Access Road and Dudley Street Upgrade
Infrastructure Finance and Capital Works
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AECOM

Traffic and Transport Impact Assessment

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Client: Infrastructure Finance and Capital Works

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Quality Information

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Executive Summary

The ACT Government's Infrastructure Finance and Capital Works (IFCW) has engaged AECOM Australia Pty Ltd (AECOM) to prepare a Traffic and Transport Impact Assessment for the proposed upgrade of Dudley Street and associated access road (the Project) to support the development of the proposed Canberra Brickworks Precinct in Yarralumla, ACT.

The Project

Dudley Street provides a link from north western Canberra to the suburbs of Yarralumla and Deakin. It connects Cotter Road to the roundabout intersection of Dudley Street / Novar Street / Adelaide Avenue off ramp / Kent Street (Novar Street roundabout). A traffic assessment undertaken in 2016 determined that Dudley Street is functioning at capacity under existing traffic use conditions. Upgrades are required to allow Dudley Street to operate safely and to meet the design requirements for a 'major collector road'.

The Canberra Brickworks Precinct is located in the central Canberra suburb of Yarralumla, around three kilometres from the Canberra Central Business District (CBD). The Canberra Brickworks Precinct is proposed to be developed into around 380 residential dwellings and would repurpose a highly valued historical amenity. A new Access Road is required to service the Canberra Brickworks Precinct from Dudley Street and is a predevelopment requirement. The development of the Canberra Brickworks Precinct is not part of this Project would be undertaken as part of a separate Proposal (by the DOMA Group).

A feasibility design, concept design and preliminary sketch plan design have been developed for the Project which have identified improvements for Dudley Street and proposed an alignment for the new Access Road, including a new intersection from Dudley Street. The Project has been optimised during each of these design stages to minimise ecological and community impacts, while meeting design objectives and road design requirements.

The key features of the Project include:

- upgrading Dudley Street
- construction of a new roundabout intersection between Dudley Street and the new Access Road to the Canberra Brickworks Precinct
- construction of a new Access Road travelling north from the new roundabout intersection on Dudley Street to the proposed Canberra Brickworks Precinct
- off road shared path to the north of Dudley Street
- provisions to maintain pedestrian access along the Uriarra Track, including a minor diversion to allow pedestrians to see passing vehicles and a pedestrian refuge for safe crossing
- ancillary works including utilities diversion and/or relocation, earthworks, drainage modifications, provision of new street lighting, upgrades to kerbs and landscaping.

Subject to approval, construction is expected to commence in 2018 and take about 12 months to complete. The Access Road is required to be open prior to the proposed Canberra Brickworks Precinct construction works commencing to minimise construction traffic impacts and disruption (including site decontamination works) for residents of Yarralumla.

Operational impacts

The upgrade of Dudley Street is required to allow Dudley Street to operate safely and to meet the design requirements for a 'major collector road'. In order to meet current Estate Development Code guidelines for a major collector road, the typical cross section of Dudley Street must meet a minimum carriageway width of 10 metres. Dudley Street is currently six metres wide and does not have a sealed shoulder. Traffic counts undertaken in 2017 identified that Dudley Street had daily movements of 8,100 vehicles per day while its design capacity is currently for 6,000 vehicles per day.

The upgrade of Dudley Street is also needed to enable an access to the proposed Canberra Brickworks Precinct. This estate is likely to generate about 3,000 additional vehicles per day when fully developed. Approximately 80% of this traffic or 2,400 vehicles per day would access the estate via Dudley Street, via Cotter Road or Novar Street. There would also be background growth on Dudley Street with further development and growth in Yarralumla and Deakin, as well as a change in trip patterns as a result of further development of Molonglo.

In recent years traffic has been growing at about four per cent per annum due to growth in traffic from Molonglo and in Deakin. It is assumed that this background growth would continue for the next few years. Further traffic growth would occur as a result of the Canberra Brickworks Precinct, adding about 1,200 vehicles per day to the eastern end of Dudley Street (i.e. about 13 per cent more traffic). The improvements to Dudley Street would help alleviate the impacts of increased traffic due to the Brickworks development. The Project itself is unlikely to affect the amount of traffic using Dudley Street.

The Project aims to alleviate traffic congestion, shorten travel times and improve road safety when completed and operational. It would assist traffic movements along Dudley Street in the short- to medium-term. The primary benefits would be improved pedestrian and cycle facilities and enabling access to the proposed Canberra Brickworks Precinct.

The intersection of Dudley Street with Cotter Road is controlled by traffic signals and Novar Street by a roundabout. The Cotter Road intersection is operating efficiently with small delays and queues during peak periods. The Novar Street roundabout is near capacity.

Recent traffic modelling has highlighted the need to upgrade Novar Street roundabout within the next 10 years by removing the existing roundabout and installing traffic signals. Funding is likely to be sought by ACT Government to implement the Kent Street works in future. Actual timing for the works would depend on future monitoring of traffic growth and the operation of the Novar Street roundabout.

The Project would provide improved public transport provision and service to existing nearby Yarralumla residents and future residents of the Canberra Brickworks Precinct. New indented stops would be built close to the proposed access road intersection and new footpath connections would be provided to these stops.

Currently there are no formal paths or on-road cycle lanes on Dudley Street. The Project would address the lack of pedestrian and bicycle facilities on Dudley Street, enabling safer and more efficient connections between Yarralumla, Deakin and places west of Dudley Street via Cotter Road.

There is an existing informal recreation track to the north of Dudley Street (Uriarra Track) that would be impacted by the proposed Canberra Brickworks Precinct access road that forms part of the Project. A pedestrian refuge crossing arrangement would be provided on the Access Road to serve the track crossing.

As part of the Project pine log fencing be constructed to help prevent cars crossing the verge to access the Uniting Church via Dudley Street. This would improve traffic safety and reduce impacts to the adjoining environment.

Construction impacts

Potential impacts on traffic movement during construction would include increased travel times due to construction zone speed limits, truck and construction machinery movements, lane closures and stop/go operation. Works with the potential for traffic disruption, such as utility adjustments along the trafficked pavement, would be scheduled to take place outside of peak commuting periods in order to minimise road user delays. Works impacting on traffic lanes should be undertaken off peak or at night.

Temporary realignment of Dudley Street would be required to maintain traffic flow during construction of the upgrade and so temporary disruption to traffic is likely and is anticipated to be most acute during peak hours.

Dudley Street would remain open to traffic at all times. There would be some temporary traffic diversions built to allow construction that would involve traffic switch-overs. There would be minor delays at the time of traffic switch-overs, with traffic controlled by stop/go staff, but these would be

scheduled at times when traffic volumes are light. Stop/go operation under traffic control can be managed without undue traffic impacts and queuing.

One site compound is proposed at the west end of the site, so as to avoid unnecessary movement of trucks and equipment across the traffic lanes that remain open to general traffic on Dudley Street.

The day to day movement of construction plant (e.g. deliveries, mobile plant movements) is anticipated to generate on average about 5 to 10 truck movements on normal working days for delivery of construction material. It is envisaged that the peak number of truck movements would be generated by earthworks at the site (up to about 15 heavy vehicle trips per day).

The Project would cause minor delays to pedestrian and cyclist movements that cross Dudley Street west of the Novar Street roundabout during construction. This would not occur during peak periods and the proposed works would ensure that access is maintained.

Recommendations

Mitigation measures would be implemented to minimise traffic, transport and access impacts during construction and operation of the Project. Prior to the commencement of construction, a Construction Traffic Management Plan (CTMP) would be prepared as part of the Construction Environmental Management Plan.

Recommended measures to be implemented during construction include:

- procedures for preparing and implementing Traffic Control Plans (TCPs) for any detours or traffic controls to manage temporary road disruptions
- maximising safety and maintaining accessibility for pedestrians and cyclists
- ensuring adequate sight lines and providing stop/go staff to allow for safe entry and exit from the construction site
- parking locations for construction workers away from residential areas (e.g. at site compound) and details of how this would be monitored for compliance
- routes to be used by heavy construction-related vehicles to minimise impacts on local streets by using Dudley Street, the Kent Street bridge and the surrounding arterial road system
- scheduling of works/deliveries to avoid peak commuter and school times and limiting works in the road carriageway as much as practicable
- measures to manage traffic flows around the area affected by the Project, including as required regulatory and direction signposting, line marking and variable message signs and all other traffic control devices necessary for the implementation of the CTMP
- ensure that any work undertaken near Cotter Road does not disrupt traffic movements along Cotter Road; the construction of new pavement adjacent to the eastbound carriageway of Cotter Road may require late night road works to minimise disruption
- limiting impacts on through traffic movements on Dudley Street by avoiding traffic lane closures and diversions during peak hours
- providing advance notice of upcoming works to permit drivers to avoid travel or adjust speed and safely negotiate past the work site on Dudley Street
- advising local businesses, residents, bus operators and emergency service providers of the upcoming works
- monitoring of the performance of all Project traffic arrangements during construction
- schedule works with the potential for traffic disruption, such as utility adjustments along the trafficked pavement outside of peak commuting periods in order to minimise road user delays. Works impacting on traffic lanes to be undertaken off peak (or at night)

- secure work zones to prevent unauthorised access, including pedestrian access with site perimeter fencing and secured gate(s), as required, in particular to prevent access outside work hours
- implementing temporary speed restrictions as appropriate, in consultation with TCCS
- Despite the absence of observed pedestrian and cycle movements and facilities on Dudley Street, advance warning for cyclist and pedestrians of proposed shoulder/ lane closures should be provided and that traffic controllers be available to monitor and supervise a safe route for pedestrians and cyclists past the worksite

1.0 Introduction

The ACT Government's Infrastructure Finance and Capital Works (IFCW) has engaged AECOM Australia Pty Ltd (AECOM) to complete a Traffic and Transport Impact Assessment for the proposed upgrade of Dudley Street and associated access road to support the development of the proposed Canberra Brickworks Precinct in Yarralumla, ACT.

