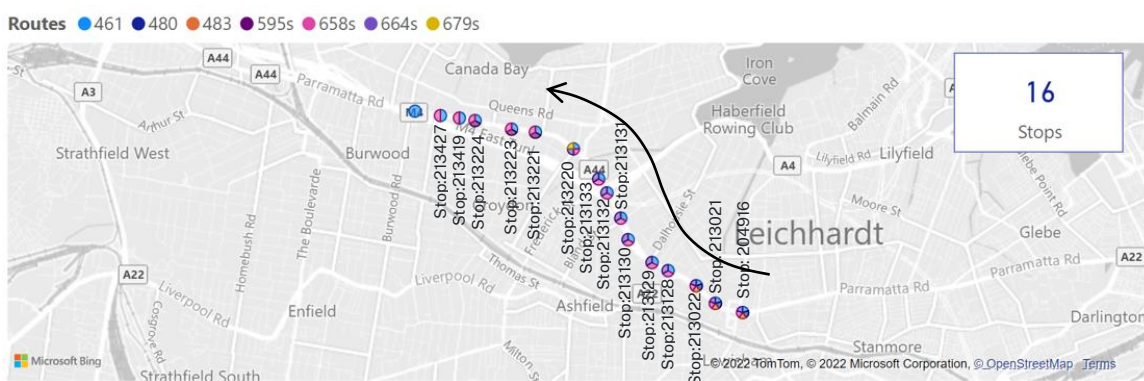
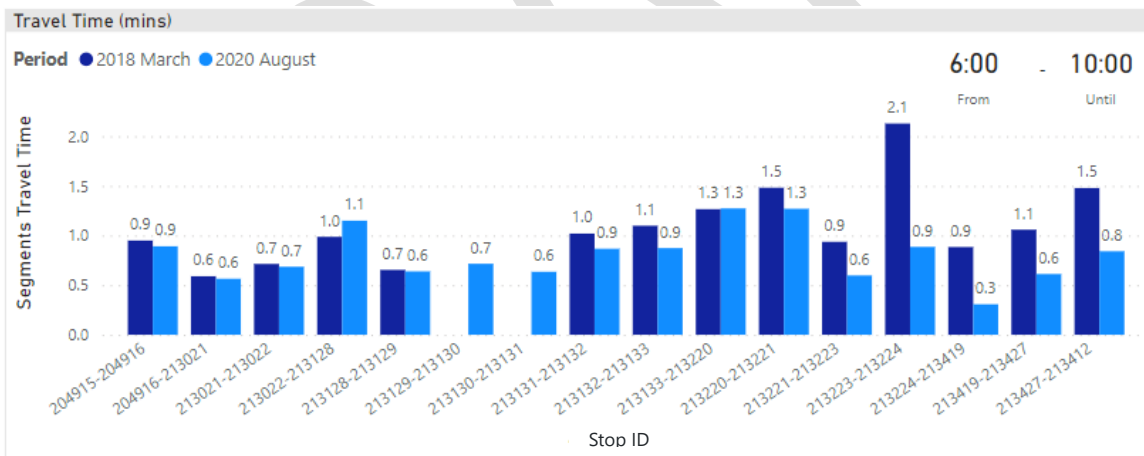


Figure 5-8 presents a comparison of the pre-opening and post-opening bus travel times in the westbound direction along Parramatta Road during the AM peak between 6am and 10am. The assessments indicate that eastbound bus travel times during the AM peak have generally improved between Burwood Road and Frederick Steet/ Wattle Street, with travel time savings of up to a minute per segment. This accumulates to a total travel time saving of approximately 3 minutes and 40 seconds.

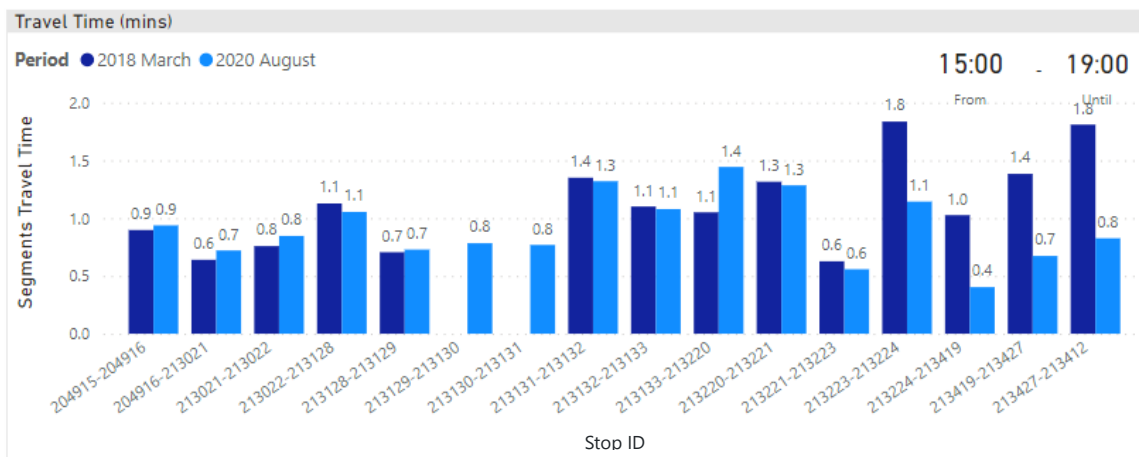
Figure 5-8 Comparison of westbound bus travel times on Parramatta Road (AM peak)



Note: Travel time data was missing or incomplete on two-segments assessed in 2018. Average changes in travel time were taken from segments with 2018 and 2020 data only. Bus travel times and travel speeds are presented from east to west

Figure 5-9 presents a comparison of the pre and post opening bus travel times in the westbound direction along Parramatta Road during the PM peak between 3pm and 7pm. The assessments indicate that eastbound bus travel have generally remained similar or improved in some segments, with travel time savings of up to a minute per segment. The majority of time-savings were observed further west on Parramatta Road, with a total travel time saving of approximately 3 minutes.

Figure 5-9 Comparison of westbound bus travel times on Parramatta Road (PM peak)



Note: Travel time data was missing or incomplete on two-segments assessed in 2018. Average changes in travel time were taken from segments with 2018 and 2020 data only.

5.2.3 Summary

The above analysis indicates that bus travel times have generally improved on Parramatta Road for most stop-to-stop segments in each direction, across the weekday peak periods. Bus travel times have generally reduced in the range of 1 to 4 minutes, with most of these savings experienced on the western section of the corridor, west of Liverpool Road. This is likely associated with the reductions in traffic volumes in these segments associated with the opening of the M4 East. Since the travel time for buses along the corridor have been improved, and the assessment has not identified any significant impact to bus operations due to the opening of the M4 East, bus priority measures have not been proposed as part of this report.

In comparison, the analysis of general traffic travel times presented in Section 5.1 indicated a greater extent of travel time savings of 10 – 20 minutes on Parramatta Road. This is because the general traffic analysis encompasses a longer section of Parramatta Road (noting there no standard services that continue to travel west of Burwood Road on Parramatta Road) and bus stopping patterns and dwell times.

6. Road safety performance

Crash data was reviewed along key road corridors within the study area to assess road safety performance for the 12-months pre-opening and post-opening of the M4 East. Crash data was also reviewed between 2016 and 2018 to determine if the trends during the period assessed were generally consistent with previous years.

6.1 Parramatta Road

Road safety performance along Parramatta Road between Centenary Drive in Homebush West and Flood Street in Leichhardt demonstrated an overall improvement with the opening of the M4 East project, with crash analysis indicating an overall reduction of 15% in crashes when comparing the time periods 12 months prior to and post-opening. The reduction in the number of crashes along Parramatta Road corresponds to an overall decrease in traffic volumes along most sections of Parramatta Road before and after the opening of M4 East.

Crash trends along Parramatta Road within this period include:

- A total of 93 crashes occurring during the 12 months pre-opening of the M4 East, including one fatality.
- A total of 79 crashes occurring during the 12 months post-opening of the M4 East.
- The most common type of crash was rear end crashes accounting for 38% and 34% of overall crashes before and after opening respectively, followed by lane-changing or sideswiping incidents accounting for 15% and 10% of all crashes respectively.
- A reduction in pedestrian related crashes with 5 pedestrian related incidents before the M4 East opening compared to 4 incidents post-opening.

