

Master Specification

Part RD-EL-D2

Traffic Signal Design

September 2024



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RD-EL-D2 Traffic Signal Design

1 General

- a) This Master Specification Part sets out the requirements for traffic signal design for new, modified and temporary traffic signal sites, including:
 - i) the documentation requirements, as set out in section 2;
 - ii) the requirements for traffic management during construction, as set out in section 3;
 - iii) the traffic signal design requirements, as set out in section 4;
 - iv) the traffic signal hardware requirements, as set out in section 5; and
 - v) the traffic control device approval requirements, as set out in section 6.
- b) Traffic signal design must comply with the Reference Documents, including:
 - i) Austroads Guide to Road Design (AGRD);
 - ii) Austroads Guide to Temporary Traffic Management (AGTTM);
 - iii) AS 2144 Traffic signal lanterns;
 - iv) AS 2339 Traffic signal posts, mast arms and attachments;
 - v) AS 1742 Manual of uniform traffic control devices;
 - vi) AS/NZS 3008 Electrical installations - Selection of cables;
 - vii) Department Manual of Legal Responsibilities and Technical Requirements for Traffic Control Devices - Part 2: Code of Technical Requirements;
 - viii) Department Operational Instruction 14.2 Traffic Signal Faces (available from: https://dit.sa.gov.au/standards/standards_and_guidelines);
 - ix) Department Pavement Marking Manual (available from: https://dit.sa.gov.au/standards/standards_and_guidelines);
 - x) Department Road Design Presentation Standards (available from: https://dit.sa.gov.au/standards/standards_and_guidelines);
 - xi) Department Traffic Modelling Guidelines: SIDRA Intersection;
 - xii) Department Traffic Signal Standard - TS001 Signal Timings;
 - xiii) Office of the Technical Regulator – Building safely near powerlines;
 - xiv) Office of the Technical Regulator – Building safely near powerlines;
 - xv) TSI-SP-069 Control Equipment for Road Traffic Signals, TfNSW; and
 - xvi) the Department Standard Drawings.

2 Documentation

2.1 Design Documentation

In addition to the requirements of PC-EDM1 “Design Management”, the Design Documentation must include where manufacturer-specific devices have been proposed in the traffic signal design, the device make and model details, as required by section 5.2.

2.2 Design Report

2.2.1 General

If not already specified in the Contract Documents, the Contractor must clarify with the Principal:

- a) whether CCTV is required to be included in the design, and if so, the required communications method for transmitting video;
- b) the required method for providing SCATS communications to the signal controller;
- c) whether a UPS is required to be included in the design;
- d) whether microwave pedestrian sensors are required to be included in the design; and
- e) whether the site is a high criticality or a low criticality signal site,

prior to producing the Traffic Signal Design Report.

2.2.2 Traffic Signal Design Report

- a) The Design Report must include a Traffic Signal Design Report which must include details of all permanent and temporary traffic signal equipment to be provided, including:
 - i) system and operational descriptions of the phasing operation, turning movement operation, phase times during peak periods, linking, and red, yellow, minimum green, cycle and pedestrian walk and clearance time settings;
 - ii) a list of all traffic signal hardware equipment or products specified or intended to be used;
 - iii) where required by section 4h), the written approval of the OTR to use non-complying clearances;
 - iv) location of all equipment and accompanying justification;
 - v) details of all applicable Reference Documents used in the design of traffic signals;
 - vi) a full description (including diagrams) of how the optimised traffic signal coordination is intended to operate for each period of the day, including offset parameters for linking to adjacent traffic signal sites;
 - vii) signal group allocations;
 - viii) traffic signal hardware documentation;
 - ix) the design, procurement, installation, integration and commissioning program;
 - x) specification for supply and installation of traffic signals, and all related construction materials;
 - xi) details of the traffic signal controller design, including I/O allocations and how the design and location of traffic signal controllers meets the requirements of section 5.6;
 - xii) in relation to vehicle detectors:
 - A. the locations of each loop detector in accordance with the requirements of section 5.12; and
 - B. input allocations;
 - xiii) details of all queue detectors, including how the design complies with the requirements of RD-EL-C2 "Installation of Traffic Signals";
 - xiv) where split-approach phasing is proposed to be used, evidence of the benefits of increased capacity and reduced delays for whole of day operations as required by section 4c)ii);

