

NSW Department of Education and  
Communities

**Lindfield Learning Village**

Traffic and Transport Assessment -  
SEARs Comment Response

Issue | 20 November 2017

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

It is not intended for and should not be relied  
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**ARUP**

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# 1 Introduction

## 1.1 Background

Lindfield Learning Village is expected to cater for some 2,100 students and 160 teaching staff. It would also provide community facilities. The project will be built in two stages with Stage 1 catering for 1,050 students.

The NSW Department of Education and Communities has commissioned Arup to develop a Traffic and Transport Assessment for the proposed Lindfield Learning Village. The proposed site is located at the former UTS Ku-ring-gai Campus, which has since been vacated in 2015.

Arup has submitted a report supporting the development SSD8114 titled:

“NSW Department of Education and Communities, Lindfield Learning Village, Traffic and Transport Assessment, RevC, 13 June 2017”

This report will be referred to as “the TTA”.

## 1.2 Comments

Agency comments on the TTA have now been received which are summarised in Table 1. The following sections of this report provide responses to the comments.

Table 1: List of comments and organisations

Section	Date of submission	Organisation	Document name
2	14/08/2017	Roads & Maritime Services	LINDFIELD LEARNING VILLAGE - 100 ETON ROAD, LINDFIELD
3.5	11/08/2017	Transport for NSW comments	Lindfield Learning Village (SSD 8114) Notice of Exhibition
6	9/08/2017	Ku-ring-gai Council Comments	Proposed Lindfield Learning Village, UTS site 100 Eton Road, Lindfield
7	16/08/2017	Department of Planning & Environment	Lindfield Learning Village - 100 Eton Road, Lindfield (SSD 8114)

## 1.3 Consultation

A meeting regarding the traffic and transport issues was held on 27 September 2017. Representatives from Department of Planning and Environment, RMS, TfNSW, Arup, DesignInc and Savills were present. The meeting minutes are appended in Appendix C.

## 2 Roads & Maritime Services Comments

Table 2: Roads &amp; Maritime Services

R#	Comment	Arup response
R1	[1] Given the narrow nature of the Eton Road access to the campus/school grounds, Roads and Maritime requires clarification regarding emergency vehicle access in emergencies.	Discussed in section 2.1
R2	[2] The existing bus bay/turnaround facility has inadequate holding capacity for the proposal as the proposed bus volumes will queue out onto Eton Road. Roads and Maritime does not consider the proposed bus bay appropriate for the following reasons:	The number of buses accessing the bus bay at any one time will be limited to its holding capacity.
R3	[2.1] The bus bay rank arrangement only allows for buses to arrive in a specific order to access their specific route rank. If buses arrive out of order, heavy delays will result from buses having to queue outside the bus bay. There are no opportunities available for buses to leap frog each other to get into the correct order before proceeding into the bus bay.	<p>Buses will not need to arrive in any specific order. The proposal shown in Section 2.2 allows enough pedestrian area for students to proceed to the correct bus when it arrives. Buses will be scheduled to arrive ahead of the pick-up time. Buses will therefore wait in order and depart at the same time.</p> <p>The proposed design looks at an arrangement where pedestrians walk on a 3m wide footpath around the bus bays This results widening of the bus roadway into the central void space to allow for bus turning.</p> <p>It was agreed that buses would not be able to leap frog past each other. The proposed arrangement would have buses waiting for children, negating the need for leap frogging. It was agreed that fencing would be provided for the safety of students as well as the possibility of a gate system at the pedestrian boarding locations. It was agreed that these access points need to be monitored and managed by traffic wardens / teachers.</p> <p>DPE advised that the bus bay could be dealt with as a condition of consent. The design requires formal approval from Council, TfNSW and RMS, and would need to include a detailed design and a detailed explanation of how students would board the buses. Safety is paramount.</p>
R4	[2.2] Buses using the bus bay do not appear to have enough clearance to safely navigate the bus bay without rubbing up against concrete walls or pedestrian fences. The 600mm body clearance has not been achieved.	Please refer to revised swept paths in Appendix A.

R#	Comment	Arup response
R5	[2.3] Buses exiting the bus bay are required to mount the western kerb of Eton Road when turning right. This will damage the kerb as it is repeatedly run over by buses as well as increase the wear and tear of buses.	Please refer to revised swept paths in Appendix A.
R6	[2.4] The existing bus bay cantilever structure was constructed to a single bus at the time. Roads and Maritime requires clarification that the existing structure can handle the extra 3 buses, passengers and kerb without failing.	A structural review is underway.
R7	[3] Roads and Maritime will not support non-standard School Zone times.	<p>Based on consultation, RMS is unresponsive of school zones given it is a policy change issue which will take time to implement. It was agreed in the meeting that temporary measures will be investigated and implemented, such as appropriate signage and to calm traffic in the area. This is until a change in school zone policy is made in the future.</p> <p>DPE has highlighted the need for this policy revision given staggered start times will be more prevalent with schools in the future. It was agreed that staggered start and finish times help ease traffic conditions and will only be required for Stage 2 of the project. RMS is willing to review this policy at a later stage when more schools require this policy change.</p>
R8	[4] Roads and Maritime require further information regarding mode share. The current submission assumes that 50% of kindergarten to Grade 6 students will use school buses to travel to school. Section 6 case studies provide no evidence that kinder to grade 6 children will use school buses when travelling to and from school, rather the evidence indicates that parents either drive to school or park nearby and walk children to school	Lindfield Public School has been surveyed and discussed in section 6.1 of the TTA. Surveys have found that 42% of the students arrive by car. The remaining students can therefore only arrive by an alternative form of transport such as walking, school buses and public transport. The remaining 58% will therefore be split into the various non-car mode shares. We have assumed 50% will use school buses to allow for a more conservative school bus requirement planning assessment.
R9	[5] Section 5.2.3 of the submission stipulates that it may take 14 mins for parents to drop their children off at school. This is an unacceptable delay that would result in driver frustration. The queue lengths, particularly on rainy days when more children will arrive by car, will likely have heavy impacts on local traffic.	Arup would like to clarify that the entire drop-off process will take approximately 14 minutes if all the 284 vehicles collectively arrive at once. This is highly unlikely for a drop-off period. A typical arrival profile for students is shown in Figure 24. The drop-off arrangement is expected to operate efficiently with minimal queuing and waiting for parents.
R10	[6] It is unclear that the submitted modelling includes the 160 Staff for the proposed school. Furthermore it is	Section 10.2 of the TTA summarises the traffic generated from the various facilities of the Learning Village, which includes the

R#	Comment	Arup response
	understood a child care facility will be incorporated on site, Roads and Maritime requires more information regarding the impacts of the proposed child care centre.	childcare centre. The modelling therefore includes 160 staff and 12 childcare staff. It also includes consideration for the 94 childcare children. The traffic generation rate for each facility is shown in Appendix A1.
R11	[7] The foot paths along Eton Road are very narrow and hard up against the kerb. Roads and Maritime raises safety concerns over children accidentally falling onto the road shared with other traffic including buses due to the large volume of children who are expected to use these facilities to walk to school.	We agree that footpaths are narrow and require expansion as mentioned several times in the report in section 3.5.3 of the TTA. Detailed drawings of the proposed footpath upgrades to the satisfaction of Council can be provided as a Condition of Consent.
R12	[8] It is not acceptable to remove the bus stop on Pacific Highway to facilitate right turn extension. Roads and Maritime requires further information regarding the impacts of extending the Pacific Highway right turn lane into Grosvenor Road without removing the existing bus stop:	The initial traffic distribution assumptions provided in the TTA were based on all traffic from the north west accessing the site via the Pacific Highway. Based on the almost finalised draft boundary amendments to accommodate new schools recently received from the Department of Education, we have reassessed the routes and traffic has been reassigned with only 9% of the traffic using the Pacific Highway to turn right to access the site.
R13	[8.1] A civil investigation incorporating the property impacts and a cost estimate of works (including utility relocation).	Revised modelling results of the Pacific Highway / Grosvenor Road intersection shows that if traffic uses the Lady Game Drive / Grosvenor Road intersection to access the site, the Pacific Highway intersection would operate at an efficient level of service C.
R14	[8.2] The modelling assessment indicates that the proposed right turn bay extension to 170m is shorter than the future queue length of 200m. Roads and Maritime raises concerns that the queue will regularly block through traffic on the Pacific Highway and cause significant congestion.	Considering that Stage 1 of the project is for half of the Stage 2 number of Students (1,050) there will be no need to upgrade the Pacific Highway/Gosvenor Road intersection in Stage 1.
R15	[9] Roads and Maritime requests the applicant to investigate the following congestion alleviating upgrades.	For the Lady Game Drive intersection, the new distribution has 12% of school traffic utilising this intersection. These additional vehicles will not impact on the operation of this intersection as queuing is influenced by the downstream road operations. The additional vehicles will join the southbound queue and leave to turn left at Grosvenor Road, hence they will not impact the downstream source of queuing.  Please refer to section 4.1 for modelling clarification and upgrade options in section 3.5.

## 2.1 Emergency vehicles

Emergency vehicle swept paths have been carried out for different areas of the site using MRV Fire Ladder 7.8 metre truck or a CAT 1 Tanker. The swept path analysis has indicated multiple opportunities for the truck to turnaround efficiently, shown in Appendix A.

## 2.2 Bus bay

To improve student queuing at the bus bay and to retain the existing roadway for bus turning, an alternative design with a pedestrian walkway extended to the inside of the existing structure is being investigated, illustrated in Figure 1. The proposed design would have a three-metre-wide footpath.

The existing central void is also proposed to be cut back by extending the bus access road into the void. This is to allow the 14.5 metre buses to negotiate the bend with sufficient clearances, with an indicative plan and swept paths shown in Figure 3.

This would be wide enough to contain queuing zones for the five bus positions and a bypass route for passengers to walk around to the appropriate bus location. Buses will be scheduled to arrive prior to the pick-up time and be waiting for the students to arrive. Students will then have a clear line of sight to each bus and join the relevant boarding queue.

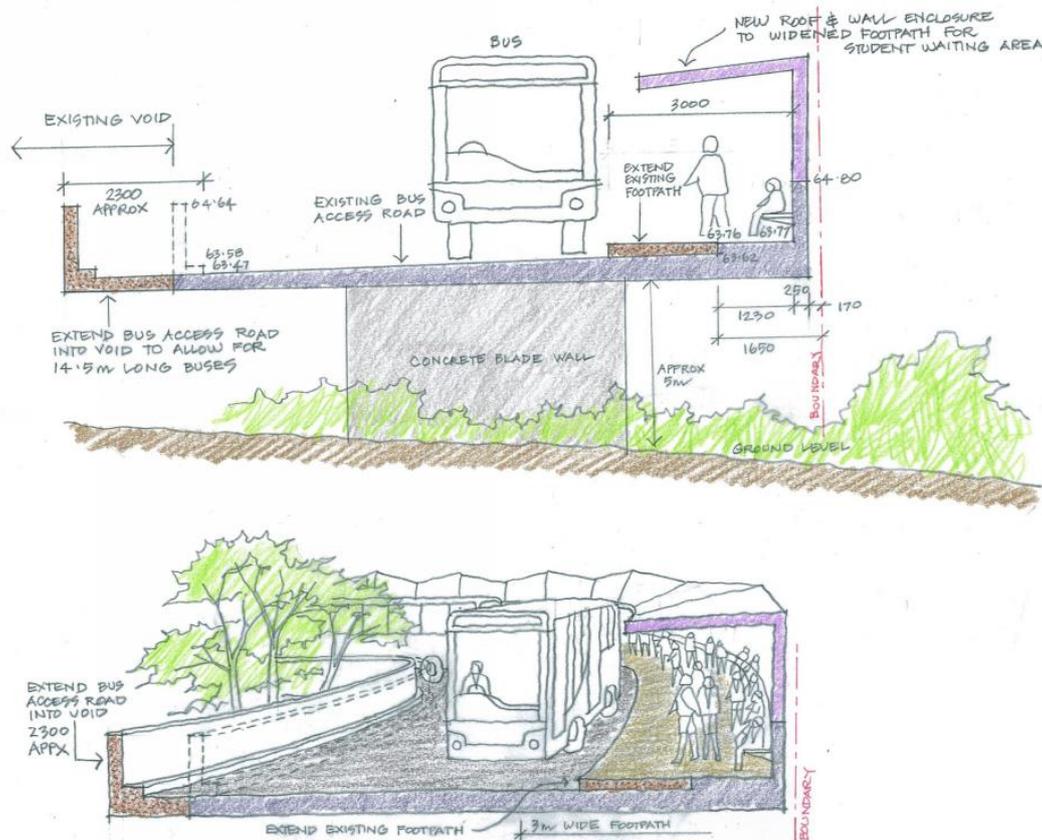


Figure 1: Proposed bus setdown using existing structure, walkway extended to inside of existing structure

Source: DesignInc

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The bus bay would be able to accommodate five 12.5 metre buses as shown in Figure 2. The use of 14.5 metre school and public buses shall be discouraged to serve the Learning Village due to reduction in storage capacity. It is likely that the majority of the buses would span 12.5 metres.

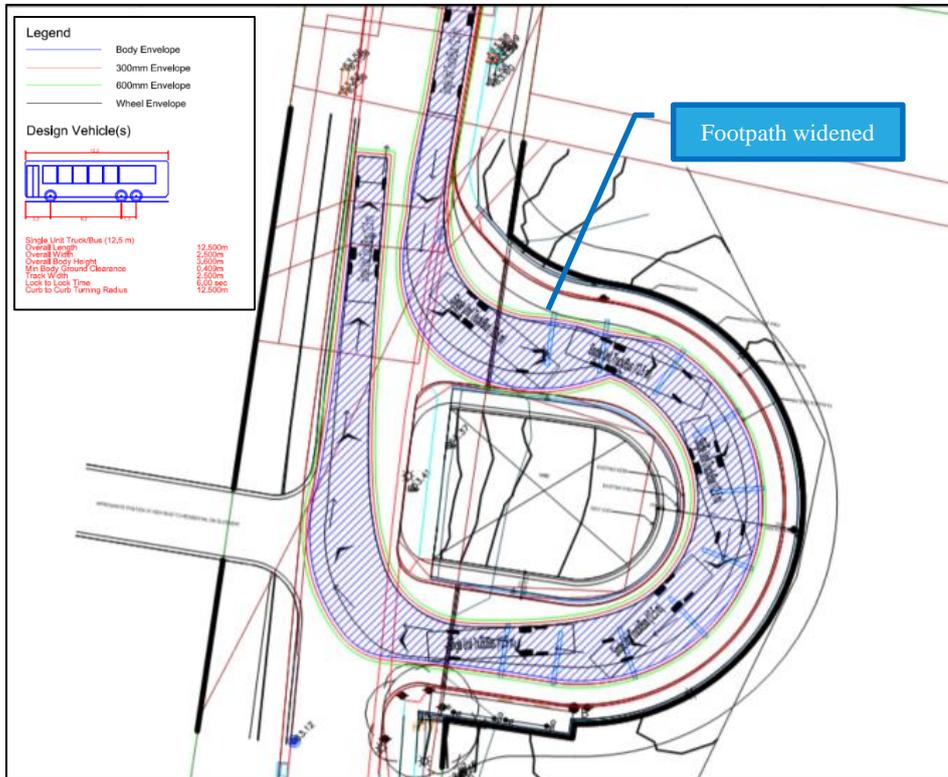


Figure 2: Proposed design swept path using 12.5m buses

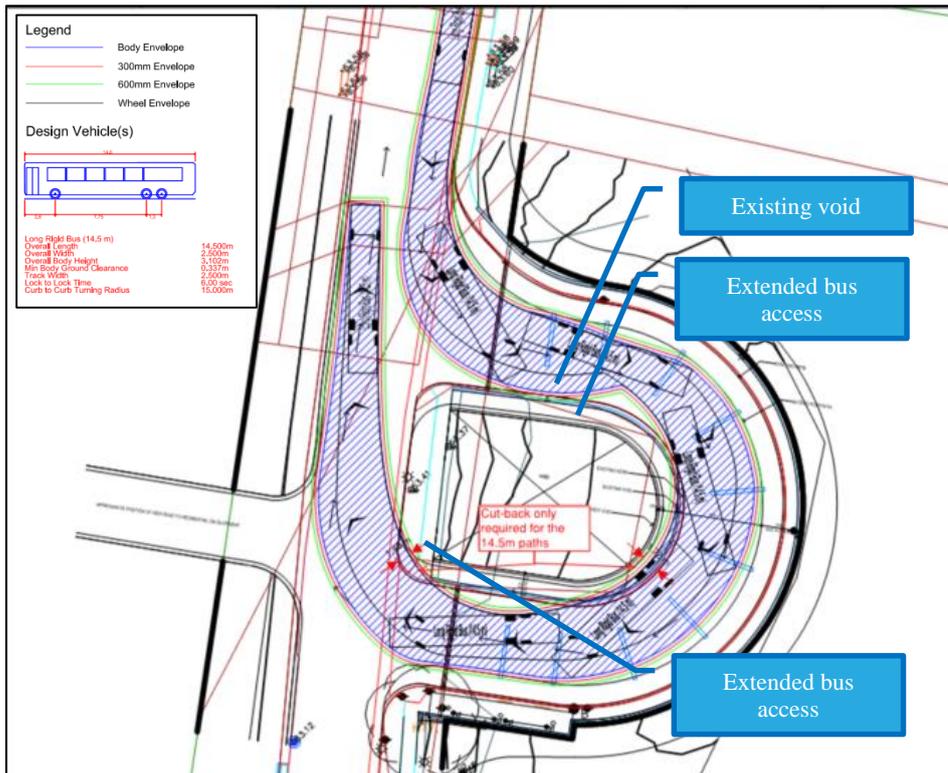


Figure 3: Proposed design swept path using 14.5m buses

## 3 Stage 1 Assessment

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### 3.1 Stage 1 indicative school catchment

There would be up to 1,050 students in the initial opening of school in Stage 1. In reviewing the RMS submissions and the responding draft traffic report with the Department of Education (DoE), the DoE were able to confirm the almost finalised draft boundary amendments to accommodate the new School, which also impacts surrounding schools.

The draft amendments, released to the project team in late October 2017, for the purposes of traffic modelling only, have revealed that far less traffic will be coming from the North from the Pacific Highway than the assumptions made in the previous model which assumed an equal split of 25% of traffic from each direction. The draft boundaries covered off both primary and high school student splits.

School boundaries are highly controversial and sensitive, and can affect house prices. These school boundary plans cannot be made available to the public prior to Department formal release.

The plans therefore cannot be made visually available in this report. Should more information be required, Urbis would facilitate a mechanism where the information can be confidentially shared.

## 3.2 Stage 1 revised traffic distribution

Based on the indicative school catchment and the relative area of residential dwellings within it, a proportional split of enrollments are derived. The vehicular routes and proportion of each area relative to the school (see Figure 4).

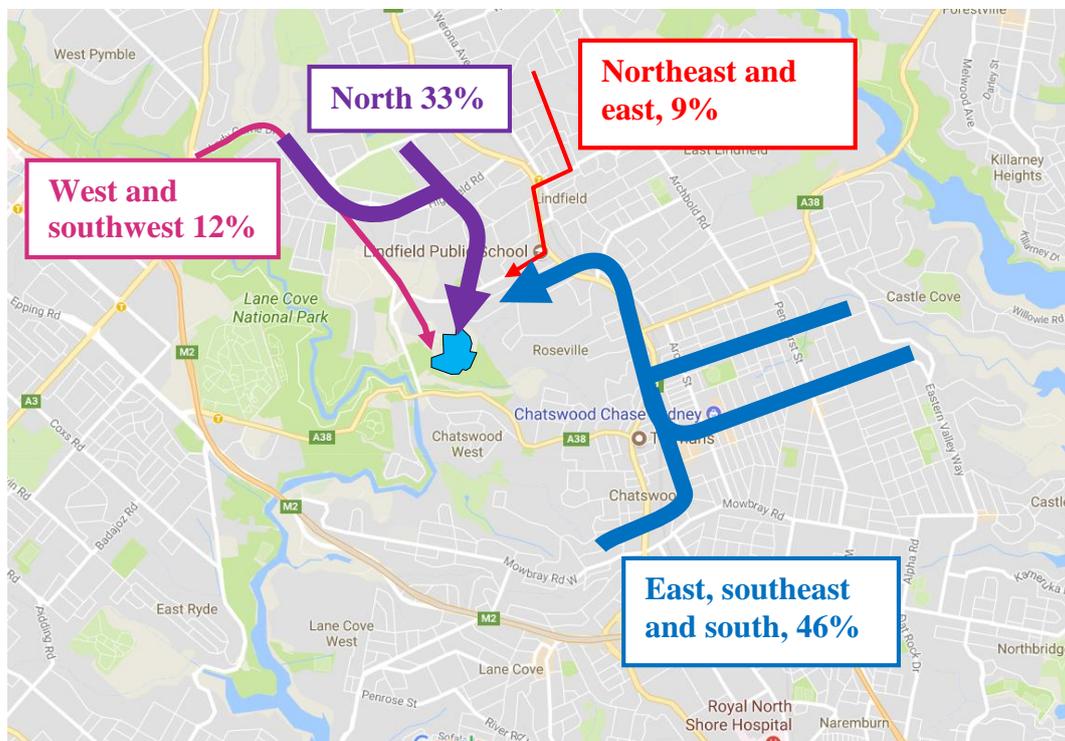


Figure 4: Approximate proportional splits of enrolments based on the indicative school catchment

**East, south and southeast (46%)** – A majority of the enrolments and hence traffic would arrive east and south of the school. Vehicles from the southeast area would make right turns onto the Pacific Highway via various intersections such as William Street, Ashley Street and Boundary Street. Vehicles located nearer to Clanville Road would use the right turn at the Pacific Highway / Clanville Road intersection, to get onto the Pacific Highway. All the vehicles would then turn left onto Eton Road or Westbourne Road from the Pacific Highway.