This Traffic and Transport Impact Assessment has been prepared as a component of the Environmental Planning and Sustainable Development Directorate (EPSDD) requirements for EIS Exemption in accordance with Section 211 of the *Planning and Development Act 2007* and other relevant legislation. It would also be used to support a National Capital Authority (NCA) Works Approval.

1.1 Background

Dudley Street provides a link from north western Canberra to the suburbs of Yarralumla (via Novar Street) and Deakin, Hughes and Garran (via Kent Street). It is presently only six metres wide and does not have a sealed shoulder. An upgrade of the width of the road and provision for cyclists is desirable, as it is a major collector proposed to carry over 9,000 vehicles per day.

Dudley Street connects Cotter Road to the Dudley Street / Novar Street / Adelaide Avenue off ramp / Kent Street (Novar Street roundabout), which is the primary constraint to traffic movement along Dudley Street. It carries a high volume of traffic during peak periods, including a high proportion of trips to the Deakin Commercial Area to the south of Dudley Street and Yarra Glen.

In 2016, AECOM prepared a traffic assessment which determined that Dudley Street is functioning at capacity under existing traffic conditions. Upgrades are required to allow Dudley Street to operate safely and to meet the design requirements for a 'major collector road' and to enable safe access to the proposed Canberra Brickworks Precinct.

1.2 Project objective

The Project aims to alleviate traffic congestion, shorten travel times and improve road safety when completed and operational. Temporary realignment of Dudley Street would be required to maintain traffic flow during construction of the upgrade and so temporary disruption to traffic is likely and is anticipated to be most acute during peak hours.

1.3 Study area

The proposed access road and Dudley Street is located in Yarralumla, south of the Canberra Brickworks. The general area of the Brickworks site and the current alignment of Dudley Street is shown in Figure 1.

The following are close to the vicinity of the study area:

- Government House is situated to the north-west off Dunrossil Drive
- Yarralumla Uniting Church to the north of Dudley Street
- Yarralumla residential area, Yarralumla shops, Royal Canberra Golf Club and Lake Burley Griffin to the north
- Deakin commercial area to the south.

Figure 1 Regional context of the Project

1.4 Proposed works

The Project would include the following key elements:

- upgrading Dudley Street
- construction of a new roundabout intersection between Dudley Street and the new Access Road to the Canberra Brickworks Precinct
- construction of a new Access Road travelling north to connect the new roundabout intersection on Dudley Street to the proposed Canberra Brickworks Precinct
- provision of upgraded bus stops including associated path networks
- provision of an off road shared path north of Dudley Street
- provisions to maintain pedestrian access along the Uriarra Track

- ancillary works including services diversion and/or relocation, earthworks, drainage modifications, provision of new street lighting, upgrades to kerbs and landscaping.

The Project layout and surrounding environment is provided in Figure 2. The Project would provide the publicly funded access to allow the development of the Canberra Brickworks Precinct. As the responsible party for developing the majority of roads in ACT, the ACT Government (IFCW) is the proponent for the Project.

A new access road is required to service the Canberra Brickworks Precinct from Dudley Street. The Canberra Brickworks Precinct is proposed to be developed into around 380 residential dwellings and would repurpose a highly valued historical amenity. The development of the Canberra Brickworks Precinct is not part of this Project would be undertaken as part of a separate proposal (by the DOMA Group).

Currently, there is only one residential access road to the Canberra Brickworks Precinct which is Denman Street. To cater for the development, a new access road to the Canberra Brickworks Precinct from Dudley Street is required together with upgrading Dudley Street which is at capacity under existing traffic use conditions.

A feasibility design, concept design and preliminary sketch plan (PSP) design have been developed for the Project which have identified improvements for Dudley Street and proposed an alignment for the new access road, including a new intersection from Dudley Street. The Project has been optimised during each of these design stages to minimise ecological and community impacts, while meeting design objectives and road design requirements.

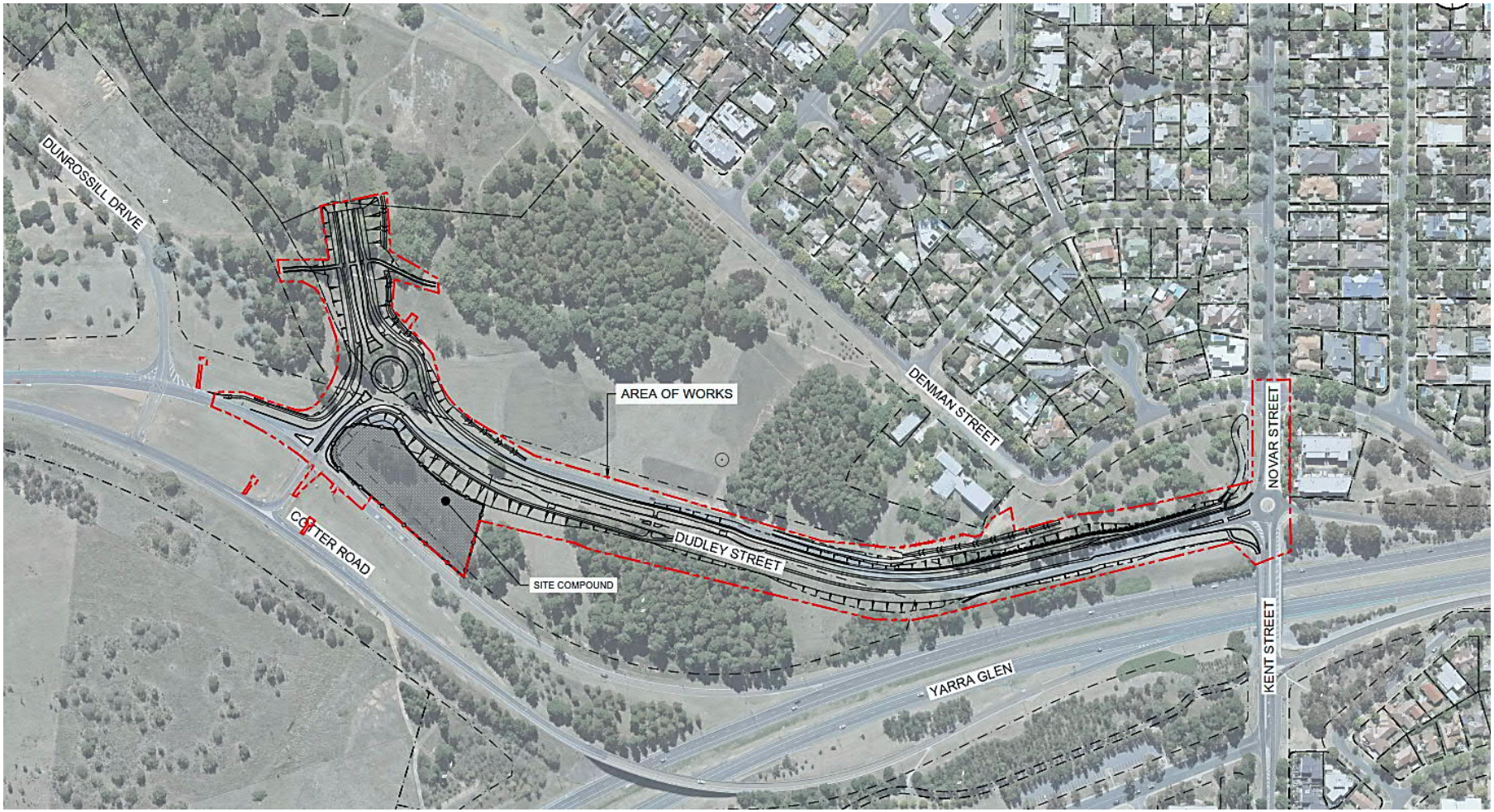


Figure 2 Project layout and surrounding environment

1.5 Scope of study

This traffic and transport impact assessment provides a high level assessment of the potential impacts of the Project on traffic, access and road safety. The purpose of this report is to:

- describe the existing traffic and transport conditions on the existing road and intersections to be upgraded as part of the Project
- evaluate the design of the Project to safely and efficiently cater for future growth in traffic and transport demand on Dudley Street
- assess the potential traffic and transport impacts of the Project on Dudley Street and the surrounding road network during construction and operation
- recommend mitigation measures to manage adverse traffic and transport impacts, if required.

Table 1 summarises the location in this report of information required to support this assessment.

Table 1 Required information for a scoping application

Required information under Form 1M	Location in this report
Existing traffic and transport conditions	Section 2.0
Evaluation of the design of the Project	Section 3.0
Potential traffic and transport impacts of the project during operation	Section 3.0
Potential traffic and transport impacts of the project during construction	Section 5.0
Mitigation measures to manage adverse traffic and transport impacts	Section 6.0

Site visits to observe current traffic conditions at the site and a number of recent technical documents have informed this assessment. The documents referred to are:

- Canberra Brickworks Precinct Site Investigation - Traffic, Transport and Carparking (AECOM, February 2016)
- Canberra Brickworks Precinct Access Road and Dudley Street Upgrade – Preliminary Sketch Plan Report (AECOM, June 2017)
- Canberra Brickworks Precinct Access Road and Dudley Street Upgrade – Development Application Report (AECOM, October 2017)
- Novar Street / Kent Street Intersection – Concept Design Report (AECOM, November 2017).

