Prepared for
Transport for NSW
ABN: 76 236 371 088

Road Network Performance Review Plan

NorthConnex (SSI 6136)

8-August-2022
NorthConnex

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Road Network Performance Review Plan

NorthConnex (SSI 6136)

Client: Transport for NSW

ABN: 76 236 371 088

Prepared by

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Table of Contents

Terms and abbreviations i
Executive Summary ii
1 Introduction 6
1.1 Background 6
1.2 Purpose of this report 7
1.3 Structure of this plan 7
1.4 Overview of the project 8
1.5 Extent of this review 10
2 Approach and methodology 12
2.1 Approach 12
2.2 Stakeholder consultation 12
2.3 Methodology 15
2.4 Data collection 15
3 Road network performance 20
3.1 Review of land use changes 20
3.2 Road network performance measures 22
3.3 Roadway level of service and volumes 24
3.4 Intersection performance 30
3.5 Travel times 43
3.6 Bus performance 45
3.7 Walking and cycling activity 50
3.8 Summary of road network performance 52
4 Stakeholder and community feedback 53
4.1 Negative feedback 53
4.2 Positive feedback 61
5 Mitigation measures 62
5.1 Proposed measures 62
5.2 Toll avoidance schemes 64

List of Tables

Table E-1-1	Summary of post-opening feedback received in relation to NorthConnex	v
Table 1-1	Report structure and relevant items addressed from Condition E28	7
Table 2-1	Summary of feedback received from Councils	12
Table 2-2	Extents of LinSig models	19
Table 3-1	Overview of land use changes within general vicinity of Pennant Hills Road	21
Table 3-2	Mid-block level of service definitions and criteria – multi lane roads	22
Table 3-3	Level of service criteria – intersections	23
Table 3-4	Comparison of average daily mid-block volumes from automated traffic counts	25
Table 3-5	Comparison of average daily mid-block traffic volumes from TfNSW counters	27
Table 3-6	Comparison of mid-block traffic level of service	28
Table 3-7	Summary of intersection volumes and LOS	31
Table 3-8	Comparison of average travel time on Pennant Hills Road	43
Table 3-9	Comparison of average travel time on Pacific Highway	44
Table 3-10	Comparison of average travel time on Hills M2 Motorway	44
Table 3-11	Comparison of bus operating travel times on Pennant Hills Road	45
Table 3-12	Comparison of bus operating travel speeds on Pennant Hills Road	45
Table 3-13	Walking and cycling infrastructure delivered as part of NorthConnex project	51
Table 4-1	Summary of post-opening feedback received in relation to NorthConnex	53

List of Figures

Figure E-1	Extent of review	ii
Figure 1-1	Overview of the project alignment and surrounding locality	8
Figure 1-2	Average daily traffic volumes using NorthConnex	9
Figure 1-3	Extent of road network performance review	11
Figure 2-1	Methodology adopted for the preparing this plan	15
Figure 2-2	Location of intersection and mid-block traffic counts	17
Figure 2-3	Routes used for travel time surveys	18
Figure 3-1	Land use changes along Pennant Hills Road corridor	20
Figure 3-2	Mid-block locations assessed in the road network performance review	24
Figure 3-3	Intersections assessed in this plan	30
Figure 3-4	Routes used for travel time surveys	43
Figure 3-5	Comparison of northbound bus travel times on Pennant Hills Road (weekday)	46
Figure 3-6	Comparison of northbound bus travel times on Pennant Hills Road (weekend)	46
Figure 3-7	Comparison of northbound bus travel speeds on Pennant Hills Road (weekday)	47
Figure 3-8	Comparison of northbound bus travel speeds on Pennant Hills Road (weekend)	47
Figure 3-9	Comparison of southbound bus travel times on Pennant Hills Road (weekday)	48
Figure 3-10	Comparison of southbound bus travel times on Pennant Hills Road (weekend)	48
Figure 3-11	Comparison of southbound bus travel speeds on Pennant Hills Road (weekday)	49
Figure 3-12	Comparison of southbound bus travel speeds on Pennant Hills Road (weekend)	49
Figure 3-13	Higher pedestrian activity areas on Pennant Hills Road	50
Figure 4-1	Average Daily Traffic – Pacific Highway, Warrawee (Station ID 53003)	55
Figure 4-2	Average Daily Light Vehicle Traffic – Pacific Highway, Warrawee	56
Figure 4-3	Average Daily Heavy Vehicle Traffic – Pacific Highway, Warrawee	56
Figure 4-4	Percentage of Heavy Vehicles – Pacific Highway, Warrawee	57
Figure 4-5	Average Daily Traffic – Ryde Road, West Pymble	58
Figure 4-6	Average Light Vehicle Daily Traffic – Ryde Road, West Pymble	59
Figure 4-7	Average Heavy Vehicle Daily Traffic – Ryde Road, West Pymble	59
Figure 4-8	Percentage of Heavy Vehicles – Ryde Road, West Pymble	60
Figure 5-1	Proposed upgrades on Pennant Hills Road and North Rocks Road, Carlingford	62
Figure 5-2	Proposed Installation of Pedestrian Refuge on Campbell Avenue, Normanhurst	63
Figure 5-3	Pennant Hills Road regulatory signage	64

Terms and abbreviations

Term	Definition
ATC	Automatic Traffic Counter
Condition E28	Refers to Item E28 of the NorthConnex project's conditions of approval, which required the preparation of the Road Network Performance Review Plan.
EB	Eastbound
EIS	Environmental Impact Statement
km	kilometre
LinSig	A modelling platform that simulates traffic signal operation and their effect on traffic capacities and queuing. It is also used to determine optimal traffic signal timing settings to reduce delay or increase flow capacity at an intersection or a group of interlinked intersections. LinSig has been used as the software platform for the NorthConnex Environmental Impact Statement and has been retained to model traffic signal operations as part of this Road Network Performance Review Plan.
LOS	Level of Service
m	metre
NB	Northbound
Nearmap	An aerial map imagery provider
NSW	New South Wales
PCU	(Equivalent) Passenger Car Units
Pre-opening	Referring to road network conditions in November 2019, about a year prior to the opening of NorthConnex
Post-opening	Referring to road network conditions in February/March 2022, about 15 months after opening of NorthConnex. Due to the impacts of the COVID19 restrictions, traffic movements on the road network 12 months after the opening of NorthConnex, or in November 2021, would likely have not been representative of general road network conditions intended to be assessed as part of Condition E28.
PTIPS	Public Transport Information and Priority System, a real-time data platform for bus operations.
SB	Southbound
SSI	State Significant Infrastructure
V/C ratio (or V/C)	The ratio of traffic volume to capacity of a roadway
WB	Westbound

Executive Summary

Introduction

The NorthConnex Project provides a key link to the National Highway network, linking the M1 Pacific Motorway at Wahroonga to the Hills M2 Motorway in West Pennant Hills via twin road tunnels around 9 kilometres long. It generally follows the alignment of Pennant Hills Road, as shown in Figure E-1.

The NorthConnex project also involved integration works along the Hills M2 Motorway, road network changes as part of the Northern Interchange, and minor arrangements to facilitate access to the project's operational facilities, including the Motorway Operations Centre on Eaton Road and the Tunnel Support Facilities on Wilson Road and Trelawney Street (access from and egress to Pennant Hills Road).

On 13 January 2015, the NSW Minister for Planning granted approval to the State Significant Infrastructure (SSI) application for NorthConnex project, subject to a number of conditions. Part E of the conditions of approval outlines conditions for environmental management, reporting and auditing during operations of the project.

Condition E28 required the preparation of a Road Network Performance Review Plan ("the Plan") at 12 months and at 5 years following commencement of operations, which occurred on 31 October 2020. This document presents the findings of the 12-months[1] post-opening Road Network Performance Review for the first timing point as per Condition E28.

Figure E-1 illustrates the extent of this performance review.

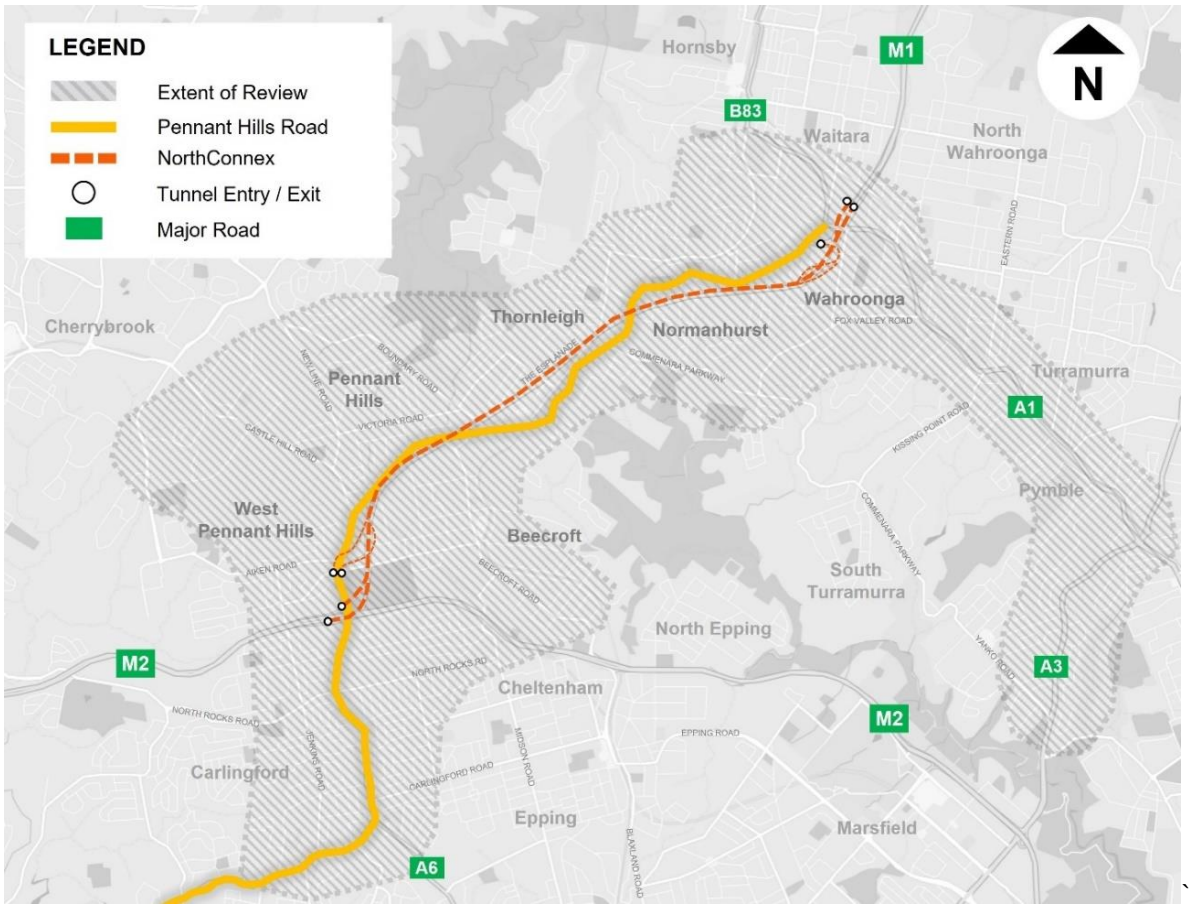


Figure E-1 Extent of review

[1] To enable a more representative assessment of the performance of the road network following changed travel patterns as a result of COVID-19 restrictions, road traffic data used for this 12-month post-opening assessment was gathered in February 2022 instead of October-November 2021.

Approach and methodology

The project's traffic and transport assessment, which was a component of the Environmental Impact Statement (EIS) prepared in 2014 was used as a reference for the preparation of the Plan. The purpose of the Plan is to review the traffic performance of the adjoining surface road network, focused on Pennant Hills Road, before (pre-opening) and 12 months after (post-opening) commencement of operations and identify any mitigation measures that may be required where the traffic performance has been negatively impacted by the opening of the project.

Stakeholder and community consultation was undertaken to inform the scope of the Plan.

The following data was analysed to assess the road network performance:

- Land use changes
- Traffic surveys
- Travel time savings
- Traffic signal phasing and timing data
- Bus performance data
- Walking and cycling activity.

Road network performance

Land use changes

A comparison of NearMap imagery from 2019 and 2022 was conducted to identify locations that have experienced land use changes along the Pennant Hills Road corridor from West Pennant Hills near the Hills M2 Motorway north towards Hornsby. The review identified ten locations that have undergone land use changes during this period, which would likely generate additional traffic since the opening of the project and are likely to impact the road network performance.

The land use changes are primarily concentrated within the suburbs of Hornsby, Waitara, and Normanhurst, with additional developments along the Pennant Hills Road corridor. These changes include a redeveloped hospital, school, retirement villages and industrial estate, new residential building, and new buildings for the operation and maintenance of NorthConnex.

Roadway level of service and volumes

Mid-blocks counts were undertaken along key roads to compare traffic volumes between pre-opening (2019) and post-opening (2022) and assess the performance of key surface road corridors between intersections. A total of nineteen (19) mid-block locations were assessed, as well as four (4) locations with permanent traffic counters operated by Transport for NSW (TfNSW).

Generally, light vehicle and heavy vehicle volumes have reduced following the opening of NorthConnex, with moderate increases at some locations. However, increases in average daily traffic volumes have been observed along North Rocks Road (A14)[2] and New Line Road (A25).

Intersection performance

Classified intersection traffic count surveys along key roads were undertaken in 2019 and 2022 at locations chosen to assess the traffic performance of Pennant Hills Road and other key roads for the pre-opening and post-opening scenarios between the AM and PM peak periods. These locations were also chosen to identify any changes in broader traffic patterns based on community and stakeholder feedback[3].

A total of twenty-five (25) intersections were assessed for both pre-opening and post-opening scenarios. Generally, traffic volumes have reduced along the surface road network following the opening of NorthConnex, except for the following locations, which experienced an increase in traffic volumes.

[2] "A" = mid-block; number = location ID (e.g. A14)
[3] These locations are consistent with those originally identified in the NorthConnex EIS (2014)

- Pennant Hills Road/ North Rocks Road (B1)[4]
- Pennant Hills Road/ M2 Hills Motorway (B2)
- Pennant Hills Road/ Pacific Highway (B15)
- Pacific Highway/ Ingram Road/ Woolcott Avenue (B19)

Despite increases to traffic volumes at the above locations, peak hour intersection performance has remained the same or improved at all locations following the opening of NorthConnex, except for Pacific Highway/ Ingram Road/ Woolcott Avenue (B16). The degradation of performance of the Pacific Highway/ Ingram Road/ Woolcott Avenue intersection is not considered to be a direct result of the operation of the project. This could be attributed to the land use changes within the surrounding locality, as discussed in Section 3.1.

Travel times

Travel time surveys were undertaken during the AM and PM peak periods along the following three routes, which align with those reported in the NorthConnex project's EIS[5] (2014):

- Pennant Hills Road, between the M1 Pacific Motorway interchange and M2 Hills Motorway interchange
- Pacific Highway, between the M1 Pacific Motorway interchange and Ryde Road intersection
- Hills M2 Motorway, between the Pennant Hills Road and Windsor Road interchanges.

The surveys were conducted on 19 November 2019 for the pre-opening scenario and on 17 February 2022 for the post-opening scenario, to compare the pre-opening and post-opening performance along the routes.

During the AM peak, all travel times significantly decreased in both directions following the opening of NorthConnex, except for Pacific Highway (northbound) which experienced a minor increase of 9 seconds.

During the PM peak, travel times on Pennant Hills Road and Pacific Highway significantly decreased in both directions, however, travel times on Hills M2 Motorway increased by 19 seconds northbound and 40 seconds southbound (peak direction of traffic).

Bus performance

Bus performance was measured in terms of average daily journey times and average travel speeds of all scheduled bus routes operating along Pennant Hills Road on weekdays and weekends for both northbound and southbound directions. Data for November 2019 (pre-opening) and February 2022 (post-opening) were used for the comparative analysis.

Following the opening of NorthConnex, bus operating travel times have significantly improved in both directions, with significant reductions on weekdays of up to 5.5 minutes.

Bus travel speeds have also significantly improved in both directions, with an average bus operating speed increase of between 2 to 6 kilometres per hour.

Walking and cycling activity

A review of walking and cycling activity between the pre-opening and post-opening scenarios was undertaken using a combination of publicly available data and site observations.

Walking and cycling along Pennant Hills Road remain relatively low. Based on site observations, higher pedestrian activity is generally concentrated within commercial centres and educational establishments along the corridor. Cycling also remains at relatively low levels, remaining more prevalent during weekends.

[4] "B" = intersection; number = location ID (e.g. B14)
[5] https://pp.planningportal.nsw.gov.au/major-projects/projects/northconnex

Stakeholder feedback

Following the opening of NorthConnex in October 2020, TfNSW received feedback from the community and stakeholders in relation to key issues of relevance to this project. Table E presents a summary of negative feedback received by TfNSW.

Table E-1-1 Summary of post-opening feedback received in relation to NorthConnex

Issue	Description	Response
Toll Avoidance/ Heavy Vehicles	Heavy vehicles use local streets to avoid NorthConnex and regulatory gantries on Pennant Hills Road, in particular Campbell Avenue.	• Heavy vehicle restrictions apply to several local streets. • A proposal has been prepared by Hornsby Council for the installation of a refuge island on Campbell Avenue, Normanhurst at the time of writing this report. This would restrict the road to light vehicle movements only.
	There is an increase in the number of heavy vehicles using Pacific Highway to avoid NorthConnex.	• Avoiding NorthConnex to travel on M2 would add 20 minutes travel time and still incur a toll. • A review of traffic count data from the TfNSW Traffic Volume reveals that heavy vehicle volumes on the Pacific Highway at Warrawee have decreased since the opening of NorthConnex. • Volumes of light vehicles along the same route also decreased, but at a much faster rate than that of heavy vehicles. • As a result, the percentage of heavy vehicles as part of total traffic has increased. This is likely to result in a perception that heavy vehicles have increased, which is not true based on the analysis of classified traffic data along the Pacific Highway.

TfNSW also received positive feedback during an event celebrating the one-year anniversary of tunnel operations. This feedback generally praised the project for reducing congestion on Pennant Hills Road and improving travel times.

Proposed mitigation measures

To mitigate the performance of the surrounding road network and address key concerns by the community, upgrades are currently proposed at the following intersections:

- Pennant Hills Road/ North Rocks Road, Carlingford
- Pennant Hills Road/ Campbell Avenue, Normanhurst

Based on the outcomes of the traffic modelling presented in this report, the following intersection is recommended for further investigations to mitigate the change in performance:

- Pacific Highway/ Ingram Road/ Woolcott Avenue, Wahroonga

1 Introduction

1.1 Background

On 13 January 2015, the New South Wales (NSW) Minister for Planning granted approval to the State Significant Infrastructure (SSI) application for the NorthConnex 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 E28 lists the requirement for the preparation of a Road Network Performance Review Plan:

> *"At 12 months, and 5 years, after the commencement of operation of the SSI, or as otherwise agreed to by the Secretary, the Proponent shall prepare a* ***Road Network Performance Review Plan*** *("the Plan") in consultation with relevant Councils that includes:*
>
> *a. an updated analysis, including modelling of traffic impacts to the adjoining road network, as a consequence of the SSI. This shall include a review of new information available about potential land use changes;*
>
> *b. an updated description and explanation of the extent of SSI improvements and the area of affected road network considered in the updated analysis and its consistency or otherwise with the affected network;*
>
> *c. identification of potential mitigation measures to manage any predicted traffic performance deficiencies, including bus priority measures and management measures to minimise toll avoidance, particularly for heavy vehicles;*
>
> *d. the predicted traffic performance improvements from these measures, including any cumulative improvements;*
>
> *e. justification of why the predicted 'without project' performance of any intersection on the adjoining road network cannot be improved; and*
>
> *f. details of any complaints received relating to traffic, transport and access impacts, and how they have been addressed in the Plan.*
>
> *The Plan shall be submitted to the Secretary, Transport for NSW (in relation to impacts on bus services) and to relevant Council within 60 days of its completion and made publicly available.*
>
> *The purpose of the Plan is to optimise road network performance 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."*

1.2 Purpose of this report

This report presents the Road Network Performance Review Plan ("the Plan") to compare the impacts of the project on the performance of the road network 12-months following start of operations[6] on 31 October 2020 (post-opening) with the performance of the road network prior to opening of the project (pre-opening). This is the first timing point of Condition E28 of the SSI approval.

1.3 Structure of this plan

This plan has been prepared to address the requirements of Condition E28 discussed in Section 1.1. Table 1-1 presents the sections of this document relevant to the E28 conditions of approval.

Table 1-1 Report structure and relevant items addressed from Condition E28

Condition E28 item	Item requirements	Relevant Report Sections	Page
A	*"an updated analysis, including modelling of traffic impacts to the adjoining road network, as a consequence of the SSI. This shall include a review of new information available about potential land use changes"*	Chapter 2, Section 2.4.1	Page 12
		Chapter 3, Section 3.3.2 and Section 3.4	Page 20
B	*"an updated description and explanation of the extent of SSI improvements and the area of affected road network considered in the updated analysis and its consistency or otherwise with the affected network"*	Chapter 1, Section 1.4 and Section 1.5	Page 12
C	*"identification of potential mitigation measures to manage any predicted traffic performance deficiencies, including bus priority measures and management measures to minimise toll avoidance, particularly for heavy vehicles"*	Chapter 5, Section 5.1 and Section 5.2	Page 62
D	*"the predicted traffic performance improvements from these measures, including any cumulative improvements"*	Chapter 3, Section 3.3.2, Section 3.4, Section 3.5, Section 3.6 and Section 3.7	Page 20
E	*"justification of why the predicted 'without project' performance of any intersection on the adjoining road network cannot be improved"*	Chapter 3, Section 3.4	Page 20
F	*"details of any complaints received relating to traffic, transport and access impacts, and how they have been addressed in the Plan"*	Chapter 4 Section 4.1	Page 53

[6] To enable a more representative assessment of the performance of the road network following changed travel patterns as a result of COVID-19 restrictions, road traffic data used for this 12-month post-opening assessment was gathered in February 2022 instead of October-November 2021.

1.4 Overview of the project

The NorthConnex project is a nine-kilometre twin road tunnel linking the M1 Pacific Motorway at Wahroonga to the Hills M2 Motorway at West Pennant Hills. The project also includes on and off-ramps onto Pennant Hills Road at West Pennant Hills and Wahroonga. Each of the tunnels are provided with two 3.5-metre traffic lanes with an additional 2.8 m wide breakdown lane in case of an incident or emergency.

The project also involved integration works along the Hills M2 Motorway, road network changes as part of the northern interchange, and minor arrangements to facilitate access to the project's operational facilities, including the Motorway Operations Centre on Eaton Road and the Tunnel Support Facilities on Wilson Road and Trelawney Street (access from and egress to Pennant Hills Road).

The project provides the missing link in the National Transport Network improving freight access, connectivity and reliability across Greater Sydney and the wider region. The project has been designed to the highest safety standards and as a solution to bypass one of NSW's most congested routes: Pennant Hills Road. Figure 1-1 illustrates the project alignment and the surrounding locality, including Pennant Hills Road.

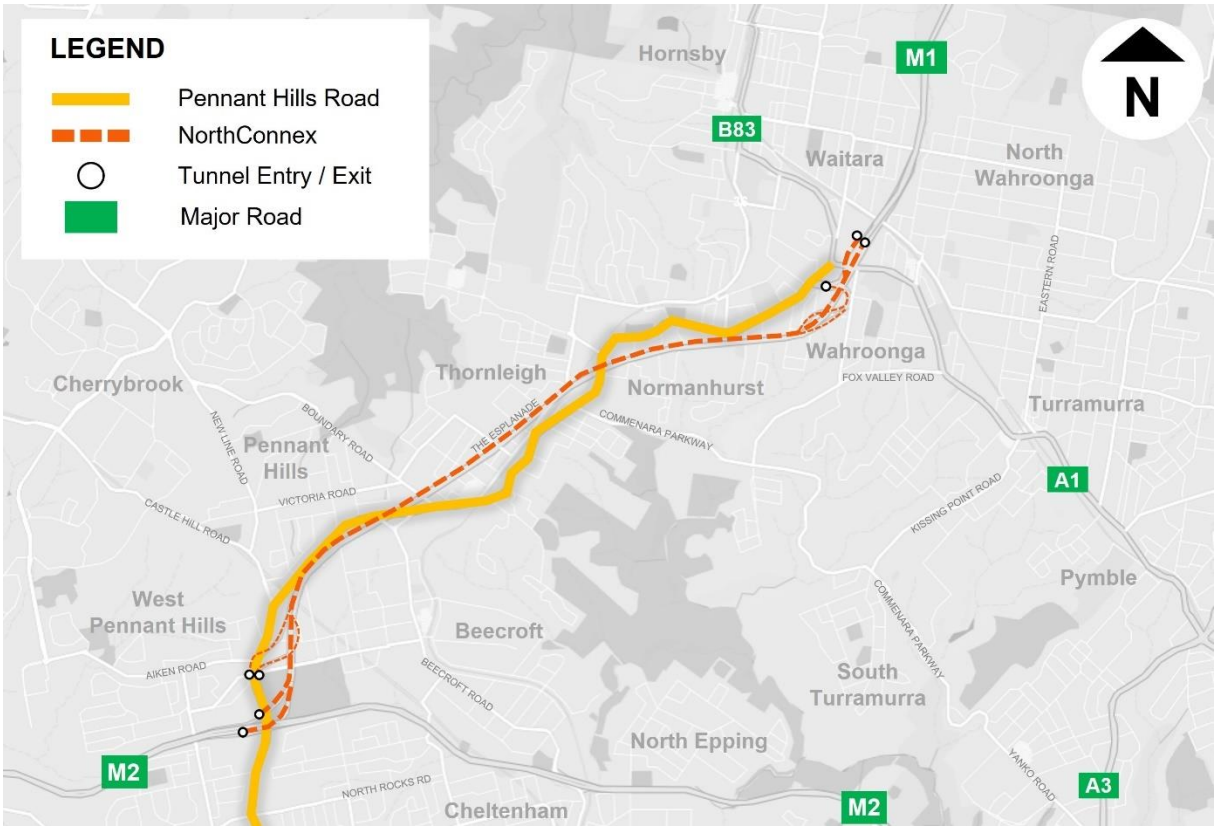


Figure 1-1 Overview of the project alignment and surrounding locality

The project has registered average daily traffic volumes in both directions in the order of 35,000 to 40,000 vehicles, except during the lockdown months between July to September 2021, when the daily volumes averaged about 15,000 vehicles. Figure 1-2 shows the average daily traffic volumes for the project since commencement of operations up to (and including) February 2022.

