Preface

The traffic signal design guidelines have been developed to assist in designing traffic control signals. The information contained in the various parts is intended to be used as a guide to good practice. Discretion and judgement should be exercised, taking into account all the factors that may influence the design of traffic signals at any particular site.

The guidelines make reference, where relevant, to current Australian Standards or the Austroads Guides, and are intended to supplement and otherwise assist in their interpretation and application. If any conflict arises, the Australian Standards, the Austroads Guides and the RMS Supplements are to prevail.

The complete set of traffic signal design guidelines is as follows.

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Primary references and complementary material

Roads and Maritime has adopted the Australian Standards and the Austroads Guides as its primary technical references. Roads and Maritime has developed the following complementary material which must be used in conjunction with the Standards and Guides.

- Australian Standards Traffic Supplements.
- Supplements to the Austroads Guides.
- Delineation Manual.
- NSW Bicycle Guidelines.
- Standard Drawings.
- Technical Directions.
- Technical Specifications.


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<td>Lyndall Johnson, Network Operations</td>
</tr>
<tr>
<td>Contributors:</td>
<td>Alan Dixon (Network Operations); Len Clay, Peter Ellis, Jorge Sales-Luis (Road Design Engineering)</td>
</tr>
<tr>
<td>Endorsed by:</td>
<td>Alan Dixon, Principal Manager Network Operations</td>
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<tr>
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<td>Craig Moran, General Manager Road Network Operations</td>
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3.1. Introduction
Traffic signals should be designed to suit a coordinated operation, even if coordination is not required in the first instance. Nevertheless, they should be designed to suit SCATS operation (Sydney Coordinated Adaptive Traffic System). A systems approach should be adopted for all traffic signal designs so that all the implications to a coordinated system are fully taken into account. Consultation with the officers responsible for each activity during the appropriate design stage is essential to ensure that all their requirements are met.

3.2. Design steps
Steps involved in the traffic signal design process are shown in Figure 3.1.

![Diagram](image-url)
3.3. Initial site inspection

At the beginning of the design process an initial site inspection should be carried out to identify existing conditions that need to be considered, and to become familiar with current traffic patterns, land usage and the general local amenity. It is at this time that photographs are usually taken as part of the data collection process and to allow review and discussion during the preliminary design stage (see Section 3.6.3). Specific items that should be noted and shown on the site plan are listed in Section 3.4.

3.4. Site plan

This plan shows site information, at a scale of 1:200, approximately 50-60 m in each direction along a road from a site.

Site plan details can vary depending upon whether a site exists, or is a site to be constructed or reconstructed (see Section 3.4.1).

A site plan shows the road layout and all the existing or proposed features likely to affect the traffic signal design. These include:

- Kerb lines (see Section 3.4.1), end of kerb, kerb ramps, and any other gutter crossings
- Stormwater grates, lintels and inlets.
- Edges of medians and islands, including gaps in medians.
- Edge of pavement and shoulders.
- Driveways, laneways, other streets.
- Property boundaries and fences.
- Paved paths, including pedestrian, bicycle and shared paths.
- All roadside furniture including signs, bus shelters, seats, telephone booths, gardens, garbage bins, mail boxes, steps, retaining walls, guard fence, fencing and hoardings.
- Trees, including type, diameter of trunks, height and spread of foliage.
- Public utilities such as power poles, light poles, pillars, service pits, manhole covers.
- Overhead clearances from the road to utilities, or structures.
- Extent of awnings, height above kerb, distance back from the kerb face, position of any support posts, height variations, blinds and under-awning advertising signs and other overhead restrictions.
- Bridge decks, including abutments, expansion or contraction joints, and any handrails and safety fences.
- Type of building development on each corner of the intersection.

3.4.1 Kerb lines

Where traffic signal installation is in conjunction with construction or reconstruction road work plans, only the kerb line and channelisation for those road works are shown on the site plan, i.e. any existing pavement limits, kerb line or channelisation which is not part of the final intersection layout is not shown on the site plan.
Where existing kerb line or channelisation adjustments are shown on the design layout plan all existing details are shown on the site plan. Any superseded outline of pavement, kerb line and/or channelisation is converted to broken line once the geometric layout is finalised.

3.5. Preliminary design

A preliminary traffic signal design is drawn upon the site plan. A preliminary design is adopted from the preferred concept option prepared during the investigation process (see Section 1 Investigation). The concept option should be reviewed and refined at this stage and adopted as the preliminary design if there is little or no change to the basic concept.

If a review results in major changes to geometry and phasing the revised concept should be referred back to the investigation stage to ensure it remains the most suitable treatment before adoption as the preliminary design.

