

Chapter 17

Lighting

Manual Contents

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1		First Issue	Steering Committee	June 2001
2	17.5.2	New Section-Intersection, Roundabout Motorway and Interchange Lighting	Steering Committee	August 2004
	17.5.6	New Section-Lighting in the Vicinity of Aerodromes.		
	17.5.5	New Section-Vehicle Inspection Sites.		
	17.7.4	New sub-section-Lighting on or in the Vicinity of Bridges		
	17.7.4	New sub-section- Underpasses and Tunnels		
	17.7.4	New sub-section-Semi-Rigid and Flexible Roadside Barriers		
	17.7.4	New sub-section- Constructional Clearances		
	17.7.8	New Section- Conduit Alignment		
	17A	Revised (Presentation information removed and to be added to Drafting and Design Presentation Standards)		
	17C	Revised		
	17E	New Section- Rate 2 Design Process in Energex's area.		
All	Amended to agree with Austroads, Guide to Traffic Engineering Practices, Part 7			

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Chapter 17

Lighting

17.1 Scope

This Chapter describes the Standard Conditions for the Provision of Public Lighting Services for the design, installation and maintenance of public lighting installations throughout Queensland. It is prepared on the basis of assisting road designers to make the necessary allowances for lighting in their designs. Detailed design of the lighting itself is to be carried out by the relevant specialists.

The conditions cover Rate 1, 2 and 3 lighting. This Chapter should be read in conjunction with the following:

- AS/NZS 1158 “Road Lighting”;
- Department of Main Roads Standing Offer Arrangement No. 19: “Road Lighting Poles and Outreach Arms”;
- Department of Main Roads Standing Offer Arrangement No. 25: “Road Lighting Luminaires”;
- Queensland Department of Main Roads, Standard Drawings Roads;
- Queensland Department of Main Roads, Standard Specifications Roads;
- Queensland Transmission and Supply Corporation (QTSC): “QTSC Group - Standard Conditions for the Provision of Public Lighting Services”; and
- Queensland Department of Main Roads, Drafting and Design Presentation Standards.

17.2 Definitions

For the purposes of this standard, the definitions given in the following apply:

- AS/NZS 1158 “Road Lighting”;
- AS 1348.1 Road and Traffic Engineering - Glossary of Terms;
- AS 1798 Australian Standard; Lighting Poles and Bracket arms - Preferred Dimensions;
- AS 3000 SAA Wiring Rules; and
- AS 1158.6 Lighting for roads and public spaces - Luminaires.

Approved Contractor - shall mean a Private Company or Public Body authorised by the Electricity Supply Corporation to install public lighting.

Channelisation - a system of controlling traffic by the introduction of an island or islands or markings on a carriageway to direct traffic into predetermined paths, usually at an intersection or junction.

Motorway – A declared Motorway or a divided highway performing a motorway function for through traffic with full control of access and with interchanges provided at intersections where access to the local road system is required.

Point of Supply - The point of supply determined by the Electricity Supply Corporation after negotiation with the Public Body.

Public Body - The public body defined as by the Queensland Department of Main Roads (i.e. Main Roads).

Public Lighting Tariff - A tariff set by the Regulator and levied for the provision of Rate 1, 2 or 3 lighting. These tariffs are only available to Public Bodies.

QTSC - The Queensland Transmission and Supply Corporation and shall include all Electricity Supply Corporations within Queensland.

Rate 1 Lighting - Public lighting supplied, installed, owned and maintained by the Electricity Supply Corporation.

Rate 2 Lighting - Public lighting owned and maintained by the Electricity Supply Corporation. Either the Electricity Supply Corporation or an Approved Contractor may install the lighting.

Rate 3 Lighting - Public lighting supplied, installed, owned and maintained by the Public Body.

Regulator - A defined in the Electricity Act.

SOA - Main Roads' Standing Offer Arrangement with a supplier.

AADT - Annual Average Daily Traffic in vehicles per day (vpd).

Urban Area - For road lighting purposes, "urban area" is defined as an area where a network of cross streets exist, and the section of road in question is constructed with a paved roadway, kerbs, gutters and footpaths, or along which the frontages are substantially developed with residential, retail, commercial or industrial premises.

17.3 Objectives of Public Lighting

In order to realise Main Roads objectives, lighting shall be in accordance with the requirements of AS/NZ1158 and employ the use of sound traffic engineering and safety principles. In the context of this standard, public lighting is the lighting of roads and other public thoroughfares.

AS/NZ1158 classifies Public Lighting into two broad categories:

- (a) **Category V Lighting** - Lighting which is applicable to roads on which the visual requirements of motorists are dominant. (e.g. major roads).
- (b) **Category P Lighting** - Lighting which is applicable to roads and outdoor public areas where the visual requirements of pedestrians are dominant (e.g. minor roads, car parks, pathways, etc).

Objectives for Category V "Vehicular Traffic Lighting"

The objective of major road lighting is to provide a lighted environment that is conducive to the safe and comfortable movement of vehicular and pedestrian traffic at night. However, the visual requirements of the motorist predominate.

To accomplish this, the lighting shall reveal necessary visual information. This will consist of the alignment of the road ahead, kerbs, footpaths, road furniture and surface imperfections, together with other road users including pedestrians, cyclists and vehicles, and their movements, and any other animate or inanimate obstacles.

A public lighting scheme designed and installed according to the requirements of AS/NZ1158 (Category V) achieves the above requirements.

Objectives for Category P "Pedestrian Area Lighting"

The objective of pedestrian area lighting is to provide a lighted environment to assist pedestrians to orient themselves, detect potential hazards and to discourage crime against both person and property.

The lighting, with certain exceptions, is not meant to provide drivers with adequate visibility if motor vehicle traffic is present at

the location; for this the vehicle headlights are used. The exceptions are where there is interactive pedestrian and vehicular activity in designated areas (e.g. transport interchanges, car parks).

A public lighting scheme designed and installed according to the requirements of AS/NZ1158 (Category P) achieves the above requirements.

17.4 Public Lighting Tariffs

17.4.1 General

All lighting tariffs are set by the Regulator and are reviewed at regular intervals.

17.4.2 Public Lamps - Tariff 71

Public lighting charges are to cover specific installations, operation and energy costs for Rate 1, 2 and 3 lighting installations.

For current relevant charges refer to the Regulator or the local Electricity Supply Corporation.

These installations are unmetered and the charges are based upon lamp type, wattage and operation by a Photo electric (P.E.) cell or other switching controller and charged on a rate per lamp on an annual basis.

17.5 Warrants for Main Roads Public Lighting

17.5.1 General

Road lighting shall be determined by consideration of the warrants set out below. However, it should be recognised that, while warrants may or may not be met, all relevant factors need to be taken into consideration and sound engineering judgement exercised as to the need and/or appropriateness of road lighting.

17.5.2 Intersection, Roundabout, Motorway and Interchange Lighting

General Provision

Lighting shall be considered at intersections with channelisation where traffic volumes (i.e. AADTs) approximating those given in Figure 17.1 are encountered. This figure also gives the category of lighting to be applied in accordance with AS/NZ1158.

Where intersection channelisation is in the form of raised islands or medians, lighting shall be provided over the extent of that channelisation in accordance with AS/NZ1158 regardless of the vehicle volumes. Turning roadway kerb does not require lighting, as it is not considered "raised channelisation" for road lighting design.

Where intersection channelisation is in the form of painted islands or medians, lighting may not be required if retroreflectorised signage and pavement markers are installed and deemed adequate for delineation of the intersection. However, a further determination should be made with reference to the "Special Cases" sub-section as to the appropriateness of lighting.

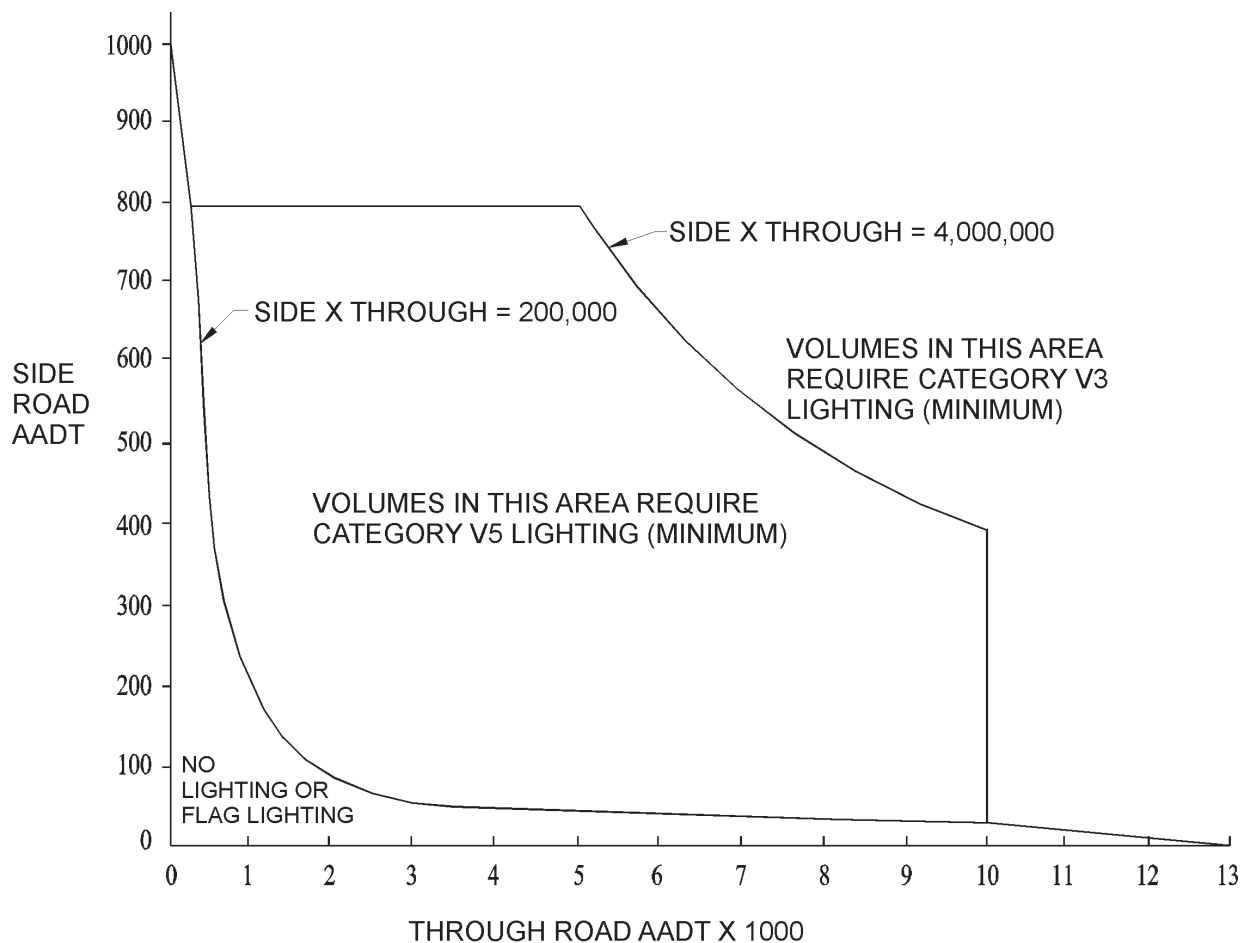


Figure 17.1 Warrants for Consideration of Road Lighting

Intersection Design Area

If Category V lighting is deemed necessary at an intersection because of the traffic volumes, or for any special road safety concerns, then the minimum design area shall comprise the surface of the carriageway extending at least 10m beyond the prolongation of the kerb lines of the intersecting roads. This shall be further extended to include raised islands and medians, changes in road alignment and locations of potential traffic conflict in or near the intersection.

