Road Compliance Review

Parkes Way Slip Lane - UNSW Canberra

Prepared for UNSW / 6 December 2024

231606

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Contents

Revision Register

Rev	Date	Prepared By	Approved By	Remarks
A	16/09/2024	RoCo	CP	For Discussion
B	1/10/2024	RoCo	CP	For Discussion
C	22/11/2024	RoCo	CP	For Discussion
D	6/12/2024	RoCo	CP	For Works Approval

1.0 Introduction

The University of New South Wales (UNSW) proposes to redevelop the existing carpark on Block 12 Section 3 Parkes and part of the existing Canberra Institute of Technology Campus on Block 12 Section 33 Reid, into the UNSW Canberra Campus, providing research and tertiary education facilities within the heart of Canberra. The campus is proposed to be delivered across multiple stages over an extended development period, with the first stage anticipated to complete construction in 2026.

As part of the redevelopment the National Capital Authority (NCA) has requested that a slip lane from Parkes Way into the site be provided to reduce the volume of traffic using Constitution Avenue. This option was presented to Transport Canberra City Services Directorate (TCCS) who requested a look into the compliance and safety considerations regarding a slip lane off Parkes Way.

TTW, on behalf of the University of New South Wales (UNSW), has undertaken an assessment of the proposed slip lane with regards to compliance to the following standards:

- Austroads Guides for Road Design
- Austroads Guides for Traffic Management
- TCCS Municipal Infrastructure Standards

The following report details the findings of TTWs assessment and provides recommendations on the safety of the slip lane.

2.0 Existing Conditions

2.1 Site Location

The existing site on Block 12 Section 3 Parkes is bounded on three sides by major roads, Constitution Avenue to the northeast, Parkes Way to the southwest, and Coranderrk Street to the northwest. To the southeast the site is bounded by a residential development on Block 15 Section 3 Parkes called the Griffin. In the eastern corner of the site, off Constitution Avenue, an existing roadway, with an access easement in favour of Block 15 provides access to the existing carpark on the site and Block 15 to the southeast. Refer to Figure 1 for site locality plan.

Figure 1: Site Locality Plan (Site image from Nearmap Friday September 29 2023)

Parkes Way is currently a dual carriageway arterial road, with two lanes in both directions and a posted speed of 80km/h. There is currently a left-in left-out (LILO) access off Parkes Way at the southern corner of the site, with an existing slip lane separated from the through lanes on Parkes Way by an open channel invert (OCI). The existing access provides entry and exit to the existing carpark on the block, with the carpark connecting through to the Griffin development.

Upstream of the access is the Parkes Way – Coranderrk Street roundabout, which has temporary signals on one leg that operate during peak times. Downstream of the access is the Parkes Way – ANZAC Parade roundabout.

2.2 Site observations

TTW attended site on 4 and 5 December 2023, 11 June and 19 November 2024 with the following observations recorded impacting the access to the site:

- Vehicles exiting and entering the Griffin development were observed driving through the existing car park to exit onto Parkes Way during peak times.
- Traffic at the ANZAC Parade intersection regularly queued back to the Coranderrk Street intersection, blocking the entry/exit to the site in both morning and evening peak times.
- Vehicles exiting onto Parkes Way often struggled to find reasonable gaps in traffic when the traffic was free flowing at the 80km/h speed limit.

3.0 Proposed Options

Two different locations on Parkes Way were looked at as part of the proposed options. Under both options the slip lane at Parkes Way will be changed to a left in only, with the left-out turn removed.

The first location was the location of the existing access on to Parkes Way.

The second option proposed to move the slip lane further south to align with the existing access off Constitution Avenue, providing a through link between Parkes Way and Constitution Avenue. The new link road between the Parkes Way and Constitution Avenue is proposed to be handed over to the Territory to form part of the road network. The UNSW campus would then have a driveway off the proposed new link road.

