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# Traffic Signals Approval Policy

Network Operations  
Directorate

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D17#582749  
September 2021



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## Traffic Signals Approval Policy – Network Operations Directorate

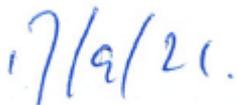
This document is owned and authorised by the Executive Director Network Operations. Please submit all comments and requests to the Manager Traffic Management Services.

### Authorisation

As Executive Director Network Operations I authorise the issue and use of this Traffic Signals Approval Policy – Network Operations Directorate.



Approved by EXECUTIVE DIRECTOR NETWORK OPERATIONS



Date:

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# Document Control

<b>Owner</b>	Bassam Abu Shamleh – Manager Traffic Management Services, Network Operations
<b>Custodian</b>	Maryely Rueda – Traffic Services Coordinator (DAATM), Network Operations
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# Amendments

Revision Number	Revision Date	Description of Key Changes	Section / Page No.
0	March 2018	Document Developed	All
1.0	5.1, 6.3.1, 6.3.2, Appendix 5	Minor changes to clarify approval stages	March 2019
2.0	5.3 and 8	Decommission of existing Traffic Signals	August 2021

## 1 PURPOSE

The purpose of this Traffic Signals Approval Policy document is to set out the circumstances under which Main Roads' Network Operations Directorate (NOD) will consider approving the modification of existing traffic signals and the provision of new traffic signals on all roads in Western Australia (WA).

## 2 SCOPE

This policy and the related procedures apply to all permanent traffic signal installations or modifications where Main Roads is the final asset owner.

## 3 ROLES & RESPONSIBILITIES

The Commissioner of Main Roads, under Regulation 297 of the *Road Traffic Code 2000*, has the sole authority to erect, establish or display, and alter or take down any traffic control signal in Western Australia. To this extent, all traffic control signal installations, removals, or alterations must be formally approved by NOD.

Notwithstanding the above, it should be noted that the Commissioner has delegated approval of traffic control signals exclusively to the Executive Director of Network Operations (EDNO).

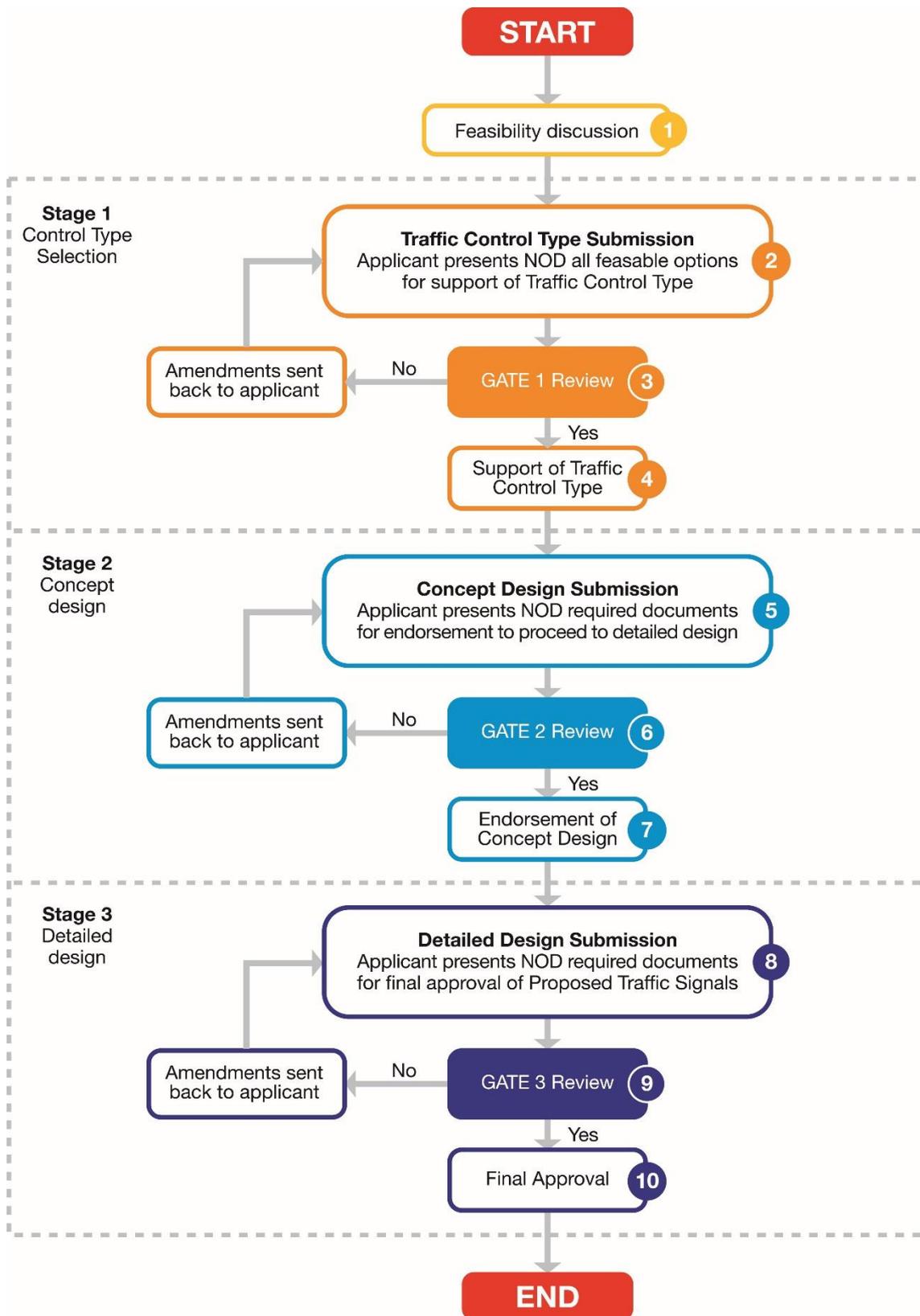
## 4 DEFINITIONS

The following definitions apply in this document:

Term	Definition
<b>DOS</b>	Degree of saturation
<b>LG</b>	Local Government
<b>LMA</b>	Light Maintenance Traffic Signal Drawing
<b>LMB</b>	Light Maintenance Pavement Marking and Signs Drawing
<b>LOS</b>	Level of Service
<b>Main Roads</b>	Main Roads Western Australia
<b>MTH</b>	Medium Term Horizon
<b>NOD</b>	Main Roads Network Operations Directorate
<b>PRC</b>	Practical Reserve Capacity
<b>RM</b>	Regional Manager
<b>STH</b>	Short Term Horizon
<b>Traffic Control Signal</b>	As defined in Regulation 3 in the <i>Road Traffic Code 2000</i> means any light or lights (coloured or otherwise), however operated, for the control or regulation of traffic, by the use of an illuminated word or words, an illuminated symbol or symbols, a coloured light or coloured lights or any combination of those things
<b>TMS</b>	Main Roads Traffic Management Services
<b>TSAR</b>	Traffic Signal Assessment Report

## 5 APPROVAL PROCESS

### 5.1 APPROVAL PROCESS FOR PROPOSED NEW TRAFFIC SIGNALS



Notes:

- (1) For applications in the Metropolitan area, please contact Traffic Management Services (TMS) and, for applications in regional areas, please contact Main Roads Regional Manager (RM)

**Stage 1: Control Type Selection**

- (2) The applicant shall undertake a comparison of all feasible treatments to solve the problem(s) before considering traffic signals. The applicant shall submit documents as per Section 6.3.1 for GATE 1 Review
- (3) GATE 1 submission documents will be allocated to TMS for review and approval as appropriate
- (4) If traffic signals are the appropriate traffic control treatment, written support will be issued to the applicant. This support shall only remain valid for a period of **two years** from the date of notification