Intersection geometry should be examined to ensure its compliance with design guidelines and its appropriateness as a solution to site problems. The design must be checked against concurrent road construction plans for the site (if applicable) to ensure it is compatible and, if necessary, any appropriate adjustments made. Control points are to be common to both sets of plans.


The design may need to be refined several times until optimum performance is achieved. Further aspects of analysis specific to geometry and phasing may be found in Section 5 Geometry and Section 7 Phasing and Signal Group Display Sequence respectively.

It is important that this step is done correctly, as the installation of inadequate or inappropriate traffic signal control could cause increases in delay, fuel usage, accidents and driver aggravation. A phasing arrangement that is more sophisticated than necessary may result in greater delays, especially during off-peak periods when traffic flows are low.

In addition to the site plan information, the preliminary plan must show:

(a) The proposed location of the:
- Controller and possible source of supply.
- Detectors.
- Posts and signal faces.
- Stop lines and marked foot crossings lines.

(b) Phasing diagrams.

(c) Dimensioning for the location of the controller, posts, pavement marking, and any geometric layout adjustments.

All preliminary designs must be prepared using computer aided design (CAD). Plan information must be stored in separate layers and the required layers will need to be superimposed to form a complete preliminary plan. Refer to Section 3.6 of the CADD Manual.

3.6. Design/site inspection

A hard copy of the preliminary design plan is taken on a design/site inspection to determine if the proposed traffic signal information shown on the plan is adequate or needs adjustment. Checks
should be made to ensure that all existing information affecting traffic signal installation has been picked up by the original site survey. If necessary, additional existing information affecting signal installation should be picked up and recorded on the preliminary plan. Unless this information is for reference only, the site plan will need to be corrected accordingly.

Look for anything that will affect the:
- Location of the controller and its footing (see Section 12 Controller).
- Height and location of posts and their footings (see Section 9 Posts).
- Location and size of detectors (see Section 11 Detectors).
- Visibility of signal faces, sight restriction due to horizontal and/or vertical alignment of approaches, trees, awnings, signs, bus shelters, telephone booths etc (see Section 8 Lanterns).
- Location of marked foot crossings and ramps, preferably downstream of drainage inlets.
- Dimensioning to accurately locate the controller, posts, pavement marking, and geometric layout adjustments.

Other details for inclusion:
- Possible source of power supply (see section 3.6.1).
- Communication system required for coordination and monitoring purposes (see section 3.6.2).
- Pavement condition for suitability of detector installation (may require reconstruction).
- Distance to adjacent traffic signal sites if less than 200 m.
- Location of any nearby fire station, ambulance station, police station, public buildings or railway level crossing that may influence design (see appendices F and G for level crossing concept of operations and signal design).
- Bus stops and routes that may need to be catered for.
- Adequate sight distance (horizontal, vertical) for through and turning traffic.
- Adequate sight distance for pedestrians.
- Sufficient clearance between overhead wires and mast arms (see section 9 Posts).
- The need for 300 mm aspects, mast arms, closed visors and louvres.
- Extent of existing turn bays, and marked lanes on each approach.
- One way traffic movements.
- Regulatory signs such as turn bans, parking, give way, and stop.
- Any other features which may affect the design.

A hard copy of the preliminary design should be marked up with all additional details discovered during the site inspection relevant to the installation of traffic signals and kept as a record for future reference together with photographs of the site.

### 3.6.1 Power supply

The power supply may come from overhead or underground sources. Where power supply comes from an overhead source, steel and concrete poles cannot be used. Poles carrying solely street lighting are not suitable for power supply unless the supply authority is prepared to run a continuous single-phase 240V main to the pole.
In the Sydney Metropolitan area, Electricity Supply Authorities require the power supply connection point to be within 30 m of the signal controller position for an application for connection to be acceptable. Beyond this distance, the Electricity Supply Authority requires a design plan to be prepared by an Accredited Level 3 Service Provider (ASP 3), before they will consider or approve an extension to their infrastructure network. This can cause significant delays to the installation of the Traffic signals.

Following the initial site inspection, when possible sources of supply would be noted, the following is to take place:

- The location of the proposed connection point be confirmed by an Accredited Level 2 Service Provider (ASP 2). (A list of Accredited Level 2 Service Providers is available from NSW Resources and Energy.)
- Confirm the Electrical Supply Authority asset number of the service pole or pillar from which the supply connection will be made.
- A copy of the site investigation report from the Level 2 Service Provider (ASP 2) showing company name and licence number.
  
  If a suitable supply point is not available at the site, then advice that a Level 3 Service Provider (ASP 3) design is required must be provided.

