



**TRAFFIC AND PARKING IMPACT ASSESSMENT OF
THE STAGED DEVELOPMENT OF LORETO KIRRIBILLI
AT 85 CARABELLA STREET, KIRRIBILLI**



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Development Type: Loreto Kirribilli

Site Address: 85 Carabella Street, Kirribilli

Prepared for: Artazan Property Group

Document reference: 16575.02FA

Status	Issue	Prepared By	Checked By	Date
Draft	A	CHM/TH		13 March 2017
Draft	B	TH		28 March 2017
Draft	C	TH		11 July 2017
Draft	D	TH		17 July 2017
Draft	E	TH		21 July 2017
Final	A	TH	CM	25 July 2017

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1 INTRODUCTION

McLaren Traffic Engineering (MTE) was commissioned by *Artazan Property Group* to provide a Traffic and Parking Impact Assessment in regards to the staged development of Loreto Kirribilli at 85 Carabella Street, Kirribilli. The relevant plans are reproduced in **Annexure A** for reference.

1.1 Description and Scale of Development

Loreto Kirribilli includes classes from year groups Kindergarten to Year 12, with an existing approval for a total of 1100 students. A detailed description of the school operations is provided in **Section 3**, with a summary of the characteristics relevant to this Traffic and Parking Impact Assessment provided below:

- A total of 1080 students enrolled in 2017 including:
 - 135 students in years K – 4;
 - 112 students in year 5 - 6;
 - 569 students in years 7 - 10;
 - 264 students in years 11 – 12;
 - Typical absenteeism of 4%.
- Total of 180 staff members;
- School start time of 8:29am, finish at 3:10pm.

The proposed alterations include increasing student numbers by 100 to 1200, staff numbers by 2 and demolition and construction works.

For the purposes of the Master Plan the site has been divided into 5 precincts, each with a different character:

- Campus Core
- Western Precinct
- Southern Precinct
- Eastern Precinct
- Northern Precinct

Stage 1 of the Master Plan includes the demolition of Block B and the construction of a new Learning Hub to support a STEaM curriculum. The Learning Hub interfaces with the existing Gymnasium, providing access to the Gymnasium via a new lift and stairs as well as additional teaching space comprising of a new Learning Studio, Weights Area, relocated Change Rooms, new Storage and Outdoor Learning Area. This stage also includes vertical connectors located in the Eastern, Southern and Northern Precincts.

Works in the stages to follow Stage 1 include the demolition of the Mary Ward building and construction of a new Performing Arts Centre as well as the demolition of the existing Junior School and replacement with a new Junior School.

The site provides on-site parking for 72 cars (80 in a tandem arrangement) in an underground car park with access from Elamang Avenue. In addition to formal parking areas, an agreement exists with the nearby Royal Sydney Yacht Squadron for the use of 20 car parking spaces for staff during school hours.

1.2 State Environmental Planning Policy (Infrastructure) 2007

The proposed development does qualify as a development with relevant size and/or capacity under Clause 104 of the SEPP (Infrastructure) 2007 being an 'Educational Establishment' of 50 or more students. Accordingly, formal referral to the Roads and Maritime Services (RMS) is necessary and the Department of Planning and Environment will assess and determine this proposal accordingly.

1.3 Site Description

The subject site is located within the North Sydney Council Local Government Area and is generally surrounded by low – high-density residential development, with St Aloysius College situated to the south-west. The Kirribilli area is geographically constrained, being bounded by water to the north, east and south. As a result, vehicle routes to and from the site are limited.

The subject site has two (2) road frontages, being Carabella Street to the south-west and Elamang Avenue to the north-east. There are multiple vehicular access points to the school on both road frontages, with the primary area for parent drop-off and pick-up on Carabella Street between the junctions with Fitzroy Street and Parkes Street.

1.4 Site Context

The site location is shown on a map and aerial imagery in **Figure 1 & Figure 2** respectively.



— Site Location

FIGURE 1: SITE CONTEXT – AERIAL PHOTO



— Site Location

FIGURE 2: SITE CONTEXT – STREET MAP

2 EXISTING TRANSPORT AND PARKING CONTEXT

2.1 *Road Hierarchy*

The road network surrounding the site has the following characteristics.

2.1.1 Carabella Street

- Unclassified LOCAL road;
- Varying width of between 10m (to the north) and 7.5m (to the south) facilitating two-way passing and kerbside parking where sufficient width is available;
- Signposted 50km/h speed restriction;
- Three bus stop zones;
- Restricted 2hr kerbside parking permitted along both sides of the street between 8:30AM – 6:00PM (7 days – permit holders exempt) with two sections for parent drop off / pick up zones between 8:00am – 9:30am & 2:30pm – 4:00pm school days only as well as a bus zone and loading zone at the immediate frontage of the school.

