

St Catherine's School

Travel Strategies

Transport Report

Issue | 1 July 2015

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number Job number

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Executive Summary

Arup has been engaged by Sandrick Project Directions on behalf of St. Catherine's School, Waverley (the School) to respond to issues raised by the NSW Department of Planning and Environment (NSWDPE) following public exhibition of the School's Development Application (DA), seeking concept approval for a campus Master Plan and detailed approval for Stage 1 of the Master Plan (RPAC). Arup recently produced a transport assessment report supporting the DA for the redevelopment of the School in August 2014. The formal DA was submitted in September 2014. A summary of the key issues raised by the NSWDPE following public exhibition of the application as related to Traffic and Parking is provided in the table below, with the relevant traffic and parking advice issued by NSWDPE on 19 December 2014.

ID number	Key issues	Arup section
1	The Department is concerned with the traffic and on-street parking impacts to the local road network as a result of additional private vehicle trips in association with the proposed intensification of the use of the site. In this regard further consideration should be given to measures to mitigate these impacts, which should include:	
	additional mitigation measures to maintain existing levels of service at the nearby intersections (Macpherson Street/Albion Street and Macpherson Street/Leichhardt Street);	Chapter 3
	provision of an on-site drop-off and pick-up zone;	Section 2.2
	provision of on-site parking to cater for the use of the proposed facilities not associated with enrolled students of the School (i.e. the use of the auditorium for non-school related events with up to 500 patrons and the learn to swim programs);	Section 6.1 and 7.4
	the hours of operation of the proposed pool facilities for activities not associated with enrolled students of the School.	Section 6.2
2	Identify at which stage of the campus expansion that traffic generated by the development would result in a change of Level of Service for each of the Macpherson Street/Albion Street and Macpherson Street/Leichhardt Street intersections (i.e. identify how many additional students in combination with operation of the new facilities can be supported before the performance of intersections would deteriorate).	Section 7.3
3	Provide further details of the travel demand management measures that will be implemented to promote a modal shift away from private vehicle.	Chapter 3
4	Provide further details regarding the operation of proposed shuttle bus services for events and the feasibility of such services for each type of event, including the number of services, pick-up times, the capacity of the service, drop-off zone and the likely usage for each type of event.	No longer considered based on Chapter 6
5	Provide the complete results from the St. Catherine's School Travel Surveys in the Traffic and Transport Assessment.	Provided separately

In addition, the NSWDPE has appointed Samsa Consulting to Peer Review the Transport Reports prepared by Arup, and provide independent traffic advice to assist with the successful resolution of the traffic and parking issues associated with the original application. Key issues raised by Samsa Consulting on behalf of NSWDPE (in email dated 11 May 2015) are summarised in the following table.

ID number	Key issues	Arup section
1	The arrival and departure traffic generation analysis (Section 6.3.1 and Table 12 and Table 13 of the TTA) only accounts for single direction student drop-off / pick-up movements. There would also be a return movement by the driver after dropping-off or before picking up students. Therefore, the traffic generation has been under-estimated.	Section 7.2
2	Further justification and clarification is required for the 30 per cent discount factor for traffic generation due to a number of factors such as extracurricular activities, early drop-offs / late pick-ups, vehicles using nearby streets and varying day-to-day travel patterns.	Section 7.2
3	Traffic distribution assessment assumes car trips would be to the nearest drop-off and pick-up location and does not factor in the restrictions for the zones for particular school years.	Section 2.2.3
4	The car mode/occupancy assumptions of 2.5 people per car and 80 per cent car mode share for events requires further information to support the assumptions.	Section 6.1
5	The School drop-off/pick-up period of 15 minutes appears to be optimistic and is more likely to last at least 30 minutes.	Section 7.3
6	The car parking demand should factor in any demand from organisers/performers and any staff that are not already on-site prior to the event(s).	Section 6.1
7	Further consideration of how on-street parking impacts would be managed is required as events are likely to start before residents return home.	Section 6.1.1
8	Further details are required regarding briefing and instructions for traffic controllers at the drop-off/pick-up zone.	Section 2.2
9	Further details are required regarding management of event parking given the ramp to the car park has a very short queue length (2 cars).	Section 6.1.1
10	Further consideration of potential safety implications of the relocated pedestrian crossing in the vicinity of the car park entrance is required.	Section 2.1

A range of behavioural and travel strategies have been identified and considered to address the underlying issues associated with the proposal for new facilities within St. Catherine's School, Waverley.

The principle is that the strategies adopted will reduce the overall car travel mode for both staff and students associated with the increased School population and the additional School facilities to a level that results in an improvement to the surrounding road network. A summary of this report has found that:

- Both Leichhardt Street and Albion Street experience significant congestion. With the new Macpherson street upgrades and proposed drop-off and pick-up allocations, it is expected that 34-35% less traffic associated with drop-offs and pickups respectively would occur along Leichhardt Street. Similarly 8-

29% less traffic would be expected on Albion Street during drop-off and pick-up respectively.

- The preferred travel alternatives for students have been identified as carpooling, promoted public transport and a minibus service. The estimated mode shift away from private vehicle users are approximately 142 less cars during the drop-off and pick-up periods. These are based on conservative targets (no reference made to survey data).
- The preferred travel alternatives for School staff have been identified as carpooling, subsidised public transport, active transport and encouraging cycling. The estimated mode shift away from private vehicle users are approximately 43 less car users, bringing car staff usage to a total of 115 cars, compared with 150 existing. These are based on conservative targets (no reference made to survey data).
- According to recent survey data, mode shift from students currently using private vehicles is favourable, with 42 per cent agreeable to School minibuses and 65 per cent agreeable to carpooling.
- According to recent survey data, carpooling is the most favourable form of mode shift for existing private vehicles users (staff) with 40 per cent agreeable to a carpool mode shift.
- A range of other travel measures have been considered by the School but found to be unfeasible due to risks imposed on student safety.
- A detailed campaign promoting and implementing the plan would be developed by the School.
- Surveys have been developed to gain an understanding of the likelihood of adopting the proposed travel strategies. One survey was directed at both students (years 5-12) and parents (children in years K-4), while another was directed at staff of the School.
- The School will exercise management strategies to avoid overlap when it is expected that the new Auditorium will be operating at capacity. This means the aquatic centre would not operate during these large events.
- During the occurrence of a maximum capacity event (up to 7 times in a year) in the new Auditorium, the surrounding network would have to accommodate an additional 80 car trips. With car parking available within the School for events, approximately 85 cars may park on-street – an additional 5 cars compared to existing maximum capacity events conducted within the DJSC. With reference to the 2014 parking surveys carried out by Arup, it is considered that there will be sufficient supply of parking to cater for events and residents in surrounding streets.
- The new Aquatic Centre's timetable is arranged such that most of the external lessons occur outside of peak hours. The new timetable shifts the timeframes of existing activities to occur before morning peak hours (St. Catherine's School students only), hence likely reducing the traffic congestion in the network. The Aquatic Centre is estimated to reduce private vehicle morning peak drop-offs by an additional 82 cars, afternoon pick-ups by 29 cars and commuter peak car trips by 34 cars. 60 additional car trips are expected during the weekend peak.

- By adopting a range of strategies and travel alternatives, private car usage can be reduced during morning and afternoon school peak periods. Parking provision would be lower in demand from staff and congestion would be reduced in the surrounding networks.
- The number of cars generated with the proposed School population and updated usage profile scenario is significantly less than the existing School population and existing usage profile scenario when all initiatives are implemented. The net outcome would result in a net decrease of cars generated by the School during weekday peak hours in comparison to the existing situation.
- As the School has proposed a number of initiatives to reduce car use, this will reduce dependence on surrounding intersections. The result will be an improvement of the overall network performance and less congestion on streets around the School. Level of service of surrounding intersections will generally improve relative to the existing situation.
- Approximately 150 car trips are assumed to be currently generated by staff travelling to and from school, which include 56 parked on-site and up to 94 staff cars parked on surrounding streets. With the proposed initiatives and a net increase of 19 parking spaces proposed at completion of the campus Master Plan, this will result in 115 car trips generated by staff, which therefore include 75 parked on site and 40 cars parked on surrounding streets. This results in a net decrease in car parking demand of 54 cars on surrounding streets compared to the existing situation.
- A range of collaborative initiatives have been investigated. Drop-off and pick-up locations are proposed to be altered, along with an upgrade on Macpherson Street, addressing congestion and safety issues. Alternative travel methods will also be introduced and have been seen as highly favourable from recent survey data from students, parents and staff. The Performing Arts Auditorium will host evening events (6pm onwards) with full capacity attendance up to seven times per year (two events occur biennially) and are not likely to affect on-street parking adversely. A new usage profile for the Aquatic centre encourages students to attend school earlier or stay back at school, improving traffic during peak hours from pick-up and drop-offs. Based on all the initiatives, conservative calculations (survey results show a much higher desire for mode shift as compared to calculations) show an overall reduction in private vehicle usage from the master plan and campus growth, compared to the existing situation. The master plan would ultimately improve the peak hour congestion issues around the School during normal school days.

E1 Transport report summary of results

Traffic Generation

- A summary of the number of existing and future cars generated by the school, as a result of the proposed campus growth is shown in Table E1. It also shows the effects all the initiatives have on the car numbers compared to not having any.
- These numbers are based on:
- An existing campus population of
 - 971 students, of which the School has provision for up to 70 Boarders (years 7-12) and
 - 202 Staff (175 full-time)
- A proposed campus population
 - 1200 students (similar boarding numbers)
 - 212 Staff (185 full-time)

Table E1: Summary of No. of Cars (Existing Vs. Forecast)

	Scenario	Campus Pop. (NI)		Campus Pop. (AI)		Variance (NI vs AI)	
		AM	PM	AM	PM	AM	AM
Staff	Existing	150	150	-	-	-	-
	Proposed	158	158	117	117	41	41
Students	Existing	498	403	-	-	-	-
	Proposed	618	486	476	344	142	142

Notes:

NI = No Initiatives

AI = All Initiatives (theoretical, without survey data)

Survey Results

Based on the May 2015 survey results, the number of private vehicle users who are willing to consider the proposed travel modes is shown in Table E2.

Table E2: May 2015 Survey Results: Travel Initiatives

	Time Period	A	B	C	No. of respondents willing to consider proposed travel mode			
					Minibus	Carpool	Public Transport	Cycle/Walk
Staff	AM	112	94	84%	N/A	38	19	13
	PM	N/A	94	84%	N/A	38	19	13
Students	AM	748	452	60%	182	287	-	-
	PM	N/A	341	46%	143	222	-	-

Notes:

A = Number of survey respondents

B = Number of private vehicle users based on number of respondents

C = private vehicle users as a percentage of respondents

E2 Initiatives/Strategies to improve school generated traffic and parking issues

Table E3: Summary of initiatives

Issue	
Campus Population (Students)	Relocate pedestrian crossing on Macpherson St further east to increase car bays on Macpherson St frontage (increase from 17 to 20)
	<ul style="list-style-type: none"> design to accommodate 2 way bus travel consider a raised pedestrian platform with appropriate threshold treatments (discuss with Council) NB: design to be reviewed with Council for endorsement
	Relocate drop-off and pick-up zones for Years 3-4 from Leichhardt St to Macpherson St, Years 7-10 to Macpherson St only and years 11-12 to Albion St only
	Amend departure time of years 5-6 from 3:00pm to 3:15pm
	Travel Initiatives <ul style="list-style-type: none"> Minibuses Carpooling Promotion of public transport
	Traffic Line Manager required at all drop-off and pick-up zones (i.e. Leichhardt St, Macpherson St and Albion St)
Campus Population (Staff)	Junior School student registration/number scheme - Traffic Line Manager matches students to numbers/names on car windscreens
	Travel Initiatives <ul style="list-style-type: none"> Cycling/walking/end-of-trip facilities Carpooling Subsidised public transport
	Work Place Travel Plan for Staff incl. provision of on-site parking
General	Operational Management Plan for facilities <ul style="list-style-type: none"> Aquatic Centre – weekend on-site parking Performing Arts Auditorium – on-site parking for events Pick-up/drop-off frontages – Traffic Line Managers
	Provision of 22x car spaces beneath RPAC
Initiatives/Strategies to be discussed with Authorities	<ul style="list-style-type: none"> Waverley Council: Design of kerb extensions on Macpherson St Measures to improve walking and cycling networks Waverley Traffic Committee Rationalisation of "No Parking" signposting

1 Introduction

1.1 Background

Arup has been engaged by Sandrick Project Directions on behalf of St. Catherine's School, Waverley (the School) to respond to issues raised by the NSW Department of Planning and Environment (NSWDPE). Arup recently produced a transport assessment report supporting the development application (DA) for the redevelopment of the School in August 2014. The formal DA was submitted in September 2014. A summary of the key issues raised during public exhibition of the application is provided in Table 4, with the relevant traffic and parking advice issued by NSWDPE on 19 December 2014.

Table 4: NSWDPE Forwarding Submissions (19 December 2014)

ID number	Key issues	Arup section
1	The Department is concerned with the traffic and on-street parking impacts to the local road network as a result of additional private vehicle trips in association with the proposed intensification of the use of the site. In this regard further consideration should be given to measures to mitigate these impacts, which should include:	
	additional mitigation measures to maintain existing levels of service at the nearby intersections (Macpherson Street/Albion Street and Macpherson Street/Leichhardt Street);	Chapter 3
	provision of an on-site drop-off and pick-up zone;	Section 2.2.1
	provision of on-site parking to cater for the use of the proposed facilities not associated with enrolled students of the School (i.e. the use of the auditorium for non-school related events with up to 500 patrons and the learn to swim programs);	Section 6.1 and 7.4
	the hours of operation of the proposed pool facilities for activities not associated with enrolled students of the School.	Section 6.2
	Identify at which stage of the campus expansion that traffic generated by the development would result in a change of Level of Service for each of the Macpherson Street/Albion Street and Macpherson Street/Leichhardt Street intersections (i.e. identify how many additional students in combination with operation of the new facilities can be supported before the performance of intersections would deteriorate).	Section 7.3
3	Provide further details of the travel demand management measures that will be implemented to promote a modal shift away from private vehicle.	Chapter 3
4	Provide further details regarding the operation of proposed shuttle bus services for events and the feasibility of such services for each type of event, including the number of services, pick-up times, the capacity of the service, drop-off zone and the likely usage for each type of event.	No longer considered based on Chapter 6
5	Provide the complete results from the St. Catherine's School Travel Surveys in the Traffic and Transport Assessment.	Provided separately

During the exhibition, certain issues were raised by the community regarding the existing situation in the area. These include:

- Residents concerned with existing traffic congestion
- Safety issues occurring from improper drop-off and pick-up activity by parents

Concerns were also raised about the proposed upgrades to the School:

- Generating additional traffic
- Campus population increase to 1,200 by 2029
- Reduced road network functionality
- Increased congestion from more drop-off and pick-ups
- Decrease in parking availability
- Zoning issues (overdevelopment)

In addition, the NSWDPPE have appointed Samsa Consulting to Peer Review the Transport Reports prepared by Arup, and provide independent traffic advice to assist with the successful resolution of the traffic and parking issues associated with the original application. Key issues raised by Samsa Consulting on behalf of NSWDPPE (in email dated 11 May 2015) are summarised in Table 5.

Table 5: NSWDPPE commentary (11 May 2015)

ID number	Key issues	Arup section
1	The arrival and departure traffic generation analysis (Section 6.3.1 and Table 12 and Table 13 of the TTA) only accounts for single direction student drop-off / pick-up movements. There would also be a return movement by the driver after dropping-off or before picking up students. Therefore, the traffic generation has been under-estimated.	Section 7.2
2	Further justification and clarification is required for the 30 per cent discount factor for traffic generation due to a number of factors such as extracurricular activities, early drop-offs / late pick-ups, vehicles using nearby streets and varying day-to-day travel patterns.	Section 7.2
3	Traffic distribution assessment assumes car trips would be to the nearest drop-off and pick-up location and does not factor in the restrictions for the zones for particular School years.	Section 2.2
4	The car mode/occupancy assumptions of 2.5 people per car and 80 per cent car mode share for events requires further information to support the assumptions.	Section 6.1
5	The School drop-off/pick-up period of 15 minutes appears to be optimistic and is more likely to last at least 30 minutes.	Section 7.3

ID number	Key issues	Arup section
6	The car parking demand should factor in any demand from organisers/performers and any staff that are not already on-site prior to the event(s).	Section 6.1
7	Further consideration of how on-street parking impacts would be managed is required as events are likely to start before residents return home.	Section 6.1.5
8	Further details are required regarding briefing and instructions for Traffic Line Managers at the drop-off/pick-up zone.	Section 2.2
9	Further details are required regarding management of event parking given the ramp to the car park has a very short queue length (2 cars).	An electronically operated traffic control system and adjustments to the internal driveway will be considered during detail design.
10	Further consideration of potential safety implications of the relocated pedestrian crossing in the vicinity of the car park entrance is required.	Section 2.1

The NSW DPE received submissions from a number of local and state government agencies and responses to the issues raised are provided in the Table 6.

Table 6: Local and State Government Agency submissions

Issue Raised	Arup response
Randwick City Council	
Construction traffic routes – two of the three routes identified will impact on Randwick residents and the Randwick Junction Town Centre.	The Construction Traffic Management Plan will be developed with key routes for access avoiding local streets. As suggested, use of Moore Park Road, Sydney Einfeld Drive and Carrington Road will be considered.
Car parking associated with the Aquatic Centre and Performing Arts Auditorium will place pressure on on-street car parking, particularly when both facilities are in use concurrently for an afternoon or evening major event.	The School will exercise management strategies to avoid overlap when it is expected that Performing Arts Auditorium will be operating at capacity. This asserts that the Aquatic Centre would not operate during these large events, hence reducing overall traffic and parking generation of the site. During the occurrence of these large events, on-site car parking for 75 cars may be available and managed under a School generated operational management plan. The existing on-site car parking is not currently used during events and hence there will be a significant improvement in minimising on-street parking demand.
The proposed shuttle bus loop service will not be effective.	The School will not be using a shuttle bus loop service. Instead, travel demand management measures have been identified for staff and student travel as outlined in Section 3.0.