**North (33%)** – The next largest proportion of enrolments would come from the north of the school, west of the Pacific Highway. Access to Grosvenor Road consists of a permeable local road network, using Bent Street, Highfield Road, Cook Road and Beaconsfield Parade. Most of the routes consist of priority controlled intersections and local roads with low levels of traffic.

**West and southwest (12%)** – Enrolments from the west and southwest are estimated to be 12%. These vehicles would use Lady Game Drive.

**Northeast and East (9%)** – This consists of the smallest proportions of enrolments, with an estimated 9% coming from this area. Vehicles coming from this area would turn left from Strickland Avenue onto the Pacific Highway southbound. They would then proceed to utilise the right turn bay at the Pacific Highway / Grosvenor Road intersection.

### 3.3 Mode share modelling assumptions

Traffic generation rates discussed in section 10.2 of the TTA have assumed a highly conservative rate of 42% of the students using private vehicles with 1.2 people per car for both Kinder to Grade 6 students and Year 7 to Year 12 students (Table 3). These rates were used in the TTA and will be used for the purpose of this report.

With effective travel strategies (school buses and walking), this number will be considerably lower given that high school students are more likely to take public transport, based on Killara High School surveys, which observed an efficient use of the school bus system.

The learning village should aim to achieve a 10% car mode share for High School Students as seen in Killara High School, shown in Table 4. This will result in better modelling results for all the intersections including the Pacific Highway / Grosvenor Road intersection.

Table 3: Traffic generation rates used for modelling

Table colour	% drive	Car occupancy
All Students	42%	1.2 per car

Table 4: Target traffic generation rates

Table colour	% drive	Car occupancy
Kinder to Year 6	42%	1.602 per car
High school	10%	1.4 per car

## 3.4 Stage 1 opening of the learning village

### 3.4.1 Traffic

A staged opening of the learning village is essential to reasonably allow for traffic impact monitoring and review of final operating scale. For stage 2 of the development, a staggered start time would need to occur.

This assessment reviews the impacts and requirements of the Stage 1 opening which will result in an enrolment of up to 1,050 students.

Using similar traffic generation rates in the TTA (refer to section 4.2.1) and traffic distribution based on the new indicative school catchment (section 3.2), the impact of the critical intersection, Pacific Highway /Grosvenor Road is assessed with results shown in Table 5. The scenarios tested the following conditions:

- If a staggered start time is required
- If extension of the Pacific Highway right turn bay is required before opening of the Stage 1 of the learning village

Table 5: Stage 1 SIDRA assessment results for 1,000 students, critical AM peak hour

Pacific Highway / Grosvenor Road intersection	Peak	Deg. Satn	Average Delay (s)	Level of Service	95 <sup>th</sup> ile q (m) of Pacific Highway Right turn bay
Existing conditions	AM	0.767	30.0	C	57
Stage 1 – No upgrades and no staggered start times	AM	0.94	41.8	C	58

### Modelling results

Based on the modelling results, the Pacific Highway / Grosvenor Road would continue to perform at an efficient level of service C, with the opening of Stage 1 of the learning village. According to the model's 95<sup>th</sup> %ile queue, the 70m right turn bay from Pacific Highway into Grosvenor Road are predicted to operate efficiently with no occurrence of a spillover.

It should be noted however that the western approach of Grosvenor Road is predicted to reduce in performance and at an average delay of 125 seconds (existing 77 seconds). The model predicts a 95<sup>th</sup> %ile queue length of 126 metres along Grosvenor Road. This is due to the high proportion of vehicles coming from the southeast, and would exit the learning village by turning right from Grosvenor Road onto Pacific Highway. The model has been set up to prioritise the state classified Pacific Highway, therefore less green time is given to the minor approach of Grosvenor Road. Vehicles who experience high delays using Grosvenor Road could choose to use alternate right turn arrangements located at the Shirley Road / Pacific Highway intersection, however this option is not modelled to assess a conservative estimate.

The south approach (non-peak direction) along the Pacific Highway is also expected to reduce in performance from a LoS C to a still efficient LoS D. The peak southbound direction is predicted to perform efficiently according to the model.

The modelling results are conservative and assume:

- No staggered start times are adopted in Stage 1
- Dead green time in the AM peak is retained
- A high car mode share assumption is used for both primary school and high school students
- The high school student car occupancy is expected to be lower with a larger proportion using public transport and school buses or walking

Based on the mode share assumptions and the indicative school catchment, Stage 1 would be able to operate with 1,050 students and no staggered start times would be required. Based on the overall efficient predicted level of service, the Pacific Highway / Grosvenor Road intersection would not require upgrades to accommodate the additional Stage 1 traffic.

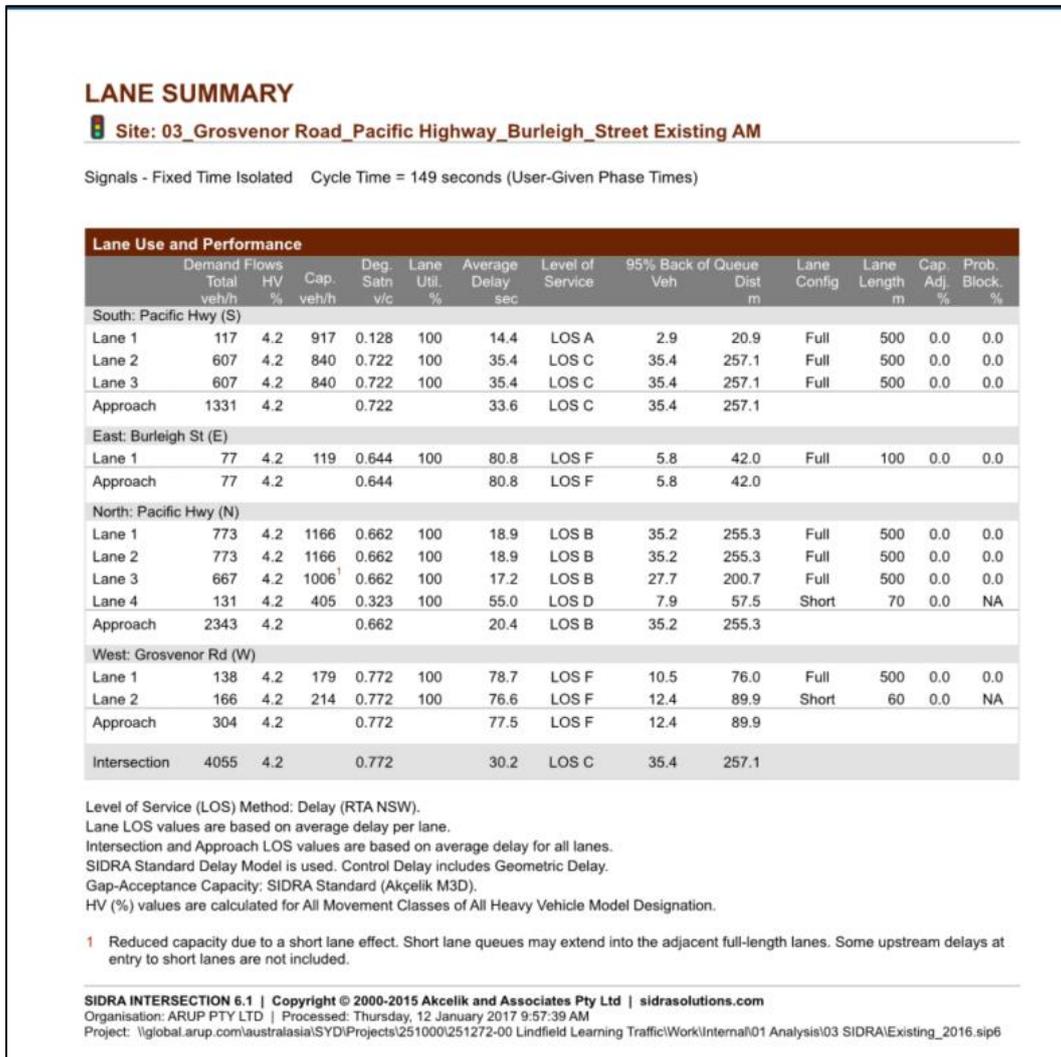


Figure 5: Existing performance, Pacific Highway / Grosvenor Road intersection

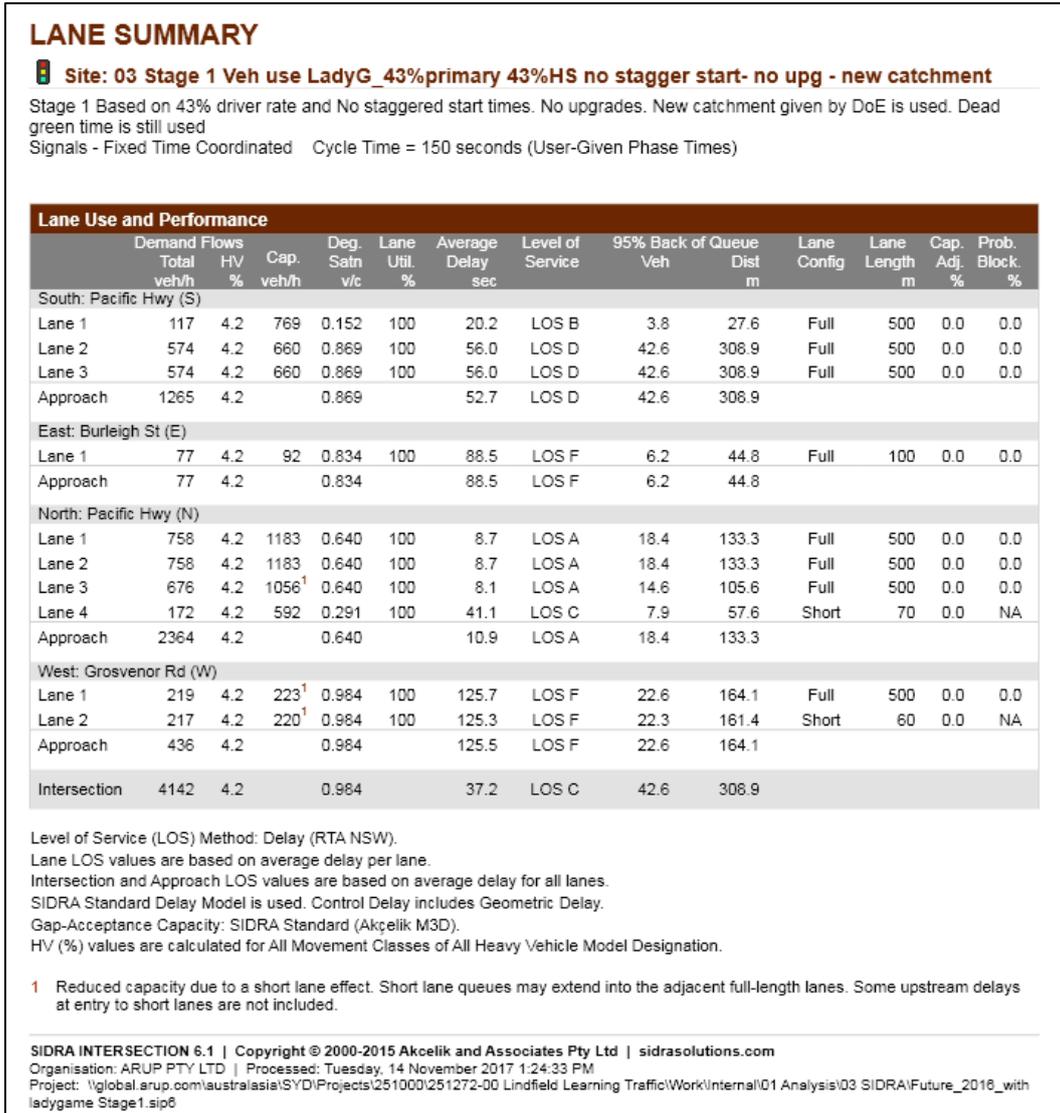


Figure 6: Stage 1 – No upgrades and no staggered start times, Pacific Highway / Grosvenor Road intersection, Stage 1 traffic modelling results assuming the indicative school catchment is used, with no staggered start times

### 3.4.2 School buses

Using the preferred mode split discussed in section 8.1 of the TTA, the estimated mode split of stage 1 students (1,050 students) that would use school buses are:

- 50% of Kinder to Grade 6 (250 students)
- 65% Year 7 to 12 (325 student)

With approximately 75 students per bus, some 7 to 8 buses would be required in stage 1.

#### **Student drop-off**

With up to 5 buses at a time able to utilise the bus bay, buses would arrive randomly to set-down students, with an empty out time of 2 minutes anticipated. Public buses would intersperse where necessary.

#### **Student pick-up**

If no staggering of the school start times for stage 1 is adopted, the arrival of school buses for the pick-up period needs to be scheduled to match the available storage space within the bus bay which can only hold up to five 12.5 metre buses, discussed in section 2.2. School bus arrivals for pick-up period can be organised in groups:

- 5 school buses to arrive in one group
- 3 school buses to arrive in a separate group after the first 5 have left. This allows flexibility for 2 additional buses to be added to this time slot if required

During the afternoon, it is proposed that the buses would wait for students in the bus bay.

Observations from Killara High School discussed in section 6.2 of the TTA found that students would typically take 10 minutes to load onto a bus. Each bus group would therefore be able to leave within 10 minutes. The scheduled timetable for public buses is shown in Table 6.

A number of school start times have been tested for the 1,050 students in Stage 1 to understand how they may impact on the regular route bus service using the same bus stop:

- Commence at 7:30am, finish at 2:00pm, 8 school buses
- Commence at 8:30am, finish at 3:00pm. 8 school buses
- Commence at 9:00am, finish at 3:30pm, 8 school buses

As seen from the timetable, the second option of finishing at 3:00pm requires the adjustment of public buses arriving at 3:04pm and 3:13pm.

The commencement of school at Stage 1 at either 7:30am or 9:00am would allow the pickup of two groups of buses. The commencement of school at 8:30am would require the adjustment of the public bus timetable. Alternatively the time between the first and second group of buses could be increased to allow for the route bus to access the bus stop.

Table 6: Arrival of school buses in Stage 1 and public buses, based on different school start times.

Rank 1	Bus	Arrival time	Direction
1	565	1:21pm	NB
1	565	1:38pm	SB
1	Sch 1	7:30am start time 2:00pm end time 11 mins	
2	Sch 2		
3	Sch 3		
4	Sch 4		
5	Sch 5		
1	Sch 1	7:30am Start time 10 mins	
2	Sch 2		
3	Sch 3		
1	565	2:21pm	NB
1	565	2:33pm	SB
<b>1</b>	<b>565</b>	<b>3:04pm</b>	<b>NB</b>
1	Sch 1	8:30am start time 3:00pm end time Require timetable Adjustment for public buses	
2	Sch 2		
3	Sch 3		
4	Sch 4		
5	Sch 5		
1	Sch 1	8:30am start time 3:00pm end time Require timetable Adjustment for public buses	
2	Sch 2		
3	Sch 3		
<b>1</b>	<b>565</b>	<b>3:13pm</b>	<b>SB</b>
1	565	3:26pm	NB
1	Sch 1	9:00am Start time 3:30pm end time 10 mins	
2	Sch 2		
3	Sch 3		
4	Sch 4		
5	Sch 5		
1	Sch 1	9:00am Start time 3:30pm end time 17 mins	
2	Sch 2		
3	Sch 3		
1	565	3:53pm	SB
1	565	4:01pm	NB

Note: Only one start time and one end time would be adopted given that no staggered school start times are required. The table above shows various start time options for the 1,000 students in Stage 1

### 3.5 Alternate public bus route

#### 3.5.1 Servicing residential area

As an alternative to modifying the existing public transport timetable, an alternate bus route could be adopted. This would have the benefit of better servicing residents living along the route shown in Figure 7. This proposed route is subject to the proposed internal vehicle access arrangements of the residential developments and would require the northern segment of the road to operate in a one-way direction eastbound. Preliminary swept paths are shown below using a 14.5m bus.



Figure 7: Alternate public bus route



Figure 8: Southeast corner entry from Eton Road



Figure 9: Southwest corner entry from Shout Ride

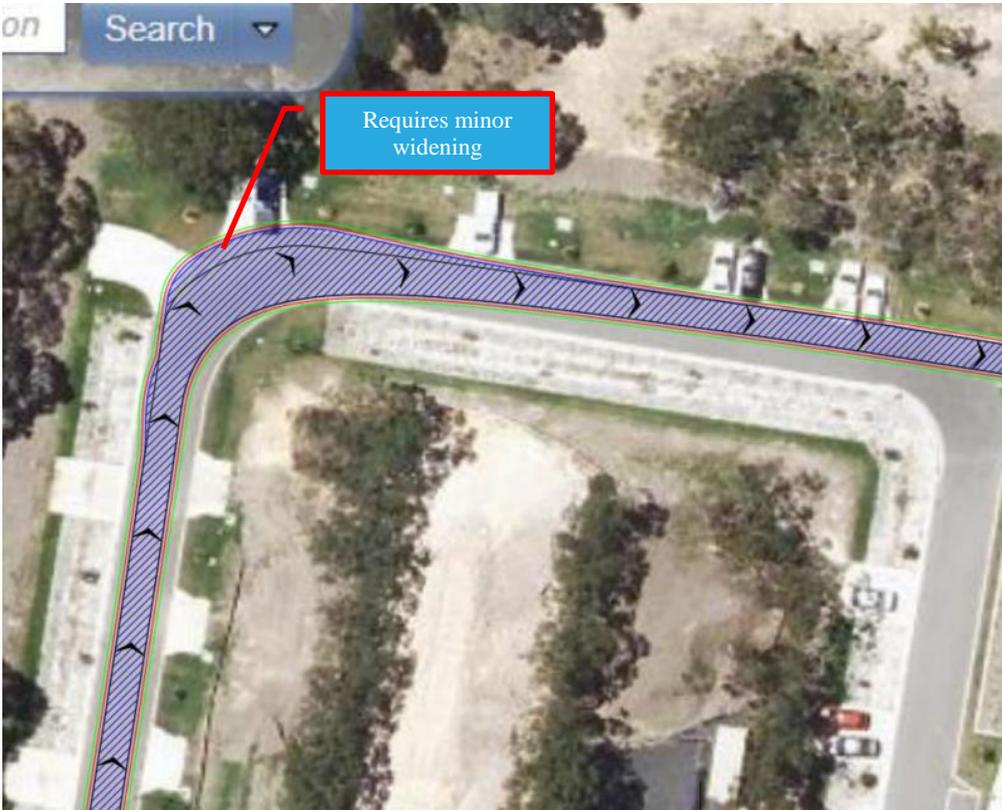


Figure 10: Northwest corner

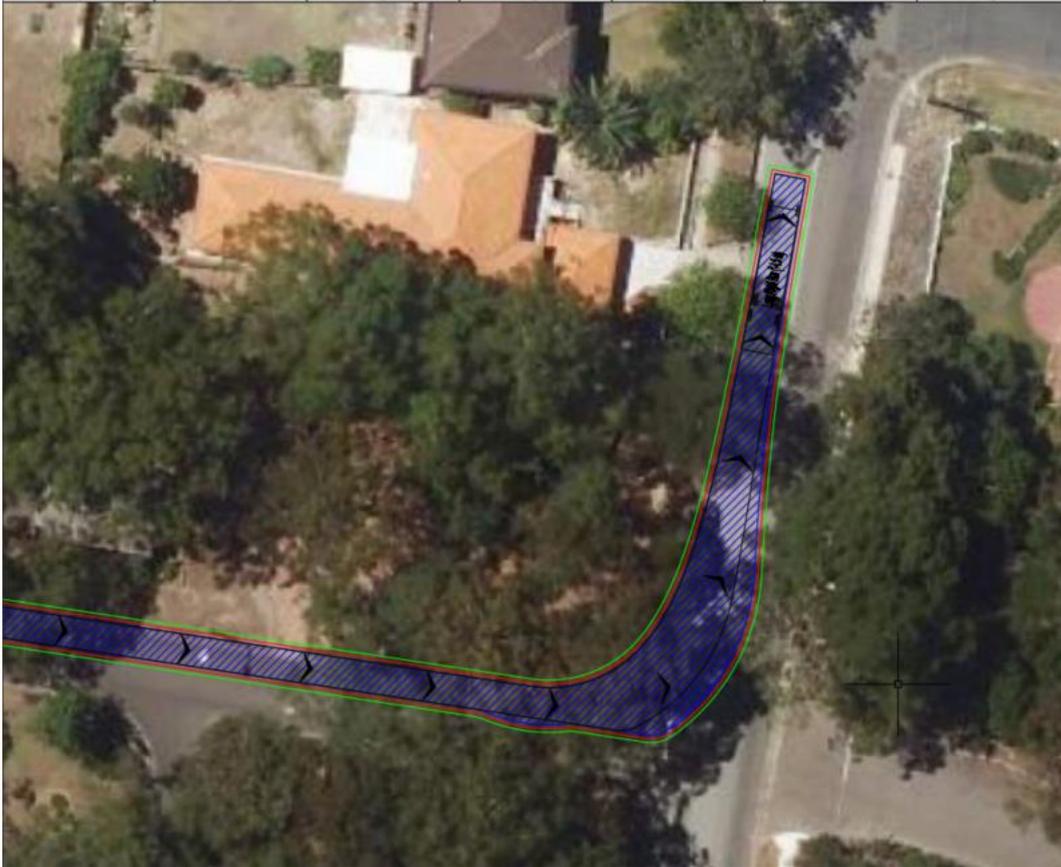


Figure 11: Exit onto Eton Road

### 3.5.2 Utilising existing roundabout

Another option would be to utilise the existing roundabout at Shout Ridge and Hamilton Corner. This option would allow 12.5 metre buses to make a turnaround shown in Figure 12. This manoeuvre was previously organised during the development of the former UTS site. Buses were temporarily re-routed from Eton Road bus bay. Council has informed that this was only applied for 12.5 metre buses due to the size of the roundabout.

As such this option would restrict access from 14.5 metre buses.