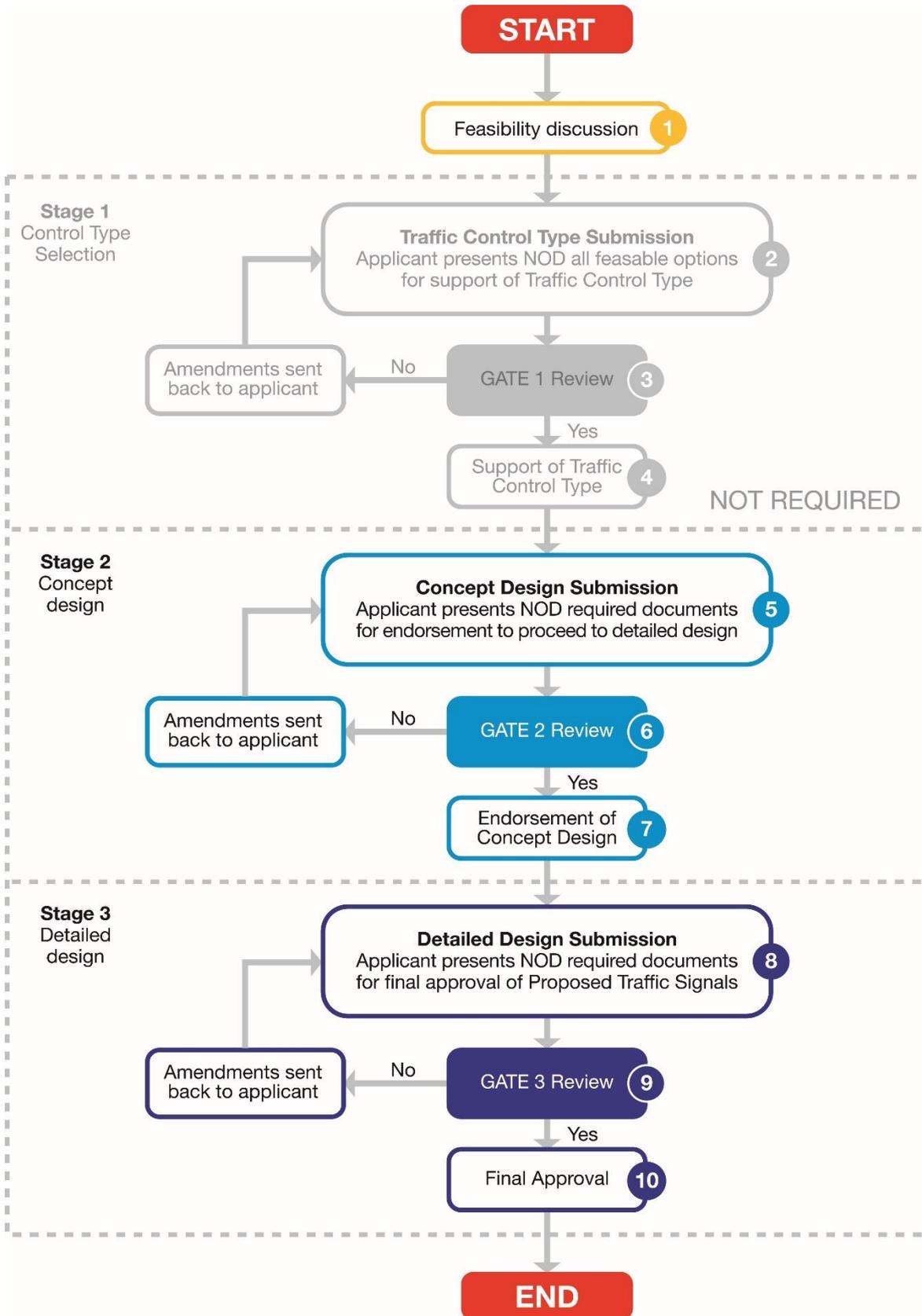
**Stage 2: Concept Design**

- (5) The applicant shall submit documents as per Section 6.3.2 for GATE 2 Review
- (6) GATE 2 submission documents will be reviewed and approved as appropriate
- (7) Written endorsement will be issued to the applicant. This endorsement shall only remain valid for a period of **two years** from the date of notification

**Stage 3: Detailed Design**

- (8) The applicant shall submit documents as per Section 6.3.3 for GATE 3 Review
- (9) GATE 3 submission documents will be reviewed and approved as appropriate
- (10) Written approval and stamped final design drawings will be issued to the applicant. This approval shall only remain valid for a period of **two years** from the date of notification.

## 5.2 APPROVAL PROCESS FOR TRAFFIC SIGNAL MODIFICATIONS



Notes:

- (1) For applications in the Metropolitan area, please contact TMS and for applications in regional areas, please contact the RM

**Stage 1: Control Type Selection**

Not applicable

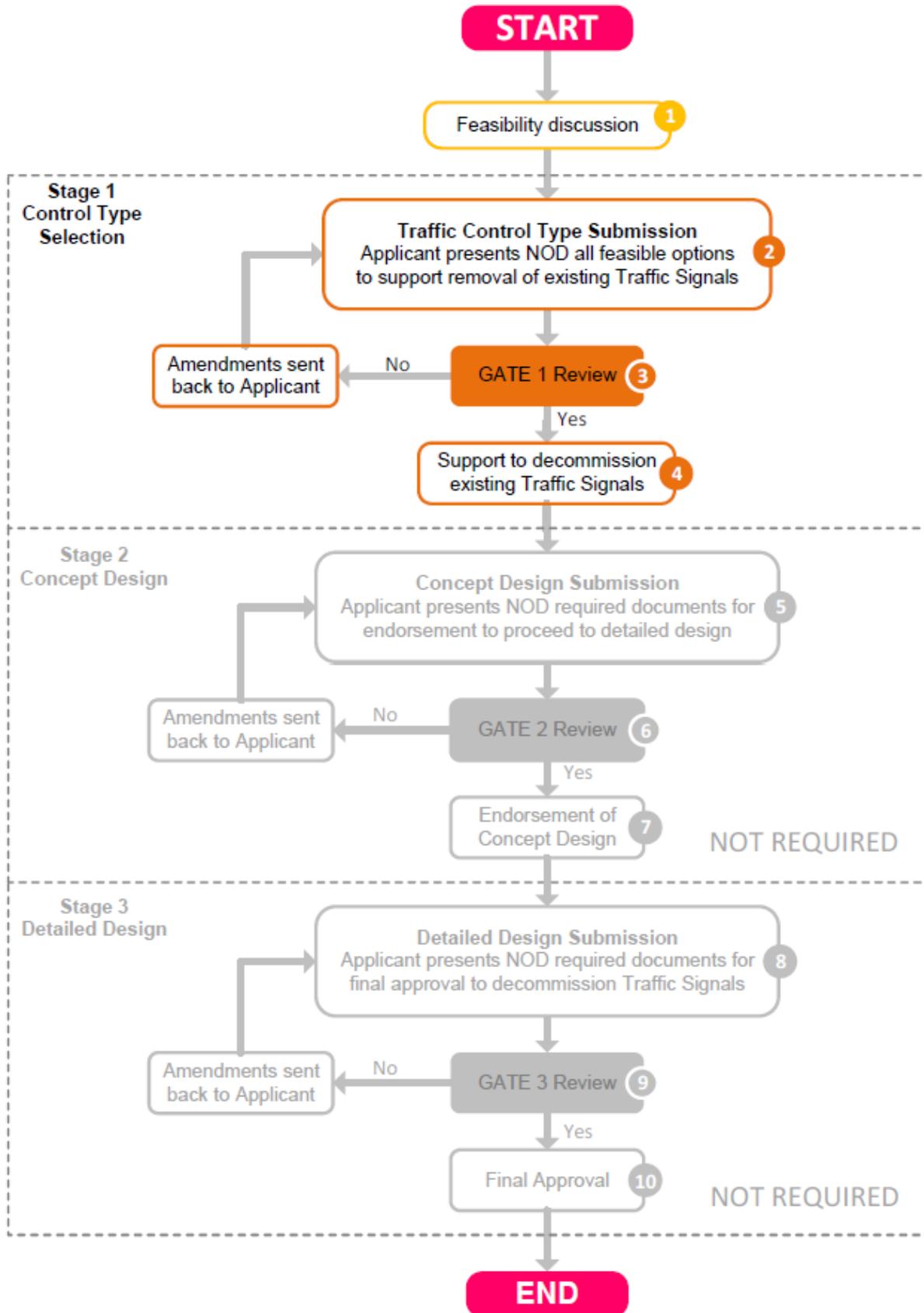
**Stage 2: Concept Design**

- (5) The applicant shall submit documents as per Section 7.1 for GATE 2 Review
- (6) GATE 2 submission documents will be reviewed and approved as appropriate
- (7) Written endorsement will be issued to the applicant. This endorsement shall only remain valid for a period of **two years** from the date of notification

**Stage 3: Detailed Design**

- (8) The applicant shall submit documents as per Section 7.2 for GATE 3 Review
- (9) GATE 3 submission documents will be reviewed and approved as appropriate
- (10) Written approval and stamped final design drawings will be issued. This approval shall only remain valid for a period of **two years** from the date of notification.

### 5.3 APPROVAL PROCESS TO DECOMMISSION EXISTING TRAFFIC SIGNALS



Notes:

- (1) For applications in the Metropolitan area, please contact TMS and, for applications in regional areas, please contact Main Roads' RM.

**Stage 1: Control Type Selection**

- (2) The applicant shall undertake a comparison of feasible treatments to support the removal of Traffic Signals. The applicant shall submit documents as per Section 8.1 for GATE 1 Review
- (3) GATE 1 submission documents will be allocated for review and approval as appropriate
- (4) If the proposed traffic control type is appropriate, written support to decommission the existing traffic signals will be issued to the applicant. This support shall only remain valid for a period of **two years** from the date of notification.

**Stage 2: Concept Design**

Not applicable

**Stage 3: Detailed Design**

Not applicable

## 6 PROPOSED NEW TRAFFIC SIGNALS

Requests for the installation of traffic signals come from many sources including WA Police Force, Local Governments, traffic and road safety committees, developers, politicians, advocacy groups and members of the public.

In meeting Main Roads' obligation to ensure the most effective 24-hour operation of the road network, decisions regarding intersection control shall take into account network operations and planning aimed at achieving safe, reliable, efficient and sustainable road access as part of an integrated transport system. Strategic decision-making during the planning and/or investigation of control measures must consider all activities directly related to operating a safe and efficient road network, including; public transport, future rail and road networks, pedestrians, heavy vehicles (freight vehicles), and cyclists. For further information, please refer to Main Roads' document "*Towards a Safe System Approach – Guidelines for the Selection of Intersection Control*".

### 6.1 TRAFFIC SIGNAL JUSTIFICATION

Congestion, safety and operational management of the existing road network is a major challenge facing Main Roads and, therefore, our principle is to ensure all alternative options are considered, and a comparative analysis is provided, to justify and demonstrate that traffic control signals deliver the optimum solution for all periods of the day.

