33 Traffic, transport and access

33.1 Introduction

An assessment of potential traffic and transport impacts of the indicative long term development of the proposed airport has been undertaken.

This chapter builds upon the consideration of potential traffic and transport impacts associated with the proposed Stage 1 development presented in Chapter 15 (Volume 2a). It is based upon a comprehensive Surface Transport and Access Study provided in Appendix J (Volume 4).

33.2 Methodology

The methodology used for assessing the long term development was consistent with that used for the proposed Stage 1 development (see Chapter 15 (Volume 2a) for more details). Two modelling 'scenarios' were developed for the purpose of this assessment.

- 'Without airport' which represents the likely transport network improvement and likely population and employment size and distribution without consideration of the expected additional demand generated by the proposed airport; and
- 'With airport' includes consideration of the expected additional demand generated by the proposed airport.

The NSW Bureau of Transport Statistics Strategic Travel Model (Version 3) (STM3) was used and the assessment was undertaken in four main stages:

1. trip generation, or travel frequency (how many trips would occur to and from a nominated travel zone with regard to the demographics and land uses of that zone);
2. trip distribution (where these trips are likely to go);
3. travel mode choice (car, bus, rail or a combination); and
4. assignment (route chosen for each trip, for each mode, between each origin-destination pair). This stage provides the detail for the number of vehicles on each road and people on each public transport service.

The assumed road network for the 2063 assessment year is generally consistent with the model used to assess the Stage 1 development, with the addition of the proposed Castlereagh Highway and the proposed Outer Sydney Orbital. The Outer Sydney Orbital has been included in the network for assessment purposes. However, this road is still subject to investigation by the NSW Government and no construction timeframe has been announced.

With the exception of a rail connection to the proposed airport (through a possible extension of the South West Rail Link to the airport site and on to St Marys), the assumed public transport network is also similar to that modelled as part of the Stage 1 assessment.

It should be noted that the NSW and Australian governments have not commenced planning any road or transport upgrades beyond 2041. As information about the transport network beyond 2041 is not available, the 2063 airport demand forecasts have been assigned to a 2051 transport network provided with the STM model.

33.2.1 Assessment criteria

Assessment of the potential traffic, transport and access impacts has been undertaken with reference to the *Guide to Traffic Generating Developments* (RTA 2002). This guideline suggests a process and methodology to undertake the assessment which is familiar to NSW stakeholders and the community. The operational traffic assessment process outlined in the guidelines stipulates that the operating characteristics need to be compared with agreed performance criteria as described below.

33.2.1.1 Midblock capacity

The capacity of urban roads is generally determined by the capacity of the intersections or the 'midblock' capacity (the sections of roads between intersections). The mid-block capacities for roads can be estimated and compared to the existing traffic volumes in terms of volume to capacity ratios (VCR).

The VCR is a measure of the amount of traffic carried by a section of road compared to its nominal capacity. As the VCR nears one, the speed on the link decreases and both the likelihood and the duration of flow breakdowns increase.

The Austroads *Guide to Traffic Management*[3] outlines Level of Service (LoS) criteria for mid-block sections of road based on the VCR. A summary of the LoS criteria is presented in Table 33–1.

Table 33–1 Level of Service descriptions for roads

Level of Service (LoS)	Uninterrupted flow facilities (Motorways)	Uninterrupted flow facilities (Arterial and collector roads)	Volume/capacity ratio
A	Free flow conditions in which individual drivers are unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to manoeuvre within the traffic stream is extremely high, and the general level of comfort and convenience provided is excellent.	Primarily free flow operations at average travel speeds, usually about 90% of the free flow speed (FFS) for the given street class. Vehicles are completely unimpeded in their ability to manoeuvre within the traffic stream. Control delay at signalised intersections is minimal.	0.00 to 0.34
B	Zone of stable flow and drivers still have reasonable freedom to select their desired speed and to manoeuvre within the traffic stream, although the general level of comfort and convenience is less than with LoS A.	Reasonably unimpeded operations at average travel speeds, usually about 70% of the FFS for the street class. The ability to manoeuvre within the traffic stream is only slightly restricted and control delays at signalised intersections are not significant.	0.35 to 0.50
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.	Stable operations; however ability to manoeuvre and change lanes in mid-block locations may be more restricted than at LoS B, and longer queues, adverse signal coordination or both may contribute to lower average travel speeds of about 50% of the FFS for the street class.	0.51 to 0.74

[3] *Part 3: Traffic Studies and Analysis (2009)*

Level of Service (LoS)	Uninterrupted flow facilities (Motorways)	Uninterrupted flow facilities (Arterial and collector roads)	Volume/capacity ratio
D	Close to the limit of stable flow and is 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.	A range in which small increases in flow may cause substantial increases in delay and decreases in travel speed. LoS D may be due to adverse signal progression, inappropriate signal timing, high volumes or a combination of these factors. Average travel speeds are about 40% of FFS.	0.75 to 0.89
E	Occurs when 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.	Characterised by significant delays and average travel speeds of 33% of the FFS or less. Such operations are caused by a combination of adverse progression, high signal density, high volumes, extensive delays at critical intersections and inappropriate signal timing.	0.90 to 0.99
F	In the zone of forced flow. With LoS F, the amount of traffic approaching the point under consideration exceeds that which can pass it. Flow breakdown occurs and queuing and delays result.	Characterised by urban street flow at extremely low speeds, typically 25% to 33% of the FFS. Intersection congestion is likely at critical signalised locations, with high delays, high volumes and extensive queuing.	1.0 or greater

Source: Adapted from Austroads Guide to Traffic Management – Part 3: Traffic Studies and Analysis.

33.3 Assessment of impacts during operation

To assess the potential transport network impacts of the indicative long term airport development, consideration was given to the travel demand that would be created by passengers, airport employees and freight. The expected trip generation for each of these is considered in Sections 33.3.1, 33.3.2 and 33.3.3 respectively. The consequential transport network impacts are discussed in Section 33.3.6.

The assessment has not considered traffic associated with future commercial development. While the proposed airport includes authorisation for future non-aeronautical commercial development, the details of such development would be developed by the Airport Lessee Company and would be subject to separate authorisation under the *Airports Act 1996*.

33.3.1 Passenger trips

In 2063, it is estimated that the proposed airport would be operating to support an anticipated demand of 82 million annual passengers. As explained in Chapter 15 (Volume 2a), to understand the transport impact these passenger movements may have, they need to first be translated into trips and then assigned to the surrounding road network using STM3. The process of determining passenger trips from flight movements, passenger movements and an assignment to different transport modes is summarised below.

33.3.1.1 Flight movements

A passenger flight profile for the indicative long term development was developed based on the number of daily and peak hour passenger flights. The profile for 2063 is shown in Figure 33–1.

