Prepared for
Gartner Rose
ABN: 31 059 738 242

AECOM

TAP Waitara Station

Traffic Transport & Access Report (including Pedestrian Modelling)

03-May-2022
Transport Access Program - Waitara Station
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Client: Gartner Rose

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Prepared by

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Revision History

Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
A	03-May-2022	System Design Review	Hugh Harrington Project Manager	

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1.0 Introduction

Transport for New South Wales (TfNSW) via the Transport Access Program (TAP) is delivering a program of accessibility upgrades to transport infrastructure at Waitara Station. This will improve access for people with disabilities, the elderly, and customers travelling with children and/or luggage with the key objective of ensuring compliance with the Disability Standards for Accessible Public Transport 2002 (DSAPT) and the Disability Discrimination Act 1992 (DDA).

AECOM has been engaged by Gartner Rose to undertake the detailed design of the upgrade of Waitara Station (the project).

AECOM were engaged to conduct pedestrian analysis, parking assessments and pedestrian crossing assessments at Waitara Station due to the changes proposed as part of the TAP upgrades.

The parking availability will be affected during construction and operational stages of the project. Due to these changes, a parking assessment was conducted to analyse the extent of these impacts and identify whether there is sufficient capacity in the adjacent network to mitigate these impacts.

A new pedestrian entry/exit to the station from/to Alexandria Parade is proposed at the northern end of the platform as part of the project. Analysis of the number of pedestrians expected to cross Alexandria Parade to/from the new entry/exit was undertaken and subsequently the type of pedestrian crossing required was determined.

1.1 Structure of this report

- **Project description**: An overview of proposed upgrades and key changes affecting parking and pedestrians, including a site plan showing the extent of the project.
- **Pedestrian modelling analysis**: An analysis of assessment of the proposed station design on future pedestrian movements in design year.
- **Pedestrian crossing assessments**: An analysis of existing conditions and pedestrian volumes, future pedestrian volumes and assessment of the type of crossing required on Alexandria Parade.
- **Parking assessments**: An analysis of existing parking occupancy, assessment of the parking spaces that will be affected during construction and operations of the project as well as recommendations for an offset parking strategy at Waitara station.

2.0 The Project

Waitara Station is a suburban station located at Alexandria Parade, Waitara. The station is situated on the T1 North Shore Line, 24.2km from Central Station. Waitara Station is situated between residential and industrial areas of Waitara and is easily accessible from both sides of the railway line. Commercial buildings are on the west side of Waitara Station, towards the east there are residential properties and small businesses.

Waitara Station is considered a community railway station in the Sydney metropolitan area which provides local residents with an entry point to the Sydney Trains network. Customers seek to access employment, shopping and education in nearby Hornsby and destinations further afield including Macquarie Park, Chatswood and the Sydney CBD.

Improvements to the station access and functionality have the potential to impact positively on the public transport experience for all customers.

The project will consist of the construction of a proposed underpass to the west of the station, presented in Figure 1. Following are the key changes proposed as part of the project:

- Upgraded station entries ensuring accessible paths of travel
- New accessible pathways on Alexandria Parade, including a new compliant pedestrian road crossing and new compliant underpass forecourt
- New ramp pathways within the station car park including a new DDA compliant parking space
- A new accessible parking space and Kiss and Ride space on Alexandria Parade
- A new Kiss and Ride space within the station carpark

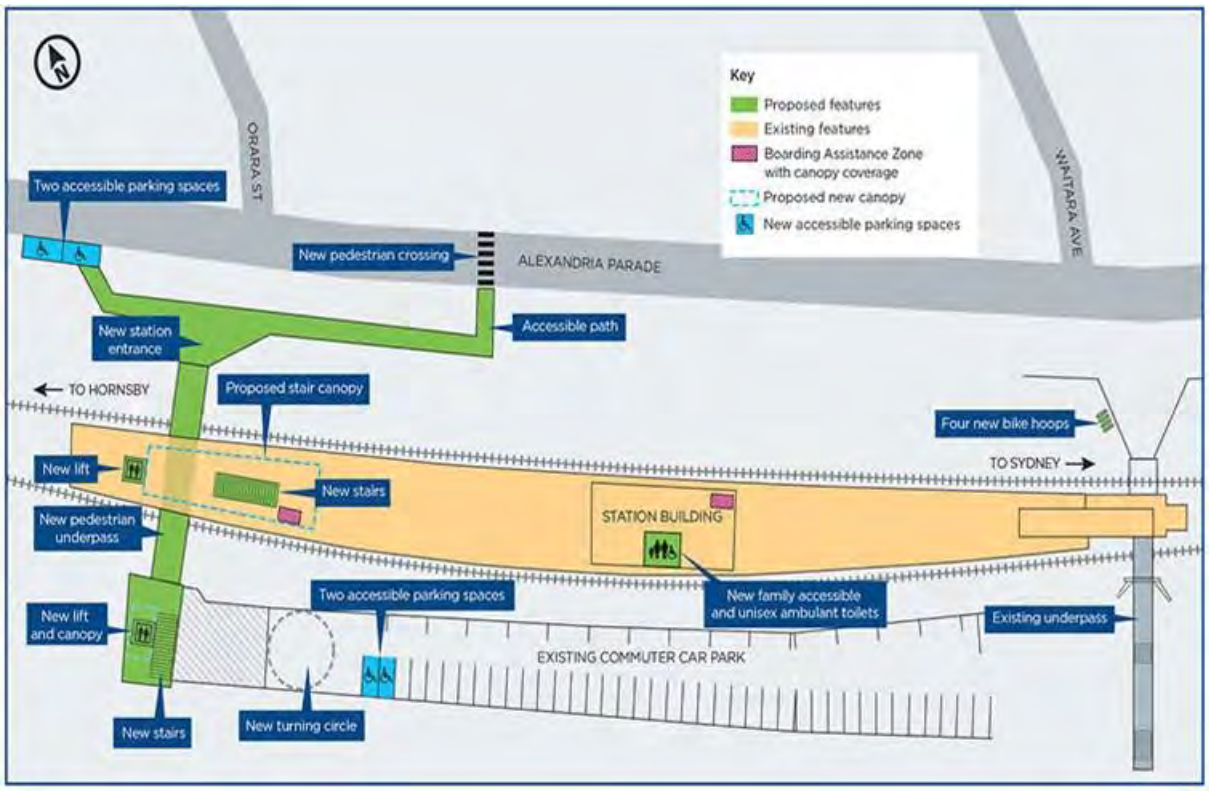

Figure 1 Proposed TAP Upgrades – Waitara Station

[Source: TfNSW, 2022]

3.0 Pedestrian Modelling Analysis

3.1 Existing Conditions

3.1.1 Station Layout

The station comprises one platform island with stair access from a pedestrian tunnel. There is ramp access from the tunnel to Alexandria Parade on the north side of the station, and stairs to Waitara Avenue on the south side of the station.

T1 services to the City run from Platforms 1 on the north side of the station while trains to Hornsby run from Platform 2 on the south side. Figure 2 illustrates the existing layout of Waitara Station.

Figure 2 Waitara Station existing layout
Source: Sixmaps, modified by AECOM, 2022

3.1.2 Pedestrian Movements

Pedestrian movement counts have been used to inform the distribution of pedestrian movements for Waitara Station. A survey was previously undertaken in November 2014 to inform analysis for the Waitara Station Precinct Accessibility Upgrade Concept Design Plan Report (Cardno, 2015). A more recent pedestrian count survey was undertaken on Tuesday 5 April 2022. This survey provides peak-hour north-south platform access and egress movement splits and updates the east-west station access and egress movement splits on the northern side of the station since several new residential towers have been developed on the north of the station since 2014. The 2022 survey did not capture the east-west pedestrian movement split on the southern side of the station, instead the 2014 survey splits will still be applied since population and employment land use on the southern side of the station has not changed significantly since 2014.