Considering the above, Main Roads has adopted a position that roundabouts or other treatments will be preferred over traffic signalisation, unless evaluation clearly demonstrates those other solutions are unsuitable. This approach has been adopted as non-signalised options, particularly roundabouts, can improve traffic flow, provide significant road safety benefits and in most cases assist with reducing congestion. Roundabouts may be chosen as an appropriate form of control to address current problems at an intersection, even though traffic signals may be envisaged in the long term.

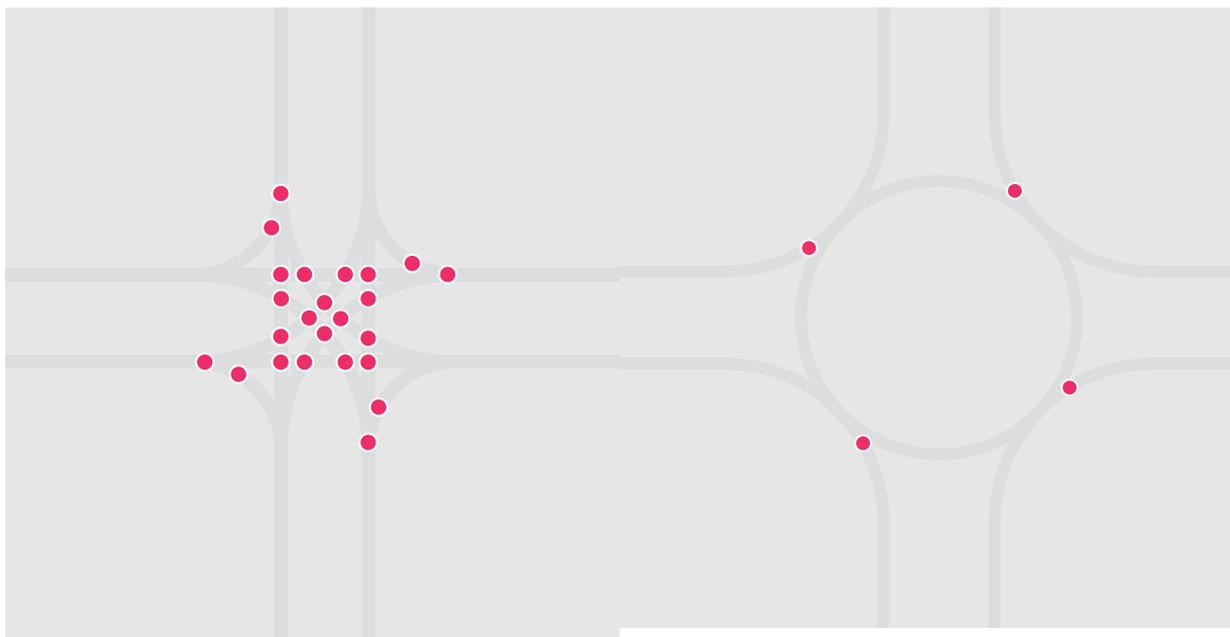
Roundabouts, when designed correctly, have significant benefits over traffic signals including in the following areas:

- Operational (over 24/7 period): Improved traffic flow with delays and journey times reduced in both peak and off-peak periods. Traffic is only required to give way at a roundabout and, in some cases, more traffic can be accommodated in the same amount of time. Roundabouts can also provide greater access opportunities and minimise delays to traffic moving through minor streets.
- Environmental: A reduction in noise, air pollution and fuel consumption as a result of improved traffic flow and frequent and prolonged stopping and starting avoided.
- Sustainability: Roundabouts typically require more area at the intersection compared to conventional signalised intersections; however, they may not need as much area on the approaches (Refer to Appendix 1).

Whilst initial construction cost may be higher, a roundabout can have less operating and maintenance costs over its operating asset life than traffic signals.

The service life is also significantly longer – approximately 25 years, compared with 10 years for typical signals. There are also no electrical components to malfunction.

- Safety: Roundabouts provide a safer form of control than T- or 4-way intersections and reduce the incidence and severity of crashes. There are fewer conflict points at a roundabout and they are further separated than those at signalised sites. Roundabout layouts satisfy safe intersection design principles in relation to conflict points, minimising the number of conflict points and separating the areas of conflict as demonstrated in the following diagram:



Signalised intersection  
24 conflict points

Roundabout  
4 conflict points

Crashes occurring at roundabouts are typically less severe than those occurring at signalised sites because all traffic streams merge or diverge at small angles and at slower speeds, achieved through curved travel paths. In this regard, roundabouts fall within the “Safe System” approach to road safety.

The safe system approach takes human error into account, acknowledging that crashes will continue to occur but seeking to avoid death and serious injury as outcomes. Studies have consistently shown that the installation of roundabout results in a 75% reduction in crashes causing death or serious injury.

Roundabouts also facilitate safe U-turning movements, with minimal impact to efficiency, where traffic circulation is desirable in a shopping or town precinct.

- Aesthetic: Roundabouts deliver opportunities to introduce a traffic calming measure and effective speed transition measure, as well as enhancing the road environment, improving landscaping and providing gateway treatments.

## 6.2 TRAFFIC CONTROL INVESTIGATION

Decisions on the type of intersection control play an important role in road network operations and the assessment of the appropriate intersection control is a key element of the planning approval and development application processes. Early consultation with NOD is essential to ensure proposed traffic signals are approved by Main Roads during the development of strategic plans and/or projects where signals may be considered appropriate.

### 6.2.1 Selection considerations

A comparison of all feasible solutions that will satisfy competing requirements must be undertaken before considering traffic control signals. A thorough investigation must be conducted to avoid major problems occurring during the detailed design phase. The depth of the investigation will depend upon the complexity of site conditions.

The investigation shall take into account all relevant peak periods, such as weekday morning and afternoon, as well as peak conditions outside these periods such as public holidays, special events and/or other factors which reflect the highest traffic demand, together with full consideration of the efficient operation 24/7.

The analysis must include the existing intersection treatment and all feasible solutions such as roundabouts, restriction of turn movements, stop and give way signs, channelisation, streetscape enhancements (entry treatments), shared spaces, etc. At this feasibility stage, NOD is supportive of use of either Sidra or LinSig modelling software, amongst other tools, in the assessment of capacity and the performance of isolated intersections and basic networks.

The choice of the intersection control type should only be made after considering the following factors, not just capacity and road safety:

1. Identification of the problem(s) to be solved.
2. Existing geometric conditions of the intersection (ensure the geometry of any concept layout is in accordance with design guidelines and will provide a safe and efficient solution).
3. Space available, topography and access to adjacent properties – operational and physical constraints must be clearly identified.
4. Identification of the road classification, function and road environment.
5. Pedestrian characteristics and needs – pedestrian volumes on each crosswalk during peak times (special attention to vulnerable road users).
6. Bicycle, public transport and heavy vehicle needs.
7. The form of control at adjacent intersections – the potential for interaction or compatibility between adjacent intersection treatments and the subsequent effect on connectivity.
8. Future operation requirements and lifespan of the project.
9. The impact and size of local developments.
10. Traffic volumes and turning movements from each approach, classified by vehicle type – these need to be appropriately managed to ensure that safety and operational efficiency are optimised.
11. Posted speed limit and/or 85<sup>th</sup> percentile speed of approaching traffic (if appropriate).
12. Percentage of heavy vehicles based on current volumes.
13. User delay.
14. Road safety – five-year collision diagram showing accidents by type, direction of movement and severity.

Consideration of the project life can influence decisions on the form of control, particularly where significant future traffic growth may be expected. Consideration of the type of control and its

compatibility with other future works is also an important input in the decision process. For example, a single lane roundabout constructed as an initial form of control may be a staging of a two or three-lane roundabout in the longer term.

The final design must comply with the appropriate design standards and safety requirements. It is necessary to assess the impact of the different options on network capacity, in order to determine which layout delivers the best performance. This assessment is critical and accurate modelling and analysis is required to give confidence to planning and design decisions. Naturally the type of modelling and analysis depends on variables such as the size of the network being assessed and the level of congestion present within the study area.

Table 1 provides a broad guide on the suitability of the type of traffic control in relation to functional classification of roads. This table is based on the general appreciation of the need to provide a satisfactory level of mobility on arterial roads. Please consider the table above carefully as whilst traffic signals may be an appropriate form of control, roundabouts remain the preferred treatment.

Main Roads' document *Towards a Safe System Approach - Guidelines for the Selection of Intersection Control* provides assistance to practitioners to determine appropriate control and discusses issues related to assessment of safety and operational performance, geometric control and user impact.

Road Type	Primary Distributor (Excluding Freeways)	Distributor A	Distributor B & Local Distributor	Access Road
<b>TRAFFIC SIGNALS</b>				
Primary Distributor (Excluding Freeways)	O	O	O	X
Distributor A	O	O	O	X
Distributor B & Local Distributor	O	O	X	X
Access Road	X	X	X	X
<b>ROUNDBABOUTS</b>				
Primary Distributor (Excluding Freeways)	A	A	X	X
Distributor A	A	A	A	X
Distributor B & Local Distributor	X	A	A	O
Access Road	X	X	O	O
<b>STOP SIGNS OR GIVE WAY SIGNS</b>				
Primary Distributor (Excluding Freeways)	X / O	X / O	A	A
Distributor A	X / O	X / O	A	A
Distributor B & Local Distributor	A	A	A	A
Access Road	A	A	A	A
A	Most likely to be an appropriate treatment			
O	May be an appropriate treatment			
X	Usually an inappropriate treatment			

Source: Adapted from (Austroads 2013)

**Table 1: Suitability of Types of Traffic Control for Different Road Types**

### 6.2.2 Other considerations

Practitioners are reminded that at the beginning of the design process an initial physical site inspection should be carried out to identify existing conditions that need to be considered (such as gradients) and to become familiar with current traffic patterns, land usage and the general local amenity. It is important that the needs of all road users, including pedestrians, cyclists, public transport and heavy vehicles are addressed when considering design options. An analysis of the surrounding area, and the identification and importance of existing places such as educational institutions, transport hubs, areas of employment or commerce should be included, to ensure that the street will serve all users in a balanced way.