A minimum of an additional 200 car parking spaces are required on campus.	Travel demand management measures have been identified for staff and student travel to reduce the reliance on the use of private vehicles as a primary mode of travel to and from School as outlined in Section 3.0. These will be implemented to result in an overall reduction in demand for car parking by staff. The School will exercise management strategies to avoid overlap when it is expected that Performing Arts Auditorium will be operating at capacity. During the occurrence of large events (up to 7 in one year), on-site car parking for 75 cars may be available and managed under a School generated operational management plan.
Waverley Council	
A minimum of an additional 200 car parking spaces are required on campus.	See response to Randwick City Council.
A drive through drop off/pick up area be integrated into the proposal	Section 2.2.
A condition of consent should also be incorporated to include a requirement that the School development a mode shift policy with specific performance indicators aimed at minimising traffic volumes and parking capacity issues.	Chapter 3.0.
The vehicular access ramp to the RPAC car park should be either widened to allow for full two way operation or be fitted with an electronically operated traffic control system that will allow only one vehicle on the ramp at a time. The ramp gradient and sight distance requirements need to be amended to comply with AS2890.1:2004.	An electronically operated traffic control system and adjustments to the internal driveway will be considered during detail design.
Service vehicles accessing the site off Albion Street will be required to enter and exit the site in a forward direction at all times.	All deliveries by small trucks and vans will occur at Gate 1. A loading zone will be allocated adjacent to the bus parking area. Only vans will use Gate 3 for access to a timed parking space for deliveries.
Waste collection – the bin storage area needs to be located in the vicinity of the substation.	The proposed bin storage area is immediately adjacent to the substation with gate access to the corner of Leichhardt Lane for collection.
Waverley Traffic Committee	
A minimum of an additional 200 car parking spaces are required on campus.	See response to Randwick City Council.
A drive through drop off/pick up area be integrated into the proposal	Section 2.2.
The School develop a modal shift with specific performance indicators	Chapter 3.0.
The existing driveway on Macpherson Street being widened at the car park entry and on Macpherson Street to cater for full and unimpeded two way operation and improve driver sighting of pedestrians.	An electronically operated traffic control system and adjustments to the internal driveway will be considered during detail design. The driveway is in the existing building and cannot be widened.

<p>The car park in the basement under the RPAC building being designed without blind aisles in order to improve circulation and prevent gridlock and queuing back out onto Macpherson Street during events at the School both during and outside school hours.</p>	<p>A car park of some 47 parking spaces is unlikely to have significant queues. If required, a bay occupancy system or equivalent management system may be considered to monitor the level of use and allow a "car park full" sign to be installed at the entry. If vehicles are observed to queue into the entry, vehicles will likely drive around to find a parking space on-street rather than block Macpherson Street. The new car park has turnaround provision in front of the internal ramp.</p>
<p>Parking associated with the operation of the aquatic centre should be fully catered for on-site.</p>	<p>The School will exercise management strategies to avoid overlap when it is expected that Performing Arts Auditorium will be operating at capacity. This asserts that the Aquatic Centre would not operate during these large events, hence reducing overall traffic and parking generation of the site. During the occurrence of these large events, on-site car parking for 75 cars may be available and managed under a School generated operational management plan. The existing on-site car parking is not currently used during events and hence there will be a significant improvement in minimising on-street parking demand.</p>
<p>The relocation of the existing pedestrian crossing on Macpherson Street to the east to provide additional spaces for vehicles in the drop off/pick up zone will require consultation with affected residents prior to implementation. It should be noted it is likely there will be significant opposition to the relocation of the crossing by residents who will lose on street parking outside and near to their dwellings.</p>	<p>Overall, there is a net increase in on-street car spaces provided in this location as a result of the proposed relocation.</p>
<p>The "Traffic and Transport Assessment" report failed to determine the impact there will be on traffic and parking should there be more than one event taking place at the School at the one time.</p>	<p>The School will exercise management strategies to avoid overlap when it is expected that Performing Arts Auditorium will be operating at capacity. During the occurrence of large events, on-site car parking for 75 cars may be available and managed under a School generated operational management plan.</p>
<p>The parking surveys undertaken in streets near the School should be carried out over a longer time period to cater for differing parking demands at the School on different days of the week.</p>	<p>Parking surveys have already been undertaken by Lyle Marshall and Associates and Arup during separate occasions. Both surveys have indicated similar conclusions.</p>
<p>There be better and improved organisation of the operation of the drop off/pick up zones on all road frontages to reduce the incidence of illegal parking and queuing of traffic through intersections, both in the short term, and longer term (see Clause 2 above).</p>	<p>Section 2.2.</p>
<p>Concern is raised for the adequacy of the drop off/pick up zone on Leichhardt Street to cater for</p>	<p>Section 2.2.</p>

any increase in the number of students using the gates at that zone to enter and exit the School.	
There be a localised widening of Leichardt Lane on its western side near the substation to cater for the manoeuvring of delivery vehicles and Council's waste removal trucks so that they can enter and exit Leichardt Lane in a forward direction.	Negligible amendments are proposed to the current waste collection arrangement conducted at the School. Independent of this application, Waverley Council may wish to assess the feasibility of adjusting their assets to provide a turning circle within Leichardt Lane to accommodate Council's waste removal trucks.
A detailed construction vehicle and pedestrian plan of management should be submitted to Council for approval for all stages of the development.	The Construction Traffic Management Plan will be developed with key routes for access avoiding local streets. As suggested, use of Moore Park Road, Sydney Einfeld Drive and Carrington Road will be considered.
There being a lack of a comprehensive and sustainable transport plan.	Chapter 3.0.
There needs to be further investigation into the performance of the intersections of Macpherson Street and Albion Street and Macpherson Street and Leichardt Street with a view to maintaining the current level of service.	A conservative SIDRA modelling approach was carried out in section 6.1.5. This does not include Green Travel initiatives discussed in Chapter 3.0. It is agreed that further observations be done in the future to monitor the effects of these implemented changes.
There is a lack of detail relating to the operation of a shuttle bus service for special events regarding the number of buses envisaged, who will operate them, what size buses will operate and where the buses will legally park.	This is no longer relevant as external events have reluctantly been withdrawn from the indicative Facilities Usage Profile in response to feedback received during public exhibition as well as further consultations with the NSWDPPE.
Transport for NSW	
The proposal may cause delays to current bus services on the surrounding road network.	Chapter 3.0 outlines travel demand measures that will be implemented to reduce the overall impact of the student and staff increases on the road system to maintain or improve current operating conditions.
The proposed integrated kerb extensions located on Macpherson Street should be constructed to accommodate two-way bus movements.	This will be incorporated into the design.
Measures and opportunities to improve, walking and cycling networks should be identified and implemented in accordance with Council's pedestrian and cycling strategies.	Discussions will be held with Council to provide feedback on more popular student walking routes. Council may then consider these upgrades.
Non-infrastructure measures should be considered such as promotion of walking and cycling and providing safety and confidence courses for school children (and staff).	See Chapter 3.0.
The design of the proposed pedestrian crossing on Macpherson Street should be reviewed by Council. They may consider a raised pedestrian platform with appropriate threshold treatments to ensure safe pedestrian crossing of this street.	This will be undertaken during detailed design.

Consideration should be given to providing bicycle parking facilities in excess of the minimum requirement. The NSW Bicycle Guidelines and Austroads - Cycling Aspects for Austroads Guides should be referenced for a suitable type of bicycle parking facility.	Bicycle parking demand for staff and students will be monitored by the school to ensure adequate facilities are provided so that this active mode can be promoted.
Bicycle parking facilities should be located in a convenient, accessible area which incorporates passive surveillance (i.e. visitors on the ground level, accessibility linked to building entrances, staff on level one/basement). The parking facilities should be distributed to coincide with the various pedestrian access points. The proposed bicycle parking facility which is accessed via a vehicle driveway and car park is not supported as it would result in a conflict between school children on bicycles and vehicle reversing in the car park.	Bicycle parking locations will be reviewed to provide accessible and safe locations.
Roads and Maritime Services	
The traffic study for the proposal indicates the intersections of Macpherson Street/Albion Street and Macpherson/Leichhardt Street will perform poorly in the future. The applicant, in consultation with Council, needs to further investigate the performance of these intersections, with a view of maintaining the current level of service.	Chapter 3.0 outlines travel demand measures that will be implemented to reduce the overall impact of the student and staff increases on the road system to maintain or improve current operating conditions.
Any changes to the existing parking controls around the School need to be approved by the Local Traffic Committee.	Noted.
All works/regulatory signposting associated with the proposed development are to be at no cost to Roads and Maritime.	Noted.
NSW Police Force	
Road network congestion - The development application currently does not adequately address the issue of traffic congestion and instead indicates that there will be an increase in vehicle movements as a result. Consideration needs to be given to the encouragement in the use of public transport services which frequent the area and bicycle use by staff and students.	Chapter 3.0 outlines travel demand measures that will be implemented to reduce the overall impact of the student and staff increases on the road system to maintain or improve current operating conditions.
School Drop Off and Pick Up Safety - The development application has identified that there will be a 23% increase in the student capacity to 1200 however, has not made a provision to alleviate the relative increase in vehicle movements.	Chapter 3.0 outlines travel demand measures that will be implemented to reduce the overall impact of the student increase with the current levels of drop-off and pick-up expected to be maintained or improved.
With the increase in student capacity and relevant vehicle movements, serious consideration needs to be given to the provision off street 'loop' style drop-off and pick-up facilities on the School grounds.	See Section 2.2.1
Provision of parking - Eastern Suburbs Local Area Command submits that off street parking will need to be increased to an appropriate figure not less than 200 to accommodate the increase in	Travel demand management measures have been identified for staff and student travel as outlined in Section 3.0. These will be implemented to result in an overall reduction in car parking by staff. The

functions and the capacity of venues within the School.	School will exercise management strategies to avoid overlap when it is expected that Performing Arts Auditorium will be operating at capacity. During the occurrence of large events, on-site car parking for 75 cars may be available and managed under a School generated operational management plan.
Reported crash rates - Eastern Suburbs Local Area Command submits that using low crash rates as a mechanism to provide support for this development application is unreliable.	The crash analysis has been undertaken to provide an understanding of the types of crashes occurring so that the School can respond to these in their educational/ information campaigns aimed at students and parents.
Access to and from RPAC Car Park - the car park entrance operate on a 'left turn in, left turn out' basis. To enforce this, Eastern Suburbs Local Area Command submits that a raised concrete median strip be installed adjacent to the car park entrance and the relevant signs be installed.	See Section 6.1.1.

1.2 Objectives

This report has been prepared to provide advice for future planning measures for the School to mitigate possible impacts from the increase of campus population (staff and students) and usage profile management.

It will address this by recommending that consideration be given to implementing a combination of strategies and measures, which would be adopted to produce a cumulative strategy to address the issues raised.

1.2.1 Campus population

The ultimate goal is to reduce existing and mitigate future traffic congestion and parking issues caused by the School's campus population, thereby effectively mitigating the traffic and parking impacts associated with the proposed School development. Key issues to address include

- Reducing private vehicle usage from Staff and therefore demand for parking provisions
- Reducing private vehicle usage (pick-ups and drop-offs) from parents of students

The campus population assessed in the Arup Transport report (2014) is shown below in Table 7. This table shows both the current population and the proposed population in 2029.

Table 7: Campus population – current and proposed

Years	As at Oct. 2013	Proposed by 2029
K	34	50
1	50	50
2	49	50

Years	As at Oct. 2013	Proposed by 2029
3	43	50
4	51	50
5	78	100
6	72	100
7	104	125
8	110	125
9	102	125
10	111	125
11	84	125
12	83	125
Sub-totals	971	1200

It should be noted that 70 students of the above totals are boarders that reside within the School and would not generate a trip as a result. These students are assumed to be spread amongst the Senior School (Years 7-12), equating to approximately 11 per year group. This is not expected to change as a result of the population increase.

Additionally, the 2014 transport report identified 175 full-time staff and 27 part-time staff. It is proposed to increase full-time staff numbers by an extra 10 full-time staff members, bringing the campus population to a total of 212 staff by 2029.

1.2.2 Indicative usage profile for Stage 1 facilities

The existing and future effects of the School on the surrounding network will be examined. The key issues addressed are:

- Traffic congestion and selected local intersection performance
- Provision of adequate parking facilities

1.3 Methodology

The following methodology has been adopted thus far:

- Travel methods were derived by investigating innovative initiatives both globally and locally with regards to:
 - Advantages and disadvantages of the travel method and applicability to the School
 - The relevance to the DA considered together with the implementation strategy
- Travel methods were classified into addressing:
 - Existing and proposed campus Population
 - Indicative usage profile of proposed facilities in Stage 1 of the Master Plan
 - Assess a combination of longer term behavioural change and more immediate benefits to existing and proposed situations

- The initiatives with theoretical performance targets and associated benefits were then presented to the Headmistress and Head of Finance and Operations
- A workshop was undertaken with the Headmistress and Head of Finance and Operations with the primary objective being to endorse a shortlist of travel initiatives to inform the preparation of online surveys used to gather further data from the School population specific to these strategies. Key areas of interest were:
 - Current barriers to the adoption of alternate modes of travel
 - Interest in adopting proposed initiatives
 - Incentives available to encourage mode shift
- A subsequent workshop was conducted with the NSWDPPE and their traffic consultant to discuss the proposed travel initiatives and their impact towards addressing issues raised during public exhibition, as they relate to car parking, traffic and transport management
- A second online traffic survey was prepared by ARUP and distributed to the School population to confirm the likelihood of the School population to adopt the alternate travel modes proposed
- A subsequent meeting was conducted with Randwick City Council to discuss the School's response to their submission during public exhibition
- A subsequent meeting was conducted with Waverley Council to discuss the School's response to their submission during public exhibition
- Data gathered from the online survey, the workshop with the NSWDPPE and meetings with local government was used to inform and refine the proposed implementation of the travel initiatives detailed within this report

2 Overview of School generated traffic

The Arup transport report submitted with the development application in 2014 outlined the proposed reallocations of drop-off and pick-up locations. This section investigates the effects these changes might have on each street around the School while taking into consideration the campus population increase by 2029.

2.1 Proposed site accesses

The School has identified the following objectives for the Campus Master Plan:

- Create new Junior School and Senior School pedestrian entries off Albion Street and Leichhardt Street (respectively), which are sympathetic to existing traffic conditions and provide a safe, accessible pedestrian link between Albion Street and Leichhardt Street for the School community
- Create a new, safe formal School entry from Macpherson Street directly to the Administration Building via the Museum (Gate 6), separating vehicle entry from pedestrian entry whilst emphasising the significance of the School's heritage

The campus will consolidate a number of entry/exit points so that access is more controlled into School grounds. This will provide an accessible through site link from Albion Street to Leichhardt Street for wet weather throughout the campus. Changes to the site accesses are shown below in Figure 1.

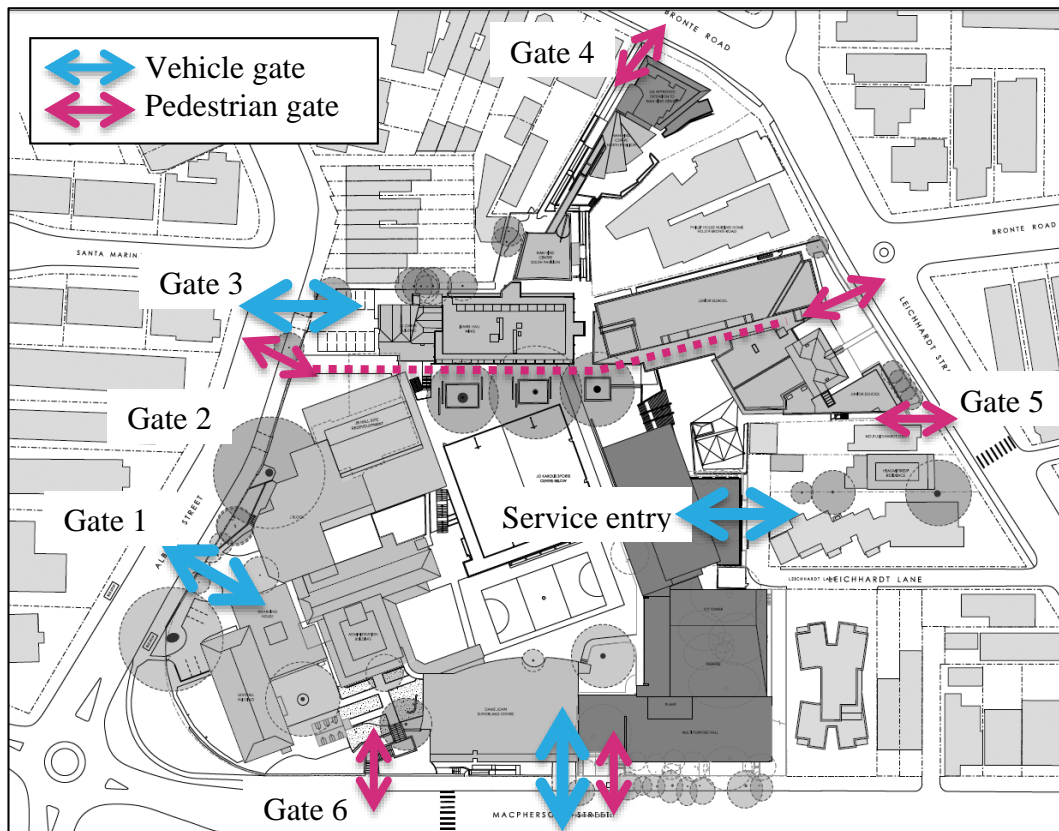


Figure 1: Proposed site accesses

Macpherson Street

School access to the Macpherson Street school zone will be improved by the new pedestrian access to the School via the RPAC building as shown in Figure 2.