These details must be submitted with the Traffic Signal Design plan at review for recommendation and acceptance to avoid unnecessary delays and costly alterations to supply arrangements during construction.

### 3.6.1.1 Uninterrupted power supply (UPS)

When traffic signals at an intersection are blacked out due to loss of power supply, police are notified to perform point duty. However, police cannot perform point duty effectively at complex intersections. Emergency power needs to be supplied at these locations.

Portable generators can be used to provide emergency power at non-complex intersections when a power outage is expected to last two hours or more. However, an uninterrupted power supply must be used where one or more of the following conditions apply:

- Conflicting, opposing and parallel through approaches cannot be seen from any approach stop line.
- More than one Police officer is required to work the point.
- There are five or more approaches.
- At a railway level crossing.
- UPS is required at the direction of the Principal Manager Network Operations due to complex geometric design and inadequate sight distance factors.

### 3.6.2 Communication system

A means of communication should always be provided and this may not necessarily mean a physical cable or data cable and it may not necessarily be provided only by Telstra. Other means of communication should be considered.

Nevertheless, in most cases, the closest Telstra termination pit to the proposed controller location will be the method used and, where this is the case, it must be confirmed in conjunction with Telstra.

Whatever the actual communication system chosen, it must be in agreement with the Principal Manager, Network Operations prior to commencing the detail design.
3.6.3 **Photographs**

Photographs should be taken during the investigation stage, however, if they were not taken then they must be taken during the initial site inspection. Photographs should be taken from each approach (minimum 2 photos) to show a clear view of the intersection. Additional photographs should be taken to show problem utilities or distant obstructions (such as trees, curves or crests) to assist in the design.

3.7. **Modify design/site plan**

If there are no changes following the design/site inspection, the preliminary design can be used for consultation purposes.

If changes are necessary, modify the design or site plan in accordance with details picked up during the design/site inspection before using it for consultation purposes.

Given that the procedures in Section 3.1 to Section 3.6 have been done adequately, sufficient information should be available to produce a complete preliminary design plan.

3.8. **Consultation**

The preliminary design plan should be shown to other officers with an interest in the design to ensure that their suggestions or specific requirements are considered. Network Operations must be consulted early in the design process to ensure the proposed signal design is workable. Other stakeholders include (but not restricted to) Network and Safety Services, and Road Design Engineering. Once comments have been obtained and considered, the preliminary design plan should be amended as necessary.

3.9. **Non-standard designs**

A non-standard design is a design which proposes to use **any** practice (including the operation of the signals) which is not currently documented within the Traffic Signal Design manual. A non-standard design would typically be new or unique practice not previously used, or rarely used, in RMS. [eg. any proposal to use **joint** infrastructure at a combined traffic signal / level crossing site.]

When considering non-standard designs consultation should be undertaken with the Principal Manager Network Operations, and Network Operations’ Research Officer from the concept development stage through to the final design.

Non-standard designs may be prepared by external designers but the external designers must work in close partnership with Road Design Engineering and Network Operations.

3.10. **Final site inspection**

This inspection need only be done if there are any changes to the preliminary design layout that the information gained from the design/site inspection would not cover.

3.11. **Detail design**

Once agreement has been reached between all officers involved with the preliminary design, the detail design is prepared. Detail design procedures involve the preparation of base plans, design layout plan, setting-out plan (if required), and electrical plans. Internally designed electrical plans must be prepared by an officer of Traffic Signal Operations in Road Design Engineering (see Section 4 **Plan Requirements**).
3.12. Approval

The approval of standard traffic signal designs is a three tiered process that must be followed for both RMS prepared designs and Consultant prepared designs. Sections 3.12.1 and 3.12.2 detail this process. Section 3.12.3 details the approval process for non-standard designs.

3.12.1 RMS prepared standard designs

- Full name of the designer must be shown, initials will not be accepted.
- Full name of the checker must be shown, initials will not be accepted. (Must be an independent checker, not the designer.)
- Full name of the site inspector and date the site was checked must be shown, initials will not be accepted.
- The design is approved for its technical correctness in accordance with relevant technical manuals and guidelines by the Traffic Signal Design Manager, Road Design Engineering. During the approval procedure comment/agreement must be sought from authorised RMS officers responsible for the civil, electrical and delineation features of the design.
- Two RMS signatures are then required to recommend acceptance.
- The design is first recommended for acceptance of its technical correctness in accordance with relevant technical manuals and guidelines by the Traffic Signal Design Manager, Road Design Engineering. During this process comment/agreement must be sought from authorised RMS officers responsible for the civil, electrical and delineation features of the design.
- The design is then recommended for acceptance by an authorised officer within RMS' Network Operations section (including Regional Network Operations Officers). This recommendation takes into account the adaptive features of the design and the impact the design will have on overall network efficiency and compatibility with the surrounding network.
- The design is finally accepted by the appropriate RMS officer responsible for implementation of the construction. This acceptance takes into account the constructability of the design and suitability for the particular site and project objectives.

