

**Infrastructure Committee
9 February 2017**

Report for Agenda Item: 2

Department: Property & Infrastructure

Revision of Southern Light Strategy and Technical Specifications

Purpose

The purpose of this report is to seek adoption of the revised QLDC Southern Light documents.

Recommendation

That the Infrastructure Committee:

1. **Note** the contents of this report;
2. **Adopt** the Southern Light Strategy and Southern Light Technical Specifications.

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20/01/2017

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23/01/2017

Background

- 1 QLDCs current lighting strategy was adopted by Council in December 2006. Since the time of adoption, there have been significant advancements in industry best practices and in the technology to support this. QLDC has carried out a review of the 2006 strategy, resulting in an updated strategy, which is supported by a technical specification to facilitate the community and developers delivering a comprehensive and unified approach to lighting in the district.
- 2 The Southern Light Strategy reflects the intent of the Australian and New Zealand Standard - Lighting for Roads and Public Spaces (AS/NZ 1158) which outlines the performance criteria for road and public space lighting. Schemes can include any or all of three basic aims of: facilitating safe movement, discouraging illegal

acts and contributing to the amenity of an area through increased aesthetic appeal.

- 3 These documents are included as attachments 1 and 2 to this report. The development of these documents aligns with the review of the District Plan and the QLDC Land Development and Subdivision Code of Practice has also been considered.

Comment

International Dark Sky Accreditation (IDA)

- 4 Definition: An IDA International Dark Sky Reserve is public or private land possessing an exceptional or distinguished quality of starry nights and nocturnal environment that is specifically protected for its scientific, natural, educational, cultural, heritage and/or public enjoyment. Reserves consist of a core area meeting minimum criteria for sky quality and natural darkness, and a peripheral area that supports dark sky preservation in the core. Reserves are formed through a partnership of multiple land managers who have recognised the value of the natural nighttime environment through regulations and long term planning.
- 5 The amended Southern Light strategy identifies certain areas of the district which may seek to obtain Dark Sky accreditation. The strategy enables communities to indicate their interest through Annual Plan submissions and Requests For Service. These potential areas of collaboration can be explored using the Better Business Case approach.

Options

- 6 This report identifies and assesses the following reasonably practicable options for assessing the matter as required by section 77 of the Local Government Act 2002.

- 7 Option 1 Do nothing – Not adopt revised strategy

Advantages:

- 8 The existing developer community are familiar with this strategy.

Disadvantages:

- 9 Perpetuates disparate and inconsistent development and the use of out-of-date technology, not reflecting current best practice.
- 10 Current feedback from the developer community is that the 2006 strategy is difficult to decipher.

- 11 Option 2 Adopt as recommended

Advantages:

- 12 Council's standard will reflect industry best practice and be aligned to the national standard for lighting.

- 13 Encourages consistent development throughout the district.
- 14 Utilises modern and efficient materials to assist in reducing on-going maintenance and energy costs.
- 15 Provides clarity of intent by separating the strategy from technical specifications.

Disadvantages:

- 16 Developers will be required to adapt to the new strategy
- 17 Option 3 Adopt as recommended with a further review in 24 months

Advantages:

- 18 All advantages as per option two with the addition of allowing time to embed amendments and receive further feedback from interested parties following use of the new documentation
- 19 A period of 24 months has been chosen to avoid timetable clashes with 10-Year Plan development.

Disadvantages:

- 20 This may create uncertainty within the developer community due to frequently changing strategies
- 21 This report recommends Option 3 for addressing the matter because it allows for any gaps to be addressed whilst providing the District consistency and stability

Significance and Engagement

- 22 This matter is of [low] significance, as determined by reference to the Council's Significance and Engagement Policy. The significance level has been determined by assessment of its importance to the QLDC community interest, inconsistency with existing policy and strategy, and the impact on the Council's capability and capacity. Whilst the documents will have an impact on the wider environment, it will provide best practice and is aligned to the current New Zealand standard. Due to the high level of technical content, targeted consultation with specific stakeholders (internal and external) via workshops, peer reviews, email and direct contact was carried out.

Risk

- 23 This matter relates to the strategic risk SR1 - Current and future development needs of the community (including environmental protection) and SR6a - Assets critical to service delivery (infrastructure assets), as documented in the Council's risk register. The risk is classed as low. This matter relates to these risks because the likelihood of it occurring is low due to Council's policies and procedures for dealing with potential non-compliance.

24 The purpose of these documents is to mitigate the risk by providing guidance to the developer community when constructing assets that may be vested in Council. The measures include adopting best practice and utilising the latest national standards:

Financial Implications

25 Potential reduction in on-going maintenance costs by adopting current national standards as best practice.

Council Policies, Strategies and Bylaws

26 The following Council policies, strategies and bylaws were considered:

- Infrastructure Asset Management Strategy
- QLDC Land Development and Subdivision Code of Practice
- The Southern Light Strategy
- Parks and open Space Strategy 2016
- The Operative and Proposed District Plan

27 The recommended option is consistent with the principles set out in the named policy/policies.

28 This matter is not directly included in the 10-Year Plan/Annual Plan

- This document does not require additional funding and has no impact on current budgets. Its on-going review of best practice is business as usual.
- Additional funding has been requested in the 2018-2028 10-Year Plan to allow for upgrades of the QLDC street light network to comply with this new strategy.

Local Government Act 2002 Purpose Provisions

29 The recommended option:

- Will help meet the current and future needs of communities for good-quality local infrastructure, local public services, and performance of regulatory functions in a way that is most cost-effective for households and businesses by adopting current national standards and best practice;
- Can be implemented through current funding under the 10-Year Plan and Annual Plan;
- Is consistent with the Council's plans and policies; and
- Would not alter significantly the intended level of service provision for any significant activity undertaken by or on behalf of the Council, or transfer the ownership or control of a strategic asset to or from the Council.

Consultation: Community Views and Preferences

30 The persons who are affected by or interested in this matter are the developer community, community groups and Council Officers

- 31 The Council has internally reviewed the documentation with technical experts from the Property and Infrastructure Department and the Planning and Development Department. Workshops were held with external technical experts as well as Central Otago District Council and NZTA. The documentation was technically and peer reviewed by Council's Chief Engineer and his staff and the Planning and Development /Resource Engineering group.

Attachments

- A Southern Light Part A Strategy
- B Southern Light Part B Technical Specifications



QUEENSTOWN LAKES DISTRICT COUNCIL

SOUTHERN LIGHT PART ONE – A LIGHTING STRATEGY

JANUARY 2017

DOCUMENT CONTROL








Document History	Date	Prepared by	Reviewed by	Approved by
Initial review of current strategy	June 2016	Deborah Lind / Andrew Edgar		
Re-write, separating technical, asset management and strategic elements	September 2016	Alison Tomlinson / Polly Lambert	Deborah Lind / Andrew Edgar	David Wallace
Final document pending Infrastructure Committee adoption	January 2017	Alison Tomlinson / Polly Lambert	Ulrich Glasner	Peter Hansby

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1. INTRODUCTION

This strategy is to guide the Queenstown Lakes District community to deliver a consistent lighting environment that achieves the following community and strategic outcomes:

Community Outcomes		Southern Light Strategy	Southern Light Outcome
Sustainable growth management		The Planned Environment	Fit for purpose, specific zoning and community guidelines
Quality landscapes and natural environment with enhanced public access			Recyclable materials and reducing carbon footprint
A safe and healthy community that is strong, diverse and inclusive for people of all age groups and incomes		Environmental Sustainability	Facilitating safe movement and reducing criminal activities
Effective and efficient infrastructure that meets the needs of growth		Safety and Security	Stakeholder engagement
High quality urban environments, respectful of the character of individual communities		Collaboration	The visual aesthetic appeal
A strong and diverse economy		Amenity	Effectively utilising efficient technology
Preservation and celebration of the district's local cultural heritage		Cost Effective	Notable features, artworks, monuments
		Feature and Festive Lighting	

This strategy considers, but is not limited to:

- Road vehicle and pedestrian lighting (public and private) - appropriate levels of lighting for safe movement of vehicles, pedestrians and cyclists
- Closed Circuit Television Camera (CCTV) - rendition of images
- Private and commercial lighting - building exteriors, illuminated signs
- Amenity lighting – public precincts, outdoor carparks, parks and open spaces, sports fields
- Promoting consistency of materials and fittings

This document is a revision of the 2006 Southern Light Strategy. It has separated the strategic objectives from the technical standards to facilitate the community and developers to deliver a comprehensive and unified approach to lighting in the district.

Complying with Southern Light, Part Two – Technical Specifications will assist in the delivery of the strategic outcomes in the Southern Light, Part One – A Lighting Strategy. Both documents should be read in conjunction with the following QLDC documents:

- Operative and Proposed District Plan
- Urban Design Guidelines
- Land Development and Subdivision Code of Practice.

The QLDC Land Transportation Asset Management Plan includes detail on the street lighting assets. Further details of asset management practices can be found in QLDC's Infrastructure Asset Management Strategy.

QLDC has a policy for street lighting on private roads which includes provision of separate power supplies.

The Southern Light Strategy reflects the intent of the Australian and New Zealand Standard - Lighting for Roads and Public Spaces (AS/NZ 1158) which outlines the performance criteria for road and public space lighting schemes can include any or all of three basic aims of:

- Facilitating safe movement
- Discouraging illegal acts and
- Contributing to the amenity of an area through increased aesthetic appeal

2. STRATEGIC CONTEXT

The Queenstown Lakes District is internationally renowned for its outstanding landscape. Outdoor lighting contributes to the appreciation of this landscape by night and enhances the safe enjoyment of the District. The quality of the environment is an important factor in supporting economic growth within the district.

The District is a recognised tourism destination which supports economic growth across the southern part of the South Island. As growth has increased new developments have transformed previously dark rural areas into bright urban areas and it has been recognised a consistent approach is required to support best practice.

As a premier adventure and tourist destination, the District attracts global and local events and festivals. QLDC recognises the need to enhance the experience of these events through the use of lighting whilst protecting the night skies.

Due to a lack of clear and up to date technical specifications there has been a disjointed approach to the implementation of street and amenity lighting infrastructure. There is currently a large variety of outdated lighting infrastructure which has led to high and complicated on-going maintenance costs.

Advancing technology in efficient and effective lighting infrastructure Light Emitting Diode (LED) has increased the capability of lighting whilst reducing whole of life costs and addressing environmental impacts e.g. reduced carbon emissions. It is important to maximise the opportunities this technology brings to enable and guide future development.

The community planning process including District Plan and Annual Plan submissions and Requests for Service have identified urban and rural communities wanting a level of lighting that provides safe and comfortable night time travel while protecting the night time sky and rural character of the district.

Some communities may seek to obtain Dark Sky accreditation from the International Dark Sky Association (IDA). Consultation will be carried out to understand the financial and technical implications.

Where historic deficiencies have been identified, QLDC intends to address street lighting within the district to align with this strategy.

3. THE STRATEGIC OUTCOMES

3.1. Safety and Security

Effective lighting facilitates the safety of night-time road users and pedestrians and helps reduce criminal activity such as vehicle crime and assaults. High quality lighting aids the use of CCTV.

QLDC's Safety and Security strategy is to facilitate safe movement and provide a sense of security.

1. Facilitating safe movement by:
 - Providing safe lighting for drivers to react to hazards and averting crashes
 - Improving the ability of pedestrians to recognise objects and to discern oncoming pedestrian's facial features and intentions. These contribute to better hazard identification and avoidance
2. Discouraging illegal acts by:
 - Prioritising lighting in areas of high crime risk and high public use
 - Reduce maintenance outages by utilising progressive technology
 - Effective lighting to support the use of CCTV

Safety and Security will be achieved by:

- Providing a good level of quality lighting within town centre streets including lanes and access ways
- Lighting off-street car parks and their connections
- Providing safe routes by lighting selected connections between activity generators, visitor attractions and accommodation venues
- Lighting parks and public spaces to promote the feeling of safety at night. Particularly those with a night time activity such as BBQ, public toilet, car park, clubhouse, playing field or significant visitor attraction such as Queenstown Gardens, St Omer Park or Roy's Bay, Wanaka
- Lighting public amenities such as toilets, transport hubs and their access routes
- Consideration shall be given to restrict the use of lighting within rural areas to that which is only essential in terms of traffic safety at road junctions, and visual guidance and orientation for pedestrians elsewhere. For example, flag lighting at rural intersections where there are identified safety concerns
- Potential QLDC non-compliance may be identified through Annual Plan submissions, Requests for Service and technical surveys/inspections, these will follow the Better Business Case framework

3.2. Amenity – The Visual Aesthetic Appeal

The visual aesthetic appeal of our night environment is influenced by several lighting related elements.

Sky glow, or atmospheric pollution, is caused by light being spilled upwards which is wasted light and creates a glow in the sky, limiting our ability to see the stars and surrounding landscape at night. This can detract from recreational and scientific night sky observations where views of major constellations such as the Southern Cross may be obscured.

The aesthetic appeal can be influenced by the spectrum of light. This can be utilised to define and express the distinct difference between town centres, heritage precincts, suburban neighbourhoods, parks and open spaces, and rural areas.