- xv) details of all CCTV infrastructure as required by section 5.7e) (unless CCTV is specified by the Principal to be not required);
 - xvi) power system, volt drop and fault loop impedance calculations;
 - xvii) details of the UPS including load calculations which demonstrate that the UPS will support the load for a minimum of 4 hours (unless a UPS is specified by the Principal to be not required);
 - xviii) details of the method of connection to the SAPN connection point, including the connection point location;
 - xix) how the traffic signals will be integrated with the Principal's systems, including details of the proposed connection between the traffic signal controllers and the Principal's SCATS, traffic signals communications and CCTV networks in accordance with the requirements of sections 5.9 and 5.10;
 - xx) details of all retained, modified and new Bluetooth capture stations;
 - xxi) how interfaces with other relevant systems will be coordinated and managed, including:
 - A. the Principal's existing SCATS, traffic signals communications and CCTV networks; and
 - B. any other third party systems;
 - xxii) evidence, including drawings, demonstrating that the traffic signal design meets the swept path and turning movement requirements of RD-GM-D1 "Road Design" for the required design and checking vehicles;
 - xxiii) all data collected in the course of developing the traffic signal design and related traffic models;
 - xxiv) how traffic signal phasing will be modified throughout the construction of the Works and Temporary Works (as applicable), in accordance with the requirements of section 3a);
 - xxv) the network and intersection impacts of traffic signal changes associated with each major construction stage, in accordance with the requirements of section 3b);
 - xxvi) how the needs of buses, heavy vehicles and freight have been taken into account in the design of traffic signals; and
 - xxvii) how the needs of pedestrians and cyclists have been taken into account in the design of traffic signals in accordance with the requirements of section 5.13, including:
 - A. where 2 pedestrian crossings have been provided at a T-intersection, the evidence required by section 5.13b);
 - B. how signal phasing has been adjusted and coordinated at adjacent intersections to accommodate new or modified pedestrian and bicycle crossings;
 - C. how the design of new pedestrian crossings aligns with pedestrian desire lines;
 - D. how the design of pedestrian crossings caters for cyclists;
 - E. how the needs of cyclists have been taken into account in the design of traffic signals;
 - F. where the provision of microwave pedestrian sensors are required to extend crossing times, as required by section 5.13e); and
 - G. for level crossings, the details of 4 standard inputs to be provided via the hard wired connection in accordance with the requirements of section 5.14.
- b) Where the Traffic Signal Design Report refers to new or existing intersections forming part of the Works or Temporary Works, the Contractor must ensure that the following information (where relevant to the design) is referenced:
- i) traffic signal site number;

- ii) Telstra PSTN and port service numbers;
- iii) 4G/5G modem number; and
- iv) fibre optic and switch details.

2.2.3 Traffic Signals Operational Performance Report

The Design Documentation must include a Traffic Signals Operational Performance Report in accordance with the requirements of RD-GM-D4 "Traffic Analysis and Modelling".

2.3 Design Drawings

- a) The Contractor must prepare Design Drawings as part of the design of both permanent and temporary traffic signals, which must include:
 - i) traffic signal layout drawings and phasing plans;
 - ii) turning path drawings to demonstrate clearances, and to demonstrate that the proposed design operation is achieved;
 - iii) signal conduit and pits layout drawings, including pole details and circuit details tables;
 - iv) equipment drawings, including an extension housing cabinet layout, power and comms single line diagram and network connection for the extension housing if it is required in the design;
 - v) locations of pedestrian and cyclist push buttons; and
 - vi) hardware schedules, including an equipment schedule listing all traffic signal products and a pole details table listing all equipment attached to each pole.
- b) The Design Drawings required by section 2.3a) must:
 - i) reference the traffic signal site TS/PC numbers allocated by the Principal;
 - ii) label traffic signal group numbers, traffic signal phase labels, detector numbers and post numbers in accordance with Department Standard Drawing S-6841, sheets 1 and 2; and
 - iii) be prepared in accordance with the following Department Road Design Presentation Standards:
 - A. DP011 Traffic Signals;
 - B. DP012 Traffic Signal Conduit; and
 - C. DP018 Intelligent Transport Systems (ITS) (where an extension housing is required in the design).