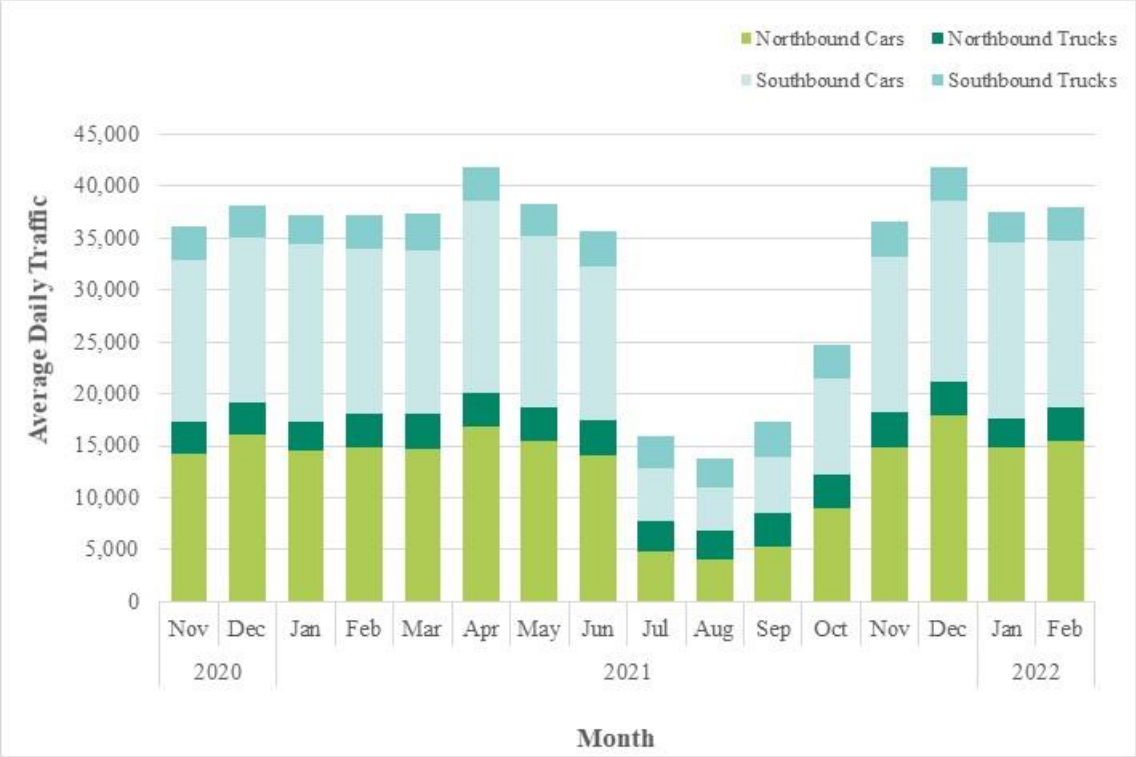


Figure 1-2 Average daily traffic volumes using NorthConnex

Data source: Transport for NSW (2022)

1.5 Extent of this review

The extent of this road network performance review was identified based on the assumptions used in the project EIS and feedback received from the stakeholders as detailed in Section 2.2. The review mainly includes the Pennant Hills Road (A28) corridor which links the Hills M2 Motorway with the M1 Pacific Motorway and other key roads, intersections, and segments within the affected area, perceived to be alternate routes between these two motorways, including:

- Pacific Highway (A1, B83)
- Ryde Road/ Lane Cove Road (A3)

This review also includes key local roads such as:

- Aiken Road
- Beecroft Road
- Boundary Road
- Castle Hill Road
- Fox Valley Road
- Jenkins Road
- Sefton Road
- Malsbury Road
- Midson Road
- Milson Parade
- New Line Road
- North Rocks Road
- The Comenarra Parkway
- The Esplanade

This Review also covers the access and egress interchanges that are part of the project, including interchanges with:

- M1 Pacific Motorway (Northern Interchange)
- M2 Hills Motorway (Southern Interchange)

The following factors were considered in identifying the extent of review to identify potential impacts on the surface road network as a result of the Project:

1) Traffic generation/induced demand
2) Toll avoidance
3) Road network changes as a result of the Project (e.g. entry/exit ramps to the Project).

Figure 1-3 illustrates the extent of the road network performance review.

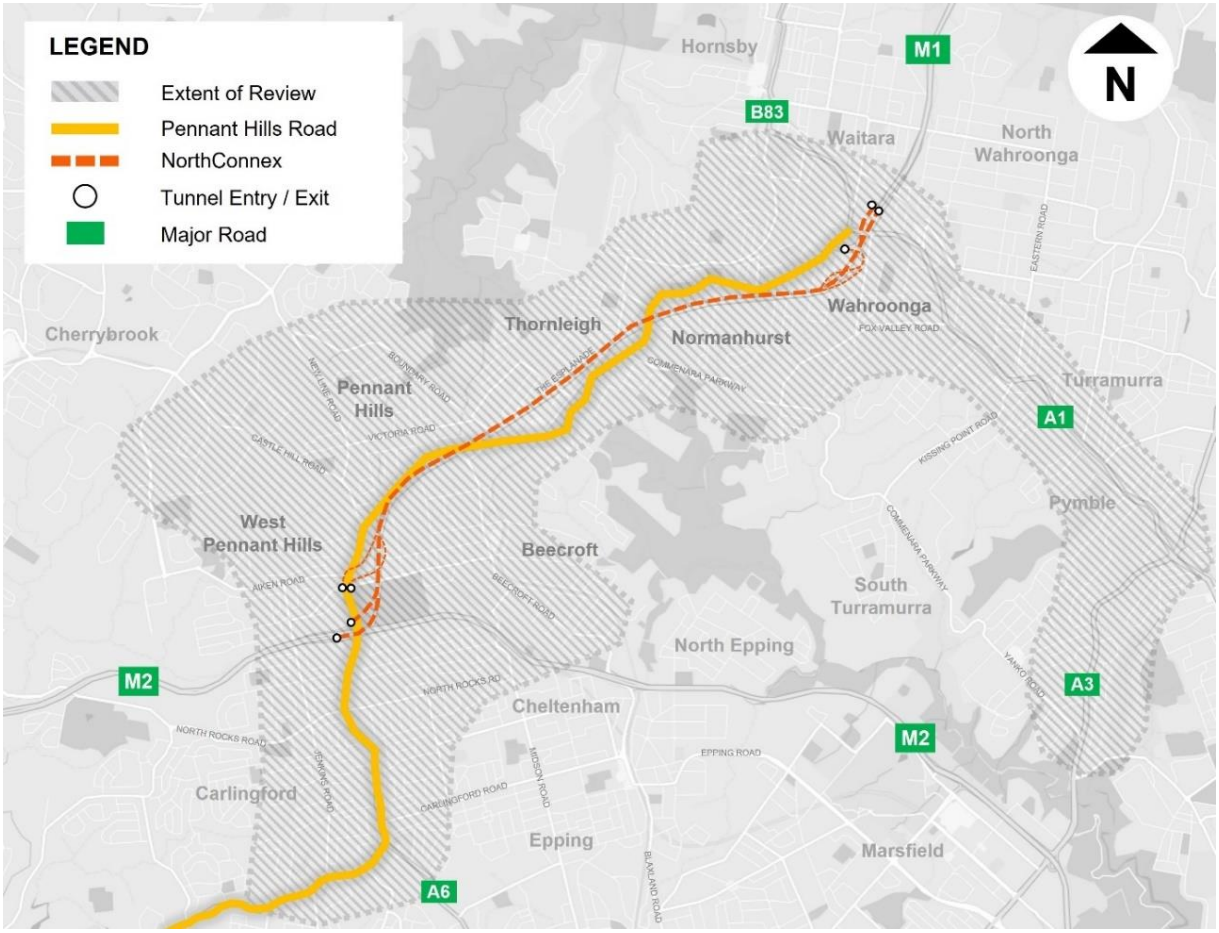


Figure 1-3 Extent of road network performance review

2 Approach and methodology

2.1 Approach

The purpose of the Plan is to review the traffic performance of the adjoining surface road network, namely Pennant Hills Road, before (pre-opening) and after (post-opening) opening of the project and identify any mitigation measures that may be required where the traffic performance has been negatively impacted by the opening of the project.

The NorthConnex Environmental Impact Statement (EIS), undertaken in 2014, assessed the road network performance at the expected opening of the project (2019) and in the future (2029), including scenarios with and without the project. However, in consideration of stakeholder and community feedback, the EIS forecasted future scenarios were deemed not indicative of actual pre-opening and post-opening conditions. To better assess more realistic scenarios, field surveys were undertaken in November 2019 and February to March 2022 to assess the pre-opening and post-opening road network performance. For further details regarding data collection, please refer to Section 2.4.

The road network performance review has been undertaken using a combination of traffic modelling, mid-block assessments, bus performance assessments and travel time observations. The inputs required to assess the performance of the road network were based on traffic surveys undertaken for the following scenarios:

- Pre-opening scenario: November 2019
- Post-opening scenario: February-March 2022[7]

Stakeholder and community engagement was also undertaken as part of the development of the assessments documented in this plan. The intersection and mid-block locations that were surveyed were identified in consultation with the Ku-ring-gai, City of Parramatta, Hornsby Shire and The Hills Shire Councils and the community.

2.2 Stakeholder consultation

TfNSW have engaged with key stakeholders during the preparation of this Plan, including City of Parramatta, Ku-ring-Gai, Hills Shire and Hornsby Shire Councils. Feedback was provided by the Councils in relation to the scope of potential locations to be assessed as part of this Plan, as summarised in Table 2-1. Refer to Appendix A for additional inputs provided by the Councils. Community information sessions were also held in August and September 2019, prior to the preparation of the pre-opening assessment.

Table 2-1 Summary of feedback received from Councils

Suggested mid-block location	Response	Location ID of count station in this Plan
Parramatta Council		
Beecroft Road near Kandy Ave	Mid-block included	A9
Beecroft Road near Cheltenham Road	Mid-block included	A10
Carlingford Road near Elbon Avenue	Mid-block included	A11
Marsden Road near Rickard Street	Mid-block included	A12
Midson Road beside Hills M2	Mid-block included	A13
North Rocks Road near Pennant Hills Road Park	Intersection included	B1

[7] To enable a more representative assessment of the performance of the road network following changed travel patterns as a result of COVID-19 restrictions, road traffic data used for this 12-month post-opening assessment were gathered in February 2022 instead of October-November 2021.

Suggested mid-block location	Response	Location ID of count station in this Plan
North Rocks Road near Morshead Avenue	Mid-block included	A15
Eaton Road	Mid-block included	A18
Ku-ring-gai Council		
Eastern Arterial Road (rat run on eastern side of highway)	Picked up by mid-block on Junction Road east of Grosvernor Rd	A19
Lady Game Drive / The Comenarra Parkway (rat run western side of highway)	Picked up by mid-block on Comenarra Parkway, west of Fox Valley Road and at intersection of Comenarra Parkway / Fox Valley Road	A20
Lane Cove Road is very constrained and may attract extra heavy vehicles.	Added counts at RMS count stations on Ryde Road (A3) for reference to background traffic growth.	C2
Key local streets to monitor Ada Avenue and Lucinda Avenue, Wahroonga	Mid-block included	A21, A22
Council would be interested to see impacts at Lindfield, Gordon, St Ives, Turramurra, Roseville	Added counts at RMS (TfNSW) count stations on Pacific Highway for reference to background traffic growth. Would be difficult to assess impacts in local streets	C1
Hills Shire Council		
Castle Hill Road just east of Old Northern Road	Picked up as part of counts for intersection at Pennant Hills Road / Castle Hill Road	B5
Highs Road just south of Castle Hill Road	Mid-block included	A27
New Line Road just north of Castle Hill Road	Mid-block included	A25
Pennant Hills Road south of Castle Hill Road	Mid-block included	A2
Castle Hill Road just west of Pennant Hills Road	Picked up as part of counts for intersection at Pennant Hills Road / Castle Hill Road	B5
Aiken Road west of Oakes Road	Picked up by intersection counts on Pennant Hills Road/Aiken Road	B4
Aiken Road east of Hill Road	Covered by other locations on Aiken Road and Oakes Road	-
Aiken Road west of Pennant Hills Road	Covered by intersection count at Aiken Road / Pennant Hills Road	B4
Highs Road north of Coonara Avenue	Added	A27
Copeland Road just east of Pennant Hills Road	Covered by intersection count at Pennant Hills Road / Karollon Road / Copeland Road (B3)	-
Karloon Road just west of Pennant Hills Road	Covered by intersection count at Pennant Hills Road / Karloon Road / Copeland Road	B3

Suggested mid-block location	Response	Location ID of count station in this Plan
Karloon Road at Eaton Road	Captured using intersection count at Pennant Hills Road / Karloon Road / Copeland Road	B3
Oakes Road south of Eaton Road	Picked up in intersection count at Eaton Road/ Oakes Road	B35
Pennant Hills Road just north of M2	Already included	A2
Boundary Road at Pennant Hills Road	Intersection included	B8
Boundary Road at New Line Road	Mid-block included	A30
Hornsby Shire Council		
Key rat run is west of Pennant Hills Road: College Crescent/ Clarke Road/ Malmsbury Road to The Esplanade/ Yarrara Road	Potential rat runs have been captured through counts at Duffy Avenue/The Esplanade/Chilvers Road intersection	B24
Concern for delays on The Comenarra Parkway, this encourages rat running via roads to the south via Wood Street to access Pennant Hills Road.	Mid-block included	A20
Also concern for ability to turn right onto Pennant Hills Road from The Comenarra Parkway and right from Duffy Avenue, due to congestion which leaves minimal capacity.	Intersections included	B11, B20
Concern for safety and delays at The Esplanade/ Chilvers Road/ Duffy Ave intersection.	Intersection included	B24
Interest in Boundary Road for rat running	Mid-block included	A30
Interest in Bellamy Street and Stevens Street to and from Yarrara Road and Boundary Road.	Captured by the intersections counts at Pennant Hills Road/Yarrara Road and Pennant Hills Road/Boundary Road	B8 & B9
Interest in Pennant Hills Road and Dartford Road, Normanhurst Road, Wells Street and Duffy Avenue.	Intersections included	B20, B21, B26, B27

2.3 Methodology

The methodology adopted to prepare this plan is outlined in Figure 2-1.

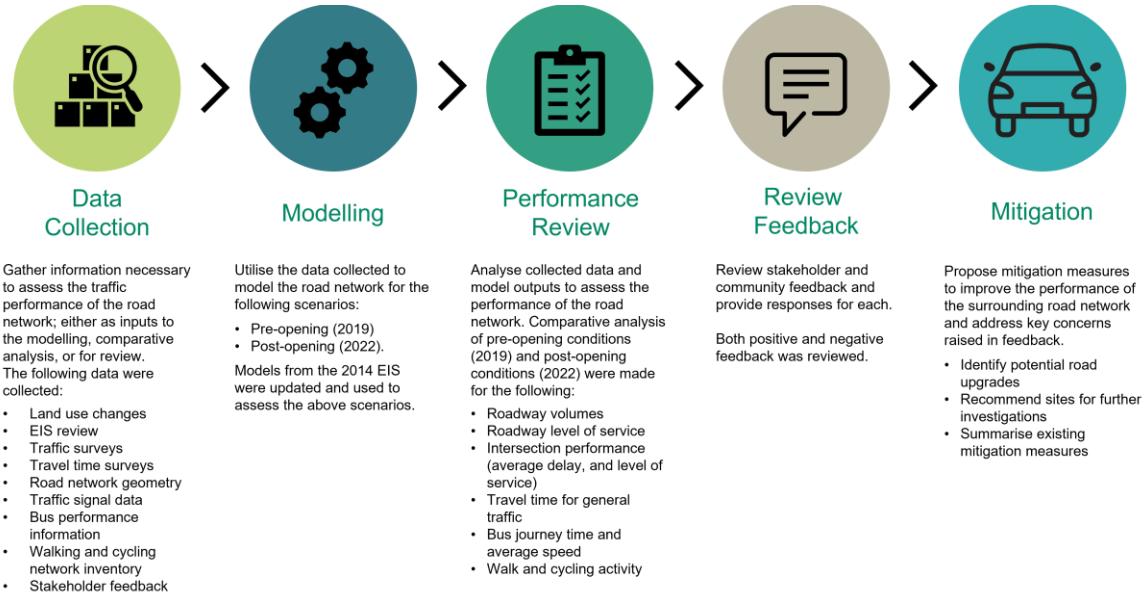


Figure 2-1 Methodology adopted for the preparing this plan

2.4 Data collection

This section summarises the data collected to feed into the assessments required to prepare this plan.

2.4.1 Land use changes

The locality surrounding the project has experienced ongoing growth and development through changes to the intensity of existing land uses between pre-opening (2019) and post-opening (2022). Delineating the potential impact of these land use changes is essential to accurately assess the impacts of the project.

A comparison of NearMap imagery from 2019 and 2022 was conducted to identify locations that have experienced land use changes along the Pennant Hills Road corridor from West Pennant Hills near the Hills M2 Motorway north towards Hornsby. A desktop review of available information on these developments at these locations was also conducted to assess potential trip generation and associated impacts on road network performance.

2.4.2 Traffic surveys

Classified intersection surveys and mid-blocks counts along key roads were undertaken. The locations were chosen to enable the traffic performance of Pennant Hills Road and other key roads to be assessed for the pre-opening and post-opening scenarios. These locations were also chosen to identify any changes in broader traffic patterns. Queue length surveys at the intersections along Pennant Hills Road were also undertaken to support the validation of the LinSig traffic models. The survey locations are illustrated and presented in Figure 2-2.

Traffic surveys consisted of intersection counts recording the number of vehicles moving through an intersection during peak periods of a typical day and automated traffic counts which recorded the number and classification (light/ heavy) of vehicles travelling on a segment of road over a period of seven days (24 hours) during a typical week.

The automated traffic count surveys for the pre-opening scenario were undertaken between 19 and 25 November 2019 by Matrix Traffic and Transport Data, with intersection counts that informed the LinSig models undertaken on 19 November 2019. Follow up surveys to account for technical issues at some sites were also undertaken on 27 November 2019.

The automated traffic count surveys for the post-opening scenario were conducted by the Matrix Traffic and Transport Data between 15 and 21 February 2022, with intersection counts that informed the LinSig models undertaken on 17 February 2022. Follow up surveys to account for technical issues at some sites were also undertaken on 10 March 2022.

In addition to these surveys, existing TfNSW data at permanent traffic count stations[8] were used to review and identify potential traffic changes in the wider road network because of the project; hence additional standalone surveys were not commissioned at those locations. The data from these permanent count stations were also used to review any toll avoidance behaviour by heavy vehicles following operation of the project. The locations of the TfNSW permanent counters used for this plan are presented is Figure 2-2.

The difference in average daily traffic volumes at all mid-block locations shown in Figure 1-3 are reported in Section 3.3.1, excluding mid-block locations A1, A3, A23 and A50. This section also includes assessment of average daily traffic volumes at the TfNSW permanent traffic counter locations (C1 to C4).

The capacity assessment of mid-block locations, including A1, A3, A23 and A50 are presented in Section 3.3.2. Volumes for these mid-blocks were estimated based on intersection turning counts undertaken for the peak hours. The capacity assessment of study area intersections (B1 to B25) using LinSIG is detailed in Section 3.4.

[8] Transport for NSW Traffic Volume Viewer, accessed via https://roads-waterways.transport.nsw.gov.au/about/corporate-publications/statistics/traffic-volumes/aadt-map/index.html#/?z=6 on 6 May 2022.

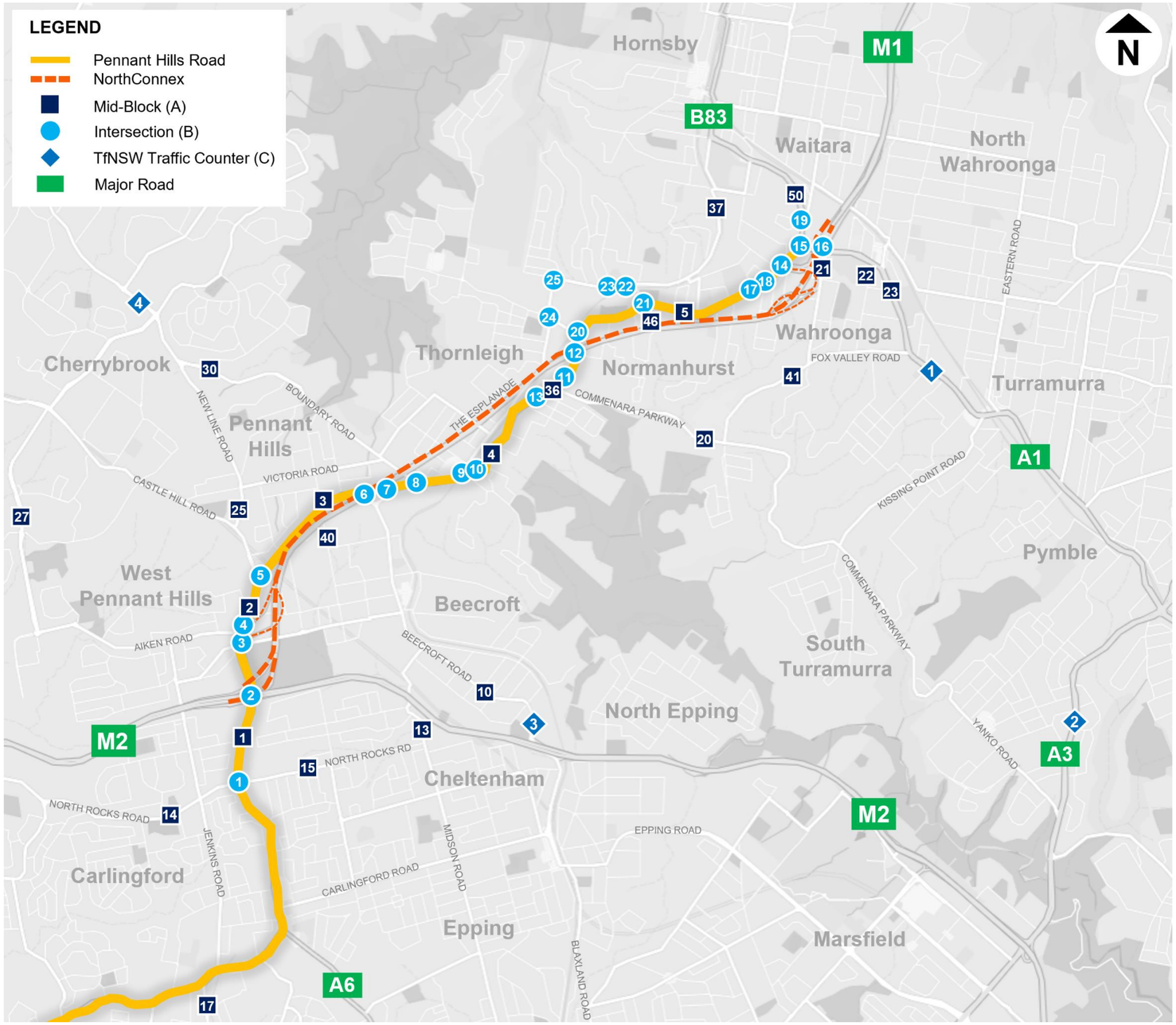


Figure 2-2 Location of intersection and mid-block traffic counts

Mid-Blocks

A1	Pennant Hills Road, North Rocks Road to M2 Hills Motorway
A2	Pennant Hills Road, M2 Hills Motorway to Castle Hill Road
A3	Pennant Hills Road, Castle Hill Road to Beecroft Road
A4	Pennant Hills Road, Beecroft Road to The Comenarra Parkway
A5	Pennant Hills Road, The Comenarra Parkway to Pacific Highway
A10	Beecroft Road, north of Cheltenham Road
A13	Midson Road, north of Kerry Avenue
A14	North Rocks Road, east of Akira Road
A15	North Rocks Road, west of Kimberley Road
A17	Adderton Road, north of Homelands Avenue
A20	The Comenarra Parkway, west of Fox Valley Road
A21	Lucinda Avenue, south of Pacific Highway
A22	Ada Avenue, south of Pacific Highway
A23	Pacific Highway, north of Pennant Hills Road
A25	New Line Road, north of Castle Hill Road
A27	Highs Road, north of Coonarra Avenue
A30	Boundary Road, east of New Line Road
A36	Wood Street, south of The Comenarra Parkway
A37	Malsbury Road, south of Clarke Road
A40	Hull Road, north of Albert Road
A41	Fox Valley Road, west of Lucinda Avenue
A46	Campbell Avenue, south of Pennant Hills Road
A50	Pacific Highway, east of M1 Pacific Motorway Interchange

Intersections

B1	Pennant Hills Road / North Rocks Road
B2	Pennant Hills Road / M2 Hills Motorway Interchange
B3	Pennant Hills Road / Copeland Road / Eaton Road
B4	Pennant Hills Road / Aiken Road
B5	Pennant Hills Road / Castle Hill Road
B6	Pennant Hills Road / Beecroft Road (west)
B7	Pennant Hills Road / Beecroft Road (east)
B8	Pennant Hills Road / Boundary Road
B9	Pennant Hills Road / Yarrara Road
B10	Pennant Hills Road / Railway Street / The Crescent
B11	Pennant Hills Road / The Comenarra Parkway / Parkes Street
B12	Pennant Hills Road / Phyllis Avenue / Loch Maree Avenue
B13	Pennant Hills Road / Bellevue Street
B14	Pennant Hills Road / M1 Pacific Motorway Interchange
B15	Pennant Hills Road / Pacific Highway
B16	Pacific Highway / M1 Pacific Motorway Interchange
B17	Pennant Hills Road / Jasmine Road
B18	Pennant Hills Road / Hinemoa Road
B19	Pacific Highway / Ingram Road / Woolcott Avenue
B20	Pennant Hills Road / Duffy Avenue
B21	Pennant Hills Road / Dartford Road
B22	Milson Parade / Dartford Road
B23	Dartford Road / Sefton Road / Milson Parade
B24	Chilvers Road / The Esplanade / Duffy Avenue
B25	Sefton Road / Chilvers Road

TfNSW Traffic Counters

C1	Pacific Highway, east of Blytheswood Avenue
C2	Ryde Road, south of Lofberg Avenue
C3	Beecroft Road, north of Old Beecroft Road
C4	New Line Road, south of Tennyson Close

2.4.3 Travel time surveys

Travel time surveys along three routes were undertaken by Matrix Traffic and Transport Data. The surveys were conducted on 19 November 2019 for the pre-opening scenario and on 17 February 2022 for the post-opening scenario, to compare the pre-opening and post-opening performance along the routes. The three routes surveyed matched those reported in the NorthConnex project's EIS (2014) and are:

- Pennant Hills Road, between the M1 Pacific Motorway interchange and Hills M2 Motorway interchange
- Pacific Highway, between the M1 Pacific Motorway interchange and Ryde Road intersection
- Hills M2 Motorway, between the Pennant Hills Road and Windsor Road interchanges.

Figure 2-3 illustrates the routes used for travel time surveys during the AM and PM peak hours for the pre-opening and post-opening scenarios, as well as in the EIS.

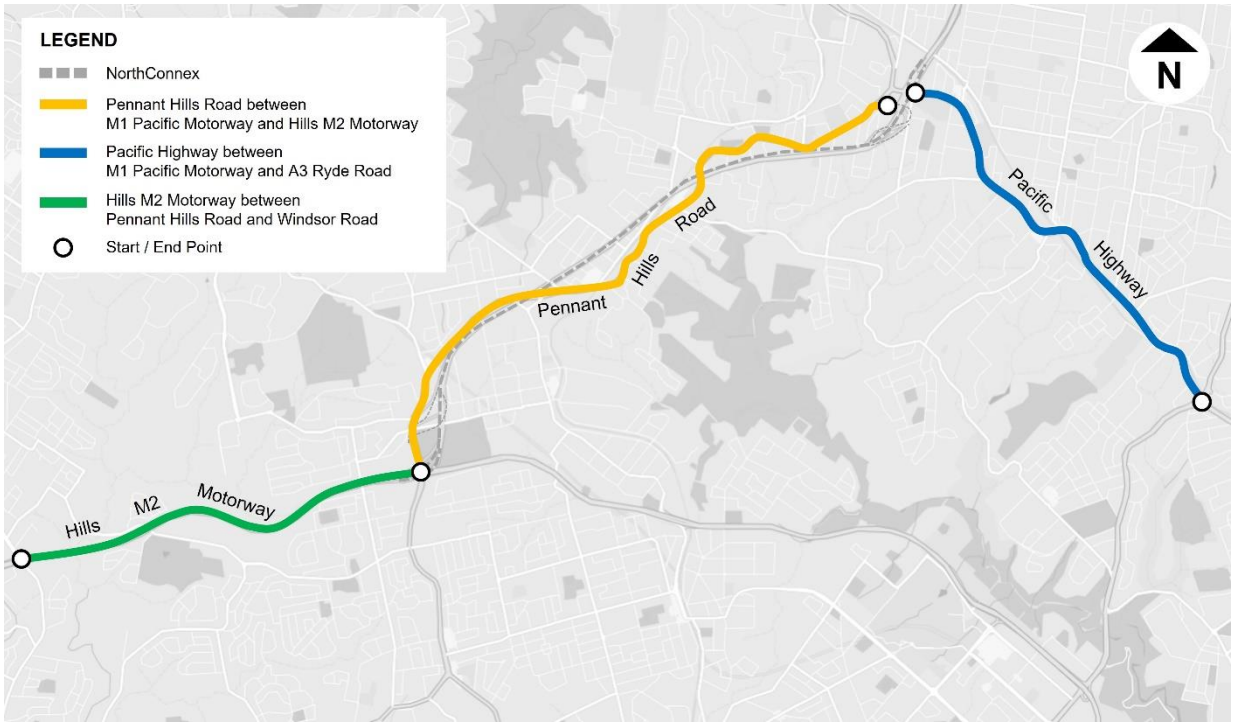


Figure 2-3 Routes used for travel time surveys

2.4.4 Traffic signal phasing and timing data

The extents of the LinSig models used for the assessments are presented in Table 2-2. Traffic signal phasing and timing data for the signalised intersections that were covered by the LinSig models, for both pre-opening and post-opening scenarios, were obtained from the TfNSW SCATS database.

The signal phasing and timings were extracted for the AM and PM peak hours for the same day as the intersection counts (Refer Section 2.4.1) to ensure consistency.