In addition to this minimum design area, an additional 2 spans of lighting shall be provided on the main through road approaches in accordance with AS/NZS1158.1.1 Clause 3.4.3.5.

Note:- The designer should exercise some judgement ascertaining whether this additional lighting is covered under the extent of the intersection conflict points or changes in carriageway width to avoid unnecessary costs in over extending the design limits (refer Figure 17.2).

Where the intersecting roads have comparable traffic volumes then the additional 2 spans of lighting as detailed above shall be provided on each approach.

To aid in the identification of the intersection for motorists approaching from a side road ensure that one luminaire is located in each side road approach (refer Figure 17.2).

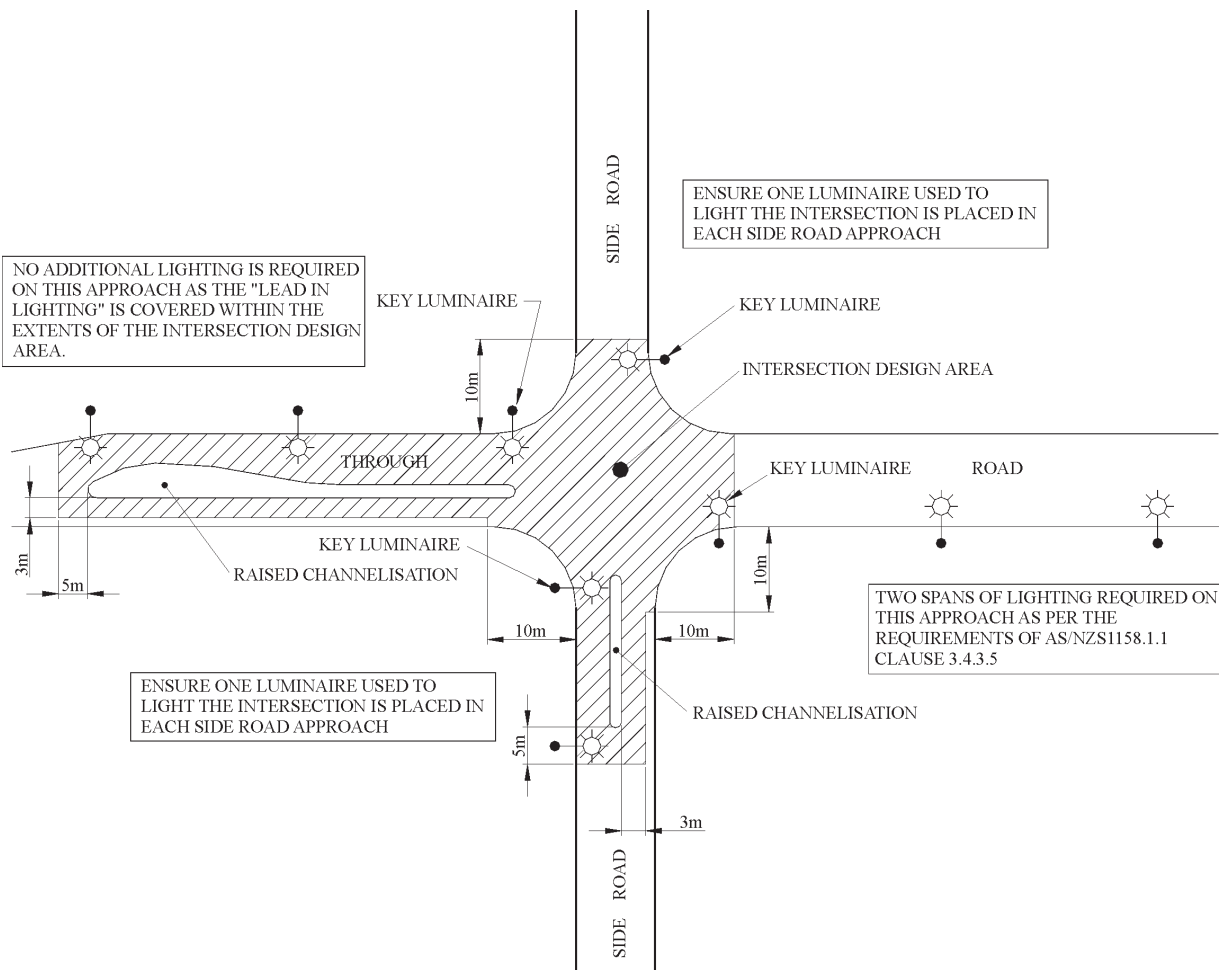


Figure 17.2 Extent of Lighting at an Intersection

Where painted channelisation is present, the use of retroreflectorised raised pavement markers in accordance with the Manual of Uniform Traffic Control Devices” (MUTCD) section 4.6 is highly recommended to define the extent of the intersection.

Special Cases

Provision of lighting under special cases is subject to the approval of the District Director.

For traffic volumes less than those requiring lighting according to Figure 17.1, or at intersections without raised channelisation, other conditions that may require consideration for the provision of intersection lighting include:

- (a) Restricted Visibility where traffic facilities are not visible at night over an approach distance of:
 - 120m in a 60km/h zone, or
 - 200m in a 100km/h zone.
- (b) Adverse conditions such as:
 - road location and geometry;
 - background lighting (including offset of opposing headlights);
 - weather conditions (such as frequent fog);
 - separate needs of pedestrians indicates the existence of a special road safety risk; or

- High night to day accident ratio (eg. Ratio > 1.3:1).
- (c) Painted channelisation or auxiliary passing lanes in cases such as:
- predominant heavy right turn volumes,
 - predominant movements of heavy vehicles, or
 - tourist areas where drivers are not familiar with local conditions.

(d) Flag Lighting

In practice there will be locations that will require lighting for indication purposes only or to highlight isolated localised conflicts even though the requirements of the above mentioned warrants are not met. Such lighting is known as “flag” lighting. These locations may require special treatment that is not strictly in accordance with the lighting objectives of AS/NZ1158. However, where the above mentioned warrants exist, full road lighting shall be provided.

Any “flag” lighting used must not constitute a safety hazard. Only dished prismatic bowl type luminaires are to be used where flag

lighting is installed, as there will only be one or two luminaires around the immediate vicinity of the intersection. These are used to draw the attention of the motorists to the presence of an intersection from a sufficient distance away. (e.g. Figure 17.3)

A maximum 150W luminaire should be used at a mounting height of 10.5m.

Examples of some special locations that may require consideration are as follows:

- Isolated intersections in fog prone areas. These locations may require one or two luminaires so that on foggy nights the turn-off can be readily identified.
- Train Crossings where there is regular shunting or the crossing is frequently blocked at night. These sites may require one luminaire situated on either side of the road in appropriate locations to provide lighting in accordance with AS/NZ1158 only on the actual rail crossing conflict. For example on a 9m carriageway a luminaire located 20m from the track on either side as shown in Figure 17.4 will provide approximately V5 coverage on the crossing conflict.
- Painted channelised intersections not provided with code lighting.

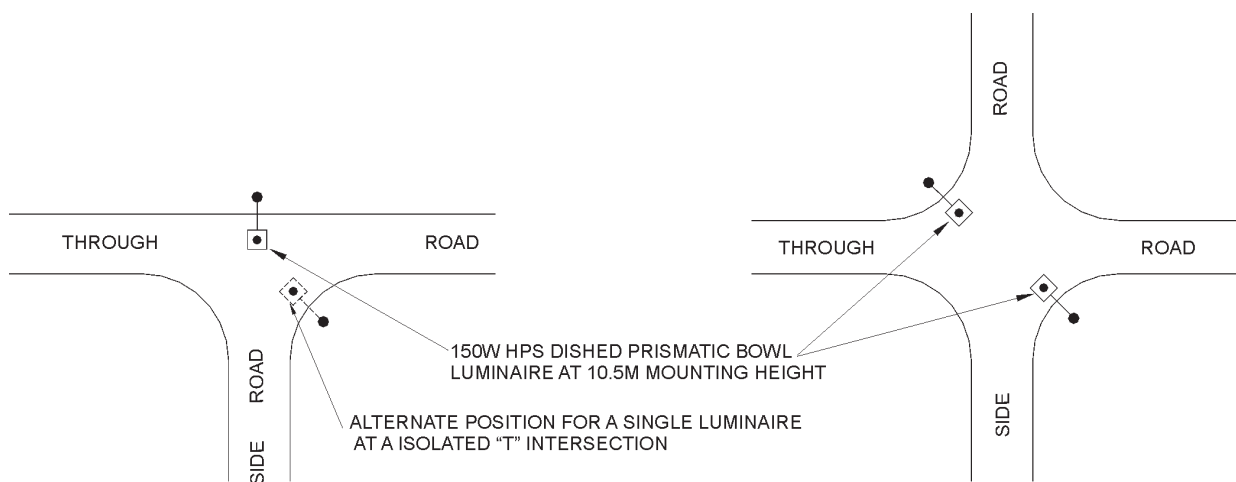


Figure 17.3 Flag Lighting at Isolated Intersections

- Luminaires shall be located and their light directed so as not to interfere with, or obscure visibility of either road or railway devices.

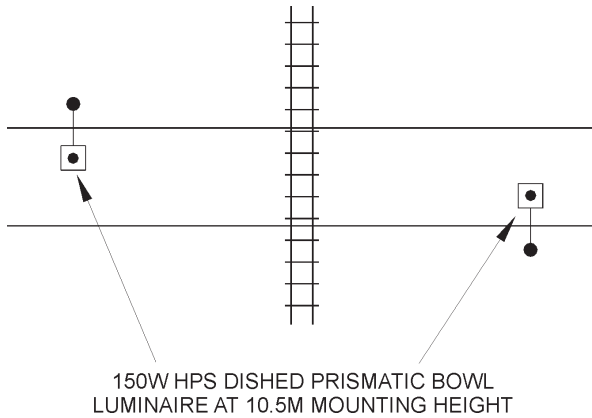


Figure 17.4 Flag Lighting at Train Crossing

Signalised Intersections and Signalised Mid Block Pedestrian Crossings

At locations involving the upgrading or installation of traffic signals, intersection lighting to Category 'V' standard should be provided regardless of the road lighting categories or traffic volumes of the intersecting roads.

Roundabouts

As for signalised intersections, Category 'V' lighting should be provided on roundabouts regardless of the road lighting categories or traffic volumes of the intersecting roads.

Motorways and Interchanges

This sub-section applies to all declared motorways and all divided highways for through traffic that have no access for traffic between interchanges and that have grade separation at all intersections.

Generally, route lighting is not provided on urban or rural motorways. However, in urban areas where background lighting levels and night-time vehicle volumes are high route lighting is common practice.