2.1.2 Elamang Avenue

- Unclassified LOCAL road;
- Approximately 12m in width facilitating two-way passing and kerbside parking;
- Signposted 50km/h speed restriction;
- Restricted 2hr kerbside parking permitted along both sides of the street immediately along the school frontage; with some ½hr sections as well as a no parking zone (1 car space) immediately next to the school driveway. Past the school frontage, the parking is unrestricted kerbside for both sides of Elamang Avenue.

2.2 *Existing Traffic Management*

- STOP sign controlled intersection of Carabella Street / Peel Street;
- STOP sign controlled intersection of Elamang Avenue / Willoughby Street;
- Pedestrian crossing along Carabella Street near the intersection with Fitzroy Street;
- STOP sign controlled intersection of Carabella Street / Burton Street.

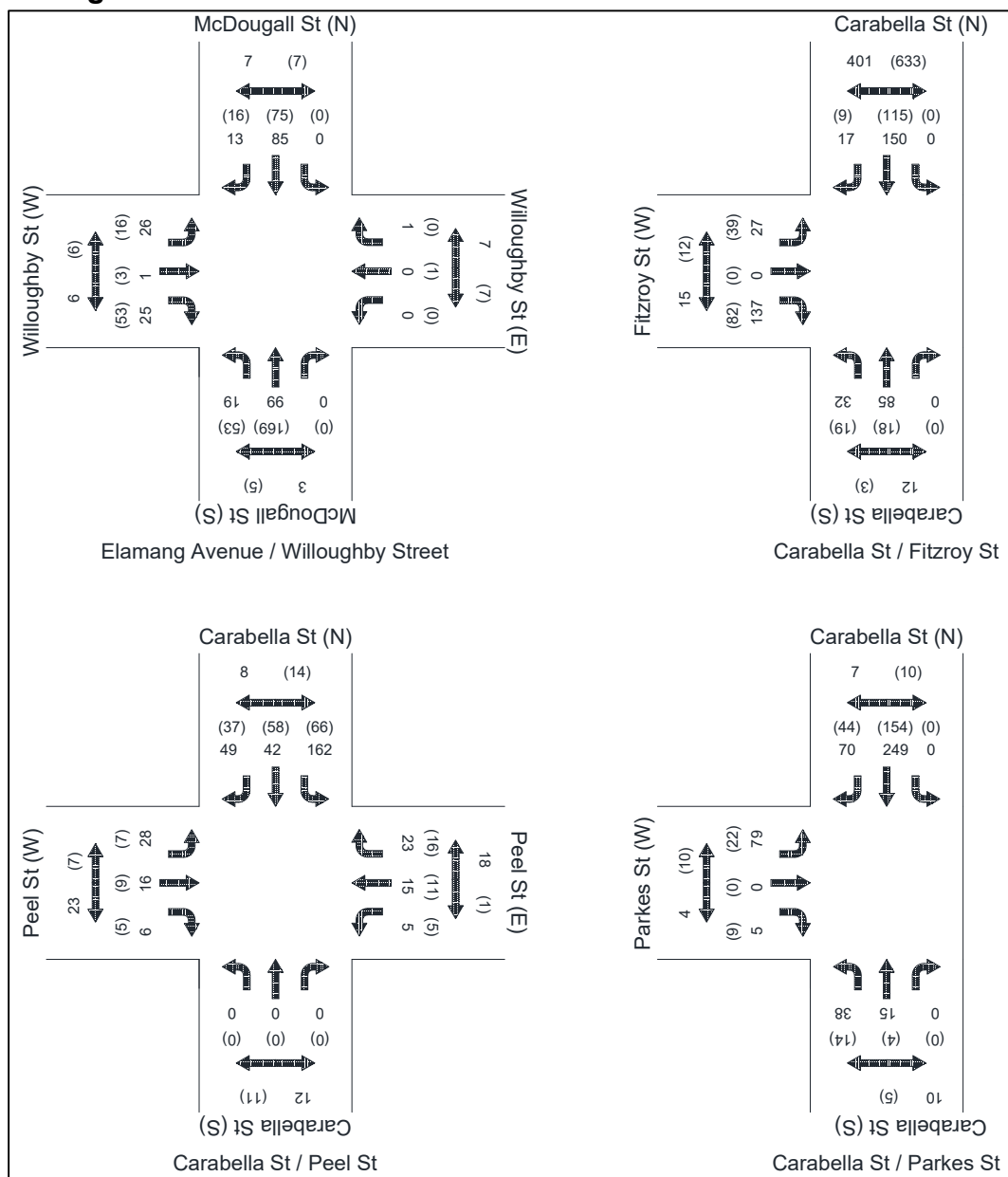
2.3 Existing Traffic Environment

2.3.1 Intersection Volumes

Turning movement counts were undertaken from 7:00 am - 10:00 am and 2:00 pm - 5:00 pm on Wednesday 27 July 2016, reflecting peak school drop-off and pick-up times during a typical weekday, at the following intersections:

- Carabella Street / Fitzroy Street;
- Carabella Street / Parkes Street;
- Carabella Street / Peel Street;
- McDougall St / Willoughby Street / Elamang Avenue.

Detailed survey results are provided in **Annexure B**, with the results for the peak times provided in **Figure 3**.



Note: PM Peak Hour Volumes in (Brackets)

FIGURE 3: INTERSECTION SURVEY RESULTS

2.3.2 Two-Way Traffic Volumes

Traffic tube surveys were undertaken from the 7th of February 2017 to the 14th February 2017 along both Elamang Avenue and Carabella Street to determine the existing characteristics of these roads in terms of:

- Peak traffic volumes and speeds;
- Daily traffic volumes and speeds;
- Classification of vehicles.

Detailed results are reproduced in **Annexure C**, with the results summarised in **Table 1**.

TABLE 1: 7-DAY TUBE SURVEY RESULTS

Road	Direction	Peak Hour Volume		Average Daily Volume	85 th Percentile Speed	Heavy Vehicles
		Time	Volume			
Carabella Street	Northbound	AM (8am – 9am)	27	285	41km/h	4.2%
		PM (3pm – 4pm)	18			
	Southbound	AM (11am – 12pm)	104	1631	46km/h	4.1%
		PM (5pm – 6pm)	133			
Elamang Avenue	Northbound	AM (8am – 9am)	42	568	45km/h	3.7%
		PM (3pm – 4pm)	48			
	Southbound	AM (11am – 12pm)	42	571	48km/h	3.7%
		PM (12pm – 1pm)	52			

2.3.3 Intersection Performances

The results of the intersection surveys have been assessed using SIDRA INTERSECTION 7.0 to determine the existing performance of the road network in terms of delays and queues. The results of this analysis are summarised in **Table 2**, with detailed results provided in **Annexure D**.

TABLE 2: INTERSECTION PERFORMANCES (SIDRA INTERSECTION 7)

Intersection	Peak Hour	Degree of Saturation ⁽¹⁾	Average Delay ⁽²⁾ (sec/veh)	Level of Service ⁽³⁾	Control Type	Worst Movement	95th Percentile Queue
EXISTING PERFORMANCE							
Elamang Avenue / Willoughby Street	AM	0.10	6.8 (Worst: 7.9)	A (Worst: A)	Give Way	RT from McDougall Street (N)	0.4 veh (2.7m) Elamang Avenue (S)
	PM	0.19	7 (Worst: 8.9)	A (Worst: A)		RT from McDougall Street (N)	0.8 veh (5.6m) Elamang Avenue (S)
Carabella Street / Fitzroy Street	AM	0.22	4.7 (Worst: 7.8)	A (Worst: A)	Give Way	LT from Carabella Street (S)	1 veh (7.3m) Carabella Street (N)
	PM	0.22	6.2 (Worst: 9.4)	A (Worst: A)		LT from Carabella Street (S)	1 veh (6.9m) Carabella Street (N)
Carabella Street / Parkes Street	AM	0.17	1.8 (Worst: 6.1)	A (Worst: A)	Give Way	RT from Parkes Street (W)	0.4 veh (3.1m) Carabella Street (N)
	PM	0.11	1.5 (Worst: 5.3)	A (Worst: A)		RT from Parkes Street (W)	0.3 veh (1.8m) Carabella Street (N)
Peel Street / Carabella Street	AM	0.20	6.8 (Worst: 7.9)	A (Worst: A)	Give Way	LT from Carabella Street (N)	0.9 veh (6.3m) Carabella Street (N)
	PM	0.14	6.6 (Worst: 7.7)	A (Worst: A)		LT from Carabella Street (N)	0.5 veh (3.8m) Carabella Street (N)

NOTES:

(1) Degree of Saturation is the ratio of demand to capacity for the most disadvantaged movement.

(2) The average delay is the delay experienced on average by all vehicles. The value in brackets represents the delay to the most disadvantaged movement.