Table 2-2 Extents of LinSig models

Model Number	Extent of Model
Model 1	• Pennant Hills Road/ North Rocks Road (B1) • Pennant Hills Road/ Hills M2 Motorway Interchange (B2) • Pennant Hills Road/ Eaton Road/ Copeland Road (B3) • Pennant Hills Road/ Aiken Road (B4)
Model 2	• Pennant Hills Road/ Beecroft Road (west) (B6) • Pennant Hills Road/ Beecroft Road (east) (B7) • Pennant Hills Road/ Boundary Road (B8)
Model 3	• Pennant Hills Road/ Jasmine Road/ Hinemoa Avenue (B17 & B18) • Pennant Hills Road/ M1 Pacific Motorway Interchange (B14) • Pennant Hills Road/ Pacific Highway (B15) • Pacific Highway/ M1 Pacific Motorway Interchange (B16) • Pacific Highway/ Ingram Road/ Woolcott Avenue (B19)
Model 5	• Pennant Hills Road/ Duffy Avenue (B20) • Pennant Hills Road/ Dartford Road (B21) • Chilvers Road/ The Esplanade/ Duffy Avenue (B24) • Sefton Road/ Chilvers Road (B25) • Dartford Road/ Sefton Road/ Milson Parade (B23) • Milson Parade/ Dartford Road (B22)
Model 6	• Pennant Hills Road/ Bellevue Street (B13) • Pennant Hills Road/ The Comenarra Parkway/ Parkes Street (B11) • Pennant Hills Road/ Phyllis Avenue/ Loch Maree Avenue (B12)
Model 7	• Pennant Hills Road/ Yarrara Road (B9) • Pennant Hills Road/ Railway Street/ The Crescent (B10)
Model 11	• Pennant Hills Road/ Castle Hill Road (B5)

Note: Models 4, 8, 9 and 10 were created initially but became redundant during the EIS process in 2014. The model numbering has been retained for consistency and recording reasons.

2.4.5 Bus performance data

Bus performance was measured in terms of average daily journey times and travel speeds of all scheduled bus routes operating along Pennant Hills Road between Pennant Hills and Wahroonga. Bus performance information was extracted from the TfNSW database (PTIPS) covering weekday and weekends for both northbound and southbound directions. Data for November 2019 (pre-opening) and February 2022 (post-opening) were used for the comparative analysis.

2.4.6 Walking and cycling activity

A review of walking and cycling activity between the pre-opening and post-opening scenarios was undertaken using a combination of publicly available data and site observations.

3 Road network performance

3.1 Review of land use changes

A review of land uses was undertaken along the Pennant Hills Road corridor from West Pennant Hills near the Hills M2 Motorway north towards Hornsby. This was completed in line with Requirement A of Condition E28. Based on a comparison of NearMap imagery from November 2019 and February 2022, land use changes have been identified, which are likely to impact upon the road network performance, as illustrated in Figure 3-1.

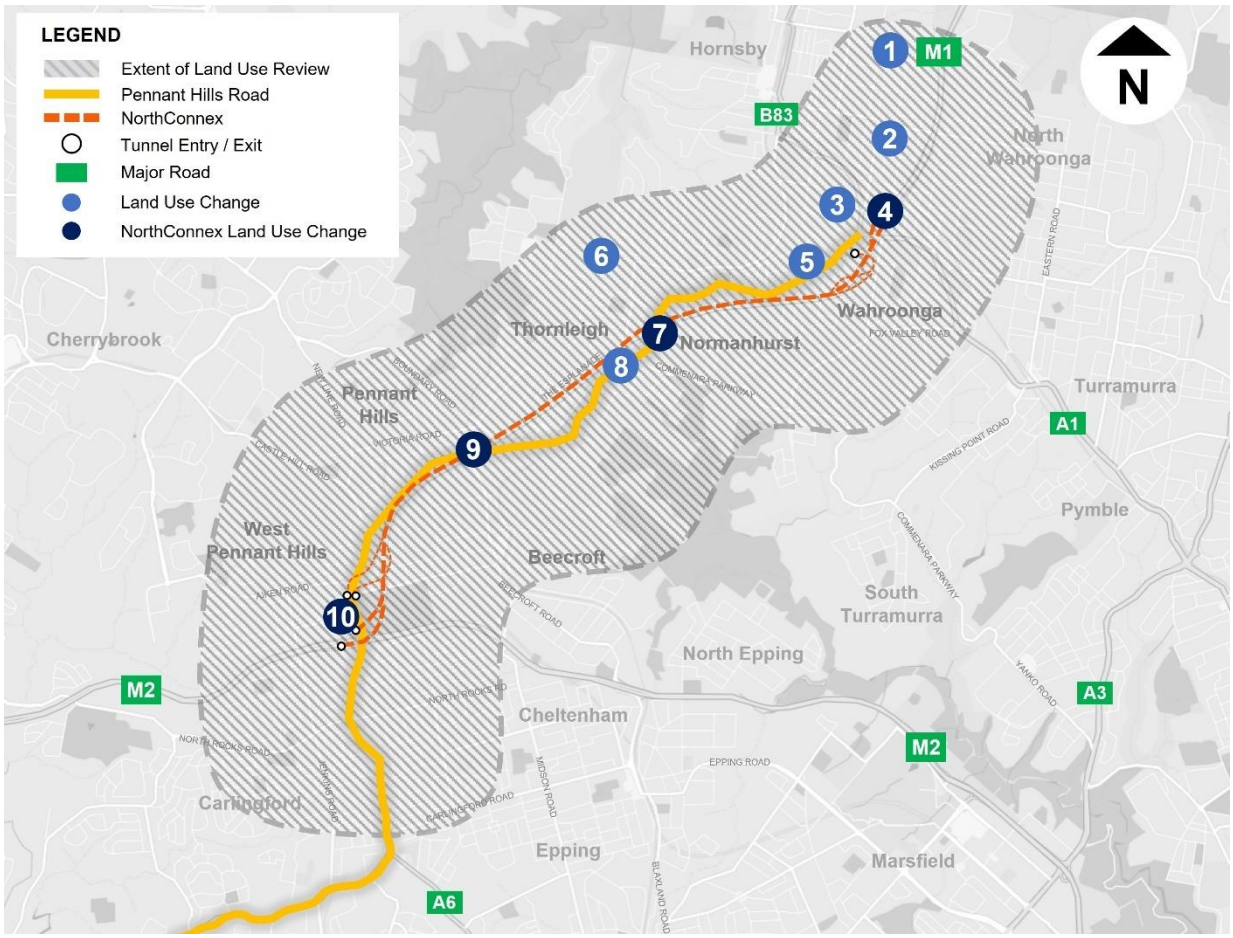


Figure 3-1 Land use changes along Pennant Hills Road corridor

Table 3-1 presents additional information on the land use changes illustrated in Figure 3-1. It is noted that land use changes delivered for the operation and maintenance of NorthConnex are anticipated to generate minimal vehicle movements and are therefore not expected to have any additional impacts on the road network.

Table 3-1 Overview of land use changes within general vicinity of Pennant Hills Road

ID	Description	Overview	Impacted Intersection/s	Projected traffic generation
Hornsby				
1	Hornsby Kuring-Gai Hospital Upgrade Project – Stage 2	*Construction of a new clinical services building and expanding the existing Hornsby Kuring-gai Hospital Emergency Department.*	B19	**+258** overall peak trips[9]
Waitara				
2	Waitara Public School Upgrade Project	*The upgrade accommodates up to 1,000 students to serve the needs of the student community*	B19	**+131** AM peak (school hours) **+100** PM peak (school hours)[10]
3	Catholic Healthcare McQuoin Park Redevelopment	*Demolition of existing structures and construction of 168 independent living units and community facilities.*	B15, B19	**+42** AM peak **+74** PM peak[11]
Wahroonga				
4	Northern Ventilation Facility Northern Interchange Facility	*Support facilities for the operation and maintenance of NorthConnex, located adjacent to the northern interchange with M1 Pacific Motorway.*	B14, B16	Minimal traffic generation
Normanhurst				
5	Uniting Bowden Brae Retirement and Independent Living Village Redevelopment	*Construction of 137 independent living units, basement carpark, swimming pool, open terrace, and community facilities*	B14, B17, B18	**+14** overall peak trips[12]
Thornleigh				
6	Enterprise Industrial Estate	*Construction of 32 industrial warehouses with vehicular access and parking*	B24, B25	**+46** AM peak **+46** PM peak[13]
7	Trelawney Street Tunnel Support Facility	*Support facility for the operation of NorthConnex, located south of M1 Pacific Motorway interchange.*	B11, B12	Minimal traffic generation
8	Zantia, Thornleigh	*Construction of 66 apartments with 6 mixed-use commercial premises on ground floor*[14]	B11, B13	**+21** AM peak per hour **+18** PM peak per hour[15]
Pennant Hills				
9	Wilson Road Tunnel Support Facility	*Support facility for the operation of NorthConnex, located north of Hills M2 Motorway interchange.*	B6, B7	Minimal traffic generation
10	Motorway Operations Centre Motorway Control Centre Southern Ventilation Facility Maintenance Yard	*Support facilities for the operation and maintenance of NorthConnex, located adjacent to the southern interchange with Hills M2 Motorway.*	B2, B3, B4	Minimal traffic generation

Note: The ID numbers refer to the locations shown in Figure 3-1. The impacted intersections refer to locations shown in Figure 2-2.

[9] Transport and Accessibility Assessment - Hornsby Ku-ring-gai Hospital Stage 2, prepared by TTW, dated 24 October 2017
[10] Traffic Impact Assessment – Waitara Public School Expansion, prepared by GHD, dated August 2017
[11] Traffic Impact Assessment – McQuoin Park, prepared by GTA Consultants, dated 1 April 2015 (DA/394/2015 as modified)
[12] Traffic and Parking Assessment Report – Bowden Brae Village, prepared by Varga Traffic Planning, dated 9 December 2015 (DA/1613/2015 as modified)
[13] Traffic and Parking Assessment Report – Proposed Lot 6 Industrial Unit and Self-Storage Facility, prepared by Terraffic, dated 28 June 2018 (DA/619/2018 as modified)
[14] Traffic and Parking Assessment Report – Proposed Mixed-Use Development, prepared by Varga Traffic Planning, dated 29 April 2016 (DA/590/2016 as modified)

3.2 Road network performance measures

The following road network performance measures are reported in this plan:

- Mid-block/ roadway volumes
- Roadway performance (level of service)
- Intersection performance (level of service)
- Travel times
- Bus performance
- Walking and cycling activities.

Level of service for roadways and intersections is described further in Section 3.2.1 and Section 3.2.2. Other metrics are described in Section 2.

3.2.1 Roadway level of service

Mid-block traffic volume/ capacity (V/C) ratios provide an indication of the saturation level of a segment of roadway, based on theoretical design capacity. These mid-block V/C ratios can be used to provide a corresponding level of service (LOS) for roadway operations, as detailed in Austroads Guide to Traffic Management – Part 3 Traffic Studies and Analysis (Austroads, Second Edition, 2013). There are six levels of service for midblock locations – LOS A to LOS F, with LOS A representing optimum operating conditions (free flow) and LOS F the poorest (forced or breakdown in flow).

Table 3-2 details the LOS definitions and corresponding V/C ranges for the road operation conditions that apply to the assessment of the project. Assessment of mid-block level of service for Pennant Hills Road will use the V/C ratio ranges for multi-lane roads, and assessment of motorways will use the volume/ capacity ratio ranges for freeways.

Table 3-2 Mid-block level of service definitions and criteria – multi lane roads

LOS	Definition	V/C ratio criteria	
		Multi-lane Roads[16]	Freeways [17]
A	A condition of free flow in which individual drivers are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and manoeuvre within the traffic stream is extremely high.	V/C ≤ 0.26	V/C ≤ 0.30
B	In the zone of stable flow where drivers still have reasonable freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort is a little less than with level of service A.	0.26 < V/C ≤ 0.41	0.30 < V/C ≤ 0.48
C	Also, in the zone of stable flow, but most drivers are restricted to some extent in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience declines noticeably at this level.	0.41 < V/C ≤ 0.59	0.48 < V/C ≤ 0.70
D	Close to the limit of stable flow and approaching unstable flow. All drivers are severely restricted in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is poor, and small increases in traffic flow will generally cause operational problems.	0.59 < V/C ≤ 0.81	0.70 < V/C ≤ 0.90
E	Traffic volumes are at or close to capacity, and there is virtually no freedom to select desired speeds or to manoeuvre within the traffic stream. Flow is unstable and minor disturbances within the traffic stream will cause breakdown.	0.81 < V/C ≤ 1.00	0.90 < V/C ≤ 1.00

[16] Where free flow speed is taken as 70 kilometres per hour
[17] Where free flow speed is taken as 100 kilometres per hour

LOS	Definition	V/C ratio criteria	
		Multi-lane Roads[16]	Freeways [17]
F	In the zone of forced flow, where the amount of traffic approaching the point under consideration exceeds that which can pass it. Flow breakdown occurs, and queuing and delays result.	1.00 > V/C	1.00 > V/C

Source: Austroads, Guide to Traffic Management – Part 3 Traffic Studies and Analysis, Second Edition, 2013

3.2.2 Intersection level of service

Average delay is commonly used to assess the operational performance of intersections, with the level of service used as an index. A summary of the level of service criteria is shown in Table 3-3.

Table 3-3 Level of service criteria – intersections

Level of service	Average delay/ vehicle (secs/veh)	Traffic signals/ roundabouts	Give way and Stop signs
A	<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	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; at signals incidents will cause excessive delays	At capacity; requires other control mode
F	>70	Roundabouts require other control mode	At capacity; requires other control mode

Source: Guide to Traffic Generating Developments, RTA, 2002

When a roadway or intersection level of service falls below LOS D, investigations are generally initiated to provide suitable remediation, however constraints in built-up urban areas mean that LOS E and LOS F are regularly experienced by motorists at pinch points on the existing strategic road network in Sydney. These conditions are generally experienced during traffic peak periods.

3.3 Roadway level of service and volumes

Figure 3-2 illustrates the mid-block locations assessed in this report, including sites assessed in terms of weekday average daily traffic at roads in the local network and peak hour mid-block level of service.

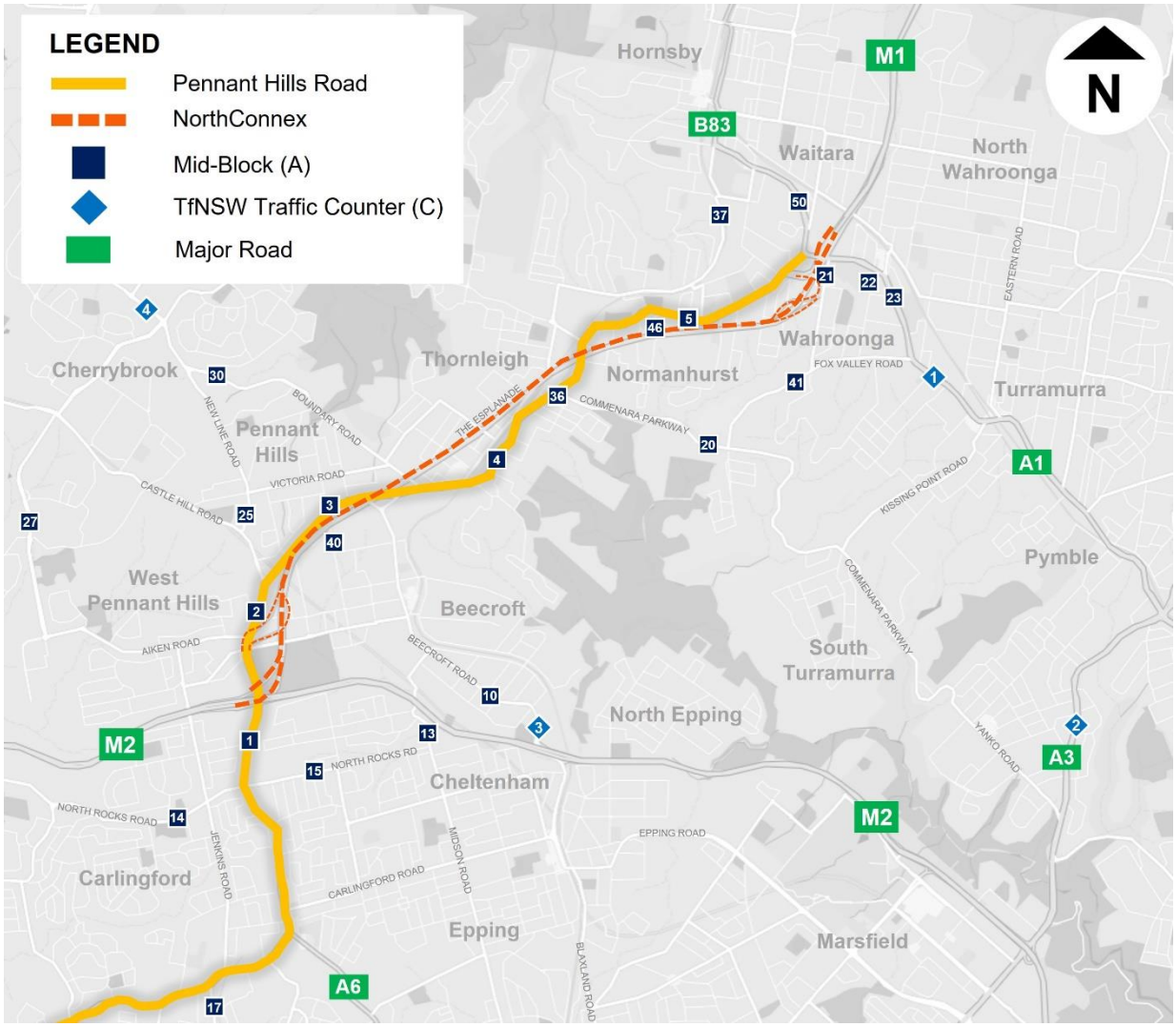


Figure 3-2 Mid-block locations assessed in the road network performance review

3.3.1 Roadway volumes

To assist in the investigation of stakeholder concerns regarding changes in traffic on the wider road network due to the project, average weekday daily traffic was compared for the pre-opening and post-opening scenarios to identify changes, if any.

Table 3-4 presents a comparison of the mid-block traffic volumes for the pre-opening and post-opening scenarios based on automated traffic surveys undertaken. The mid-block traffic volumes used for this comparison is the average weekday traffic volumes.

Table 3-4 Comparison of average daily mid-block volumes from automated traffic counts

Site	Location	Dir	Pre-opening scenario (2019)		Post-opening scenario (2022)		Change (vehicles per day)			
			LV	HV	LV	HV	LV	% LV change	HV	% HV change
A2	Pennant Hills Road Hills M2 Motorway to Castle Hill Road	NB	33,753	6,725	33,011	3,049	-742	-2% ▼	-3,676	-55% ▼
		SB	33,210	6,493	25,804	1,927	-7,406	-22% ▼	-4,566	-70% ▼
A4	Pennant Hills Road Beecroft Road to The Comenarra Parkway	NB	31,177	6,504	26,437	1,556	-4,740	-15% ▼	-4,948	-76% ▼
		SB	29,290	6,349	25,642	1,766	-3,648	-12% ▼	-4,583	-72% ▼
A5	Pennant Hills Road, The Comenarra Parkway to Pacific Highway	NB	27,106	6,116	21,675	1,438	-5,431	-20% ▼	-4,678	-76% ▼
		SB	26,658	5,816	22,087	1,676	-4,571	-17% ▼	-4,140	-71% ▼
A10	Beecroft Road north of Cheltenham Road	EB	15,914	621	13,461	603	-2,453	-15% ▼	-18	-3% ▼
		WB	14,731	603	14,496	591	-235	-2% ▼	-12	-2% ▼
A13	Midson Road north of Kerry Avenue	NB	1,891	68	1,921	40	+30	+2% ▲	-28	-41% ▼
		SB	2,533	35	2,335	54	-198	-8% ▼	+19	+54% ▲
A14	North Rocks Road east of Akira Road	EB	12,281	596	6,713	800	-5,568	-45% ▼	+204	+34% ▲
		WB	12,935	878	8,532	914	-4,403	-34% ▼	+36	+4% ▲
A15	North Rocks Road west of Kimberley Road	EB	3,271	158	3,712	111	+441	+13% ▼	-47	-30% ▼
		WB	3,061	307	3,824	246	+763	+25% ▲	-61	-20% ▼
A17	Adderton Road north of Homelands Avenue	NB	5,102	194	4,219	147	-883	-17% ▼	-47	-24% ▼
		SB	4,676	109	4,658	166	-18	-0% ▼	+57	+52% ▲
A20	The Comenarra Parkway west of Fox Valley Road	EB	8,865	306	9,374	223	+509	+6% ▲	-83	-27% ▼
		WB	10,492	203	9,662	234	-830	-8% ▼	+31	+15% ▲

Site	Location	Dir	Pre-opening scenario (2019)		Post-opening scenario (2022)		Change (vehicles per day)			
			LV	HV	LV	HV	LV	% LV change	HV	% HV change
A21	Lucinda Avenue south of Pacific Highway	NB	3,183	125	2,642	134	-541	-17% ▼	+9	+8% ▲
		SB	496	31	402	40	-94	-19% ▼	+9	+28% ▲
A22	Ada Avenue south of Pacific Highway	NB	2,468	78	2,401	76	-67	-3% ▼	-2	-3% ▼
		SB	2,544	80	2,378	122	-166	-7% ▼	+42	+53% ▲
A25	New Line Road north of Castle Hill Road	NB	7,841	585	6,812	276	-1,029	-13% ▼	-309	-53% ▼
		SB	7,399	307	7,727	277	+328	+4% ▲	-30	-10% ▼
A27	Highs Road north of Coonarra Avenue	NB	6,314	270	5,248	332	-1,066	-17% ▼	+62	+23% ▲
		SB	5,481	198	4,311	259	-1,170	-21% ▼	+61	+31% ▲
A30	Boundary Road east of New Line Road	EB	12,339	970	10,541	1,294	-1,798	-15% ▼	+324	+33% ▲
		WB	11,372	899	9,972	1,167	-1,400	-12% ▼	+268	+30% ▲
A36	Wood Street south of The Comenarra Parkway	NB	2,023	64	1,653	87	-370	-18% ▼	+23	+35% ▲
		SB	4,055	163	3,009	157	-1,046	-26% ▼	-6	-3% ▼
A37	Malsbury Road south of Clarke Road	NB	8,631	218	6,709	198	-1,922	-22% ▼	-20	-9% ▼
		SB	9,246	228	7,094	138	-2,152	-23% ▼	-90	-40% ▼
A40	Hull Road north of Albert Road	NB	1,160	31	723	48	-437	-38% ▼	+17	+54% ▲
		SB	677	22	746	25	+69	+10% ▲	+3	+13% ▲
A41	Fox Valley Road west of Lucinda Avenue	NB	9,215	299	7,855	166	-1,360	-15% ▼	-133	-45% ▼
		SB	8,851	319	8,324	307	-527	-6% ▼	-12	-4% ▼
A46	Campbell Avenue south of Pennant Hills Road	NB	117	4	202	7	+85	+73% ▲	+3	+75% ▲
		SB	448	19	386	18	-62	-14% ▼	-1	-5% ▼

TfNSW provides publicly available data on mid-block volumes recorded by permanent counters in NSW (TfNSW Traffic Volume Viewer[18]). Permanent counters which were closest to the extent of the road network were chosen for analysis. Table 3-5 presents a comparison of mid-block traffic volumes for the pre-opening and post-opening scenarios based on TfNSW permanent traffic counters. The mid-block traffic volumes used for this comparison are the average weekday traffic volumes calculated for the same week as the traffic surveys for both the pre-opening (November 2019) and post-opening (February 2022) scenario (shown in Table 3-4).

Table 3-5 Comparison of average daily mid-block traffic volumes from TfNSW counters

Site/ Location	Dir	Pre-opening scenario (2019)		Post-opening scenario (2022)		Change (veh/day)			
		LV	HV	LV	HV	LV	%	HV	%
C1 Pacific Highway, east of Blytheswood Avenue	NB	29,201	3,402	19,636	2,819	-9,565	-33% ▼	-583	-17% ▼
	SB	31,637	3,747	24,111	3,037	-7,526	-24% ▼	-710	-19% ▼
C2 Ryde Road, south of Lofberg Avenue	NB	26,312	3,881	26,248	3,811	-64	-0% ▼	-70	-2% ▼
	SB	29,913	4,289	27,475	4,068	-2,438	-8% ▼	-221	-5% ▼
C3 Beecroft Road, north of Old Beecroft Road	NB	15,862	883	14,608	929	-1,254	-8% ▼	+46	+5% ▲
	SB	15,659	944	14,412	1,054	-1,247	-8% ▼	+110	+12% ▲
C4 New Line Road, south of Tennyson Close	EB	13,561	1,448	12,037	1,404	-1,524	-11% ▼	-44	-3% ▼
	WB	15,718	1,516	14,929	1,566	-789	-5% ▼	+50	+3% ▲

The comparison shows that the daily average weekday traffic volumes have decreased since pre-opening for all locations except for Beecroft Road, north of Old Beecroft Road and for New Line Road, south of Tennyson Close. The increase in heavy vehicles along Beecroft Road is about 5 percent[19], which is considered within the normal annual growth ranges (for both LV and HV), or part of the seasonal traffic volume variance for this area. New Line Road sees a decrease in heavy vehicle movement in the eastbound direction but an increase in heavy vehicle movement in the westbound direction.

3.3.2 Roadway level of service

The post-opening traffic surveys generally indicate lower traffic volumes compared to the pre-opening scenario. Light vehicle volumes at some sites have gone up, however, heavy vehicle volumes across the study area have declined significantly compared with the volumes prior to the operation of NorthConnex.

The theoretical mid-block capacity for a single lane on Pennant Hills Road and the Pacific Highway has been adopted as 1,400 passenger car units (PCU) per lane for the peak hour based on urban arterial roads with interrupted flow[20]. No changes to the number of mid-block travel lanes between 2019 and 2022 have been observed that would otherwise impact the performance assessments.

During the AM peak hour, the mid-block sections operate at LOS C or better at all locations except for Pennant Hills Road, between North Rocks Road and Hills M2 Motorway, Pennant Hills Road, between Beecroft Road and The Comenarra Parkway and Pacific Highway, north of Pennant Hills Road. For all

[18] https://roads-waterways.transport.nsw.gov.au/about/corporate-publications/statistics/traffic-volumes/aadt-map/index.html#/?z=6
[19] Over the period from November 2019 to February 2022
[20] Austroads, Guide to Traffic Management Part 3: Traffic Studies and Analysis, Second Edition, April 2013, page 63

other sections, the levels of service have either improved from LOS D to LOS C or remained the same for northbound and southbound directions. Pennant Hills Road (northbound), between North Rocks Road and the Hills M2 Motorway currently (post-opening) operates at LOS E compared to LOS D in the pre-opening scenario and Pacific Highway (northbound), north of Pennant Hills Road currently (post-opening) operates at LOS D compared to LOS C during the pre-opening scenario.

During the PM peak hour, the mid-block sections operate at LOS D or better at all locations except for Pennant Hills Road, between North Rocks Road and Hills M2 Motorway and Pacific Highway, north of Pennant Hills Road. For all other sections, the levels of service have either improved or remained the same for northbound and southbound directions. Pennant Hills Road (northbound), between North Rocks Road and the Hills M2 Motorway currently (post-opening) operates at LOS D compared to LOS C in the pre-opening scenario and Pacific Highway (southbound), north of Pennant Hills Road currently (post-opening) operates at LOS C compared to LOS B in the pre-opening scenario.

It is noted that Pennant Hills Road (northbound) between M2 and North Rocks Road is not directly connected to the project. This section is over capacity in the post-opening scenario during the AM peak and was near capacity during the pre-opening scenario. The change in performance is likely due to general background development in the area and the shift away from public transport due to COVID - 19. Future upgrade works to the Pennant Hills Road/ North Rocks Road are proposed by TfNSW (Refer Section 5.1) to address wider road network performance issues in the vicinity, which is not directly related to NorthConnex.

Table 3-6 presents a comparison of the peak hour mid-block traffic volumes and levels of service along critical sections of Pennant Hills Road and Pacific Highway corridors between the pre-opening and post-opening scenarios.

