GLEN IRIS ESTATE

APPENDIX 9
TRANSPORT IMPACT ASSESSMENT

Eastcourt Property Group

Glen Iris Estate

Structure Plan Transport Impact Assessment: updated report

August 2023

Project Code: 06066

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1 Introduction

1.1 Background & Proposal

The site of the proposed structure plan is the previous Glen Iris Estate Golf Course, currently undergoing structure planning under the City of Cockburn's Town Planning Scheme No. 3 to facilitate predominantly residential development. The proposed structure plan will have between 500 – 600 dwellings on large sized lots (typically 600sq.m), as well as a 0.7ha area set aside for a local centre likely to include a small supermarket and supporting shops. The structure plan concept assessed in this Transport Impact Assessment (TIA) is the result of over 12 months of focussed community consultation and input from a range of subject matter experts including town planners, landscape architects, civil engineers and environmental scientists.

PJA has been engaged by Acumen Development Solutions on behalf of the landowner Eastcourt Property Group, in May 2023 to undertake a transport impact assessment of the proposed Structure Plan. This updated report is an extension to the previous work undertaken by GTA Consultants (GTA) in April 2020.

1.2 Purpose of this Report

Volume 2 of the Western Australian Planning Commission Transport Assessment Guidelines (WAPC Guidelines) provide direction on the preparation of a TIA for Structure Plans. The WAPC Guidelines identify that a TIA for a Structure Plan is to provide a broad-brush assessment.

The WAPC policy requires structure plans to be supported by a transport impact assessment.

In accordance with the WAPC Guidelines, this TIA outlines:

- Existing transport conditions proximate to the site
- Suitability of the proposed parking provision within the site
- The adequacy of the proposed site layout
- The traffic generating characteristics of the proposed development
- The anticipated impact of the proposed development on the surrounding road network.

1.3 Summary of key issues

From a traffic and transport point of view, the following key provisions are immediately identified for this TIA:

- The existing road network currently supporting the existing Glen Iris Estate was not intended to cater for a high proportion of future increase in traffic volumes. As such, the structure plan will likely need to rely on the provision of its own movement network and new intersections.
- The existing road network geometry is prohibitive to the running of public transport vehicles through the existing Glen Iris Estate and consequently, the existing residence have poor public transport access to services. More than three-quarters of the existing estate is outside of a 400m typical walking catchment of the bus stops on Berrigan Drive.

  As such, the structure plan should provide opportunity to improve the accessibility and services of public transport to existing and future residents and visitors of the estate.

- Traffic volumes along Berrigan Drive have continued to grow at a consistent and relatively high rate over the past 5 years to 2021, resulting in very poor and worsening levels of service and diminishing safety for existing residents to be able to access Berrigan Drive and beyond. Currently, most of the residents are wholly dependent on priority controlled (also referred to as "uncontrolled") full movement intersections with long queues and delays.

  As such, the structure plan should provide bold traffic management solutions which should assist the existing residents in Glen Iris Estate with an improved level of service and improved safety to be able to access the wider network.

1.4 Previous Studies

- Cockburn Regional Analysis (Main Roads WA) March 2016
- Centre Development Strategy – DRAFT (Taktics4) March 2021.

1.5 References

In preparing this report, reference has been made to the following:

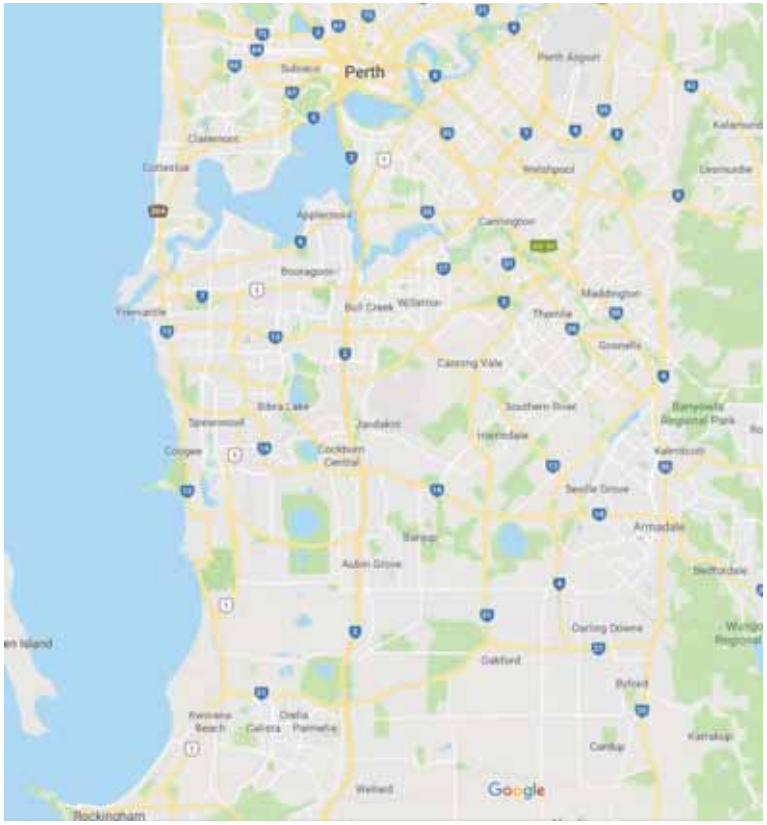
- City of Cockburn Town Planning Scheme No. 3
- Liveable Neighbourhoods Guidelines – 2009
- WAPC Transport Assessment Guidelines for Development: Volume 2 – Planning Schemes, Structure
- Plans and Activity Centre Plans
- plans for the proposed structure plan prepared by Rowe Group
- traffic surveys as referenced in the context of this report
- various technical data as referenced in this report
- an inspection of the site and its surrounds
- other documents as nominated.

2 Structure Plan Outline

2.1 Regional Context

The subject site is in the suburb of Jandakot, within the City of Cockburn. The site is approximately 17 km south of the Perth CBD and directly adjacent the eastern side of the Kwinana Freeway.

Figure 2.1: Location Map



(PhotoMap courtesy of Google Maps)

2.2 Proposed Land Uses

The Structure Plan is predominantly residential with current planning to provide 500 – 600 dwellings at full development. This quantum of lots proposed is much less than otherwise possible on this land under the permissible zoning (some 900 lots). There is also provision for a small supermarket-based local centre totalling 2,500sq.m of Gross Floor Area (GFA). The proposed layout is shown below in Figure 2.2 (overleaf).

2.3 Attractors or Generators of Traffic (non-residential)

The only non-residential land use with the potential to attract external trips is the proposed local centre which is currently located immediately to the north of Berrigan Drive, abutting the existing commercial centre on the Berrigan Drive / Dean Road north-west corner.

The catchment for this local centre would be limited to predominantly residents local to the Glen Iris Estate due to its size and commercial offerings discussed further in the Centre Development Strategy . The Centre Development Strategy predicts a very localised catchment with a small external market from outside the Jandakot / Glen Iris community as follows:

- South Lake: 6%
- Cockburn Central: 1%
- Leeming: 9%
- Treeby: 4%.

Figure 2-2: Structure Plan Layout

(Source: Rowe Group)

3 Existing Situation

3.1 Subject Site

The site comprises 54ha of land previously used as the Glen Iris Golf Course. This golf course was central in the Glen Iris Golf Course Estate which established residential development around all edges of the course. In 2020 the previous owners of the land closed the golf course and then sold the land to a local property developer who is now in the process of lodging the necessary structure plan over the site to facilitate residential development.

The 54ha of golf course land runs in a north-south alignment separated by Berrigan Drive. The structure plan area is bound by Dean Road, Glen Iris Drive and Prinsep Road on the east and The Lakes Boulevard, Hartwell Parade and Glen Iris Drive on the west. Vehicular access to and from the site is only possible via Berrigan Drive with full movement priority-controlled intersections at The Lakes Boulevard, Turnbury Park Drive and Prinsep Road as well as a four-way signal-controlled intersection at Dean Road/Jandakot Road/Berrigan Drive.

The site also has Kwinana Freeway immediately to the west and Roe Highway to the north, however, given these are major roads in the network hierarchy, these cannot facilitate any new intersections for this development.

The existing heavy rail Thornlie Railway Line also runs east-west along to the north of the site providing public transport services from Perth to Armadale. The Perth to Mandurah Railway Line runs north south in the middle of the Kwinana Freeway. METRONET is also currently constructing the heavy rail connection between Thornlie and Cockburn Railway Stations, discussed further in Section 4.4.

The City of Cockburn Town Planning Scheme No. 3 currently identifies the subject site as 'Special Use 1 Zone', with a small portion of 'Residential R40' and it is zoned 'Urban' under the Metropolitan Region Scheme (MRS).

The surrounding properties include a mix of zones including the Residential R-20 and Resource Zone (predominantly rural-residential dwellings).

The location of the subject site and the surrounding environs is shown in Figure 3.1, and the land zoning is shown in Figure 3.2.

Figure 3.1: Subject Site and its Environs

(PhotoMap courtesy of NearMap Pty Ltd)

Figure 3.2: Land Zoning Map

(Reproduced from City of Cockburn Intramaps)

3.2 Existing Movement Network

3.2.1 Roads (inc RAV Networks)

The existing road network internal to the structure plan area does not exist given the historic use as a golf course. However, for the purpose of this Transport Impact Assessment the internal road network of the existing Glen Iris Estate north and south (of Berrigan Drive) is included and discussed.

3.2.2 Distributor A Roads

Berrigan Drive

Berrigan Drive runs east-west between the north and southern portions of the structure plan area connecting Jandakot Road to the Kwinana Freeway. It is identified as a District Distributor A road under the Main Roads WA functional road hierarchy and has a posted speed limit of 70km/hr. Berrigan Drive also forms part of the Restricted Access Vehicle Network up to and including Category 4 vehicles which can be represented by a 27.5m B-Double road train.

Existing traffic volumes are provided in Table 3.1.

3.2.3 Local Distributor Roads

Prinsep Road

Prinsep Road runs north-south along the eastern boundary of the southern portion of the structure plan forming a connection between Berrigan Drive and Verde Drive. It is a Local Distributor under the Main Roads WA functional road hierarchy and has a posted speed limit of 60km/hr.

Existing traffic volumes are provided in Table 3.1.

3.2.4 Access Roads

The road network within the Glen Iris Estate is limited to 'Access Roads'. These roads have typical local street typologies with pavement widths ranging from 6.5m to 7.2m. Majority of these streets have footpaths on one verge and do not support frequent on street parking. There are Local Area Traffic Management (LATM) devices implemented through-out the existing Glen Iris Estate in the form of slow points, central blister islands and raised flat top speed humps. As these streets do not provide any access for 'external – external' trips through Glen Iris, the purpose of these LATM devices are primarily to control vehicle speeds within the precinct. All local streets within Glen Iris are subject to the default 50km/h built up speed limit. 'Access Roads' with direct interaction with the proposed structure plan include the following:

- Dean Road
- Glen Iris Drive
- Turnbury Park Drive
- Hartwell Parade
- The Lakes Boulevard
- Imlah Court.

In 2017 the City of Cockburn constructed two culs-de-sacs at the intersection of Imlah Court and The Lakes Boulevard to improve local amenity and discourage heavy vehicle traffic that was using Imlah Court and The Lakes Boulevard as a shortcut to the Kwinana Freeway to by-pass the Prinsep Road / Berrigan Drive intersection. The structure plan does not propose to modify this existing road layout and intends for the two local roads to remain disconnected, as desired by the existing residents.

3.2.5 Pedestrian and Cyclist Network

As the structure plan area was previously a public golf course there is no formal pedestrian or cycling network within the site itself.

In the adjacent areas, concrete paths typically 1.5 – 2.0m wide are provided on one-side only over much of the local street network that surrounds the site including:

- Dean Road
- Glen Iris Drive
- Hartwell Parade
- Turnbury Park Drive.

There are no formal cycling facilities throughout the development but traffic volumes and speeds on the local streets themselves are conducive to shared on-street cycling. However, the long winding internal road with few opportunities to safely overtake (for cars that may want to overtake bikes) could lead to frustration from drivers and result in risky driving behaviour which is of a safety concern for residents.

The existing Principal Shared Path (PSP) that is only on the western side of the Kwinana Freeway means residents must travel north or south in the area to Berrigan Drive and then ride / walk along Berrigan Drive, over the freeway to access the PSP.

There is also an existing pedestrian underpass connecting the northern and southern golf course areas under Berrigan Drive. This existing underpass does not meet the latest best practice standards such as Crime Prevention Through Environmental Design (CPTED), however, the project team is

currently investigating the upgrade of this facility with a preference to retain the underpass if possible.

3.2.6 Public Transport

Bus services in the Glen Iris area are limited. The 515 service has two bus stops either side of Berrigan Drive shown in Figure 3.3.

Due to the long north-south nature of the Glen Iris Estate there is a limited number of dwellings within the 400m walkable catchment to these existing stops, with over three-quarters of residences outside this typical walkable catchment (refer Figure 3.4). As an example, the existing northern dwellings in the estate are over a 2.0km walk away to any public transport facilities.

The Cockburn Central Railway Station is accessible via cycling along the PSP on the western side of the Kwinana Freeway, this trip is approximately 3.0km from the bus stops on Berrigan Drive, or 5.0km from the northern residencies.

The Cockburn Central Railway Station park and ride facility is an 8-minute drive via Prinsep Road or the Kwinana Freeway.

There was a clear desire noted in the community consultations to date to improve current bus service accessibility.

Figure 3.3: Existing Bus Stop Locations

(map source: Google)

Figure 3.4: Existing Bus Stops 400m Walking Catchment

(map source: Google)

3.3 Existing Road Network (Within 2km)

There are several key roads within 2km of the proposed structure plan that warrant discussion in this TIA most importantly the works currently been undertaken by Main Roads WA for the Northlake Road Extension and Grade Separated Interchange with Kwinana Freeway discussed in more detail in Chapter 5.

Figure 3.5: Existing Road Network within 2km

(map source: Reproduced with permission from Nearmap)

3.4 Traffic Counts (within 2km)

Several different sources were referred to obtain a full picture of the current traffic movements in the Glen Iris area.

Table 3.1 details publicly available tube counts showing Average Week Daily Traffic from Main Roads WA and the City of Cockburn, collected between 2018 and 2020.

Without any change in development of the Glen Iris Estate between 2018 and 2021, it is considered the 2018 counts are suitably accurate for the purpose of structure planning assessment.

Traffic volumes on external routes such as Berrigan Drive and Jandakot Road with a much larger catchment are referenced for years more recent.

Table 3.1 : Existing Traffic Volumes

	Location	Year	Monday to Friday Average	% Cars	% Trucks
1	Berrigan Drive – East of Kwinana Freeway	2020	27,780	89.2	10.8
2	Jandakot Road – East of Berrigan Drive	2019	18,261	91.7	8.3
3	Prinsep Road – South of Berrigan Drive	2020	5,525	81.8	18.2
4	The Lakes Boulevard – South of Berrigan Drive	2020	499	95.5	4.5
5	Turnbury Park Drive – West of Hartwell Parade	2018	1,067	96.0	4.0
6	Hartwell Parade – North of St James Mews	2018	1,049	96.3	3.7
7	Glen Iris Drive – North of Edie Court	2020	598	93.7	6.3
8	Glen Iris Drive – South of Bonville Glen	2020	405	96.2	3.8
9	Dean Road – North of Berrigan Drive	2021	2,187	94.6	5.4

In addition to the publicly available counts, the project team also commissioned turning vehicle movement surveys. These were undertaken in November 2020 between 7:00 – 9:00am during the AM period and between 4:00pm – 6:00pm during the PM peak period for the following intersections along Berrigan Drive for the purpose of undertaking traffic analysis of these intersections:

1 The Lakes Boulevard / Berrigan Drive

2 Turnbury Park Drive / Berrigan Drive

3 Prinsep Road / Berrigan Drive.

These collated turning volumes are shown in Figure 3.6 and Figure 3.7.

Figure 3-6: Intersection Turning Movement Counts – AM Peak

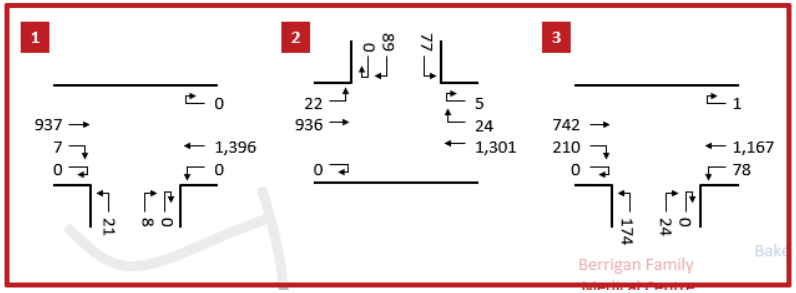


Figure 3-7: Intersection Turning Movement Counts – PM Peak

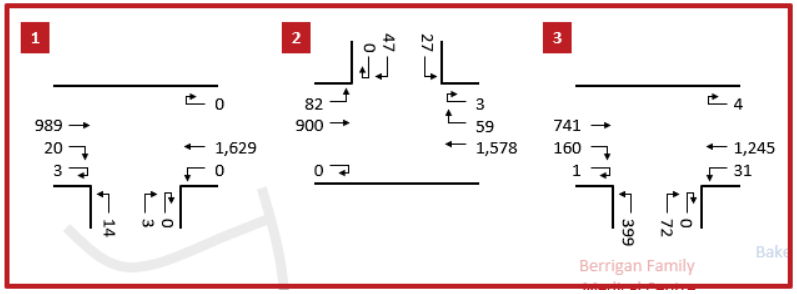


Figure 3-8: Existing Intersections – Berrigan Drive

Source: Google Maps

4 Proposed Internal Transport Networks

4.1 Proposed Road Hierarchy, Road Reserve Widths and Speed Limits

Due to the nature of this structure plan with large amounts of linear open spaces and larger lot sizes, reduces the need for on street parking. As such, typical cross-sections from Liveable Neighbourhoods guidelines can be modified to suit the intended purposes of the street typology without providing infrastructure unlikely to be used.

Figure 4.1 shows the proposed road hierarchy for the structure plan. The structure plan area contains a short section of Neighbourhood Connector A road off Berrigan Drive and a *modified* Neighbourhood Connector B or Access Street road running north-south through the structure plan area. The remaining of the street network will be Give-Way type lower order Access Streets. The internal road network within the structure plan area has been designed to provide frequent and logical connections to the existing road network to allow existing residents to travel through the structure plan area to access the Berrigan Drive corridor, thus relieving some existing traffic pressure on existing local roads such as Dean Road and Turnbury Park Drive.

As the area will be built up residential, the road network will be subject to default 50km/h speed limit, however through thoughtful street design it is proposed that the Neighbourhood Connector roads will have a target operating speed of no more than 50km/h while the Access Streets will be designed with target operating speeds between 30 – 40km/h. Additionally, street amenity is to be prioritised through the provision of trees and slow speeds.

Due to the larger sized residential blocks being proposed, on-street parking is *not* envisaged to be frequently required. As such dedicated on-street parking has been excluded from the typical Neighbourhood Connector style roads and road reservations could be as follows:

- Neighbourhood Connector A: typically 20m, allowing for traffic lanes, a dual use path on one side, with trees, light poles and drainage structures to be provided either within the verge area or proposed central median.
- Neighbourhood Connector B: typically 13.5 – 15m, allowing for traffic lanes, and a dual use path on one side of the road.
- Access Street: typically 13.5 – 15m, with a similar layout to Neighbourhood Connector B roads.

Proposed Internal Transport Networks

Figure 4-1: Structure Plan Road Hierarchy

(map base: Rowe Group, 2023

The road cross section layouts will be finalised through the detailed design of civil engineering drawings in the subdivision stages. A number of indicative cross section layouts have been prepared; however, it should be noted that these are representative only with flexibility in the layout enabling changes with final infrastructure selected or omitted (i.e. parking, cycle lanes and bus route, becomes apparent). Items to be addressed in the further development of the cross sections includes such things as:

- Neighbourhood Connector A Lane width of 3.2 to 3.5m (3.2m width is preferred to remove unsafe squeeze points for cyclists riding on the road) and flexibility for Public Transport Authority (PTA) buses, if there is opportunity for future public transport buses to connect from Karel Avenue (refer discussion in Section 4.4 – Public Transport)
- Provision for embayed parking in the street surrounding public open spaces.

Figure 4-2: Indicative Road Reserve for Neighbourhood Connector A

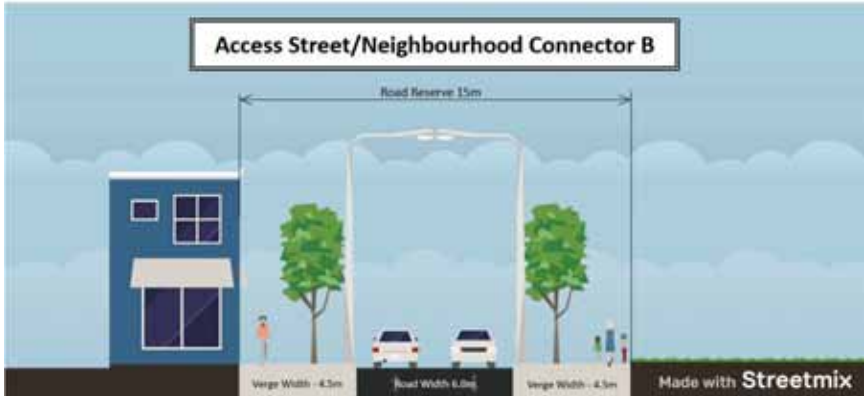
While it is not proposed to provide on street parking for the full length of Neighbourhood Connector Roads, there are areas where embayed parking can be provided. These areas will be focused around public open space and the medium density dwellings as required. Embayed parking allows the development to retain tighter and low-speed local streets while still providing the parking function to support relevant land uses.

Neighbourhood Connectors A road reserves of 20m allow flexibility in the pavement lane widths of 3.2m to 3.5m (preferred to be 3.2m to avoid a car or truck trying to take over a cyclist in this section and creating a cyclist squeeze points).

Liveable Neighbourhoods allows for flexibility in the various cross-sectional elements in a road reserve. In the case of each of the Neighbourhood Connectors the following has been considered:

- Neighbourhood Connector A: The 'typical' cross section is 24.4m and includes 1.5m wide on-road cycle lanes, 3.5m wide traffic lanes and a 2m wide median. It also allows the verge area of 6.5m to be narrowed to indented parking where provided. The basic indented parking can thus reduce the road reserve to 23m and this is noted in Liveable Neighbourhoods guidelines. If the provision for cyclists is to be off-road in the form of shared paths, the removal of the on-road cycle lanes from this 'typical' width would then reduce the road reserve to 20m. Additionally, if there was provision of an on-road bike lanes here, it will be only for short lengths either side of Berrigan Drive and have no connectivity to the road network further north and south along the Neighbourhood Connector B or Access Streets. The provision of off-road shared paths however, will allow connectivity into the shared path on the north side of Berrigan Drive which then connects to the PSP within the Kwinana Freeway reserve. Omitting any on-road bike lanes with a road reserve width of 20m is suitable and can provide for traffic lanes of 3.2m with a median or cut into the median for lane widths of 3.5m width (if enforced and creating undesirable cyclist squeeze points). The 3.2m is recommended as cyclists riding on a lane of 3.1m provides for increased cyclists' safety. At the same time, to allow for the possibility of long term future bus services, a bus lane with a median should not be any narrower than 3.2m. Thus, a 3.2m lane has been suggested as it provides for use by both cyclists on-road (if they so desire) and allows bus services to operate on the roadway in the long term future if land allows the connection to/from Karel Avenue.

Figure 4-3: Indicative Road Reserve for Neighbourhood Connector B / Access Street



- Neighbourhood Connector B / Access Street: These streets are required where they link neighbourhoods and towns. Neighbourhood Connector B are akin to higher order Access Streets. These road types typically carry up to about 3,000vpd. The main distinction between

Neighbourhood Connector B streets and Access Streets is that buses are typically provided for on Neighbourhood Connector B streets. Also, parking in both Neighbourhood Connector B and Access Streets should only need to be provided where there is expected to be parking demand on the street.

In the case of the proposed Neighbourhood Connector B in the southern cell, there is not proposed to be any bus route in this section and the street does not connect neighbourhoods and therefore is really a local Access Street. The function of this section of street is more closely aligned to an Access Street and thus 3.5m wide traffic lanes with embayed parking would not be required as would a Neighbourhood Connector B type street cross section. Traffic flows on this section of street are expected to be in the order of 1,000vpd and a cross section of an Access Street D could suffice (this with a 6m wide roadway and allowing for on-road parking). The proposed 15m road reserve on this section can then allow for the expected traffic flow and traffic composition.

For the proposed Neighbourhood Connector B / Access Street in the northern cell north of Hartwell Parade roundabout, this section is unlikely to carry a bus route in the immediate future. It is also not performing the function of a neighbourhood connector but an Access Street. This street will function similar to the parallel Dean Road, east of the structure plan area. Dean Road carries about 2,100vpd and is approximately 6.4m wide with a barrier line prohibiting on-road parking along its length. That is the same approach proposed for the proposed Neighbourhood Connector B in the proposed northern cell. The roadway is a meandering 6m width with a barrier line. This 6m pavement width is adopted to avoid removal of significant portions of trees along the roadway and maximising the amenity which the scheme amendment approval was to prioritise. The barrier line will also prohibit on-road parking. With no on-road parking, this road will be able to carry 3,000vpd. The expected daily flows on this road are expected to be 2,900vpd (conservative on the high side estimate) and thus catered for.