QLDC's Amenity strategy is to protect the night sky and aesthetic appeal of the District by:

1. Supporting recreational and scientific night sky observation by minimising sky glow
2. Minimising upward waste light
3. Defining the colour appearance of light to create an inviting environment
4. Controlling levels of brightness and glare
5. Controlling obtrusive and nuisance light spill
6. Defining consistent light fittings and materials

Amenity will be achieved by:

- Applying the technical specifications
- Ensuring potential QLDC non-compliance may be identified through Annual Plan submissions, Requests for Service and technical surveys/inspections, which will all follow the Better Business Case framework

3.3. The Planned Environment

This strategy aligns with the Operative and Proposed District Plan and urban design requirements. Where plans have been developed for specific communities, these shall follow the intent of this strategy, but variations may be considered.

QLDC's strategy for a Planned Environment is to:

1. Promote a structured approach to accommodate growth
2. Ensure lighting is fit for purpose and meets community expectations

This is achieved by:

- Complying with the Operative and Proposed District Plan which contains rules relating to the amount of light that may be "spilt" beyond a site boundary
- Adopting Community specific plans for key areas where there are heritage, cultural and natural features to consider outside the standard street lighting requirements. These plans should seek to avoid a "Disneyland" effect with lighting and focus on subtle lighting of outstanding features within the overall townscape. This low-key approach is consistent with other objectives of energy conservation and reducing "sky glow". Contact should be made with QLDC to ascertain current status of community specific plans
- Applying QLDC's urban design requirements in respect of consolidation, i.e. more intensive forms of urban settlement and sensitivity to noise and light spill.
- Effective parks lighting. QLDC provide a number of open spaces that produce experiences for the community and visitors who use the parks. Developers will be required to engage with QLDC Parks and Reserves early (at the Plan Change stage) to ensure an appropriate mix of parks/open spaces are provided. Principles of parks lighting include:
 - Parks and Open Spaces will only be lit as part of the street lighting network providing perimeter lighting to describe the boundaries of parkland, unless they form part of a

recognised safe walking route (connection) or have a night time activity generator located in the park

- Large areas of parks, reserves or open space will not be illuminated where it is not encouraged for people to go at night or is detrimental to natural habitats and breeding grounds of fauna
- Sports ground lighting should encourage greater use of the sportsground, but should be sensitive to the night time environment with light spill and glare where appropriate.

3.4. Feature and Festive Lighting

QLDC has a number of existing public decorative lighting installations where cultural icons, significant landscape and architectural features benefit from careful and considered lighting. These include:

- Tree bud, and fairy lighting in Earnslaw Park
- War memorials (Wanaka & Queenstown)
- Queenstown Gardens Fountain
- Tree lighting in Brian Smith Park

Festive lighting can create and enhance short-term impact which enriches the experiences of events. QLDC has committed to provide significant investment to support both commercial and community events in the District. QLDC's vision for events is to promote and support a balanced portfolio of sporting and cultural events that meet community objectives for the District as a whole in respect of recreational activities, community infrastructure and economic growth.

QLDC's Feature and Festive strategy is to:

1. Provide the opportunity to celebrate and highlight the special features in the community without over saturation of lighting
2. Allow for special circumstances where upward waste light requirements may be exceeded by exception. Special dispensation must be approved by QLDC (Events Office) and will take into account the communities' intention to seek accreditation for Dark Skies

This will be achieved by:

- Feature Lighting
 - Decorative lighting of trees
 - Included in individual Reserve Development Plans or by specific agreement with Parks and Reserves
 - Bud and fairy lighting is not encouraged as it is maintenance and cost intensive
 - Limit permanent installations as they damage foliage, prevent effective maintenance and contribute to high glare
 - Take advantage of shadow play e.g. down lighting rather than up lighting
 - Use vertical surfaces such as walls and areas of dense vertical foliage to reflect light and to create a sense of boundary
 - Strip lighting under pedestrian barriers to illuminate paths without wasted upward light
 - Vested infrastructure (including bollards) must be cost effective and should be a nationally and readily available product, approved by QLDC
- Festive and Event lighting

- Festive lighting may utilise QLDC infrastructure (i.e. cabling and controls) subject to QLDC approval. All associated costs are the responsibility of the event holder
- Approval for temporary festive lighting displays must be sought from QLDC

3.5. Environmental Awareness

QLDC aims to promote and maintain an effective and efficient approach to sustainable lighting in the district.

QLDC's environmental strategy is to:

1. Reduce energy and greenhouse gas emissions
2. Decommission traditional gas discharge lamps
3. Reduce light pollution (covered under Section 3.2 - Amenity)

This will be achieved by:

- Utilising energy efficient technology
- Monitoring and assessing emerging technologies
- Identifying opportunities for energy efficiency through effective procurement of service providers and suppliers
- Minimise maintenance costs, asset replacement and reduce carbon emissions
- Traditional street lighting contains quantities of heavy metals such as mercury, which is a hazardous substance and is a bio-accumulative toxin. New technology, such as LEDs, avoid these complications
- QLDC will make careful consideration for the disposal of legacy products

3.6. Collaboration

Whilst QLDC is the major provider of public lighting on roads, parks and open spaces, civic buildings and monuments, the lighting of businesses, private buildings and homes or landscape features can impact on the overall lighting effect and quality of the environment.

QLDC's Collaborative strategy is to promote and support effective stakeholder engagement by:

1. Set a good example
2. Educate
3. Engage with stakeholders

This will be achieved by:

- QLDC's infrastructure, facilities and venues adhering to this strategy and complying with the technical specifications
- Providing consistency and alignment of QLDC's corporate plans and strategic documents
- Ensure the public is well informed by providing access to relevant strategies, technical specifications and urban design guidelines
- Support contractors with knowledge of lighting design principles and District Plan requirements, to specify and design lighting improvements
- Work with local organisations in protecting their community's light spill
- Work with the New Zealand Transport Agency (NZTA) as a co-investor who part funds the maintenance and operations of road lighting and provides public lighting on the state highway network
- Explore contractual shared service opportunities with neighbouring councils

- Potential areas for collaboration such as communities investigating Dark Sky Accreditation may be identified through Annual Plan submissions and Requests For Service, these will follow the Better Business Case framework

3.7. Cost Efficient and Value for Money

QLDC's strategy is to promote and deliver a cost efficient and affordable lighting network for the community.

This will be achieved by:

1. Implementation of the Southern Light Strategy
2. Providing clear technical specifications and design rules
3. Capital investment based on a robust framework for evidence based investment (Better Business Case Framework)
4. Facilitating and continually maturing asset management consistent with good industry practice (ISO55000) and as documented in the QLDC Infrastructures Asset Management Strategy
5. Robust contract management for operational and maintenance activities
6. Cost efficient procurement of suppliers and service providers

4. REVIEW, MONITORING AND ACTIONS

The Southern Light Strategy has been programmed in the QLDC Bylaws, Policies and Strategies Register for review in 2021.

Review and monitoring of the actions will be undertaken to ensure the strategy is being successfully implemented through the following methods:

- The QLDC Asset Management Performance Plan will be the repository of actions and monitoring and will reflect the actions of this strategy
- Continual review of community feedback through QLDC's Annual Plan and Long Term Plan
- Continual review of community feedback through QLDC customer satisfaction surveys and 'Requests for Service' process

5. SUPPORTING ELEMENTS

The following section lists the standards, regulations and QLDC associated documents applicable to the Southern Light Strategy.

All QLDC documents can be found on the QLDC website <http://www.qldc.govt.nz/>

The latest copies of standards and their amendments shall apply.

- QLDC Southern Light Part Two – Technical Specification
- QLDC Operative and Proposed District Plan Rules
- QLDC Land Transportation Asset Management Plan
- QLDC Asset Management Performance Plan
- QLDC Land Development and Subdivision Code Of Practice
- QLDC Parks Strategies and Reserve Management and Development Plans
- QLDC Urban Design Strategy
- QLDC Policy Lighting on Private Roads

- QLDC Queenstown town centre strategies
- AS/NZS 1158 Lighting for Roads and Public Spaces Set
- NZTA M30 & M26
- IPWEA Practice Note 11 2014
- Crime Prevention through Environmental Design (CPTED)
- ISO31000:2009 Risk Management Framework.
- ISO55000:2014 Asset Management
- Refer to the International Dark Sky Association (IDA) for general information and guidelines



**QUEENSTOWN LAKES
DISTRICT COUNCIL**

**SOUTHERN LIGHT
PART TWO – TECHNICAL
SPECIFICATIONS**

JANUARY 2017

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1 INTRODUCTION

The purpose of this document is to ensure that lighting infrastructure meets the outcomes specified in the Southern Light, Part One – A Lighting Strategy through providing safe environments for pedestrians, vehicles and to discourage illegal acts as well as ensuring that public lighting is attractive, robust, easy to maintain, cost effective and fit for purpose. This document will set out accepted best practice, minimum manufacturing and performance standards, as well as QLDC asset management and strategic objectives throughout the district, including QLDC vested road and outdoor lighting, private lighting and new developments (such as the 5 Mile commercial area), as well as parks and feature lighting.

This technical guide should be read in conjunction with the Southern Light, Part One – A Lighting Strategy 2016, the QLDC Land Development and Subdivision Code of Practice and the operative District Plan.

This document shall be used by developers, contractors, consultants, service/utility operators, QLDC design engineers, planners, project managers and others involved in the design, installation and management of new lighting installations. It may be used as a guide to repair or replace existing lighting infrastructure.

It is acknowledged the District has community specific urban design requirements and these will be referenced individually.

The main scope of this document includes areas covered by the AS/NZS 1158

- Roads (public & private)
- Reserves and public activity areas
- Pedestrian (Zebra) crossings
- Pedestrian and cycle paths
- Public precincts (e.g. shopping precincts)
- Public access areas (e.g. connecting elements including steps, ramps, subways, footbridges and CCTV)
- Outdoor car parks

It also provides indicative design guidelines for areas outside AS/NZS 1158 which includes, but not limited to

- Parks and Reserves and sports fields
- Illuminated Signs
- Feature Lighting (up-lighting & spot lighting)

Guidelines for exterior lighting can be found in AS/NZS 1680, AS/NZS 2293 and the NZ Building Code. Guidelines for sports lighting (interior/exterior) can be found in AS 2560.

QLDC's has a policy for street lighting on private roads which encompasses the following:

- Maintenance and operating costs of lights installed on private roads and rights of way after 01 January 2004 shall be the responsibility of lots serviced by such private access roads; and
- All lights installed on private roads and Rights of Way after 01 January 2004 shall be isolated from the QLDC lighting network.

Southern Light is a live document subject to periodic review and may be amended at any time as and when directed by QLDC.

In summary this document describes how to complete the detailed design and calculations required for compliance with the applicable standards to achieve the following:

- Provision of vehicular route lighting for vehicle and pedestrian safety
- Provision of pedestrian route/area lighting for pedestrian safety, crime prevention and to enhance the environment

- Provision of lighting infrastructure (luminaires, columns, arms and associated equipment) that is energy efficient, cost effective and will cope with regional climatic and environmental conditions such as extreme temperatures and weather conditions
- Provision of feature and festive lighting (whether temporary or permanent) that do not create excessive glare or spill light into neighbouring properties. Exemptions must be granted by QLDC where this lighting contravenes Southern Light.
- While achieving safe and compliant lighting (as described above) also minimising any negative impacts such as obtrusive (spill) light, glare and light pollution (upward waste light contributing to sky glow)

2 APPLICABLE STANDARDS AND REGULATIONS

The following section lists the standards and regulations applicable to the design, installation and maintenance of road lighting installations. The latest copies of standards and their amendments shall apply.