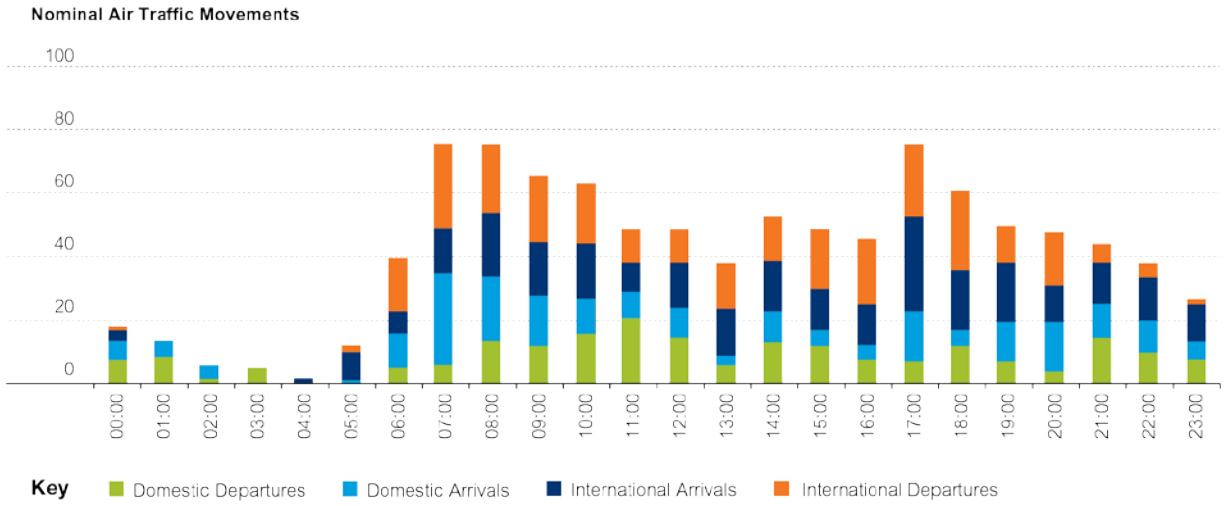


Figure 33–1 Hourly flight arrivals / departures

In 2063, there are expected to be a total of 1,006 passenger flights per day of which 576 are expected to be domestic and 430 are expected to be international. During the peak hour, there are expected to be 76 passenger flights of which 40 are expected to be arrivals (domestic and international) and 36 are expected to be departures (domestic and international).

33.3.1.2 Passenger movements

For each domestic and international flight, a profile for the passengers entering and exiting the proposed airport was determined based on the Sydney Airport Land Transport Model, (as explained in Section 15.2.2), to generate a ground transport demand profile. The ground transport demand profile is shown in Figure 33–2.

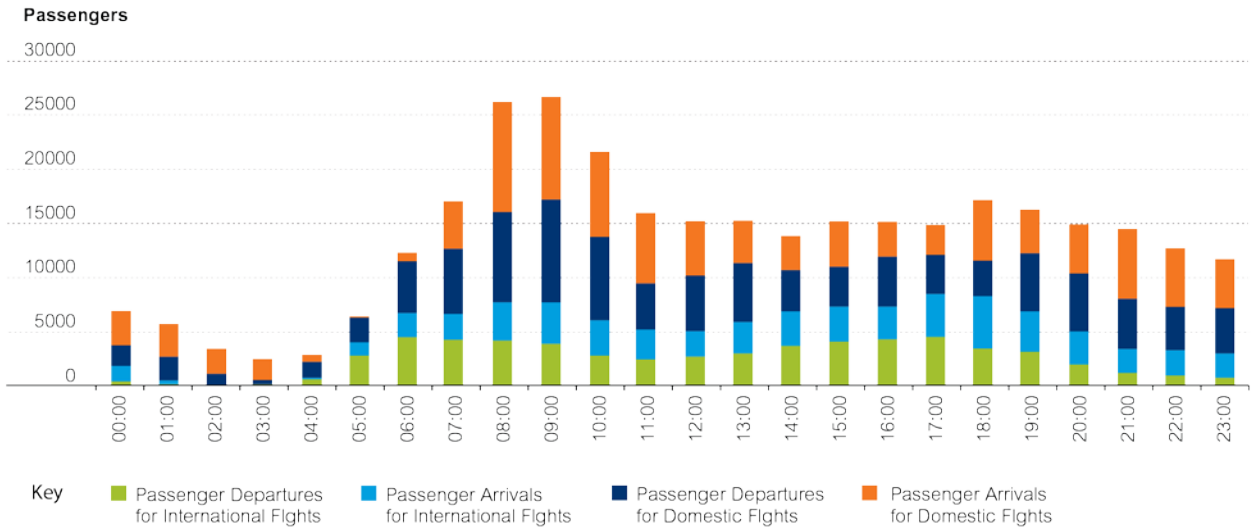


Figure 33–2 2063 ground transport demand per hour

33.3.1.3 Transport mode split

The Sydney Airport Land Transport Model (and its assumed mode split) was used to assign the calculated ground transport demand to the modes listed in Table 33–2.

Table 33–2 2063 assumed mode split

Mode	2063 assumed mode split			
	Domestic		International	
	Drop-off	Pick-up	Drop-off	Pick-up
Kiss 'n' fly	22%	22%	26%	26%
Park 'n' fly	20%	20%	18%	18%
Taxi	20%	20%	20%	20%
Shuttles	5%	5%	5%	5%
Bus	13%	13%	13%	13%
Train	20%	20%	18%	18%

Suitable dwell times for each transport mode were then applied (with, for example, longer times assumed for international kiss 'n' fly passengers when compared to their domestic counterparts).

Figure 33–3 shows the number of forecast passenger arrivals via ground transport at the airport. Figure 33–4 shows the total departures expected via ground transport from the proposed airport.