Apart from the roadway, the required verge of 4.1m can be provided on the western side, to cater for servicing and footpaths. On the side of the street with trees, the verge only needs to be wide enough to cater for drainage and street lighting (if provided on that side of the roadway). Any proposed pathway/shared path can then meander through the trees maximising residential amenity.

Thus the 4.1m wide verge on the western side of the roadway, the 6m wide roadway and the 1.5m for drainage/lighting on the eastern side would only require a road reservation of 11.6m. The proposed typical cross section of 15m will be able to cater for this requirement.

If there is to be a bus route in the long term future connecting to Karel Avenue, then the trees could then be removed at that time and the roadway widened to 7m width.

On sections of the street where there may be the requirement to provide on-street parking to one side the verge area could then be 5.5m width (with indented parking). With the 6m wide roadway the verge on the non-parking side of the street could be 3.5m width, this wide enough to cater for drainage and street lighting.

Typically, Access Streets throughout the proposed structure plan (due to it being a 'closed' catchment – ie no through traffic) will all carry well below 1,000 vehicles per day and will be designed with 5.5m – 6.0m pavements intended to function as yield or give-way streets.

External to the subject site, adjacent to the east, Prinsep Road has a history of resident complaints regarding speeding, noise and vibration. Previously installed speed humps were removed in 2020 as part of the Soloman Road Upgrade Project. The City has undertaken community consultation regarding the need for slow point treatments. The final outcome of the community consultation is yet to be determined; however has been noted by the City that the speed humps or similar may be reinstated. The reinstallation of the speed humps on Prinsep Road is unlikely to have an effect on the internal road network of the Structure Plan as there is no direct alternative route that would enable a faster travel path than that of Prinsep Road.

4.2 Intersection Controls

In response to the Department of Planning, Lands and Heritage (DPLH) requested modifications to the scheme amendment in May 2023, the Applicant can confirm that:

- The Fairway, to the south of Berrigan Drive, has a road reservation that involves an offset carriageway and if the road is required to be widened, will be to the golf course side.
- The Twin Waters Pass Bridge will be preserved, as a significant element of the existing character of the area.
- The potential for a mini-roundabout at the future four-way intersection of Twin Waters Pass / Portsea Gardens / New Road will be considered as part of the implementation of the subdivision and detailed on the civil engineering design plans. Notwithstanding, further discussion and a recommendation on a preferred treatment of Twin Waters Pass / Portsea Gardens / New Road is provided below for the City's consideration.

Any modifications to the existing local road network, required to facilitate development of the Structure Plan area, are to be undertaken entirely at the landowner/applicant's cost.

Internal to the structure plan, many intersections are adequate as priority-controlled T-intersections due to the very low traffic volumes.

There are two roundabouts proposed internally to the structure plan and two existing roundabouts that are proposed to be modified to include a fourth leg.

The two existing roundabouts that are proposed to be modified to provide a fourth leg are located at Bonville Glen / Glen Iris Drive and Turtle Point Cove / Glen Iris Drive, as shown below in Figure 4.4 and Figure 4.5 (overleaf).

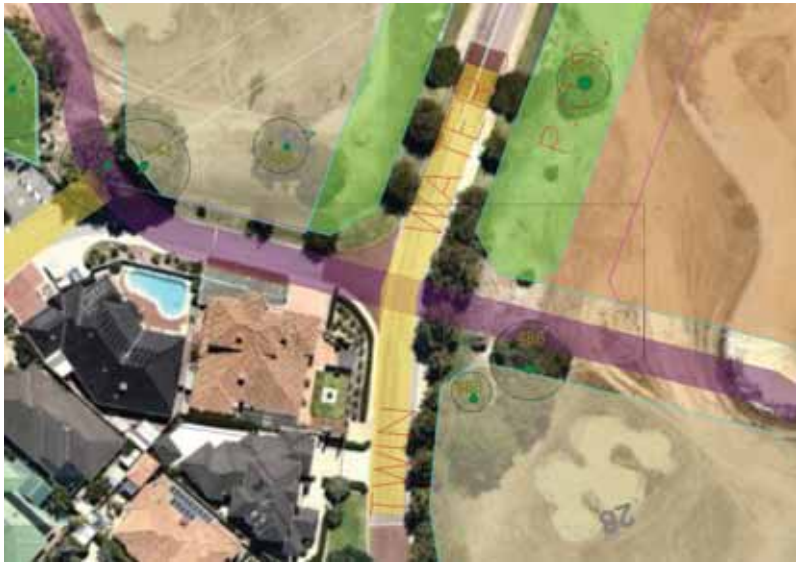
Figure 4-4: Bonville Glen / Glen Iris Drive

Figure 4-5: Turtle Point Cove / Glen Iris Drive

Both roundabouts have central islands of 6m radius and 7m circulating widths and are considered appropriate for the volume of future traffic anticipated (i.e. with development) which is less than 2,000 vehicles per day.

Another alternative intersection arrangement is the four-way priority-controlled intersection with the existing Twin Waters Pass shown below in Figure 4.6. Given that a four-way intersection has a likely higher crash risk than other alternative layouts, such as roundabout or a staggered T-intersection, treatment of this intersection as a raised intersection to control traffic speeds along the Neighbourhood Connector / Access Street and control speeds through the intersection is recommended. The future volume of traffic through this intersection is likely to be between 2,000 – 2,900 vehicles per day. However, given the location constraints with Portsea Drive verges, the need to retain the Twin Water Pass Bridge as a signification element of the existing character of the area and to meet adequate sight distances while minimising impacts to existing properties, a raised four-way intersection design is considered a better and more appropriate intersection treatment at this location.

Figure 4-6: Twin Waters Pass 4-Way Intersection



(map source: Reproduced with permission from Nearmap)

The DPLH also requested an assessment of the proposed and/or modified intersections of Bonville Glen / Glen Iris Drive, Turtle Point Cove / Glen Iris Drive and Twin Water Pass / planned new road, OR the DPLH asked for a suitable justification as to why an assessment of these proposals is not required. From a traffic engineering perspective, these streets will be low volume (below 3,000 vehicles per day at full development) and low speeds (target below 50km/hr) and operationally do not require capacity assessment as they will operate with spare capacity and very little vehicular delays. However, engineering assessments will be undertaken at all three aforementioned intersections and will be considered as part of the implementation of the subdivision.

Lastly there is a proposal to include an important and new signalised intersection along Berrigan Drive to cater for new development traffic but also to greatly improve the unsafe and inefficient access for the existing residents who are currently having to use uncontrolled intersections at Turnbury Parkway and The Lakes Boulevard. The current inefficiency and diminishing safety were a strong and consistent message from the community consultation undertaken from all residents who provided input into traffic matters.

Therefore, a high level concept plan for a proposed new signalised intersection is shown in Figure 4.7. While this concept does not show any pedestrian facilities, it is intended that the intersection provides protected pedestrian crossing ability across Berrigan Drive. This intersection is in concept stage and is currently undergoing the formal endorsement process through Main Roads WA with the support of the City of Cockburn at the time of writing this report. The proposed signalised intersection provides existing residents who are struggling to maintain good access with the ability to make protected right turn movements to and from Berrigan Drive, also a protected pedestrian crossing ability and it also provides a better access point for future bus services north and south into the Glen Iris Estate.

In relation to the proposed signals, the project team met with Main Roads WA officers along with City of Cockburn's Traffic Engineering representative in May 2021. The City of Cockburn expressed in-principal support for the proposed intersection in response to community concerns around safety and performance of the existing priority-controlled intersections along Berrigan Drive. Main Roads WA has since provided Gateway 1 endorsement for traffic signals at this location (submitted 6 September 2021) under the Traffic Signal Approval Policy determining that traffic signal control was the most appropriate form of intersection control for the new required intersection as detailed in Appendix D.

Figure 4-7: Berrigan Drive Intersection – Concept Design only

(map source: Reproduced with permission from Nearmap)

4.3 Pedestrian/Cycle Networks and Crossing Facilities

In April 2016, WA's laws were changed to allow cyclists of all ages to use footpaths, unless otherwise signed. The amendment to the Road Traffic Code 2000 brought WA's bicycle laws into line with the rest of Australia, making it legal for parents to cycle alongside their children on footpaths, improving safety.

All streets within the structure plan are proposed to include a 2.0m path on one side of the street as a minimum. Strategic routes through the structure plan including those that follow any future bus routes will have paths provided on both sides of the street.

In addition to the path network provided within the road reserve, there is also a proposed dual-use path that travels through all 25% open space proposed within the structure plan. This trail is approximately 7km long and provides excellent recreational amenity for both existing residents and residents within the structure plan area.

City of Cockburn long term cycle network supports the duplication of the Kwinana Freeway PSP with a PSP on the eastern side of the freeway in addition to the existing PSP, with local connections planned into the Glen Iris Estate. A commuter cycle route is also proposed along Prinsep Road that links in with the new PSP and provides access to Cockburn Central Railway Station. At the time of writing this TIA no timing for these works is confirmed, it is noted that the additional density and development at Glen Iris would likely have a positive impact on any business cases to support these works.

4.4 Public Transport Routes

The project team met with the PTA in May 2021 to discuss future public transport servicing for the Glen Iris Structure Plan. The PTA expressed a keen interest in making the existing 515 route more attractive by providing a connection between Murdoch and Cockburn train stations. The PTA suggested that if there was to be a future service that travelled into the Glen Iris Structure Plan area it would need to enter from the north and exit at Berrigan Drive. Given the closed catchment, the route that was put forward was the 515-bus travel along Karel Avenue turning into Lakes Way then accessing the structure plan area via the historical road reserve that exists between Dean Road and Lakes Way. The bus would then use Twin Waters Pass to access the proposed new internal road network within the new structure plan area and travel south to the proposed signalised intersection at Berrigan Drive before continuing its journey west along Berrigan Drive to Cockburn station via Semple Court and Muriel Way.

The feasibility of this route to connect into the Glen Iris structure plan is dependent on land availability as the desired bus route would need to traverse what is currently privately owned land.

Feasibility internal to the structure plan is dependent on available sight distance, appropriate road widths and turning circles, and potential stop locations. The structure plan provides a north-south orientated internal road network that is capable of accommodating future PTA buses but the

Proposed Internal Transport Networks

feasibility of a road connection to the north-east outside of the structure plan area is not currently possible.

The PTA confirmed the southern area of the structure plan (south of Berrigan Drive) is reasonably well covered in terms of the 400m walking catchment to the existing PTA bus stops on Berrigan Drive. As such, it is more critical to provide a bus service that travels through the northern estate to increase the walkable catchment to a bus stop.

In addition to the more localised public transport there is the current METRONET project for the construction of Perth's first orbital (i.e. cross line - not direct to/from the Perth CBD) heavy rail line connecting the Mandurah and Armadale/Thornlie line. Residents of existing and future Glen Iris will be able to access areas such as Canning Vale, Cannington Strategic Metropolitan Centre and the Burswood Peninsula for a range of employment, sporting and recreation opportunities. Currently residents would have to travel all the way back into the Perth CBD before switching lines to travel back down to Thornlie / Armadale.

As noted earlier in this TIA under Section 1.3, more than three-quarters of the existing estate is outside of a 400m typical walking catchment of the only bus stops on Berrigan Drive. As such, should land ownership allow the opportunity, the structure plan does not omit the possibility to improve the accessibility and services of public transport to existing and future residents and visitors of the estate.

5 External Transport Networks

5.1 Proposed Modifications to Existing Road Network

As introduced in Section 4.2 the structure plan proposes to modify the three existing uncontrolled intersections with Berrigan Drive to enable the creation of a single, new, safer and “controlled” intersection with Berrigan Drive. This intersection will improve the efficiency for all approach demands.

For this to occur it is proposed to convert the existing full-movement uncontrolled intersection of Berrigan Drive / The Lakes Boulevard into a left-in-left-out arrangement. This will still provide a level of permeability in the local road network and a convenient access to the Kwinana Freeway for residents. The problematic right turn movements which is currently experiencing unacceptable delays would be removed and instead undertaken at the proposed signalised intersection. This proposal received positive support from the resident representatives during the consultation phase leading to this structure plan.

Due to the geometric requirements of a signalised intersection and maintaining adequate separation between the Kwinana Freeway interchange and the existing Dean Road traffic signals, Turnbury Park Drive is required to be closed completely with no access permitted onto Berrigan Drive. Instead, residents will be able to access their local street network via the proposed controlled signalised intersection. While this is a marginally longer vehicle trip for a small portion of residents, the benefit of a dedicated right turn priority at the new signalised intersection makes for a safer and more efficient journey overall removing the long wait times currently being experienced. Turnbury Park Drive cannot be retained as a left-in-left-out arrangement like The Lakes Boulevard due to the proximity of the intersection to the new intersection. Again, this proposal received positive support from the resident representatives during the consultation phase leading to this structure plan.

5.2 Armadale Road to North Lake Road Bridge

There is a large construction project being undertaken by Main Roads WA to the south of the structure plan area at North Lake Road / Armadale Road. The North Lake Road Bridge Project will connect North Lake Road to Armadale Road via a bridge over the Kwinana Freeway. It also includes a Collector Distributor (CD) road between the Berrigan Drive freeway interchange and the North Lake Road freeway interchange.

This project has the potential to significantly impact (improve) the local road network adjacent to the structure plan, in particular Berrigan Drive. The fast-growing suburb of Treeby and the existing light industry / service commercial land uses surrounding Cutler Road and Solomon Road all have

access to and from Armadale Road. At present though Armadale Road is experience very high levels of traffic congestion, so much so, it is plausible that residents and other drivers that frequent the area are seeking out alternative routes.

Once the North Lake Road Bridge Project is completed it would provide a much more convenient and direct route for traffic accessing these areas directly via the Kwinana Freeway instead of using Berrigan Drive to exit. This could see potentially between 3,000 – 6,000 vehicles per day transfer from Berrigan Drive onto North Lake Road / Armadale Road.

Figure 5-1: Schematic - Armadale Road to North Lake Road Project

Source: Main Roads WA

6 Integration with Surrounding Area

6.1 Trip Attractors/Generators within 800m

The proposed structure plan is primarily residential with a relatively small local centre designed to service the immediate community. As such there is limited potential for attraction of high proportions of external trips outside of the Glen Iris community into the structure plan area.

Most trip attractors for this community are outside of an 800m catchment as the Glen Iris area is predominately residential in nature. There is potential Jandakot Airport and the service-industrial land around Cutler Road could be considered as employment attractors with both areas connected via the existing road network.

Lakelands Senior High School and South Lake Primary School are the closest schools to the proposed structure plan approximately 1.2km and 2.5km to the west of the structure plan area, respectively.

6.2 Proposed Changes to Land Uses within 800m

The current rural residential land east of Glen Iris is currently subject to a Planning Investigation Area (PIA) known as the Jandakot/Treeby Planning Investigation Area. According to the DPLH, a land use for this PIA will be finalised as part of the 2021 review of the *South Metropolitan Peel Sub-Regional Planning Framework*.

6.3 Travel Desire Lines from Structure Plan to these Attractors/Generators

Due to the shape of the existing Glen Iris Estate, the travel and desire lines to/from external trip attractors rely on Berrigan Drive and residents must travel north / south to Berrigan Drive to then travel along Berrigan Drive to access the Kwinana Freeway or Roe Highway.

6.4 Adequacy and Deficiencies in External Transport Networks

Berrigan Drive exists as a major barrier to pedestrians and cyclists wishing to cross the road corridor unprotected. Being a four-lane dual carriageway carrying approx. 27,000 vehicles per day, the road presents a challenge to cross, particularly for vulnerable road users.

At present, the only controlled crossing points are at the Kwinana Freeway traffic signals or the Dean Road traffic signals. The underpass is available however does not currently meet CPTED design requirements as previously noted.

Therefore, the proposed new signalised intersection with protected crossing phases and a potentially refurbished underpass will provide much needed alternatives for pedestrians and cyclists wishing to cross Berrigan Drive.

At present emergency access to the northern portion of Glen Iris Estate from Berrigan Drive is limited to the Dean Road / Berrigan Drive signalised intersection and the uncontrolled intersection of Turnbury Park Drive / Berrigan Drive. The proposed structure plan and accompanying street network proposes a new signalised intersection for safe and more efficient access onto Berrigan Drive as well as a new and more direct street network that runs directly to the north of the existing Glen Iris Estate. This new intersection and street network will reduce pressure on the existing lower order street networks of Glen Iris Drive and Dean Road and will allow emergency services such as police, fire and ambulances a more direct and efficient access into the area than the current street network allows.

7 Analysis of Transport Networks

7.1 Assessment Year(s) and Time Period(s)

The site is currently undergoing a formal structure planning process with development envisaged to commence around 2023. It is expected that full development of the site could be completed within 4-5 years making the full build out year 2028.

Accordingly, this TIA assesses the existing road network in 2023 as the 'base year without development' and then '2028 with full development', as per WAPC Guidelines Volumes 2, to satisfy "the structure plan should be undertaken for the (assumed) year of full development".

There is a concurrent process of traffic signals approval for the Berrigan Drive intersection and the modified (closed) intersection of Turnbury Park Drive and this is being undertaken as a separate but concurrent exercise through the Main Roads Traffic Signal Approval Policy (TSAP) process. This modelling for a new set of traffic signals assesses the same 2023 base opening year and then a full build out at 2028, with an additional plus five years to 2033 in accordance with the policy. These time horizons were pre-agreed with Main Roads WA through their formal Traffic Modelling Instruction Form (TMIF) at the start of the Stage 1 TSAP process.

Stage 1 TSAP application for a set of traffic signals at Berrigan Drive was endorsed by Main Roads WA in 2022.

At present (July 2023) the project team is working through the Stage 2 TSAP LinSig models which are currently being assessed by Main Roads Network Operations Directorate. This includes the two future year scenarios (2028 and 2033) and traffic flows have been completed following multiple consultations and are being reviewed by Main Roads. Weekday AM and PM peak periods form the basis for assessment of the LinSig modelling.

A specific query relating to a community oval in the structure plan has been raised in the scheme amendment approval. However, this land use typically has a trip generation peak during weekends outside of the weekday commuter AM and PM peak periods. The survey data shows that the daily and peak flows on weekends in the area are some 30% less than the busiest weekday PM peak period on the road network and therefore the use of a future community oval is not expected to result in detrimental traffic flow effects. Further, this non-competing peak traffic demand impact assessment is a detail that can be assessed post structure plan approval.

7.2 Structure Plan Generated Traffic

The trip generation rates used in this TIA are shown in Table 7.1 below. As mentioned previously, the local centre will predominately service residents who are local to Glen Iris with the project's

Glen Iris Retail Assessment study concluding 80% of the trips associated with the local centre will likely be internal – internal trips. Relating this to traffic modelling, this 80% is supported by the fact that it is an existing local centre being expanded and the existing retail trips are collected as 'existing' data in the traffic surveys. The 80% has therefore been adopted in the traffic modelling.

It is assumed most of the vehicle traffic generated by the residential component will be travelling externally to the site given the limited local trip attraction. Total trips on the external road network from the structure plan is expected to be about 4,200 to 5,000 trips per day, with up to approximately 485 trips in the AM peak and 500 trips in the PM peak (this generated from the north, central and south precincts). To put this into context and assuming an even traffic distribution in the peak hours, the new traffic because of development is only 8.3 vehicle trips per minute two-way (north, central and south precincts).

Figure 7-1: Structure Plan Trips Generation Rates

Land Use	Units	Weekday	AM	PM	AM In	AM Out	PM In	PM Out	Source
Residential	Dwelling	8	0.8	0.8	25%	75%	63%	37%	WAPC
Local Centre	100m² GFA	46.0	1.0	4.0	62%	38%	48%	52%	ITE – 9th Edition

At the time of the preparation of the initial TIA, the trip rates for the local centre were based on the Institute of Transportation Engineers (ITE) Trip Generation Manual rates (9th/10th editions that were the latest available at the time of the preparation of the original TIA). A metrically converted rate of 1 trip per 100m2 in the AM peak and 4 trips per 100m2 in the PM peak was applied. This aligns close to the non-food Retail rates suggested in the Transport Assessment Guidelines (WAPC 2016). However, the recent 11th edition ITE manual was released just after the submission of this TIA. At the request of the WAPC, a comparison was undertaken of the various editions and the resultant effect on the traffic flows adopted in the modelling in the AM and PM peak periods. This is summarised below in Figure 7-2.

Figure 7-2: Trip Generation Rates Comparison

	ITE 9th Edition	ITE 10th Edition	ITE 11th Edition	WAPC
2,500m² existing Local Centre - Daily				
Daily per 100m²	46	41	59	~45
Total Daily Generation	1,150	1,020	1,465	~1,125
After 80% Discount	230	205	295	~225
2,500m² existing Local Centre - PM				
PM per 100m²	4.0	4.1	7.1	4.0
Total PM Generation	100	105	180	100

	ITE 9th Edition	ITE 10th Edition	ITE 11th Edition	WAPC
After 80% Discount	20	20	36 (~+2 to +3 per mvt)	20
5,000m² combined Local Centre - PM				
PM per 100m²	4.0	4.1	5.6	4.0
Total PM Generation	100	105	140	100
After 80% Discount	20	20	28 (~+1 to +2 per mvt)	20

A comparison of the total floor area of the commercial/retail strip that will be created on the north side of Berrigan Drive was undertaken. The development proposes the existing local centre be expanded to create a total commercial centre of approximately 5,000m2.

The assessment shows that the choice of traffic flow edition will not make a material difference as the generation has not changed substantially (as expected) when directions and movements are taken into account and considering the overall commercial floorspace. It has been found that the difference in traffic lows would be in the order of 1-2vph per movement at the Berrigan Drive intersection and this does not materially change the modelling results.

The above was presented to WAPC in a meeting in June 2023 and was verbally accepted and agreed by the attending officers, subject to the TIA being updated accordingly (this report).

Figure 7-3: Structure Plan Trip Generation

Land Use	Quantity	Weekday	AM	PM
Residential	500 – 600 dwellings	4,000 – 4,800	400 - 480	400 - 480
Local Centre	2,500m2 GFA	230 (external trips)	5 (external trips)	20 (external trips)
Total		5,030	485	500

7.3 Extraneous (Through) Traffic

The internal street network for the proposed structure plan area has been carefully designed to assist existing traffic from the existing Glen Iris Estate to be able to use the new road network. This to enable significantly better access to/from Berrigan Drive then what is currently being afforded.

As requested by the City of Cockburn in a separate exercise, the effects of the proposed Surf Park near Cockburn Central has also been assessed with a traffic modelling sensitivity test undertaken to examine the effects of the additional traffic expected from this proposed development. An interim period of 2025/26 was assessed, where the modified intersection of Turnbury Drive at Berrigan Drive had not yet been constructed but 250 lots of the Glen Iris structure plan had been delivered, north of Berrigan Drive.

The SIDRA modelling for intersection of Berrigan Drive / Jandakot Road / Dean Road intersection was re-modelled with the trips to be generated by the Surf Park. Given the smaller traffic distribution of 25% of Surf Park traffic to use Prinsep Road to then head north-east, it was found that these will be likely to turn right to Berrigan Drive (or left from Berrigan Drive going the other way) and then to/from Berrigan Drive north-south road's north approach.

The traffic report that was prepared to support the Surf Park development notes trips of 74 eastbound and 74 westbound trips in the peaks, which was therefore applied to Berrigan Drive and added on top of the Glen Iris structure plan traffic in 2025 and 2026, in both the AM and PM peak scenarios.

In the AM peak, the impact of Surf Park onto the Berrigan Drive new Glen Iris signalised intersection is insignificant in both 2025 and 2026 scenarios due to the directional distribution of the Surf Park. Additionally, the existing Berrigan Drive / Jandakot Road / Dean Road signalised intersection has an overall DoS remaining the same as without the Surf Park, as the through movements are not the critical movement.

For the PM peak, the Surf Park additional trips will increase the Berrigan Drive / Jandakot Road / Dean Road signalised intersection DoS of the intersection from 0.69 to 0.72 in 2025 and 0.73 to 0.75 in 2026. This is still within capacity, however the queue on the westbound approach is expected to slightly increase as previously reported, due to additional demand.

Other than that, the additional Surf Park trips do not materially change the traffic performance of the delay and cycle time of the intersections assessed.

Again, the Surf Park traffic is not expected to impact the proposed new signalised intersection, west of Prinsep Road. The location of the Surf Park is such that it has a more attractive access (and close proximity) towards the south via Armadale Road and the Kwinana Freeway interchange, as highlighted by the Surf Park report's assumed traffic distribution.