(3) The level of Service is a qualitative measure of performance describing operational conditions. There are six levels of service, designated from A to F, with A representing the best operational condition and level of service F the worst. The LoS of the intersection is shown in bold, and the LoS of the most disadvantaged movement is shown in brackets.

As shown, the surrounding intersections are operating satisfactorily, with low average delays and queue lengths. It should be noted that SIDRA Intersection cannot model the impacts of a high turnover of on-street parking or of a pedestrian-dominant environment (as generally exists around schools). The SIDRA Intersection models demonstrate that there is ample capacity for the surrounding intersections to accept an increase in vehicles during the peak hours but cannot reflect other traffic conditions in the surrounds of the school.

2.4 Existing Parking Environment

Surveys of the on-street parking supply within 200m walking distance of the site were undertaken on Tuesday 7 February 2017 between the hours of 7:00am – 10:00am and 2:00pm – 5:00pm to examine the availability of on-street parking during school drop-off and pick-up hours. The results of these surveys are summarised in **Table 3**, with the detailed results provided in **Annexure E** for reference. A detailed map of the streets surveyed and corresponding results are provided in **Annexure F**.

**TABLE 3: ON-STREET PARKING AVAILABILITY:
AUSTRALIAN STANDARD DIMENSIONS
(WITHIN 200M WALKING DISTANCE)**

Total Capacity	Morning Peak (8:00am – 8:15am)	Afternoon Peak (3:00pm – 3:15pm)
363	67 (18.4%)	32 (8.8%)

As shown, there were a minimum of 67 and 32 parking spaces observed to be available during the survey, corresponding to occupancy rates of 81.6% and 91.2% respectively.

It was observed during the survey that some lengths of kerb were occupied by a higher-than-capacity number of cars (often due to a high use of small cars and lower tolerances when parking). This is typically observed in urban environments where on-street parking is in high demand.

Based on the maximum observed occupancy of each parking area (rather than the dimensions suggested by the Australian Standards), the surrounding streets have a total capacity for approximately 400 cars, rather than the 363 suggested by the Australian Standards (which assume a high proportion of large cars). The observed parking capacity and resulting vacant spaces at peak times is summarised in **Table 4**.

**TABLE 4: ON-STREET PARKING AVAILABILITY:
OBSERVED CAPACITY
(WITHIN 200M WALKING DISTANCE)**

Total Capacity	Morning Peak (8:00am – 8:15am)	Afternoon Peak (3:00pm – 3:15pm)
400	83 (20.7%)	42 (10.5%)

In addition to the public transport provided by public buses and trains, school buses are provided to the students which provide access to Balmoral, Cremorne, Manly, Epping, Lane Cove, Chatswood, Ryde, North Curl Curl and Avalon. The school is provided six (6) school special buses in the AM period and twenty-one (21) in the PM period as detailed in **Table 5** and **Figure 5**.

TABLE 5: DEDICATED SCHOOL BUS SERVICES

Bus Number	Time Period	From	To
568	PM	Loreto	Taronga Zoo
569	PM	Loreto	Balmoral
589	PM	Loreto	Cremorne
598	PM	Loreto	St Leonards Park
617	PM	Loreto	Manly Wharf
648	PM	Loreto	Epping Station
662	PM	Loreto	Lane Cove Library
673	AM	Croydon Park	Chatswood Station
681	AM	Ryde Shops	Loreto
	PM	Loreto	Ryde Shops
707	PM	Loreto	North Balgowlah
708	PM	Loreto	Musgrave St Wharf
710	PM	Loreto	Dee Why
711	PM	Loreto	Warringah Mall
760	PM	Loreto	Bantry Bay
761	PM	Loreto	Manly Wharf
763	PM	Loreto	North Curl Curl
764	PM	Loreto	Clontarf
765	PM	Loreto	Manly Wharf
769	PM	Loreto	Avalon
770	PM	Loreto	Northbridge
772	PM	Loreto	Blaxlands Corner
773	AM	Lane Cove West	Loreto
774	AM	Northwood	Loreto
775	AM	Lane Cove West	Loreto
776	PM	Loreto	Chatswood Station
778	AM	Lane Cove West	Loreto



FIGURE 5: SCHOOL BUS ROUTES

2.6 Future Road and Infrastructure Upgrades

From North Sydney Council Development Application tracker and website, it appears that there are no future planned road or public transport changes that will affect traffic conditions within the immediate vicinity of the subject site.

3 EXISTING SCHOOL OPERATIONS

Travel mode surveys were conducted by teachers to determine the typical way in which students travel to and from school. Survey sheets, as reproduced in **Annexure G**, were provided to teachers, who asked their students about their mode of travel to and from school on that day. These results have been compiled and are presented below.