2022 survey volumes for the AM and PM peak hour are shown in Figure 3 and Figure 4 respectively. It is noted that the volumes on the south side of the station are 2022 survey volumes that have been split into eastbound and westbound movements using the proportions from the 2014 survey data.

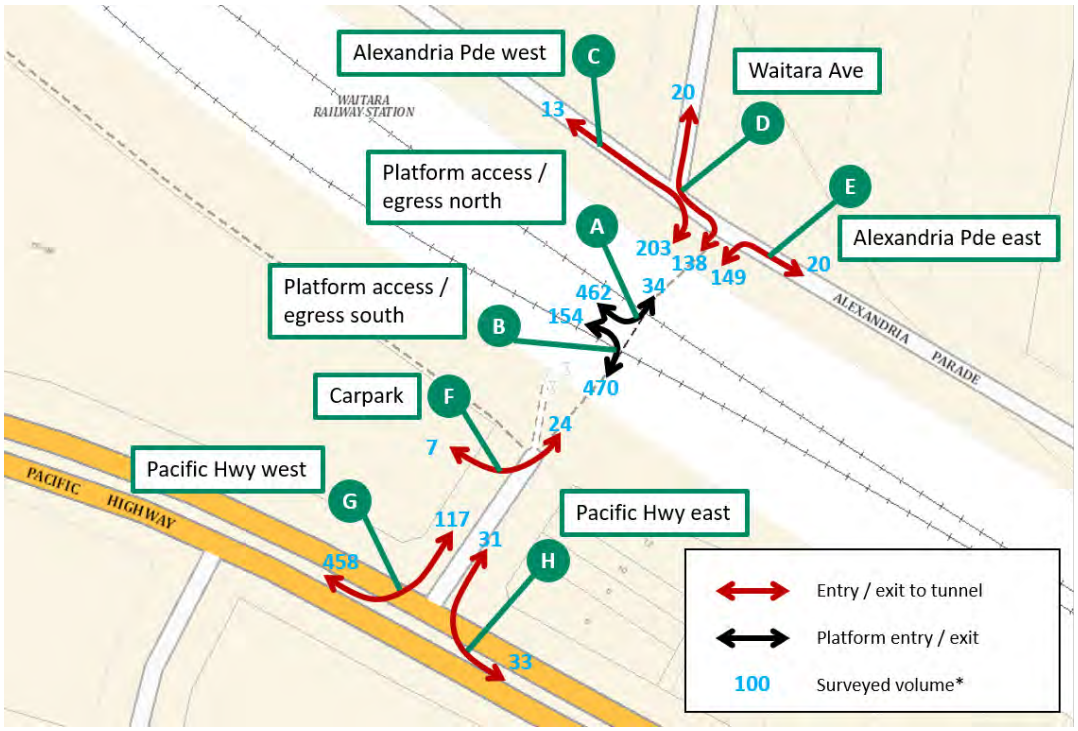

Figure 3 2022 AM peak hour pedestrian volumes

** Volumes on the north side of the station and accessing the platforms are 2022 surveyed volumes. Volumes on the south side of the station are based on 2022 survey volumes distributed based on 2014 survey data.*

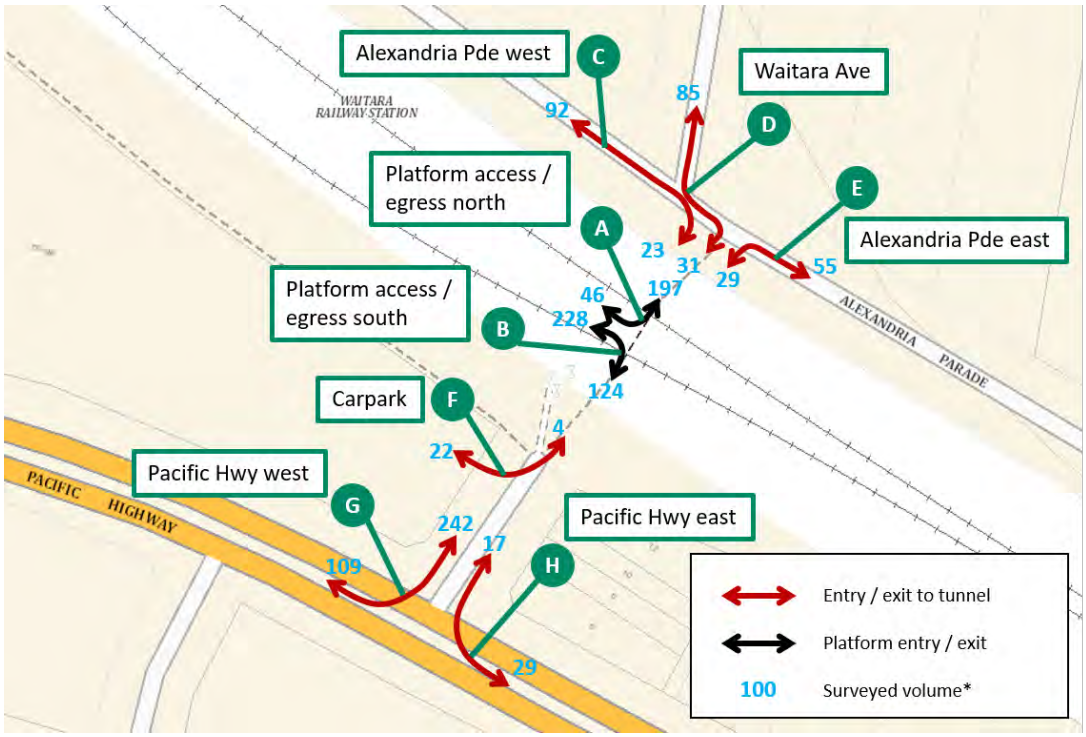

Figure 4 2022 PM peak hour pedestrian volumes

** Volumes on the north side of the station and accessing the platforms are 2022 surveyed volumes. Volumes on the south side of the station are based on 2022 survey volumes distributed based on 2014 survey data.*

3.2 Proposed station upgrades

The Waitara Station upgrade will result in the following changes:

- No change to existing pedestrian tunnel and existing stair to platform widths.
- A new pedestrian tunnel and new stairs to the platform will be provided at the western end of the platform. The width of the new tunnel and stairs is 3m. A lift will be installed to access the platform from the tunnel. The southern end of the new pedestrian tunnel will connect to / from the existing commuter car park via stairs and a lift which will be installed as part of the new pedestrian tunnel. Lifts will be installed such that there is a dedicated waiting area away from the main tunnel passageway.
- Pedestrian circulation patterns will change with the introduction of the new tunnel and platform stairs. The distribution of pedestrians between the two sets of stairs has been outlined in section 3.4.2.

3.3 Pedestrian analysis assumptions

3.3.1 Level of Service (LOS)

Fruin parameters

Pedestrian space planning is based upon passenger density and John J. Fruin's concept of Levels of Service (LOS). Fruin's levels of service are based on pedestrian flows per unit width per minute for walkways, stairways and queuing areas. These pedestrian flows (flow rates) provide an indication of the performance of the space under investigation, with results evaluated against a scale which ranges from LOS A (very good) to LOS F (very poor). The levels of service are based on a pedestrian's perceived level of comfort, satisfaction and frustration. Table 1 provides a description for each level of service.

Table 1 Fruin Levels of Service

LOS	Description
A	Free circulation
B	Uni-directional flows and free circulation. Reverse and cross-flows with only minor conflicts.
C	Slightly restricted circulation due to difficulty in passing others. Reverse and cross-flows with difficulty.
D	Restricted circulation for most pedestrians. Significant difficulty for reverse and cross-flows.
E	Restricted circulation for all pedestrians. Intermittent stoppages and serious difficulties for reverse and cross-flows.
F	Complete breakdown in traffic flow with many stoppages.