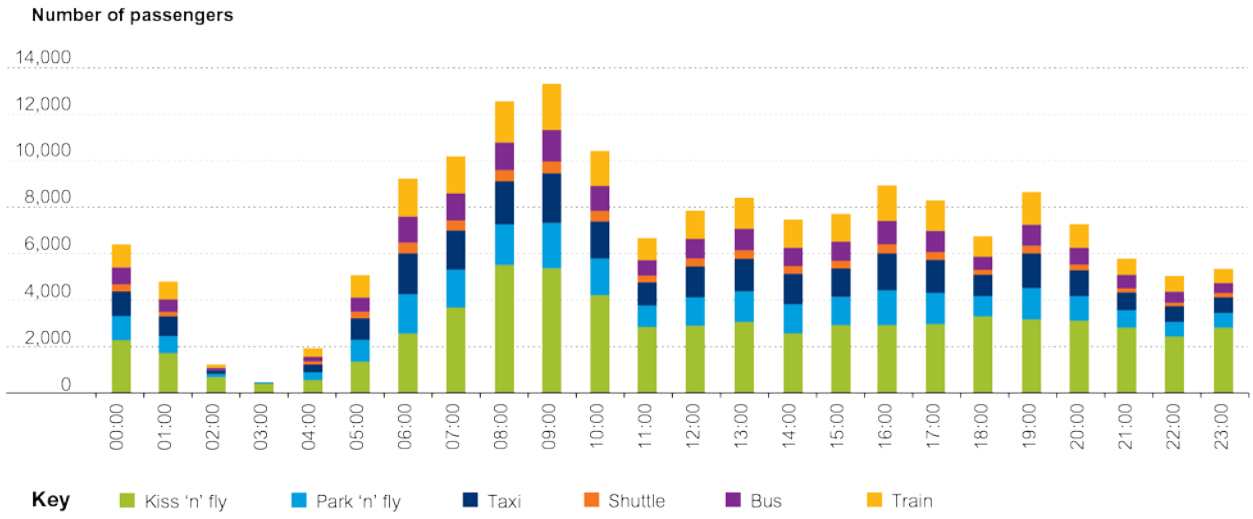


Figure 33–3 Total passenger arrivals at the airport via ground transport

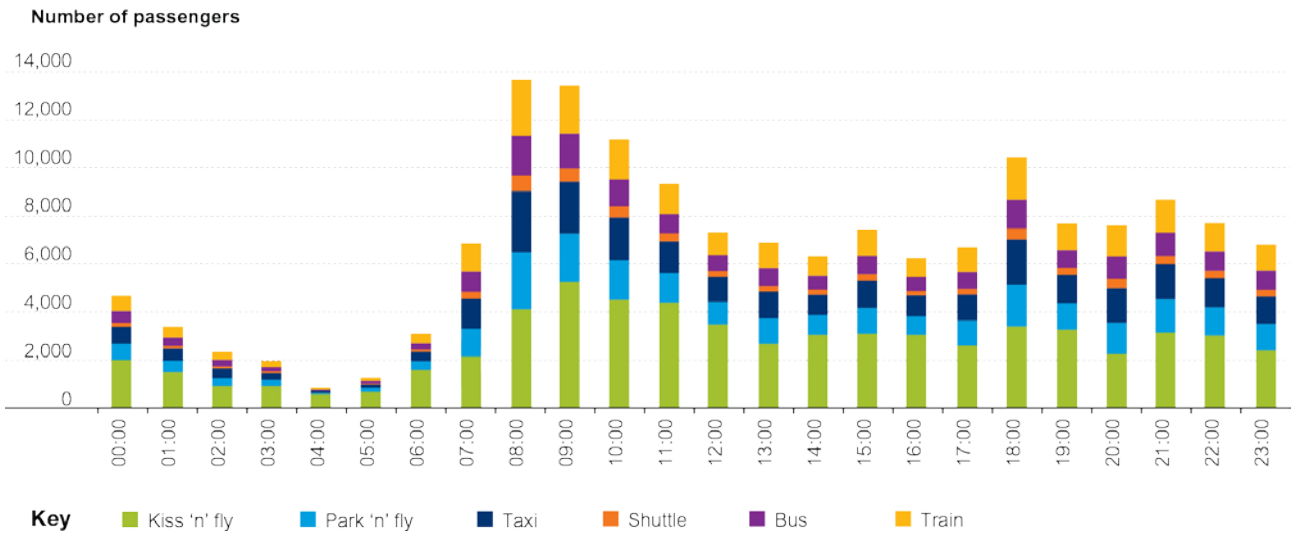


Figure 33–4 Total passenger departures at the airport via ground transport

33.3.1.4 Traffic generation

The trips (by mode) shown in Figure 33–3 and Figure 33–4 were assigned to vehicles entering and exiting the airport site to determine the passenger related traffic generation (excluding vehicle movements that only circulate internally within the airport site, such as some taxi movements).

Figure 33–5 shows that in 2063, 6,782 vehicles are predicted to enter the airport site during the peak hour between 9.00 am and 10.00 am. The figure also shows a peak arrival volume of 4,479 during the period 4.00 pm to 5.00 pm. Figure 33–6 shows that in 2063, there is predicted to be 6,795 passenger vehicles leaving the proposed airport during the peak period between 9.00 am and 10.00 am. The figure also shows a peak departure volume of 5,242 vehicles during the period between 6.00 pm and 7.00 pm.