If traffic signals are the chosen treatment, it is important to consider the following aspects to ensure the best outcomes for the operation of the signals can be achieved. These include:

1. Traffic volumes for existing and future years.
2. Intersection layouts demonstrating lane configurations, lengths and other features and dimensions are appropriate to maintain level of service and appropriate degree of saturation.
3. Proposed phasing plans.
4. Optimisation of phase intergreens ('lost' time), phase timings and cycle times.
5. Ensuring that optimised parameters and phasing can be delivered into operations.
6. Capacity analysis.
7. Pedestrian needs. Guidance on the design of pedestrian facilities can be found in the *Planning and designing for pedestrians: Guidelines*, published by the Department of Transport WA.
8. Bicycle, public transport and heavy vehicle needs.

Note the aforementioned also applies where changes to signal timings or lane configurations are proposed at existing signal controlled sites. All new signalised sites shall provide the most efficient lane configuration and phasing as supported by appropriate traffic modelling.

## 6.3 APPROVAL PROCESS FOR NEW TRAFFIC SIGNALS

The approval of new traffic signals requires the completion of three stages:

- Stage 1 requirements are detailed in Section 6.3.1
- Stage 2 requirements are detailed in Section 6.3.2
- Stage 3 requirements are detailed in Section 6.3.3

### 6.3.1 STAGE 1: Control Type Selection Submission

Requests for traffic signals shall be directed to TMS in the Metropolitan area or the RM in Main Roads regional offices. Every situation will be assessed on individual merit and proponents wishing to seek approval for the installation of traffic signals must provide a compelling technical argument to support the proposal.

Submissions for Stage 1 support shall contain:

1. Results of the initial investigation outlining all design decisions and demonstrating the compelling need for traffic signals.
2. Concept plans showing the geometric layouts used to evaluate all concepts investigated.
3. Preliminary traffic signal design layout and phasing diagrams adopted from the preferred concept option.
4. Electronic version of the traffic model/s used to compare all options.
5. Traffic volumes – a peak hour turning movement traffic count in both AM and PM peak periods. This should include a count of pedestrians and cyclists where appropriate.
6. Percentage of heavy vehicles based on current volumes (Traffic counts will need to be presented in Austroads classes 1-12 as supporting data).
7. Accident data – a collision diagram showing all crashes in the intersection or mid-block area for a minimum of the previous five years.
8. Design vehicle swept paths and road gradients.
9. Future developments information – information on any known or likely future developments in the surrounding area.
10. Information regarding the particular strategy to be adopted to manage the traffic, i.e. which movements should be encouraged, discouraged, banned or maintained, particularly public transport priorities.
11. Site photographs from all approaches sufficient to give a drivers view which should show any obstructions or peculiarities, such as over-hanging trees, poles, etc.
12. Completed TSAR (Refer to Appendix 3).
13. Intersection capacity analysis in LinSig or Sidra taking into consideration the degrees of saturation, cycle times, saturation flows, lane configurations and other variables (Please refer to Appendix 5 for modelling requirements).

For Metropolitan projects, TMS, and for regional projects the RM must be consulted early in the design process to ensure the proposed signal design is workable. Constant dialogue is encouraged throughout the project's life cycle.

If a review results in major changes to geometry and phasing (in case of signalised concepts), the revised concept should be referred back for further investigation to ensure it remains the most suitable treatment before following to the next stage.

If traffic signals are the appropriate traffic control treatment, written support will be issued to the applicant. This support shall only remain valid for a period of **two years** from the date of notification.

### 6.3.2 STAGE 2: Concept Design Submission

Following TMS's endorsement that traffic signals are the most suitable treatment, TMS will check relevant designs at 15% design with the corresponding intersection capacity analysis for endorsement to proceed to final design.

Please note, that for operational reasons to support implementation, NOD has adopted LinSig as its preferred software for the assessment of intersections. LinSig is capable of modelling isolated or small coordinated networks of traffic intersections, and assessing performance at individual intersections or at small network level for existing or future year design options. Please refer to Main Roads' [Operational Modelling Guidelines](#) document for further information on the application of the software.

Submissions for Stage 2 endorsement shall contain:

1. Traffic signal drawing (15% design).
2. Pavement marking and signs drawing (15% design).
3. Updated TSAR (Refer to Appendix 3).
4. Electronic version of the LinSig traffic model/s with the required outputs. (Refer to Appendix 5)
5. Traffic volumes and origin of data for current year and forecast year(s) of the project lifespan. (There may be additional requirements to these volumes as specified by Main Roads).
6. Percentage of heavy vehicles based on current volumes (Traffic counts will need to be presented in Austroads classes 1-12 as supporting data).

While TMS will assess and audit all project documents, the applicant has the responsibility to ensure that all traffic signal models meet the requirements, and to ensure proposed model submissions are provided with detailed analysis set out within the Modelling Requirements in Appendix 5.

Careful consideration needs to be given if the proposed project has the potential to impact Main Roads network in particular any of the metropolitan roads shown in the Network Operations Area and Route Map in Appendix 4. If this is the case, the review shall be subject to further scrutiny by Main Roads.

It is noted that in case the proposal has less capacity than the existing conditions, and if the impact in terms of degree of saturation, queuing and delay is estimated to be severe, the proposal may not be approved and will need to be amended.

If the review demonstrates that the suggested lane configuration, phasing and all required outputs are acceptable at the proposed location, written endorsement will be issued to the applicant. This endorsement shall only remain valid for a period of **two years** from the date of notification.

It is recommended that detailed design does not commence until endorsement to proceed has been provided by NOD.

### 6.3.3 STAGE 3: Detailed Design Submission

TMS will check 100% design drawings to ensure requirements of GATE 2 endorsement are incorporated.

Submissions for Stage 3 approval shall contain:

1. Traffic Signal drawing in LMA format (100% design. Refer to Appendix 2)
2. Pavement marking and signs drawing in LMB format (100% design)

Written approval and stamped final design drawings will be issued to the applicant. This approval shall only remain valid for a period of **two years** from the date of notification.

Please note that should the final submission fail to reflect the requirements of GATE 2 endorsement, traffic models will need to be re-submitted to substantiate changes.

Under no circumstances shall any work commence on site without NOD final approval.

### 6.3.4 Traffic Signal Assessment Report (TSAR)

The applicant is to provide a TSAR as part of their traffic signal submission to Main Roads. The TSAR summarises the objectives of the intended work and will enable NOD to make informed decisions when assessing and reviewing each project and the likely impacts of the proposed changes within the existing road network. A sample of a TSAR is attached in Appendix 3.

TSAR should be submitted in Stage 1 and be updated with more detailed information in Stage 2 as part of the approval process.

## 7 TRAFFIC SIGNALS MODIFICATIONS

Traffic signal modifications or removal requires written authorisation from NOD and is subject to the presentation of satisfactory designs. The decision to modify an existing traffic signal at an intersection should be based on thorough evaluation and comparison of all possible alternative intersection design treatments for a particular site.

For Metropolitan projects, TMS, and for regional projects RM must be consulted early in the design process to ensure the proposed signal design is workable. Constant dialogue is encouraged throughout the project's life cycle.

The need for a traffic signal modification may arise as a result of:

1. Changes in phasing.
2. Changes on lanes configuration.
3. Changes in the volume distribution of traffic or pedestrians using the intersection (i.e need for right turn phase, parallel walk).
4. The need for safety and efficiency improvements.
5. The need to modernise the equipment.
6. The need for public transport priority features.

### 7.1 STAGE 2: CONCEPT DESIGN SUBMISSION FOR TRAFFIC SIGNAL MODIFICATIONS

Following feasibility discussion, TMS will check relevant designs at 15% design with the corresponding intersection capacity analysis for endorsement to proceed to final design.

Please note, that for operational reasons to support implementation, NOD has adopted LinSig as its preferred software for the assessment of intersections. LinSig is capable of modelling isolated or small coordinated networks of traffic intersections, and assessing performance at individual intersections or at small network level for existing or future year design options. Please refer to Main Roads [Operational Modelling Guidelines](#) document for further information on the application of the software.

Submissions for the Stage 2 endorsement shall contain:

1. Traffic signal drawing (15% design).
2. Pavement marking and signs drawing (15% design).
3. Complete TSAR (Refer to Appendix 3).
4. Electronic version of the LinSig traffic model/s with the required outputs. (Refer to Appendix 5)
5. Traffic volumes and origin of data for current year and forecast year(s) of the project lifespan (There may be additional requirements to these volumes as specified by Main Roads).
6. Percentage of heavy vehicles based on current volumes (Traffic counts will need to be presented in Austroads classes 1-12 as supporting data).

While TMS will assess and audit all project documents, it is the applicant's responsibility to ensure that all traffic signal models meet the requirements, and to ensure proposed model submissions are provided with detailed analysis set out within the Modelling Requirements in Appendix 5.