Electrical:

The Electricity Act 1992

The Electricity (Safety) Regulations 2010

The NZ Electrical Codes of Practice

The NZ Building Code

AS/NZS 3000: Electrical installations (known as the Australian/New Zealand Wiring Rules)

Lighting:

AS 2560 (Series): Sports lighting

AS 4282: Control of the obtrusive effects of outdoor lighting

AS 60529: Degrees of protection provided by enclosures (IP Code)

AS/NZS 1158.0: Lighting for roads and public spaces, Part 0: Introduction

AS/NZS 1158.1.1: Lighting for roads and public spaces, Part 1.1: Vehicular traffic (Category V) lighting - Performance and design requirements

AS/NZS 1158.1.2: Lighting for roads and public spaces, Part 1.2: Vehicular traffic (Category V) lighting - Guide to design, installation, operation and maintenance

AS/NZS 1158.2: Lighting for roads and public spaces, Part 2: Computer procedures for the calculation of light technical parameters for Category V and Category P lighting

AS/NZS 1158.3.1: Lighting for roads and public spaces, Part 3.1: Pedestrian area (Category P) lighting - Performance and design requirements

AS/NZS 1158.4: Lighting for roads and public spaces, Part 4: Lighting of pedestrian crossings

AS/NZS 1158.5: Lighting for roads and public spaces, Part 5: Tunnels and underpasses

AS/NZS 1680 (Series): Interior and workplace lighting

AS/NZS 2293 (Series): Emergency escape lighting and exit signs for buildings

AS/NZS 60598.2.3: Luminaires - Particular requirements - Luminaires for road and street lighting

IEC 62262, Ed. 1.0: Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)

NZTA M30: Specification and Guidelines for Road Lighting Design

Refer to the International Dark Sky Association (IDA) for general information and guidelines

Lighting poles (design and construction):

AS/NZS 1214: Hot-dip galvanized coatings on threaded fasteners (ISO metric coarse thread series)

AS 1798: Lighting poles and bracket arms - Recommended dimensions

AS 2979: Traffic signal mast arms

AS 2309: Durability of galvanized and electrogalvanized zinc coatings for the protection of steel in structural applications - Atmospheric

AS 4100: Steel structures
AS/NZS 1170: Structural design actions - Set
AS/NZS 1554: Structural steel welding - Set
AS/NZS 1665: Welding of aluminium structures
AS/NZS 2312: Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings
AS/NZS 4676: Structural design requirements for utility services poles
AS/NZS 4677: Steel utility services poles
AS/NZS 4680: Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
AS/NZS 7000: Overhead line design
NZS 3101: Concrete structures standard
NZS 3404: Steel structures standard
NZTA M26: Specification for Lighting Columns

3 DESIGN REQUIREMENTS

The applicable design standards shall be the New Zealand requirements of the AS/NZS 1158 series and the following sections provide a summary of the main requirements. The designer shall be responsible for applying all the specific design requirements of AS/NZS 1158 (as well as any other QLDC specific rules or procedures) to the extent they are applicable whether or not they are included in this document.

3.1 Light Sources and Adverse Lighting Effects

All new lighting installations shall utilise light emitting diode (LED) technology luminaires. Refer to NZTA M30 for a list of acceptable luminaires. Alternative LEDs may be considered provided they meet the minimum manufacturing, testing and performance requirements of NZTA M30 including warranty period. QLDC reserves the right to exclude any alternative LED (not on the current NZTA M30 list) if the designer or supplier cannot clearly demonstrate full compliance with NZTA M30. Other technologies may be considered and shall be confirmed by QLDC before final design is finalised.

New installation of mercury vapour (MV), metal halide (MH) or high pressure sodium (HPS) luminaires are NOT permitted. The only exception is the use of MH or HPS luminaires as in-fill maintenance lighting or temporary lighting during project construction.

As part of the lighting design process the designer shall take into account and minimise any potential adverse or obtrusive lighting effects such as spill light, glare and sky glow (upward light). The limits of adverse lighting and methods of mitigation, as provided in NZTA M30, shall be followed.

Feature and festive lighting outside of M30 may be approved by QLDC on an individual basis.

3.2 Lighting Categories

The primary aim of any road lighting scheme is to facilitate the safe movement of people and there are two main categories of lighting (category V and P), and various subcategories, that provide varying levels of lighting based on a number of particular traffic (vehicular and pedestrian) parameters applicable for each type of road.

Category V lighting is applicable to roads where the visual requirements of motorists are dominant e.g. arterial or main roads, motorways and sub-arterial roads. Category P lighting is applicable to roads and other outdoor public spaces where the visual requirements of pedestrians are dominant e.g. local roads, pedestrian pathways and cycleways.

The decision to install a lighting scheme in compliance with AS/NZS 1158 (and any other QLDC policies and procedures), including which subcategory of lighting is applicable, rests with QLDC. This decision is typically based on factors such as night time traffic flows, composition of traffic (vehicular and/or pedestrian), the need to enhance prestige, risk of crime and other patterns of use.

The designer shall not commence any design work until the lighting category has been established and confirmed with QLDC. Note that more than one subcategory may be required within one development, e.g. different road hierarchies and car park lighting.

The designer (or nominated QLDC representative) may be required to assist in the evaluation process, but no design shall be commenced until QLDC approval has been obtained.

The following information has been extracted from the relevant parts of the AS/NZS 1158 series to provide indicative guidance on the application of the different categories and subcategories of lighting. The table numbers and figure numbers are the actual numbers used in the applicable standards.

It is the responsibility of the designer to ensure they have current copies of AS/NZS 1158 and any other QLDC lighting standards, policies and procedures.

Figure 2.1 from AS/NZS 1158.1.1 - Example Road and Public Space Types and Indicative Lighting Categories and Subcategories

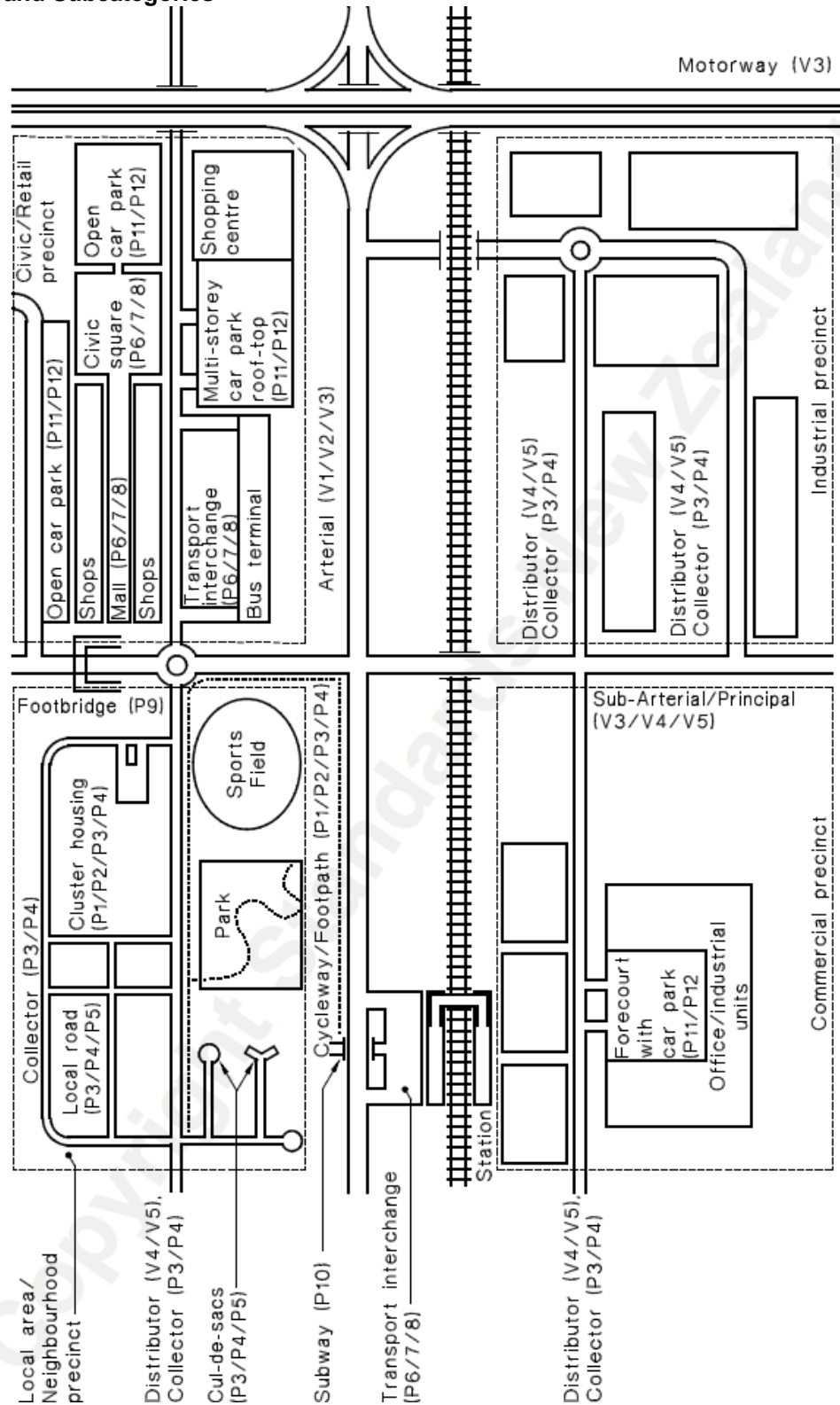


Table 2.1 from AS/NZS 1158.1.1 - Category V Lighting Applications

Typical applications		Lighting subcategory
Description of road or area type	Operating characteristics	
Arterial or main roads in central and regional activity centres of capital and major provincial cities, and other areas with major abutting traffic generators	<ul style="list-style-type: none"> —Mixed vehicle and pedestrian traffic —High to very high vehicle volume —High to very high pedestrian volume —Moderate to low vehicle speeds —Stationary vehicles alongside the carriageway —Through and local traffic —High traffic generation from abutting properties 	V1
Arterial roads that predominantly carry through traffic from one region to another, forming principal avenues of communication for traffic movement, with major abutting traffic generators	<ul style="list-style-type: none"> —Mixed vehicle and pedestrian traffic —High vehicle volume —High pedestrian volume —Moderate to high vehicle speeds —Stationary vehicles alongside the carriageway —Through and local traffic —High traffic generation from abutting properties 	V2
Freeways, motorways and expressways consisting of divided highways for through traffic with no access for traffic between interchanges and with grade separation at all intersections	<ul style="list-style-type: none"> —Vehicle traffic only —High to very high vehicle volume —High speeds 	V3
Arterial roads that predominantly carry through traffic from one region to another, forming principal avenues of communication for traffic movements	<ul style="list-style-type: none"> —Mixed vehicle and pedestrian traffic —Moderate to high vehicle volume —High pedestrian volume —Moderate to low vehicle speeds —Stationary vehicles alongside the carriageway —Through and local traffic —Moderate traffic generation from abutting properties 	
Sub-arterial or principal roads which connect arterial or main roads to areas of development within a region, or which carry traffic directly from one part of a region to another part	<ul style="list-style-type: none"> —Mixed vehicle and pedestrian traffic —Moderate traffic volume —Low pedestrian volume —Moderate to low vehicle speeds —Low traffic generation from abutting properties 	V4* or V5

* V4 is the minimum subcategory recommended for application in New Zealand.

Table 2.1 from AS/NZS 1158.3.1 - Category P Lighting Applications for Road Reserves

1	2	3	4	5	6
Type of road or pathway	Selection criteria ^{a,b)}				Applicable lighting subcategory ^{c,d)}
General description	Basic operating characteristics	Pedestrian/cycle activity	Risk ^o of crime	Need to enhance prestige	
Collector roads or non-arterial roads which collect and distribute traffic in an area, as well as serving abutting properties	Mixed vehicle and pedestrian traffic	N/A	High	N/A	P1
		High	Medium	High	P2
		Medium	Low	Medium	P3
		Low	Low	N/A	P4
Local roads or streets used primarily for access to abutting properties, including residential properties	Mixed vehicle and pedestrian traffic	N/A	High	N/A	P1
		High	Medium	High	P2
		Medium	Medium	Medium	P3
		Low	Low	N/A	P4
		Low	Low	N/A	P5 ^{e)}
Common area, forecourts of cluster housing	Mixed vehicle and pedestrian traffic	N/A	High	N/A	P1
		High	Medium	High	P2
		Medium	Low	Medium	P3
		Low	Low	N/A	P4

Table 2.2 from AS/NZS 1158.3.1 - Category P Lighting Applications for Pathways and Cycleways

1	2	3	4	5	6
Type of pathway		Selection criteria ^{a,b)}			Applicable lighting subcategory
General description	Basic operating characteristics	Pedestrian/cycle activity	Risk of crime ^{d)}	Need to enhance prestige	
Pedestrian or cycle orientated pathway, e.g. footpaths, including those along local roads ^{d)} and arterial roads ^{d)} , walkways, lanes, park paths, cycleways	Pedestrian/cycle traffic only	N/A	High	N/A	P1 ^{e)}
		High	Medium	High	P2 ^{e)}
		Medium	Low	Medium	P3
		Low	Low	N/A	P4

Table 2.3 from AS/NZS 1158.3.1 - Category P Lighting Applications for Public Activity Areas (Excluding Car Parks)

1	2	3	4	5	6
Type of area or activity		Selection criteria ^{a,b)}			Applicable lighting subcategory
General description	Basic operating characteristics	Night time vehicle movements	Risk of crime ^{e)}	Need to enhance prestige	
Areas primarily for pedestrian use, e.g. city, town, suburban centres, including outdoor shopping precincts, malls, open arcades, town squares, civic centres	Generally pedestrian movement only	N/A	High	High	P6
		Medium	Medium	Medium	P7
		Low	Low	N/A	P8
Transport terminals and interchanges, service areas	Mixed pedestrian and vehicle movement	High	High	High	P6
		Medium	Medium	Medium	P7
		Low	Low	N/A	P8

Table 2.4 from AS/NZS 1158.3.1 - Category P Lighting Applications for Connecting Elements

Type of area	Applicable lighting subcategory
Steps and stairways, ramps, footbridges, pedestrian ways	P9
Subways, including associated ramps or stairways	P10

NOTE: Subways are listed as a separate subcategory because of a high risk of crime.