The intersection of Parramatta Road/ Frederick Street/ Wattle Street was previously identified by Transport as a safety concern. Between pre-opening and post-opening, crashes at this location have reduced from 4 to 3. There is no clear correlation between the types of crashes at this intersection. Traffic volumes on Parramatta Road at this location reduced by 21% for travel towards the City and 25% towards Parramatta during the AM peak, reducing by 38% for travel towards the city and 12% towards Parramatta in the PM peak.

Overall crashes have either reduced or remained the same along Parramatta Road, with the exception of:

Parramatta Road/Dalhousie Street intersection

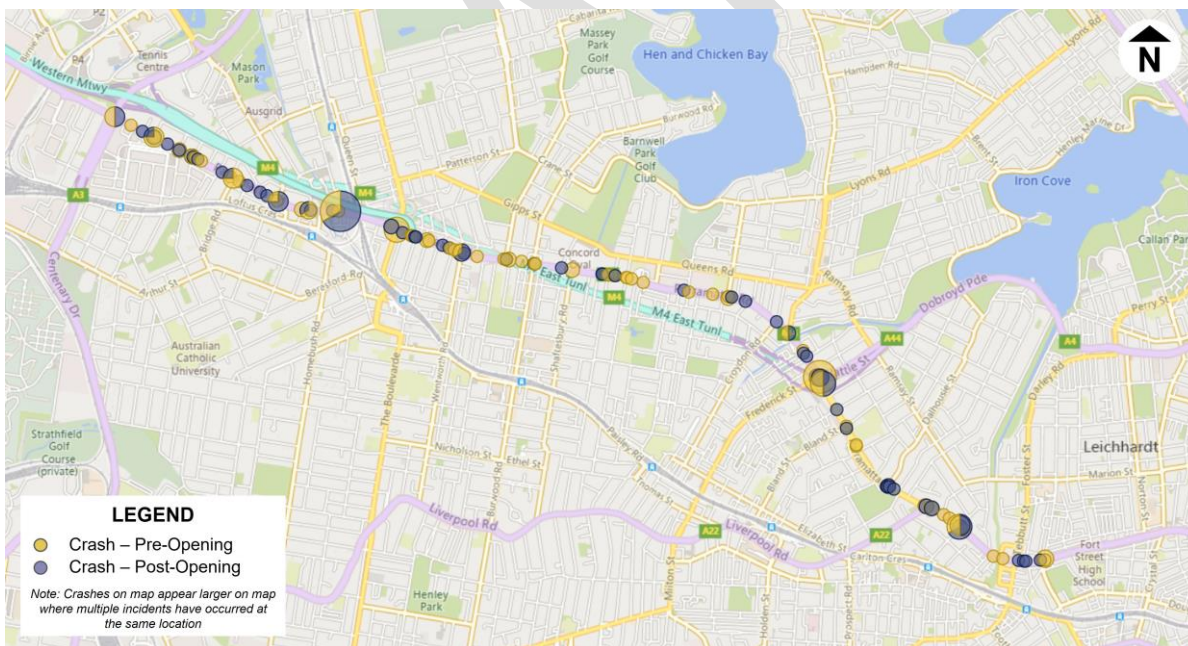
- During the 12 months prior to opening, there were zero recorded crashes at the location. Post-opening, 5 crashes were recorded, notably higher than crash data for previous years (2016 and 2017) where a maximum of 2 crashes were recorded per year. The nature of crashes at this location varied and did not show a discernible pattern including one lane sideswipe, one rear end crash, one avoiding vehicle, and one proceeding in lane. The appearance of the cluster of crashes post M4 East opening may be attributed to the marked increase in traffic volumes at this intersection, with a 21% increase in intersection volumes post M4 East opening compared to pre-opening. The intersection is located close to the M4 East ramps, near high volumes of merging vehicles.
- No incidents involving pedestrians occurred during the 12 months pre-and post-opening, however there have been several near miss occurrences. Based on observation from Transport, there have been several near miss incidents between vehicles exiting the M4 East tunnel portals and pedestrians crossing at Dalhousie Street to and from Ashfield Park. There

is low visibility of drivers exiting the tunnel (unable to see the pedestrian crossing beyond the crest in the road), coupled with the proximity of the pedestrian crossing to the tunnel portal exits has caused concern for pedestrian safety at this intersection.

- Parramatta Road/Sloane Street intersection** – during the 12 months pre-opening, there were 2 recorded crashes at the location, consistent with crash data for previous years (2016 and 2017). Post-opening, 4 incidents occurred, of which all were rear-end crashes. This intersection is located further south-east of Dalhousie Street and has experienced similar increases in traffic volumes.
- Parramatta Road between Tebbutt Street/ Old Canterbury Road and Flood Street** – during the 12 months pre-opening, there were no recorded crashes on this segment, lower than previous years where a maximum of 3 incidents occurred (2017). Post-opening, 4 incidents occurred within this segment. No incidents involving pedestrians occurred during the 12 months pre or post-opening. Traffic volumes on Parramatta Road at Tebbutt Street/ Old Canterbury Road increased by 111 vehicles (1.8%) and 498 vehicles (13.1%) post-opening during the AM and PM peak periods respectively. There is no clear correlation between the cause of each crash; it is also unlikely that this can be directly attributed to the opening of the M4 East given it is over 1km away from the tunnel entrance on Parramatta Road.

Figure 6-1 illustrates crash locations during the 12 months pre-and post-opening on Parramatta Road between Centenary Drive in Homebush West and Flood Street in Leichhardt.

Figure 6-1 Crash locations on Parramatta Road



6.2 Frederick Street, Wattle Street, Dobroyd Parade and City-West Link Road

Frederick Street, Wattle Street, Dobroyd Parade and City-West Link Road form the north-east/south-west corridor travelling perpendicularly to Parramatta Road. Road safety performance remained consistent along this corridor between John Street in Ashfield and Balmain Road in Leichardt, with the number of overall crashes remaining similar when comparing the time periods 12 months prior to and following the opening of the M4 East.

Frederick Street has been previously identified as a location of concern by Transport. Between John Street and Parramatta Road, 2 crashes were recorded pre-opening, increasing to 6 crashes

post-opening. There is no clear correlation between the types of crashes on this road. On Frederick Street, during the AM peak, traffic volumes have remained similar to pre-opening levels for travel towards Hume Highway and increased by 222 vehicles (22%) towards City-West Link Road. During the PM peak, traffic volumes decreased by 89 vehicles (8%) for travel towards Hume Highway and increased by 136 vehicles (14%) towards City-West Link Road.

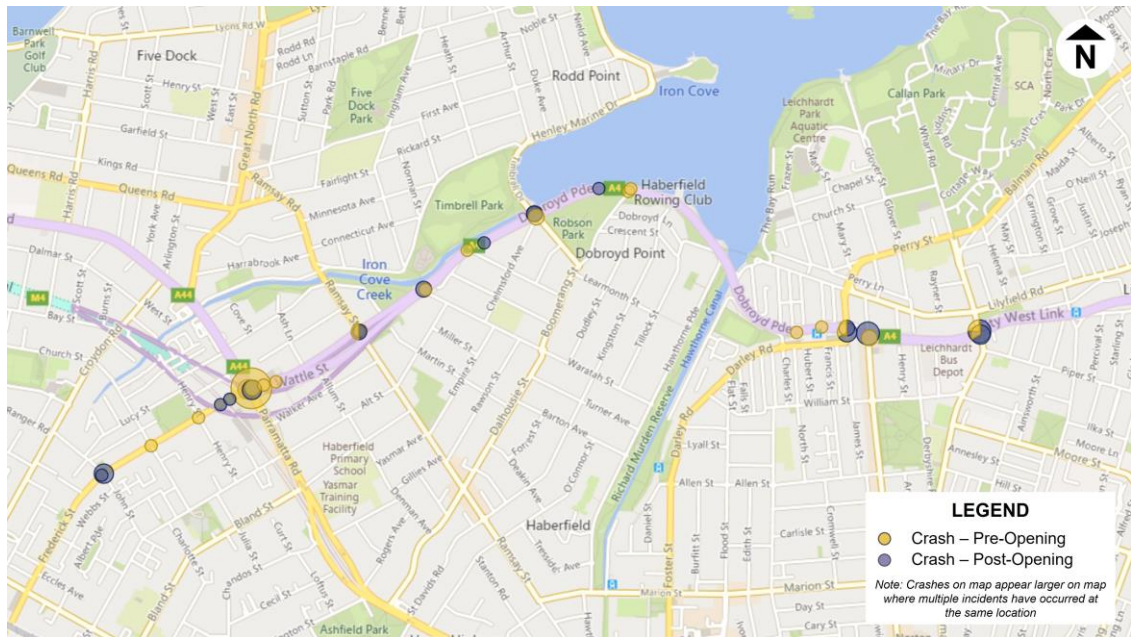
In early 2022, a fatal crash involving a pedestrian occurred at the intersection of Frederick Street and John Street. The incident occurred outside of peak times and unlikely to be related to the M4 East. Transport is conducting a separate road safety assessment of Frederick Street to identify potential measures to improve safety of the corridor