3 Traffic management during construction

- a) The Contractor must modify (where necessary) traffic signal phasing and utilise workzone traffic management (in accordance with PC-SM1 "Traffic and Pedestrian Management") to facilitate temporary traffic arrangements during the construction of the Works and Temporary Works (as applicable), including where required to enable temporary road closures and detour routes.
- b) The Contractor must assess the network and intersection impacts of traffic signal changes associated with each major construction stage using modelling conducted in accordance with the requirements of RD-GM-D4 "Traffic Analysis and Modelling".
- c) Where a construction stage change involves the provision of traffic signals which require signal controller programming, the construction staged change must be developed and processed as if it were a permanent traffic signal installation.

4 Traffic signal design

- a) Traffic signal phasing must be designed to provide the most flexible operation.
- b) Traffic signal phasing sequences must minimise the number of phases, have the most non-conflicting, compatible movements in a single phase and maximise the number overlapping movements between phases.
- c) Traffic signal phasing must comply with the following:
 - i) all phasing arrangements and sequences must be compatible with SCATS operating requirements;
 - ii) split-approach phasing must not be used unless the Contractor can demonstrate the benefits of increased capacity and reduced delays for whole of day operations as part of the Traffic Signal Design Report;
 - iii) all right turn movements must be controlled with right turn arrows and controlled separately from through movements. Filter right turning movements must not be used;
 - iv) intersection phase times must take into consideration the impact of pedestrian movements; and
 - v) time settings for minimum green, intergreen (yellow and red) and pedestrian walk and clearance must be in accordance with Department Traffic Signal Standard - TS001 Signal Timings.
- d) Intersection layouts must be designed to achieve the most flexible signal operation possible and adequate provision must be made to cater for all possible traffic signal phase arrangements and sequences.
- e) The traffic signal design must satisfy the following requirements:
 - i) the traffic signal design must meet all road design requirements of RD-GM-D1 "Road Design", including the swept path and turning movement requirements for the design and checking vehicles;
 - ii) opposed turns at cross intersections must be designed to allow clearance between design vehicle swept paths in accordance with the requirements of RD-GM-D1 "Road Design", regardless of the whether the phasing sequence allows the turns to operate concurrently;
 - iii) the traffic signal design must provide right turn and left turn movements with a dedicated turning lane;
 - iv) the design of turning lanes must provide deceleration to the back of the 95th percentile queue as determined by intersection modelling in accordance with RD-GM-D4 "Traffic Analysis and Modelling"; and
 - v) lanes must not be designed to have more than one movement per lane. Shared lanes are not permitted in traffic signal design.
- f) Intersection modelling in accordance with RD-GM-D4 "Traffic Analysis and Modelling" must be used to demonstrate that the proposed traffic signal design and operation will satisfy the performance criteria.
- g) The design of traffic signals and associated infrastructure must be capable of being installed in accordance with RD-EL-C2 "Installation of Traffic Signals".
- h) The Contractor must ensure that clearances of traffic signal infrastructure to overhead and underground electrical cables (including transport related distribution cables) comply with the requirements of the OTR and the Technical Requirements. In the event that the design is unable to comply with minimum clearances, the Contractor must obtain the written approval of the OTR to use non-complying clearances which must be submitted as part of the Traffic Signal Design Report.

5 Traffic signal hardware

5.1 General

All traffic signals and associated equipment must comply with the requirements of:

- a) RD-EL-C2 "Installation of Traffic Signals";
- b) RD-EL-S3 "Supply of LED Traffic Signal Lanterns"; and
- c) RD-EL-C3 "Supply and Installation of Conduits and Pits".

5.2 Approved products

Where manufacturer-specific devices have been proposed in the design:

- a) the device make and model details must be submitted with the Design Documentation for approval by the Principal; and
- b) the device make and model number or version of all manufacturer-specific power equipment proposed must be included in the AEMO National Electricity Market Load Table.