Table 2.5 from AS/NZS 1158.3.1 - Category P Lighting Applications for Outdoor Car Parks

1	2	3	4	5
Selection criteria ^{a)}				
Type of area	Night time vehicle or pedestrian movements	Night time occupancy rates (NTOR)	Risk of crime ^{b)}	Applicable lighting subcategory ^{c)}
Parking spaces, aisles and circulation roadways	High	>75%	High	P11a
	Medium	≥25%, ≤75%	Medium	P11b
	Low	<25%	Low	P11c
Designated parking spaces specifically intended for people with disabilities	N/A	N/A	N/A	P12

3.3 Lighting Categories and District Plan

To assist in the interpretation of this standard, QLDC has summarised AS/NZS 1158.3.1 Tables 2.1 - 2.5 of the standard to reflect the local needs based on the District Plan zones. Refer QLDC Table 1 below.

Category P (pedestrian) will be the main lighting standard used as it provides standards applicable to the majority of roads managed by the council.

QLDC preference is for *P5 as minimum requirement in residential areas. However factors such as night time traffic flows, composition of traffic (vehicular and/or pedestrian), the need to enhance prestige, risk of crime and other patterns of use should also be taken into consideration when selecting final subcategory.

QLDC Table 1 Lighting Category Summary for Road Reserves in Local Areas (Category P)

Area of Activity	District Plan Zone	Lighting Subcategory*
Collector Road or non-arterial	All	P4
Local Roads or street used primarily for access to abutting properties including residential properties	* Township, Residential Zones, Rural Zones, Special Zones	P5
	Town Centre, High Density Residential, Industrial and Business zones	P4
Pathways (including cycle ways, footpaths along roads, walkways and park paths) where these have been identified for lighting.	Town Centres – designated safe routes	P3
	Town Centres - other pathways	P4
	Pathways outside of Town Centres	P4
Town Centre and Township pedestrian activity areas (malls, open arcades, town squares, civic centres)	Town Centre and Township	P8
Transport terminals and service areas with mixed pedestrian and vehicle movements during hours of darkness	All	P8

3.4 Design Methodology

The following definitions and sections describe the main types of road lighting calculations required and their particular application is dependent on the category of lighting required.

Illuminance (E)

Illumination is a general expression for the process of light arriving at a surface and the physical measure of this is illuminance. Illuminance is the luminous flux (lumen - lm) arriving at a surface divided by the area of the illuminated surface.

Unit: lux (lx); 1 lx = 1 lm/m².

Illuminance calculations are required for category P roads and nominated locations on category V roads.

Luminance (L)

Luminance is the physical quantity of light corresponding to the brightness of a surface (e.g. a lamp, luminaire or reflecting material such as the road surface) when viewed from a specified direction.

Unit: candela per square metre (cd/m²).

Luminance calculations are only required for category V roads.

Uniformity (U)

The uniformity is a calculated ratio that is used to measure how evenly the light is distributed over a given area or length of roadway. Uniformity calculations are required for both category V and P roads; however the method of calculation differs between the two categories.

3.4.1 Category V Design Objectives

The principal design objectives for category V lighting are to provide the following:

- (a) Luminance and uniformity of luminance of the carriageway surface to a specified level.
- (b) Glare control to a specified level.
- (c) Illumination on intersections, carriageway verges, splitter islands and other nominated locations to a specified level.
- (d) Limitation of upward spill light from luminaires to a specified level.
- (e) A maintenance regime such that the lighting scheme complies at all times during each maintenance cycle.
- (f) Minimal energy consumption.

Refer to AS/NZS 1158.2 for the minimum design areas and applicable calculation fields.

3.4.2 Category P Design Objectives

The principal design objectives for category P lighting are to provide the following:

- (a) Illuminance and uniformity of illuminance over the road reserve to a specified level.
- (b) Glare control to a specified level.
- (c) Limitation of upward spill light from luminaires to a specified level.
- (d) Limitation to a specified level of the light spilled into adjacent properties.
- (e) A maintenance regime such that the lighting scheme complies at all times during each maintenance cycle.
- (f) Minimal energy consumption.

Refer to AS/NZS 1158.2 for the minimum design areas and applicable calculation fields.

3.4.3 Light Technical Parameters

The principal design objectives (outlined in the above two sections) are formally specified in terms of the following light technical parameters (LTPs):

- (a) Parameters that relate to the attainment of the required level of lighting performance.
- (b) Parameters that limit the adverse effects of the lighting on:
 - i. Users of the lit space e.g. pedestrians, vehicle drivers (i.e. control of glare);
 - ii. Night sky viewing conditions (i.e. reducing sky glow);
 - iii. Occupants of adjoining properties (i.e. minimise the amount of spill light).

The following tables of LTPs have been extracted from the relevant parts of the AS/NZS 1158 series and they indicate the minimum levels of compliance that are required for each category and subcategory of lighting. The table numbers are the actual numbers used in the applicable standards.

Table 2.2 from AS/NZS 1158.1.1 - Values of LTPs for Category V Lighting

1	2	3	4	5	6	7	8	9	10
Lighting subcategory	Light technical parameters								
	For straight sections, curves and intersections						For intersections and other specified locations		For all applications
	Average carriageway luminance ^{c,d)} (\bar{L}) cd/m ²	Overall uniformity ^{a,d)} (U_o)	Longitudinal uniformity ^{d)} (U_L)		Threshold increment ^{e)} (TI) %	Surround verge illuminance ^{d)} (E_s) %	Point horizontal illuminance ^{c,d)} (E_{ph}) lx	Illuminance (horizontal) uniformity ^{e)} Cat V (U_{E1})	Upward waste light ratio ^{e)} ($UWLR$) %
			In Australia	In New Zealand					
V1	1.5	0.33	0.5	0.3	20	50	15	8	3
V2	1.0	0.33	0.5	0.3	20	50	10	8	3
V3	0.75	0.33	0.5	0.3	20	50	7.5	8	3
V4 ^{b)}	0.5	0.33	0.5	0.3	20	50	5	8	3
V5	0.35	0.33	0.5	0.3	20	50	3.5	8	3

^{a)} The calculated value for U_o may be less than 0.33, provided the corresponding value for \bar{L} is 10% or more above the specified minimum, but shall in no case be less than 0.31.

^{b)} V4 is the minimum subcategory recommended for application in New Zealand.

^{c)} These values are maintained.

^{d)} Compliance is achieved by being greater than or equal to the applicable table value.

^{e)} Compliance is achieved by being less than or equal to the applicable table value.

NOTES:

- 1 For the purpose of determining compliance with Table 2.2, the specified light technical parameters should be taken as being justified to two decimal places.
- 2 See Table 2.1 for typical applications of each of the lighting subcategories for which light technical parameters are specified.
- 3 The specification of separate requirements for U_L in Australia and New Zealand arises from differences in the method of calculating this parameter, particularly the assumed observer position chosen (see Clauses 3.2.1 and 3.3.3).
- 4 See Section 3 for the design methods and requirements for use in assessing compliance with the specified light technical parameters.

Table 2.6 from AS/NZS 1158.3.1 - Values of LTPs for Category P Lighting of Roads and Pathways

1	2	3	4	5	6
Lighting subcategory	Light technical parameters				Permissible luminaire type (see Table 2.10)
	Average horizontal illuminance ^{a,b} (\bar{E}_h) lux	Point horizontal illuminance ^{a,b} (E_{ph}) lux	Illuminance (horizontal) uniformity ^c Cat. P (U_{E2})	Point vertical illuminance ^{a,b} (E_{pv}) lux	
P1	7	2	10	2	Type 4 where part of a road reserve or Types 2, 3, 4 or 6 elsewhere
P2	3.5	0.7	10	0.7	
P3 ^e	1.75	0.3	10	0.3 ^d	
P4 ^e	0.85	0.14	10	N/A	
P5 ^e	0.5	0.07	10	N/A	

^{a)} These values are maintained.

^{b)} Compliance is achieved by being greater than or equal to the applicable table value.

^{c)} Compliance is achieved by being less than or equal to the applicable table value.

^{d)} The vertical illuminance requirement only applies when subcategory P3 is selected for application to pathways, i.e. it does not apply for local roads.

^{e)} The values for New Zealand for subcategories P3 and P3R are also subject to the lamp source lumen derating values as per Clause 2.6. The New Zealand values are as per the table below. In New Zealand, when the luminaires are to be supported on existing reticulation poles, the subcategories P3R and P4R may be designated and the following reduced levels applied:

Subcategory	\bar{E}_h	E_{ph}	E_{pv}
P3 (NZ)	1.3	0.22	0.22
P3R	0.9	0.11	N/A
P4R	0.7	0.07	N/A

Subcategory P5 lighting shall not be chosen for this situation.

NOTES:

- 1 Validation of the values in Columns 2 to 5 is by calculation, not field measurement. This is particularly relevant to small values in Columns 2, 3 and 5, which will typically be difficult to validate by field measurements.
- 2 See Section 3 for the design methods and requirements for use in assessing compliance with the specified light technical parameters.

Table 2.7 from AS/NZS 1158.3.1 - Values of LTPs for Category P Lighting of Public Activity Areas (Excluding Car Parks)

1	2	3	4	5	6
Lighting subcategory	Light technical parameters				Permissible luminaire type (see Table 2.10)
	Average horizontal illuminance ^{a,b} (\bar{E}_h) lux	Point horizontal illuminance ^{a,b} (E_{ph}) lux	Illuminance (horizontal) uniformity ^c Cat. P (U_{E2})	Point vertical illuminance ^{a,b} (E_{pv}) lux	
P6	21	7	10	7	Types 2, 3, 4, 5 or 6
P7	14	4	10	4	
P8	7	2	10	2	

^{a)} These values are maintained.

^{b)} Compliance is achieved by being greater than or equal to the applicable table value.

^{c)} Compliance is achieved by being less than or equal to the applicable value.

NOTE: See Section 3 for the design methods and requirements for use in assessing compliance with the specified light technical parameters.

Table 2.8 from AS/NZS 1158.3.1 - Values of LTPs for Category P Lighting of Connecting Elements

1	2	3	4	5	6
Lighting subcategory	Light technical parameters				Permissible luminaire type (see Table 2.10)
	Average horizontal illuminance ^{a,b,d)} (\bar{E}_h) lux	Point horizontal illuminance ^{a,b)} (E_{ph}) lux	Illuminance (horizontal) uniformity ^{c)} Cat. P (U_{E2})	Point vertical illuminance ^{a,b)} (E_{pv}) lux	
P9	Same as for highest lighting subcategory applying to areas that abut the connecting element but, where forming part of a road or pathway, to be not less than subcategory P8 in Table 2.3.				
P10	35	17.5	10	17.5	Types 3, 4, 5 or 6

a) These values are maintained.

b) Compliance is achieved by being greater than or equal to the applicable table value.

c) Compliance is achieved by being less than or equal to the applicable value.

d) For steps, the requirements assume that the noses of the treads are clearly delineated by a contrasting stripe or other equally effective means. If this does not apply, the illuminance should be at least twice the value specified.

NOTES:

- 1 It is recommended that the walls of subways be finished in a light colour to facilitate interreflection of light within the space. Such interreflected light may be taken into account in the achievement of the specified light technical parameters.
- 2 See Section 3 for the design methods and requirements for use in assessing compliance with the specified light technical parameters.

Table 2.9 from AS/NZS 1158.3.1 - Values of LTPs for Category P Lighting of Outdoor Car Parks

1	2	3	4	5	6
Lighting subcategory	Light technical parameters ^{a)}				Permissible luminaire type (see Table 2.5)
	Average horizontal illuminance ^{a,b)} (\bar{E}_h) lux	Point horizontal illuminance ^{a,b)} (E_{ph}) lux	Illuminance (horizontal) uniformity ^{c)} Cat. P (U_{E2})	Point vertical illuminance ^{a,b)} (E_{pv}) lux	
P11a	14	3	10	3	Types 3, 4, 5 or 6
P11b	7	1.5	10	1.5	
P11c	3.5	0.7	10	—	
P12	—	≥ 14 and $\geq \bar{E}_h$ ^{d)}	—	—	

a) These values are maintained.

b) Compliance is achieved by being greater than or equal to the applicable table value.

c) Compliance is achieved by being less than or equal to the applicable table value.

d) E_{ph} shall be determined for each P12 area in the car park and, in each case, it shall be greater than the value stated and greater than the average for the overall car park.

NOTES:

- 1 See Section 3 for the design methods and requirements for use in assessing compliance with the specified light technical parameters.
Compliance with the light technical parameters in Table 2.9 is based on an open, unoccupied car park, i.e. free of vehicles. However, it is important that the design of the lighting system (e.g. numbers, locations, heights and outputs of the luminaires) be such that adequate light is provided between parked vehicles.
- 2 Where raised obstructions are present, e.g. to limit vehicle movement in parking areas, these obstructions present potential hazards for pedestrians. Such obstructions should therefore be of such a material, or so finished, as to provide a high visual contrast with the paved surface.
- 3 See Table 2.8 for the requirements that apply to connecting elements, including steps, ramps and pedestrian crossing points, within car parks.
- 4 The luminaires should be positioned to highlight physical obstructions or other similar hazards to pedestrian and vehicular traffic.
- 5 Lighting requirements for indoor car parks are set out in AS 1680.2.1.