Table 3-6 Comparison of mid-block traffic level of service

Location	Scenario	Direction	Capacity (PCU)	Light vehicles	Heavy vehicles	V/C	LOS
AM peak hour							
Pennant Hills Road, North Rocks Road to Hills M2 Motorway (A1)	Pre-opening	NB	2,800	1,500	180	0.72	D
	Post-opening	NB	2,800	1,830	160	**0.82**	**E**
	Pre-opening	SB	2,800	1,640	110	0.70	D
	Post-opening	SB	2,800	1,770	110	0.75	D
Pennant Hills Road, Hills M2 Motorway to Castle Hill Road (A2)	Pre-opening	NB	4,200	2030	340	0.72	D
	Post-opening	NB	4,200	1940	120	**0.55**	**C**
	Pre-opening	SB	4,200	1,980	240	0.63	D
	Post-opening	SB	4,200	1,620	80	**0.44**	**C**
Pennant Hills Road, Castle Hill Road to Beecroft Road (A3)	Pre-opening	NB	4,200	2,290	300	0.76	D
	Post-opening	NB	4,200	1,990	100	**0.54**	**C**
	Pre-opening	SB	4,200	1,930	260	0.64	D
	Post-opening	SB	4,200	1,780	70	**0.47**	**C**
Pennant Hills Road, Beecroft Road to The Comenarra Parkway (A4)	Pre-opening	NB	4,200	2,050	330	0.71	D
	Post-opening	NB	4,200	2,430	110	0.66	D
	Pre-opening	SB	4,200	1,890	260	0.63	D
	Post-opening	SB	4,200	1,880	80	**0.55**	**C**
Pennant Hills Road, The Comenarra Parkway to Pacific Highway (A5)	Pre-opening	NB	4,200	1,800	340	0.66	D
	Post-opening	NB	4,200	1,880	90	**0.51**	**C**
	Pre-opening	SB	4,200	2,000	260	0.65	D
	Post-opening	SB	4,200	1,740	90	**0.48**	**C**
	Pre-opening	NB	2,800	1,300	80	0.55	C

Location	Scenario	Direction	Capacity (PCU)	Light vehicles	Heavy vehicles	V/C	LOS
Pacific Highway, north of Pennant Hills Road (A50)	Post-opening	NB	2,800	1,680	70	0.68	D
	Pre-opening	SB	4,200	1,050	80	0.30	B
	Post-opening	SB	4,200	1,380	60	0.37	B
Pacific Highway, east of M1 Pacific Motorway Interchange (A23)	Pre-opening	NB	4,200	1,530	100	0.45	C
	Post-opening	NB	4,200	1,700	110	0.49	C
	Pre-opening	SB	4,200	3,040	140	0.82	E
	Post-opening	SB	4,200	2,700	100	**0.71**	**D**
PM peak hour							
Pennant Hills Road, North Rocks Road to Hills M2 Motorway (A1)	Pre-opening	NB	2,800	1,330	60	0.53	C
	Post-opening	NB	2,800	1,660	60	0.65	D
	Pre-opening	SB	2,800	1,550	110	0.66	D
	Post-opening	SB	2,800	1,850	90	0.75	D
Pennant Hills Road, Hills M2 Motorway to Castle Hill Road (A2)	Pre-opening	NB	4,200	3,030	200	0.86	E
	Post-opening	NB	4,200	2,530	50	**0.64**	**D**
	Pre-opening	SB	4,200	2,180	250	0.69	D
	Post-opening	SB	4,200	1,810	60	**0.47**	**C**
Pennant Hills Road, Castle Hill Road to Beecroft Road (A3)	Pre-opening	NB	4,200	2,030	140	0.58	C
	Post-opening	NB	4,200	1,600	30	**0.40**	**B**
	Pre-opening	SB	4,200	2,100	220	0.65	D
	Post-opening	SB	4,200	1,980	60	**0.51**	**C**
Pennant Hills Road, Beecroft Road to The Comenarra Parkway (A4)	Pre-opening	NB	4,200	2,500	200	0.73	D
	Post-opening	NB	4,200	2,140	40	**0.54**	**C**
	Pre-opening	SB	4,200	1,980	230	0.63	D
	Post-opening	SB	4,200	2,300	60	**0.59**	**C**
Pennant Hills Road, The Comenarra Parkway to Pacific Highway (A5)	Pre-opening	NB	4,200	2,390	180	0.69	D
	Post-opening	NB	4,200	1,720	40	**0.44**	**C**
	Pre-opening	SB	4,200	1,840	190	0.57	C
	Post-opening	SB	4,200	1,800	50	0.46	C
Pacific Highway, north of Pennant Hills Road (A50)	Pre-opening	NB	2,800	1,110	50	0.44	C
	Post-opening	NB	2,800	1,370	20	0.51	C
	Pre-opening	SB	4,200	1,370	40	0.35	B
	Post-opening	SB	4,200	1,690	40	0.43	C
Pacific Highway, east of M1 Pacific Motorway Interchange (A23)	Pre-opening	NB	4,200	2,810	90	0.73	D
	Post-opening	NB	4,200	2,670	70	0.68	D
	Pre-opening	SB	4,200	1,730	60	0.45	C
	Post-opening	SB	4,200	1,550	50	**0.40**	**B**

3.4 Intersection performance

Using intersections listed in Table 2-2, traffic modelling was undertaken in LinSIG to assess the performance of each intersection during the pre-opening and post-opening scenarios. Figure 3-3 illustrates the intersections assessed in the review.

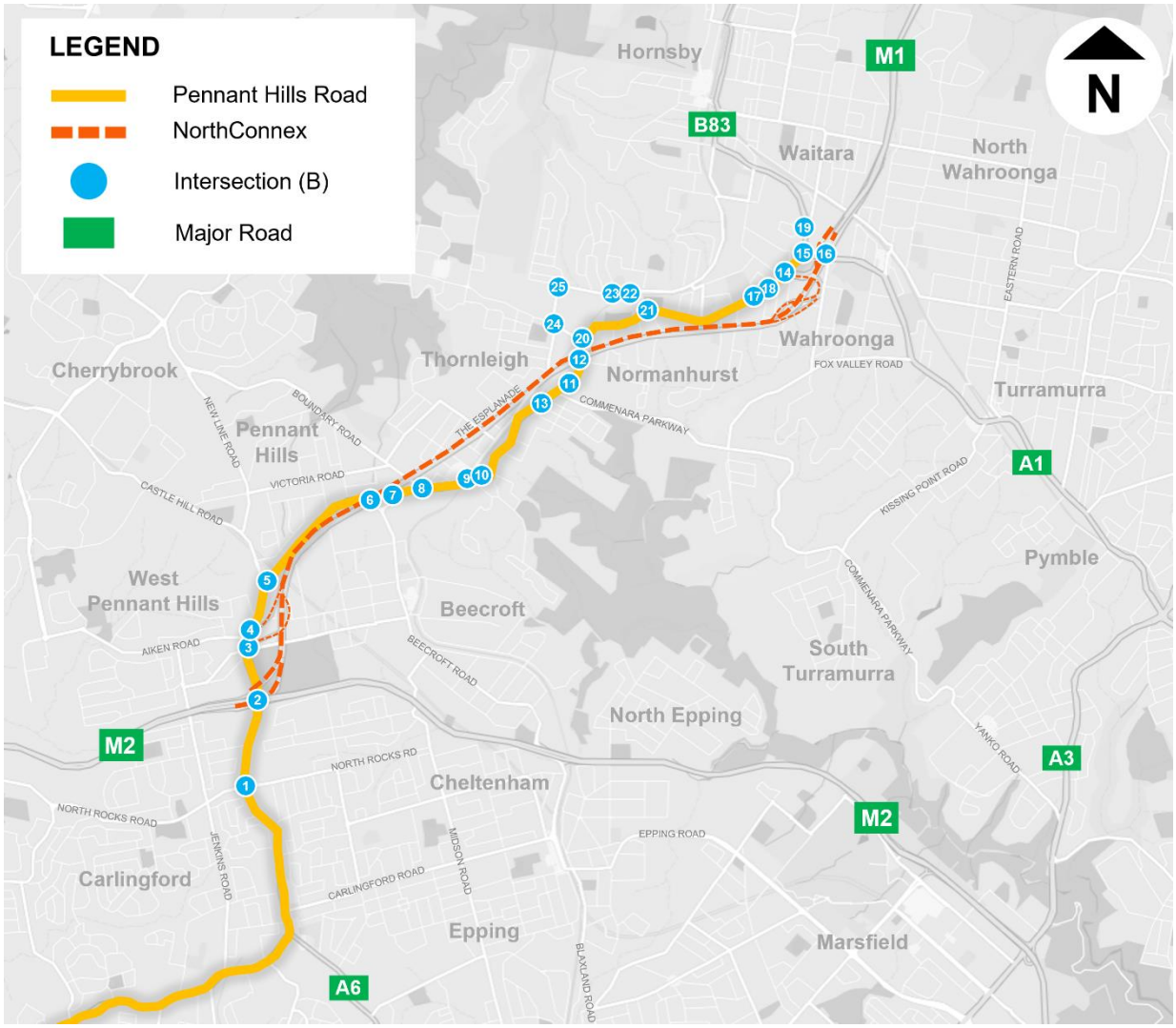


Figure 3-3 Intersections assessed in this plan

Intersection turning movement surveys were undertaken for the pre-opening and post-opening scenarios as detailed in Section 2.4.1. A review of the traffic volumes at the intersections indicate that they are generally lower than volumes forecast in the EIS. Some intersections included in this plan have delays that are at similar levels to the delays forecast by the EIS, although the intersection volumes are less. It is concluded that this is because conflicting turning movements are higher and through movements are less, which impacts signal timing and hence the overall delay. Signal plans that were used in the future year modelling in the EIS were also found to be different to the actual signal plans currently used at the intersections, which could be a factor in the difference in performance levels.

The intersections were modelled in LinSIG as small networks of intersections as detailed in Table 2-2. A summary of the intersection traffic volumes, average delays and LOS, especially along the Pennant Hills Road, is presented in Table 3-7. A summary for each intersection is included below the table.

Table 3-7 Summary of intersection volumes and LOS

Intersection/ Peak	Pre-Opening (2019)			Post-Opening (2022)			Comparison		
	Volume[21] (PCU)	Average Delay[22] (s)	LOS	Volume (PCU)	Average Delay (s)	LOS	Volume (PCU)	Average Delay (s)	LOS
Pennant Hills Road/ North Rocks Road (B1)									
AM Peak	5040	168	F	5100	290	F	+60 ▲	+122 ▲	No change
PM Peak	4820	96	F	4980	183	F	+160 ▲	+87 ▲	No change
Pennant Hills Road/ Hills M2 Motorway Interchange (B2)									
AM Peak	7230	52	D	6940	55	D	-290 ▼	+3 ▲	No change
PM Peak	6600	73	F	6780	101	F	+180 ▲	+28 ▲	No change
Pennant Hills Road/ Eaton Road/ Copeland Road (B3)									
AM Peak	6890	56	D	5230	28	B	-1660 ▼	-28 ▼	Improved
PM Peak	6280	32	C	4890	27	B	-1390 ▼	-5 ▼	Improved
Pennant Hills Road/ Aiken Road (B4)									
AM Peak	6710	18	B	5200	17	B	-1510 ▼	-1 ▼	No change
PM Peak	6610	23	B	5130	18	B	-1480 ▼	-5 ▼	No change
Pennant Hills Road/ Beecroft Road (west) (B6)									
AM Peak	6890	96	F	5260	27	B	-1630 ▼	-69 ▼	Improved
PM Peak	6350	94	F	4900	28	B	-1450 ▼	-66 ▼	Improved
Pennant Hills Road/ Beecroft Road (east) (B7)									
AM Peak	8210	181	F	6340	17	B	-1870 ▼	-164 ▼	Improved
PM Peak	7130	8	A	5630	14	A	-1500 ▼	+6 ▲	No change
Pennant Hills Road/ Boundary Road (B8)									
AM Peak	8330	36	C	6950	30	C	-1380 ▼	-6 ▼	No change
PM Peak	7820	36	C	6520	20	B	-1300 ▼	-16 ▼	Improved
Pennant Hills Road/ Jasmine Road/ Hinemoa Avenue (B17 & B18)									
AM Peak	5650	26	B	4200	10	A	-1450 ▼	-16 ▼	Improved
PM Peak	5450	21	B	3870	9	A	-1580 ▼	-12 ▼	Improved

[21] Volumes have been rounded to the nearest 10 PCU
[22] Average delays have been rounded to the nearest second

Intersection/ Peak	Pre-Opening (2019)			Post-Opening (2022)			Comparison		
	Volume[21] (PCU)	Average Delay[22] (s)	LOS	Volume (PCU)	Average Delay (s)	LOS	Volume (PCU)	Average Delay (s)	LOS
Pennant Hills Road/ M1 Pacific Motorway Interchange (B14)									
AM Peak	5570	33	C	4630	26	B	-940 ▼	-7 ▼	Improved
PM Peak	5470	48	D	4230	33	C	-1240 ▼	-15 ▼	Improved
Pennant Hills Road/ Pacific Highway (B15)									
AM Peak	3600	55	D	4520	48	D	920 ▲	-7 ▼	No change
PM Peak	3380	39	C	4060	38	C	680 ▲	-1 ▼	No change
Pacific Highway/ M1 Pacific Motorway Interchange (B16)									
AM Peak	5480	116	F	5160	38	C	-320 ▼	-78 ▼	Improved
PM Peak	5280	71	F	4780	46	D	-500 ▼	-25 ▼	Improved
Pacific Highway/ Ingram Road/ Woolcott Avenue (B19)									
AM Peak	3000	55	D	3650	73	F	650 ▲	18 ▲	Reduced
PM Peak	2790	39	C	3350	64	E	560 ▲	25 ▲	Reduced
Pennant Hills Road/ Duffy Avenue (B20)									
AM Peak	5290	40	C	4830	31	C	-460 ▼	-9 ▼	No change
PM Peak	5870	43	D	4580	27	B	-1290 ▼	-16 ▼	Improved
Pennant Hills Road/ Dartford Road (B21)									
AM Peak	2870	30	C	2430	22	B	-440 ▼	-8 ▼	Improved
PM Peak	5620	64	E	2240	18	B	-3380 ▼	-46 ▼	Improved
Chilvers Road/ The Esplanade/ Duffy Avenue (B24)									
AM Peak	2700	63	E	2400	58	E	-300 ▼	-5 ▼	No change
PM Peak	2630	92	F	2290	76	F	-340 ▼	-16 ▼	No change
Sefton Road/ Chilvers Road (B25)									
AM Peak	1950	3	A	1660	2	A	-290 ▼	-1 ▼	No change
PM Peak	1850	3	A	1580	2	A	-270 ▼	-1 ▼	No change
Dartford Road/ Sefton Road/ Milson Parade (B23)									
AM Peak	1990	3	A	1650	3	A	-340 ▼	0	No change
PM Peak	1890	2	A	1590	2	A	-300 ▼	0	No change

Intersection/ Peak	Pre-Opening (2019)			Post-Opening (2022)			Comparison		
	Volume[21] (PCU)	Average Delay[22] (s)	LOS	Volume (PCU)	Average Delay (s)	LOS	Volume (PCU)	Average Delay (s)	LOS
Milson Parade/ Dartford Road (B22)									
AM Peak	2030	34	C	1790	21	B	-240 ▼	-13 ▼	Improved
PM Peak	1970	140	F	1710	23	B	-260 ▼	-117 ▼	Improved
Pennant Hills Road/ Bellevue Street (B13)									
AM Peak	5920	18	B	2010	20	B	-3910 ▼	+2 ▲	No change
PM Peak	6070	25	B	5040	15	B	-1030 ▼	-10 ▼	No change
Pennant Hills Road/ The Comenarra Parkway/ Parkes Street (B11)									
AM Peak	6090	124	F	2670	51	D	-3420 ▼	-73 ▼	Improved
PM Peak	6120	81	F	5230	68	E	-890 ▼	-13 ▼	Improved
Pennant Hills Road/ Phyllis Avenue/ Loch Maree Avenue (B12)									
AM Peak	5210	48	D	3500	41	C	-1710 ▼	-7 ▼	Improved
PM Peak	5490	35	C	4350	20	B	-1140 ▼	-15 ▼	Improved
Pennant Hills Road/ Yarrara Road (B9)									
AM Peak	7260	38	C	6050	21	B	-1210 ▼	-17 ▼	Improved
PM Peak	7140	34	C	5750	16	B	-1390 ▼	-18 ▼	Improved
Pennant Hills Road/ Railway Street/ The Crescent (B10)									
AM Peak	6430	86	F	5360	39	C	-1070 ▼	-47 ▼	Improved
PM Peak	6400	46	D	5180	45	D	-1220 ▼	-1 ▼	No change
Pennant Hills Road/ Castle Hill Road (B5)									
AM Peak	6210	13	A	4830	14	A	-1380 ▼	+1 ▲	No change
PM Peak	6830	24	B	5060	18	B	-1770 ▼	-6 ▼	No change

3.4.1 Pennant Hills Road/ North Rocks Road (B1)

The analysis confirms that the Pennant Hills Road and North Rocks Road intersection continues to operate at LOS F. The increase in traffic volumes at this intersection is 60 and 160 vehicles during the AM and PM peaks respectively, which is less than 5% in 27 months (since pre-opening surveys were completed in November 2019). Increases up to 5% per year can typically be attributed to background traffic growth in the area.

The Pennant Hills Road and North Rocks Road intersection was already heavily congested prior to the opening of the project and, as such, minor increase in traffic volumes will have adverse effects to the average delay experienced at this intersection. The average delay experienced at this intersection has increased; however, it cannot be directly attributed to the operation of the project. It is likely due to background traffic growth in addition to the already heavily congested intersection (previously operating at LOS F), that an increase in average delay is seen (refer to Section 5.1 for a discussion on proposed measures to address this issue).

Peak Hour	Volume	Average Delay	Findings
AM	↑	↑	The intersection currently operates at LOS F with an average delay of 290 seconds. The volume has increased by 60 PCUs and the average delay has increased by about 120 seconds, while operating at a similar LOS compared with pre-opening.
PM	↑	↑	The intersection currently operates at LOS F with an average delay of 183 seconds. The volume has increased by 160 PCUs and the average delay has increased by about 85 seconds, while operating at a similar LOS compared with pre-opening.

3.4.2 Pennant Hills Road/ Hills M2 Motorway Interchange (B2)

The analysis confirms that the Pennant Hills Road and Hills M2 Motorway interchange continues to operate at a similar performance with the pre-opening scenario (LOS D during the AM peak hour and LOS F during the PM peak hour). This intersection currently operates with decreased traffic volumes during the AM peak hour and increased traffic volumes during the PM peak hour. Average delays have increased, and the LOS remains unchanged in both peak periods.

The increase in traffic volumes during the PM peak is 180 vehicles, which is less than 5% in 27 months (since pre-opening surveys completed in Nov 2019). Increases up to 5% per year can typically be attributed to background traffic growth in the area. No increase in traffic volumes were observed in the AM peak. Therefore, the increase in traffic volumes during the PM peak cannot be directly attributed to the operation of the project.

Peak Hour	Volume	Average Delay	Findings
AM	↓	↑	The intersection currently operates at LOS D with an average delay of 55 seconds. The volume has decreased by 290 PCUs and the average delay has increased by about 5 seconds, while operating at a similar LOS compared with pre-opening.
PM	↑	↑	The intersection currently operates at LOS F with an average delay of 101 seconds. The volume has increased by 180 PCUs and the average delay has increased by about 30 seconds, while operating at a similar LOS compared with pre-opening.

3.4.3 Pennant Hills Road/ Eaton Road/ Copeland Road (B3)

The analysis confirms that the Pennant Hills Road, Eaton Road and Copeland Road intersection has had an overall improvement in performance since the project opened. This intersection currently operates with decreased traffic volumes, decreased average delays and improvements to the LOS.

Peak Hour	Volume	Average Delay	Findings
AM	⬇	⬇	The intersection currently operates at LOS B with an average delay of 28 seconds. The volume has decreased by 1660 PCUs and the average delay has decreased by about 30 seconds, while operating at an improved LOS compared with pre-opening.
PM	⬇	⬇	The intersection currently operates at LOS B with an average delay of 27 seconds. The volume has decreased by 1390 PCUs and the average delay has decreased by about 5 seconds, while operating at an improved LOS compared with pre-opening.

3.4.4 Pennant Hills Road/ Aiken Road (B4)

The analysis confirms that the Pennant Hills Road and Aiken Road intersection continues to operate at a similar performance with the pre-opening scenario (LOS B). This intersection currently operates with decreased traffic volumes and decreased average delays, but the LOS remains unchanged.

Peak Hour	Volume	Average Delay	Findings
AM	⬇	⬇	The intersection currently operates at LOS B with an average delay of 17 seconds. The volume has decreased by 1510 PCUs and the average delay has decreased by up to 1 second, while operating at a similar LOS compared with pre-opening.
PM	⬇	⬇	The intersection currently operates at LOS B with an average delay of 18 seconds. The volume has decreased by 1480 PCUs and the average delay has decreased by about 5 seconds, while operating at a similar LOS compared with pre-opening.

3.4.5 Pennant Hills Road/ Beecroft Road (west) (B6)

The analysis confirms that the Pennant Hills Road and Beecroft Road (west) intersection has had an overall improvement in performance since the project opened. This intersection currently operates with decreased traffic volumes, decreased average delays and improvements to the LOS.

Peak Hour	Volume	Average Delay	Findings
AM	⬇	⬇	The intersection currently operates at LOS B with an average delay of 27 seconds. The volume has decreased by 1630 PCUs and the average delay has decreased by about 70 seconds, while operating at an improved LOS compared with pre-opening.
PM	⬇	⬇	The intersection currently operates at LOS B with an average delay of 28 seconds. The volume has decreased by 1450 PCUs and the average delay has increased by about 65 seconds, while operating at an improved LOS compared with pre-opening.

3.4.6 Pennant Hills Road/ Beecroft Road (east) (B7)

The analysis confirms that the Pennant Hills Road and Beecroft Road (east) intersection has had an improvement in performance during the AM peak hour but continues to operate at a similar performance with the pre-opening scenario during the PM peak hour (LOS A). This intersection currently operates with decreased traffic volumes. Average delays have decreased during AM peak hours with improvements to the LOS, whereas average delays have increased during PM peak hours, but the LOS remains unchanged.

Peak Hour	Volume	Average Delay	Findings
AM	↓	↓	The intersection currently operates at LOS B with an average delay of 17 seconds. The volume has decreased by 1870 PCUs and the average delay has decreased by about 165 seconds, while operating at an improved LOS compared with pre-opening.
PM	↓	↑	The intersection currently operates at LOS A with an average delay of 14 seconds. The volume has decreased by 1500 PCUs and the average delay has increased by about 5 seconds, while operating at a similar LOS compared with pre-opening.

3.4.7 Pennant Hills Road/ Boundary Road (B8)

The analysis confirms that the Pennant Hills Road and Boundary Road intersection has had an overall improvement in performance since the project opened. This intersection currently operates with decreased traffic volumes and decreased average delays, but the LOS remains unchanged during the AM peak hour whereas the LOS has improved during the PM peak hour.

Peak Hour	Volume	Average Delay	Findings
AM	↓	↓	The intersection currently operates at LOS C with an average delay of 30 seconds. The volume has decreased by 1380 PCUs and the average delay has decreased by about 5 seconds, while operating at a similar LOS compared with pre-opening.
PM	↓	↓	The intersection currently operates at LOS B with an average delay of 20 seconds. The volume has decreased by 1300 PCUs and the average delay has decreased by about 15 seconds, while operating at an improved LOS compared with pre-opening.

3.4.8 Pennant Hills Road/ Jasmine Road/ Hinemoa Avenue (B17 & B18)

The analysis confirms that the Pennant Hills Road, Jasmine Road and Hinemoa Avenue intersection has had an overall improvement in performance since the project opened. This intersection currently operates with decreased traffic volumes, decreased average delays and improvements to the LOS.

Peak Hour	Volume	Average Delay	Findings
AM	↓	↓	The intersection currently operates at LOS A with an average delay of 10 seconds. The volume has decreased by 1450 PCUs and the average delay has decreased by about 15 seconds, while operating at an improved LOS compared with pre-opening.
PM	↓	↓	The intersection currently operates at LOS A with an average delay of 9 seconds. The volume has decreased by 1580 PCUs and the average delay has decreased by about 10 seconds, while operating at an improved LOS compared with pre-opening.

3.4.9 Pennant Hills Road/ M1 Pacific Motorway Interchange (B14)

The analysis confirms that the Pennant Hills Road and M1 Pacific Motorway interchange has had an overall improvement in performance since the project opened. This interchange currently operates with decreased traffic volumes, decreased average delays and improvements to the LOS.

Peak Hour	Volume	Average Delay	Findings
AM	⬇	⬇	The interchange currently operates at LOS B with an average delay of 26 seconds. The volume has decreased by 940 PCUs and the average delay has decreased by about 5 seconds, while operating at an improved LOS compared with pre-opening.
PM	⬇	⬇	The interchange currently operates at LOS C with an average delay of 33 seconds. The volume has decreased by 1240 PCUs and the average delay has decreased by about 15 seconds, while operating at an improved LOS compared with pre-opening.

3.4.10 Pennant Hills Road/ Pacific Highway (B15)

The analysis confirms that the Pennant Hills Road and Pacific Highway interchange continues to operate at a similar performance with the pre-opening scenario (LOS D during the AM peak hour and LOS C during the PM peak hour). The interchange currently operates with increased traffic volumes and decreased average delays, but the LOS remains unchanged.

Peak Hour	Volume	Average Delay	Findings
AM	⬆	⬇	The intersection currently operates at LOS D with an average delay of 48 seconds. The volume has increased by 920 PCUs and the average delay has decreased by about 5 seconds, while operating at a similar LOS compared with pre-opening.
PM	⬆	⬇	The intersection currently operates at LOS C with an average delay of 38 seconds. The volume has increased by 680 PCUs and the average delay has decreased by up to 1 second, while operating at a similar LOS compared with pre-opening.

3.4.11 Pacific Highway/ M1 Pacific Motorway Interchange (B16)

The analysis confirms that the Pacific Highway and M1 Pacific Motorway interchange has had an overall improvement in performance since the project opened. This interchange currently operates with decreased traffic volumes, decreased average delays and improvements to the LOS.

Peak Hour	Volume	Average Delay	Findings
AM	⬇	⬇	The intersection currently operates at LOS C with an average delay of 38 seconds. The volume has decreased by 320 PCUs and the average delay has decreased by about 80 seconds, while operating at an improved LOS compared with pre-opening.
PM	⬇	⬇	The intersection currently operates at LOS D with an average delay of 46 seconds. The volume has decreased by 500 PCUs and the average delay has decreased by about 25 seconds, while operating at an improved LOS compared with pre-opening.

3.4.12 Pacific Highway/ Ingram Road/ Woolcott Avenue (B19)

The analysis indicates that the Pacific Highway, Ingram Road, and Woolcott Avenue intersection has had an overall reduction in performance compared to the pre-opening scenario. This intersection currently operates with increased traffic volumes compared to the pre-opening scenario, which can be attributed to the land use changes within the surrounding locality, as discussed in Section 3.1. Average delays have increased, and the LOS has decreased.

Based on a review of traffic surveys undertaken during the pre-opening and post-opening scenarios, it is observed that heavy vehicle volumes have decreased at this location since the project opened. The alignment of the project does not bypass this intersection. As such, this intersection will have traffic irrespective of the project, as vehicles travelling to and from Hornsby and Waitara need to use this intersection similar to the pre-opening scenario. Therefore, the increase in volumes and delays cannot be directly attributed to the operation of the Project.

Peak Hour	Volume	Average Delay	Findings
AM	↑	↑	The intersection currently operates at LOS F with an average delay of 73 seconds. The volume has increased by 650 PCUs and the average delay has increased by about 20 seconds, while operating at a reduced LOS compared with pre-opening.
PM	↑	↑	The intersection currently operates at LOS E with an average delay of 64 seconds. The volume has increased by 560 PCUs and the average delay has increased by about 25 seconds, while operating at a reduced LOS compared with pre-opening.

3.4.13 Pennant Hills Road/ Duffy Avenue (B20)

The analysis confirms that the Pennant Hills Road and Duffy Avenue intersection has had an improvement in performance during the PM peak hour but continues to operate at a similar performance with the pre-opening scenario during the AM peak hour (LOS C). The intersection currently operates with decreased traffic volumes and decreased average delays with improvements to the LOS during the PM peak hour, but the LOS remains unchanged during the AM peak hour.

Peak Hour	Volume	Average Delay	Findings
AM	↓	↓	The intersection currently operates at LOS C with an average delay of 31 seconds. the volume has decreased by 460 PCUs and the average delay has decreased by about 10 seconds, while operating at a similar LOS compared with pre-opening.
PM	↓	↓	The intersection currently operates at LOS B with an average delay of 27 seconds. The volume has decreased by 1290 PCUs and the average delay has decreased by about 15 seconds, while operating at an improved LOS compared with pre-opening.