Source: SPSG, 2005

Table 2 and Table 3 include the LOS criteria that have been adopted to guide the assessment of operational performance, particularly pedestrian circulation and movement, at Waitara Station. These levels of service have also been used to critique proposed station design options for the upgrade of Waitara Station.

Table 2 Walkways

LEVEL OF SERVICE	DENSITY (ped / m^2)		SPACE (m^2 / ped)		FLOW RATE (ped / m / min)	
	Min	Max	Min	Max	Min	Max
A		0.31	3.25			23.0
B	0.31	0.43	2.32	3.25	23.0	32.8
C	0.43	0.72	1.39	2.32	32.8	49.2
D	0.72	1.08	0.93	1.39	49.2	65.6
E	1.08	2.15	0.46	0.93	65.6	82.0
F	2.15			0.46	82.0	

Source: J Fruin, Pedestrian Planning and Design

Table 3 Stairs

LEVEL OF SERVICE	DENSITY (ped / m²)		SPACE (m² / ped)		FLOW RATE (ped / m / min)	
	Min	Max	Min	Max	Min	Max
A		0.54	1.86			16.4
B	0.54	0.72	1.39	1.86	16.4	23.0
C	0.72	1.08	0.93	1.39	23.0	32.8
D	1.08	1.54	0.65	0.93	32.8	42.7
E	1.54	2.69	0.37	0.65	42.7	55.8
F	2.69			0.37	55.8	

Source: J Fruin, Pedestrian Planning and Design

Customer design requirements

It is desired that the new station infrastructure be designed to accommodate expected future demand at Fruin LOS C.

The Transport for NSW design standards do not specify a minimum platform clearance time or performance standard which designs should attempt to meet. For the purposes of this assessment, it has been assumed that 2 minutes would be an appropriate platform clearance time. This has been used to inform the minimum width of the platform staircases to ensure there is enough vertical circulation capacity.

3.3.2 Pedestrian movements

The following assumptions regarding the volumes and directions of pedestrian movements within Waitara station have been made for the purpose of this analysis:

- The AM peak 15 minute 2036 + 15% total station entry and exit forecast volumes used in the Waitara Station Precinct Accessibility Upgrade Concept Design Plan Report (Cardno, 2015), have been applied for modelling purposes
- The PM peak 15 minute 2036 + 15% total station entry and exit forecast volumes are the reverse of the AM volumes, factored down by 15%. This factor is informed by Opal data analysis which shows that PM peak hour volumes at Waitara station (2017 to 2022) are consistently about 35-40% lower than the AM peak hour volumes. A 15% reduction is a conservative estimate for PM peak hour demand since there is limited data about the pre-Covid changes to the directional split of movements in the PM peak compared to the AM peak.
- In the AM peak 15-minutes, it is assumed that exits are evenly distributed between Up and Down direction trains (towards and away from the CBD), and entries are evenly distributed to the Up direction trains only.
- In the PM peak 15-minutes, it is assumed that exits are evenly distributed to Down direction trains only (away from the CBD), and entries are evenly distributed between the Up and Down direction trains.
- Pedestrians arrive evenly across the 3-minute period prior to the scheduled arrival of a train.
- A handrail clearance has been allowed for on platform stairs. This clearance is 100mm for the new western stairs and 150mm for the existing eastern stairs.
- A clearance of 300mm for user comfort has been allowed when modelling the pedestrian tunnels

3.3.3 Train services

For the purposes of this assessment, it has been assumed that the existing AM and PM peak hour train timetable would remain unchanged in 2036. This is detailed in Table 4.

Table 4 Waitara rail timetable

Period	AM peak hour (7:15-8:15)		PM peak hour (17:00-18:00)	
Direction	To City	From City	To City	From City
Services	7:15	7:17	17:00	17:01
	7:18	7:23	17:05	17:08
	7:30	7:32	17:09	
	7:33	7:37	17:12	
	7:45	7:45	17:15	17:16
	7:48	7:50	17:20	17:23
		7:57	17:24	
	8:00	8:02	17:27	
	8:03	8:06	17:30	17:31
	8:15		17:39	17:40
			17:42	
			17:45	17:48
			17:54	17:55
			17:59	
Total	**9**	**9**	**14**	**8**

Source: Sydney Trains, 2022

3.3.4 Assessment criteria

With consideration to the customer design requirements previously discussed, it is proposed that the station staircases and tunnels are designed to meet the following criteria:

- The width of staircases will allow all alighting rail passengers to clear the platform within two minutes of arrival, at a rate of 33 pedestrians per metre per minute (Fruin LOS C for staircases).
- The width of tunnels will allow pedestrians to walk through within one minute of entry, at a rate of 49 pedestrians per metre per minute (Fruin LOS C for walkways).

3.4 Forecast conditions

3.4.1 Pedestrian volumes

As stated in Section 3.3.2, this assessment has applied 2036 + 15% AM peak period station entry and exit volumes taken from the Waitara Station Precinct Accessibility Upgrade Concept Design Plan Report (Cardno, 2015). As previously explained in Section 3.3.2, these volumes are reversed and reduced by 15% in the PM peak, with this reduction applied based on analysis of historical Opal data for Waitara station. These volumes are shown in Table 5.

Table 5 Peak period forecast 2036 + 15% patronage

Period	Entry	Exit	Total
AM peak hour	1,600	963	2,563
AM peak 15-minutes	480	323	803
PM peak hour	819	1,360	2,179
PM peak 15-minutes	275	408	683

Source: AM peak period volumes taken from the Waitara Station Precinct Accessibility Upgrade Concept Design Plan Report (Cardno, 2015).

3.4.2 Future demand split

For the purposes of pedestrian assessments, survey volumes from 2022 have been used to inform the north south split for platform access and egress, as well as the east-west split for station access and egress north of the station, while 2014 survey volumes have been used to inform the east-west split for station access and egress south of the station. Further adjustments have been made to these movements to account for a proportion of persons using the commuter car park being expected to continue using the eastern entrance, as well as assumptions for a proportion of persons who exit to the south-west in AM peak who would be headed to Yardley Avenue and be expected to continue using the east access in the future. The pedestrian movement splits derived are shown in Figure 5 and Figure 6.

