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Balancing Mobility, Safety and Amenity: Roundabouts in Marsden Park, Australia

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Abstract

The nexus between the land use development and the demand for land and facilities for transport in the Marsden Park Section 94 development contributions plan (the Plan) was reviewed by the Independent Pricing and Regulatory Tribunal (IPART). The assessment of the Plan was undertaken by IPART because the proposed maximum residential contribution exceeds the 30,000 per dwelling contribution cap for greenfield areas as specified in the Section 94E Ministerial Direction. The Australian Road Research Board (ARRB) was engaged to determine whether the nexus of eight roundabout intersections proposed in the Plan is reasonable in terms of the benefits to a wider network rather than only to adjoining land uses.

A two-step review approach was undertaken. The first step involved examining the road and traffic characteristics of intersecting roads, including the adopted road classification and anticipated traffic volumes, which was followed by the second step, which was the assessment of each intersection against the two functional objectives of providing a safe and efficient intersection operation: traffic management, and road safety and local amenity.

The assessment outcome revealed all, except one roundabout, were reasonable in terms of nexus and as such should be funded via the development contributions. The methodology utilised in the study demonstrated how safety and amenity in addition to mobility can be considered in the evaluation of roundabout as a form of intersection control.

Key words: roundabout, nexus, mobility, traffic management, safety, amenity

1. Introduction

The content of this paper is primarily extracted from an ARRB internal report (Karndacharuk 2017). ARRB was commissioned by IPART to review the nexus of eight intersections in the Plan for the Marsden Park Precinct (the Precinct) (Blacktown City Council 2016b). The review outcome has informed the assessment of the Plan against the nexus criterion in the revised local development contributions practice note (Practice Note) from the NSW Department of Planning and Infrastructure (2014).

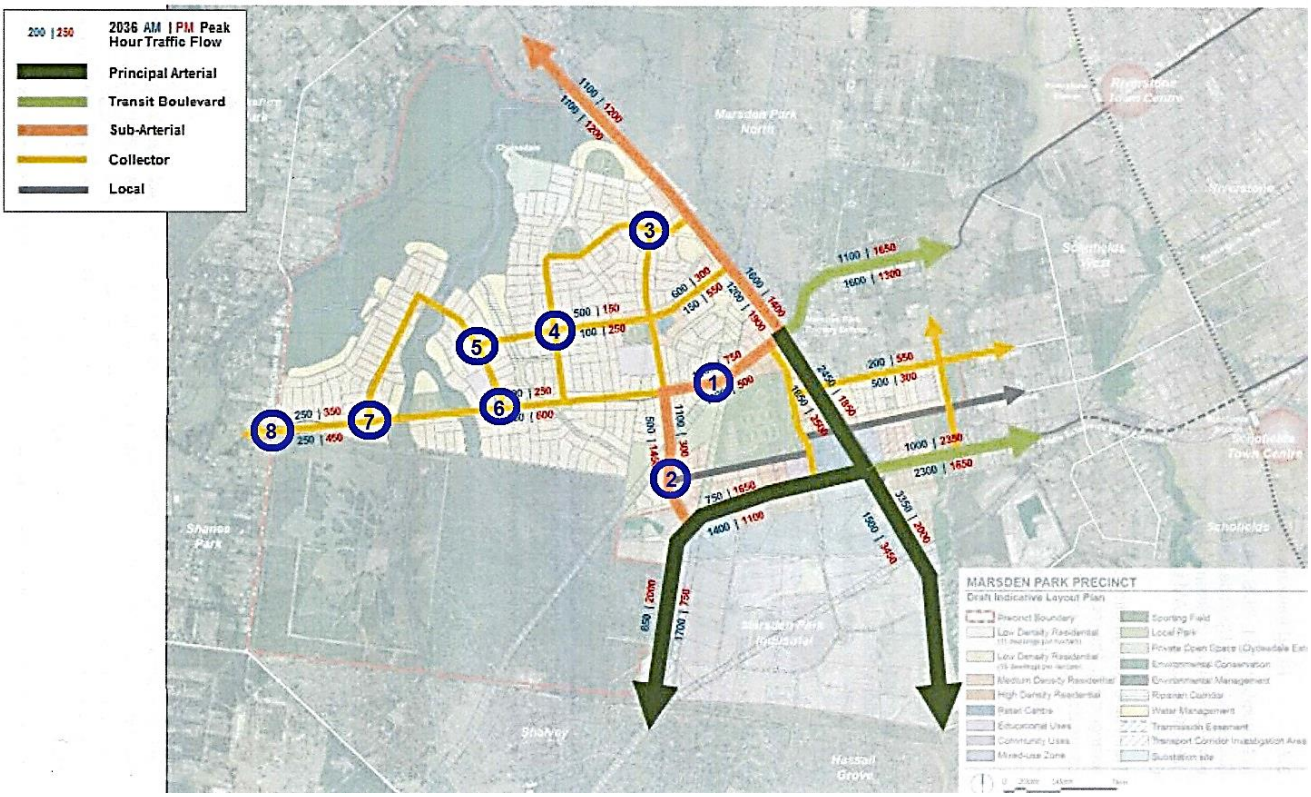
The Precinct, located in the North West priority growth area in Sydney (Department of Planning and Environment 2017b), is approximately 1,800 hectares. It is expected to accommodate 10,000 dwellings, and supported by local activity and education centres.