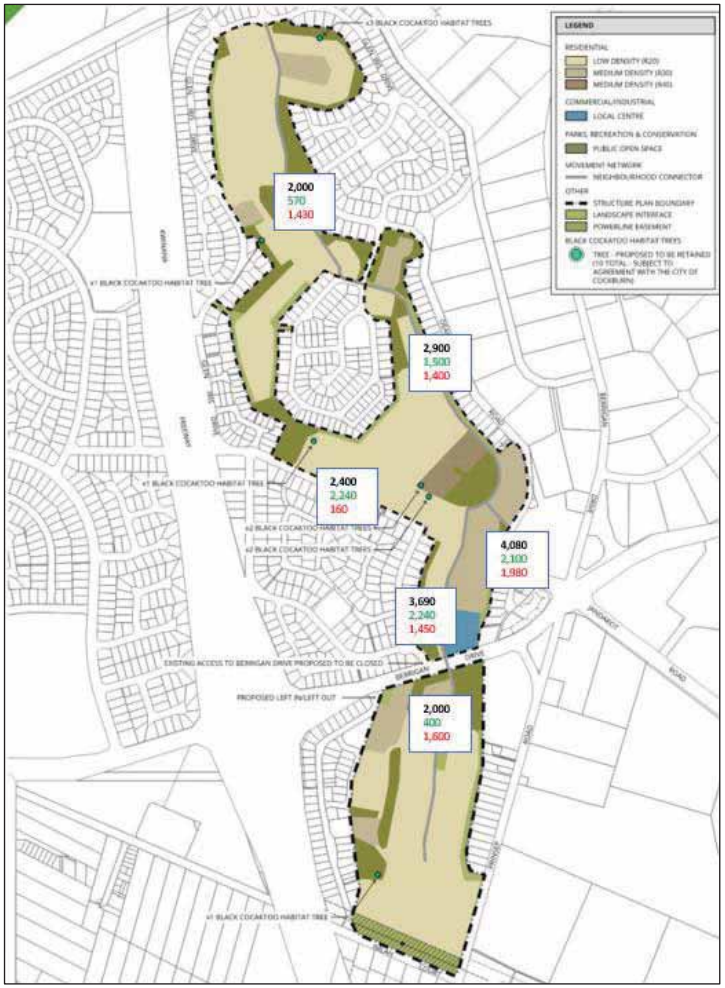
The previous conclusions remains the same in that the intersection of Berrigan Drive / Jandakot Road / Dean Road can accommodate the development of the Glen Iris Structure Plan of some 250 occupied dwellings by end of 2026 and with the Surf Park noted estimated traffic, without the proposed new traffic signals required at Berrigan Drive.

7.4 Design Traffic Flows (i.e., Total Traffic)

Vehicle trips were manually assigned onto the road network based on directness of the route and length of travel.

Figure 7.1 shows the total traffic generated onto the external road network. The numbers in bold represents the total traffic. The numbers green represent vehicle trips associated with existing dwellings within the Glen Iris Estate. The numbers in red represent the expected structure plan traffic. As can be seen, the traffic associated with the proposed structure plan largely stays on the proposed internal network, which was purposely designed for. There are however some trips associated with lots directly fronting Hartwell Parade, but these are minor at only 160 trips per day (1 vehicle every 3.8 minutes in the busiest peak hour, two-way).

Figure 7-1: Expected Total Trip (two-way) Daily Volumes



(base map source: Rowe Group, 2023)

7.5 Level of Service Concepts

The level of service concept describes the quality of traffic service in terms of six levels, designated A to F, with level of service A (LOS A) representing the best operating condition (i.e. at or close to free flow), and level of service F (LOS F) the worst (i.e. forced flow). More specifically:

- LOS A: Primarily free flow operations at average travel speeds, usually about 90% of the FFS (free flow speed) for the given street class. Vehicles are completely unimpeded in their ability to manoeuvre within the traffic stream. Control delay at signalised intersections is less than 10 seconds. At non-signalised intersections the average control delay is less than 10 seconds.
- LOS B: Reasonably unimpeded operations at average travel speeds, usually about 70% of the FFS for the street class. The ability to manoeuvre within the traffic stream is only slightly restricted, and control delays at signalised intersections are between 10 and 20 seconds. At non-signalised intersections the average control delay is between 10 and 15 seconds.
- LOS C: Stable operations; however, ability to manoeuvre and change lanes in mid-block locations may be more restricted than at LOS B, and longer queues, adverse signal coordination, or both may contribute to lower average travel speeds of about 50% of the FFS for the street class. Signalised intersection delays are between 20 and 35 seconds. At non-signalised intersections the average control delay is between 15 and 25 seconds.
- LOS D: A range in which small increases in flow may cause substantial increases in delay and decreases in travel speed. LOS D may be due to adverse signal progression, inappropriate signal timing, high volumes, or a combination of these factors. Average travel speeds are about 40% of FFS. Signalised intersection delays are between 35 and 55 seconds. At non-signalised intersections the average control delay is between 25 and 35 seconds.
- LOS E: Characterised by significant delays and average travel speeds of 33% of the FFS or less. Such operations are caused by a combination of adverse progression, high signal density, high volumes, extensive delays at critical intersections (between 55 and 80 seconds), and inappropriate signal timing. At non-signalised intersections the average control delay is between 35 and 50 seconds; and,
- LOS F: Characterised by urban street flow at extremely low speeds, typically 25% to 33% of the FFS. Intersection congestion is likely at critical signalised locations, with high delays (in excess of 80 seconds), high volumes, and extensive queuing. At non-signalised intersections the average control delay is greater than 50 seconds.

In addition to the above:

- Average Delay: is the average of all travel time delays for vehicles through the intersection; and,
- Queue: is the queue length below which 95% of all observed queue lengths fall.

Degree of Saturation: Ratio of the traffic flow to the capacity for that lane/movement.

7.6 Intersection Controls

The project team also undertook traffic counts at the existing priority-controlled intersections and have subsequently analysed their performance in SIDRA as a network with the Kwinana Freeway intersections and the existing signalised intersection at Dean Road.

Table 7-4: Existing Intersection Performance – 2020 AM Peak

Location	Arm	DOS	Avrg Delay	95th %ile Q
Berrigan Drive / The Lakes Boulevard - AM 2020	The Lakes Boulevard (S)	0.22	31s	3m
	Berrigan Drive (E)	0.54	0s	95m
	Median RT (W)	0.07	34s	2m
	Berrigan Drive (W)	0.28	0s	0m
	Intersection	0.54	1s	95m
Berrigan Drive / Turnbury Park Dr - AM 2020	Median RT (E)	0.11	16s	3m
	Berrigan Drive (E)	0.39	1s	0m
	Turnbury Park Drive	0.53	47s	14m
	Berrigan Drive (W)	0.28	0s	0m
	Intersection	0.53	7s	14m
Berrigan Drive / Prinsep Road - AM 2020	Prinsep Road (S)	0.38	30s	20m
	Berrigan Drive (E)	0.33	0s	0m
	Median RT (W)	1.13	174s	18m
	Berrigan Drive (W)	0.22	0s	176m
	Intersection	1.13	26s	358m

Figure 7-5: Existing Intersection Performance – 2020 PM Peak

Location	Arm	DOS	Avrg Delay	95th %ile Q
Berrigan Drive / The Lakes Boulevard - PM 2020	The Lakes Boulevard (S)	0.13	32s	5m
	Berrigan Drive (E)	0.44	0s	196m
	Median RT (W)	0.20	44s	4m
	Berrigan Drive (W)	0.28	0s	0m
	Intersection	0.44	1s	196m
Berrigan Drive / Turnbury Park Dr - PM 2020	Median RT (E)	0.19	13s	5m
	Berrigan Drive (E)	0.44	0s	338m
	Turnbury Park Drive	0.49	62s	12m
	Berrigan Drive (W)	0.28	0s	0m
	Intersection	0.49	4s	338m
Berrigan Drive / Prinsep Road - PM 2020	Prinsep Road (S)	1.03	75s	187m
	Berrigan Drive (E)	0.45	0s	0m
	Median RT (W)	0.71	34.5	30m
	Berrigan Drive (W)	0.22	0s	0m
	Intersection	1.34	17.8	187m

As can be seen from the intersection performance above (and as expressed by residents through the community consultation), the uncontrolled intersections are resulting in very high levels of delays. In the case of Prinsep Road, significant queuing is modelled and observed largely due to the high volume of through traffic along Berrigan Drive.

As these intersections are uncontrolled there is no delays attributed to the through movements along Berrigan Drive as they are unopposed. The presence of queuing on these legs in the above table is due to downstream lane blocking at the Kwinana Freeway intersection in the case of the Berrigan Drive (E) approach and Dean Road signals for the Berrigan Drive (W) approach in the peak periods modelled.

It is apparent from the above analysis that the uncontrolled intersections of Turnbury Park Drive and The Lakes Boulevard would not continue to function with increased traffic growth from either the proposed structure plan or the background growth occurring along Berrigan Drive. These SIDRA analysis results, coupled with a review of the existing crash history, and of course the consistent community feedback, led the project team to conclude that an alternative access arrangement needed to be put in place for the proposed structure plan as well as increase safety and efficiency for the existing residents of Glen Iris.

A signalised intersection was selected in order to provide the opportunity to coordinate the new intersection with the existing signals at the Kwinana Freeway and Dean Road / Jandakot Road intersection. The approval of this critically needed new intersection and its form needs to adhere to the Main Roads WA Intersection Control Guidelines and the Main Roads WA TSAP, and this supporting documentation was submitted as part of the Gateway 1 application to Main Road WA in September 2021. Gateway 1 received formal endorsement from Main Roads WA in 2022.

For completeness, the modelling analysis of all intersection form options (roundabout and signals) assessed is provided within Appendix C. This also includes the modelling (now updated following discussions with DPLH) that was included in the TSAP Stage 1 approvals with Main Roads. This includes models for 2023, 2028 and 2033 networked from the Kwinana Freeway to the intersection of Dean Road/Jandakot Road/Pilatus Street.

Dean Road

Dean Road currently forms a four-way signalised intersection with Berrigan Drive and Jandakot Road. SCATS data was collected from September 2020 to obtain traffic volumes to undertake the intersection traffic analysis. Phasing and signal timings were also adopted from SCATS for the 2020 scenario. The analysis results shown in Table 7.6 and Table 7.7 show an intersection that is currently operating with a good Degree of Saturation and delay. The analysis suggests that if needed the Dean Road intersection could cater for an increase in traffic volumes on Dean Road in the short to medium term but not in the medium to longer term.

The SCATS data also confirms that the priority movements from Dean Road are the left and right turns out onto Berrigan Drive, this presents a possibility for the intersection to be modified with the Dean Road approach being double right turning lanes and a single through lane to Jandakot Drive. This is supported by the current phasing arrangement where Dean Road and Jandakot Road are running in split phases so there is no overlap turn.

Table 7-6: Dean Road / Jandakot Road / Berrigan Drive – 2020 AM Peak

Location	Arm	DOS	Avrg Delay	95th %ile Q
Berrigan Drive Jandakot Road_AM 2020	Jandakot Road	0.90	28s	219m
	Berrigan Drive East	0.21	22s	30m
	Dean Road	0.42	37s	35m
	Berrigan Dr West	0.60	33s	69m
	Intersection	0.90	30s	219m

Table 7-7: Dean Road / Jandakot Road / Berrigan Drive -2020 PM Peak

Location	Arm	DOS	Avrg Delay	95th %ile Q
Berrigan Drive Jandakot Road_PM 2020	Jandakot Road	0.46	22s	74m
	Berrigan Drive East	0.78	36s	148m
	Dean Road	0.36	42s	24m
	Berrigan Dr West	0.59	34s	100m
	Intersection	0.78	32s	148m

There is currently a proposal by others to modify the Dean Road intersection to include a double signalised left turn lane from Jandakot Road onto Berrigan Drive (south to west). This is being progressed separately to the Glen Iris structure plan by another landowner. The project team had not had the opportunity to review the modelling or supporting documentation for this separate proposal, however it will be accounted for in any future decision making on the form and function of the existing Dean Road traffic signals for the longer term.

7.7 Pedestrian / Cycle Networks

With a path network proposed throughout a deliberately connected public open space within the structure plan, the residents of Glen Iris Estate will have access to over 7km of new walking/cycling trails. This is in addition to the path network that exists along the street alignments.

The additional street network also provides a more direct link to Berrigan Drive for pedestrians and cyclists that are required to the use the Berrigan Drive path network to access the PSP along Roe Highway and the Kwinana Freeway.

In the medium to longer term City of Cockburn has planning in place for the duplication of the Kwinana Freeway PSP to/from the western side of the Kwinana Freeway via local connections into the Glen Iris Estate. The proposed structure plan will assist with this east-west future desire line, providing a path network that currently does not exist through the previous golf course land.

7.8 Impact Assessment

7.8.1 Trip Distribution

Given that the land use proposed within the structure plan will be the same as the existing land use within Glen Iris Estate, the trip distribution for new trips was adopted from current traffic movements at the existing intersections with Berrigan Drive.

AM + PM Peak:

- 60% trips west

- 40% trips east.

Trips were assigned at individual intersections based on existing turning movements.

7.8.2 Traffic Impact of Development Traffic

The proposed structure plan has the potential to introduce an additional 5,000 vehicle trips onto Berrigan Drive per day (two-way, from both the north, central and south precincts, equating to 8.3 vehicle trips trip every minute), an increase of approximately 15% based on the most recent traffic counts along Berrigan Drive. Please note that "trips" are NOT the same as the number of "vehicles", rather a trip or direction of travel from an origin to a destination. Therefore, a visit to the shops from a house as an example would equate to TWO trips for the 'to' trip and the 'return' trip.

Impact of the structure plan on the existing local street network within Glen Iris can be considered minimal with up to 95% of the dwellings proposed within the structure plan utilising the new street network and only 5% of the generated trips needing to use a small portion of the existing local network.

Conversely it is estimated that traffic from the existing development could contribute up to 50% of total trips on some streets within the structure plan area closer to Berrigan Drive.

The structure plan therefore has the potential to have a positive impact on the existing residents within Glen Iris providing for safer and more efficient access out onto Berrigan Drive.

It is expected that with the additional trips assigned to Berrigan Drive, there will be some reduction in the performance of Berrigan Drive for through vehicles travelling to / from Dean Road and the Kwinana Freeway, however this is countered by the improved safety and access for right turning vehicles making turns to/from Berrigan Drive.

Getting the balance of safety and performance for a corridor such as Berrigan Drive is crucial for all involved. Developing an approved solution is underway with Main Roads WA and will be presented outside the scope of this impact assessment report. At the time of writing this TIA consultation is already underway for the modelling of the Berrigan Drive corridor and the consideration of various access options to best facilitate development and improve safety along this section of road. It is also worth noting that current traffic volumes along Berrigan Drive have a high probability of changing (reducing) with the opening of the North Lake Road Bridge and interchange with the Kwinana Freeway. The completion of this project will likely see the volumes along Berrigan Drive decrease, allowing for improved operational performance for the critically needed new traffic signals along this route.

8 Conclusion

Based on the analysis and discussions presented within this report, the following traffic and transport conclusions are made:

1 The scheme amendment approval was on the basis of modifications prioritising amenity in the development for existing and new residents of Glen Iris. Accordingly, there are proposed to be over 7km of new path network within the Structure Plan for walking and cycling through the area with numerous opportunities for connections to the existing network for existing residents to be able to make use of the new paths. The path network will be made attractive to walking and cycling through landscaping and shade which is a characteristic of the existing estate that will be retained.

2 The proposed road reserve widths provide flexibility to enable public transport services from Karel Avenue towards Berrigan Drive signals once a route can be established through private land outside the structure plan area to the north-east.

3 The existing road network in the existing Glen Iris Estate was not intended to cater for a high proportion of future increase in traffic volumes. Further, traffic volumes along Berrigan Drive have continued to grow at a consistent and relatively high rate over the past 5 years to 2021, resulting in very poor and worsening levels of service and diminishing safety for existing Glen Iris Estate residents to access Berrigan Drive and beyond. Currently, most of the residents are wholly dependent on priority controlled (also referred to as "uncontrolled") full movement intersections and experiencing long queues and delays.

   As such, the Glen Iris Structure Plan has been designed to rely on the provision of its own movement network with 95% of the proposed lots accessing the new internal street network rather than existing streets. A new intersection with Berrigan Drive is also critically needed and desired to alleviate much of the existing traffic delays currently experienced by road users to improve safety.

   The new intersection, if in the form of signals, will also support protected pedestrian and cycling crossing opportunities across Berrigan Drive (north to south).

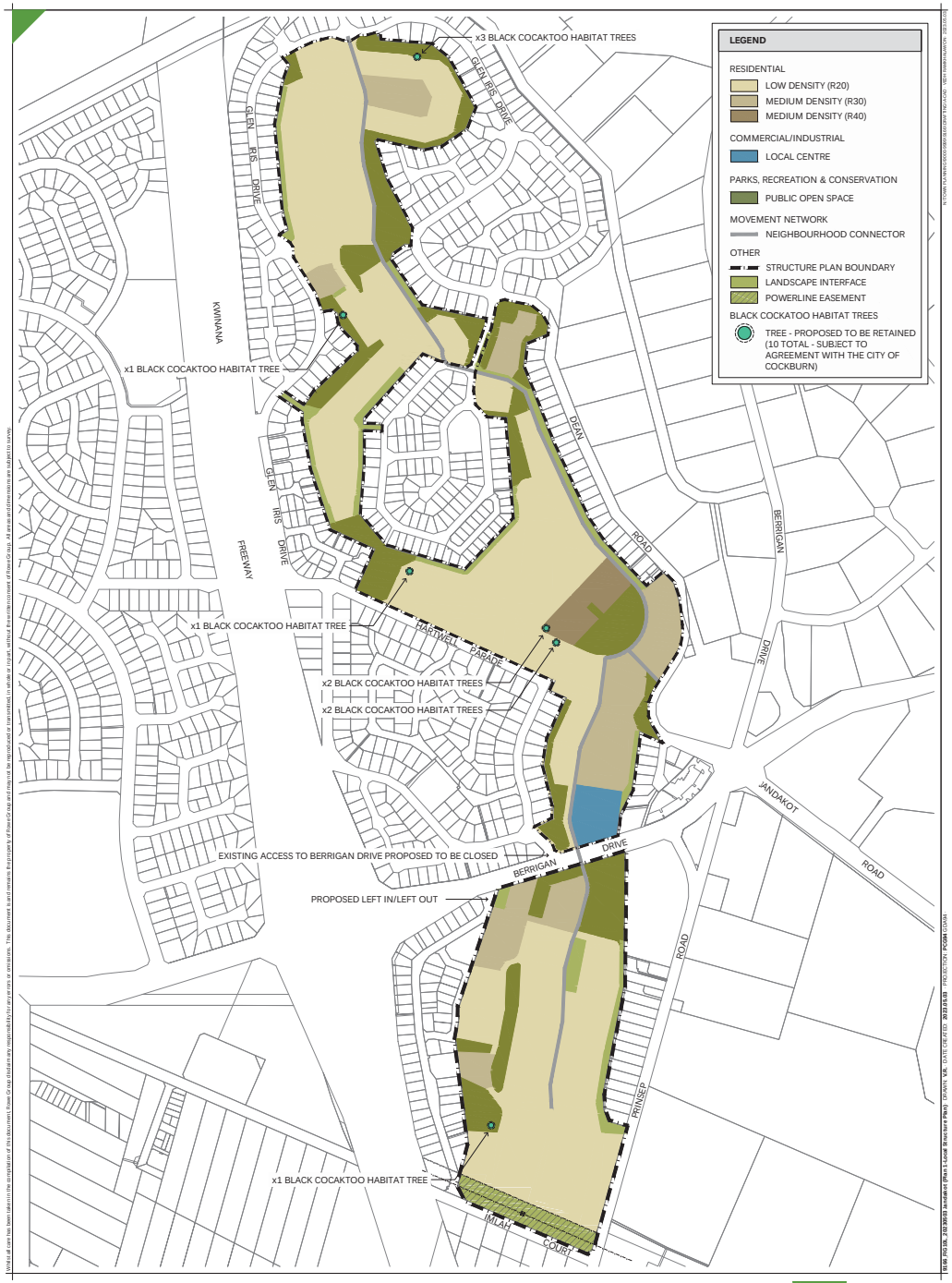
4 The existing traffic that is being generated by the existing Glen Iris Estate is in the order of 7,200 vehicle trips per day. The new Structure Plan with 500-600 lots proposed and a small local centre is estimated to generate up to 5,000 vehicle trips per day (two-way, from both the north, central and south precincts, equating to ~8.3 vehicle trips every minute). Please note that "trips" are not the number of "vehicles", rather a direction of travel from an origin to a destination. Therefore, a visit to the shops from a house as an example would equate to TWO trips for the 'to' trip and the 'return' trip.

5 Figure 4.1 shows the proposed road hierarchy for the Structure Plan. The structure plan area contains a short section of Neighbourhood Connector A road from Berrigan Drive and a modified Neighbourhood Connector B/Access Street running north-south through the structure plan area. The remaining of the street network will be Give Way type lower order Access Streets. The road cross section widths will be detailed with subdivision to include:

- Neighbourhood Connector A, which are relatively short sections of streets, will have lane widths of 3.2m with a wide median as proposed to avoid cyclist squeeze zone while allowing flexibility for longer term buses (subject to land). The road reserve width of 20m accommodates this with a dual use path on the verges to prioritise pedestrian and cycle lanes.
- Typically, Access Streets throughout the structure plan will be well below 1,000 vehicles per day and will be designed with 5.5m – 6.0m pavements.

6 Overall, from a traffic impact perspective, with the combination of the existing capacity available at the Dean Road signalised intersection in the short term and a new signalised intersection on Berrigan Drive in the medium to longer term, the proposed Structure Plan impacts can be managed acceptably to support the proposed development to the year 2028 with full buildout.

Appendix A Proposed Structure Plan



PLAN 1 - LOCAL STRUCTURE PLAN
GLEN IRIS DRIVE
JANDAKOT

ROWE GROUP DESIGN

Appendix B SIDRA Reports

USER REPORT FOR NETWORK SITE

All Movement Classes

Project: 210824_W191120_Berrigan Drive - TSAP_Gate_1 **Template: Default Site User Report**

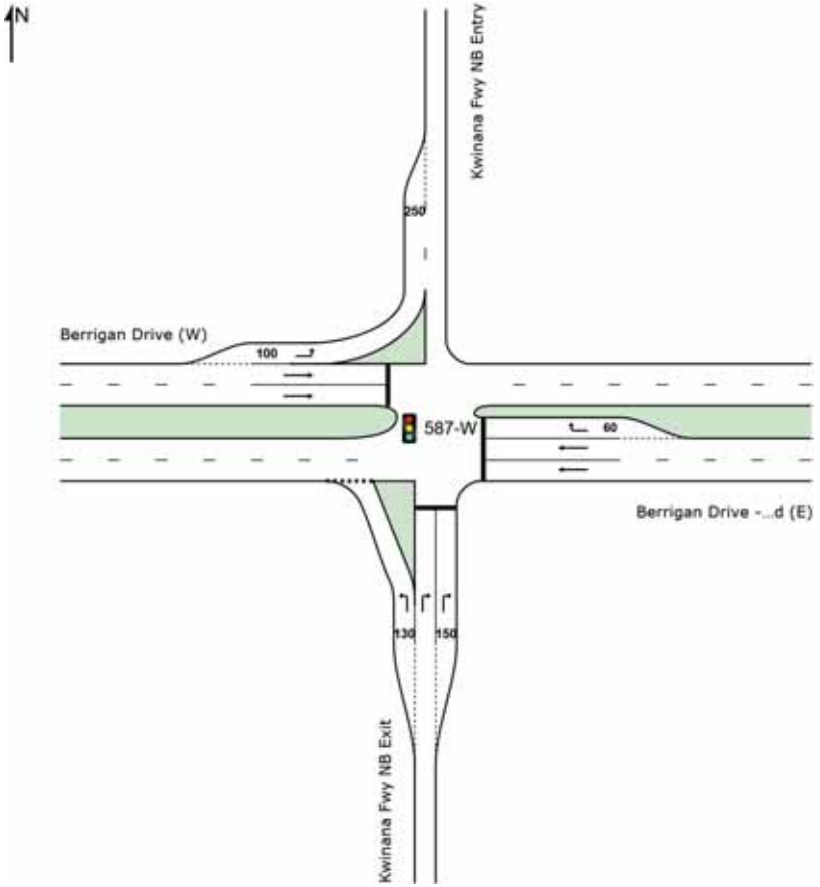
Site: 587-W [Kwinana Freeway / Berrigan West - AM 2033 (Site Folder: Proposed - 2033)] **Network: 3 [TCS - 2033 AM (Network Folder: Proposed Option - 2033)]**

2036 AM Peak (Report Option 1)
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 138 seconds (Network User-Given Cycle Time)
Common Control Group: CCG1 [Fwy]

Timings based on settings in the Network Timing dialog
Phase Times determined by the program
Downstream lane blockage effects included in determining phase times
Phase Sequence: CCG Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D, F
Output Phase Sequence: A, B, C, D, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