3.1 *Student and Staff Numbers*

Loreto School caters for Years K – 12, with a total of 1080 students distributed as detailed in **Table 6**:

TABLE 6: SCHOOL STRUCTURE - STUDENTS

Year Group	K	1	2	3	4	5	6	7	8	9	10	11	12
Students	27	24	28	28	28	56	56	148	142	143	136	130	134

It should be noted that the school exhibits a typical 4% absenteeism (corresponding to some 43 students). The above student numbers correspond to a nine (9) “home base” primary school and a six (6) stream high school.

The school employs a total of 180 staff as per the following:

- 100 teaching staff;
- 50 administration staff;
- 4 casual staff;
- 6 cleaning staff;
- 20 volunteers.

3.2 *Transport Characteristics*

In-class surveys were undertaken on Tuesday 14th February 2017 to determine students’ mode of transport when travelling both to and from school. The detailed results of the surveys are shown in **Annexure H** and summarised in **Table 7 & Table 8**.

TABLE 7: STUDENT TRANSPORT MODE (K – 6)

Direction	Bus	Train	Family Car	Friend Car	Own Car as Driver	With Staff Member	Walking	Bicycle	Ferry	Other
Travelling to School	17.5%	8.1%	58.9%	3.3%	0.0%	0.0%	8.5%	0.0%	3.7%	0.0%
Travelling From School	20.0%	10.0%	49.2%	6.4%	0.0%	0.0%	10.8%	0.0%	3.6%	0.0%

TABLE 8: STUDENT TRANSPORT MODE (7 – 12)

Direction	Bus	Train	Family Car	Friend Car	Own Car as Driver	With Staff Member	Walking	Bicycle	Ferry	Other
Travelling to School	31.1%	20.5%	34.4%	3.4%	0.9%	0.6%	1.6%	0.0%	5.4%	2.1%
Travelling From School	37.7%	22.9%	26.6%	2.4%	0.6%	0.6%	1.7%	0.0%	5.9%	1.6%

The resulting alternative transport use and vehicle trips per student are presented in **Table 9**.

TABLE 9: STUDENT TRANSPORT CHARACTERISTICS

Year Group	Alternative Transport ⁽¹⁾	Combined Car Trips ⁽²⁾	Private Vehicle Trips Per Student ⁽³⁾	Number of Students	Total Trips
K-6	41.1%	4.8%	0.54	247	134
7-12	71.0%	3.0%	0.26	833	217

Notes:

- (1) Includes all trips made by Bus, Train, Walking, Bicycle and Other
- (2) Includes students travelling with friends or staff members.
- (3) Calculated as $1 - (\text{Alternative Transport} + \text{Combined Car Trips})$ to provide proportion of students that make private vehicle trips.
- (4) Does not include deductions for siblings.

As shown, each junior school student contributes 0.54 private vehicle trips per drop-off/pick-up; each senior school student 0.26. Student drop-off and pick-up trips do not generate long-term parking in the surrounding streets.

It has been estimated, based on past experience, that 90% of school staff drive to and park on or around the site corresponding to a total of 162 parking spaces; 80 of which are located on-site. It should be noted that this estimate of staff driving rates is very high, considering the favourable position of the site with regard to public transport services. A 90% figure has been utilised throughout the report to provide for a conservative result.

3.2.1 Use of External Parking

It has been advised that there is an ongoing agreement between The School and the nearby Royal Sydney Yacht Club, whereby 20 spaces are available for use by School staff during weekday school hours & approximately 80 car spaces are available to the Yacht Club during evening and weekend hours.

Based on the estimated existing parking demand and the supply of parking both on-site and in the nearby Yacht Club, it is estimated that there is a total existing displacement of 62 staff vehicles to the surrounding streets.

4 PARKING IMPACT ASSESSMENT

4.1 Staff Parking

4.1.1 Council Parking Requirement

Reference is made to *North Sydney Council's DCP 2013: Section 10 – Car Parking and Transport* which states the following with regards to the provision of parking for Schools:

“Educational establishments 1 space / 6 staff”

As previously identified, the increase sought for approval is 100 students and 2 teachers. **Table 10** summarises the resulting Council's DCP parking requirement.

TABLE 10: DCP PARKING REQUIREMENTS

Land Use	Type	Scale	Rate	Spaces Required	Spaces Provided
School	Existing Staff	180	1 per 6 staff	30	100
	Future Staff	2		0.3	
	Total Staff	182		30.3	
Total				30.3 (31)	100

As shown, under the North Sydney Council development control plan, the school requires a total of 30.3 parking spaces for staff. 80 car parking spaces are provided on-site and 20 off-site in the Sailing Club (for a total of 100), exceeding the North Sydney Council requirement for 182 staff.