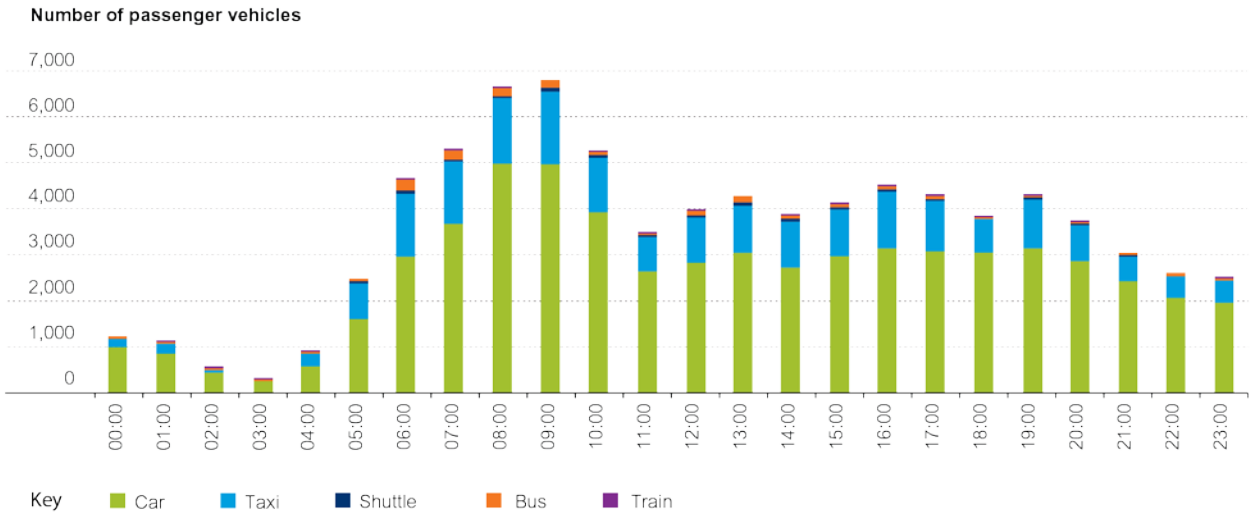


Figure 33–5 Passenger vehicles entering the airport site

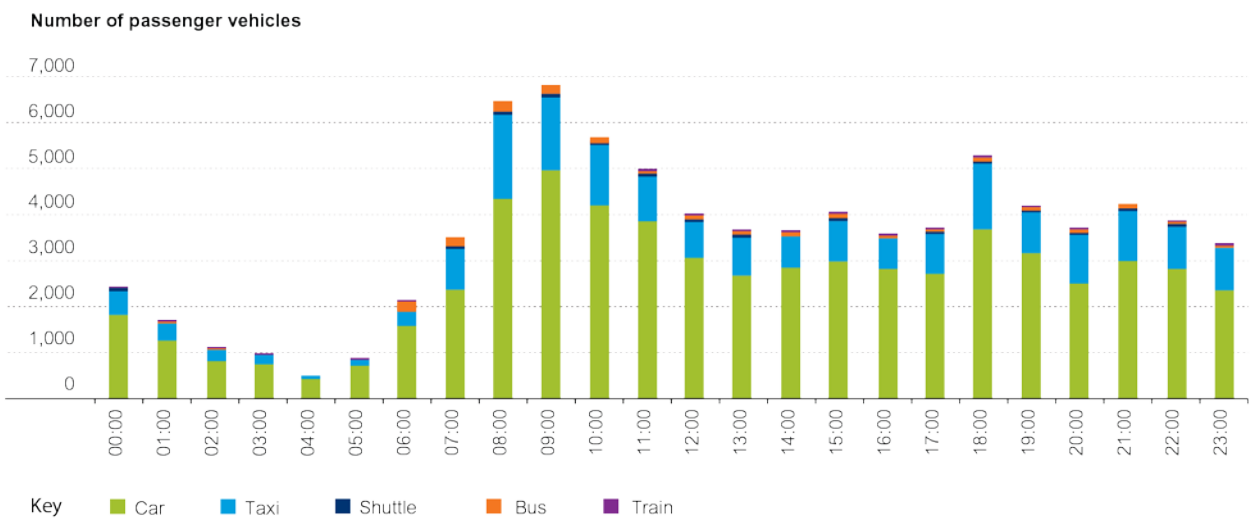


Figure 33–6 Passenger vehicles leaving the airport site

33.3.2 Employee trips

33.3.2.1 Employees and shifts

Based on a ratio of 750 employees per one million annual passengers, the number of employees required at the proposed airport in 2063 is estimated to be 61,500. Consistent with the experience at Sydney Airport and other international airports, it was assumed that up to 80 per cent of employees (49,200) would be on-site on any given day. Table 33–3 shows how the proposed airport employees were categorised.

Table 33–3 Proposed 2063 employee shift profiles

Employee type	Start	Finish	% total employees	Employees on site
Airfield overnight	21:00	05:00	2	984
Airfield day	05:00	13:00	3	1,476
Airfield afternoon	13:00	21:00	3	1,476
Terminal support morning	06:00	13:00	10	4,920
Terminal support afternoon	13:00	20:00	10	4,920
Terminal supplementary morning	06:00	10:00	14	6,888
Terminal supplementary afternoon	15:00	19:00	14	6,888
Office early start	07:00	17:00	21	10,332
Office later start	09:00	19:00	23	11,316
			Total	49,200

33.3.2.2 Employee arrival and departure profiles

A profile for employee arrivals and departures prior to and after their shifts was developed and is shown in Figure 33–7. The profile acknowledges that some employees would arrive in the hour before their shift starts and/or leave in the hour after their shift finishes.

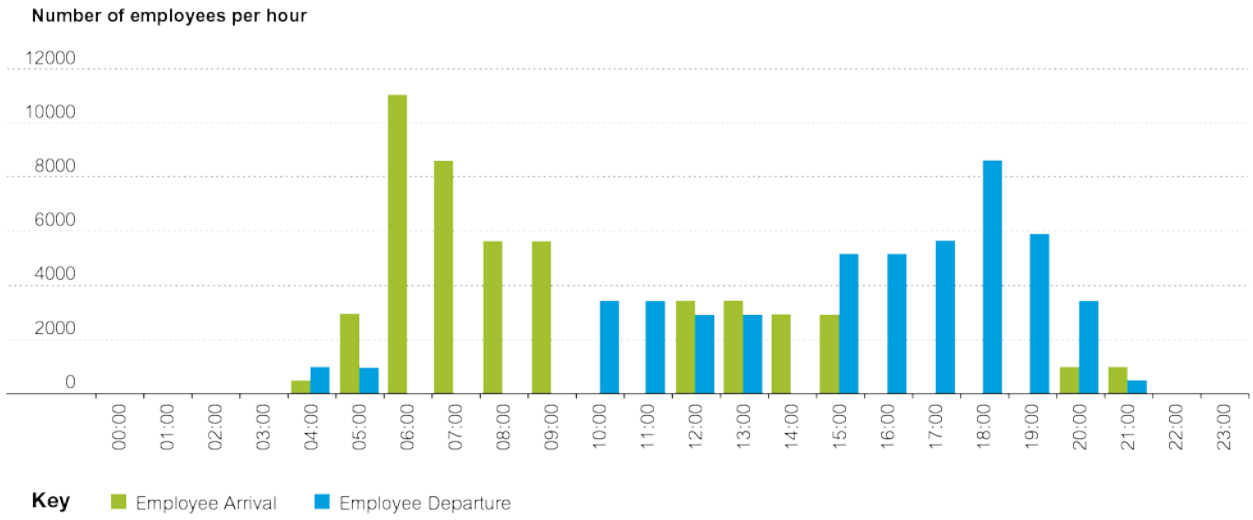


Figure 33–7 Employee arrival and departure profile

Figure 33–7 shows that the peak arrival for the AM peak period would be 11,070 employees (between 6.00 am and 7.00 am) and the PM peak departure for employees (between 6.00 pm and 7.00 pm) would be 8,610 employees.

33.3.2.3 Mode split

The employee mode spilt for the indicative long term development was determined by taking the base mode split used for Stage 1 operations and modifying it as follows:

- modifying the split for car modes to reflect the potential capacity of a staff car park; and
- distributing the staff trips to bus and rail modes.

Figure 33–8 and Figure 33–9 show the expected distribution of arrivals and departures respectively by mode. It can be seen that for arriving employees, the dominant transport modes are train and cars. For departing employees, the primary transport mode is by train.