3.4.14 Pennant Hills Road/ Dartford Road (B21)

The analysis confirms that the Pennant Hills Road and Dartford Road intersection has had an overall improvement in performance since the project opened. This intersection currently operates with decreased traffic volumes, decreased average delays and improvements to the LOS.

Peak Hour	Volume	Average Delay	Findings
AM	⬇	⬇	The intersection currently operates at LOS B with an average delay of 22 seconds. The volume has decreased by 440 PCUs and the average delay has decreased by about 10 seconds, while operating at an improved LOS compared with pre-opening.
PM	⬇	⬇	The intersection currently operates at LOS B with an average delay of 18 seconds. The volume has decreased by 3380 PCUs and the average delay has decreased by about 45 seconds, while operating at an improved LOS compared with pre-opening.

3.4.15 Chilvers Road/ The Esplanade/ Duffy Avenue (B24)

The analysis confirms that the Chilvers Road, The Esplanade and Duffy Avenue intersection continues to operate at a similar performance with the pre-opening scenario (LOS E during the AM peak hour and LOS F during the PM peak hour). This intersection currently operates with decreased traffic volumes and decreased average delays, but the LOS remains unchanged.

This intersection forms part of an alternative route to Pennant Hills Road between Pennant Hills and Hornsby which was potentially used as a rat run route prior to the opening of the project. Since the opening of the project, traffic volumes at this intersection have reduced by over 300 vehicles during both AM and PM peak hours. This suggests the use of Pennant Hills Road has become a more viable option for local access since the opening of the Project. It also further demonstrates that the Project has not adversely impacted this intersection since opening.

Peak Hour	Volume	Average Delay	Findings
AM	⬇	⬇	The intersection currently operates at LOS E with an average delay of 58 seconds. The volume has decreased by 300 PCUs and the average delay has decreased by about 5 seconds, while operating at a similar LOS compared with pre-opening.
PM	⬇	⬇	The intersection currently operates at LOS F with an average delay of 76 seconds. The volume has decreased by 340 PCUs and the average delay has decreased by about 15 seconds, while operating at a similar LOS compared with pre-opening.

3.4.16 Sefton Road/ Chilvers Road (B25)

The analysis confirms that the Sefton Road and Chilvers Road intersection continues to operate at a similar performance with the pre-opening scenario (LOS A). This intersection currently operates with decreased traffic volumes and decreased average delays, but the LOS remains unchanged.

Peak Hour	Volume	Average Delay	Findings
AM	⬇	⬇	The intersection currently operates at LOS A with an average delay of 2 seconds. The volume has decreased by 290 PCUs and the average delay has decreased by up to 1 second, while operating at a similar LOS compared with pre-opening.

Peak Hour	Volume	Average Delay	Findings
PM	↓	↓	The intersection currently operates at LOS A with an average delay of 2 seconds. The volume has decreased by 270 PCUs and the average delay has decreased by up to 1 second, while operating at a similar LOS compared with pre-opening.

3.4.17 Dartford Road/ Sefton Road/ Milson Parade (B23)

The analysis confirms that the Dartford Road, Sefton Road, and Milson Parade intersection continues to operate at a similar performance with the pre-opening scenario (LOS A). This intersection currently operates with decreased traffic volumes, but average delays and the LOS remains unchanged.

Peak Hour	Volume	Average Delay	Findings
AM	↓	–	The intersection currently operates at LOS A with an average delay of 3 seconds. The volume has decreased by 340 PCUs and the average delay remains unchanged, while operating at a similar LOS compared with pre-opening.
PM	↓	–	The intersection currently operates at LOS A with an average delay of 2 seconds. The volume has decreased by 300 PCUs and the average delay remains unchanged, while operating at a similar LOS compared with pre-opening.

3.4.18 Milson Parade/ Dartford Road (B22)

The analysis confirms that the Milson Parade and Dartford Road intersection has had an overall improvement in performance since the project opened. This intersection currently operates with decreased traffic volumes, decreased average delays and improvements to the LOS.

Peak Hour	Volume	Average Delay	Findings
AM	↓	↓	The intersection currently operates at LOS B with an average delay of 21 seconds. The volume has decreased by 240 PCUs and the average delay has decreased by about 15 seconds, while operating at an improved LOS compared with pre-opening.
PM	↓	↓	The intersection currently operates at LOS B with an average delay of 23 seconds. The volume has decreased by 260 PCUs and the average delay has decreased by about 120 seconds, while operating at an improved LOS compared with pre-opening.

3.4.19 Pennant Hills Road/ Bellevue Street (B13)

The analysis confirms that the Pennant Hills Road and Bellevue Street intersection continues to operate at a similar performance with the pre-opening scenario (LOS B). This intersection currently operates with decreased traffic volumes. Average delays have increased during the AM peak hour but decreased during the PM peak hour. The LOS remains unchanged for both periods.

Peak Hour	Volume	Average Delay	Findings
AM	↓	↑	The intersection currently operates at LOS B with an average delay of 20 seconds. The volume has decreased by 3910 PCUs and the average delay has increased by up to 2 seconds, while operating at a similar LOS compared with pre-opening.

Peak Hour	Volume	Average Delay	Findings
PM	⬇	⬇	The intersection currently operates at LOS B with an average delay of 15 seconds. The volume has decreased by 1030 PCUs and the average delay has decreased by about 10 seconds, while operating at a similar LOS compared with pre-opening.

3.4.20 Pennant Hills Road/ The Comenarra Parkway, and Parkes Street (B11)

The analysis confirms that the Pennant Hills, The Comenarra Parkway, and Parkes Street intersection has had an overall improvement in performance since the project opened. This intersection currently operates with decreased traffic volumes, decreased average delays and improvements to the LOS.

Peak Hour	Volume	Average Delay	Findings
AM	⬇	⬇	The intersection currently operates at LOS D with an average delay of 51 seconds. The volume has decreased by 3420 PCUs and the average delay has decreased by about 75 seconds, while operating at an improved LOS compared with pre-opening.
PM	⬇	⬇	The intersection currently operates at LOS E with an average delay of 68 seconds. The volume has decreased by 890 PCUs and the average delay has decreased by about 15 seconds, while operating at an improved LOS compared with pre-opening.

3.4.21 Pennant Hills Road/ Phyllis Avenue/ Loch Maree Avenue (B12)

The analysis confirms that the Pennant Hills Road, Phyllis Avenue and Loch Maree Avenue intersection has had an overall improvement in performance since the project opened. This intersection currently operates with decreased traffic volumes, decreased average delays and improvements to the LOS.

Peak Hour	Volume	Average Delay	Findings
AM	⬇	⬇	The intersection currently operates at LOS C with an average delay of 41 seconds. The volume has decreased by 1710 PCUs and the average delay has decreased by about 5 seconds, while operating at an improved LOS compared with pre-opening.
PM	⬇	⬇	The intersection currently operates at LOS B with an average delay of 20 seconds. The volume has decreased by 1140 PCUs and the average delay has decreased by about 15 seconds, while operating at an improved LOS compared with pre-opening.

3.4.22 Pennant Hills Road/ Yarrara Road (B9)

The analysis confirms that the Pennant Hills Road and Yarrara Road intersection has had an overall improvement in performance since the project opened. This intersection currently operates with decreased traffic volumes, decreased average delays and improvements to the LOS.

Peak Hour	Volume	Average Delay	Findings
AM	⬇	⬇	The intersection currently operates at LOS B with an average delay of 21 seconds. The volume has decreased by 1210 PCUs and the average delay has decreased by about 15 seconds, while operating at an improved LOS compared with pre-opening.

Peak Hour	Volume	Average Delay	Findings
PM	↓	↓	The intersection currently operates at LOS B with an average delay of 16 seconds. The volume has decreased by 1390 PCUs and the average delay has decreased by about 20 seconds, while operating at an improved LOS compared with pre-opening.

3.4.23 Pennant Hills Road/ Railway Street/ The Crescent (B10)

The analysis confirms that the Pennant Hills Road, Railway Street and The Crescent intersection has had an improvement in performance during the AM peak hour but continues to operate at a similar performance with the pre-opening scenario during the PM peak hour (LOS D). This intersection currently operates with decreased traffic volumes and decreased average delays with improvements to the LOS during the AM peak hour, but the LOS remains unchanged during the PM peak hour.

Peak Hour	Volume	Average Delay	Findings
AM	↓	↓	The intersection currently operates at LOS C with an average delay of 39 seconds. The volume has decreased by 1070 PCUs and the average delay has decreased by about 45 seconds, while operating at an improved LOS compared with pre-opening.
PM	↓	↓	The intersection currently operates at LOS D with an average delay of 45 seconds. The volume has decreased by 1220 PCUs and the average delay has decreased by up to 1 seconds, while operating at a similar LOS compared with pre-opening.

3.4.24 Pennant Hills Road/ Castle Hill Road (B5)

The analysis confirms that the Pennant Hills Road and Castle Hill Road intersection continues to operate at a similar performance with the pre-opening scenario (LOS A during the AM peak hour and LOS B during the PM peak hour). This intersection currently operates with decreased traffic volumes. Average delays have increased during the AM peak hour, but the LOS remains unchanged, whereas average delays have decreased during the PM peak hour, but the LOS also remains unchanged.

Peak Hour	Volume	Average Delay	Findings
AM	↓	↑	The intersection currently operates at LOS A with an average delay of 14 seconds. The volume has decreased by 1380 PCUs and the average delay has increased by up to 1 second, while operating at a similar LOS compared with pre-opening.
PM	↓	↓	The intersection currently operates at LOS B with an average delay of 18 seconds. The volume has decreased by 1770 PCUs and the average delay has decreased by about 5 seconds, while operating at a similar LOS compared with pre-opening.

3.5 Travel times

Travel time surveys were undertaken during weekday AM and PM peak hours for the following routes:

- Pennant Hills Road, between the M1 Pacific Motorway interchange and Hills M2 Motorway interchange
- Pacific Highway, between the M1 Pacific Motorway interchange and Ryde Road intersection
- Hills M2 Motorway, between the Pennant Hills Road and Windsor Road interchanges.

Figure 3-4 illustrates the routes used for travel time surveys during the AM and PM peak hours for the pre-opening and post-opening scenarios.

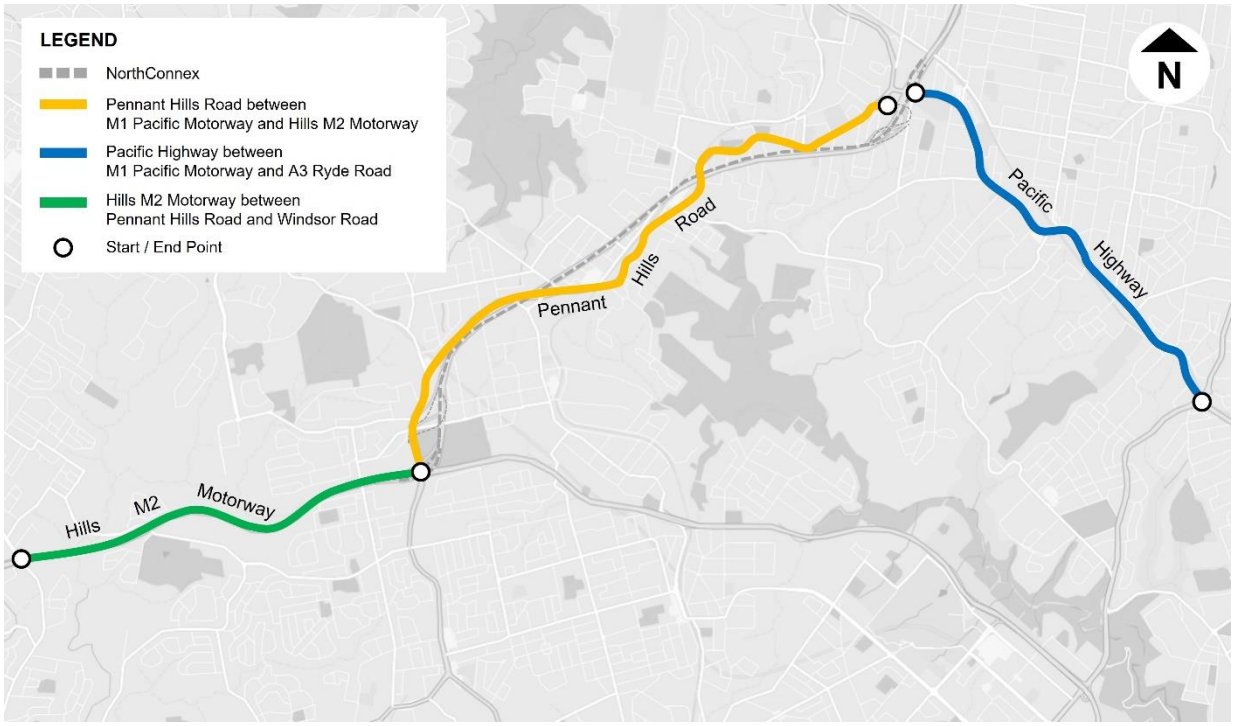


Figure 3-4 Routes used for travel time surveys

3.5.1 Pennant Hills Road

Travel time surveys along the Pennant Hills Road corridor (between the Pennant Hills Road/ Hills M2 Motorway interchange and the Pennant Hills Road/ M1 Pacific Motorway interchange, approximately eight kilometres) were undertaken for both AM and PM peak hours. A comparison of average travel time between the pre-opening and post-opening scenarios is presented in Table 3-8.

Consistent with the intersection performance results, the post-opening travel times are shorter than the pre-opening travel times. This is especially so for the peak direction in each peak hour, i.e., southbound in the AM peak hour and northbound in the PM peak hour.

Table 3-8 Comparison of average travel time on Pennant Hills Road

Direction	AM Peak Hour Average Travel Time (min:sec)			PM Peak Hour Average Travel Time (min:sec)		
	Pre-opening	Post-opening	Change	Pre-opening	Post-opening	Change
Northbound	15:35	12:30	-03:05 ▼	12:40 (peak direction)	10:49 (peak direction)	-01:51 ▼
Southbound	20:23 (peak direction)	11:29 (peak direction)	-08:54 ▼	14:38	13:14	-01:24 ▼

3.5.2 Pacific Highway

Travel time surveys along the Pacific Highway corridor (between the Pacific Highway/ Ryde Road intersection and the Pacific Highway/ M1 Pacific Motorway interchange, about 5.4 kilometres) were undertaken for both AM and PM peak hours. A comparison of average travel time between the pre-opening and post-opening scenarios is presented in Table 3-9.

The post-opening travel times are significantly shorter than the pre-opening travel times in the southbound direction with most gains occurring when southbound is the peak direction (AM). In the northbound direction, travel times are similar between post-opening and pre-opening scenarios, with a slight increase in travel time when northbound is the off-peak direction and a slight decrease when northbound is the peak direction.

Table 3-9 Comparison of average travel time on Pacific Highway

Direction	AM Peak Hour Average Travel Time (min:sec)			PM Peak Hour Average Travel Time (min:sec)		
	Pre-opening	Post-opening	Change	Pre-opening	Post-opening	Change
Northbound	08:54	09:03	+00:09 ▲	11:10 (peak direction)	10:46 (peak direction)	-01:51 ▼
Southbound	14:28 (peak direction)	9:38 (peak direction)	-04:50 ▼	9:06	8:13	-00:53 ▼

3.5.3 Hills M2 Motorway

Travel time surveys along the Hills M2 Motorway (between the Pennant Hills Road and Windsor Road interchanges) were undertaken for both AM and PM peak hours. A comparison of average travel time between the pre-opening and post-opening scenarios is presented in Table 3-10.

The post-opening travel times are shorter than the pre-opening travel times in the AM peak for both eastbound and westbound directions. In the PM peak, there has been an increase in travel time for both directions.

Table 3-10 Comparison of average travel time on Hills M2 Motorway

Direction	AM Peak Hour Average Travel Time (min:sec)				PM Peak Hour Average Travel Time (min:sec)			
	Pre-opening	Post-opening	Change		Pre-opening	Post-opening	Change	
Northbound	05:03 (peak direction)	04:22 (peak direction)	-00:41	▼	04:17	04:36	+00:19	▲
Southbound	04:38	03:48	-00:50	▼	05:25 (peak direction)	06:05 (peak direction)	+00:40	▲

3.6 Bus performance

Analysis of the weekday and weekend bus performance along Pennant Hills Road was undertaken for both pre-opening and post-opening scenarios. The bus data was extracted from the TfNSW bus operating database from PTIPS for the weekday and weekend periods in November 2019 representing pre-opening conditions, and in February 2022 representing post-opening (12-months[23]) conditions. Table 3-11 presents a comparison of pre-opening and post-opening bus travel times along Pennant Hills Road. The average travel times between 6am and 7pm on weekdays and 9am to 6pm during weekends is reported in Table 3-11.

Table 3-11 Comparison of bus operating travel times on Pennant Hills Road

Direction of Travel	Time of week	Pre-Opening Average Daily Journey Time (min:sec)	Post-Opening Average Daily Journey Time (min:sec)	Average Time Difference (min:sec)	
Northbound	Weekday	18:54	16:23	-02:31	▼
	Weekend	15:25	14:25	-01:00	▼
Southbound	Weekday	24:54	19:19	-05:35	▼
	Weekend	20:42	17:23	-03:19	▼

Table 3-12 presents a comparison of pre-opening and post-opening bus travel speeds along Pennant Hills Road.

Table 3-12 Comparison of bus operating travel speeds on Pennant Hills Road

Direction of Travel	Time of week	Pre-Opening Average Daily Journey Speed (km/h)	Post-Opening Average Daily Journey Speed (km/h)	Average Speed Difference (km/h)	
Northbound	Weekday	31.12	35.76	+4.64	▲
	Weekend	36.47	38.53	+2.06	▲
Southbound	Weekday	28.78	34.50	+5.72	▲
	Weekend	33.78	37.44	+3.66	▲

Refer Section 3.6.1 for a detailed breakdown of travel times and speeds for northbound buses on Pennant Hills Road and Section 3.6.2 for southbound buses.

3.6.1 Pennant Hills Road - Northbound

3.6.1.1 Travel times

Figure 3-5 presents a comparison of the pre-opening and post-opening bus travel times in the northbound direction along Pennant Hills Road on a typical weekday between 6am and 7pm. The assessments indicate that northbound bus travel times during a typical weekday have generally become faster post-opening of the project, with an average travel time saving of about 2.5 minutes.

[23] To enable a more representative assessment of the performance of the bus network following changed travel patterns as a result of COVID-19 restrictions, bus performance data used for this 12-month post-opening assessment were based on February 2022 information instead of November 2021.

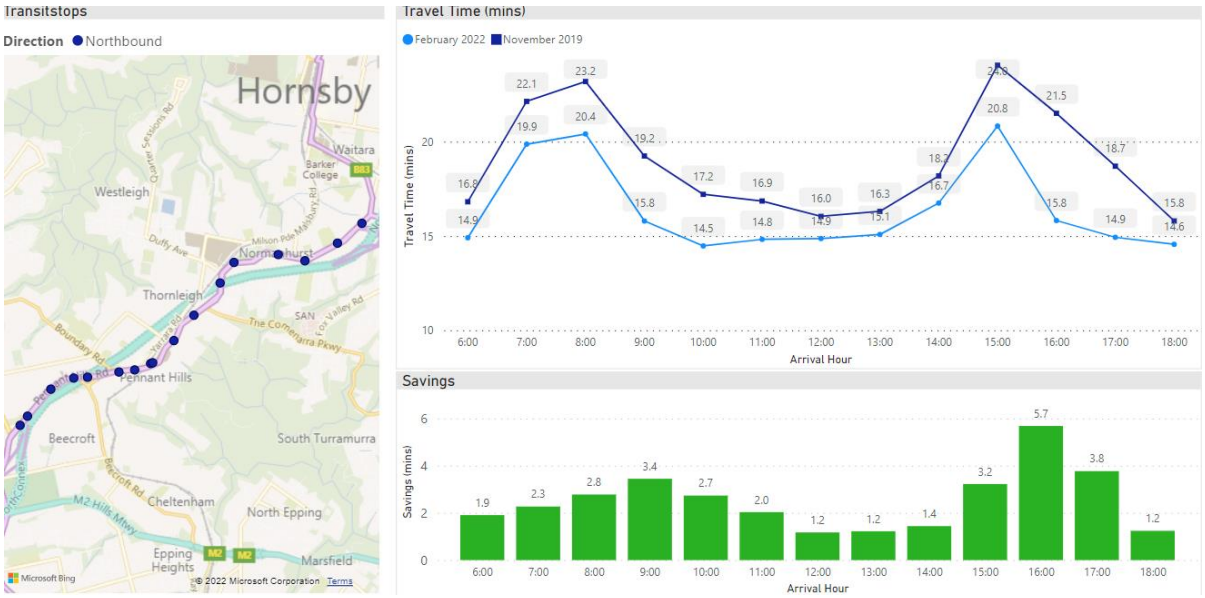


Figure 3-5 Comparison of northbound bus travel times on Pennant Hills Road (weekday)

Figure 3-6 presents a comparison of the pre-opening and post-opening bus travel times in the northbound direction along Pennant Hills Road on a typical weekend between 9am and 6pm. The assessments indicate that northbound bus travel times during a typical weekend have generally become faster post-opening of the project, with an average travel time saving of about 1 minute.

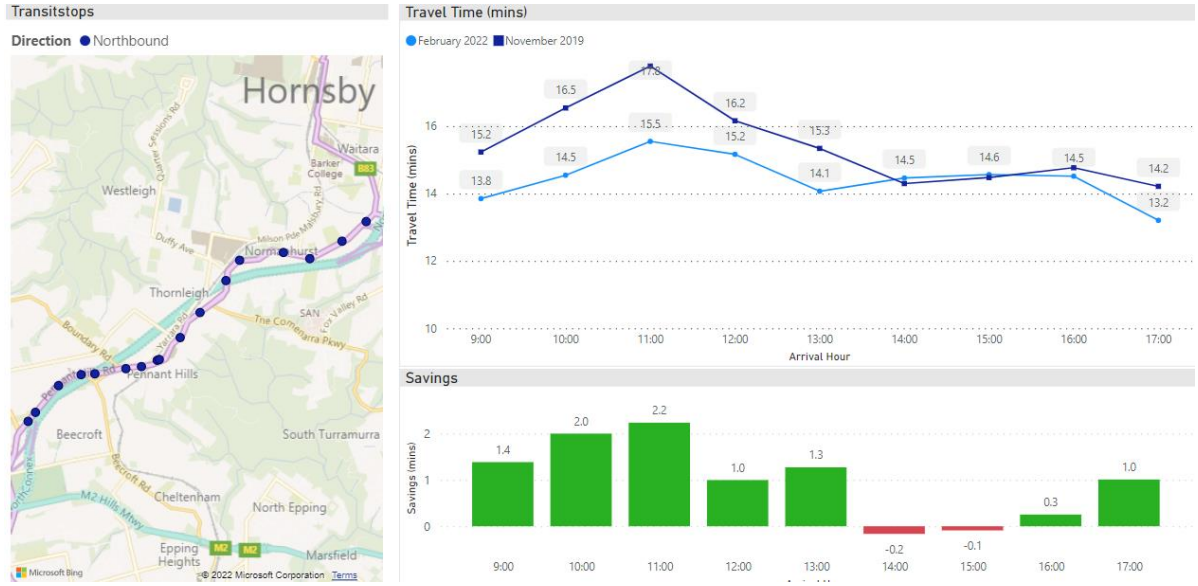


Figure 3-6 Comparison of northbound bus travel times on Pennant Hills Road (weekend)

3.6.1.2 Travel speeds

Figure 3-7 presents a comparison of the pre-opening and post-opening bus travel speeds in the northbound direction along Pennant Hills Road on a typical weekday between 6am and 7pm. The assessments indicate that northbound bus travel speeds during a typical weekday have generally become faster post-opening of the project, with an average increase of about 4.5 km/h.

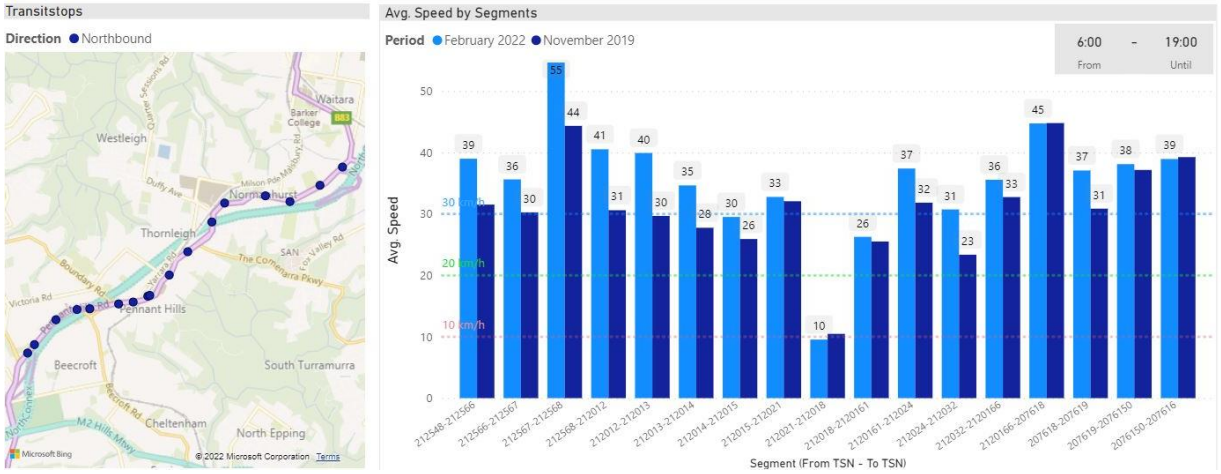


Figure 3-7 Comparison of northbound bus travel speeds on Pennant Hills Road (weekday)

Figure 3-8 presents a comparison of the pre-opening and post-opening bus travel speeds in the northbound direction along Pennant Hills Road on a typical weekend between 9am and 6pm. The assessments indicate that northbound bus travel speeds during a typical weekend have generally become faster post-opening of the project, with an average increase of about 2 km/h.

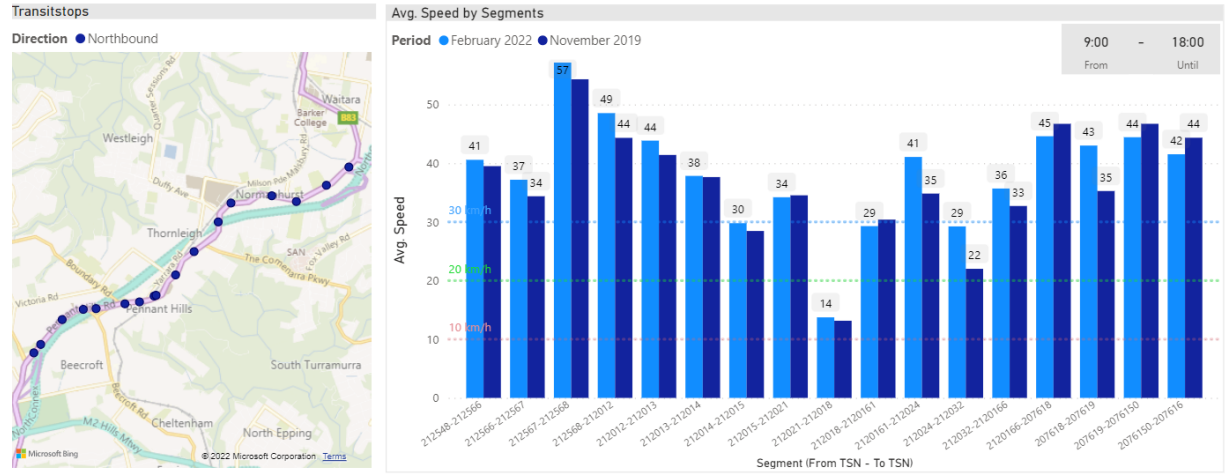


Figure 3-8 Comparison of northbound bus travel speeds on Pennant Hills Road (weekend)

The “slow point” on the graphs represents the bus delays in accessing Pennant Hills Transport Interchange on Railway Street, which requires buses to travel off Pennant Hills Road. It is noted that the bus operational performance data also includes bus dwell times for customer boarding and alighting.