3.4.4 Calculation of Light Technical Parameters

The calculations of all LTPs for category V and P roads shall be carried out in accordance with the computer based design procedures provided within AS/NZS 1158.2. This standard provides the basic formulae for the LTPs and the associated grid of points (calculation field) over which the calculations are to be made. Hand calculations shall not be accepted.

The use of a specific software application called “SAA STAN” is mandatory for the calculation of the luminance based LTPs for the category V straight road elements. This can be achieved using the software “Perfect Lite” or another shell program that is built around “SAA STAN” and which can be demonstrated to reproduce the values of all LTPs provided by “Perfect Lite”.

“AGi32” shall be used for the illuminance based calculations required for category V road lighting designs. “Perfect Lite” shall be used for the luminance based calculations required for category V road lighting designs.

“Perfect Lite” or “AGi32” shall be used for the illuminance based calculations required for category P road lighting designs.

It shall be the responsibility of the designer to ensure the appropriate software is used to carry out all the required calculations.

Spill light calculations shall be undertaken for all street lights adjoining residential activities.

3.4.5 Maintenance Factor

A design maintenance factor (MF) is used in the calculations to account for the combined light losses resulting from depreciation in the LED’s lumen output and accumulation of dirt on the luminaire over a nominated maintenance period.

The MF is calculated as the product of the following depreciation factors:

- (a) *Luminaire maintenance factor (LMF)*: The factor selected from table 14.4 of AS/NZS 1158.1.2 applicable for the luminaire lamp chamber ingress protection (IP) rating, pollution category and the luminaire cleaning interval.

TYPICAL LUMINAIRE MAINTENANCE FACTORS						
Cleaning interval	Typical luminaire maintenance factors (Note 1)					
	Ingress Protection Number of Lamp Chamber					
	IP54			IP6X		
	Pollution category (Note 2)					
months	High	Medium	Low	High	Medium	Low
12	0.89	0.90	0.92	0.91	0.92	0.93
18	0.87	0.88	0.91	0.90	0.91	0.92
24	0.84	0.86	0.90	0.88	0.89	0.91
36	0.76	0.82	0.88	0.83	0.87	0.90
48	0.66	0.76	0.86	0.75	0.84	0.89

- (b) *Lumen Depreciation Factor (LDF)*: The amount of light (lumen output) available at the end of a nominated operating period, as a proportion of the initial lumen output (when the LED was new), expressed as a decimal fraction. The LDF used to determine the design MF shall be obtained from the luminaire supplier.

The design MF can be calculated as follows:

$$MF = LMF \times LDF$$

However, based on the current version of AS/NZS 1158 the actual MF applied to the calculations of the LTPs shall not exceed the following:

- (a) For IP 5X luminaires: 0.7
- (b) For IP 6X luminaires: 0.8

The above limitations were applied based on the use of high intensity discharge (HID) lighting (luminaires using MH or HPS lamps) and does not allow for new technology LED luminaires. With new technology LED luminaires it is expected that they will have longer lifecycles, lower rates of lumen depreciation and longer cleaning intervals than HID luminaires; and the maximum allowable MFs may no longer be appropriate. QLDC will accept higher MFs provided the designer can clearly demonstrate that the LEDs will perform as expected over the maintenance period.

It is important to note that the design results are based on applying a realistic MF which needs to take into account the actual nominated maintenance (cleaning interval) that is expected to take place as well as the lumen depreciation.

As part of the design delivery process the designer is required to provide information on the MF used in the calculations including the following supporting information:

- (a) Luminaire ingress protection (IP) rating.
- (b) Luminaire cleaning cycle.
- (c) Maximum allowable lumen depreciation.

Although the designer is required to supply the information relating to the MF used in the calculations it is the responsibility of QLDC to ensure that the appropriate levels of maintenance are applied so as to maintain the correct performance of the lighting scheme over the nominated maintenance period.

3.4.6 Design Output Deliverables

The designer shall submit the following design documents for QLDC approval before commencement of the installation works. Refer to Appendix D of AS/NZS 1158.1.1 and AS/NZS 1158.3.1 for a full list of the mandatory design information required to be submitted. Work shall not be started until the design documents have been approved by QLDC.

Layout Drawings (Refer Appendix 3)

The layout drawings shall be produced using a CAD based computer program and shall include the following minimum information:

- (a) Locations of all poles (dedicated lighting poles and/or overhead power poles) where the luminaires are installed and dimensions clearly showing the pole spacings.
- (b) All the particular roadway features including kerbs, carriageway edges, lane markings, property boundaries, traffic islands, pedestrian crossings, and any other features that form part of the road reserve or carriageway.
- (c) Equipment legend detailing the luminaire types (LED count and driver current), mounting arrangements, poles and outreach arms.

Design Report or Design Statement

A design report or design statement shall be provided along with layout drawings and shall contain comprehensive information detailing all aspects of the design and (in conjunction with the layout drawings) shall be used as a method of verification that the design is fully compliant with the New Zealand requirements of AS/NZS 1158 and any other particular QLDC requirements. As a minimum the following information shall be provided:

- (a) The applicable categories and subcategories for each road.
- (b) A list of the design methods employed and presentation of the modelling results to demonstrate compliance. This can be a list of tabulated calculation results with suitable printouts from the lighting software used.

- (c) Any areas of non-compliance (with the NZ standards and/or QLDC requirements) shall be noted along with explanatory notes describing why a fully complying design was not achieved. QLDC approval shall be required for any areas of non-compliance.
- (d) Details of the lighting arrangement (single sided, staggered, opposite, etc.) and geometry (spacing, mounting height, overhang, up cast angle).
- (e) Details of the lighting columns including type, size, material, finish and any particular mounting requirements (frangible, shear based, etc.).
- (f) Luminaire details including luminaire name, description, input power, LED count, driver current, optical setting, lumen output and IP/IK rating.
- (g) The origin of the photometric file (used in the design modelling) for the luminaires.
- (h) The name and source of the computer software used.
- (i) The MF used and the basis for the MF selection (refer to section 3.3.5).

Calculation Results (Refer Appendix 2 and 4)

A printout of the calculation results (directly from the lighting software) shall be required to be submitted for approval along with the other design information listed above. The calculation results can be pasted into the design report or onto a drawing information sheet provided it is a direct output from the lighting software.

Combination Layout Drawings and Design Information (Refer Appendix 1 and 2)

QLDC will accept a set of drawings with the calculation results and design information pasted onto an information sheet, provided all of the above mentioned design information is clearly presented.

Spill Light Calculation Results

Spill light calculations shall be carried out in accordance with NZTA M30 for all new category V street lighting installations adjoining residential properties. The spill light calculations shall be carried out with a maintenance factor of 1.0. Spill light calculations are not required for category P lighting installations unless specifically requested by QLDC. Examples where spill light calculations might be requested would be:

- Commercial P11a/P11b car parks bordering residential areas
- Lighting of pedestrian activity areas or narrow alleyways adjacent to residential (particularly multi-story apartments where windows may be close to light poles)
- Lighting of areas elevated above other residential development

QLDC will reject any design that is submitted with missing or incomplete information, or any unjustified areas of non-compliance.

3.5 Flag Lighting

At isolated rural unlit intersections, where particular night time safety issues have been identified, flag lighting (in addition to reflective strips) should be used as a means of providing advance warning to alert approaching motorists to the presence of the intersection. In such cases specific illuminance design is not required and the following table has been provided as a guide to selecting the most appropriate luminaire and mounting parameters.

QLDC Table 2 Parameters for Flag Lighting

Vehicle Volume (VPD)	Subcategory	Maximum Mounting Height (m)	Maximum Lumen Output (lm)
> 20,000	V2	12	18,000
7,500 to 20,000	V3	10.5	14,000
< 7,500	V4	9	9,000

QLDC will advise each applicant whether flag lighting is required on a case by case basis.

4 DIFFERENCES BETWEEN THE QLDC TECHNICAL SPECIFICATION AND AS/NZS STANDARDS

Where there are differences between the QLDC Technical Specification and the AS/NZS Standards this Technical Specification takes precedence. The following are instances where QLDC's requirements differ from (or are in addition to) the Standards:

- Luminaire tilt angles shall not exceed 5°
- Spill light shall be controlled as per District Plan
- On Category V roads the Threshold Increment (TI) shall not exceed 10% (AS/NZS 1158 allows up to 20%)

The QLDC may also impose other requirements (that deviate from these specifications and/or the AS/NZS Standards) based on special site or community specific requirements, and in such cases the applicant shall be advised accordingly.

5 EQUIPMENT SELECTION AND INSTALLATION REQUIREMENTS

All equipment specified by the designer shall be subject to final approval by QLDC. The design life and durability performance shall be 20 years for all luminaires and 50 years for all other equipment.

5.1 Luminaires

The following LED minimum performance requirements are applicable to all new lighting installations and shall be read in conjunction with NZTA M30:

QLDC Table 3 LED Minimum Performance Requirements

Main Characteristics	
Colour Temperature	Between 3000 and 4000K
CRI	≥ 70
Rated Optical Life	≥ 85,000 hours
Insulation Class	II
Protection Degree	IP66
Impact Protection	IK08
LED Modules	Removable
Tilt Angle	0° - 5° (Adjustable on site).
Weight	≤ 15kg
Mounting	Bracket attachment Ø42mm to Ø60mm
Temperature Range	-10° to +40°
Gear Tray	Removable plate
Electrical Characteristics	
Rated Voltage	230V (50Hz)
Power Factor	>0.9 (at full load)

Integrated Surge Protection	Up 10kV/10kA
Total Harmonic Distortion	≤ 20%

All luminaires shall be designed to enable the LED light engine to be replaced and/or upgraded. The IP66 rating of the complete luminaire shall not be compromised as a result of either replacement or upgrade of the luminaire components.

The integral Surge Protection Device (SPD) shall be an electronic device capable of sustaining 5 strikes with automatic reset capability and must be of a type capable of protecting all electronic components within the luminaire. Varistor type SPD devices shall not be used as their operating times are not always fast enough to protect electronic components. Suppliers shall provide details of the SPD's characteristics and demonstrate that the installed device will protect all electronic componentry.

The 20 year design life applies to all component parts of the luminaire and includes the housing, lens, gaskets, LEDs, compartments, drivers and control gear.

In addition to meeting the above minimum standards the LED manufacturer and/or supplier shall provide a 10 year performance warranty on the luminaire, based on normal LED operation within the QLDC district. The warranty must be in the name of QLDC and details must be provided with As-built information.

QLDC may impose other requirements that differ from those stated above or in NZTA M30 e.g. it may be more appropriate to apply a lower colour temperature. 3000K is the standard colour temperature required in Category P residential areas. 4000K is only allowed in areas where CCTV coverage is required and on main arterial routes as defined by QLDC.

The introduction of smart computerised central management systems (CMS) can provide greater flexibility in how lighting systems are operated. Simple on/off functionality can now be replaced with a CMS which allows remote control and dimming functions to be implemented. QLDC may require each LED luminaire to be provided with integral CMS ready control gear such as a 7-Pin NEMA socket (with shorting cell) and a DALI compatible driver. QLDC will advise each applicant of any particular CMS requirements. As a minimum requirement the QLDC requires all new LED luminaires to have dimmable drivers with the ability to add an integral control unit (now or at a later date) without requiring the luminaire to be taken down and modified.

Refer to NZTA M30 for the acceptable LED testing procedures and methods of determining optical performance, production of photometric files (IES and CIE format) and method of measuring lumen depreciation.

NZTA M30 contains a list of accepted LED luminaires that have been assessed as meeting the M30 criteria and this list has been adopted by QLDC, except for colour temperature requirements. Refer to section 3.1.

5.2 Environmental Conditions

All equipment selected for use in QLDC region shall have to cope with particular climatic and environmental conditions including seasonal weather fluctuations such as heavy winds (wind loadings), heavy snow (snow loadings) in the winter and very high temperatures in the summer.

5.3 Poles

The new luminaires shall be mounted on any combination of the following configurations:

- New street lighting poles.
- Existing overhead power poles using suitable outreach arms mounted onto each power pole.
- Joint use mast arm (JUMA) or joint use signal (JUSP) poles.

- (d) Mounted directly onto buildings (or other infrastructure) using suitable mounting brackets and hardware.

All new poles (and mounting hardware) shall comply with the relevant structural standards and the performance and durability requirements of NZTA M26 in addition to any local environmental conditions such as high wind and/or snow loadings and poor ground conditions.

In the case of any building mounted luminaires, permission from the building (or asset) owner is required prior to installation.

5.3.1 New Poles

Unless otherwise advised by QLDC all new lighting columns shall be octagonal steel (hot dip galvanised) ground planted poles complete with curved outreach arms. The poles shall be unpainted unless there are particular visual or environmental concerns that need to be addressed. QLDC shall approve the colour and painting shall be carried out by the pole manufacturer during fabrication and assembly.

All new lighting poles shall be of the frangible type as a minimum requirement, however certain ground conditions or safety issues may require the poles are shear or flange based (with either a stub base or concrete foundation). High speed areas exceeding 70kph will require use of shear or flange based poles. Specific design may also be required at locations that have particular environmental or physical constraints i.e. bridges, retaining walls, gabion baskets, or other structural elements that may be present.

