ALEX AVENUE PUBLIC SCHOOL, SCHOFIELDS
TRAFFIC IMPACT ASSESSMENT

FOR

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1. INTRODUCTION

1.1 BACKGROUND

This Traffic Impact Assessment has been prepared by Bitzios Consulting on behalf of the Schools Infrastructure NSW (the Applicant). It accompanies an Environmental Impact Statement (EIS) in support of State Significant Development Application (SSD 18_9368) for the new Alex Avenue Public School at the corner of Farmland Drive and future realignment of Pelican Road in Schofields (the site). The site is legally described as proposed Lots 1 and 2, being part of existing Lot 4 in DP1208329 and Lot 121 in DP1203646.

The new school will cater for approximately 1,000 primary school students and 70 full-time staff upon completion. The proposal seeks consent for:

- Construction of a 2-storey library, administration and staff building (Block A) comprising:
  - School administrative spaces including reception;
  - Library with reading nooks, makers space and research pods;
  - Staff rooms and offices;
  - Special programs rooms;
  - Amenities;
  - Canteen;
  - Interview rooms; and
  - Presentation spaces.
- Construction of four 2-storey classroom buildings (Block B) containing 40 homebases comprising:
  - Collaborative learning spaces;
  - Learning studios;
  - Covered outdoor learning spaces;
  - Practical activity areas; and
  - Amenities.
- Construction of a single storey assembly hall (Block C) with a performance stage and integrated covered outdoor learning area (COLA). The assembly hall will have OOSH facilities, store room areas and amenities;
- Associated site landscaping and open space including associated fences throughout and games courts;
- Pedestrian access points along both Farmland Drive and the future Pelican Road;
- Substation on the north-east corner of the site; and
- School signage to the front entrance.

All proposed school buildings will be connected by a covered walkway providing integrated covered outdoor learning areas (COLAs). School staff will use the Council car park for the adjacent sports fields pursuant to a Joint Use agreement. The proposed School pick up and drop off zone will also be contained within the future shared car park and will be accessed via Farmland Drive.

The purpose of this Traffic Impact Assessment is to:

- review the proposed architectural plans regarding layout, access, parking, manoeuvrability and provisions for service/refuse vehicles in accordance with Blacktown City Council requirements and Australian Standards AS2890;
- assess the traffic and transport impacts and infrastructure provisions in accordance with the *Secretary's Environmental Assessment Requirements (SEARs, 2018)* issued for SSD 9368;
- assess the development's traffic generation and impact on the surrounding road network and intersections during the AM and PM peak periods based on the volumes extracted from the GCSTM strategic model;
- model and analyse the impact of the school development traffic on the key Schofields Road / Junction Road / Pelican Road intersection for the future scenario;
- assess the proposed site access location, form and operation (including pick-up and drop-off areas);

- assess the proposed school car park requirements against AS2890 and Blacktown City Council *Growth Centre Precincts Development Control Plan* 2018 requirements;
- assess the public transport, pedestrian and cycling networks and connectivity within the vicinity of the site; and
- assess the proposed car park layout for general traffic and service vehicle manoeuvrability via swept path analysis.

1.2 RESPONSE TO SEARS

The Traffic Impact Assessment is required by the Secretary's Environmental Assessment Requirements (SEARs) for SSD 18_9368. This table identifies the SEARs and relevant reference within this report.

Table 1.1: SEARS - Transport and Accessibility Requirements

Performance Objective	Document Reference
Accurate details of the current daily and peak hour vehicle, existing and future public transport networks and pedestrian and cycle movement provided on the road network located adjacent to the proposed development;	▪ Section 2.3 ▪ Section 3.3, 3.4 ▪ Section 7.5
Details of estimated total daily and peak hour trips generated by the proposal, including vehicle, public transport, pedestrian and bicycle trips based on surveys of the existing and similar schools within the local area;	▪ Section 7.1, 7.2, 7.3
The adequacy of existing public transport or any future public transport infrastructure within the vicinity of the site, pedestrian and bicycle networks and associated infrastructure to meet the likely future demand of the proposed development.	▪ Section 2.3 ▪ Section3.2, 3.3, 3.4 ▪ Section 4.5 ▪ Section 5.1 ▪ Section 6.2, 6.4.4 ▪ See Green Travel Plan
Measures to integrate the development with the existing/future public transport network.	▪ Section 2.2.2, 2.3 ▪ Section 6.2
The impact of trips generated by the development on nearby intersections, particularly Schofields Road and Pelican Road, with consideration of the cumulative impacts from other approved developments in the vicinity, and the need/associated funding for, and details of, upgrades or road improvement works, if required (Traffic modelling is to be undertaken using SIDRA network modelling for current and future years).	▪ Section 7.6
The identification of infrastructure required to ameliorate any impacts on traffic efficiency and road safety impacts associated with the proposed development, including details on improvements required to affected intersections, additional school bus routes along bus capable roads (i.e. minimum 3.5m wide travel lanes), additional bus stops or bus bays.	▪ Section 3.2, 3.4 ▪ Section 4.3, 4.4, 4.5 ▪ Section 6.1, 6.2, 6.4
Details of travel demand management measures to minimise the impact on general traffic and bus operations, including details of a location specific sustainable travel plan (Green Travel Plan and specific Workplace travel plan) and the provision of facilities to increase the non-car mode share for travel to and from the site.	▪ Section 4.5 ▪ Section 5.3 ▪ Section 6.4.4 ▪ See Green Travel Plan
The proposed walking and cycling access arrangements and connections to public transport services.	▪ Section 3.4 ▪ Section 6.1, 6.2 ▪ See Green Travel Plan

The proposed access arrangements, including car and bus pick-up/drop-off facilities, and measures to mitigate any associated traffic impacts and impacts on public transport, pedestrian and bicycle networks, including pedestrian crossings and refuges and speed control devices and zones.	▪ Section 5.3 ▪ Section 6
Proposed bicycle parking provision, including end of trip facilities, in secure, convenient, accessible areas close to main entries incorporating lighting and passive surveillance.	▪ Section 4.5
Proposed number of on-site car parking spaces for teaching staff and visitors and corresponding compliance with existing parking codes and justification for the level of car parking provided on-site.	▪ Section 4.2 ▪ Section 5.1, 5.2, 5.3 ▪ Section 7.3.4
An assessment of the cumulative on-street parking impacts of cars and bus pick-up/drop-off, staff parking and any other parking demands associated with the development.	▪ Section 4.3, 4.4 ▪ Section 5.1, 5.3
An assessment of road and pedestrian safety adjacent to the proposed development and the details of required road safety measures and personal safety in line with CPTED.	▪ Section 4.3 ▪ Section 5.3.5 ▪ Section 6.1
Emergency vehicle access, service vehicle access, delivery and loading arrangements and estimated service vehicle movements (including vehicle type and the likely arrival and departure times).	▪ Section 4.6 ▪ Section 6.3
The preparation of a preliminary Construction Traffic and Pedestrian Management Plan to demonstrate the proposed management of the impact in relation to construction traffic.	▪ See Construction Traffic Management Plan

1.3 SITE LOCATION AND LAYOUT

The proposed Alex Avenue Public School is located at the corner of Farmland Drive and future realignment of Pelican Road, shown below in Figure 1.1.

Figure 1.1: Site location of Proposed Alex Avenue Public School

The layout of the proposed school overlaid on the contextual surrounds is depicted in Figure 1.2 below.

Figure 1.2: Alex Avenue Public School Site Layout

2. EXISTING CONDITIONS

2.1 LOCAL AREA

According to the Blacktown Council *Local Environmental Plan* (LEP) 2015, the proposed school is located in an area zoned under the State Environmental Planning Policy (SEPP) (*Sydney Region Growth Centres 2006*). This policy provides comprehensive planning for the North West Growth Centre, the South West Growth Centre, and the Wilton Priority Growth Area of the Sydney region. The purpose of the policy is to coordinate growth centres to incorporate residential, employment and other urban development, and create sustainable neighbourhoods for community well-being and high-quality local amenity. The proposed planning of this zone will be presented in Section 2.2.

Currently the location of the proposed development is a greenfield site with a number of existing roads surrounding the school. Schofields Road is located 200 metres north of the site, Antonia Parade is located 230 metres east and the school is proposed to be adjacent to Farmland Drive.

The following figures show the existing site and surrounding road network.

Figure 2.1: Existing conditions of site location of proposed Alex Avenue Public School – looking south

Figure 2.2: Existing conditions of site location of proposed Alex Avenue Public School – looking southwest

Figure 2.3: Existing conditions of Farmland Drive – Westbound

Figure 2.4: Existing conditions of Farmland Drive – Eastbound

Figure 2.5: Existing conditions of Schofields Road/Junction Road Intersection under construction – Northbound

Figure 2.6: Existing conditions of Schofields Road/Junction Road Intersection under construction – Southbound

Figure 2.7: Existing conditions of Schofields Road/Junction Road Intersection under construction without the northbound approach – Southbound

2.2 ROAD NETWORK

2.2.1 Schofields Road

Schofields Road is a regional road between Hambledon Road and Railway Terrace, the section in vicinity of the proposed Alex Avenue Public School. The recent upgrades to roadway infrastructure in the area has resulted in an increase in capacity, solidifying Schofields Road as a major East-West arterial road in the region, connecting Schofields and Rouse Hill and linking to Richmond Road and Windsor Road.

Near the school site, Schofields Road is a four lane, two-way road with two lanes in each direction separated by a wide median strip (around 15m wide). The posted speed limit is 70km/h. Traffic signals are installed at intersections along Schofields Road, including at Junction Road and Alex Avenue. Bus services are well-accommodated along Schofields Road, with priority bus lanes at all nearby intersections and additional dedicated bus lanes further to the east (east of Tallawong Road).

Further upgrades to intersection layouts along Schofields Road are proposed, discussed further in Section 3.2.

2.2.2 Pelican Road

Pelican Road is currently planned to undergo a future realignment to fulfil the role of a North-South local collector road connecting Schofields Road in the north and Burdekin Road in the South, to be undertaken by Top Place Construction. The road currently extends northwest towards Schofields Station but is proposed to be realigned and extended north to connect to the Schofields Road / Junction Road intersection. Construction on the south approach of this intersection (running along the western edge of the proposed Alex Avenue Public School) has not yet been completed.

The existing road is two-lane, two-way with a speed limit of 60km/h. This speed limit is likely to be maintained in the future and will likely include a new 40km/h school zone area provided on the road adjacent the proposed primary school.

2.2.3 Surrounding Road Network

The road network surrounding the proposed school is currently under development; however, the main existing roads Alex Avenue and Farmland Drive operate as local two-way, two lane roads with unrestricted parking on both sides of the street. Alex Avenue currently functions as the main local collector servicing the school, until the future realignment of Pelican Road is completed. With the development of the precinct, the configuration and parking restrictions are likely to be adjusted to suit the needs of the neighbourhood.

2.3 PUBLIC TRANSPORT

As the area is currently under development, there is a limited public transport network. There is currently no direct public transport accessibility to the proposed site. The closest bus stop is located east of the proposed school on Alex Avenue, south of Farmland Drive at a walking distance of approximately 1.3km. This can be reduced to approximately 800m once the roadway link on Farmland Drive between Prairie Street and Fortunato Street is open to public (this is assumed to occur prior to commencement of school given the current stage of construction).

The Schofields train station is located to the west of the site within approximately 1.3km walking distance. A bus terminal is also located at the train station. It is noted that this existing walking distance is measured prior to the completion of Pelican Road and assumes students/staff directly access the Schofields Road footpath via an informal pedestrian route on Frederick Jones Crescent (as opposed to detouring east to Alex Avenue first, which would double the walking distance). Following the opening of Pelican Road, there is a more direct route to the station, reducing the walking distance to approximately 1km via Pelican Road and Jerralong Drive.

2.3.1 Bus Services

The following table lists the current services that operate in the vicinity of the proposed site, mainly along Schofields Road and Alex Avenue.

Table 2.1: Existing Bus Services Near the Proposed Development

Bus Number	Bus Route	Frequency
T74	Riverstone to Blacktown	15 minutes (morning peak) 30 minutes (off-peak)
	Blacktown to Riverstone	
T72	Rouse Hill to Blacktown	30 minutes 1 hour (after 8 PM)
	Blacktown to Rouse Hill	
751	Rouse Hill Town Centre to Blacktown	1 hour
	Blacktown to Rouse Hill Town Centre	

There are also other long-distance bus services passing through the area such as the N71 route, which only operates during the early hours of the morning (mostly between 1AM and 6AM) and is therefore not of particular relevance to the proposed school development.

2.3.2 Train Services

The Schofields train station services two network lines.

The T1 Western Line operates between Richmond, Emu Plains and the Sydney City. All trains passing Schofields Station on the T1 line stop at the station, with eight (8) services in the morning between 8:00AM and 9:00AM and eight (8) services in the afternoon between 3:00PM and 4:00PM, between the two directions. Other major stations on the line include Penrith, Quakers Hill, Blacktown, Seven Hills, Parramatta, Strathfield and the City Circle.

The T5 Cumberland Line operates between Leppington and Richmond, providing interconnectivity between the suburbs of Western Sydney. There are three (3) services in the morning between 8:00AM and 9:00AM and two (2) services in the afternoon between 3:00PM and 4:00PM. Other major stations on the line include Quakers Hill, Blacktown, Seven Hills, Parramatta, Cabramatta and Liverpool.

3. PROPOSED CONDITIONS

3.1 PROPOSED SURROUNDING USES

Regions that fall under the SEPP *Sydney Region Growth Centres 2006* are coordinated into growth centres by the NSW Department of Planning and Environment. The proposed school is located in the North West Growth Centre and will fall within the Alex Avenue Precinct.

The SEPP (Sydney Region Growth Centres) *Amendment (Riverstone and Alex Avenue Precincts) 2010* outlines the surrounding uses within each precinct. The plan was finalised in May 2010, where the Alex Avenue Precinct is proposed to encompass 420 hectares and include the following:

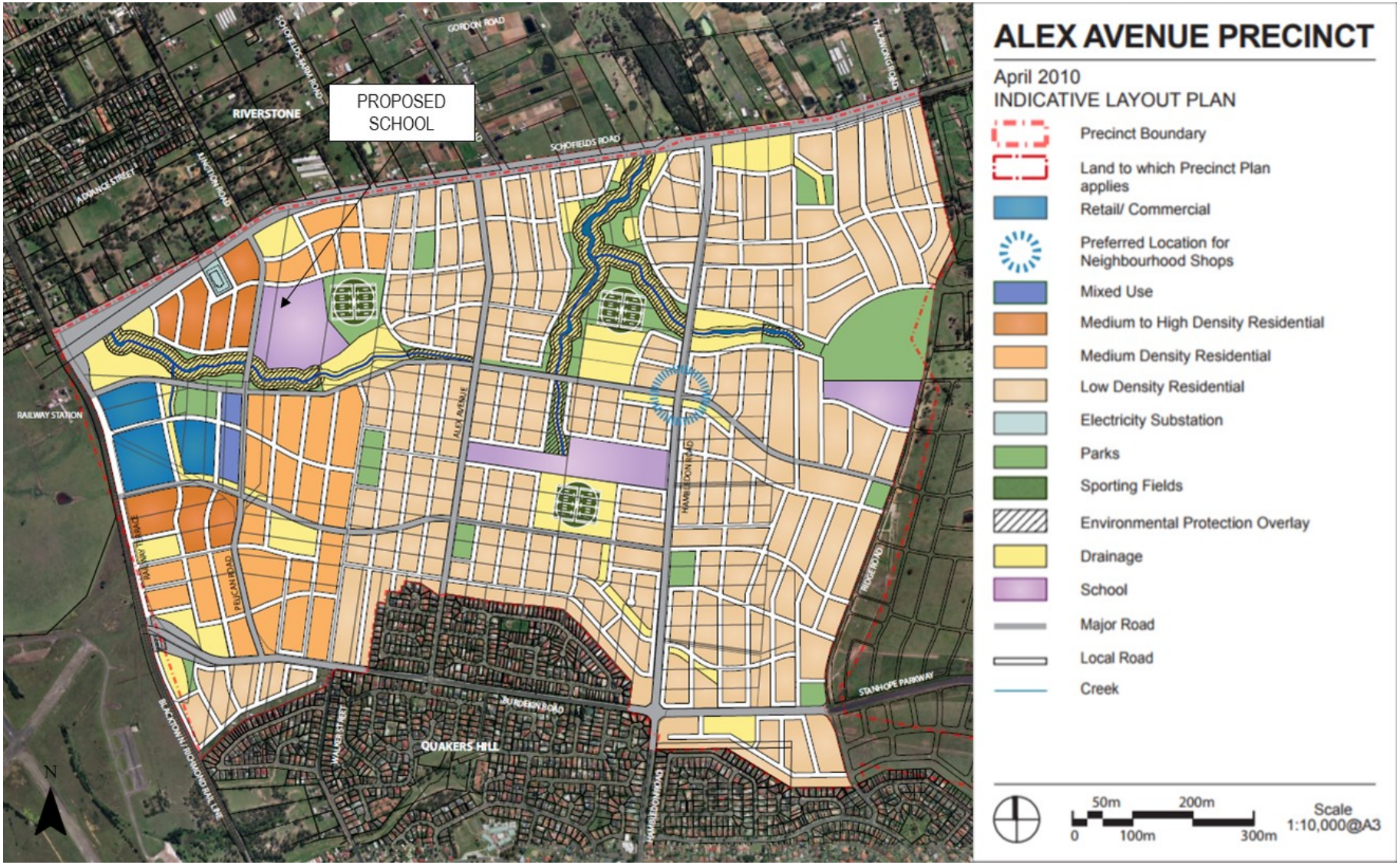
- up to 6,300 new dwellings;
- two new schools with adjoining playing fields;
- a new railway station at Schofields with a commuter car park;
- at least 25,000 square metres of retail space;
- access to the duplicated Richmond Rail line;
- upgrades to Schofields Road including a rail crossing; and
- improvements to the pedestrian and cycling connectivity.

The proposed land use near the school is characterised by the following:

- Medium to High Density Residential to the west of the school, on the other side of Pelican Road;
- Medium Density Residential to the north of the school, between Farmland Drive and Schofields Road (most of this region has already constructed, largely single dwelling houses);
- A sporting field on the immediate east side of the school, with shared boundary;
- Low Density Residential to the east of the school, comprising the majority of the land use within the Alex Avenue Precinct;
- A creek with associated riparian corridor and drainage land along the south boundary of the school;
- Medium Density Residential to the south of the school, connected via Pelican Road; and
- Mixed Use and Retail/Commercial developments to the south-west of the school, next to the Schofields Train Station, which are expected to form the commercial town centre of Schofields.

The development within the Alex Avenue Precinct and associated Schofields region is a part of strategic planning in the North West Growth Centre by Roads and Maritime Services and the Department of Planning and Environment. The upgrades to the area will include the configuration and adjustment of the current road network surrounding the proposed site, and additional land development around the school. To determine the traffic impact of the proposed school, the future road network has been considered in this TIA.

The Alex Avenue Indicative Layout Plan (ILP) presents the proposed land uses within the Alex Avenue Precinct, shown in Figure 3.1.



