28 September 2023

Stuart Murray
Site Research & Development Pty Ltd
PO Box 134
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Dear Stuart

RE: School Development Application DA2022/0390, The Southern Parkway Forster - Traffic Peer Review

Introduction

SCT Consulting was requested to undertake a peer review of work completed by Seca Solution in support of the Development Application to support a response to a request for information by the Midcoast Council.

The subject site is Lot 1 DP 1264355. It is located on The Southern Parkway, Forster. The development application number is DA2022/0390.

Following a meeting of the Planning Panel, Council raised the following requests for information (**Table 1**).

Table 1 Council feedback excerpts

Topic	Summary concerns
Access Points & Circulation	The application seeks to create two new access points for entry and exit off The Southern Parkway with an internal one-way movement. This is to service onsite parking, drop off/pick up for staff, parents and buses. In its current form this arrangement creates a conflict between vehicles turning right out of Akala Avenue and vehicles entering the site. Any queuing associated with these movements further exacerbates these conflicts for which we cannot provide support of the current layout. It is suggested that this conflict may be resolved by the relocation of the driveway further to the south to better align with Akala Avenue, and the construction of a new roundabout in this location however this advice has not been acted upon.
Queuing	It is expected a maximum of 120 cars will require use of the drop off zone during the morning period. On-site parking with 5 spaces would need to meet an expected turnaround time frame of 1 minute 15 seconds from entering the site to exiting. This excludes any delays associated with entry and exit movements. … we can advise that the concerns raised as part of the circulation are further exacerbated by these calculations to which we cannot provide support for the proposed layout in its current form.
Parking	The proposed development seeks to provide parking on site in the form of 5 short term spaces, 10 spaces allocated to staff and 2 for visitors. Whilst acknowledging commentary provided regarding rates associated with the DCP which is consistent with advice provided at the DAP meeting, the proposal falls short on this requirement by 1 space and seeks to rely heavily on on-street parking which raises several concerns. [Regarding overspill parking impacts] More specifically it should be highlighted the dead-end arrangements in Tandara Place and Paruna Court. These cul-de-sacs are limited in terms of parking availability as well as circulation. The impacts on the surrounding road network as mentioned above will be felt much more severely in these locations given any inability to prevent access to these streets during the pick-up period. Objections to the development have been received from residents in these streets which need to be considered in conjunction with this commentary.