Careful consideration needs to be given if the proposed project has the potential to impact Main Roads network in particular any of the metropolitan roads shown in the Network Operations Area and Route Map in Appendix 4. If this is the case, the review shall be subject to further scrutiny by Main Roads.

It is noted that in case the proposal has less capacity than the existing conditions, and if the impact in terms of degree of saturation, queuing and delay is estimated to be severe, the proposal may not be approved and will need to be amended.

If the review demonstrates that the suggested lane configuration, phasing and all required outputs are acceptable at the proposed location, written endorsement will be issued to the applicant. This endorsement shall only remain valid for a period of **two years** from the date of notification.

It is recommended that detailed design does not commence until endorsement to proceed has been given.

## **7.2 STAGE 3: DETAILED DESIGN SUBMISSION FOR TRAFFIC SIGNAL MODIFICATIONS**

TMS will check 100% design drawings to ensure requirements of GATE 2 endorsement are incorporated.

Submissions for Stage 3 approval shall contain:

1. Traffic Signal drawing in LMA format (100% design. Refer to Appendix 2)
2. Pavement marking and signs drawing in LMB format (100% design)

Written approval and stamped final design drawings will be issued to the applicant. This approval shall only remain valid for a period of **two years** from the date of notification.

Please note that should the final submission fail to reflect the requirements of GATE 2 endorsement, traffic models will need to be re-submitted to substantiate changes.

Under no circumstances shall any work commence on site without NOD final approval.

## 8 DECOMMISSION OF EXISTING TRAFFIC SIGNALS

The decommission of existing traffic signals requires written authorisation from NOD and is subject to the presentation of satisfactory designs. The decision to remove existing traffic signals at an intersection should be based on a thorough evaluation of the predicted impacts before signal removal is recommended.

### 8.1 STAGE 1: SUBMISSION FOR THE DECOMMISSION OF EXISTING TRAFFIC SIGNALS

Requests to decommission existing traffic signals shall be directed to TMS in the Metropolitan area or the RM in Main Roads regional offices. Every situation will be assessed on individual merit and proponents wishing to seek approval must provide a compelling technical argument to support the proposal. Main Roads WA must be consulted early in the design process to ensure the removal of traffic signals is workable. Constant dialogue is encouraged throughout the project's life cycle.

Submissions for the decommission of existing traffic signals shall contain:

1. Results of the initial investigation outlining all design decisions and demonstrating the need for decommissioning existing traffic signals.
2. Concept plans showing the geometric layouts used to evaluate the concepts investigated.
3. Traffic volumes – a peak hour turning movement traffic count in both AM and PM peak periods. This should include a count of pedestrians and cyclists where appropriate. Off peak periods or shopping peak periods may be necessary depending on the project.
4. Percentage of heavy vehicles based on current volumes (Traffic counts will need to be presented in Austroads classes 1-12 as supporting data).
5. Accident data – a collision diagram showing all crashes in the intersection or mid-block area for a minimum of the previous five years.
6. Design vehicle swept paths and road gradients.
7. Future developments information – information on any known or likely future developments in the surrounding area.
8. Information regarding the strategy to be adopted to manage the traffic, i.e. which movements should be encouraged, discouraged, banned or maintained, particularly public transport priorities.
9. Site photographs from all approaches sufficient to give a driver's view showing any obstructions or peculiarities, such as over-hanging trees, poles, etc.
10. Completed TSAR (Refer to Appendix 3).
11. Intersection capacity analysis taking into consideration the degrees of saturation, lane configurations and other variables (Please refer to Appendix 5 for modelling requirements).
12. Electronic version of the traffic model/s used to compare the existing traffic signal and the proposed control type.

It is noted that in case the proposal has less capacity than the existing conditions, and if the impact in terms of degree of saturation, queuing and delay is estimated to be severe, the proposal may not be approved and will need to be amended. Under no circumstances shall any work commence on site without NOD final approval.

If decommissioning of traffic signals is appropriate, written support will be issued to the applicant. This support shall only remain valid for a period of **two years** from the date of notification.

## 9 REFERENCES AND RELATED DOCUMENTS

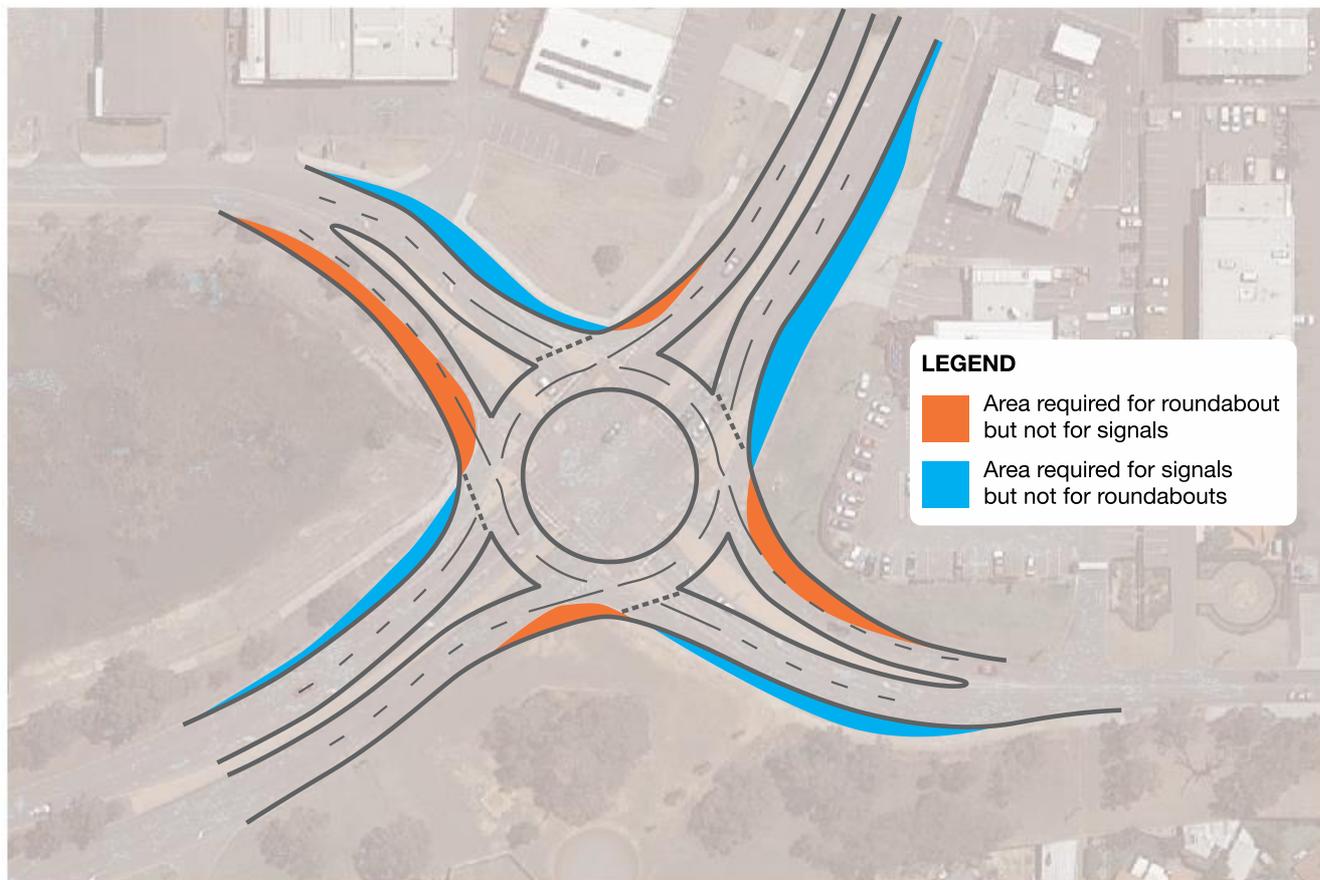
Document Number	Description
<b>AGTM03-13</b>	Austrroads Guide to Traffic Management – Part 3: Traffic Studies and Analysis
<b>N/A</b>	Roundabouts and Traffic Signals – Guidelines for the Selection of Intersection Control
<b>D20#211505</b>	Operational Modelling Guidelines
<b>D20#211103</b>	Auditing Process for Operational Modelling
<b>D19#532308</b>	Guidelines for Pedestrian Facilities at Traffic Signals

## 10 APPENDICES

Appendix	Title
<b>Appendix 1</b>	Space requirements for roundabouts
<b>Appendix 2</b>	Design drawings
<b>Appendix 3</b>	Traffic Signal Assessment Report (TSAR)
<b>Appendix 4</b>	Network Operations Area and Route Map
<b>Appendix 5</b>	Modelling requirements