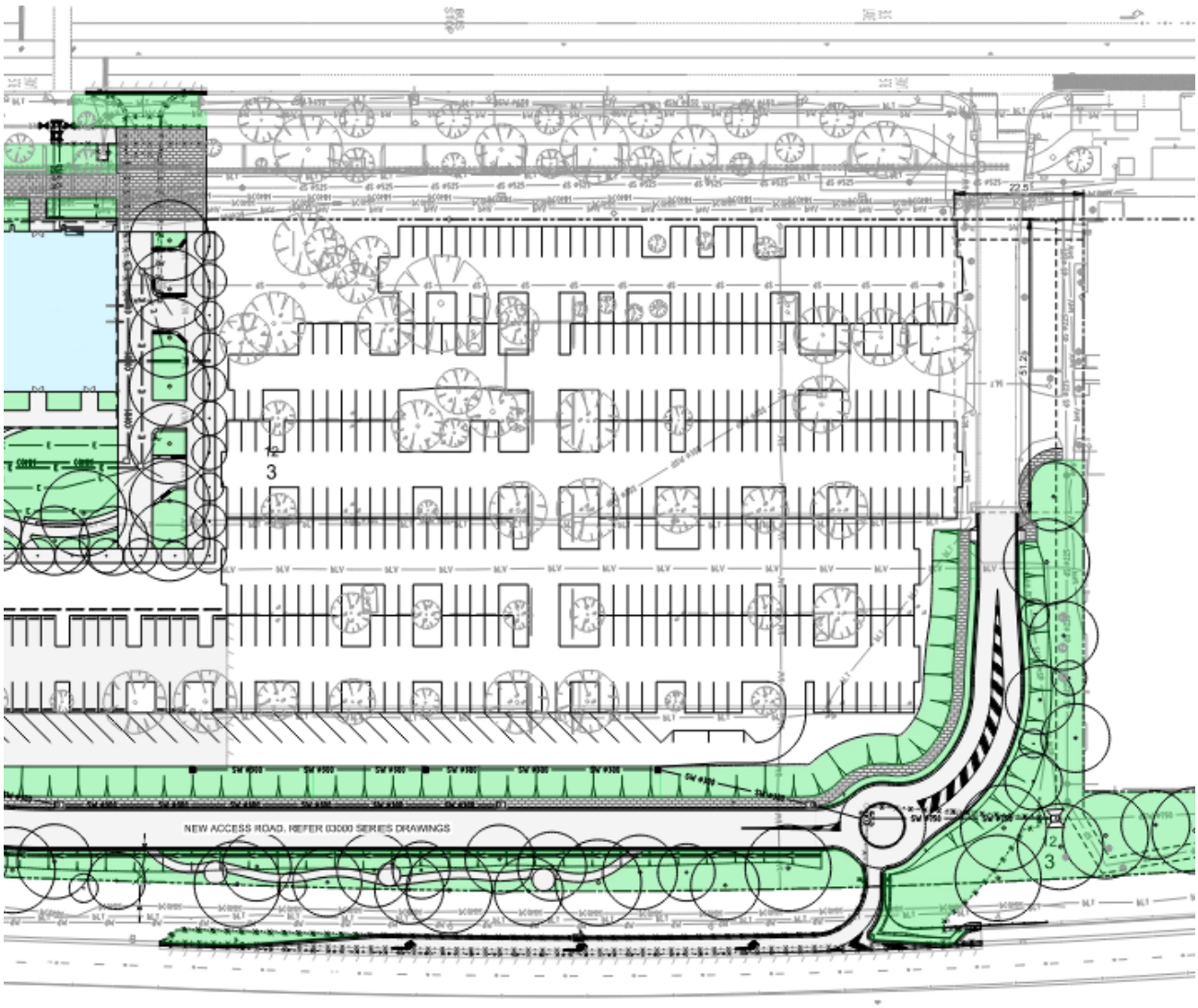


Figure 2: Slip Lane Arrangement for Location 1

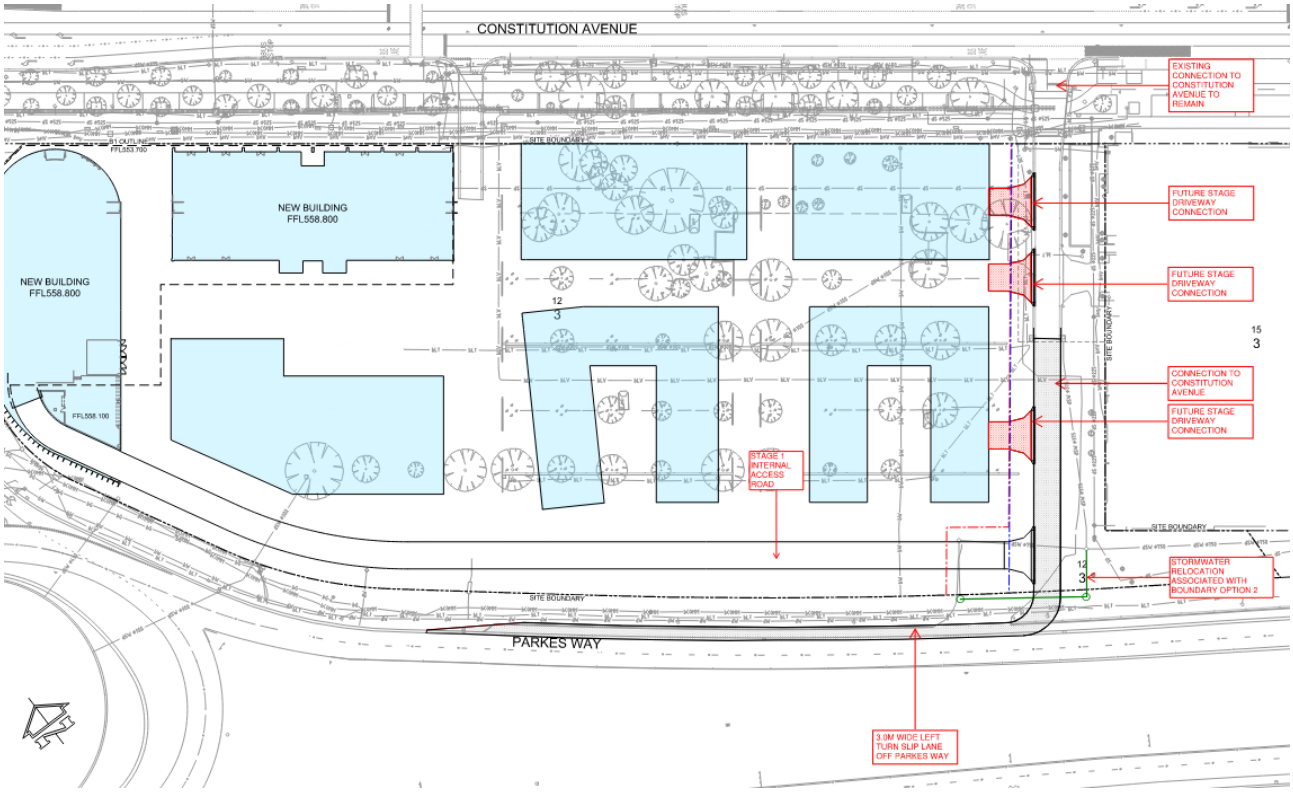


Figure 3: Slip Lane Arrangement for Location 2

4.0 Deceleration Lane Geometry Design

Lane geometry for the slip lane has been assessed against Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections (AGRD4A).

As the proposed slip lane is intended to service the UNSW Canberra Campus masterplan, the slip lane will need to accommodate the approved Campus Masterplan internal roadway. As such, the masterplan driveway was provided on the through road, and the maximum radius of the entry slip lane was determined to be 9m. based on a super elevation of 5%, the maximum design speed through the corner was determined to be 20km/h.