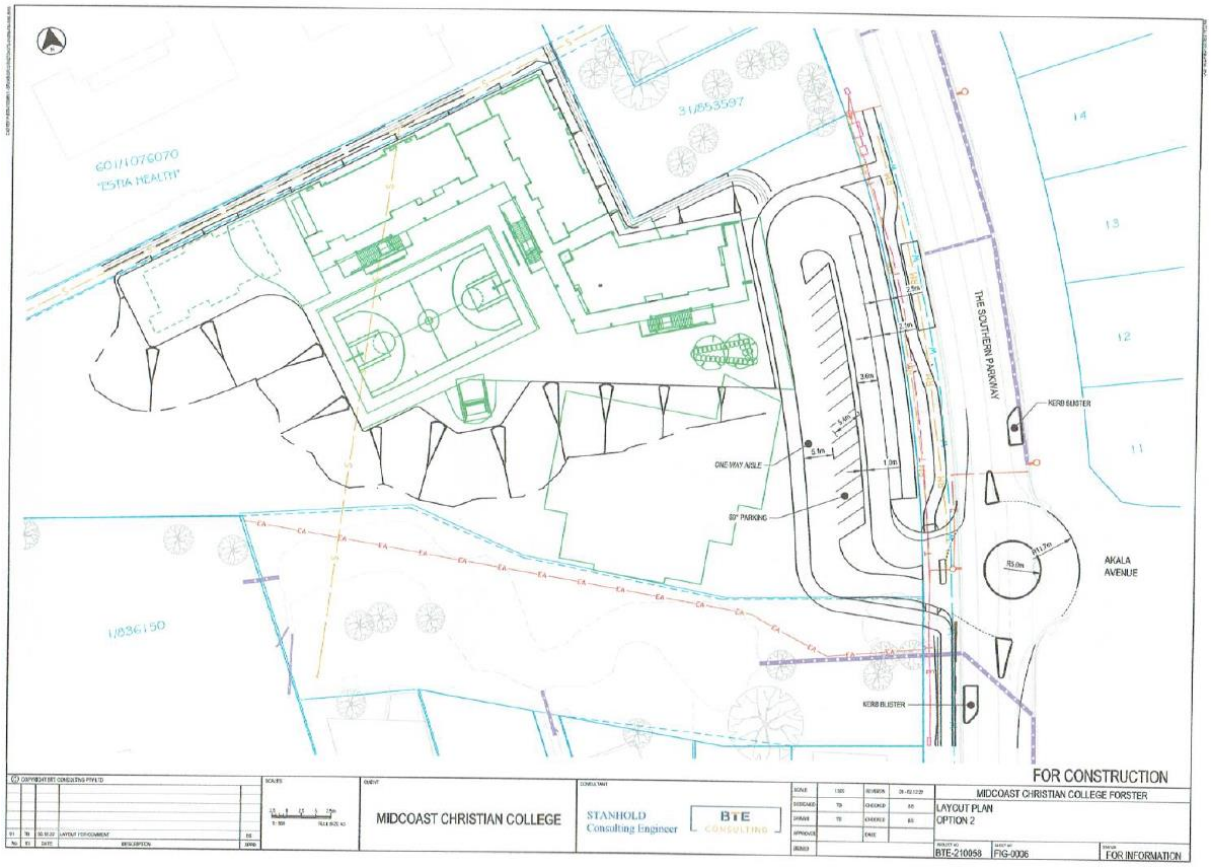
The Christian College layout has been developed over two successive Traffic Impact Assessments. The project team has expanded the offering from having a kiss ‘n drop proposed on The Southern Parkway to an on-site solution. This letter provides a peer review of the current layout against Council RFI’s.

RFI #1: Access points and circulation

Council RFI notes concerns about the "conflict between vehicles turning right out of Akala Avenue and vehicles entering the site". It then goes on to note that "this conflict may be resolved by the relocation of the driveway further to the south to better align with Akala Avenue, and the construction of a new roundabout in this location".

I refer to the Seca Solution TIA dated 20 December 2022 Attachment 1, second page, which is reproduced below (**Figure 1**).