The road layout proposed in the Plan and the location of the intersections under investigation were consistent with the Precinct's Indicative Layout Plan (ILP) documented in the 2013 final planning package (Department of Planning and Environment 2017a), and the Precinct road hierarchy in the Development Control Plan (Blacktown City Council 2016a).

1.1. Purpose and Scope of the Study

The aim of the study was to determine whether eight proposed roundabouts are reasonable in terms of nexus in accordance with the Practice Note. The location of the eight roundabout intersections is shown in Figure 1.

Figure 1: Roundabout intersections in the Marsden Park Precinct under investigation



Source: Based on AECOM (2013, p.23).

The main technical document that provides a basis for assessing the nexus of the roundabouts in the Plan was a traffic and transport assessment report prepared by AECOM (2013). The eight roundabouts as the intersection control in the Plan were considered a scope deviation in infrastructure provision from the recommendations in the supporting technical study. The nexus review in this report was therefore undertaken to determine whether the deviation (proposed roundabouts) is reasonable in terms of its benefit to a wider network (rather than only to adjoining land uses) and as such should be funded via the proposed s94 contributions.

Roundabout Related Transport Items in the Plan

In the schedule of traffic and transport management facilities in Appendix D2 of the Plan (Blacktown City Council 2016b), the following four transport items are related to roundabouts.

- Road MP1.1 that includes one roundabout on Glengarrie Road near South Street.
- Road MP1.2 that includes two roundabouts on the Garfield Road extension.
- Road MP4.1 that includes half roundabout at the Stony Creek Road intersection.
- Miscellaneous item for local traffic management for six roundabouts.

The proposed roundabout implementation, hence, involved ten intersections in the Precinct. Eight of which were within the scope of this review as identified in Figure 1. The roundabout at the Garfield Road extension/western north-south collector intersection was recommended in the technical document (AECOM 2013), but was outside the scope for this review study. The other roundabout that was not part of this study was on the Garfield Road extension near Richmond Road where no detailed traffic analysis was provided in the AECOM study to support its implementation.

2. Methodology

The AECOM report adopted a functional road classification to guide design standards relating to road transport infrastructure (including intersections) in the Precinct. The road hierarchy consisted of:

- Arterial Road – connecting large urban areas.
- Transit Boulevard – located close to centres and allowing for dedicated future busways with a pedestrian friendly environment.
- Sub-Arterial Road – linking town centres with provisions for major bus routes.
- Collector Road – connecting neighbourhoods.
- Local Road – designed to slow residential traffic with pedestrian and cyclist priority.

Within the road network hierarchy, the nexus between the development in the Precinct and the need for a road intersection, taken at face value, at the eight location has been established through the precinct planning process and the development of the ILP. This is primarily because the intersections are located on higher-order roads (i.e. collector and sub-arterial) that provide connectivity for through (non-local) traffic beyond the local land-use area. This review of the nexus of the eight roundabouts in the Plan is, therefore, related exclusively to the type of intersections (which ranges from uncontrolled, priority controlled and roundabout to signalised and grade-separated intersections).