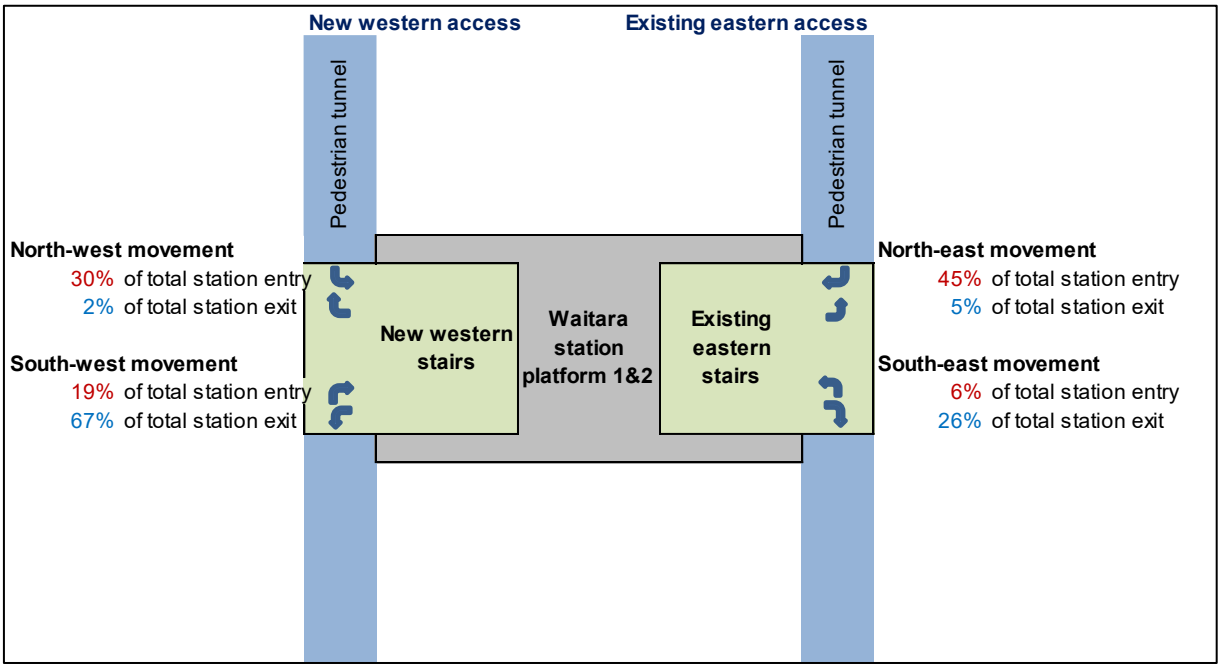

Figure 5 Future AM peak pedestrian movement splits applied

Source: AECOM based on 2022 and 2014 survey data

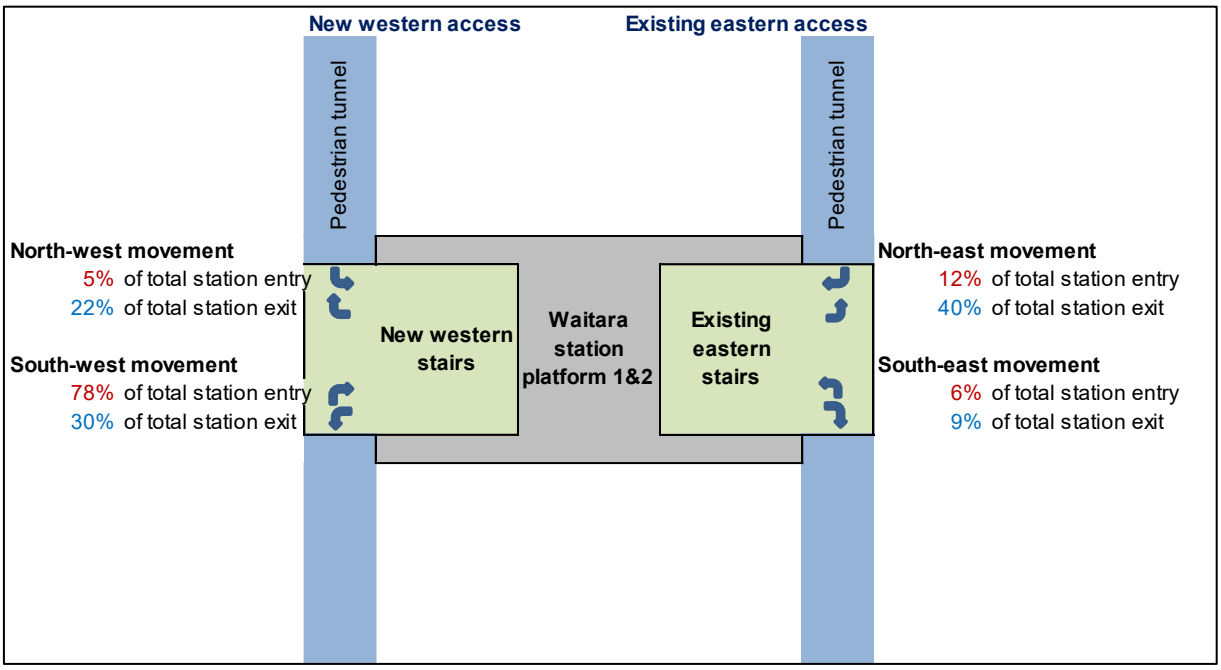

Figure 6 Future PM peak pedestrian movement splits applied

Source: AECOM based on 2022 and 2014 survey data

3.5 Station performance

A spreadsheet assessment to determine the performance of key pedestrian infrastructure at Waitara station in 2036 was undertaken for both the AM and PM peak hour.

3.5.1 AM peak period

The flow rates shown reflect the busiest 1-minute peak during the peak hour. In the AM peak hour, results show that the western stairs perform just outside of LoS C at a low LoS D during the peak 1-minute with a flow of 33.8 ppl/m/minute (LoS C for staircases has a flow rate of 23.0 - 32.8 ppl/m/min). These LoS D conditions occur only for a short period of time when two trains arrive concurrently, with a 2-minute platform clearance time. The current distribution of passengers between the east and west stairs is based on best estimates from survey data and land use analysis. A sensitivity test shows that small shift of 2% of pedestrians from the western stairs to the eastern stairs would result in a LoS of C being achieved on the western stairs.

The existing eastern stairs are also expected to operate at LoS D during the peak AM 1-minute period.

The pedestrian tunnels perform at LOS B.

The single flight of stairs from the southern end of the western tunnel towards the southern commuter carpark require a width of at least 2.3m (handrail to handrail) to perform at LOS C – it is understood that these stairs towards the commuter carpark will be widened to allow LoS C to be achieved.

AM peak period results on station platform stairs and pedestrian tunnels are shown in Figure 7.

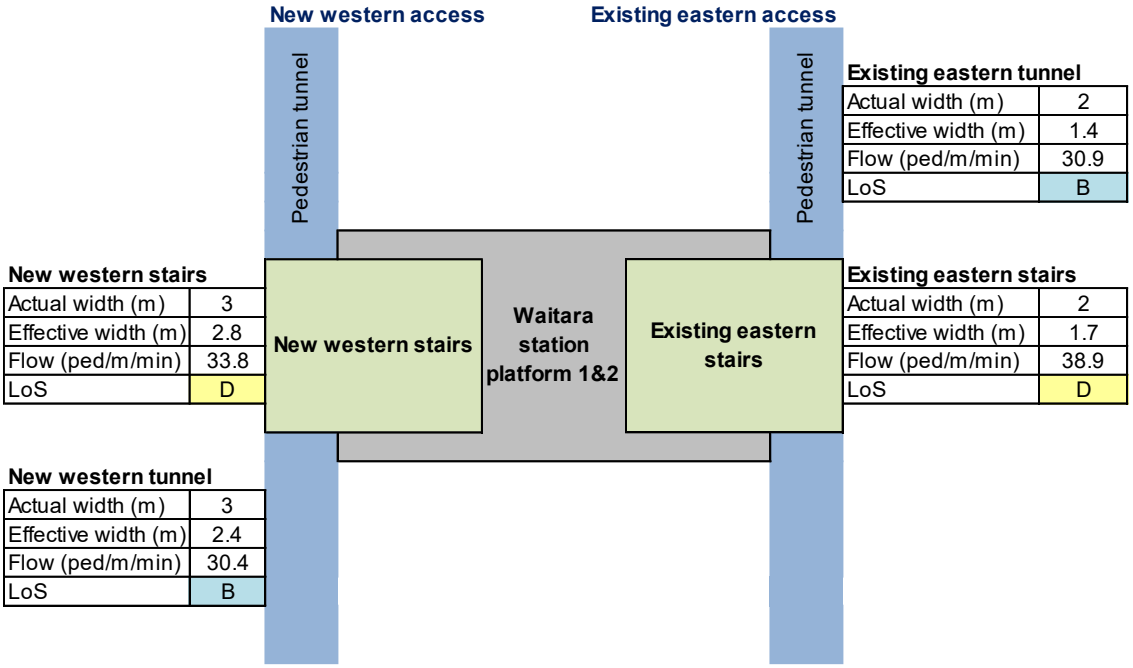

Figure 7 2036 weekday AM peak level of service (LoS)

Source: AECOM, 2022

3.5.2 PM peak period

The flow rates shown reflect the busiest 1-minute peak during the peak hour. The PM peak hour results show that both the western and eastern stairs and tunnel perform at a LoS C or better during the peak 1-minute.