2.0 Existing conditions

2.1 Road network

Figure 3 shows the road network and hierarchy in the area, as well as available traffic counts and observed speeds. The blue boxes provide recent count data, whilst the grey boxes are older counts.

The classification of roads in the ACT is based on a formal road hierarchy. The classification fundamentally relates to the predominant function of a road and to the extent it serves the two basic purposes of the road network – the movement of traffic and access to property.

Arterial roads predominantly serve longer distance travel within a district and through traffic from one district to another. Traffic capacity is a function of the design of the road rather than being constrained by environmental objectives.

Major collector roads collect and distribute traffic within residential, industrial and commercial areas. They form the link between the primary network and the roads within local areas and should carry only traffic originating or terminating in the area. The volume of traffic carried is constrained by environmental objectives - safety and traffic noise - rather than road geometry and reflects the limited area that they serve.

Minor collector roads collect and distribute traffic from access streets, linking to the major collector roads within the neighbourhood. They can also provide secondary connections direct to the external arterial road network. Traffic volumes are compatible with direct property access.

Access streets are used where the residential environment is dominant, traffic is subservient, speed and traffic volumes are low and pedestrian and cycle movements are facilitated. The primary role of Access Streets is to provide direct property access. Access streets can link traffic from the local network (including rear lanes) to collector roads.

It is considered good practice in designing roads in new estates in ACT to achieve the following volumes of traffic for different road classifications:

- Arterial roads – no limit and is dependent on design and number of lanes
- Major collector roads – generally not greater than 6,000 vehicles per day, but can exceed this for sections of road with no direct property accesses
- Minor collector roads – traffic volumes up to 3,000 vehicles per day are compatible with direct property access
- Access streets - traffic volumes not greater than 1,000 vehicles per day are desirable

Figure 3 indicates that the road classifications in Yarralumla are good indicators as to the daily traffic volumes on the roads surveyed. Some access streets exceed their environmental volume capacity in the vicinity of the shops, which would be primarily due to a higher number of trips around the shops.

Cotter Road, Novar Street and Kent Street intersect with Dudley Street.

Cotter Road is a two-way dual-carriageway road with two lanes in each direction to the west of Dudley Street and a single lane in each direction to the east of Dudley Street. The carriageway widths of Cotter Road vary from about 5.5 m to 9.0 metres within the vicinity of the site. The current daily traffic volumes for this road are about 16,000 vehicles per day east of Dudley Street. On-road cycle lanes are located on Cotter Road in the vicinity of the site.

Novar Street is a major collector road that meets Kent Street on the overpass allowing vehicles leaving Adelaide Avenue and Yarra Glen to access key generators such as the hospital. Novar Street is currently configured with a two-way single carriageway road with a single lane in each direction. These lanes are configured with approximate lane widths of four metres.

Kent Street is a major collector road running south from the Dudley Street and Novar Street roundabout. It provides connectivity between Yarralumla, Deakin and Hughes. In the vicinity of the site it is a two-way single-carriageway road with one lane in each direction. The lane widths are about 3.3 metres wide immediately south of the site. The current daily traffic volumes on Kent Street directly south of the site are about 13,000 vehicles per day.

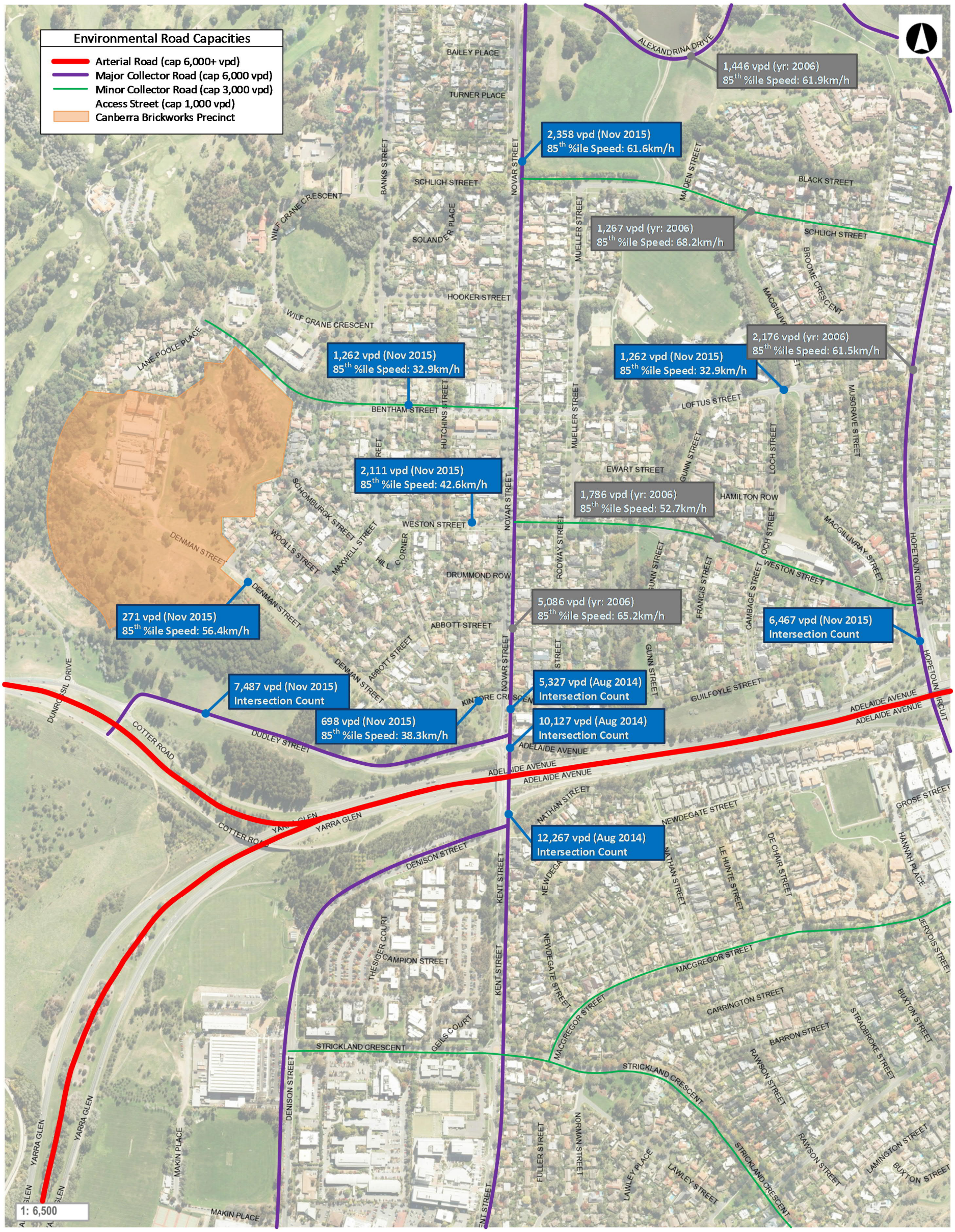


Figure 3 Daily traffic volume and speed summary

2.2 Dudley Street

Dudley Street is a major collector road located between Cotter Road and Novar and Kent Streets. It is a key eastbound road link between Cotter Road and the suburbs of Yarralumla and Deakin. Dudley Street is currently a two-way single-carriageway road with a single lane in each direction typically three metres in width. The current daily traffic for this road is around 8,100 vehicles per day (based on a traffic count in June 2017). There are two existing bus stops located on Dudley Street that are currently not in use, and an informal access to the Yarralumla Uniting Church. There are no pedestrian or cyclist facilities. It is poorly lit with street lighting facilities at intersections either end of the road, but no lighting mid-block. The upgrading of Dudley Street is a major component of the Project.

There are currently two bus stops on Dudley Street, shown in Figure 4, and an informal access to the Yarralumla Uniting Church. There are no pedestrian or cyclist facilities. It is poorly lit with street lighting facilities at intersections either end of the road, but no lighting mid-block.

Figure 4 View of the Dudley Street bus stops looking west from the near the Yarralumla Uniting Church

The intersection of Dudley Street with Cotter Road is controlled by traffic signals and Novar Street by a roundabout. The Cotter Road intersection is operating efficiently with small delays and queues during peak periods. The Novar Street roundabout is near capacity. The peak hour performance of these intersections is summarised in Table 2.

Table 2 SIDRA summary table

Intersection	AM Peak Performance				PM Peak Performance			
	Degree of Saturation	Average Delay (secs)	Level of Service	95th %ile Queue	Degree of Saturation	Average Delay (secs)	Level of Service	95th %ile Queue
Novar Street/ Dudley Street/ Kent Street / Adelaide Avenue	0.773	18.1	B	81m	0.864	11.7	A	126m
Kent Street/ Adelaide Avenue Off Ramp	0.801	5.9	A	48m	0.643	4.5	A	24m
Dudley Street/ Cotter Road (Eastbound)	0.887	20.4	B	192m	0.840	20.1	B	178m
Dudley Street/ Cotter Road (Westbound)	0.247	5.3	A	1m	0.661	5.2	A	1m

Level of Service (LoS) is determined by the average delay for each vehicle. The range definitions for level of service can be seen in Table 3 below.

Table 3 Level of service definition table

Level of Service	Average Delay / Vehicle (sec/veh)	Traffic Signals, Roundabouts
A	Less than 14	Good Operation
B	15 to 28	Good with acceptable delays and spare capacity
C	29 to 42	Satisfactory
D	43 to 56	Operating near capacity
E	57 to 70	At capacity; at signals incidents would cause excessive delays
F	>70	Roundabouts require other control mode

95th percentile queue indicates that 95% of the time the queue would be less than the indicated length during the peak hour modelled.