5.3 Traffic signal operating voltage

- a) The traffic signal design for new intersection or pedestrian crossings must incorporate ELV traffic signal controllers and associated equipment.
- b) Voltage drop and loop impedance for ELV or LV distribution from traffic signal controller to end devices must be calculated in compliance with AS/NZS 3008 Electrical installations — Selection of cables, using standard traffic signal multicore cable V-90 PVC insulated with 2.5 mm² active switching, 10 mm² neutral and 10 mm² earth.

5.4 Traffic signal lanterns

- a) All traffic signal lanterns at new traffic signal sites must:
 - i) be LED type;
 - ii) be 42 volt ELV;
 - iii) comply with AS 2144 Traffic signal lanterns; and
 - iv) be listed in the Department Approved Products List.
- b) Where additional lanterns are to be provided at an existing traffic signal site, they must:
 - i) be LED type;
 - ii) be either:
 - A. of the same voltage (LV or ELV) as the existing lanterns; or
 - B. where the existing signal controller is being replaced as a part of the design, compatible with the operating voltage of the replacement signal controller;
 - iii) comply with AS 2144 Traffic signal lanterns; and
 - iv) form part of the Department Approved Products List.
- c) 200 mm or 300 mm aspects must be provided in accordance with Department Operational Instruction 14.2 Traffic Signal Faces.

5.5 Location of signal equipment and signal face layouts

The location, size and arrangement of traffic signal faces must be in accordance with Department Operational Instruction 14.2 Traffic Signal Faces.

5.6 Traffic signal controller

- a) All new traffic signal controllers must:
 - i) comply with the requirements of RD-EL-C2 "Installation of Traffic Signals";
 - ii) comply with the requirements of TSI-SP-069 Control Equipment for Road Traffic Signals, TfNSW; and
 - iii) be listed in Department Approved Products List.
- b) The location of the traffic signal controllers must be detailed as part of the Traffic Signal Design Report, and must:
 - i) minimise obstruction to pedestrians;
 - ii) minimise visual obstruction to drivers;
 - iii) minimise the risk of accidental damage by traffic;
 - iv) provide for safe and easy access for maintenance personnel and associated vehicles;
 - v) permit maintenance staff to have a clear view of the whole of the intersection from the controller as far as is practicable; and
 - vi) be orientated so that the cabinet doors open away from the centre of the intersection.
- c) Where the location of the traffic signal controller is not near an existing point of supply, the design must determine the optimum cost-effective solution for provision of a new point of supply versus larger cable sizes which would be required for long runs.
- d) For large intersections requiring 14 or more signal groups or more than 22 detectors, a single controller capable of controlling 32 signal groups and 48 detectors (VC6 personality) must be provided.
- e) Where an existing site is to be modified and:
 - i) the existing signal controller is required to be relocated; and
 - ii) the existing signal controller is not compliant with TSI-SP-069 Control Equipment for Road Traffic Signals, TfNSW,

then the signal controller must be replaced with a new compliant controller operating on ELV. Any associated equipment such as lanterns, audio tactile units and cabling which is not compatible with ELV operation must also be replaced.

5.7 CCTV cameras and associated telecommunications equipment

- a) Unless otherwise specified by the Principal as part of the Contract Documents, CCTV must be provided as part of all:
 - i) traffic signal controlled intersections that are installed or modified. In which case, CCTV coverage must include the signalised intersection and all approaches;
 - ii) traffic signal controlled intersections or crossings that are adjacent to level crossings (refer to section 5.14 for further detail). In which case, CCTV coverage must include the signalised intersection or crossings and all approaches as well as the road surface between the signalised intersection up to and including the level crossing;
 - iii) queue relocation installations at level crossings where queue relocation management strategies are used to prevent queuing over the level crossing. In which case, CCTV coverage must include the approaches to the queue relocation signals as well as the road surface between the queue relocation signals up to and including the level crossing; and
 - iv) signalised locations where ramp metering is installed. In which case, CCTV coverage must include the signalised intersection and all approaches and must also be capable

of providing coverage of the ramp from the traffic signals up to and including the ramp metering signals.

