

The background of the page is a close-up photograph of a traffic signal lens. The lens is dark, and the green light is glowing brightly. The light is composed of many small, individual LEDs arranged in a grid pattern. The lens is circular, and the light is visible through it. The background is dark, and the light is the primary focus.

Traffic signal design

Section 3 – Design process

The traffic signal design guidelines have been developed to assist in designing traffic control signals.

The guidelines are to comprise 16 sections and 5 appendices. These are initially being released individually and in no specific order. The sections which are to be released are as follows:

Part	Title
Section 1	Investigation
Section 2	Warrants
Section 3	Design Process
Section 4	Plan Requirements
Section 5	Geometry
Section 6	Pavement Marking
Section 7	Phasing and Signal Group Display Sequence
Section 8	Lanterns
Section 9	Posts
Section 10	Signs
Section 11	Detectors
Section 12	Controller
Section 13	Provision for Future Facilities
Section 14	Signalised Mid-block Marked Footcrossings
Section 15	Special Situations
Section 16	References
Section 17	Alignment signs and markers
Appendix A	Design Plan Checklist
Appendix B	Traffic Signal Symbols
Appendix C	Location and Function of Lanterns
Appendix D	Location and Dimensions of Components
Appendix E	Left Turn on Red

To determine which sections are currently available go to:

www.rta.nsw.gov.au/doingbusinesswithus/downloads/technicalmanuals/trafficsignaldesign_d11.html

The information contained in the various parts is intended to be used as a guide to good practice. Discretion and judgement should be exercised in the light of the many factors that may influence the design of traffic signals at any particular site. The guidelines make reference, where relevant, to current Australian Standards and are intended to supplement and otherwise assist in their interpretation and application.

Traffic Signal Design

Section 3

DESIGN PROCESS





Roads and Traffic Authority

www.nsw.rta.gov.au

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APPROVED BY:

SIGNED

Craig Moran
A/General Manager
Traffic Management

SIGNED

Steve Levett
A/General Manager
Safer Roads

AUTHORISED FOR USE BY:

SIGNED

Michael Bushby
Director
Network Management

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For policy and technical enquiries regarding these guidelines please contact:

Traffic Management Branch
Email: technical_directions_publication@rta.nsw.gov.au
Phone: (02) 9218 6287
Fax: (02) 9218 6693

To access electronic copies of these and other guidelines go to:

www.rta.nsw.gov.au/doingbusinesswithus/downloads/technicalmanuals/technicalmanuals_dl1.html

For the latest amendments (if any) to these guidelines go to:

www.rta.nsw.gov.au/doingbusinesswithus/downloads/technicalmanuals/trafficsignaldesign_dl1.html

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Amendment record

Please note that the following updates have been made to this document.

Version Number	Page	Description	issued
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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.