Crash trends along this corridor between John Street, Ashfield and Balmain Road, Leichardt include:

- A total of 35 crashes occurred during the 12 months pre-opening of the M4 East, including one fatality.
- A total of 34 crashes also occurred during the 12 months post-opening of the M4 East, with no fatalities.
- The most common type of crash was rear end crashes accounting for 38% of overall crashes before and after opening, followed by cross traffic incidents accounting for 12% and 18% of all crashes respectively.
- The number of pedestrian related incidents reduced with three pedestrian related crashes occurring before the M4 East opening and one occurring post-opening. Pre-opening, all incidents occurred at Parramatta Road/Frederick Street/Wattle Street; post-opening, the one incident occurred at Frederick Street/John Street
- Crashes occur at a higher frequency at the large intersections of Parramatta Road/Frederick Street/Wattle Street and City-West Link Road/Balmain Road, due to various causes, but is otherwise distributed along the corridor without great concentration at other locations.
- At the intersection of Parramatta Road/Frederick Street/Wattle Street, there were 17 crashes pre-opening, consistent with the number of crashes occurring in previous years (2016 and 2017); this significantly reduced to 9 crashes post-opening, likely due to a reduction in traffic volumes.

Figure 6-2 illustrates crash locations during the 12 months pre-and post-opening on Frederick Street, Wattle Street, Dobroyd Parade and City-West Link Road between John Street, Ashfield and Norton Street, Lilyfield.

Figure 6-2 Crash locations on Frederick St, Wattle St, Dobroyd Parade and City-West Link Road



6.3 Homebush Bay Road and Centenary Drive

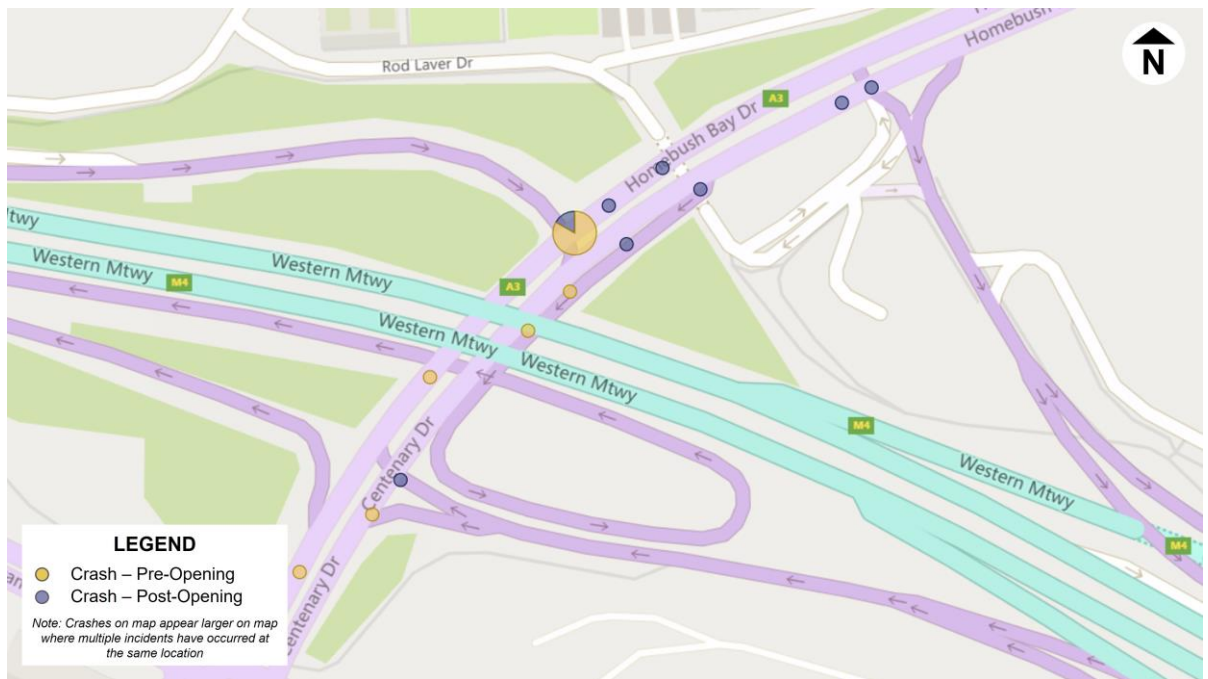
Homebush Bay Road and Centenary Drive form part of a major north-south arterial road (A3) between the Northern Beaches and Princes Highway at Kogarah. The M4 Motorway intersects with Homebush Bay Road and Centenary Drive in Homebush West over three intersections, connecting with an eastbound on-ramp at the northern-most intersection, westbound off-ramp in the middle and eastbound off-ramp and westbound on-ramps at the southern-most intersection.

Road safety performance between the northern and southern intersections slightly improved overall, with the number of crashes reducing by 20% when comparing the time periods 12 months prior to and following the opening of the M4 East. Further crash trends along this corridor within this period include:

- A total of 10 crashes occurred during the 12 months pre-opening of the M4 East. The same number of crashes were recorded in 2017, however this is notably lower than 2016 when 17 crashes were recorded.
- A total of 8 crashes also occurred during the 12 months post-opening of the M4 East
- The cause of each crash was generally unique for pre-opening and post-opening.
- Road safety performance notably improved at the M4 westbound off-ramp intersection with crashes reducing from 5 crashes pre-opening to 2 crashes post-opening.

Figure 6-3 illustrates crash locations during the 12 months pre-and post-opening on Homebush Bay Road and Centenary Drive at the M4 Motorway Interchange.

Figure 6-3 Crash locations on Homebush Bay Drive and Centenary Drive at M4 Motorway Interchange



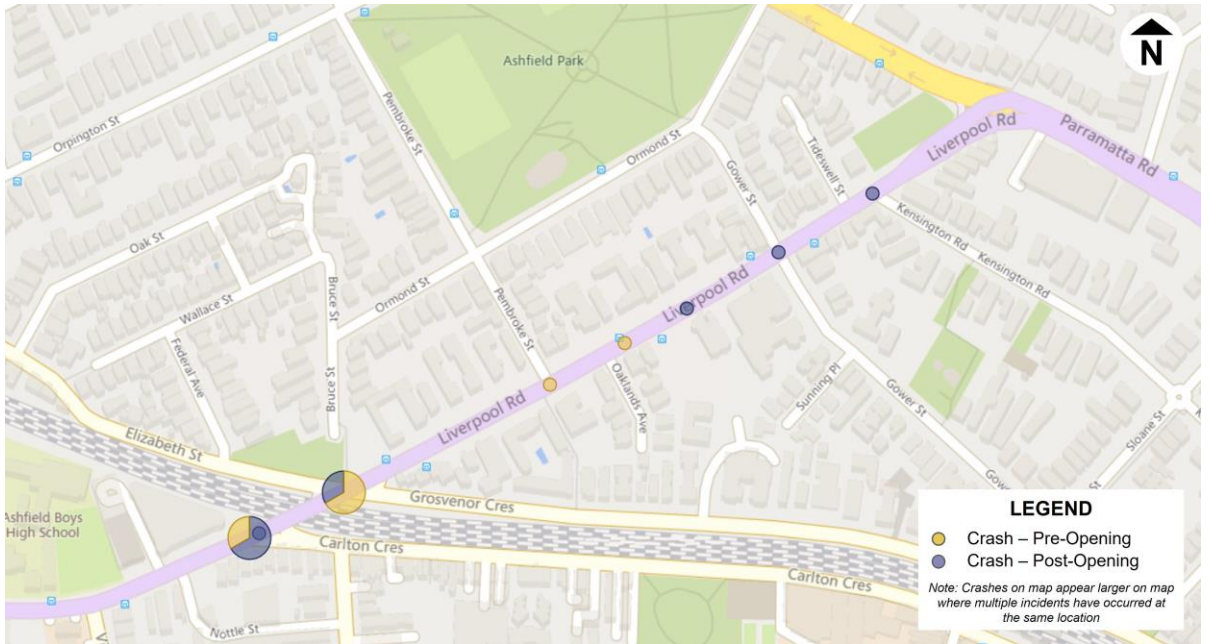
6.4 Liverpool Road (Hume Highway)