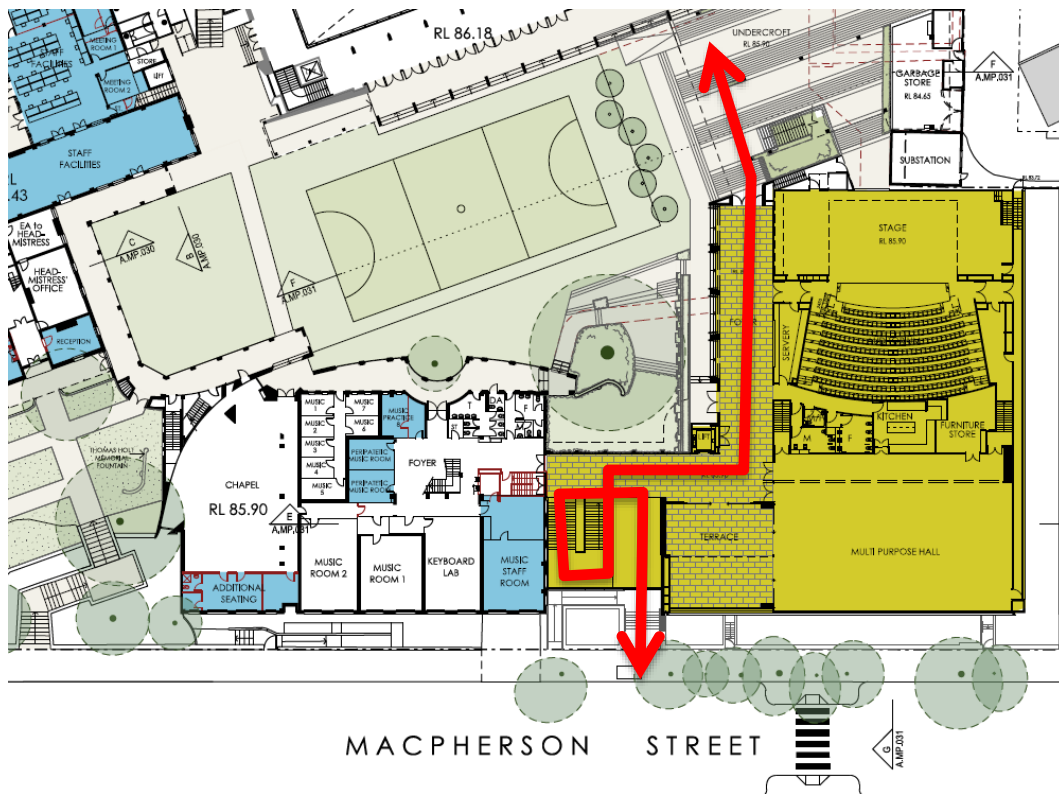


Figure 2: New School pedestrian access to Macpherson Street

With the School access being located further to the east of Macpherson Street than the existing formal access, the existing drop-off / pick-up zone will function more efficiently as it will encourage vehicles to proceed further east and hence reduce the occurrence of vehicle queuing back towards the Albion Street / Macpherson Street roundabout. Further improvements to the Macpherson Street school zone have been identified to provide a more efficient level of operation and to allow additional use by the School. These are shown in Figure 3 and include:

- Relocating the existing zebra crossing to the east to coordinate with the existing bus zones and to relate to the new School pedestrian access via the RPAC building. This results in increased queuing capacity.
- Building integrated kerb extensions on each side of the pedestrian crossing so that the crossing is better defined and complies with Roads and Maritime Services (RMS) guidelines for appropriate 'No Stopping' areas on approach and departure. This results in improved operational safety.
- Relocating the kerbside bus zones, so that they are on the departure side of the zebra crossing (i.e. located after passing the crossing in the respective travel lane). This results in increased queuing capacity and improved operational safety.
- Creating a continuous 'No Parking' drop-off/pick-up zone for up to 20 vehicles which will permit an efficient flow of vehicles.

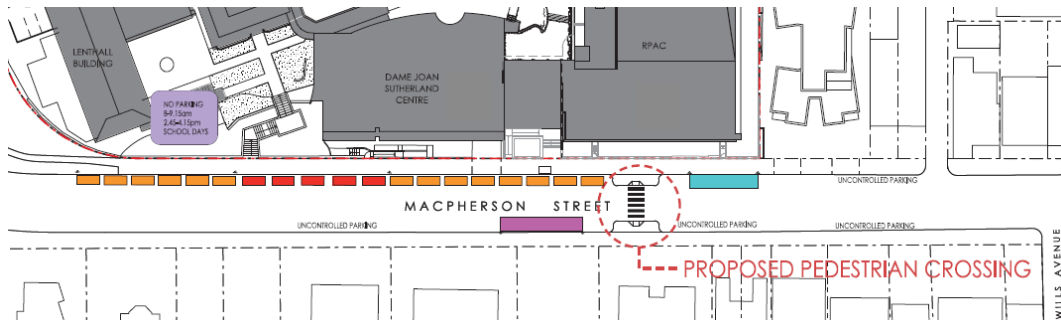


Figure 3: Proposed adjustments to the zebra crossing in Macpherson Street

The relocation of the pedestrian crossing will remove the previous break in the car-line along Macpherson Street, which currently has cars often queued illegally over the crossing. Efficiencies will be gained as the pick-up facility will be managed as a single unbroken carline. There were no issues identified with queuing at this location currently and the 3 extra spaces will limit potential queuing onto the travel lanes. It should be considered that Years 7-10 will be gradually making their way to the pick-up whereas the Years 5-6 will be carefully managed to ensure they are picked-up quickly.

The proposed crossing is located a similar distance away from the car park access and has better sightlines due to the proposed kerb build-out.

The existing zebra crossing is closer than the proposed location to the car park driveway and located on a right turn from the site which is inherently unsafe. While it is acknowledged that the car park is increasing in size, the location on a left turn is much safer. There are at least 3 car spaces before the driveway and vehicles will likely give-way to exiting vehicles during use of the crossing.

Driveway will be restricted from use during pick-up periods and will be managed by school traffic line managers during drop-off to allow for vehicles to enter if required. If required, the school traffic line managers may let vehicles out by breaking the carline. Cars will only be allowed to turn left.

2.2 Proposed Drop-off and Pick-up Locations

With improvements to the Macpherson Street No Parking zones, it is recommended that additional pick-up and drop-off activity can occur with use by Years 3-4 prior to Years 5-6 and Years 7-12. The proposed locations of the set-down areas are shown in Figure 4 (note that kerbside lengths may not be to scale).

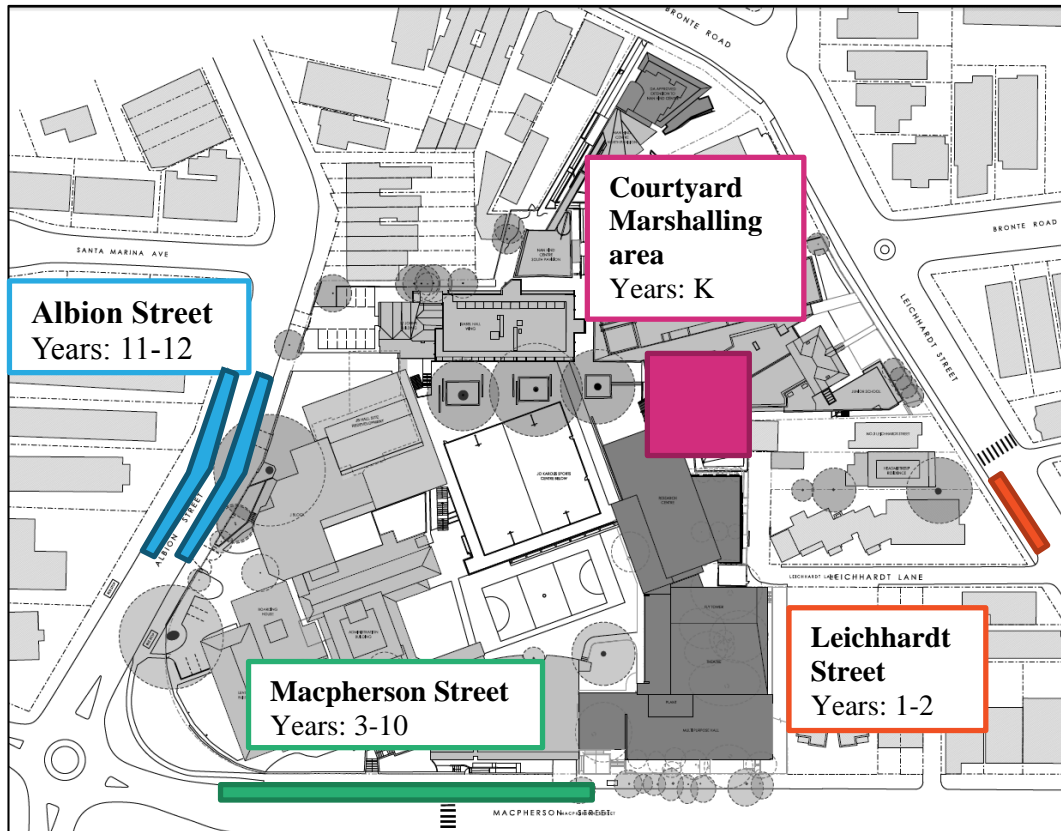


Figure 4: Proposed drop-off and pick-up locations

Travel survey data was analysed to generate an estimate of the existing proportions of students who use private vehicles as a form of transport. Coupling this data with the known proposed campus population profiles (see Section 1.2.1), an estimate of the future and existing trends can be analysed.

A detailed Operational Traffic Management Plan will be prepared to determine key aspects of drop-off and pick-up operation including briefing and instructions for Traffic Line Managers at the drop-off/pick-up zone.

2.2.1 On-site drop off bays

An off-street pick-up /drop-off facility has been investigated by PD Mayoh. The only suitable location was found to be from gates along Albion Street, as shown on Figure 5.

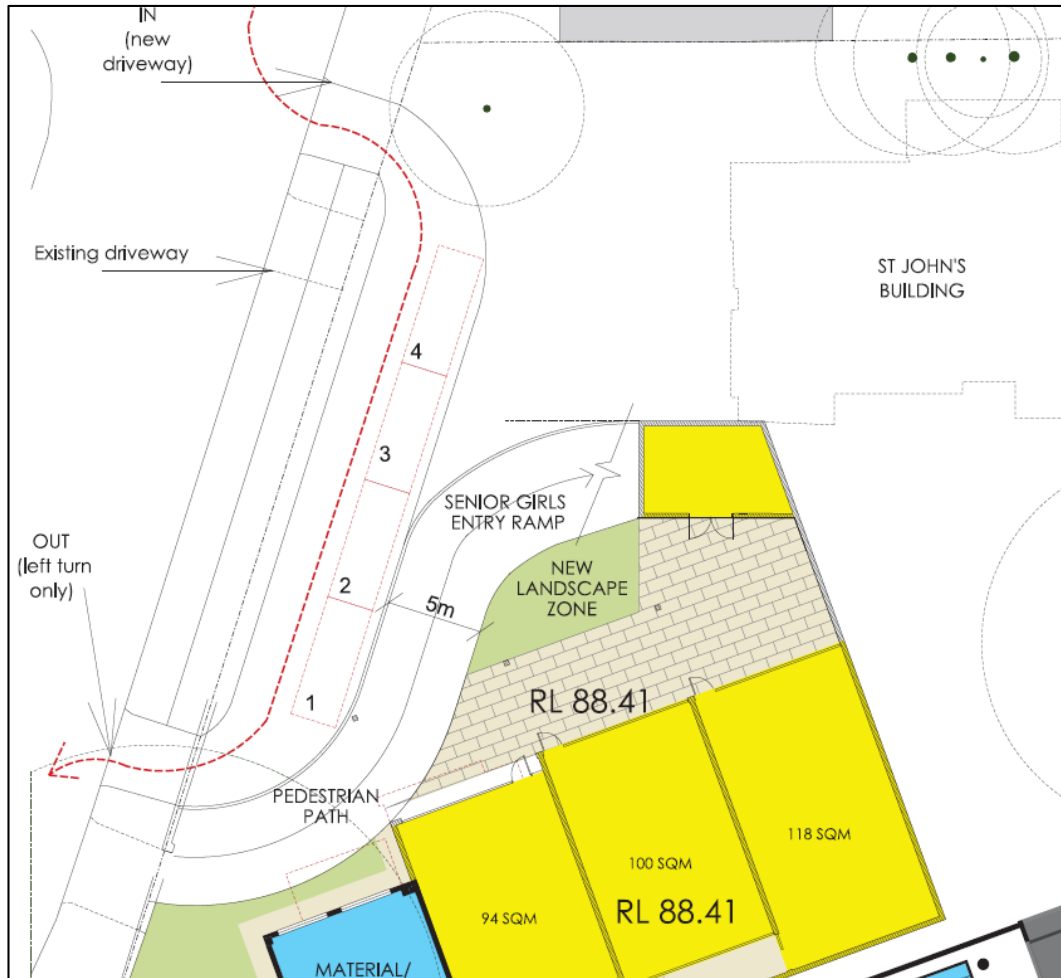


Figure 5: Off-street drop-off facility

An assessment was undertaken of plans prepared by PD Mayoh on the potential facility and the review found that:

- Only four bays have been provided within the length specified (only one option – illustrates impact on proposed pedestrian crossing and possibility for relocation) which is grossly undersized for the pick-up and drop-off requirements of the School;
- The constrained nature of the site does not lend itself to any other feasible alternative without significantly impacting existing built forms;
- There is insufficient length within each bay (6.4m) for vehicles to drive forwards in, so independent operation would be hindered (only reverse manoeuvres would be physically possible for bays 1-3);
- Due to limited capacity, a carline would be required with potential queues onto the street and over the footpath since queue lengths would not be accommodated within the site;
- The vehicles are required to cross the footpath to access the site, introducing conflicts with pedestrians already on Albion Street, which would likely include a number of students; and
- There would be high demand for vehicles from Albion Street (south), which would likely conflict with vehicles from Albion Street (north). This would be

difficult to manage and as such, queues are likely to develop for vehicles attempting to turn right into the site.

2.2.2 Drop-Off

The proposed drop-off locations compared to the existing are shown in Table 8. The Courtyard is located within the Junior School precinct and parents park in surrounding streets to walk-in students ensuring their safe travel to the School. This allows St Catherine's School staff to maintain supervision of all Kindergarten students until all students arrive.

Table 8: Proposed adjustments to drop-off zone allocation

Year	Existing drop-off arrangements		Proposed drop-off arrangements	
	Arrival time	Drop-off location	Arrival time	Drop-off location
K	7.20am – 8.20am	Courtyard	7.20am – 8.20am	Courtyard
1-2		Leichhardt Street		Leichhardt Street
3-4		Leichhardt Street		Macpherson Street
5-6		Macpherson Street		Macpherson Street
7-10		Macpherson/Albion Street		Macpherson Street
11-12		Macpherson/Albion Street		Albion Street

A total of 550 responses with credible data were collected through the initial traffic survey. A summary of each year group for car mode drop-off is found in Table 9. Based on existing student enrolments, this shows that there is a greater proportion of the students relying on private vehicles as a mode of transport to School in the Junior School years (K-6) between 66-94%. It should be noted that 70 students are assumed to board in the Senior School only (Years 7-12), equating to approximately 11 per year group.

Table 9: Students who use private vehicle for drop-offs

Year	Proportion of private vehicle users	2013 Students using private vehicle	2029 Students using private vehicle
Kindergarten	75%	26	38
Year 1	93%	46	46
Year 2	92%	45	46
Year 3	94%	40	47
Year 4	78%	40	39
Year 5	81%	63	81
Year 6	66%	47	66
Year 7	61%	57	70
Year 8	54%	53	61
Year 9	46%	42	53
Year 10	52%	52	60
Year 11	50%	37	57
Year 12	68%	49	77
Total Private Vehicle Users		597	741

Note that the figures in Table 9 are revised from the 2014 transport report as the car mode has been broken down by the year group to allow for a more refined model.

The forecasted number of private car users arriving to school in 2029 was found to be approximately 741 students based on the 2013 car mode share per year group. It should also be noted the travel survey indicated that 20% of students had a sister travelling to the School, so therefore there is a car occupancy factor of 1.2 that should also be applied. Using the factor and number of students travelling to school by car, the number of cars assumed to arrive at the School in 2013 and 2029 is 498 cars and 618 cars respectively. The estimated utilisation for each street, based on the existing and proposed drop-off locations for 2029 are shown in Table 10.

Table 10: Future car utilisation of drop-off locations during the AM peak hour

Street	Current usage (2014)	Existing drop-off locations		Proposed drop-off locations	
		Future Usage	Change from 2014	Future Usage	Change from 2014
Leichhardt Street	164	180	+16 (10%)	108	-56 (34%)
Macpherson Street	213	280	+67 (32%)	398	+185 (87%)
Albion Street	121	158	+36 (30%)	112	-9 (9%)
Total	498	618		618	

Queuing from the Leichhardt Street drop-off zone is currently an issue into the Leichhardt Street / Macpherson Street roundabout given that the majority of private car users are in the Junior School years which drop-off/pick-up at this location. The queuing from this location often spills back into the roundabout and its approaches, limiting the network capacity by stopping all road users in the area.

The reallocation of some Year groups to the Macpherson Street drop-off (which was observed to have significantly more capacity) will reduce the queuing experienced in Leichhardt Street by limiting the turning movements into Leichhardt Street and increasing overall capacity of the road network. Directing vehicles to Macpherson Street, even if they use the Leichhardt Street roundabout in the future, will have potentially more space for queuing along Macpherson Street and vehicles may be able to detour or divert up Leichhardt Street if the queues were an issue to avoid the area.

2.2.3 Pick-ups

Changing the pick-up time of Years 5-6 students from 3.00pm to 3.15pm will create a staggered arrival time for parents to further minimise congestion experienced around the School. This will increase the kerbside pick-up capacity available by forcing parents to move on (given the parking restrictions applicable). At the completion of each School day, Junior School students are marshalled in the Junior School precinct Courtyard. This allows St Catherine's School staff to maintain supervision of all kindergarten students until their parents arrive, ensuring their safe travel home from School. Parents of Kindergarten students typically park in nearby surrounding streets temporarily and walk their students from the School.

Table 11: Proposed adjustments to pick-up zone allocation

Year	Existing pick-up arrangements		Proposed pick-up arrangements	
	Finish time	Pick-up location	Finish time	Pick-up location
K	2.45pm	Courtyard	2.45pm	Courtyard
1-2	2.50pm	Leichhardt Street	2.50pm	Leichhardt Street
3-4	3.00pm	Leichhardt Street	3.00pm	Macpherson Street
5-6	3.00pm	Macpherson Street	3.15pm	Macpherson Street
7-10	3.20pm	Macpherson/Albion Street	3.20pm	Macpherson Street
11-12	3.20pm	Macpherson/Albion Street	3.20pm	Albion Street

A summary of each year group for car mode pick-up is found in Table 12. This shows that most of the students relying on private vehicles as a mode of transport to School, are similarly in junior years (K-6) between 51-93%. There is a greater proportion of Junior School students relying on private vehicle.