Taking into account the nexus assessment criteria (as documented in the Practice Note) and the Austroads Guides for road design and traffic management, the method of reviewing and determining whether a roundabout is an appropriate type for the intersections involves two review steps. The first step was to examine the road and traffic characteristics, including the adopted road classification (of intersecting roads) and anticipated hourly traffic volumes based on the full development scenario in 2036.

The second step was an assessment of each location of the proposed roundabouts against the following two functional objectives (and requirements) in providing an efficient and safe intersection:

- traffic management
- road safety and local amenity.

The following section examines the two functional aspects in more detail in order to form a basis of assessing the nexus (appropriateness) of the proposed roundabouts in the Plan.

3. Functional Objectives of Roundabouts

This section discusses the relevant factors that need to be considered in the selection and implementation of a roundabout in a predominantly urban residential environment such as that in the Precinct.

3.1. Traffic Management

A roundabout is a form of intersection channelisation in which vehicular traffic circulates around a central island and all entering traffic is required to give way to traffic on the circulating roadway (Austroads 2013). The exposure to traffic conflict is relatively low for the traffic entering roundabouts as there is only one movement direction of circulating traffic.

While single-lane roundabouts can be employed satisfactorily at a wide range of suitable sites on arterials, collectors and local streets as well as in pairs at motorway interchanges, multi-lane roundabouts are suitable for use at T- and four-leg junctions that intersection at or close to 90°. Roads intersecting at oblique angles increase the risk of movement conflicts at exists where drivers on the circulating carriageway can experience difficulty in positioning the vehicle in an appropriate lane for left, through or right-turns on some of the approaches

As shown in Table 1, the *Austroads Guide to Traffic Management* (2013) provides a general planning guide for selecting a suitable intersection control based on various functional road classification. The red highlight indicates the area of relevance to the proposed roundabouts in the Plan.

Table 1: Suitability of types of traffic controls to different road types

Road type	Primary arterial	Secondary arterial	Collector and local crossing road	Local street
Traffic signals				
Primary arterial	A	A	O	X
Secondary arterial	A	A	O	X
Collector & local crossing road	O	O	X	X
Local street	X	X	X	X
Roundabouts				
Primary arterial	O	O	X	X
Secondary arterial	O	O	O	X
Collector & local crossing road	X	O	A	O
Local street	X	X	O	A
***Stop* signs or *give way* signs**				
Primary arterial urban/(rural)	X/(O)	X/(O)	A	A
Secondary arterial urban/(rural)	X/(O)	X/(O)	A	A
Collector & local crossing road	A	A	A	A
Local street	A	A	A	A

A = Most likely to be an appropriate treatment
O = May be an appropriate treatment
X = Usually an inappropriate treatment

Source: Based on Austroads (2013, p.36).

The main reason a roundabout is not an appropriate treatment for a location where a high-order, high-volume road intersecting with a low-volume road is the efficiency (vehicle throughput) of the arterial road where a satisfactory level of mobility cannot be provided.

Additional information on appropriate and inappropriate sites for roundabouts is also provided in the traffic management guide (Austroads 2013). Relevant considerations can be

summarised in no particular order in Table 2. These considerations as well as the suitability guide in Table 1 are taken into account in the discussion and analysis in Section 4.

Table 2: Characteristics of appropriate and inappropriate sites

Site Characteristics	
Appropriate	**Inappropriate**
▪ At intersections where traffic volumes on the intersecting roads are such that: – Stop or give way signs or the T-junction rule result in unacceptable delays for the minor road traffic. – Traffic signals would result in greater delays than a roundabout.	▪ Where traffic flows are unbalanced with high-volumes on one or more approaches, and some vehicles would experience long delays.
▪ At intersections where there are high proportions of right-turning traffic. However, satisfactory operation is dependent on the entering flows being balanced so that a heavy right-turn does not cause excessive delay on subsequent entries.	▪ Where a major road intersects a minor road and a roundabout would result in unacceptable delay to the major road traffic.
▪ At locations where traffic growth is expected to be high and where future traffic patterns are uncertain or changeable.	▪ Where a satisfactory geometric design cannot be provided due to insufficient space or unfavourable topography or unacceptably high cost of construction.
▪ At intersections of local roads where it is desirable not to give priority to either road.	▪ At an isolated intersection in a network of linked traffic signals.
▪ At arterial and collector road intersections in outer urban areas and country towns, where only short periods of congestion occur.	▪ Where large combination vehicles or over-dimensional vehicles frequently use the intersection and insufficient space is available to provide for the required geometric layout.