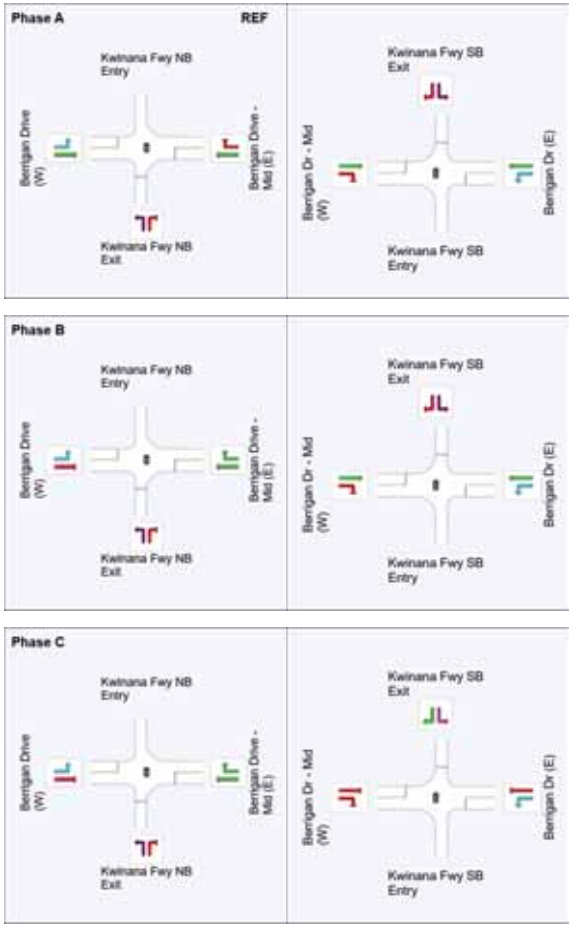
Lane Use and Performance (CCG)

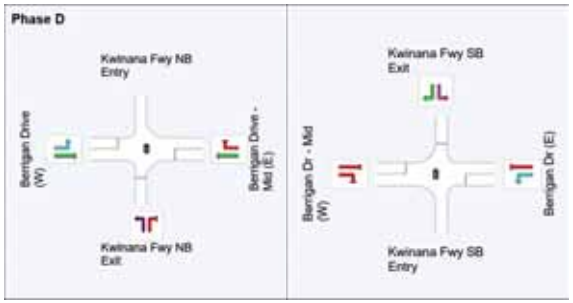
	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
Site: 587-W [Kwinana Freeway / Berrigan West - AM 2033]															
South: Kwinana Fwy NB Exit															
Lane 1	89	3.6	89	3.6	482	0.186	100	6.3	LOS A	0.3	2.5	Short	130	0.0	NA
Lane 2	125	6.4	125	6.4	114	1.089	100	172.6	LOS F	8.8	68.6	Full	500	0.0	0.0
Lane 3	125	6.4	125	6.4	114	1.089	100	172.6	LOS F	8.8	68.6	Short	150	0.0	NA
Approach	339	5.7	339	5.7		1.089		128.7	LOS F	8.8	68.6				
East: Berrigan Drive - Mid (E)															
Lane 1	1019	7.5	800	8.0	1455	0.550	100	0.5	LOS A	1.4	11.1	Full	120	0.0	0.0
Lane 2	560	7.5	440	8.0	1455	0.302	55[7]	0.4	LOS A	0.5	4.0	Full	120	0.0	50.0[8]
Lane 3	917	3.9	718	4.2	731[1]	0.982	100	46.8	LOS D	15.7[N4]	120.0[N4]	Short	60	35.0[N2]	NA
Approach	2496	6.2	1958[N1]	6.6		0.982		17.5	LOS B	15.7	120.0				
West: Berrigan Drive (W)															
Lane 1	928	5.5	928	5.5	1772	0.524	100	14.8	LOS B	0.0	0.0	Short	100	0.0	NA
Lane 2	308	5.6	308	5.6	406	0.759	100	36.2	LOS D	9.3	72.1	Full	500	0.0	0.0
Lane 3	308	5.6	308	5.6	406	0.759	100	36.2	LOS D	9.3	72.1	Full	500	0.0	0.0
Approach	1544	5.5	1544	5.5		0.759		23.3	LOS C	9.3	72.1				
Intersection	4379	5.9	3841[N1]	6.7		1.089		29.6	LOS C	15.7	120.0				
Site: 587-E [Kwinana Freeway / Berrigan East - AM 2033]															
East: Berrigan Dr (E)															
Lane 1	1312	4.9	1057	5.1	882	1.199	100	242.1	LOS F	38.8[N4]	300.0[N4]	Full	300	0.0	50.0
Lane 2	630	4.4	507	4.6	423	1.199	100	255.5	LOS F	39.0[N4]	300.0[N4]	Full	300	-50.0[N3]	50.0
Approach	1942	4.7	1565[N1]	4.9		1.199		246.4	LOS F	39.0	300.0				
North: Kwinana Fwy SB Exit															
Lane 1	460	5.0	460	5.0	964	0.477	100	6.4	LOS A	2.5	19.1	Short	115	0.0	NA
Lane 2	463	10.5	463	10.5	386[1]	1.198	100	256.6	LOS F	42.2	344.1	Full	500	0.0	15.5
Lane 3	241	10.5	241	10.5	202	1.198	100	266.2	LOS F	22.8	185.6	Short	130	-50.0[N3]	NA
Approach	1164	8.3	1164	8.3		1.198		159.8	LOS F	42.2	344.1				
West: Berrigan Dr - Mid (W)															
Lane 1	382	6.5	374	6.5	1154	0.324	100	0.7	LOS A	0.4	3.5	Full	120	0.0	0.0
Lane 2	382	6.5	374	6.5	1154	0.324	100	0.7	LOS A	0.4	3.5	Full	120	0.0	0.0
Lane 3	165	3.3	162	3.3	184	0.879	100	73.5	LOS E	7.1	53.8	Short	50	0.0	NA
Approach	929	5.9	909[N1]	5.9		0.879		13.6	LOS B	7.1	53.8				
Intersection	4036	6.0	3638[N1]	6.7		1.199		160.5	LOS F	42.2	344.1				

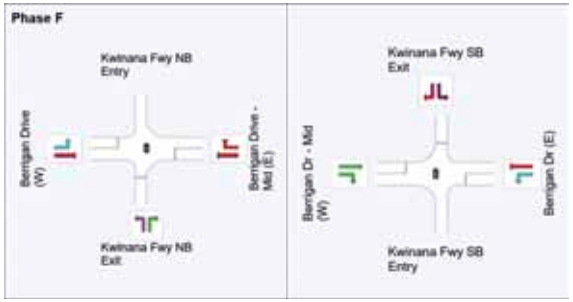
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
7 Lane under-utilisation specified by the user

Output Phase Sequence (CCG)







REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

Site: 587-E [Kwinana Freeway / Berrigan East - AM 2033 (Site Folder: Proposed - 2033)]

Network: 3 [TCS - 2033 AM (Network Folder: Proposed Option - 2033)]

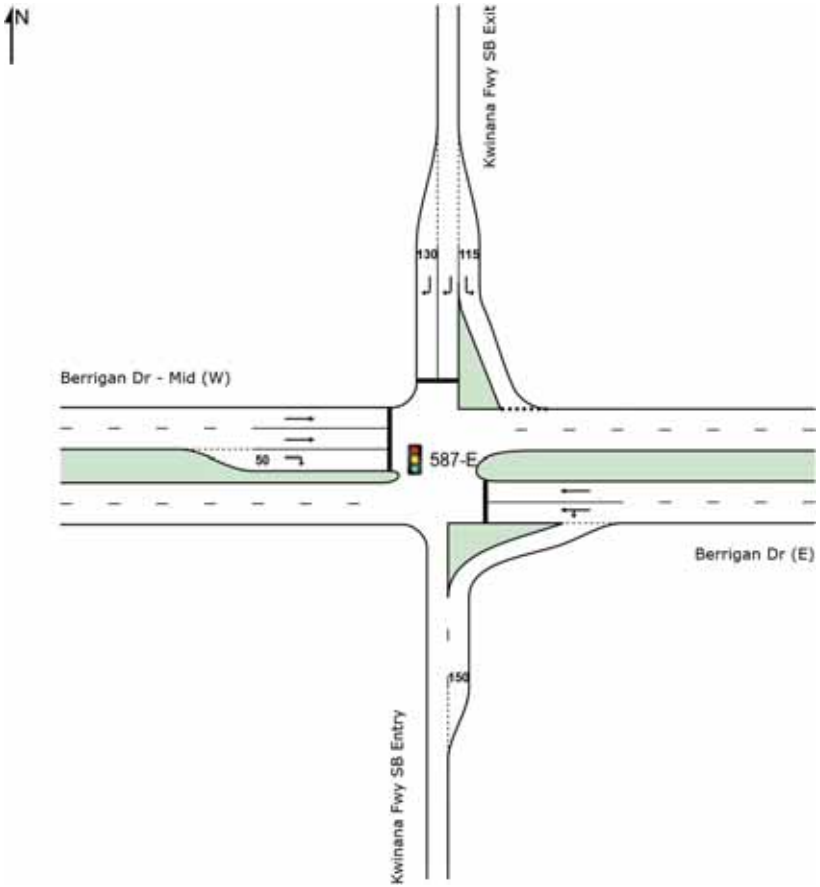
Glen Iris
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 138 seconds (Network User-Given Cycle Time)
Common Control Group: CCG1 [Fwy]

Timings based on settings in the Network Timing dialog
Phase Times determined by the program
Downstream lane blockage effects included in determining phase times
Phase Sequence: CCG Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D, F
Output Phase Sequence: A, B, C, D, F

Some CCG output elements have been omitted as they have already been included under other Sites belonging to the same CCG.

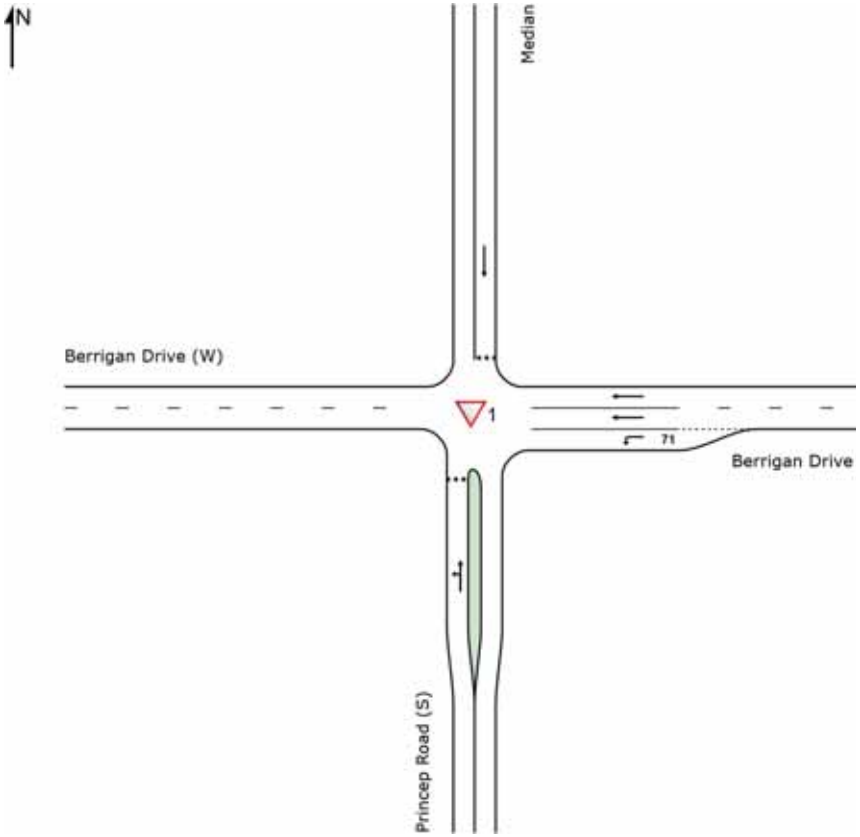
Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

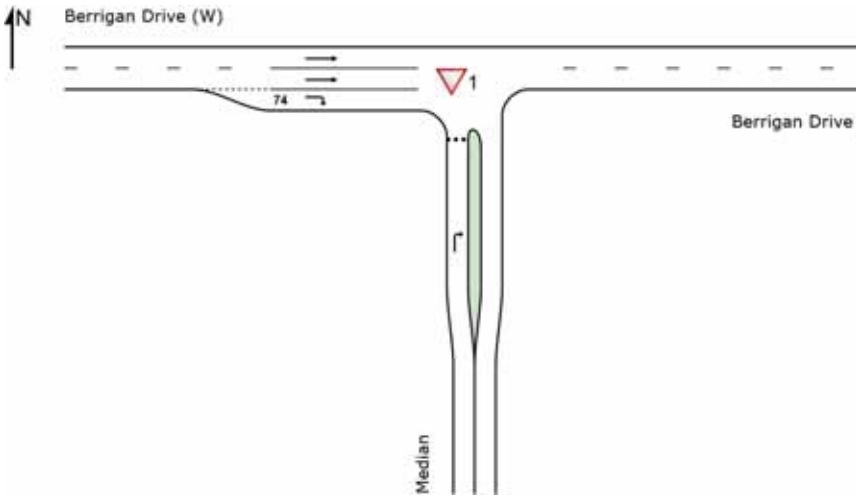
	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Princep Road (S)															
Lane 1	208	28.3	208	28.3	309	0.675	100	20.8	LOS C	1.3	12.0	Full	200	-46.8 N7	0.0
Approach	208	28.3	208	28.3		0.675		20.8	LOS C	1.3	12.0				
East: Berrigan Drive (E)															
Lane 1	82	8.9	71	9.4	1623	0.044	100	5.7	LOS A	0.0	0.0	Short	71	0.0	NA
Lane 2	766	4.2	663	4.4	1841	0.360	100	0.0	LOS A	4.5 N5	35.1 N5	Full	135	0.0	35.7
Lane 3	766	4.2	663	4.4	1841	0.360	100	0.0	LOS A	6.8 N5	53.0 N5	Full	135	0.0	37.1
Approach	1614	4.4	1398 N1	4.7		0.360		0.3	NA	6.8	53.0				
North: Median															
Lane 1	221	9.0	219	9.0	274	0.799	100	39.5	LOS E	0.8 N4	7.0 N4	Full	7	0.0	49.9
Approach	221	9.0	219 N1	9.0		0.799		39.5	LOS E	0.8	7.0				
Intersection	2043	7.4	1825 N1	8.2		0.799		7.4	NA	6.8	53.0				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.
N4 Average back of queue has been restricted to the available queue storage space.
N5 Continuous Lane results determined by Back of Queue values of downstream lanes (proportional to lane movement flows).
N7 The capacity reduction has been determined from the queue blockage probability of a Site further downstream due to intermediate continuous lanes.

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Median															
Lane 1	25	33.3	25	33.3	235	0.108	100	17.0	LOS C	0.1	1.4	Full	7	0.0	0.0
Approach	25	33.3	25	33.3		0.108		17.0	LOS C	0.1	1.4				
West: Berrigan Drive (W)															
Lane 1	509	5.5	503	5.5	1802	0.279	100	0.0	LOS A	0.0	0.0	Full	190	0.0	0.0
Lane 2	509	5.5	503	5.5	1802	0.279	100	0.0	LOS A	0.0	0.0	Full	190	0.0	0.0
Lane 3	221	9.0	219	9.0	1600	0.137	100	5.9	LOS A	1.8[N5]	14.9[N5]	Short	74	0.0	NA
Approach	1239	6.1	1225[N1]	6.1		0.279		1.1	NA	1.8	14.9				
Intersection	1264	6.7	1250[N1]	6.7		0.279		1.4	NA	1.8	14.9				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.
N5 Continuous Lane results determined by Back of Queue values of downstream lanes (proportional to lane movement flows).

Site: LM01173 [Berrigan Drive_Jandakot Road_AM 2033 (Site Folder: Proposed - 2033)]

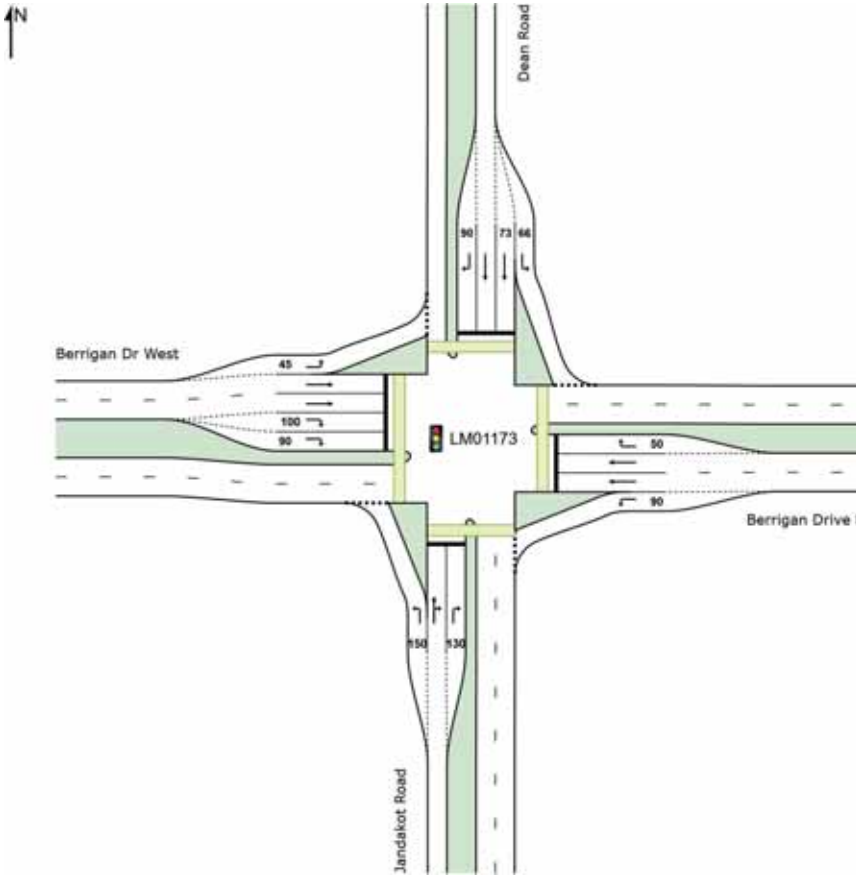
Network: 3 [TCS - 2033 AM (Network Folder: Proposed Option - 2033)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 138 seconds (Network User-Given Cycle Time)

Timings based on settings in the Network Timing dialog
Phase Times determined by the program
Downstream lane blockage effects included in determining phase times
Phase Sequence: Variable Phasing
Reference Phase: Phase E
Input Phase Sequence: A, B, C, D, E
Output Phase Sequence: A, B, C, D, E

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



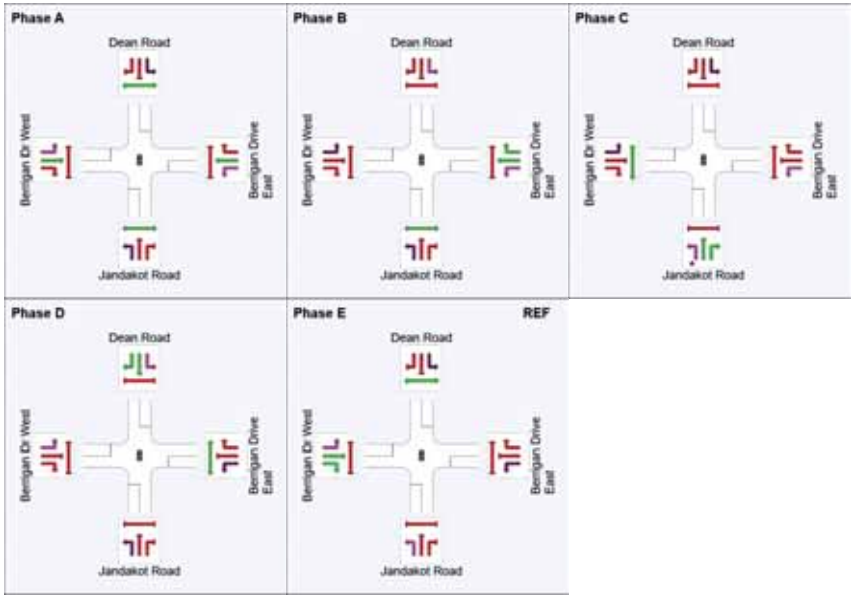
Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Jandakot Road															
Lane 1	1351	5.2	1351	5.2	1167[1]	1.158	100	194.4	LOS F	95.5	707.5	Short	150	0.0	NA
Lane 2	258	4.9	258	4.9	510	0.506	100	48.5	LOS D	9.0	66.2	Full	230	0.0	100.0[8]
Lane 3	252	5.2	252	5.2	498	0.506	100	50.9	LOS D	8.8	64.9	Short	130	0.0	NA
Approach	1861	5.2	1861	5.2		1.158		154.7	LOS F	95.5	707.5				
East: Berrigan Drive East															
Lane 1	161	23.3	161	23.3	1113	0.145	100	8.7	LOS A	1.3	11.8	Short	90	0.0	NA
Lane 2	90	23.3	90	23.3	174	0.518	100	65.6	LOS E	3.7	32.3	Full	125	0.0	0.0
Lane 3	90	23.3	90	23.3	174	0.518	100	65.6	LOS E	3.7	32.3	Full	125	0.0	0.0
Lane 4	14	4.5	14	4.5	79	0.173	100	78.2	LOS E	0.6	4.2	Short	50	0.0	NA
Approach	355	22.6	355	22.6		0.518		40.2	LOS D	3.7	32.3				
North: Dean Road															
Lane 1	102	5.2	102	5.2	859	0.119	100	11.7	LOS B	1.2	9.1	Short	66	0.0	NA
Lane 2	23	5.2	23	5.2	290	0.078	100	54.1	LOS D	0.8	5.9	Short	73	0.0	NA
Lane 3	23	5.2	23	5.2	290	0.078	100	54.1	LOS D	0.8	5.9	Full	110	0.0	0.0
Lane 4	147	0.0	147	0.0	286	0.516	100	64.5	LOS E	5.7	39.8	Short	90	0.0	NA
Approach	295	2.6	295	2.6		0.516		44.6	LOS D	5.7	39.8				
West: Berrigan Dr West															
Lane 1	27	4.5	27	4.5	1380	0.020	100	6.6	LOS A	0.1	0.8	Short	45	0.0	NA
Lane 2	272	4.6	269	4.6	622[1]	0.433	100	38.1	LOS D	8.5	62.9	Full	135	0.0	0.0
Lane 3	279	4.6	276	4.6	638	0.433	100	38.2	LOS D	8.8	64.8	Full	135	0.0	0.0
Lane 4	257	4.6	255	4.6	500	0.509	100	50.9	LOS D	8.8	65.1	Short	100	0.0	NA
Lane 5	257	4.6	255	4.6	500	0.509	100	50.9	LOS D	8.8	65.1	Short	90	0.0	NA
Approach	1094	4.6	1082[N1]	4.6		0.509		43.4	LOS D	8.8	65.1				
Intersection	3604	6.5	3593[N1]	6.5		1.158		100.8	LOS F	95.5	707.5				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
8 Probability of Blockage has been set on the basis of a queue that overflows from a short lane.
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase

Site: 101 [Berrigan Drive / Turnbury Park Dr / Access - AM 2033 - TCS (Site Folder: Proposed - 2033)]

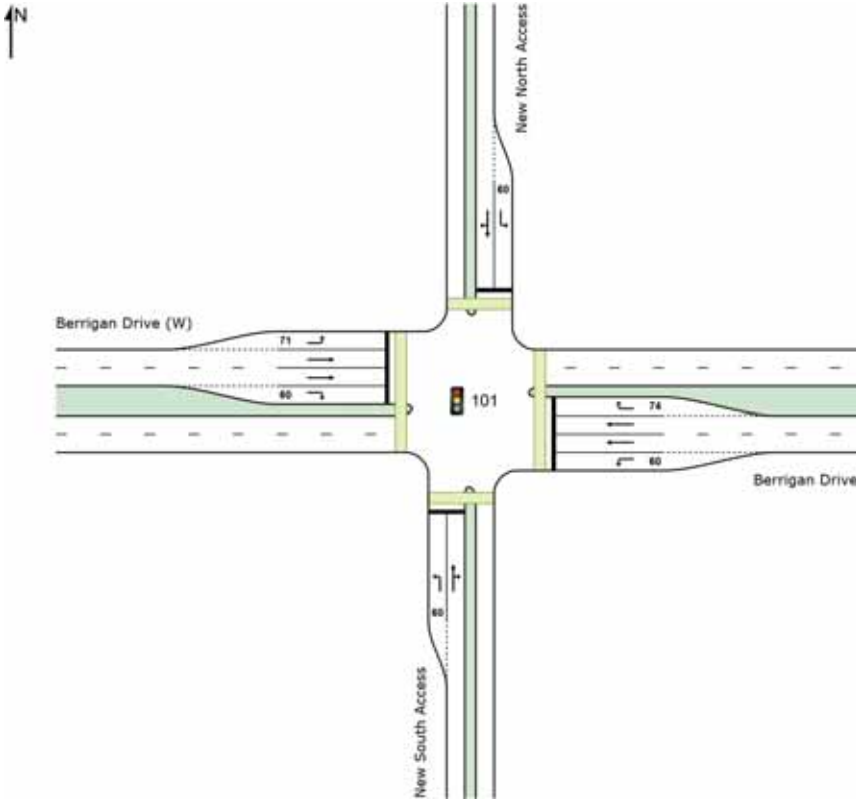
Network: 3 [TCS - 2033 AM (Network Folder: Proposed Option - 2033)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Downstream lane blockage effects included in determining phase times
Phase Sequence: Variable Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C, C1*, C2*
Output Phase Sequence: A, B, C
(* Variable Phase)