The provision of route lighting on all motorway facilities can reduce night accidents by improving traffic operations in congested conditions, where position relative to traffic lanes and adjacent vehicles is important. Reduce glare from vehicle headlights and can also be of significant benefit during emergencies, particularly where there may be pedestrian/emergency services activity on the carriageway:

The provision of isolated lighting at interchanges may be justified at lower volumes than continuous motorway lighting. This may be a staged development of future continuous motorway lighting aimed at improving the level of safety and traffic service in the following situations (listed in order of precedence):

- (i) Ramp intersections, including the service road between these intersections where closely spaced lamps are involved.
- (ii) At ramp exits, including gore areas.
- (iii) At ramp entries, including gore areas.
- (iv) Along ramps, particularly where substandard alignment is involved.
- (v) At merge, diverge and weaving areas on the motorway.

Motorways in Urban Areas

The following guidelines are suggested in respect to the provision of lighting on urban motorways.

- (a) Continuous full motorway lighting is warranted where one or more of the following conditions exist:
 - (i) The current AADT is 40,000 vpd or greater.
 - (ii) On all unlit sections less than 2km long between sections of complete lighting.

- (iii) If road design standards are significantly less than normal (particularly those related alignment, sight distance, cross-section and clear zone).
 - (iv) If a significant night-time accident record is likely to be corrected by lighting.
 - (v) If adjacent roads are provided with Category V lighting or where the background illumination in the vicinity of the motorway is likely to affect the visibility of motorists if lighting is not provided.
- (b) Full lighting of interchanges (i.e. lighting of ramps, intersections, crossroads and main carriageways though the interchange only) is warranted where one or more of the following conditions exist:
- (i) If the total AADT (existing or estimated) on the ramps is greater than 10,000 vpd. (i.e. the sum of the volumes entering and leaving the motorway at the interchange).
 - (ii) If connecting roads are provided with Category V lighting, which might adversely affect the visibility of drivers using the interchange.
 - (iii) If warrants for continuous lighting are satisfied.
- (c) Partial lighting of interchanges (i.e. lighting of the entry and exit gore areas plus ramps, intersections and crossroads) is warranted where one or more of the following conditions exist:
- (i) If the current AADT on the motorway is greater than 25,000 vpd.
 - (ii) If the total AADT on the ramps is greater than 5,000 vpd. (i.e. the sum of the volumes entering and leaving the motorway at the interchange).
- (iii) If the road design standards are significantly below those of the approaches.
- (iv) If a significant night-time accident record exists, which is likely to be corrected by lighting.
- (v) If connecting roads are provided with Category V lighting, which might adversely affect the visibility of drivers using the interchange.
- (d) The lighting of the ramp crossroad intersections and the crossroad between them is warranted when one or more of the following conditions exist:
- (i) If continuous motorway or complicated interchange lighting is provided.
 - (ii) If the crossroad approaches are lit.
 - (iii) If the crossroad is divided between the ramp intersections, or if there are raised islands at the ramp intersections.
 - (iv) If the volume on the crossroad though the intersection is 3,600 vpd or greater.
- (e) The lighting of crossroads, without connections to motorways, is warranted if the crossroad approaches are lit, or if there is a possibility of glare or distraction from the motorway lighting.

Motorways in Rural Areas

In general, rural motorways need not be provided with route lighting. However at interchanges, as a minimum, the entry and exit gore areas should be lit (refer to Figures 17.5 and 17.6).

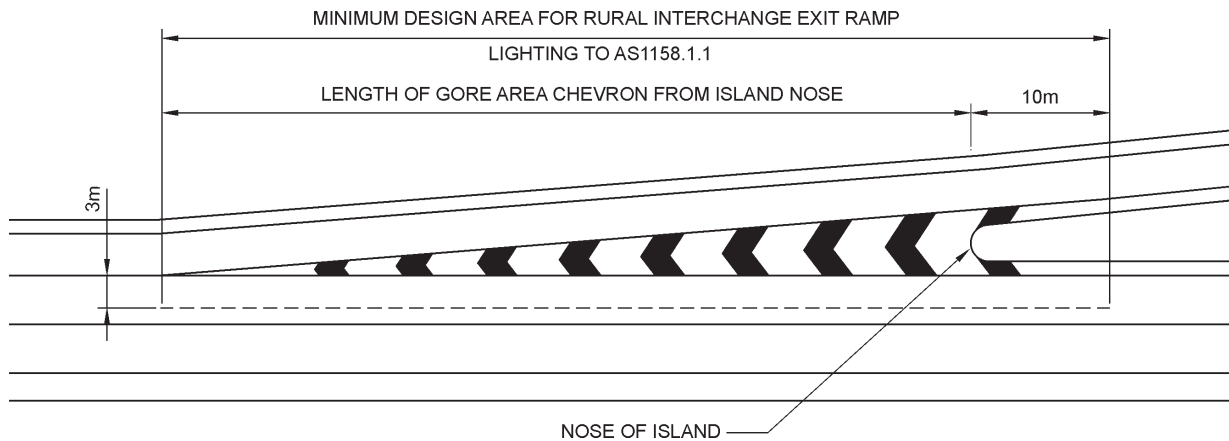


Figure 17.5 Extent of lighting for exit ramps for rural motorways

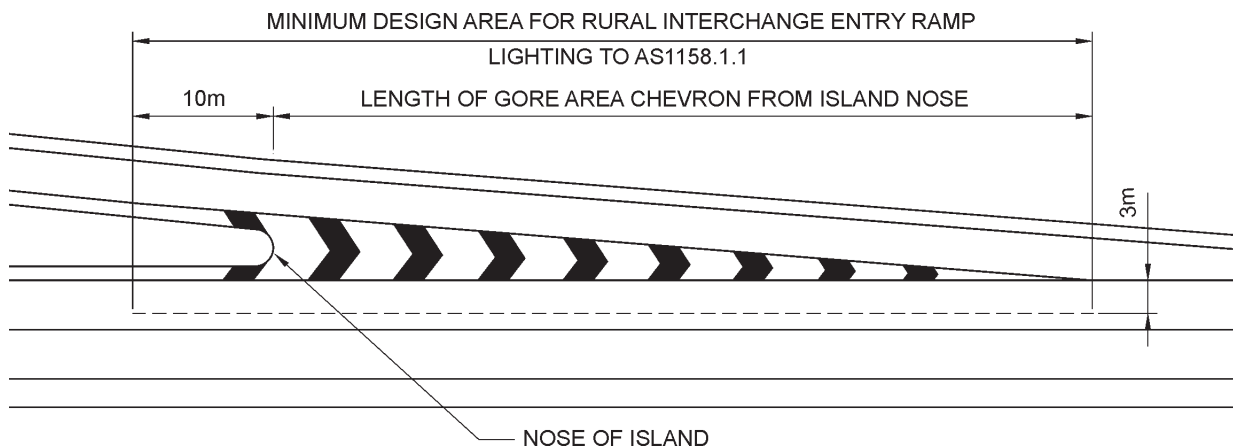


Figure 17.6 Extent of Lighting for Entry Ramps for Rural Motorways

Provision of additional lighting for rural motorways may be warranted in one or more of the following situations:

- (a) Where there are unusual conditions such as a location with a high night-time accident rate likely to be corrected by lighting.
- (b) A high volume interchange exists with reduced geometric standards.
- (c) At a location where the background of illumination in the vicinity of the motorway is likely to adversely affect the visibility of motorists if lighting is not provided.

17.5.3 Route Lighting

General Provision

Lighting may be provided in areas where:

- (a) The traffic volume (AADT) is approaching or exceeds 10,000 vpd; and/or
- (b) the District Director considers that the road is associated with a special road safety risk that warrants route lighting; and/or
- (c) Main Roads and local government have indicated their willingness to participate in cost sharing arrangements as detailed

in the agreement between the Local Government Association of Queensland and Main Roads "Cost Sharing Based on Responsibilities within State Controlled Roads".

17.5.4 Supplementary Lighting at Pedestrian Crossings

General Provision

Lighting may be provided in areas where the traffic volume (AADT) exceeds 1,000 vpd. Where lighting is provided, it shall be designed in accordance with AS1158.4, with the following amendment to the requirements for supplementary carriageway lighting.

- Lighting to at least Category V5 shall exist or be provided on the carriageway in line with the following:
 - i. Where the posted speed is 60 km/h and up to and including 70 km/h – 1 span either side of the crossing.
 - ii. Where the posted speed is greater than 70km/h – 2 spans either side of the crossing.

Special Cases

Provision of lighting under special cases is subject to the approval of the District Director.

For volumes of less than 1,000 vpd, other conditions that may suggest supplementary lighting at pedestrian crossings include the following:

- road location geometry;
- background lighting (including offsets of opposing headlights);
- weather conditions (such as fog);
- separate needs of pedestrians indicate the existence of a special risk; or
- accident history.

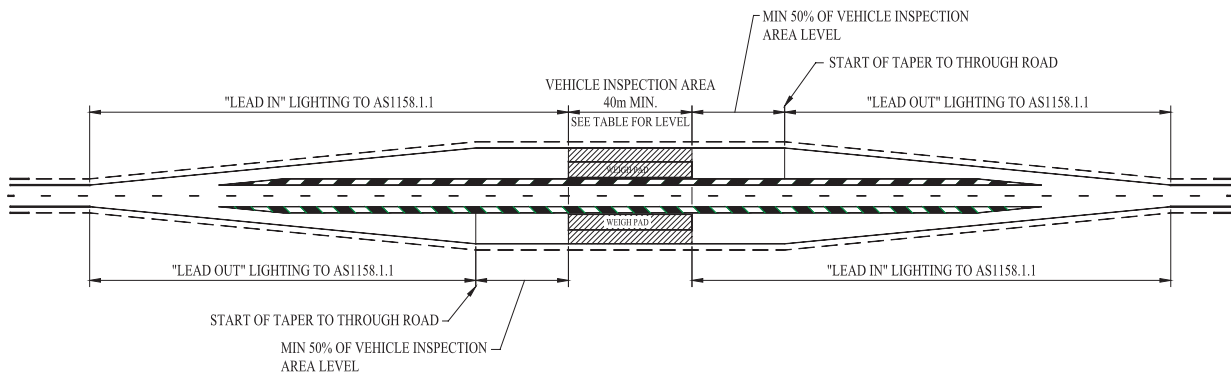
17.5.5 Vehicle Inspection Sites

Where an Inspection Site is to be lit, the lighting shall be provided as per the following requirements and Figure 17.7.

The Vehicle Inspection Area shall be floodlit with Metal Halide Lamps. Floodlights shall have a maximum mounting height of 15m and the lamp wattage shall not exceed 1000W. Aiming of the floodlight shall be directly across the Vehicle Inspection Area and a minimum 30 degree lateral cut-off shield shall be fitted to the floodlight to minimise glare to through traffic. Where the Inspection Site is located remote to the through road the provision of floodlighting from both sides of the Vehicle Inspection Area is recommended.

The "lead in" and "lead out" lighting shall be provided in accordance with AS1158.1.1. The through road shall determine the category of lighting required.

Power to the site shall be via a metered supply. Refer to the Local Electricity Authority for the type of meter and access requirements. Where an Inspection Site building exists, it is recommended that a circuit breaker switch be provided in the building for operation of the luminaries, otherwise a keyed switch should be located in the switchboard.