$$R = \frac{V^2}{127(e+f)} \qquad 9$$

where

R = curve radius (m)

V = speed (km/h)

e = superelevation (m/m)

f = side friction factor between vehicle tyres and the pavement (refer to Table 5.4)

Figure 4: Equation 9 from AGRD4A - Curve Radius from Design Speed

Noting the proximity to the Coranderrk Street intersection, 60km/h, 70km/h and 80km/h design speeds have been assessed for the Parkes Way approach. As determined above, the exit lane uses a design speed of 20km/h.

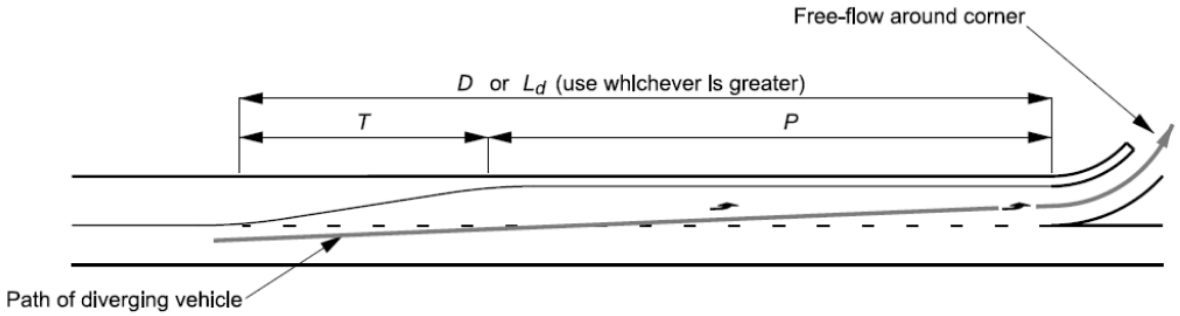
To determine the best outcomes for the slip lane to the site, both free left turn and signalised turn into the new access road were assessed.