Figure 12: Utilising existing roundabout option, 12.5 metre bus

### 3.5.3 Further consultation

The alternate public bus routes and adjustment of timetables still requires further consultation with TfNSW, bus service providers and private road owners.

## 4 Stage 2 Assessment

### 4.1 Assessment of Lady Game Drive

The Lady Game Drive / Grosvenor Road intersection consists of a three leg roundabout. Lady Game Drive provides access to North Ryde via Dehli Road and to Chatswood via Millwood Avenue. During the AM peak, the high southbound traffic demand creates a queue which extends past the roundabout, starting from the Millwood Avenue intersection. A screenshot of the typical AM peak queue length is shown in Figure 13. Typical google traffic travel time metrics show slow rolling queues extending about 300 metres north of the intersection, shown in Figure 14.



Figure 13: Lady Game Drive / Grosvenor Road intersection

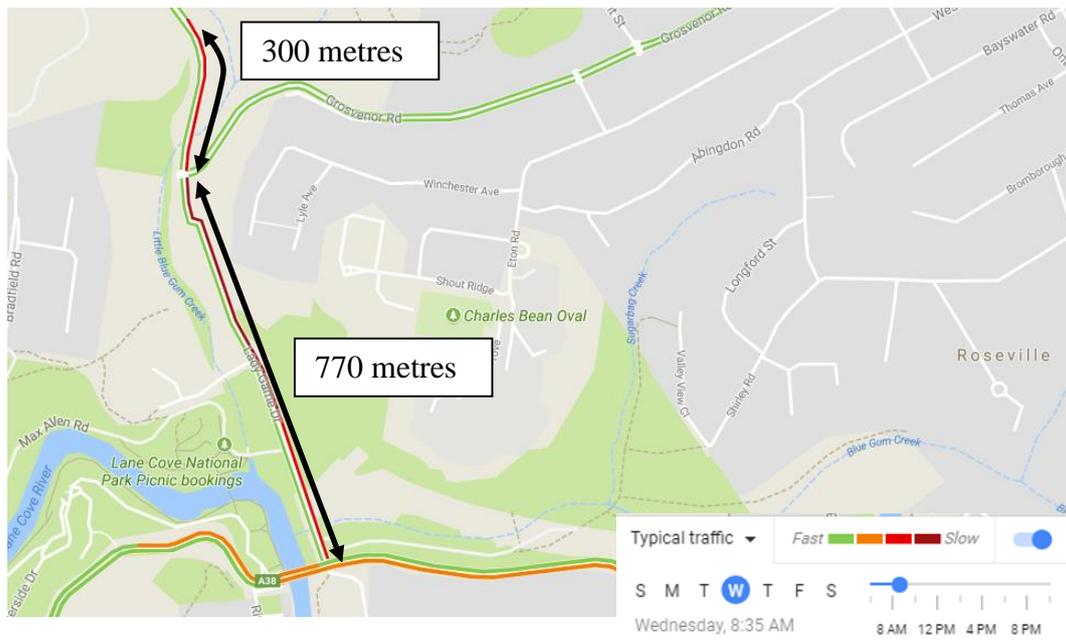


Figure 14: Google Maps Traffic, typical travel time on Wednesday 8:35am shown to be slow as observed on-site

### 4.1.1 Initial traffic distribution

The TTA report has assumed an overconservative traffic distribution assumption, that none of the traffic generated from the site would use Lady Game Drive to access the site.

The assumed traffic distribution for arrivals and departures are shown in Figure 15 and Figure 16.

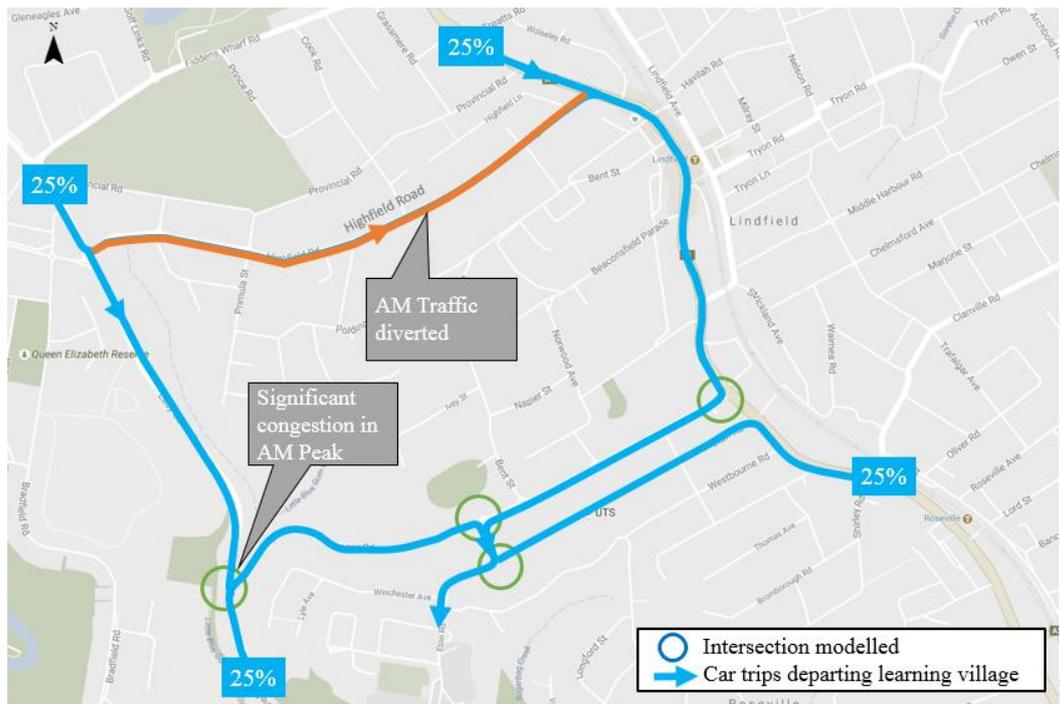


Figure 15: Car trips to the Learning Village (assumed in the TTA)

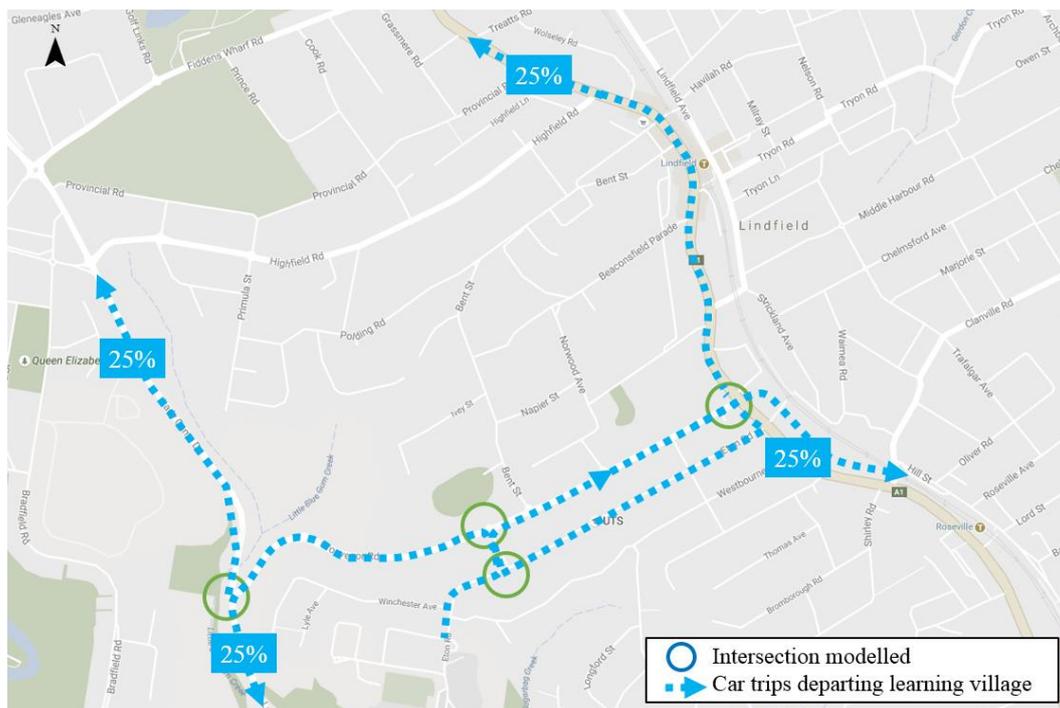


Figure 16: Car trips departing the Learning Village



## 4.2 Stage 2 modelling

### 4.2.1 Assuming the school catchment is retained

This section investigates the road network impacts, assuming the Stage 1 indicative school catchment is retained (section 3.1) and a similar traffic distribution is adopted. Similar mode shares in the TTA are also used, with the results shown in Table 7.

Table 7: Stage 2 SIDRA results, assuming the new catchment is adopted

Pacific Highway / Grosvenor Road intersection	Peak	Deg. Satn	Average Delay (s)	Level of Service	95 <sup>th</sup> ile q (m) of Pacific Highway Right turn bay
Existing conditions	AM	0.767	30.0	C	57
Stage 2 – No upgrades and no staggered start times	AM	0.94	44.2	D	66

### Modelling results

Based on the modelling results, the Pacific Highway / Grosvenor Road would continue to perform at a satisfactory level of service D, with the opening of Stage 2 of the learning village and the indicative school catchment. According to the model's 95<sup>th</sup>ile queue, the 70m right turn bay from Pacific Highway into Grosvenor Road are predicted to operate efficiently with no occurrence of a spillover.

It should be noted however that the western approach of Grosvenor Road is predicted to reduce in performance to a level of service F and at an average delay of 96 seconds. The model predicts a 95<sup>th</sup> %ile queue length of 158 metres along Grosvenor Road. This is due to the high proportion of vehicles coming from the southeast, and would exit the learning village by turning right from Grosvenor Road onto Pacific Highway. The model has been set up to prioritise the state classified Pacific Highway, therefore less green time is given to the minor approach of Grosvenor Road. Vehicles who experience high delays using Grosvenor Road could choose to use alternate right turn arrangements located at the Shirley Road / Pacific Highway intersection, however this option is not modelled to assess a conservative estimate.

Based on the modelling assumptions, the provision of school buses and the adoption of the indicative school catchment, the intersection of Pacific Highway / Grosvenor Road would be able to perform satisfactorily at an overall level of service D with no upgrades to the intersection required.

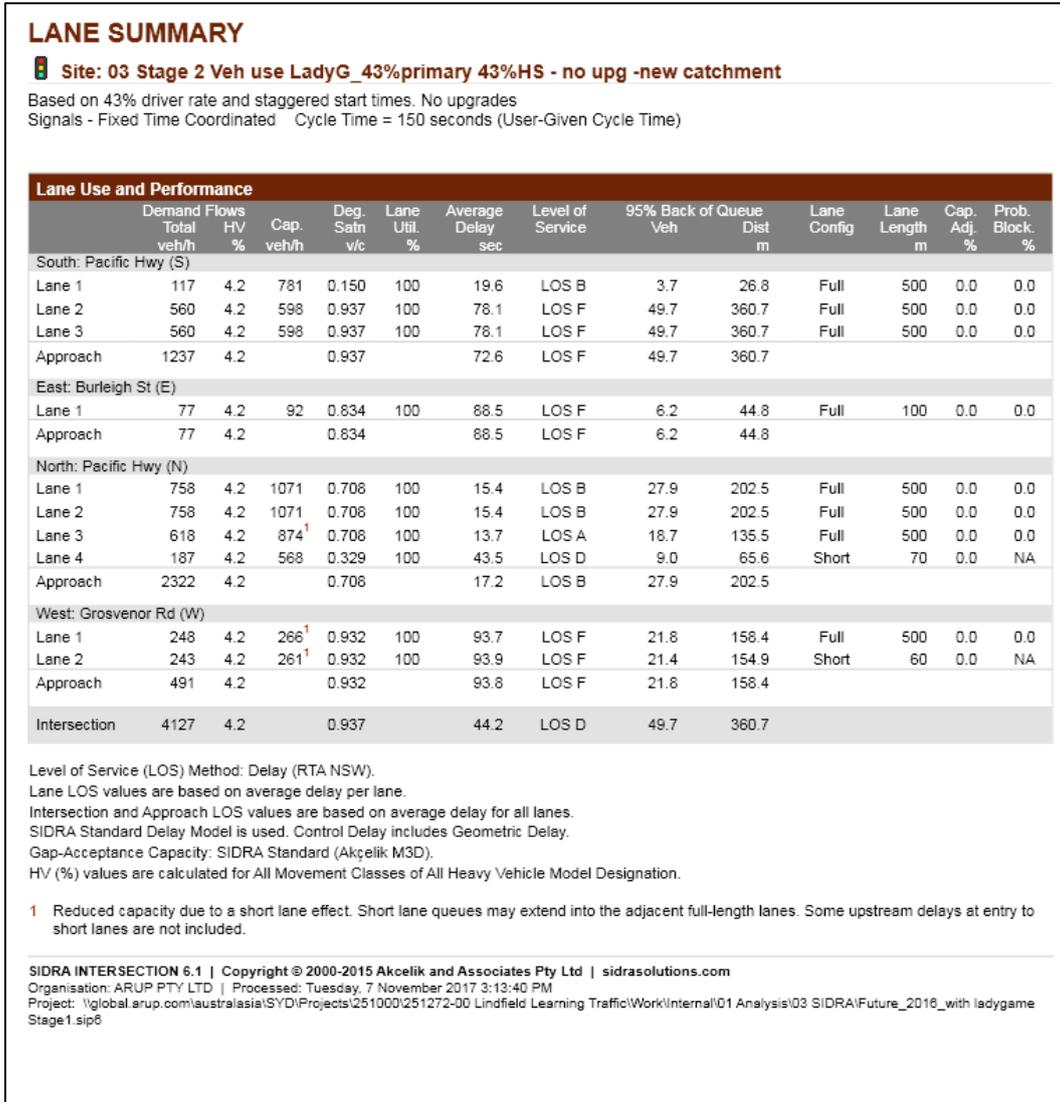


Figure 19: Stage 2 traffic modelling results assuming the indicative school catchment is retained

## 4.2.2 Assuming an equal traffic distribution

A worst case scenario has been modelled in the TTA, where none of the traffic uses Lady Game Drive. These were based on the assumptions that the school catchment has not been developed and none of the traffic would use Lady Game Drive to access the school. With no vehicles accessing the school via Lady Game Drive is deemed over conservative as discussed in section 4.1.

In the event that the indicative school catchment changes, the arrival of vehicles would change. This section investigates the effects a more distributed catchment, with traffic arriving in equal proportions from every direction.

Some 25% of the traffic generated by the site would use Lady Game Drive / Grosvenor Road to access the site. This would reduce the demand for entries from the Pacific Highway by half when compared to the initial assumed traffic distribution assumptions in the TTA.

Modelling results of the Pacific Highway / Grosvenor Road intersection shows that if traffic uses the Lady Game Drive / Grosvenor Road intersection to access the site, the Pacific Highway intersection would operate at an efficient level of service C. Results of the initial TTA modelling and the new traffic assignments are shown in Table 8. The model has adopted the following assumptions:

- 43% of students (including high school) arrive by car with a car occupancy rate of 1.2 people/car
- 25% of traffic generated uses Lady Game Drive to enter / exit
- 25% of traffic generated uses the Pacific Highway / Grosvenor Road to enter / exit
- Existing intersection geometry retained
- Existing dead green time is retained

Table 8: Stage 2 SIDRA results, assuming a 25% traffic distribution from each direction

Pacific Highway / Grosvenor Road intersection	Peak	Deg. Satn	Average Delay (s)	Level of Service	95%ile q (m) of Pacific Highway Right turn bay
Existing conditions	AM	0.772	30.2	C	57
Initial traffic distribution No traffic using Lady Game Drive (results from the TTA)	AM	1.020	77.4	F	353
Revised traffic distribution 25% using Lady Game Drive	AM	0.846	33.4	C	121

Based on the assumption that traffic would use Lady Game Drive and the modelling results, the Pacific Highway / Grosvenor Road would not require any additional upgrades to the intersection. The upgrades previously proposed in the TTA have assumed that none of the traffic generated by the site would use Lady Game Drive.

As such it can be concluded that Lady Game Drive is a key access to the school and is a more favourable point of entry than the Pacific Highway for vehicles travelling from the west. With a more distributed traffic assignment to the learning village, the overall intersection performance would be at an efficient level. However, the model predicts a 95%ile worst queue of 120 metres along the right turn bay of the Pacific Highway. This result considers the effects of dead

green time and is likely to perform better should downstream congestion issues be alleviated.

The model also indicates a 50%ile worst queue of 70 metres. This indicates that the queue would not spillover 50% of the time. The model also indicates that there is also a 0% probability of lane blockage, indicating the adjacent lanes are able to accommodate the through movements despite a spillover from the right turn bay.

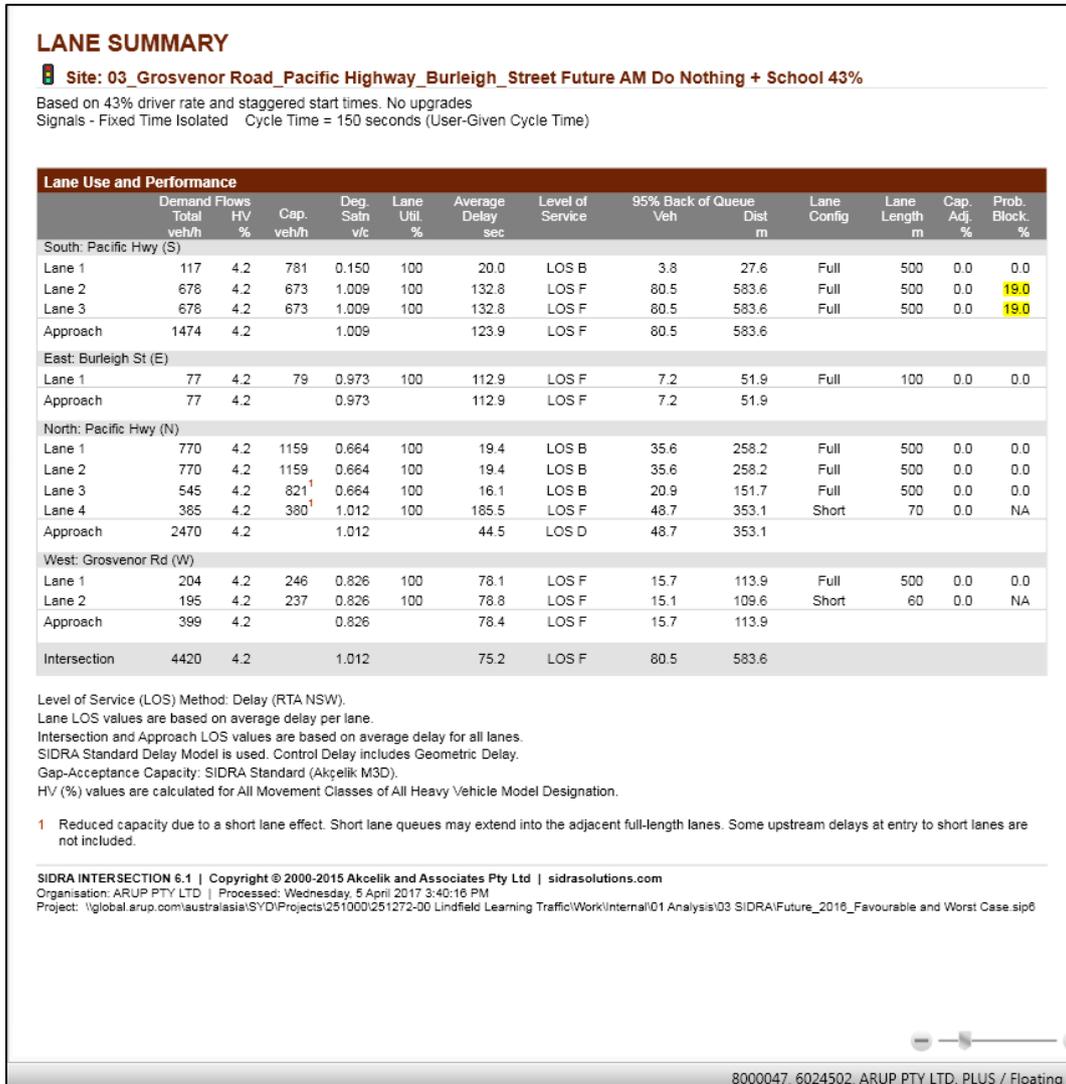


Figure 20: Stage 2 TTA Initial traffic distribution SIDRA results, Pacific Highway / Grosvenor Road. No traffic using Lady Game Drive to access the school.