LIGHTING LEVEL REQUIREMENTS FOR INSPECTION SITES

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Vehicle Inspection Area Lighting Levels		
Through Road	Average Illuminance at ground level	Maximum Illuminance Uniformity E_{max}/E_{min}
Route Lighting exists	70 lux	8
Route Lighting does not exist	30 lux	

Figure 17.7 Vehicle Inspection Site Requirements

17.5.6 Lighting in the Vicinity of Aerodromes

Where road lighting is to be installed within 6km of an aerodrome, the lighting design should be submitted to the relevant aerodrome authority to ensure that all Civil Aviation Authority requirements are adhered to. Reference should be made to regulation 94 of Civil Aviation Regulation 1988 for guidance in relation to lighting in the vicinity of aerodromes - airports.

Where a design falls within this 6km radius, it is recommended that aeroscreen luminaires be used. Height restriction limits may exist where lighting is installed in the vicinity of the runway approaches.

17.6 Requirements for Rate 1 and 2 Public Lighting

Refer QTSC Group - Standard Conditions for the Provision of Public Lighting Services. For Rate 2 road lighting designs carried out in Energex's area refer to Appendix 17E for the design process to be followed.

17.7 Requirements for Main Roads Rate 3 Public Lighting

17.7.1 General

Main Roads is responsible for the provision of road lighting on declared roads in Queensland. Rate 3 public lighting may only be installed on roads or other public thoroughfares with the written approval of Main Roads. Under this rate, the complete public lighting installation is supplied, installed, owned and maintained by Main Roads.

17.7.2 Design

General

Lighting designs must conform to AS/NZ1158 as a minimum standard. The design of public lighting is divided into two distinct categories, as follows:

- Lighting layout design; and
- Electrical layout design.

A Registered Professional Engineer of Queensland (RPEQ) with the appropriate qualifications must undertake certification of the lighting layout design and electrical layout design.

Lighting Layout Design

The lighting layout design must comply with AS/NZ1158 and Main Roads' policies and standards. Refer to Appendix 17A for the documentation requirements and *Interim Chapter 10 of the Drafting and Design Presentation Standards* for the presentation requirements of lighting layout designs.

Electrical Layout Design

The electrical layout design must fully comply

with the requirements of the SAA Wiring Rules, Main Roads' policies and standards and any dispensations by the Regulator (refer Section 17.7.5). Refer to Appendix 17A for the documentation requirements and *Interim Chapter 10 of the Drafting and Design Presentation Standards* for the presentation requirements of electrical layout designs

Note:- Presently start and run currents vary for Rate 3 and Rate 2 luminaires of a similar wattage.

Since Main Roads uses power factor corrected luminaires, the length of circuit runs generally can be considerably more than for non-power factor corrected luminaires. Special consideration needs to be given to fault loop impedance requirements detailed in the Wiring Rules to ensure correct operation of protective devices in providing protection against indirect contact should a fault occur. Refer to Section 17.7.3 (Electrical Cable) for standard cable sizes to be used for Main Roads lighting.

The electrical layout designer shall obtain the "point of supply" from the Electricity Supply Corporation. Once the electrical design is completed, the designer shall submit a set of fully detailed drawings and voltage drop calculations to the Electricity Supply Corporation for approval under the terms of the Electricity Act. A written record of this transaction shall be provided to Main Roads before the commencement of any installation works.

Lighting Design Compliance

In accordance with the requirements of AS/NZ1158 Part 1.1, a certificate of compliance shall be provided with each lighting design. Refer to the Appendix 17B for the certificate proforma.

The above mentioned standard requires that the lighting installation complies with minimal initial and maintained values of average

carriageway luminance and illuminance. This requires the introduction of a maintenance factor, which is the lamp maintenance factor (Table 14.3 of AS/NZ1158 Part 1.3), multiplied by the lamp lumen depreciation factor. The lamp lumen depreciation factor is available from the manufacturer.

Appendix 17A and 17B detail the documentation requirements and *Interim Chapter 10 of the Drafting and Design Presentation Standards* detail the presentation requirements of the design. All designs must be in accordance with these requirements.

17.7.3 Equipment

General

Only equipment complying with current Main Roads specifications at the design date, where the design date is no more than two years prior to construction, is to be used.

For specifications for road lighting equipment refer to Main Roads Standard Specifications - Roads.

Aeroscreen Luminaires

Aeroscreen luminaires should only be used in a lighting design where:

- an increase in luminaire glare may result in loss of visual performance for motorists or pedestrians; or
- where a reduction in stray light is deemed appropriate.

Typical examples of appropriate use of aeroscreen luminaires are as follows:

- (a) To satisfy the requirements of the Civil Aviation Authority, in areas surrounding aerodromes - airports. (Refer to Section 17.5.6)
- (b) To reduce spill light onto properties abutting roads that require Category

V lighting (e.g. residential properties adjacent to motorways).

- (c) To reduce glare at locations where the background is intrinsically dark (e.g. isolated intersections, small radius crest vertical curves, bridges, and overpasses).

Alterations to Existing Luminaires

It is not generally the policy of Main Roads to fix internal or external shields to road lighting luminaires, or to retrofit existing dish prismatic bowl type luminaires with aeroscreen luminaires.

The fitting of shields or aeroscreen luminaires may interfere with the light distribution such that compliance with AS/NZ1158 may be compromised. Where a shield is to be fitted, a suitably qualified designer shall carry out the design of the shield.

Removal of Existing Luminaires

Approval is required from Main Roads where the removal of existing luminaires may impact on the traffic operations (e.g. where an existing road is being modified and the luminaire is marked for removal but in its present location it is providing temporary lighting for traffic movements while construction takes place).

If a luminaire is removed then a record of the date it is de-energised needs to be detailed in writing and provided to Main Roads and the Local Electricity Authority. This information is important to maintain accurate network data and ensure correct billing takes place. *Interim Chapter 10 of the Drafting and Design Presentation Standards* provides a table, which should be used to detail any removal of road lighting equipment.

Combination Traffic Signal Mast Arms and Joint Use Road Lighting Poles

Wherever possible, when lighting

intersections and junctions at which traffic signals are to be installed, combination traffic signal mast arms and joint use road lighting poles should be used. This reduces the amount of roadside furniture around the intersection or junction.

Road Lighting Poles

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Only road lighting equipment may be installed/attached to Rate 3 poles. No signs, banners or decorations are permitted to be either temporarily or permanently installed/attached to these poles.

Solar lighting

Where there is no economical access to the local power grid, solar lighting may be an acceptable alternative to traditional lighting. Solar lighting is generally available using two lamp types:

- Low pressure sodium (SOX) lamps, and
- Fluorescent lamps.

Given the right road geometry, it may be possible to achieve Category V5 road lighting levels. Solar lighting could also be used in:

- isolated car parks;
- isolated rest areas;
- amenities blocks; and
- “flag” lighting

Electrical Cable

Standard cable sizes for Main Roads lighting supply circuits shall be 25mm², 16mm², 10mm², 6mm² and 4mm². Where 25mm² cable is used, it may be stepped down to 16mm² but no further. Where 16mm² to 4mm² is used, then the supply circuit shall have a cable of continuous size for the length of the circuit including any tee-offs. Cable sizes

from a junction box to a lighting pole shall be as stated on the standard drawings.

Future additional lighting works shall be taken into account when selecting the size of the supply cable.

17.7.4 Road Lighting Pole Placement Guidelines

General

For guidelines for the use and placement of rigid and frangible road lighting poles refer to AS/NZS 1158.1.3 Appendix B.

Urban Areas

In addition to the guidelines set out in AS/NZS 1158.1.3 for lighting in urban areas, road lighting poles should be located on an alignment with property boundary junctions wherever possible. At the same time, designers should ensure compliance with AS/NZS 1158.

Joint Use Road Lighting Poles

Where joint use poles are located in medians, they are to be located at least 1m from the median nose.

Joint use poles should not be located in medians less than 2m wide.

Lighting on or in the Vicinity of Bridges

Where a bridge crosses a road to be lit, the bridge should be flagged as a major point for consideration early in the design process. Wherever possible, the luminaries should be located so the bridge position is mid span between two luminaries. This reduces the amount of shadowing under the bridge and helps reduce glare to over bridge traffic. If a luminaire must be placed close to a bridge, then it is recommended that it be placed a minimum distance of 15m from the bridge and an aeroscreen luminaire installed.

If poles must be placed on a bridge, due its length, or to maintain a lighting layout, then it is **imperative** that the bridge designer is made aware of this requirement early in the design process. Only though consultation with the bridge designer can an accurate determination be made on the location of the road lighting poles. Also, at this time of consultation the requirements for conduits and cable access at the pole shall be stipulated. Details of the conduit and cable access junction box shall be shown on the bridge drawings.

Underpasses and Tunnels

For underpasses less than 25m in length, luminaires need not be installed within the underpass if it can be demonstrated that the required lighting performance can be attained using luminaires located outside the underpass. When locating luminaires, consideration should be given to the possible adverse effects to users of any transport system above the underpass.

Where the underpass cannot be effectively lit from luminaires located on the outside, supplementary luminaires should be installed within the underpass. These luminaires should be of an aeroscreen type. The location of and clearance to any horizontal and vertical outreaches or conduits, which need to be mounted under the bridge, shall be checked with the bridge designer. The lighting design should be illuminance based and should satisfy the requirements for intersections and other specified locations in Section 2 of AS/NZS 1158.1.1. An important consideration for the lighting design of the underpass/bridge is to ensure that installation of lighting does not compromise minimum clearances, and these should be checked in consultation with the road/bridge designers.

In the absence of an Australian Standard for underpass and tunnel lighting, refer to CIE Publication No.88 "Guide for the Lighting

of Road Tunnels and Underpasses" for underpasses over 25m long and tunnels.

Semi-Rigid and Flexible Roadside Barriers

Poles located behind roadside barriers should be "fixed based" and must be located at the correct offset from the barrier. The use of frangible poles is not recommended, as the correct operation of the pole cannot be guaranteed if impacted.

As a general rule, if poles are required closer than 1.2m to the front of a semi-rigid barrier (e.g. W-beam, Thie-beam) or 2m to a flexible barrier (e.g. wire rope), the pole position shall be confirmed with the road designer to ensure that the pole is not located in the deflection zone of the barrier. Also, poles are not to be located within the runout length of barriers, the pole position shall be confirmed with the road designer.

Clearances from Overhead Lines

General

Care should be taken with the placement of poles in the vicinity of overhead lines. Allowances should be made for design, constructional, dynamic and maintenance clearances as appropriate. The local Electricity Supply Corporation should be consulted before installation with respect to agreed clearances having regard to applicable legislation and practical application.

Design Clearances

These should be calculated taking into account:

- the most adverse position to which a conductor may swing under the influence of wind;
- the worst position a conductor may assume by sag under the influence of

load current;

- the maximum design deflection of the lighting structure under the influence of wind; and
- the movement of impacted frangible poles.

Clearances “VC and HC” in Figure 17.8 between poles and overhead lines shall comply with Queensland Department of Main Roads Standard Drawing No.1333 “Minimum Clearance of Overhead Electric Lines from Ground and Structures”. In all cases, clearances apply to both rigid and frangible poles. However, in general, dynamic clearances will be the determining factor for frangible poles. For the purposes of calculating vertical clearances, the distance should be taken as the vertical distance between the conductor and the horizontal projection of the highest point on the lighting structure (Refer Figure 17.8).