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



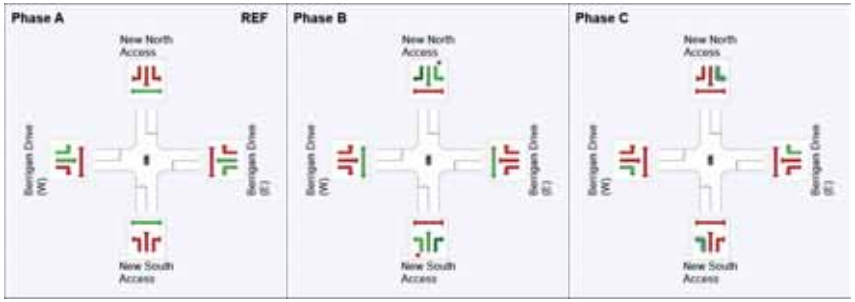
Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: New South Access															
Lane 1	29	0.0	29	0.0	204	0.144	100	52.7	LOS D	2.0[N5]	14.0[N5]	Short	60	-50.0[N3]	NA
Lane 2	37	3.9	37	3.9	223	0.165	100	64.3	LOS E	1.5	10.6	Full	500	0.0	0.0
Approach	66	2.1	66	2.1		0.165		59.1	LOS E	2.0	14.0				
East: Berrigan Drive (E)															
Lane 1	91	4.5	80	4.9	1137	0.070	100	16.6	LOS B	1.3	9.8	Short	60	0.0	NA
Lane 2	826	6.3	729	6.8	570[1]	1.280	100	323.1	LOS F	25.2[N6]	190.0[N6]	Full	190	-50.0[N3]	50.0
Lane 3	840	6.3	742	6.8	579[1]	1.280	100	322.8	LOS F	7.1[N5]	53.8[N5]	Full	190	-50.0[N3]	0.0
Lane 4	49	20.8	44	22.3	64	0.689	100	90.2	LOS F	2.2	18.9	Short	74	0.0	NA
Approach	1806	6.6	1595[N 1]	7.1		1.280		301.2	LOS F	25.2	190.0				
North: New North Access															
Lane 1	146	5.2	146	5.2	394	0.371	100	54.3	LOS D	5.3	39.5	Short	60	0.0	NA
Lane 2	172	0.0	172	0.0	136	1.261	100	325.5	LOS F	1.7[N5]	11.6[N5]	Full	500	-49.7[N3]	0.0
Approach	318	2.4	318	2.4		1.261		200.7	LOS F	5.3	39.5				
West: Berrigan Drive (W)															
Lane 1	45	4.5	45	4.5	1140	0.039	100	16.3	LOS B	0.7	5.4	Short	71	0.0	NA
Lane 2	590	3.7	582	3.7	1182[1]	0.492	100	15.2	LOS B	13.4	97.9	Full	300	0.0	0.0
Lane 3	581	3.7	573	3.7	1165[1]	0.492	100	15.1	LOS B	13.2	95.8	Full	300	0.0	0.0
Lane 4	23	4.5	23	4.5	72	0.317	100	86.0	LOS F	1.1	7.8	Short	60	0.0	NA
Approach	1239	3.7	1223[N 1]	3.7		0.492		16.6	LOS B	13.4	97.9				
Intersection	3429	5.1	3202[N 1]	5.5		1.280		177.5	LOS F	25.2	190.0				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.
N3 Capacity Adjustment due to downstream lane blockage determined by the program.
N5 Continuous Lane results determined by Back of Queue values of downstream lanes (proportional to lane movement flows).
N6 Continuous Lane results determined by Back of Queue values of downstream lanes (proportional to lane movement flows) but average back of queue has been restricted to the available queue storage space.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

Organisation: STANTEC NEW ZEALAND | Licence: NETWORK / Enterprise | Created: Monday, 13 September 2021 1:35:12 PM
Project: P:\W19100-19199\W191120 Glen Iris Golf Course Re-Develop\Modelling\210824_W191120_Berrigan Drive - TSAP_Gate_1.sip9

USER REPORT FOR NETWORK SITE

All Movement Classes

Project: 210824_W191120_Berrigan Drive - TSAP_Gate_1

Template: Default Site User Report

Site: 587-W [Kwinana Freeway / Berrigan West - PM 2033 (Site Folder: Proposed - 2033)]

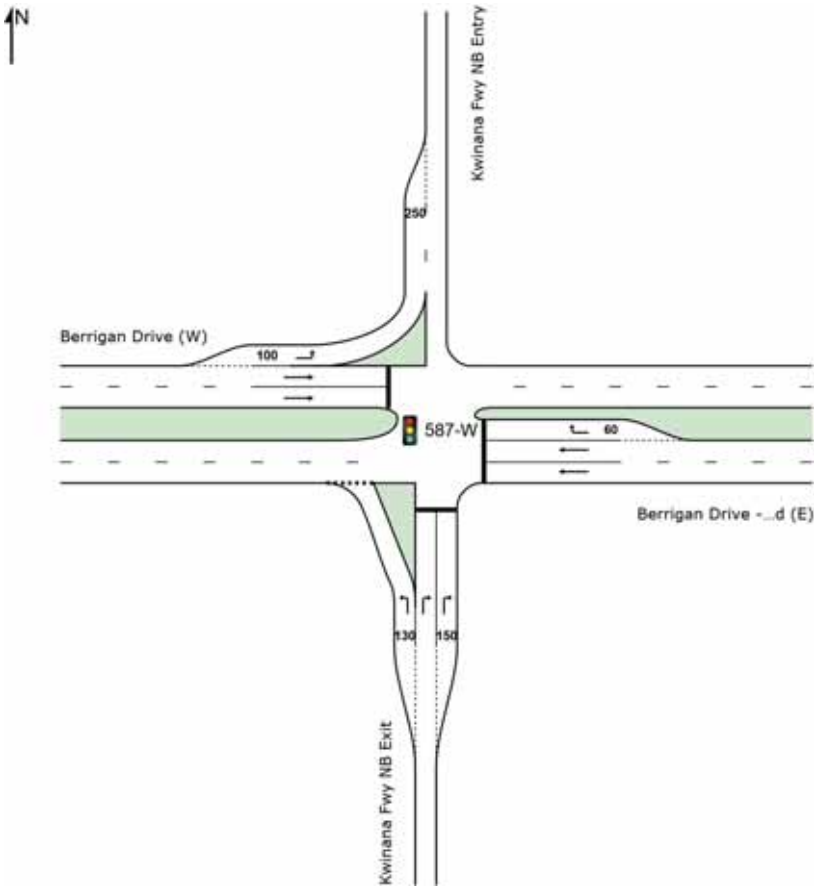
Network: 6 [Roundabout - 2033 PM (Network Folder: Proposed Option - 2033)]

2036 AM Peak (Report Option 1)
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 132 seconds (Network User-Given Cycle Time)
Common Control Group: CCG1 [Fwy]

Timings based on settings in the Network Timing dialog
Phase Times determined by the program
Downstream lane blockage effects included in determining phase times
Phase Sequence: CCG Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D, F
Output Phase Sequence: A, B, C, D, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



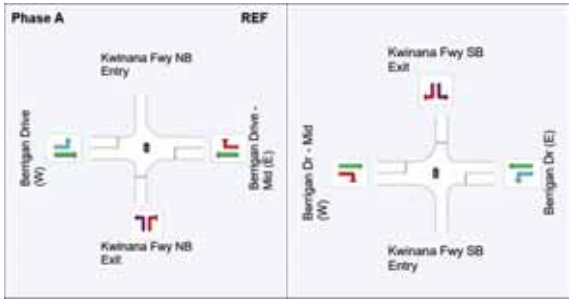
Lane Use and Performance (CCG)

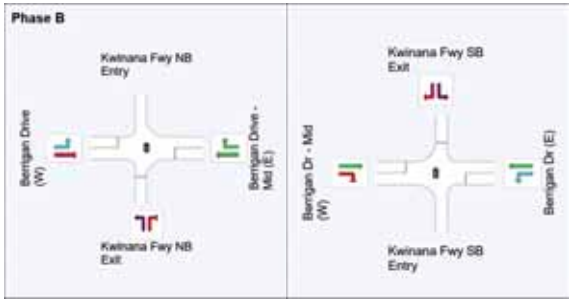
	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
Site: 587-W [Kwinana Freeway / Berrigan West - PM 2033]															
South: Kwinana Fwy NB Exit															
Lane 1	132	3.6	132	3.6	314	0.419	100	6.9	LOS A	1.1	8.1	Short	130	0.0	NA
Lane 2	43	6.4	43	6.4	80	0.539	100	76.7	LOS E	1.8	14.1	Full	500	0.0	0.0
Lane 3	43	6.4	43	6.4	80	0.539	100	76.7	LOS E	1.8	14.1	Short	150	0.0	NA
Approach	218	4.7	218	4.7		0.539		34.5	LOS C	1.8	14.1				
East: Berrigan Drive - Mid (E)															
Lane 1	1027	3.1	897	3.3	1546	0.580	100	0.5	LOS A	1.6	12.2	Full	120	0.0	0.0
Lane 2	1027	3.1	897	3.3	1546	0.580	100	0.5	LOS A	1.6	12.2	Full	120	0.0	0.0
Lane 3	573	3.1	500	3.3	951	0.525	100	13.4	LOS B	5.7	43.7	Short	60	5.0 N2	NA
Approach	2626	3.1	2293 N 1	3.3		0.580		3.3	LOS A	5.7	43.7				
West: Berrigan Drive (W)															
Lane 1	620	3.3	620	3.3	1812	0.342	100	7.8	LOS A	0.0	0.0	Short	100	0.0	NA
Lane 2	368	3.2	368	3.2	391	0.941	100	59.0	LOS E	14.5	109.8	Full	500	0.0	0.0
Lane 3	368	3.2	368	3.2	391	0.941	100	59.0	LOS E	14.5	109.8	Full	500	0.0	0.0
Approach	1356	3.2	1356	3.2		0.941		35.6	LOS D	14.5	109.8				
Intersection	4200	3.2	3867 N 1	3.5		0.941		16.4	LOS B	14.5	109.8				
Site: 587-E [Kwinana Freeway / Berrigan East - PM 2033]															
East: Berrigan Dr (E)															
Lane 1	1286	1.2	1016	1.2	1104	0.920	100	41.7	LOS D	40.3 N4	300.0 N4	Full	300	0.0	50.0
Lane 2	825	1.3	651	1.3	708	0.920	100	59.5	LOS E	29.4	219.1	Full	300	0.0	20.9
Approach	2111	1.2	1667 N 1	1.2		0.920		48.7	LOS D	40.3	300.0				
North: Kwinana Fwy SB Exit															
Lane 1	719	3.3	719	3.3	1084	0.663	100	9.6	LOS A	16.7	127.1	Short	115	0.0	NA
Lane 2	506	6.1	506	6.1	551 1	0.919	100	69.0	LOS E	23.0	179.6	Full	500	0.0	0.0
Lane 3	506	6.1	506	6.1	551 1	0.919	100	69.0	LOS E	23.0	179.5	Short	130	0.0	NA
Approach	1732	4.9	1732	4.9		0.919		44.4	LOS D	23.0	179.6				
West: Berrigan Dr - Mid (W)															
Lane 1	356	2.6	356	2.6	1004	0.354	100	5.2	LOS A	2.6	19.3	Full	120	0.0	0.0
Lane 2	356	2.6	356	2.6	1004	0.354	100	5.2	LOS A	2.6	19.3	Full	120	0.0	0.0
Lane 3	105	3.8	105	3.8	150	0.701	100	68.6	LOS E	4.2	32.0	Short	50	0.0	NA
Approach	817	2.8	817	2.8		0.701		13.4	LOS B	4.2	32.0				
Intersection	4659	2.9	4216 N 1	3.2		0.920		40.1	LOS D	40.3	300.0				

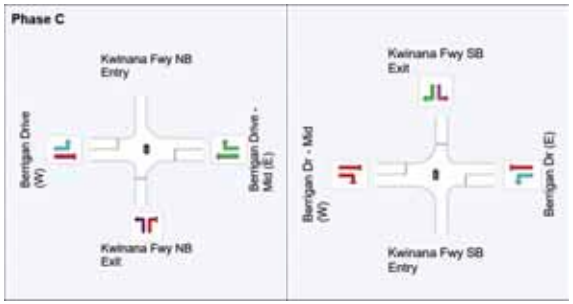
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

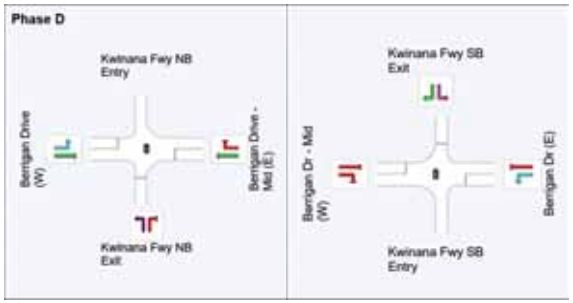
1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

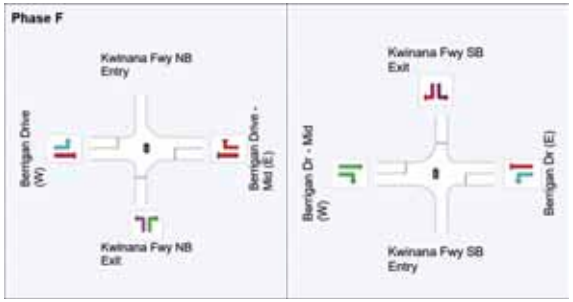
Output Phase Sequence (CCG)



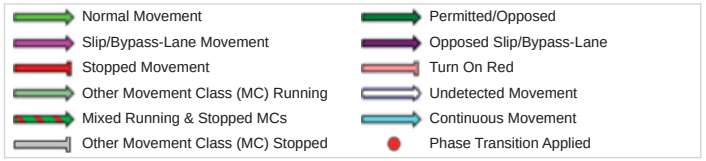








REF: Reference Phase
VAR: Variable Phase



Site: 587-E [Kwinana Freeway / Berrigan East - PM 2033 (Site Folder: Proposed - 2033)]

Network: 6 [Roundabout - 2033 PM (Network Folder: Proposed Option - 2033)]

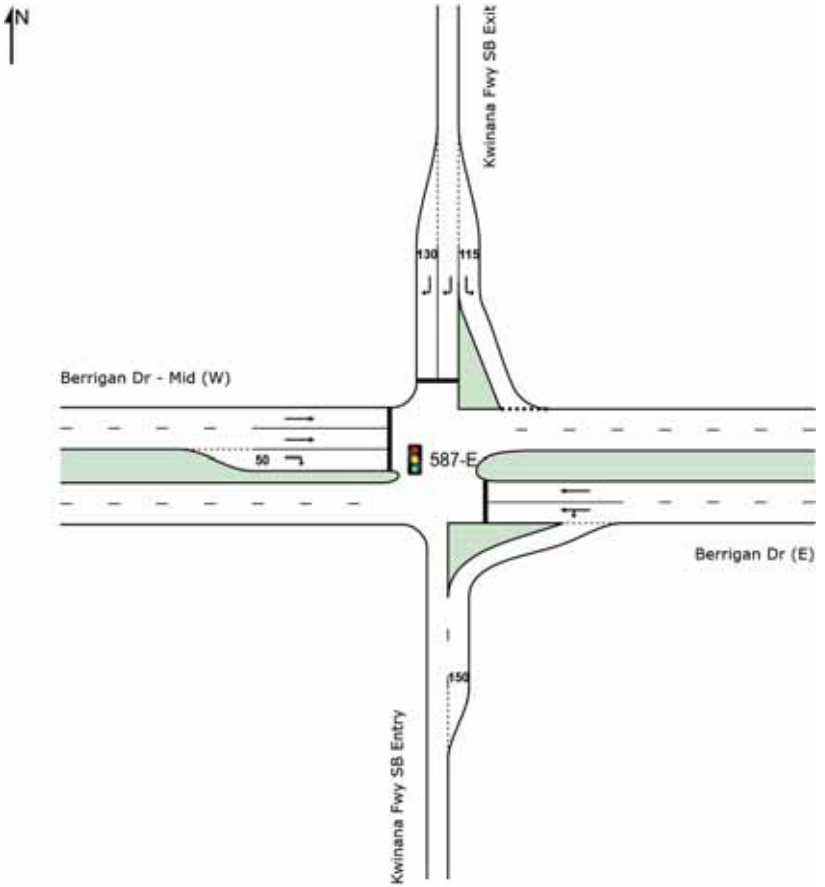
Glen Iris
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 132 seconds (Network User-Given Cycle Time)
Common Control Group: CCG1 [Fwy]

Timings based on settings in the Network Timing dialog
Phase Times determined by the program
Downstream lane blockage effects included in determining phase times
Phase Sequence: CCG Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D, F
Output Phase Sequence: A, B, C, D, F

Some CCG output elements have been omitted as they have already been included under other Sites belonging to the same CCG.

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Site Layout

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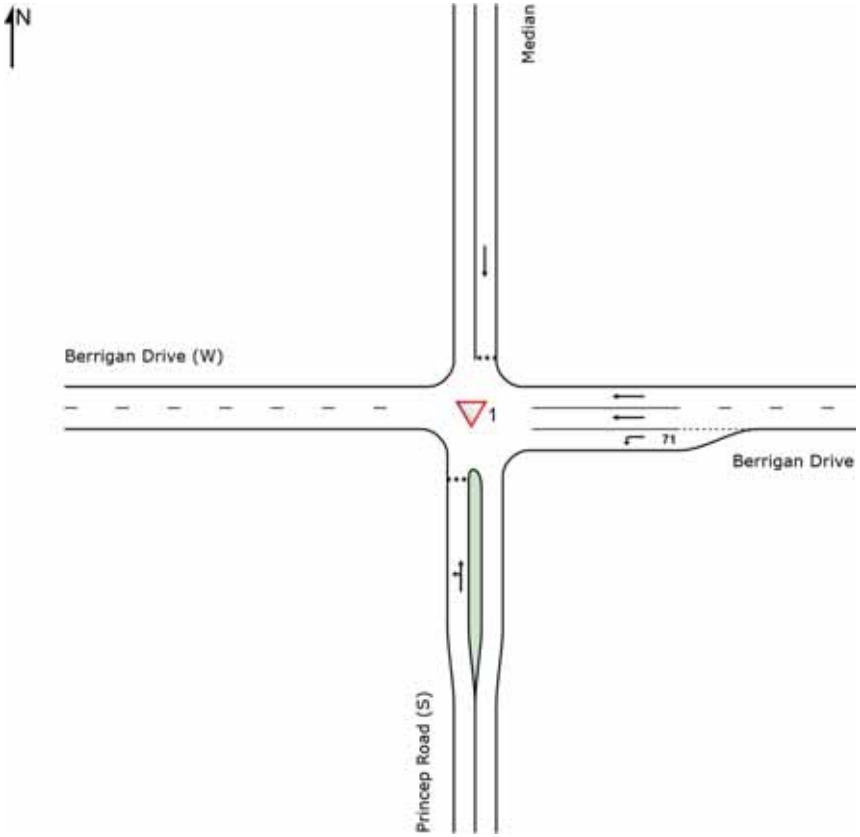


Lane Use and Performance

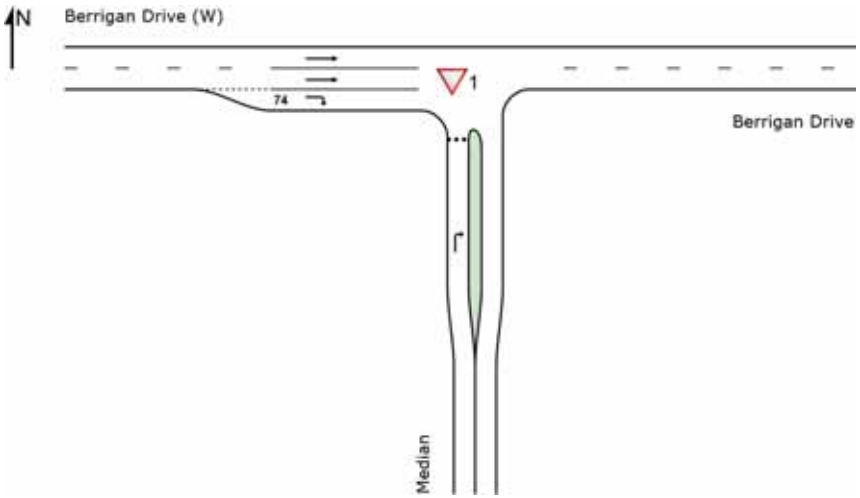
	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Princep Road (S)															
Lane 1	452	3.5	452	3.5	285	1.583	100	547.8	LOS F	44.8	341.9	Full	200	-45.8 N7	100.0
Approach	452	3.5	452	3.5		1.583		547.8	LOS F	44.8	341.9				
East: Berrigan Drive (E)															
Lane 1	34	12.1	33	12.1	1643	0.020	100	5.7	LOS A	0.0	0.0	Short	71	0.0	NA
Lane 2	822	3.1	814	3.1	945	0.862	100	0.7	LOS A	0.0	0.0	Full	135	-49.9 N7	0.0
Lane 3	822	3.1	814	3.1	945	0.862	100	0.7	LOS A	0.0	0.0	Full	135	-49.9 N7	0.0
Approach	1678	3.3	1662 N 1	3.3		0.862		0.8	NA	0.0	0.0				
North: Median															
Lane 1	167	7.5	167	7.5	192	0.872	100	67.4	LOS F	0.9 N4	7.0 N4	Full	7	0.0	49.9
Approach	167	7.5	167	7.5		0.872		67.4	LOS F	0.9	7.0				
Intersection	2297	3.6	2281 N 1	3.7		1.583		114.0	NA	44.8	341.9				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.
N4 Average back of queue has been restricted to the available queue storage space.
N7 The capacity reduction has been determined from the queue blockage probability of a Site further downstream due to intermediate continuous lanes.

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Median															
Lane 1	69	1.5	48	1.5	265	0.181	100	14.7	LOS B	0.2	1.7	Full	7	-6.1 [N3]	0.0
Approach	69	1.5	48 [N1]	1.5		0.181		14.7	LOS B	0.2	1.7				
West: Berrigan Drive (W)															
Lane 1	534	1.8	534	1.8	1908	0.280	100	0.0	LOS A	0.0	0.0	Full	190	0.0	0.0
Lane 2	502	1.8	502	1.8	1792	0.280	100	0.0	LOS A	0.0	0.0	Full	190	-6.1 [N3]	0.0
Lane 3	167	7.5	167	7.5	1709	0.098	100	5.8	LOS A	2.3 [N5]	17.9 [N5]	Short	74	0.0	NA
Approach	1203	2.6	1203	2.6		0.280		0.8	NA	2.3	17.9				
Intersection	1273	2.5	1251 [N1]	2.6		0.280		1.4	NA	2.3	17.9				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.
N3 Capacity Adjustment due to downstream lane blockage determined by the program.
N5 Continuous Lane results determined by Back of Queue values of downstream lanes (proportional to lane movement flows).