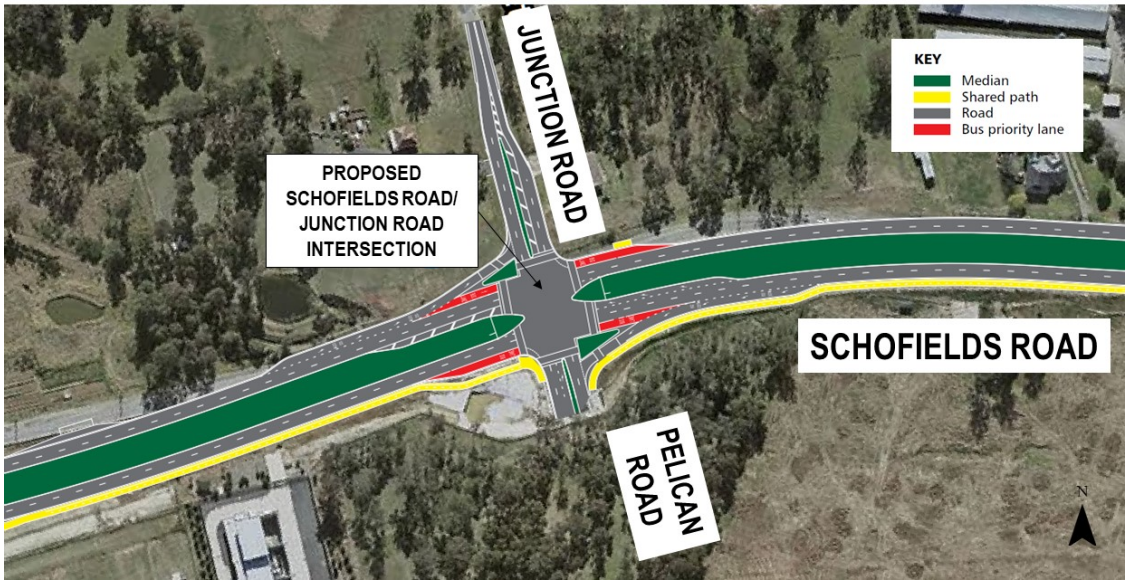
Source: Schedule 1 Alex Avenue Precinct, Blacktown City Council

Figure 3.1: Site location of proposed Alex Avenue Public School in the ILP

3.2 PROPOSED ROAD NETWORK

The main road network upgrade relevant to the proposed school occurs at the Schofields Road / Junction Road intersection. The future realignment of Pelican Road is proposed to connect to the intersection on the southern approach, enabling Pelican Road to function as a local north-south collector between Burdekin Road and Schofields Road.

The proposed layout of this intersection is shown in Figure 3.2 below. It is noted that the majority of the upgrade works along Schofields Road have been recently completed; however, the realignment of Pelican Road has not yet been undertaken.



Source: Schofields Road Upgrade and Extension, Roads and Maritime 2017

Figure 3.2: Proposed Layout of the Schofields Road/ Junction Road Intersection

The new Schofields Road / Junction Road intersection will connect to the proposed extension of Pelican Road, which will run adjacent to the proposed school. Figure 3.2 indicates lanes reserved for the future right turn movement into Pelican Road and from Junction Road, marked with chevrons. The right turn bay onto Schofields Road from Junction Road is provided to allow room to expand in the future. The right turn bay on Schofields Road onto Pelican Road will be accessible when the area is fully developed. The intersection is configured with left turn slip lanes and bus priority lanes proposed westbound and eastbound at the Schofields Road approaches to the intersection.

Pelican Road itself is proposed to be upgraded, with the new road featuring a total road reserve of 20m. The road reserve is divided between vehicle carriageway and verge, with the former planned to be 11m wide and the latter 4.5m wide on each side of the road for a total of 9m (source: 14 Schofields Road, Schofields TIA prepared by TSA September 2017). Additional pedestrian infrastructure is proposed in the form of concrete footpaths along the length of Pelican Road, providing a vital pedestrian walking link for the proposed Alex Avenue Public School.

3.3 PUBLIC TRANSPORT

3.3.1 Greater Sydney

Blacktown and Schofields are part of the Central City District around Greater Parramatta in the Metropolis of Three Cities. The strategic vision of *Future Transport 2056* and *A Metropolis of Three Cities* aims to realise the concept of a 30-minute city, where all residents in the region can travel to their closest metropolitan centre within half an hour. Achieving this requires not only a development of the transport corridors through the region, but an improvement to road and rail public transport services and infrastructure. Some of the long-term initiatives outlined in the *Central City District Plan (2018)* include:

- Improved transport links between strategic centres, including bus priority infrastructure to support new services;
- Programs to influence travel behaviour to reduce private vehicle demand on the transport network;
- On-demand bus services on local bus routes to provide more convenient options for integration with the greater rail network; and
- Investment in Smart Roads, leading to future exploration of transportation technology including automated and connected vehicles.

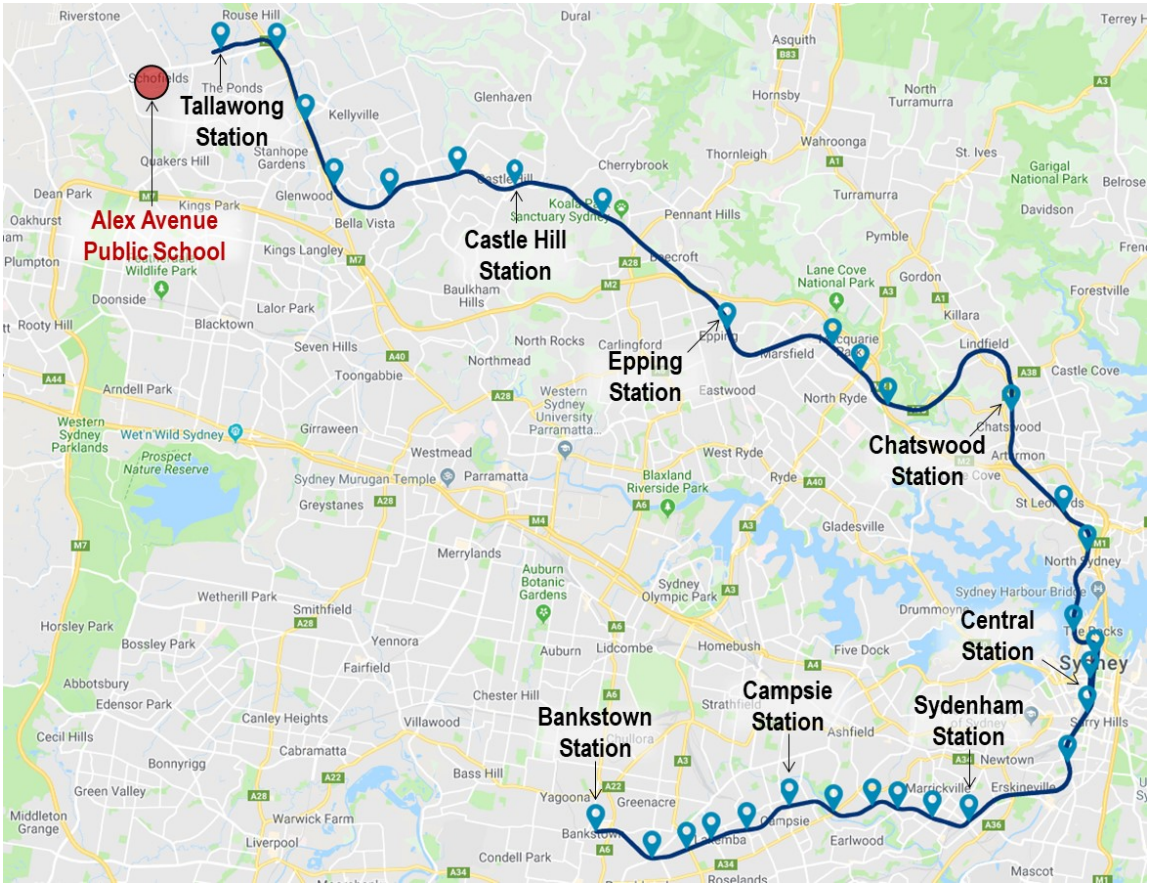
As such, a more developed public transport network is anticipated surrounding the proposed school as the Precinct becomes more established under the planning initiatives of the Greater Sydney and Future Transport 2056 strategies.

3.3.2 Sydney Metro

Sydney Metro West is a major infrastructure project aiming at servicing the Sydney CBD and Greater Parramatta through an extensive underground metro railway. The addition of the connection between Parramatta and Sydney alleviates demand on the T1 Western Line by providing additional separated services to carry the load. Interconnectivity between suburban rail and metro services is anticipated at intersections between metro and rail lines at the same station (rail above ground with metro underneath), allowing commuters to interchange between services smoothly.

Simultaneously, Sydney Metro Northwest is the first stage of the Sydney Metro project, adding both underground and skybridge rail links through Chatswood, Epping, Castle Hill and Rouse Hill. The Tallawong Road (also known as Cudgegong Road) metro station is one of the new Sydney Metro stations and is one of the ends of the Sydney Metro line (with the other being Bankstown via Sydney CBD). Construction of the station started in late 2015, and it is to be an open-cut station, situated below the ground level but open to the air.

A map of the Sydney Metro stations including the new Northwest stations is shown in Figure 3.3.



Source: Sydney Metro

Figure 3.3: Sydney Metro Northwest Map

The Tallawong Station is located between Tallawong Road and Cudgegong Road, Rouse Hill, adjacent to Schofields Road. The metro station is approximately 2.5km away from the proposed school development. This is a significant distance to travel, especially for a primary school student, therefore it is unlikely to be utilised by students at Alex Avenue Public School. However, the greater permeability of public transport connectivity throughout the Sydney network offers staff members more opportunities for 'green' methods of travelling to work.

3.4 ACTIVE TRANSPORT

A continuous off-street shared path is provided on the south side of Schofields Road, providing a cycle link between Schofields Station and Alex Avenue. While existing footpaths and cycling routes immediately adjacent to the school site are limited due to the locality of the streets, on-going development in the area promises to supplement the region's existing footpaths and pedestrian and cycle connectivity with new links. Blacktown City Council's 2016 Bike Plan proposes future cycling routes within the Alex Avenue Precinct. Figure 3.4 shows the proposed routes near the proposed primary school.

Source: 2016 Bike Plan Existing and Future Proposed Routes, Blacktown City Council

Figure 3.4: Proposed Cycling Routes within the Alex Avenue Precinct

Proposed cycle routes are located adjacent to the school site on Pelican Road and Farmland Drive. These cycle routes connect to the existing shared paths southeast of the proposed school on Burdekin Road and further develop the Blacktown Cycle Network.

For pedestrian facilities in the Alex Avenue Precinct, at minimum it is expected that footpaths will be installed along both sides of the roads marked 'Major Road' in the Indicative Layout Plan (see Figure 3.1). Near the proposed Alex Avenue Public School, the relevant streets include Schofields Road (south side already completed), Pelican Road, Jerralong Drive and Alex Avenue. With the latter three roads being the main collectors in the precinct near the school, pedestrian footpaths along their lengths allow for an easy diffusion of students into the local network of Alex Avenue. A recently constructed footpath on the south side of Farmland Drive between Fortunato Street and Prairie Street is indicative of an intention to provide footpaths along the length of Farmland Drive.

One option for a future expansion of connectivity between cycle and pedestrian networks can consider the implementation of shared paths along the main bicycle routes. It is noted that regardless of this, NSW Road Rules allow children under 16 years of age (all primary school students) to ride on a footpath.

The complete Blacktown City Council 2016 Bike Plan is attached in Appendix B.

4. PROPOSED SITE PARKING AND ACCESS

4.1 COMPARISON OF MASTERPLAN OPTIONS

During the design process for the Alex Avenue Public School Masterplan, three (3) options were prepared and evaluated from a traffic and transport perspective. A summary of the comparative assessment is outlined below. It was ultimately determined that Option C was the most suitable layout for the school.

4.1.1 Option A

Option A for the design of the school Masterplan featured a main school entry on Pelican Road, with the core school facilities (administration office, library, hall) located along the western side of the site.

Source: Alex Avenue Public School Urban Design Report

Figure 4.1: Masterplan Option A

Advantages:

Convenience of direct access to main school entrance on Pelican Road for students travelling via the future local collector road.

School Hall is located next to on-site parking area for ease of deliveries and other service vehicle movements.

Administration building near main entrance and parking allows ease of access and direction by visitors to the school.

Disadvantages:

Relies on completion of the Pelican Road link before the functionality of the school layout can be fully realised.

In interim period, this Masterplan layout would require the construction of a service road to allow vehicular access to the parking and/or service areas.

Main school entrance located on Pelican Road would require additional infrastructure to ensure pedestrian safety. As a collector road, it would experience higher volumes of through traffic than the surrounding local streets, and children crossing movements must be catered for via infrastructure such as a midblock signalised or pedestrian crossing.

Secondary accesses on Farmland Drive and from the Oval are detached from the school admin facilities, increasing response times in case of any issues.

4.1.2 Option B

Option B for the design of the school Masterplan expressed a re-arrangement of the site layout. Similar to Option A, the main entrance of the school is located on Pelican Road, with a large open Entry Forecourt space. The locations of the homebase buildings were adjusted to interface with the secondary entry pedestrian entry locations.

Source: Alex Avenue Public School Urban Design Report

Figure 4.2: Masterplan Option B

Advantages:

Convenience of direct access to main school entrance on Pelican Road for students travelling via the future local collector road.

Improved visibility of primary and secondary pedestrian entry points from school administration building.

Disadvantages:

Relies on completion of the Pelican Road link before the functionality of the school layout can be fully realised.

In interim period, this Masterplan layout would require the extension of Farmland Drive through the construction of a service road to access the delivery / refuse collection location.

A large turn-around facility must be provided to accommodate service vehicle turning movements at the end of the temporary Farmland Drive cul-de-sac.

No on-site car parking is provided.

Main school entrance located on Pelican Road would require additional infrastructure to ensure pedestrian safety. As a collector road, it would experience higher volumes of through traffic than the surrounding local streets, and children crossing movements must be catered for via infrastructure such as a pedestrian crossing.

4.1.3 Option C

Option C for the design of the school Masterplan featured a relocation of the main entrance from Pelican Road to Farmland Drive. This has a number of benefits to school operation, especially during the interim period prior to the construction of Pelican Road during the future realignment.

Source: Alex Avenue Public School Urban Design Report

Figure 4.3: Masterplan Option C

Advantages:

Main school entrance on Farmland Drive improves pedestrian safety on the adjacent road. Farmland Drive is expected to experience more local traffic conditions than Pelican Road, and therefore have a lower volume of through vehicles and/or potentially a lower speed limit.

School layout is functional prior to the construction of Pelican Road, with the main entrance on the existing section of Farmland Drive.

Core facilities (library, administration, hall) are more centralised in the school layout, enabling a greater ease in access from all locations and featuring a larger presence on the public oval side of the school.

Enables a potential shared use of school and public facilities, which can allow for a greater sense of integration with the community.

School Hall is located next to the parking area for ease of deliveries and other service vehicle movements.

Disadvantages:

There is a slight reduction in convenience of main school access in its repositioning onto Farmland Drive. Distance from the train station is increased slightly. However, a future secondary entry is to be located on Pelican Road, which mitigates the negative aspects of the relocation.

Minimal on-site car parking is provided. However, the relocation of the core facilities to the eastern side of the site enables a potential shared use of the Council's playing field car park.

4.2 PROPOSED PARKING ARRANGEMENT

The proposed site Masterplan aims for the Alex Avenue Public School parking provision to be supplied through a *Joint Use Strategy* with Blacktown City Council.

The site on the east boundary of the Alex Avenue Public School site is to be developed as a public park with a sporting field (see Figure 3.1). A 100-space car park is proposed to be constructed on the north side of the park, interfacing with Farmland Drive. The usage of this car park is proposed to be shared between school staff and the general public.

Details of the shared use functionality and design of the car park is to be confirmed and prepared at a later stage by Blacktown City Council. A preliminary management scheme for the parking operations has been prepared at this stage, detailed in Section 5.3.

4.3 DROP-OFF / PICK-UP ZONE

A drop-off / pick-up zone is to be provided as a part of the Joint Use shared car park with the adjacent playing field. The zone is proposed to be approximately 50 metres long, allowing for simultaneous usage by 8 to 9 vehicles. The zone is located off the main roadway of Farmland Drive, within the body of the shared car park, with a long parking aisle allowing for off-road storage of queueing vehicles.

The positioning of the zone allows for students disembarking from vehicles to step directly onto the adjacent footpath and access the school via a shared plaza. By not requiring students to cross any roads, student safety enhances and smoother vehicle flow facilitates through reducing pedestrian-vehicle conflict zones. There is continuous pedestrian connectivity between the drop-off / pick-up zone and the school entrance.

An indicative design for the drop-off / pick-up zone is highlighted below in Figure 4.4.

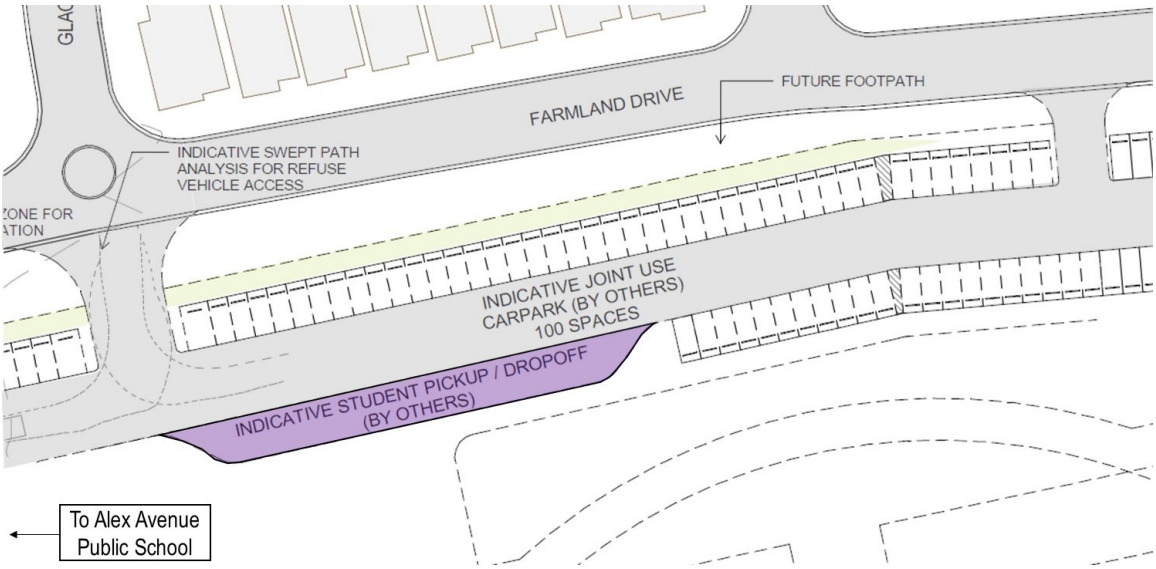


Figure 4.4: Drop-off / Pick-up Zone

A secondary drop-off / pick-up zone is provided along the school frontage on Farmland Drive, specifically for Person with Disability (PWD) use. The zone is proposed to be approximately 35m long, and is located immediately adjacent to the main entrance of the school (closer than the main drop-off / pick-up zone in the shared car park), allowing for more direct and unimpeded access for any PWD students, staff or visitors. This acts to provide greater accessibility to the school both in proximity and by separating any people with disabilities from the expected crowding and rush during the peak hours before and after school at the main drop-off zone.