3.6.2 Pennant Hills Road - Southbound

3.6.2.1 Travel times

Figure 3-9 presents a comparison of the pre-opening and post-opening bus travel times in the southbound direction along Pennant Hills Road on a typical weekday between 6am and 7pm. The assessments indicate that southbound bus travel times during a typical weekday have generally become faster post-opening of the project, with an average travel time saving of about 5.5 minutes.

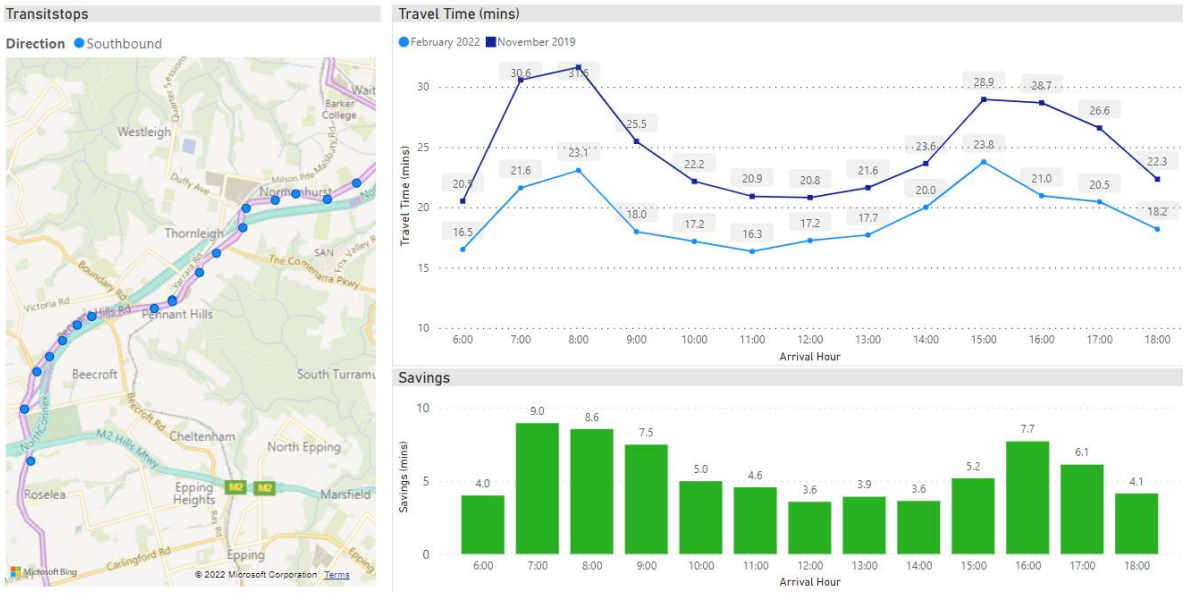


Figure 3-9 Comparison of southbound bus travel times on Pennant Hills Road (weekday)

Figure 3-10 presents a comparison of the pre-opening and post-opening bus travel times in the southbound direction along Pennant Hills Road on a typical weekend between 9am and 6pm. The assessments indicate that southbound bus travel times during a typical weekend have generally become faster post-opening of the project, with an average travel time saving of about 3 minutes.

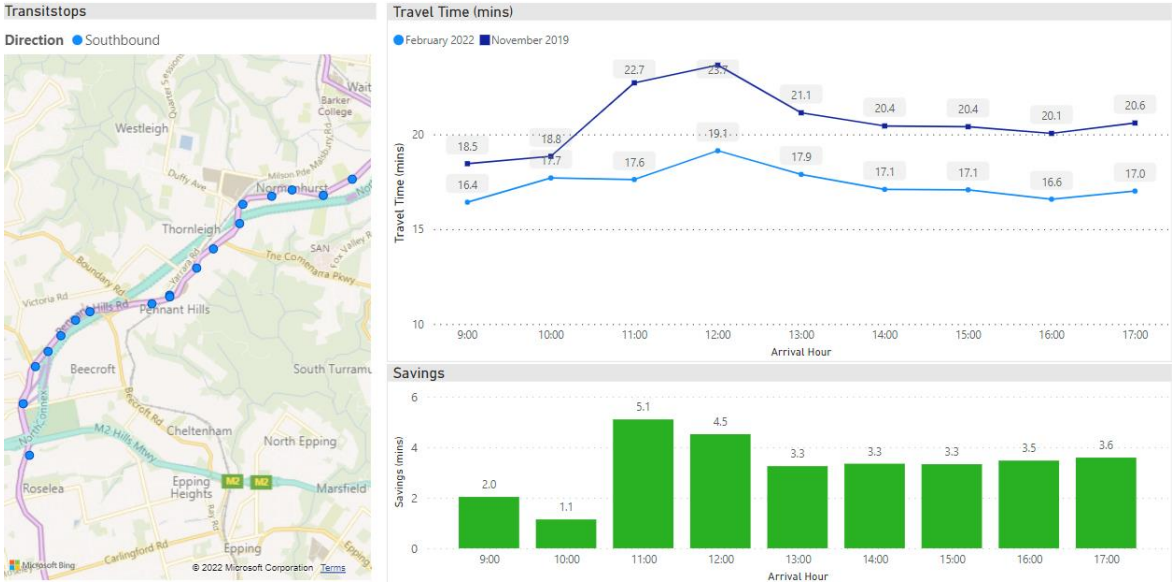


Figure 3-10 Comparison of southbound bus travel times on Pennant Hills Road (weekend)

3.6.2.2 Travel speeds

Figure 3-11 presents a comparison of the pre-opening and post-opening bus travel speeds in the southbound direction along Pennant Hills Road on a typical weekday between 6am and 7pm. The assessments indicate that southbound bus travel speeds during a typical weekday have generally become faster post-opening of the project, with an average increase of about 5.5 km/h.

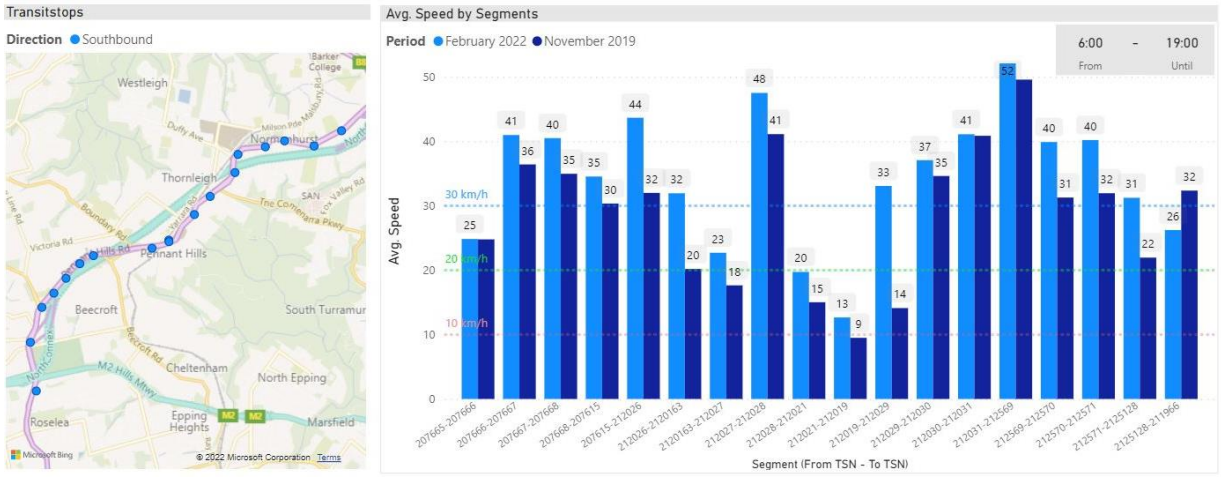


Figure 3-11 Comparison of southbound bus travel speeds on Pennant Hills Road (weekday)

Figure 3-12 presents a comparison of the pre-opening and post-opening bus travel speeds in the southbound direction along Pennant Hills Road on a typical weekend between 9am and 6pm. The assessments indicate that southbound bus travel speeds during a typical weekend have generally become faster post-opening of the project, with an average increase of about 3.5 km/h.

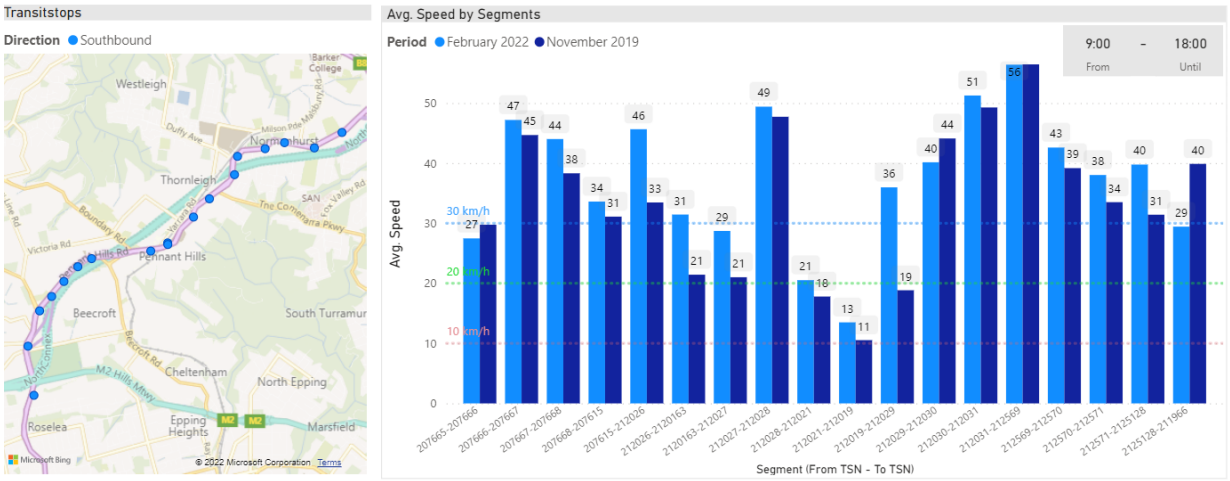


Figure 3-12 Comparison of southbound bus travel speeds on Pennant Hills Road (weekend)

The “slow point” on the graphs represents the bus delays in accessing Pennant Hills Transport Interchange on Railway Street, which requires buses to travel off Pennant Hills Road. For the southbound direction, these require right turns into and out of Railway Street, which would add to the journey time and thus have a slower average speed.

It is noted that the bus operational performance data also includes bus dwell times for customer boarding and alighting.

3.7 Walking and cycling activity

Walking and cycling along Pennant Hills Road remains relatively low. Based on site observations, higher pedestrian activity is generally concentrated within commercial centres and educational establishments along the corridor. As illustrated in Figure 3-13, key pedestrian activity areas in the Pennant Hills Road corridor include:

- **Normanhurst Boys High School, Normanhurst Primary School and Loretto Normanhurst:** During school zone hours (8–9.30am and 2.30–4pm, weekdays), a large number of students use the bus stops on Pennant Hills Road to catch local bus services (587, 589 and 600), as well as the signalised crossings and pedestrian overpass.
- **Thornleigh mixed-use commercial precinct between Bellevue Street and Wells Street:** During the AM and PM weekday peak periods, commuters access the Thornleigh Train Station. Activity is otherwise relatively low, yet constant, with pedestrians accessing retail, commercial and residential premises.
- **Pennant Hills vehicle sales precinct between Stevens Street East and George Street:** During weekends, pedestrian activity increases to vehicle sales premises on both sides of Pennant Hills Road, as well as a fast-food outlet on the corner of George Street.
- **Pennant Hills mixed-use commercial precinct between Railway Street and Trebor Road:** During the AM and PM weekday peak periods, commuters access Pennant Hills Station, as well as around midday/lunchtime near commercial premises. Activity is otherwise relatively moderate, with pedestrians accessing retail, commercial and residential premises.
- **Mount St Benedict College between Beecroft Road and Loftus Road:** During school zone hours (8–9.30am and 2.30–4pm, weekdays), a large number of students use the bus stops on Pennant Hills Road to catch local bus services (625, 632), as well as the signalised crossings and pedestrian overpass.
- **West Pennant Hills mixed-use commercial precinct south of Cardinal Avenue to Castle Hill Road:** Pedestrian activity is relatively high during the middle of the day throughout the week. Activity is relatively constant throughout the week due to an extensive range of retail and commercial premises.

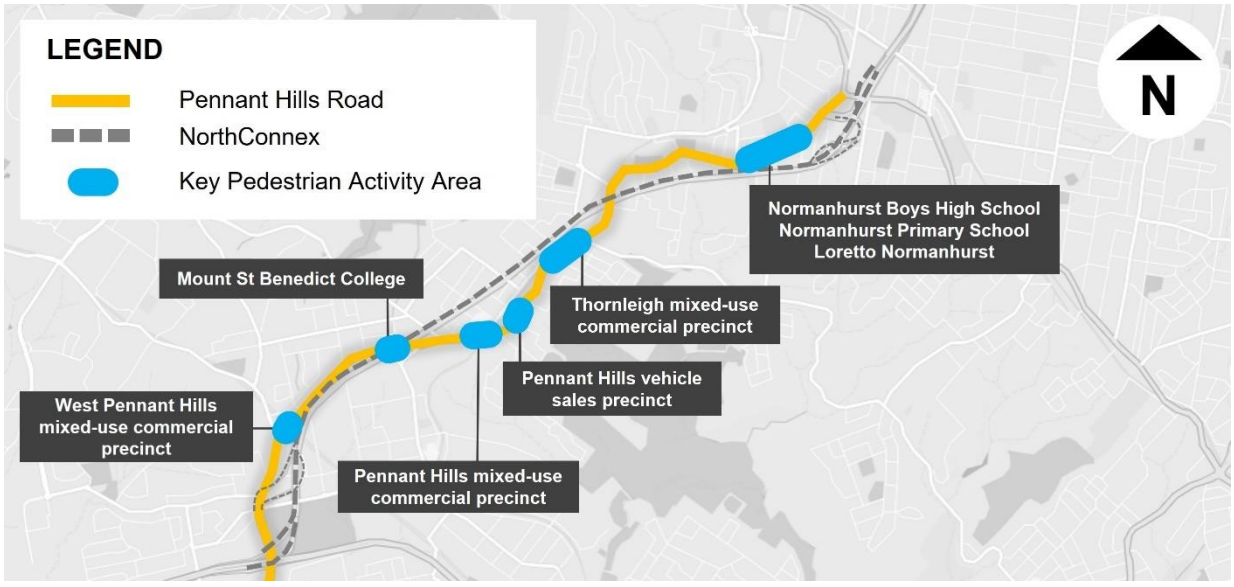


Figure 3-13 Higher pedestrian activity areas on Pennant Hills Road

Cycling also remains at relatively low levels, however, some additional weekday cycling activity has been observed on Pennant Hills Road, likely due to a reduction in surface vehicle movements. Higher cycling activity is generally prevalent during weekends, which is primarily comprised of on-road cyclists and mountain bike riders travelling towards trails in Westleigh and Hornsby.

As part of the NorthConnex project, new and improved walking and cycling infrastructure has been delivered on surface roads along the tunnel alignment. A reduction in surface vehicle movements as a result of the project has significantly improved the overall amenity for active travel, particularly along Pennant Hills Road. The new active travel infrastructure delivered as part of the project has supported increased walking and cycling activity. Table 3-13 presents the location and details of improvements to walking and cycling infrastructure completed as part of the project.

Table 3-13 Walking and cycling infrastructure delivered as part of NorthConnex project

Location	Description	Integration with Existing Facilities
Pennant Hills Road between Hills M2 Motorway and Copeland Road	New shared user path on western side of NorthConnex on-ramp	Direct connection with new cycle only off-ramp from M2 Motorway (eastbound), and existing shared user crossing over Pennant Hills Road to continue on the M2 towards Macquarie Park.
	New on-road cycle lane on M2 on-ramp (eastbound) on the eastern side of NorthConnex off-ramp	Direct connection with existing on-road cycle on M2 Motorway on-ramp (eastbound), and existing shared path on eastern side of Pennant Hills Road between M2 Motorway and mid-block crossing at Roselea Park, Beecroft.
M2 Motorway (eastbound) between Oakes Road and Pennant Hills Road	New cycle only underpass to continue on M2 and off-ramp from M2 Motorway (eastbound) onto Pennant Hills Road	Underpass connected with existing M2 shoulder, off-ramp connects with new shared user path on Pennant Hills Road, and existing shared user crossing over Pennant Hills Road.
M2 Motorway (westbound), west of Pennant Hills Road	New cycle only bridge over M2 Motorway on-ramp (westbound) from Pennant Hills Road and NorthConnex	Bypasses on-ramp to provide continuous cycle lane along the M2 (westbound), removing the previous conflict point for cyclists at this location.
Pennant Hills Road at Campbell Avenue	Widened footpath on southern side of Pennant Hills Road adjoining new regulatory gantry	Connects with existing footpath corridor along Pennant Hills Road, providing additional capacity for pedestrians travelling towards local parks, Normanhurst station and town centre.
M1 Pacific Motorway, north of Millewa Avenue	New cycle lane on western side of NorthConnex off-ramp	Provides continuous on-road cycle lane for cyclists travelling southbound, removing a conflict with vehicles existing the tunnel.
	New cycle lane on eastern side of NorthConnex on-ramp	Provides continuous on-road cycle lane for cyclists travelling southbound, removing a conflict with vehicles entering the tunnel.

Sources: Transurban (2022), NorthConnex Environmental Impact Statement (2014)

New and improved walking and cycling infrastructure delivered by the project will also support planned extensions to local active travel networks by others. The *Draft Walking and Cycling Strategy, 2020* from Hornsby Shire Council identifies sections of Pennant Hills Road in Normanhurst and West Pennant Hills for the delivery of new shared paths within the next 6-10 years.

3.8 Summary of road network performance

The assessments indicate that road network performance has generally improved since the opening of the project. Majority of the intersections analysed as part of this plan show an improvement in performance (decreased traffic volumes, decreased averaged delays and improved LOS) following opening of the project. Intersections which showed no change in performance (LOS) continue to operate at a satisfactory level or higher (LOS D or higher) except for the following three intersections which continue to operate over capacity (LOS E or lower):

- Pennant Hills Road/ North Rocks Road
- Chilvers Road/ The Esplanade/ Duffy Avenue
- Pennant Hills Road/ Hills M2 Motorway Interchange.

The Pacific Highway/ Ingram Road/ Woolcott Avenue intersection was the only intersection in the assessment which showed a reduced level of performance compared to the pre-opening scenario. During the AM peak, the performance changed from LOS D to LOS F while for the PM peak the performance changed from LOS C to LOS E. The degradation of performance of the Pacific Highway/ Ingram Road/ Woolcott Avenue intersection is not considered to be a direct result of the operation of the project. The reduced level of performance of this intersection could be primarily attributed to the land use changes within the surrounding locality, as discussed in Section 3.1.

Section 5.1 outlines the proposed next steps to mitigate the change in performance.

Average travel times have improved significantly along the surveyed Pennant Hills Road corridor, seeing average travel times decreasing by up to nine minutes. The Pacific Highway corridor sees decreased average travel times by up to five minutes but sees a slight increase in average travel time (less than a minute) during the AM peak hour northbound movement. The Hills M2 Motorway has had a slight decrease in average travel times (by up to a minute) during the AM peak hour but sees a slight increase during the PM peak hour (by up to a minute).

Bus performance along Pennant Hills Road has improved compared with the pre-opening conditions. Average bus travel times have decreased with weekday southbound movements benefitting the most by up to six minutes. Average daily journey speeds have increased with weekday southbound movements similarly benefitting the most by up to six kilometres per hour.

Walking and cycling along Pennant Hills Road remains relatively low; however, some additional weekday cycling activity has been observed on Pennant Hills Road. A reduction in surface vehicle movements as a result of the project has significantly improved the overall amenity for active travel, particularly along Pennant Hills Road.

4 Stakeholder and community feedback

4.1 Negative feedback

Following the opening of NorthConnex in October 2020, TfNSW has received feedback from the community in relation to key issues of relevance to this project. Table 4-1 presents a summary of negative feedback received by TfNSW, with a detailed response to each issue raised following overleaf.

Table 4-1 Summary of post-opening feedback received in relation to NorthConnex

Issue	Description	Response
Toll Avoidance/ Heavy Vehicles	Heavy vehicles use local streets to avoid NorthConnex and regulatory gantries on Pennant Hills Road, in particular Campbell Avenue	• Heavy vehicle restrictions apply to several local streets. • A proposal has been prepared by Hornsby Council for the installation of a refuge island on Campbell Avenue, Normanhurst. This would restrict the road to light vehicle movements only.
	There is an increase in the number of heavy vehicles using Pacific Highway to avoid NorthConnex	• Avoiding NorthConnex to travel on M2 would add 20 minutes travel time and still incur a toll. • A review of traffic count data from the TfNSW Traffic Volume reveals that heavy vehicle volumes on the Pacific Highway at Warrawee are decreasing. • Volumes of light vehicles along the same route are also decreasing, but at a much faster rate than that of heavy vehicles. • As a result, the percentage of heavy vehicles as part of total traffic is increasing.

Issue: The community has raised concerns about heavy vehicles using local streets to avoid NorthConnex and regulatory gantries on Pennant Hills Road. The regulatory gantries are located at the corners of Campbell Avenue and Kenley Road, Normanhurst, and Oratava Avenue and Hannah Street, West Pennant Hills.

Response

An average of 6000 heavy vehicles use NorthConnex each day, exceeding the 5000 heavy vehicles that were predicted to use the tunnel. The Pennant Hills Road regulation prohibits vehicles over 12.5m long or over 2.8m clearance height travelling on Pennant Hills Road between the M1 Pacific Motorway at Wahroonga and the Hills M2 Motorway at West Pennant Hills, unless they have a genuine destination along the corridor or a valid exemption/permit, including oversized vehicles and dangerous goods.

In December 2017, an amendment was made to the *Road Transport Act 2013* to allow for camera technology to be used to detect and certify vehicle length, in addition to already approved measure of height. Regulatory gantries have been installed on Pennant Hills Road in Normanhurst and West Pennant Hills/Beecroft to measure the length and height of vehicles using the corridor.

Vehicles detected by both gantries that exceed size restrictions and do not have a local destination or valid exemption will receive a $194 fine with no loss of demerit points. Many local roads along Pennant Hills Road also have restrictions on the size of vehicles that can use them; this limit is generally 3 tonnes.

Heavy vehicle restriction signage is currently displayed at the entrance of the following roads along Pennant Hills Road between the M1 and M2 motorways:

- Hinemoa Avenue, Normanhurst
- The Comenarra Parkway, Thornleigh
- Yarrara Road, Pennant Hills
- Aiken Road, West Pennant Hills
- Eaton Road, West Pennant Hills
- Copeland Road, Beecroft.

The installation of additional signage displaying heavy vehicle restrictions on local roads that intersect with Pennant Hills Road will be considered as a potential mitigation strategy to reduce the likelihood of heavy vehicles using local roads.

A proposal for the installation of a refuge island and associated signage at the entrance of Campbell Avenue, Normanhurst has been prepared by Hornsby Shire Council. The proposal was publicly exhibited in May 2022 and will be finalised based on community and stakeholder feedback.

Additional infrastructure-based treatments including kerb extensions and refuge islands will also be considered to physically limit the size of vehicles that can enter and exit at locations of concern.

Issue: The community has raised concerns about an increase in heavy vehicles using Pacific Highway between the M1 Pacific Motorway and A3 Ryde Road to avoid NorthConnex.

Response: Pacific Highway is a major arterial road facilitating the movement of vehicles between Sydney and Brisbane. The corridor is an approved B-double route for vehicles up to 26m long between the M1 Pacific Motorway at Wahroonga and the Gore Hill Freeway at Artarmon. Ryde Road, which intersects with Pacific Highway at Pymble, is also an approved B-double route.

Heavy vehicles travelling south are permitted to use Ryde Road via Pacific Highway as an alternative, toll-free route to NorthConnex. Concerns were not raised about an increase in heavy vehicles on Ryde Road, however given it forms part of an alternative route to NorthConnex for heavy vehicles travelling south, consideration has been made towards this corridor, in addition to Pacific Highway.

Historical traffic count information from January 2019 to April 2022 at two locations was reviewed using data gathered from the TfNSW Traffic Volume Viewer website[24]. These are at:

- Station ID 53003 – Pacific Highway, 10m east of Blytheswood Avenue, Warrawee
- Station ID 53005 – Ryde Road, 30m south of Lofberg Road, West Pymble

Pacific Highway, Warrawee (Station ID 53003)

Figure 4-1 illustrates the average daily traffic on Pacific Highway at Warrawee between January 2019 and April 2022. Prior to the opening of NorthConnex, the average daily traffic on Pacific Highway in both directions was a combined 61,816[25] for light and heavy vehicles.

Following the opening of NorthConnex the average daily traffic from November 2020 to April 2022 reduced to 48,693.

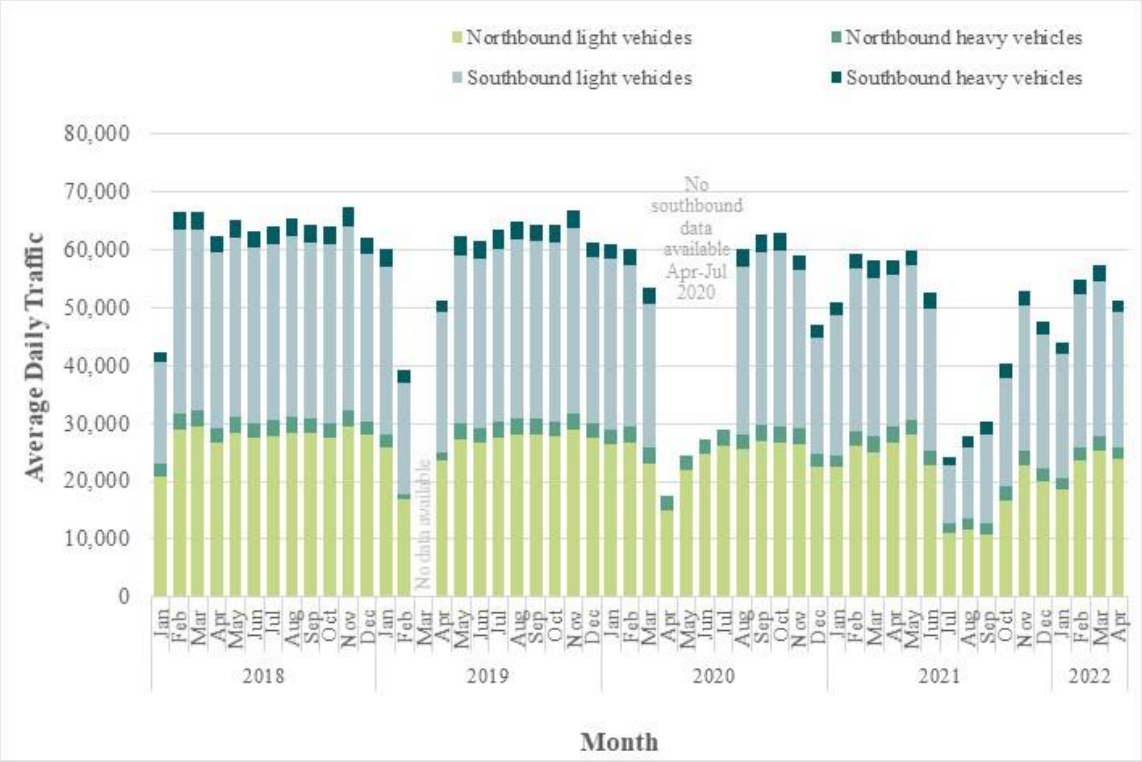


Figure 4-1 Average Daily Traffic – Pacific Highway, Warrawee (Station ID 53003)

[24] https://roads-waterways.transport.nsw.gov.au/about/corporate-publications/statistics/traffic-volumes/aadt-map/index.html#/?z=6

[25] Excluding the period April to July 2020, when the counter on the southbound direction was not operational.

A breakdown of the volumes of the light vehicles and heavy vehicles at the counting station on Pacific Highway, Warrawee further demonstrates the decreasing trend.

Figure 4-2 and Figure 4-3 show the volumes and trends in the volumes of light vehicles and heavy vehicles, respectively, along Pacific Highway in Warrawee from January 2019 to April 2022.

The significant decrease in traffic volume in the period July to October 2021 covers the lockdown periods resulting from COVID-19 travel restrictions in Greater Sydney.