Table 12: Students who use private vehicle for pick-ups

Year	Proportion of private vehicle users	2013 Students using private vehicle	2029 Students using private vehicle
Kindergarten	81%	28	41
Year 1	93%	46	46
Year 2	92%	45	46
Year 3	88%	38	44
Year 4	91%	47	46
Year 5	76%	59	76
Year 6	51%	37	51
Year 7	43%	40	50
Year 8	45%	44	51
Year 9	22%	20	25
Year 10	37%	37	42
Year 11	13%	9	14
Year 12	45%	33	51
Total Private Vehicle Users		483	583

Note that these figures are revised from the 2014 transport report as the car mode has been broken down by the year group to allow for a more refined model.

The forecasted number of private car users departing the School in 2029 was found to be approximately 583 students based on the 2013 car mode share per year group. It should also be noted the travel survey indicated that 20% of students had a sister travelling from the School, so therefore there is a car occupancy factor of 1.2 that should also be applied. Using the factor and number of students travelling to School by car, the number of cars assumed to depart the School in 2013 and 2029 is 403 cars and 486 cars respectively. The estimated utilisation for each street, based on the existing and proposed drop-off locations for 2029 are shown in Table 13.

Table 13: Future car utilisation of pick-up locations during PM peak hour

Street	Current usage (2014)	Existing Pick-up locations		Proposed Pick-up locations	
		Future Usage	Change from 2014	Future Usage	Change from 2014
Leichhardt Street	170	186	+16 (9%)	111	-59 (35%)
Macpherson Street	156	203	+46 (30%)	321	+165 (105%)
Albion Street	77	97	+20 (27%)	54	-23 (29%)
Total	403	486		486	

Similarly to the AM peak hour, queuing from the Leichhardt Street pick-up zone is currently an issue into the Leichhardt Street / Macpherson Street roundabout given that the majority of private car users are parents of students in the Junior School. The reallocation to the Macpherson Street pick-up (which was observed to have significantly more capacity) will limit the queuing experienced in Leichhardt Street by limiting the turning movements into Leichhardt Street and increase overall capacity of the road network.

2.2.4 Key Findings

Traffic distribution in the 2014 transport assessment assumed that car trips to and from the site from surrounding residential areas would be to the nearest drop-off and pick-up location. As such, 35% was assigned to Albion Street, 45% to Macpherson Street and 20% to Leichhardt Street. Notably, the proportions assigned in the 2014 report are relatively consistent with our drop-off and pick-up analysis of the 2029 student population at existing drop-off locations, without the proposed drop-off diversions described in sections above.

Given the local congestion on streets surrounding the site, this may not be unrealistic as car users dropping off or picking up students may approach from the nearest street to the closest drop-off or pick-up relative to their year group. (e.g. Junior School students are more likely to approach from Macpherson Street than Albion Street). In addition, outgoing trips from the drop off / pick-up zone may either continue straight or turn around via the number of roundabouts. We have analysed the additional traffic turning around at the roundabouts, as this conservatively constrains capacity (vehicles are within the roundabout longer and stop all approaches).

Leichhardt Street currently experiences significant congestion with the drop-off/pick-up activity associated with the Junior School (Years 1-6). Similarly, Albion Street experiences congestion with impacts to public transport and pedestrian uses.

The utilisation and limited capacity of these drop-offs and pick-ups were observed to negatively affect the road network operation surrounding the School, reducing safety for all road users and pedestrians. It was observed that excessive network queuing through the roundabouts resulted in traffic undertaking dangerous manoeuvres such as parking across driveways, illegal overtaking, illegal U-turns and double parking.

With the proposed allocations, it is expected that approximately 34-35% less traffic associated with drop-offs and pickups respectively would occur along Leichhardt Street. Similarly with Albion Street, 8% -9% less traffic associated with drop-off and pick-up would be expected respectively.

It is anticipated that the proposed upgrades to Macpherson Street drop-off/pick-up zone will increase kerbside capacity (of approximately three cars and no break in carline due to the zebra crossing). With the additional spreading of finish times, this zone will therefore be able to accommodate the shift in drop-off and pick-up traffic, without excessive queuing. It is anticipated that this will decrease overall road network congestion and improve safety of the area, as there will be less parents searching for kerbside spaces and blocking the carriageway for other road users.

2.3 Staff travel

The School had 202 employees as of October 2013 (including 175 full time and 27 part time employees). The Master Plan will provide the potential for up to 10 additional employees (approximately).

The 2014 School travel survey identified the travel modes of the staff and the results of the survey are outlined below in Table 15. From the data, it was found that approximately 75% of full-time staff drive and 71% of part-time staff drive. This was relatively consistent with 2011 Journey to Work Census data and is detailed in the 2014 transport report.

Table 14: Staff trips by mode undertaken during the peak hours

Morning Arrival	No.	Car			Public Transport		Walk		Ride-share	
		%	No. People	No. Cars	%	No. People	%	No. People	%	No. People
Existing (2013)										
Full-time staff	175	75%	131	131	17%	29	6%	11	2%	4
Part-time staff	27	71%	19	19	29%	8	0%	0	0%	0
Total Staff	202		150	150		37		11		4
Proposed (2029)										
Full-time staff	185	75%	139	139	17%	31	6%	11	2%	4
Part-time staff	27	71%	19	19	29%	8	0%	0	0%	0
Total Staff	212		158	158		39		11		4
Change	+10		+8	+8		+2		0		0

It is assumed that the extra staff will result in an extra 8 trips during the AM and PM peak hours. It should be noted that PM peak hour for staff occurs during the PM commuter peak hour (5:00-6:00pm) rather than the PM school peak hour (2:30-3:30pm). The AM peak hour for staff is assumed to coincide with the student arrival peak hour (7:30-8:30am).

3 Travel Methods

A range of travel method alternatives have been recommended as well as incentives to change travel behaviour over the short and longer term period. The purpose is to encourage mode shifts away from private vehicle usage and create a positive outlook for active transport.

These initiatives aim to improve the existing and future conditions of campus population increase by:

- Reducing private vehicle usage from staff and therefore parking demand
- Reducing private vehicle usage (pick-ups and drop-offs) from students
- Reducing traffic congestion and improving intersection performance

The targets associated with these travel methods aim to reduce car trips to the development so there is no net impact from School population and proposed development increases on existing traffic conditions.

3.1 Students Preferred Methods

The list of travel methods presented by Arup were reviewed by the School. Several preferred travel initiatives to address the above mentioned criteria were identified. Three travel methods for students were selected by the School's Headmistress and Head of Finance and Operations for further investigation.

3.1.1 Mini Buses

This initiative should be a long term initiative which should be constant throughout the entire School term. Based on information provided by the School, the School currently has three mini buses, two of which are 25 seat capacity and one which is 12 seat capacity. During the existing operation, the School runs one bus which services between 6-19 students on a given day. The travel survey has assumed a total of 7-9 children using the single bus service.

Given the high reliance on private vehicle usage by students, Arup have identified an opportunity to significantly reduce cars on the road network by providing two additional bus services/routes specifically for local students. If three 25 seat buses are assumed in the future at 75% capacity, discounting the existing students using the students gives a reduction of approximately 50 students or 42 cars (with assumed car occupancy of 1.2).

In the last survey conducted by Arup, the street name and suburb of staff and students was obtained, allowing for future route planning. A dedicated bus set-down and pick-up bay in School periods could be allocated as part of the Macpherson Street set-down /pick-up zone.

3.1.2 Carpooling

The School would set up a system where real-time carpool information from participants can be displayed or changed. Schedules can be managed through a cloud, google maps or various smartphone applications. Carpooling should be a

long term initiative. With consistent promotion of this travel mode and incentives, students and parents will become aware of the benefits and convenience.

An implementation strategy would need to be considered so that student privacy is protected. It is assumed that such an initiative would likely operate through parents on a carpooling forum. This initiative would operate under management of the School by encouraging parents to be proactive in offering carpooling services. This can be promoted in School newsletters, parent teacher meetings and by educating students on the benefits of this initiative. As an incentive for parents, car pool stickers can be given out, giving these shared cars prioritised and designated drop off locations.

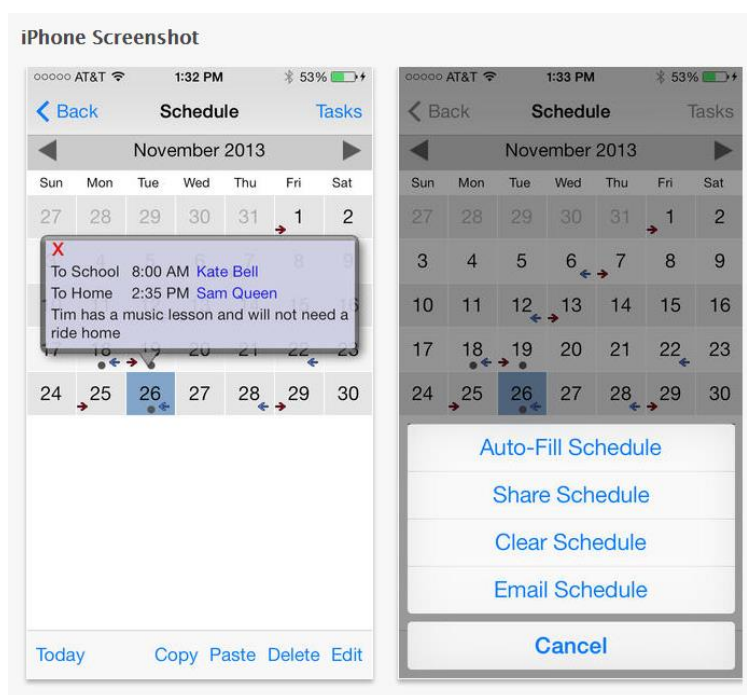
Arup have identified an opportunity to significantly reduce cars on the road network by carpooling. Based on a student mode shift of 5% from private vehicle mode to carpool, this may result in a net reduction of approximately 50 cars during both the AM and PM peak hours.

3.1.2.1 Car pool Apps

A range of free apps are currently available online to assist with the implementation of this initiative; two examples are provided below for information. The School will investigate the most appropriate app that aligns with its Child Protection Policies before promoting this initiative.

Carpool – School Edition

This app is designed specifically for students who carpool to school. It allows students to identify which of their friends live nearby and invite them from their contacts provided they have the app as well. This app is available only on iPhone Operating Systems, however the calendar schedule can be emailed to computers.



Source: iTunes

Figure 6: Carpool School Edition

KarPooler

KarPooler acts as a scheduler and also lets you text all adults linked to the kids in the carpool.

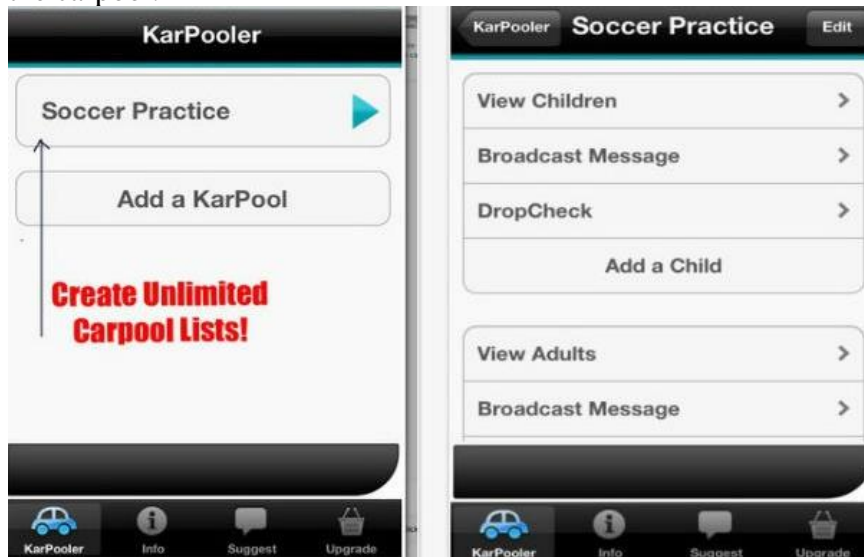


Figure 7: KarPooler app

Pool My Ride

This app is public in nature where anyone with the app can view your travel preference. This would therefore suit staff mostly, as it would be assumed that parents would rather other parents, of the same School to be driving their children to school.

This app requires a Facebook account to login. One can create a car pool route or choose to join the route. The app also allows for communication.

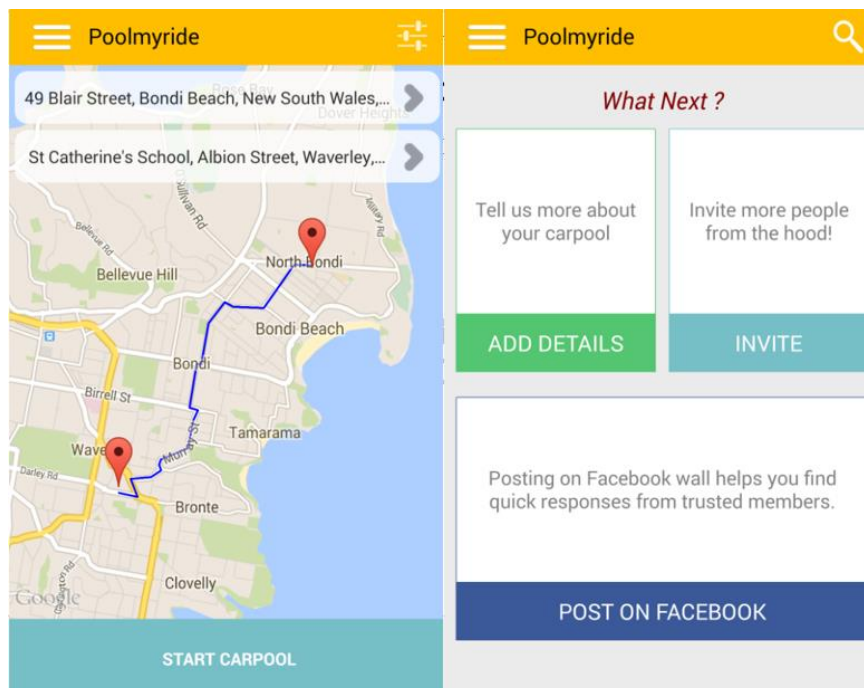


Figure 8: Pool My Ride app

3.1.3 Promote Public Transport

Currently students have to pay for public transport if they live within a certain distance of the School. This varies between the year groups and costs up to \$52 per term if they live within the distances as follows:

- a primary student (Years 3-6) who lives more than 1.6km (radial distance) from school, or 2.3km or more by the most direct practical walking route
- a secondary student (Year 7-12) who lives more than 2km (radial distance) from school, or 2.9km or more by the most direct practical walking route

It should be noted that an infant student (K, Year 1 and Year 2) older than 4 years and 6 months who lives any distance between home and school does not need to pay for public transport passes.

The School currently coordinates the process of having bus passes arranged for students (about 500 passes issued). The School will continue to do this and raise awareness of this as an offering, to encourage greater use of public transport.

Arup have identified an opportunity to reduce the number of cars on the road network by reinforcing the benefits of utilising public transport to the School population. Based on a student mode shift of 5% from private vehicle, this may result in a net reduction of 50 cars during both the AM and the PM peak hours.

3.2 Staff initiatives

The list of travel methods presented by Arup were reviewed by the School. Several preferred travel initiatives to address the issues were identified. Three travel methods for staff were selected by the School's Headmistress and Head of Finance and Operations for further investigation.

It is envisaged that the following initiatives would:

- Reduce parking demand from staff
- Reduce private vehicle usage of staff
- Reduce traffic congestion and improve existing intersection performance

3.2.1 Subsidised Public Transport

Under this scheme the School would subsidise the cost of public transport (in part or in full) utilised by Staff during their travel to and from School on business days. Interested participants would register their interest prior to commencement of each calendar year.

It has been assumed that 10% of all staff (part-time and full-time) may take up an offer such as this. This would lead to 23 staff changing from car mode to public transport during both the AM and PM peak hours.

3.2.2 Active Transport/ Bike/ Scooter

Promoting active transport through cycling and walking should be considered. Provision of adequate end of trip shower and locker facilities was considered during the development of the concept design for the Master Plan. Bike loan or subsidised bicycle schemes could also provide staff with an incentive to adopt active transport.

Staff should also be encouraged to ride scooters or motorcycles to work. Parking spaces should be provided to provide an incentive for users.

It has been assumed that a mode shift of 5% may occur with improved facilities and promotion. This would result in a mode shift reduction of 11 cars (including both part-time and full-time staff) during both the AM and PM peak hours.

3.2.3 Carpooling

Staff should also be encouraged to participate in carpooling. Possible ways to further encourage carpooling may include staff registering their interest in carpooling by indicating where they live and matching their shift times with colleagues. Incentives in terms of priority parking on the campus should be considered for car pool users.

Under this scheme, the School would set up a system where real-time carpool information from participants can be displayed or changed. Schedules can be managed through a cloud, google maps or various smartphone applications (examples provided in Section 3.1.1). Carpooling should be a long term initiative. With consistent promotion of this travel mode and incentives, staff should be aware of the benefits and convenience.

It has been assumed that a mode shift of 5% may occur with improved promotion and management. This would result in a mode shift reduction of 9 cars (for full-time staff only as part-time staff would have various start and finish times) during both the AM and PM peak hours.

3.3 Potential Mode Shifts

A high level study of the potential mode shift from students is analysed in this section. The 2029 projected campus population based on no mode shift is compared with the potential mode shift through introducing travel alternatives using the car trip data from the 2014 report.

The take up of initiatives have been calculated based on relatively low mode shifts from private car use. These assumptions will be adjusted based on the results of the questionnaires, but they are considered at this stage to be conservatively low. Detailed calculations and assumptions used are found in Appendix A.

3.3.1 Students

Based on the proposed travel modes for students, the estimated number of car trip reductions over the proposed campus population numbers are shown in Table 15. The following numbers are indicative targets formulated before survey results

were received, indicating a potential reduction of 142 cars during pick-up and drop-off periods.

Table 15: Potential private vehicle usage reduction to drop-off and pick-up

Initiative	Assumed reduction in cars to 2029 forecast School population
Mini Buses	-42
Carpooling	-50
Promote Public Transport	-50
Total	-142

The existing traffic generation to the site is 498 cars during the AM peak and 403 cars during PM peak. Given that the forecast traffic generation is approximately 618 cars during AM peak and 486 cars during PM peak with campus population increase, if all initiatives are implemented the forecast number of car trips identifies a reduction of 22 cars during the AM peak and 58 less cars during the PM peak compared to traffic generation associated with existing (2013) campus population. This will however result in minimal changes to the overall network performance and congestion on streets around the School due to high background growth in the area. Level of service and delay of surrounding intersections will remain similar to the existing situation with the proposed initiatives.