Source: Based on Austroads (2013).

The *Austroads Guide to Road Design* (2015) also discusses methods and parameters used in the geometric design of roundabouts. These considerations are outlined in Table 3 with a comment on their relevance to the proposed roundabouts in the Plan.

Table 3: Design considerations of roundabouts

Consideration	Description	Relevance to Nexus Review
Number of legs	▪ Single-lane roundabouts can operate satisfactorily with more than four legs. ▪ For multi-lane roundabouts, the provision of more than four legs should be avoided due to increased conflicts at exits.	All roundabouts under study are 4-leg, except Intersection 7.
Number of entry, circulating and exit lanes	▪ The number of roundabout lanes should be limited to the minimum. ▪ Due to overtaking issues within the roundabout, it is suggested to provide a single-lane roundabout until traffic volumes warrant the use of a two-lane facility. ▪ Lane continuity is important for arterial roads where a two-lane approach should have two entry lanes even if capacity analysis shows one lane would be adequate.	Information about roundabout lanes are not provided.

Consideration	Description	Relevance to Nexus Review
Central island	▪ Central islands are preferably be circular as changes in curvature of the circulating carriageway result in speed differentials and increased driver workload. ▪ Roundabout central islands, sized to accommodate design vehicles and desired speeds, should be raised to improve intersection visibility.	These factors are not directly relevant to the nexus review as they can be addressed at a concept design stage if land for the road reserve is adequately allocated.
Approach and entry geometry	▪ The approach and entry treatment is the most important geometric parameter to control the speeds of entering traffic from a safety performance perspective.	
Circulating carriageway	▪ The width of circulating carriageway is determined based on the number of circulating lanes and the radius of vehicle swept path. ▪ The design vehicles (e.g. heavy vehicles) and their swept path requirements may be different for the various paths through a roundabout.	
Exit curves	▪ Exit curves should be designed for drivers to efficiently negotiate from the circulating roadway through the exit, except in a high pedestrian area where a smaller radius exit curve is used for pedestrian crossing.	
Entry and exit widths	▪ While the width of the entry should not be any wider than necessary to enable a safe entry speed, the exit widths should enable traffic to leave the circulating roadways as efficiently as possible.	
Others	▪ These include a consideration of the separation between legs, superelevation, gradient and drainage.	

Source: Based on Austroads (2015).

3.2. Road Safety and Amenity

While the focus of the discussion in Section 3.1 is on the traffic management of motor vehicles, the role an urban roundabout plays in road safety and local amenity is primarily related to the need and expectations of non-vehicular road users, particularly in a residential area. The emphasis is to be placed on reducing the dominance of motor vehicles (e.g. speed and volume) and negative impact on the road environment (e.g. noise, vibration and air pollution).

From a road safety perspective, a well-design roundabout is the safest form of intersection control. Due to the lower operating speeds of vehicles, fewer injury crashes occur at roundabouts than other forms of intersection that contain traffic signals, stop or give-way signs. According to Austroads (2015), the most important geometric considerations in the provision and design of roundabouts are:

- adequate sign distances to enable driver to:
  - easily identify the intersection as a roundabout
  - observe the movements of other road users (including cyclists and pedestrians) travelling within and on the approaches to the roundabout
  - observe a gap in the circulating traffic and enter in a safe manner
- entry geometry to restrict drivers to a safe speed on entry to the roundabout.

It is, nonetheless, noted that the risk of vulnerable users being involved in a crash increase at a roundabout. This is because, unlike traffic signals via signal phasing, pedestrians and cyclists at a crossing point do not have priority over through or turning traffic (unless a zebra

crossing is incorporated in a roundabout design). Some users may subsequently experience a reduced level of accessibility.

Incorporating horizontal speed control features, roundabouts can be employed as a traffic calming (speed management) measure. An implementation of a roundabout within a local traffic area to influence a change in driver behaviour to improve road safety and amenity is considered a local area traffic management (LATM) technique. Research on the impact of LATM treatments in Australia suggested a typical 85th percentile speed and casualty crash reduction of 44% and 43%, respectively, for a roundabout located on a local or collector road (Jurewicz 2009).