Overall, the average delays for the intersections were fairly low. This relates to an overall intersection level of service of A or B which would normally indicate good operation. However, some legs experience greater queuing and delays.

The main findings from the SIDRA results are:

- The Novar Street/Dudley Street/Kent Street/Adelaide Avenue roundabout in the AM peak experiences 95th percentile queues of 81 metres on Dudley Street and 70 metres on Novar Street. Similarly, in the PM peak a 95th percentile queue of 126 metres on the Kent Street approach is shown. Although overall the intersection is operating at an acceptable Level of Service (LoS B in the AM Peak), these queue lengths indicate that these movements within the

intersection are operating close to capacity and intersection improvement measures would likely be necessary if increases in traffic volumes were expected.

- The Dudley Street/Cotter Road (Eastbound) intersection in the AM peak experiences a 95th percentile queue of 192 metres on the Cotter Road approach. Similarly, in the PM peak a 95th percentile queue of 178 metres on the northern Dudley Street approach as indicated. In both of these peak periods the indicated level of service for the intersection remains satisfactory (LoS C for the worst movement of each leg of the intersection).

2.3 Public transport facilities

Maps showing the bus routes in the vicinity of the study area are shown in Figure 5 and Figure 6 for weekdays and weekends, respectively. None of these buses currently use Dudley Street, although legacy bus stops exist on Dudley Street.

While there are a large number of bus routes which travel along Cotter Road and Adelaide Avenue past the site, there are currently no stops which give residents of Yarralumla access to these services. However, some of the Weston/Molonglo routes are planned to re-route via Dudley Street to serve the future Canberra Brickworks Precinct and a stop is envisaged nearby as part of the proposed light rail link between City and Woden.

There is currently a single route which services Yarralumla, being Route 1 on a weekday or Route 932 on a weekend. Route 1 travels between Woden Town Centre and Dickson Group Centre and Route 932 travels between Belconnen Town Centre and Woden Town Centre. Within Yarralumla both routes travel along Novar Street, Schlich Street and Hopetoun Circuit.

A summary of current bus headways or frequencies for routes passing in vicinity of the site is given in Table 4. This indicates that the bus service to the Yarralumla area is acceptable in the peak periods, but limited during off-peak and on weekends. However, it would improve significantly in future.

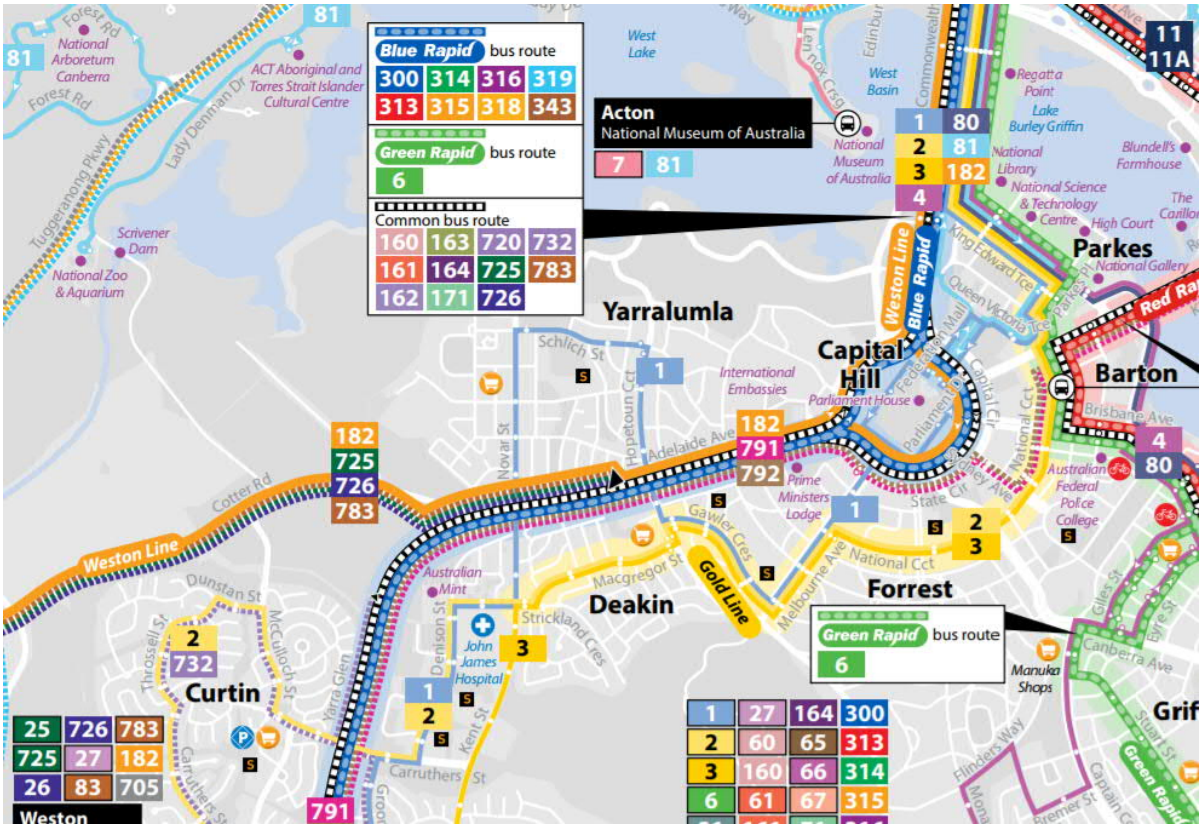


Figure 5 Weekday public transport routes

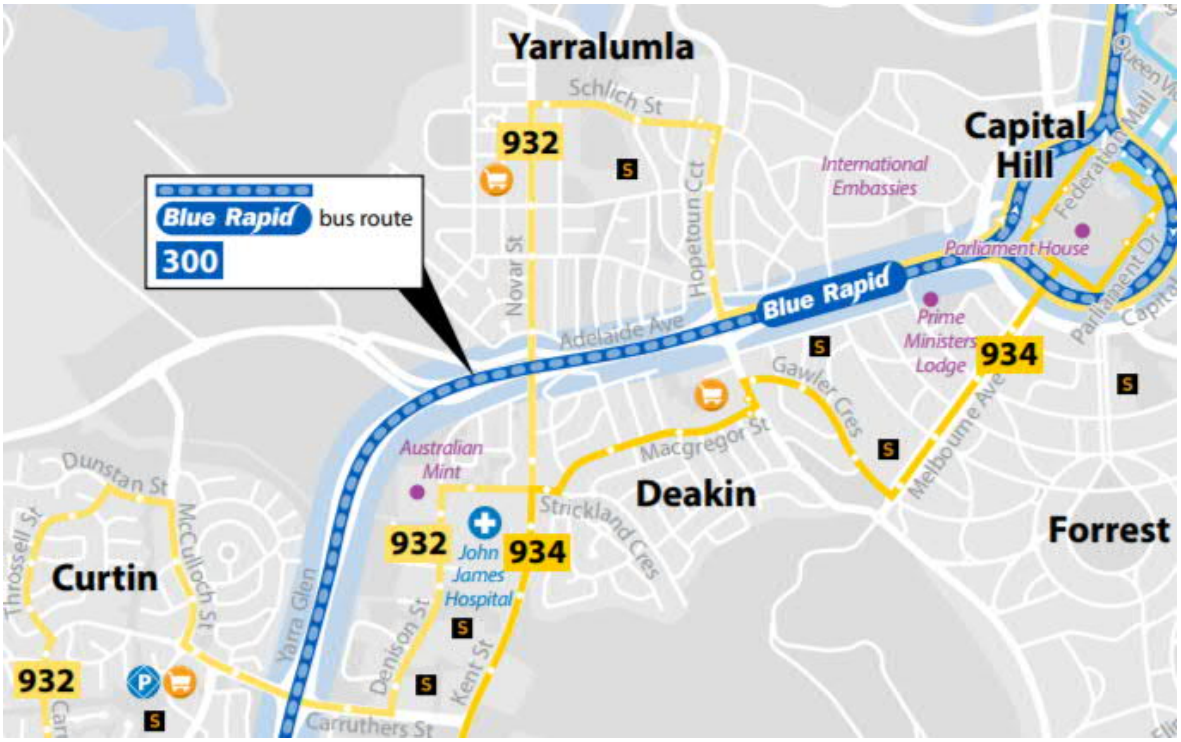


Figure 6 Weekend public transport routes

Table 4 Public transport provision

Service	Route #	Route Description	Headway (Peak/Off Peak)
Weekday Bus	1	Woden to Dickson	20 mins / 60 mins
	182	Woden to Dickson	20 mins / 60 mins
	725	City to Woden	30 mins/ 30 mins
	726	Woden to Cooleman Court	25 mins / 60 mins
	783	Woden to Chapman	25 mins / 60 mins
	791	Woden to Cooleman Court	45 mins / 60 mins
	792	Woden to Fairbairn Park	20 mins / NA
	300	Belconnen to Tuggeranong	15 mins/ 15 mins
Weekend Bus	300	Belconnen to Tuggeranong	15 mins/ 15 mins
	932	Woden to Belconnen	60 mins / 60 mins

2.4 Active transport

A map showing existing paths in the area is provided in Figure 7. Yarralumla has an excellent provision of footpaths with almost all verges containing paths. The quality of the paths is generally reasonable although there are isolated areas of cracking or level differences.