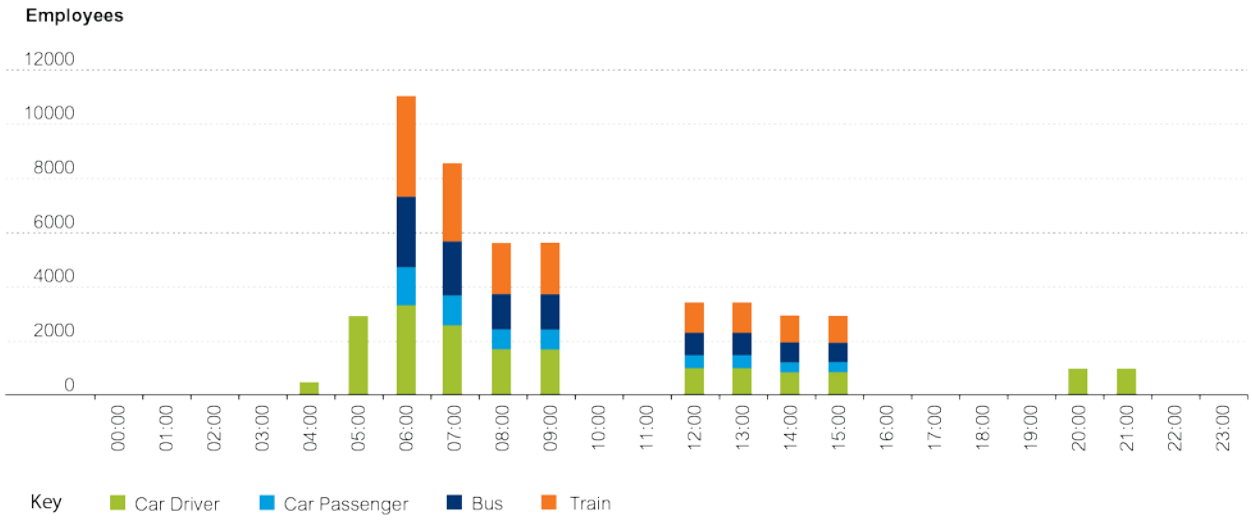


Figure 33–8 2063 employee arrivals by mode and time of day

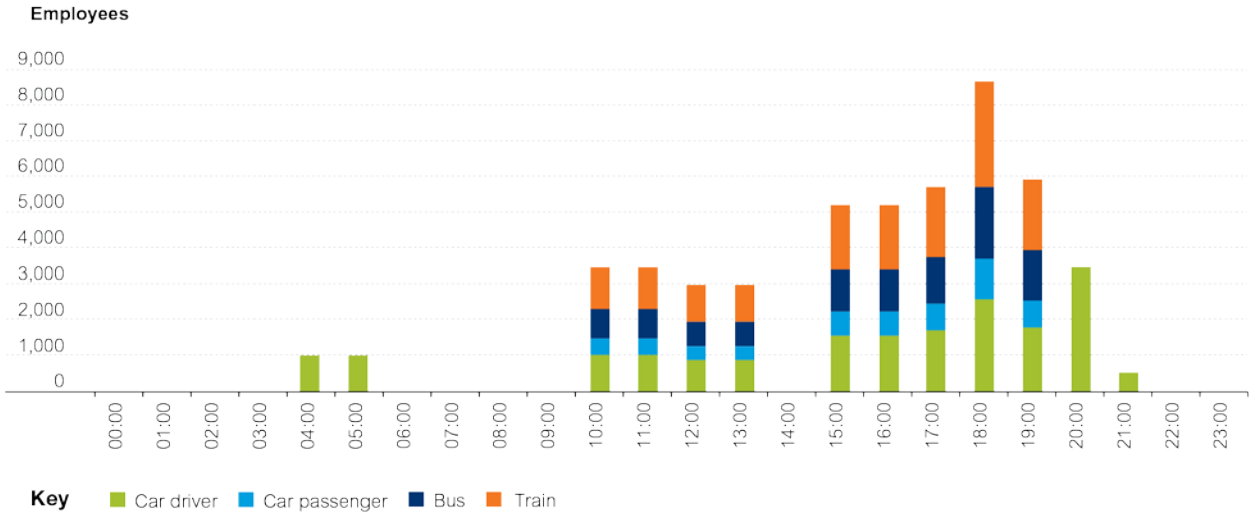


Figure 33–9 2063 employee departures by mode and time of day

33.3.2.4 Traffic generation

The calculated employee arrivals and departures were assigned to vehicles to determine the number of vehicles entering and leaving the airport site throughout the 24-hour operational period. The results are shown in Figure 33–10 for arrivals and Figure 33–11 for departures. The figures show that the employee traffic generation peaks are expected to be outside the main traffic peaks of 7.00 am to 9.00 am, and 4.00 pm to 6.00 pm.

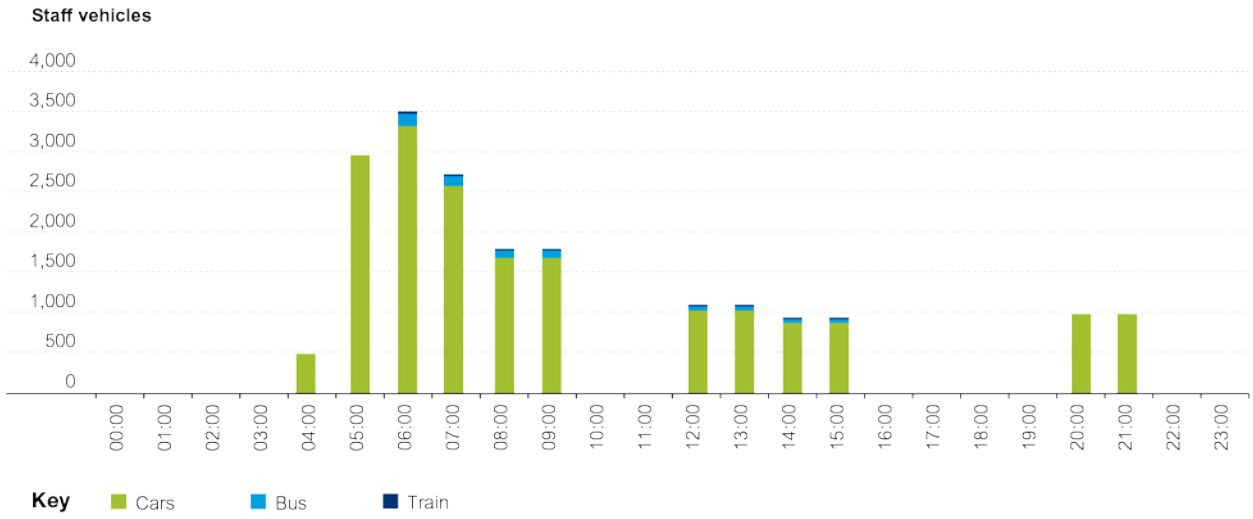


Figure 33–10 2063 employee vehicle arrivals by mode

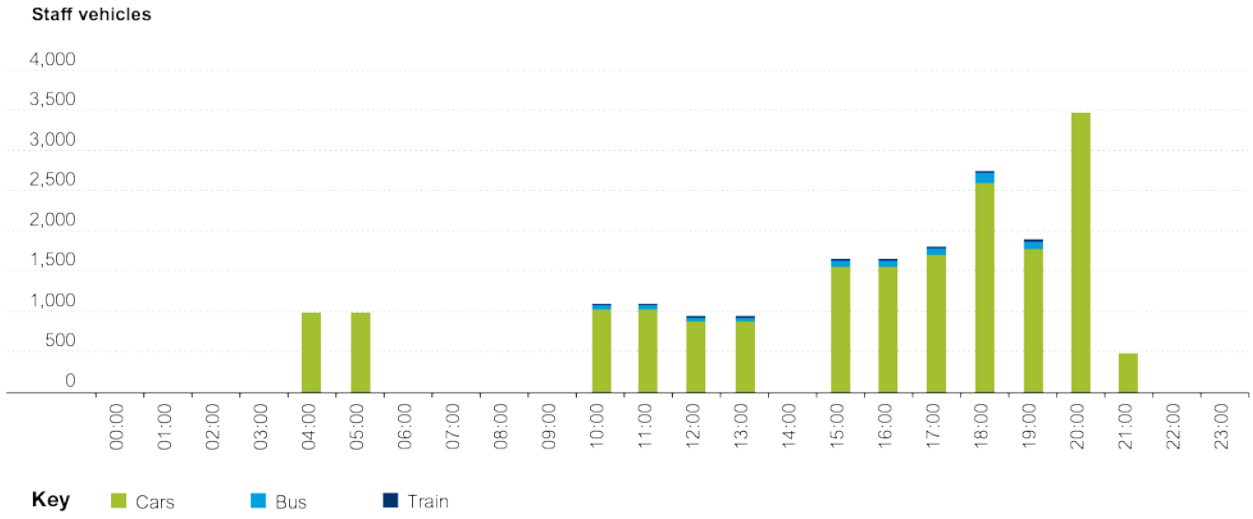


Figure 33–11 2063 employee vehicle departures by mode

33.3.3 Freight trips

Freight demand has been identified for air freight cargo with aviation fuel assumed to be supplied by pipeline in this analysis. Demand estimates for airport consumables (e.g. food, retail items) or waste removal cannot be calculated before a detailed terminal plan is developed and have therefore been excluded from the assessment.