Site: LM01173 [Berrigan Drive_Jandakot Road_PM 2033 (Site Folder: Proposed - 2033)]

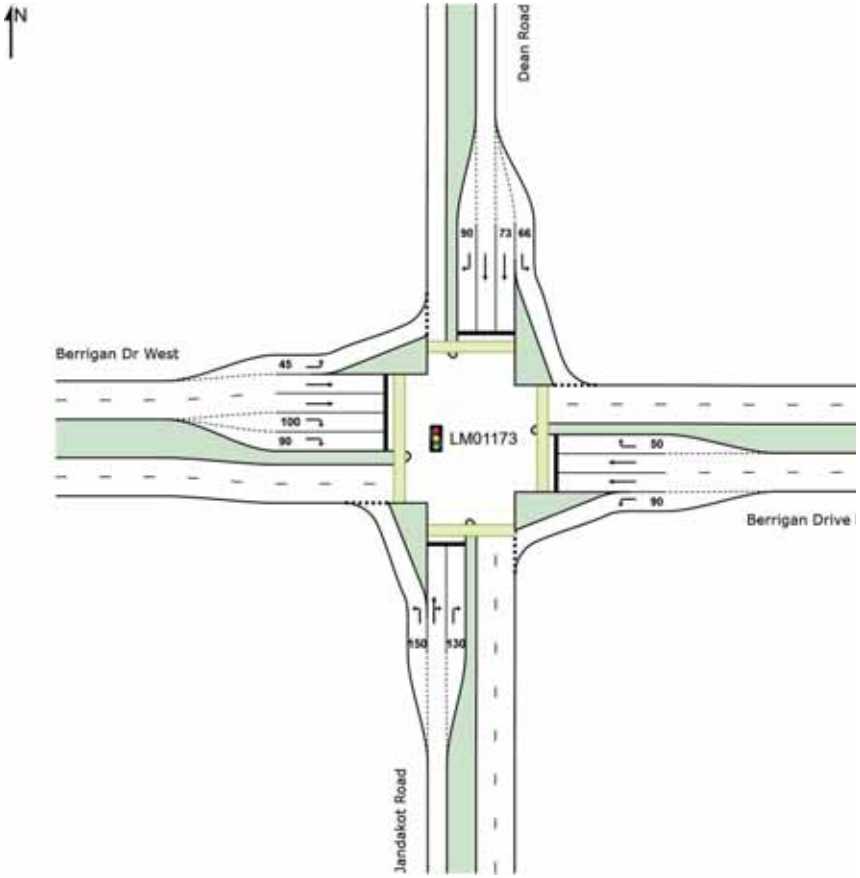
Network: 6 [Roundabout - 2033 PM (Network Folder: Proposed Option - 2033)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 106 seconds (Site User-Given Phase Times)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times specified by the user
Phase Sequence: Variable Phasing
Reference Phase: Phase E
Input Phase Sequence: A, B, C, D, E
Output Phase Sequence: A, B, C, D, E

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



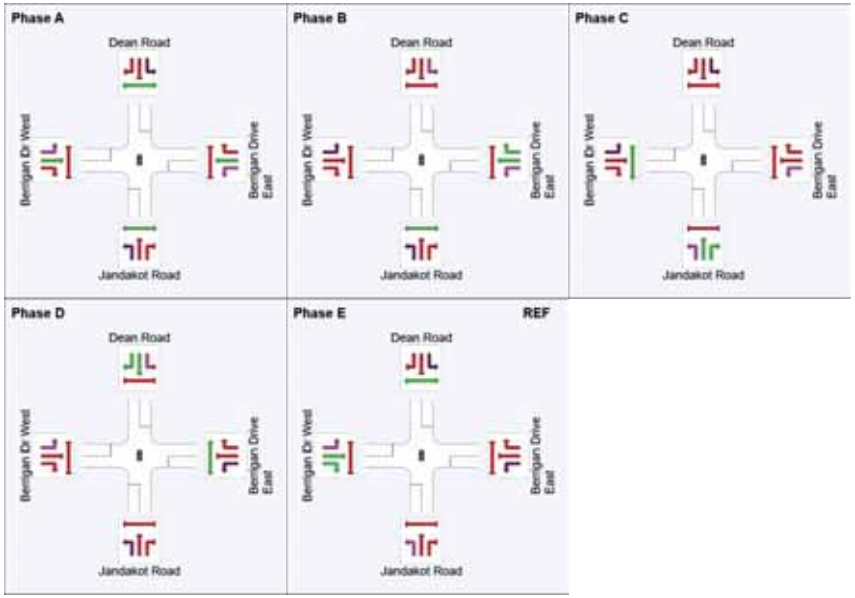
Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Jandakot Road															
Lane 1	637	5.5	637	5.5	1002	0.636	100	18.2	LOS B	11.7	86.8	Short	150	0.0	NA
Lane 2	137	1.8	137	1.8	294	0.466	100	45.4	LOS D	4.1	29.0	Full	230	0.0	0.0
Lane 3	97	5.5	97	5.5	273	0.355	76[5]	50.3	LOS D	2.8	21.0	Short	130	0.0	NA
Approach	871	4.9	871	4.9		0.636		26.0	LOS C	11.7	86.8				
East: Berrigan Drive East															
Lane 1	495	4.3	495	4.3	1207	0.410	100	10.6	LOS B	5.6	41.2	Short	90	0.0	NA
Lane 2	472	4.3	472	4.3	468[1]	1.010	100	96.1	LOS F	23.6	173.5	Full	125	0.0	81.4
Lane 3	487	4.3	487	4.3	482[1]	1.010	100	95.6	LOS F	24.3	178.5	Full	125	0.0	84.2
Lane 4	79	1.8	79	1.8	140	0.565	100	59.9	LOS E	2.6	18.4	Short	50	0.0	NA
Approach	1533	4.2	1533	4.2		1.010		66.5	LOS E	24.3	178.5				
North: Dean Road															
Lane 1	46	3.2	46	3.2	796	0.058	100	12.3	LOS B	0.5	3.6	Short	66	0.0	NA
Lane 2	15	3.2	15	3.2	200	0.074	100	47.2	LOS D	0.4	3.1	Short	73	0.0	NA
Lane 3	15	3.2	15	3.2	200	0.074	100	47.2	LOS D	0.4	3.1	Full	110	0.0	0.0
Lane 4	96	0.0	96	0.0	195	0.492	100	56.0	LOS E	3.0	21.0	Short	90	0.0	NA
Approach	172	1.4	172	1.4		0.492		42.7	LOS D	3.0	21.0				
West: Berrigan Dr West															
Lane 1	97	0.0	95	0.0	1401	0.068	100	7.4	LOS A	0.5	3.8	Short	45	0.0	NA
Lane 2	137	1.4	134	1.4	884	0.152	100	18.1	LOS B	2.5	17.5	Full	135	0.0	0.0
Lane 3	137	1.4	134	1.4	884	0.152	100	18.1	LOS B	2.5	17.5	Full	135	0.0	6.1[8]
Lane 4	397	1.4	390	1.4	521	0.749	100	46.4	LOS D	11.8	83.7	Short	100	10.0[N2]	NA
Lane 5	397	1.4	390	1.4	521	0.749	100	46.4	LOS D	11.8	83.7	Short	90	10.0[N2]	NA
Approach	1164	1.3	1144[N1]	1.3		0.749		36.5	LOS D	11.8	83.7				
Intersection	3739	3.3	3719[N1]	3.3		1.010		46.7	LOS D	24.3	178.5				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
5 Lane under-utilisation found by the program
8 Probability of Blockage has been set on the basis of a queue that overflows from a short lane.
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.
N2 Capacity Adjustment specified by user.

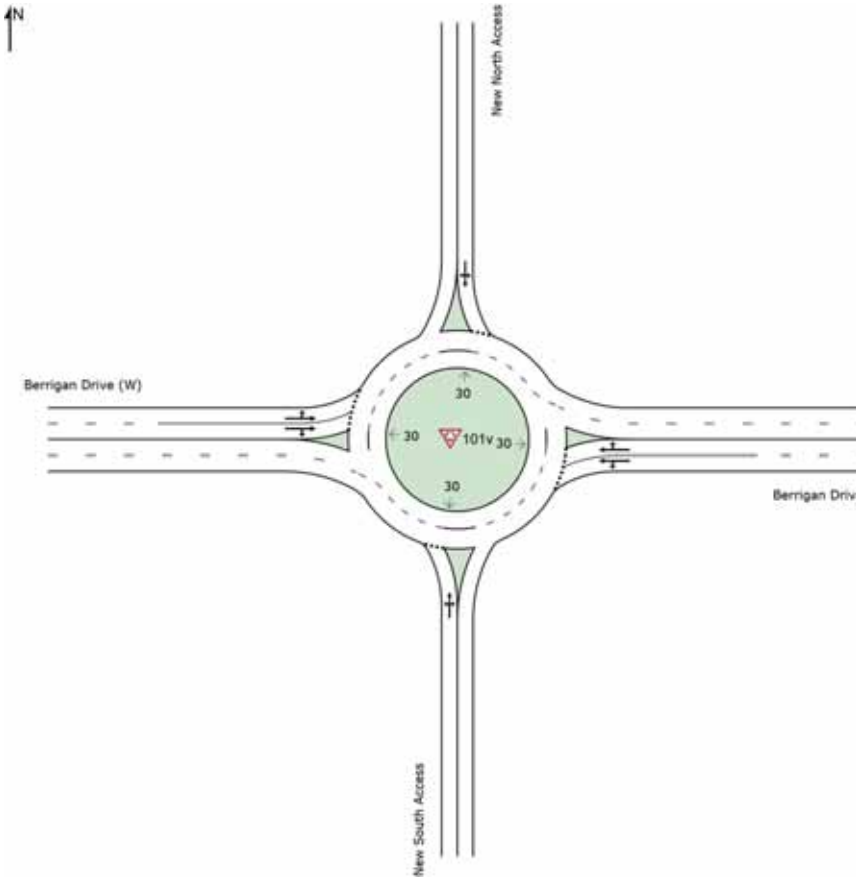
Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: New South Access															
Lane 1[d]	37	1.3	37	1.3	184	0.200	100	17.1	LOS B	0.3	2.3	Full	500	-28.6[N3]	0.0
Approach	37	1.3	37	1.3		0.200		17.1	LOS B	0.3	2.3				
East: Berrigan Drive (E)															
Lane 1	731	2.0	684	2.0	590	1.160	100	159.0	LOS F	26.5[N4]	189.9[N4]	Full	190	-48.4[N3]	49.9
Lane 2[d]	1393	2.0	1305	2.0	1125	1.160	100	154.7	LOS F	26.5[N4]	189.9[N4]	Full	190	-20.9[N3]	49.9
Approach	2124	2.0	1989[N1]	2.0		1.160		156.2	LOS F	26.5	189.9				
North: New North Access															
Lane 1[d]	154	1.2	154	1.2	511	0.301	100	11.9	LOS B	0.5	3.8	Full	500	-14.6[N3]	0.0
Approach	154	1.2	154	1.2		0.301		11.9	LOS B	0.5	3.8				
West: Berrigan Drive (W)															
Lane 1[d]	760	2.0	760	2.0	1451	0.523	100	4.2	LOS A	1.8	13.0	Full	300	0.0	0.0
Lane 2	673	2.3	673	2.3	1286	0.523	100	4.9	LOS A	1.8	12.7	Full	300	0.0	0.0
Approach	1433	2.1	1433	2.1		0.523		4.5	LOS A	1.8	13.0				
Intersection	3747	2.0	3612[N1]	2.1		1.160		88.5	LOS F	26.5	189.9				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.
N3 Capacity Adjustment due to downstream lane blockage determined by the program.
N4 Average back of queue has been restricted to the available queue storage space.

USER REPORT FOR NETWORK SITE

All Movement Classes

Project: 210824_W191120_Berrigan Drive - TSAP_Gate_1 **Template: Default Site User Report**

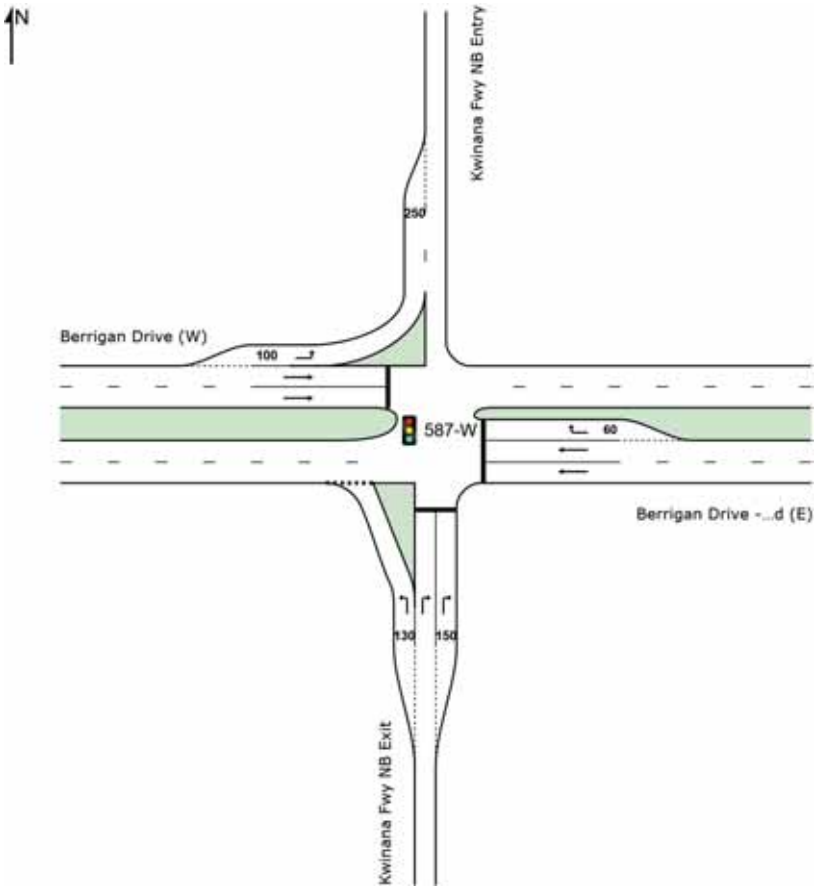
Site: 587-W [Kwinana Freeway / Berrigan West - PM 2033 (Site Folder: Proposed - 2033)] **Network: 4 [TCS - 2033 PM (Network Folder: Proposed Option - 2033)]**

2036 AM Peak (Report Option 1)
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 132 seconds (Network User-Given Cycle Time)
Common Control Group: CCG1 [Fwy]

Timings based on settings in the Network Timing dialog
Phase Times determined by the program
Downstream lane blockage effects included in determining phase times
Phase Sequence: CCG Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D, F
Output Phase Sequence: A, B, C, D, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



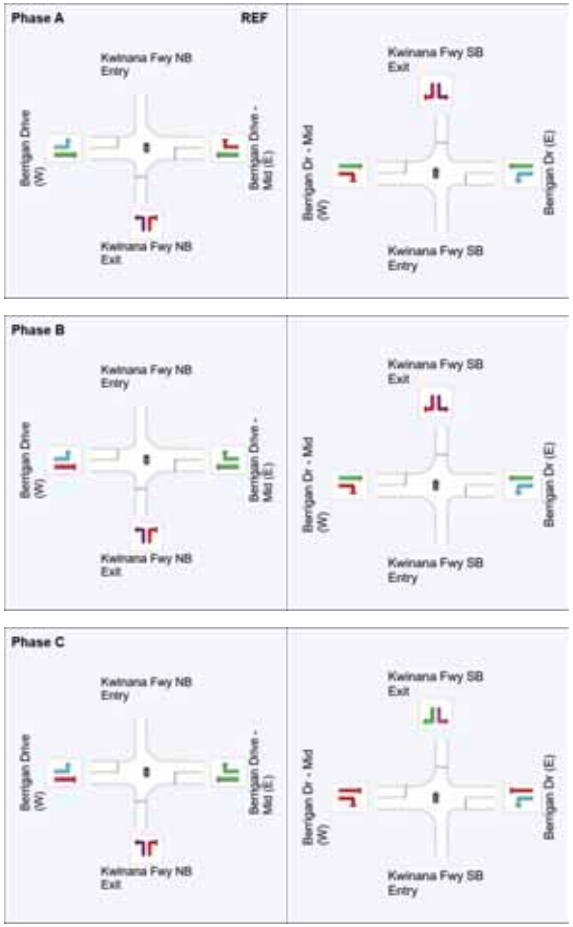
Lane Use and Performance (CCG)

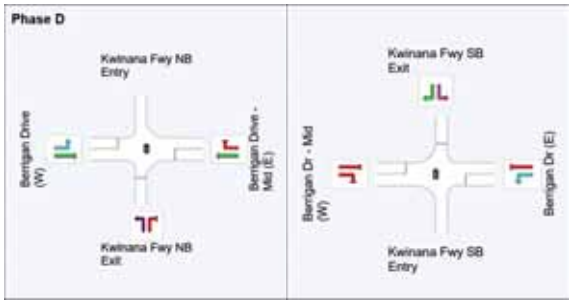
	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
Site: 587-W [Kwinana Freeway / Berrigan West - PM 2033]															
South: Kwinana Fwy NB Exit															
Lane 1	132	3.6	132	3.6	303	0.434	100	7.3	LOS A	1.3	10.1	Short	130	0.0	NA
Lane 2	43	6.4	43	6.4	80	0.539	100	76.7	LOS E	1.8	14.1	Full	500	0.0	0.0
Lane 3	43	6.4	43	6.4	80	0.539	100	76.7	LOS E	1.8	14.1	Short	150	0.0	NA
Approach	218	4.7	218	4.7		0.539		34.8	LOS C	1.8	14.1				
East: Berrigan Drive - Mid (E)															
Lane 1	1027	3.1	923	3.3	1547	0.597	100	0.5	LOS A	1.7	13.0	Full	120	0.0	0.0
Lane 2	1027	3.1	923	3.3	1547	0.597	100	0.5	LOS A	1.7	13.0	Full	120	0.0	0.0
Lane 3	573	3.1	514	3.3	879	0.585	100	17.4	LOS B	8.4	63.6	Short	60	5.0 N2	NA
Approach	2626	3.1	2360 N 1	3.3		0.597		4.2	LOS A	8.4	63.6				
West: Berrigan Drive (W)															
Lane 1	620	3.3	620	3.3	1812	0.342	100	7.9	LOS A	0.0	0.0	Short	100	0.0	NA
Lane 2	368	3.2	368	3.2	463	0.794	100	35.3	LOS D	11.0	83.3	Full	500	0.0	0.0
Lane 3	368	3.2	368	3.2	463	0.794	100	35.3	LOS D	11.0	83.3	Full	500	0.0	0.0
Approach	1356	3.2	1356	3.2		0.794		22.8	LOS C	11.0	83.3				
Intersection	4200	3.2	3934 N 1	3.4		0.794		12.3	LOS B	11.0	83.3				
Site: 587-E [Kwinana Freeway / Berrigan East - PM 2033]															
East: Berrigan Dr (E)															
Lane 1	1286	1.2	1040	1.2	1103	0.943	100	49.6	LOS D	40.3 N4	300.0 N4	Full	300	0.0	50.0
Lane 2	825	1.3	667	1.3	708	0.943	100	66.6	LOS E	32.0	238.2	Full	300	0.0	28.6
Approach	2111	1.2	1707 N 1	1.2		0.943		56.3	LOS E	40.3	300.0				
North: Kwinana Fwy SB Exit															
Lane 1	719	3.3	719	3.3	1084	0.663	100	9.6	LOS A	16.7	127.1	Short	115	0.0	NA
Lane 2	506	6.1	506	6.1	551 1	0.919	100	69.0	LOS E	23.0	179.6	Full	500	0.0	0.0
Lane 3	506	6.1	506	6.1	551 1	0.919	100	69.0	LOS E	23.0	179.6	Short	130	0.0	NA
Approach	1732	4.9	1732	4.9		0.919		44.4	LOS D	23.0	179.6				
West: Berrigan Dr - Mid (W)															
Lane 1	356	2.6	356	2.6	1004	0.354	100	5.2	LOS A	2.6	19.3	Full	120	0.0	0.0
Lane 2	356	2.6	356	2.6	1004	0.354	100	5.2	LOS A	2.6	19.3	Full	120	0.0	0.0
Lane 3	105	3.8	105	3.8	150	0.701	100	68.6	LOS E	4.2	32.0	Short	50	0.0	NA
Approach	817	2.8	817	2.8		0.701		13.4	LOS B	4.2	32.0				
Intersection	4659	2.9	4255 N 1	3.2		0.943		43.2	LOS D	40.3	300.0				

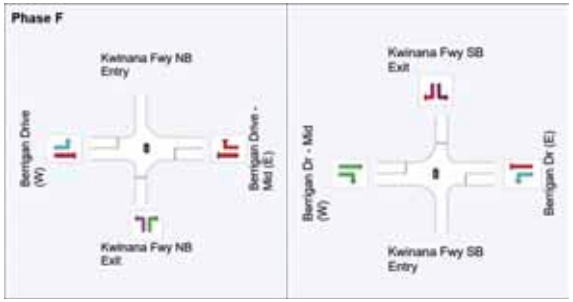
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Output Phase Sequence (CCG)







REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

Site: 587-E [Kwinana Freeway / Berrigan East - PM 2033 (Site Folder: Proposed - 2033)]

Network: 4 [TCS - 2033 PM (Network Folder: Proposed Option - 2033)]

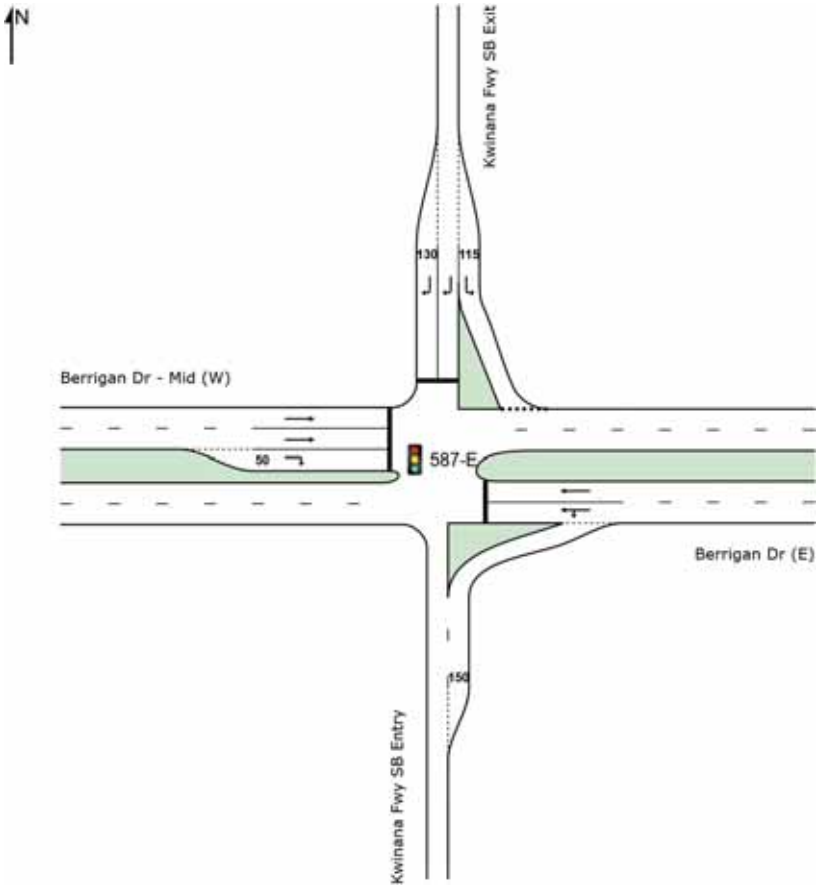
Glen Iris
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 132 seconds (Network User-Given Cycle Time)
Common Control Group: CCG1 [Fwy]

Timings based on settings in the Network Timing dialog
Phase Times determined by the program
Downstream lane blockage effects included in determining phase times
Phase Sequence: CCG Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D, F
Output Phase Sequence: A, B, C, D, F

Some CCG output elements have been omitted as they have already been included under other Sites belonging to the same CCG.

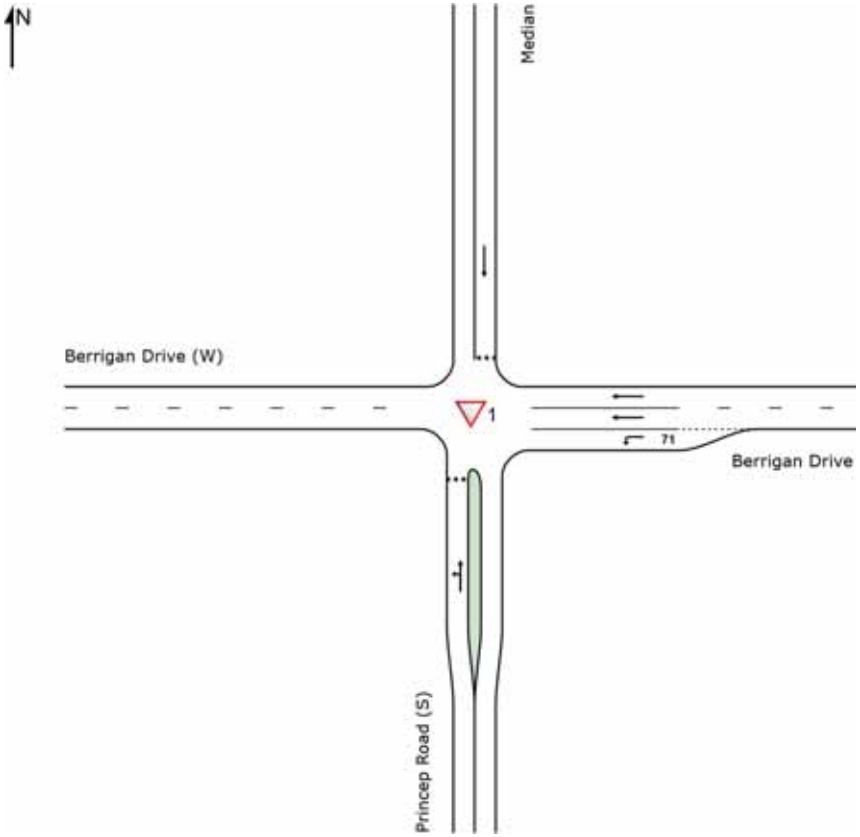
Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

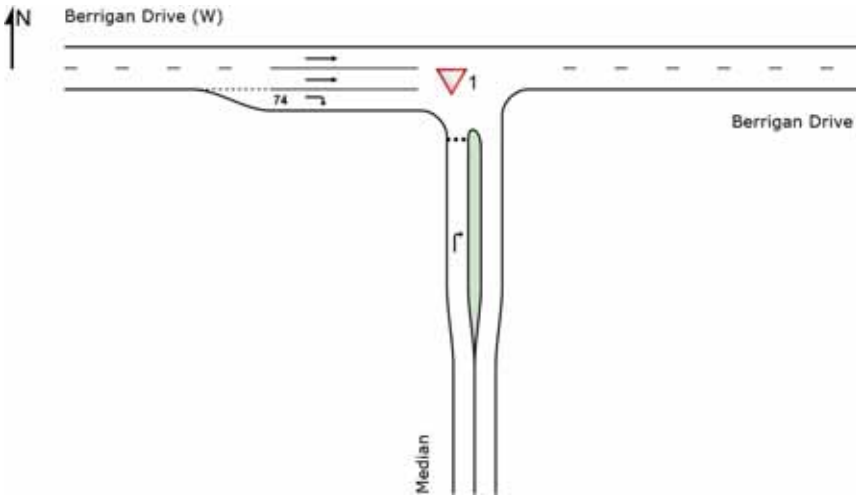
	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Princep Road (S)															
Lane 1	452	3.5	452	3.5	278	1.622	100	582.2	LOS F	46.4	354.5	Full	200	-45.8[N7]	100.0
Approach	452	3.5	452	3.5		1.622		582.2	LOS F	46.4	354.5				
East: Berrigan Drive (E)															
Lane 1	34	12.1	34	12.1	1643	0.020	100	5.7	LOS A	0.0	0.0	Short	71	0.0	NA
Lane 2	822	3.1	822	3.1	1888	0.436	100	0.0	LOS A	0.0	0.0	Full	135	0.0	0.0
Lane 3	822	3.1	822	3.1	1888	0.436	100	0.0	LOS A	0.0	0.0	Full	135	0.0	0.0
Approach	1678	3.3	1678	3.3		0.436		0.2	NA	0.0	0.0				
North: Median															
Lane 1	167	7.5	167	7.5	184	0.908	100	78.9	LOS F	0.9[N4]	7.0[N4]	Full	7	0.0	49.9
Approach	167	7.5	167	7.5		0.908		78.9	LOS F	0.9	7.0				
Intersection	2297	3.6	2297	3.6		1.622		120.3	NA	46.4	354.5				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N4 Average back of queue has been restricted to the available queue storage space.
N7 The capacity reduction has been determined from the queue blockage probability of a Site further downstream due to intermediate continuous lanes.