According to Austroads (2016), a standard roundabout is the second most commonly used LATM device by local government authorities in Australia and New Zealand. The most commonly used device is stop or give-way sign. Other frequently LATM devices speed limit sign, lane narrowing/kerb extension, threshold treatment and road cushion. The advantages and disadvantages of roundabouts in the LATM context are summarised in Table 4.

Table 4: Advantages and disadvantages of LATM roundabouts

Roundabouts for LATM	
Advantage	**Disadvantage**
▪ Reduction of vehicle conflict points and road crashes at intersections.	▪ Restriction to larger service and emergency vehicles and buses unless the roundabout is mountable.
▪ Reduction of vehicle speeds on the approach and through the intersection.	▪ Relatively expensive especially if land needs to be acquired.
▪ Control of traffic movement and provision of orderly and largely uninterrupted flow of traffic.	▪ Traffic noise may possibly increase due to braking and acceleration.
▪ Increase in the visibility of the intersection.	▪ Reduction of the availability of on-street parking.
▪ Clarification of the priority of traffic movements.	▪ Difficulty for cyclists and pedestrians to negotiate.
▪ Enhancement in the appearance of the street when landscaped.	
▪ Reduction of vehicle conflict points and road crashes at intersections.	

Source: Based on Austroads (2016).

Landscaping and street furniture, when carefully planned and designed, can improve safety and amenity by making the intersection a focal point while creating a perception of a low-speed environment. Safe and forgiving streetscape provisions should not (Austroads 2015):

- be a roadside hazard to road users
- impede sight distances available to drivers approaching a roundabout
- obscure the view of a driver at the holding line of a roundabout.

In the predominantly residential context of the roundabouts in the Plan, the provision of roundabouts and landscape planting provides not only improved amenity of local streets, but also interrupts the visual continuity of the street layout with relative wide and straight roads (e.g. 11 m wide carriageway for a collector road).

4. Discussion and Analysis

This section contains a two-step nexus analysis of the eight intersections in the Plan by first reviewing the road and traffic characteristic of each roundabout intersection. Each roundabout is subsequently reviewed against the two functional objectives as discussed in Section 2 in order to determine whether a roundabout is an appropriate form of intersection control at each location.

4.1. Road and Traffic Characteristics

The first review step is to examine road network and traffic characteristics of the intersections in question. Based on the information in the traffic and transport study (AECOM 2013), Table 1 outlines the road name, classification and peak traffic volumes of the intersecting roads at each intersection location. The hourly peak flows are shown in passenger car units for both morning and afternoon periods in 2036. Two values are shown in the 'Hourly peak flow' column, representing the traffic volumes in the directions either 'eastbound and westbound' or 'northbound and southbound'. Where there is only one value in the peak flow columns for a major or a minor road, there is one approach on that road, representing a 3-leg arrangement for the intersection.

The following points are observed from the intersection comparison in Table 5:

- Based on the peak traffic volumes, each intersections can be placed in the following two groups to reflect the catchment it serves:
    - Higher-order intersections, including Intersections 1, 2, 6, 7 and 8. These intersections are located on the road sections of the Garfield Road extension and the north-south extension of Glengarrie Road. The sections closer to Richmond Road are classified as Sub-Arterial Road.
    - Lower-order intersections, including Intersections 3, 4 and 5. Given Access Road 1 is not identified as a main access route to the Precinct, the traffic demand for Intersection 3, albeit being located close to Richmond Road, will be low. Intersections 4 and 5 will service a limited local catchment given that Access Road 2 runs parallel to the Garfield Road extension that links Richmond Road with Stony Creek Road.
- Intersection 8 (Stoney Creek Road / Garfield Road extension) has been assessed in the AECOM study. A priority intersection was recommended as a method of intersection control.
- The technical study (AECOM 2013) proposed the (out-of-scope) intersection of the Garfield Road extension and the western north-south collector to be constructed as a multi-lane roundabout. The 3-leg arrangement is consistent with the ILP.
- The (out-of-scope) roundabout, proposed in the Plan, on the sub-arterial section of the Garfield Road extension has not been discussed (and recommended) by AECOM. No supporting information has been provided to assess the impact of the collector realignment on the south approach of this intersection.