- b) For CCTV equipment installed at intersections, the CCTV support equipment (including power and communications) must be housed in an extension housing attached to the top of the traffic signal controller cabinet.
- c) The design of the ITS equipment in the extension housing required by section 5.7b) must be in accordance with RD-ITS-D1 "Design of Intelligent Transport Systems (ITS)".
- d) CCTV equipment must meet the requirements of RD-ITS-S5 "Imaging Equipment".
- e) The following information regarding the CCTV must be included with the Traffic Signal Design Report (unless CCTV is specified by the Principal to be not required):
 - i) pole type;
 - ii) bracket arrangement;
 - iii) maintainability and access;
 - iv) mounting height above road level; and
 - v) CCTV support equipment and where it is housed.

5.8 Uninterruptible power supply

- a) Unless otherwise specified in Contract Documents, UPS must be provided for all new traffic signal controlled intersections.
- b) General layout and interconnection between the uninterruptible power supply and traffic signal controller must be in accordance with Department Standard Drawing S-4055, sheet 73.

5.9 Provision of telecommunications for CCTV

- a) Where CCTV is included in the design requirements, the CCTV equipment must be connected to the Principal's CCTV communications network:
 - i) via direct connection to the Principal's fibre network where the Principal's fibre network is also used for SCATS connection; or
 - ii) via an alternate proposed communications method proposed by the Contractor as part of the Design Documentation. Acceptance of the proposed communications method is subject to approval by the Principal as a part of the design approval process.
- b) The specifications of the proposed connection between CCTV equipment and the Principal's CCTV communications network must be clearly specified in the traffic signal Design Basis report, including details of the proposed communications path, associated cable and connection products.

5.10 Provision of telecommunications for SCATS

- a) All traffic signal controllers must be connected to the Principal's SCATS traffic signal communications networks via a telecommunications method specified in Table RD-EL-D2 5-1.
- b) The specifications of the proposed connection between the traffic signal controllers and the Principal's SCATS traffic signals communications network must be clearly specified in the Traffic Signal Design Report, including details of the proposed communications path, associated cable and connection products.

Table RD-EL-D2 5-1 Selection of telecommunications methods for SCATS connection

SCATS telecommunications method	Signal criticality rating ⁽¹⁾ = high	Signal criticality rating ⁽¹⁾ = low
New signal controller connection is within 30 m of nearest Metropolitan Area Broadband Network (MABN) termination pit	Direct connection to the Department's fibre network	Direct connection to the Department's fibre network
New signal controller connection is more than 30 m from nearest MABN termination pit	Combination of ethernet (wireless area network) and 4G/5G services, alternatively 4G/5G multi carriers services ⁽¹⁾	Single carrier 4G/5G service

Table notes:

(1) As required by the Contract Documents.

5.11 Bluetooth capture stations

- a) Bluetooth capture stations must be provided with all new traffic signal controller cabinets in accordance with the requirements of:
 - i) RD-ITS-D1 "Design of Intelligent Transport Systems (ITS)"; and
 - ii) RD-EL-C2 "Installation of Traffic Signals".
- b) The Bluetooth capture stations required by section 5.11a) must:
 - i) comprise an industrial DIN-mount programmable communications platform capable of Bluetooth (classic and low energy) and Wi-Fi MAC address capture from passing vehicles;
 - ii) be compatible with:
 - A. classic Bluetooth (v2.1);
 - B. Bluetooth low energy (v4.x);
 - C. undiscoverable Bluetooth classic (Bluetooth lower address part only); and
 - D. Wi-Fi (2.4GHz and 5GHz) technology;
 - iii) include an external antenna mounted to the top of the traffic signal cabinet or extension housing and be configured to provide full intersection coverage; and
 - iv) be compatible with the "AddInsight" traffic intelligence system 2023 protocol v3 and backwards compatible with v1/v2, including beacon and broadcast functionality.
- c) Where a TrafficNet network access point Layer 2 switch is located within the traffic signal controller extension housing, the Bluetooth capture station must connect to a port of that switch.
- d) Where a TrafficNet Layer 2 switch is not to be installed with the traffic signal controller:
 - i) the Bluetooth data station must connect to a traffic signal controller linking control module (LCM); and
 - ii) the LCM must be connected to the 4G/5G router.
- e) The design must note clearly that the installation of the antenna required in section 5.11b)iii) must not compromise the ingress protection (IP) rating of the traffic signal controller housing or extension housing.