To facilitate the potential extra amount of time required to embark/disembark the vehicle, this drop-off zone should allow a longer time for vehicle parking than that of the main drop-off zone.

The location of the PWD drop-off zone is highlighted in Figure 4.5.

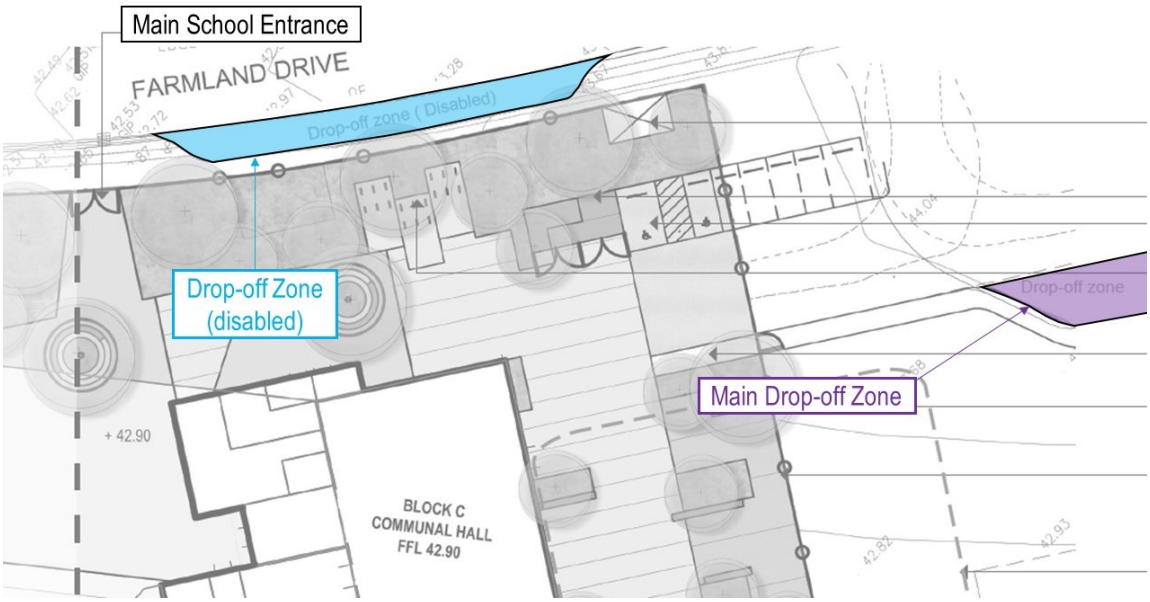


Figure 4.5: Drop-off / Pick-up Zone (Disabled)

4.4 BUS LAYBY

A future bus layby is proposed on Pelican Road, following construction of the new road link during the realignment of Pelican Road. A local school bus service will function from this bus layby once it is operational. The bus layby is proposed to be approximately 44m long, which allows for simultaneous usage by at least two (2) buses, which is deemed adequate for the capacity of the school. Bus Zone signs (sign no. R5-20) should be installed on each end of the bus layby to delineate the extents of the bus zone to manage kerbside parking.

Prior to the completion of these works, buses are not proposed to access Farmland Drive. An alternative travel option for students in lieu of a school bus service is proposed as a 'Walking School Bus' (see Section 6.4.4 for more details).

4.5 BICYCLE PARKING

A pair of areas on the proposed school site are dedicated for bicycle parking. The bicycle areas are to be fitted out with bicycle rack parking facilities. For ease of cyclist access and parking on site, the parking areas are positioned near the entrance points to the school. The parking areas should be provided with lighting where necessary to maximise visibility and consolidate passive surveillance of the space.

The areas are:

- Near the Main Entry Plaza (between main pedestrian entry and car park access) on Farmland Drive; and
- Adjacent to the future secondary entry on Pelican Road.

These bicycle facilities are shown in Figure 4.6.

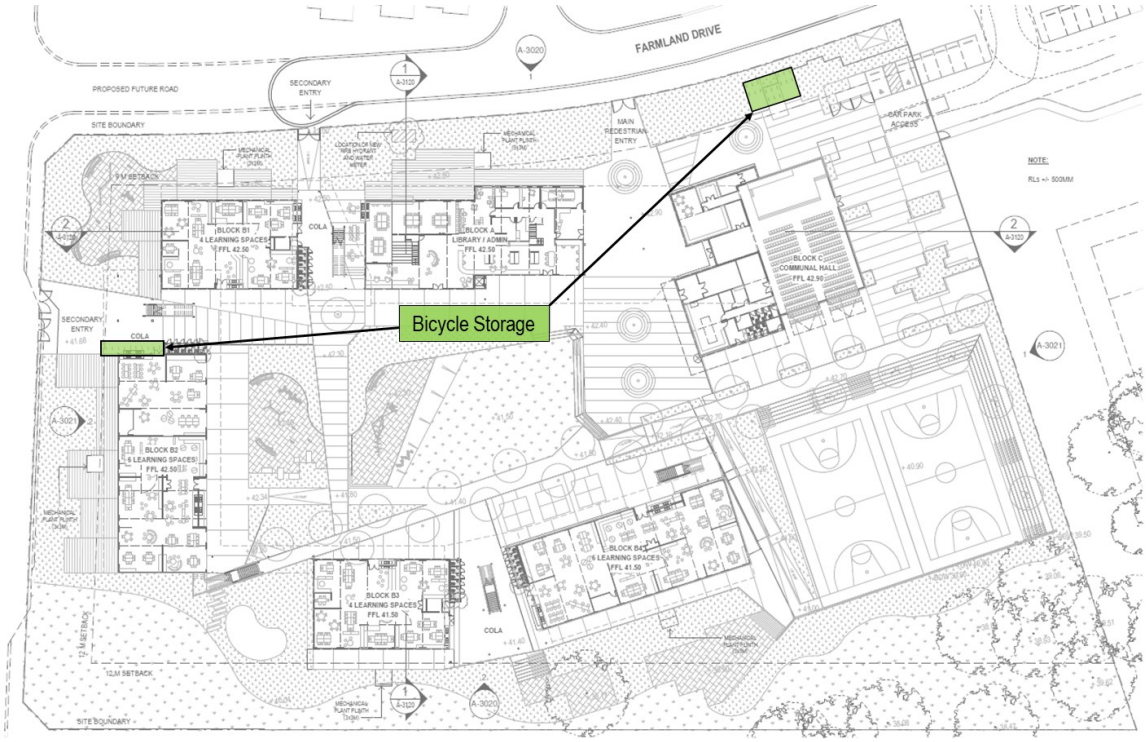


Figure 4.6: Location of Bicycle Parking Areas

The bicycle parking area near the main entrance is outfitted with a group of double-sided horizontal bicycle parking racks alongside the edge of the space (garden space). A similar straight row of racks is provided at the west entry on Pelican Road. 18 racks are provided at the former parking area, while 10 racks are provided at the latter area, for a total of 28 racks. This amounts to a total of 56 parking spaces.

A shower/change facility is provided on-site as an end-of-trip facility for staff members cycling to work.

4.6 EMERGENCY VEHICLE ACCESS

A 6m Right of Way is proposed along the future alignment of Pelican Road. The easement will allow service access to the western side of the site before the Pelican Road works is completed.

Access by emergency vehicles is to be provided via the shared use sports field car park to the east of the site. The aisle on the western end of the car park allows vehicles to approach the School Hall building, and if necessary, can be used to access the main entry plaza or shared plaza. To maximise internal site access, the kerb should be designed to be mountable (around 100mm high) and a minimum vertical clearance of 4.5m should be maintained in this area.

5. PARKING ASSESSMENT

5.1 PARKING PROVISION

An assessment of parking requirements, proposed provision and vehicular access to and within the proposed school was conducted against the relevant standards, guidelines and planning documents, including:

- Australian Standards;
  - Parking facilities Off-street car parking (AS2890.1);
  - Parking facilities Off-street car parking for people with disabilities (AS2890.6);
- Blacktown City Council Growth Centre Precincts Development Control Plan July 2018 (BCC Growth Centre Precincts DCP).

The NSW Department of Education is noted to adopt the principle that "*A school is not obliged to provide parking on site to anyone at any time".* However, as the BCC Growth Centre Precincts DCP stipulates specific parking requirements for a primary school (outlined in Table 5.1 below), compliance was measured against these controls to ensure a minimal parking impact on the surrounding on-street car parking areas.

Bicycle parking provision rates were adapted from Planning Guidelines for Walking and Cycling (NSW Government, December 2004), which recommend the number of spaces to be based a percentage of staff journey-to-work trips. For this assessment, this value has also been supplemented by the number of students in Year 4 to 6 (assumed to be around 3/7ths of the school students).

Table 5.1: Parking Requirements

Vehicle	Parking requirement rates	Required Spaces	Spaces provided	Compliance
Car	1 space per staff member	70 spaces	100 spaces	**Yes**
	1 space per 100 students	10 spaces		
Bicycle	8-15% of the number of staff members plus students Year 4-6	40 – 75 spaces	56 spaces	**Yes**

A total of 80 spaces are required by DCP requirements for a primary school parking provision. The rate is noted to provide each staff member with their own parking space, with an additional amount based on the number of students. There are a number of public transportation options near the school site suitable for staff members, including the Schofields Train Station and bus services on Alex Avenue. There is also the potential in the future for an expansion of services on Pelican Road. Therefore, it is expected that the mode share of staff members will not be entirely private vehicles – that is, not all parking spaces will be occupied. This is reinforced by mode share data for primary school staff in the Blacktown LGA, analysed from 2016 Census data, outlined in Section 7.3.4. This shows that around 86.5% of staff members travel to school via private vehicle. Of the 70 staff members, around 61 are expected to occupy a parking space, leaving a surplus in parking supply of 19 spaces.

During weekdays, the shared car park should have sufficient parking spaces for normal use by visitors to the playing fields. Larger events are likely to occur on the weekends, where there will be a minimal number of staff vehicles parked (if any). For preliminary details on the management of the shared car park, see Section 5.3.

The available bicycle parking (see Section 4.5) allows for 56 bicycle parking spaces provided on-site, which is deemed satisfactory to meet the bicycle parking demand. It is noted that there is available room on-site for a future expansion of facilities as necessary after commencement of school operations.

5.2 PARKING COMPLIANCE

An assessment of the two (2) parking spaces that are provided within the school property line has been prepared in accordance with AS2890.1 and AS2890.6, summarised in Table 5.2.

Table 5.2: Summary of car park compliance with Australian Standards

Requirement	Provision	Provided	Compliance
Persons With Disabilities (PWD) Spaces			
Dimensions	2400 x 5400 mm	2400 x 5400 mm 2400 x 5400 mm	**Yes**
Shared Space Dimensions	2400 x 5400 mm	2400 x 5400 mm	**Yes**
Bollard	800 +/- 50 mm from open end of space	800 mm	**Yes**
Aisle			
Aisle Width	5800 mm	Approx. 8900 mm (min)	**Yes**
Wheel Stops			
Spacing	900mm for rear into low kerb	900mm	**Yes**
Bicycle Parking			
Spacing between adjacent racks	1000mm min.	1000mm min.	**Yes**

All parking spaces are to be delineated with linemarking and symbols as required by AS2890.1 and AS2890.6 requirements.

A design compliance assessment of the shared car park should be undertaken for the shared car park once the layout is finalised to ensure compliance of parking layout and space specifications in accordance with AS2890.1 and AS2890.6.

5.3 PARKING MANAGEMENT SCHEME

The Joint Use Strategy with Blacktown City Council for the proposed shared use of the car park is currently underway. A preliminary parking management scheme has been prepared to suggest operational guidelines for the shared use. The considerations are outlined below.

5.3.1 Space Allocation

A total of 100 angled 90-degree parking spaces are proposed to be provided in the shared car park, with a central aisle and two access locations. To meet the parking demand of the school, parking spaces should be allocated for specific use by school staff members. As a preliminary number, the 80 spaces required by the BCC Growth Centre Precincts DCP should be dedicated to staff members during the general operating hours of the school (Monday – Friday, 8:00AM to 5:00PM). To ensure a logical arrangement of spaces and convenience and access, this should be the 80 spaces closest to the school.

Clear signage and/or linemarking is to be installed to identify the school-allocated spaces, as well as the hours within which the parking restrictions apply. It is recommended to commence the parking restrictions slightly prior to school hours in the morning (around 6:00 or 7:00AM), to ensure teachers will have a parking space if travelling early to school.

5.3.2 Management during School Hours

During school hours, management of the car park should be the responsibility of the Alex Avenue Public School administration. A staff member should be present at the car park during the school peak periods (immediately before and after school) near the drop-off / pick-up zone to oversee car park operations and safety of students. Compliance with the allowed stopping times should be enforced to facilitate smoother traffic operations during the busy peak period, minimising the traffic impact on the surrounding roads.

As a preliminary number, 20 of the parking spaces are free for standard usage by public (visitors to the park, etc), with any timed parking restrictions as identified by Blacktown City Council.

5.3.3 Management outside of School Hours

Outside of school hours, all parking spaces (100) within the car park should revert to public usage, with any timed parking restrictions as identified by Blacktown City Council.

5.3.4 Events

As the car park services a playing field, it is possible that there will be sporting and/or other events using the park, unrelated to the school. While events of this nature are often scheduled for weekends (and hence not affected by the shared use by school staff members), in the case that any events are proposed to occur during school hours, there should be consultation between the school administration, Blacktown City Council and the event holder. Where possible, events should be coordinated or rescheduled to after school hours to avoid any cumulative parking demand. In the event where this is not possible, an agreement should be made between all parties on the usage of the car park during the event period.

For example, such an agreement could take the form of the Alex Avenue Public School staff scheduling a Ride to Work day, with some portion of staff agreeing to seek active or public modes of transportation to school on that day, hence freeing up car park spaces for use by the event.

Due to the variable nature of these circumstances, any such situation should be dealt with on a case-by-case basis.

5.3.5 Security and Amenity

The shared use of the car park acts to expand the borders of the area traversed by the primary school students. As such, all care should be taken to ensure the security and amenity of the car park in line with Crime Prevention Through Environmental Design (CTPED) principles. Some of the steps to take include:

- An enhancement of the natural surveillance of the area. Landscaping within and around the car park should be restricted to low shrubs and flower beds to ensure that natural sight lines are maintained. This includes visibility from the nearby school core facilities, shared plaza space and also the public Council playing fields.
- The installation of lighting within the car park to ensure maximum visibility during low-light conditions. While relevant throughout the entire car park (which is noted to be quite lengthy), this should especially focus on the areas near the drop-off / pick-up bay, refuse bin enclosure, bicycle parking space, and the entry and exits on Farmland Drive. This improves visibility and hence safety of pedestrians during evening out of school hours activities (weekdays 3:00PM to 6:30PM) and any shared usage of school facilities (school hall, basketball courts, etc).
- Access control should be highlighted and made clear to all visitors to the car park, in the form of signage and linemarking delineating staff allocated spaces and school drop-off / pick-up bay. The bin enclosure and bicycle parking areas should also be visibly separate from the public car park space (with additional security measures such as locking gates to prevent unauthorised access to the bins).
- Upgrades, cleaning and maintenance of the car park should be undertaken as necessary to ensure amenity and hygiene of the space. Responsibility for any such works should be identified with Blacktown City Council under the finalised parking management scheme.

5.4 DROP OFF BAY ASSESSMENT

A high-level assessment was undertaken to determine the preliminary suitability of the proposed main drop-off / pick-up bay in accommodating peak hour traffic. Due to the variability of traffic behaviour, the following assumptions were made for the purpose of this assessment:

- Excluding the 61 staff generated trips (who will not be using the drop off bay), the remaining total trip generation calculated in Section 7.2 is assumed to all utilise the drop off bay;
- School attendance for the assessed day is at maximum;
- A total of 8 vehicles can be serviced at the drop-off at one time, with other vehicles queueing;
- The service time for each parking bay was assumed to be 30 seconds;
- The corresponding service rate was assumed to be 2 vehicles / minute; and
- The trips are normally distributed in the AM peak period between 7:45AM and 9:30AM, peaking between 8:30AM and 8:45AM; and
- The trips reflect a half-normal distribution in the PM peak period between 3:30PM and 4:30PM, with utilisation of the drop off bay commencing at 3:30PM.

The results are shown in the graphs below.

5.4.1 AM Peak Period

The estimated number of vehicles arriving in each 15-minute interval during the AM peak is depicted in Figure 5.1.

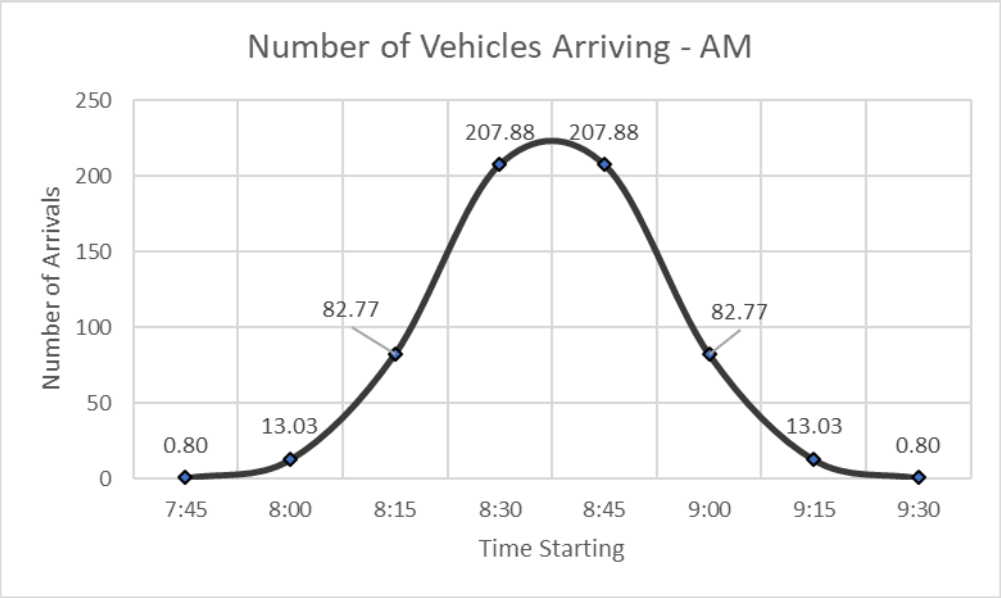


Figure 5.1: Vehicles Arriving in AM Peak

The maximum number of vehicles arriving during the AM peak occurs at a peak between 8:30AM and 8:45AM, estimated to be around 225 vehicles. This entails an arrival rate of approximately 15 vehicles / minute. With the provided 8 drop off bays, there is a total service rate of 16 vehicles / minute under the assumptions above. This amounts to a utilisation ratio of around 0.94 (which is under 1.00), therefore the arrival rate can be accommodated by the provided bay.