Liverpool Road forms part of a major north-east / south-west arterial road (A22) between Haberfield and Casula. Liverpool Road intersects with Parramatta Road, south-east of the eastern tunnel portals for the M4 East. Road safety performance on the segment between Parramatta Road and Carlton Crescent remained relatively similar, with the number of crashes increasing from 8 to 9 following the opening of the M4 East. Further crash trends along this corridor within this period include:

- A total of 8 crashes occurred during the 12 months pre-opening of the M4 East.
- A total of 9 crashes also occurred during the 12 months post-opening of the M4 East.
- The most common type of crash for pre-opening was rear end crashes (38%) and vehicles turning right colliding with vehicles travelling through an intersection (25%)
- The most common type of crash for post-opening was vehicles turning right colliding with vehicles travelling through an intersection and vehicles losing control and crashing, both representing 22% of all crashes.
- The number of pedestrian related incidents reduced from one pedestrian related crash occurring before and zero after the M4 East opening.

Figure 6-4 illustrates crash locations during the 12 months pre-and post-opening on Hume Highway between Parramatta Road and Carlton Crescent, Ashfield.

Figure 6-4 Crash locations on Liverpool Road (Hume Highway)



6.5 Dobroyd Parade/ Waratah Street intersection

The pedestrian crossing at Dobroyd Parade and Waratah Street connects Haberfield with Timbrell Park and is a two-stage pedestrian crossing with a centre median between the westbound and eastbound carriageways of Dobroyd Parade to store pedestrians.

Safety concerns for pedestrians and cyclists have been raised following several vehicle collisions with the centre median where there are often people waiting to cross, including children from the local public school on Waratah Street.

7. Potential mitigations

This report is a preliminary report only and potential mitigations to impacts identified have not yet been determined. As such, the potential mitigations section (Section 7) of the report is not currently populated. Once the plan has been completed following further consultation with council, the final Road Network Performance Review Plan will be submitted to DPE and made publicly available.





Appendix A – Intersection assessment summary for pre-opening (2018) and post-opening (2019)

For each site, AM and PM peak SIDRA intersection models were developed to provide a comparison of intersection performance prior to and after the M4 East opening. These models were based on surveyed traffic volumes travelling through the intersections. The pre-opening baseline survey was carried out in March 2018. This was done to provide a true representation of the network performance before the M4 East's completion. The post-opening surveys used in this analysis were carried out in September 2019.

Intersection 1 – Parramatta Road/Potts Street

Table A-1 presents a performance summary and comparison of the intersection, using traffic volumes observed prior to and after the opening of the M4 East for 2018 and 2019.

Table A-1 Summary of intersection performance at Parramatta Road/Potts Street

Parramatta Road/Potts Street – 2018 v 2019						
	Pre M4 East (2018)		Post M4 East (2019)		Difference	
	AM	PM	AM	PM	AM	PM
 Traffic Volumes	3,537	3,314	3,692	3,493	+188	+185
 Queue Length (m) Approach	212.0	232.8	324.6	254.0	+112.6	-0.5
	North-West	North-West	North-West	North-West		
 Average Delay (sec)	9.2	6.1	11.2	7.3	+2.0	+1.2
 Intersection LoS	LoS A	LoS A	LoS A	LoS A	=	=

Since the opening of the M4 East, overall performance at this intersection has remained similar during the AM and PM peaks.

Key changes in performance observed at this intersection are as follows:





- Average delays have increased marginally by up to 2 seconds in general; however, the LoS of Potts Street improved from LoS E to D during the AM peak. Average delays increased on the north-western approach of Parramatta Road during both the AM and PM peak, but increased on the south-eastern approach during the PM peak only.
- Vehicle queue lengths have increased on the north-western approach of Parramatta Road and slightly increased on Potts Street during the AM peak. Queue lengths have increased on all approaches during the PM peak.

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Intersection 5 – Concord Road/Patterson Street

Table A-2 presents a performance summary and comparison of the intersection, using traffic volumes observed prior to and after the opening of the M4 East for 2018 and 2019.

Table A-2 Summary of intersection performance at Concord Road/Patterson Street

Concord Road/Patterson Street – 2018 v 2019						
	Pre M4 East (2018)		Post M4 East (2019)		Difference	
	AM	PM	AM	PM	AM	PM
 Traffic Volumes	2,841	3,048	3,263	3,224	+422	+176
 Queue Length (m) Approach	166.8	254.2	166.5	169.9	-0.3	-84.3
	South	South	South	South		
 Average Delay (sec)	34.0	44.6	38.9	47.4	+4.9	+2.8
 Intersection LoS	LoS C	LoS D	LoS C	LoS D	=	=

Since the opening of the M4 East, overall performance at this intersection has remained similar during the AM and PM peaks.





Key changes in performance observed at this intersection are as follows:

- Average delays have been reduced on the northern approach of Concord Road and increased on Patterson Street during the AM peak. This is due to increased green time on Concord Road to accommodate additional vehicles accessing the M4 East at Sydney Street. The LoS on both approaches of Concord Road has remained at LoS C, degrading on Patterson Street from LoS C to LoS E
- Vehicle queue lengths have increased on all approaches during the AM peak and increased on Patterson Street and the northern approach of Concord Road during the PM peak.

Intersection 6 – Concord Road/ Sydney Street

Table A-3 presents a performance summary and comparison of the intersection, using the volumes observed prior to and after the opening of the M4 East for 2018 and 2019.

Table A-3 Summary of performance at Concord Road/Sydney Street

Concord Road/Sydney Street – 2018 v 2019						
	Pre M4 East (2018)		Post M4 East (2019)		Difference	
	AM	PM	AM	PM	AM	PM
 Traffic Volumes	1,813	2,834	3,056	2,833	+1,243	-1
 Queue Length (m) Approach	92.1	140.3	59.0	71.4	-33.1	-68.9
	North	North	North	North		
 Average Delay (sec)	18.7	21.2	14.9	17.9	-3.8	-3.3
 Intersection LoS	LoS B	LoS B	LoS B	LoS B	=	=

Since the opening of the M4 East, overall performance at this intersection has remained similar during the AM and PM peak periods.







Key changes in performance observed at this intersection are as follows:

- Average delays have increased on Sydney Street, with LoS degrading from LoS C to LoS E during the AM peak and LoS D to LoS E during the PM peak. This is due to increased green time on Concord Road to accommodate vehicles entering and exiting the M4 East.
- Vehicle queue lengths have increased on Sydney Street during the AM peak, again due to increased green time on Concord Road. Queue lengths have increased on the southern approach of Concord Road during the AM and PM peaks, likely due to the removal of one northbound lane at the intersection to accommodate vehicles exiting the M4 East

Intersection 7 – Parramatta Road/ Concord Road/ Leicester Avenue

Table A-4 presents a performance summary and comparison of the intersection, using the volumes observed prior to and after the opening of the M4 East for 2018 and 2019.

Table A-4 Summary of performance at Parramatta Road/Concord Road/Leicester Avenue

Concord Road/Sydney Street – 2018 v 2019						
	Pre M4 East (2018)		Post M4 East (2019)		Difference	
	AM	PM	AM	PM	AM	PM
 Traffic Volumes	3,918	4,349	4,169	4,490	+251	+141
 Queue Length (m) Approach	200.5	369.3	195.7	298.5	-4.8	-70.8
	South	North	South	North		
 Average Delay (sec)	59.6	72.7	54.9	74.2	-4.7	+1.5
 Intersection LoS	LoS E	LoS F	LoS D	LoS F		

Since the opening of the M4 East, overall performance at this intersection has improved during the AM peak and remained similar during the PM peak. It is noted that the intersection was operating close to capacity prior to opening, with a LoS E during the AM peak and LoS F during the PM peak.