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Median															
Lane 1	69	1.5	49	1.5	175	0.279	100	13.2	LOS B	0.2	1.6	Full	7	-50.0 N3	0.0
Approach	69	1.5	49 N1	1.5		0.279		13.2	LOS B	0.2	1.6				
West: Berrigan Drive (W)															
Lane 1	518	1.8	518	1.8	1908	0.271	100	0.0	LOS A	0.0	0.0	Full	190	0.0	0.0
Lane 2	518	1.8	518	1.8	1908	0.271	100	0.0	LOS A	1.8 N5	13.3 N5	Full	190	0.0	0.0
Lane 3	167	7.5	167	7.5	1709	0.098	100	5.8	LOS A	2.3 N5	18.0 N5	Short	74	0.0	NA
Approach	1203	2.6	1203	2.6		0.271		0.8	NA	2.3	18.0				
Intersection	1273	2.5	1252 N1	2.6		0.279		1.3	NA	2.3	18.0				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.
N3 Capacity Adjustment due to downstream lane blockage determined by the program.
N5 Continuous Lane results determined by Back of Queue values of downstream lanes (proportional to lane movement flows).

Site: LM01173 [Berrigan Drive_Jandakot Road_PM 2033 (Site Folder: Proposed - 2033)]

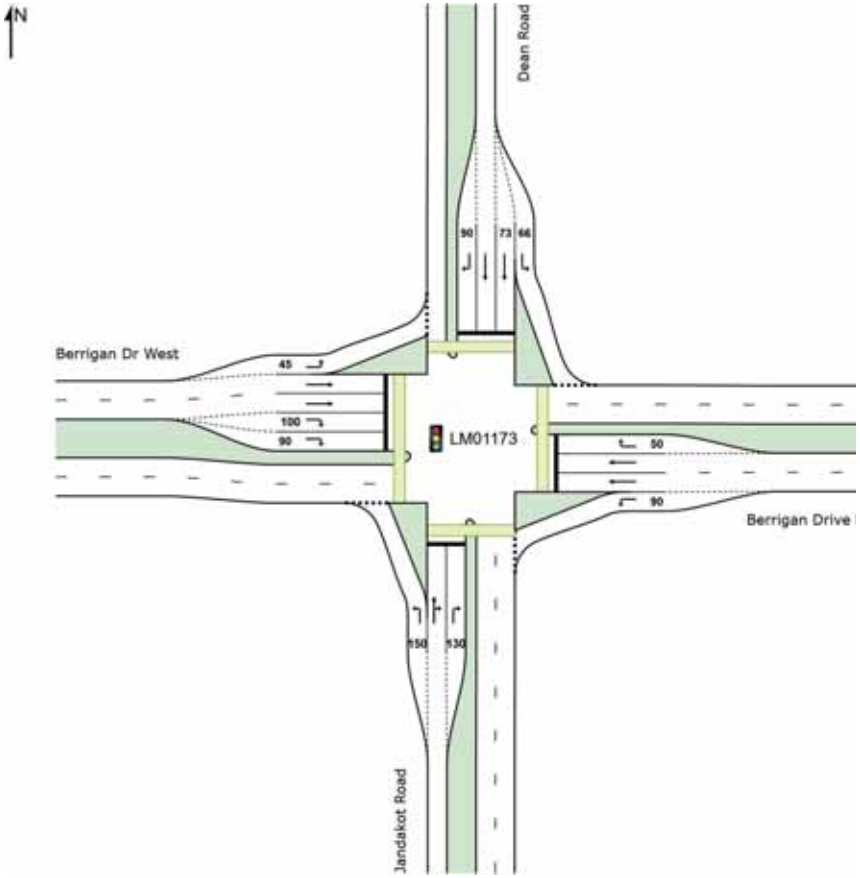
Network: 4 [TCS - 2033 PM (Network Folder: Proposed Option - 2033)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 132 seconds (Network User-Given Cycle Time)

Timings based on settings in the Network Timing dialog
Phase Times determined by the program
Downstream lane blockage effects included in determining phase times
Phase Sequence: Variable Phasing
Reference Phase: Phase E
Input Phase Sequence: A, B, C, D, E
Output Phase Sequence: A, B, C, D, E

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



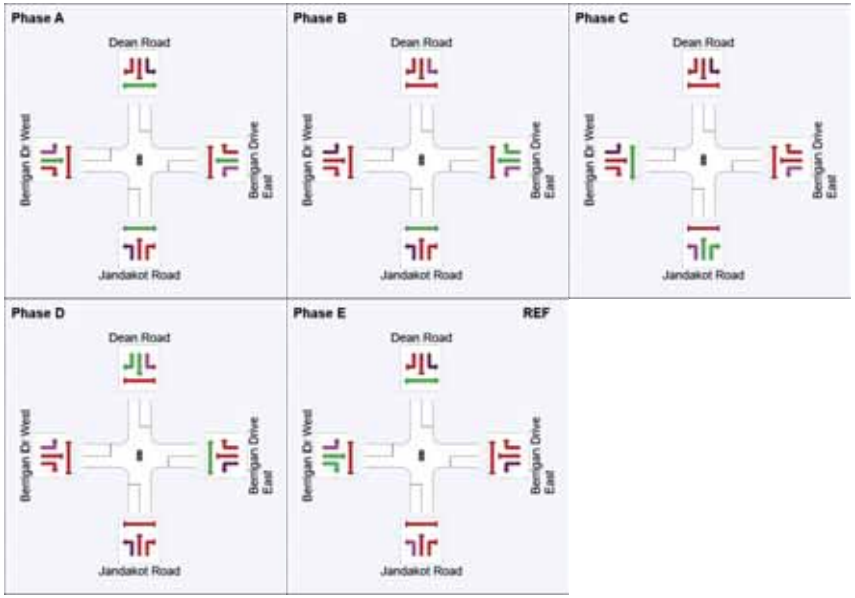
Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Jandakot Road															
Lane 1	637	5.5	637	5.5	952	0.669	100	21.2	LOS C	15.1	112.4	Short	150	0.0	NA
Lane 2	137	1.8	137	1.8	266	0.515	100	58.2	LOS E	5.1	36.6	Full	230	0.0	0.0
Lane 3	97	5.5	97	5.5	246	0.393	76[5]	62.8	LOS E	3.6	26.5	Short	130	0.0	NA
Approach	871	4.9	871	4.9		0.669		31.6	LOS C	15.1	112.4				
East: Berrigan Drive East															
Lane 1	495	4.3	495	4.3	1231	0.402	100	11.9	LOS B	7.0	51.7	Short	90	0.0	NA
Lane 2	436	4.3	436	4.3	460[1]	0.947	100	73.0	LOS E	20.3	149.4	Full	125	0.0	66.9
Lane 3	523	4.3	523	4.3	553[1]	0.947	100	72.4	LOS E	25.1	184.1	Full	125	0.0	87.3
Lane 4	79	1.8	79	1.8	393	0.201	100	51.7	LOS D	2.6	18.3	Short	50	0.0	NA
Approach	1533	4.2	1533	4.2		0.947		52.0	LOS D	25.1	184.1				
North: Dean Road															
Lane 1	46	3.2	46	3.2	672	0.069	100	21.0	LOS C	0.9	6.2	Short	66	0.0	NA
Lane 2	15	3.2	15	3.2	219	0.067	100	56.8	LOS E	0.5	3.8	Short	73	0.0	NA
Lane 3	15	3.2	15	3.2	219	0.067	100	56.8	LOS E	0.5	3.8	Full	110	0.0	0.0
Lane 4	96	0.0	96	0.0	213	0.449	100	66.1	LOS E	3.6	25.4	Short	90	0.0	NA
Approach	172	1.4	172	1.4		0.449		52.3	LOS D	3.6	25.4				
West: Berrigan Dr West															
Lane 1	97	0.0	95	0.0	1327	0.072	100	7.5	LOS A	0.6	4.2	Short	45	0.0	NA
Lane 2	137	1.4	135	1.4	651	0.207	100	33.5	LOS C	3.8	26.7	Full	135	0.0	0.0
Lane 3	137	1.4	135	1.4	651	0.207	100	33.5	LOS C	3.8	26.7	Full	135	0.0	43.4[8]
Lane 4	397	1.4	390	1.4	424[1]	0.920	100	75.8	LOS E	17.7	125.7	Short	100	10.0[N2]	NA
Lane 5	397	1.4	390	1.4	424[1]	0.920	100	75.8	LOS E	17.7	125.7	Short	90	10.0[N2]	NA
Approach	1164	1.3	1145[N1]	1.3		0.920		60.2	LOS E	17.7	125.7				
Intersection	3739	3.3	3720[N1]	3.3		0.947		49.8	LOS D	25.1	184.1				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
5 Lane under-utilisation found by the program
8 Probability of Blockage has been set on the basis of a queue that overflows from a short lane.
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.
N2 Capacity Adjustment specified by user.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase

Site: 101 [Berrigan Drive / Turnbury Park Dr / Access - PM 2033 - TCS (Site Folder: Proposed - 2033)]

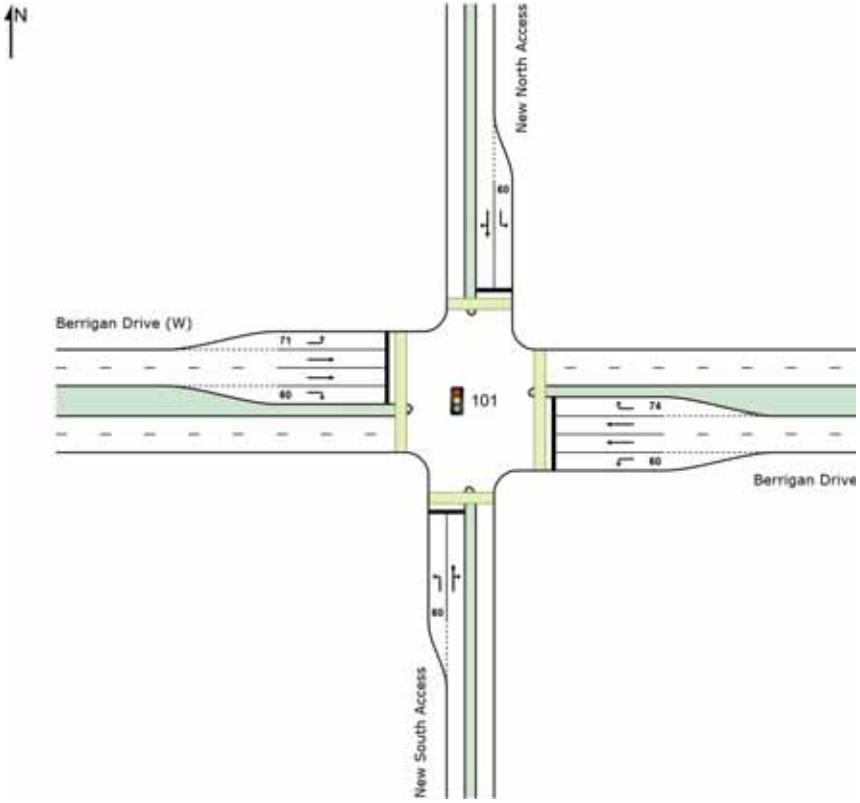
Network: 4 [TCS - 2033 PM (Network Folder: Proposed Option - 2033)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Downstream lane blockage effects included in determining phase times
Phase Sequence: Variable Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C, C1*, C2*
Output Phase Sequence: A, B, C, C2*
(* Variable Phase)

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



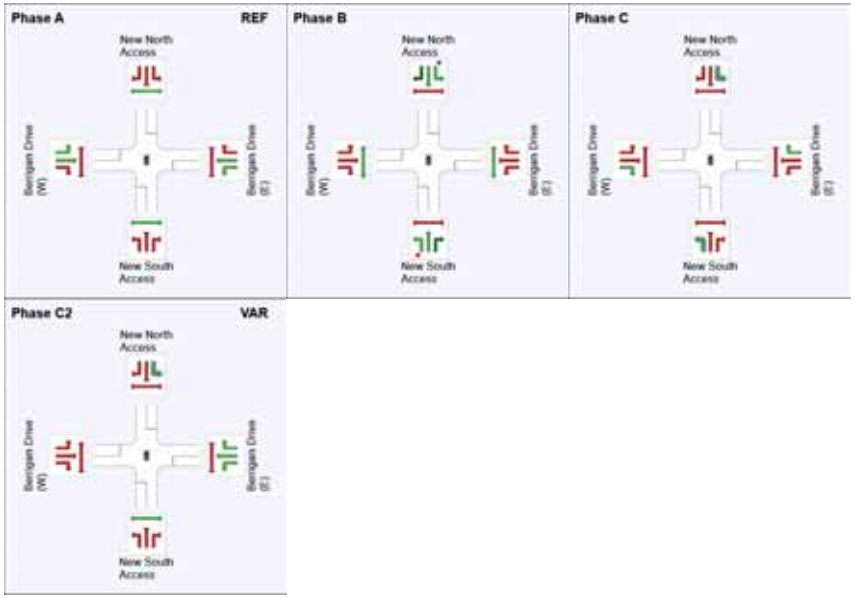
Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: New South Access															
Lane 1	15	0.0	15	0.0	118	0.125	100	66.3	LOS E	0.6	4.2	Short	60	-50.0 N3	NA
Lane 2	22	2.1	22	2.1	114	0.193	100	76.9	LOS E	1.0	7.0	Full	500	0.0	0.0
Approach	37	1.3	37	1.3		0.193		72.6	LOS E	1.0	7.0				
East: Berrigan Drive (E)															
Lane 1	46	1.8	44	1.8	1382	0.032	100	10.4	LOS B	0.5	3.4	Short	60	0.0	NA
Lane 2	858	2.0	813	2.0	711 1	1.144	100	200.1	LOS F	26.5 N4	190.0 N4	Full	190	-50.0 N3	50.0
Lane 3	1112	2.0	1053	2.0	921 1	1.144	100	192.6	LOS F	26.5 N4	190.0 N4	Full	190	-33.4 N3	50.0
Lane 4	107	1.8	102	1.8	208	0.489	100	74.3	LOS E	4.4	31.3	Short	74	0.0	NA
Approach	2124	2.0	2012 N1 1	2.0		1.144		185.7	LOS F	26.5	190.0				
North: New North Access															
Lane 1	60	3.2	60	3.2	363	0.165	100	55.5	LOS E	2.2	15.8	Short	60	0.0	NA
Lane 2	94	0.0	94	0.0	84	1.114	100	203.1	LOS F	7.6	53.0	Full	500	-32.9 N3	0.0
Approach	154	1.2	154	1.2		1.114		145.5	LOS F	7.6	53.0				
West: Berrigan Drive (W)															
Lane 1	148	0.0	148	0.0	1263	0.118	100	14.2	LOS B	2.2	15.7	Short	71	0.0	NA
Lane 2	621	2.5	621	2.5	1239 1	0.501	100	11.9	LOS B	12.8	92.4	Full	300	0.0	0.0
Lane 3	598	2.5	598	2.5	1193 1	0.501	100	11.7	LOS B	12.1	87.4	Full	300	0.0	0.0
Lane 4	65	0.0	65	0.0	74	0.879	100	95.2	LOS F	3.3	23.1	Short	60	0.0	NA
Approach	1433	2.1	1433	2.1		0.879		15.9	LOS B	12.8	92.4				
Intersection	3747	2.0	3635 N1 1	2.1		1.144		115.9	LOS F	26.5	190.0				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.
N3 Capacity Adjustment due to downstream lane blockage determined by the program.
N4 Average back of queue has been restricted to the available queue storage space.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase

Organisation: STANTEC NEW ZEALAND | Licence: NETWORK / Enterprise | Created: Monday, 13 September 2021 1:39:19 PM
Project: P:\W19100-19199\W191120 Glen Iris Golf Course Re-Develop\Modelling\210824_W191120_Berrigan Drive - TSAP_Gate_1.sip9

USER REPORT FOR NETWORK SITE

All Movement Classes

Project: 210824_W191120_Berrigan Drive - TSAP_Gate_1 **Template: Default Site User Report**

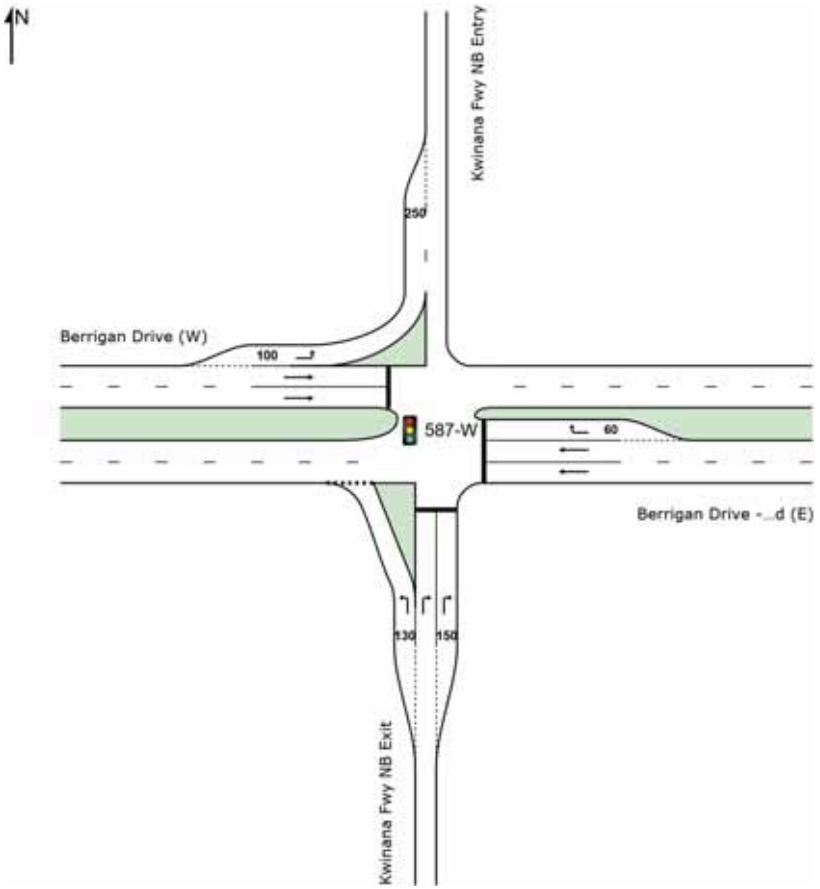
Site: 587-W [Kwinana Freeway / Berrigan West - AM 2033 (Site Folder: Proposed - 2033)] **Network: 5 [Roundabout - 2033 AM (Network Folder: Proposed Option - 2033)]**

2036 AM Peak (Report Option 1)
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 138 seconds (Network User-Given Cycle Time)
Common Control Group: CCG1 [Fwy]

Timings based on settings in the Network Timing dialog
Phase Times determined by the program
Downstream lane blockage effects included in determining phase times
Phase Sequence: CCG Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D, F
Output Phase Sequence: A, B, C, D, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



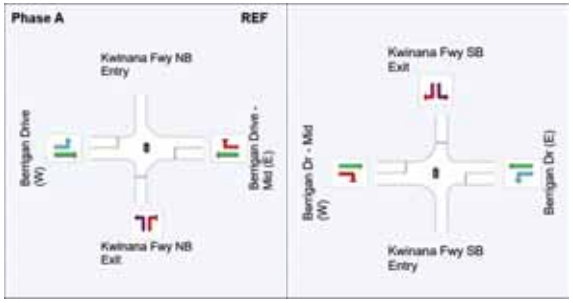
Lane Use and Performance (CCG)

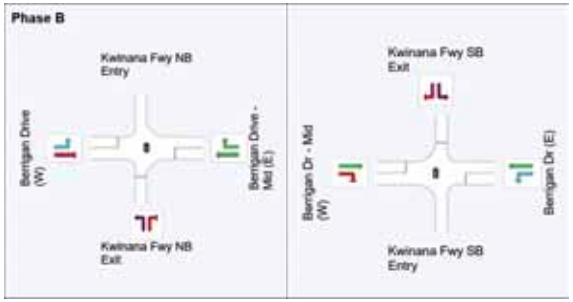
	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
Site: 587-W [Kwinana Freeway / Berrigan West - AM 2033]															
South: Kwinana Fwy NB Exit															
Lane 1	89	3.6	89	3.6	483	0.185	100	6.3	LOS A	0.3	2.5	Short	130	0.0	NA
Lane 2	125	6.4	125	6.4	114	1.089	100	172.6	LOS F	8.8	68.6	Full	500	0.0	0.0
Lane 3	125	6.4	125	6.4	114	1.089	100	172.6	LOS F	8.8	68.6	Short	150	0.0	NA
Approach	339	5.7	339	5.7		1.089		128.7	LOS F	8.8	68.6				
East: Berrigan Drive - Mid (E)															
Lane 1	1019	7.5	799	8.2	1453	0.550	100	0.5	LOS A	1.4	11.1	Full	120	0.0	0.0
Lane 2	560	7.5	439	8.2	1453	0.302	55[7]	0.4	LOS A	0.5	4.0	Full	120	0.0	50.0[8]
Lane 3	917	3.9	716	4.3	730[1]	0.981	100	46.3	LOS D	15.7[N4]	120.0[N4]	Short	60	35.0[N2]	NA
Approach	2496	6.2	1954[N1]	6.8		0.981		17.3	LOS B	15.7	120.0				
West: Berrigan Drive (W)															
Lane 1	928	5.5	928	5.5	1772	0.524	100	14.8	LOS B	0.0	0.0	Short	100	0.0	NA
Lane 2	308	5.6	308	5.6	406	0.759	100	36.2	LOS D	9.3	72.1	Full	500	0.0	0.0
Lane 3	308	5.6	308	5.6	406	0.759	100	36.2	LOS D	9.3	72.1	Full	500	0.0	0.0
Approach	1544	5.5	1544	5.5		0.759		23.3	LOS C	9.3	72.1				
Intersection	4379	5.9	3837[N1]	6.7		1.089		29.5	LOS C	15.7	120.0				
Site: 587-E [Kwinana Freeway / Berrigan East - AM 2033]															
East: Berrigan Dr (E)															
Lane 1	1312	4.9	1076	5.3	881	1.222	100	261.5	LOS F	38.7[N4]	300.0[N4]	Full	300	0.0	50.0
Lane 2	630	4.4	516	4.8	422	1.222	100	274.5	LOS F	38.9[N4]	300.0[N4]	Full	300	-50.0[N3]	50.0
Approach	1942	4.7	1592[N1]	5.1		1.222		265.7	LOS F	38.9	300.0				
North: Kwinana Fwy SB Exit															
Lane 1	460	5.0	460	5.0	964	0.477	100	6.4	LOS A	2.5	19.1	Short	115	0.0	NA
Lane 2	463	10.5	463	10.5	386[1]	1.198	100	256.6	LOS F	42.2	344.1	Full	500	0.0	15.5
Lane 3	241	10.5	241	10.5	202	1.198	100	266.2	LOS F	22.8	185.6	Short	130	-50.0[N3]	NA
Approach	1164	8.3	1164	8.3		1.198		159.8	LOS F	42.2	344.1				
West: Berrigan Dr - Mid (W)															
Lane 1	382	6.5	374	6.5	1154	0.324	100	0.7	LOS A	0.4	3.5	Full	120	0.0	0.0
Lane 2	382	6.5	374	6.5	1154	0.324	100	0.7	LOS A	0.4	3.5	Full	120	0.0	0.0
Lane 3	165	3.3	162	3.3	184	0.879	100	73.5	LOS E	7.1	53.8	Short	50	0.0	NA
Approach	929	5.9	909[N1]	5.9		0.879		13.6	LOS B	7.1	53.8				
Intersection	4036	6.0	3666[N1]	6.6		1.222		169.6	LOS F	42.2	344.1				