4.1 Free left turn

Free left turn slip lane dimensions for each of the assessed design speeds are noted in Table 1.

Table 1: Free Left Turn Slip Lane Design Dimensions

	Existing	**60km/h**	**70km/h**	**80km/h**
Width, W (m)	2.5	3	3.5	3.5
Taper, T (m)	3	16.5	23	25
Deceleration length, D (m)	125	50	70	95
Distance from Coranderrk Street Roundabout (m)	70	145	125	100



(b) Deceleration to a turning speed

Figure 5: Excerpt from Figure 5.1 of AGRD4A

4.2 Signalised Turn

For a signalised intersection the queueing length for vehicles waiting at the intersection also needs to be included in the lane length. As such the queueing to get into the access road from Parkes Way was determined based on the number of vehicles anticipated to enter the site once all stages of the University Campus are in operation. For greater detail on this refer to Section 5.0. The 95th percentile for the number of vehicles expected to queue in the peak AM, which is anticipated to be the highest use time for the intersection was 4 vehicles. A queueing length of 6m per vehicle was adopted for a 24m queueing length.

Signalised turn dimensions for each of the assessed design speeds are noted in Table 2.

Table 2: Signalised Turn Slip Lane Design Dimensions

	Existing	**60km/h**	**70km/h**	**80km/h**
Width, W (m)	2.5	3	3.5	3.5
Queueing Distance (m)	N/A	24	24	24
Taper, T (m)	3	16.5	23	25
Deceleration length, D (m)	125	55	75	100
Total Length (m)	125	76	99	124
Distance from Coranderrk Street Roundabout (m)	70	126	106	81

5.0 Queueing Modelling

In order to determine the queueing distance for the signalised intersection the following assumptions were made:

- 40% of traffic approaching the Campus travel from the west on Parkes Way to approach the site.
- 40% of parking for the final campus will be on the Parkes side of Constitution, with the remaining parking on the Reid side, based on the available area of each side of the campus.
- 20% of traffic generated by the Griffin enters the site in the morning peak.

Based on the Master Plan population of 2715 off-site students, 370 staff and the parking requirements under the NCA Detailed Conditions of Planning, a total of 580 parking spaces was anticipated on the Parkes site. At a conservative rate of 80% of parking spaces being filled in the morning peak, this would result in 464 vehicles accessing the site in the AM peak. With the split as described in the assumptions above, a total of 198 vehicles are anticipated to access the Parkes site from Parkes Way.

SIDRA analysis of a proposed signalised slip lane was undertaken in accordance with TCCS Guidelines for SIDRA Analysis, providing a 95th percentile back of queue of 3.2 vehicles at a 22.4 m queue distance. This was rounded to 4 vehicles at 6m per vehicle to 24m queueing length for design purposes.

6.0 Further Considerations

6.1 Auxiliary Lane Location

There is no definite clearance distance within Austroads Design Guides as to the distance between an auxiliary lane and another intersection, with intersections on Parkes Way associated with Commonwealth Avenue being within similar proximity to other intersections. As such, the appropriateness of the slip lane placement has been assessed against approach the approach site distance (ASD) within AGRD4A. Based on a 2.5 second reaction time for inner city reaction times and a 0.26 coefficient of deceleration, the equation in Figure 6 was used to determine the approach site distance for each of the previously nominated design speeds which are recorded in Table 3.

$$ASD = \frac{R_T \times V}{3.6} + \frac{V^2}{254 \times (d + 0.01 \times a)} \quad (1)$$

where

ASD = approach sight distance (m)

R_T = reaction time (sec), refer to *AGRD Part 3* (Austroads 2016a) for guidance on values

V = operating (85th percentile) speed (km/h)

d = coefficient of deceleration, refer to Table 3.1. Refer also to *AGRD Part 3,* Table 5.3 for further information on coefficient selection

a = a longitudinal grade in % (in direction of travel: positive for uphill grade, negative for downhill grade)

Figure 6: Equation 1 from AGRD4A - Approach Sight Distance

Table 3: Approach Sight Distances

85th Percentile Design Speed	**60 km/h**	**70 km/h**	**80 km/h**
ASD	94m	120m	149m

Based on the lane lengths defined in Section 5.0, either of the 60km/h design options has sufficient distance between the Coranderrk Street intersection and the slip lane for the ASD. The free left turn for the 70km/h design speed would also have sufficient distance, but the signalised 70km/h option and both 80km/h options would require the ASD to be within the Coranderrk Street roundabout.