The freight demand for air cargo is estimated to be 1,800,000 tonnes in 2063. It has been assumed that the cargo freight arrives and departs the proposed airport on heavy rigid trucks, semi-trailers and B-doubles. Table 33–4 gives the estimated heavy vehicle volumes (and car equivalents) adopted for the assessment.

Table 33–4 2063 two-way truck movements

Vehicle type	2063 annual movements	2063 daily movements	2063 hourly movements	2063 passenger car equivalents per hour
Heavy Rigid Truck (12.5 metres long)	137,647	458.82	38.24	76.47
Semi-Trailer (19 metres long)	18,000	60.00	5.00	15.00
B-Double (23 -26 metres long)	5,455	18.18	1.52	7.58

33.3.4 Total airport traffic generation estimate

A total airport trip generation for 2063 has been calculated using the totals for passengers, employees and freight provided in the previous sections. Table 33–5 presents the results by period, with a 24-hour total.

Table 33–5 Total modelled traffic to / from the proposed airport in 2063

	AM Peak	Interpeak	PM Peak	Evening	24-Hour
Accessing Airport					
Passengers	5,944	4,597	4,290	2,400	83,534
Airport Workers	2,250	815	3,728	685	19,220
Freight	45	45	45	3	537
Total (Accessing)	8,239	5,456	8,063	3,088	103,291
Egressing from Airport					
Passengers	4,958	4,762	3,728	2,605	83,534
Airport Workers	-	672	1,681	806	19,557
Freight	45	45	45	3	537
Total (Egressing)	5,002	5,479	5,454	3,414	103,628

Notes: Each peak period is presented as the average hourly trip generation of that period.
AM peak (7.00am to 9.00am), Interpeak (9.00am to 3.00pm), PM peak (3.00pm to 6.00pm), Evening (6.00pm to 7.00am)

33.3.5 Background traffic growth

As a result of existing and future planned developments in the Western Sydney region, there is expected to be considerable development growth in the coming years. Examples include:

- South West Priority Land Release Area;
- Western Sydney Employment Area;
- Western Sydney Priority Growth Area;
- Greater Macarthur Land Release Investigation Area; and
- smaller growth centres.

In the context of these development areas, Figure 33–12 provides a summary of vehicles generated in the vicinity of the proposed airport and shows the potential growth to 2063. The data in Figure 33–12 assumes that a South West Rail Link Extension from Leppington to St Marys via the proposed airport is operational.

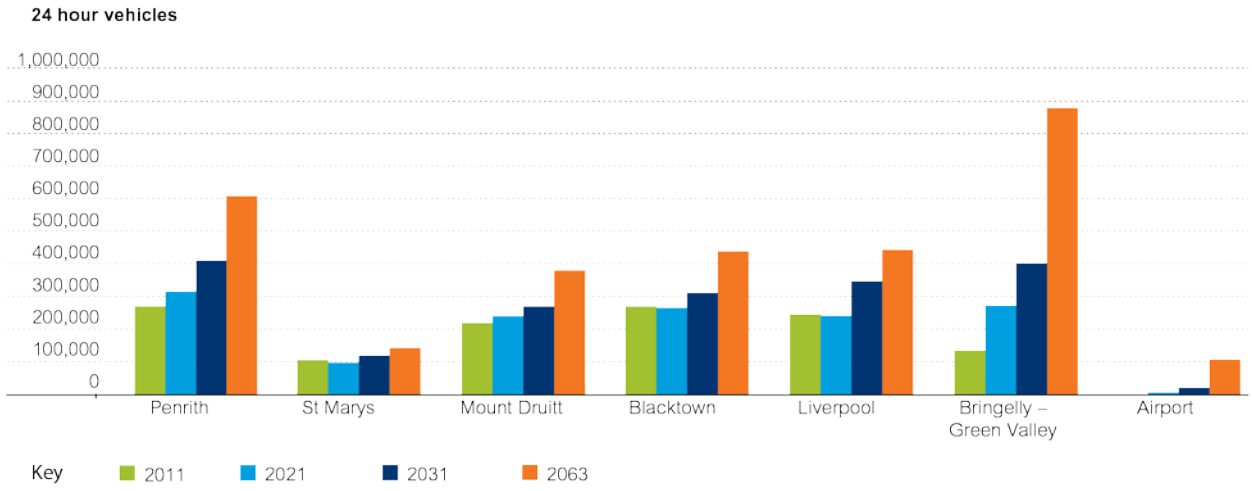


Figure 33–12 Vehicle movements originating in the vicinity of the airport site (24 hour)

Figure 33–12 illustrates that the proposed airport represents a very small component of overall trip demand in 2031, but this would increase substantially from 2031 to a predicted 103,000 or so trips in each direction by 2063. This would, however, occur in the context of much larger growth in other areas, particularly the Greater Macarthur Investigation Area (Bringelly/Green Valley).

33.3.6 Effect on road network performance

As noted in Section 33.3.4, operation of the indicative long term airport is predicted to result in 103,291 vehicles accessing the airport site and 103,628 vehicles leaving the site each day. The slight discrepancy in accessing and egressing totals is due to park-and-fly trips where access and egress profiles are calculated separately and external taxi trips where the inbound and outbound occupancy rates differ.

It should be noted that because of the significant time horizon being forecast and the lack of available information on possible future road network upgrades beyond 2041, the 2063 airport demand forecasts have been assigned to a 2051 road network. For example, no local road infrastructure works are assumed beyond those identified as part of the Western Sydney Infrastructure Plan and no upgrade of Elizabeth Drive has been assumed. As a result, it is reasonable to suggest this analysis of road network performance is a worst-case scenario and that additional traffic capacity infrastructure would be provided in the 20 years between 2041 and 2063.

Table 33–6, Figure 33–13 and Figure 33–14 show the 2063 network conditions for the Without Airport and With Airport assessment scenarios, for the respective AM and PM peak periods. With or without the proposed airport, the road network is forecast to be considerably congested by 2063. The key findings of the assessment are provided below for different classes of road.

33.3.6.1 Motorways

- With the airport, traffic volumes on the M12 near the entrance to the airport increase by between 1,000 and 3,000 vehicles per hour compared to the Without Airport scenario. This additional traffic causes the level of service to degrade to a lower performance level (LoS D).
- With the airport, traffic volumes on the M7 near the M12 are predicted to increase by less than 20 per cent of Without Airport volumes. The most congested sections of the M7, between Fifteenth Avenue and the M4, move from LoS E to LoS F.
- With the airport, the Outer Sydney Orbital carries less than 1,000 additional vehicles per hour to and from the north of Elizabeth Drive compared to the Without Airport scenario and retains a performance level of LoS D or better.
- With the airport, traffic volumes do not change significantly on the Outer Sydney Orbital to the south of Elizabeth Drive compared to the Without Airport scenario because only north facing ramps are assumed at the Elizabeth Drive interchange. Furthermore, no interchange is present between the M12 and Outer Sydney Orbital.
- With the airport, volume increases on the rest of the motorway network are less than 10 per cent of the Without Airport volumes.