On category P roads, that are being installed as part of a new subdivision, decorative or heritage style poles may be used provided they meet all of the performance requirements listed within this design guide, on approval by QLDC.

New lighting poles shall be designed and constructed based on the luminaire mounting parameters, weights and sail areas specified in the following table.

QLDC Table 4 Luminaire Mounting Parameters

Luminaire Mounting Height (m)	Maximum Bracket Outreach (m)	Maximum Luminaire Weight (kg)	Maximum Luminaire Sail Area (m ²)
12.00	4	15	0.15
10.50	4	15	0.15
9.00	3	10	0.12
7.50	3	9	0.10
6.00	2	9	0.10

Where possible the above standard mounting heights shall be used, however there may be special circumstances where other mounting heights and/or outreach lengths are required, and in such cases compliance with the structural and durability requirements of NZTA M26 will need to be demonstrated in addition to obtaining QLDC approval prior to pole selection.

Refer to Appendix 5 for typical arrangement.

5.3.2 Existing Power Poles

At locations where there are existing overhead power poles and it is not practical to install new street lighting poles, the luminaires may be able to be mounted onto the existing poles using suitable steel (hot dip galvanised) outreach arms, subject to approval from the local electricity distribution company.

All new outreach arms (and mounting hardware) shall comply with the relevant structural standards and the steel performance and durability requirements of NZTA M26.

5.3.3 Traffic Poles

Where new lighting is required at signalised intersections involving the addition of new signal poles the preference is to mount the luminaires onto JUSP or JUMA poles.

6 POWER SUPPLY AND CONTROL REQUIREMENTS

6.1 Power Supply and Cabling Requirements

The design and installation of power supplies to the new lighting, including alterations and extensions to the street lighting network (SLN), shall be undertaken by an experienced and competent designer and/or contractor “approved” by the local electricity network company.

All installation work shall be carried out in accordance with the requirements of the local electricity network company and all related electrical regulations and standards including (but not limited to) AS/NZS 3000 (wiring rules) and the NZ Electricity (Safety) Regulations.

6.2 Lighting Control Systems

Road lighting control systems typically involve any combination of the following:

- (a) Manual switching from a central location (area substation) supplying a group of luminaires.
- (b) Photocell control from a central location supplying a group of luminaires or individual photocells mounted on each luminaire.
- (c) CMS or SCADA control using signals transmitted over a local network to remotely control and/or dim groups of lights.

As a minimum all new luminaires shall come with dimmable drivers in accordance with M30.

7 COMMUNITY SPECIFIC DESIGN GUIDELINES

This section draws attention to urban design, the QLDC District Plan, community specific requirements as well as non road related elements. It is important to adhere to the Southern Light Part One - A Lighting Strategy, the operative QLDC District Plan and the QLDC Urban Design Strategy which provides design guidelines and other urban design reference documents.

Where community specific guidelines are available these shall be taken into consideration throughout the design and construction of subdivisions and development. Contact should be made to QLDC to ascertain current status of community specific plans.

8 DESIGN GUIDELINES FOR LIGHTING NOT COVERED IN AS/NZS 1158

AS/NZS 1158 provides minimum performance and design requirements for the lighting of roads and public spaces. However there are other forms of outdoor lighting that are not covered within the AS/NZS 1158 series (or are included in other standards), and the following sections provide guidance to designers and others responsible for lighting schemes (permanent or temporary) that fall outside AS/NZS 1158.

As a minimum requirement all lighting listed within this section shall comply with the requirements of AS 4282 which covers the control of the obtrusive effects of the following outdoor lighting applications:

- For work or recreation (outdoor workplace lighting shall also comply with AS/NZS 1680.5)
- For safety or security
- For amenity
- For advertising or display

AS 4282 excludes:

- Road and public lighting
- Lighting installed for the purposes of colour television broadcasting

Vested infrastructure must be cost effective and should be a nationally and readily available product, approved by QLDC.

8.1 Feature Lighting (Up-lighting and Flood Lighting)

Adherence to the Southern Light Strategy and Technical Specifications gives the Council and private owners the opportunity to celebrate and highlight the special features in our community without over saturation of lighting. While some festive and feature lighting may contravene the upward waste light requirement, there are some circumstance where this will be allowed through both permanent and temporary installations. Special dispensation must be approved by QLDC and may reflect the communities' intention to seek accreditation for Dark Skies.

Feature lighting (including in-ground up-lighting, bollards and above ground floodlighting) shall only be provided for specific locations that are of special or historical significance. There are no specific minimum or maximum illumination levels, however each individual design shall be submitted (for approval by Council) with accompanying calculations clearly showing the horizontal and/or vertical illuminance values corresponding to each feature being lit.

In the case of a statue, tree, building façade or sign the vertical design area shall match (as closely as possible) the item being illuminated. Where multiple floodlights are required to illuminate the perimeter of a tree or statue a vertical calculation shall be required for each floodlight aimed at the item.

All floodlights shall be directionally aimed and focused towards the items required to be illuminated, and in no case shall any up-light be aimed straight up into the atmosphere. The Council's preference is to have building or pole mounted floodlights aimed down (below the horizontal) towards the items being lit. The Council recognises that this may not always be practical and will allow in-ground floodlights to be used subject to their approval.

The Council reserves the right to withhold approval for any feature lighting in a public setting if the adverse lighting effects are deemed to be too excessive, and in such cases the lighting designer may be required to submit an alternative design using lower lumen output fittings.

All feature lighting equipment (luminaires, housings, columns, fixing brackets, etc) shall comply with the durability requirements in section 4. Any in-ground luminaires, located where vehicles may be active, shall have a maximum surface load capacity of 5,000 kg.

8.2 Parks and Open Spaces

Parks and Open Spaces must adhere to public spaces within AS/NZS 1158 where appropriate. Areas containing feature lighting (e.g. trees, shrubs or monuments) are covered in Feature Lighting.

8.3 Illuminated signs

For externally illuminated signs it is preferential that the light source is positioned to point downwards towards the sign rather than upwards to minimise upward light pollution (sky glow). Refer to Feature Lighting for further details.

All illuminated sign shall adhere to Section 18, Signs of the Operative and Proposed District Plan. Signs exceeding 150cd/m² of illumination require QLDC consent.

8.4 Outdoor Domestic Lighting

While the QLDC does not have a vested interest in domestic outdoor lighting installations, there may be occasions where neighbours (or pedestrians) raise complaints about excessive glare and/or spill light.

This document does not cover outdoor domestic lighting, however AS 4282 contains some informative text on good practice including the use of passive infra-red movement detectors or low brightness (dimmed) lighting when continuous (over-night) operation is required.

8.5 Outdoor Workplaces

The design and performance requirements for outdoor workplace lighting are covered under AS/NZS 1680.5, and should be followed for all applicable areas. The obtrusive effects of outdoor workplace lighting can be mitigated by applying the requirements of AS 4282.

APPENDIX 1 - TYPICAL INFORMATION SHEET DRAWING

LUMINAIRE AND POLE LIST

TYPE	LUMINAIRE DESCRIPTION	POLE DESCRIPTION	MOUNTING HEIGHT	ARM LENGTH	TLT ANGLE	Nb. OFF
A	ACETALCO 100TA 400 2000 300 150 LED	SPINATE 1.5M SUBVERSIVISION POLE C/W CURVED 0° TIECH ARM	7.5	2	5	10
B	ACETALCO 100TB 200 1000 400 150 LED	SPINATE 1.5M SUBVERSIVISION POLE C/W CURVED 0° TIECH ARM	7.5	2	5	2
C	ACETALCO 100TM 200 1000 400 150 LED	SPINATE 1.5M SUBVERSIVISION POLE C/W CURVED 0° TIECH ARM	4.0	6.0	5	19
	ACETALCO 100TM 200 1000 400 150 LED	SPINATE 1.5M SUBVERSIVISION POLE C/W CURVED 0° TIECH ARM	4.0	6.0	5	4

LEGEND

- A NEW LUMINA® MOUNTED ON NEW LIGHTING POLE (LETTER DENOTES PARTICULAR LUMINA® TYPE AND POLE MOUNTING DETAILS AS PER THE LUMINA® AND POLE LIST)**

- EXISTING LUMINAIRE MOUNTED ON EXISTING LIGHTING POLE

- ## ESQUEMA DOATOUR LINES

NOTES

- [illegible]

REFERENCE DRAWINGS

FOR THE LAYERS OF THE FLOORING

CALCULATION RESULTS

[illegible]

Fitted model									
Model	Log-likelihood	-2 log-likelihood	AIC	BIC	Bayesian information criterion				
Model 1	-10.00	20.00	20.00	20.00	20.00				
Model 2	-10.00	20.00	20.00	20.00	20.00				
Model 3	-10.00	20.00	20.00	20.00	20.00				
Model 4	-10.00	20.00	20.00	20.00	20.00				
Model 5	-10.00	20.00	20.00	20.00	20.00				
Model 6	-10.00	20.00	20.00	20.00	20.00				
Model 7	-10.00	20.00	20.00	20.00	20.00				
Model 8	-10.00	20.00	20.00	20.00	20.00				
Model 9	-10.00	20.00	20.00	20.00	20.00				
Model 10	-10.00	20.00	20.00	20.00	20.00				
Model 11	-10.00	20.00	20.00	20.00	20.00				
Model 12	-10.00	20.00	20.00	20.00	20.00				
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Model 32	-10.00	20.00	20.00	20.00	20.00				
Model 33	-10.00	20.00	20.00	20.00	20.00				
Model 34	-10.00	20.00	20.00	20.00	20.00				
Model 35	-10.00	20.00	20.00	20.00	20.00				
Model 36	-10.00	20.00	20.00	20.00	20.00				
Model 37	-10.00	20.00	20.00	20.00	20.00				
Model 38	-10.00	20.00	20.00	20.00	20.00				
Model 39	-10.00	20.00	20.00	20.00	20.00				
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Model 97	-10.00	20.00	20.00	20.00	20.00				
Model 98	-10.00	20.00	20.00	20.00	20.00				
Model 99	-10.00	20.00	20.00	20.00	20.00				
Model 100	-10.00	20.00	20.00	20.00	20.00				

NOT FOR CONSTRUCTION

[illegible]

APPENDIX 2 - TYPICAL DESIGN NOTES AND CALCULATION RESULTS

Drawing Notes (alternative to design report):