5.12 Vehicle detection

- a) The design must document the location of all vehicle loop detectors.

- b) Vehicle detection loops must be as detailed on Department Standard Drawing No. S-4500, Sheets 1 and 2. Other loops must be arranged appropriate to their function.
- c) Vehicle stop line type detectors suitable for SCATS operations must be provided for all lanes irrespective of the control function. Loops on non-controlled lanes, e.g. left turn lanes, must be provided and connected to traffic controllers.
- d) Advanced detectors must be provided on approaches with speed limits 80 km/h and over. The location of the detector relative to the stop line approach is to be calculated on the basis of the design speeds and must consider the approach gradient.
- e) Alternative technologies to loop detection may be considered providing they are compatible with SCATS operation.
- f) Where temporary vehicle detection is required as a result of construction staging and temporary traffic arrangements, non-intrusive based vehicle detection technology may be considered, where the Contractor has provided detail product information and supporting justification as part of the Construction Documentation.

5.13 Pedestrian and bicycle detection and control

- a) Subject to section 5.13b), pedestrian crossing facilities must be provided at all approaches to signalised intersections forming part of the Works and Temporary Works.
- b) Two pedestrian crossings may be provided at T-intersections, one across the minor road and the other across the major road on the left side of the stem of the T-intersection.
- c) Where 2 pedestrian crossings are provided at a T-intersection in accordance with section 5.13b), the Contractor must provide evidence as part of the Traffic Signal Design Report that the pedestrian desire lines and volumes align with the proposed provision of crossing facilities.
- d) In relation to pedestrian and bicycle infrastructure at intersections, the Contractor must:
 - i) design pedestrian activated crossings in accordance with the relevant Department Standard Drawings;
 - ii) ensure that pedestrian displays must be incorporated in the phasing at all sites;
 - iii) adjust and coordinate signal phasing at adjacent intersections to accommodate new or modified pedestrian and bicycle crossings;
 - iv) ensure that the location and design of new pedestrian crossings aligns with pedestrian desire lines;
 - v) ensure that the design of pedestrian crossings caters for cyclists;
 - vi) ensure that all pedestrian movements are demand actuated by audio tactile pedestrian push buttons;
 - vii) provide pedestrian push buttons for each pedestrian movement (including on median islands), that:
 - A. must meet the approved product requirements of section 5.2;
 - B. are orientated so that the face of the push button is in line with or parallel to the crosswalk marking, and in accordance with the relevant Department Standard Drawings;
 - C. incorporate arrow legends in the audio tactile display on all pedestrian pushbuttons;
 - D. incorporate legends and buttons correctly oriented to guide visually impaired pedestrians in the same direction indicated by cross walk markings; and
 - E. only have one audio tactile pedestrian push button located on a post.

- e) The Contractor must determine the need for microwave pedestrian sensors to facilitate the extension of clearance time based on the location of each pedestrian crossing and where extended crossing times may be required and included with the Design Documentation.
- f) Microwave pedestrian sensors must not be provided where pedestrian displays are controlling marked foot crossings less than 15 m long.
- g) The Contractor must provide push buttons for cyclists on side road approaches, main road approaches where the clearance distance is greater than 30 m wide and at locations where extended minimum green time is required.
- h) The cyclist push buttons required by section 5.13g) must have push button faces positioned parallel to the kerb and adjacent to the road carriageway within reach of a cyclist stopped at the stop line (and stopped in the bicycle lane, where it exists).
- i) Where the signal post is located out of reach of a cyclist when waiting at the stop line, an additional short post fitted with a cyclist pushbutton is provided at 1 m offset from the cyclist stop line.
- j) Where an on-road bicycle lane is situated between marked traffic lanes, in-ground stop line loop detection must be provided.
- k) Where a bicycle box area is provided between the bicycle stop line and a stop line for general traffic, in-ground loop cycle detection for cyclists must be provided.
- l) The Contractor must demonstrate how the needs of cyclists has been considered in the design of signals as part of the Traffic Signal Design Report.