Figure 1 Alteration to the proposed layout



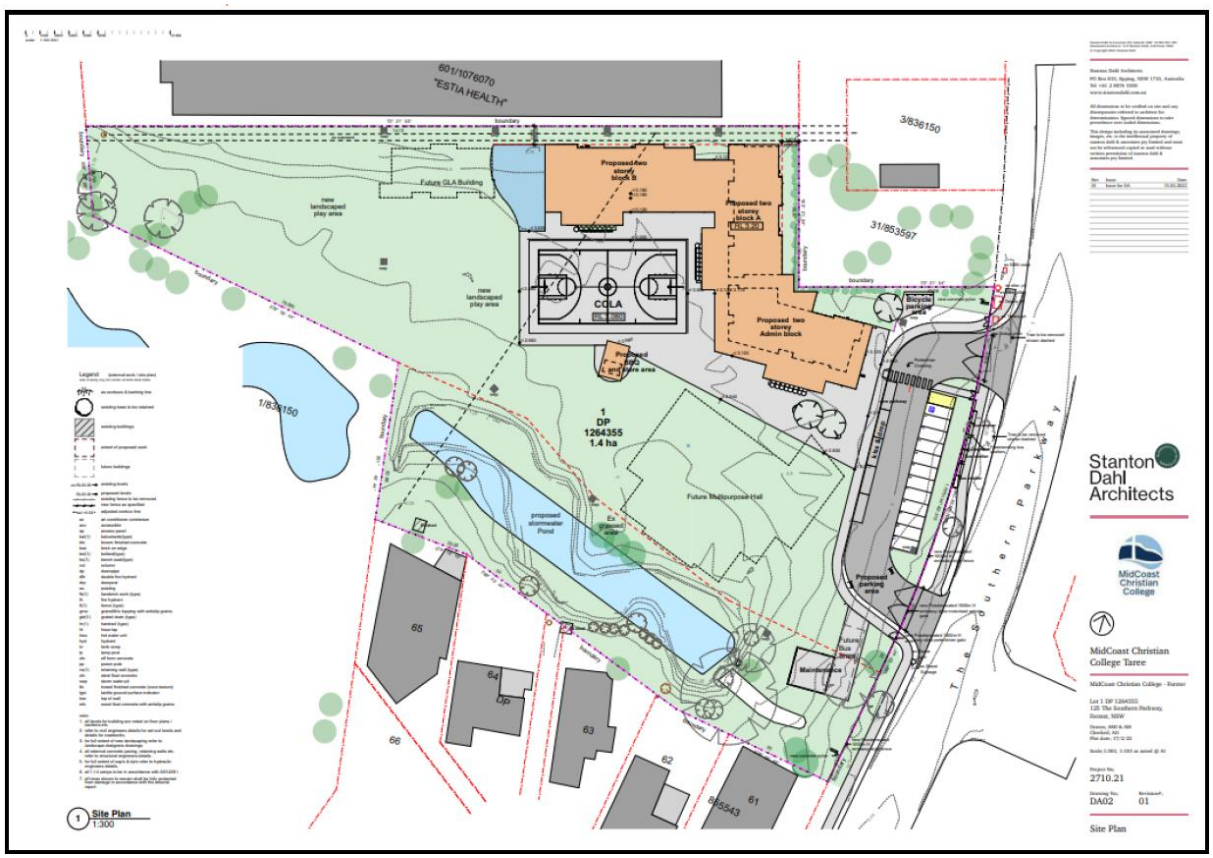
Source: Stanhold Consulting Engineer & BTE Consulting, 2022

The site layout now proposed a roundabout that forms a consolidated four-way intersection with Akala Avenue per the Council's request. I therefore consider that this request for information has been addressed to the Council's requirement.

RFI #2: Queuing

The original plan tabled provided five kiss 'n drop parallel parking bays in a northbound aisle – refer to **Figure 2**.

Figure 2 Original (now superseded) design



Source: Stanton Dahl Architects, 2021

Based on this design, the Council noted:

> *Referring to Section 3.2.4 of the TIA, we refer to the following commentary provided in relation to queuing for the proposed development:*
>
> - *"no queuing is expected for the traffic entering and exiting the site".*
>
> *Reviewing this statement in conjunction with commentary provided for the access points and circulation, we would also refer to the commentary provided in Section 3.4.4:*
>
> - *"Allowing for a maximum of 120 cars approaching the site"; and*
> - *"In the morning drop off, the vehicles can arrive on site over a 20-30 minute period and as such the majority of this drop off can occur within the site and create minimal on-street parking demands accordingly".*
>
> *Based on these statements, it is expected a maximum of 120 cars will require use of the drop off zone during the morning period. On-site parking with 5 spaces would need to meet an expected turnaround time frame of 1 minute 15 seconds from entering the site to exiting. This excludes any delays associated with entry and exit movements.*
>
> *Referring to the previous commentary, we can advise that the concerns raised as part of the circulation are further exacerbated by these calculations to which we cannot provide support for the proposed layout in its current form.*

It is inferred that Council is concerned that a pick-up or drop-off time of 1 minute and 15 seconds would be unlikely to be achieved. In response, the design has now been superseded by that proposed in **Figure 1**. This design has a parallel parking aisle of approximately 48m in length on the eastern side. Based on AS2890.1 Figure 2.5, this space would cater for eight parallel parking spaces (**Table 2**).

Table 2 Running length & allocation of parking spaces

Space	#1	#2	#3	#4	#5	#6	#7	#8
Space length	5.4m	5.9m	5.9m	5.9m	5.9m	5.9m	5.9m	5.4m
Running total	5.4m	11.3m	17.2m	23.1m	29.0m	34.9m	40.8m	46.2m

I note that the western aisle of the design is 5.1m. Assuming that all the angled parking spaces are occupied by teachers or cordoned off, the western side of the aisle could also cater for kiss 'n drop. Based on a width of 2.1m for parallel parking spaces, the 5.1m aisle width would allow for a 3.0m travel lane, which is sufficient. On this basis, there is another indicatively 47m of kiss n' drop space available. Based on AS2890.1 Figure 2.5, the space length must increase to 6.3m, which means only 7 spaces can be provided on the western approach. This produces a total of 15 kiss 'n drop spaces.