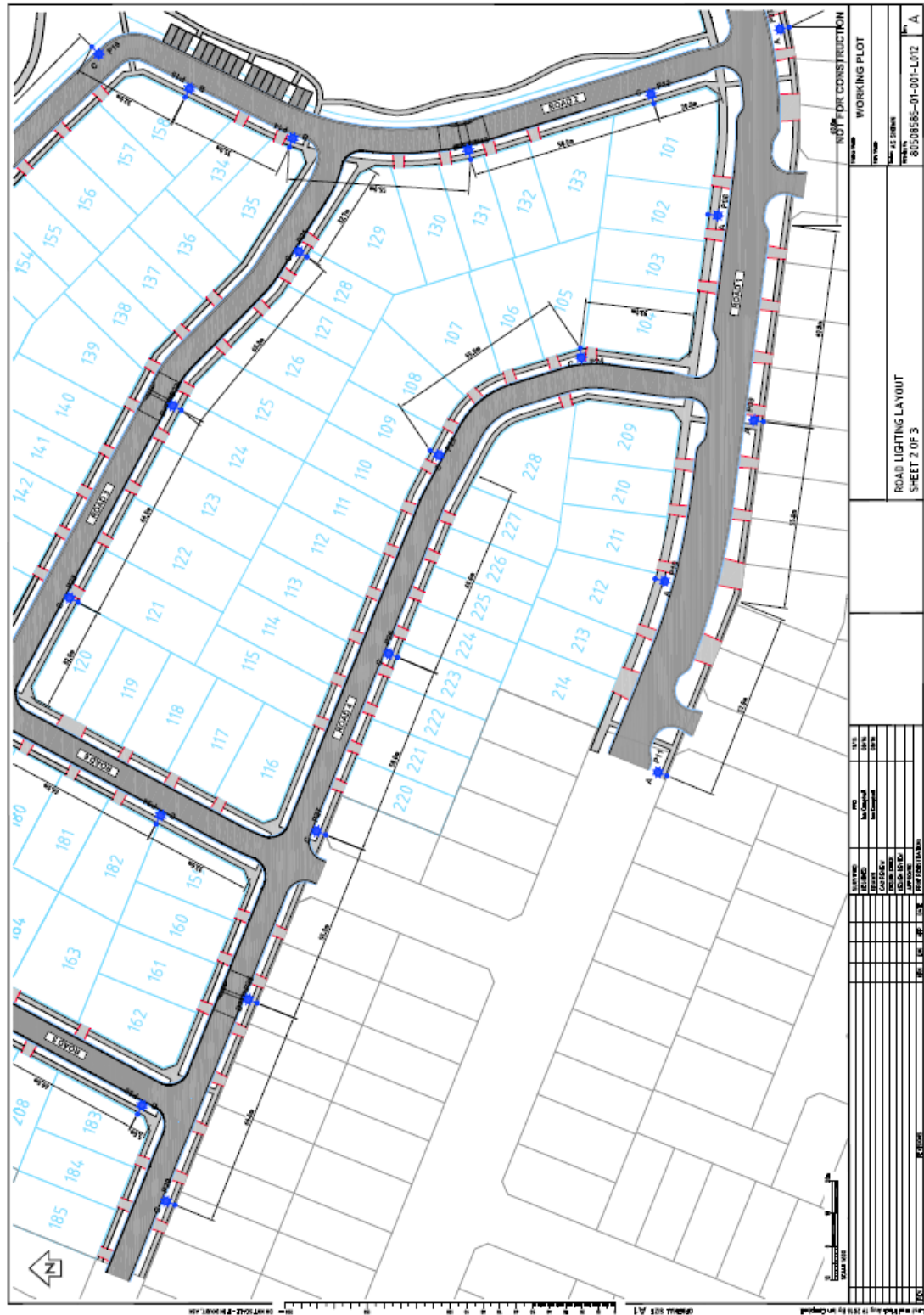
NOTES

1. ALL NEW STREET LIGHTING POLES SHALL BE SPUNLITE (OR EQUAL) TAPERED OCTAGONAL STEEL FRANGIBLE GROUND PLANTED COLUMNS COMPLYING WITH NZTA M26.
2. THE NEW STREET LIGHTING POLES SHALL BE LOCATED IN FRONT OF THE PROPERTY BOUNDARIES (WITHIN THE ROAD RESERVE) OR WHERE SHOWN ON THE DRAWINGS.
3. THE ROAD LIGHTING HAS BEEN DESIGNED TO COMPLY WITH THE CATEGORY P REQUIREMENTS OF AS/NZS 1158.3.1 AND THE QLDC SOUTHERN LIGHTS STRATEGY. THE LIGHTING ALONG ROAD 1 (OFF SH6) HAS BEEN DESIGNED IN ACCORDANCE WITH THE CATEGORY P4 REQUIREMENTS AND THE ROAD LIGHTING ALONG THE REMAINING ROADS HAS BEEN DESIGNED IN ACCORDANCE WITH THE CATEGORY P5 REQUIREMENTS. THE PARKING AREA ON ROAD 2 HAS BEEN DESIGNED IN ACCORDANCE WITH THE CATEGORY P11c REQUIREMENTS.
4. THE LUMINAIRES SHALL BE AEC ITALO LEDs (OR EQUAL), WITH MODULES AND WATTAGES AS SPECIFIED IN THE LUMINAIRE AND POLE LIST. THE QUALITY OF MANUFACTURE AND OPTICAL PERFORMANCE OF ANY ALTERNATIVE LED LUMINAIRES SHALL MATCH OR EXCEED THAT OF THE AEC ITALO (INCLUDING THE CURRENT DESIGN SPACINGS) AND SUPPORTING CALCULATIONS SHALL BE SUBMITTED ALONG WITH ANY ALTERNATIVE LUMINAIRES OFFERED.
5. WHEN INSTALLED ALL NEW LUMINAIRES SHALL HAVE MOUNTING HEIGHTS, OUTREACH ARM LENGTHS AND TILT ANGLES AS SPECIFIED IN THE LUMINAIRE AND POLE LIST.
6. WHEN POLES ARE SET IN PLACE THEY SHALL BE VERTICAL TO WITHIN 2°. WHEN EACH LUMINAIRE IS FITTED IT SHALL HAVE THE REQUIRED TILT TO WITHIN 2° AND THE AXIS OF THE LUMINAIRE BEAM SHALL BE IN A VERTICAL PLANE TO WITHIN 2°.
7. ALL MATERIALS (INCLUDING LUMINAIRES, POLES, ARMS AND MOUNTING HARDWARE) SHALL COMPLY WITH THE DURABILITY REQUIREMENTS OF NZTA M26 AND M30.
8. THIS DRAWING ONLY DEPICTS THE LUMINAIRES, POLE LOCATIONS AND MOUNTING REQUIREMENTS ASSOCIATED WITH THE LIGHTING DESIGN. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY STREET LIGHTING NETWORK (SLN) DESIGN AND INSTALLATION (THAT MAY BE REQUIRED TO ESTABLISH AND/OR EXTEND THE SLN) AND ALL WORK SHALL BE UNDERTAKEN BY AN EXPERIENCED AND COMPETENT CONTRACTOR "APPROVED" BY THE LOCAL LINES COMPANY.
9. THE CONTRACTOR SHALL COMPLY WITH THE NZ ELECTRICITY (SAFETY) REGULATIONS, NZ WIRING RULES (AS/NZS 3000) AND ANY SPECIFIC LINES COMPANY RULES AND PROCEDURES. THIS SHALL INCLUDE MAINTAINING THE REQUIRED CLEARANCES BETWEEN POWER LINES AND ANY LIGHTING AND CONSTRUCTION EQUIPMENT DURING THE CONSTRUCTION PERIOD AND FOLLOWING COMPLETION WHEN ALL THE LIGHTING EQUIPMENT HAS BEEN INSTALLED.

Illuminance Calculation results (exported from AGi32):

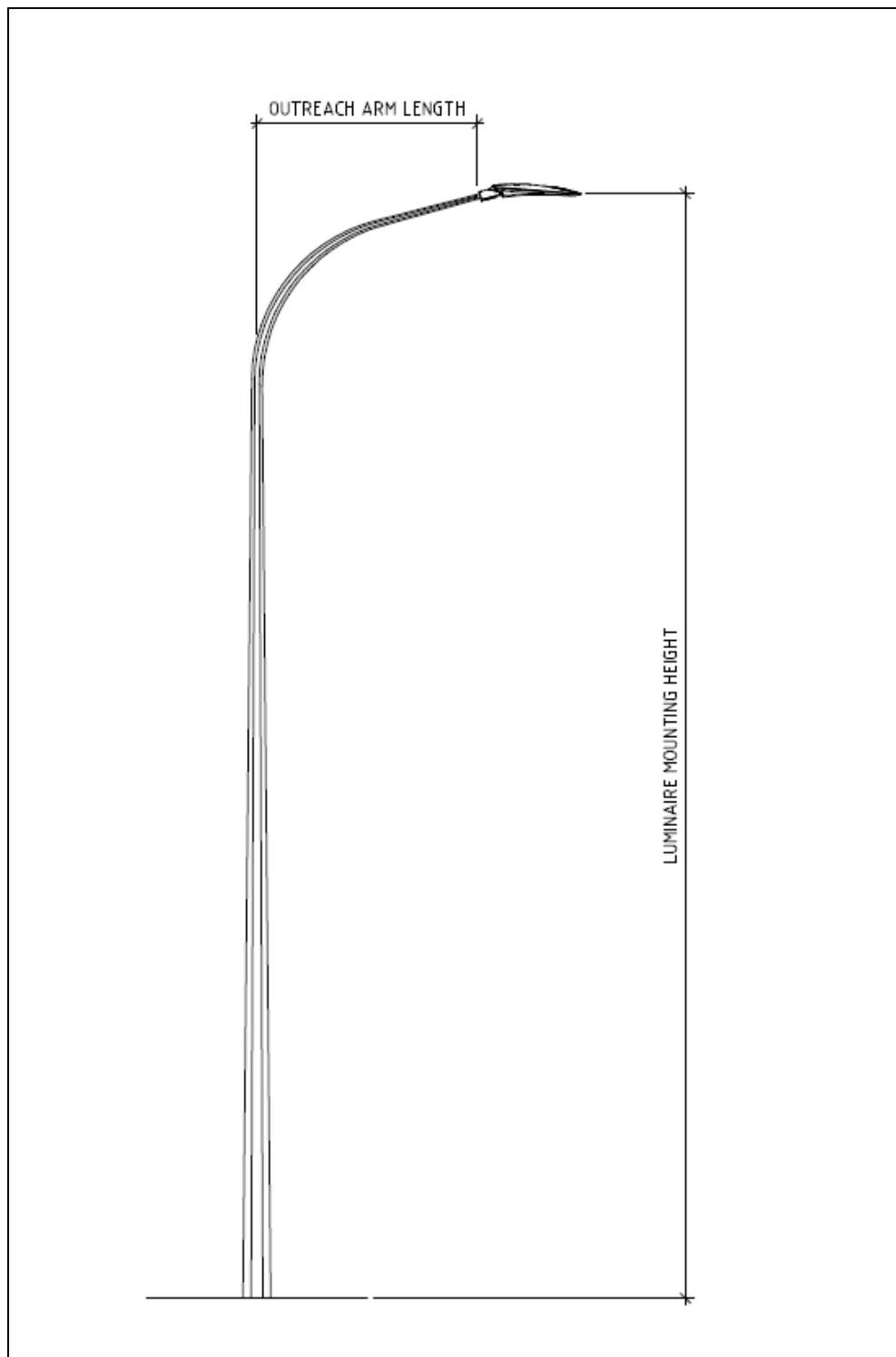
AS/NZS 1158.3.1 Category P - Calculation Summary						
Scene: Scene_1						
Label	CalcType	Units	Avg	Min	Max/Avg	Description
Road 2 Car Parks	Illuminance	Lux	4.23	0.9	2.62	Category P11c - 3.5 Lux (Avg), 0.7 Lux (Min) & Uniformity (Max/Avg) of 10 (Max)
Road 2 LATM 131 L	Illuminance	Lux	N.A.	3.6	N.A.	Category P5 - 3.5 Lux (Min)
Road 2 LATM 131 R	Illuminance	Lux	N.A.	4.0	N.A.	Category P5 - 3.5 Lux (Min)
Road 2 LATM 149 L	Illuminance	Lux	N.A.	4.2	N.A.	Category P5 - 3.5 Lux (Min)
Road 2 LATM 149 R	Illuminance	Lux	N.A.	4.1	N.A.	Category P5 - 3.5 Lux (Min)
Road 3 LATM 139 L	Illuminance	Lux	N.A.	4.6	N.A.	Category P5 - 3.5 Lux (Min)
Road 3 LATM 139 R	Illuminance	Lux	N.A.	4.1	N.A.	Category P5 - 3.5 Lux (Min)
Road 4 LATM 161 L	Illuminance	Lux	N.A.	4.1	N.A.	Category P5 - 3.5 Lux (Min)
Road 4 LATM 161 R	Illuminance	Lux	N.A.	4.5	N.A.	Category P5 - 3.5 Lux (Min)