Given the saturation level, some queueing is still expected in this situation due to the turnover times. However, the interpeak period is fairly brief, with the arrival rate dropping steeply both prior and following the busy period. It is further noted that existing base traffic volumes along Farmland Drive in the westbound direction are low at present (due to lack of connectivity), and not anticipated to be very high in future (local street servicing primarily residential traffic). Additionally, the drop off bay is positioned off the main road way due to its location within the shared playing field car park, therefore queueing vehicles can be stored off the public route of travel.

5.4.2 PM Peak Period

The estimated number of vehicles arriving in each 15-minute interval during the PM peak is depicted in Figure 5.2.

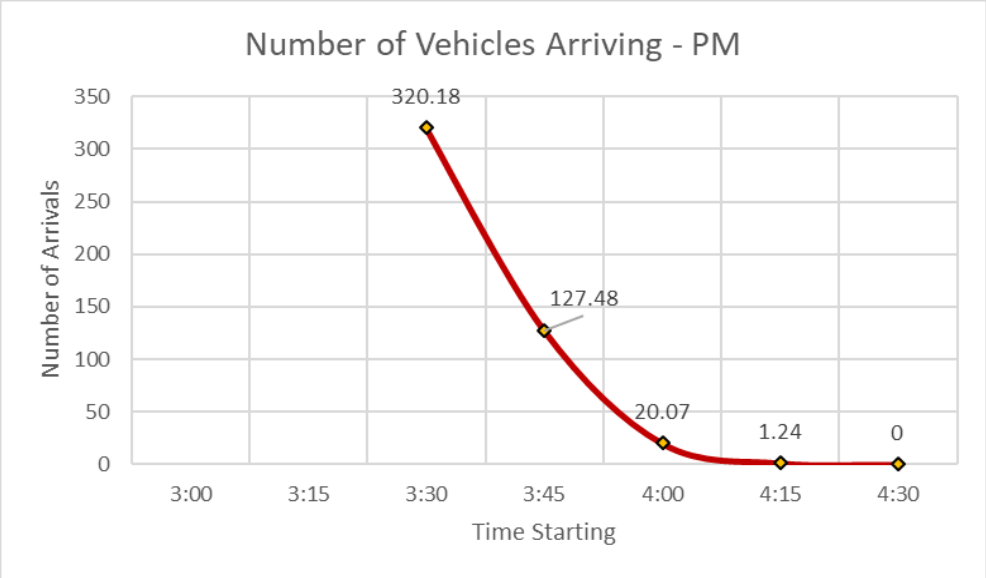


Figure 5.2: Vehicles Arriving in PM Peak

The maximum number of vehicles arriving during the PM peak is assumed to occur at 3:30PM with the release of school students. This is expected to be the busy period, as students must find their way to the waiting vehicle. For this assessment, it's assumed that no students are released earlier, with pick-ups commencing at 3:30PM sharp. The maximum arrival rate in this scenario amounts to approximately 21 vehicles / minute. With the provided 8 drop off bays, there is a total service rate of 16 vehicles / minute under the assumptions above. This amounts to a utilisation ratio of around 1.31 (which is over 1.00), therefore the arrival rate exceeds the available service rate of the provided bay.

Queueing is therefore expected during the first 15-minute period. As the arrival rate quickly drops off to around 8.5 vehicles / minute at 3:45PM, the high saturation level primarily occurs within the initial period due to the simultaneous release of all children forcing a concentration of arrivals.

This assessment is tempered by the following characteristics:

- Before and After School activities can shift the incoming trips to a wider time interval, as students travel to school earlier in the mornings and leave later in the afternoons.
  - This reduces the concentration of arrivals to specific saturated time periods.
  - Some examples include band practice, sports, club activities and other social events.
- Due to convenience of travel direction and time constraints, it's possible that some parents will not utilise the drop-off zone when delivering their child to school.
  - On-street kerbside stops can be made on the local streets in vicinity of the school to allow children to disembark.
- Depending on school attendance on a given day, some reduction in daily trips is possible.
- Enforcement, management and marshalling of drop-off bay operations by staff members can enhance the smoothness of traffic flow at the area by ensuring that parents don't wait too long.
- Staggering release times in the afternoon
  - By staging the release times of students in the afternoon, a more even distribution of arrivals in the after-school period can be achieved, reducing the intensity of the school release spike.
- Drop-off capacity may be slightly larger than assessed depending on driver behaviour (closeness of parking, taper length, etc), improving the service rate.

If deemed necessary, a more detailed queueing assessment should be undertaken following commencement of the school, with survey data to determine appropriate assumptions on parent traffic behaviour and arrival rates.

6. ACCESS ASSESSMENT

6.1 PEDESTRIAN FACILITIES AND MOVEMENT

An assessment of pedestrian circulation and connectivity between the proposed school and the surrounding road network was undertaken. Pedestrians and students can access the school via three main entrances. Of the three entry locations, two are located on the north side of the site along Farmland Drive, and one is located on the west side of the site along the proposed Pelican Road.

The main entrance to the school is to be opposite Hyde Street, and enters onto the main entry plaza. The other pedestrian entrance on Farmland Drive is located to the west of the main entrance, entering the site between the library and classroom buildings. A third pedestrian entrance is proposed to be positioned on the west side of the site, allowing access and egress onto Pelican Road (pending future construction).

Aside from these three entry points, students and staff can also enter the school site from the shared car park and main drop-off/pick-up zone via a shared plaza on the east side of site. This connects directly onto the school forecourt and covered outdoor terrace spaces.

Pedestrian footpaths are proposed along the south side of Farmland Drive along the school and sports field frontage, enhancing pedestrian movements along this road section and linking between the two local collectors of Pelican Road and Alex Avenue. To facilitate safe pedestrian movement to the Alex Avenue Public School, warning signs and school speed zones should be implemented along sections of Farmland Drive and Pelican Road adjacent to the school site. Furthermore, a pedestrian crossing is proposed on the southern approach to the Glacier Street intersection, spanning the egress roadway from the shared car park. This is intended to provide connectivity for pedestrians walking to school from the east and enhances pedestrian safety especially during the peak hours where there are large volumes of vehicles entering and exiting the shared car park to access the drop-off / pick-up zone.

The primary pedestrian routes and access points to the school site are marked out in Figure 6.1.

Figure 6.1: Shared Use Arrangement Concept Plan

For pedestrians utilising the disabled drop-off bay on Farmland Drive, there is a continuous footpath along the south side of the road. This provides a direct connection between the zone and the school entrances, therefore no road crossing movements are required.

6.2 PEDESTRIAN ACCESS TO BUS STOPS

The closest existing bus stop is located on Alex Avenue, approximately 750m away via Farmland Drive, a walk of around ten to fifteen minutes. It services the T72 bus route between Blacktown and Rouse Hill. It is noted that at present, there are no footpaths along this route, and a couple of links along Farmland Drive are still under construction.

The future bus layby is located on Pelican Road, adjacent to the west side of the school. A pedestrian entry is planned immediately next to the bus layby, providing direct access for students arriving or leaving school via public transport. Due to limited carriageway width and volume of vehicular traffic on Farmland Drive (due to drop-off/pick-up zone during the peak periods), the school bus service is expected to operate via Pelican Road. The proposed Pelican Road width should be suitable in meeting the minimum 3.5m lane widths for bus routes. Details on the proposed bus route and schedule are to be determined in consultation with the local bus service operator (Busways).

6.3 SWEPT PATH ANALYSIS

6.3.1 PWD Spaces

For the two (2) PWD spaces provided within the school boundary, swept path analysis was undertaken to determine suitability of the car park layout in accessing the spaces. It was found that due to the wide parking aisle and compliant parking spaces, a B99 design vehicle was capable of accessing the spaces in both a forward and reverse in movement. It was further confirmed that the corresponding reverse and forward out movements were possible without encroaching on any physical obstructions or adjacent spaces.

The swept path diagrams for these movements are included in Appendix D.

6.3.2 Waste Collection

A waste collection zone (bin enclosure) is proposed on the eastern side of the site within the school boundaries and is accessed via the shared car park for the adjacent playing field. The location of the zone is shown in Figure 6.2 below.

Figure 6.2: Waste Collection Area

Waste vehicle access and egress to and from the site was assessed via swept path analysis using a 12.5m Heavy Rigid Vehicle (HRV). The analysis indicated the vehicle can:

- From the parking aisle, pull up alongside the proposed bin enclosure, perform duties, reverse back along the parking aisle and turn right to exit the site towards the roundabout in a forward direction; Or

- From the parking aisle, turn right towards the roundabout, reverse left towards the bins, perform duties, and turn left to exit the site towards the roundabout in a forward direction.

For the site exit manoeuvre, due to the length of the design vehicle, it was required to mount the temporary roundabout island to navigate the intersection when performing a right turn or through manoeuvre. To ensure this is possible, the design of the roundabout should allow for a mountable island (no fencing, signage or landscaping on the island).

The swept path diagrams for these movements are included in Appendix D.

As the vehicle is required to reverse in the parking aisle during on-site manoeuvres, it is therefore recommended to engage waste collection services to attend the site during times with minimal pedestrian and vehicular traffic within the staff car park. At minimum, waste vehicle access is recommended to be banned between the hours of 8.00am and 3.30pm on school days, to minimise impact on school traffic during peak hours and reduce school children exposure to large waste vehicles.

6.4 TEMPORARY ACCESS ARRANGEMENTS

The construction of Pelican Road is planned to occur at a future date post-commencement of the school. In the interim period between the start of school and opening of Pelican Road to the public, some temporary arrangements must be established for traffic and transport purposes. These are outlined in the sections below.

6.4.1 Farmland Drive Cul-de-sac

A cul-de-sac is proposed to be constructed at the end of Farmland Drive west of Hyde Street to facilitate westbound vehicles to perform a U-turn to turn around and return along Farmland Drive in an eastbound direction. As the drop-off / pick-up zone is accessed to the east of site, egress from the shared car park allows for a right turning movement, and the Hyde Street intersection is located immediately before the end of the road, the number of vehicles expected to travel the full length of Farmland Drive is not expected to be significant.

The cul-de-sac is to be removed once Pelican Road is constructed to allow Farmland Drive to connect through. This would also restore pedestrian footpath connectivity.

6.4.2 Parking Restrictions

No Stopping parking restrictions should be put in place while the cul-de-sac on Farmland Drive is present. At a minimum, these should be located on both sides of Farmland Drive west of Hyde Street, to prevent obstruction of U-turning vehicle manoeuvres. Due to the relative narrowness of the road (approximately 9m), it is also recommended to install No Parking restrictions on the south side of Farmland Drive along the school frontage.

6.4.3 Temporary Roundabout at Glacier Street and Shared Car Park

A temporary roundabout is proposed to be implemented at the Glacier Street / Farmland Drive / Car park access road intersection, to be constructed as a part of the shared car park works (Section 4.1). This is established to enable easier traffic operations due to the large volume of inbound and outbound vehicles during school peak hours utilising the drop-off/pick-up zone.

6.4.4 Walking School Bus

Due to the current self-contained nature of the street network near the school site, bus vehicles accessing Farmland Drive cause traffic issues in their need to turn around and manoeuvre back towards Alex Avenue. Blacktown City Council has restricted the use of buses on Farmland Drive prior to the construction of Pelican Road, when a corresponding future bus lay-by on the west side of site will be constructed.

In the interim period, a 'Walking School Bus' has been nominated for pedestrian (student) journeys to the school. A Walking School Bus (WSB) is an initiative to have a group of primary school students walking to and from school together as a group, guided by a minimum of two (2) supervising adults. Supervisors can

be staff members, volunteers and parents, and they usually guide the 'bus' with one leading and one bringing up the rear. During the course of the program, supervisors are expected to model, teach and encourage safe walking habits, including crossing the road at safe locations, stopping at kerbs and doing safety observation checks (look left-right-left).

A WSB program can have a number of beneficial effects for school, children and the larger community as a whole. It can inspire healthier modes of transportation, reduce congestion and traffic load, build social relationships and a sense of community, and establish physically active travel patterns from a young age.

For the Alex Avenue Public School, the WSB can follow a set route through the local Alex Avenue Precinct, depending upon where participating students live. Due to distance and safety reasons, it is recommended to restrict the route to the south side of Schofields Road such that the WSB is not required to cross the higher volume arterial road. At maximum, the route should be no longer than 2km, preferably within a 30 minute journey. Catchment areas based on radii of 500m and 1km centred on the school are shown in Figure 6.3 below.

In recognition of the health and social benefits of active transport as a means of travelling to school, it is recommended that the program is continued following the completion of Pelican Road and commencement of school bus services. Effort should be made to endorse and encourage participation in the WSB amongst students and parents.

Figure 6.3: Catchment Radii for Walking School Bus Planning

7. TRAFFIC ASSESSMENT

7.1 COMPARATIVE STUDY

To estimate the development traffic generation from the proposed Alex Avenue Public School, a comparison study was conducted with Rouse Hill Public School located adjacent to Schofields. Given the proximity of Rouse Hill Public School and the similar characteristics to the proposed Alex Avenue Public School, Rouse Hill is an appropriate comparative case study to estimate the proposed development traffic generation.

7.2 DEVELOPMENT TRAFFIC GENERATION

The traffic assessment for the proposed Alex Avenue Public School considered the ultimate future scenario for generation and distribution purposes – that is, following the construction of Pelican Road (to the west of site) and the corresponding extension of Farmland Drive to adjoin the new North-South link. The general operating hours of the school are Monday – Friday, 8:00AM to 5:00PM.

Traffic generation rates for the proposed primary school were obtained from the *Trip Generation Surveys, Schools Analysis Report (2014)* by GTA Consultants to evaluate trip generation persons and vehicles from schools. The trip generation rates can be multiplied by the number of enrolled students to obtain the total number of trips generated by all traffic, inclusive of trips made both to and from the school during the AM and PM peak periods. The results from this study have been used to assist in determining the number of trips generated to the proposed development.

Traffic generation rates were considered from public schools in the Sydney Metropolitan Area for the expected school capacity of 1000 students and 70 full-time staff. Table 7.1 indicates the traffic generation for the proposed development.

Table 7.1: Trip Generation of the Proposed Development

Trips	Trip Generation Rate	Trip Generation
Morning Peak		
Trips per student	1.59 trips per student	1590
Vehicle trips per student	0.67 vehicle trips per student	670
Afternoon Peak		
Trips per student	1.80 trips per student	1800
Vehicle trips per student	0.53 vehicle trips per student	530

Based on these trip generation rates, the school would ultimately generate 1590 people trips in the morning peak and 1800 people trips during the afternoon peak. Of these trips, 670 trips are vehicle trips during the morning peak, and 530 in the afternoon.

Traffic behaviour for school-generated trips tends to see a mirroring of outbound trips to inbound trips. This is due to the extremely short duration of most trips to the school, in that most vehicle journeys are parents dropping their children off to school or picking them up afterwards. For these types of trips, both the inbound and outbound legs of the journey occur within the same hour period, and sometimes return along the same route, causing a double impact effect on the one intersection. It is assumed that this occurs for the traffic assessment undertaken.

7.3 TRAVEL MODE

7.3.1 Local Residents

The comparison study with Rouse Hill Public School included an analysis of the travel modes observed from the 2016/17 Household Travel Survey. For the Rouse Hill region, the majority of residents were

reported as travelling by car, with up to 80 percent of the total trips as drivers or passengers. Public transportation made up 8 percent of the trips, with only 1 percent recorded as taking the train. It is noted that Rouse Hill is not directly serviced by a train line, with the closest station in Schofields (a distance of approximately 7km from the Rouse Hill town centre). This likely contributes to the low utilisation of trains as a mode of transportation in the area – reinforced by the average journey distance of 44 km. The train trips that were undertaken were mostly long distance, likely to the Sydney CBD (approximately 45 km away).

Trips where walking was the sole method of transportation made up 10 percent of the total trips, with an average travel distance of 1 km.

Table 7.2 presents a breakdown of the travel modes within Rouse Hill, alongside a comparison with the adjacent Blacktown – North SA3 region (of which Schofields is a part of).

Table 7.2: Household Travel Survey 2016/17

Travel Mode	Rouse Hill		Blacktown – North	
	Average Distance (km)	Percentage of Total Trips	Average Distance (km)	Percentage of Total Trips
Vehicle Driver	12 km	57%	11 km	52%
Vehicle Passenger	9 km	23%	7 km	29%
Train	44 km	1%	26 km	4%
Bus	21 km	7%	16 km	8%
Walk Only	1 km	10%	1 km	7%
Other	13 km	2%	6 km	1%

Similar statistics are noted for the Blacktown – North region, indicating the similarity between the two zones. Slight variations in percentages are observed, including an increase of trains to 4 percent and a decrease of walking to 7 percent.

7.3.2 Journey to Work

The Household Travel Survey incorporates data from all types of journeys, including work, childcare, shopping, and personal and recreational trips. A large portion of this occurs outside of the network (commuter) peak hours. Detailed Journey to Work data was therefore assessed to determine mode share for workers, who make up the main body of travellers during the AM and PM commuter peak hour periods. Figure 7.1 shows the mode share split from Journey to Work statistics (based on 2016 Census data) for the Schofields region.

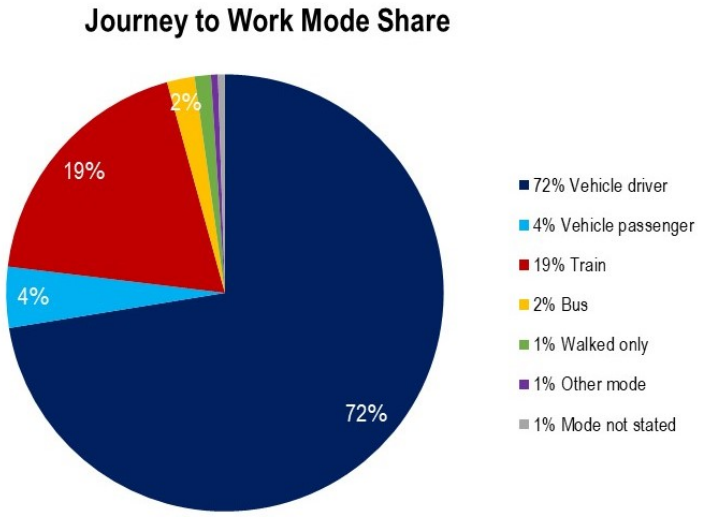


Figure 7.1: Journey to Work (Mode Share)

7.3.3 Parents and Students

Data from the *Trip Generation Surveys, Schools Analysis Report (2014)* by GTA Consultants was used to show the average modal split of trips to and from Primary Schools in Sydney. It was found that travel to and from Primary Schools were primarily comprised of either car or active transport (mainly walking), with a small percentage of public transportation. A wide variation of mode share percentages was noted in the surveyed schools, indicative of the dependence of mode share on school characteristics.

The average statistics for Primary Schools within the Sydney Metropolitan area are reproduced in Table 7.3 below:

Table 7.3: Primary School Mode Split

School Type	Period	Car	Bus	Walk
Sydney Metropolitan Area	AM	50%	2%	48%
	PM	40%	2%	58%

Source: Trip Generation Surveys, Schools Analysis Report (2014, GTA Consultants)

The mode share data is depicted visually in Figure 7.2.