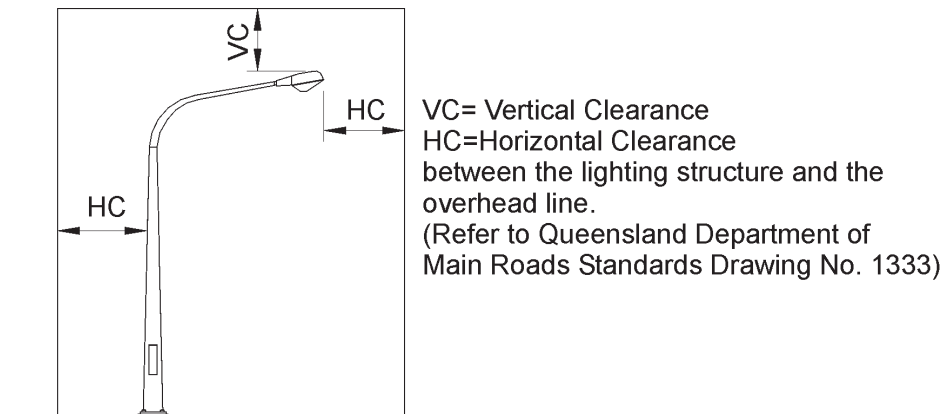


Figure 17.8 Design Clearances

Constructional Clearances

Where it is necessary to install a pole near an overhead line, the required statutory construction clearances prior to design should be obtained from arrangement with the local Electricity Supply Corporation if the lines can be de-energised or shouuded.

Dynamic Clearances

Dynamic clearances should be used for frangible poles (Slip Base Poles currently used by the Department) to minimise the likelihood of any gyrating lighting structure (resulting from vehicle impact) striking the conductors of a nearby overhead line.

The recommended clearances are illustrated in Figure 17.9.

The recommended minimum horizontal clearance of a slip base pole from an overhead line is $0.6H$, where H is the mounting height of the luminaire. However, if the overhead line traverses the direction of traffic flow, the clearance for slip base poles should be increased to $1.2H$. This situation occurs when an overhead line crosses the carriageway, or at an intersection (refer Figure 17.9).

Maintenance Clearances

Maintenance clearances to overhead lines are required for all pole types in order that the luminaire may be serviced safely.

Details of appropriate clearance should be sought in applicable regulations and by consultation with the local Electricity Supply Corporation.

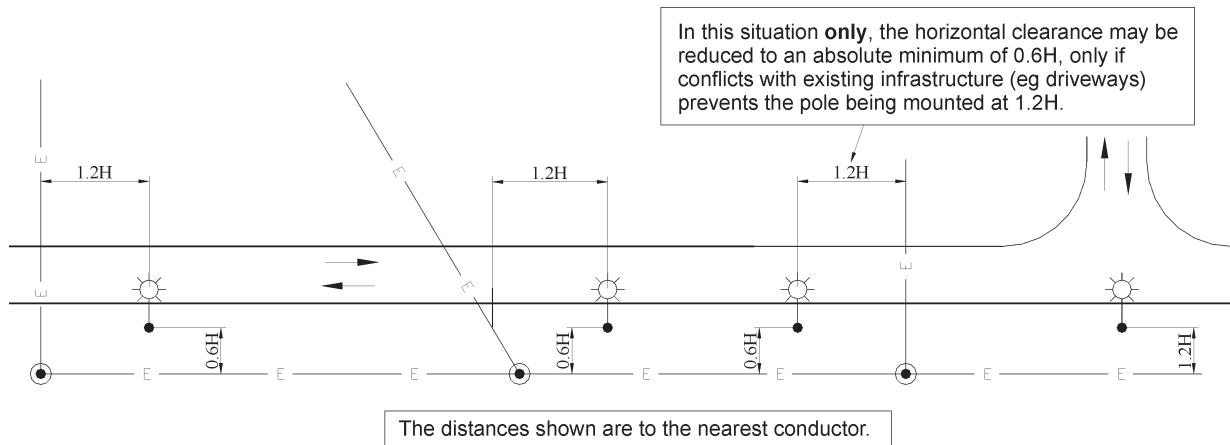


Figure 17.9 Dynamic Clearances

17.7.5 Installation

General

The public lighting installation may be carried out by:

- Main Roads;
- The Electricity Supply Corporation; or
- Approved Contractor.

Installation must be in accordance with Main Roads' policies and standard drawings. Main Roads have been granted approval by the Regulator (their reference 18813 dated 27 February 1997 (latest issue)) to wire in accordance with the requirements of the QTSC. (Refer Standard Drawings Roads).

The Electricity Supply Corporation provides only electrical power to the installation. Rate 3 luminaires or luminaire equipment will not normally be permitted on Electricity Supply Corporation's poles.

The Electricity Supply Corporation will not commission the public lighting installation until all requirements comply with the Electricity Regulations.

Under no circumstances may the electrical contractor connect the new public lighting installation to the Electricity Supply Corporation's point of supply. The connection will be carried out by the Electricity Supply Corporation's personnel or authorized contractor after inspection at the time of commissioning.

Once commissioned no electrical alterations can be made to a Rate 3 public lighting installation without the written approval of the Electricity Supply Corporation.

Pole Identification

All Main Roads Rate 3 public lighting installations must be marked with the numeral 3 attached to the roadside of the pole or structure, refer Figure 17.10. Main Roads is responsible for ensuring that the Rate 3 identification label is always clearly visible. Where individual pole numbers are required they are to be located below the Rate 3 identification label, refer Figure 17.10.

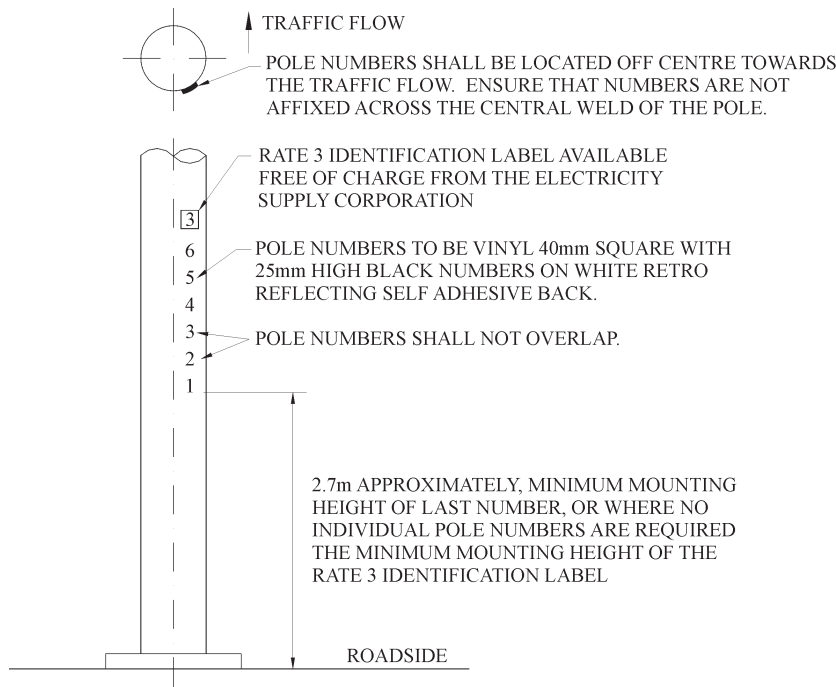


Figure 17.10 Pole Identification Requirements

17.7.6 Wiring Details

Wiring details for the supply of Rate 3 public lighting installations are to be in accordance with Appendix 17D.

17.7.7 Switching Arrangements for Luminaire Control

The current public lighting tariff structure is based upon an average of 4,200 night time hours of luminaire operation controlled either by a P.E cell and/or control device. Rate 3 lighting tariff will only be provided for public lighting installations that comply with the above requirement.

Designers should ensure that the Rate 3 public lighting design includes P.E. cell(s) capable of switching the connected electrical load unless a switched supply is provided by the Electricity Supply Corporation.

Where P.E. cells are included (NEMA base), each cell should have a switch “on” level of

30 lux \pm 25%, and a switch “off” level of not more than 30 lux.

17.7.8 Conduit Alignment

Generally, the standard alignment for Rate 3 lighting is from pole to pole using a 80mm heavy duty conduit. As Rate 2 standards may vary across the State, the Local Electricity Authority should be contacted for their requirements.

17.8 Landscaping

Where landscaping is to be installed in the vicinity of a road lighting pole, adequate clearance must be maintained around the pole to allow maintenance access.

The location and height of plants must not interfere with the overhead lighting or wires, cast undesirable shadows on the road formation or cause non-uniform illumination of the roadway during day or night-time.

18 References

Queensland Main Roads: Standard Drawings
- Roads.

Queensland Main Roads: Standard
Specifications - Roads.

AS/NZ1158 - AS/NZS 1158. - Road Lighting

Austrroads – Guide to Traffic engineering
Practice, Part 12 – Roadway Lighting

SAA Wiring Rules - AS 3000.

Queensland Transmission and Supply
Corporation (QTSC): “QTSC Group -
Standard Conditions for the Provision of
Public Lighting Services”.

Queensland Main Roads: Drafting and
Design Presentation Standards.

Appendix 17A: Road Lighting Documentation

17A.1 General

Parties other than the Department of Main Roads may carry out Road lighting and/or electrical layout designs. These include the following:

- Electricity Supply Corporations:
- Public Bodies: or
- Consultants.

All lighting and electrical designs are to be certified by an appropriately qualified Registered Professional Engineer of Queensland (RPEQ).

Public Lighting Tariff Rate 1 and 2

Where Rate 1 and 2 road lighting and/or electrical layout designs are carried out, the design standards and documentation shall be as required in the following documents:

- AS/NZ1158
- QTSC “Standard Conditions for the Provision of Public Lighting Services”; and
- any specific Electricity Supply Corporation requirements.

The design documentation shall be for each road lighting project from the nominated point of supply.

Public Lighting Tariff Rate 3

Where Rate 3 road lighting and/or electrical layout designs are carried out, the design standards and documentation shall be as required in the following documents and as detailed in Section 17.7 of the Chapter

- AS/NZS 1158 “Road Lighting”.

- AS 3000 “SAA Wiring Rules”.
- Queensland Main Roads, Standard Specifications Roads;
- Queensland Main Roads, Standard Drawings Roads.
- Department of Main Roads Standing Offer Arrangement No. 19 “Road Lighting Poles and Outreach Arms”; and
- Department of Main Roads Standing Offer Arrangement No. 25 “Road Lighting Luminaires”.

The design documentation shall be for each road lighting project from the nominated point of supply.

17A.2 Lighting Design Documentation Rate 3

The required documentation to be submitted for Rate 3 lighting designs is detailed in Table 17A.1, or as specified by the Principal.

All documentation is to include the Job Number and District details of the particular design.

Table 17A.1 – Details of design documents to be submitted for Rate 3 lighting.