Figure 4-2 Average Daily Light Vehicle Traffic – Pacific Highway, Warrawee

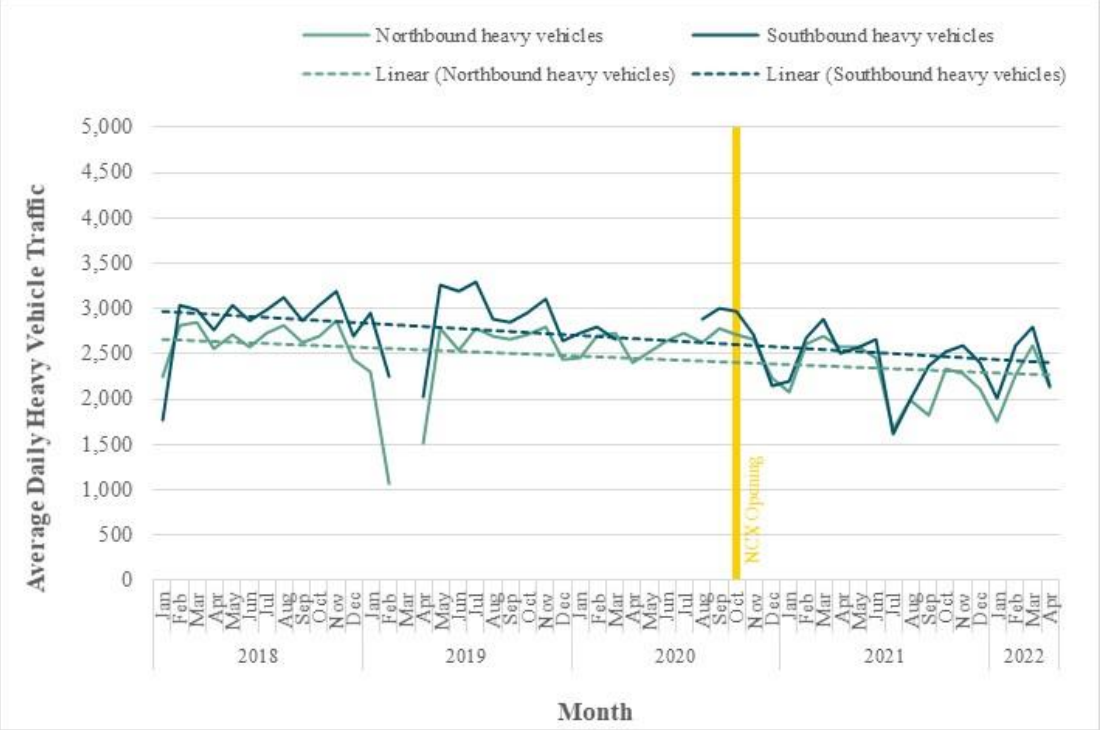


Figure 4-3 Average Daily Heavy Vehicle Traffic – Pacific Highway, Warrawee

Both Figure 4-2 and Figure 4-3 reveal the decreasing trend in traffic volumes at this location. It is also noticeable that the rate of decrease in light vehicle traffic volumes is greater than the rate of decrease of heavy vehicle volumes.

This is better demonstrated with a chart showing the heavy vehicle traffic volumes as a percentage of total average daily traffic volumes, shown in Figure 4-4.

Figure 4-4 demonstrates that the percentage of heavy vehicles in the total traffic stream has been steadily increasing, with a significant increase during the lockdown period between July and October 2020, during which heavy vehicles comprised between 12 and 14 percent of total traffic, as opposed to an average of 8 to 10 percent prior to the lockdown.

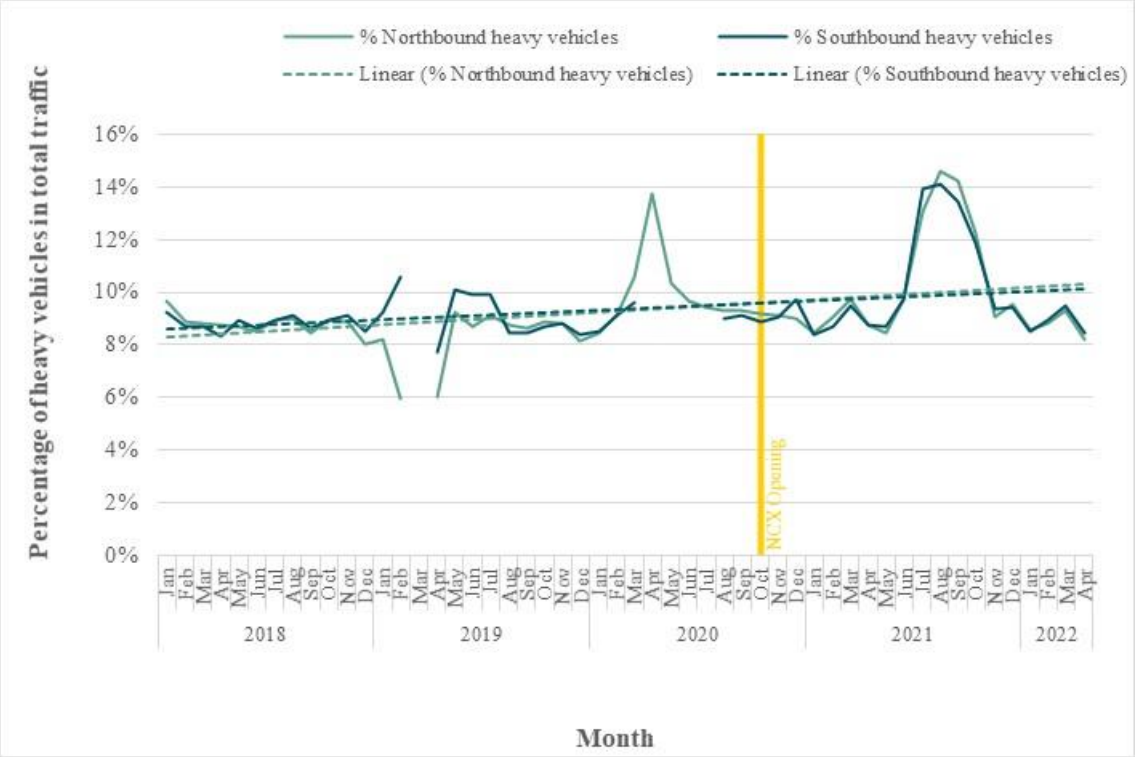


Figure 4-4 Percentage of Heavy Vehicles – Pacific Highway, Warrawee

While there has been an increase in the proportion of heavy vehicles in traffic volumes on Pacific Highway, the data provides evidence that the volume of heavy vehicles has been on a steady decreasing trend from 2018, continuing even after the opening of NorthConnex in October 2020.

Ryde Road, West Pymble (Station ID 53005)

Figure 4-5 illustrates the average daily traffic on Ryde Road at West Pymble between January 2019 and April 2022. Prior to the opening of NorthConnex, the average daily traffic on Ryde Road in both directions was a combined 56,689 for light and heavy vehicles.

Following the opening of NorthConnex the average daily traffic from November 2020 to April 2022 reduced to 49,209[26].

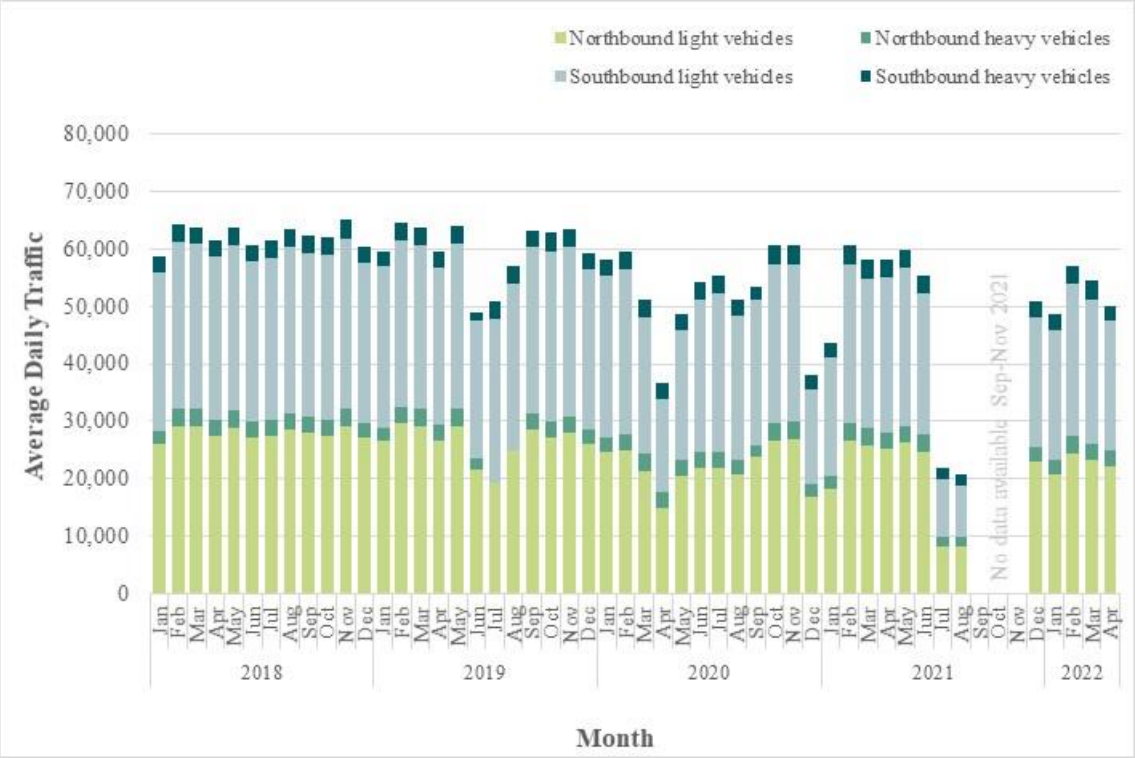


Figure 4-5 Average Daily Traffic – Ryde Road, West Pymble

A breakdown of the volumes of the light vehicles and heavy vehicles at the counting station on Ryde Road, West Pymble further demonstrates the decreasing trend.

Figure 4-6 and Figure 4-7 show the volumes and trends in the volumes of light vehicles and heavy vehicles, respectively, along Ryde Road in West Pymble from January 2019 to April 2022.

The significant decrease in traffic volume in the period July to October 2021[10] covers the lockdown periods resulting from COVID-19 travel restrictions in Greater Sydney.

[26] Excluding the period from September to November 2021, when the counter in both directions was not operational.

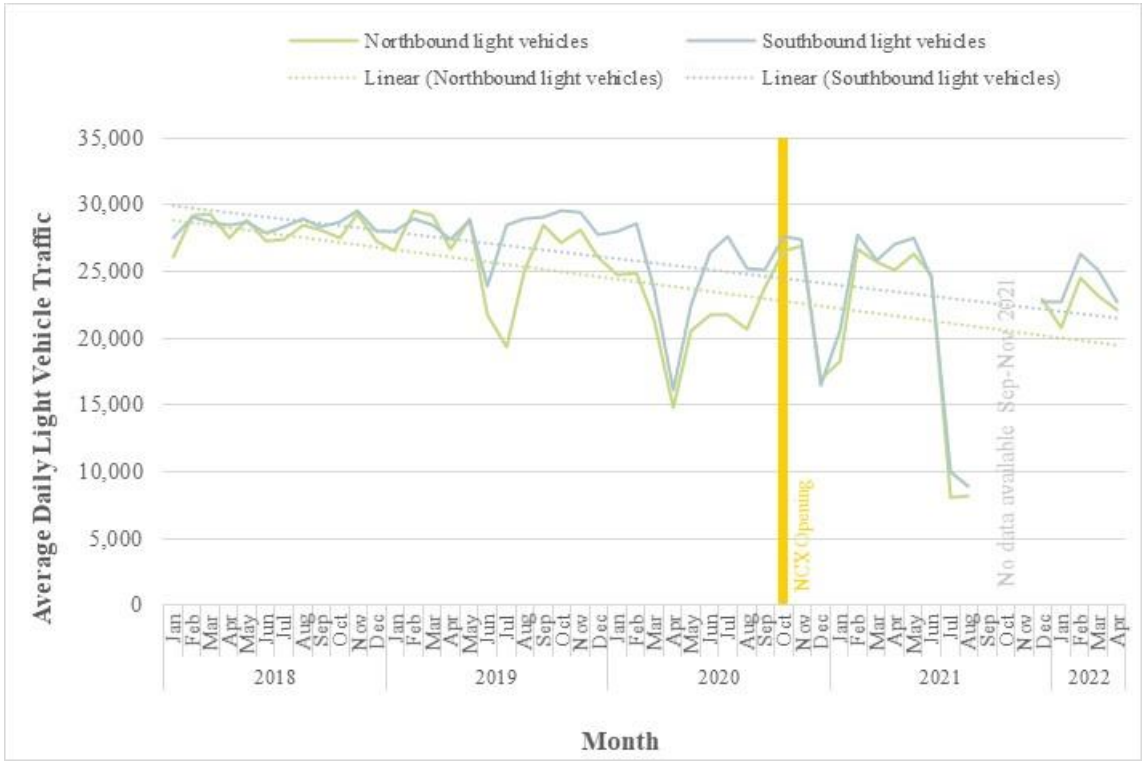


Figure 4-6 Average Light Vehicle Daily Traffic – Ryde Road, West Pymble

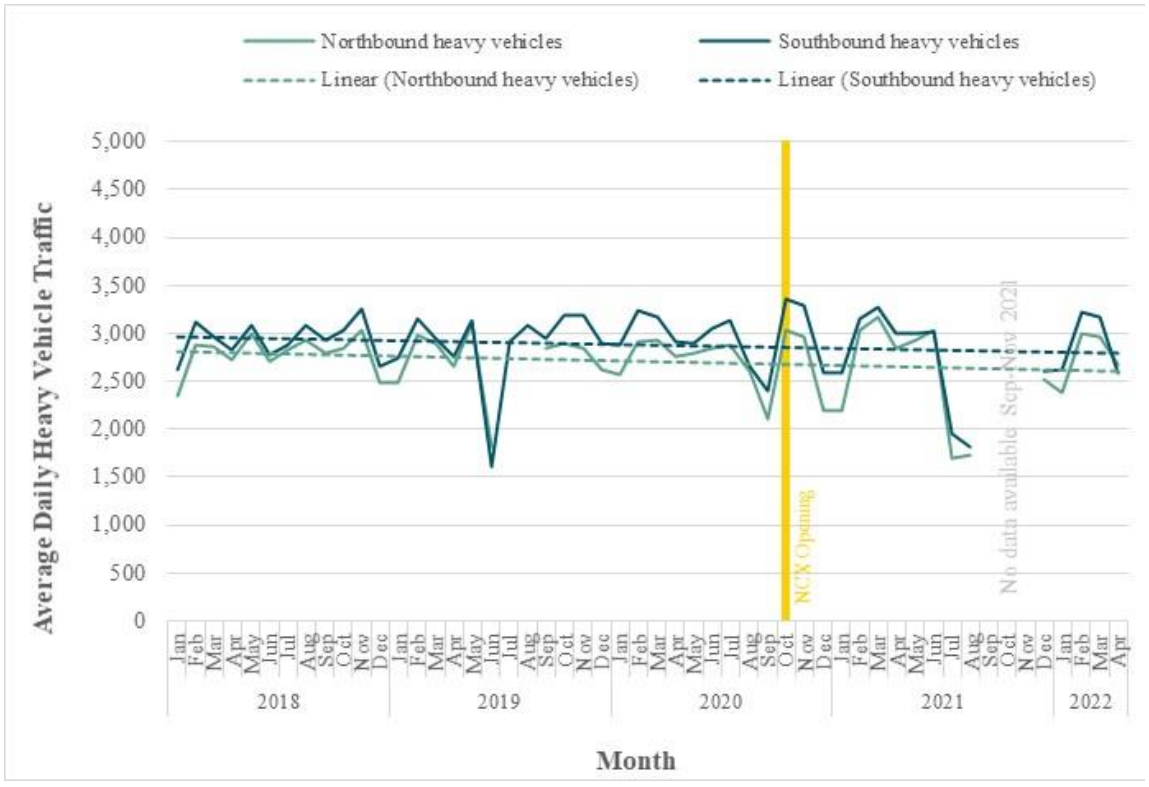


Figure 4-7 Average Heavy Vehicle Daily Traffic – Ryde Road, West Pymble

Both Figure 4-6 and Figure 4-7 reveal the decreasing trend in traffic volumes at this location. It is also noticeable that the rate of decrease in light vehicle traffic volumes is greater than the rate of decrease of heavy vehicle volumes.

This is better demonstrated with a chart showing the heavy vehicle traffic volumes as a percentage of total average daily traffic volumes, shown in Figure 4-8.

Figure 4-8 demonstrates that the percentage of heavy vehicles in the total traffic stream has been steadily increasing, with a significant increase during the lockdown period between July and October 2021, during which heavy vehicles comprised around 17 percent[27] of total traffic, as opposed to an average of around 10 percent prior to the lockdown.

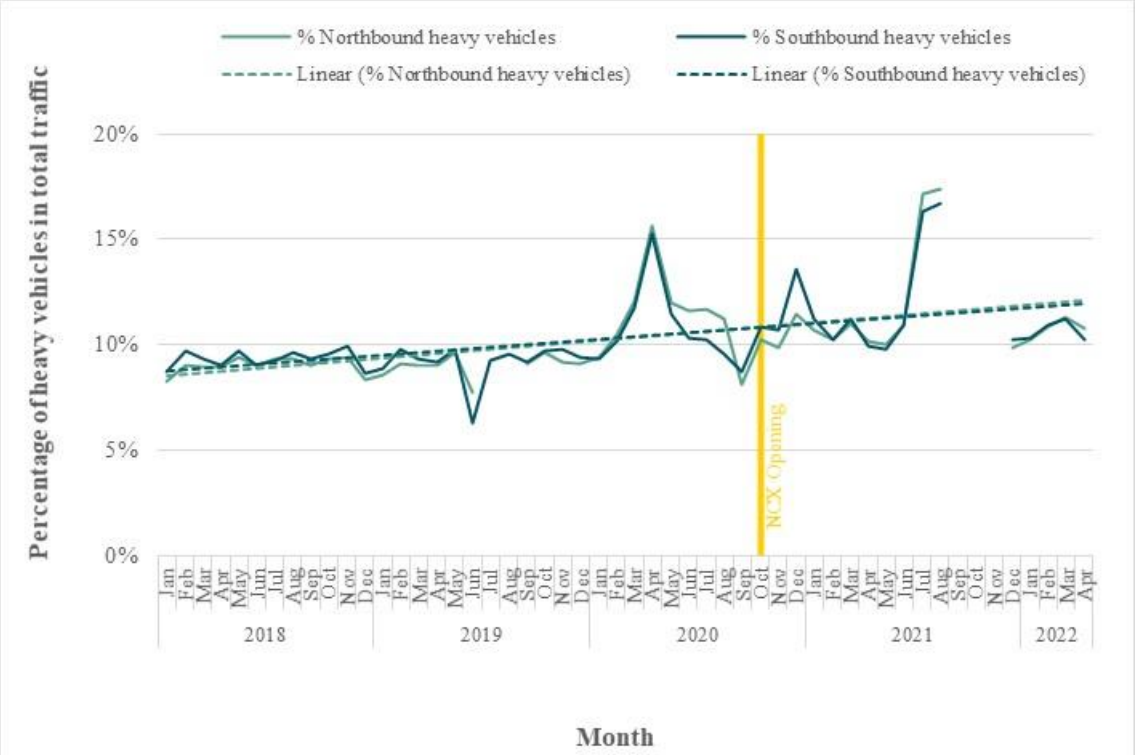


Figure 4-8 Percentage of Heavy Vehicles – Ryde Road, West Pymble

While there has been an increase in the proportion of heavy vehicles in traffic volumes on Ryde Road, the data provides evidence that the volume of heavy vehicles has been on a decreasing trend from 2018, continuing on following the opening of NorthConnex in October 2020.

[27] Excluding the period from September and October 2021, when the counter in both directions was not operational.

4.2 Positive feedback

NorthConnex has received extensive media coverage during the various stages of the project. In November 2021, local and national media organisations were invited to attend an event celebrating the one-year anniversary of tunnel operations. During this event, the following feedback was received from the local community:

- *"NorthConnex has helped our business enormously. Between 3-6pm on Monday to Friday nights were really slow because of the traffic gridlock.*

  "Business has now picked up by 30 per cent and it's a lot quieter and cleaner without the trucks and the diesel dust they created."

  - Steve Aisbett, Director – Thornleigh Golf Centre
- *"Back in 2019 Pennant Hills Road was voted one of the worst congested roads in the State. Since the opening of NorthConnex, travelling on Pennant Hills Road is quicker and easier with surrounding local streets also benefiting from a reduction in traffic.*

  This is a win not just for locals but anyone using NorthConnex or Pennant Hills Road to get to work and home each day."

  - Matt Kean, Member for Hornsby (at the time of feedback)
- *"[The] data confirms what I've been hearing from locals in my electorate, that NorthConnex has been a real game-changer for our area."*

  - Julian Leeser, Member for Berowra

In addition, the following feedback was received from a local resident:

- *"We've lived in the local area for the last 27 years. Until NorthConnex, it's just gotten worse and worse and worse. All the noise and traffic on Pennant Hills Road is now non-existent."*

  - Trevor Lyon, Local Resident

5 Mitigation measures

5.1 Proposed measures

To mitigate the performance issues of the surrounding road network (refer to Section 3.8) and address key concerns raised in the feedback (refer to Section 4.1), upgrades are currently proposed at the following intersections:

- **Pennant Hills Road/ North Rocks Road, Carlingford**
  Proposed upgrades by TfNSW, as illustrated in Figure 5-1 include:
  - Widening on Pennant Hills Road and North Rocks Road
  - Installation of a raised median and additional turning lanes
  - New pedestrian crossing and widened footpaths.

Figure 5-1 Proposed upgrades on Pennant Hills Road and North Rocks Road, Carlingford

Source: https://roads-waterways.transport.nsw.gov.au/projects/01documents/pennant-hills-road-north-rocks-road-carlingford/pennant-hills-road-north-rocks-road-carlingford-community-consultation-report-2021-05.pdf (accessed May 2022)

- **Pennant Hills Road/ Campbell Avenue, Normanhurst**
  Proposed upgrades by Hornsby Shire Council, as illustrated in Figure 5-2 include:
  - Construction of two concrete islands in Campbell Avenue
  - Installation of 'No Left Turn – Vehicles Under 11m Excepted' signs on Pennant Hills Road
  - Installation of additional parking restrictions to improve visibility for pedestrians.

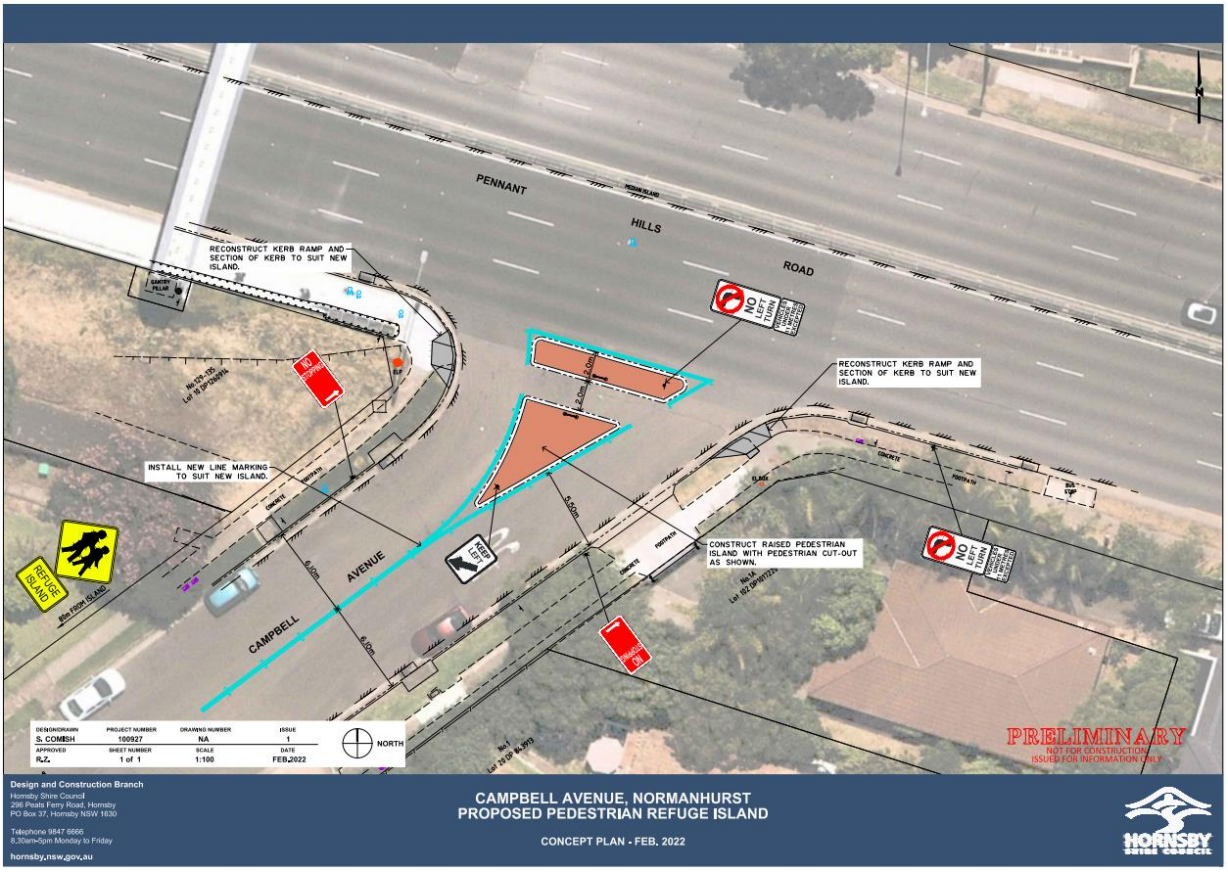


Figure 5-2 Proposed Installation of Pedestrian Refuge on Campbell Avenue, Normanhurst

Source: https://www.hornsby.nsw.gov.au/council/noticeboard/your-say/current-exhibitions/Public-Consultation-Campbell-Avenue,-Normanhurst-Proposed-Installation-of-Pedestrian-Refuge (accessed May 2022)

- **Pacific Highway/ Ingram Road/ Woolcott Avenue**: Based on the outcomes of the traffic modelling presented in this plan, the Pacific Highway/ Ingram Road/ Woolcott Avenue intersection was the only intersection which showed a reduced performance following the project's opening compared to the pre-opening scenario. While this can largely be attributed to the land use changes within the surrounding locality, as discussed in Section 3.1, it is recommended that further investigations (by others) be undertaken to better understand the underlying causes of the performance issues, in order to propose further measures that could mitigate the degradation in performance.

5.2 Toll avoidance schemes

Trucks and buses (over 12.5m long or over 2.8m clearance height) travelling between the M1 and M2 must use NorthConnex unless they have a genuine pick up or delivery destination only accessible via Pennant Hills Road.

Two gantries monitor trucks and buses on Pennant Hills Road – in the north at Normanhurst and in the south at Beecroft/ West Pennant Hills. Cameras in the gantries record the height and length of trucks and buses. Only trucks and buses that pass under both gantries with the flow of traffic will be checked for compliance with the regulation (if they are not eligible to use Pennant Hills Road). Signage is displayed in strategic locations on approach to Pennant Hills Road, similar to that illustrated in Figure 5-3.

Figure 5-3 Pennant Hills Road regulatory signage

Warning signs are currently displayed at the following locations:

- **M1 Pacific Motorway,** south of Ku-Ring-Gai Chase Road, Asquith
- **Pacific Highway** at Romsey Street, Waitara and north of Gilda Avenue, Wahroonga
- **Pennant Hills Road** at Campbell Avenue, Normanhurst and Aiken Road, West Pennant Hills, and south of Murray Farm Road, Carlingford
- **Hills M2 Motorway**, north of Barclay Road, Carlingford and north of Wycombe Street, Epping.

Appendix A – Council feedback

City of Parramatta Council – Meeting Notes 29 April 2019

Attendees: 2 representatives from Council including Michael Jollon, Transport Planning Manager

Pat Doyle, Sonja Shand, Sarah Rosewell

Council interested in monitoring (locations determined by marks on map):

- Beecroft Road near Kandy Ave
- Beecroft Road near Cheltenham Road
- Carlingford Road near Elbon Avenue
- Marsden Road near Rickard Street
- Midson Road beside Hills M2
- North Rocks Road near Pennant Hills Road Park
- North Rocks Road near Morshead Avenue
- Pennant Hills Road near Janell Crescent

Dundas valley is not a designated B-double route.

Council interested in any increase on Marsden Road onto Silverwater (as is already constrained).