Figure 7 Existing formal pathways

No formal paths or on-road cycle lanes currently exist on Dudley Street. There are pedestrian and bicycle facilities at either end of Dudley Street, on Cotter Road and Novar Street/Kent Street. The off-road cycle path that crosses the northern end of Dudley Street and connects Yarralumla with Deakin and Woden is highlighted in the map in Figure 7 and shown in the photo in Figure 8. While on site it was noticed that there was a large number of cyclists crossing Dudley Street utilising the pedestrian refuge. As there is currently no keep clear section marked on the road the bikes must sometimes weave through the two lanes of traffic that are queued while waiting for the roundabout.

Figure 8 View of the pedestrian / cycle crossing of Dudley Street near the Novar Street / Kent Street roundabout

On-road cycle lanes are provided along Cotter Road, Adelaide Avenue and Yarra Glen. There is indirect connectivity between the local off-road cycle path network and on-road cycle lanes. Connections are provided city-bound to Adelaide Avenue near the eastern end of the on-ramp from Novar Street south of the intersection of Guilfoyle Street and Newman Street. There is also a connection to Cotter Road via the Kent Street bridge and an off-road cycle path south of Yarra Glen, which also connects to Yarra Glen. These connections are shown in Figure 9.

Figure 9 Bicycle travel links

The Uriarra Track is an existing informal track that traverses the site in an east west direction, as shown in Figure 10 and Figure 11. It is used by recreation walkers. The track would be impacted by the earthworks for the proposed access road to the Canberra Brickworks Precinct off Dudley Street.

Figure 10 Aerial view of approximate location of Uriarra track

Figure 11 View of Uriarra track looking east

2.5 Parking

There is no car parking on or adjacent to Dudley Street. However, cars access car parking adjacent to the Yarralumla Uniting Church across the verge of Dudley Street. These cars have worn a dirt track towards the church, as shown in Figure 12.

Figure 12 View showing the unauthorised access from Dudley Street to the Yarralumla Uniting Church car park

3.0 Operational impacts

3.1 Future demand

The upgrade of Dudley Street is needed to enable an access to the proposed Canberra Brickworks Precinct. This is likely to generate about 3,000 vehicles per day when fully developed. Approximately 80% of this traffic or 2,400 vehicles per day would access the estate via Dudley Street; the remainder via Denman Street (i.e. 600 vehicles per day).

In the peak hours the majority of traffic from the Canberra Brickworks Precinct is expected to use Cotter Road to access the arterial road system (about 60%), via the short link between the proposed roundabout access on Dudley Street and the Cotter Road signals. The remaining traffic would likely use the eastern leg via the Novar Street roundabout. There would be a shift in traffic, with a greater proportion using the Cotter Road access as traffic grows and congestion builds at the Novar Street roundabout.

There would also be background growth on Dudley Street with further development and growth in Yarralumla and Deakin, as well as a change in trip patterns as a result of further development of Molonglo. Table 5 shows the recent historic and future forecast traffic growth along Dudley Street. In recent years traffic has been growing at about four per cent per annum due to growth in traffic from Deakin and Molonglo. It is expected that this background growth would continue for the next few years; that is, traffic on Dudley Street would continue to grow with or without the Project. Further traffic growth would occur as a result of the Canberra Brickworks Precinct, adding about 1,200 vehicles per day to the eastern end of Dudley Street (i.e. about 13% more traffic).

Table 5 Forecast daily traffic

Project impacts	Year	Vehicles per day on Dudley Street	
		No Canberra Brickworks Development	With Canberra Brickworks Development
Do nothing	Nov 2015	7,500	N/A
	June 2017	8,100	N/A
	2020	9,100	N/A
With Project	2020	9,100	10,300

Note: The forecasts are based on midblock traffic flows west of Novar Street and assuming the Canberra Brickworks Precinct is fully developed by 2020 (i.e. 380 dwellings)

The upgrades to Dudley Street would include improvements to the vertical alignment (i.e. reducing changes in heights) and horizontal geometry (i.e. less tight curves) which better suit the speed limits currently in place along this road. Modifications would include an improved entry angle at the Dudley Street / Cotter Road intersection making it safer for vehicles to turn left off Cotter Road into Dudley Street. There would be improvements to the Dudley Street intersection at the Novar Street roundabout with the provision of a greater length of the left hand turn lane which would reduce queuing.

Overall the Project would assist traffic movements along Dudley Street in the short and medium-term and provide for an access to the Canberra Brickworks Precinct. There are future potential opportunities to improve the level of service at the Novar Street roundabout which are considered in further detail below.

3.2 Traffic

The improvements to Dudley Street would help alleviate the impacts of increased traffic due to the Canberra Brickworks Precinct development. The Project itself is unlikely to affect the amount of traffic using Dudley Street. The Project would assist traffic movements along Dudley Street in the short and medium term. The primary benefits would be improved pedestrian and cycle facilities and enabling access to the proposed Canberra Brickworks Precinct.

The increased traffic demand on Dudley Street would put additional pressure on nearby intersections at either end of the Kent Street bridge (see Figure 13). These intersections are already near capacity.

Recent traffic modelling of these intersections by AECOM (November 2017) indicated the need for upgrading these intersections within the next 10 years. In determining the suitability of the current network to accommodate future growth, the future volumes were applied to the current network. The resulting impact for the AM peak was an almost exponential increase in delays. This has been plotted in Figure 14. This increase in delay is largely the result of increased background traffic growth.

Figure 13 Intersections requiring future capacity upgrades

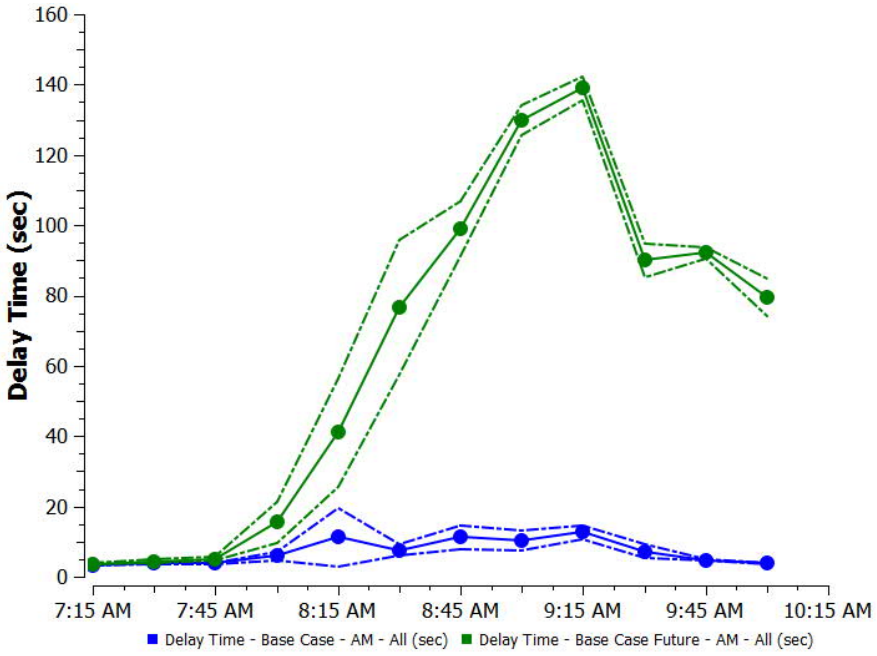
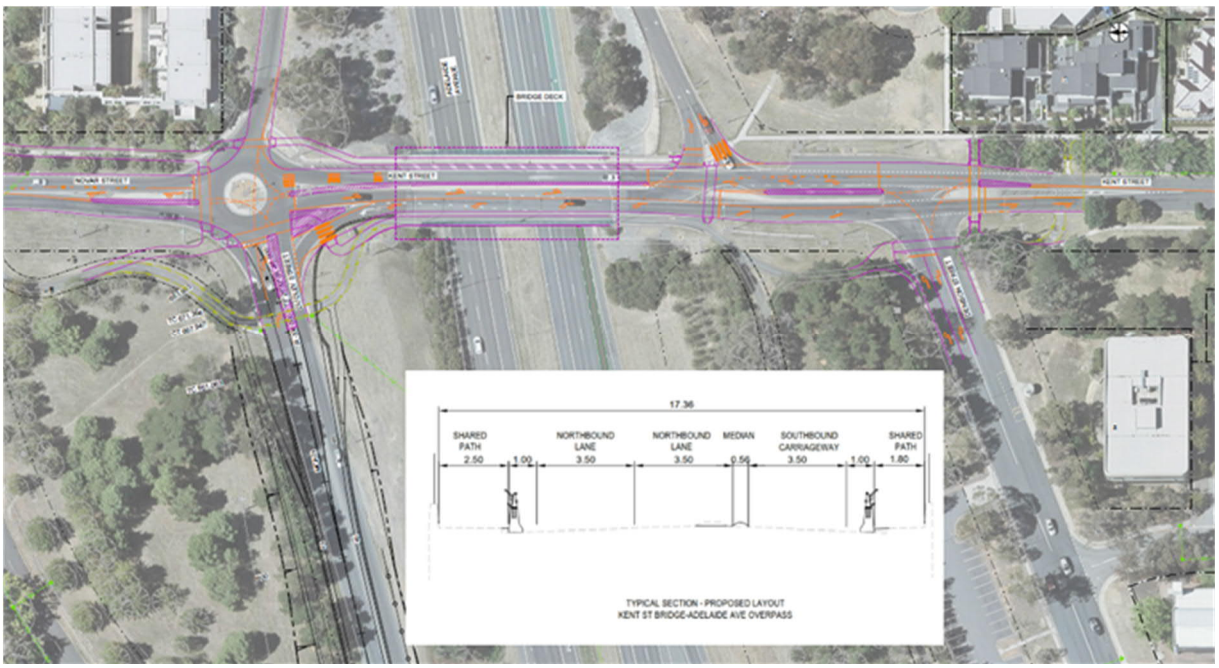


Figure 14 Dudley Street Approach to Kent Street - AM Base Case - Future Volumes

The PM 'do nothing' case has a similar but less severe delay time differential.