6.2 Driveway Locations

Within Austroads Guide to Road Design Part 4: Intersections and Crossings: General (AGRD4), corner clearances for signalised intersections are provided in Figure B3: Corner clearance – Channelised Intersection, with a minimum distance of 60m from the turning lane to the nearest driveway on the departure side from a main road. As the driveway is only 9m from the channelised intersections, this is considered non-compliant to Austroads Standards. Noting that the Constitution Avenue intersection for the Access Road is non-channelised, a minimum of 40m is required from the intersection to the first driveway, with the Griffin driveway 50m from the intersection, satisfying the AGRD4.

To provide a compliant solution, the driveway into the UNSW Campus would need to be moved 60m from the slip lane, as shown in Figure 7.

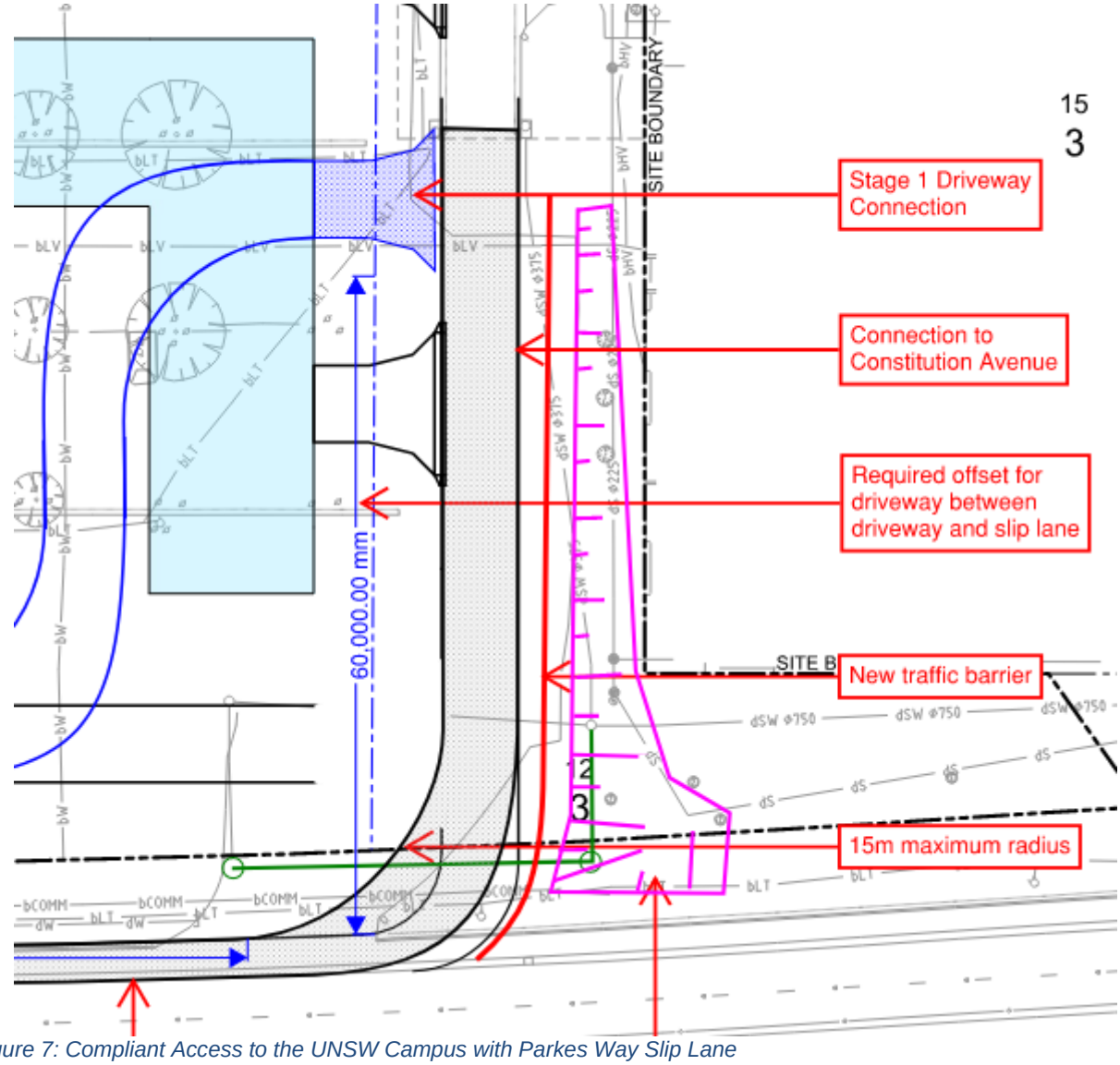


Figure 7: Compliant Access to the UNSW Campus with Parkes Way Slip Lane

7.0 Slip Way Options

As part of assessing the viability of the slip lane off Parkes Way, TTW assessed the following options:

1. Retention of the existing free left-in turn with the removal of the left out turn.
2. Free left turn off Parkes Way with the Stage 1 driveway in accordance with the Masterplan.
3. Free left turn off Parkes Way compliant to Austroads Design Guides.
4. 70km/h design speed signalised turn off Parkes Way with the Stage 1 driveway in accordance with the Masterplan.
5. 60km/h design speed signalised turn off Parkes Way with the Stage 1 driveway in accordance with the Masterplan.
6. Removal of the Parkes Way Slip Lane.

7.1 Retention of the Existing Free Left-In with the Removal of the Left-Out

Retention of the existing driveway connection between Parkes way and the UNSW site as per the arrangement illustrated on the TCCS TCD database would allow vehicles to freely exit off Parkes Way into the UNSW site. This allows vehicles to enter directly into Stage 1 of the proposed UNSW development.

This option has the following positives and negatives:

- Pros
  - Allows for future development as per the approved Masterplan.
  - Reduces queueing on the Parkes Way slip lane through a free left turn.
  - Reduced traffic volume on Constitution Avenue in the morning peak (198 vehicles).
  - Removal of the left-out movement onto Parkes Way rectifies safety issues associated with merging traffic on Parkes Way.
  - Minimises the grading required around the Griffin development.
  - Road treatment past the boundary can be in accordance with AS2890 rather than Austroads, reducing the internal UNSW development roadway design speeds to 20km/h.
  - The existing slip lane length is sufficient to meet Austroads Standards.
- Cons
  - The width of the slip lane off Parkes Way into the site is non-compliant to Austroads Standards for lane widths.
  - An Open Channel Invert (OCI) currently sits between the slip lane and the through lane on Parkes Way, impacting vehicles abilities to safely use the slip lane.
  - The existing driveway has a severe design radius at the end of the slip lane. This is unable to be changed as it is required to accommodate the internal roadways without impacting the future masterplan.
  - Vehicles using the offside lane at Coranderrk Street roundabout must cross two lanes on Parkes Way to access the slip lane resulting in increased vehicle conflict.
  - Slip lane approach sight distance encroach on the Coranderrk Street roundabout.

Noting the driveway connection is an existing condition and vehicles frequently use this arrangement, the location of the driveway is seen as acceptable, especially considering that the slip lane length is sufficient to Austroads design guides. Provided that the slip lane width is widened to 3m and the OCI is removed from between the slip lane and Parkes Way, TTW believes that this option is acceptable with regards to safety.

7.2 Free Left Turn to suit Masterplan

This option would see vehicles able to freely exit off Parkes Way onto the access road, with access to Stage 1 of the development directly adjacent to the slip lane.

The following positives and negatives were determined for this option:

- Pros
  - Allows for future development as per the approved Masterplan.
  - Reduces potential queueing on the Parkes Way slip lane through a free left turn.
  - Reduced traffic volume on Constitution Avenue in the morning peak (198 vehicles).
- Cons
  - Non-compliant driveway location to Austroads Standards
  - High accident risk due to poor sightlines for the development and low intersection control.
  - Significant regrading around the Griffin development required to provide safe operating conditions and traffic barriers including the adjustment of existing services to match the new levels.
  - Requires a severe design radius at the end of the slip lane to accommodate the driveway, increasing crash risk between vehicles and the adjacent barrier.
  - Vehicles using the offside lane at Coranderrk Street roundabout must cross two lanes on Parkes Way to access the slip lane resulting in increased vehicle conflict.

Due to the significant risk associated with the conflict point of the Stage 1 driveway and the lack of sight lines, TTW believes that this option is unacceptable with regards to safety.

7.3 Free Left Turn Compliant to Austroads

As shown in Figure 7, an Austroads compliant left turn lane will allow vehicles to safely exit off Parkes Way while having sufficient sight distances to reduce the risk of accidents. The following pros and cons were determined for this option:

- Pros
  - Compliant to Austroads Design guides.
  - Reduced risk of accidents through good design practices.
  - Reduces potential queueing on the Parkes Way slip lane through free left turn.
  - Reduced traffic volume on Constitution Avenue in the morning peak (198 vehicles).
- Cons
  - Impacts on future building envelopes nominated in the approved masterplan.
  - Not in line with the approved Masterplan.
  - Significant regrading around the Griffin development required to provide safe operating conditions and traffic barriers including the adjustment of existing services to match the new levels.
  - Increased number of vehicles passing ground floor apartments at the Griffin, anticipated up to 1000 vehicles a day.
  - Vehicles using the offside lane at Coranderrk Street roundabout must cross two lanes on Parkes Way to access the slip lane resulting in increased vehicle conflict.