5.14 Level crossings

- a) For all level crossings located within the Site:
 - i) interlocking between level crossings and adjacent traffic signal installations must be provided with a hard-wired connection;
 - ii) 4 standard inputs must be provided via the hard-wired connection, which must be documented in the Traffic Signal Design Report;
 - iii) the hard wire connection from the level crossing must be monitored by the signal controller, which must report an alarm via SCATS if the integrity of the hard wire connection is impaired;
 - iv) for level crossings that:
 - A. are adjacent to a signalised intersection;
 - B. may be affected by queues from a signalised intersection; or
 - C. may have signalling conflict with a signalised intersection,the Contractor must provide a cable link in a conduit between the level crossing controller and the relevant traffic controller, which enables the traffic signal controller to be forced to a safe state before the level crossing closes to permit the passage of a train; and
 - v) queue relocation signals must be provided which are controlled independently from the adjacent intersections by a separate controller. The queue relocation signal controller must also be connected to the level crossing.
- b) The provision of equipment for level crossings and the method of control is subject to approval of the Principal and the relevant rail Authority.
- c) Level crossings are considered “adjacent to” traffic signals or “within the site” where the traffic signals could be interpreted to conflict with the level crossing wigwag signs or where the level crossing is expected to create queues across the intersection, or vice versa.

5.15 Traffic signal posts

- a) The location of traffic signal posts must take into account site constraints such as Utility Services and roadside furniture.
- b) The traffic signal post locations must ensure that the signals can be sited where they can be clearly seen by approaching drivers (refer to the Department Operational Instruction 14.2 Traffic Signal Faces).
- c) The Contractor must ensure that traffic signal posts are not located where lanterns, including backing boards and visors, are likely to be struck by vehicles following a conventional turning path, or where long vehicles may mount the kerb while negotiating a turn.
- d) The Contractor must ensure the post locations are achievable without compromising the driver's visibility of all the signal aspects, or safe clearances. Primary lanterns are to be located in line with, or downstream of, the stop line.
- e) When utilising a traffic signal post for mounting a pedestrian push button, the push button must be accessible by wheelchair users. For push button signal locations at kerb ramps, refer to Department Standard Drawing S-4074, sheet 7.
- f) Traffic signal posts must not be located within painted medians or islands, i.e. where there are no kerbed islands, or there is an area physically raised from the road, which is designed only to discourage overrunning by large vehicles.
- g) Wherever possible, combination posts comprising road lighting and traffic signals must be used to minimise the number of signal posts. The placement of combination posts is primarily determined by the requirements for traffic signal operation. In general, combination posts should not be installed in islands or medians.
- h) Where a traffic signal site is specified to incorporate ELV operation and LV road lighting on combination posts, appropriate electrical segregation must be maintained between the 2 systems.
- i) Where combination posts are to be incorporated into the traffic signal design, consideration must be given to source of the electrical supply for the road lighting. Provision of this type of post must not compromise the design of either the road lighting or the traffic signals.
- j) The provision of road lighting must not compromise the safe location and distribution of traffic signal posts. Traffic signal posts are to be located for optimal design. Where the signal post location is also a suitable location for a road lighting post then combining of the functions on a common post must be considered.
- k) In addition to the requirements of this Master Specification Part, combination posts incorporating both lighting and traffic signals must also meet the requirements of RD-EL-D1 "Design of Road Lighting".

5.16 Pavement markings

Pavement line marking at signalised sites must be in accordance with the Reference Documents including the Department Pavement Marking Manual.

5.17 Signs

In relation to regulatory signs forming part of signalised intersections:

- a) non-illuminated regulatory signs must not be used in place of illuminated signs on traffic signal posts;
- b) where regulatory signs (including no left turn / no right turn signs) are provided for part time regulation, a symbolic internally illuminated sign must be provided at a stop line post and a secondary (or tertiary) post;
- c) sign equipment must meet the approved product requirements of section 5.2; and

- d) internally illuminated regulatory signs controlled by the signal controller must be equipped with fault monitoring, and report faults back to the signal controller. The signal controller must then report the fault to the Principal via the Principal's SCATS network.

6 Traffic control device approval review period

Traffic control devices require approval pursuant to the *Road Traffic Act 1961 (SA)*. The Contractor must ensure that a review period of 15 Business Days is provided to the Principal for the approval of traffic control devices which include new and modified traffic signals, in accordance with PC-EDM1 "Design Management".