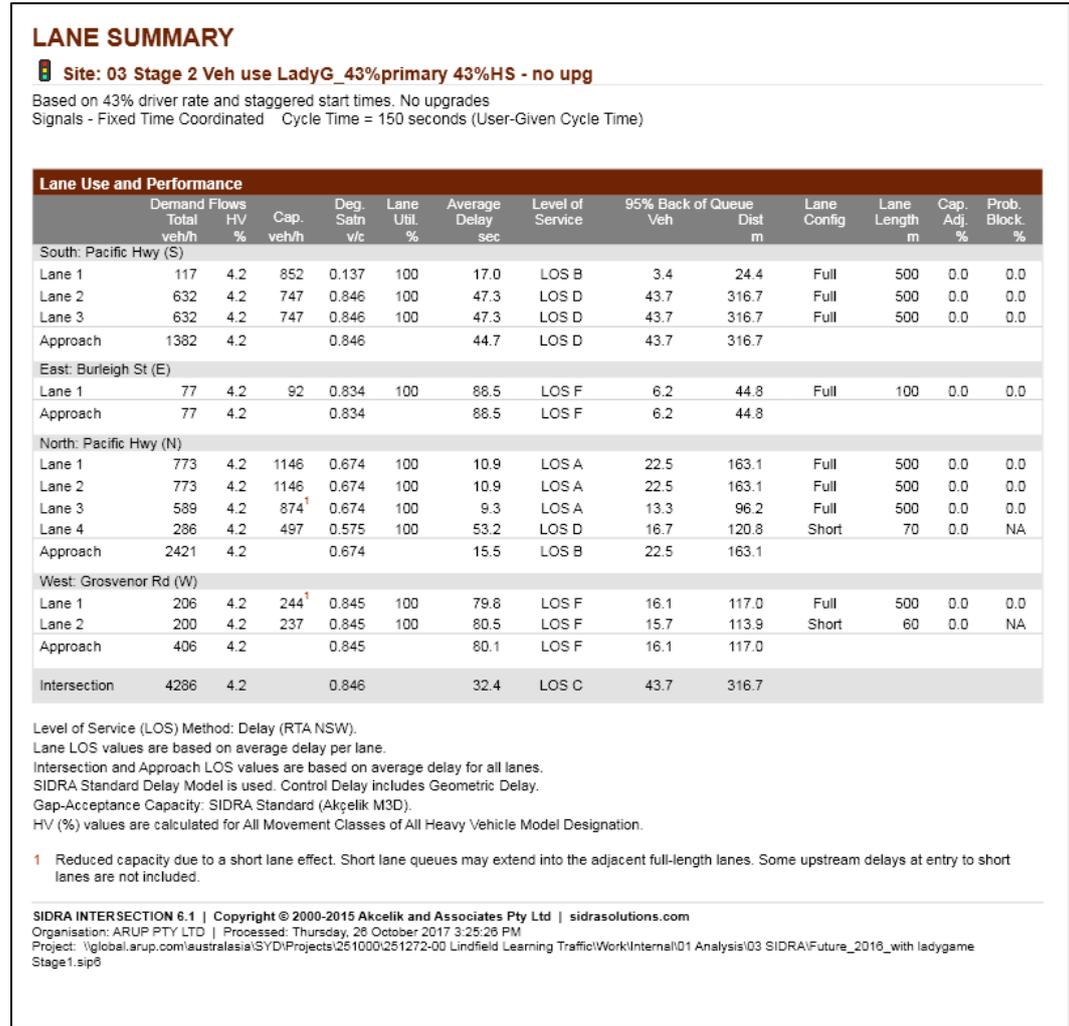


Figure 21: Stage 2 Revised traffic distribution SIDRA results, Pacific Highway / Grosvenor Road, with vehicles now using Lady Game Drive. A 25% approach from each direction

### 4.3 Pacific Highway right turn bay

This section explores various options for the Pacific Highway / Grosvenor Road intersection upgrades as possible outcomes, but are not part of the Lindfield Learning Village development.

The existing right turn bay from the Pacific Highway into Grosvenor Road is 70m long. Modelling discussed in Section 4.2 has predicted a 120 metre 95%ile queue along the right turn bay upon completion of the school. This section elaborates further on the potential right turn bay extension upgrade, however it should be noted that the intersection would perform satisfactorily (LoS C) despite the spillover from the right turn bay.

#### 4.3.1 Option 1 – removal of the existing bus stop



Figure 22: Schematic of proposed upgrades

This option (not part of the Lindfield Learning Village development) was previously proposed in the TTA and would be the most cost efficient upgrade option. The upgrades would have minimal impact the existing surrounding land use (minimal land acquisition) and would yield a positive outcome from an economic and performance point of view. Extension of the right turn bay to 170 metres can accommodate the predicted 120 metre 95%ile queue.

### **Preliminary assessment**

Preliminary on-site measurements have been carried out along the Pacific Highway, near Grosvenor Road. The cross sectional measurements are shown in Appendix B. The findings have shown that with the removal of the existing bus indent and narrowing of the road median, only minor road works would be required to facilitate an extended right turn bay into Grosvenor Road. A more detailed survey and design will be required.

### **Impact on public transport**

Extension of the right turn bay would result in the removal of the existing bus stop shown in Figure 23. The bus stop currently has no bus poles, wayfinding or bus shelter. There is no visual indication of a bus stop existing and as a result, is likely underutilised, as shown by Opal data discussed below.

The bus stop currently serves one bus route, 565.



Figure 23: Location of Lindfield Public School, bus stop Stop ID: 207045

### Opal data assessment

TfNSW has provided Opal data for three key northbound bus stops (Figure 24), including the stop ID 207045 which is proposed to be removed as part of Option 1. Weekday data was collected from 6:45am to 8:45pm, with the daily total number of Opal tap-ons / tap-offs for each bus stop shown in Table 9. The data shows that the stop ID 207045 is highly underutilised with only one tap-off recorded throughout one full week in August 2017. Removal of the bus stop is therefore justifiable on a basis of low passenger usage.

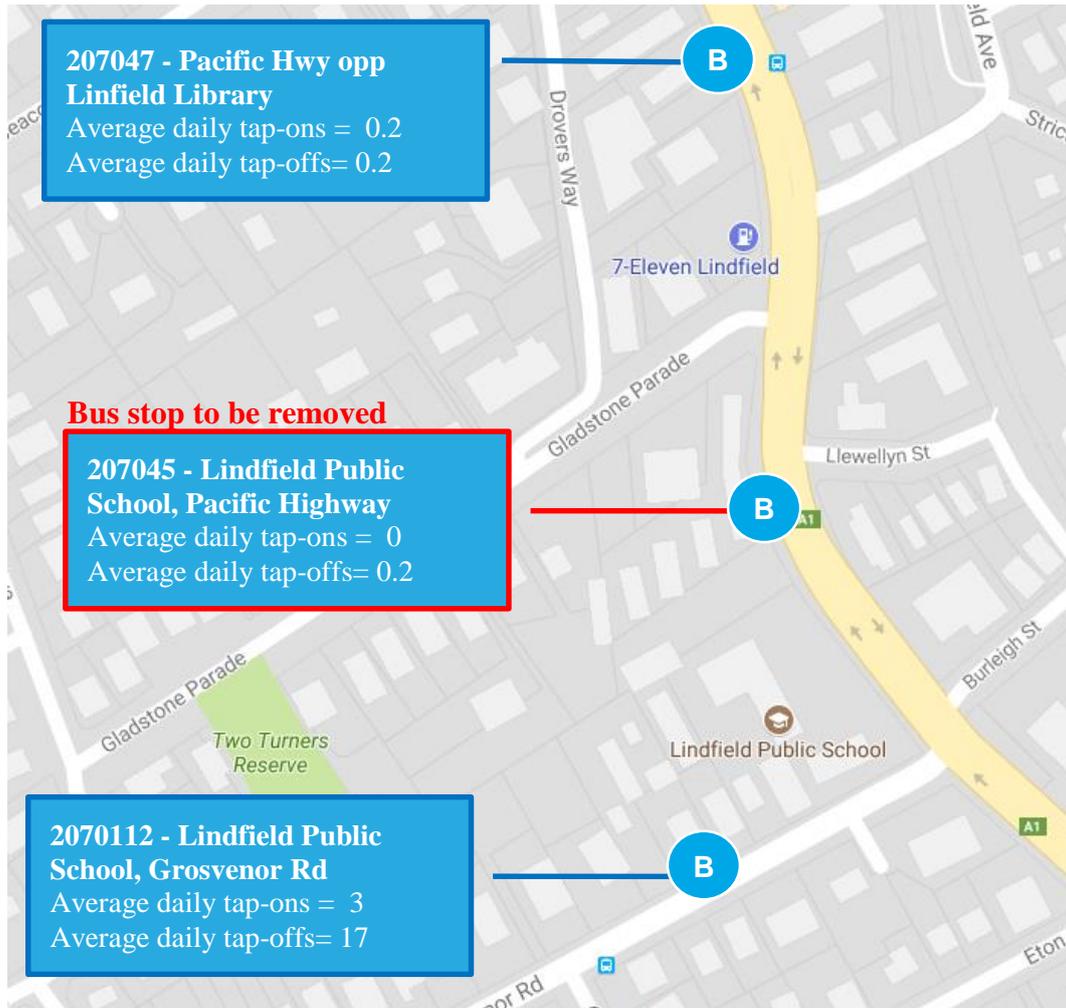


Figure 24: Bus stop locations and average daily Opal data over five weekdays

Table 9: Total daily number of Opal tap-ons / tap-offs

Date 6:45am to 8:45pm	2070112		207045		207047	
	On	Off	On	Off	On	Off
Monday, 14 August 2017	6	26	0	0	0	0
Tuesday, 15 August 2017	2	9	0	0	0	0
Wednesday, 16 August 2017	2	19	0	0	1	1
Thursday, 17 August 2017	1	11	0	1	0	0
Friday, 18 August 2017	4	20	0	0	0	0
<b>Average</b>	<b>3</b>	<b>17</b>	<b>0</b>	<b>0.2</b>	<b>0.2</b>	<b>0.2</b>

## Proximity of other bus stops

There are two northbound bus stops located within close proximity of the existing Lindfield Public School bus stop, 200 metres north and southwest, shown in Figure 25. The existing northbound bus stop located along Grosvenor Road is located in a more ideal location than the subject bus stop, given it is located just outside the Lindfield Public School pedestrian entrance. It is likely to be more utilised and directly serves the school.

The existing southbound bus stops are located 550 metres apart. This means that passengers travelling southbound would have to walk a maximum of 225 metres to access the closest bus stop. Should the proposed bus stop be removed, passengers would have to travel a maximum of 200 metres.

As such, the removal of the existing bus stop would not affect passenger's travel distance significantly as there are still alternative options within a suitable walking distance. This will still be a shorter walking distance when compared to the existing practice distances between the southbound bus stops.

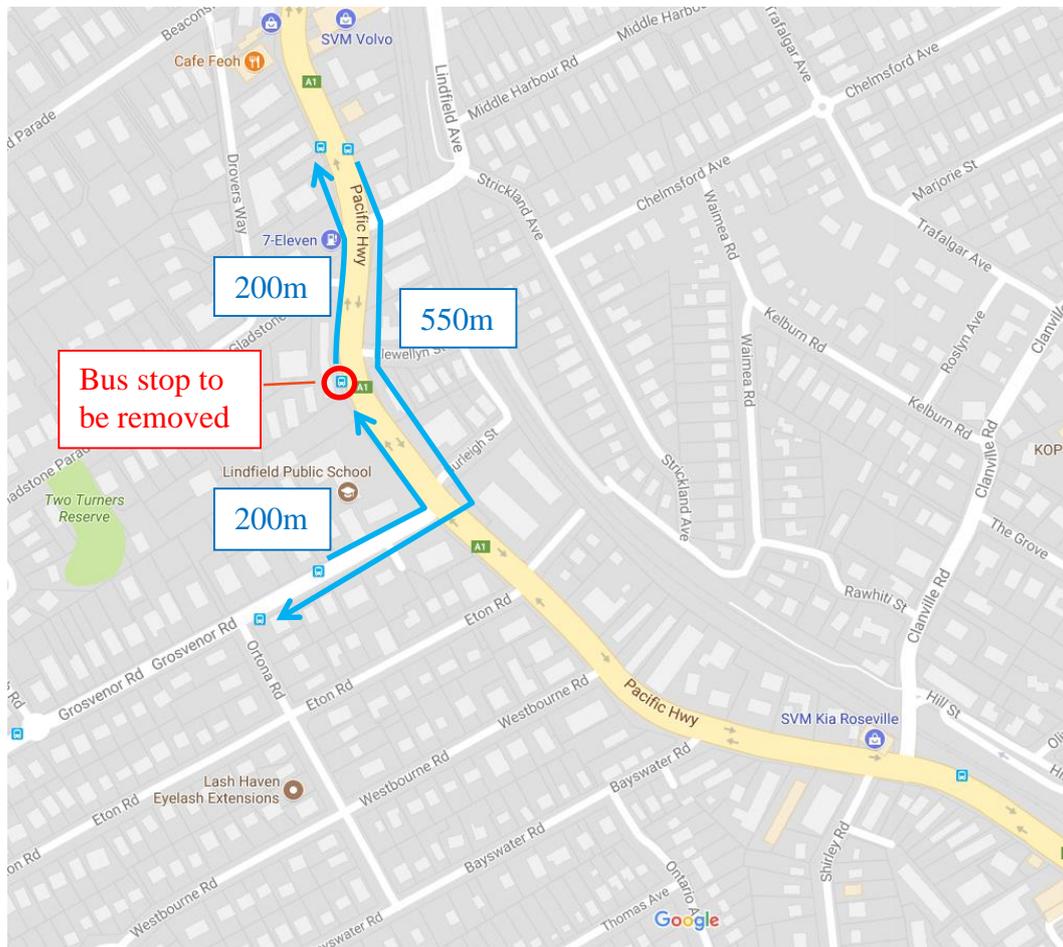


Figure 25: Proximity of existing bus stops

## Frequency of buses

Bus route 565, which operates hourly (timetable shown in Figure 26), services Chatswood and Macquarie University. It predominantly travels along the Pacific Highway and services the residential area around the site.

The low frequency of buses further suggests that the bus stop could be decommissioned. While it is proposed that the bus frequency be increased to facilitate the increase in students and staff to the Learning Village, the existing Lindfield Public School bus stop location is not crucial to the functioning of the Learning Village.

Monday to Friday												
map ref	Route Number	565	565	565	565	565	565	565	565	565	565	
A	Chatswood Station Railway Street	...	...	...	07:37	08:00	...	10:15	11:15	12:15	13:10	14:10
B	Roseville Station Pacific Highway	...	...	...	07:42	08:10	...	10:20	11:20	12:20	13:15	14:15
C	Crimson Hill Estate Eton Road	06:40	...	...	07:48	08:19	09:26	10:26	11:26	12:26	13:21	14:21
D	Lindfield Station Pacific Highway	06:47	07:02	07:35	07:55	08:26	09:33	10:33	11:33	12:33	13:28	14:28
E	West Lindfield CSIRO	...	07:08	07:41	08:01	08:33	09:41	10:38	11:38	12:38	13:34	14:36
F	West Killara Beaumont Road	...	07:13	07:46	08:06	08:42	09:45	10:42	11:42	12:42	13:39	14:42
G	Macquarie Centre Herring Road	...	07:30	...	...	09:01	09:58	10:56	11:56	12:56	13:51	...
H	Macquarie University	...	07:33	...	...	09:05	10:02	10:59	11:59	12:59	13:54	...

Monday to Friday (continued...)												
map ref	Route Number	565	565	565	565	565	565	565	565	565	565	
A	Chatswood Station Railway Street	14:50	...	...	B 15:42	16:09	...	16:45	...	17:28	...	18:08
B	Roseville Station Pacific Highway	14:55	...	...	15:54	16:14	...	16:50	...	17:33	...	18:13
C	Crimson Hill Estate Eton Road	15:01	15:26	...	16:01	16:20	16:41	16:56	17:19	17:39	17:56	18:19
D	Lindfield Station Pacific Highway	15:10	15:34	15:56	16:08	16:27	16:48	17:03	17:26	17:46	18:03	18:26
E	West Lindfield CSIRO	A	15:42	16:04	16:16	16:33	16:56	17:09	17:34	17:52	18:11	18:33
F	West Killara Beaumont Road	15:30	15:49	16:09	16:23	16:40	17:03	17:16	17:41	17:59	18:17	18:38
G	Macquarie Centre Herring Road	...	...	16:21	...	16:53	...	17:29	...	18:18	...	18:56
H	Macquarie University	...	...	16:24	...	16:56	...	17:32	...	18:22	...	19:00

Monday to Friday (continued...)						
map ref	Route Number	565	565	565	565	
A	Chatswood Station Railway Street	...	...	...	...	
B	Roseville Station Pacific Highway	...	...	...	...	
C	Crimson Hill Estate Eton Road	...	19:11	19:41	20:11	20:42
D	Lindfield Station Pacific Highway	18:50	19:17	19:47	20:17	20:48
E	West Lindfield CSIRO	18:56	19:23	19:53	20:23	20:54
F	West Killara Beaumont Road	19:01	19:27	19:57	20:27	20:59
G	Macquarie Centre Herring Road	...	...	...	...	
H	Macquarie University	...	...	...	...	

Figure 26: Bus route 565 timetable

## Key findings

In summary, it is suggested that the removal of the Lindfield Public School, Pacific Hwy Stop ID: 207045 be reconsidered to facilitate the upgrade of the right turn bay. This is based on the following merits:

- Minimal land acquisition and relocation of utilities required
- No existing physical indication of bus stop
- Two northbound bus stops located in close proximity along Pacific Highway and Grosvenor Road. The Grosvenor Road bus stop is located directly outside the school entrance and hence removal of the subject bus stop would not impact the school
- Low existing frequencies and expected utilisation
- Greater economic benefit and use of infrastructure due to underutilisation of the existing subject bus stop

### 4.3.2 Option 2 – modifying the existing bus stop

This option (not part of the Lindfield Learning Village development) proposes a similar extension of the right turn bay while retaining the bus stop. This would however require some land acquisition and access modifications to the Lindfield Public School car park, schematically shown in Figure 27. The car park access would be limited to one entry point only

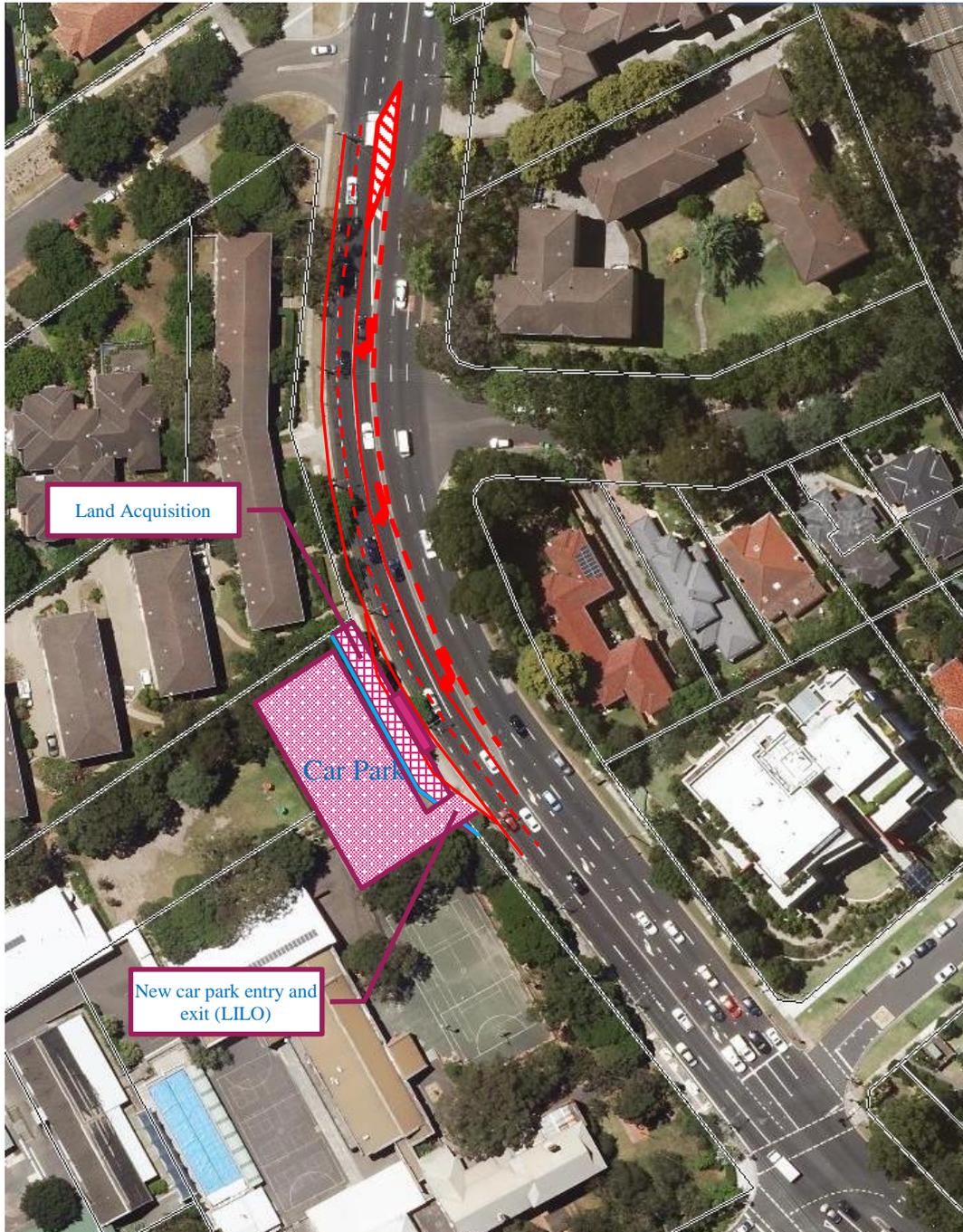


Figure 27: Lengthened right turn bay with indented bus bay

Note: LILO, Left in left out

### 4.3.3 Option 3 – dual right turn bays

Option 3 (not part of the Lindfield Learning Village development) proposes two 70 metre right turn bays into Grosvenor Road, shown in Figure 28. Modelling indicates that there would be sufficient storage space within the right turn bays upon completion of the school. This is however the most expensive option given the large requirement of land acquisition and civil works required to facilitate for footpaths on the western side of the Pacific Highway and Grosvenor Road. This option would also require widening Grosvenor Road to facilitate two exit lanes.