The western aisle could only be used if the angled parking spaces were not in operation. Any manoeuvre from the 60-degree angled staff parking spaces would be unable to be completed at the same time as pick up and drop off. As the pick-up and drop-off periods do not overlap with staff entry and exit times, this could be managed with traffic cones which are placed on any empty parking space before pick-up and drop-off occurs.

The Council notes their assumption that the school would generate 120 vehicles ("Based on these statements, it is expected a maximum of 120 cars will require the use of the drop off zone during the morning period"). Based on this assumption, an M/M/c queue model was developed for the kiss 'n drop operations.

The M/M/c model is a mathematical model of a queue that is based on:

– Each parking space is one 'server', which can 'process' cars on average at a particular rate (which is a function of dwell time)

– There are multiple servers – the same as the number of parking spaces

– The model accounts for the random arrival of cars within the window as well as variance in dwell times for drivers.

A full reproduction of the model is provided in **Appendix A**. The model assumptions are:

– Analysis of the afternoon pick-up period, which is assumed to be the most difficult as students need to find the correct car

– A 30-minute drop-off and pick-up window

– 120 vehicles arrive during the drop-off and pick-up window

– The dwell time for cars is 2 minutes 30 seconds (double of previously assessed assumptions due to Council's comments)

– There are 16 parking spaces available for kiss 'n drop.

Under this situation, there is a 98th percentile queue length of three vehicles. The design has room for queueing to occur, with 100m of roadway for vehicles to store on. Hence the probability of queues leaving the site is considered very low. This queue length of three vehicles (occurring 2 per cent of the time) would have room to store within the facility.

It is recommended that the school manage kiss 'n drop movements, particularly as the school grows. With any school approval, the increase in student population will be gradual and won't be on-site on day one. The probability of queueing occurring on day one is insignificant as the population would be much lower than the capacity nominated.

As the school expands, the executive team should monitor queuing and driver behaviour and may need to actively manage the facility. A potential management approach could be:

– Identification of zones within the pick-up area based on the last name of the student (e.g., students with last names A-G in the first three spaces, last names H-N in the next, etc.). This reduces the chance that a student is waiting for their parent on the incorrect side of the facility, leading to longer drop-off times.

– Cars picking up students could have the last name displayed on a printed sheet of A4 paper on the dashboard so that staff can direct students to the correct car.

This would be only in the afternoon peak when students need to find the correct vehicle. In the morning peak, students can disembark their vehicles quickly and without the need for staff facilitation.

Based on the above analysis, the probability of queues overspilling into the network is considered very low. Based on this finding, signage should be adjusted for the facility to have:

– No parking signage for all kiss ‘n drop areas, with the no parking signage being 8am-9.30am and 2.30-4pm

– No stopping signage for all kiss ‘n drop areas outside of peak times (6am-8am, 9.30am-2.30pm, and 4-10pm).

RFI #3: Parking

The revised parking layout now provides 16 angled parking spaces and 15 kiss ‘n drop parking spaces. The 16 angled parking spaces would be more than sufficient for staff and visitors to the school.

This exceeds the requirements laid out in the DCP. Based on the satisfaction of the DCP, the probability of drivers using the surrounding residential streets is considered low.

Conclusion

I have reviewed the design and based on the following modifications, believe the design would address Council requirements:

1. Extension of kiss ‘n drop spaces to the western side of the parking facility, including updating the signage
2. Staff to prohibit the use of angled parking spaces during kiss ‘n drop periods by putting up traffic cones
3. School to monitor kiss ‘n drop periods and put in place active management if queuing approaches The Southern Parkway.