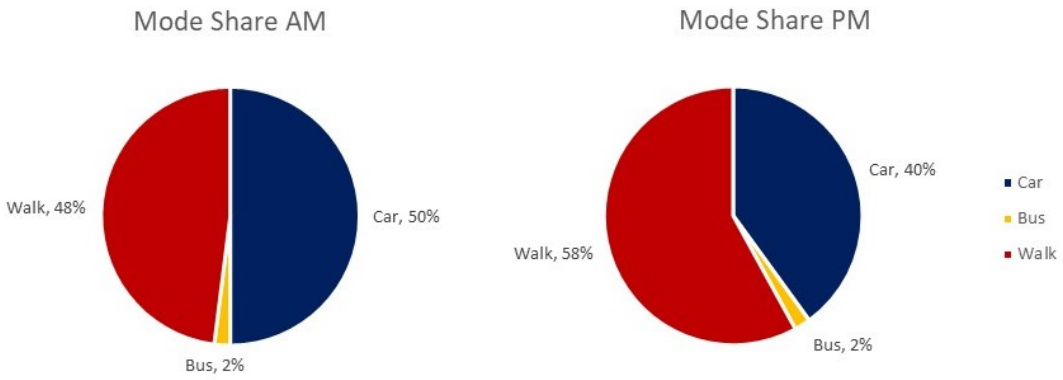


Figure 7.2: Primary School Mode Split

A larger portion of students were found to walk home during the PM, likely attributed to the fact that the school PM peak does not coincide with the standard commuter peak (therefore parents are still at work and aren't able to pick up their children). Private primary schools are noted to have a higher mode split towards cars (increase of 25% in AM and 16% in the PM).

As the proposed school is a public primary school and given the availability of public schools within the area, utilisation of public transportation by children aged 4-12 and parents to the Alex Avenue Public School is expected to be relatively low. This is especially noted for travel via train, as primary school catchments tend to be focused on the local area, with not many students who live far enough away to require taking a train. This mode share would be more relevant to staff travelling to school.

Furthermore, considering the proposed future integrated pedestrian and cycling networks throughout Alex Avenue Precinct, it is assumed a large percentage of students will walk or cycle to the school, with the majority of the students and staff still estimated to travel by private vehicle.

7.3.4 Staff

For the staff member modal splits, data from the 2016 Census was accessed via the Australian Bureau of Statistics TableBuilder to determine travel mode percentages for staff members working in primary education within the Blacktown LGA. The results are shown in Figure 7.3.

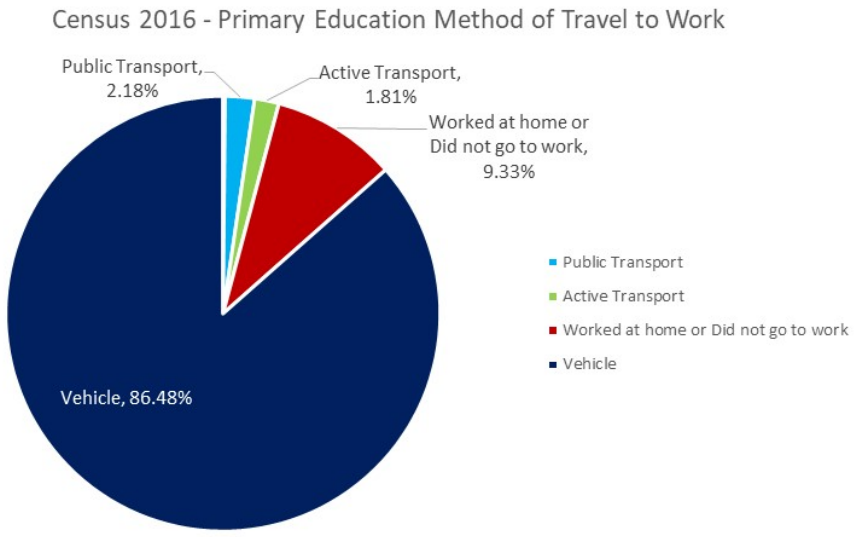


Figure 7.3: Method of Travel to Work in Primary Education (Blacktown LGA)

As depicted, approximately 86.5% of teachers/staff within the Primary Education field working in the Blacktown LGA take a private vehicle to work, as either a driver or passenger. For a consideration of the critical case, it is assumed that all teachers travelling to school via private vehicle are driving and park on-site. Small percentages (around 2% each) are noted to use public transport, active modes of transportation to get to work.

7.4 TRIP DISTRIBUTION

The trip distribution for the proposed Alex Avenue Public School considered the primary education facilities in surrounding areas, directionality of travel based on place of employment and positioning of Schofields Station. The estimated trip distribution of the Alex Avenue Public School is presented in Table 7.4.

Table 7.4: Trip Distribution to Proposed Development

Location	Percentage of Trip Distribution
Within the Alex Avenue Precinct	78%
Schofields Road / Junction Road / Pelican Road	20%
Schofields Train Station	2%

A combination of public and private schools is available to the north, east, and south of the site. At the moment, the region west of the site remains largely undeveloped. As such, the majority of the trip distribution is likely to come from within the precinct itself. Given the proximity to Schofields Road, a portion of the trips are estimated to have origins and destinations from the north. To travel to the Alex Avenue Public School, these trips would need to pass through the Schofields Road / Junction Road / Pelican Road intersection.

A small portion of trips to the school (2%) were considered to travel from the Schofields Train Station. This is a notably small percentage given the unlikelihood that primary school students and parents would travel long distances via public transport with a number of schools available in the surrounding area and as per the description of travel modes in Section 7.3. As such, the stated trip distribution from the train station would mainly be comprised of staff trips, and likely to be overestimated.

The majority of the trips that originate within the Alex Avenue Precinct are assumed to be either chain trips or internal to the precinct. In this situation, chain trips are trips which would occur even without the school development, where drivers stop by on their way to their ultimate destination. For example, parents dropping their children off to school before continuing on to Schofields Train Station where they commute to work. In the case that parents return home after sending their children to school, the trips within the Alex

Avenue Precinct would be largely self-contained, with travel routes mainly on local streets or on Alex Avenue itself. These trips are not expected to impact traffic operations on Schofields Road. This assessment focuses on 'new' trips – that is, trips that are solely generated or attracted by the school development.

The directionality of trip distribution was informed by existing travel patterns for the Schofields area. Journey to Work (JTW) statistics based on 2016 Census data shows a distribution of employment locations, as shown in Figure 7.4.

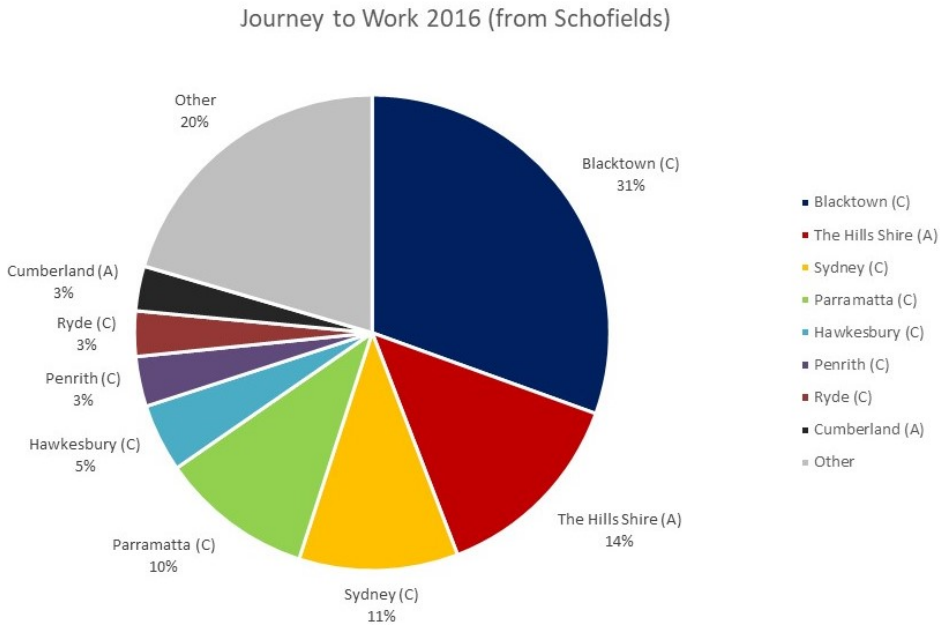


Figure 7.4: Journey to Work from Schofields

The majority of residents in Schofields work within the Blacktown Local Government Area (LGA), which covers a large portion of the surrounding suburbs. Other major areas of employment include The Hills Shire (14%), Sydney (11%) and Parramatta (10%). The 'Other' category encompasses the smaller employment areas (LGAs with distribution under 3%) and employment with no fixed address.

The directions of the main city centres for each LGA relative to the developments site are:

- Blacktown: South
- The Hills Shire: East
- Sydney: East (over 30km)
- Parramatta: South-East
- Hawkesbury: North
- Penrith: West

The development traffic passing through Schofields Road / Junction Road / Pelican Road is assumed to come from the north and west approaches as shown in Figure 7.5 below. For the purpose of the AM peak assessment, half of these trips are further assumed to return back through the intersection (based on JTW statistics and percentage of trips to work via train), distributing west towards Railway Parade (and Schofields Station) and east towards Rouse Hill. The remaining outbound journeys are expected to turn left onto Pelican Road from Farmland Drive and continue in a southbound direction towards Quakers Hill and Blacktown.

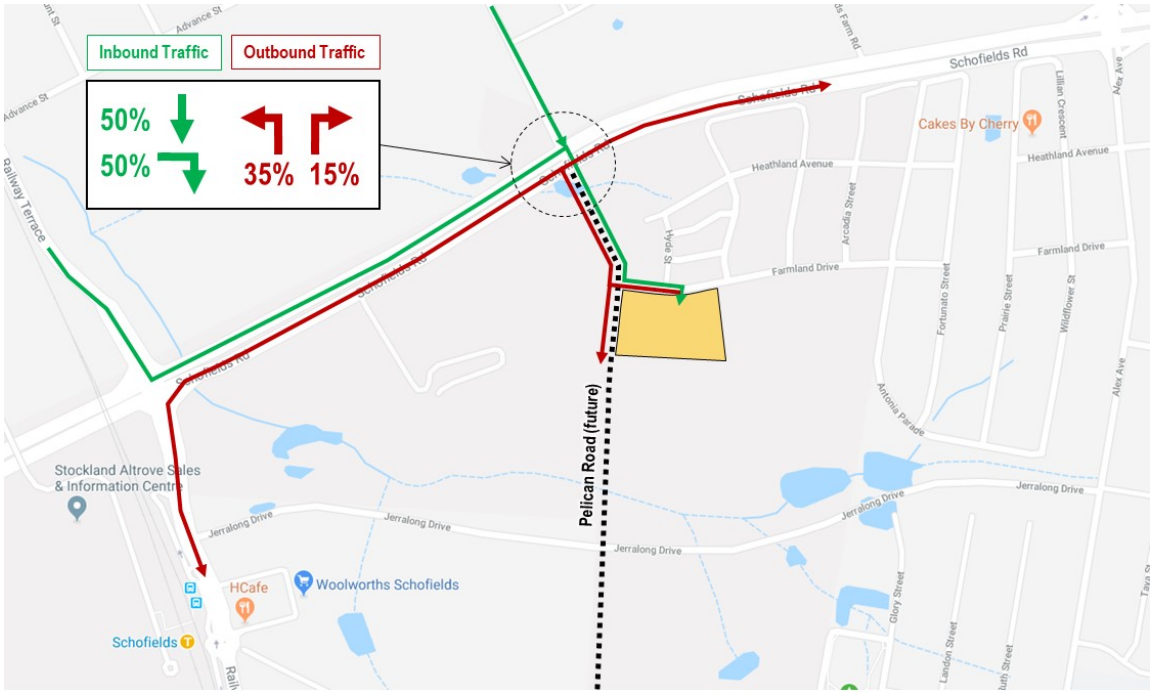


Figure 7.5: AM - Trip Distribution at Schofields Road / Junction Road / Pelican Road

No left turning movements from Schofields Road onto Pelican Road are included as it is expected that all vehicles would have turned left earlier onto Alex Avenue if approaching the school from that direction.

During the PM peak, outbound traffic movements at the Schofields Road / Junction Road / Pelican Road intersection were adjusted, as trip destinations are now orientated to place of residence (as opposed to place of work) as students are picked up and returned home. It is noted that the PM peak for schools does not always coincide with the commuter peak (usually earlier at around 3:00PM – 4:00PM), therefore vehicle trips can no longer be assumed to be primarily chain trips. However, trips contained within the Alex Avenue Precinct are still not expected to cause traffic impacts at the nominated intersection.

The distribution of development traffic during the PM peak period is shown in Figure 7.6.

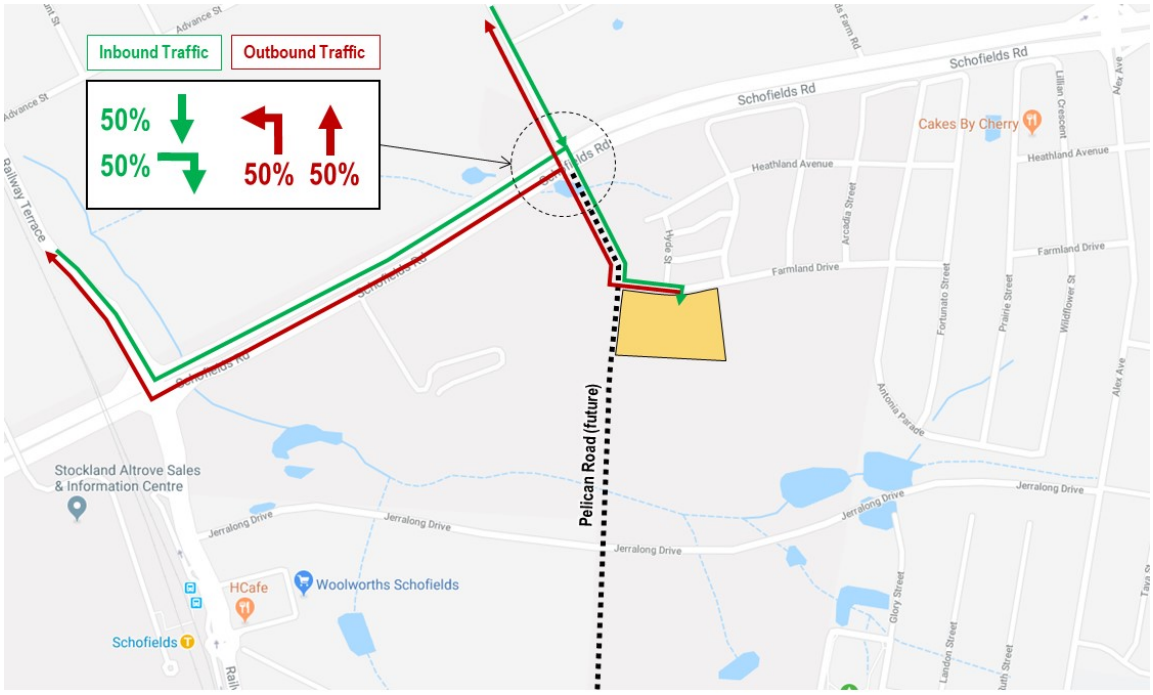


Figure 7.6: PM - Trip Distribution at Schofields Road / Junction Road / Pelican Road

7.5 PROJECTED TRAFFIC VOLUMES

Traffic Volumes for 2016 and project volumes for 2026 were extracted from the Sydney General Metropolitan Area (GMA) Strategic Traffic Forecasting Model (STM) for the study area. The following table presents the projected traffic volumes at the Schofields Road / Junction Road / Pelican Road intersection.

Table 7.5: Projected Traffic Volumes of the Schofields Road / Junction Road / Pelican Road Intersection

Approach	Direction	AM Peak			PM Peak		
		2016	2026	2026 (with school traffic)	2016	2026	2026 (with school traffic)
Junction Road Southbound	Left	183	162	162	244	128	128
	Through	-	93	160	-	113	166
	Right	9	54	54	15	9	9
Schofields Road Westbound	Left	-	3	3	-	3	3
	Through	572	1,310	1,310	440	1,373	1,373
	Right	142	116	116	183	168	168
Pelican Road Northbound (new link in 2026)	Left	-	211	258	-	226	279
	Through	-	93	93	-	107	160
	Right	-	11	31	-	5	5
Schofields Road Eastbound	Left	13	0	0	12	0	0
	Through	434	1,336	1,336	410	1,339	1,339
	Right	-	92	159	-	142	195

These volumes were compared against the projected volumes from the TSA *Traffic and Parking Impact Assessment for 14 Schofields Road, Schofields (Proposed Residential Flat Building Development)*, where the proposed development is located within proximity to the proposed Alex Avenue Public School. Traffic volumes from the STM were found to be consistent with the volumes determined in the report. As such, these numbers were considered appropriate for the initial analysis of performance at Schofields Road / Junction Road intersection for 2016 and 2026.

Diagrams showing the intersection turning volumes for the future 2026 scenarios including school traffic are depicted below in Figure 7.7

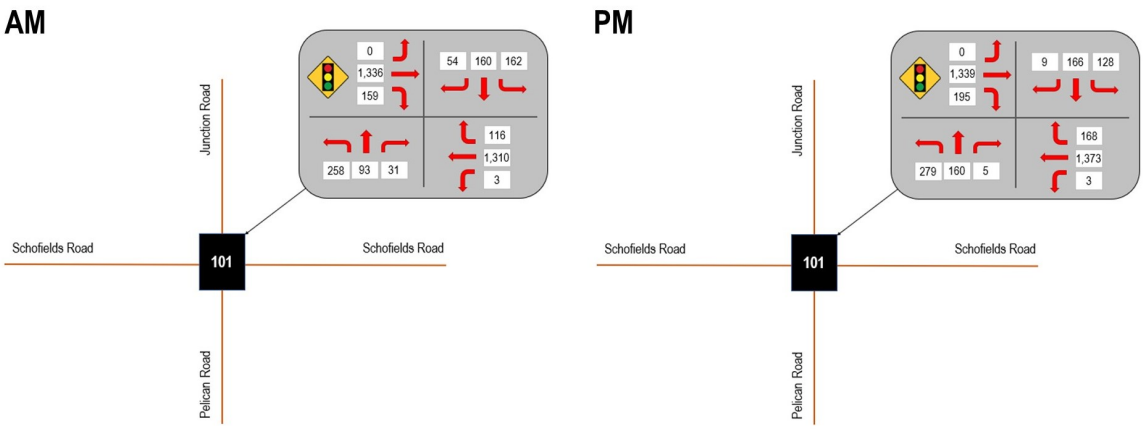


Figure 7.7: Schofields Road / Junction Road / Pelican Road Intersection (With Development)

7.6 INTERSECTION ANALYSIS

An intersection analysis was conducted on the Schofields Road / Junction Road / Pelican Road intersection using SIDRA software. From the analysis, a Level of Service (LOS) was determined on each approach and the overall intersection. To understand the results of the SIDRA analysis, Table 7.6 presents the criteria of each LOS category.