Council believes there may be increased traffic on North Rocks Road because of NorthConnex.

RMS Sydney has developed Road Network Plan with council. RMS will access this internally.

If there's an increase in trucks Council are looking for it to be mitigated.

Council want traffic through Epping town centre to be as manageable as possible, despite significant construction and increased density

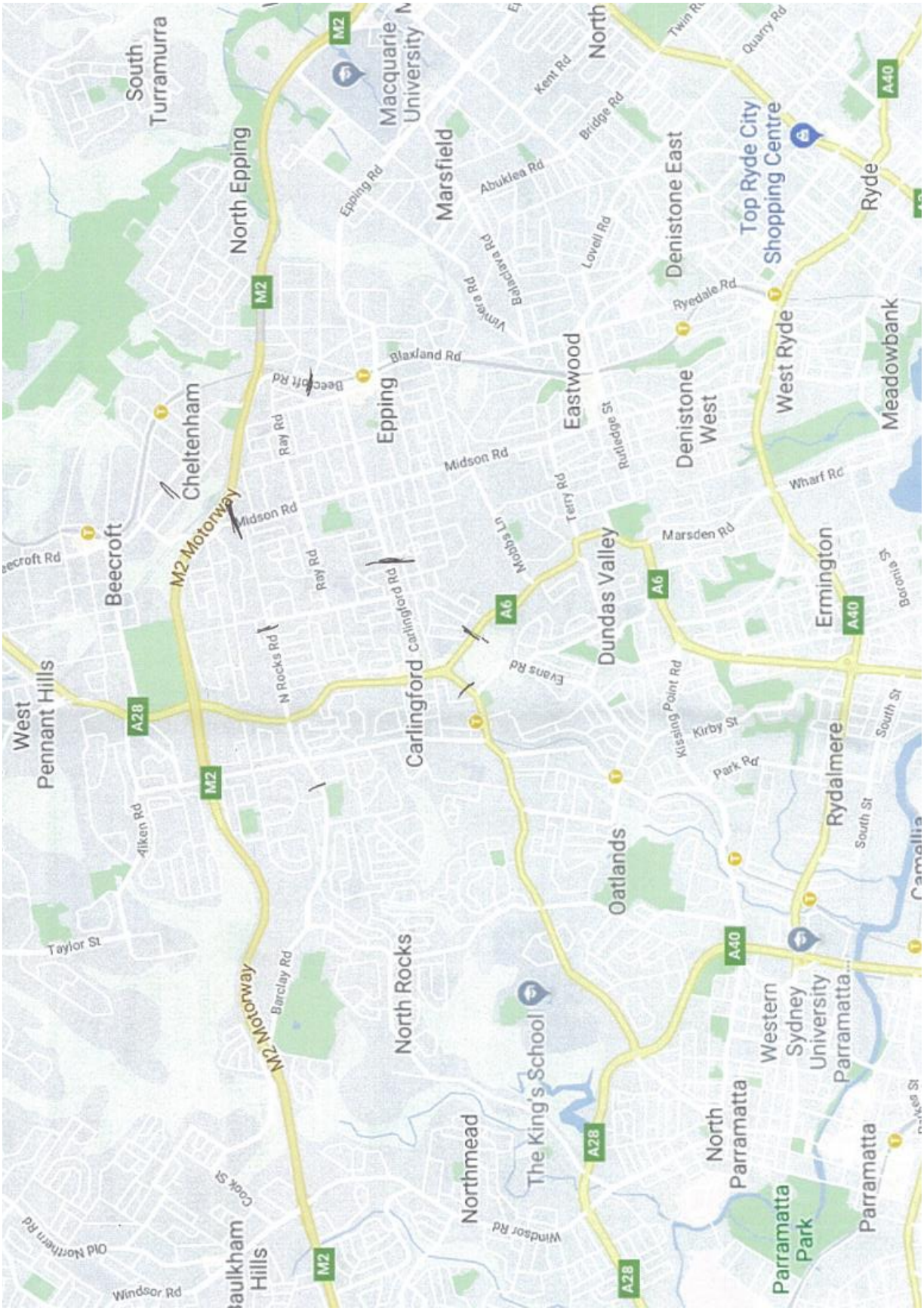
Lots of construction traffic around Epping not related to NorthConnex construction

Local freight vehicles service the area as well as garbage trucks, school buses and removalists

Expect possible increase in general traffic on Adderton/Addison Road.

Eaton Road is good to have in an incident so you don't want to increase or encourage freight or heavy vehicles

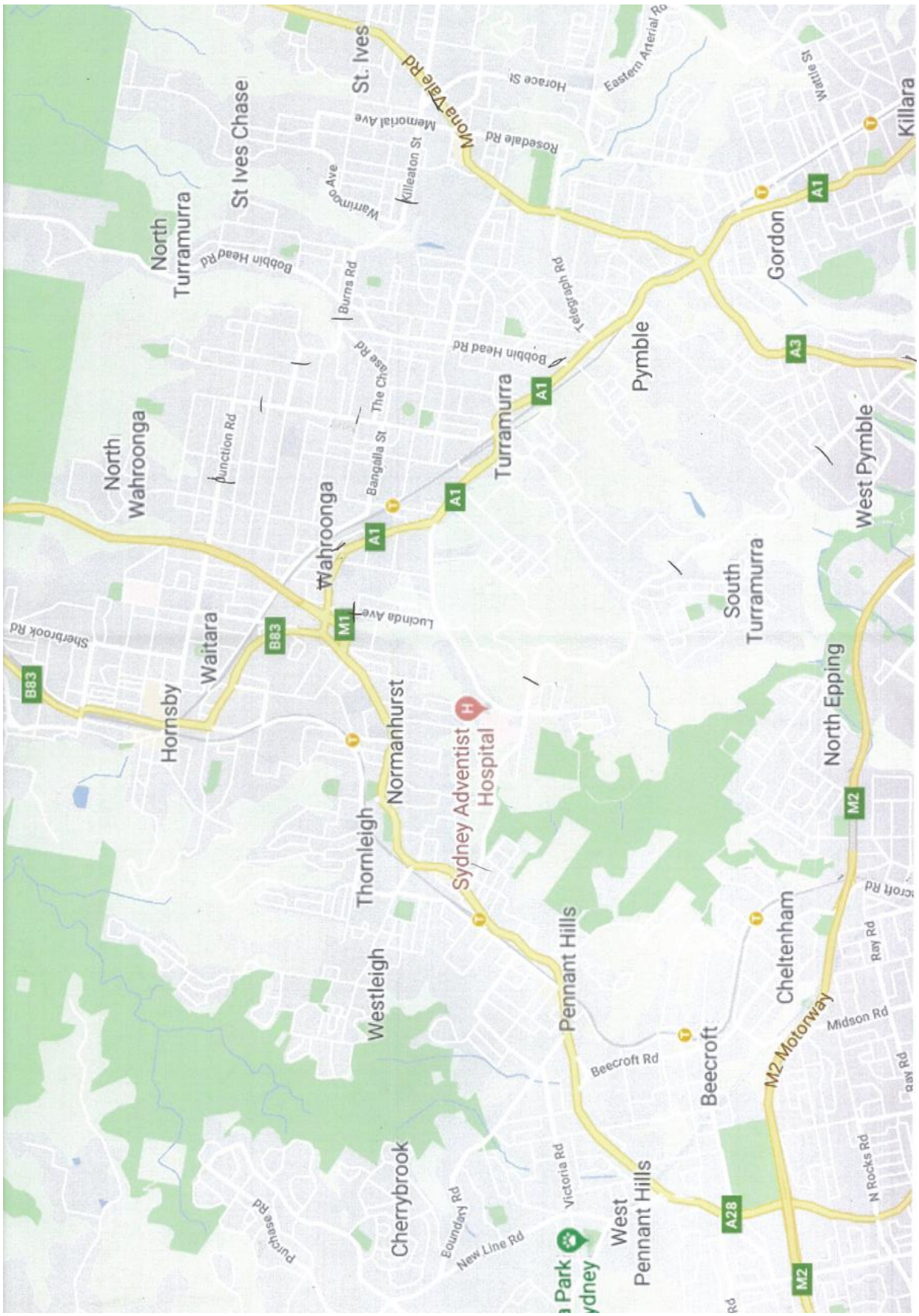
There are always heavy vehicles coming from the Silverwater industrial area using Pennant Hills Road.


South Turramurra
North Epping
Macquarie University
Marsfield
Kent Rd
North
Twin Rd
Quarry Rd
Bridge Rd
Abuklea Rd
Epping Rd
Lovell Rd
Denistone East
Top Ryde City Shopping Centre
Ryde
A40
Ryedale Rd
Balaclava Rd
Vimiera Rd
Blaxland Rd
Beecroft Rd
Epping
Eastwood
Denistone West
West Ryde
Meadowbank
Cheltenham
Ray Rd
Midson Rd
Rutledge St
Wharf Rd
Terry Rd
Mobbs Ln
Marsden Rd
Beecroft
Beecroft Rd
M2 Motorway
M2
A6
A28
Dundas Valley
Ermington
Carlingford
Carlingford Rd
N Rocks Rd
Evans Rd
Kissing Point Rd
Kirby St
Park Rd
South St
Rydalmere
West Pennant Hills
Aiken Rd
Taylor St
Barclay Rd
Oatlands
North Rocks
Northmead
The King's School
Western Sydney University Parramatta...
North Parramatta
Parramatta Park
Parramatta
Windsor Rd
Old Northern Rd
Cook St
Windsor Rd
Hills

Ku-Ring-Gai Council – Meeting Notes 30 April 2019

Attendees: Joseph Picoli, Pat Doyle, Sonja Shand, Sarah Rosewell

- Council interested in impacts and potential changes for 3 key routes:
- Eastern Arterial Road (rat run on eastern side of highway)
- Pacific Highway (sections described below)
- Lady Game Drive / The Comenarra Parkway (rat run western side of highway)
- Lane Cove Road is very constrained and may attract extra heavy vehicles.
- RMS has recently run workshops with council to develop a Road Network Plan. RMS will access this internally.
- Place vs function is the key trade off when improvements in traffic are achieved RMS wants to 'bank' improvements for traffic flow while councils want to do placemaking.
- Freight - will be interesting to see how much it changes
- Through traffic on Pacific Highway may need encouragement to use NCX/M2/LCT. Council expect increased heavy vehicles on Pacific Highway. Heavy vehicle usage already high.
- Coonanbarra Road and Redleaf Ave are the last chance to access the Pacific Highway at Wahroonga town centre. Contentious due to
- Key local streets to monitor Ada Avenue and Lucinda Avenue, Wahroonga
- Council would be interested to see impacts at Lindfield, Gordon, St Ives, Turramurra, Roseville
- Local strategy planning statement as some of these areas will change
- Pacific Highway Corridor important – key road artery but serves as local access as well and has many school zones
- Wahroonga – Turramurra
- Turramurra – Gordon
- Gordon – Lindfield
- Bobbin Head Road
- Would be good to validate predictions against EIS traffic locations
- Council offered to share traffic data. They have a scattered snapshot of traffic counts for 1 week last and next 6 months.


St. Ives
Mona Vale Rd
Horace St
Eastern Arterial Rd
Wattle St
Killara
St Ives Chase
Memorial Ave
Rosedale Rd
Killeaton St
Warrimoo Ave
North Turramurra
Bobbin Head Rd
Burns Rd
Telegraph Rd
Gordon
A1
A3
Pymble
Bobbin Head Rd
The Chase Rd
Bangalla St
Junction Rd
North Wahroonga
Turramurra
A1
West Pymble
Wahroonga
A1
Lucinda Ave
M1
B83
Sherbrook Rd
South Turramurra
Hornsby
Waitara
B83
Normanhurst
Thornleigh
Sydney Adventist Hospital
North Epping
M2
Westleigh
Pennant Hills
Cheltenham
Ray Rd
Midson Rd
Beecroft Rd
Beecroft
M2 Motorway
Cherrybrook
Victoria Rd
Boundary Rd
New Line Rd
West Pennant Hills
A28
N Rocks Rd
M2

Hills Shire Council – Meeting notes 3 May 2019

Attendees: 3 representatives of Hills Shire Council including David Reynolds, Michael Lathlean and a traffic consultant

Sonja Shand and Sarah Rosewell

Strong concern for impacts on Castle Hill Road. It has zero capacity and F level of service.

Council concerned for traffic flow on Castle Hill Rd at New Line Road.

Strong need to improve services between The Hills / Norwest areas and Parramatta. Council says as many people commute from The Hills to Parramatta as to the city. From Pennant Hills Valley there is limited access for public transport.

Interested in bus priority for Pennant Hills Road. Have been dealing with Matt Faber of TfNSW – we encouraged them to continue following this issue with TfNSW.

David Grey of TfNSW was at Parramatta Council and knows Pennant Hills Bus Priority and the situation well.

Hard to get onto Pennant Hills Road at Cox's Corner. Need to improve north – south routes for the region to enhance access for public transport so they are not so reliant on Pennant Hills Road.

NorthConnex's impact on Pennant Hills Road may reduce traffic volumes along North Rocks Road. It may reduce the need to rat run at Cook Street / Windsor Road.

Interested in Highs Road, Aiken and Oakes Road

Council would be very interested in any traffic data we capture.

Council can't get data from TfNSW, RMS, DPE for the train/metro station. There was a working group involving NSW Government and council for precinct planning around Metro which has ceased for the last 6 months. Council does not have data on the impact of Metro on Castle Hill Road. Council may have 2 development sites opposite Cherrybrook Station with plans for 20 storeys. Council believes NSW Government is planning for the development on the northern side of Cherrybrook Station.

Council marked up suggested monitoring locations:

Castle Hill Road just east of Old Northern Road

Highs Road just south of Castle Hill Road

New Line Road just north of Castle Hill Road

Pennant Hills Road south of Castle Hill Road

Castle Hill Road just west of Pennant Hills Road

Aiken Road west of Oakes Road

Aiken Road east of Hill Road

Aiken Road west of Pennant Hills Road

Highs Road north of Coonara Avenue

Copeland Road just east of Pennant Hills Road

Karloon Road just west of Pennant Hills Road

Karloon Road at Eaton Road

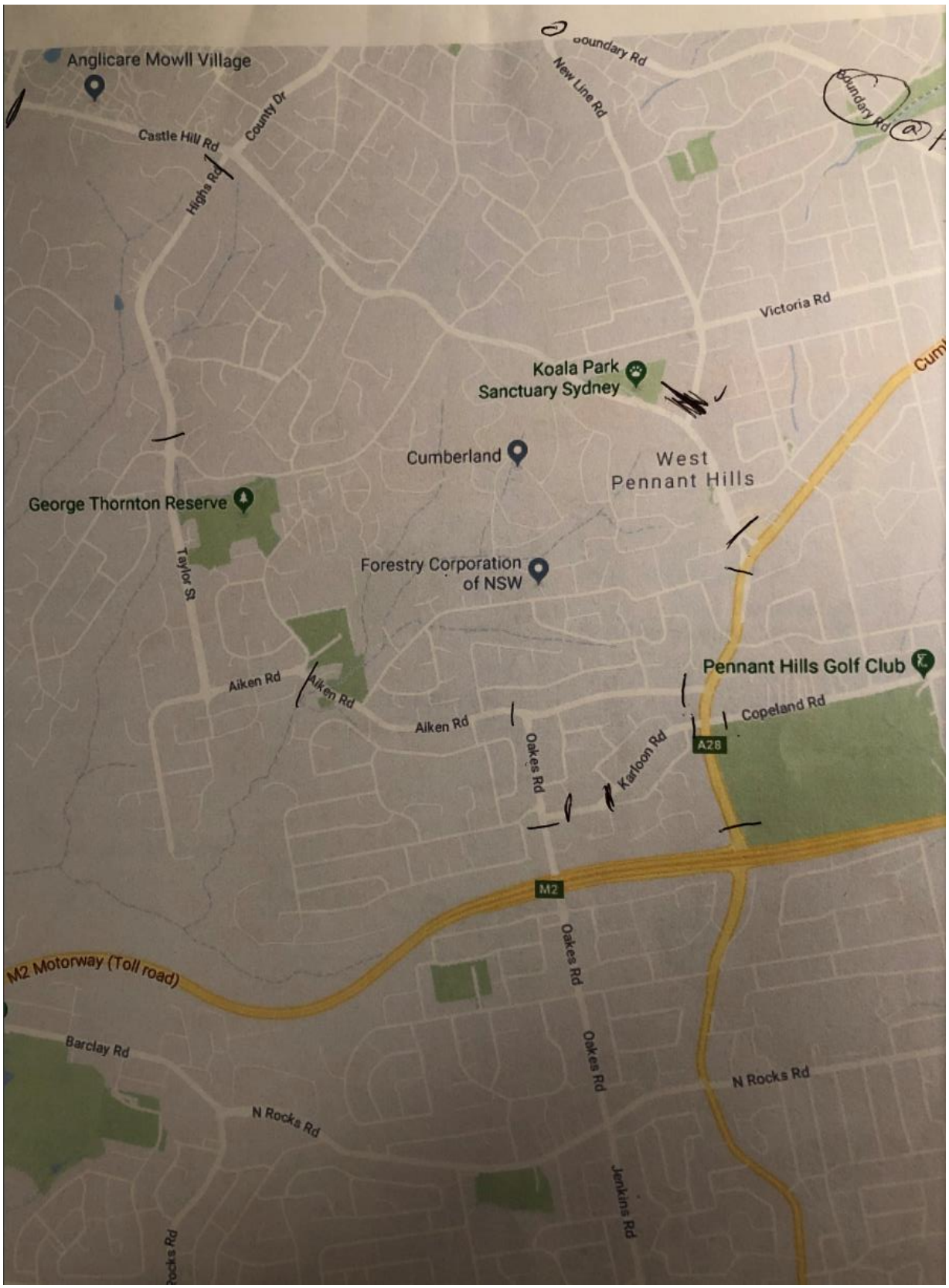
Oakes Road south of Eaton Road

Pennant Hills Road just north of M2

Boundary Road at Pennant Hills Road

Boundary Road at New Line Road

Council welcomed any further discussion.


Anglicare Mowll Village
Castle Hill Rd
County Dr
Highs Rd
New Line Rd
Boundary Rd
Victoria Rd
Koala Park Sanctuary Sydney
Cumberland
West Pennant Hills
George Thornton Reserve
Taylor St
Forestry Corporation of NSW
Aiken Rd
Pennant Hills Golf Club
Copeland Rd
A28
Oakes Rd
Karloon Rd
M2
M2 Motorway (Toll road)
Barclay Rd
N Rocks Rd
Jenkins Rd

Hornsby Shire Council – Meeting Notes 1 May 2019

Attendees: Mayor Ruddock, Brian Ash, Margaret Murray, Marcia Horvai, representative of Pennant Hills Civic Trust, Councillor, Stephen Head, Bob Stephens

Pat Doyle, Sonja Shand, Sarah Rosewell

Rat runs and access to turn onto Pennant Hills Road are of major concern to the community.

Key rat run is west of Pennant Hills Road: College Crescent/ Clarke Road/ Malmsbury Road to The Esplanade/ Yarrara Road. Discussion about how much parking occurs along the route, further adding to the congestion.

Concern for delays on The Comenarra Parkway, this encourages rat running via roads to the south via Wood Street to access Pennant Hills Road. Also concern for ability to turn right onto Pennant Hills Road from The Comenarra Parkway and right from Duffy Avenue, due to congestion which leaves minimal capacity.

Concern for safety and delays at The Esplanade/ Chilvers Road/ Duffy Ave intersection.

Interest in Boundary Road for rat running

Interest in Bellamy Street and Stevens Street to and from Yarrara Road and Boundary Road.

Interest in Pennant Hills Road and Dartford Road, Normanhurst Road, Wells Street and Duffy Avenue.

Requested that we capture traffic queues and how well an intersection operates not simply traffic numbers passing through an intersection.

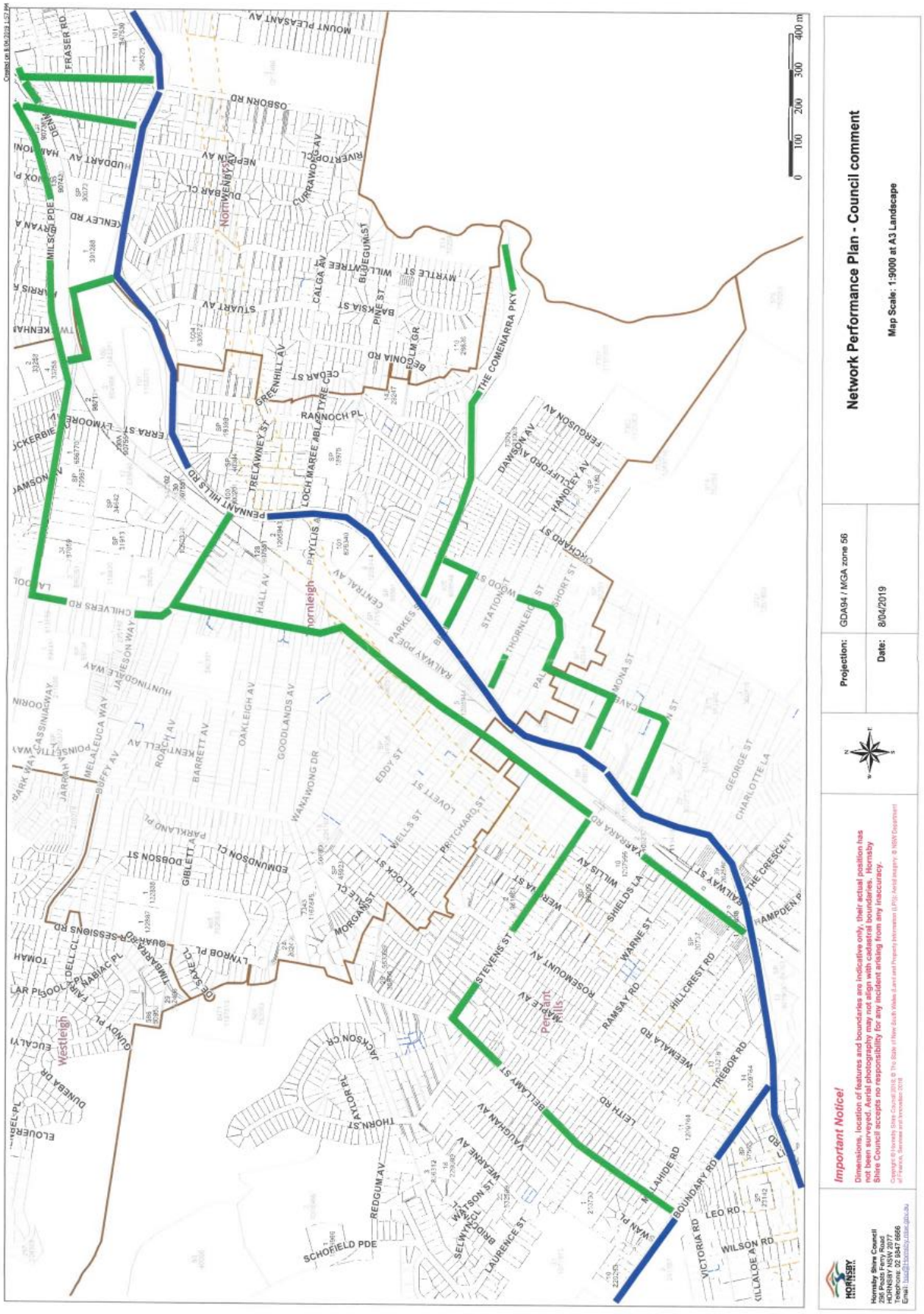
It is important to understand the functioning of these roads not just at key intersections therefore where the traffic counters are placed is important. Are we going to count in the same locations as the EIS counted? Are we going to update the EIS counts as they are now years out of date? When will the counts be undertaken? Nowhere is there an assessment of queueing on each leg of an intersection. It would be good to understand an assessment of performance and the level of service at each intersection.

Strong interest by Mayor and community members for safety improvements in Yarrara Road, particularly adjacent to Pennant Hills Station due to the potential for conflict between vehicles and pedestrians. Yarrara Road to and from Hillcrest Avenue is an issue. Council was aware and assured community they were working with RMS Sydney and this was outside scope of NorthConnex.

Council clarified that any urgent need for upgrades were not delayed by NorthConnex and were a matter for Council and RMS Sydney. Some discussion about local road issues and Stephen Head clarified that these were issues council is discussing with RMS Sydney (not RMS NorthConnex).

Discussed RMS was consulting all 4 councils re E28 and would consider monitoring of local, regional and state roads. RMS reiterated previous email correspondence to Brain Ash that RMS is currently developing the scope of the Road Network Performance Review Plan and will be undertaking traffic monitoring before and after the opening of NorthConnex. The analysis will look at traffic impacts to the adjoining road network, as a consequence of the project.

To finalise the scope of the analysis, RMS will consider a range of factors including the information and data in the NorthConnex Environmental Impact Statement, as well as areas suggested by local Council and other stakeholders. We will define this scope by the end of 2019. The Road Network Performance Review Plan will not be completed until at least 12 months after the opening of NorthConnex. In accordance with the Infrastructure Approval, this plan will be submitted to the Secretary, Transport for NSW and to relevant Councils within 60 days of its completion and made publicly available.


Network Performance Plan - Council comment
Map Scale: 1:9000 at A3 Landscape
Projection: GDA94 / MGA zone 56
Date: 8/04/2019
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0 100 200 300 400 m
Westleigh
Normanhurst
Thornleigh
Pennant Hills
MOUNT PLEASANT AV
FRASER RD
OSBORN RD
NEPEAN AV
CURRAWONG AV
RIVERTOP CCT
MYRTLE ST
WILLOUGHTREE ST
BLUEGUM ST
CALGA AV
STUART AV
PINE ST
BANKSIA ST
BEGONIA RD
EDLUM GR
CEDAR ST
GREENHILL AV
THE COMENARRA PKY
RANNOCH PL
LOCH MAREE ABLETTYRE CCT
TRELAWNEY ST
PENNANT HILLS RD
FERGUSON AV
DAWSON AV
HANDLEY AV
ORCHARD ST
STATION ST
THORNLEIGH ST
SHORT ST
MONA ST
CHILVERS RD
HALL AV
CENTRAL AV
RAILWAY PDE
PARKES ST
WANAWONG DR
EDDY ST
LOVETT ST
WELLS ST
PRITCHARD ST
TILLOCK ST
MORGAN ST
EDMUNDSON CL
GIBLETT CL
DOBSON ST
PARKLAND PL
OAKLEIGH AV
GOODLANDS AV
BARRETT AV
ROACH AV
KENTWELL AV
BUFFY AV
MELALEUCA WAY
JARRAH WAY
HUNTINGDALE WAY
JAMESON WAY
POINSETTIA WAY
PARK WAY
CASSINIA WAY
TOORIN
TOMAH
LAR PLACE
FAIRY DELL CL
NABIAC PL
GUNDY PL
EUCALYPTUS
DUNBAR DR
FLOWERPOT PL
TIMBARRA RD
SESSIONS RD
LYNROB PL
DE SAXE CL
JACKSON CR
THORN ST
TAYLOR PL
REDGUM AV
SCHOFIELD PDE
WEARNE AV
VAUGHAN AV
WATSON ST
SELWYN CL
BRIDGE ST
LAURENCE ST
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LEITH RD
LAHIDE RD
BOUNDARY RD
LEO RD
WILSON RD
VICTORIA RD
ILLALOE AV
WAN PL
STEVENS ST
ROSEMOUNT AV
MAPLE AV
WARNE ST
RAMSAY RD
HILLCREST RD
WEEMALA RD
TREBOR RD
SHIELDS LA
WILLIS AV
WERONA AV
RAILWAY ST
THE CRESCENT
HAMPDEN PL
CHARLOTTE LA
GEORGE ST
CARRARA RD

HORNSBY SHIRE COUNCIL	**Network Performance Plan - Council comment**	**Map Scale: 1:8000 at A3 Portrait**
Hornsby Shire Council 296 Pacific Highway HORNSBY NSW 2077 Telephone: 02 9847 6666 Email: hsc@hornsby.nsw.gov.au	Important Notice! Dimensions, location of features and boundaries are indicative only, their actual position has not been surveyed. Aerial photography may not align with cadastral boundaries. Hornsby Shire Council accepts no responsibility for any incident arising from any inaccuracy. Copyright © Hornsby Shire Council 2018; © The State of New South Wales (Land and Property Information (LPI)). Aerial Imagery: © NSW Department of Finance, Services and Innovation 2016	Projection: GDA94 / MGA zone 56 Date: 8/04/2019 1:10 PM