33.3.6.2 Arterial roads

- With the airport, The Northern Road has traffic volume increases of up to 40 per cent, although this equates to less than 1,000 passenger car units (pcu) per hour. In the AM peak, LoS on The Northern Road increases from C/D to E/F between Bringelly Road and the M4.
- Elizabeth Drive is predicted to have a LoS F in the Without Airport scenario. Elizabeth Drive carries a substantial amount of airport traffic. The greatest increase is inbound towards to the airport in the AM peak and outbound in the PM peak. The changes in predicted traffic volumes compared to the Without Airport scenario next to the airport entrance are approximately 1,220 pcu per hour in the AM peak and 910 pcu per hour in the PM peak. In the counter-peak direction, a reduction in demand is shown. This is due to drivers re-routeing trips that would have used Elizabeth Drive if the airport was not there, by choosing another route due to the localised congestion.

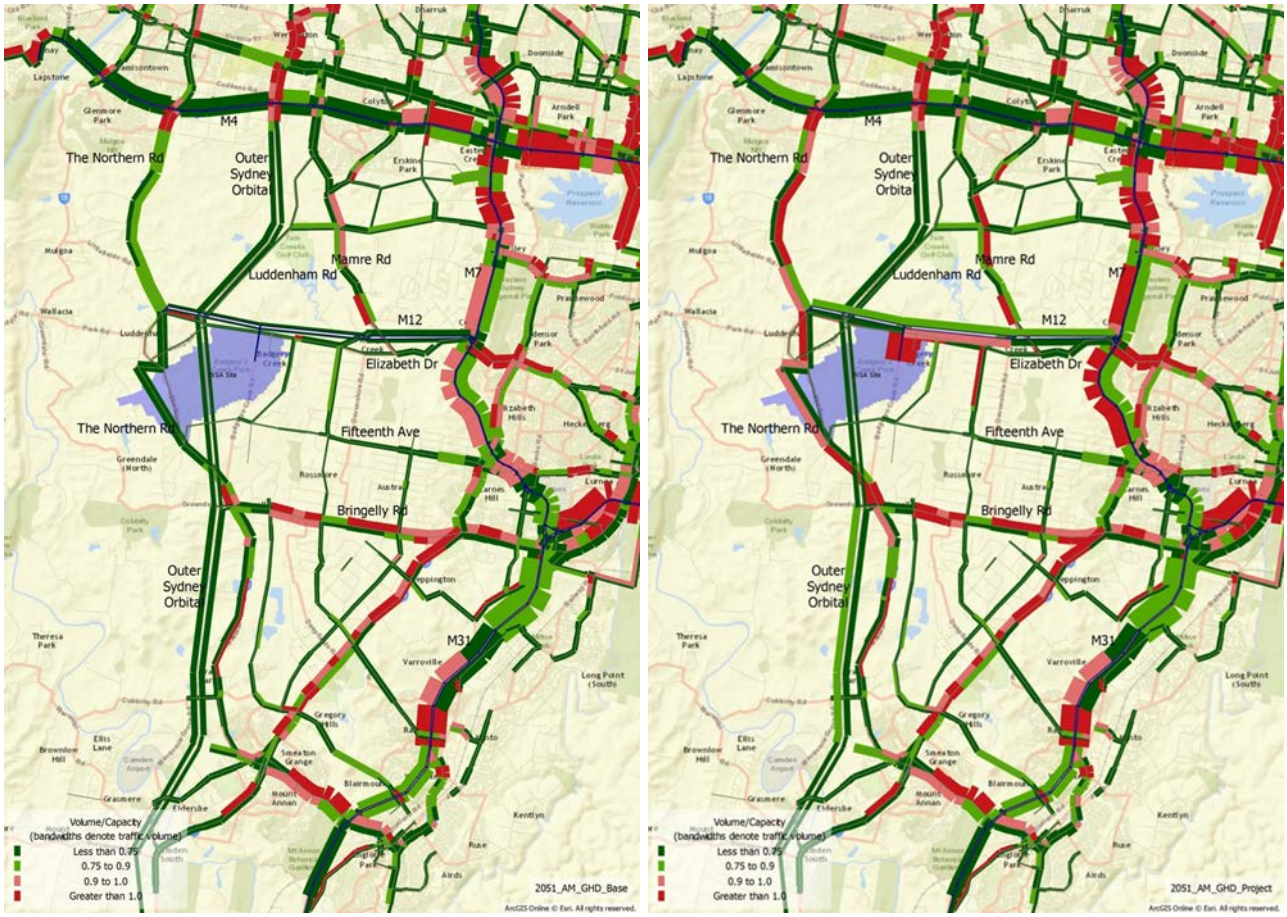
33.3.6.3 Local roads

- With the airport, Luddenham Road experiences traffic volume increases of between 40 and 60 per cent (southbound in the AM peak and northbound in the PM peak) compared to the Without Airport scenario—an increase of at most approximately 200 pcu per hour. While predicted LoS changes from A/B to B/C as a consequence of the airport traffic, so Luddenham Road is predicted to continue to operate within capacity in the With Airport scenario.
- With the airport, Mamre Road traffic volumes generally increase by less than 20 per cent compared to the Without Airport scenario, which equates to an increase of less than 100 pcu per hour, changing the LoS from E to F in the AM peak in the most congested section.
- The proposed airport is predicted to increase the volume of traffic on the north-south routes in the study area, such as Lawson Road (LoS change from C to D on most congested section) and Western Road (LoS change from D to E/F).