Key changes in performance observed at this intersection are as follows:

- Average delays have increased for the western approach of Parramatta Road during the AM peak, with the LoS degrading from LoS D to LoS E. During the PM peak, average delays have reduced on both approaches of Parramatta Road due to additional green time, increasing on Leicester Avenue and Concord Road. Concord Road continues to perform at LoS F post-opening, with Leicester Avenue degrading from LoS D to LoS E
- Vehicle queue lengths have slightly increased on Concord Road during the AM peak and increased on Leicester Avenue and the western approach of Parramatta Road during the PM peak
- During the AM peak, the northern approach shows an improvement for the right turn following the reallocation of lanes in favour of that movement; however, the left turn movement from Concord Road has degraded
- Based on a review of available crash data for 12 months before and after the opening of the M4 East, 1 crash occurred at this intersection pre-opening, with no additional crashes post-opening.

Intersection 9 – Dobroyd Parade/ Waratah Street

Table A-5 presents a performance summary and comparison of the intersection, using the volumes observed prior to and after the opening of the M4 East for 2018 and 2019.

Table A-5 Summary of performance at Dobroyd Parade/Waratah Street (2018 v 2019)

Dobroyd Parade/Waratah Street – 2018 v 2019						
	Pre M4 East (2018)		Post M4 East (2019)		Difference	
	AM	PM	AM	PM	AM	PM
 Traffic Volumes	2,927	3,419	4,176	4,692	+1,249	+1,273
 Queue Length (m) Approach	217.4	339.2	436.2	109.1	+218.8	-230.1
	South-West	South-West	South-West	South-West		
 Average Delay (sec)	12.3	13.4	27.3	14.2	+15.0	+0.8
 Intersection LoS	LoS A	LoS A	LoS B	LoS A		

Since the opening of the M4 East, overall performance at this intersection marginally degraded during the AM peak and remained similar during the PM peak. It is noted that two lanes on the south-western approach directly exit the M4 East tunnels which are separated from Dobroyd Parade at this intersection.







Key changes in performance observed at this intersection are as follows:

- Traffic volumes on all approaches have increased, with the exception of the site access (northern approach). This is likely due to additional traffic generation from the M4 East interchange immediately west of this intersection
- Average delays have generally increased on all approaches during the AM peak, with additional vehicles entering and exiting the M4 East. With the exception of Waratah Street, the LoS has slightly degraded on all other approaches. During the PM peak, increase in intersection delay is generally limited.
- Vehicle queue lengths have generally increased on all approaches during the AM peak, with additional vehicles entering and exiting the M4 East. Site observations have indicated that the queues on the south-west approach along Dobroyd Parade often extend into the M4 East tunnel portal. This is primarily due to queues from the Dobroyd Parade/Timbrell Drive/Mortley Avenue intersection extending till this intersection, resulting in reduced downstream capacity for the northbound through movements thereby resulting in queues extending till the tunnel portals. During the PM peak, queue lengths have increased on all approaches, likely as a result of increased generated by the M4 East interchange immediately south-west of this intersection, with the exception of the south-western approach on Dobroyd Parade where both have decreased

Intersection 10 – Dobroyd Parade/ Timbrell Drive/ Mortley Avenue

Table A-6 presents a performance summary of the existing site, using the volumes observed prior to and after the opening of the M4 East for 2018 and 2019.

Table A-6 Summary of performance at Dobroyd Parade/Timbrell Drive/Mortley Avenue (2018 v 2019)

Dobroyd Parade/Timbrell Drive/Mortley Avenue – 2018 v 2019						
	Pre M4 East (2018)		Post M4 East (2019)		Difference	
	AM	PM	AM	PM	AM	PM
 Traffic Volumes	4,471	4,721	5,219	5,961	+748	+1,240
 Queue Length (m) Approach	341.2	460.0	514.8	427.2	+173.6	-32.8
	South-	South-	South-	South-		
 Average Delay (sec)	39.5	51.7	64.9	53.5	+25.4	+1.8
 Intersection LoS	LoS C	LoS D	LoS E	LoS D		

Since the opening of the M4 East, overall performance at this intersection has degraded during the AM peak and remained similar during PM peak.





Key changes in performance observed at this intersection are as follows:

- Average delays have increased on all approaches during the AM peak, with the exception of Mortley Avenue. The LoS on the south-western approach of Dobroyd Parade has degraded. During the PM peak, average delays have increased on Timbrell Drive and the south-eastern approach of Dobroyd Parade. The LoS of the north-eastern approach of Dobroyde Parade has degraded from LoS C to LoS D; this may be due to increased demand generated by the M4 East
- Vehicle queue lengths have increased on Dobroyd Parade during the AM peak. Site observations have indicated that the queues on the south-west approach along Dobroyd Parade often extend into the Dobroyd Parade/Waratah Street intersection. This is primarily due to downstream queuing, increase in green time for right turn from Timbrell Drive towards Dobroyd Parade, and increase in pedestrian movements at this intersection. During the PM peak, queue lengths have increased on Timbrell Drive and the south-eastern approach of Dobroyd Parade. There has been a significant increase in queue length on the north-eastern approach of Dobroyd Parade. This may be due to additional vehicles travelling on Dobroyd Parade towards the M4 East
- Based on a review of available crash data for 12 months before and after the opening of the M4 East, 1 crash occurred at this intersection pre-opening and post-opening.

Intersection 11 – City-West Link Road/ James Street

Table A-7 presents a performance summary and comparison of the intersection, using the volumes observed prior to and after the opening of the M4 East for 2018 and 2019.

Table A-7 Summary of performance at City-West Link Road/James Street (2018 v 2019)

City-West Link Road/James Street – 2018 v 2019						
	Pre M4 East (2018)		Post M4 East (2019)		Difference	
	AM	PM	AM	PM	AM	PM
 Traffic Volumes	4,531	5,353	5,189	5,659	+658	+306
 Queue Length (m) Approach	206.8	218.3	124.0	353.4	-82.8	+135.1
	South	East	South	East		
 Average Delay (sec)	31.0	33.3	36.7	26.8	+5.7	-6.5
 Intersection LoS	LoS C	LoS C	LoS C	LoS B	=	▲

Since the opening of the M4 East, overall performance at this intersection has remained similar during the AM peak and improved during the PM peak.





Key changes in performance observed at this intersection are as follows:

- Average delays increased on City-West Link Road during the AM peak and increased for the eastern approach on City-West Link Road during the PM peak. The increase in vehicles using City-West Link Road is likely due to vehicles using this corridor to access the M4 East at Haberfield. The LoS on City-West Link Road degraded from LoS B to LoS C on the western approach. Green time has been reallocated from James Street to City-West Link Road, reducing the number of vehicles pass through the intersection from James Street. During the PM peak, average delays have increased for the eastern approach on City-West Link Road.
- Vehicle queue lengths have increased on City-West Link Road during the AM and PM peak periods. Green time has been reallocated from James Street to City-West Link Road, reducing the number of vehicles passing through the intersection from James Street
- Based on a review of available crash data for 12 months before and after the opening of the M4 East, 2 crashes occurred at this intersection pre-opening and post-opening.

Intersection 12 – City-West Link Road/ Norton Street

Table A-8 presents a performance summary of the existing site, using the volumes observed prior to and after the opening of the M4 East for 2018 and 2019.

Table A-8 Summary of performance at City-West Link Road/Norton Street (2018 v 2019)

City-West Link Road/Norton Street – 2018 v 2019						
	Pre M4 East (2018)		Post M4 East (2019)		Difference	
	AM	PM	AM	PM	AM	PM
 Traffic Volumes	4,469	5,395	4,996	5,801	+527	+406
 Queue Length (m) Approach	214.5	355.9	216.7	607.8	+2.2	+251.9
	North	South	North	South		
 Average Delay (sec)	29.9	32.2	30.0	49.6	+0.1	+17.4
 Intersection LoS	LoS C	LoS C	LoS C	LoS D	=	▼

Since the opening of the M4 East, overall performance at this intersection has remained similar during the AM peak but degraded during the PM peak.