This option allows for sufficient sight and stopping distances for vehicles exiting off Parkes Way and eases the severity of the turn off Parkes Way. TTW believes that this option is acceptable with regards to safety.

7.4 70km/h Design Speed Signalised Slip Lane

In order to reduce the risk associated with having the Stage 1 driveway immediately after the slip lane, traffic signals have been considered to reduce the impact of insufficient sightlines and improve operational safety. The following pros and cons for this option were determined:

- Pros
  - Allows for future development as per the approved masterplan.
  - Reduced traffic volume on Constitution Avenue in the morning peak (198 vehicles).
  - Provides a minor increase in safety at the intersection compared to Option 1 through reducing dependency on sightlines through the signalisation of the intersection.
- Cons
  - Non-compliant driveway location to Austroads Standards
  - Potential queueing on Parkes Way due to the signalised intersection, resulting in a 95th percentile queue distance for 4 vehicles.
  - Slip lane approach sight distance encroach on the Coranderrk Street roundabout.
  - Significant regrading around the Griffin development required to provide safe operating conditions and traffic barriers including the adjustment of existing services to match the new levels.
  - Requires a severe design radius at the end of the slip lane to accommodate the driveway, increasing crash risk between vehicles and the adjacent barrier.
  - Increased number of vehicles passing ground floor apartments at the Griffin, anticipated up to 1000 vehicles a day.
  - Vehicles using the offside lane at Coranderrk Street roundabout must cross two lanes on Parkes Way to access the slip lane resulting in increased vehicle conflict.
  - Potential risk of accident associated with vehicles increasing speed on approach to the intersection to make the light sequence.

This option is not compliant to Austroads Guides, inherently increasing the risk of the design to the Territory and the University should this option be adopted. While this option does reduce the risk around sightlines for vehicles exiting off Parkes Way, there are other significant safety issues surrounding the behaviour of drivers at signalised intersections and trying to make the sequence of lights. This risk is increased with this design option due to how severe the radius needs to be into the access road to accommodate the Stage 1 driveway. As such TTW believes this option is unacceptable with regards to safety.

7.5 60km/h Design Speed Signalised Slip Lane

This option has all the benefits of the 70km/h design speed signalised slip lane, with an increase in safety due to the reduction in speeds of vehicles. The following pros and cons for this option were determined:

- Pros
  - Allows for future development as per the approved masterplan.
  - Provides a minor increase in safety at the intersection compared to Option 1 through reducing dependency on sightlines through the signalisation of the intersection.
  - Sufficient space between the Coranderrk roundabout and the slip lane for the approach site distance to the lane.
  - Reduced traffic volume on Constitution Avenue in the morning peak (198 vehicles).
- Cons
  - Non-compliant driveway location to Austroads Standards.
  - Potential Queueing on Parkes Way due to the signalised intersection.
  - Significant regrading around the Griffin development required to provide safe operating conditions and traffic barriers including the adjustment of existing services to match the new levels.
  - Requires the reduction of posted speed on Parkes Way to 60km/h. This will lead to an increase in driver frustration, especially during off-peak times when this section of road can easily be navigated at higher speeds.
  - Requires a severe design radius at the end of the slip lane to accommodate the driveway, increasing crash risk between vehicles and the adjacent barrier.
  - Potential risk of accident associated with vehicles increasing speed on approach to the intersection to make the light sequence.
  - Vehicles using the offside lane at Coranderrk Street roundabout must cross two lanes on Parkes Way to access the slip lane resulting in increased vehicle conflict.
  - Increased number of vehicles passing ground floor apartments at the Griffin, anticipated up to 1000 vehicles a day.