4.1.2 NSW Department of Education and Communities Parking Requirement

The design and provision of school facilities are controlled by the Educational Facilities Standards and Guidelines (EFSG), which provides rates of *maximum* parking provision on school premises. The relevant extracts from the EFSG for primary and secondary school facilities are provided in **Figure 6** and **Figure 7** respectively.

Based on the nine (9) primary school home bases and six (6) high-school streams, the school has a maximum parking provision of $15 + 100 = 115$ parking spaces. A total of 80 are provided on site, with an additional 20 available off-site, which is within the maximum.

PS609 VEHICULAR CIRCULATION

Room ID	Room name	Measure	Sq M	School size — Core (No. Home Bases)					
				1 (1)	3 (2-4)	7 (5-10)	14 (11-17)	21 (18-24)	28 (25-30)
PS609.01	Service Road - Heavy Duty	Maximum	600	1*	1*	1*	1*	1*	-
PS609.02	Service Road - Light Duty	-	-	*	*	*	*	*	-
PS609.03	Service Road - Access	Maximum	400	1*	1*	1*	1*	1*	-
PS609.11	Bulk Waste Pad	-	9	1	1	1	1	1	-
PS609.21	Car Parking	Maximum	-	-	5	15	26	36	-
PS609.31	Bus Zone	-	-	*	*	*	*	*	-
PS609.41	Bicycle Storage Area	No of Bicycle	-	-	-	12	24	36	-
PS609.51	Crossovers	-	-	-	*	*	*	*	-

FIGURE 6: EFSG PRIMARY SCHOOL PARKING GUIDELINES

HS609 VEHICULAR CIRCULATION

Room ID	Room name	FTS	Measure	Sq M	School size — streams						
					1	2	3	4	5	6	7
HS609.01	Service Road - Heavy Duty	-	maximum	800	-	1*	1*	1*	1*	1*	1*
HS609.02	Service Road - Light Duty	-	-	-	-	*	*	*	*	*	*
HS609.03	Service Road - Access	-	maximum	100	-	1*	1*	1*	1*	1*	1*
HS609.04	Bulk Waste Pad	-	-	9	-	1	1	1	1	1	1
HS609.05	Car Parking	-	Maximum	-	-	48	64	76	88	100	112
HS609.06	Bus Zone	-	-	-	-	*	*	*	*	*	*
HS609.07	Bicycle Enclosure	-	No of bicycles	-	-	24	30	36	42	48	54
HS609.08	Crossovers	-	-	-	-	*	*	*	*	*	*

FIGURE 7: EFSG SECONDARY SCHOOL PARKING GUIDELINES

4.1.3 Parking Impact

Based on the 90% vehicle driver rate of staff, the additional 2 staff will result in an additional on-street parking demand for 2 staff. The resulting impact on the parking supply in the streets surrounding the site is summarised in **Table 11**.

TABLE 11: ESTIMATED PARKING IMPACT

Scenario	Available Spaces (No School) ⁽¹⁾	Staff	Staff Demand (spaces)	Remaining Spaces Available	
				Morning Peak (8:00am – 8:15am)	Afternoon Peak (3:00pm – 3:15pm)
Existing	131	180	62	69 (19.0%)	34 (9.3%)
Future		182	64	67 (18.4%)	32 (8.8%)

As shown, the increase in staff will have an insignificant effect on the on-street parking supply surrounding the site.

Considering that the site has sufficient parking to satisfy the requirements of both the North Sydney Council DCP and the NSW Department of Education and Communities and the insignificant impact on the existing on-street parking; the supply of off-street parking is acceptable in the context of the subject development application.

4.2 Parent Drop-Off and Pick-Up

School parents currently affect drop-off and pick-up along the eastern side of Carabella Street, between Fitzroy Street and Parkes Street. The increase of 100 senior school students, with a typical traffic generation of 0.26 vehicles per student, will result in an increased demand for 26 set down spaces in both the morning and afternoon. Typically the drop-off of senior school students is of low duration (less than two minutes) and can be undertaken in the streets surrounding the site such that students can walk the short distance to the school entrance.

Considering the existing operation of the site, the additional 100 senior students will not significantly increase the demand for parking facilities for parents or detrimentally affect the surrounding streets in terms of parking supply.