Key changes in performance observed at this intersection are as follows:

- Average delays have remained relatively similar during the AM peak. During the PM peak, average delays have significantly increased for the south-eastern approach on City-West Link Road. The LoS for this approach has degraded from LoS C to LoS F, which may be due to additional vehicles using this approach to access the M4 East further west on Dobroyd Parade. On Norton Street, average delays have increased on the northern approach due to an increase in vehicles.
- Based on a review of available crash data for 12 months before and after the opening of the M4 East, 1 crash occurred at this intersection pre-opening and post-opening.

Intersection 14 – Parramatta Road/ Dalhousie Street

Table A-9 presents a performance summary of the existing site, using the volumes observed prior to and after the opening of the M4 East for 2018 and 2019.

Table A-9 Summary of performance at Parramatta Road/Dalhousie Street (2018 v 2019)

Parramatta Road/Dalhousie Street – 2018 v 2019						
	Pre M4 East (2018)		Post M4 East (2019)		Difference	
	AM	PM	AM	PM	AM	PM
 Traffic Volumes	3,754	3,848	4,260	4,919	+506	+1,071
 Queue Length (m) Approach	334.7	223.7	408.1	639.6	+73.4	+415.9
	North-	North-	North-	North-		
 Average Delay (sec)	29.2	20.8	34.8	43.2	+5.6	+22.4
 Intersection LoS	LoS C	LoS B	LoS C	LoS D	=	▼

Since the opening of the M4 East, overall performance at this intersection has remained similar during the AM peak but degraded during the PM peak.





Key changes in performance observed at this intersection are as follows:

- Average delays have reduced for the north-western approach on Parramatta Road during the AM peak. This is likely due to the additional green time on Parramatta Road during the AM peak to support additional traffic exiting the M4 East onto Parramatta Road immediately north-west of this intersection. During the PM peak, all approaches have experienced an increase in average delays, with the exception of the south-eastern approach on Parramatta Road where average delays have reduced. The increase on the other approaches is likely due to additional vehicles using Parramatta Road to access M4 East immediately west of this intersection. The LoS of Dalhousie Street has degraded from LoS D to LoS E during the AM peak and LoS C to LoS F during the PM peak, likely due to increased priority on Parramatta Road
- Vehicle queue lengths have increased on Dalhousie Street during the AM peak. During the PM peak, all approaches have experienced increases in queue lengths, with the exception of the south-eastern approach on Parramatta Road. This increases on the other approaches are likely due to additional vehicles using Parramatta Road to access the M4 East immediately west of this intersection
- Based on a review of available crash data for 12 months before and after the opening of the M4 East, no crashes occurred at this intersection pre-opening. Five crashes were recorded post-opening.

Intersection 15 – Parramatta Road/ Liverpool Road

Table A-10 presents a performance summary and comparison of the intersection, using the volumes observed prior to and after the opening of the M4 East for 2018 and 2019.

Table A-10 Summary of performance at Parramatta Road/Liverpool Road (2018 v 2019)

Parramatta Road/Liverpool Road – 2018 v 2019						
	Pre M4 East (2018)		Post M4 East (2019)		Difference	
	AM	PM	AM	PM	AM	PM
 Traffic Volumes	4,211	4,889	4,486	5,695	+275	+806
 Queue Length (m) Approach	286.3	402.3	342.3	507.2	+56.0	+104.9
	South-East	South-East	South-East	South-East		
 Average Delay (sec)	29.2	40.5	42.1	45.1	+12.9	+4.6
 Intersection LoS	LoS C	LoS C	LoS C	LoS D	=	▼

Since the opening of the M4 East, overall performance at this intersection has remained similar during the AM peak but degraded during the PM peak.





Key changes in performance observed at this intersection are as follows:

- Average delays have increased on all approaches during the AM and PM peak periods. During the AM peak, signal phases have been shortened by 15 seconds, with green time reduced on most approaches. As a result, the LoS on both approaches of Parramatta Road have degraded from LoS B to LoS C. Liverpool Road has remained at LoS E despite left turning vehicles more than doubling; this is likely due to vehicles using Parramatta Road to access the M4 East entrance further north-west. During the PM peak, green time has been significantly increased on Parramatta Road to increase priority for vehicles travelled towards and away from the M4 East. Despite this, the LoS has degraded on Parramatta Road from LoS B to LoS C on the north-west western approach and LoS B to LoS D on the south-eastern approach. Liverpool Road degraded from LoS E to LoS F, likely due to the large increase in left-turning vehicles, similar to the AM peak
- Vehicle queue lengths have increased on all approaches during both the AM and PM peak periods
- Based on a review of available crash data for 12 months before and after the opening of the M4 East, 2 crashes occurred at this intersection pre-opening and post-opening

Intersection 16 – Parramatta Road/ Sloane Street

Table A-11 presents a performance summary of the existing site, using the volumes observed prior to and after the opening of the M4 East for 2018 and 2019.

Table A-11 Summary of performance at Parramatta Road/Sloane Street

Parramatta Road/Sloane Street – 2018 v 2019						
	Pre M4 East (2018)		Post M4 East (2019)		Difference	
	AM	PM	AM	PM	AM	PM
 Traffic Volumes	4,145	4,682	4,372	5,576	+227	+894
 Queue Length (m) Approach	170.6	137.1	146.3	139.1	-24.3	+2.0
	North-West	North-West	North-West	North-West		
 Average Delay (sec)	13.6	13.4	13.3	14.6	-0.3	+1.2
 Intersection LoS	LoS A	LoS A	LoS A	LoS B	=	▼

Since the opening of the M4 East, overall performance at this intersection has remained similar during the AM peak but marginally degraded during the PM peak.

Key changes in performance observed at this intersection are as follows:

- Average delays have increased on Sloane Street during both the AM and PM peak periods, likely due to increased priority for Parramatta Road to support additional traffic generation from the M4 East. The LoS of the south-western approach on Sloane Street degraded during the AM peak and both approaches on Sloan Street degraded during the PM peak
- Vehicle queue lengths increased on Sloane Street during the AM peak. During the PM peak, queue lengths increased on all approaches, with the exception of the north-eastern approach of Parramatta Road which saw a slight decrease
- Based on a review of available crash data for 12 months before and after the opening of the M4 East, 2 crashes occurred at this intersection pre-opening, with 3 crashes recorded post-opening.

Appendix B – Haberfield, Ashfield and Leichardt Intersection Analysis Summary

Source: Technical Advice Operational Traffic Performance Review for Selected Intersections

A1 – James Street/ Lilyfield Road

	2018		2019		2020		2019-2018		2020-2018	
	Pre-M4E Opening Pre-Covid-19		Post-M4E Opening Pre-Covid-19		Post-M4E Opening Post-Covid-19		AM Peak	PM Peak	AM Peak	PM Peak
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak				
Intersection Volume	1,047	1,277	1,202	1,141	1,049	1,146	155	-136	2	-131
Intersection Queue Length (m)	31.7	55.0	51.6	29.6	34.7	27.8	20	-25	3	-27
Approach with Longest Queue	South	East	East	South	South	North				
Intersection Delay (sec)	28.2	38.9	36.0	26.6	27.7	26.8	8	-12	-1	-12
Intersection Level of Service	B	C	C	B	B	B				

A2 –Norton Street/ Lilyfield Road

	2018		2019		2020		2019-2018		2020-2018	
	Pre-M4E Opening Pre-Covid-19		Post-M4E Opening Pre-Covid-19		Post-M4E Opening Post-Covid-19		AM Peak	PM Peak	AM Peak	PM Peak
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak				
Intersection Volume	564	773	737	821	610	677	173	48	46	-96
Intersection Queue Length (m)	1.6	2.5	1.9	3.2	1.9	2.4	0.3	0.7	0.3	-0.1
Approach with Longest Queue	West	West	West	West	West	West				
Intersection Delay (sec)	3.6	4.1	3.8	4.4	3.7	4.3	0.2	0.3	0.1	0.2
Intersection Level of Service	A	A	A	A	A	A				