3.3.2 Staff

Based on the proposed travel modes for staff, the estimated number of car trip reductions are shown in reductions over the proposed campus population numbers are shown in Table 16. It shows that there is a potential to reduce the number of car trips by approximately 43 vehicles.

Table 16: Potential private vehicle usage reduction to current car trips

Initiative	Reduction in car users to 2029 forecast population increase
Subsidised Public Transport	-23
Active Transport/Bike/Scooter	-11
Carpooling	-9
Total	-43

Given staff trips currently account for 150 cars during the given peak hours and are forecast to increase to 158 with the campus population increases, a reduction of 43 vehicles signifies an overall net reduction of trips on the road network. The forecast future traffic on the network would be 115 cars during both the AM and PM peak hours, resulting in improvements of the overall network performance and congestion on streets around the School. Level of service and delay of surrounding intersections will improve and generally remain similar to the existing situation with the proposed initiatives given the high background traffic figures during peak hours.

3.4 Other considered initiatives

This section describes the list of transport alternatives considered by the School. A number of these were deemed less favourable due to a range of prohibitions.

3.4.1 Walking School Bus

Children walk in a group, with adult volunteers at the front and rear of the group. Walking school buses promote a healthy lifestyle by keeping children active. Walking to and from school gives children the opportunity to engage in physical activities with their peers.

How It Works:

- Children will be picked up along the way to school by a volunteer parent at designated walking bus stops
- Walking bus stops may be in a form of a landmark, like a bus stop, or at the front gate of the student's house
- Typical sizes of walking school buses are 8-12 children with two adults, with a maximum of 8 children for every adult
- Routes used should be the fastest and safest, with a maximum of 30 minutes travel or 2km

Benefits:

- Children gain a sense of independence
- get regular physical activity and exercise
- develop as individuals through involvement in a responsible and disciplined activity
- experience being part of a group or team
- learn about traffic safety and good road sense
- become more familiar with their own neighbourhood and surroundings
- have a chance to build friendships
- have fun getting to school
- arrive at school alert and ready to learn.

Source: <https://www.vichealth.vic.gov.au/programs-and-projects/walking-school-bus>

Issues to be aware of:

- identification of potential risk and implementation of strategies to minimise risk to children in the traffic environment. This would include assessment of local traffic conditions, distance students need to travel, age of students and other risks or hazards.
- provision of public liability insurance
- heavy school bags

- implementation of satisfactory child protection procedures
- provision of strategies to address absences/unavailability of bus 'drivers' and supervisors
- provision of strategies to address unsuitable weather conditions
- provision of effective strategies to manage behaviour of children in the traffic environment
- provision of comprehensive training for school bus 'drivers' and supervisors
- procedures for determining parental permission for student involvement in a Walking School Bus
- procedures for managing daily participation in a Walking School Bus e.g. late comers, absent students, attendance lists

Source:

<http://www.curriculumsupport.education.nsw.gov.au/policies/road/travel/walkingbus1.htm>

Consideration

This initiative was discarded due to the School having child protection and child safety concerns, as well as general discouragement of such arrangements from the NSW Department of Education.

3.4.2 Cycling and Kick Scooting Classes

Consider providing cycling or kick scooting classes during PE sessions. This is done in the UK and in Victoria. Cycling classes can even cater to staff or parents.

How It Works:

- Children should be split into different groups, beginners or intermediate
- Volunteers or teachers will help children cycle/scoot in the beginners class
- Children in the intermediate classes can engage in cycle/scoot activities around the campus
- Children are taught the responsible practice of cycling/scooting on public roads in a safe environment
- Tape markings and cones which simulate road situations can prepare children and teach them the basics of road safety
- Schools can loan these scooters or bicycles for children to take home, on a condition they use it to cycle or scoot to school at least three times per week
- Provide incentive systems for children to use bicycles or kick scooters

Benefits:

- help children gain confidence in cycling or scooting
- safe learning environment in school
- encourage healthy transport methods through loan system

- get regular physical activity and exercise
- have fun getting to school
- arrive at school alert and ready to learn
- children get to bring home a bicycle or scooter as an incentive

Issues to be aware of:

- identification of potential risk and implementation of strategies to minimise risk to children in the traffic environment. This would include assessment of local traffic conditions, distance students need to travel, age of students and other risks or hazards.
- heavy school bags
- implementation of satisfactory child protection procedures
- provision of effective strategies to manage behaviour of children in the traffic environment

Consideration

This initiative was discarded as a majority of students have heavy bags with equipment for extracurricular activities such as music and sporting facilities and would not be able to cycle or ride a scooter to school safely.

3.4.3 Cycling and Kick Scooting Buses

Similar to a Walking School Bus, a volunteer will pick up children at designated locations. The children will then cycle or kick scoot in groups. A minimum of two adults should accompany any one group. "Riding School Bus" is used in several schools in the Moreland City Council, Victoria. Moreland City Council typically achieves over 55 per cent of their students regularly walking or riding to school.

Source: <http://www.moreland.vic.gov.au/parking-roads-and-transport/sustainable-transport/travelsmart.html>

Consideration

This initiative was discarded as students have heavy bags and would not be able to cycle to school safely.

3.4.4 Kiss and Walk

Designate certain kiss and walk plans.

How It Works:

- Parents can pick up and drop off away from sensitive residential areas
- Students then walk the last 500m to school gates
- Provide incentives like free coffee for parents at these locations

Benefits

- Decreases congestion at critical residential areas

- encourage healthy transport methods through loan system
- get regular physical activity and exercise
- arrive at school alert and ready to learn

Issues to be aware of:

- safe walking path with sufficient crossing provisions (i.e. pedestrian signals etc.)
- heavy school bags and equipment for extracurricular activities
- topography of site's location
- implementation of satisfactory child protection procedures
- suitable drop off location

Consideration

The School was very interested in adopting this scheme, however no suitable location for a drop-off or pick-up site within reasonable walking distance was identified.

3.4.5 After School Activities

After school group activities can be staggered according to student levels. This will assist in planning staged pick up times for students.

Consideration

This initiative is already undertaken by the School and will further do so if the proposed indicative usage profile is approved.

3.4.6 After School Cycling Club

School will provide bicycles to students. This can be done as an extracurricular activity which will boost confidence for students to use bicycles.

Consideration

This initiative was discarded as students have heavy bags / numerous items and would not be able to cycle to school easily.

4 Supporting Green Travel

Before and after the implementation of the preferred travel alternatives, the School should develop ways to promote and support the travel method. This section details several initiatives which can be carried out.

4.1 Travel characteristic shifts

Marketing the chosen travel plan will be an important aspect in promoting and implementing the plan. Getting students and staff involved will create a more relaxed and fun environment to encourage students and staff to walk or cycle to school.

4.1.1 Student travel characteristic shifts

Potential for student involvement may involve some initiatives held by other schools such as Cottesloe Primary, include holding a drawing contest for the healthy travel to school plan logo. Student leaders are also appointed who will encourage and teach peers on the benefits of active transport. These leaders should be properly trained in road safety rules which will help educate peers. This will boost school spirit and foster leadership skills to achieve change. Some possible incentives include:

- Food or snack vouchers can be given to students who walk or cycle to school. This can be given out to by teachers at entrances.
- Pedometers for walking competitions
- Awards such as different pins for cyclists or children who walk to school
- Most number of steps walked for each year competition

A culture shift to electronic based teaching and learning is required to aid the initiatives identified. Text books could be provided electronically to limit the need to carry heavy books to and from school. Therefore, students will then have to carry less material to school

4.1.2 Staff travel characteristic shifts

Some possible incentives to encourage staff to mode shift include:

- Subsidise the cost of public transport travel to and from School for staff
- Bike loan schemes for staff, in a form of interest free loans to purchase bicycles or gear

5 Travel Survey Questionnaire

5.1 Survey questions

Based on the preferred travel plan, a travel questionnaire of students and their parents/guardians has been undertaken as outlined in Table 17. A similar survey was undertaken for staff and is shown in Table 18. The survey questions have been set up to provide a good basis for future planning of travel methods and to determine the willingness of students and staff to adopt the alternative travel methods being proposed.

Table 17: Student survey questionnaire

No.	Question	Response Options
	<p>St. Catherine's School, Waverley is investigating potential travel initiatives that would encourage parents and students to reduce dependence on the use of private vehicles as a primary form of travel to and from school.</p> <p>Your valuable input will greatly assist St. Catherine's School's investigations into improving traffic congestion around the school during afternoon pick-up and morning drop-off periods.</p> <p>This short survey is completely confidential, will take less than 5 minutes to complete and will provide important information to inform the study. If you experience difficulties with any of the questions, please ask your parent/guardian/teacher to assist you.</p> <p>Thank you for participating in our survey. Your feedback is important.</p>	Text Only
	<p>Please enter the address you typically travel to school from, and from school to, below. (this may be where you live)</p> <p>Note that your street number is not required for the purpose of this study.</p>	Text Only
1	What is the name of the street you travel to school from? (e.g. Carrington Road)	Open-Ended Response
2	What suburb do you travel to school from?*	Waverley
		Queens Park
		Bronte
		Clovelly
		Tamarama
		Bondi
		Bondi Junction

No.	Question	Response Options
		Randwick
		Coogee
		Other (please specify)
3	What year are you currently attending at St. Catherine's School?*	Year
4	Do you have any sisters at St Catherine's?*	No
		Yes (specify number of sisters)
5	Please indicate any days that you start school before 7.30am for extra-curricular activities?*	I don't attend extracurricular activities before school
		Monday
		Tuesday
		Wednesday
		Thursday
		Friday
6	Please indicate any days that you finish school after 4.00pm for extra-curricular activities?*	I don't attend extracurricular activities after school
		Monday
		Tuesday
		Wednesday
		Thursday
		Friday
7	What time do you usually arrive to school (if not attending extra-curricular activities)?*	Before 7:00am
		7:00-7:30am
		7:30-7:45am
		7:45-8:00am
		8:00-8:15am
		8:15-8:30am
		After 8:30am
8	What time do you usually depart from school (if not attending extra-curricular activities)?*	Before 2:45pm
		2:45-3:00pm
		3:00-3:15pm
		3:15-3:30pm
		3:30-3:45pm
		3:45-4:00pm
		After 4:00pm
9	On a typical day, how do you currently travel to school, from home?*	Walk only (from home to school)
		Private vehicle (car drop-off)
		The St Catherine's School bus (minibus)
		Public transport (public bus and/or train)

No.	Question	Response Options
		Car-pool (ride-share with other St Catherine's School students)
		Other (please specify)
10	On a typical day, how do you currently travel home from school?*	Walk only (from school to home)
		Private vehicle (car drop-off)
		The St Catherine's School bus (minibus)
		Public transport (public bus and/or train)
		Car-pool (ride-share with other St Catherine's School students)
		Other (please specify)
11	If you don't currently walk to and from school, could you please provide details as to why you don't walk?*	Bag is too heavy / I have too many bags
		Walking route isn't safe
		It is too far to walk
		My parent/guardian drops me off or picks me up on the way to/from work
		Other (please specify)
12	What would encourage you to walk to and from school each day?	Open-Ended Response
13	If you don't currently use St Catherine's School's minibus service, could you please provide details as to why you don't use it?*	I currently use this service
		I didn't know about this service
		The minibus service is too expensive
		The minibus service does not pass by my house
		My parent/guardian takes me to school/picks me up from school on the way to/from work
		I have extracurricular activities before/after school most days and timing doesn't suit the current minibus service
		Other (please specify)
14	The School is considering expanding the existing minibus service to pick-up more local students. Would you consider taking this service to school instead of your current mode of travel? (You can select one or multiple options below)*	Yes
		No (please specify why not)
15	What would encourage you to use the School's minibus service to and from school each day?	Open-Ended Response
16	If you don't currently use public transport to school, could you please provide details as to why you don't use it?*	I currently travel to and from school by public transport
		Public transport is too expensive
		There are no services near my house
		There is no direct service from my house to school

No.	Question	Response Options
		My parent/guardian takes me to school on the way to/from work
		I have extracurricular activities before/after school most days
		Services are too infrequent
		Other (please specify)
17	What would encourage you to take public transport to and from school each day?	Open-Ended Response
	St. Catherine's School is considering a scheme to encourage those students that travel by private vehicle to pick up their friends/family who also attend St Catherine's School on the way. This is known as carpooling and will assist in reducing traffic congestion by reducing the number of cars that are travelling to and from school each day.	Text Only
18	Would you consider participating in a carpooling scheme with other students who also attend St. Catherine's School?*	Yes
		No (please specify why not)
19	What would encourage you to car pool to and from school each day with other students who also attend St. Catherine's School?	Open-Ended Response
20	Please rank the following initiatives you would consider in order of preference from 1 to 4, number 1 being the most desirable and number 4 being the least desirable.*	St. Catherine's School minibus service
		Carpooling
		Public Transport
		Walking
		I wouldn't use any of the above (please tick NA box to any initiatives you wouldn't consider using at all)
21	St. Catherine's School would like to know what would encourage you to consider alternative modes of travel away from the use of private vehicles. *	A mufti day once a term
		House points
		I don't travel by private vehicle (please tick both NA boxes)
22	Some suggestions have been provided above, however we would love to hear some of your own. Please feel free to write some further suggestions.	Open-Ended Response

No.	Question	Response Options
23	<p>Thank you for participating in this survey. This information will be used to inform St. Catherine's School's study into reducing traffic congestion around the School during morning drop-off and afternoon pick-up.</p> <p>If you have any further suggestions, we would love to hear your feedback.</p> <p>We thank you for your valuable time and input.</p>	Open-Ended Response

Table 18: Staff survey questionnaire

No.	Question	Response Options
	<p>St. Catherine's School, Waverley is investigating potential travel initiatives that would encourage staff to reduce dependence on the use of private vehicles as a primary form of travel to and from the School.</p> <p>Your valuable input will greatly assist St. Catherine's School's investigations into improving traffic congestion around the School.</p> <p>This short survey is completely confidential, will take less than 5 minutes to complete and will provide important information to inform the study.</p> <p>Thank you for participating in our survey. Your feedback is important.</p>	Text Only
	<p>Please enter the address you typically travel to work from, and from work to, below. (this may be where you live)</p> <p>Note that your street number is not required for the purpose of this study.</p>	Text Only
1	What is the name of the street you travel to work from? (e.g. Carrington Road)	Open-Ended Response
2	What suburb do you travel to work from?*	Waverley Queens Park Bronte Clovelly Tamarama Bondi Bondi Junction Randwick

No.	Question	Response Options
		Coogee
		Other (please specify)
3	Please specify if you are part-time or full-time.*	Full-time
		Part-time (please specify how many days per week you work)
4	What time do you usually arrive to school (on a typical day)?*	Before 7:00am
		7:00-7:30am
		7:30-7:45am
		7:45-8:00am
		8:00-8:15am
		8:15-8:30am
		After 8:30am
5	What time do you usually depart from school (on a typical day)?*	Before 2:45pm
		2:45-3:00pm
		3:00-3:15pm
		3:15-3:30pm
		3:30-3:45pm
		3:45-4:00pm
		4:15-4:30pm
		4:30-4:45pm
		4:45-5:00pm
		5:15-5:30pm
		5:30-5:45pm
		5:45-6:00pm
		After 6:00pm
6	On a typical day, how do you currently travel to and from work?*	Walk only (from home to school)
		Cycle
		Private vehicle (car drop-off)
		Public transport (public bus and/or train)
		Car-pool (ride-share with other St Catherine's School staff)
		Other (please specify)
7	If you don't currently walk to work, could you please provide details as to why don't walk?*	Bag is too heavy / I have too many bags
		Walking route isn't safe
		It is too far to walk
		A family member/partner/friend/colleague drops me off or picks me up
		Other (please specify)

No.	Question	Response Options
8	What would encourage you to walk to and from work each day?	Open-Ended Response
9	If you don't currently cycle to work, could you please tell us why? (you can select more than option)*	I currently cycle to work Distance to work Hilly topography surrounding school Safety of streets on route to work I have too many bags / bags are too heavy Not enough bike racks or showers at work Other (please specify)
10	The School is considering providing improved end of trip facilities such as showers and secure cycle/motorcycle parking. Would you walk, cycle (or motorcycle) every day if this was provided?*	Yes I would walk Yes I would cycle No (please specify why not)
11	What would encourage you to cycle/walk to work each day?	Open-Ended Response
12	If you don't currently use public transport to school, could you please provide details as to why you don't use it?*	I currently travel to and from school by public transport Public transport is too expensive There are no services near my house There is no direct service from my house to school Services are too infrequent Driving is quicker Other (please specify)
13	Would you consider taking public transport every day if the School partially subsidised the cost of public transport?*	Yes No (please specify why not)
14	What would encourage you to take public transport to and from school each day?	Open-Ended Response
	St. Catherine's School is considering a scheme to encourage staff that travel by private vehicle to pick up a family member/partner/friend/ colleague who also attends St. Catherine's School on the way. This is known as carpooling and will assist in reducing traffic congestion by reducing the number of cars that are travelling to and from school each day.	Text Only
15		Yes

No.	Question	Response Options
	Would you consider participating in a carpooling scheme with other staff members who also attend St. Catherine's School?*	No (please specify why not)
16	What would encourage you to car pool with your colleagues to and from work each day? (e.g. on-site parking for cars with 3 or more staff)	Open-Ended Response
17	Please rank the following initiatives you would consider in order of preference from 1 to 3, number 1 being the most desirable and number 3 being the least desirable.*	Carpooling
		Subsidised Public Transport
		Walking/cycling
		I wouldn't use any of the above (please tick N/A boxes if you wouldn't consider using these initiatives at all)
18	St. Catherine's School would like to know what would encourage you to consider alternative modes of travel away from the use of private vehicles. (Please rank the same way as per previous question.)*	Priority on-site parking for car pool users
		Improved walking and cycling facilities (showers and lockers)
		Additional secure cycling/motorcycling parking on-site
		I don't travel by private vehicle (please tick N/A boxes above)
19	Some suggestions have been provided above, however we would love to hear some of your own. Please feel free to write some further suggestions.	Open-Ended Response
20	<p>Thank you for participating in this survey. This information will be used to inform St. Catherine's School's study into reducing traffic congestion around the School during morning drop-off and afternoon pick-up.</p> <p>If you have any further suggestions, we would love to hear your feedback.</p> <p>We thank you for your valuable time and input.</p>	Open-Ended Response

5.2 Survey results

In late May 2015, an additional questionnaire survey was distributed online to students and parents, as well as staff. The purpose of the survey was to gain an understanding of the likelihood to change travel methods from private vehicle usage to the preferred travel alternatives.