It is important to note that the road and traffic characteristics, discussed in the report, are based on the AECOM study for the forecast future year with full development. When surrounding land uses are yet to be fully developed, temporary traffic management and control may be implemented as an interim measure (e.g. priority control at a future signalised intersection). In an event of a major modification to the road layout and/or functional hierarchy, in response to, for example, Council policy or development requests, traffic demand and distribution are likely to change. As such, the assumptions that form the basis of this nexus review are to be re-investigated

Table 5: Road and traffic characteristics of roundabouts in full development (2036) scenario

Intersection	Major Road				Minor Road				Recommended form of control in technical report
	Name	Classification	Hourly Peak Flow		Name	Classification	Hourly Peak Flow		
			AM	PM			AM	PM	
Roundabouts under this nexus review									
1	Garfield Rd Ext	Sub-Arterial Rd	894 / 999	769 / 499	–	Local Rd	– / –	– / –	–
2	Central N-S	Sub-Arterial Rd	437 / 1 120	1 485 / 309	–	Local Rd	– / –	– / –	–
3	Access 1 Rd	Collector Rd	20 / 72	22 / –	Central N-S	Collector / Local Rd	27 / –	151 / –	–
4	Access 2 Rd	Collector Rd	255 / 84	95 / 227	Western N-S	Collector Rd	4 / 0	4 / 0	–
5	Access 2 Rd	Collector Rd	50	200	–	Collector / Local Rd	7 / 122	0 / 40	–
6	Garfield Rd Ext	Collector Rd	427 / 250	234 / 578	–	Collector / Local Rd	– / 0	– / 2	–
7	Garfield Rd Ext	Collector Rd	223 / 205	251 / 371	–	Collector Rd	14	31	–
8	Stony Creek Rd	Sub-Arterial Rd	346 / 255	464 / 132	Garfield Rd Ext	Collector Rd / –	– / 272	– / 435	4-leg, priority intersection
Roundabout recommended in technical study, and proposed in the Plan									
B	Garfield Rd Ext	Collector Rd	416 / 257	206 / 614	Western N-S	Collector Rd	14	31	3-leg, multi-lane roundabout
Roundabout not recommended in technical study, but proposed in the Plan									
–	Garfield Rd Ext	Sub-Arterial Rd	– / –	– / –	–	Local Rd	– / –	– / –	–

Source: Karndacharuk (2017).

4.2. Nexus Assessment against Functional Objectives

Taking into account the review of the road and traffic characteristics, as discussed in Section 4.1, the detailed nexus assessment of each intersection location is provided in Table 6. It aims at quantifying a net benefit during the consideration of the following two functional objectives of roundabouts:

- traffic management and intersection control
- road safety and local amenity.

The output of the nexus assessment is a determination whether a roundabout treatment is a suitable option at each intersection location based on the available information. Intersection 1 is the only location where the proposed roundabout is not considered an appropriate treatment. As such, the proposed roundabout is unreasonable in terms of nexus.

It is important to note that the outcome of this nexus analysis would have cost implication even for the proposed roundabouts with reasonable nexus. This is due to the design requirements that differ between higher- and lower-order intersections to maximise the functional benefits. In particular, for lower-order intersections with low traffic volumes, a 'mini-roundabout' with a traversable central island (Candappa 2015) can be considered. This would not only reduce the capital and operational costs of the infrastructure, but also improve the safety and amenity of the road users through local area traffic and speed management.