A3 – Norton Street/ William Street

	2018		2019		2020		2019-2018		2020-2018	
	Pre-M4E Opening Pre-Covid-19		Post-M4E Opening Pre-Covid-19		Post-M4E Opening Post-Covid-19		AM Peak	PM Peak	AM Peak	PM Peak
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak				
Intersection Volume	843	1,135	944	1,126	855	1,060	101	-9	12	-66
Intersection Queue Length (m)	6	13	6	14	6	11	0.5	1.1	-0.1	-3.2
Approach with Longest Queue	North	North	North	North	North	North				
Intersection Delay (sec)	11	14	11	14	11	13	0.3	0.6	-0.2	-1.4
Intersection Level of Service	A	A	A	A	A	A				

A4 – Hume Highway/ Carlton Crescent

	2018		2019		2020		2019-2018		2020-2018	
	Pre-M4E Opening Pre-Covid-19		Post-M4E Opening Pre-Covid-19		Post-M4E Opening Post-Covid-19		AM	PM	AM	PM
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	Peak	Peak	Peak	Peak
Intersection Volume	2,671	2,887	2,630	2,835	2,813	2,798	-41	-52	142	-89
Intersection Queue Length (m)	63.2	96.0	48.0	82.8	65.1	81.1	-15	-13	2	-15
Approach with Longest Queue	South	North	South	North	South	North				
Intersection Delay (sec)	10.2	17.0	7.6	12.0	9.4	12.3	-3	-5	-1	-5
Intersection Level of Service	A	B	A	A	A	A				

A5 – Tebbutt Street/ Hathern Street

	2018		2019		2020		2019-2018		2020-2018	
	Pre-M4E Opening Pre-Covid-19		Post-M4E Opening Pre-Covid-19		Post-M4E Opening Post-Covid-19		AM	PM	AM	PM
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	Peak	Peak	Peak	Peak
Intersection Volume	1,612	1,927	1,764	1,837	1,680	1,886	152	-90	68	-41
Intersection Queue Length (m)	91	217	100	114	85	119	10	-102	-6	-98
Approach with Longest Queue	West	North	West	North	West	North				
Intersection Delay (sec)	30	30	30	25	28	25	-0.2	-6	-3	-6
Intersection Level of Service	C	C	C	B	B	B				0

A6 – Parramatta Road/ Tebbutt Street

	2018		2019		2020		2019-2018		2020-2018	
	Pre-M4E Opening Pre-Covid-19		Post-M4E Opening Pre-Covid-19		Post-M4E Opening Post-Covid-19		AM	PM	AM	PM
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	Peak	Peak	Peak	Peak
Intersection Volume	4,039	4,614	3,572	4,876	4,307	4,927	-467	262	268	313
Intersection Queue Length (m)	467	259	105	128	287	129	-362	-131	-179	-130
Approach with Longest Queue	West	West	West	East	West	East				
Intersection Delay (sec)	23	9	7	10	20	7	-16	1	-3	-2
Intersection Level of Service	B	A	A	A	B	A				

A7 – Parramatta Road/ West Street

	2018		2019		2020		2019-2018		2020-2018	
	Pre-M4E Opening Pre-Covid-19		Post-M4E Opening Pre-Covid-19		Post-M4E Opening Post-Covid-19		AM	PM	AM	PM
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	Peak	Peak	Peak	Peak
Intersection Volume	4,170	4,744	3,906	5,007	4,640	5,056	-264	263	470	312
Intersection Queue Length (m)	200	220	149	235	200	252	-51	14	0	32
Approach with Longest Queue	West	East	West	East	West	East				
Intersection Delay (sec)	50	93	37	40	48	49	-13	-53	-2	-43
Intersection Level of Service	D	F	C	C	D	D				

Appendix C – General traffic performance analysis: 2018 and 2019 data

Parramatta Road

Figure B-0-1 and Figure B-0-2 presents a comparison of the pre-opening and post-opening average travel time during a typical weekday morning and evening peaks respectively, in each direction on Parramatta Road between Potts Street and Flood Street.

The outcomes of this analysis are consistent with year 2020 as discussed in Section 5.1, with the following key observations:

- In the eastbound direction, total travel times (across the three segments) reduced by approximately 12 minutes in both the 2019 AM and PM peaks, consistent with 2020.
- In the westbound direction, total travel reduced by approximately 8 minutes in the AM peak and remained similar to 2018, with the outcomes also consistent with 2020.
- The section of Parramatta Road between Concord Road and Wattle Street experienced the largest travel time saving due to the opening of the M4 East which provides a direct alternative route, bypassing the several traffic signals on the Parramatta Road corridor.

Figure B-0-1 Average travel times on Parramatta Road AM peak)

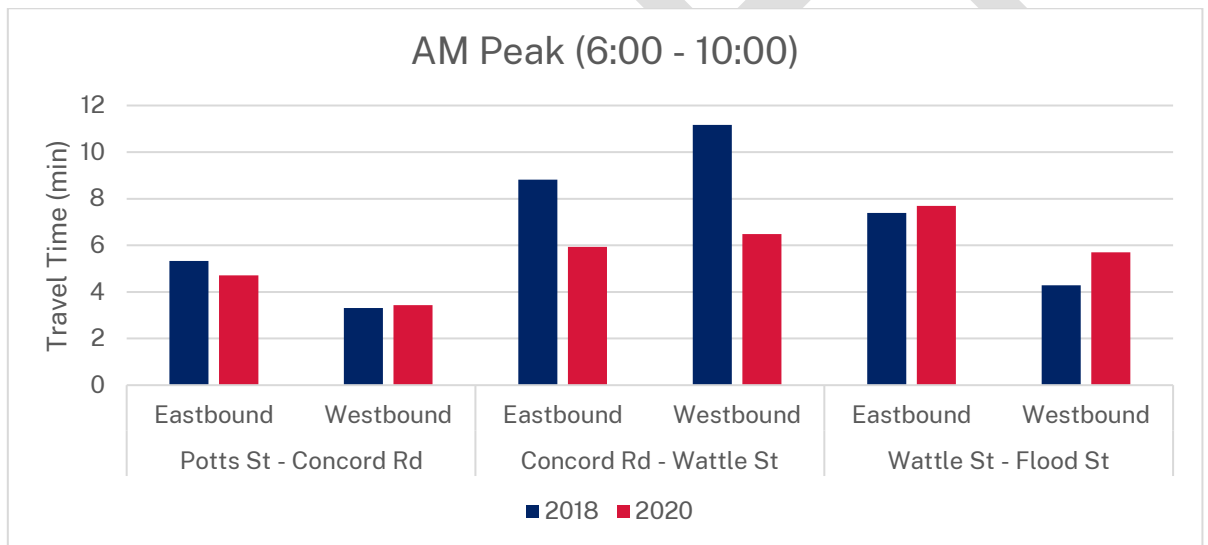
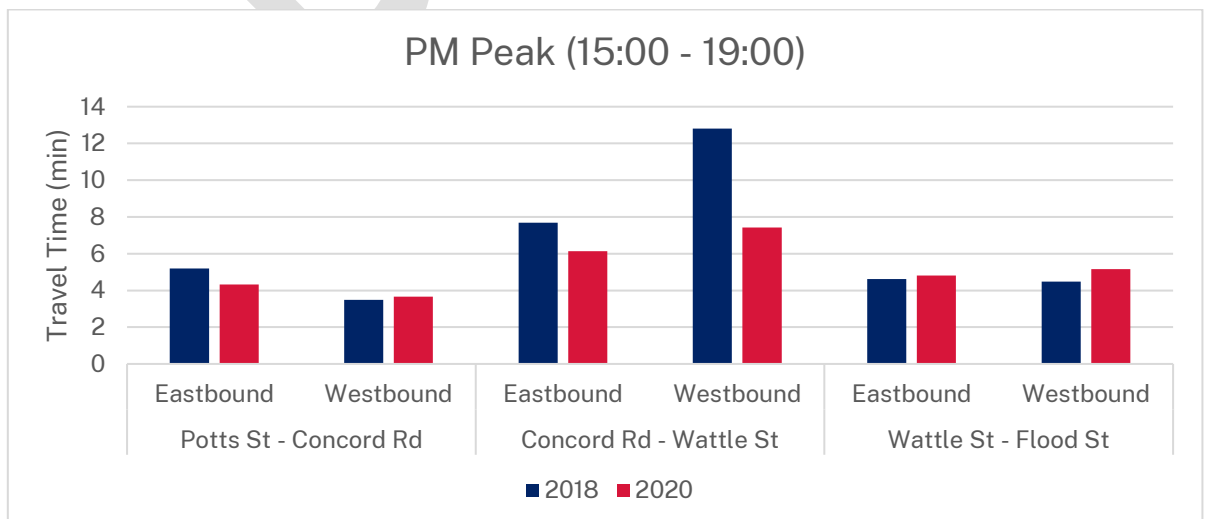


Figure B-0-2 Average travel times on Parramatta Road PM peak)



Appendix D– Bus performance analysis: 2018 and 2019 data

Parramatta Road – Eastbound

Figure B-1 presents a comparison of the pre-opening and post-opening bus travel times in the eastbound direction along Parramatta Road during the AM peak period between 6am and 10am.