The preferred intersection upgrade is for signalisation of each of the intersections. The proposed signalising of the three intersections to improve traffic safety and efficiency requires adjustments to the existing bridge and adjacent intersections as shown in the Concept Plan below (Figure 15).



Source: AECOM, November 2017

Figure 15 Preliminary concept plan for upgrade of Kent Street intersections

Key elements of this upgrade include:

- Dedicated right turn lane from Dudley Street and a separate short shared through and left turn lane
- Retention of and minor augmentation of the left slip lane form Kent Street to Dudley Street
- Two southbound lanes on Novar Street – merging to one lane before the bridge due to geometric constraints over the bridge
- A separate right and left lane on the Adelaide Avenue off ramp
- Two northbound lanes on approach to the Denison Street intersection.

This concept design is to be refined to produce a more detailed design and for ACT Government to seek future funding for these works in the short and medium term. The timing of implementation of these upgrade works would also be subject to monitoring the performance of these intersections.

3.3 Public transport

The Project would provide improved public transport provision and service to existing nearby Yarralumla residents and future residents of the Canberra Brickworks Precinct.

Transport Canberra has indicated that some of the bus routes from Weston and Molonglo would be diverted via Dudley Street following completion of the Canberra Brickworks Precinct. Also, a future public transport stop is envisaged nearby on Adelaide Avenue as part of the proposed light rail link between City and Woden.

The existing bus stops near the Uniting Church would be removed as part of the reconstruction of Dudley Street. New indented stops would be built at a location as close as possible to the proposed access road to the Canberra Brickworks Precinct. New footpath connections would be provided to these stops from the Canberra Brickworks Precinct and the existing Yarralumla suburb.

3.4 Active transport

The Project would address the lack of pedestrian and bicycle facilities on Dudley Street, enabling safer and more efficient connections between Yarralumla, Deakin and places west of Dudley Street via Cotter Road. The paths have been designed in accordance with Austroads Part 6A Pedestrian and Cyclist Paths and do not comply with AS1428, Design for Access and Mobility.

A 2.5 metre wide shared path is proposed on the eastern side of the Access Road to the roundabout and continuing along the northern verge of Dudley Street connecting to the shared path at Novar Street.

A 1.5 metre wide shared path on the western verge of the Access Road would continue past the roundabout on the southern verge of Dudley Street to the bus stop; also with connections to the existing on-road cycle lanes on Cotter Road.

There is a proposed off-road shared path along Denman Street to be provided as part of the Canberra Brickworks Precinct development works that would connect to the off-road system in Kintore Crescent.

The proposed cross-section for Dudley Street would include 1.5 metre wide shoulders that could be used for on-road cycling. The traffic lanes would be wider than currently (3.5 metre) so as to cater safely for buses and provide improved amenity to cyclists.

The Uriarra Track would be impacted by the earthworks and the cut batter for the Access Road. Due to safety concerns regarding visibility of pedestrians the crossing location has been realigned closer to the Canberra Brickworks Precinct development. A pedestrian refuge crossing arrangement would be provided on the Access Road to serve the track crossing this road.

3.5 Parking impacts

The Project would have no impact on car parking.

3.6 Property access

The Project would enable good access to the proposed Canberra Brickworks Precinct, including a new road, roundabout intersection with Dudley Street and new pedestrian and bicycle facilities.

As part of the Project, pine log fencing would be constructed to help prevent cars accessing the Uniting Church via Dudley Street. This would improve traffic safety and reduce impacts to the adjoining environment.

4.0 Construction activities

4.1 Dudley Street upgrade

Dudley Street would be upgraded from a six metre wide single carriageway to a 10 metre single carriageway to meet the design requirements for a major collector road and ACT Estate Development Code guidelines. The upgraded road will also compliment the new Access Road into the Canberra Brickworks Precinct. The proposed cross section on Dudley Street is as follows:

- 3.5 metre wide traffic lane with a 1.5 metre shoulder
- 7.0 metre wide verge on the northern side generally to cater for:
  - 2.5 metre wide shared path
  - Street lights and utilities.
- 4.5 metre wide verge on the southern side generally to cater for:
  - Street lights and utilities.

Bus stops and associated paths would also be provided.

4.2 Access road

Provision of a new 180 metre long Access Road (to be classified in the ACT as a minor collector road), and intersection, connecting from Dudley Street and extending through Yarralumla Section 94 Block 3 to provide access for the future development requirements of the Canberra Brickworks Precinct. The proposed cross section of the Access Road is as follows:

- 3.5 metre wide traffic lane
- 4.5 metre wide raised median with tree planting
- 6.7 metre wide verge on the western side generally to cater for:
  - 1.5 metre wide path
  - 1.5 metre utility corridor
  - 3.7 metre verge for tree planting and street lights.
- 7.7 metre wide verge on the eastern side generally to cater for:
  - 2.5 metre wide path
  - 1.5 metre utility corridor
  - 3.7 metre verge for tree planting and street lights.

4.3 Ancillary facilities

One construction compound location has been identified for use during the construction phase that would be used for site offices, construction staff amenities, storage of machinery, vehicles, equipment and material laydown areas. The compound would be located in the western extents of the Project between Dudley Street and Cotter Road. The compound area would also be used for the temporary realignment of Dudley Street to maintain traffic flow during construction of the upgrades of the Cotter Road / Dudley Street intersection.

The opportunity for an alternative location for the construction compound is currently being investigated. This would be within the Canberra Brickworks Precinct site prior to its development (with the agreement of the DOMA Group). The use of this location is highly dependent on the scheduling of the proposed activities and the existing development of the site, and also on successful contract negotiations between the responsible parties.

4.4 Construction staging

Subject to approval, construction is expected to commence in 2018 and take around 12 months to complete. The construction methodology would be further developed during the detailed design of the Project, in consultation with ACT Government.

The proposed construction activities for the Project are identified in Table 6. This staging is indicative and is based on the current concept design and may change once the detailed design methodology is finalised. The staging is also dependent on the Contractor's preferred methodology, program and sequencing of work.

The proposed construction staging strategy for the Project is based on ensuring that Dudley Street is open to traffic throughout the construction period (as far as practicable) to minimise traffic disruption on this highly utilised asset. Temporary tie-in works would be required to enable works on the existing Dudley Street to be undertaken while maintaining access.

Table 6 Indicative construction staging and traffic control for key activities

Stage	Activities	Traffic control
Site establishment and enabling works	• Survey and setting out • Establishment of site compound (i.e. erect fencing, tree protection zones, site offices, amenities and plant/material storage areas) • Establishment of traffic control facilities (e.g. signage and safety barriers) • Removal of identified vegetation • Services relocations	Traffic would continue to use Dudley Street in its current arrangement during this stage
Stage 1 Refer to Figure 16 for the proposed layout of Stage 1	• Construction of the new roundabout and the Access Road • Construction of new pavement and earthworks north of existing Dudley Street alignment at the approach to Novar Street intersection and temporary (eastern) tie-in to existing Dudley Street • Construction of new pavement and earthworks south of the existing Dudley Street and temporary (western) tie-in to Cotter Road intersection	Traffic would continue to use Dudley Street in its current arrangement during this stage
Stage 2 Refer to Figure 17 for the proposed layout of Stage 2	• Upgrades to Dudley Street at the approach to Novar Street • Construction on existing Dudley Street between new Stage 1 works (south of existing Dudley Street) and Novar Street	Traffic would use the new pavement from Novar Street and eastern temporary tie-in constructed in Stage 1 works and back onto existing Dudley Street further west of Novar Street.
Stage 3 Refer to Figure 18 for the proposed layout of Stage 3	• Construction on existing Dudley Street between new Stage 2 works and Cotter Road • Installation of street lights • Commissioning of the new infrastructure • Site rehabilitation and demobilising including the removal of the construction compound	Traffic would use the new pavement from Novar Street and western temporary tie-in to Cotter Road constructed in Stage 1 works.