Table 7.6: Level of Service Criteria for Intersections

LOS	Average Delay per Vehicle (secs/veh)	Traffic Signals, Roundabout	Give Way and Stop Signs
A	<14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity.
C	29 to 42	Satisfactory	Satisfactory, but accident study required.
D	43 to 56	Operating near capacity	Near capacity and accident study required.
E	57 to 70	At capacity; at signals, incidents will cause excessive delays. Roundabouts require other control mode.	At capacity, requires other control mode.

Source: Guide to Traffic Generating Developments, RTA 2002

The purpose of the analysis was to determine the impact of the proposed development traffic on the intersection, particularly on Schofields Road. Using the trip generation for vehicle trips per student and the trip distribution of the 20% of people travelling through the intersection, the analysis was conducted for the morning and afternoon school peaks. It should be noted that as the intersection is yet to be fully developed, the future intersection layout, the signal phasing and phase timing were required to be assumed. As such, only an approximation of the traffic impact can be determined at this stage. Signal phase times were calculated via SIDRA Optimal Cycle Time (Minimum Delay), resulting in a 100 second cycle time during the AM peak and 105 second cycle time during the PM peak.

The SIDRA intersection layout is shown below in Figure 7.8.

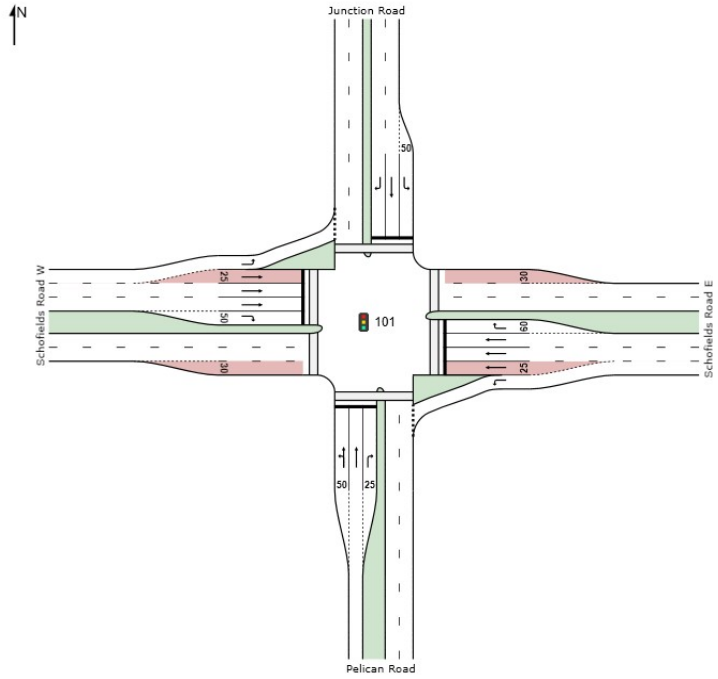


Figure 7.8: Schofields Road / Junction Road / Pelican Road Intersection Layout

Table 7.7 presents the average delay, Degree of Saturation (DOS) and Level of Service (LOS) of each approach of the intersection without and with the additional proposed school trips during the morning peak.

Table 7.7: Morning Peak Intersection Analysis Results

Schofields Rd / Junction Road/ Pelican Road	Without School Trips			With School Trips		
	Average Delay	DOS	LOS	Average Delay	DOS	LOS
North: Junction Road	47 seconds	0.485	LOS D	49 seconds	0.821	LOS D
East: Schofields Road	24 seconds	0.793	LOS B	26 seconds	0.787	LOS B
South: Pelican Road	45 seconds	0.516	LOS D	45 seconds	0.579	LOS D
West: Schofields Road	22 seconds	0.719	LOS B	26 seconds	0.834	LOS B
Total	**27 seconds**	**0.793**	**LOS B**	**30 seconds**	**0.834**	**LOS C**

Similarly, Table 7.8 presents the results for the afternoon peak.

Table 7.8: Afternoon Peak Intersection Analysis Results

Schofields Rd / Junction Road/ Pelican Road	Without School Trips			With School Trips		
	Average Delay	DOS	LOS	Average Delay	DOS	LOS
North: Junction Road	46 seconds	0.608	LOS D	53 seconds	0.894	LOS E
East: Schofields Road	32 seconds	0.836	LOS C	34 seconds	0.851	LOS D
South: Pelican Road	47 seconds	0.516	LOS D	82 seconds	0.663	LOS F
West: Schofields Road	25 seconds	0.762	LOS B	30 seconds	0.844	LOS C
Total	**32 seconds**	**0.836**	**LOS C**	**36 seconds**	**0.894**	**LOS C**

The analysis indicated a slightly larger impact on the intersection average delay in the evening peak period than the morning period. However, the analysis indicated there is a decrease in intersection Level of Service from LOS B to LOS C in the AM peak period. During the PM peak period, a Level of Service of LOS C is maintained.

For this assessment, the school development traffic was assessed against the intersection during the network PM peak period. As noted earlier, the afternoon peak period for the school is not expected to coincide with the commuter peak period – however, in doing so this assessment provides an analysis of the worst-case scenario.

Overall, the results of the Schofields Road / Junction Road / Pelican Road intersection analysis show that there is minimal traffic impact caused by additional trips from the proposed school development. The existing (and future upgraded) road network are hence capable of accommodating the new development traffic without significant decreases in traffic operations.

The detailed SIDRA movement summaries are attached in **Appendix C**.

8. SUMMARY AND CONCLUSION

The key findings and conclusions of the proposed Alex Avenue Public School Traffic Impact Assessment include:

Background

- The proposed development is located in the Alex Avenue Precinct, in the North West Growth Centre as categorised by the Department of Planning and Environment. The area is in the process of development, encompassing 420 hectares of land;
- the proposed precinct will include two schools, one of which is the proposed development assessed in this report;
- the proposed development is estimated to have a capacity of 1000 students and 70 staff members;
- the proposed precinct includes plans for an integrated cycle and pedestrian network, to reduce the reliance on vehicle use in the local area;

Parking

- A Joint Use Strategy has been proposed with Blacktown City Council for the provision of a shared car park, to be located on Farmland Drive on the adjacent future playing field site;
- a total of 100 car parking spaces are proposed to be provided within the shared car park, which satisfies the parking requirements for a Primary School in the BCC Growth Centre Precincts DCP;
- due to proximity to public transportation options (Schofields train station) and bus services on Alex Avenue, as well as potential for a future expansion of services along Pelican Road, it is not expected that all staff members will utilise their 'allocated' car parking space;
- the shared car park should have sufficient parking spaces for normal use by visitors to the playing fields, and any larger events taking place on the weekends can make full use of the car park (as there should be a minimal number of staff vehicles parked on non-school days);
- the future shared car park is to provide a 50m long drop-off/pick-up zone for use by parents and students during school peak hours, with direct footpath connectivity to the school site;
- two (2) PWD parking spaces and the corresponding shared area are proposed on the western side of the shared car park, and are located on the eastern side within the school boundary. These will be accessed by vehicles via the shared car park, with no driveway access on the school site itself;
- while the design for the future shared car park has not been fully realised at this stage, the parking spaces within the school boundary were assessed and found to be compliant with AS2890.6 requirements;
- all parking spaces should be delineated with line marking and symbols as required by AS2890.1 and AS2890.6 requirements; and
- a 35m long secondary drop-off / pick-up zone is proposed along the school frontage on Farmland Drive for PWD-exclusive use, allowing for a closer and more direct access to and from the school.

Waste Collection

- A waste collection zone (bin enclosure) is located on the eastern side of the school site, with vehicular access from the shared car park;
- a swept path analysis was undertaken for a 12.5m Heavy Rigid Vehicle (HRV) as the design refuse collection vehicle for access, egress and manoeuvrability within the car park. The swept path analysis outcomes showed that the proposed car park layout allows for a design vehicle to reverse to a position near the waste collection zone and leave the site in a forward motion; and
- due to the length of the vehicle, the design vehicle is required to travel over the roundabout island to make a right turn manoeuvre onto Farmland Drive.

Access

- Pedestrian access to the site is provided via continuous footpath connectivity to the pedestrian gates;
- where the footpath is required to cross the access driveway for the shared car park (to the east of the school site), a pedestrian crossing is proposed to reinforce pedestrian priority and provide uninterrupted connectivity;

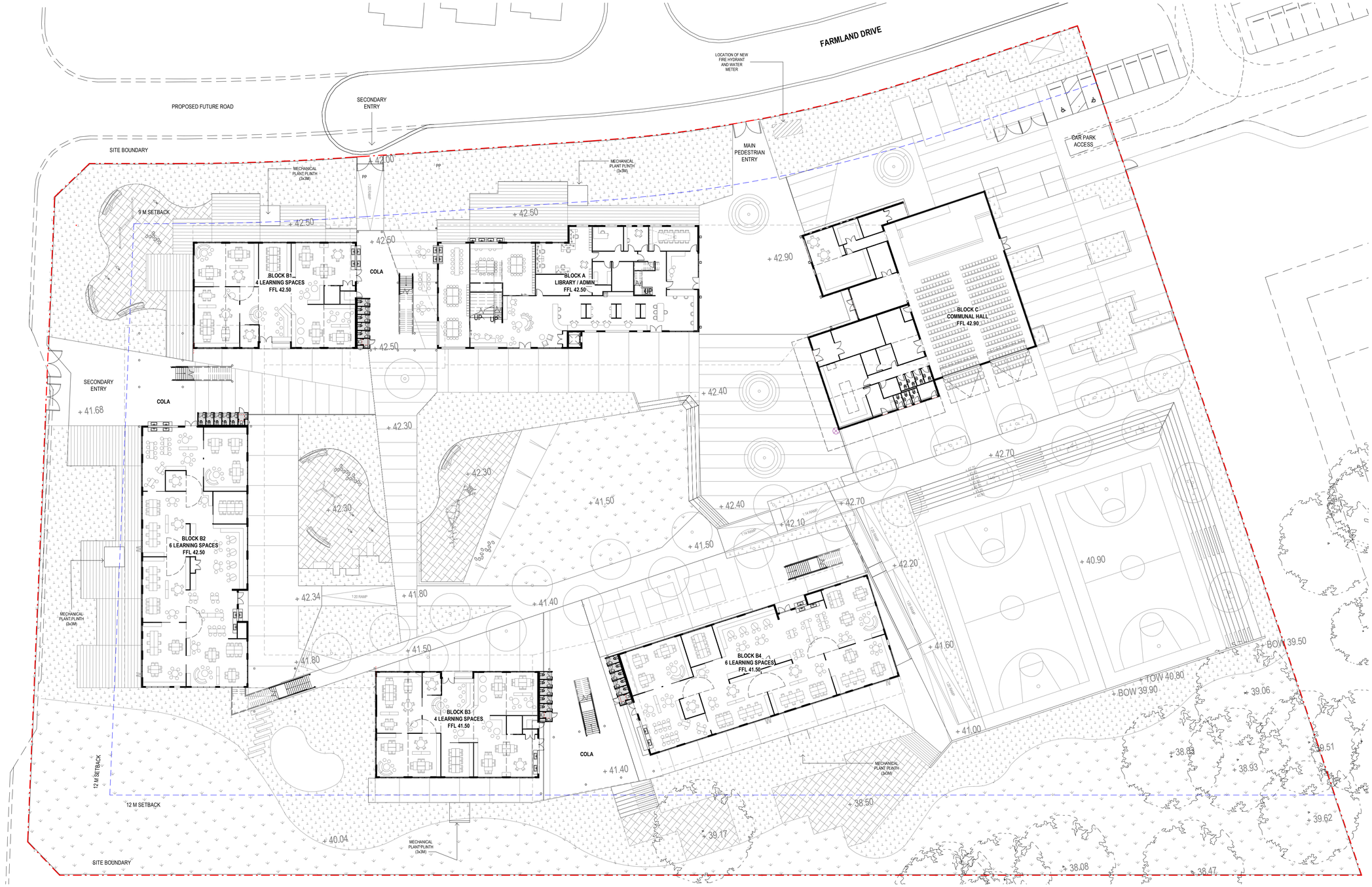
- an access route from the drop-off / pick-up zone is provided via a shared plaza space between the playing field and school site, such that students disembarking from vehicles at the zone are not required to cross any roadways;
- a future pedestrian access and school bus layby is planned to be provided on Pelican Road, pending completion of construction of the road; and
- during the interim period prior to the construction of Pelican Road, bus services have not been permitted to access Farmland Drive, therefore the establishment of a Walking School Bus program is recommended in lieu of a school bus service to encourage active modes of transportation to the school amongst the student body.

Traffic Generation

- As a local primary school, and with consideration to the other schools (existing and proposed) in the area, it is expected that the majority of the students that will attend Alex Avenue Public School will reside within or close to the Alex Avenue Precinct;
- based on existing travel patterns, it is assumed that most students and staff will travel by vehicle, with fewer than 10% travelling via existing public transportation options;
- it is anticipated that due to the locality of the area and density of residential development in the area, a large percentage of students will also walk or cycle to school, which can be promoted via school programs to encourage more sustainable modes of transport;
- the proposed development is estimated to generate 670 vehicle trips in the morning peak and 530 vehicle trips in the afternoon peak period;
- a SIDRA intersection analysis was undertaken for the future signalised intersection at Schofields Road / Junction Road / Pelican Road post-upgrades to determine the traffic impact of the proposed development on the key intersection;
- due to the locality of expected trip origins and destinations, as well as many of the trips being chain trips, an assumption was made that only 20% of the development traffic will pass through the Schofields Road / Junction Road / Pelican Road intersection;
- the analysis results indicated that there will be minimal impact to the intersection during both the morning and afternoon peak periods, with increases in delays of three (3) and four (4) seconds respectively;
- overall intersection Level of Service is noted to decrease from LOS B to LOS C during the AM peak with the introduction of school traffic; however, this is still a satisfactory level of service at a signalised intersection; and
- therefore, the development traffic is expected to be able to be accommodated within the future road geometry and network.

APPENDIX A

ALEX AVENUE PUBLIC SCHOOL PROPOSED LAYOUT



Amendments

Issue	Description	Date
A	PRELIMINARY ISSUE	06.02.2019

PRELIMINARY

Consultant
Northrop
T (02) 9241 4188
Civil and Structural

Consultant
Meinhardt
T (02) 9699 3088
Services

Consultant
Consultant Company Details

Consultant
Consultant Company Details

Client
NSW GOVERMENT EDUCATION
Client Details

GROUP GSA
Group GSA Pty Ltd ABN 76 002 113 779
Level 7, 80 William St East Sydney NSW
Australia 2011
www.groupgsa.com

T +612 9361 4144 F +612 9332 3458

architecture interior design urban design landscape
nom architect M. Sheldon 3990

Project Title
ALEX AVENUE

Drawing Title
SITE GROUND FLOOR

Scale	1 : 300
Drawing Created (date)	02/06/19
Drawing Created (by)	Author
Plotted and checked by	Designer
Verified	Checker
Approved	Approver

Project No	Drawing No	Issue
180645	A-1151	A

7/02/2019 5:12:05 PM

School security fence to site boundary. Set back with planting in front. Refer to architect's detail.

Nature play area

Outdoor learning areas attached to classroom

Primary entry

Climbing nets to level change with softfall under

Outdoor learning area attached to classroom

Kitchen garden

Primary pedestrian link

Future activation space.

Bioretention basin

Make good grass area. Allow to grade existing levels to match with proposed levels

School security fence to site boundary. Refer to architect's detail.

Secondary entry

Outdoor learning area attached to classroom

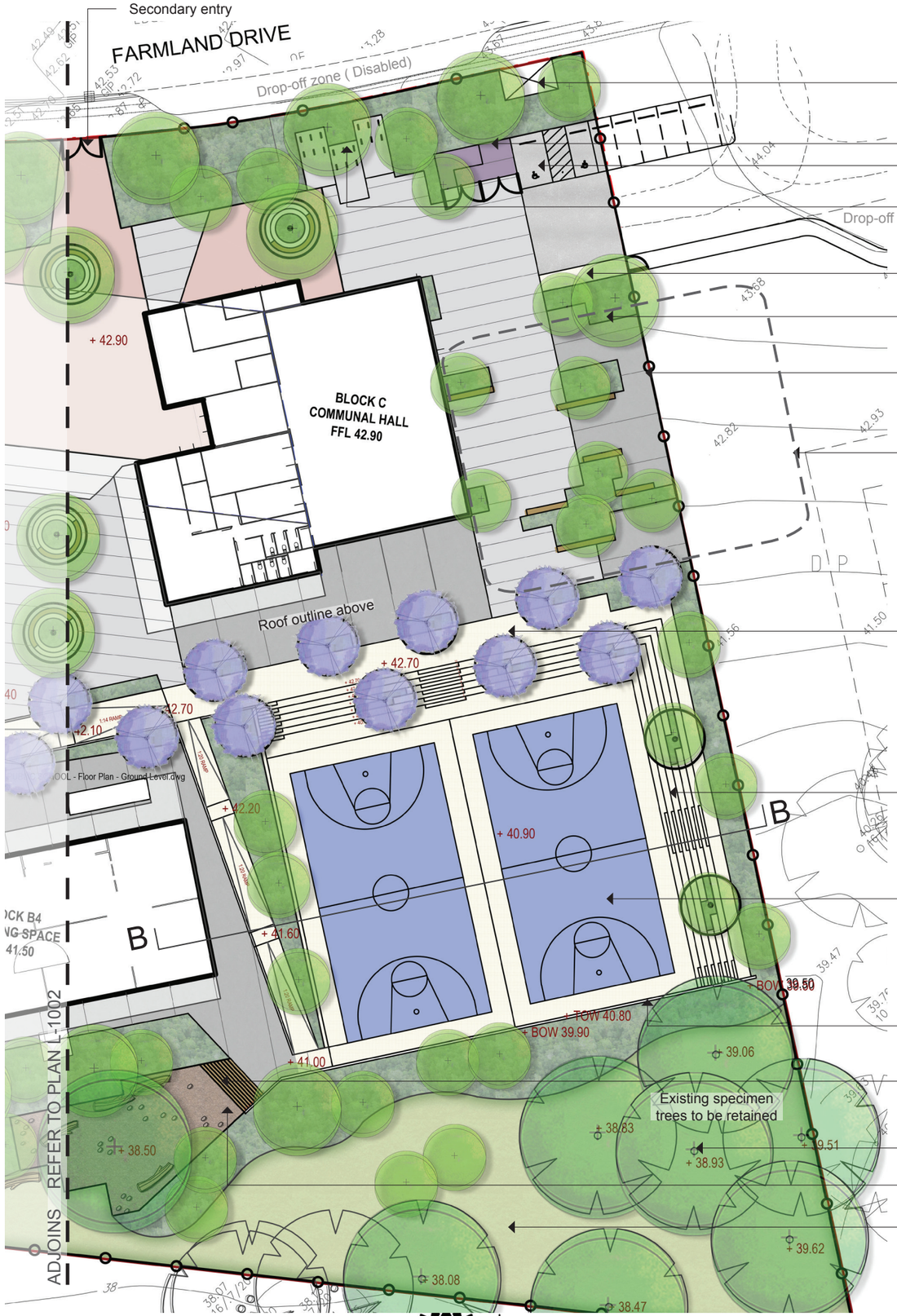
Deck connection to natural play / gathering area

GROUPGSA FOR NSW GOVERNMENT Education

DRAWING	NUMBER	REVISION	DATE	SCALE
GENERAL ARRANGEMENT PART 1	L-1002	E	01/02/2019	1:500 @ A3

SSD

ALEX AVENUE



Substation

Bin storage

Disable car parking
(within site boundary)

Bike storage

Pedestrian path to
drop-off zone

Future planting

School security fence
to site boundary
Refer to architect's
detail.