Figure B-1 Comparison of eastbound bus travel times on Parramatta Road (AM peak)

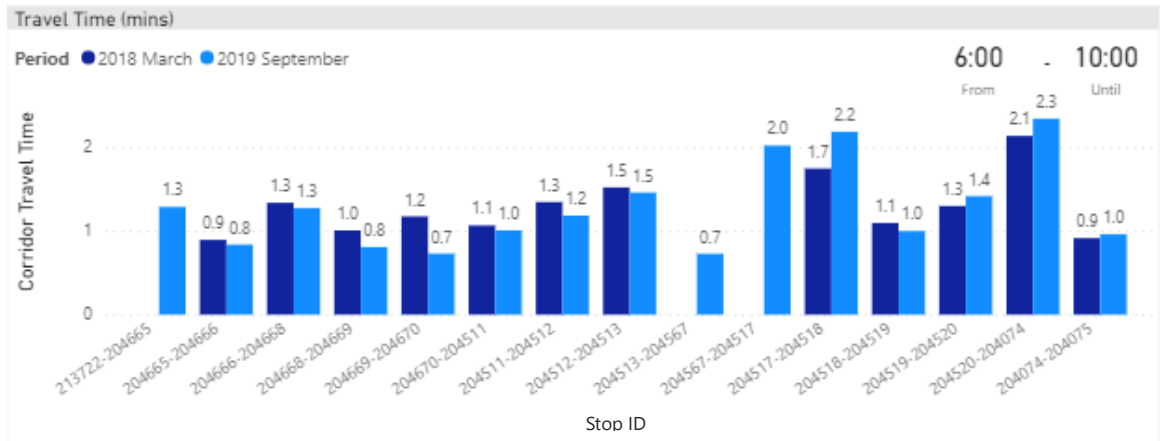
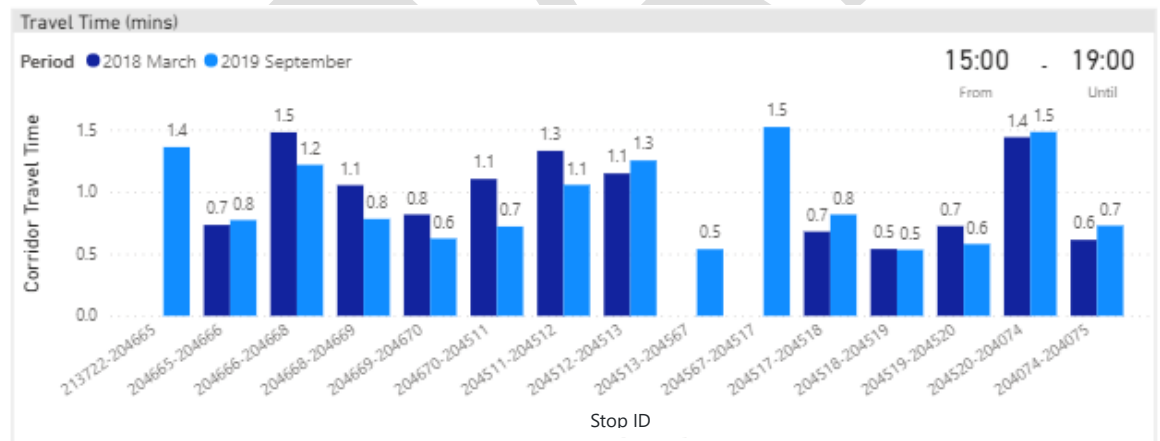


Figure B-2 presents a comparison of the pre-opening and post-opening bus travel times in the eastbound direction along Parramatta Road during the PM peak between 4pm and 7pm.

Figure B-2 Comparison of eastbound bus travel times on Parramatta Road (PM peak)



Parramatta Road – Westbound

Figure B-5 presents a comparison of the pre-opening and post-opening bus travel times in the eastbound direction along Parramatta Road during the AM peak between 6am and 10am.

Figure B-0-3 Comparison of westbound bus travel times on Parramatta Road (AM peak)

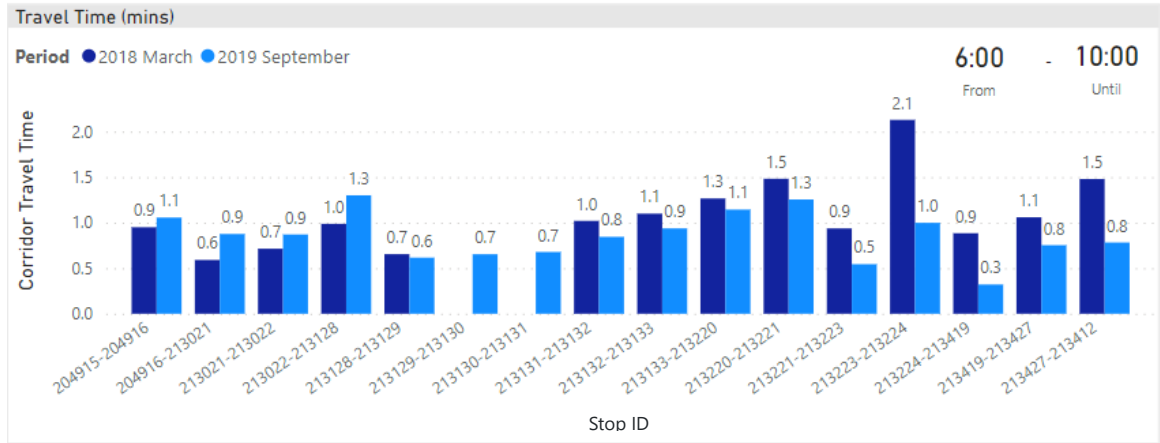
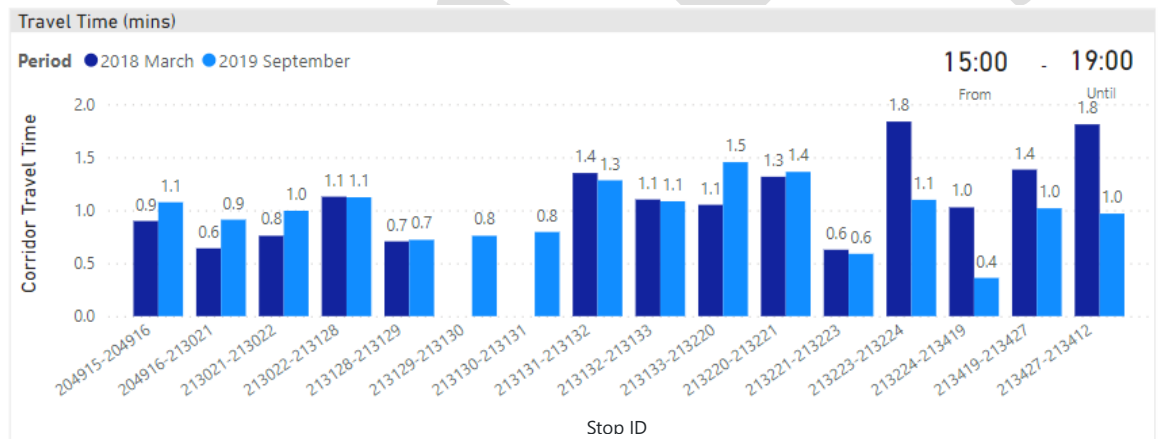


Figure B-6 presents a comparison of the pre-opening and post-opening bus travel times in the westbound direction along Parramatta Road during the PM peak between 4pm and 7pm.

Figure B-0-4 Comparison of eastbound bus travel times on Parramatta Road (PM peak)



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