APPENDIX 3 - TYPICAL LAYOUT DRAWING

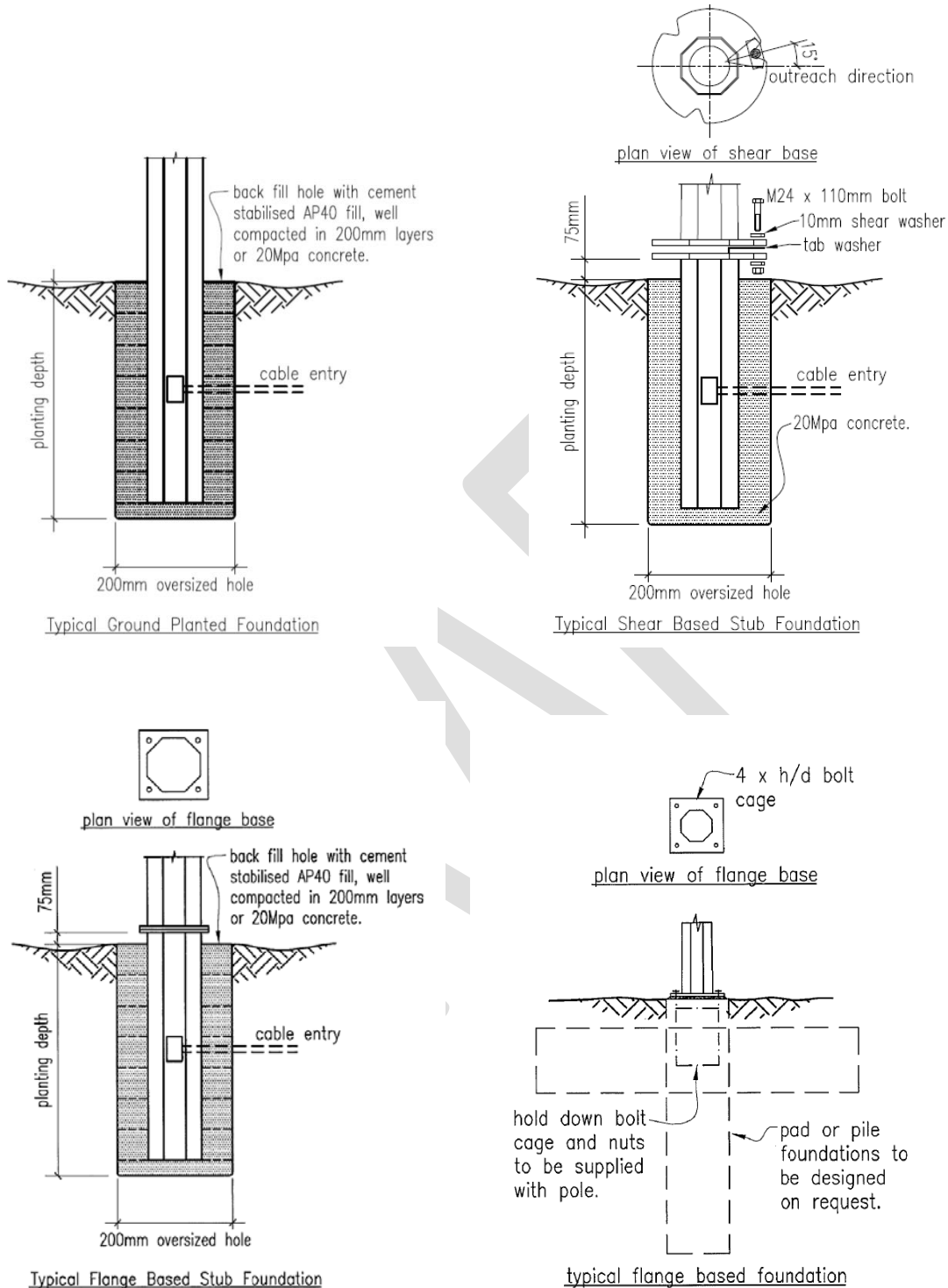


APPENDIX 5 - TYPICAL POLE DETAILS

Tapered Octagonal Steel Lighting Pole c/w Curved Outreach Arm



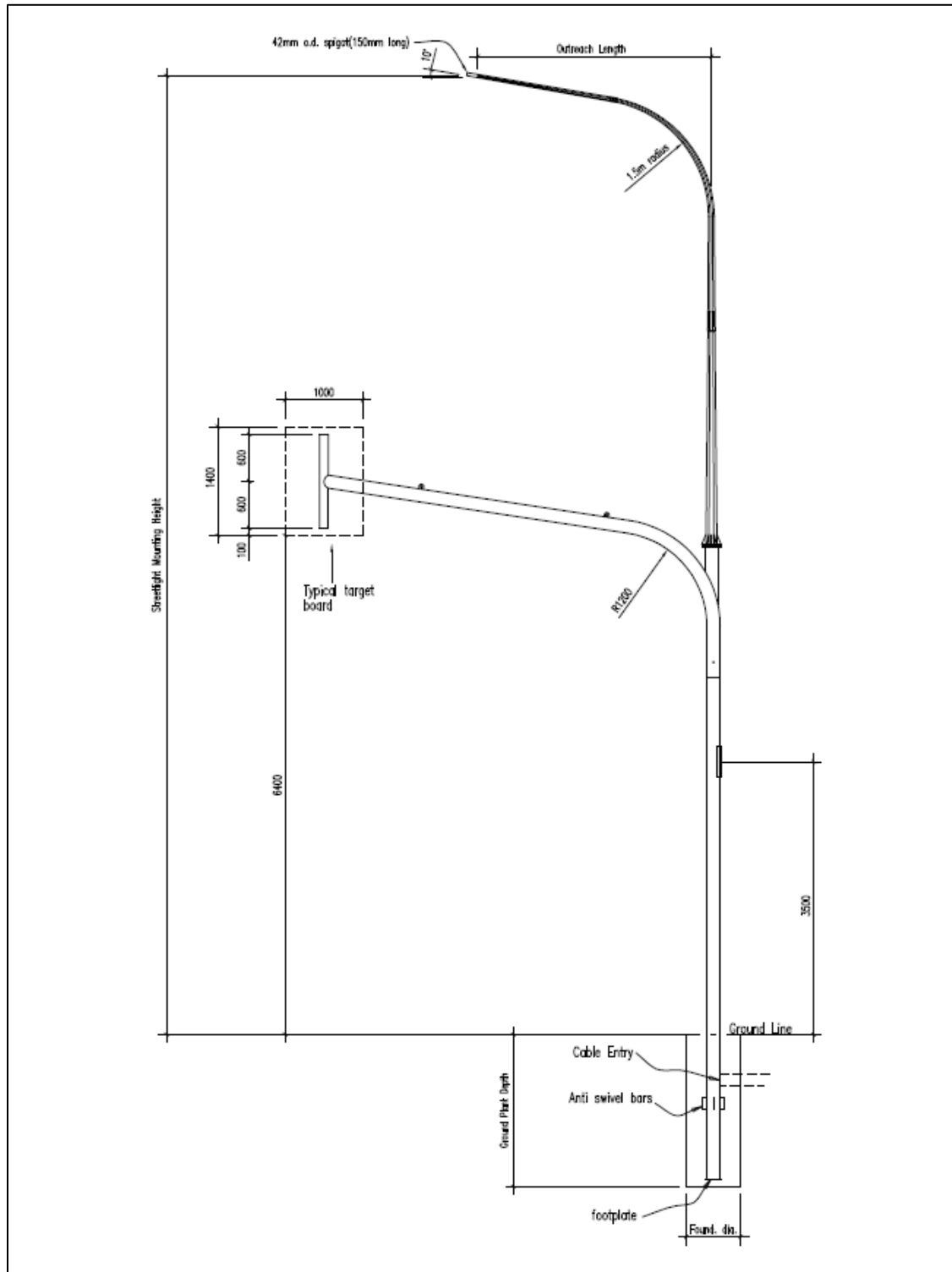
Typical Lighting Pole Foundation Details



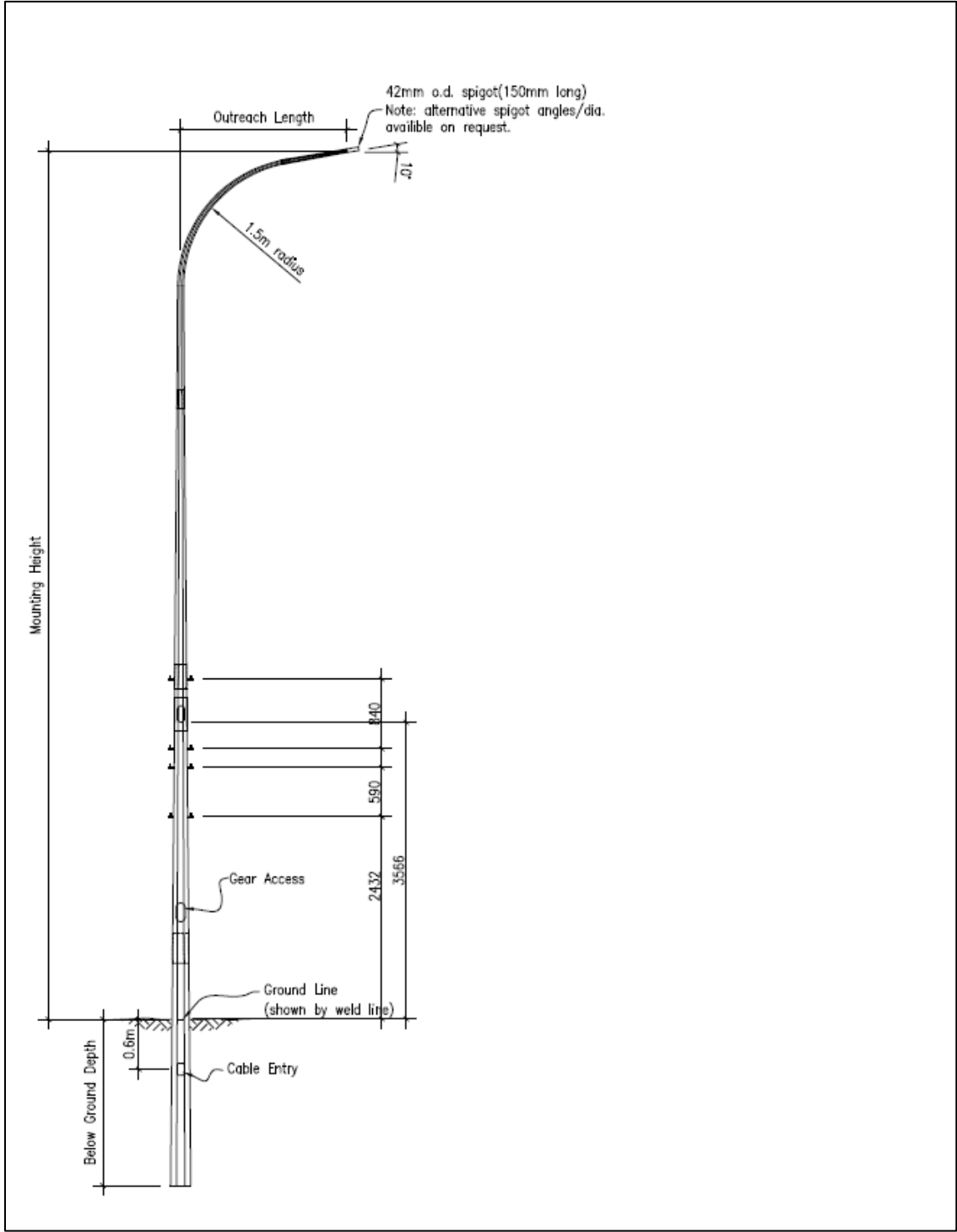
Note: The above arrangements depict typical details only and the actual mounting details may vary between pole suppliers. Specific design may also be required due to site specific ground conditions.

JUMA and JUSP Signal Poles

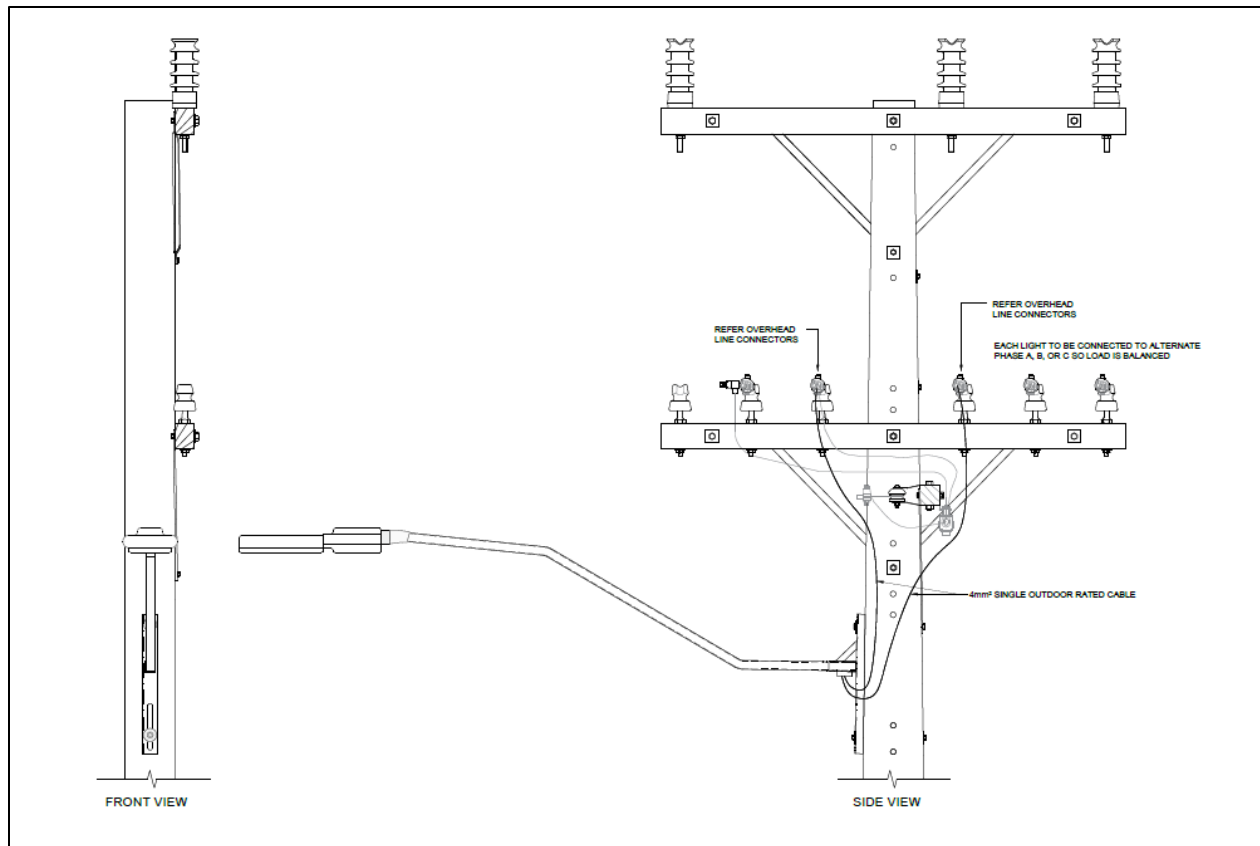
JUMA Signal Pole:



JUSP Signal Pole:



Typical Power Pole Mounting Details



Note: The above arrangement is typical only and any work on or near overhead lines shall be undertaken by the local electricity network company or a contractor approved by the local electricity network company.

APPENDIX 6 - EXAMPLE OF COMMUNITY SPECIFIC DESIGN (CARDRONA)

The following images have been presented as an example of a community specific design that was applied to a lighting upgrade at Cardrona where equipment (luminaires and poles) were selected to blend in with the historical context of the Cardrona Hotel and surrounding environment.

Image date December 2009 (before upgrade):



Image date July 2015 (after upgrade):