Table 6: Nexus assessment of roundabouts against functional objectives

Roundabout	Nexus Review		Review Outcome
	Traffic Management	Road Safety and Amenity	
1	▪ Traffic flows at intersection are likely to be unbalanced due to the intersection of a sub-arterial with local roads. ▪ It is likely that one or more approaches would experience long delays during peak hours. ▪ There is a possibility that traffic to/from minor local roads (esp. right-turners) will cause an unacceptable delay to the major road traffic. ▪ Its proximity to a signalised intersection could result in 'rat running' in local residential streets to avoid traffic signals.	▪ The roundabout will provide improved safety through speed management, particularly on the sub-arterial road. ▪ The local amenity benefit is limited due to a higher standard (e.g. size) required for roundabout design on a higher-order road.	▪ The negative traffic management impact outweighs the road safety and amenity benefit. ▪ The roundabout is, therefore, **not** considered an appropriate treatment at this location.
2	▪ Traffic flows at intersection are likely to be unbalanced due to the intersection of a sub-arterial with local roads. ▪ It is likely that one or more approaches would experience long delays during peak hours. ▪ There is a possibility that traffic to/from minor local roads (esp. right-turners) will cause an unacceptable delay to the major road traffic.	▪ The roundabout will provide improved safety through speed management, particularly on the sub-arterial road. ▪ The sub-arterial roundabout would function as a gateway treatment to indicate a transition between residential and industrial areas.	▪ The negative traffic management impact does not outweigh the road safety and amenity benefit. ▪ The roundabout is, therefore, considered an acceptable treatment at this location.
3	▪ Based on Table 1, a roundabout treatment is suitable for an intersection between a collector and a local road. ▪ A relatively high proportion of right-turning traffic onto Access Road 1 (collector road) is anticipated during the afternoon peak. With low traffic volumes on other approaches, excessive delay is unlikely.	▪ The roundabout will provide improved road safety and local amenity benefits as discussed in Section 3.2.	▪ There is a net positive impact for implementing the roundabout. ▪ The roundabout is, therefore, considered an appropriate treatment at this location.
4	▪ Based on Table 1, a roundabout treatment is suitable for an intersection between two collectors. ▪ With the very low traffic flows on the minor road (Western N-S Rd) during peak periods, unbalanced flow patterns are likely with some vehicles experiencing some delays.	▪ The roundabout will provide improved road safety and local amenity benefits as discussed in Section 3.2.	▪ There is a net positive impact for implementing the roundabout. ▪ The roundabout is, therefore, considered an acceptable treatment at this location.
5	▪ Based on Table 1, a roundabout treatment is suitable for an intersection between a collector and a local road.	▪ The roundabout will provide improved road safety and local amenity benefits as discussed in Section 3.2.	▪ There is a net positive impact for implementing the roundabout. ▪ The roundabout is, therefore, considered an appropriate treatment at this location.

Roundabout	Nexus Review		Review Outcome
	Traffic Management	**Road Safety and Amenity**	
6	▪ Based on Table 1, a roundabout treatment is suitable for an intersection between two collectors. ▪ With the very low traffic flows on the minor roads during peak periods, unbalanced flow patterns are likely with some vehicles experiencing some delays.	▪ The roundabout will provide improved road safety and local amenity benefits as discussed in Section 3.2.	▪ There is a net positive impact for implementing the roundabout. ▪ The roundabout is, therefore, considered an acceptable treatment at this location.
7	▪ Based on Table 1, a roundabout treatment is suitable for an intersection between two collectors. ▪ Stop or give-way control at this intersection is likely to result in unacceptable delays for the minor road traffic.	▪ The roundabout will provide improved road safety and local amenity benefits as discussed in Section 3.2.	▪ There is a net positive impact for implementing the roundabout. ▪ The roundabout is, therefore, considered an appropriate treatment at this location.
8	▪ Based on Table 1, a roundabout treatment is suitable for an intersection between a sub-arterial and a collector road. ▪ The road classification of the west approach is unknown, but its traffic characteristics are unlikely to result in unsatisfactory operation of a roundabout. ▪ The AECOM study has demonstrated that a priority (stop or give-way) controlled intersection can operate satisfactorily at this location, which challenges the need for a roundabout.	▪ The roundabout will provide improved safety through speed management, particularly on Stony Creek Rd. ▪ The roundabout will provide improved local amenity benefits as discussed in Section 3.2.	▪ There is a net positive impact for implementing the roundabout. ▪ The roundabout is, therefore, considered an acceptable treatment at this location.

Source: Karndacharuk (2017).

5. Conclusion

This paper documents an assessment method that takes into account the mobility, safety and amenity functions of road space for the nexus evaluation of the eight roundabouts in Marsden Park. Most likely similar to what practitioners are following, the review approaches the determination of their reasonableness by considering the following two functional objectives of implementing roundabouts:

- Traffic management
- Road safety and local amenity.

A two-step nexus analysis has been undertaken by first reviewing the road and traffic characteristic of the roundabout intersections. Each roundabout was subsequently reviewed against the two objectives to determine whether the roundabout is a suitable form of intersection control at each location.

Accepted by IPART, the review outcome revealed that Intersection 1 is the only location where the proposed roundabout is not considered an appropriate treatment. The proposed roundabout at all other locations are considered reasonable in terms of its benefit to a wider network (rather than only to adjoining land uses) and as such should be funded via the proposed s94 contributions.

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