4.3 Bicycle & Motorcycle Parking Requirements

North Sydney Council's DCP does not require the provision of bicycle parking facilities and as such, no additional bicycle parking facilities are proposed. It should be noted that there is an extremely low usage of bicycles to travel to and from the site, with no students recorded using bicycles to travel to and from school in the travel survey.

4.4 Servicing & Loading

The existing waste management procedures of the site will not be altered by the proposed development. Waste is collected from Elamang Avenue by a private contractor. Further details regarding the waste management of the site are available in the Waste Management Plan produced by MRA Consulting included as part of the submission.

Existing deliveries to the site are undertaken kerbside on Carabella Street in the existing Loading Zone or at the rear of the site from Elamang Avenue, no change to these loading procedures are proposed as part of this development application. The new learning hub building will include a loading area with access via the existing driveway to Carabella Street. This loading area is dimensionally restricted to use by vehicles of up to 5.2m length, as insufficient turning area is available for vehicles of larger dimensions.

4.5 Disabled Parking

Council's DCP does not provide any disabled parking provision rates for the subject land use. However, the BCA classifies schools as a class 9B building and therefore requires 1 space for every 100 car parking spaces or part thereof. Considering that no changes are proposed to the car parking areas on-site, the existing provision of disabled parking spaces will be unchanged as part of this development proposal.

4.6 Car Park Design & Compliance

The on-site car park is not proposed to be modified and as such, remains consistent with previous approvals and is not subject to a compliance review.

Swept path testing of the proposed on-site loading and delivery areas has been undertaken and is reproduced in **Annexure I** for reference.

5 TRAFFIC ASSESSMENT

The impact of the expected traffic generation levels associated with the subject proposal is discussed in the following sub-sections.

5.1 *Traffic Generation*

As previously identified, the increase sought for approval is 100 students and 2 teachers. The traffic generation associated with the increase of 100 students and 2 teachers can be established utilising the in-class surveys undertaken (refer to **Section 3.2**). Based on the in-class surveys, the traffic generation associated with 100 students and 2 teachers is summarised in **Table 12**. This analysis has been undertaken on the basis of the extra 100 students being added immediately to the school, rather than gradually over time as is intended.

TABLE 12: STUDENT FORECAST TRANSPORT MODE

Direction		Bus	Train	Family Car	Friend Car	Own Car as Driver	With Staff Member	Walking	Bicycle	Ferry	Other	Staff
Arriving to School	Percentage	31.1%	20.5%	34.4%	3.4%	0.9%	0.6%	1.6%	0.0%	5.4%	2.1%	90%
	Total	31	21	34	3	1	1	2	0	5	2	2
Departing from School	Percentage	44.4%	25.3%	18.6%	1.3%	0.4%	0.6%	1.9%	0.0%	6.4%	1.0%	90%
	Total	44	25	19	1	0	1	2	0	6	1	2

As shown, for the additional 100 students during the morning period, the additional private car traffic would be some 37 vehicles; in the afternoon period some 22 as per the following:

5.1.1 AM Peak Period

- 1 student drives to school = 1 inbound movement;
- 2 staff members drive to school = 2 inbound movements;
- 38 students arrive as car passenger, average of 1.09 students per car = 35 inbound vehicles and 35 outbound vehicles, a total of 70 trips;
- A total of 38 inbound movements and 35 outbound movements, a total of 73 trips.

5.1.2 PM Peak Period

- 1 student departs school = 1 outbound movement;
- 2 staff members drive home = 2 outbound movements;
- 21 students depart as car passenger, average of 1.06 students per car = 20 inbound vehicles and 20 outbound vehicles, a total of 40 trips;
- A total of 20 inbound movements and 23 outbound movements, a total of 43 trips.

5.2 Traffic Assignment

Following an assessment of the of the surrounding road network and the existing traffic flows at the surrounding intersections, traffic travelling to and from the site has been assumed to take the following route:

- Entry
 - 50% from the Carabella Street north via Willoughby Road
 - 50% from Fitzroy Street.
- Exit
 - 70% via the Elamang Street / Willoughby Road Exit
 - 30% via Carabella Street south.

5.3 Traffic Impact

The traffic generation estimated in **Section 5.1** has been added to the existing traffic volumes as per the traffic assignment in **Section 5.2** and assessed using SIDRA Intersection 7.0. The results of this analysis are summarised in **Table 14**.