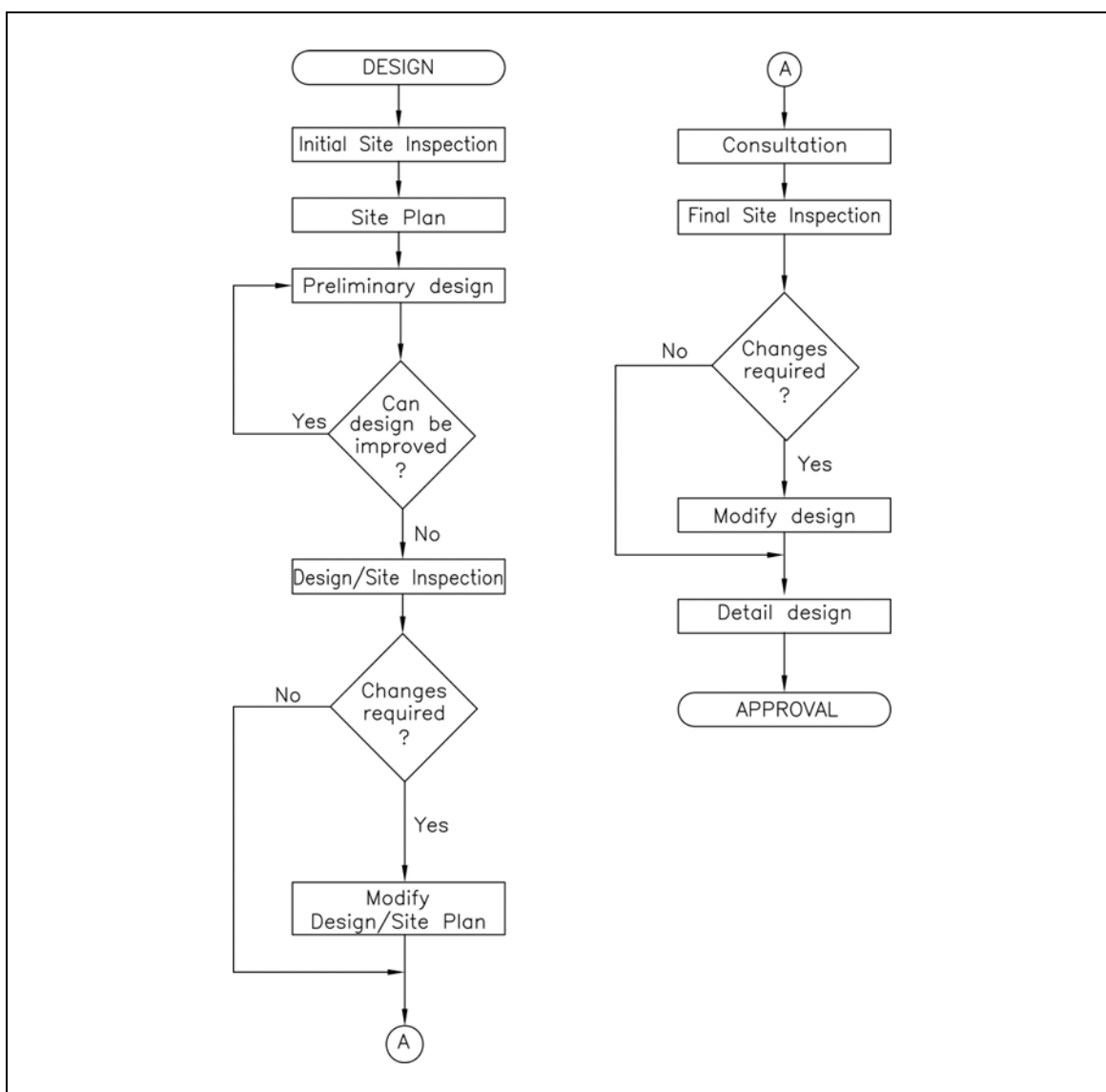


Figure 3.1 Steps in the design process

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 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 footpaths
- 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. 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 phasing requirements should be examined to ensure optimum performance for site geometry. This can be done manually using the techniques outlined in ARR123 Traffic Signals: Capacity and Timing Analysis or using a computer program such as INTANAL, SIDRA, or SCATES. 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 (if overhead)
 - 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.

For manual designs the above information can be shown in pencil on a copy of the site plan. For computer aided design (CAD), plan information will be stored in separate layers and the required layers will need to be superimposed to form a complete preliminary plan.

3.6 DESIGN/SITE INSPECTION

A hard copy of the preliminary design layout 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*)
- height and location of posts and their footings (see *Section 9*)
- location and size of detectors (see *Section 11*)
- 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*)
- 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 to look for include:

- possible source of power supply.
- 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.
- 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*)
- 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

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. The source of supply should not be confused with the point of supply (point of attachment), which is confirmed at the construction stage.

Following the initial site inspection, when possible sources of supply would be noted, a meeting with representatives of the local supply authority must be held to confirm the actual availability and source of supply, together with the probable point of supply. This is to avoid unnecessary and costly alterations to supply arrangements during construction.

3.6.1.1 Uninterrupted power supply (UPS)

Uninterrupted power supply should only be provided to traffic signal sites in special circumstances. These special circumstances may include

- Sight restrictions between opposing and or conflicting stop lines
- Complex intersection design where there are more than four approaches

Any proposals to provide uninterrupted power supply must first be approved by the Manager Network Operations, Transport Management Centre.

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 such as fixed copper line, optic fibre, leased line, PSTN dial-up, mobile GSM, mobile GPRS, ADSL, radio, TCP/IP network, multiplexers, multidrop etc.

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 Manager, Network Operations, Transport Management Centre, 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 layout.

3.8 CONSULTATION

The preliminary design layout should be shown to other officers, with an interest in the design, to ensure that their suggestions, or specific requirements, can be considered. This includes (but is not restricted to) Network Operations, signposting, electrical, adaptive engineering, traffic management and signal construction staff. Once comments have been obtained and considered, the preliminary design layout 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 guidelines. A non-standard design would typically be new or unique practice not previously used, or rarely used, in the RTA. [e.g. 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 Manager Network Operations – Transport Management Centre and the Leader Traffic Design Policy, Traffic Management from the concept development stage through to the final design.

Given the fact that there are no RTA guidelines for non-standard designs, these designs are to be prepared using RTA resources.

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 - the latter being prepared by an officer of the electrical design section (see *Section 4*).

3.12 APPROVAL

The approval of standard traffic signal designs is a three tiered process that must be followed for both RTA 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 RTA prepared standard designs

- The design is first **approved** for its technical correctness in accordance with relevant technical manuals and guidelines by an officer with the appropriate authority within the RTA. During the approval procedure comment/agreement must be sought from authorised RTA officers responsible for the adaptive, electrical and delineation features of the design.
- The design is then **recommended** for acceptance by an authorised officer within the RTA's 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 finally **accepted** by the appropriate RTA 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 should accompany the submission for approval:

- traffic data (including a recent traffic count, traffic assignment, traffic accident records, etc)
- 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
- completed traffic signal design layout
- minute or memorandum of formal submission (as appropriate)

3.12.2 Consultant prepared standard designs

- The design is first **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 RTA officers responsible for the adaptive, electrical and delineation features of the design.
- Two RTA 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 an officer with the appropriate authority within the RTA. During this process comment/agreement must be sought from authorised RTA officers responsible for the adaptive, 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 impact the design will have on overall network efficiency and compatibility with the surrounding network.

- The design is finally **accepted** by the appropriate RTA 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:

- a copy of the concurrence from the RTA 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)
- 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 Manager, Network Operations – Transport Management Centre. 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 Manager, Network Operations – Transport Management Centre, 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 the Leader, Traffic Design Policy, Traffic Management, 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 design is first **approved** for its technical correctness by an officer with the appropriate authority within the RTA following the **concurrence** of the RTA's Leader Traffic Design Policy, Traffic Management. During the approval procedure comment/agreement must be sought from authorised RTA officers responsible for the adaptive, electrical and delineation features of the design.
- The design is then **recommended** for acceptance by an authorised officer within the RTA's Network Operations section (including Regional Network Operations Officers) following the **concurrence** of the RTA's Manager Network Operations – Transport Management Centre. This recommendation takes into account the impact the design will have on overall network efficiency and compatibility with the surrounding network.
- The design is finally **accepted** by the appropriate RTA officer responsible for implementation of the construction with the **concurrence** of the RTA's General Manager Traffic Management. This acceptance takes into account the constructability of the design and suitability for the particular site and project objectives.

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