Submitted Documents	Requirements to be Included in Submitted Documents
Voltage Drop Calculations	<ul style="list-style-type: none"> • In accordance with AS3000 • lamps to be power factor corrected • Run current of lamp to be used
Fault Loop Impedance Calculations	<ul style="list-style-type: none"> • In accordance with AS3000
Estimate	<ul style="list-style-type: none"> • Use Main Roads program ESTIMATE, or as directed by the Principal • In accordance with Department of Main Roads Specifications
Certificate of Compliance	<ul style="list-style-type: none"> • In accordance with AS/NZS 1158.1.1, Appendix C, See Appendix 17B for certificate proforma.
Road lighting layout & electrical design plans	<ul style="list-style-type: none"> • Refer to Interim Chapter 10 of the Drafting and Design Presentation Standards
Schedules	<ul style="list-style-type: none"> • Refer to Interim Chapter 10 of the Drafting and Design Presentation Standards
Standard and Supplementary Specifications	As required
Standards Drawings Roads	As required

Appendix 17B: Certificate of Compliance and Design Documentation

B1 ELEMENT DETAILS:

- Intersection Lighting
- Route Lighting
- Roundabout Lighting
- Pedestrian Crossing Lighting

B2 LIGHTING CATEGORY

- Lighting category

B3 INSTALLATION GEOMETRY

- Arrangement
- Mounting Height
- Overhang
- Upcast Angle
- Spacing

B4 LUMINAIRE/LAMP DETAILS:

- Luminaire Identification:
- Lamp Type:
- Design Lamp Lumens:
- I-Table Number:
- Lighting Tariff:

B5 PHOTOMETRIC DATA DETAILS:

- Origin

B6 LIGHT TECHNICAL PARAMETERS:

- Design Method: Computer Based
- Element: Straights and Curves
Description:- As per Table 17B.1.
- Element: Intersection and Junctions
Description:- As per Table 17B.2

Table 17B.1 Template: Light Technical Parameters - Straights and Curves

Light Technical Parameters												
Cat	L(cd/m ²)		U _o		U _L		T ₁ (max)		E _S (l/r)		UWLR	
	Code (maintained)	Design Value	Code	Design Value	Code	Design Value	Code	Design Value	Code	Design Value	Code	Design Value
V3	0.75		0.33		0.5		20		50		6	
	0.83		0.31									

Table 17B.2 Template: Light Technical Parameters - Intersection and Junctions

Light Technical Parameters						
Cat	E min		E _{max} /E _{min}		UWLR	
	Code (maintained)	Design Value	Code	Design Value	Code	Design Value
V3	7.5		8		6	

B7 ROAD SURFACE REFLECTION CHARACTERISTICS DETAILS:

- Road Surface Reflection Characteristics.

B8 COMPUTER PROGRAM DETAILS:

- Name of Program:
- Source of Program:
- Compliance: Complies with the requirements of AS/NZ1158

B9 MAINTENANCE DETAILS:

Maintenance Factor Details:

- Lamp Maintenance Factor: (As shown in Table 14.3 of AS/NZS 1158.1.3, Typical Luminaire Maintenance)
- Lamp Lumen Depreciation Factor: (As supplied by the manufacturer)
- Total Maintenance Factor
- Schedule of Maintenance:
- The road lighting design is based on maintenance strategies detailed in Appendix 17C:

B9.2.1 Bulk lamp replacement

Bulk lamp replacement shall be carried out at ___monthly intervals. At this time the following shall also occur:

- All optical surfaces, both internal and external, of the luminaire shall be cleaned.
- All gaskets shall be checked for deterioration and replaced where necessary.
- Damaged/weathered visors shall be replaced.
- All accessible screws, nuts etc shall be checked for tightness.

- A visual check shall be made of the electrical components and wiring for signs of overheating.
- If required, the luminaire shall be realigned or adjusted to the design specification.

B9.2.2 It is recommended that inspection patrols provide spot lamp replacements such that the maximum level of luminaire outages at any one time is not greater than 5% of the luminaire population e.g. service availability should be at least 95% (in accordance with the requirements of AS/NZS1158.1.3).

B9.2.3 Where luminaires are replaced the new luminaire shall be of an equivalent type such that the integrity of the road lighting design is maintained.

Signed

/ /

Checked

/ /

Appendix 17C: Maintenance Schedule

17C.1 Maintenance of Road Lighting Luminaires

17

Schedule of Maintenance:

The road lighting design is based on the following maintenance strategies:

Bulk lamp replacement

Bulk lamp replacement shall be carried out at a nominated monthly interval. At this time the following shall also occur:

- All optical surfaces, both internal and external, of the luminaire shall be cleaned.
- All gaskets shall be checked for deterioration and replaced where necessary.
- Damaged/weathered visors shall be replaced.
- All accessible screws, nuts etc shall be checked for tightness.
- A visual check shall be made of the electrical components and wiring for signs of overheating.
- If required, the luminaire shall be realigned or adjusted to the design specification.

Spot Lamp Replacement

It is recommended that inspection patrols provide spot lamp replacements such that the maximum level of luminaire outages at any one time is not greater than 5% of the luminaire population e.g. service availability should be at least 95% (in accordance with the requirements of AS/NZS 1158.1.3).

Luminaire Replacement

Where luminaires are replaced, the new luminaire shall be of an equivalent type such that the integrity of the road lighting design is maintained.

17C.2 Maintenance Of Road Lighting Poles

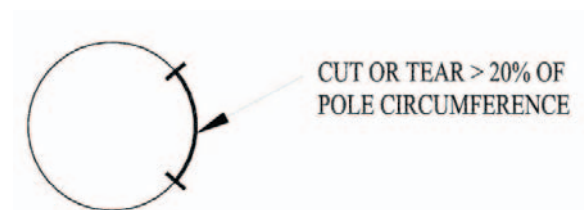
Road lighting poles shall be replaced when the following damage is evident:

Steel Poles

Horizontal Cuts or Tears

If a horizontal cut or tear in the pole exceeds 20% of the pole circumference, as illustrated in Figure 17C.1

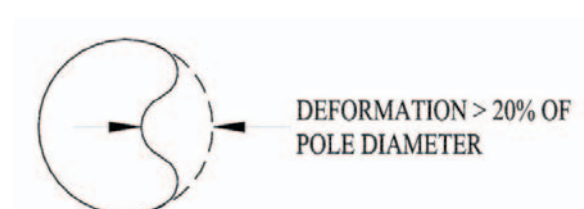
Figure 17C.1 Horizontal cut/tear exceeding 20%



Deformation of Pole

If deformation of the pole due to vehicle impact exceeds 20% of the pole diameter, as illustrated in Figure 17C.2

Figure 17C.2 Deformation of Pole exceeding 20%



Terminal Hatchway Door

If the terminal hatchway door cannot be securely fastened or is damaged to the extent that it cannot be replaced or repaired, even if the pole is not damaged as stated above.

Concrete Poles

Corrosion

Where the concrete has been cracked or damaged to the extent that the reinforcing is subject to corrosion.

Terminal Hatchway Door

If the terminal hatchway door cannot be securely fastened or is damaged to the extent that it cannot be replaced or repaired, even if the pole is not damaged.

Appendix 17D: Wiring Details - Rate 3 Public Lighting Installations

17D.1 General

Rate 3 public lighting is normally supplied from the Electricity Supply Corporation's low voltage underground/overhead distribution system or alternately from the Rate 1 or 2 public lighting system. Supply is taken from these installations via a switchboard.

The location of the switchboard is at the Electricity Supply Corporation's discretion and is at the point of supply. All installation works beyond the point of supply constitute the Rate 3 public lighting installation.

17D.2 Wiring Details

Rate 3 public lighting may be supplied by any of the following methods:

- (1) Overhead cabling. **(NB. Fixed Base Poles Only).**
- (2) Underground cabling via pits. (Preferred option)
- (3) Underground cabling looping in and out of individual poles. **(NB. Fixed Base Poles only, and generally provided in barrier situations Only).**

17D.3 Circuit Protection

Rate 3 public lighting installations are classified as consumers' installations and must comply with the Wiring Rules.

Main Roads employs protection in the poles/pits. Each termination panel at the pole or pit is considered to constitute a switchboard and the looped cabling is a sub-main.

Note: Main Roads have approval from the Regulator, Reference 18813, dated 27 February 1997 (latest issue).

17D.4 Cabling

All cables and conduit shall be installed in accordance with the requirements of the Wiring Rules and Main Roads standard practices.

All work carried out on the Electricity Supply Corporation's assets (poles, pillars and pits) shall be in accordance with the requirements of the Electricity Supply Corporation's Manual or Standard. (NB. No work shall be carried out on the above mentioned assets without first receiving permission from the Electricity Supply Corporation).

Note: The conduit used for Rate 1 and 2 public lighting is a different grade than that required by the Wiring Rules and cannot be used for Rate 3 public lighting.

17D.5 Earthing

Lighting poles installed in ground

Where the Multiple Earthed Neutral (MEN) system is used (i.e. where the pole anchor cage and footing, or a separate earth stake, is used as the earth electrode at each pole) the following applies:

- Earthing of the exposed metalwork of the lighting pole is achieved by bonding the metalwork to the neutral conductor of the two core electrical cable that provides the supply of electricity to the lighting pole. This is as shown on the relevant Standard Drawings and in accordance with AS3000 SAA Wiring Rules.
- Where an earth stake is used, this shall also be bonded to the neutral conductor.

Lighting installations on steel, concrete and wooden bridges

Where lighting poles are installed on bridges and where special outreach arms are fixed to the bridge structure for underbridge lighting and so on, the following applies.