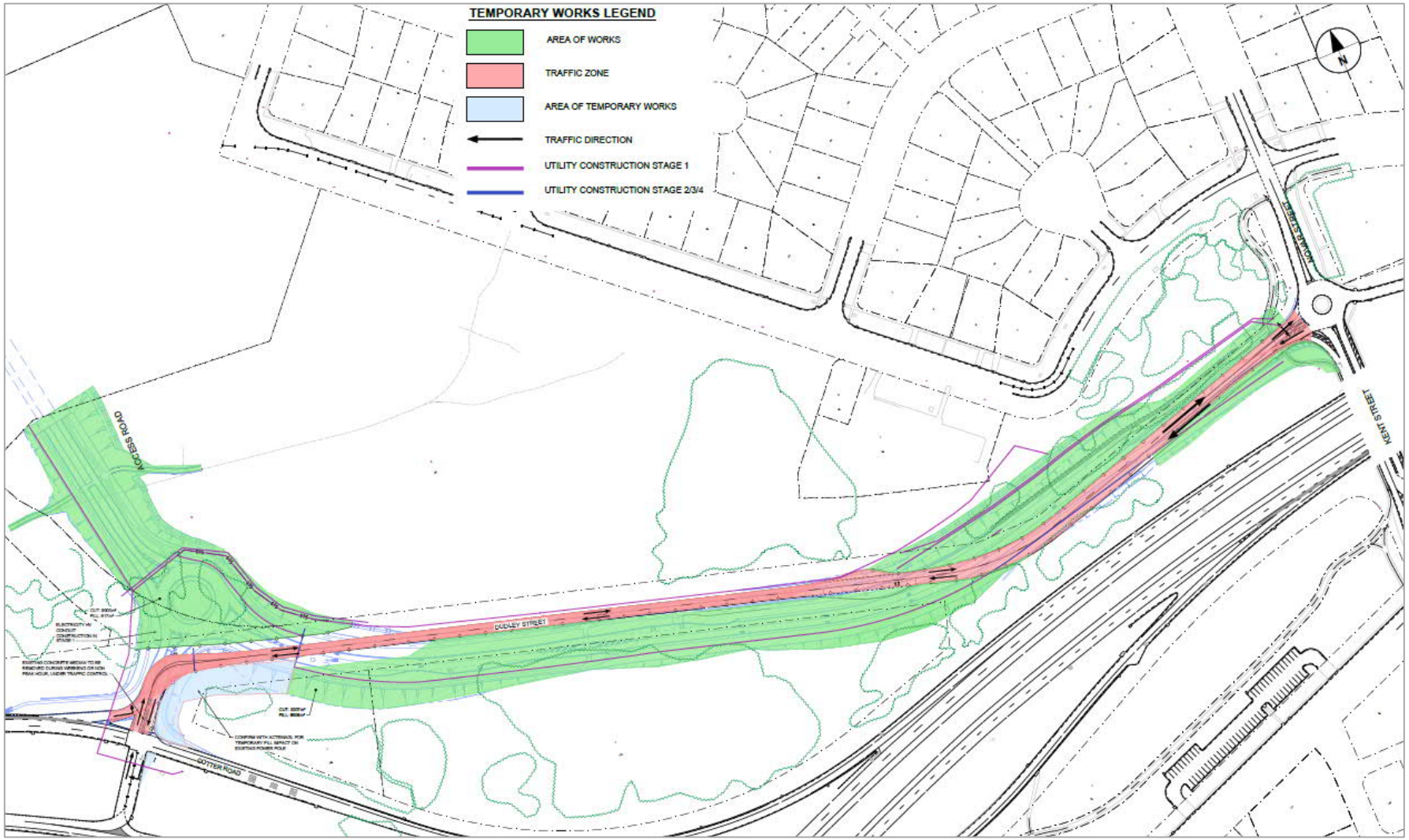


Figure 16 Stage 1 layout (*subject to detailed design*)

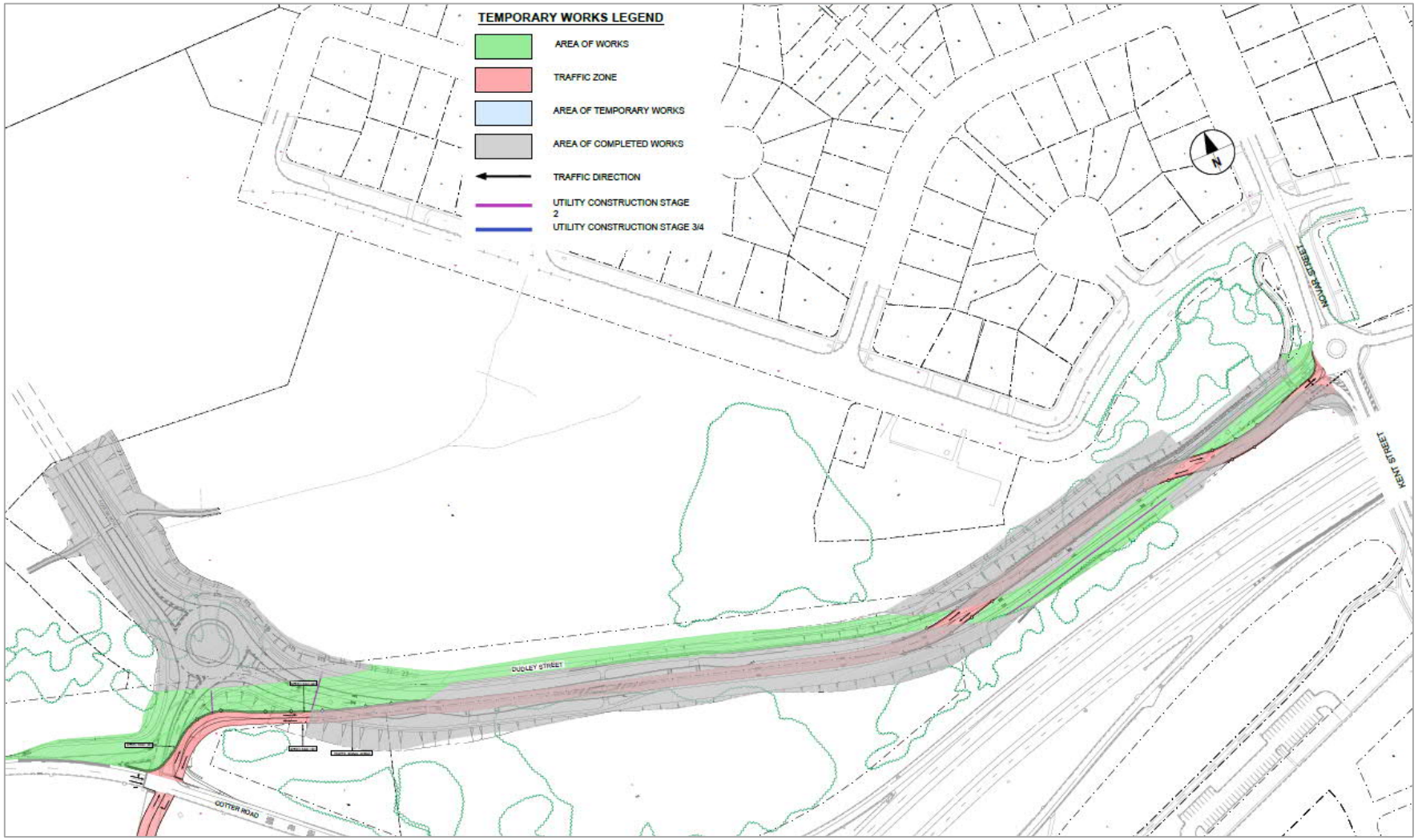


Figure 17 Stage 2 layout (*subject to detailed design*)

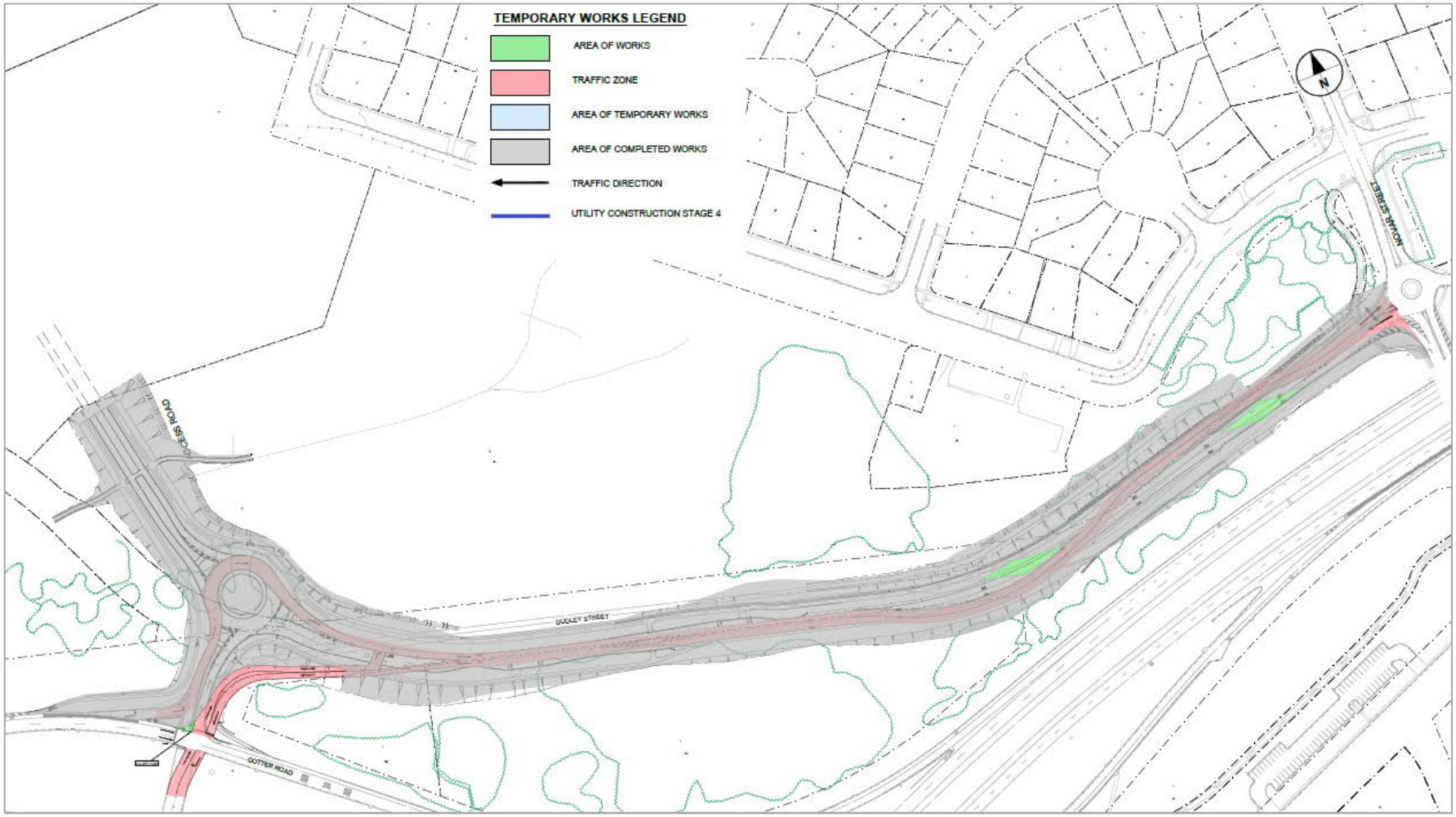


Figure 18 Stage 3 layout (*subject to detailed design*)

4.5 Construction vehicle routes

Various material, plant and equipment would be required to facilitate construction. These would be delivered by a range of various sized trucks, including small delivery trucks, rigid trucks and semi-trailers.