This option, like the 70km/h option, is not compliant to the Austroads Guides and still has all the same safety concerns surrounding the geometry and driver behaviour around signalised intersections. While there is a reduction in the severity of the risk associated with the signals by reducing the speed, the risks surrounding driver behaviour will remain unchanged. Noting this, along with the implications of impacting the operating conditions of an arterial road, TTW believes that this option is unacceptable

7.6 Removal of the Parkes Way Slip Lane

In an effort to retain the Masterplan access location to Stage 1, the option to remove the slip lane from Parkes Way was considered. The following pros and cons for this option were determined:

- Pros
  - Allows for future development as per the approved masterplan.
  - Removal of conflict on Parkes way due to a new intersection.
  - Removal of the need for further earthworks and road furniture around the Griffin.
  - Reduces the number of vehicles passing the ground floor apartments of the Griffin.
  - Safer option for vehicles and pedestrians through removing the number of conflict points and turning movements on the access road.
  - The minor increase in vehicle numbers on Constitution Avenue does not significantly impact the traffic on Constitution Avenue. The average delay on Constitution Avenue associated with the increase in the number of vehicles is less than 0.1 seconds.
- Cons
  - Minor increase of traffic on Constitution Avenue up to approximately 198 vehicles associated with the University in the morning peak.
  - Minor increase in conflicts between pedestrians and vehicles at the exit off Constitution Avenue into the access lane.

In assessing the removal of the slip lane from Parkes Way, TTW undertook preliminary modelling of the access lane intersection with the Constitution Avenue to determine the impact of a further 198 cars on Constitution Avenue in the morning peak. The number of trips entering the site was determined as noted in Section 5.0.

Noting that there is no significant impact on the traffic on Constitution Avenue, along with the removal of many of the risks associated with other options, TTW believes that this option is acceptable with regards to safety.

8.0 Conclusion and Recommendations

Based on the review undertaken by TTW for the proposed Parkes Way slip lane and associated access lane, the following key points were identified:

- There is sufficient space to provide a compliment slip lane within the Parkes Way northern verge to provide a through lane to Constitution Avenue.
- The existing slip lane location is compliant to Austroads design guides but is non-compliant in terms of width and taper length.
- The location of the proposed through road slip lane is compliant with Austroads Guides.
- The driveway location onto a Parkes to Constitution Avenue connection road, as proposed in the UNSW Campus Masterplan is non-complaint to Austroads Guides with the inclusion of the Parkes Way slip lane entry and would need to be relocated 60m away from the proposed slip lane.

From the identified key points, TTW note the three below options are deemed acceptable with regards to safety, with options ranked safest first:

- Option 6 - The Parkes Way slip lane into the site be removed from the UNSW Campus Masterplan.
- Option 3 - The UNSW Campus Masterplan be updated to move the southern access lane entry 60m away from the Parkes Way slip lane.
- Option 1 - Modification of the existing slip lane to retain the existing free left-in turn with the removal of the left out turn onto Parkes Way.

The signalisation of the slip lane is not recommended due to the significant risk associated with the non-compliant intersection and the implications of reducing the speeds of a main arterial road.

Of the three options which are deemed acceptable to safety, only Option 1 and Option 6 have limited impact on the Masterplan of the UNSW site, with Option 3 deemed as having significant impact on the future viability of the site.

TTW recommends that either Option 1 which is deemed acceptable with regards to safety and limit the impact to the masterplan, be adopted for the development.

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Appendix A

Retention of Existing Driveway Location Plan

NEW BUILDING
FFL558.800

NEW BUILDING
FFL558.800

B1 OUTLINE
FFL553.700

FFL558.100

NEW ACCESS ROAD. REFER 03000 SERIES DRAWINGS

22.5

51.29

0.0 10.0 20.0 30.0 40.0m
1:500 A1 1:1000 A3

NOT FOR CONSTRUCTION

Appendix B

Proposed Connection Between Parkes Way and Constitution Sketch Plan

CONSTITUTION AVENUE

CORANDERRK STREET

PARKES WAY

SITE BOUNDARY

B1 OUTLINE
FFL553.700

NEW BUILDING
FFL558.800

NEW BUILDING
FFL558.800

FFL558.100

STAGE 1
INTERNAL
ACCESS
ROAD

BOUNDARY
OPTION 1

3m lane width

EXISTING
CONNECTION TO
CONSTITUTION
AVENUE TO
REMAIN

FUTURE STAGE
DRIVEWAY
CONNECTION

FUTURE STAGE
DRIVEWAY
CONNECTION

CONNECTION TO
CONSTITUTION
AVENUE

FUTURE STAGE
DRIVEWAY
CONNECTION

BOUNDARY
OPTION 2

STORMWATER
RELOCATION
ASSOCIATED WITH
BOUNDARY OPTION 2

3.0M WIDE LEFT
TURN SLIP LANE
OFF PARKES WAY

0.0 10.0 20.0 30.0 40.0m
1:500 A1 1:1000 A3

NOT FOR CONSTRUCTION