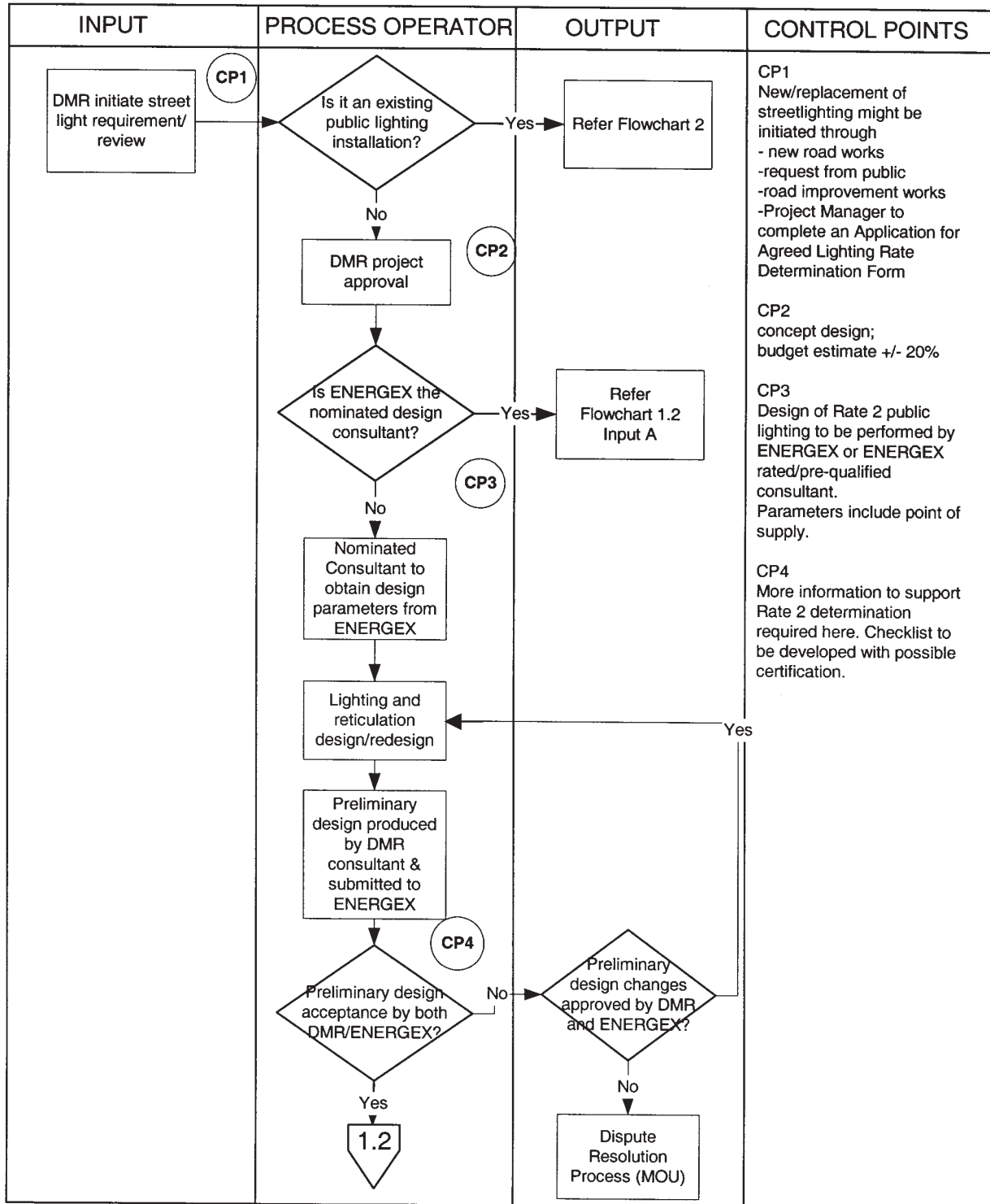
- The metal structure for each pole and outreach arm shall be bonded to a separate earth conductor, the size of which shall be determined from the relevant section of AS3000, installed with the supply cable.
- The supply cable shall be connected to the supply at one point only.
- The earth and neutral shall not be linked on the bridge structure. This is as shown on the relevant Standard Drawings and in accordance with AS3000.

Where a bridge passes over a railway overhead network, the lighting equipment may have to be bonded to Queensland Rail's traction earthing system, which must be segregated from the MEN earthing system. Check with Queensland Rail and the Local Electricity Corporation for details on earthing requirements. Where segregation is needed ensure that the earth cable is not bonded to the neutral conductor.

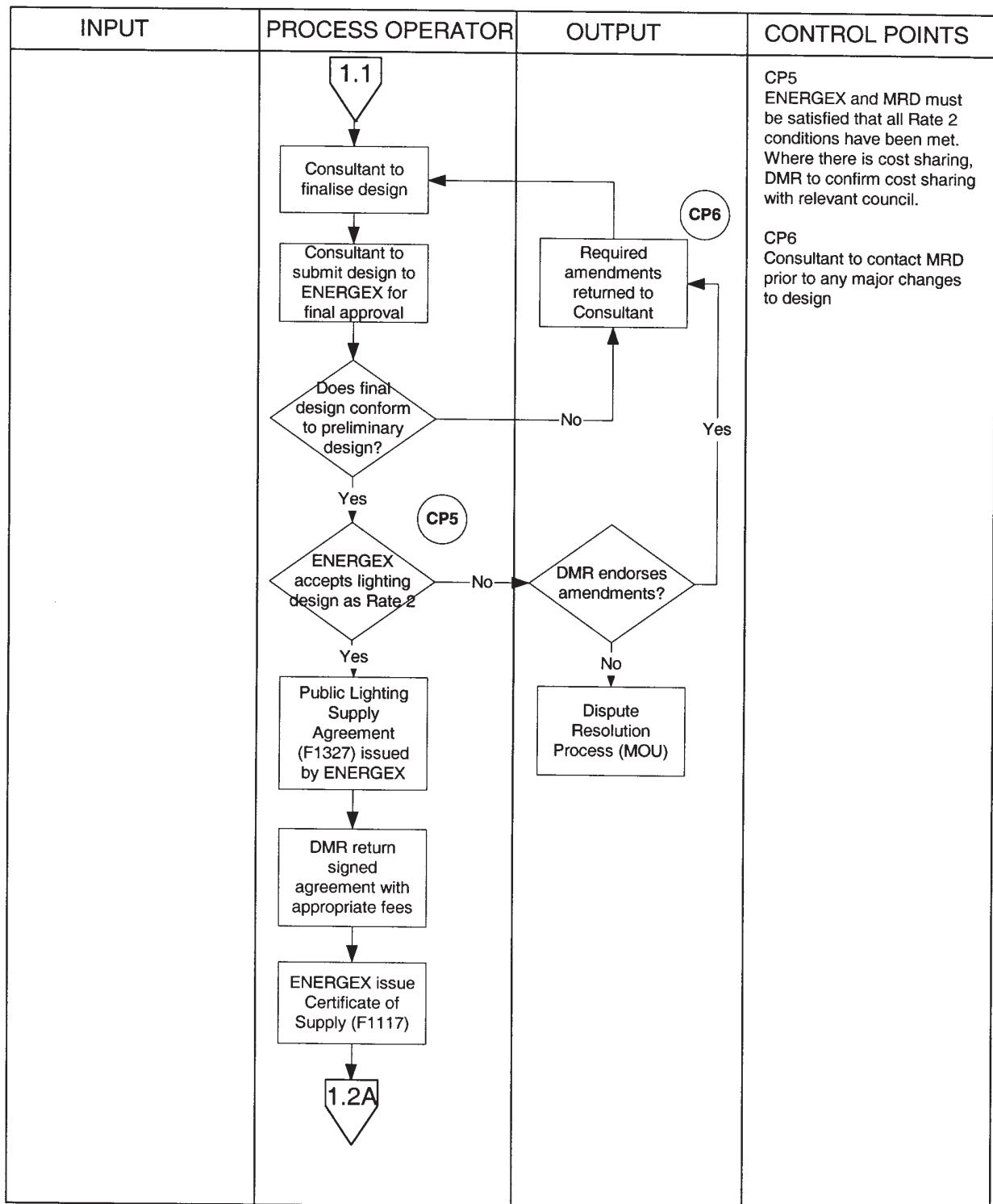
Appendix 17E : Rate 2 design process in Energex's area. Process for DMR Establishing Streetlighting

Flowchart 1.1 – Process for Rate 2 Public Lighting

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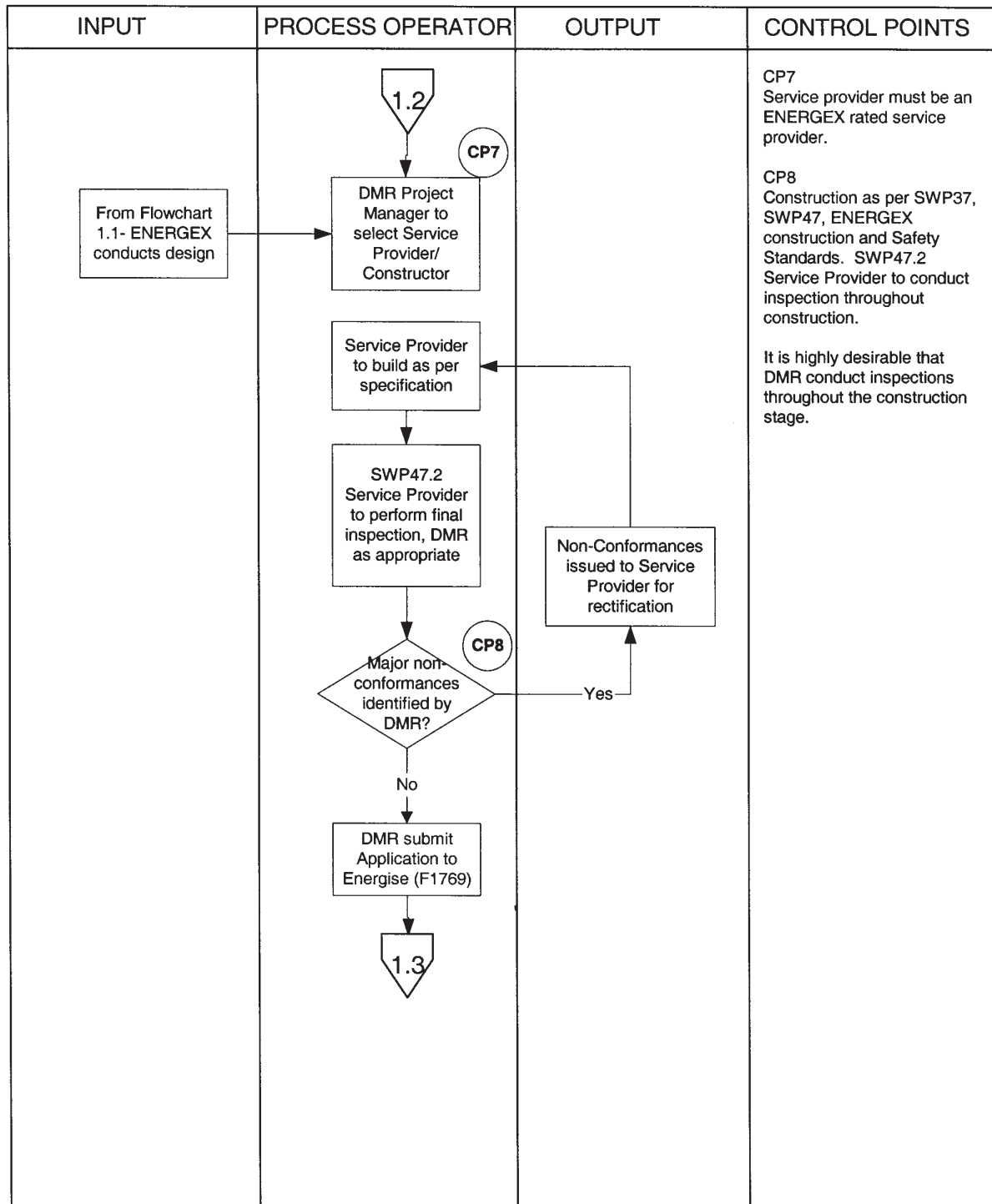