The construction site is close to the major arterial roads of Tuggeranong Parkway and Adelaide Avenue / Yarra Glen. All trucks would approach the site from these roads, then via Cotter Road, another arterial road, to Dudley Street a major collector road and the site of the construction activity.

Movements to/from the site from Yarra Glen is restricted and it is desirable that trucks accessing the site from the south use Tuggeranong Parkway and Cotter Road, as well as other major arterial roads such as Hindmarsh Drive. This should form part of the Construction Management Plan if large trucks need to access the site from the south.

4.6 Site security, site access and signage

Access to work areas would consider:

- safety of travelling public
- safety of construction workers and equipment
- impact on local communities in terms of safety, noise and road damage
- ease of access for emergency vehicles
- site security, particularly outside work hours.

4.7 Worker induction

All workers and sub-contractors engaged during the construction phase would be inducted prior to any commencement of works. The induction would identify the construction haulage routes, local speed zones, worksite protocols, staff parking facilities / public transport availability / carpooling opportunities and emergency / incident management strategies. Workers would be encouraged to park away from the station during the works.

4.8 Temporary diversions

Dudley Street would remain open to traffic at all times. There would be some temporary traffic diversions built to allow construction that would involve traffic switch-overs. There would be minor delays at the time of traffic switch-overs, with traffic controlled by stop/go staff, but these would be scheduled at times when traffic volumes are light.

Stop/go operation under traffic control can be managed without undue traffic impacts and queuing. These activities would be subject to road occupancy licence applications and speed zoning authorisations by the Contractor, once appointed.

5.0 Construction impacts

5.1 Traffic

All construction traffic generated by the works would access the site via Dudley Street. Access for heavy vehicles should preferably be via Cotter Road.

Potential impacts on traffic movement during construction would include increased travel times due to construction zone speed limits, truck and construction machinery movements, lane closures and stop/go operation. Works with the potential for traffic disruption, such as utility adjustments along the trafficked pavement, would be scheduled to take place outside of peak commuting periods in order to minimise road user delays. Works impacting on traffic lanes should be undertaken off peak or at night.

Traffic generated by construction vehicles, including staff vehicles, is likely to be small in relation to traffic currently using Dudley Street and most construction traffic movements would occur outside of peak periods. It would fluctuate dependant on the construction stage.

One site compound is proposed at the western end of the site (see Figure 2), to avoid unnecessary movement of trucks and equipment on local roads in the vicinity of the Project.

It is envisaged that parking of worker's vehicles would be accommodated within the Project area (mostly within the compound area). There are no special traffic management requirements envisaged, however the parking locations could be varied during the works to keep the parking clear of active worksites, e.g. fill dump sites, detention basins etc and truck access routes.

The day to day movement of construction plant (e.g. deliveries, mobile plant movements) is anticipated to generate on average about 5 to 10 truck movements on normal working days for delivery of construction material. It is envisaged that the peak number of truck movements would be generated by earthworks at the site.

The most common size of vehicle involved in the delivery of fill to the worksite would be "medium" size dump truck or the truck and dog combination. The delivery of earth moving equipment may require ad hoc delivery by oversize vehicle for equipment not suited to on-road operation. Should these movements be necessary, they would be to subject to separate application by the contractor, once appointed and to authority approvals.

Approval for temporary traffic management works should be sought as required. Road works would be undertaken progressively and in the minimum area and timeframe required to undertake the particular phase of work. Signage would be displayed around work areas to inform the public.

The potential location of any temporary diversions would be confirmed during detailed design and identified in the Construction Traffic Management Plan (CTMP). Any traffic switchover works would be undertaken outside of peak periods, to reduce the impacts to the community.

Most truck movements would occur during the earthworks and paving works. The approximate bulk earthworks quantities are 15,200 m^3 cut and 12,800 m^3 fill, resulting in an excess fill of around 2,400 m^3. However, this "non-balance" would be further refined in the detailed design phase.

The movement of trucks during excavation of earthworks would largely be on-site, with stop/go staff having to control traffic when trucks have to cross the existing pavement, to dump to a spoil heap or to fill. It is unknown where the excess fill would need to be taken. Potentially it could be used on the Brickworks site. It would require about 250 truck movements spread over the period of earthworks, with potentially 4 to 8 truck movements per average day, during off-peak periods.

Three types of pavements have been recommended for Dudley Street:

- Pavement Type 1 – Granular (20 year) - Access Road to Canberra Brickworks Precinct development
- Pavement Type 2 – Granular (20 year) – Dudley Street (from the roundabout) to Novar Street
- Pavement Type 3 – Full Depth Asphalt – Roundabout and extension to Cotter Road

Each of these pavement types has different thicknesses of sub-base material and bitumen. It is estimated that would involve about three to five truck movements per day during pavement works.

5.2 Public transport

The Project would not impact on existing public transport movements during construction.

5.3 Active transport

No existing formal pedestrian facilities would be impacted by the road works, but informal access on the road verge would be disrupted in the construction areas.

The Project would cause minor delays to pedestrian and cyclist movements that cross Dudley Street west of the Novar Street roundabout during construction. This would not occur during peak periods and the proposed works would ensure that access is maintained.

5.4 Parking impacts

The Project would not impact on car parking during construction.

5.5 Property access

The Project would not impact on property access during construction.

5.6 Emergency vehicle access

Access for emergency vehicles would be maintained at the construction sites in accordance with emergency vehicle requirements. Emergency services would be advised of all planned changes to traffic arrangements prior to applying the changes. Advice would include information about upcoming traffic disruptions, anticipated delays to traffic, extended times of work and locations of road possessions (if required).

Traffic controllers on site would be able to provide priority for emergency vehicle.

6.0 Recommendations

Mitigation measures would be implemented to minimise traffic, transport and access impacts during construction and operation of the Project.

6.1 Construction Traffic Management Plan

Prior to the commencement of construction, a Construction Traffic Management Plan (CTMP) would be prepared as part of the Construction Environmental Management Plan and would include as a minimum:

- ensuring adequate road signage at construction work sites to inform motorists and pedestrians of the work site ahead to ensure that the risk of road accidents and disruption to traffic is minimised
- maximising safety and maintaining accessibility for pedestrians and cyclists
- ensuring adequate sight lines and providing stop/go staff to allow for safe entry and exit from the construction site
- parking locations for construction workers away from residential areas and details of how this would be monitored for compliance (e.g. site compound shown in Figure 2)
- routes to be used by heavy construction-related vehicles to minimise impacts on local streets by using Dudley Street, the Kent Street bridge and the surrounding arterial road system
- work zones would be secured to prevent unauthorised access, including pedestrian access with site perimeter fencing and secured gate(s), as required, in particular to prevent access outside work hours
- measures to manage traffic flows around the area affected by the Project, including as required regulatory and direction signposting, line marking and variable message signs and all other traffic control devices necessary for the implementation of the CTMP

Consultation with the relevant roads authorities would be undertaken during preparation of the CTMP. The performance of all project traffic arrangements must be monitored during construction.

6.2 Mitigation measures

The following additional mitigation measures are recommended to minimise traffic, transport and access impacts during the construction of the Dudley Street works:

- ensure that any work undertaken near Cotter Road does not disrupt traffic movements along Cotter Road; the construction of new pavement adjacent to the eastbound carriageway of Cotter Road may require late night road works to minimise disruption
- providing protection of workers and road users, e.g. advance warning of roadworks, speed changes, safety barriers with adequate offsets and deflection allowance, where necessary.
- imposing temporary speed restrictions when necessary
- providing safety barriers to ensure adequate protection of site workers and motorists where necessary
- limiting impacts on through traffic movements on Dudley Street by avoiding traffic lane closures and diversions during peak hours
- providing advance notice of upcoming works to permit drivers to avoid travel or adjust speed and safely negotiate past the work site on Dudley Street
- advising local businesses, residents, bus operators and emergency service providers of the upcoming works

- Despite the absence of observed pedestrian and cycle movements and facilities on Dudley Street, advance warning for cyclist and pedestrians of proposed shoulder / lane closures should be provided and that traffic controllers be available to monitor and supervise a safe route for pedestrians and cyclists past the worksite.

Recent traffic modelling has highlighted the need to upgrade the intersection of Novar Street roundabout within the next 10 years by removing the existing roundabout and installing traffic signals. Funding is likely to be sought by ACT Government to implement the Kent Street works in future. Actual timing for the works would depend on future monitoring of traffic growth and the operation of the Novar Street roundabout.

7.0 References

AECOM (2016) Canberra Brickworks Precinct Site Investigation - Traffic, Transport and Carparking, February 2016

AECOM (2017a) Canberra Brickworks Precinct Access Road and Dudley Street Upgrade – Preliminary Sketch Plan Report, June 2017

AECOM (2017b) Canberra Brickworks Precinct Access Road and Dudley Street Upgrade – Development Application Report, October 2017

AECOM (2017c) Novar Street / Kent Street Intersection – Concept Design Report, November 2017