Yours sincerely

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Appendix A – Queue analysis

Queuing theory – M/M/c queue model

The M/M/c model belongs to a family of mathematical models of queues. The following notation is used for representing queues: A/B/c/K where A denotes the distribution of the inter-arrival time, B that of the service time, c denotes the number of servers, and K denotes the capacity of the queue. If K is omitted, we assume that K = 1.

An M/M/c queue model is based on a *Markov* model of inter-arrival time, a *Markov* model for service time and multiple ('c') servers. **In simple terms, the model has random arrivals, random departures and caters for 'c' number of parking spaces / loading bays, which is a good approximation for a parking situation.**

This is a useful approximation for queueing based on a parking situation where we take:

– each parking space as one 'server', which can 'process' cars on average at a particular rate (which is a function of dwell time)

– multiple servers – the same as the number of parking spaces

– that the distribution of inter-arrival times for cars and dwell times are exponentially distributed.

In this model:

s	the number of servers (parking spaces or loading bays) in the system
$1/\mu$	the mean service time (or dwell time)
$p = \frac{\lambda}{s\mu}$	The average utilisation of the system
$P_0 = \left[\sum_{n=0}^{s-1} \frac{(\lambda/\mu)^n}{n!} + \frac{(\lambda/\mu)^s}{s!}\left(\frac{1}{1-p}\right)\right]^{-1}$	The probability that no customers are in the system
$L_Q = \frac{P_0(\lambda/\mu)^s p}{s!\,(1-p)^2}$	The average number of customers waiting in line
$W_Q = \frac{L_Q}{\lambda}$	The average time spent waiting in line
$W = W_Q + 1/\mu$	The average time spent in the system, including service (dwelling in a parking spot or loading bay)
$L = \lambda W$	The average number of customers in the system
$P_n = \begin{cases} \frac{(\lambda/\mu)^n}{n!} P_0 \text{ for } n \le s \\ \frac{(\lambda/\mu)^n}{s!\,s^{n-s}} P_0 \text{ for } n \le s \end{cases}$	The probability that n customers are in the system at a given time

M/M/c Queue

Inputs

Assumption	Input	Symbol
Severs	15	*s*
Arrival rate	120	λ
Service rate	12	μ
Time units	Per hour	N/A

Calculated parameter	Value	Symbol
p /s	0.67	*<- must be less than 1.0*
Rho	10.00	ρ
Average utilisation	0.667	*p*
P(no customers in system)	0.0000	P_0
Avg. customers in system	0.20408	L_Q
Avg. time spent in line	0.00170	W_Q
Avg. service time	0.08503	*W*
Avg. no customers in system	10.20408	*L*
Avg. queue length	0.20408	

Percentile	Queue length
50%	0
60%	0
70%	0
80%	0
85%	0
90%	0
95%	0
98%	3

n	P_0 contribution	Queue	P(X)	C. P(X)
0	1	0	0.0%	0.0%
1	10	0	0.0%	0.0%
2	50	0	0.2%	0.3%
3	166.6666667	0	0.7%	1.0%
4	416.6666667	0	1.9%	2.9%
5	833.3333333	0	3.7%	6.6%
6	1388.888889	0	6.2%	12.8%
7	1984.126984	0	8.8%	21.6%
8	2480.15873	0	11.0%	32.6%
9	2755.731922	0	12.3%	44.9%
10	2755.731922	0	12.3%	57.1%
11	2505.210839	0	11.1%	68.3%
12	2087.675699	0	9.3%	77.6%
13	1605.904384	0	7.1%	84.7%
14	1147.07456	0	5.1%	89.8%
15	764.7163732	0	3.4%	93.2%
16	477.9477332	1	2.3%	95.5%
17	281.1457254	2	1.5%	97.0%
18	156.1920697	3	1.0%	98.0%
19	82.20635247	4	0.7%	98.7%
20	41.10317623	5	0.4%	99.1%
21	19.57294106	6	0.3%	99.4%
22	8.896791392	7	0.2%	99.6%
23	3.868170171	8	0.1%	99.7%
24	1.611737571	9	0.1%	99.8%
25	0.644695028	10	0.1%	99.9%
170	1.3779E-137	155	0.0%	100.0%