Table 33–6 Level of Service for 2063 With and Without Western Sydney Airport

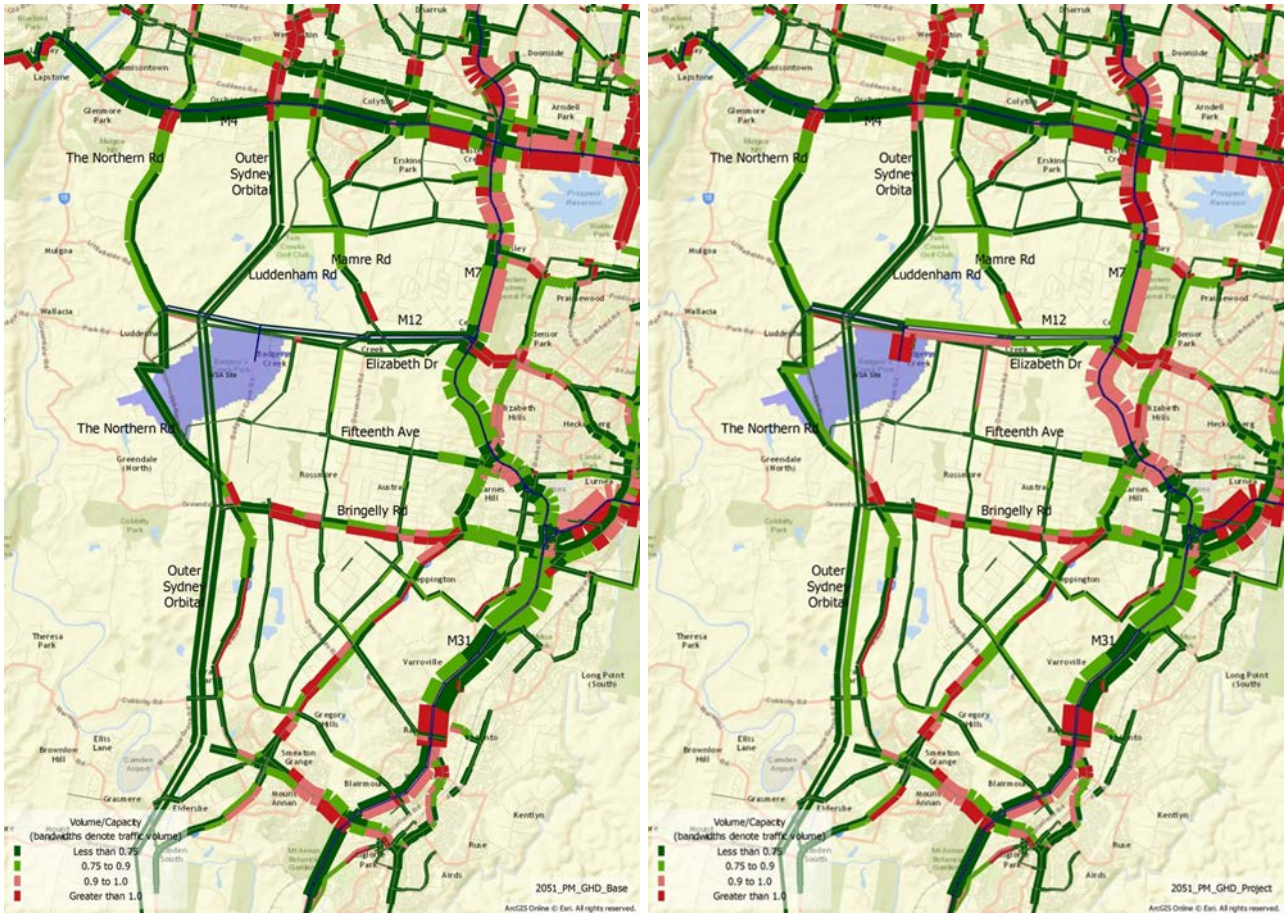
Id	Road	Location	Without Airport				With Airport			
			AM Peak		PM Peak		AM Peak		PM Peak	
			Nbd/Ebd	Sbd/Wbd	Nbd/Ebd	Sbd/Wbd	Nbd/Ebd	Sbd/Wbd	Nbd/Ebd	Sbd/Wbd
1	The Northern Road	North of Elizabeth Drive	D	D	D	C	**E**	D	**C**	**D**
2	The Northern Road	South of M4	F	F	F	F	F	F	F	F
3	The Northern Road	South of Bringelly Road	D	C	C	D	**E**	C	C	D
4	M4	West of Mamre Road	D	C	C	D	D	C	C	D
5	M4	West of M7	F	D	D	F	F	D	D	F
6	M7	South of M4	F	F	F	E	F	F	F	**F**
7	M7	South of Elizabeth Drive	E	D	D	D	**F**	D	**E**	**E**
8	M5	East of M7	F	E	E	F	F	E	**F**	F
9	M31	South of Campbelltown Road	D	D	D	D	D	D	D	D
10	Narellan Road	North of Tramway Drive	E	F	E	E	E	F	E	E
11	Bringelly Road	West of Cowpasture Road	E	E	D	F	E	E	D	F
12	Cowpasture Road	At M7	F	D	E	E	F	**E**	E	E
13	Elizabeth Drive	East of M7	F	F	F	F	F	F	F	F
14	Elizabeth Drive	West of M7	F	C	F	C	F	**D**	F	C
15	Elizabeth Drive	West of Mamre Road	A	A	A	B	A	**B**	A	B
16	Elizabeth Drive	East of the Northern Road	F	C	D	E	F	**E**	**E**	**F**
17	Mamre Road	North of Elizabeth Drive	E	B	C	C	**F**	**C**	**D**	**D**
18	Mamre Road	South of M4	E	D	F	D	E	D	F	D
19	Luddenham Drive	West of Mamre Road	B	B	A	B	B	**C**	**B**	**C**
20	Lawson Road	South of Elizabeth Drive	C	A	B	C	**D**	A	B	C
21	Western Road	South of Elizabeth Drive	D	C	C	D	**F**	C	C	**E**
22	Fifteenth Avenue	West of Cowpasture Road	C	C	C	C	C	C	C	C
23	M12	West of M7	C	B	C	C	**D**	**C**	**D**	**D**
24	M12	West of Mamre Road	A	A	A	A	**D**	**E**	**D**	**E**
25	M12	East of The Northern Road	A	A	A	A	**D**	**C**	**B**	**B**
26	Outer Sydney Orbital	North of Elizabeth Drive	C	C	C	C	C	C	C	C
27	Outer Sydney Orbital	South of Elizabeth Drive	C	B	B	B	C	B	B	B

Note: Improvements are indicated in **green bold**. Deteriorations are indicated in **red bold**.



Note: Volume/capacity ratio bandwidth definitions are outlined in Table 33–1.
The Outer Sydney Orbital will not pass through the airport site. This is a limitation of the modelling software which can only show roads as straight lines.

Figure 33–13 2063 AM Peak Volume/Capacity – Without Airport (Left), With Airport (Right)



Note: Volume/capacity ratio bandwidth definitions are outlined in Table 33–1.
The Outer Sydney Orbital will not pass through the airport site. This is a limitation of the modelling software which can only show roads as straight lines.

Figure 33–14 2063 PM Peak Volume/Capacity – Without Airport (Left), With Airport (Right)

33.4 Considerations for future development stages

Table 15-13 in Chapter 15 (Volume 2a) sets out the broad mitigation and management measures that are proposed to address the potential transport impacts associated with construction and operation of the Stage 1 development. These measures would also generally apply to the progressive development of the airport in the long term.

For the proposed airport to reach its long term capacity, rail services would be required to be introduced. For this reason, the Australian and NSW governments are undertaking a Joint Scoping Study on the Rail Needs for Western Sydney, including the proposed airport. The Scoping Study will consider the best options for future rail links, including decisions about timing and rail service options, both directly to the airport site and within the Western Sydney region. Planning for rail connections at the proposed airport is being undertaken in close consultation with Transport for NSW so that airport infrastructure considerations are aligned with Transport for NSW's planning for its rail network, including the proposed extension of the South West Rail Link.

33.5 Summary of findings

The operation of an airport in the long term is predicted to result in 103,291 vehicles accessing and 103,628 egressing the airport site each day. These additional trips would be generated in the context of substantial urban growth in Western Sydney, particularly the development of the Greater Macarthur Land Release Investigation Area.

Travel demand generated by the proposed airport and the substantial forecast development growth in Western Sydney would have a significant combined effect on the road and public transport systems. Additional transport infrastructure would be needed to address projected travel demand.

Long term operation of an airport would be reliant on the introduction of an airport rail connection after 2031. Even with a South West Rail Link extension, the identified increases in demand for 2063 show that detailed planning is required to preserve additional road corridors to cater for the population and travel growth associated with the airport and surrounding urban development.

It is recommended that more detailed planning is undertaken to address this envisioned road capacity shortfall such that potential future upgrades are not constrained by encroachment from surrounding development.