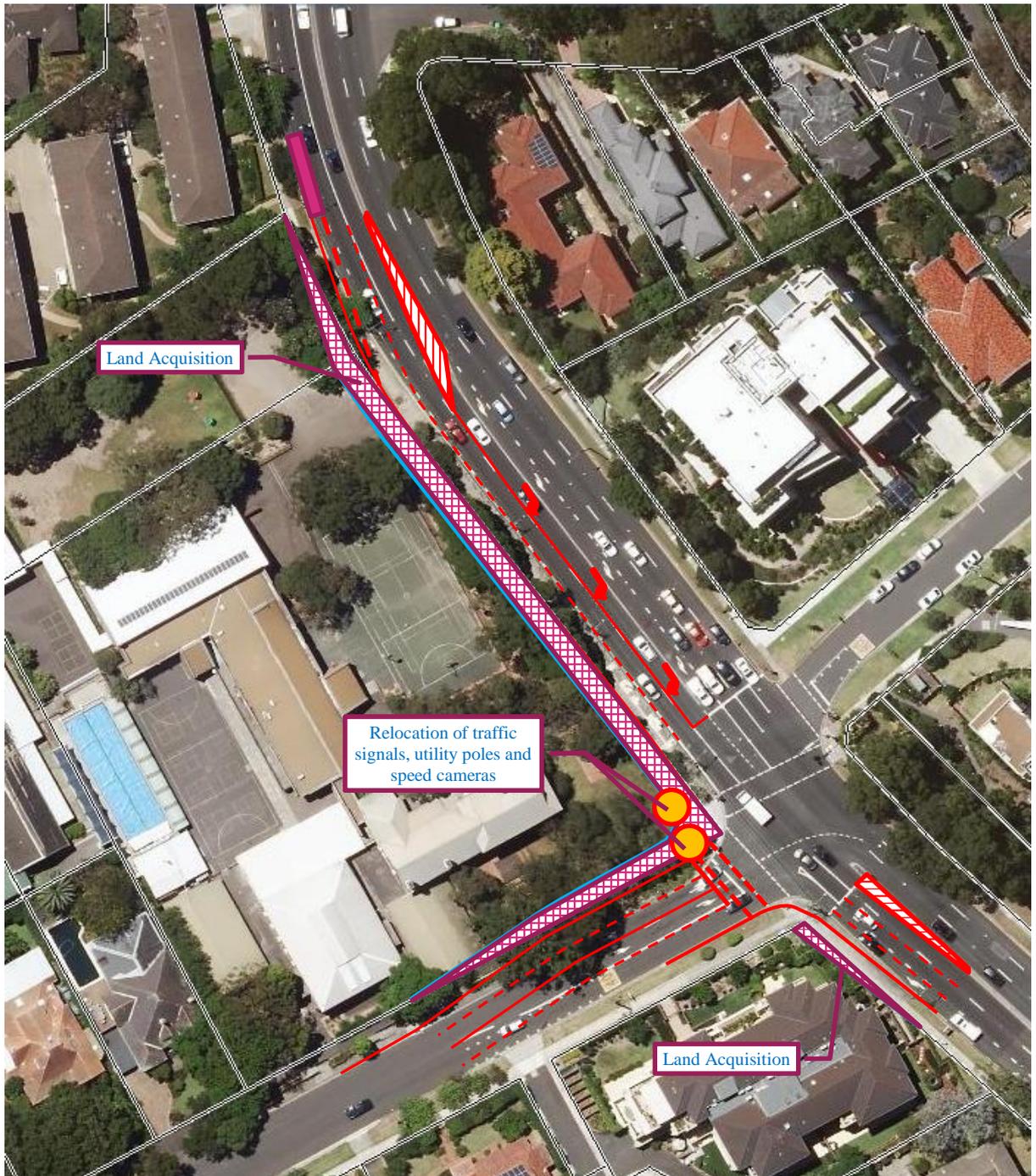


Figure 28: Double right turn bay option



Figure 29: Required relocation of traffic signals, speed cameras and utility poles



Figure 30: Required relocation of traffic signals and land acquisition



Figure 31: Required land acquisition along the Pacific Highway

## 4.4 Potential Strickland Avenue upgrades

Council has provided indicative plans (not part of the Lindfield Learning Village development) of the potential Strickland Avenue / Pacific Highway upgrades. The two indicative upgrade options are shown in Figure 32 and Figure 33. The extent of upgrades commence at Strickland Avenue and end at Llewellyn Street. Llewellyn Street is located some 140 metres north of the Pacific Highway / Grosvenor Road intersection. The proposed upgrades of the right turn bay discussed in section 4.1 requires a 120 metre right turn bay and would not affect the potential Strickland Avenue upgrades.

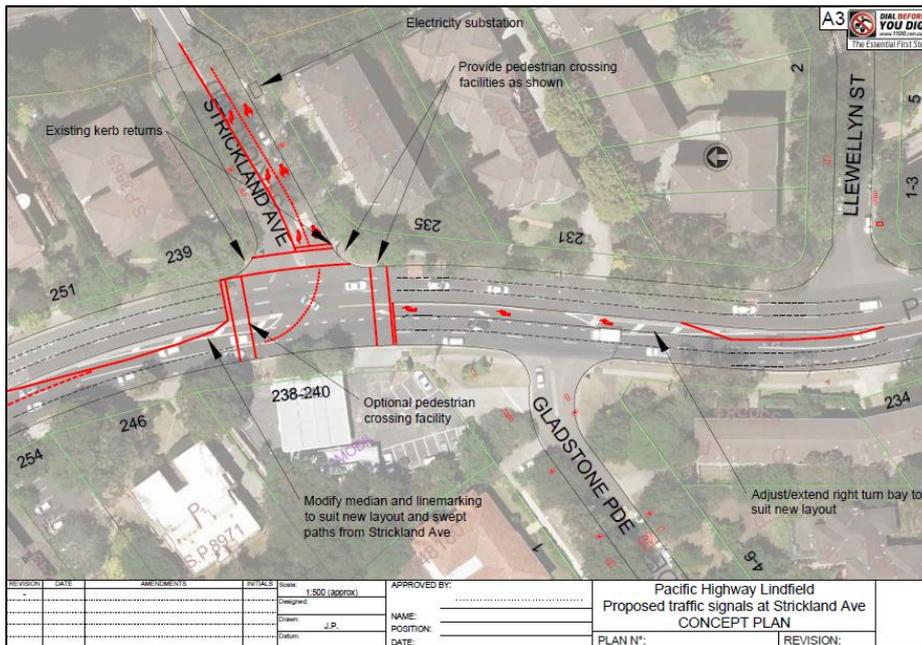


Figure 32: Proposed Strickland Avenue Concept Plan, with right turns

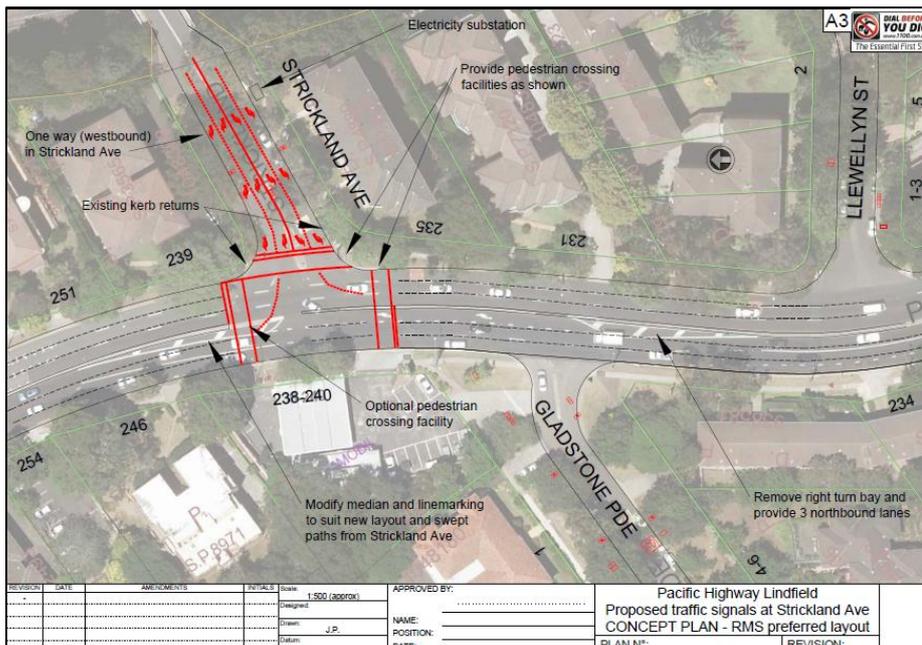


Figure 33: Proposed Strickland Avenue Concept Plan, no right turns

## 4.5 Bus timetable

The homebases for stage 2 (i.e. 2100 students) are proposed to commence at staggered times, with each homebase requiring approximately five school buses.

- 2 homebases commence at 7:30am, finish at 2:00pm, 5 school buses
- 2 homebases commence at 8:30am, finish at 3:00pm. 5 school buses
- 2 homebases commence at 9:00am, finish at 3:30pm, 5 school buses

Bus drop-off during the mornings would be quicker than pick-ups in the afternoons. During the afternoon, it is proposed that the buses would wait for students in the bus bay. As buses would not be able to drive past another bus within the bus bay, school buses shall not hinder the departure of public buses. A breakdown of the public bus and school bus arrival times are shown in Table 10. As seen from the timetable, the second homebase finishing at 3:00pm requires the adjustment of public buses arriving at 3:04pm and 3:13pm.

Table 10: Arrival of school buses and public buses

Rank 1	Bus	Arrival time	Direction
1	565	1:21pm	NB
1	565	1:38pm	SB
1	Sch 1	21 mins	
2	Sch 2		
3	Sch 3		
4	Sch 4		
5	Sch 5		
1	565	2:21pm	NB
1	565	2:33pm	SB
<b>1</b>	<b>565</b>	<b>3:04pm</b>	<b>NB</b>
1	Sch 1	Require timetable adjustment	
2	Sch 2		
3	Sch 3		
4	Sch 4		
5	Sch 5		
<b>1</b>	<b>565</b>	<b>3:13pm</b>	<b>SB</b>
1	565	3:26pm	NB
1	Sch 1	27 mins	
2	Sch 2		
3	Sch 3		
4	Sch 4		
5	Sch 5		
1	565	3:53pm	SB
1	565	4:01pm	NB

## 5 Transport for NSW Comments

Table 11: Transport for NSW

R#	Comment	Arup response
R16	<p><b>Comment</b></p> <p>The Transport Impact Assessment (TIA) (Arup, June 2017) has assessed that the Pacific Highway/ Grosvenor Road/ Burleigh Street intersection currently operates at a Level of Service (LOS) C. The future operation of this intersection has been assessed to operate at LOS F (overcapacity) in the absence of any improvements. A suggested intersection upgrade is provided which involves the extension of the southbound right-hand turning lane into Grosvenor Road and the removal of the northbound kerbside bus lane. TfNSW does not support this upgrade option as the kerbside bus lane is currently being used. As such, alternative improvements should be investigated.</p> <p><b>Recommendation</b></p> <p>TfNSW requests that the proponent investigate alternative intersection improvements, in consultation with Roads and Maritime, which maintains the availability of the northbound kerbside bus lane.</p>	<p>Please refer to the revised modelling section discussed in section 4.2 of this report.</p>
R17	<p><b>Bus Stop Design</b></p> <p><b>Comment</b></p> <p>It is likely that a number of school buses would be using the proposed bus bay at the same time. Due to the curvature and dimensions of the current design, no buses will be able to overtake other buses and/or exit their respective bus bay if there were other buses stopped at any other stops. Furthermore, the curved design would potentially pose a safety risk for children and less mobile patrons as the bus doors would open directly onto the road rather than the footpath.</p> <p><b>Recommendation</b></p> <p>TfNSW requests that the proposed bus stop design is revised or relocated having regard for the above comments. TfNSW advises that the existing bus bay would potentially be more suited to a pick-up and dropoff location for motor vehicles.</p>	<p>Refer to Section 2.2</p>

R#	Comment	Arup response
R18	<p><b>Cycling Access and Bicycle Parking Provision</b></p> <p><b>Comment</b></p> <p>The TIA assesses the requirement for 42 bicycle parking spaces and that the existing facility satisfies this requirement. The location of these spaces (existing and proposed) should be documented within the TIA and assessed for compliance with AS2890.3. Furthermore, the TIA should also identify potential cycle routes and assesses the safety of these routes.</p> <p><b>Recommendation</b></p> <ul style="list-style-type: none"> <li>• The proponent clarifies the location, type and quantity of end-of-trip facilities to be provided;</li> <li>• The proposed bicycle facilities should be located in secure, convenient, accessible areas close to main entries, incorporating adequate lighting and passive surveillance and in accordance with Austroads guidelines;</li> <li>• Separate end-of-trip facilities should be provided for staff and students; and</li> <li>• The proponent identifies potential cycle routes and assesses the safety of these routes.</li> </ul>	<p>Future bicycle facilities on local streets will need to be coordinated through the Council Bike Plan.</p> <ul style="list-style-type: none"> <li>• Two shower facilities will be provided for staff as an end-of-trip facilities. Lockers for staff will also be considered.</li> <li>• Agreed and will be included in the detailed design</li> <li>• Students will be able to use sports shower facilities</li> <li>• Refer to section 5.1 in this report</li> </ul>
R19	<p><b>Travel Plan</b></p> <p>Prior to commencement, the applicant is to submit a Green Travel Plan for the Secretary's approval, prepared by a suitably qualified person and addresses the following requirements:</p> <ul style="list-style-type: none"> <li>• Measures and initiatives to promote and encourage cycling, walking, public transport and carpooling as alternative transport modes;</li> <li>• Provision of a travel access guide, which would be issued to new students, parents and staff; and</li> <li>• Methods to monitor the effectiveness and uptake of sustainable travel measures.</li> </ul> <p><b>Road Safety Audit</b></p> <p>Prior to the issue of construction certificate, a Detailed Design Road Safety Audit (RSA) on the proposed bus stop design shall be undertaken and appropriate road safety measures should be implemented based on the outcomes of the RSA.</p>	Noted as potential Conditions of Approval

R#	Comment	Arup response
	<p><b>Walking</b></p> <p>The proponent is to undertake a Pedestrian Accessibility and Mobility Plan (PAMP) (in consultation with Council/RMS, where relevant) to identify and assess the required pedestrian safety and accessibility improvements to accommodate the future use of the site. The improvements identified within the PAMP must be implemented prior to commencement to ensure that adequate walking infrastructure is available.</p> <p><b>Additional Bus Services</b></p> <p>The TIA assesses the need to increase the frequency of Bus Route 565 services based on increased patronage from students and teachers. TfNSW would consider the additional services of the current route; subject to the TfNSW Growth Services Initiative. This would also require further discussion and assessment with the proponent prior to any agreement.</p>	<p>Noted as potential Conditions of Approval</p>

## 5.1 Cycling

A cycle map from the RMS Cycleway Finder is shown in Figure 34. It also shows the key missing cycle route along Grosvenor Road and Eton Road. Alternative roads to Grosvenor Road, such as the parallel route of Eton Road, may provide a more cycle friendly traffic environment for on-road cycling.

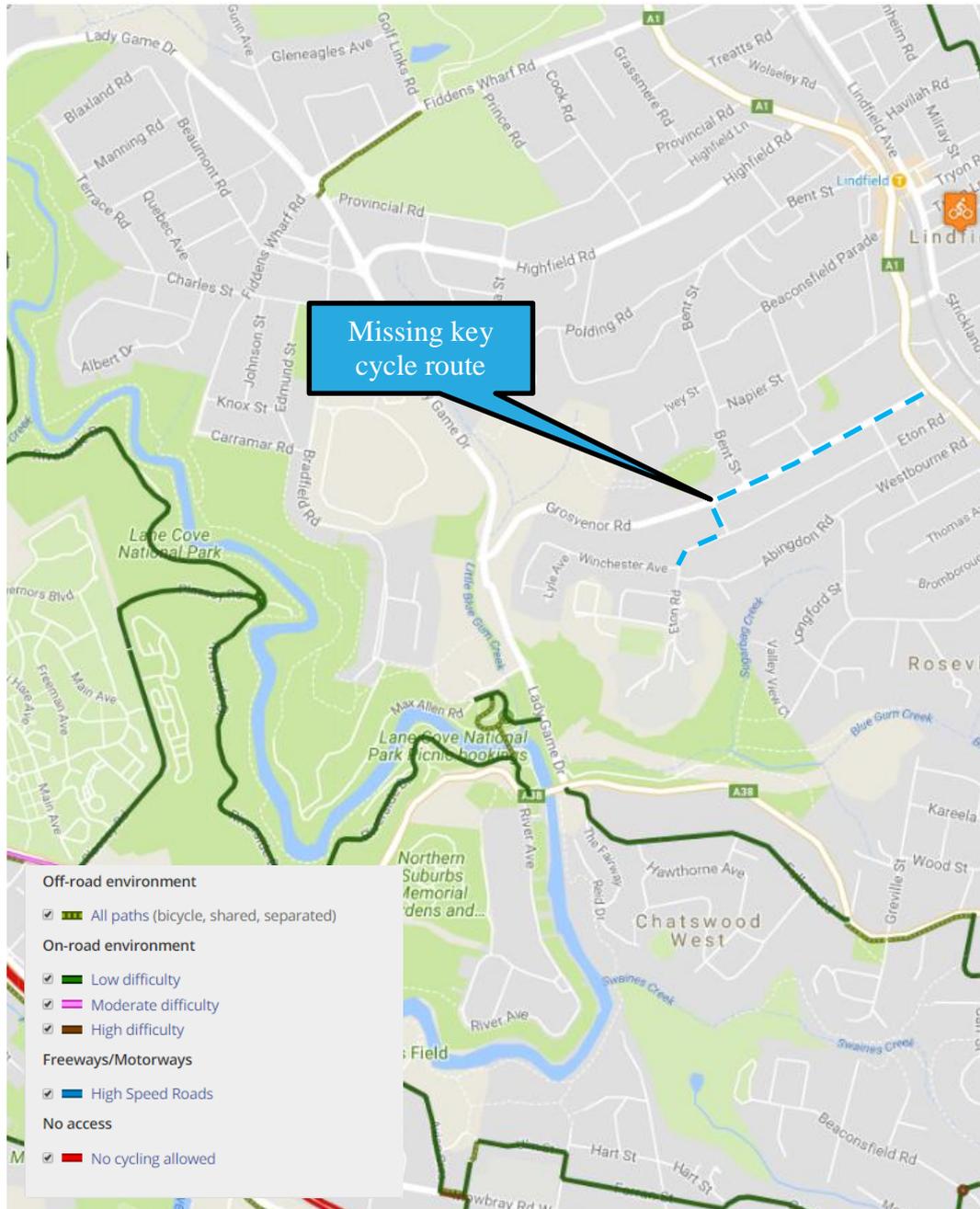


Figure 34: RMS recommended cycle routes

## 6 Ku-ring-gai Council Comments

Table 12: Ku-ring-gai Council

R#	Comment	Arup response
R20	[4.1.1] Catchment - In terms of the school catchment area, the assessment notes that the school would have a wider catchment but it is unclear whether this means wider than the 2km buffer shown in Figure 15 or some other parameter. This needs to be clarified.	The final catchment area is still being determined and will be submitted to Council at a later stage. It however, will not affect the traffic and transport assessment.
R21	[4.1.2] Drop-off and pick-up access - the proposed drop-off and pick-up areas are supported, but the times where it is proposed to implement “No Parking” and “5 Minute Parking” restrictions (to allow efficient turnover) do not align with the proposed staggered opening/closing times, and, as a result, the full capacity of the drop-off and pick-up areas may not be available prior to 8.30am.  Also, given the location of the proposed drop-off and pick-up areas with respect to the school buildings, and the site topography, there is no identification of accessible paths of travel.	It is agreed that the timings do not match the staggered start and finish times. The restrictions should be altered to: “No parking permitted from 7:30am to 9:30am and 2:00pm to 3:30pm on school days. This arrangement creates an efficient turnover.  Ten spaces on the eastern side of the car park would be used for short term, 5 minute parking from 7:30am to 9:30am and 2:00pm to 3:30pm on school days. This would allow parents with younger children to walk with their kids to school.”  Wayfinding signage will be placed at all key locations for both motorists and pedestrians. This will include drop-off and pedestrian entrance locations as well as all required road safety requirements at key crossing locations.
R22	[4.1.3] Eton Road Bus Bay - the proposed widening of the footpath in the Eton Road bus bay is supported, to cater for the expected numbers of students, although it should be clarified whether the proposed footpath width is adequate if the mode split to buses increases towards the levels currently experienced at Killara High School. There should also be a requirement to extend and widen the existing bus shelter/canopy to provide weather protection, and to provide adequate lighting in and around the shelters (for after-hours/evening events, so that dedicated shuttle bus services can be implemented if necessary).  There is no identified path between the Eton Road bus bay and the main school building, which is expected to be the principal connection for students walking between the bus stop and the main school building. This path should be wide enough to cater for expected student movements and be adequately lit (for afterhours/evening events).	See Section 2.2 for bus bay design.

R#	Comment	Arup response
R23	[4.1.4] <i>Parking</i> - Given the history of the site and the on-going parking issues experienced by the nearby residents, there is an opportunity to address and contain the impacts to the site. Relying on surrounding on-street areas to accommodate spill over parking is not supported and parking generated by the proposal should be contained within the site as far as possible.	As discussed in the TTA section 5.3, a majority of the parking can be contained within the site.  Arup agrees with the proposed changes council has proposed with regards to on-street parking and agrees that the KDCP minimum should be 213 spaces which closely aligns with the proposed provision.
R24	[4.1.5] Cycle routes and bicycle parking- The cycle routes shown in section 3.5.4 are fairly limited in terms of applicability to the site. There is a missing link from the site to the existing cycling facilities in Lane Cove National Park and most of the cycling network in the Ku-ring-gai LGA is largely absent. The north-south parallel route to Pacific Highway is probably too far from the site and not of a standard (on road/missed traffic) to allow primary school age children to cycle safely to school. In principle, the use of the existing bicycle parking facilities is supported, although further investigations should be undertaken to determine if they comply with the relevant Australian Standards in terms of location, type and class of facility and should be of a configuration such that bicycle parking facilities can be expanded if the demand for it increases.	It is agreed that existing cycle routes are limited. Council should investigate the possibility of upgrading key routes leading to the school.
R25	[4.1.6] The frequency of the existing 565 service operated by Transdev is not attractive enough to encourage commuters to use it to access Lindfield/Roseville railway stations or employment areas in Macquarie Park/Chatswood. It is agreed that improvement to bus frequencies is required to make attractive connections to the nearby railway stations.  Pedestrian infrastructure between the site and Lindfield railway station is either nonexistent or non-compliant at various points along the site and should be addressed before the Learning Village opens. The Assessment suggests that a Pedestrian Access and Mobility Plan (PAMP) should be prepared to assess pedestrian access and safety improvements, although it is our view that this should be prepared by the applicant and improvements be undertaken by the applicant.	TfNSW would consider the additional services of the current route; subject to the TfNSW Growth Services Initiative. This would also require further discussion and assessment with the proponent prior to any agreement.  It is understood that the footpath upgrades are being discussed with Council.
R26	[4.4.1] Traffic distribution - The assessment suggests that vehicles arriving in the morning peak to the site from Lady	Arup agrees with these findings with revised modelling discussed in section 4.2 of this report.