5.2.1 Students who get Dropped Off

748 students and parents responded to the survey. Two close ended questions are investigated in this section, namely:

“The School is considering expanding the existing minibus service to pick-up more local students. Would you consider taking this service to school instead of your current mode of travel?”

“Would you consider participating in a carpooling scheme with other students who also attend St. Catherine's School?”

Of the existing students who got dropped off at school (452 private vehicle users), 182 respondents (41 per cent of private vehicle users) answered “yes” to considering adopting the minibus service as a travel alternative. With respect to the carpooling question, 287 respondents (64 per cent of private vehicle users) responded “yes” to considering adopting the carpooling scheme as a travel alternative to school. The results are shown in Figure 9.

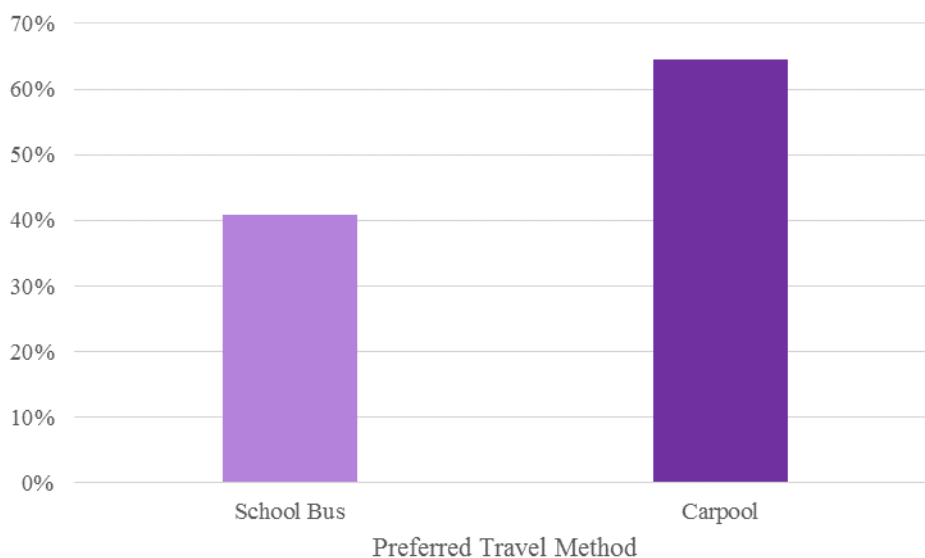


Figure 9: Proportion of existing private vehicle users agreeable for mode shifts

The year group proportion of respondents who answered “yes” to travel alternatives is shown in Figure 10 and Figure 11.

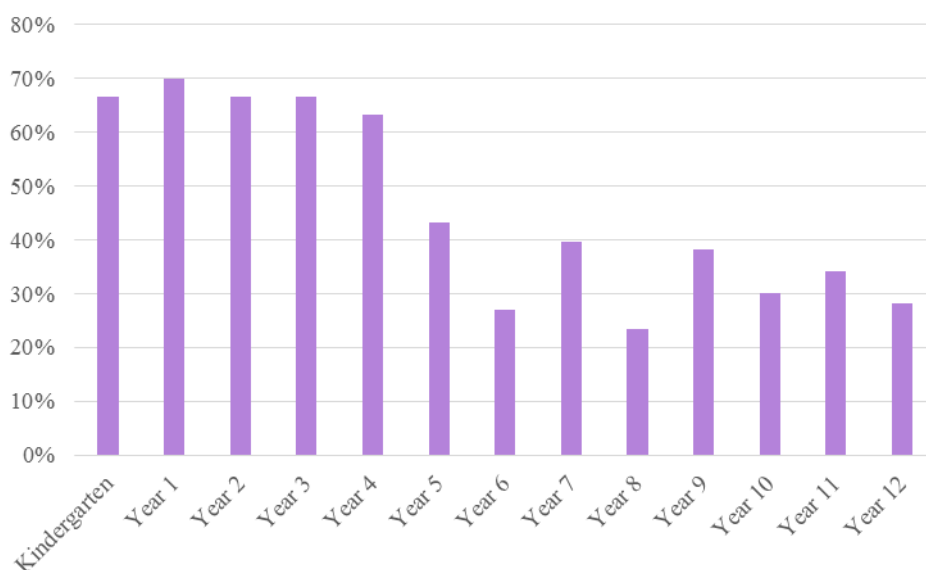


Figure 10: Minibuses - Proportion of respondents favourable to mode shift by year

As seen from the data, the proportion of respondents who would consider adopting minibuses as a travel alternative as compared to using private vehicles is highest between kindergarten to year 4.

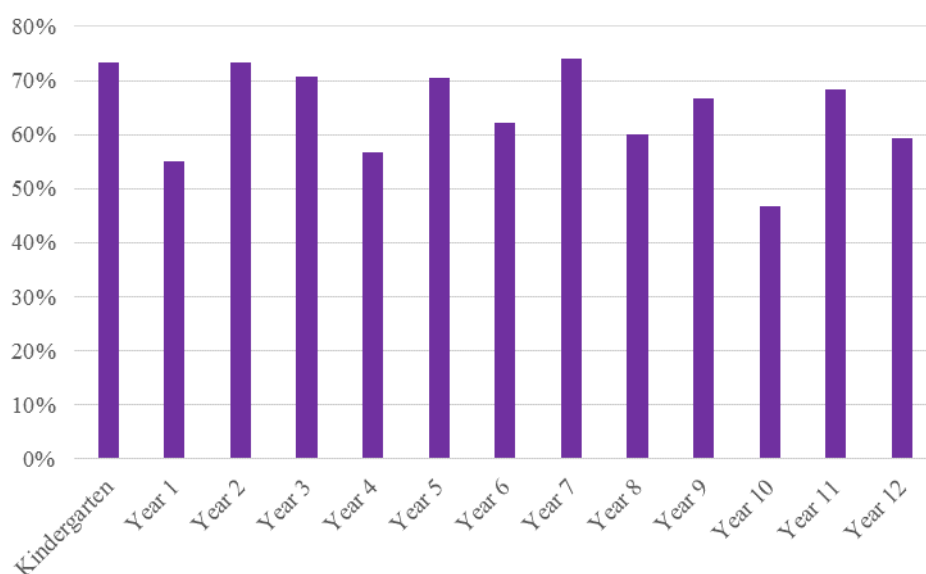


Figure 11: Carpool - Proportion of respondents favourable to mode shift by year

A more general spread across the years is observed for carpool respondents.

5.2.2 Students who get Picked-up

Of the existing students who got picked-up from school (341 private vehicle users), 143 respondents (42 per cent of private vehicle users) answered “yes” to considering adopting the minibus service as a travel alternative. With respect to the carpooling question, 222 respondents (65 per cent of private vehicle users) responded “yes” to considering adopting the carpooling scheme as a travel alternative to school. The results are shown in Figure 12.

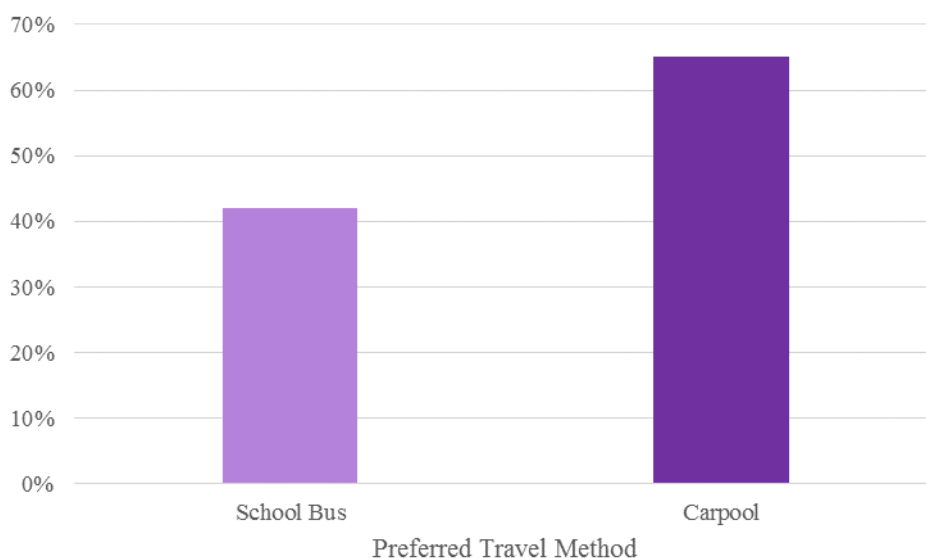


Figure 12: Proportion of existing private vehicle users agreeable for mode shifts

5.2.3 Students who do not walk to school

A total of 634 students and parents responded to the question:

“If you don't currently walk to school, could you please provide details as to why don't walk? (You can select one or multiple options below)”

The most common response was that they lived to far away (67 percent) while the second most common response was that their bags were too heavy (31 per cent)

A total of 433 students and parents responded to the open ended question:

“What would encourage you to walk to and from school each day?”

The most common incentive would be to have a lighter bag (18 per cent) followed by walking with friends (5 per cent) and rewards such as food or points (4 per cent)

The year group proportion of respondents who answered “yes” to travel alternatives is shown in Figure 13 and Figure 14.

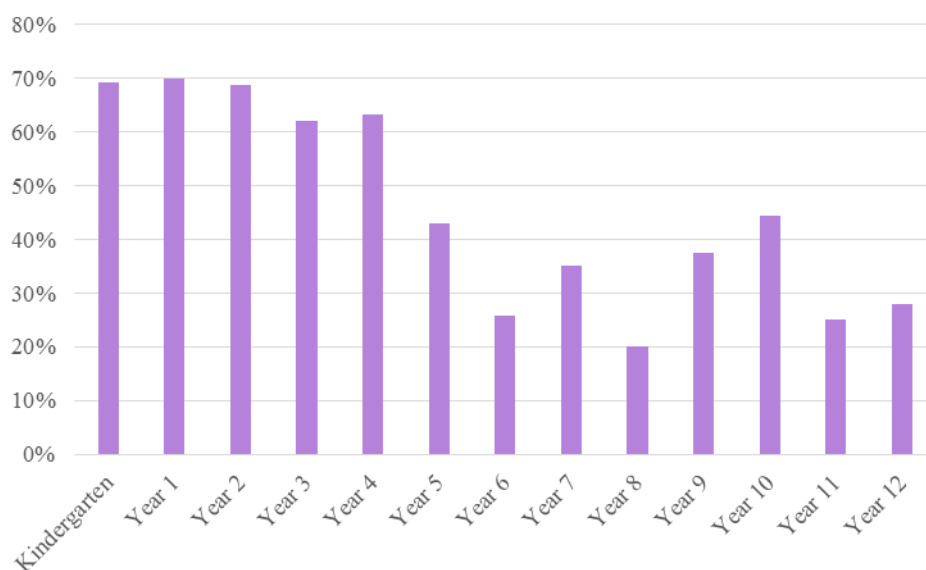


Figure 13: School Buses - Proportion of respondents favourable to mode shift by year

Similarly, the proportion of respondents who would consider adopting school buses as a travel alternative as compared to using private vehicles is highest between kindergarten to year 4.

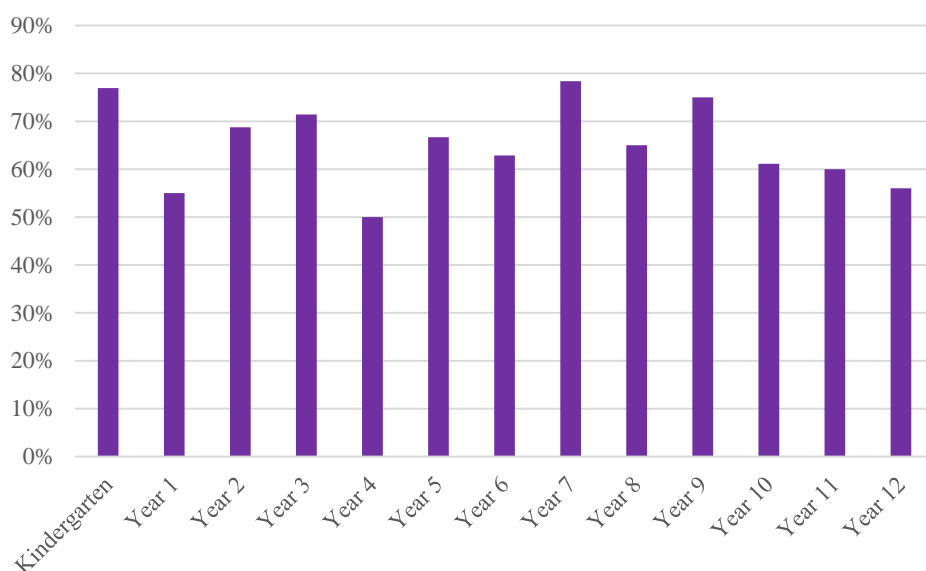


Figure 14: Carpool - Proportion of respondents favourable to mode shift by year

A more general spread across the years is observed for carpool respondents.

5.2.4 Staff

Of a total of 202 staff, 112 responded to the survey. Similar close ended questions for travel alternatives were investigated. Of the 94 existing car drivers surveyed (84 per cent), the preferred travel alternatives are shown in Figure 15.

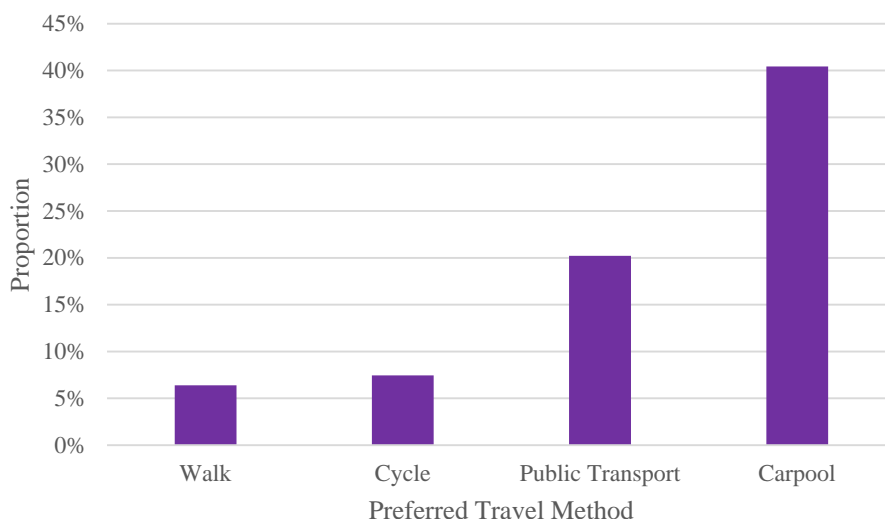


Figure 15: Proportion of existing private vehicle users agreeable for mode shifts

As seen from the data, carpooling is the most favourable form of mode shift for existing private vehicles users, at 40 per cent.

5.2.5 Key findings

The questionnaire survey received a high response rate for staff and students. The respondents have indicated a willingness to consider alternative travel methods to private vehicle use far in excess of the mode shift adopted in the travel methods analysis undertaken in Chapter 3.0. This indicates that the analysis was conservative and with the assistance of the School, the improved travel targets are achievable.

5.3 Potential mode shifts

The potential mode shift for the travel initiatives for staff and students is compared with proposed travel modes (in Section 3.3) and the survey data.

5.3.1 Students

The revised number of car trip reductions over the proposed campus population numbers using survey data is shown in Table 15. Table 15. It shows that there is a potential to reduce the number of car trips significantly during both drop-off and pick-up periods based on the survey data. This shows that the proposed targets, discussed in section 3.3, were conservative as survey results prove that there is a higher percentage of school population willing to shift from private vehicle usage. A comparison of the target mode shifts estimated by Arup, with the potential mode shift due to favourable survey responses is shown in Table 19.

Table 19: Potential private vehicle usage reduction to drop-off and pick-up

Initiative	Assumed reduction in cars to 2029 forecast school population (refer Table 12 – Section 3.3.1)	Potential reduction in cars (from survey data) to 2029 forecast school population	
		Drop-off	Pick-up
Mini Buses	-42	-261	-212
Carpooling	-50	-419	-329
Promote Public Transport	-50		

5.3.2 Staff

The revised number of car trip reductions over the proposed campus population numbers using survey data is shown in Table 16. Similarly, this data shows that the proposed targets were conservative as survey results prove that there is a higher percentage of school population willing to shift from private vehicle usage.

A comparison of the target mode shifts estimated by Arup (section 3.3), with the potential mode shift due to favourable survey responses is shown in

Table 20.

Table 20: Potential private vehicle usage reduction to number of cars

Initiative	Assumed reduction in cars to 2029 forecast school population (refer Table 13 – Section 3.3.2)	Potential reduction in cars (from survey data) to 2029 forecast school population
Subsidised Public Transport	-23	-41
Active Transport/ Bike/Scooter	-11	-28
Carpooling	-9	-85

6 Traffic and parking assessment from profiles of activity

The additional traffic generated from each facility is calculated in this section.

6.1 Performing Arts Auditorium

6.1.1 Migration of Existing Events

The opening of the Performing Arts Auditorium will result in the migration of existing events from the Dame Joan Sutherland Centre to the new Performing Arts Auditorium. The migration of existing events which will not result in an increase in attendance is shown in Table 21. Attendance of the events is assumed to be inclusive of organisers, performers and staff.

Table 21: Timetable of existing events with no change in attendance numbers

Event	Time	Freq. day/year	Existing Attendance	Additional Attendees
School Open Day	9.00am – 11.00am	5	120	0
School Open Night (Twilight Session - Term 1 and 4 only)	5.30pm - 7.30pm	3	120	0
Prep - St. Cath's Got Talent	3.00pm - 6.30pm	2	60	0
Prep - Trinity Evening	3.00pm - 6.30pm	12	60	0
Rehearse BTC Showcase Event	3.00pm - 6.30pm	11	60	0
Infants Christmas Musical Rehearsal	9.00am – 5.00pm	3	130	0
Junior Musical Rehearsal	9.00am – 5.00pm	2	150	0
Junior Musical Rehearsal	During school hours	2	150	0
Stage 2 Music Evening Rehearsal	During school hours	2	100	0
Stage 3 Music Evening Rehearsal	During school hours	2	150	0

6.1.2 Increase in Attendees for Existing Events

With additional capacity for attendees to the new Performing Arts Auditorium, certain existing events are proposed to increase in attendees. This is shown in Table 22.