PM peak period results on station platform stairs and pedestrian tunnels are shown in Figure 8.

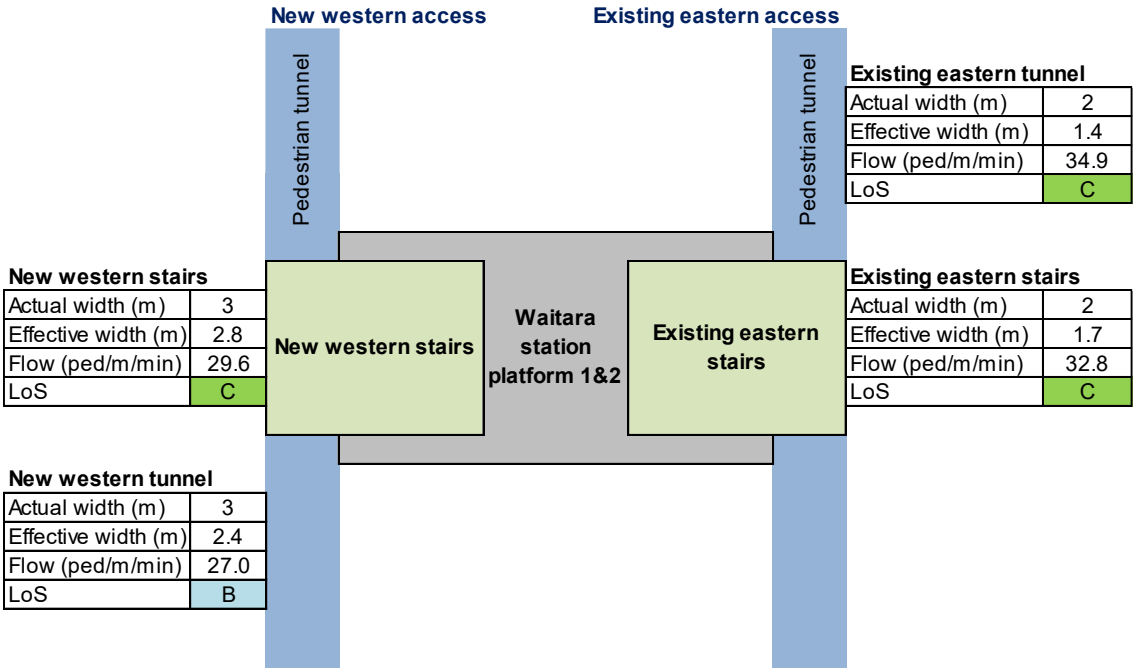

Figure 8 2036 weekday PM peak level of service (LoS)

Source: AECOM, 2022

3.5.3 Lifts

A lift is proposed to be provided between the pedestrian tunnel and platform and between the pedestrian tunnel and the commuter carpark for the new western tunnel access. The proposed location of the lifts allows for adequate queuing and waiting space. The location of the lifts allow pedestrians to queue for the lift without impacting the walkway space along the tunnel.

3.5.4 Opal readers

The peak flow for the western stairs is 33.8 ped/m/min x 2.8m = 95 ped/min. The NSW Government ESB 003 with amendments (TD 00011:2021 issued November 2021) notes that the flow rate previously used as a guide for the number of SmartCard readers required is one reader for a flow of 40 ped/min. We recommend 4 Opal Card readers be installed for pedestrians using the western stairs, three based on the expected peak flow rate for the stairs of 95 ped/min, and one for contingency in case one of the readers is not functioning.

4.0 Pedestrian crossing assessments

4.1 Existing conditions

Pedestrian surveys were conducted on the 05 April 2022 (Tuesday) from 06:30-09:00 during the AM peak period and 16:30-19:00 during the PM peak period, to primarily support the pedestrian modelling being undertaken for the project. There were three separate survey locations with multiple movements included in the survey, these locations are:

- Alexandria Parade (north of the station)
- Waitara Station (station entry/exit in the existing underpass)
- Waitara Avenue (south of the station)

The surveyed locations with the different movements are illustrated in Figure 9.

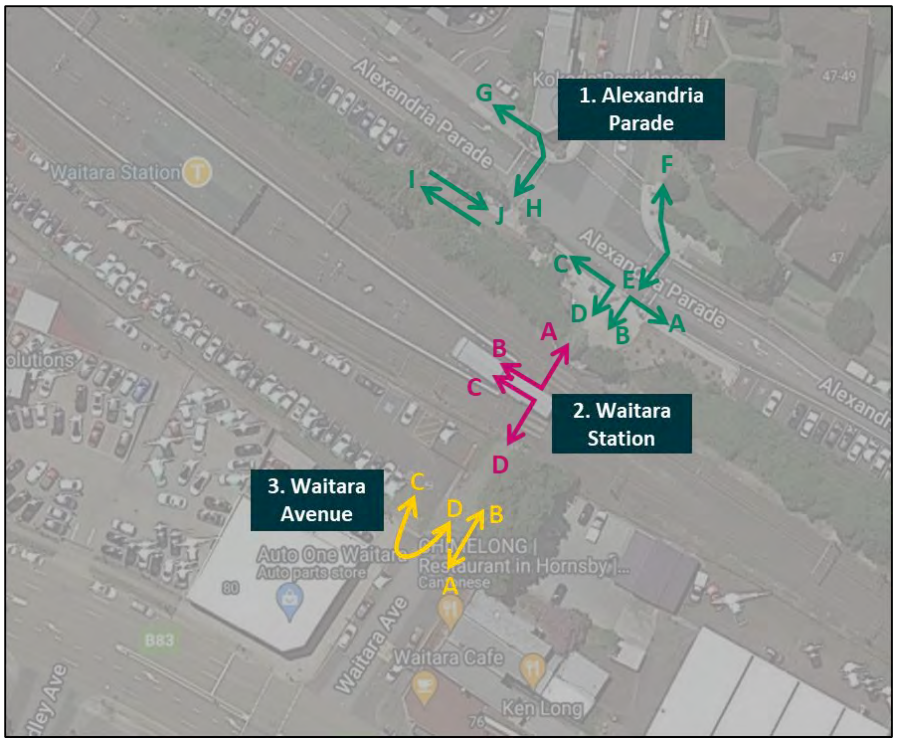

Figure 9 Surveyed pedestrian movements

[Source: Google Maps, modified by AECOM, 2022]

Section 3.1.2 presents the total pedestrian volumes at each section during the peak periods within each hour. The AM peak period had the highest number of pedestrians (3,991) compared to the PM peak period. Most pedestrians in the surveyed area have been found to access the Waitara station. Of the total pedestrians accessing the station, about 40% approach from the west during the AM peak period. The future pedestrian demands at the station are included in Section 3.4.

4.2 Pedestrian crossing distribution

Based on the pedestrian surveys undertaken, site observations and desktop assessments, the proportion of pedestrians expected to cross Alexandria Parade using the proposed pedestrian crossing next to the new entrance proposed to the north of the station is assumed to include the following:

- All pedestrians currently approaching the station from the west on Alexandria Parade along the north footpath (100% of movements G & H)
- A proportion of pedestrians currently approaching the station from the west on Alexandria Parade along the south footpath (50% of movements I & J). Site observations using the recorded video footage from the day of surveys indicate that remaining pedestrians use the on-street commuter car park spaces along the south side of Alexandria Parade.