The following documentation must accompany the submission for approval, or the design may be rejected:

- Traffic data (including a recent traffic count, traffic assignment, traffic accident records, etc).
- Turning paths.
- Site photographs.
- Results of the initial investigation.
- A design officer's report outlining all design decisions and the reasons for any unusual treatments.
- A safety audit.
- A completed Appendix A.
- Any associated road design plans or setting out details that are not shown on the design layout.
- Approved exemptions correspondence.
• Completed traffic signal design layout.
• Minute or memorandum of formal submission (as appropriate).

3.12.2 Consultant prepared standard designs

• Full name of the designer must be shown, initials will not be accepted.
• Full name of the checker must be shown, initials will not be accepted. (Must be an independent checker, not the designer.)
• Full name of the site inspector and date the site was checked must be shown, initials will not be accepted.
• The design is approved for its technical correctness in accordance with relevant technical manuals and guidelines by an appropriate authorised officer within the consultancy. During the approval procedure comment/agreement must be sought from authorised RMS officers responsible for the adaptive, electrical and delineation features of the design.
• The consultancy name may be placed at the bottom of this box.
• Two RMS signatures are then required to recommend acceptance.
  The design is first recommended for acceptance of its technical correctness in accordance with relevant technical manuals and guidelines by the Traffic Signal Design Manager, Road Design Engineering. During this process comment/agreement must be sought from authorised RMS officers responsible for the civil, electrical and delineation features of the design.
  The design is then recommended for acceptance by an officer from Network Operations section (including Regional Network Operations Officers). This recommendation takes into account the adaptive features of the design and the impact the design will have on overall network efficiency and compatibility with the surrounding network.
  The design is finally accepted by the appropriate RMS officer responsible for implementation of the construction. This acceptance takes into account the constructability of the design and suitability for the particular site and project objectives.

The following documents must accompany the recommendation for acceptance or the design may be rejected:
• A copy of the concurrence from RMS that traffic signals would be a suitable treatment at the intended intersection.
• Traffic data (including a recent traffic count, traffic assignment, traffic accident records, etc).
• Turning paths.
• Site photographs.
• Results of the initial investigation.
• A design report outlining all design decisions and the reasons for any unusual treatments
• A safety audit.
• A completed Appendix A.
• Any associated road design plans or setting out details that are not shown on the design layout.
• Approved traffic signal design layout.

During the development of the traffic signal design it may be necessary to seek advice or exemptions on various situations from the Principal Manager Network Operations. Examples of such situations are detailed in Sections 2.4, 2.5, 3.6.2, 6.2, 7.3.3, 7.4, 7.9.1, 8.6, 8.15, 9.6.19, 11.3.4.2, 11.4.3, 14.1, 15.1 and Appendix D. Notwithstanding those examples, where there are other situations outside normal procedures, concurrence must be sought from the Principal Manager Network Operations before inclusion in the design.

If exemptions are granted, or the design deviates from usual practice, this should be documented in the design report, including the name and role of the officer who authorised the exemption. A copy of the report should be sent to Network Operations’ Research Officer so that consideration can be given for inclusion of the exemption in a future revision of the Traffic Signal Design Manual or the immediate issue of a specific Technical Direction, if deemed necessary.

3.12.3 Non-standard designs

The approval process for non-standard designs is as follows:

• The initial concept requires concurrence from General Manager Road Network Operations, Principal Manager Network Operations and Network Operations’ Research Officer.

• The design is approved for its technical correctness in accordance with relevant technical manuals and guidelines by an appropriate authorised officer within the consultancy (or appropriate authority within RMS for internally prepared designs). During the approval procedure comment/agreement must be sought from authorised RMS officers responsible for the adaptive, electrical and delineation features of the design.

• The design is recommended for acceptance of its technical correctness by the Traffic Signal Design Manager, Road Design Engineering. During this process comment/agreement must be sought from authorised RMS officers responsible for the civil, electrical and delineation features of the design.

• The design is recommended for acceptance by an authorised officer within RMS’ Network Operations section (including Regional Network Operations Officers). This recommendation takes into account the impact the design will have on overall network efficiency and compatibility with the surrounding network.

• The design is accepted by the appropriate RMS officer responsible for implementation of the construction. This acceptance takes into account the constructability of the design and suitability for the particular site and project objectives.