R#	Comment	Arup response
	<p>Game Drive (travelling southerly) would divert to Highfield Road, Pacific Highway and Grosvenor Road, due to congestion near the roundabout at Grosvenor Road. While it is agreed that vehicles would divert away from the intersection with Grosvenor Road, there are shorter alternatives to the Highfield Road/Pacific Highway/Grosvenor road route (i.e. Highfield Road/Primula Street/Polding Road/Bent Street/Grosvenor Road), which would be more attractive than entering and leaving Pacific Highway as suggested in the assessment. It is unclear what the effect would be on this alternative route when additional of 25% of the total site traffic generation is assigned to this route. This needs to be clarified.</p>	
R27	<p>[4.4.2] Local road impacts The assessment notes that the Learning Village would perform at a similar level to the former UTS operation, and that local roads would experience higher peak hour traffic but lower off-peak traffic volumes. While this may be the case, the traffic volumes on some of the local roads (such as Eton Road north-east of Austral Avenue) had exceeded the 300 vehicles per hour maximum desirable environmental goal recommended for local roads (as per the RTA Guide to Traffic Generating Developments) when UTS was operating, and are likely to exceed this threshold again when the Learning Village commences operation. During the UTS operation, traffic probably increased in an incremental fashion and Council ultimately was not in a position to request traffic calming improvements from UTS. In this case though, the impacts of the proposal are known and the Learning Village should be required to contribute towards traffic calming and amenity improvements along those local roads where the environmental thresholds would be exceeded.</p>	<p>Traffic calming could be considered on the local access streets if traffic behaviour needs to be managed. The volume of traffic will be determined by the ultimate level of development in the precinct and the associated level of car use. Any traffic calming would need to be compatible with bus access.</p>
R28	<p>[4.4.3] Historical Traffic Volumes – 2007 - The comment is made that the desirable maximum of 2,000 vehicles per day for local roads assumes that the road services residential areas only, and that this would historically not apply to this area/proposal due to the presence of UTS Ku-ring-gai and Film Australia. This assumption is incorrect as the Film Australia site has since been rezoned for residential development, and the former UTS Ku-ring-gai site has partly also been rezoned for housing. Given that the whole length of</p>	<p>A public school is a community facility. It provides a real benefit to the community it serves and it is expected that some burden will be placed on the community to support its operation.</p>

R#	Comment	Arup response
	Eton Road (with the exception of the southwestern-most end) is now a low density residential area, it would be unfair and inappropriate to apply this rationale and somehow avoid any ameliorative measures to the residents along Eton Road.	
R29	[4.5.1] Pacific Highway and Grosvenor Road - Ku-ring-gai's commuter road network model, prepared for the Lindfield local centre, suggests that the current operation of the intersection of Pacific Highway and Grosvenor Road is at capacity and future traffic increases will exacerbate this. This model has been submitted to Roads and Maritime Services for their eventual concurrence, and envisages (amongst other things) minor capacity improvements on the Grosvenor Road approach to the intersection, as well as new traffic signals at the intersection of Pacific Highway and Strickland Avenue.	Revised modelling discussed in section 4.2 of this report.
R30	[4.5.2] Lady Game Drive - Planned upgrades identified by Council at 2 intersections on Lady Game Drive have been cited in the assessment. The proposal is likely to add pressure to these intersections and NSW DEC should be required to provide the suggested upgrades or at least contribute to them.	The Lady Game Drive congestion is an existing issue. Congestion is present despite the site being vacant. Southbound traffic along Lady Game Drive to the site will predominantly use the Lady Game Drive / Grosvenor Road roundabout, and not the Millwood Avenue intersection. The cause of the Lady Game Drive congestion is a result of downstream intersection inefficiencies at Lady Game Drive / Millwood Avenue and other intersections. Future traffic would not affect the critical downstream intersection performances. As such the learning village should not be required to provide upgrades or contribute to them.
R31	[4.6] The construction traffic vehicle routes shown in Figure 53 suggest Lady Game Drive would be an access route from the south-west. It should be noted that Lady Game Drive is a load limited road and due to its horizontal and vertical alignment is not suited to ongoing construction traffic, especially large rigid trucks and articulated heavy vehicles. Also, heavy construction vehicles travelling on Grosvenor Road may be subject to movement restrictions during School Zone times, to minimise conflicts with drop-offs and pick-ups associated with Lindfield Public School. Further consultation with Ku-ring-gai Council is recommended for the development of the construction routes.	Noted and will be incorporated into the Detailed Construction Management Plan.

## 7 Department of Planning & Environment

Table 13: Department of Planning &amp; Environment

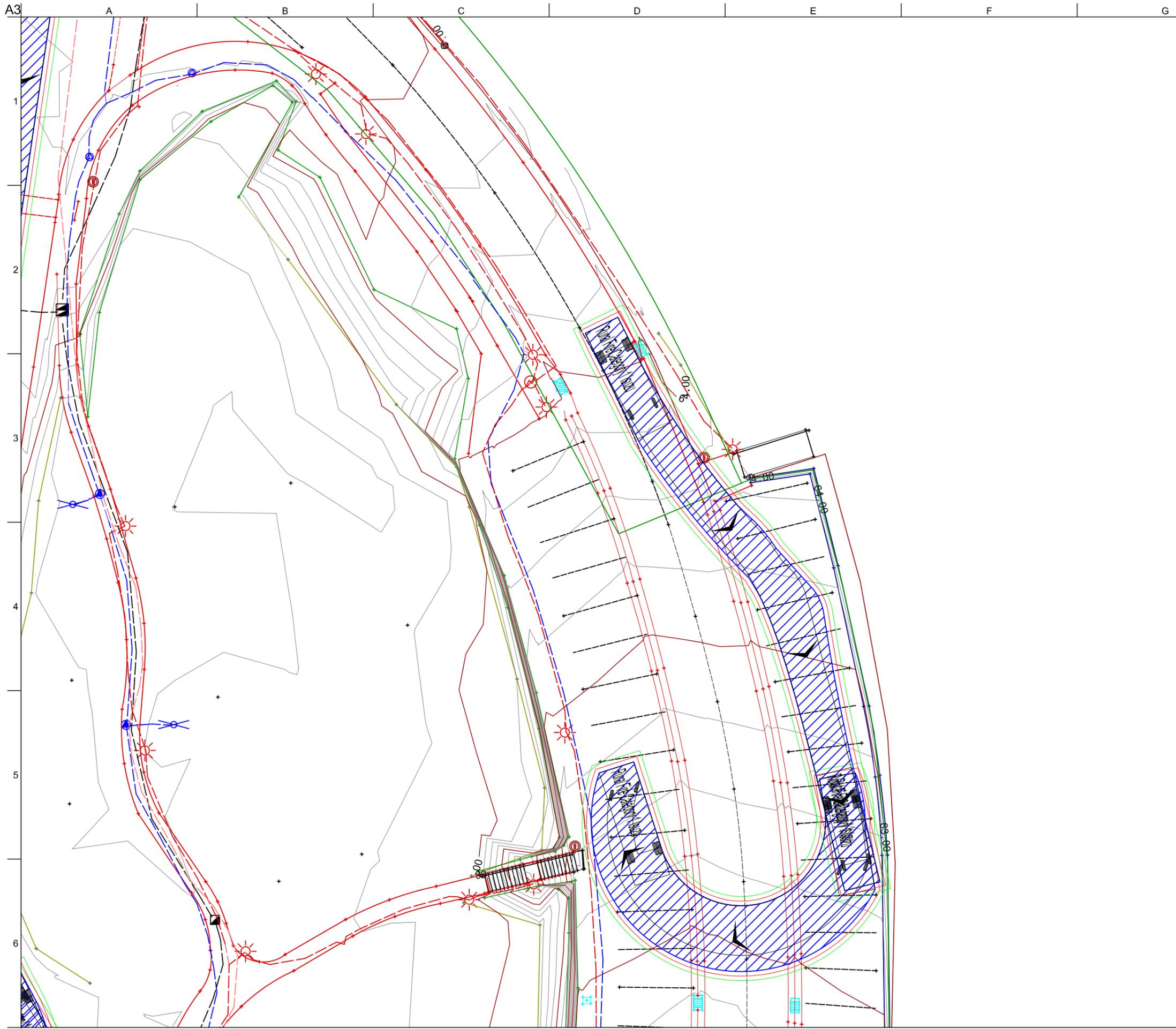
R#	Comment	Arup response
R32	[1.1] Road Network Upgrades	Please refer to the revised modelling section discussed in section 4.1 of this report.
R33	<p>[1.2] The TTA (p.25) has assumed northbound traffic movements in proximity to the site to include up to 94 vehicle movements generated by the full completion of the surrounding Defence Housing Australia (DHA) sites. The Department supports the traffic assumptions made in relation to the DHA sites, however, the TTA has not considered additional traffic movements that would be generated by the future development of the former Screen Australia site, located on the corner of Eton Road and Shout Ridge. Further, the historic traffic volumes from 2007 outlined at Section 10.2.3 of the TTA does not provide an accurate indication of current traffic volumes, particularly given the development of the surrounding area that has occurred in that time.</p> <p>The Department requests the traffic assumptions provided in the TTA (including traffic volumes and the performance of intersections) be updated to account for the future traffic volumes that would be generated by the development of the former Screen Australia site. The traffic assumptions should take into account the fact that this site, being zoned R1 General Residential, has the potential for multi-storey housing including residential flat buildings.</p>	<p>The former screen Australia site is likely to consist of no more than 100 apartments. Applying a trip generation rate of 0.19 vehicles per unit in the peak hour would result in only 19 vehicles and is deemed negligible and arbitrary in the assessment. The modelling considers highly conservative volume assumption which more than compensates for the 19 vehicles.</p>
R34	[1.3] The TTA primarily focuses on traffic impacts to higher-order roads and intersections, most notably the Pacific Highway, Lady Game Drive and Grosvenor Road. The TTA does not adequately assess the impact of increased traffic generated by the proposed school on local roads throughout the surrounding residential catchment. Further, the TTA (p.2) notes that the total daily traffic demand on local roads would perform at a similar or lower level than during 2 the site's operation as a university campus. The Department questions this assumption, particularly given the completion of several multi-storey residential housing	

R#	Comment	Arup response
	sites in proximity to the site, post university operations.	
R35	<p>[1.4] The TTA states that a staged opening of the proposed school is essential to reasonably allow for traffic impact monitoring and review of the final operating scale (p.3). The Department supports this recommendation, particularly in response to the uncertainty of the surrounding road network to accommodate the proposed development.</p> <p>The Department requests the Applicant consider a staged opening of school operations to allow for traffic impact monitoring and the implementation of suitable traffic management measures (should any future monitoring identify the need for such measures). The RtS should outline a proposed staged opening strategy for the proposed school.</p>	Noted
	<p>The TTA (p.19) notes the poor pedestrian accessibility to the site with several footpaths and key crossing facilities missing. The TTA recommends the missing footpath and pedestrian crossing links be addressed to encourage walking and improve pedestrian safety, prior to opening of the school.</p> <p>The Department requests the RtS propose a suite of upgrades to the existing pedestrian footpath network and establishment of appropriate pedestrian crossing facilities in proximity to the proposed school. Figure 8 of the TTA (p.20) shows the location of potential footpath upgrades and pedestrian crossing locations which should be considered for any future works. Evidence of consultation with Council regarding future upgrade works should be provided as part of the RtS.</p>	We agree that footpaths are narrow and require expansion as mentioned several times in the report in section 3.5.3. A detailed drawing provided at a later stage will provide details of the proposed footpath upgrades.

## Appendix A

### Swept Paths

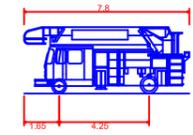




**Legend**

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- 300mm Envelope
- 600mm Envelope
- Wheel Envelope

**Design Vehicle(s)**



Rural Fire Category 1 Isuzu  
 Overall Length 7.800m  
 Overall Width 2.400m  
 Overall Body Height 3.131m  
 Min Body Ground Clearance 0.215m  
 Max Track Width 2.365m  
 Lock-to-lock time 3.50s  
 Curb to Curb Turning Radius 8.850m

A	19/09/17	RWW	AMH	AMH
For Information				
Issue	Date	By	Chkd	Appd

**ARUP**

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 Sydney, NSW, 2000  
 Tel +61(02)9320 9320 Fax +61(02)9320 9321  
 www.arup.com.au

Client  
 Department of Education

Job Title  
 Lindfield Learning Village

Drawing Title  
 Turning Paths  
 For Bushfire Cat 1 Tanker

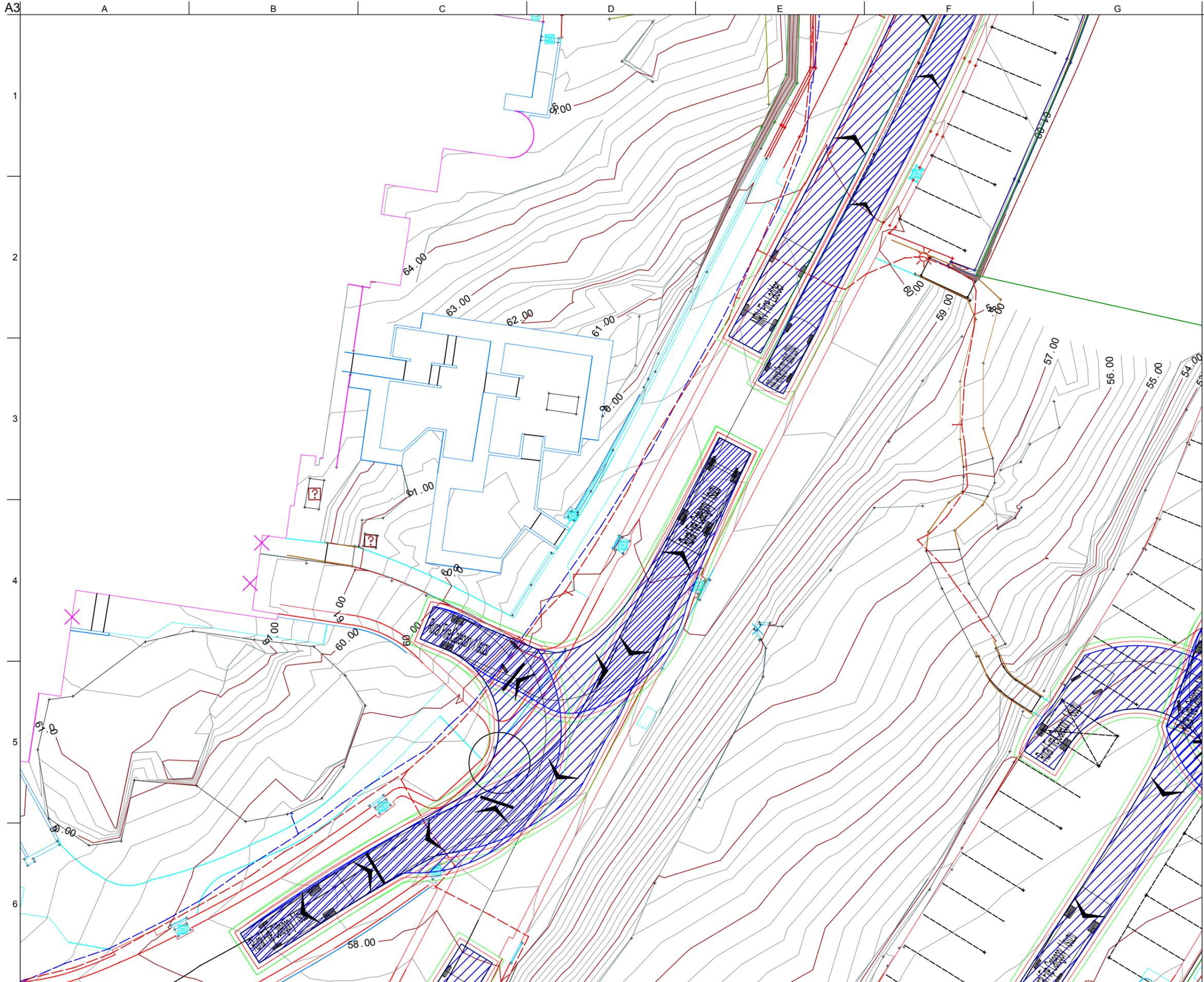
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Discipline Transport

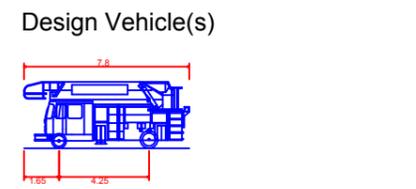
Drawing Status

**Draft**

Job No <b>251272</b>	Drawing No <b>SKT005</b>	Issue <b>A</b>
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Rural Fire Category 1 Isuzu  
 Overall Length 7.800m  
 Overall Width 2.400m  
 Overall Body Height 3.131m  
 Min Body Ground Clearance 0.215m  
 Max Track Width 2.365m  
 Lock-to-lock time 3.50s  
 Curb to Curb Turning Radius 8.850m



B99 Vehicle (Realistic min radius) (2004)  
 Overall Length 5.200m  
 Overall Width 1.940m  
 Overall Body Height 2.200m  
 Min Body Ground Clearance 0.312m  
 Track Width 1.840m  
 Lock to Lock Time 4.00 sec  
 Curb to Curb Turning Radius 6.250m

A	19/09/17	RWW	AMH	AMH
For Information				
Issue	Date	By	Chkd	Appd

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Client  
 Department of Education

Job Title  
 Lindfield Learning Village

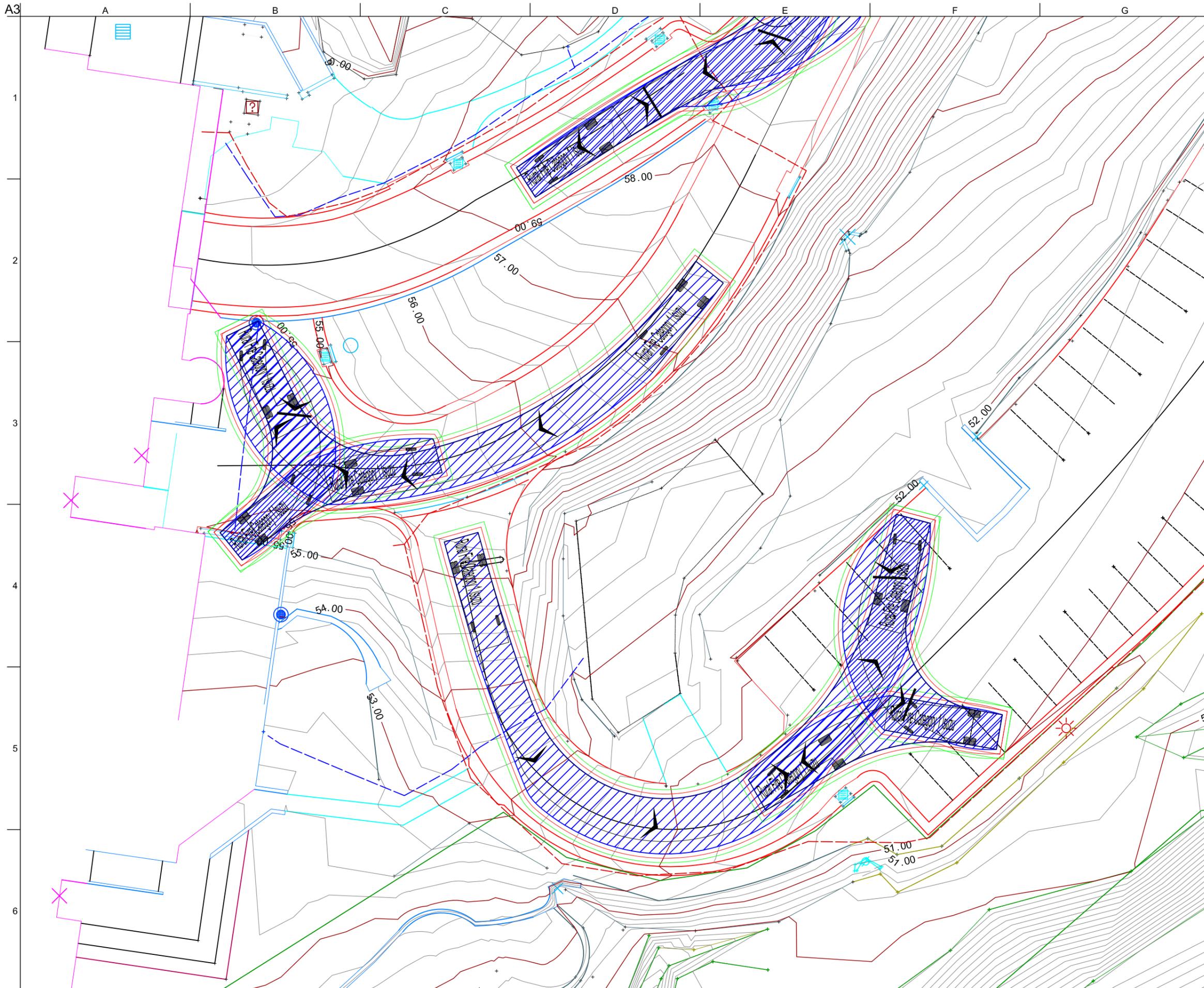
Drawing Title  
 Turning Paths  
 For Bushfire Cat 1 Tanker