Table 22: Timetable of existing events with change in attendance numbers

Event	Time	Freq. day/year	Existing Attendance	Additional Attendees	Additional Car Parking
Music Showcase	7.00pm – 9.00pm	1	220	280	90
St. Cath's Got Talent Event	6.00pm – 9.00pm	1	250	250	80
Trinity Evening	6.00pm – 10.00pm	1	250	250	80
BTC Showcase Event	6.00pm – 9.00pm	2	250	250	80
Infants Christmas Musical	9.00am – 12.00pm	1	250	50	16
Junior Musical	6.30pm - 9.30pm	2	250	150	48
Stage 2 Music Evening	6.30pm - 9.30pm	1	250	50	16
Stage 3 Music Evening	6.30pm - 9.30pm	1	250	100	32
Evening of Eminence - Junior School (Multi-Purpose Hall)	6.00pm - 8.30pm	1	160	90	29

The existing Evening of Eminence event held at the Multi-Purpose Hall is expected to generate 29 additional cars from additional attendees. The School's management plan ensures that this event will not coincide with events conducted within the new Auditorium.

6.1.3 New Events

Two new events are proposed to occur within the new Performing Arts Auditorium. These events are currently conducted off-site at NIDA and involve existing school students and their families. New proposed events are shown in Table 23.

The new Parent Event at the Research Centre will occur during school hours and not coincide with events conducted within the new Auditorium.

Table 23: Timetable of new proposed events

Existing Performing Arts Auditorium Events - New events	Time	Freq. day/ year	Proposed Attendees	Additional Car Parking
Rehearsal Senior School Musical	9am - 2pm	5	60	19
Senior School Musical Event (biennially)	6.30pm - 9.30pm	2*	500	160
Parent Event -(Research Centre)	During school hours	4	50	16

Note: *this event occurs biennially

6.1.4 Maximum Capacity Events

The DJSC, used for current events, has half the maximum capacity of the Performing Arts Auditorium. At capacity, the Performing Arts Auditorium would have 500 attendees. The occurrence of these maximum capacity events are mostly held between 6.00pm to 9.30pm and occur towards the end of the PM commuter peak hours.

Note it is anticipated that the Performing Arts Auditorium will host evening events (6pm onwards) with full capacity attendance up to seven times per year (two events occur biennially). Four of these events (6pm event start times) will likely coincide with the commuter peak hour between 5.00pm to 6.00pm.

The number of cars generated by the event has been calculated by applying an assumed car mode of 80% and car occupancy of 2.5 people. This assumption of car mode is supported by the Journey to Work car mode of 64% and large number of staff (30%) and students (60%) that live close enough to walk to the site. It is therefore assumed that people will choose to walk if parking is difficult closer to the site.

Other attendees will likely arrive to the event by taxi, walking or bus, and attendees are assumed to be two parents with one or two students. On this basis, a car parking demand and traffic generation of up to 160 cars, or 80 additional cars, is anticipated for the large at-capacity events. As a conservative estimate, it is assumed that all the trips will be made during the same hour. Event organisers, staff and performers would arrive considerably earlier than the audience of such events.

The School will exercise management strategies to avoid overlap when it is expected that Performing Arts Auditorium will be operating at capacity. This asserts that the Aquatic Centre would not operate during these large events, hence reducing overall traffic generation of the site.

6.1.5 Parking demand and management

During the occurrence of these large events, on-site car parking for 75 cars may be available and managed under a school generated operational management plan, resulting in a total of approximately 85 cars parking on-street, which is an extra 5 cars compared to the existing situation (i.e. when the DJSC is operating at maximum capacity).

Given this is predominately a residential area with parking demand mostly generated by residents, two 2014 parking surveys were carried out by Arup between 7.30pm and 8.00pm (when it is assumed that the majority of residents will have returned home for the night). At this time, it was found that there were more than 200 spaces available on surrounding streets. This would indicate that cars parking for large events commencing earlier in the evening (between 5.30pm-7.00pm) will not likely impact the availability of parking for surrounding residents. Given that the total demand for on-street parking at the events is in the order of 85 cars, there would be sufficient parking supply for both the events and residents returning home for the evening.

Under the Performing Arts Auditorium, all 47 parking spaces will be made available to event patrons. The car park is accessed from Macpherson Street via a constrained access driveway with limited width. This will only allow one car at a time through the car park roller shutter opening, and one car would have to prop at the driveway before the footpath.

A conservative assessment using the worst PM peak hour traffic flows and full turnover of the car park (all spaces egress/ingress) over an hour was undertaken using SIDRA to determine maximum queues on the approaches. The maximum (100 percentile) queues recorded were Macpherson Street right turn (entering the site) of 10 vehicles and less than 1 car queue within the site. Therefore, cars are unlikely to queue within the site and impinge on safety of the entering vehicles.

To improve safety, a restricted left-in / left-out may be considered, but a central median would not be supported. The central median will open possibilities for unsafe pedestrian storage in the centre of the road and impact road width considerably otherwise. If access to the car park is limited to left in / left out manoeuvres, all vehicles will be required to enter from the west (from Albion Street / Macpherson Street intersection) and exit to the east (to Macpherson Street / Leichhardt Street intersection). However, roundabouts at the above mentioned intersections will assist ease of accessibility to the car park for cars arriving from the eastern intersection.

6.2 Aquatic Centre

The proposed Aquatic Centre replaces the existing Outdoor Pool with two new indoor pools including a diving facility. The new pools will generate the majority of new activity from bigger class sizes.

6.2.1 Weekday Timetable

External users are defined as users not enrolled in the School. The revised indicative Aquatic Centre timetable is arranged such that most of the external lessons occur outside of the School peak hours.

Based on the forecast indicative use of the Aquatic Centre, the number of cars generated to the centre at any half hour interval was determined. For the purpose of this analysis, a car user rate of 90% is assumed with a car occupancy of 1.1 for the proposed attendees of the site. The hourly breakdown of attendees to the Aquatic Centre is shown in Table 24.

Table 24: Weekday Aquatic Centre profile (attendees per half hour intervals)

Time commencing on weekdays	Existing timetable	Proposed timetable	
	St Catherine's School girls only	St Catherine's School girls only	External users generated
5.30am	0	0	0
6.00am	20	120 *	0
6.30am	0	0	0
7.00am	50	0	0
7.30am	34	24	0
8.00am	4	0	0
8.30am	0	0	0
9.00am	0	0	0
9.30am	0	0	24
10.00am	0	0	24
10.30am	0	0	24
11.00am	0	0	24
11.30am	0	0	24
12.00pm	0	0	24
12.30pm	0	0	24
1.00pm	0	0	24
1.30pm	0	0	24
2.00pm	0	0	0
2.30pm	0	0	0
3.00pm	4	0	0
3.30pm	50	102	12
4.00pm	20	12	12
4.30pm	0	12	12
5.00pm	24	102	12
5.30pm	24	12	12
6.00pm	0	12	12
6.30pm	0	102	12
7.00pm	0	0	0
7.30pm	0	0	0
8.00pm	0	0	0

Note *: inclusive of 30 attendees from diving class which occurs once a week
School and commuter peak hours have been highlighted in table above

Internal Attendees

The proposed Aquatic Centre allows for the increase in the class sizes. The new timetable shifts the timeframes of existing activities before morning peak hours, hence reducing the traffic congestion in the network.

For example the new water polo, squad swimming and diving programme classes commences at 6am and are offered to School students only, requiring the students arrive long before the morning school peak hour. The increase in class sizes from 20 to 120 students starting at 6am is estimated to consist of some 82 cars to the school. These cars are removed from the morning peak hour between 7am to 9am.

The new timetable also encourages students to stay back in school to attend sessions. Water polo and squad swimming classes which start at 3.30pm are likely to increase by 52 students. Based on an occupancy rate of 1.1 per car and a 90% private vehicle usage rate to the aquatic centre, these classes would reduce the number of pickups occurring in the PM school peak hour (3-4pm) by 39 cars. Similarly in the PM commuter peak (5-6pm), 54 less cars are expected.

External Attendees

Morning classes which involve external attendees are scheduled to start at 9.30am, after the morning peak hour (7-9am).

The Learn to Swim classes for Years K-2 (5 years and above) children will attract external cars after the PM school peak and during PM commuter peak hours. Approximately 24 additional attendees or 20 additional external cars to the Aquatic Centre are expected during the PM commuter peak hour.

During the day, it is estimated that additional parking demand will be in the order of 40 cars per hour for the Learn to Swim as there will be 48 attendees per hour. This additional demand will only occur between 9.30am and 2.00pm when there is generally less demand for parking by residents.

External Attendees – Parking

Learn to Swim Classes attract the most external cars. The largest session starts at 10am where 20 cars are generated. This occurs just after a session of 20 cars at 9.30am. As a conservative estimate, the peak amount of cars parked is 40 as an overlap occurs between events (i.e. it is assumed that participants and parents would leave shortly after their class finishes while new participants would have arrived). The attendees for the 9.30am session would then leave shortly after 10am to allow parking for the next session attendees.

6.2.1.1 Key findings

The proposed Aquatic Centre would alter the arrival and departure times of the existing students, outside of the peak hours. These shifts in arrival and departure times more than compensate the external development traffic caused by the Aquatic Centre.

Table 25: Reduction in cars generated from revised usage profile

Peak Period	Cars (per hour)		
	Internal	External	Net Improvement to weekday peak hour
Morning (7-9am)	-82	0	-82
School (3-4pm)	-39	+10	-29
Evening (5-6pm)	-54	+20	-34

As a conservative estimate, the highest parking demand from external cars would be 40 during 9.30am to 1.30pm.

6.2.2 Weekend Timetable

The proposed Aquatic Centre would increase the class sizes of water polo training. An additional two new classes will be held including water polo for boys and men on Sundays, and Learn to Swim classes on Saturdays and Sundays. The forecast half hourly breakdown of cars generated from the Aquatic Centre is shown in Table 26.

Traffic Generation

It is expected that an additional 136 attendees, or 78 cars to the site are expected to occur on Saturday during the weekend network peak hour (12pm-1pm). This is based on an occupancy rate of 1.1 per car and a 90% private vehicle usage rate to the aquatic centre, for Learn to Swim participants. Parents or supervisors (which were assumed as external spectators in addition to the attendees) would accompany children (i.e. attendees) to the Aquatic Centre in the same car trip.

Water polo participants would likely car pool with teammates and spectators. An occupancy rate of 2.0 per car (as noted in the Arup 2014 report for all day events) and a 90% private vehicle usage rate is used for water polo participants. Therefore, it is assumed that the spectators were travelling together with the attendees as per the Learn to Swim.

The Arup 2014 report originally indicated an additional 79 cars with the previous weekend usage profile. Based on the revised weekend timetable, an additional 78 cars are forecasted with relatively similar impacts to the intersections to that of which was previously reported. This brings the total cars during the weekend peak hour to 78 cars.

Parking

During the weekend, off-street parking will be made available within the School for the Aquatic Centre uses. Up to 47 off-street parking spaces may be available within the RPAC (as minimal School staff is expected on weekends).

During the weekend network peak, there will likely be a minor impact of an additional 31 car spaces to be accommodated by surrounding on-street parking during the weekend network peak.

The largest session starts at 2pm where 64 cars are generated. This occurs just after a session of 39 cars at 1.30pm. As a conservative estimate, the peak amount of cars parked is 103 as an overlap occurs between events (i.e. it is assumed that participants and spectators would leave shortly after their match finishes while new participants would have arrived). The attendees for the 1.30pm session would then leave by 2.30pm to allow parking for the next session attendees.

This leaves 56 cars to be parked on-street during off-peak hours. In the 2014 Arup report, a total of 152 on-street car spaces were available during the 2.30pm to 3.00pm surveys, indicating a sufficient number of available spaces during that period. Therefore, the events would likely be a minor impact on the available on-street car spaces.

Table 26: Cars associated with Aquatic Centre (per half hour intervals)

Time commencing on weekends	Existing profile of use	Proposed profile of use
5.30am	0	0
6.00am	0	0
6.30am	0	0
7.00am	0	0
7.30am	18	20
8.00am	18	39
8.30am	0	20
9.00am	18	39
9.30am	18	39
10.00am	0	20
10.30am	18	39
11.00am	18	39
11.30am	0	20
12.00pm	18	39
12.30pm	0	39
1.00pm	0	20
1.30pm	0	39
2.00pm	25	64
2.30pm	0	20
3.00pm	0	39
3.30pm	0	39
4.00pm	0	20
4.30pm	0	39
5.00pm	0	39
5.30pm	0	20
6.00pm	0	0
6.30pm	0	0
7.00pm	0	0
7.30pm	0	0
8.00pm	0	0

Weekend road network peak hour has been highlighted in table above

7 Cumulative Traffic Impacts

This chapter discusses the cumulative impacts of the previous sections of the report and impacts to parking and the road network:

- Chapter 2 discussed the impacts and potential cars generated from the increase of campus population and associated impacts of redistributing cars to the drop-off/pick-up zones surrounding the School.
- Chapter 3 discussed the potential mode shift and reduction of private vehicle usage from travel initiatives.
- Chapter 6 discussed the impacts and potential cars generated from the usage profiles.

7.1 Cumulative traffic flows

The following table summarises the number of cars associated with the School, with the relevant peak hours summarised as follows:

- The AM (school and commuter) peak hour is assumed as 7:30-8:30am;
- PM school peak hour is 2:30-3:30pm; and
- PM commuter peak hour is 5:00-6:00pm.

For the purposes of the table below, staff and students are expected to coincide with the AM peak hour, but leave during the PM school peak and commuter peak hour separately. Students are expected to leave during the PM school peak hour and staff are expected to depart during the PM commuter peak hour.

Table 27: Car generated by the School during weekdays

Scenario	AM peak hour	PM school peak	PM commuter peak
Existing school population and existing usage profile	648	403	150
Proposed school population (with no initiatives) and existing usage profile	776	486	158
Proposed school population (with all initiatives) and existing usage profile	591	344	115
Proposed school population (with all initiatives) and updated RPAC usage profile	509	315	81
Difference existing and proposed with transport strategies	-139	-88	-69

As the totals show above, the number of cars generated with the proposed school population and updated usage profile scenario is significantly less than the existing school population and existing usage profile scenario when all initiatives are implemented. The net outcome would result in a net decrease of cars generated by the School during weekday peak hours in comparison to the existing situation. This compares favourably with the original development application, which sought to increase the number of cars by 172 cars during the AM peak hour and by 150 cars in the school PM peak hour.

7.2 Traffic generation and distribution

Traffic generation in the previous 2014 transport report reported the number of additional cars generated by the site. It should be noted that both directions of travel (for drop-off and pick-up of students) have been accounted for. This is described in Section 6.3.3 of the 2014 report (which discusses the assumed trip distribution) stating that additional cars are applied twice as trips onto the existing flows. To assist NSWDPPE, a diagram showing where the trips are coming from and going to has been prepared below. The diagrams indicate a simplistic analysis which shows where people may come from based on their postcode data and applied to the closest drop-off/pick-up location.

It should be noted that staff were applied to enter only during the AM peak and exit only during the PM peak to Albion Street and Macpherson Street evenly. All car trips discussed in the 2014 transport report have been assumed to the pick-up / drop-off zones shown in Figure 16 and Figure 17.



Figure 16: Ingress trips

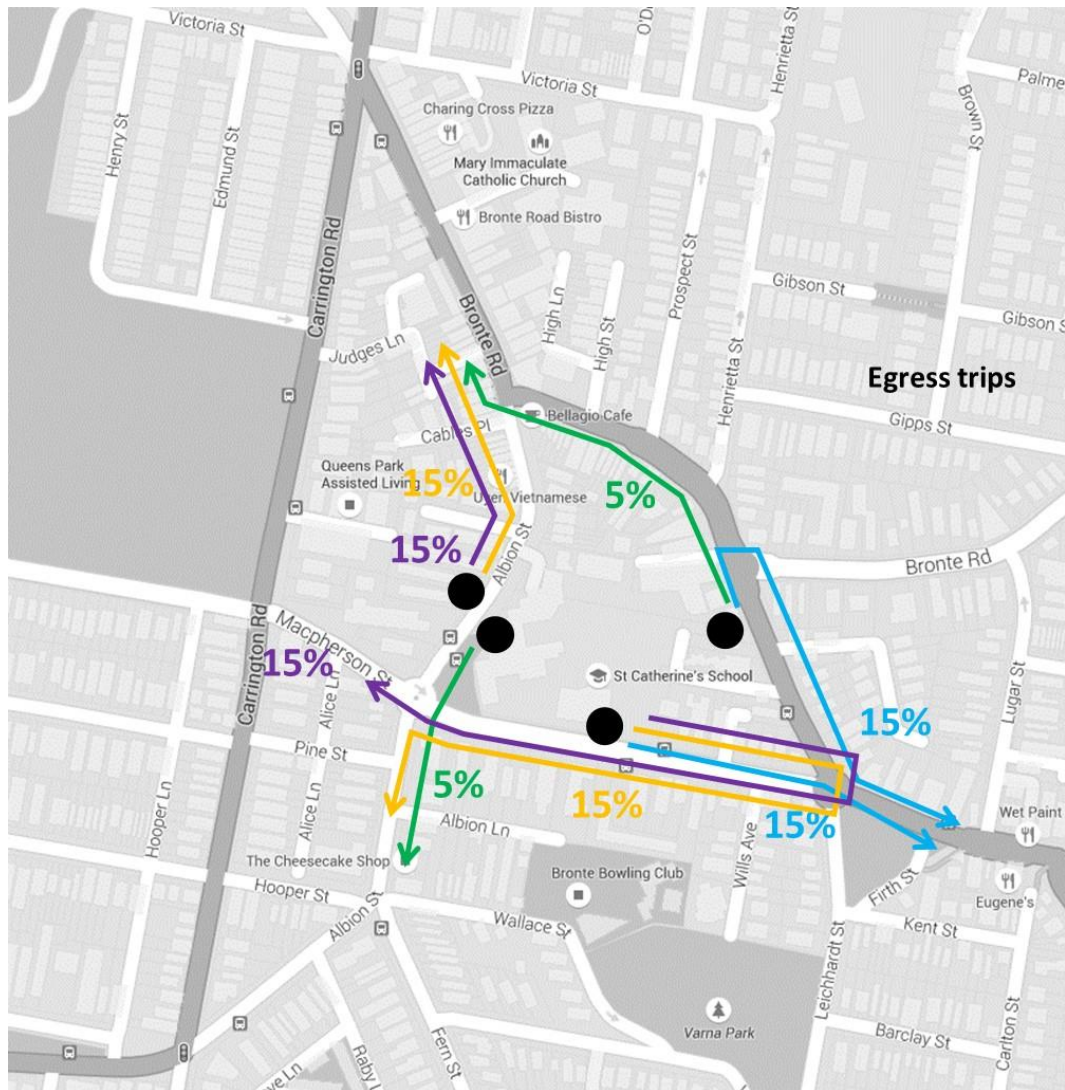


Figure 17: Egress trips

A conservative 30 percent discount factor was included in Section 6.3.2 of the previous 2014 transport report given a number of factors such as extracurricular activities, early drop-offs / late pickups, vehicles using nearby streets and varying travel patterns day to day. The Arup transport report had calculated a total of 499 and 398 cars generated by the existing 2013 student population in the AM and PM peak respectively. This was compared to the traffic volumes observed by Lyle Marshall & Associates report, which indicated that existing cars using drop-off and pick-up facilities were 259 and 153 cars in the AM and PM peak respectively. When compared, this indicates that the traffic generation calculated by Arup, may in fact be overestimated, given that the Lyle Marshall & Associates report counted approximately half the vehicles estimated in the 2014 Arup transport report. The 2015 questionnaire data supports this with over 30% of students attending before and after school activities on some days of the week.