Future pedestrian volumes for 2036 scenario were adopted from the demands used to undertake pedestrian modelling for the project (Refer Section 3.0 for further details). Based on the above assumptions and future demands, the number of pedestrians expected to use the proposed northern entrance and cross Alexandria Parade were estimated. The estimated number of pedestrians likely to use the new crossing are presented in Table 6.

Table 6 Estimated number of pedestrians crossing Alexandria Parade at the new entrance

Hour	Year 2022	Year 2036
7am to 8am	138	294
8am to 9am	121	247
5pm to 6pm	97	188
6pm to 7pm	112	187

4.3 Vehicle movements

Vehicle movements along Alexandria Parade were surveyed over a ‘typical week’ from 02 April 2022 to 08 April 2022. Figure 10 presents the average weekday vehicle movements along Alexandria Parade during a typical week and Figure 11 presents the vehicle movements along Alexandria Parade on the same day as the pedestrian surveys (05 April 2022).

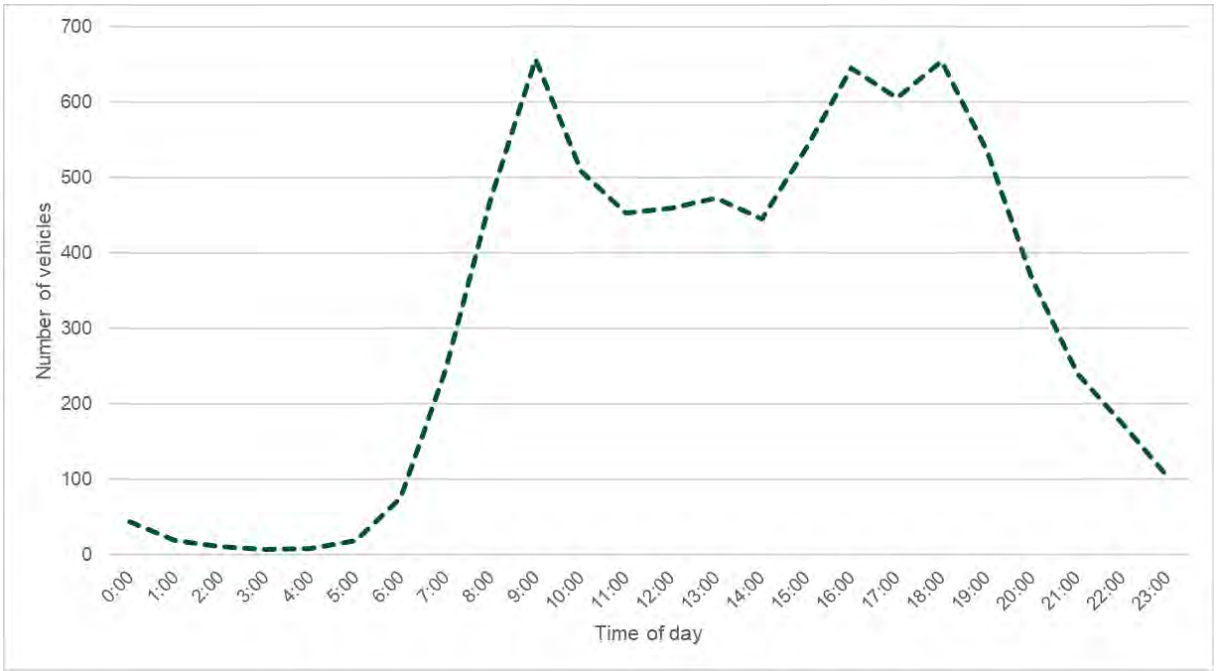

Figure 10 Average weekday vehicle movements along Alexandria Parade during a typical week

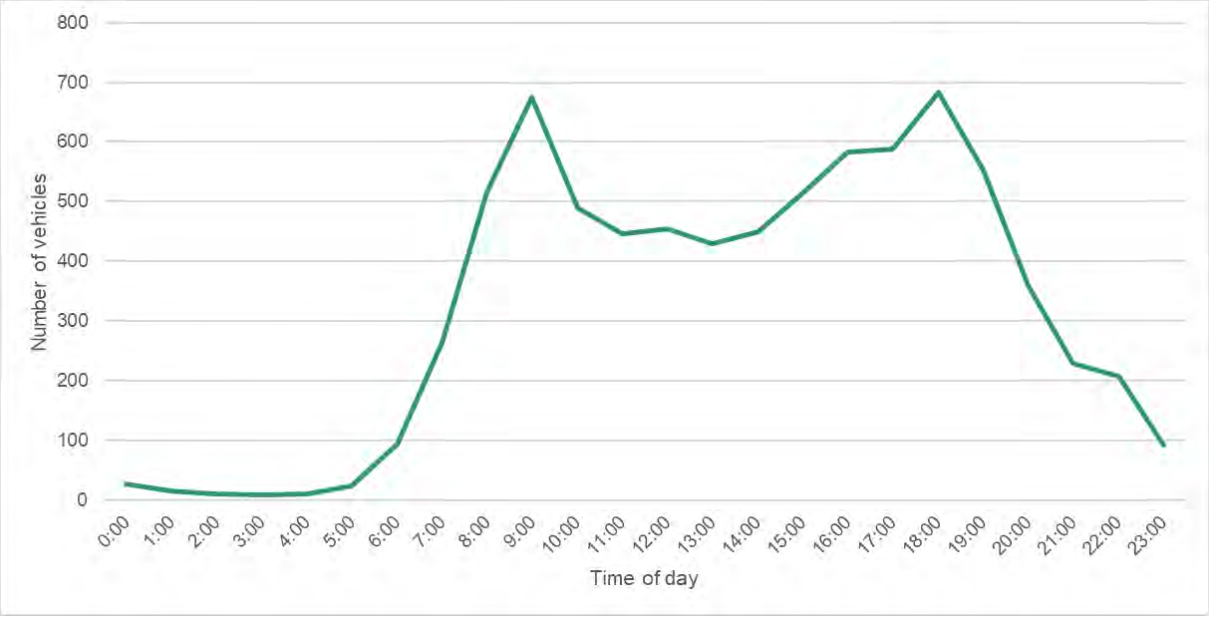

Figure 11 Vehicle movements along Alexandria Parade on the same day as the pedestrian surveys

During a typical week, an average of about 650 vehicles travel along Alexandria Parade (both directions) during both AM and PM peak hours. The average hourly vehicle movements along Alexandria Parade during four separate hours for a typical weekday in 2022 are presented in Table 7.

In order to estimate the future vehicle volumes along Alexandria Parade, a review of TfNSW permanent traffic counter located at Edgeworth David Avenue (Station Id: 74077), about 1.5km from Waitara Station, was undertaken. The review indicated that datasets were available from 2007 till 2016 and the average rate of increase of vehicular traffic near Waitara Station is about 0.2% per year. Considering that Waitara is an established suburb, the average rate of increase per year is likely to remain similar or lower along Alexandria Parade. Based on this, an average rate of increase of 0.2% per year for vehicular traffic is considered reasonable for Alexandrian Parade.

A review of TfNSW permanent traffic counter along Pacific Highway (Station Id:53003), located about 2km from Waitara, was also undertaken to compare the peak hour traffic volumes observed in 2022 against pre-Covid-19 traffic volumes in 2019. It was observed that the average traffic volumes during the peak hours in 2022 are about 9% lower during the AM peak and about 14% lower in the PM peak than pre-Covid scenario (2019).

Based on the above, the 2022 traffic volumes were increased by 9% for the AM peak and 14% for the PM peak to account for lower traffic volumes observed due to Covid-19 impacts, prior to applying the average rate of increase of 0.2% per year to determine the future traffic demand in 2036. It is also noted that the provision of Kiss and Ride facilities along Alexandria Parade as part of the project are also likely to increase the traffic volumes next to the new north entrance in line with a 12% station access mode share for Kiss and Ride predicted for 2036 (Refer Figure 14).