## Appendix 1: Space requirements for roundabouts

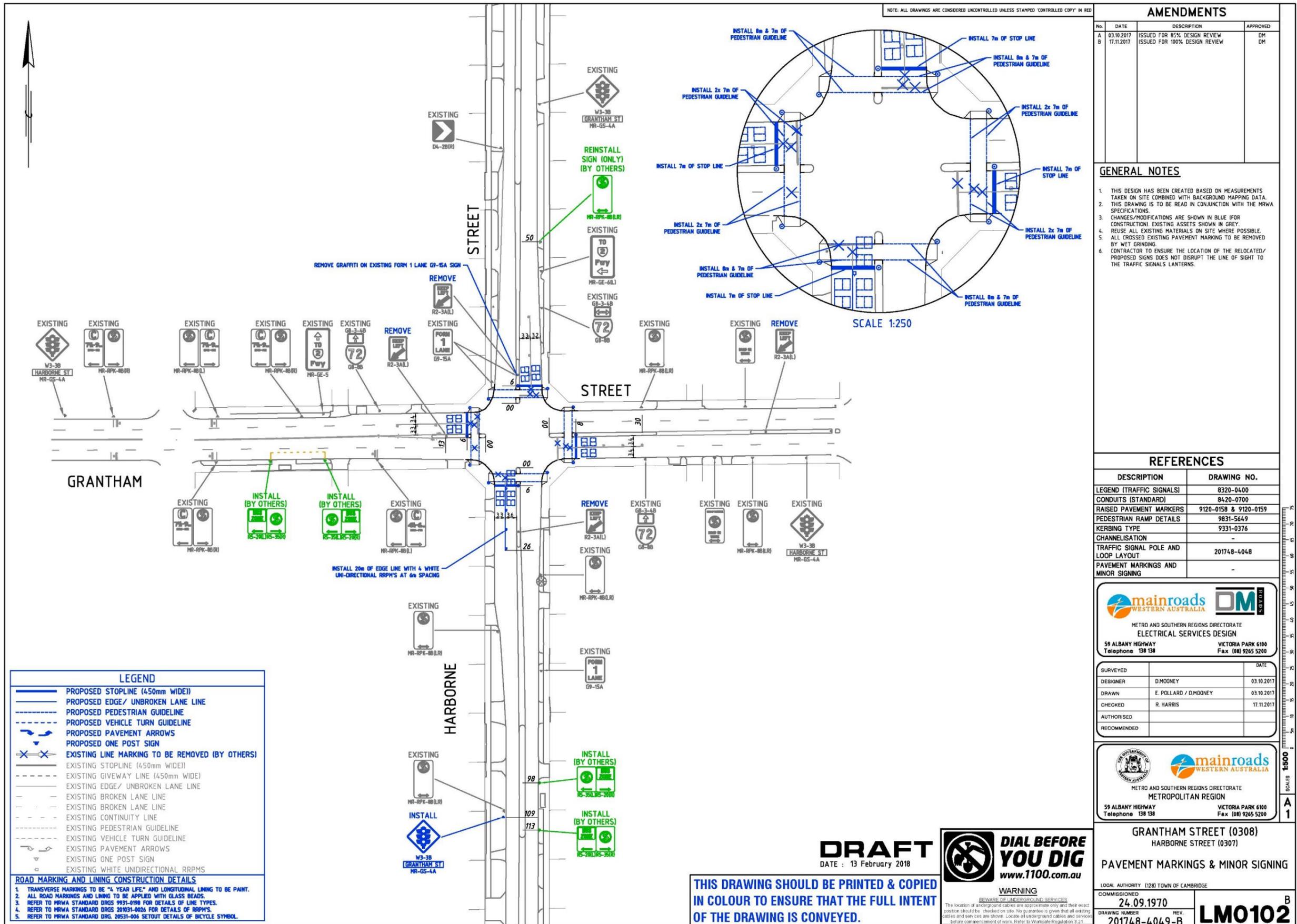
Roundabouts typically require more area at the junction than signalised intersections. However, as capacity needs increase, the increase in space required for a roundabout, as opposed to a comparable signalised intersection, is increasingly offset by the reduction in space requirements for the approaches. This is because the widening required for a roundabout can be accomplished in a shorter distance than is typically required to develop turning lanes at signalised intersections. This comparison is demonstrated in Figure 1.



**Figure 1: Area comparison: urban double-lane roundabout vs comparable signalised intersection**

The ultimate manifestation of roundabouts in a system context is to use them in lieu of signalised intersections. Efficient, signalised intersections usually require that exclusive turning lanes are provided, with sufficient storage to avoid queue spillback into through lanes and adjacent intersections. In contrast, roundabouts may require more space at the intersection, but this may be offset by not requiring as many lanes on the approaches.





AMENDMENTS			
No.	DATE	DESCRIPTION	APPROVED
A	03.10.2017	ISSUED FOR 85% DESIGN REVIEW	DM
B	17.11.2017	ISSUED FOR 100% DESIGN REVIEW	DM

**GENERAL NOTES**

- THIS DESIGN HAS BEEN CREATED BASED ON MEASUREMENTS TAKEN ON SITE COMBINED WITH BACKGROUND MAPPING DATA.
- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE MRWA SPECIFICATIONS.
- CHANGES/MODIFICATIONS ARE SHOWN IN BLUE (FOR CONSTRUCTION). EXISTING ASSETS SHOWN IN GREY.
- REUSE ALL EXISTING MATERIALS ON SITE WHERE POSSIBLE.
- ALL CROSSED EXISTING PAVEMENT MARKING TO BE REMOVED BY WET GRINDING.
- CONTRACTOR TO ENSURE THE LOCATION OF THE RELOCATED/PROPOSED SIGNS DOES NOT DISRUPT THE LINE OF SIGHT TO THE TRAFFIC SIGNALS LANTERNS.

REFERENCES	
DESCRIPTION	DRAWING NO.
LEGEND (TRAFFIC SIGNALS)	8320-0400
CONDUITS (STANDARD)	8420-0700
RAISED PAVEMENT MARKERS	9120-0158 & 9120-0159
PEDESTRIAN RAMP DETAILS	9831-5649
KERBING TYPE	9331-0376
CHANNELISATION	-
TRAFFIC SIGNAL POLE AND LOOP LAYOUT	201748-4048
PAVEMENT MARKINGS AND MINOR SIGNING	-

**mainroads** WESTERN AUSTRALIA **DM** SURVIVAL

METRO AND SOUTHERN REGIONS DIRECTORATE  
ELECTRICAL SERVICES DESIGN

59 ALBANY HIGHWAY VICTORIA PARK 6100  
Telephone 138 138 Fax (08) 9265 5200

SURVEYED	DESIGNER	DATE
	D.MOONEY	03.10.2017
	E. POLLARD / D.MOONEY	03.10.2017
	R. HARRIS	17.11.2017
AUTHORISED		
RECOMMENDED		

**mainroads** WESTERN AUSTRALIA

METRO AND SOUTHERN REGIONS DIRECTORATE  
METROPOLITAN REGION

59 ALBANY HIGHWAY VICTORIA PARK 6100  
Telephone 138 138 Fax (08) 9265 5200

GRANTHAM STREET (0308)  
HARBORNE STREET (0307)

PAVEMENT MARKINGS & MINOR SIGNING

LOCAL AUTHORITY (128) TOWN OF CAMBRIDGE

COMMISSIONED 24.09.1970

DRAWING NUMBER 201748-4049-B

REV. **LM0102**

LEGEND	
	PROPOSED STOPLINE (450mm WIDE)
	PROPOSED EDGE/ UNBROKEN LANE LINE
	PROPOSED PEDESTRIAN GUIDELINE
	PROPOSED VEHICLE TURN GUIDELINE
	PROPOSED PAVEMENT ARROWS
	PROPOSED ONE POST SIGN
	EXISTING LINE MARKING TO BE REMOVED (BY OTHERS)
	EXISTING STOPLINE (450mm WIDE)
	EXISTING GIVEWAY LINE (450mm WIDE)
	EXISTING EDGE/ UNBROKEN LANE LINE
	EXISTING BROKEN LANE LINE
	EXISTING BROKEN LANE LINE
	EXISTING CONTINUITY LINE
	EXISTING PEDESTRIAN GUIDELINE
	EXISTING VEHICLE TURN GUIDELINE
	EXISTING PAVEMENT ARROWS
	EXISTING ONE POST SIGN
	EXISTING WHITE UNIDIRECTIONAL RRPMs

**ROAD MARKING AND LINING CONSTRUCTION DETAILS**

- TRANSVERSE MARKINGS TO BE "4 YEAR LIFE" AND LONGITUDINAL LINING TO BE PAINT.
- ALL ROAD MARKINGS AND LINING TO BE APPLIED WITH GLASS BEADS.
- REFER TO MRWA STANDARD DRGS 9931-0198 FOR DETAILS OF LINE TYPES.
- REFER TO MRWA STANDARD DRGS 20931-0026 FOR DETAILS OF RRPMs.
- REFER TO MRWA STANDARD DRG. 20531-006 SETOUT DETAILS OF BICYCLE SYMBOL.

**DRAFT**  
DATE : 13 February 2018



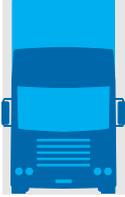
**THIS DRAWING SHOULD BE PRINTED & COPIED IN COLOUR TO ENSURE THAT THE FULL INTENT OF THE DRAWING IS CONVEYED.**

**WARNING**  
BEWARE OF UNDERGROUND SERVICES  
The location of underground cables are approximate only and their exact position should be checked on site. No guarantee is given that all existing cables and services are shown. Locate all underground cables and services before commencement of work. Refer to Worksafe Regulation 3.21.