Scale at A3

Discipline Transport

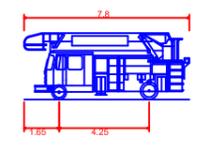
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**Design Vehicle(s)**



Rural Fire Category 1 Isuzu  
 Overall Length 7.800m  
 Overall Width 2.400m  
 Overall Body Height 3.131m  
 Min Body Ground Clearance 0.215m  
 Max Track Width 2.365m  
 Lock-to-lock time 3.50s  
 Curb to Curb Turning Radius 8.850m

A	19/09/17	RWW	AMH	AMH
For Information				
Issue	Date	By	Chkd	Appd

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Client  
 Department of Education

Job Title  
 Lindfield Learning Village

Drawing Title  
 Turning Paths  
 For Bushfire Cat 1 Tanker

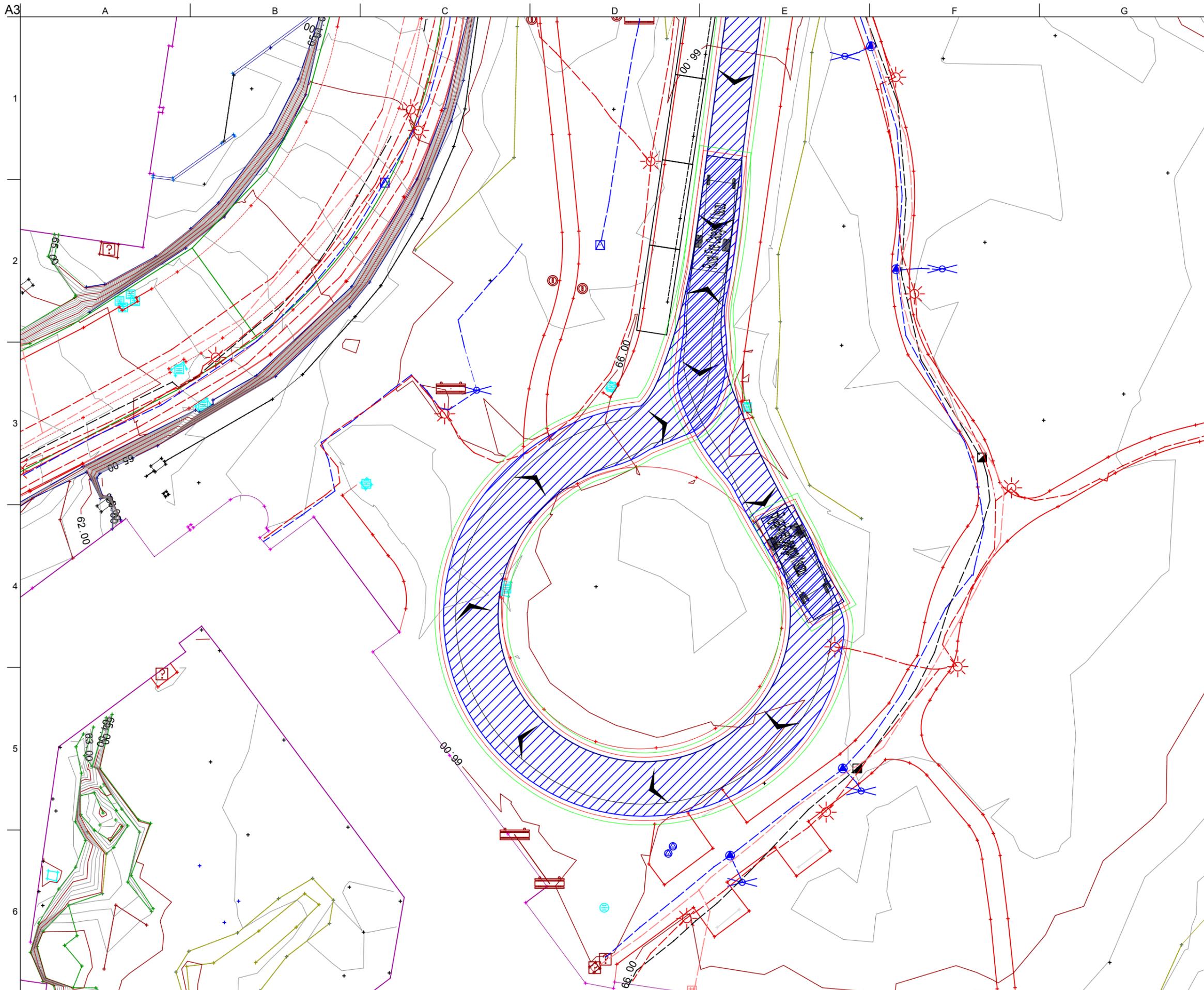
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Discipline Transport

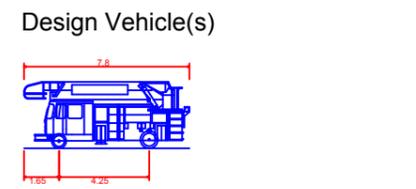
Drawing Status

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  - Wheel Envelope



Rural Fire Category 1 Isuzu  
 Overall Length 7.800m  
 Overall Width 2.400m  
 Overall Body Height 3.131m  
 Min Body Ground Clearance 0.215m  
 Max Track Width 2.365m  
 Lock-to-lock time 3.50s  
 Curb to Curb Turning Radius 8.850m

A	19/09/17	RWW	AMH	AMH
For Information				
Issue	Date	By	Chkd	Appd

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Client  
 Department of Education

Job Title  
 Lindfield Learning Village

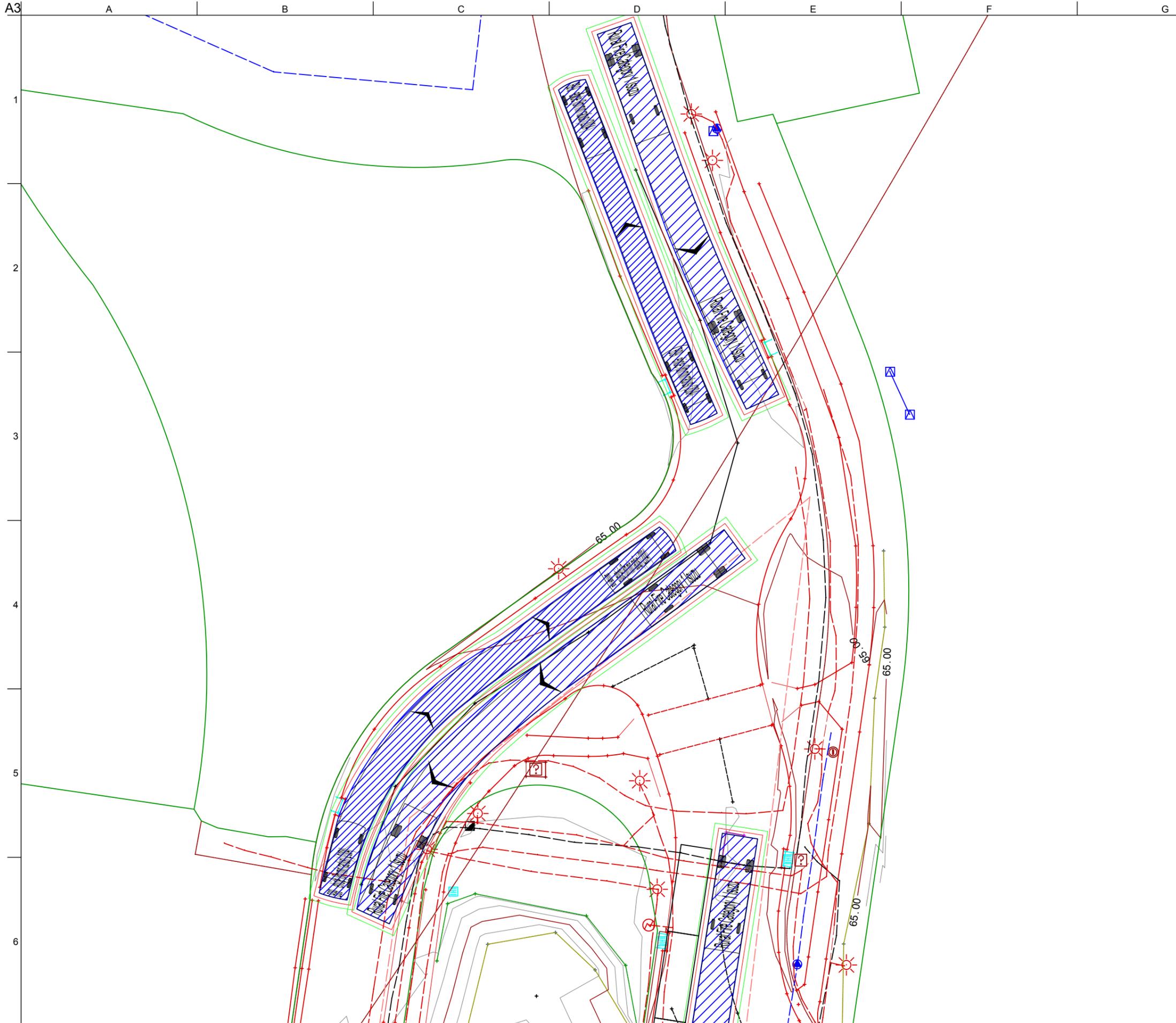
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 Turning Paths  
 For Bushfire Cat 1 Tanker

Scale at A3

Discipline Transport

Drawing Status  
**Draft**

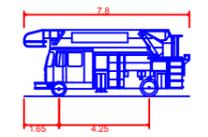
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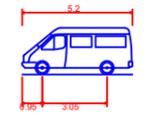
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- 600mm Envelope
- Wheel Envelope

**Design Vehicle(s)**



Rural Fire Category 1 Isuzu  
 Overall Length 7.800m  
 Overall Width 2.400m  
 Overall Body Height 3.131m  
 Min Body Ground Clearance 0.215m  
 Max Track Width 2.365m  
 Lock-to-lock time 3.50s  
 Curb to Curb Turning Radius 8.850m



B99 Vehicle (Realistic min radius) (2004)  
 Overall Length 5.200m  
 Overall Width 1.940m  
 Overall Body Height 2.200m  
 Min Body Ground Clearance 0.312m  
 Track Width 1.840m  
 Lock to Lock Time 4.00 sec  
 Curb to Curb Turning Radius 6.250m

A	19/09/17	RWW	AMH	AMH
For Information				
Issue	Date	By	Chkd	Appd



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Client  
 Department of Education

Job Title  
 Lindfield Learning Village

Drawing Title  
 Turning Paths  
 For Bushfire Cat 1 Tanker

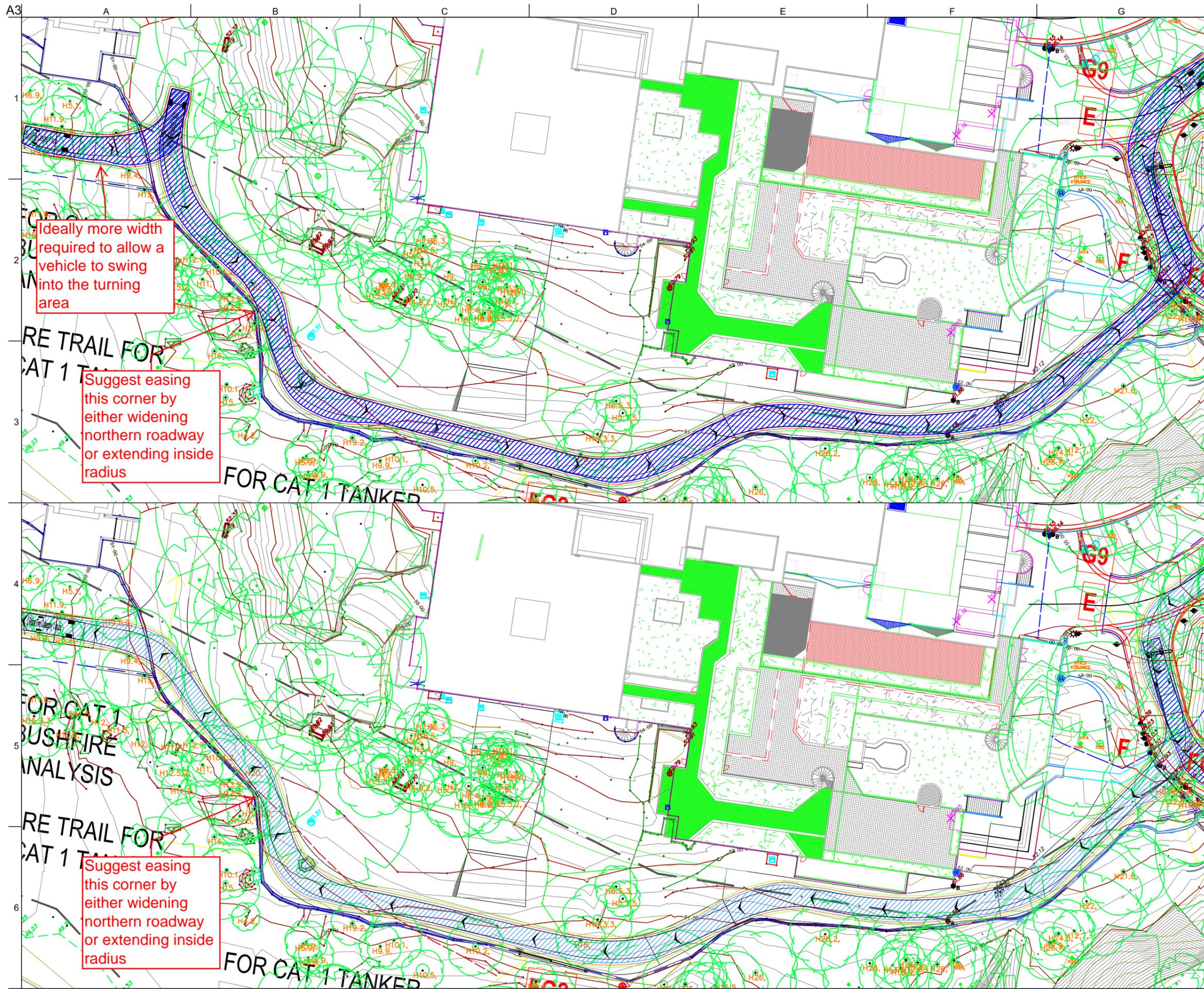
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Discipline Transport

Drawing Status

**Draft**

Job No <b>251272</b>	Drawing No <b>SKT009</b>	Issue <b>A</b>
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Ideally more width required to allow a vehicle to swing into the turning area

Suggest easing this corner by either widening northern roadway or extending inside radius

Suggest easing this corner by either widening northern roadway or extending inside radius

**Legend**

	Body Envelope
	300mm Envelope
	600mm Envelope
	Wheel Envelope

**Design Vehicle(s)**

Rural Fire Category 1 Isuzu	7.800m
Overall Length	2.400m
Overall Width	3.131m
Overall Body Height	0.215m
Min Body Ground Clearance	2.365m
Max Track Width	3.50s
Lock-to-lock time	8.850m
Curb to Curb Turning Radius	

A	12/10/17	JRT	JRT	JDM
For Information				
Issue	Date	By	Chkd	Appd

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Client  
 Department of Education

Job Title  
 Lindfield Learning Village

Drawing Title  
 Turning Paths  
 Cat1 Fire Vehicle  
 Southern fire trail

Scale at A3 1:500

Discipline Transport

Drawing Status  
**Draft**

Job No <b>251272</b>	Drawing No <b>SKT010</b>	Issue <b>A</b>
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A3

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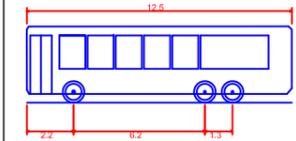
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6

Legend

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- 600mm Envelope
- Wheel Envelope

Design Vehicle(s)



Single Unit Truck/Bus (12.5 m)  
 Overall Length 12.500m  
 Overall Width 2.500m  
 Overall Body Height 3.600m  
 Min Body Ground Clearance 0.409m  
 Track Width 2.500m  
 Lock to Lock Time 6.00 sec  
 Curb to Curb Turning Radius 12.500m

C	12/10/17	JRT	JRT	JDM
A	26/09/17	RWW	AMH	AMH
For Information				
Issue	Date	By	Chkd	Appd

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Client  
**Design Inc.**

Job Title  
**Lindfield Learning Village**

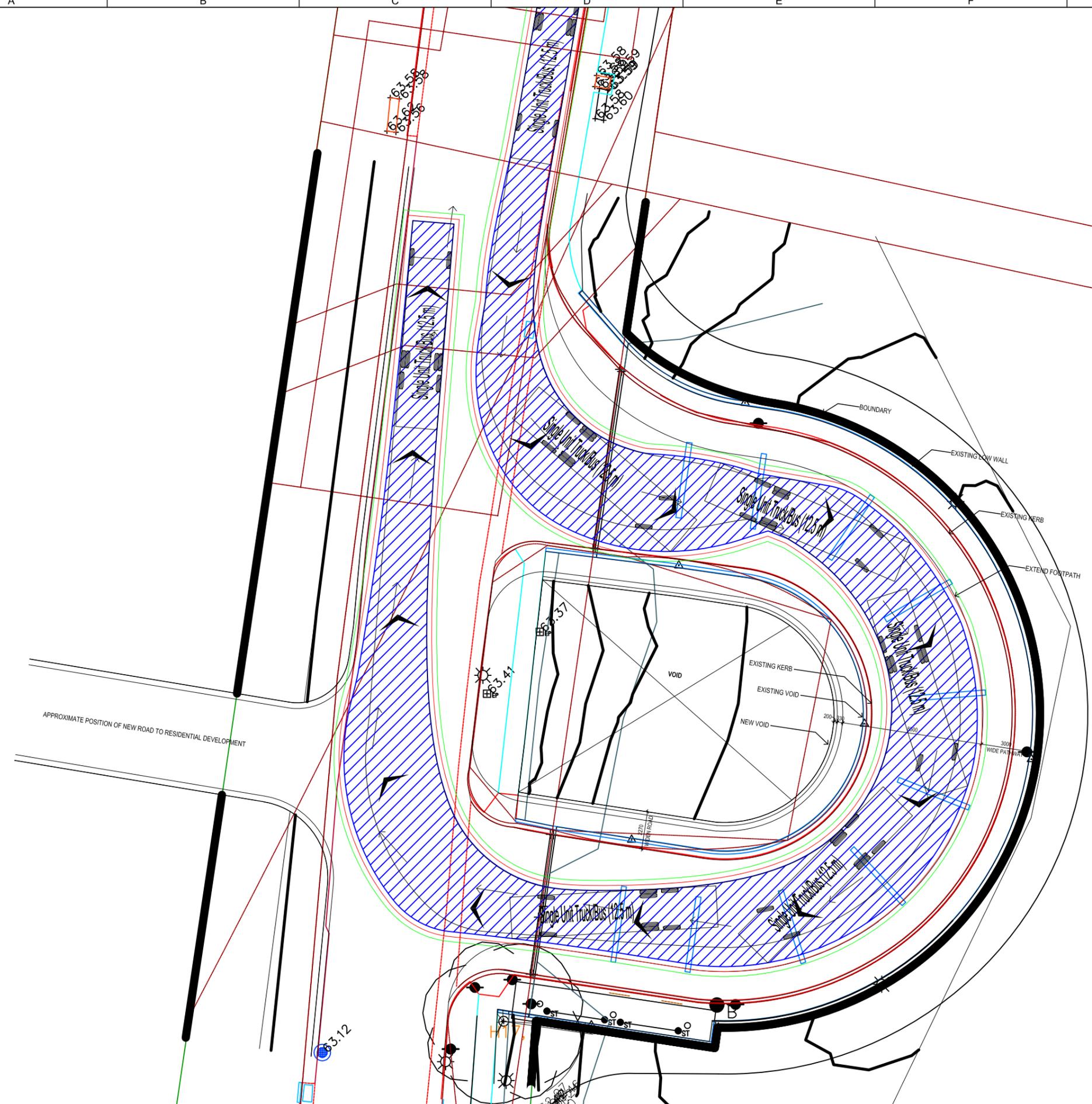
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 12.5m buses**

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Discipline  
 Transport

Drawing Status  
**Draft**

Job No <b>251272-00</b>	Drawing No <b>SKT003</b>	Issue <b>C</b>
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A3

A B C D E F G

1

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4

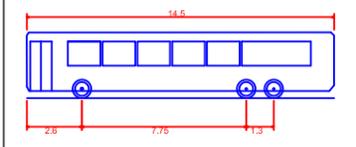
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6

Legend

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- 300mm Envelope
- 600mm Envelope
- Wheel Envelope

Design Vehicle(s)



Long Rigid Bus (14.5 m)  
 Overall Length 14.500m  
 Overall Width 2.500m  
 Overall Body Height 3.102m  
 Min Body Ground Clearance 0.337m  
 Track Width 2.500m  
 Lock to Lock Time 6.00 sec  
 Curb to Curb Turning Radius 15.000m

C	12/10/17	JRT	JRT	JDM
A	26/09/17	RWW	AMH	AMH
For Information				
Issue	Date	By	Chkd	Appd

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 www.arup.com.au

Client  
 Design Inc.