The future year 2036 vehicle volumes for the AM and PM peak periods estimated by applying this growth rate to the 2022 surveyed volumes are presented in Table 7.

Table 7 Vehicles travelling along Alexandria Parade (both directions)

Hour	Year 2022	Year 2036
7am to 8am	245	276
8am to 9am	474	534
5pm to 6pm	607	715
6pm to 7pm	623	772

4.4 Pedestrian crossing warrants assessment

In order to determine the type of crossing facility to be provided at the north end of the station, next to the proposed new entrance along Alexandria Parade, warrants assessments were undertaken. The warrants assessments were completed using future demands for 2036 (both pedestrians and vehicles).

4.4.1 Zebra crossing

According to the NSW Government Supplement to Australian Standards, manual of Uniform Traffic Control Devices, a pedestrian (Zebra) crossing is warranted where the following requirements are met for three separate one-hour periods in a typical day:

1. the pedestrian flow per hour (P) crossing the road is greater than or equal to 30 and,
2. the vehicular flow per hour (V) through the site is greater than or equal to 500 and,
3. the product PV is greater than or equal to 60,000.

Table 8 presents the warrants assessment for a zebra crossing at this location.

Table 8 Zebra crossing - warrants assessment

Peak hour	Pedestrian flow (P)	Vehicular flow (V)	Product (PV)	Warrants achieved?
Hour 1 - 7am to 8am	294	276	81,020	✗
Hour 2 - 8am to 9am	247	534	131,744	✓
Hour 3 - 5pm to 6pm	188	715	134,344	✓
Hour 4 - 6pm to 7pm	187	772	144,210	✓

Based on the above warrants assessments, a zebra crossing is required next to the new station entrance along Alexandria Parade.

4.4.2 Signalised pedestrian crossing

According to the TfNSW Traffic signal design 2008 warrants, a signalised pedestrian crossing is warranted when the following requirements are met for four separate one-hour periods of an average day:

1. the pedestrian flow per hour (P) crossing the road is greater than or equal to 250 and,
2. the vehicular flow per hour (V) through the site is greater than or equal to 600 in each direction or where there is a central median of at least 1.2m wide, 1000 vehicles/hour in each direction.

Table 9 presents the warrants assessment for a signalised pedestrian crossing.

Table 9 Signalised pedestrian crossing – warrants assessment

Peak hour	Pedestrian flow (P)	Vehicular flow (V)	Warrants achieved?
Hour 1 - 7am to 8am	294	276	✗
Hour 2 - 8am to 9am	247	534	✗
Hour 3 - 5pm to 6pm	188	715	✗
Hour 4 - 6pm to 7pm	187	772	✗

The predicted combination of pedestrian volumes and traffic volumes do not warrant a signalised pedestrian crossing until the year 2036.

Therefore, a zebra crossing is required across Alexandria Parade, next to proposed new station entrance. The proposed crossing should be no less than 3.6m wide and must be indicated by pedestrian cross walk lines. Zig-zag advance pavement markings shall also be provided on the approach to the pedestrian crossing.

Figure 12 indicates the suggested location for the pedestrian (zebra) crossing. Design development of the zebra crossing at this location should consider pedestrian safety by setting back the crossing by about 10m from the intersection with Orara Street.

Figure 12 Location for the proposed pedestrian (Zebra) crossing

[Source: Google Maps, modified by AECOM, 2022]

5.0 Parking Assessments

5.1 Existing conditions

A parking survey was conducted on Tuesday, 05 April 2022 during the AM peak period. The survey was conducted to better understand the occupancy of the car parking spaces around the station. The parking surveys focussed on parking within a 500m walking catchment of the station, which is assumed as a reasonable distance for Park and Ride customers to access the station. Figure 13 illustrates the parking survey locations.

Figure 13 Parking survey locations

[Source: Google Maps, modified by AECOM, 2022]

Key observations from the parking surveys are the following:

- Commuter car park at Waitara Avenue nears its capacity by 8am and is fully occupied by 9am.
- The unrestricted on-street parking spaces along Alexandria Parade, Orara Street, Waitara Avenue, Leonard Street, Unwin Road and Yardley Avenue also follow a similar pattern with majority of the spaces occupied by 9am.
- There are surplus unrestricted parking spaces (about 50 spaces) available at 10am within reasonable walking distance from the station along Park Avenue, Balmoral Street and Orara Street.

Table 10 presents the parking supply, observed maximum occupancy and availability of surplus parking spaces at the surveyed locations around the station.

Table 10 Summary of parking occupancy surveys

Location	Type	Parking supply / restriction						Total supply	Parking occupancy at 10am (%)	Number of available spaces	
		4P	3P	2P	1P	UR	D			UR	R
Alexandria Parade	On-street			17		296	2	315	97%	9	-
Waitara Avenue commuter carpark	Off-street					86	2	88	100%	-	-
Pattison Avenue	On-street	38		15				53	100%	-	-
Romsey Street	On-street					48		48	100%	-	-
Leonard Street	On-street					25		25	96%	1	-
Thomas Street	On-street					48		48	100%	-	-
Orara Street	On-street	23		55		44		122	91%	7	4
Waitara Avenue	On-street		62		6	48		116	68%	-	37
Park Avenue	On-street					159		159	81%	31	-
Balmoral Street	On-street					46		46	91%	4	-
Yardley Avenue	On-street					62		62	100%	-	-
Unwin Road	On-street					56		56	96%	2	-
Total		61	62	87	6	918	4	1,138		54	41

Note: UR – Unrestricted, R-Restricted, D-Disabled

The parking surveys indicate that there are up to 54 unrestricted spaces and 41 restricted spaces available around Waitara Station, within a reasonable walking distance from the station, during the AM peak period.

5.1.1 Access modes to the station

The different modes of access to Waitara station along with the proportion of customers arriving by each mode anticipated in a 3.5 hour AM peak in 2036 are presented in Figure 14. The largest access mode to the station is walking (over 60%), with the other modes sharing a similar proportion of users between them. The mode share proportions are also aligned with the Sustainable Hornsby 2040 draft plan prepared by Hornsby Shire Council, which commits to encourage active travel modes such as walking.

Any potential impacts to parking availability around the station as a result of the project (during operations) is likely to impact customers accessing the station using Park and Ride as the primary access mode to the station, which is only about 10% of the total customers accessing the station in the AM peak period.

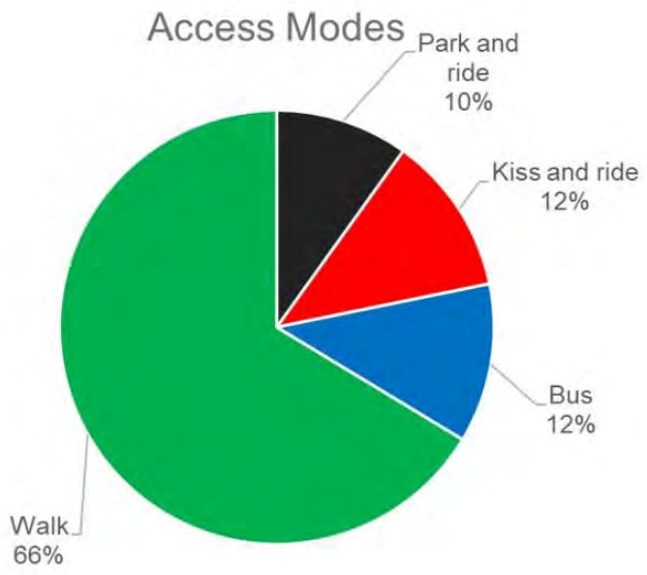

Figure 14 Waitara Station access modes

[Source: Waitara Scoping Design Study, Stantec, 2019]

5.1.2 Covid-19 impacts on parking

A review of traffic demand on the road network around Waitara Station indicated that the average traffic volumes in 2022 during the AM peak period is lower than traffic volumes observed in 2019 (pre-Covid). In the absence of any parking data available pre-Covid and existing mode share of Park and Ride customers, the scaling factor applied to increase the traffic volumes in Section 4.3 cannot directly be applied to the parking demand. In addition to this, a review of journey to work from usual place of residence data from the 2016 Census published by Australian Bureau of Statistics (ABS) for the Waitara - Wahroonga (West) SA2 indicates that about 45% of the residents drive to work. Due to Covid-19 and flexible ways of working implemented at most of the workplaces, it is likely that some of the cars observed parked on the local residential streets during the AM peak period belong to the residents and not commuters. As such, these car parking spaces are likely to be available post-Covid-19 when more people start to return to work. Therefore, it is assumed that increase in number of people accessing the station post-covid is likely balance out with the additional number of residents driving to work. Based on this, it is concluded that there is no need to factor the parking demands observed from the surveys to account for Covid-19.