As shown, when compared to the existing performance of the intersections (as shown previously in **Table 2** of this report), there is no significant increase in intersection delays or approach queues as a result of the additional traffic related to the increase of 100 children and two staff. It should be noted that whilst it is the best option available, the analysis of the surrounding intersections with SIDRA Intersection is an overly simplistic and insensitive approach to determining the impacts of the proposed increase of 100 students to the Loreto Kirribilli School. The estimated increase in private vehicle trips is likely within the daily fluctuation in vehicle trips to and from the school and it is likely that there will no noticeable impact on the function of the surrounding streets resulting from the increased student numbers.

5.4 Residential Amenity

The Roads and Maritime Services (RMS) Guide to Traffic Generating Developments (2002) Table 4.6 suggests “environmental goal” and maximum peak hourly two-way traffic volumes for residential streets of 200 and 300 vehicles respectively. The existing and future peak two-way volumes for Carabella Street and Elamang Avenue are presented in **Table 13**.

TABLE 13: EXISTING AND FUTURE TWO-WAY TRAFFIC VOLUMES

Street	Peak	Existing Two-Way Peak (vehicles)	Additional Traffic (vehicles)	Future Two-Way Peak (vehicles)
Carabella Street	AM	122	38	160
	PM	150	21	171
Elamang Avenue	AM	82	18	100
	PM	89	12	101

As shown, the future two-way volumes on both Carabella Street and Elamang Avenue are within the environmental goal volumes provided by the RMS. The increased traffic volumes resulting from the additional 100 students and 2 staff will not significantly affect residential amenity surrounding the site.

TABLE 14: FUTURE INTERSECTION PERFORMANCES - SIDRA INTERSECTION 7.0

Intersection	Peak Hour	Degree of Saturation ⁽¹⁾	Average Delay ⁽²⁾ (sec/veh)	Level of Service ⁽³⁾	Control Type	Worst Movement	95th Percentile Queue
FUTURE PERFORMANCE							
Elamang Avenue / Willoughby Street	AM	0.12	6.9 (Worst: 8.1)	A (Worst: A)	Give Way	RT from McDougall Street (N)	0.5 veh (3.3m) Elamang Avenue (S)
	PM	0.20	7 (Worst: 9)	A (Worst: A)		RT from McDougall Street (N)	0.9 veh (6.1m) Elamang Avenue (S)
Carabella Street / Fitzroy Street	AM	0.25	4.7 (Worst: 7.8)	A (Worst: A)	Give Way	LT from Carabella Street (S)	1.2 veh (8.4m) Carabella Street (N)
	PM	0.24	6.2 (Worst: 9.4)	A (Worst: A)		LT from Carabella Street (S)	1.1 veh (7.6m) Carabella Street (N)
Carabella Street / Parkes Street	AM	0.19	1.7 (Worst: 6.2)	A (Worst: A)	Give Way	RT from Parkes Street (W)	0.5 veh (3.2m) Carabella Street (N)
	PM	0.12	1.4 (Worst: 5.4)	A (Worst: A)		RT from Parkes Street (W)	0.3 veh (1.8m) Carabella Street (N)
Peel Street / Carabella Street	AM	0.23	6.9 (Worst: 8)	A (Worst: A)	Give Way	T from Carabella Street (N)	1 veh (7.3m) Carabella Street (N)
	PM	0.15	6.7 (Worst: 7.7)	A (Worst: A)		LT from Carabella Street (N)	0.6 veh (4.4m) Carabella Street (N)

NOTES:

(1) Degree of Saturation is the ratio of demand to capacity for the most disadvantaged movement.

(2) The average delay is the delay experienced on average by all vehicles. The value in brackets represents the delay to the most disadvantaged movement.

(3) The level of Service is a qualitative measure of performance describing operational conditions. There are six levels of service, designated from A to F, with A representing the best operational condition and level of service F the worst. The LoS of the intersection is shown in bold, and the LoS of the most disadvantaged movement is shown in brackets.

6 CONCLUSION

The traffic and parking impacts of the proposed alterations and additions to the existing Loreto Kirribilli Private School, as illustrated in **Annexure A**, have been assessed.

The existing site provides a total of 80 car parking spaces for staff on-site, with a further 20 available in the nearby Sailing Club during school hours, exceeding the requirements of North Sydney Council and complying with the maximum rates provided by the *New South Wales Department of Education and Communities'* Educational Facilities Standards and Guidelines. The parking demand related to the proposed increase of 100 senior students and two staff can be accommodated within the available on-street parking in the surrounds of the site.

The additional traffic generation of the site, estimated at some 73 and 43 trips in the AM and PM peak periods respectively, has been assessed to have minimal impact on the surrounding road network in terms of intersection performance or residential amenity.

In view of the foregoing, the proposed Stage 1 alterations and additions to the Loreto Kirribilli Private School are fully supported in terms of traffic and parking impacts.