Future shared plaza

Primary pedestrian link

Seating steps surround
basketball courts

New basketball court
in-situ concrete surface
with linemarkings. Allow
for basketball hoop/stand
and backboard.

Retaining wall with sports
fence on top

Timber step. Connection
to lower nature play area.

Existing trees to be
retained and protected

Natural play / gathering area

All open turf area to be
cultivated and resown with
'Hydroturf'; All grass area to
be made good as required on
completion of works.

Note:
Refer to engineers drawings for stormwater design, pit locations & levels
Final levels to be co-ordinated at detail design phase.

SSD

GROUP GSA FOR NSW GOVERNMENT Education

DRAWING	NUMBER	REVISION	DATE	SCALE
GENERAL ARRANGEMENT PART 2	L-1003	E	01/02/2019	1:500 @ A3

ALEX AVENUE

APPENDIX B

BLACKTOWN CITY COUNCIL 2016 BIKE PLAN

BLACKTOWN CITY COUNCIL

2016 BIKE PLAN

EXISTING & FUTURE PROPOSED ROUTES

- Proposed Off-Road Cycleways
- Proposed On-Road Cycleways
- Existing Cycleways
- Proposed Developer Funded
- RMS Proposed State Link
- Council Recommended State Link
- Hospitals
- Railway Station

Blacktown City Council

APPENDIX C

MOVEMENT SUMMARIES

MOVEMENT SUMMARY

Site: 101 [Schofields Rd/ Junction Rd 2026 Base AM]

P3405
Signals - Fixed Time Isolated Cycle Time = 100 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Pelican Road											
1	L2	211	0.0	0.516	43.1	LOS D	9.2	64.5	0.93	0.81	34.6
2	T1	93	0.0	0.477	47.9	LOS D	4.5	31.4	0.99	0.77	27.1
3	R2	11	0.0	0.099	56.1	LOS D	0.5	3.8	0.97	0.67	31.2
Approach		315	0.0	0.516	45.0	LOS D	9.2	64.5	0.95	0.79	32.5
East: Schofields Road E											
4	L2	3	0.0	0.002	7.0	LOS A	0.0	0.2	0.22	0.57	53.1
5	T1	1310	25.0	0.757	20.3	LOS B	25.8	212.9	0.82	0.74	45.1
6	R2	116	20.0	0.793	60.7	LOS E	6.2	51.0	1.00	0.93	23.0
Approach		1429	24.5	0.793	23.6	LOS B	25.8	212.9	0.83	0.76	42.9
North: Junction Road											
7	L2	162	0.0	0.397	42.0	LOS C	6.9	48.0	0.90	0.79	28.2
8	T1	93	0.0	0.477	47.9	LOS D	4.5	31.4	0.99	0.77	27.1
9	R2	54	0.0	0.485	58.4	LOS E	2.7	19.2	1.00	0.74	24.0
Approach		309	0.0	0.485	46.6	LOS D	6.9	48.0	0.94	0.78	27.0
West: Schofields Road W											
10	L2	1	10.0	0.001	7.4	LOS A	0.0	0.1	0.23	0.56	48.9
11	T1	1336	15.0	0.719	19.5	LOS B	25.1	191.9	0.80	0.72	45.5
12	R2	92	10.0	0.590	56.0	LOS D	4.6	35.0	1.00	0.80	30.9
Approach		1429	14.7	0.719	21.8	LOS B	25.1	191.9	0.81	0.72	44.2
All Vehicles		3482	16.1	0.793	26.8	LOS B	25.8	212.9	0.84	0.75	40.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians							
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	50	20.5	LOS C	0.1	0.1	0.64	0.64
P21	East Stage 1	50	44.3	LOS E	0.1	0.1	0.94	0.94
P22	East Stage 2	50	44.3	LOS E	0.1	0.1	0.94	0.94
P3	North Full Crossing	50	8.9	LOS A	0.1	0.1	0.58	0.58
P41	West Stage 1	50	44.3	LOS E	0.1	0.1	0.94	0.94
P42	West Stage 2	50	44.3	LOS E	0.1	0.1	0.94	0.94
All Pedestrians		300	34.4	LOS D			0.83	0.83

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [Schofields Rd/ Junction Rd 2026 Base PM]

P3405
Signals - Fixed Time Isolated Cycle Time = 105 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Pelican Road											
1	L2	226	0.0	0.516	45.7	LOS D	11.1	77.4	0.95	0.82	33.8
2	T1	107	0.0	0.516	49.8	LOS D	11.1	77.4	0.99	0.78	26.4
3	R2	5	0.0	0.047	58.3	LOS E	0.3	1.8	0.97	0.64	30.6
Approach		338	0.0	0.516	47.2	LOS D	11.1	77.4	0.96	0.81	31.7
East: Schofields Road E											
4	L2	3	0.0	0.002	7.8	LOS A	0.0	0.2	0.25	0.57	52.5
5	T1	1373	25.0	0.836	28.4	LOS B	34.2	282.8	0.87	0.85	41.0
6	R2	168	20.0	0.835	62.7	LOS E	9.6	78.4	1.00	0.96	22.5
Approach		1544	24.4	0.836	32.1	LOS C	34.2	282.8	0.88	0.86	38.7
North: Junction Road											
7	L2	128	0.0	0.278	40.1	LOS C	5.3	37.3	0.85	0.77	28.9
8	T1	113	0.0	0.608	51.8	LOS D	5.9	41.0	1.00	0.80	26.0
9	R2	9	0.0	0.085	58.8	LOS E	0.5	3.2	0.97	0.67	23.9
Approach		250	0.0	0.608	46.1	LOS D	5.9	41.0	0.92	0.78	27.3
West: Schofields Road W											
10	L2	1	10.0	0.001	8.4	LOS A	0.0	0.1	0.27	0.56	48.0
11	T1	1339	15.0	0.762	22.1	LOS B	28.5	217.2	0.83	0.75	44.1
12	R2	142	10.0	0.662	55.8	LOS D	7.3	55.9	1.00	0.83	31.0
Approach		1482	14.5	0.762	25.3	LOS B	28.5	217.2	0.84	0.75	42.4
All Vehicles		3614	16.4	0.836	31.7	LOS C	34.2	282.8	0.88	0.81	38.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	50	22.1	LOS C	0.1	0.1	0.65	0.65
P21	East Stage 1	50	46.8	LOS E	0.1	0.1	0.94	0.94
P22	East Stage 2	50	46.8	LOS E	0.1	0.1	0.94	0.94
P3	North Full Crossing	50	9.9	LOS A	0.1	0.1	0.59	0.59
P41	West Stage 1	50	46.8	LOS E	0.1	0.1	0.94	0.94
P42	West Stage 2	50	46.8	LOS E	0.1	0.1	0.94	0.94
All Pedestrians		300	36.5	LOS D			0.84	0.84

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [Schofields Rd/ Junction Rd 2026 With School AM]

P3405
Signals - Fixed Time Isolated Cycle Time = 100 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Pelican Road											
1	L2	258	0.0	0.579	42.2	LOS C	11.3	79.0	0.94	0.82	34.9
2	T1	93	0.0	0.477	47.9	LOS D	4.5	31.4	0.99	0.77	27.1
3	R2	31	0.0	0.278	57.3	LOS E	1.5	10.8	0.99	0.72	30.9
Approach		382	0.0	0.579	44.8	LOS D	11.3	79.0	0.95	0.80	32.9
East: Schofields Road E											
4	L2	3	0.0	0.002	8.7	LOS A	0.0	0.2	0.30	0.58	51.9
5	T1	1310	25.0	0.787	23.6	LOS B	27.8	229.6	0.85	0.79	43.3
6	R2	116	20.0	0.649	55.1	LOS D	5.8	47.6	1.00	0.83	24.3
Approach		1429	24.5	0.787	26.1	LOS B	27.8	229.6	0.86	0.80	41.6
North: Junction Road											
7	L2	162	0.0	0.363	40.0	LOS C	6.7	46.6	0.88	0.79	28.9
8	T1	160	0.0	0.821	54.3	LOS D	8.5	59.8	1.00	0.94	25.3
9	R2	54	0.0	0.485	58.4	LOS E	2.7	19.2	1.00	0.74	24.0
Approach		376	0.0	0.821	48.7	LOS D	8.5	59.8	0.95	0.85	26.5
West: Schofields Road W											
10	L2	1	10.0	0.001	7.4	LOS A	0.0	0.1	0.23	0.56	48.9
11	T1	1336	15.0	0.774	22.2	LOS B	28.0	213.6	0.83	0.76	44.0
12	R2	159	10.0	0.834	60.7	LOS E	8.6	65.6	1.00	0.96	29.8
Approach		1496	14.5	0.834	26.3	LOS B	28.0	213.6	0.85	0.78	41.9
All Vehicles		3683	15.4	0.834	30.4	LOS C	28.0	229.6	0.88	0.80	39.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians							
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	50	21.8	LOS C	0.1	0.1	0.66	0.66
P21	East Stage 1	50	44.3	LOS E	0.1	0.1	0.94	0.94
P22	East Stage 2	50	44.3	LOS E	0.1	0.1	0.94	0.94
P3	North Full Crossing	50	9.7	LOS A	0.1	0.1	0.60	0.60
P41	West Stage 1	50	44.3	LOS E	0.1	0.1	0.94	0.94
P42	West Stage 2	50	44.3	LOS E	0.1	0.1	0.94	0.94
All Pedestrians		300	34.8	LOS D			0.84	0.84

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [Schofields Rd/ Junction Rd 2026 With School PM]

P3405
Signals - Fixed Time Isolated Cycle Time = 105 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Pelican Road											
1	L2	279	0.0	0.663	52.6	LOS D	16.5	115.4	1.00	0.85	32.0
2	T1	160	0.0	0.663	51.2	LOS D	16.5	115.4	1.00	0.83	25.8
3	R2	5	0.0	0.047	58.3	LOS E	0.3	1.8	0.97	0.64	30.6
Approach		444	0.0	0.663	52.1	LOS D	16.5	115.4	1.00	0.84	30.0
East: Schofields Road E											
4	L2	3	0.0	0.002	9.3	LOS A	0.0	0.3	0.31	0.58	51.4
5	T1	1373	25.0	0.851	31.1	LOS C	35.8	295.8	0.89	0.89	39.9
6	R2	168	20.0	0.775	58.6	LOS E	9.1	74.9	1.00	0.90	23.5
Approach		1544	24.4	0.851	34.0	LOS C	35.8	295.8	0.90	0.89	37.9
North: Junction Road											
7	L2	128	0.0	0.268	39.2	LOS C	5.3	36.8	0.84	0.77	29.2
8	T1	166	0.0	0.894	62.9	LOS E	9.9	69.3	1.00	1.05	23.2
9	R2	9	0.0	0.085	58.8	LOS E	0.5	3.2	0.97	0.67	23.9
Approach		303	0.0	0.894	52.8	LOS D	9.9	69.3	0.93	0.92	25.4
West: Schofields Road W											
10	L2	1	10.0	0.001	8.9	LOS A	0.0	0.1	0.29	0.56	47.5
11	T1	1339	15.0	0.797	24.8	LOS B	31.2	237.9	0.85	0.79	42.7
12	R2	195	10.0	0.844	62.1	LOS E	11.1	84.3	1.00	0.96	29.4
Approach		1535	14.4	0.844	29.6	LOS C	31.2	237.9	0.86	0.81	40.4
All Vehicles		3826	15.6	0.894	35.8	LOS C	35.8	295.8	0.90	0.85	36.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians							
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	50	22.7	LOS C	0.1	0.1	0.66	0.66
P21	East Stage 1	50	46.8	LOS E	0.1	0.1	0.94	0.94
P22	East Stage 2	50	46.8	LOS E	0.1	0.1	0.94	0.94
P3	North Full Crossing	50	10.3	LOS B	0.1	0.1	0.60	0.60
P41	West Stage 1	50	46.8	LOS E	0.1	0.1	0.94	0.94
P42	West Stage 2	50	46.8	LOS E	0.1	0.1	0.94	0.94
All Pedestrians		300	36.7	LOS D			0.84	0.84

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

APPENDIX D

SWEPT PATHS

HRV
AS2890.1

HRV
AS2890.1

HRV
AS2890.1

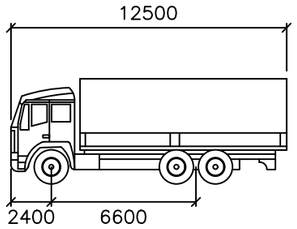
HRV
AS2890.1

HRV
AS2890.1

6481mm

6453mm

BIN ENCLOSURE



HRV mm

Width	: 2500
Track	: 2500
Lock to Lock Time	: 6.0
Steering Angle	: 36.6

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Issue	REVISIONS Revisions/Descriptions	Drawn	Date
001	Swept Path Analysis	J.Y	05.12.2018
002	Swept Path Analysis	J.Y	17.01.2019
003	Swept Path Analysis	J.Y	08.02.2019

Scale @ A3 0 2 4 6 8 10 1:200

Project: Alex Avenue Public School
Schofields
Traffic Impact Assessment

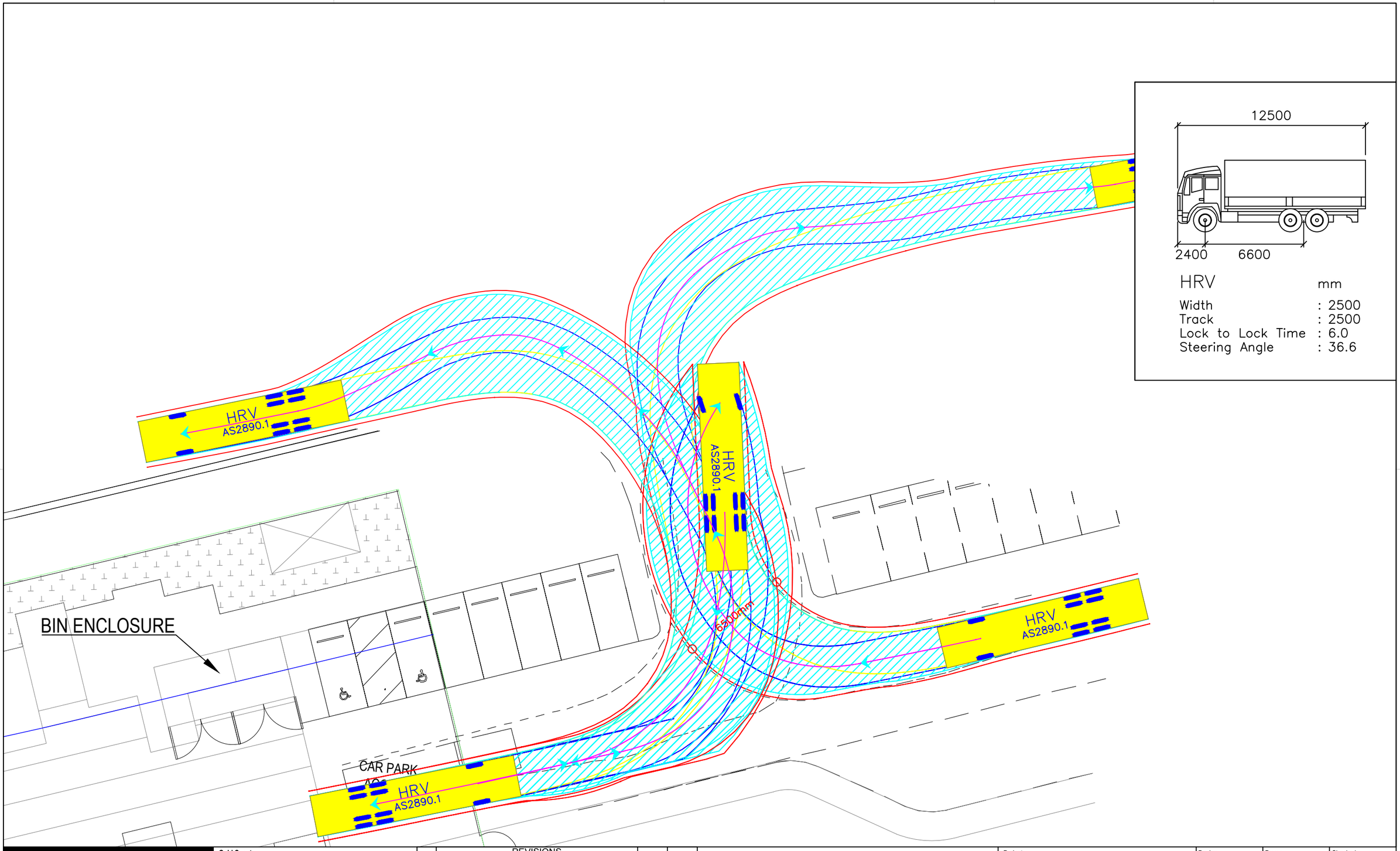
Title: Swept Path Analysis
HRV (Design Refuse Vehicle)
Forward towards bins

Design	Drawn	Checked
J.Y	J.Y	A.G

FOR INFORMATION ONLY

Date: 08.02.2019

Project Number	Sheet Number	Issue
P3405	1	003



HRV	mm
Width	: 2500
Track	: 2500
Lock to Lock Time	: 6.0
Steering Angle	: 36.6

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Issue	REVISIONS Revisions/Descriptions	Drawn	Date
001	Swept Path Analysis	J.Y	05.12.2018
002	Swept Path Analysis	J.Y	17.01.2019
003	Swept Path Analysis	J.Y	08.02.2019