Flowchart 1.2 – Process for Rate 2 Public Lighting

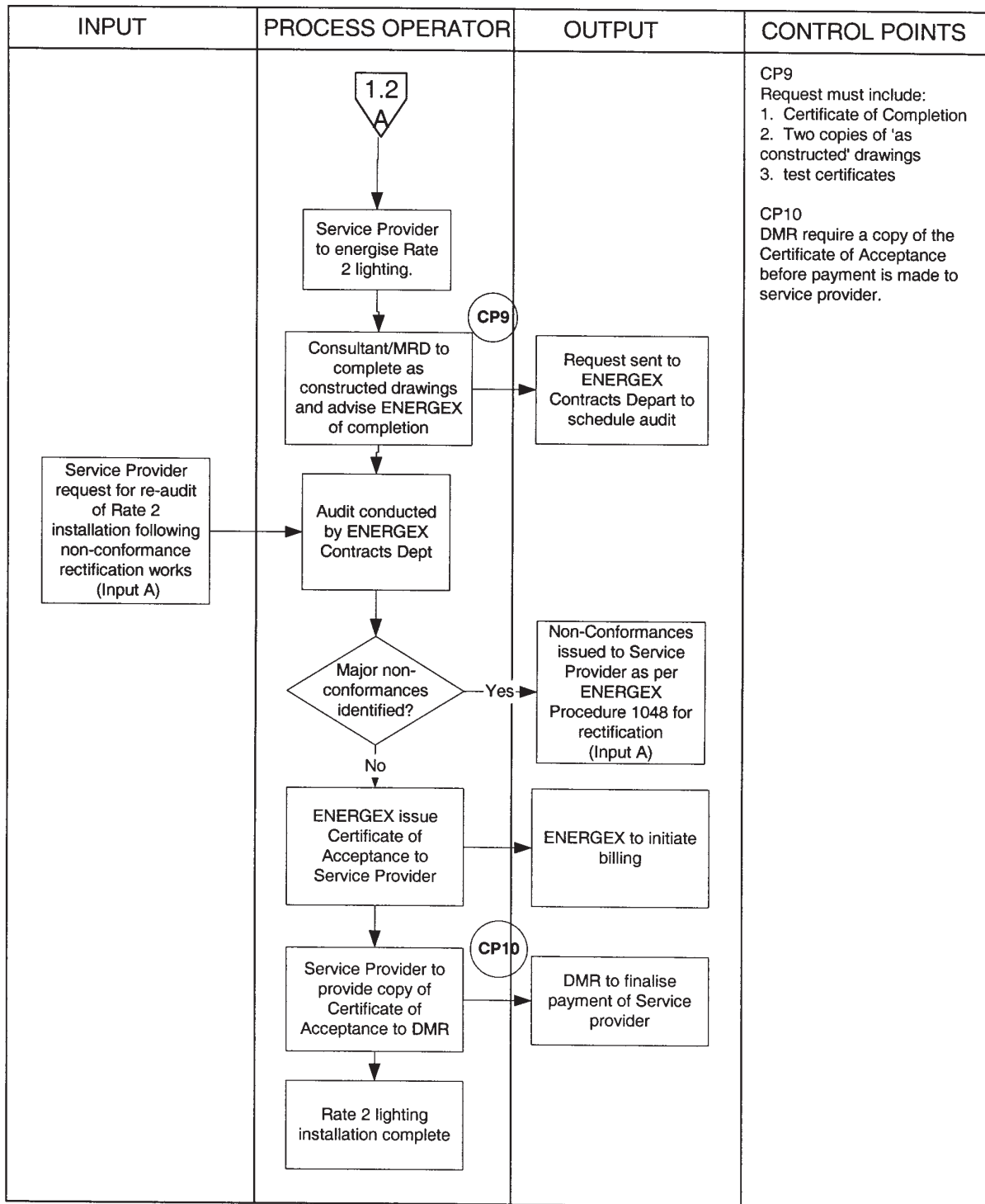


Flowchart 1.2A – Process for Rate 2 Public Lighting

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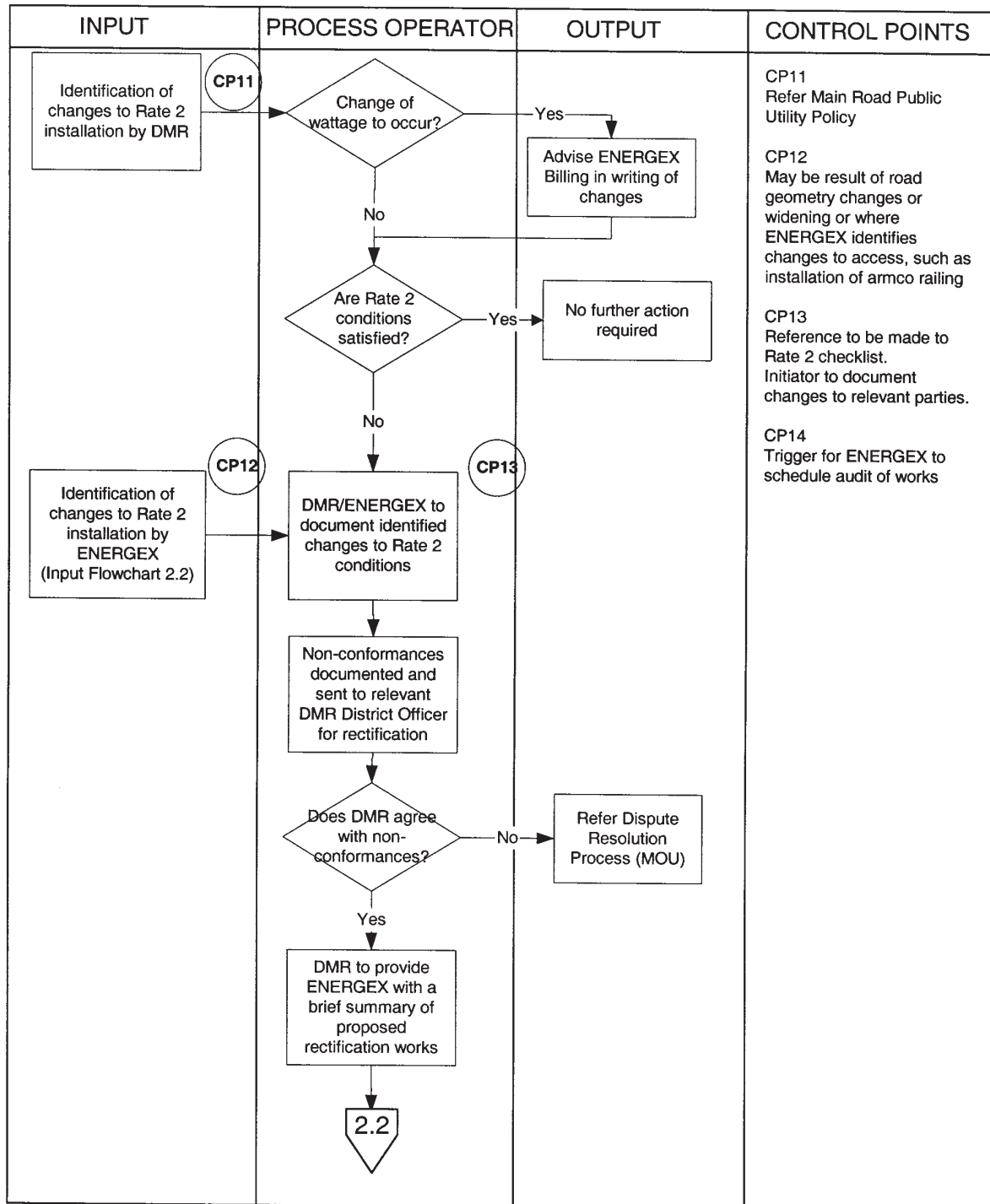


Flowchart 1.3 – Process for Rate 2 Public Lighting

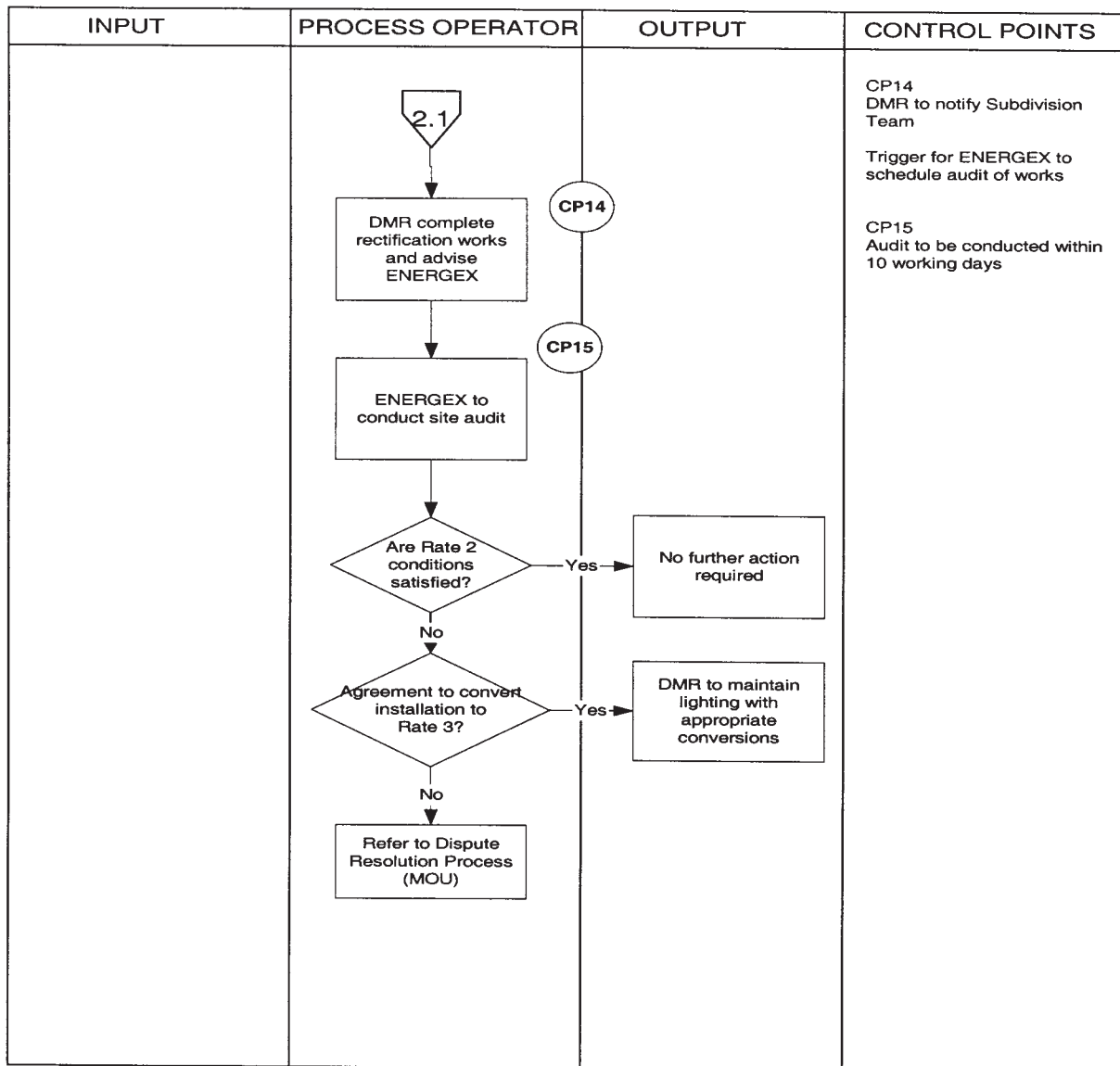


Flowchart 2.1 – Changes to Existing Rate 2 Public Lighting

17



Flowchart 2.2 – Changes to Existing Rate 2 Public Lighting



The agreed processes described by these flowcharts complements the Memorandum of Understanding of April 2002 between Department of Main Roads and ENERGEX, and is subject to its terms, as though part of it, particularly clause 3.4 (not legally binding)

Signed by Energex 9/02/04

Signed by Main Roads 19/02/04

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