### Appendix 3: Traffic Signal Assessment Report (TSAR)

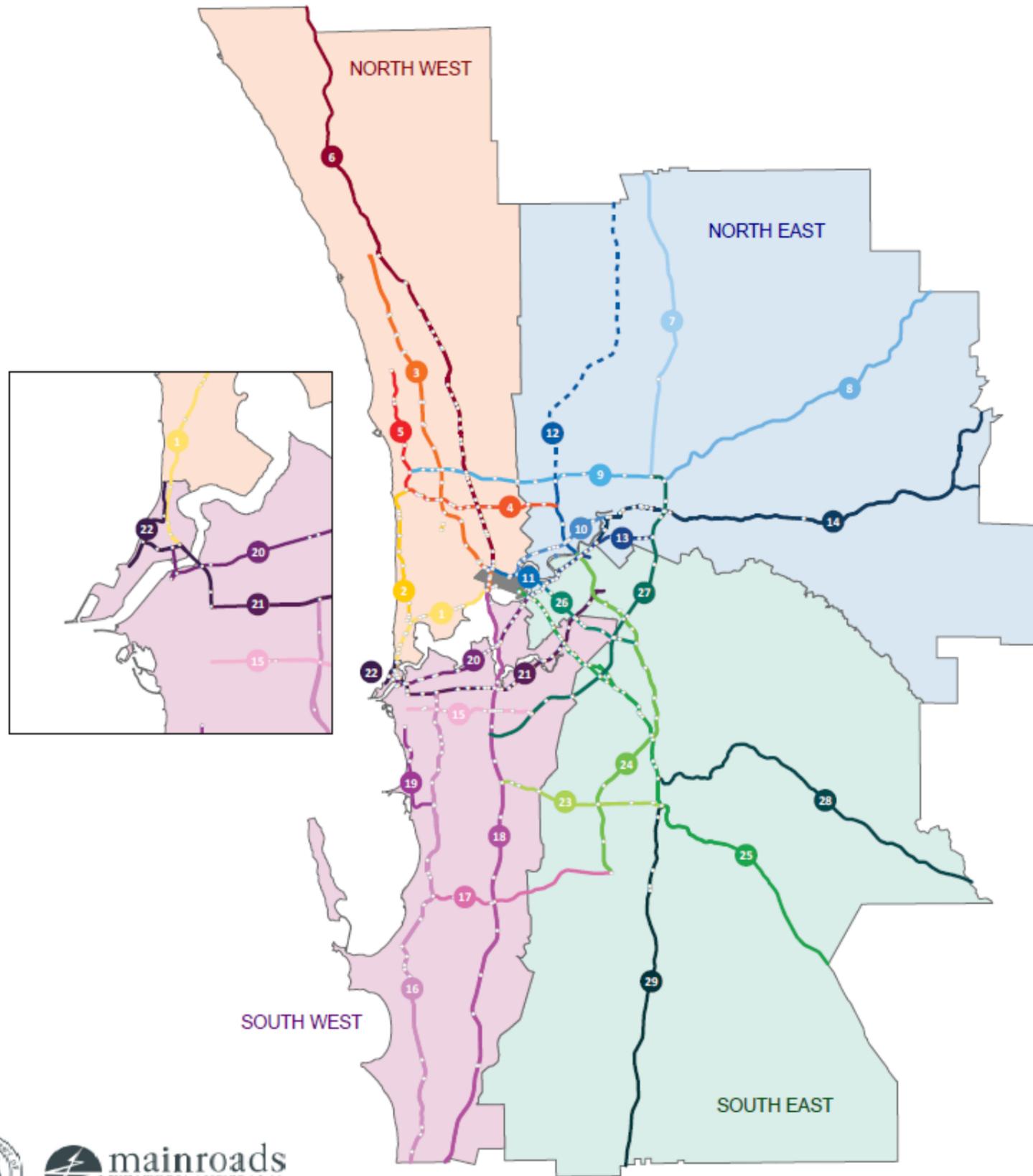
Approval for:	GATE 1	Tick as appropriate	GATE 2	Tick as appropriate		
Name of project:						
Client:	Client Name or Project Owner (Applicant)	Client Contact:	Name, address, email, telephone to whom the response will be issued			
General background:	Provide information on what is the problem, how will this be addressed (i.e. provide regulatory control, cycling facility), what is the purpose / objective of the project (i.e. safety, congestion, public realm, environment)					
Project type:	Provide what type of project is to be considered: <ul style="list-style-type: none"> <li>- Modifications to existing signals to improve facilities</li> <li>- Traffic Signal modernisation programme</li> <li>- New intersection</li> <li>- Isolated crossing / Pedestrian crossing</li> </ul>					
Road information:	Project location:	Road names including road number or SLK (Include area map)				
	Road classification:	Details as per the functional road hierarchy. (Primary Distributor, Regional Distributor, Distributor A, Distributor B, Local Distributor, Access Road)				
	Speed limit:					
	Authority:	LG Name or Main Roads				

<p><b>Funding:</b></p>	<p>Provide information on funding source (i.e LG / developer / blackspot)</p>
<p><b>Project justification:</b></p>	<p>Summarise justification for traffic signals and attach proof of justification. (demonstrate that investigation and comparison of all feasible treatments had been undertaken)</p>
<p><b>Scope of works:</b></p>	
<p><b>Crash history:</b></p>	<p>Provide crash history for the road segment of interest for the most recent 5-year period available, detailing the nature of the crashes where necessary. (include map diagram if necessary)</p>

Network Impact Assessment:	 <b>General traffic</b>	Provide quantified information about the impact the project is having on general traffic (positive, negative, neutral)		
	 <b>Cyclists</b>	Provide quantified information about the impact the project is having on cyclists		
	 <b>Pedestrians</b>	Provide quantified information about the impact the project is having on pedestrians.		
	 <b>Public transport</b>	Provide quantified information about the impact the project is having on public transport. Detailed bus routes directly affected by the proposal and how journey times will be affected.		
	 <b>Heavy vehicles</b>	Provide quantified information about the impact the project is having on heavy vehicles		
Modelling details:	Date of traffic flow data			
	Traffic peak times modelled	AM	Yes / No	Time period (i.e. 8:30 – 9:30)
		PM	Yes / No	
		Off	Yes / No	
		Weekend	Yes / No	
	Phase sequence modelled	AM	i.e. A, B, C, D	
		PM		
		Off		
		Weekend		
	Heavy vehicle %	Percentage used for heavy vehicles		
Scenarios modelled	Existing layout with current traffic demand		Yes / No	
	Proposed layout opening year		Yes / No	

		Proposed layout opening year + 5 years (STH)	Yes / No	
		Proposed layout opening year + 10 years (LTH)	Yes / No	
	Key modelling assumptions or exceptions			
	Modeller / Designer	Full name of the designer		
	Verified	Full name of person who verifies. Note this person cannot be the original modeller / designer.		
Reference documents:	Document number	Document Title		
Documents checklist:	Traffic signal modification drawing(s)	Yes / No	Traffic data for current year	Yes / No
	Pavement marking and signs drawing(s)	Yes / No	Traffic data for forecast years	Yes / No
	Percentage of heavy vehicles	Yes / No	Additional traffic data (if required)	Yes / No
	LinSig modelling (electronic version)	Yes / No	LinSig modelling outputs	Yes / No

Appendix 4: Network Operations Area and Route Management Structure Map



	#	ROUTE NAME	ROADS INCLUDED IN ROUTE
NORTH WEST	1	Stirling Hwy	H014 Stirling Hwy (Tydeman Rd to Mounts Bay Rd)
	2	West Coast Hwy	H036 West Coast Hwy H039 Stephenson Hwy
	3	Mitchell Fwy	H016 Mitchell Fwy
	4	Karinyup-Morley Hwy	H028 Karinyup-Morley Hwy
	5	Marmion Av	H029 Marmion Av
	6	Wanneroo Rd & Indian Ocean Dr	H035 Wanneroo Rd M045 Indian Ocean Dr
NORTH EAST	7	Great Northern Hwy	H006 Great Northern Hwy
	8	Toodyay Rd	H033 Toodyay Rd M026 Toodyay
	9	Reid Hwy	H021 Reid Hwy
	10	Guildford Rd	H026 Guildford Rd H037 Garatt Rd Bridge
	11	Graham Farmer Fwy	H020 Graham Farmer Fwy
	12	Tonkin Hwy North	H017 Tonkin Hwy (Reid Hwy to Great Eastern Hwy) Northlink to be included when project is completed
	13	Great Eastern Hwy Inner	H005 Great Eastern Hwy (Causeway to GEH Bypass) H019 Great Eastern Hwy Bypass H024 Brearley Av
	14	Great Eastern Hwy Outer	H005 Great Eastern Hwy (GEH Bypass to Regional Boundary) M010 Chidlow York
SOUTH WEST	15	South St	H032 South St
	16	Melville Mandurah Hwy	H002 Melville Mandurah Hwy
	17	Thomas Rd	H038 Thomas Rd
	18	Kwinana Fwy	H015 Kwinana Fwy
	19	Cockburn Rd	H025 Cockburn Rd
	20	Canning Hwy	H013 Canning Hwy H056 Beach St H031 Queen Victoria St
	21	Leach Hwy	H012 Leach Hwy H086 Airport Dr
	22	Port Access	H014 Stirling Hwy (Tydeman Rd to Leach Hwy) H030 Port Beach Rd H034 Tydeman Rd
SOUTH EAST	23	Armadale Rd	H023 Armadale Rd
	24	Tonkin Hwy South	H017 Tonkin Hwy (Great Eastern Hwy to Thomas Rd) H085 Horrie Miller Dr
	25	Albany Hwy	H001 Albany Hwy H022 Kenwick Link
	26	Orong Rd	H027 Rivervale-Wattle Grove Link
	27	Roe Hwy	H018 Roe Hwy
	28	Brookton Hwy	H052 Brookton Hwy
	29	South Western Hwy	H009 South Western Hwy