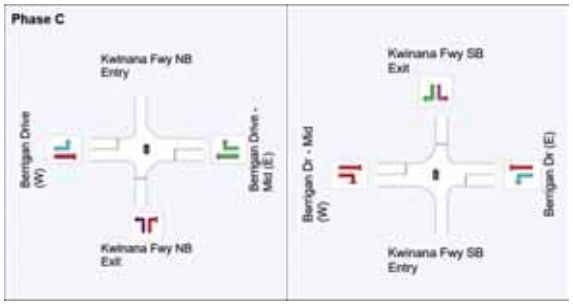
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

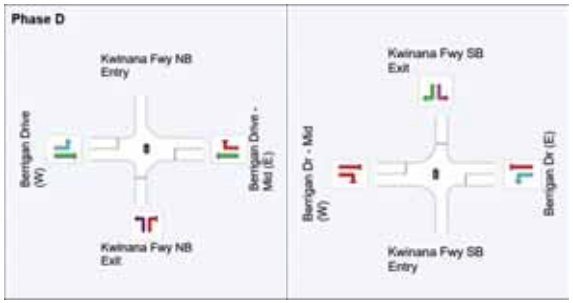
1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
7 Lane under-utilisation specified by the user

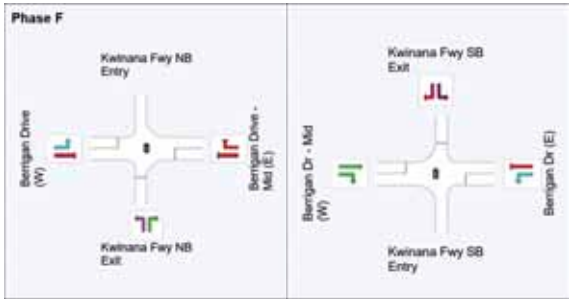
Output Phase Sequence (CCG)



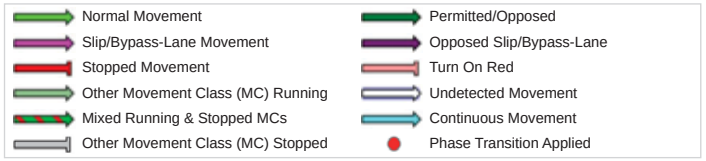








REF: Reference Phase
VAR: Variable Phase



Site: 587-E [Kwinana Freeway / Berrigan East - AM 2033 (Site Folder: Proposed - 2033)]

Network: 5 [Roundabout - 2033 AM (Network Folder: Proposed Option - 2033)]

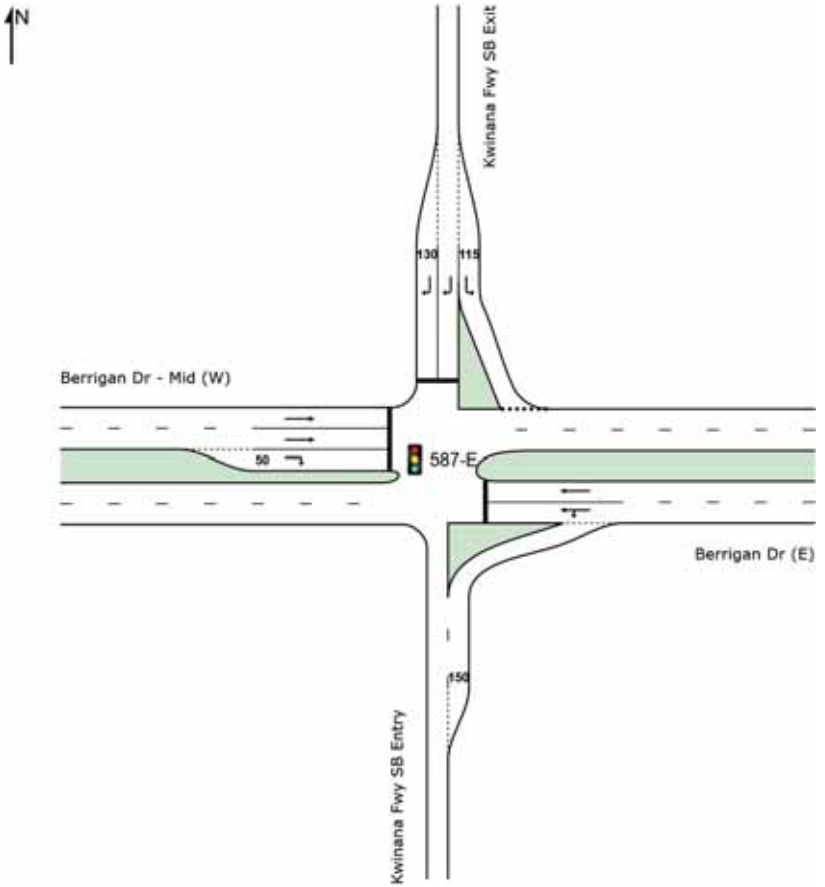
Glen Iris
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 138 seconds (Network User-Given Cycle Time)
Common Control Group: CCG1 [Fwy]

Timings based on settings in the Network Timing dialog
Phase Times determined by the program
Downstream lane blockage effects included in determining phase times
Phase Sequence: CCG Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D, F
Output Phase Sequence: A, B, C, D, F

Some CCG output elements have been omitted as they have already been included under other Sites belonging to the same CCG.

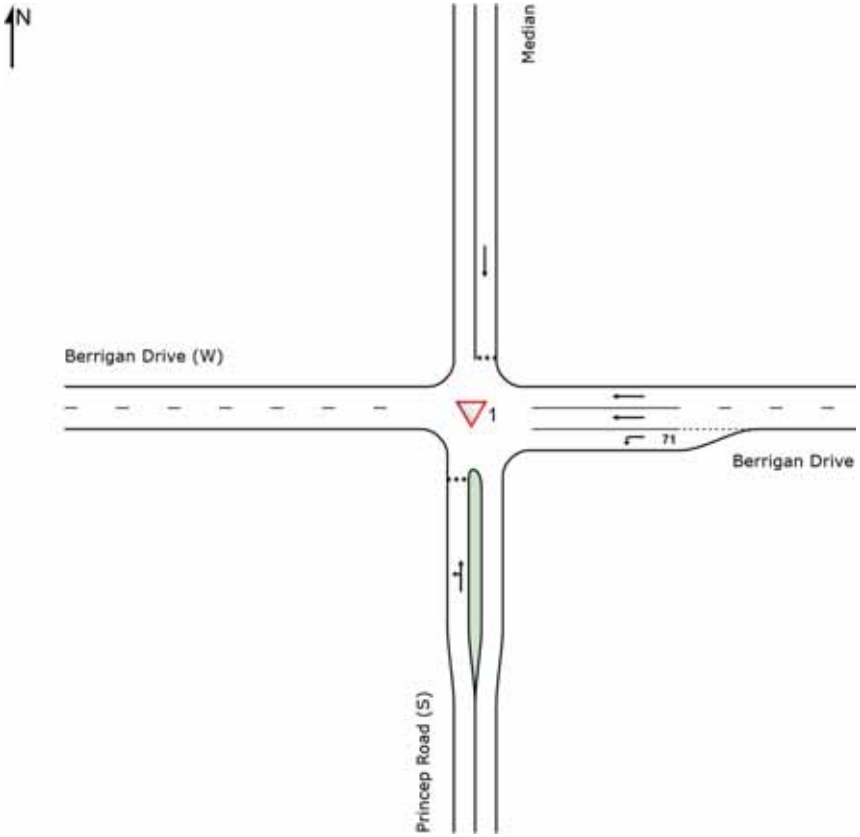
Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

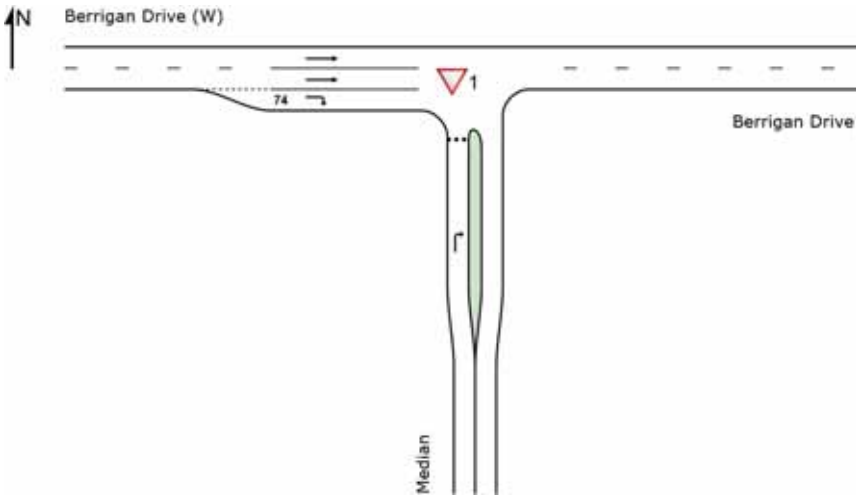
	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Princep Road (S)															
Lane 1	208	28.3	208	28.3	392	0.532	100	13.5	LOS B	0.9	8.5	Full	200	-46.7 N7	0.0
Approach	208	28.3	208	28.3		0.532		13.5	LOS B	0.9	8.5				
East: Berrigan Drive (E)															
Lane 1	82	8.9	64	9.9	1611	0.040	100	5.7	LOS A	0.0	0.0	Short	71	0.0	NA
Lane 2	532	4.2	411	4.6	919	0.447	100	0.1	LOS A	0.0	0.0	Full	135	-49.9 N7	0.0
Lane 3	1000	4.2	773	4.6	1728	0.447	100	0.1	LOS A	0.0	0.0	Full	135	-5.9 N7	0.0
Approach	1614	4.4	1248 N 1	4.9		0.447		0.4	NA	0.0	0.0				
North: Median															
Lane 1	221	9.0	219	9.0	306	0.714	100	29.5	LOS D	0.8 N4	7.0 N4	Full	7	0.0	49.9
Approach	221	9.0	219 N1	9.0		0.714		29.5	LOS D	0.8	7.0				
Intersection	2043	7.4	1675 N 1	9.0		0.714		5.8	NA	0.9	8.5				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.
N4 Average back of queue has been restricted to the available queue storage space.
N7 The capacity reduction has been determined from the queue blockage probability of a Site further downstream due to intermediate continuous lanes.

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Median															
Lane 1	25	33.3	25	33.3	171	0.148	100	23.0	LOS C	0.2	1.9	Full	7	0.0	0.0
Approach	25	33.3	25	33.3		0.148		23.0	LOS C	0.2	1.9				
West: Berrigan Drive (W)															
Lane 1	509	5.5	503	5.5	1802	0.279	100	0.0	LOS A	0.0	0.0	Full	190	0.0	0.0
Lane 2	509	5.5	503	5.5	1802	0.279	100	0.0	LOS A	0.0	0.0	Full	190	0.0	0.0
Lane 3	221	9.0	219	9.0	1600	0.137	100	5.9	LOS A	1.0 N5	8.6 N5	Short	74	0.0	NA
Approach	1239	6.1	1225 N 1	6.1		0.279		1.1	NA	1.0	8.6				
Intersection	1264	6.7	1250 N 1	6.7		0.279		1.5	NA	1.0	8.6				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.
N5 Continuous Lane results determined by Back of Queue values of downstream lanes (proportional to lane movement flows).

Site: LM01173 [Berrigan Drive_Jandakot Road_AM 2033 (Site Folder: Proposed - 2033)]

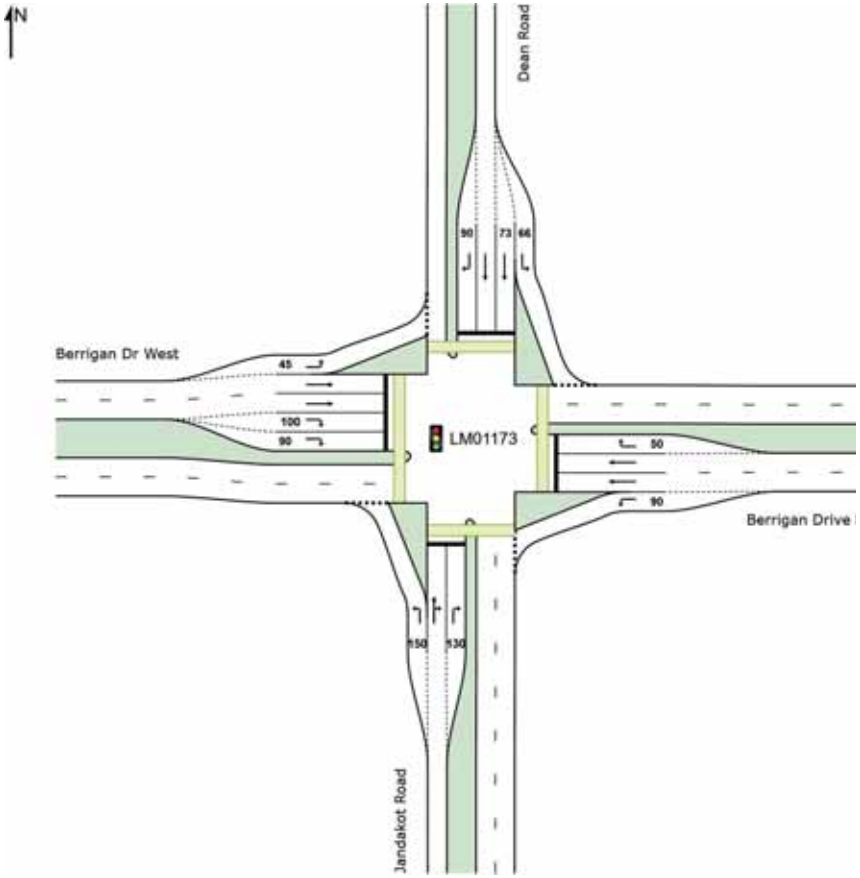
Network: 5 [Roundabout - 2033 AM (Network Folder: Proposed Option - 2033)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 109 seconds (Site User-Given Phase Times)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times specified by the user
Phase Sequence: Variable Phasing
Reference Phase: Phase E
Input Phase Sequence: A, B, C, D, E
Output Phase Sequence: A, B, C, D, E

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



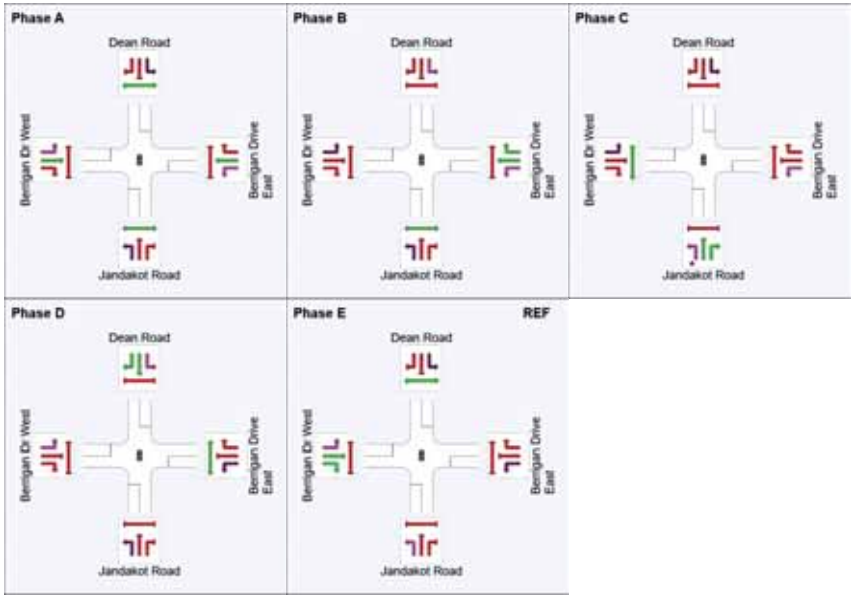
Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Jandakot Road															
Lane 1	1351	5.2	1351	5.2	1124[1]	1.201	100	229.1	LOS F	100.7	746.4	Short	150	0.0	NA
Lane 2	258	4.9	258	4.9	357	0.724	100	50.0	LOS D	8.3	61.0	Full	230	0.0	100.0[8]
Lane 3	252	5.2	252	5.2	349	0.724	100	52.5	LOS D	8.1	59.9	Short	130	0.0	NA
Approach	1861	5.2	1861	5.2		1.201		180.3	LOS F	100.7	746.4				
East: Berrigan Drive East															
Lane 1	161	23.3	161	23.3	1149	0.140	100	8.9	LOS A	1.2	10.9	Short	90	0.0	NA
Lane 2	90	23.3	90	23.3	518	0.174	100	30.1	LOS C	2.2	19.1	Full	125	0.0	0.0
Lane 3	90	23.3	90	23.3	518	0.174	100	30.1	LOS C	2.2	19.1	Full	125	0.0	0.0
Lane 4	14	4.5	14	4.5	50	0.273	100	67.9	LOS E	0.5	3.6	Short	50	0.0	NA
Approach	355	22.6	355	22.6		0.273		21.9	LOS C	2.2	19.1				
North: Dean Road															
Lane 1	102	5.2	102	5.2	775	0.132	100	10.2	LOS B	1.0	7.1	Short	66	0.0	NA
Lane 2	23	5.2	23	5.2	245	0.092	100	45.8	LOS D	0.7	4.9	Short	73	0.0	NA
Lane 3	23	5.2	23	5.2	245	0.092	100	45.8	LOS D	0.7	4.9	Full	110	0.0	0.0
Lane 4	147	0.0	147	0.0	241	0.611	100	55.8	LOS E	4.7	33.0	Short	90	0.0	NA
Approach	295	2.6	295	2.6		0.611		38.5	LOS D	4.7	33.0				
West: Berrigan Dr West															
Lane 1	27	4.5	27	4.5	1420	0.019	100	6.6	LOS A	0.1	0.8	Short	45	0.0	NA
Lane 2	276	4.6	273	4.6	860	0.317	100	20.5	LOS C	5.6	41.6	Full	135	0.0	0.0
Lane 3	276	4.6	273	4.6	860	0.317	100	20.5	LOS C	5.6	41.6	Full	135	0.0	0.0
Lane 4	257	4.6	255	4.6	317	0.804	100	57.6	LOS E	8.7	64.0	Short	100	0.0	NA
Lane 5	257	4.6	255	4.6	317	0.804	100	57.6	LOS E	8.7	64.0	Short	90	0.0	NA
Approach	1094	4.6	1082[N1]	4.6		0.804		37.6	LOS D	8.7	64.0				
Intersection	3604	6.5	3593[N1]	6.5		1.201		110.1	LOS F	100.7	746.4				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
8 Probability of Blockage has been set on the basis of a queue that overflows from a short lane.
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

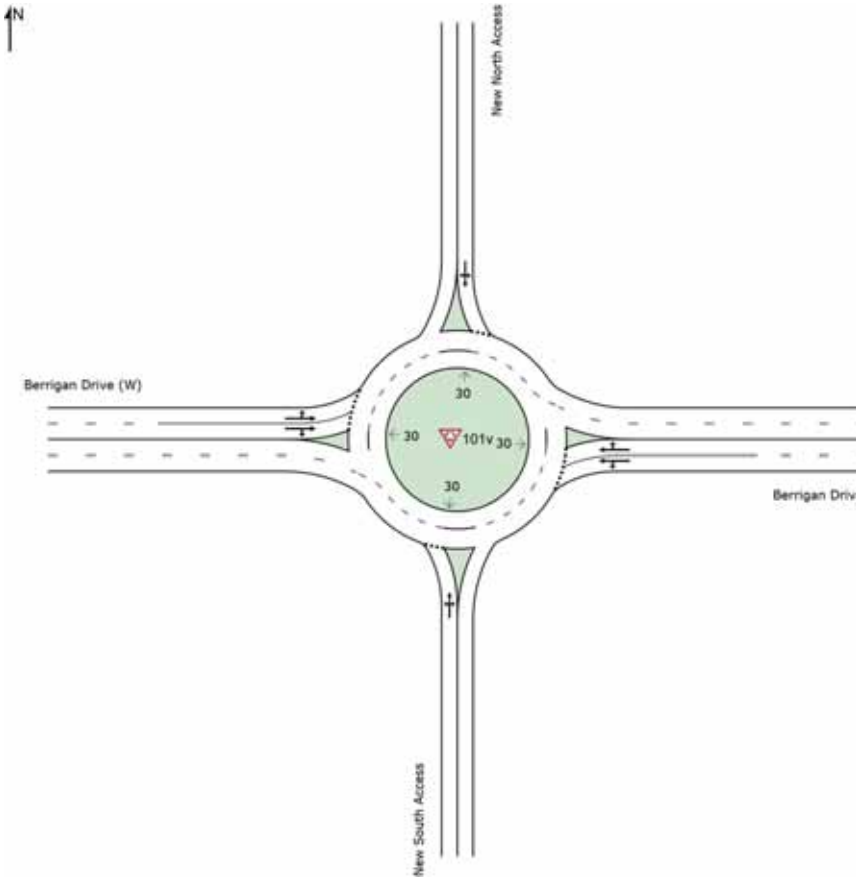
Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: New South Access															
Lane 1[d]	66	2.1	66	2.1	280	0.237	100	11.5	LOS B	2.0[N5]	14.1[N5]	Full	500	-30.8[N3]	0.0
Approach	66	2.1	66	2.1		0.237		11.5	LOS B	2.0	14.1				
East: Berrigan Drive (E)															
Lane 1[d]	970	6.1	765	7.1	675	1.133	100	134.5	LOS F	25.1[N6]	189.9[N6]	Full	190	-47.6[N3]	49.9
Lane 2	836	7.2	659	8.3	582	1.133	100	137.0	LOS F	7.7[N5]	59.3[N5]	Full	190	-48.4[N3]	0.0
Approach	1806	6.6	1424[N] 1	7.7		1.133		135.7	LOS F	25.1	189.9				
North: New North Access															
Lane 1[d]	318	2.4	318	2.4	400	0.796	100	21.1	LOS C	2.4[N5]	17.2[N5]	Full	500	-34.8[N3]	0.0
Approach	318	2.4	318	2.4		0.796		21.1	LOS C	2.4	17.2				
West: Berrigan Drive (W)															
Lane 1[d]	656	3.8	648	3.8	1507	0.430	100	4.0	LOS A	1.4	9.9	Full	300	0.0	0.0
Lane 2	583	3.7	575	3.7	1338	0.430	100	4.3	LOS A	1.3	9.8	Full	300	0.0	0.0
Approach	1239	3.7	1223[N] 1	3.7		0.430		4.1	LOS A	1.4	9.9				
Intersection	3429	5.1	3031[N] 1	5.8		1.133		67.9	LOS E	25.1	189.9				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.
N3 Capacity Adjustment due to downstream lane blockage determined by the program.
N5 Continuous Lane results determined by Back of Queue values of downstream lanes (proportional to lane movement flows).
N6 Continuous Lane results determined by Back of Queue values of downstream lanes (proportional to lane movement flows) but average back of queue has been restricted to the available queue storage space.

Appendix C WAPC Guidelines Checklist

Item	Provided	Comments/Proposals
Summary	✓	
Introduction/Background	✓	
Structure plan proposal	✓	
regional context	✓	
proposed land uses	✓	
table of land uses and quantities	✓	
major attractors/generators	✓	
specific issues	✓	
Existing situation		
existing land uses within structure plan	✓	
existing land uses within 800 metres of structure plan area	✓	
existing road network within structure plan area	✓	
existing pedestrian/cycle networks within structure plan area	✓	
existing public transport services within structure plan area	✓	
existing road network within 2 (or 5) km of structure plan area	✓	
traffic flows on roads within structure plan area (PM and/or AM peak hours)	✓	
traffic flows on roads within 2 (or 5) km of structure plan area (AM and/ or PM peak hours)	✓	
existing pedestrian/cycle networks within 800m of structure plan area	✓	
existing public transport services within 800m of structure plan area	✓	
Proposed internal transport networks		
changes/additions to existing road network or proposed new road network	✓	
road reservation widths	✓	
road cross-sections & speed limits	✓	
intersection controls	✓	
pedestrian/cycle networks and crossing facilities	✓	
public transport routes	✓	
Changes to external transport networks		
road network	✓	
intersection controls	✓	
pedestrian/cycle networks and crossing facilities	✓	
public transport services	✓	

Integration with surrounding area		
trip attractors/generators within 800 metres	✓	
proposed changes to land uses within 800 metres	✓	
travel desire lines from structure plan to these attractors/generators	✓	
adequacy of external transport networks	✓	
deficiencies in external transport networks	✓	
remedial measures to address deficiencies	✓	
Analysis of internal transport networks		
assessment year(s) and time period(s)	✓	
structure plan generated traffic	✓	
extraneous (through) traffic	✓	
design traffic flows (that is, total traffic)	✓	
road cross-sections	✓	
intersection controls	✓	
access strategy	✓	
pedestrian/cycle networks	✓	
safe routes to schools	✓	
pedestrian permeability & efficiency	✓	
access to public transport	✓	
Analysis of external transport networks		
extent of analysis	✓	
base flows for assessment year(s)	✓	
total traffic flows	✓	
road cross-sections	✓	
intersection layouts & controls	✓	
pedestrian/cycle networks	✓	
Conclusions		

Proponent's Name: Sam Gill

Company: Eastcourt Property Group Date: 07/08/2023

Transport Assessor's Name: Rodney Ding Date: 07/08/2023

Company: PJA