5.2 Car parking impacts assessment

5.2.1 During construction

On-street car parking along Pattison Avenue (19 spaces) at the corner of Romsey Street will be used by construction workers and the off-street car park (19 spaces) accessed from Romsey Street will function as the construction compound. The on-street spaces along Pattison Avenue are 4P restricted spaces that operate at 100% occupancy during the AM peak period. These parking spaces will be temporarily

lost during construction. Construction workers will be prohibited from parking in any other areas around the station to minimise impacts to parking availability to the customers during construction. The proposed construction worker parking strategy is presented in Figure 15.

Figure 15 Construction parking impacts adjacent to Waitara station

[Source: Gartner Rose, methodology, and construction staging, 2021]

During the construction stage, parking spaces will also be lost in the commuter car park south of the station as well as Alexandria Parade west of the station, where the proposed new station entrance will be located. Figure 16 presents the impacts to car parking spaces within the commuter car park and along Alexandria Parade during construction. It indicates that about 4-6 car park spaces will be impacted by the site setup and about 8 car park spaces will be impacted by the new (temporary) turning circle that will be created within the commuter car park. Also, to complete the works on the eastern forecourt, it is envisaged that the 16-18 car park spaces on Alexandria Parade will have to be closed temporarily to safely delineate the work area. Another 6-10 car park spaces may be required to allow for sufficient space to prefabricate the proposed canopy roof section. Therefore, it is anticipated that about 40 car park spaces will be temporarily impacted during the construction stage.

Figure 16 Parking impacts on Alexandria Parade and Waitara Avenue commuter carpark

[Source: Gartner Rose, Methodology, and construction staging, 2021]

5.2.2 During operations

Majority of the car park spaces lost during the construction stage will transition back into parking for customers once the upgrades are complete. However, as part of the project, about 25 parking spaces will be permanently removed to form the proposed turning circle within the commuter car park, the south entrance to the station within the commuter car park and the north entrance to the station on Alexandria Parade as indicated in Figure 17.

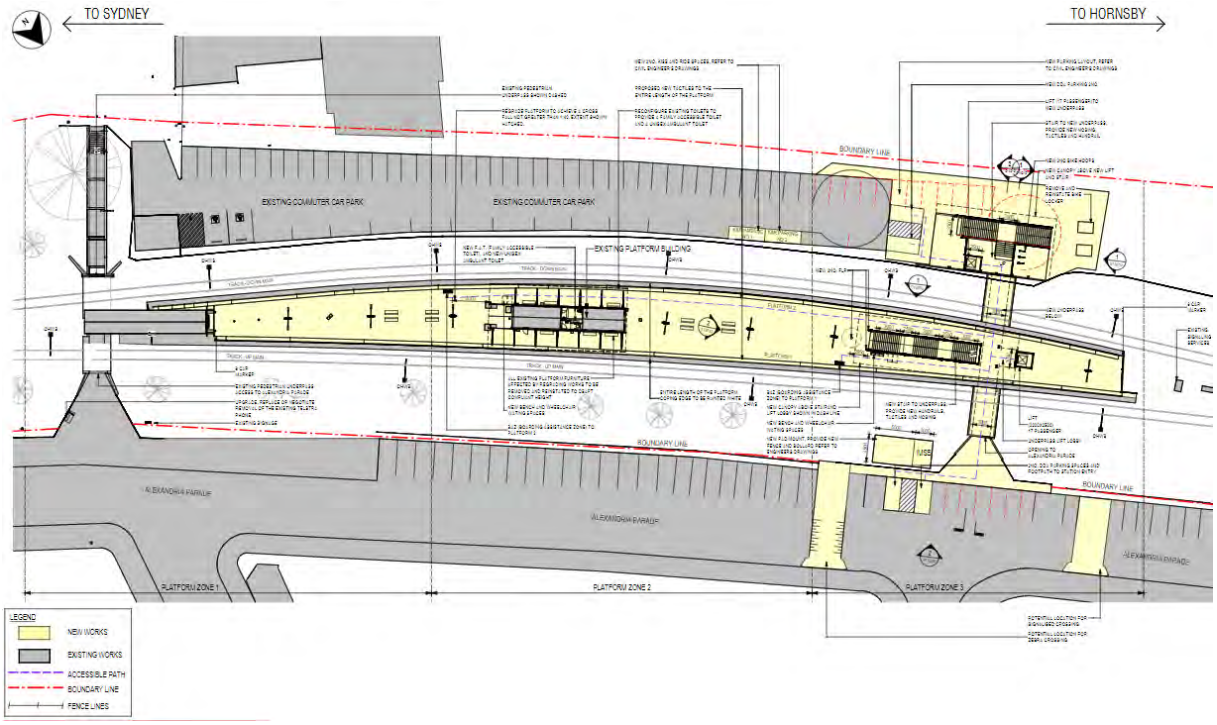

Figure 17 Operational parking impacts due to proposed upgrades

[Source: Scoping Design, AECOM 2022]

5.3 Offset parking strategy

The parking occupancy surveys indicate that there are surplus car park spaces (up to 54 unrestricted spaces and 41 restricted spaces) available within a reasonable walking distance from the station. The loss of car parking spaces as a result of the project (during both construction and operations) is therefore not likely to impact customers accessing the station using Park and Ride as the primary access mode. The following strategies are proposed to offset the parking impacts:

- Utilise surplus parking spaces on neighbouring residential streets

  Parking occupancy surveys indicate that unrestricted spaces on Alexandria Parade, Park Avenue, Balmoral Street have up to 45 unrestricted parking spaces available. These spaces can be utilised during both the construction and operational scenarios to offset potential parking impacts from the project.

- Run “Kiss and Ride” campaigns

  The project proposes to include kiss and ride spaces on both the northern and southern side of the station. Once the upgrades are fully operational, “Kiss and Ride” campaigns should be run to encourage the use of these facilities, thereby reducing the need for car parking around the station.

- Encourage active modes by providing improved infrastructure

Walking is anticipated to remain the highest access mode to the station by 2036. The proposed underpass will shorten walking and cycling travel times from the west and north and facilitate a more accessible station entrance. This will encourage more customers to take up active travel modes to access the station. In addition to this, new bicycle loops will also be installed at the station which will enable cyclists to store their bicycles at the station. These changes will encourage walking and cycling, thereby further reducing the dependency on car parking. Hornsby Shire Council's Sustainable Hornsby 2040 also encourages the use of active travel modes. Such policy changes coupled with the provision of adequate infrastructure is likely to increase the proportion of customers using active modes to access the station, thereby reducing the overall demand for car parking around the station.

- Increase parking capacity in the long-term

  In the long term, if the parking demand increases as a result of changes in land use, feasibility of providing multi-deck commuter car parking near the station may need to be considered.