Version 2 TRIM Doc: D15#680087

## Appendix 5: Modelling requirements

This appendix provides instructions and guidance on traffic modelling requirements for:

### New Traffic Signals

1. Stage 1: Traffic Control Type Submission, refer Section 6.3.1
2. Stage 2: Concept Design Submission, refer Section 6.3.2
3. Stage 3: Detailed Design Submission, refer Section 6.3.3

### Traffic Signal Modifications

1. Stage 1: Not applicable
2. Stage 2: Concept Design Submission, refer Section 7.1
3. Stage 3: Detailed Design Submission, refer Section 7.2

## 1. MODELLING PLATFORM

In determining the most appropriate traffic modelling platform / software for performance assessment of different options and scenarios, Main Roads supports:

1. Traffic Control Type Support (GATE 1): LinSig or Sidra
2. Endorsement to proceed to detail design (GATE 2): LinSig
3. Approval of Traffic Signal Modifications (GATE 3): LinSig (if required)

Main Roads reserves the right to request micro-simulation modelling if it is considered necessary to assess the full impact of the proposals. Micro-simulation modelling may be requested for the following reasons:

1. Weaving / merging behaviours at critical locations.
2. Where exit blocking is observed or likely to occur.
3. Where critical links are forecasted to be operating near or above capacity.
4. Where modelling in LinSig or Sidra is too simplistic (e.g. uneven utilisation of lanes or roundabouts with three lanes).
5. Where the study area includes a mix of different intersection control types.

When in doubt, it is recommended that the study team consults with Main Roads' Network Operations Directorate to confirm the need for microsimulation prior to undertaking any modelling assessment. Main Roads supports the use of Vissim or Aimsun if microsimulation modelling is to be undertaken.

## 2. MODELLING REFERENCE DOCUMENTS

The Main Roads [\*Operational Modelling Guidelines\*](#) document provides further detail and clear guidelines for the development of traffic models using a variety of modelling platforms. These include:

1. Information on the recommended modelling guidelines, parameters and methodology in the development of Sidra, LinSig, Vissim and Aimsun models.
2. Detail of model instruction sheets that are used to confirm Main Roads modelling requirements at different stages of the design process.
3. Information on traffic model checklists that need to be populated by the modeller and the auditing engineer.

It is strongly recommended that the study team is familiar with the above guidelines as any departures from those are likely be scrutinised by Main Roads.

### 3. MODELLING CONSIDERATIONS

This section includes brief instructions and guidelines related to input data that should be considered when developing traffic models for submission to TMS.

#### 3.1 Study area

The modelling study area should be determined taking into account considerations including, but not limited to:

1. Proximity of neighbouring intersections.
2. Impact of vehicle platooning on intersection performance.
3. Traffic congestion and queueing in and around the site.
4. Existence of merging / weaving sections.
5. Impact of acceleration profiles (e.g. heavy vehicles) on intersection performance.
6. Road gradient at the intersection approach.

It is recommended that the study team consult with Main Roads to define, and / or confirm the appropriate study area prior to undertaking modelling assessments.

#### 3.2 Road network details

The existing layout(s) and the associated geometric measurements such as lane and crossing widths, pocket lengths, lane allocation, intersection spacing and other such information should be accurately measured on-site and coded into the models. Where measurement of dimensions is not feasible, as-built drawings may be used as a suitable alternative source of information.

For all proposed options, geometric measurements should be taken from drawings relevant to the design stage.

#### 3.3 Modelling year scenarios

The following scenario years should be modelled as a minimum for each assessment option, to compare the performance and suitability of the proposals in short and medium terms:

1. Existing situation base: validated model of the existing study area.
2. Opening year (i.e. target completion year)
  - a. Existing layout
  - b. Proposed layout
3. Opening year + five years (i.e. Short Term Horizon - STH)
  - a. Proposed layout
4. Opening year + 10 years (i.e. Medium Term Horizon - MTH)
  - a. Proposed layout

Main Roads reserves the right to request additional scenario years if significant changes to network structure, traffic patterns or adjacent roadside developments are expected in interim years outside of those listed above.

### 3.4 Traffic data

Unless agreed otherwise by Main Roads, classified traffic count surveys are required for the peak hour(s) used for analysis. At a minimum, these should include full vehicle classifications and should not be older than **12 months** from the date of analysis.

The Main Roads' *Operational Modelling Guidelines* document provides further detail on traffic data collection and covers situations where minimum requirements may not be feasible. The document also provides guidelines for determining traffic growth and calculating future traffic flows.

Future traffic flow forecasts may be available from Main Roads' demand/strategic models, which could be supplied to the study team for further calibration. In absence of these forecasts, the study team may need to consider traffic growth in the area as well as background traffic growth to estimate future demand.

It is recommended that the study team consult with Main Roads to confirm forecast traffic flows and future year traffic data prior to undertaking modelling assessments.

Where new pedestrian facilities are being considered, pedestrian demand surveys may need to be conducted to establish the demand in the study area. Similarly where cyclist facilities are being considered, cycle demand surveys may need to be conducted in the study area.

### 3.5 Traffic signal design parameters

The following considerations should be taken into account for design and modelling of traffic signals where appropriate:

1. Existing parameters, such as signal phases, intergreens, timings and cycle times should be collected from SCATS for the survey dates. These should be requested from Main Roads.
2. For proposed options, **minimum cycle times** should be used to achieve the accepted performance requirements outlined in Section 4 (cycle times above **150 seconds** should be strongly avoided).
3. If the proposed intersection is within 500 metres of other signalised intersections, traffic flow patterns and cycle time of the adjacent intersection/s should be considered in detail as the new signalised site(s) may be linked to adjacent sites on a common cycle time.
4. Where the study area includes a network of intersections, the modelling analysis should identify the optimum cycle time for the entire network whilst considering options for double cycling where applicable.
5. Where pedestrian facilities are being considered, assumptions related to pedestrian demands and the frequency of demand dependant stages should be accurately coded into the models.
6. Design of pedestrian crossing facilities should consider accurate crossing widths to determine applicable pedestrian walk (green man) and clearance periods.
7. Proposed phases, phase sequences and other details should be based on standard practice on Western Australia. These shall be approved by SCATS and Electrical Services Team.

Where applicable, it is recommended that the study team consults with NOD to confirm parameters related to traffic signal design prior to undertaking modelling assessments.

### 3.6 Other considerations

For GATE 1 submissions the following will need to be considered:

1. If traffic signal control is the most appropriate intersection layout for the proposal, a comparison of alternative non-signalised layouts should also be modelled to demonstrate that performance under signal control is significantly improved.
2. When modelling in Sidra, cycle time optimisation should be based on practical cycle time option.

For all submissions the following should also be considered:

1. Modelling parameters in the appropriate modelling platforms should be duly calibrated and default values should not be used without care.
2. Where existing saturation flows apply, it is expected that these are collected on-site as per the requirements set out by Main Roads.
3. When modelling in LinSig, the intersection / network should be optimised for Practical Reserve Capacity (PRC).
4. Calculation of Level of Service (LoS) in LinSig should be based on weighted average delays for individual links.
5. Calculation of LoS criteria for intersections should use average delay per vehicle in accordance with Table 6.7 in Section 6.4.5 of "*Austrroads Guide to Traffic Management – Part 3: Traffic Studies and Analysis*".

### 3.7 Modelling outputs

The modelling outputs should include, as a minimum:

1. A comparison of the different options, for all scenarios, with regards to:
  - Overall Degree of Saturation (DoS)
  - Overall Level of Service (LoS)
  - Overall weighted average delay
  - Cycle times (where appropriate)
2. Breakdown of the DoS by lane for each intersection and each model scenario

If micro-simulation modelling is undertaken, model output should be discussed with Main Roads when the scope of microsimulation works is agreed. As a guideline, the expected model output from micro-simulation models may include:

1. Total network delay per vehicle in the whole network.
2. Network throughput.
3. Travel times along key routes / movements.
4. Individual intersection performance metrics:
  - average delay per vehicle
  - traffic throughput
  - travel time
  - queues

Where requested, electronic traffic model file(s) should be provided to Main Roads for checking/auditing.

## 4. PERFORMANCE REQUIREMENTS

Performance is one of the key criteria (along with safety, accessibility, sustainability and others) used in a multi-criteria analysis for determining suitability of proposals. In all modelling assessments carried out in Sidra or LinSig, DoS is used as the primary performance indicator for determining the suitability of proposals with LoS also used as a secondary indicator.

In general, Main Roads will aim to achieve the following performance levels related to DoS for the whole intersection (which is based on the worst approach) and LoS:

- |                           |           |                              |
|---------------------------|-----------|------------------------------|
| 1. Opening Year:          | 80% DoS   | Intersection LoS D or better |
| 2. STH (i.e. five years): | 85% DoS   | Intersection LoS D or better |
| 3. MTH (i.e. 10 years):   | <100% DoS | Intersection LoS E or better |

The following should be noted:

1. If the study area includes a mix of state and local roads, Main Roads may tolerate higher DoS on local road links (below 100%) if the target levels are maintained on the state roads.
2. Where the study area contains existing intersections operating above the target performance levels, proposed options should ensure the performance will not be worsened.

For all new proposed intersections, deviations from the target DoS performance requirements will require robust justification and will be subject to scrutiny by Main Roads.