Job Title  
 Lindfield Learning Village

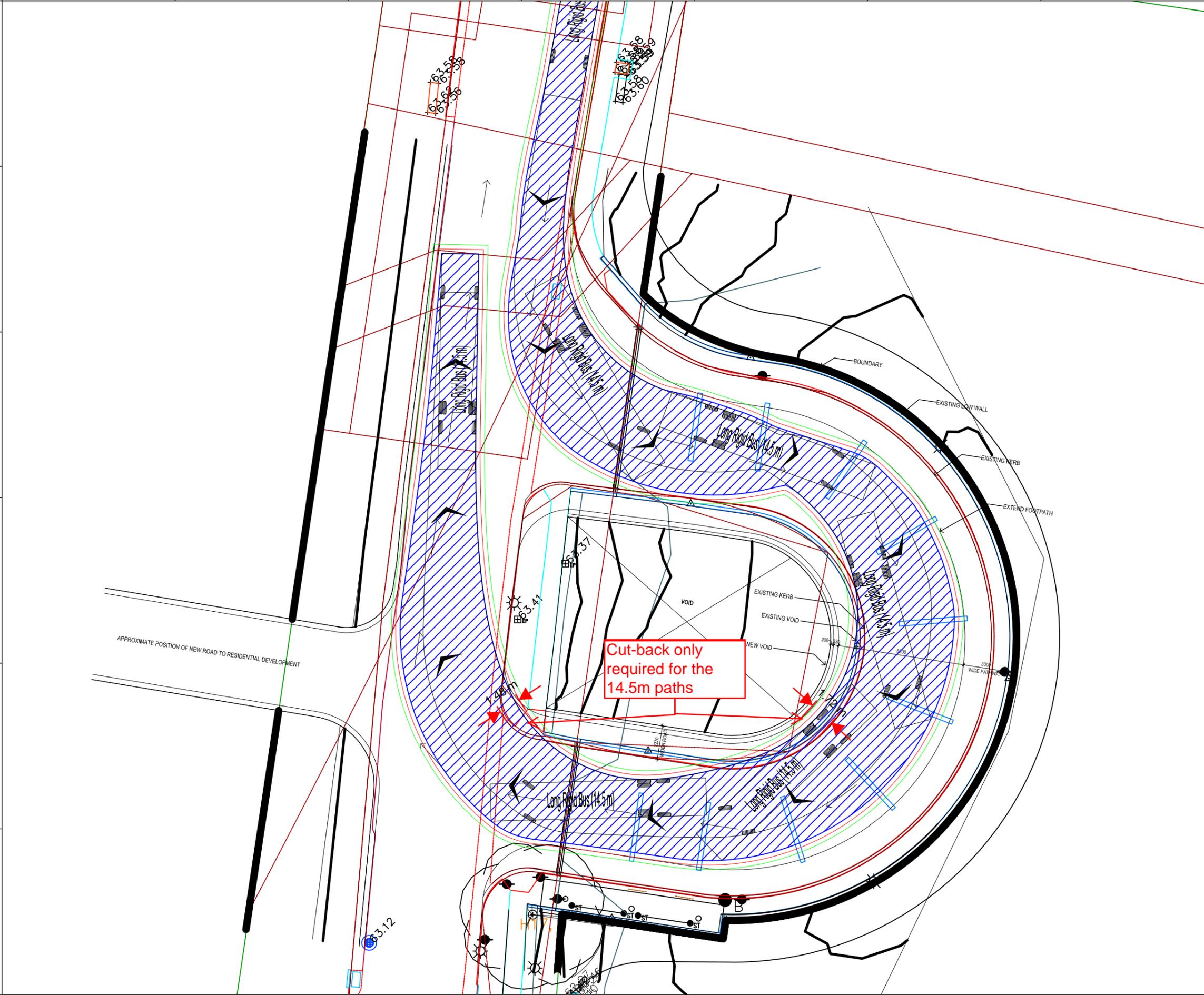
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 Turning Paths  
 14.5m buses

Scale at A3 1:250

Discipline Transport

Drawing Status  
**Draft**

Job No <b>251272-00</b>	Drawing No <b>SKT003</b>	Issue <b>C</b>
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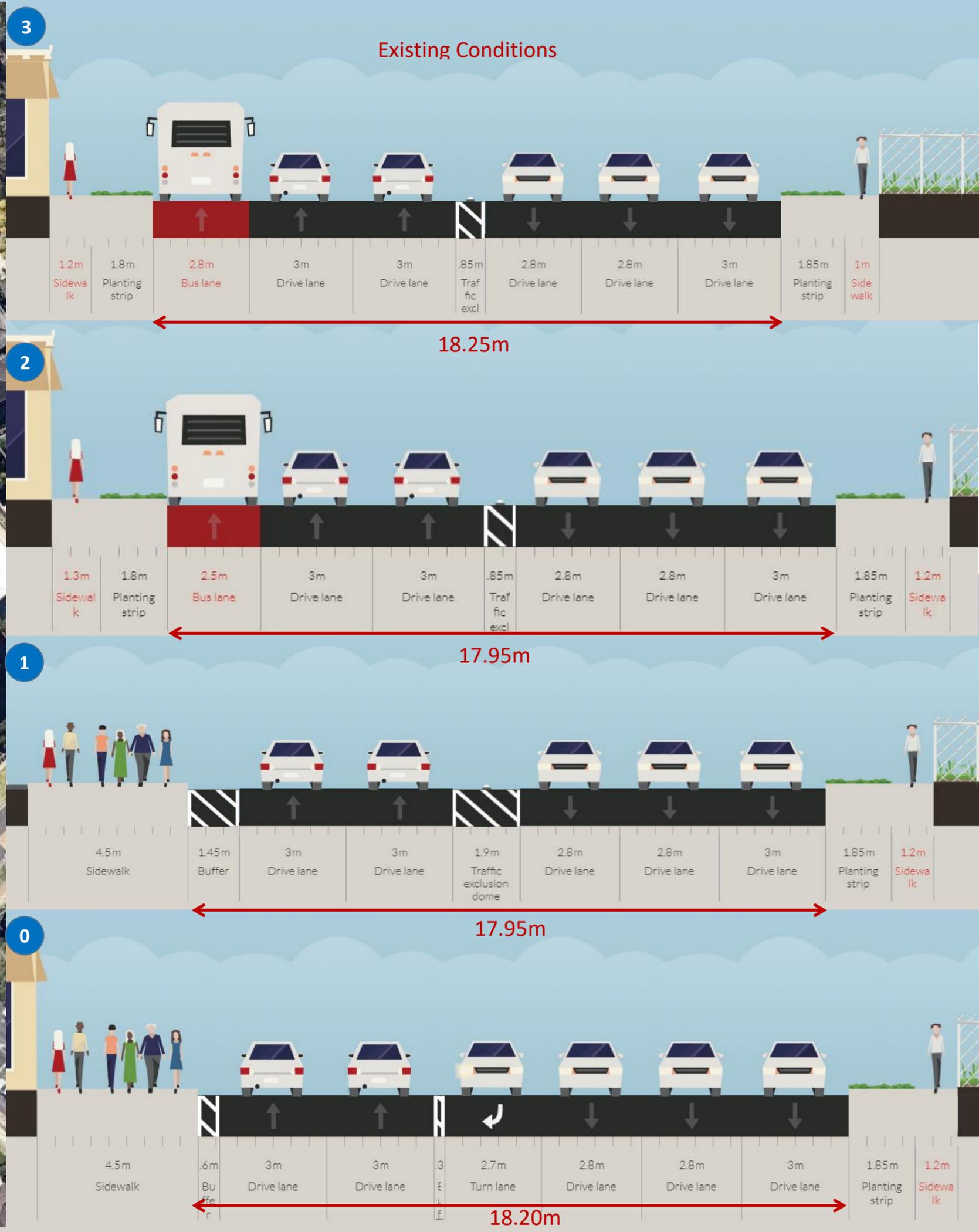


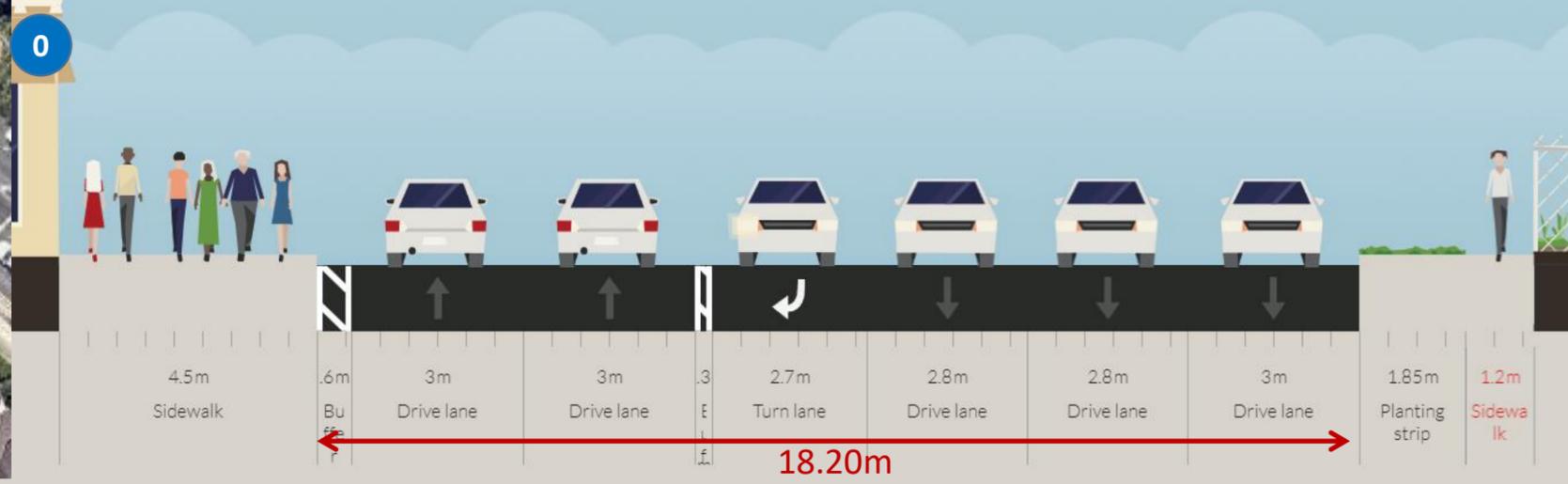
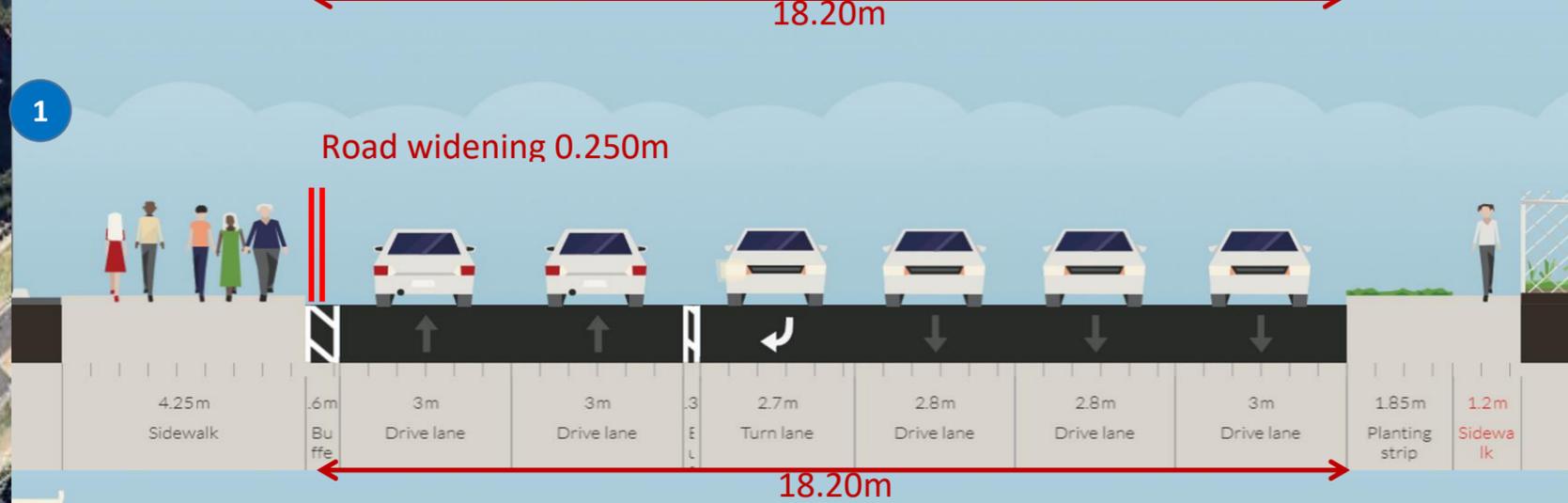
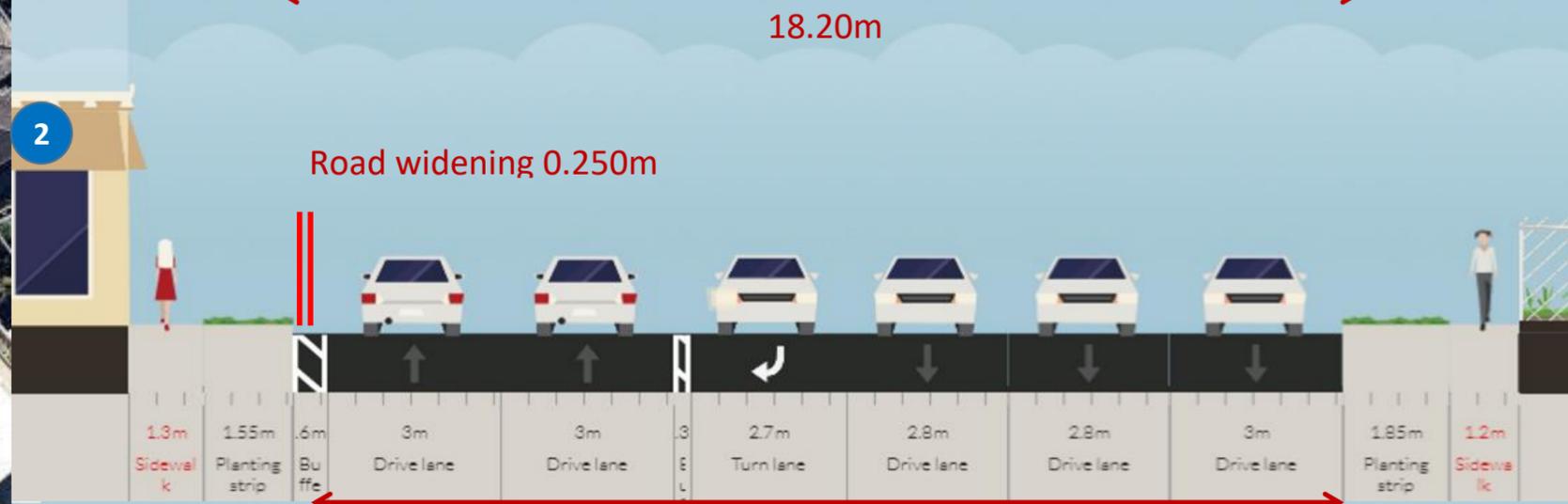
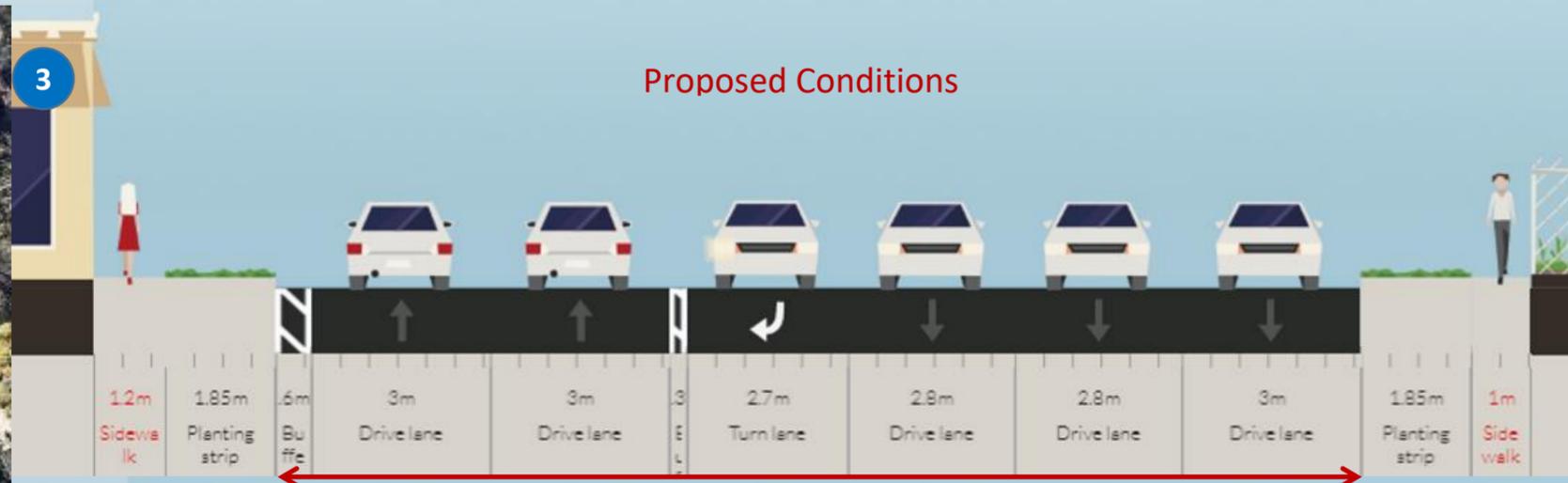
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## **Appendix B**

### **Pacific Highway Cross Sections**





## Appendix C

### Meeting Minutes

## C1 Administrative

These meeting minutes are a summary of the key outcomes of the Lindfield Learning Village discussion between RMS, TfNSW and DPE. The majority of the discussion was on traffic issues pertaining to the recent comments made by the various agencies, in relation to the Arup Lindfield Learning Village Transport Assessment - Issue C report, dated 13 June 2017.

Arup has produced a report responding to each individual comment, titled Lindfield Learning Village Transport Response -Draft 02.

### C1.1 Details

Table 14: Details of meeting

Table colour	
Date	27 September 2017
Location	420 Pitt Street, Department of Planning and Environment office
Topic	RMS, TfNSW, DPE, Council comments discussion
Time	Commencing 10:00am, ending 11:00pm

### C1.2 Attendees

Table 15: List of attendees

Department / Company	Name
DPE	Peter McManus
DPE	Andrew Beattie
RMS	Pahee Rathan
RMS	Gary
TfNSW	Mark Ozinga
Arup	Andrew Hulse
Arup	Ryan Wong
DesignInc	Sandeep Amin
DesignInc	Tim Garry
Savills	Simon Byrne

## C2 Key Outcomes

### C2.1 General project timeline

Savills informed the meeting that the submission would be issued by the last week of October 2017.

### C2.2 Meeting outcomes

Table 16: Summary of key meeting outcomes and actions

Subject	Description	Action
School Zone		
School Zone	<p>RMS is unsupportive of school zones given it is a policy change issue which will take time to implement. It was agreed in the meeting that temporary measures will be investigated and implemented, such as appropriate signage and to calm traffic in the area. This is until a change in school zone policy is made in the future.</p> <p>DPE has highlighted the need for this policy revision given staggered start times will be more prevalent with schools in the future. It was agreed that staggered start and finish times help ease traffic conditions. RMS is willing to review this policy at a later stage when more schools require this policy change.</p>	Arup to investigate appropriate signage.
Bus bay – drop-off/ pick-up		
Bus bay design	<p>The proposed design looks at a cantilever arrangement for pedestrians at the exterior of the bus bay. This results in the existing bus turning area being maintained in width. It was agreed that buses would not be able to leap frog past each other. The proposed arrangement would have buses waiting for children, negating the need for leap frogging. It was agreed that fencing would be provided for the safety of students as well as the possibility of a gate system at the pedestrian boarding locations. It was agreed that these access points need to be monitored and managed by traffic wardens / teachers.</p> <p>DPE is happy to see it as a condition for development. But will need formal approval from council, TfNSW and RMS. It has to include a detailed design and a detailed explanation of how students would board the buses. Safety is paramount.</p>	Arup and DesignInc to incorporate in implemented detailed design
Bus bay upgrade	DPE suggested that council should be consulted regarding the upgrade given land ownership issues.	DesignInc to consult with council.
Bus bay storage	The bus bay should be designed to be versatile for 14.5 metre buses. This would reduce the amount of storage but 14.5 metre buses would still be able to use the bus bay.	Arup to update swept paths.

Subject	Description	Action
<b>Possible rerouting of Route 565 bus to local residential streets</b>		
Relocation of existing bus stop	It was proposed by Arup that there may be an opportunity to relocate the existing bus stop at the bus loop to Shout Ridge, near the residential developments to the west. This will negate the need for STA buses to use the bus loop which would interfere with school buses. The access arrangements of the future residential area and the width of roads at Hamilton Corner is to be investigated.	Arup to investigate feasibility.
<b>Pacific Highway/ Grosvenor Road intersection right turn bay</b>		
Pacific Highway upgrades, modelling	RMS would like further consultation with council regarding the Pacific Highway and Grosvenor Road - Ku-ring-gai's commuter road network model, prepared for the Lindfield local centre. The effects of Northconnex should also be considered.	Arup to consult with council traffic engineers
Modelling	Revised traffic distribution for vehicles using Lady Game Drive as opposed to all vehicles using Pacific Highway was agreed to be more appropriate by RMS.	Nil
Option 1 – bus stop patronage	Removal of existing bus stop on Pacific Hwy. TfNSW indicated that there was no support from bus operators for removal of the bus stop. TfNSW is willing to investigate this further based on existing bus stop patronage. TfNSW is also willing to have further discussions with bus operator.	Arup to request occupancy data from TfNSW.
Option 1 – land acquisition	RMS raised concerns that although it is a schematic plan, the existing bus bay is narrow and land acquisition may be required to achieve a full traffic lane. A detailed survey is required which will provide a better understanding for a business case.	
Option 2	Bus indent with land acquisition along Lindfield Public School boundary in addition to Option 1 requirements. RMS is more supportive of this design.	
Option 3	Dual right turn bay option. The meeting was agreeable that this option may not provide enough right turn benefit due to the limited merge in Grosvenor Road.	Nil
<b>Other Issues</b>		
Lady Game Drive	RMS has commented that future upgrades to Lady Game Drive are still indicative. It would consist of drainage and safety upgrades rather than traffic capacity improvements.	Nil
Footpaths and cycleways	It was agreed that existing footpaths were inadequate. Footpaths should be provided to at least one side of the road at key pedestrian routes, ideally set back from the kerb line. Council is to be consulted.	DoE, Savills, DesignInc
School catchment	DPE asked if the school catchment has been decided. Savills advised that it is still being determined.	Nil