7.3 Intersection performance

Intersection performance outlined in the Arup traffic report (2014) was reported using SIDRA Intersection 6, using default values and parameters for the models (peak flow period of 30 minutes and peak flow factor of 0.95). No extensive

micro simulation or queuing modelling was undertaken. However, observations and traffic data note that there was a concentrated peak 15 minute period within the peak hour assessed, which tapered off considerably within the peak hour. This is consistent with the findings in the 2014 report. The existing intersection performance was reported in 2014 as follows:

Table 28: Intersection performance for existing situation

Intersection	Peak Period	Level of Service	Delay (s)	Degree of saturation
Bronte Road / Albion Street	AM	A	7	0.62
	PM	A	9	0.76
	Weekend	A	10	0.79
Bronte Road / Leichhardt Street	AM	A	9	0.68
	PM	A	8	0.65
	Weekend	A	10	0.69
Macpherson Street / Leichhardt Street	AM	B	20	0.92
	PM	B	26	0.97
	Weekend	B	28	0.94
Macpherson Street / Albion Street	AM	B	18	0.87
	PM	C	34	0.97
	Weekend	B	24	0.91

The traffic modelling results indicate that the intersections on Macpherson Street (Albion Street and Leichhardt Street roundabouts) are operating near capacity. Given that the degree of saturation for these intersections is already over 0.9 in the existing peak hours, the intersections are sensitive to small changes in traffic volumes and are suitable for upgrade to signalised intersection without any development from the School.

As the School has proposed a number of initiatives to reduce car use, this will reduce dependence on these intersections. The result will be an improvement of the overall network performance and less congestion on streets around the School. However, level of service and average delay of surrounding intersections will generally remain similar to the existing situation with the proposed initiatives given the high background traffic figures during peak hours.

During the weekend, the proposed external uses of the Aquatic Centre is forecast to generate an additional 78 cars to the site during the weekend network peak. This traffic generation results in a Level of Service of C for the future weekend scenarios on Macpherson Street / Leichhardt Street and Macpherson Street / Albion Street intersections. However, the Aquatic Centre trips would add approximately 1% additional traffic to the intersections during the peak hour, which is considered minor in the context of high background traffic flows.

7.4 Parking impacts

As part of the campus Master Plan, an additional 22 parking spaces are proposed in Stage 1 on the site, to bring total campus parking provision to 75 car spaces at

completion of the Master Plan (net increase of 19 spaces). Existing parking demand associated with staff reliance on private vehicle travel to and from school is approximately 150 cars of which the School currently provides 56 on-site spaces. Car usage by teachers is expected to drop by approximately 43 cars to 115 cars in 2029 as a result of the travel initiatives. It should be noted that approximately 94 staff cars currently park on surrounding streets, with the initiatives and increase of parking provision this will result in a net decrease in car parking demand of 54 cars on surrounding street compared to the existing situation. Therefore, there is no anticipated requirement to provide further parking than currently proposed to accommodate the forecasted increase in staff population

As discussed in Chapter 6, the Performing Arts Centre and Aquatic Centre will generate the majority of on-street parking demand from the development during the small number of large events. The School will implement a management plan so that there will not be crossover for large evening events. Some 160 vehicles are generated during these large events, which may have up to 85 vehicles likely to park in surrounding streets – an increase of 5 vehicles compared to the existing events held within the DJSC. When the events are scheduled to occur, there is expected to be enough capacity on the surrounding streets as demonstrated in surveys conducted by Arup in the transport report (2014).

The Aquatic Centre is expected to have the largest impact during the weekends, with an additional 78 cars generated during weekend network peak. However, as typical School operations do not occur during the weekend, a significant portion of parking demand may be accommodated within the site. Up to 47 additional cars may be accommodated on-site by the proposed increase of parking provision, resulting in a small increase in car parking demand of 13 cars on surrounding streets.

During weekdays, it is estimated that additional parking demand for the Aquatic Centre external uses will be in the order of 40 cars per hour for the Learn to Swim based on an estimate of 48 attendees per hour. This additional demand will only occur between 9.30am and 2.00pm when there is generally less demand for parking by residents. In addition, given that travel initiatives are to be implemented, there will also be more on-street parking spaces available given reduced staff reliance on private cars and on-street car parking.

8 Outline for an Operational Transport Management Plan

The School will develop an Operational Transport Management Plan that will cover a number of operational aspects associated with traffic at the School and the travel strategies being implemented. The plan will include:

- Travel strategies adopted and management requirements for each strategy
- Monitoring and reporting requirements for the travel strategies
- Operational traffic management plans specific to:
 - School pick-up / drop-off zones
 - School bus access
 - Use of the Aquatic Centre
 - Major events held within the auditorium

The Operational Transport Management Plan defines the roles and responsibilities of the School, Waverley Council, parents and carers of students attending the School and the various government agencies for management of access to the School for all modes of transport.

8.1 Travel strategies adopted and management requirements for each strategy

Student travel initiatives identified by the School include expanding the use of mini buses, carpooling and promotion of public transport use.

Staff travel initiatives identified by the School include subsidised public transport, active transport/bike/scooter use and carpooling.

Initially strategies will be developed for initiating each of the travel initiatives:

- Allocate a person responsible for developing the strategy
- Collecting and collating all necessary information to form the basis of the strategy
- Develop all promotional information
- Organise all practical aspects of achieving the travel initiative.

8.2 Monitoring and reporting requirements for the travel strategies

Maintaining an annual questionnaire survey to be completed by staff and students to enable a travel report to be prepared for submission to Council. This will be undertaken by the School using a consistent approach for annual comparison of results.

8.3 Operation traffic management plans

8.3.1 School pick-up / drop-off zones

- Work with Waverley Council and RMS to ensure all school zones are appropriately identified by physical measures and signage.
- A Traffic Line Manager to be present in Leichhardt Street, Macpherson Street and Albion Street. Traffic Line Manager to be briefed and given written instructions for effective traffic management.
- Continue to provide road safety education as part of the School curriculum.
- Regularly advise parents of the parking restrictions and rules relating to the management of the pick-up/ drop-off zone.
- Direct parents who are arriving from multiple directions to park on the correct side of the road adjacent to the School such that children do not have to cross the road.
- Remind parents of the rules relating to parking restrictions, particularly where offences create safety concerns (e.g. parking across a pedestrian crossing, double parking, parking across a driveway).
- Monitor the staggered start and finish times for students in different school years to achieve operation efficiency.

8.3.2 School bus access

With increased school mini bus use proposed, a pick-up and drop-off location will need to be identified for each bus that works in conjunction with the operations of the School.

8.3.3 Access to the RPAC

There are different levels of activity associated with the RPAC facilities which will require access and parking plans to be developed. These include:

- School use of the Aquatic Centre
- Public use of the Aquatic Centre
- School use of the Performing Arts Auditorium

Management plans will be developed to provide guidance on parking availability on the campus, use and management of the RPAC + DJSC car park, alternative travel information to be provided on all promotional material for events, etc.

9 Conclusion

A range of behavioural and travel strategies have been identified and considered to address the underlying issues associated with the proposal for new facilities within St. Catherine's School, Waverley:

- Both Leichhardt Street and Albion Street experience significant congestion. With the new Macpherson street upgrades and proposed drop-off and pick-up allocations, it is expected that 34-35% less traffic associated with drop-offs and pickups respectively would occur along Leichhardt Street. Similarly 8-29% less traffic would be expected on Albion Street during drop-off and pick-up respectively.
- The preferred travel alternatives for students have been identified as carpooling, promoted public transport and a minibus service. The estimated mode shift away from private vehicle users are approximately 142 less cars during the drop-off and pick-up periods. These are based on conservative targets (no reference made to survey data).
- The preferred travel alternatives for School staff have been identified as carpooling, subsidised public transport, active transport and encouraging cycling. The estimated mode shift away from private vehicle users are approximately 43 less car users, bringing car staff usage to a total of 115 cars, compared with 150 existing. These are based on conservative targets (no reference made to survey data).
- According to recent survey data, mode shift from students currently using private vehicles is favourable, with 42 per cent agreeable to School buses and 65 per cent agreeable to carpooling.
- According to recent survey data, carpooling is the most favourable form of mode shift for existing private vehicles users with 40 per cent agreeable to a carpool mode shift.
- A range of other travel measures have been considered by the School but found to be unfeasible due to risks imposed on student safety or less effective.
- A detailed campaign promoting and implementing the plan would be developed by the School.
- Surveys have been developed to gain an understanding of the likelihood of adopting the proposed travel strategies. The survey is directed at both students and parents, while another for staff of the School.
- The School will exercise management strategies to avoid overlap when it is expected that Performing Arts will be operating at capacity. This means the aquatic centre would not operate during these large events.
- During the occurrence of a large event at the performing centre, the surrounding network would have to accommodate an additional 80 car trips. With car parking available within the School for events, approximately 85 cars may park on-street – an additional 5 cars compared to existing events. With reference to the 2014 parking surveys carried out by Arup, it is considered that there will be sufficient supply of parking to cater for events and residents in surrounding streets.

- The new Aquatic Centre's timetable is arranged such that most of the external lessons occur outside of peak hours. The new timetable shifts the timeframes of existing activities before morning peak hours, hence likely reducing the traffic congestion in the network. The Aquatic Centre is estimated to reduce private vehicle morning peak drop-offs by an additional 82 cars, afternoon pick-ups by 29 cars and commuter peak car trips by 34 cars. 78 additional car trips are expected during the weekend network peak.
- By adopting a range of strategies and travel alternatives, private car usage can be reduced during morning and afternoon school peak periods. Parking provision would be lower in demand from staff and congestion would be reduced in the surrounding networks.
- The number of cars generated with the proposed school population and updated usage profile scenario is significantly less than the existing school population and existing usage profile scenario when all initiatives are implemented. The net outcome would result in a net decrease of cars generated by the School during weekday peak hours in comparison to the existing situation.
- As the School has proposed a number of initiatives to reduce car use, this will reduce dependence on surrounding intersections. The result will be an improvement of the overall network performance and less congestion on streets around the School. Level of service of surrounding intersections will generally improve relative to the existing situation.
- Approximately 150 car trips are assumed to be currently generated by staff travelling to and from school, which include 56 parked on-site and up to 94 staff cars parked on surrounding streets. With the proposed initiatives and a net increase of 19 parking spaces proposed at completion of the campus Master Plan, this will result in 115 car trips generated by staff, which therefore include 75 parked on site and 40 cars parked on surrounding streets. This results in a net decrease in car parking demand of 54 cars on surrounding streets compared to the existing situation.
- A range of initiatives have been investigated. Drop-off and pick-up locations are proposed to be altered, along with an upgrade on Macpherson Street, addressing congestion and safety issues. Alternative travel methods will also be introduced and have been seen as highly favourable from recent survey data from students, parents and staff. The Performing Arts Auditorium will host evening events (6pm onwards) with full capacity attendance up to seven times per year (two events occur biennially) and are not likely to affect on-street parking adversely. A new usage profile for the Aquatic centre encourages students to attend school earlier or stay back at school, improving traffic during peak hours from pick-up and drop-offs. Based on all the initiatives, conservative calculations (survey results show a much higher desire for mode shift as compared to calculations) show an overall reduction in private vehicle usage from the master plan and campus growth, compared to the existing situation. The master plan would ultimately improve the peak hour congestion issues around the School during normal school days.
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Appendix A

Mode shift from travel initiatives

A1 Student Initiatives (assumed targets)

	Scenarios	Students	Car			Initiative diff		Public Transport		Walk		School Bus		Car Pooling		Notes
			%	No	No. Cars	to 2013	to 2029	%	No	%	No	%	No	%	No	
Drop-off	Existing arrangements	971	61%	597	498			14%	137	14%	140	1%	7	2%	23	
	Proposed population (no initiative)	1200	66%	741	618			15%	175	15%	182	1%	9	2%	29	
	Initiative 1: School Bus	1200	58%	691	576	-78	42	15%	175	15%	182	5%	59	2%	29	50 seats
	Initiative 2: Car Pooling	1200	61%	681	568	-71	50	15%	175	15%	182	1%	9	7%	89	5% shift
	Initiative 3: Subsidised Public Transport	1200	61%	681	568	-71	50	20%	235	15%	182	1%	9	2%	29	5% shift
	Total	1200	48%	571	476	-219	142	20%	235	15%	182	5%	59	7%	89	all initiatives
Pick-up	Existing arrangements	971	50%	483	403			21%	203	21%	200	1%	7	1%	12	
	Proposed population (no initiative)	1200	52%	583	486			22%	263	22%	264	1%	9	1%	16	
	Initiative 1: School Bus	1200	44%	533	444	-42	42	22%	263	22%	264	5%	59	1%	16	50 seats
	Initiative 2: Car Pooling	1200	47%	523	436	-33	50	22%	263	22%	264	1%	9	6%	76	5% shift
	Initiative 3: Subsidised Public Transport	1200	47%	523	436	-33	50	27%	323	22%	264	1%	9	1%	16	5% shift
	Total	1200	34%	413	344	-109	142	27%	323	22%	264	5%	59	6%	76	all initiatives

A2 Student Initiatives (potential from survey data)

	Scenarios	Students	Car			Initiative diff		Public Transport		Walk		School Bus		Car Pooling		Notes
			%	No	No. Cars	to 2013	to 2029	%	No	%	No	%	No	%	No	
Drop-off	Existing arrangements	971	61%	597	498			14%	137	14%	140	1%	7	2%	23	
	Proposed population (no initiative)	1200	66%	741	618			15%	175	15%	182	1%	9	2%	29	
	Initiative 1: School Bus	1200	38%	429	357	140	261	15%	175	15%	182	26%	312	2%	29	50 seats
	Initiative 2: Car Pooling	1200	21%	238	199	299	419	15%	175	15%	182	1%	9	42%	503	5% shift
	Both initiatives	1200	0%	0	0	439	680	15%	175	15%	182	26%	312	42%	503	all initiatives
Pick-up	Existing arrangements	971	50%	483	403			21%	203	21%	200	1%	7	1%	12	
	Proposed population (no initiative)	1200	52%	583	486			22%	263	22%	264	1%	9	1%	16	
	Initiative 1: School Bus	1200	27%	329	274	128	212	22%	263	22%	264	21%	254	1%	16	50 seats
	Initiative 2: Car Pooling	1200	47%	188	157	246	329	22%	263	22%	264	1%	9	33%	395	5% shift
	Both initiatives	1200	0%	0	0	374	541	22%	263	22%	264	21%	254	33%	395	all initiatives

A3 Staff Initiatives (assumed targets)

Staff travel									
	No.	Car		Public Transport		Walk / Cycle / Scooter		Car Pooling	
		%	No. Cars	%	No. People	%	No. People	%	No. People
Existing									
Full-time staff	175	75%	131	17%	29	6%	11	2%	4
Part-time staff	27	71%	19	29%	8	0%	0	0%	0
Total Staff	202		150		37		11		4
Proposed with no initiative									
Full-time staff	185	75%	139	17%	31	6%	11	2%	4
Part-time staff	27	71%	19	29%	8	0%	0	0%	0
Total Staff	212		158		39		11		4
Proposed with initiative									
Full-time staff	185	55%	102	27%	50	11%	20	7%	13
Part-time staff	27	56%	15	39%	11	5%	1	0%	0
Total Staff	212		117		60		22		13
Increase of trips									
Staff	10		-41		23		11		9
Initiatives									
Car Pooling	5% increase	Full-time staff only							
Opal Cards for Staff	10% increase	All staff							
Walk / Cycle / Scooter	5% increase	All staff							

Staff travel									
	No.	Car		Public Transport		Walk / Cycle / Scooter		Car Pooling	
		%	No. Cars	%	No. People	%	No. People	%	No. People
Existing									
Full-time staff	175	75%	131	17%	29	6%	11	2%	4
Part-time staff	27	71%	19	29%	8	0%	0	0%	0
Total Staff	202		150		37		11		4
Proposed with no initiative									
Full-time staff	185	75%	139	17%	31	6%	11	2%	4
Part-time staff	27	71%	19	29%	8	0%	0	0%	0
Total Staff	212		158		39		11		4
Proposed with initiative									
Full-time staff	185	2%	4	37%	68	19%	35	42%	78
Part-time staff	27	0%	0	44%	12	13%	4	40%	11
Total Staff	212		4		80		39		89
Increase of trips									
Staff	10		-146		41		28		85
Initiatives									
	from private vehicle								
Car Pooling	40% shift								
Opal Cards for Staff	20% shift								
Walk / Cycle / Scooter	13% shift								
Applied to full-time staff only									