Scale @ A3 0 2 4 6 8 10 1:200

Project: Alex Avenue Public School
Schofields
Traffic Impact Assessment

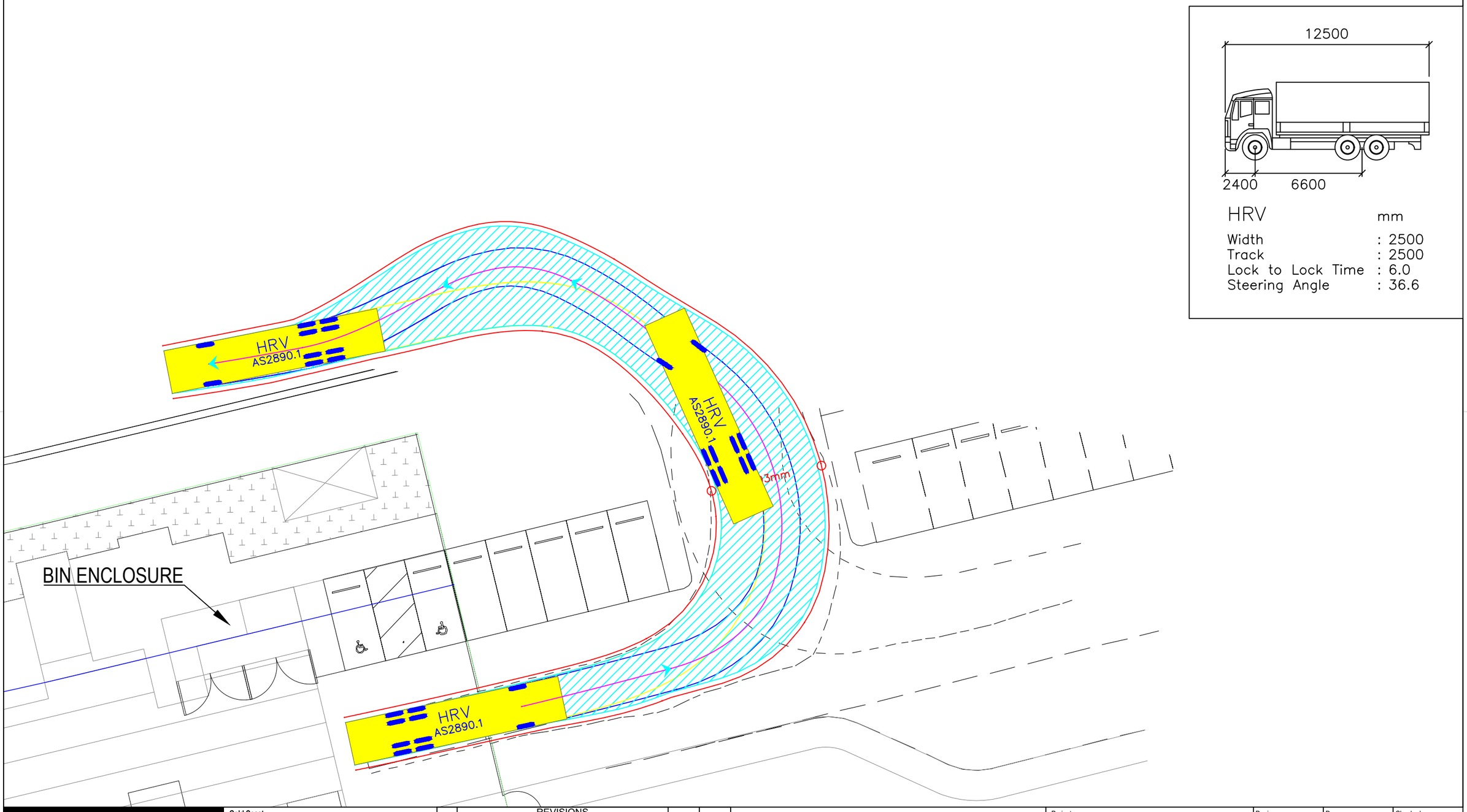
Title: Swept Path Analysis
HRV (Design Refuse Vehicle)
Reverse towards bins

Design	Drawn	Checked
J.Y	J.Y	A.G

FOR INFORMATION ONLY

Date: 08.02.2019

Project Number	Sheet Number	Issue
P3405	2	003



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REVISIONS

Issue	Revisions/Descriptions	Drawn	Date
001	Swept Path Analysis	J.Y	05.12.2018
002	Swept Path Analysis	J.Y	17.01.2019
003	Swept Path Analysis	J.Y	08.02.2019

Scale @ A3 0 2 4 6 8 10 1:200

Project: Alex Avenue Public School
Schofields
Traffic Impact Assessment

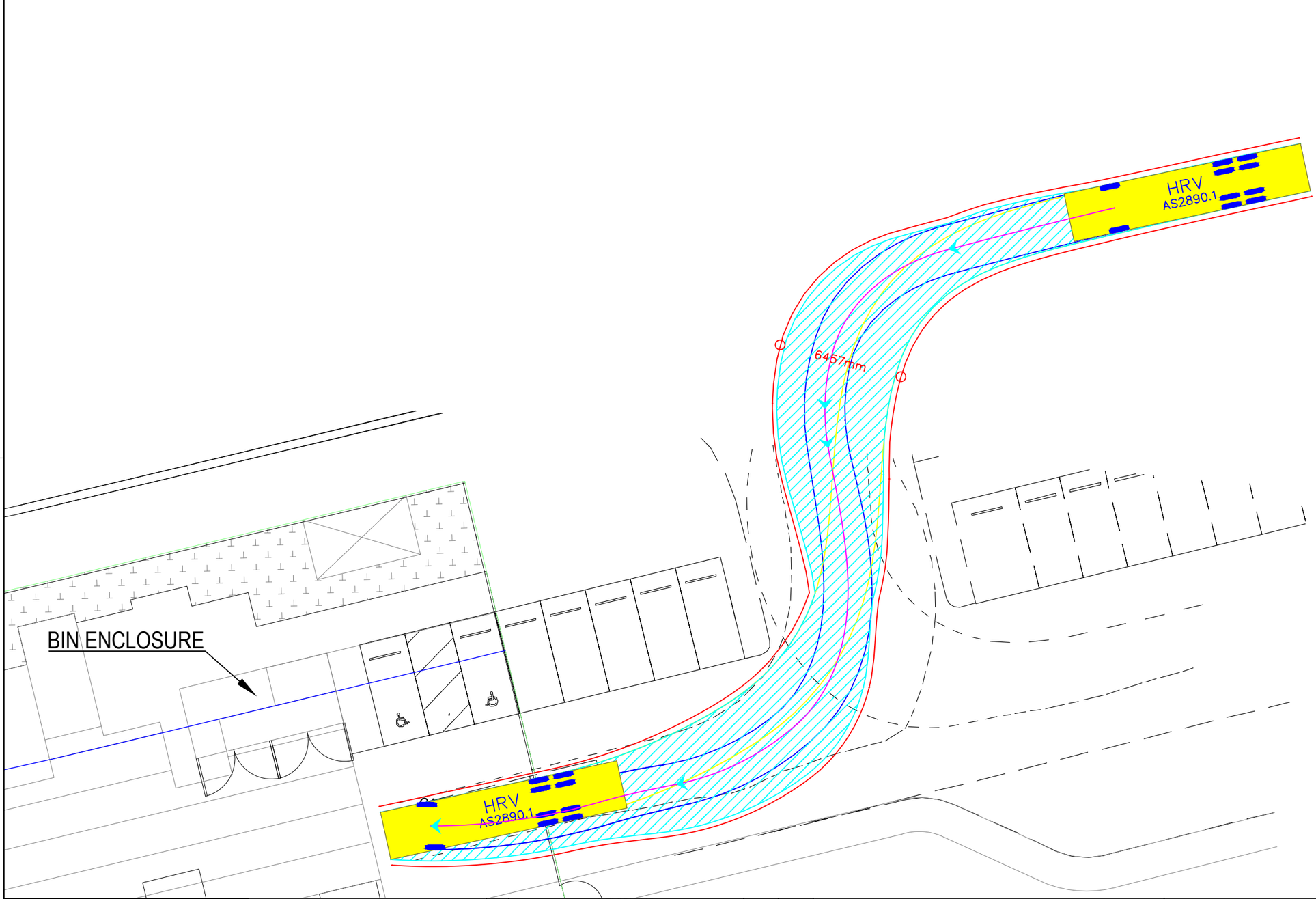
Title: Swept Path Analysis
HRV (Design Refuse Vehicle)
Left Out

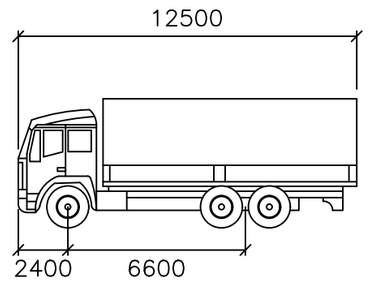
Design	Drawn	Checked
J.Y	J.Y	A.G

FOR INFORMATION ONLY

Date: 08.02.2019

Project Number	Sheet Number	Issue
P3405	3	003





HRV	mm
Width	: 2500
Track	: 2500
Lock to Lock Time	: 6.0
Steering Angle	: 36.6

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Issue	REVISIONS Revisions/Descriptions	Drawn	Date
001	Swept Path Analysis	J.Y	05.12.2018
002	Swept Path Analysis	J.Y	17.01.2019
003	Swept Path Analysis	J.Y	08.02.2019

Scale @ A3 0 2 4 6 8 10 1:200

Project: Alex Avenue Public School
Schofields
Traffic Impact Assessment

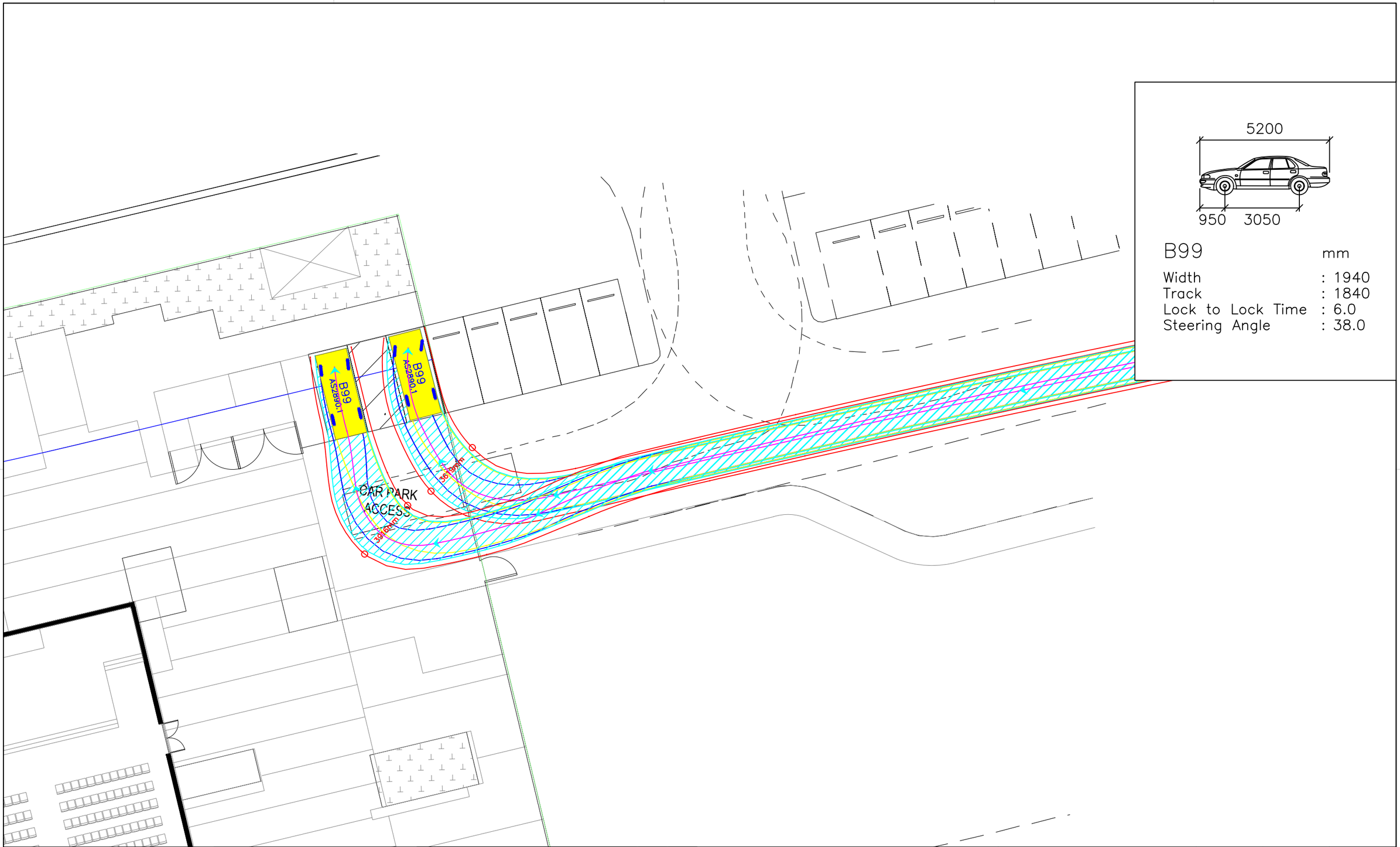
Title: Swept Path Analysis
HRV (Design Refuse Vehicle)
Left In

Design	Drawn	Checked
J.Y	J.Y	A.G

FOR INFORMATION ONLY

Date: 08.02.2019

Project Number	Sheet Number	Issue
P3405	4	003



B99 mm

Width	: 1940
Track	: 1840
Lock to Lock Time	: 6.0
Steering Angle	: 38.0

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REVISIONS

Issue	Revisions/Descriptions	Drawn	Date
001	Swept Path Analysis	J.Y	05.12.2018
002	Swept Path Analysis	J.Y	17.01.2019
003	Swept Path Analysis	J.Y	08.02.2019

Scale @ A3 0 2 4 6 8 10 1:200

Project: Alex Avenue Public School
Schofields
Traffic Impact Assessment

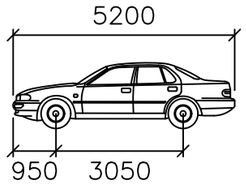
Title: Swept Path Analysis
B99 Design Vehicle
PWD Spaces - Forward In

Design	Drawn	Checked
J.Y	J.Y	A.G

FOR INFORMATION ONLY

Date: 08.02.2019

Project Number	Sheet Number	Issue
P3405	5	003



B99 mm

Width	: 1940
Track	: 1840
Lock to Lock Time	: 6.0
Steering Angle	: 38.0

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Issue	REVISIONS Revisions/Descriptions	Drawn	Date
001	Swept Path Analysis	J.Y	05.12.2018
002	Swept Path Analysis	J.Y	17.01.2019
003	Swept Path Analysis	J.Y	08.02.2019

Scale @ A3 0 2 4 6 8 10 1:200

Project: Alex Avenue Public School
Schofields
Traffic Impact Assessment

Title: Swept Path Analysis
B99 Design Vehicle
PWD Spaces - Reverse Out

Design	Drawn	Checked
J.Y	J.Y	A.G

FOR INFORMATION ONLY

Date: 08.02.2019

Project Number	Sheet Number	Issue
P3405	6	003

B99 mm

Width	: 1940
Track	: 1840
Lock to Lock Time	: 6.0
Steering Angle	: 38.0

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REVISIONS

Issue	Revisions/Descriptions	Drawn	Date
001	Swept Path Analysis	J.Y	05.12.2018
002	Swept Path Analysis	J.Y	17.01.2019
003	Swept Path Analysis	J.Y	08.02.2019

Scale @ A3 0 2 4 6 8 10 1:200

Project: Alex Avenue Public School
Schofields
Traffic Impact Assessment

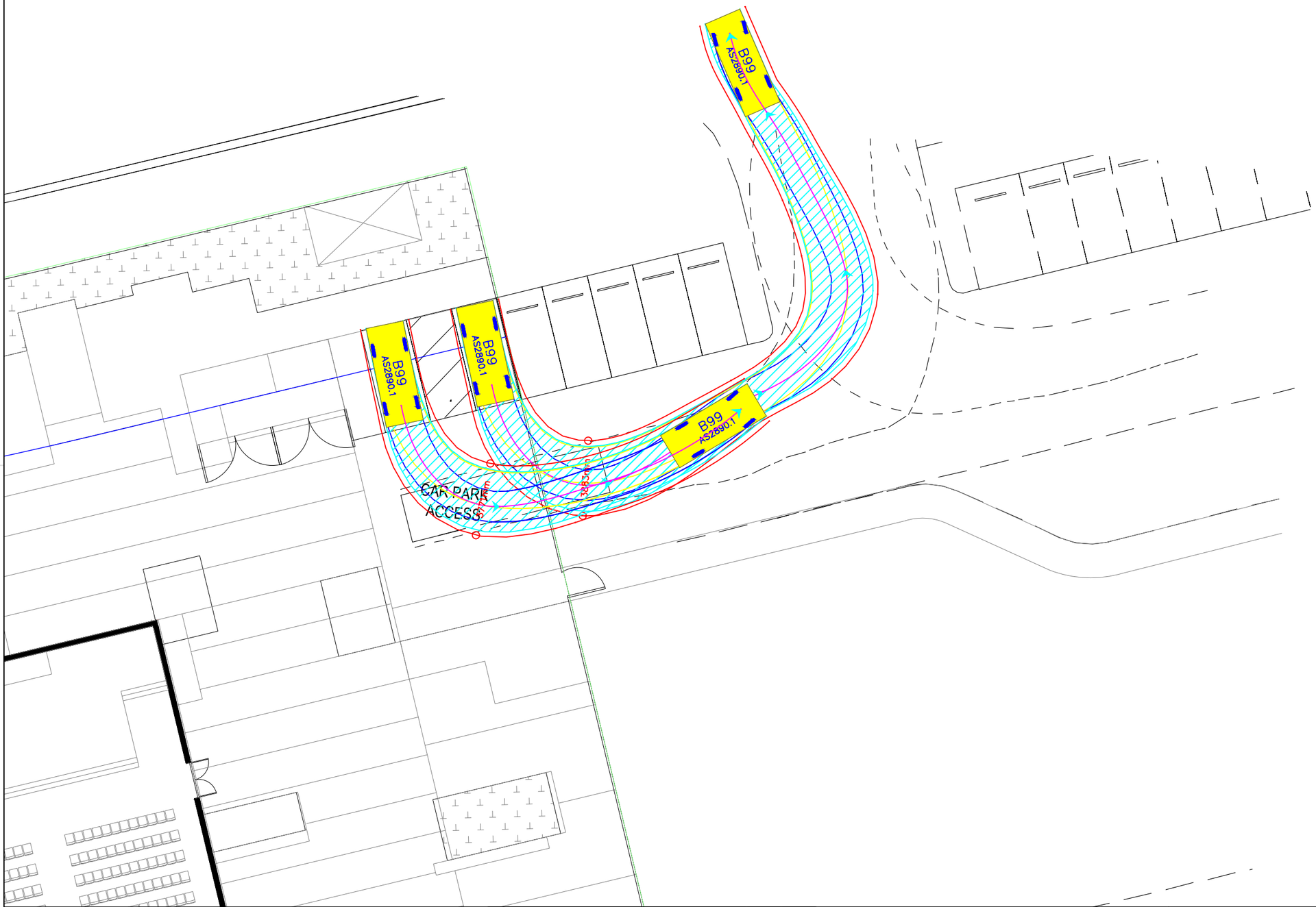
Title: Swept Path Analysis
B99 Design Vehicle
PWD Spaces - Reverse In

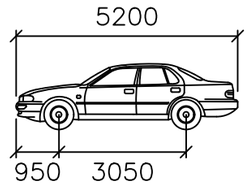
Design	Drawn	Checked
J.Y	J.Y	A.G

FOR INFORMATION ONLY

Date: 08.02.2019

Project Number	Sheet Number	Issue
P3405	7	003





B99 mm

Width	: 1940
Track	: 1840
Lock to Lock Time	: 6.0
Steering Angle	: 38.0

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Scale @ A3 0 2 4 6 8 10 1:200

Project: Alex Avenue Public School
Schofields
Traffic Impact Assessment

Title: Swept Path Analysis
B99 Design Vehicle
PWD Spaces - Forward Out

Design	Drawn	Checked
J.Y	J.Y	A.G

FOR INFORMATION ONLY

Date: 08.02.2019

Project Number	Sheet Number	Issue
P3405	8	003