Fiji Roads Authority

ROAD LIGHTING DESIGN GUIDE

March 2019

PLANNED UPDATE AND DISTRIBUTION CONTROL

Date	Principal Changes

UPDATES ADVISED

Date	To

Document Name : Road Works Standard And Specifications		Document Id : FRA-QSD-001
Issue Date :	Issue No.:01	Rev.: 00

Prepared By Program Manager Roads	Reviewed By Head of the Governance	Approved By CEO	Signed Off By Board Chairman
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FRA's Road Lighting Design Guide

Updates Record

Rev. No. Date Released	Section/s Update	Description of Revision	Authorised By
Rev 2 – 20 Jul 18	Whole Document	General Formatting and replacement of AS Tables with references	
Rev 3 – 5 March 2019	Minor revisions	Following workshops	

Acknowledgement: FRA gratefully acknowledges the generosity of the Association of Australian and New Zealand Transport and Traffic Authorities(Austroads) in allowing FRA, to use and reference much of the material used in this *Guide.*

Unless specifically identified in the *Guide*, all diagrams and tables have been sourced from the various VicRoads, NZTA and Austroads Design Guides and relevant Australian Standards.

CHAPTER TITLES

1 Introduction

The Fiji Roads Authority (FRA) is responsible for the provision of road lighting throughout Fiji and this design guide has been developed to assist those who become involved in the management and design of public lighting installations. This guide (and referenced standards) provides the technical requirements to achieve the standard of road lighting installation required by the FRA on their road network.

The FRA's objective is to ensure that the public lighting network is attractive, of good quality, easy to maintain and cost effective. The main purpose of public lighting in Fiji is to provide a safe environment for pedestrians and vehicles and to discourage illegal acts.

This guide includes the lighting of:

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

This guide excludes the lighting of:

- Building interiors and exterior building facades.
- Signs
- Indoor car parks
- Sports fields
- Privately owned roads

Note that this design guide is a live document subject to periodic review and may be amended at any time as and when directed by the FRA.

All references to the FRA within this document mean the FRA or their nominated representative.

In summary this document (design guide) describes how to complete the detailed design and calculations required for compliance with the applicable standards and the FRA Road Lighting Standards outlines what the specific design requirements are for each particular road.

2 Reference Documents

The FRA Road Lighting Design Standards.

3 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 Fiji Electricity Act Cap 180 (Chapter 180, Electricity)
AS/NZS 3000: Electrical installations (known as the Australian/New Zealand Wiring Rules)

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 1158.6: Lighting for roads and public spaces, Part 6: Luminaires IEC 62262, Ed. 1.0: Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)

Lighting poles (design and construction):
AS 1214: Hot-dip galvanized coatings on threaded fasteners (ISO metric coarse thread series) AS 1798: Lighting poles and bracket arms - Preferred 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 - Detailed procedures
NZS 3101: Concrete structures standard
NZS 3404: Steel structures standard

NZTA M26: Specification for Lighting Columns

4 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 applicable to this project. The designer shall be responsible for applying all the specific design requirements of AS/NZS 1158 to the extent they are applicable whether or not they are included in this document.

4.1 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-arterials. 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 road lighting categories (for a number of roads) have already been determined and set by the FRA and these are contained within the FRA Road Lighting Design Brief. If a road has not been categorised then the designer shall contact the FRA and seek confirmation. The designer shall not commence any design work until the road lighting category has been established. The designer (or other third party designer) may be required to assist in the evaluation process, but no design shall be commenced until FRA approval has been obtained.

The following information from AS/NZS 1158 shall be used in the design of the different categories and subcategories of lighting.

Figure 2.1 from AS/NZS 1158.1.1

Figure 2.1 provides 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

Table 2.1 sets out the appropriate road lighting categories and describes typical applications for each of the lighting subcategories.

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

Table 2.1 provides lighting categories for:

- Collector roads or nonarterial roads which collect and distribute traffic in an area, as well as serving abutting properties
- Local roads or streets used primarily for access to abutting properties, including residential properties
- Common area, forecourts of cluster housing

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

Table 2.2 provides lighting categories for pedestrian or cycle orientated pathway, e.g. footpaths, including those along local roads and arterial roads, walkways, lanes, park paths, cycleways

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

Table 2.3 provides lighting categories for:

- areas primarily for pedestrian use, e.g. city, town, suburban centres, including outdoor shopping precincts, malls, open arcades, town squares, civic centres
- transport terminals and interchanges, service areas

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

Table 2.4 provides lighting categories for:

- steps and stairways, ramps, footbridges, pedestrian ways
- subways, including associated ramps or stairways

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

Table 2.5 provides lighting categories for:

- parking spaces, aisles and circulation roadways
- **designated parking spaces specifically intended for people with disabilities**

4.2 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.

4.2.1 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) Where possible minimise energy consumption.

For category V roads the design width used for calculations is the width of the driver's carriageway or travelled lanes.

4.2.2 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 designated area 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) Where possible minimise energy consumption.

For category P roads the design width used for calculations is the width of the road reserve between opposite property boundaries.

4.2.3 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 from the relevant parts of the AS/NZS 1158 series provide the minimum levels of compliance that are required for each category and subcategory of lighting.

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

Table 2.2 provides values for the following Light Technical Parameters for Category V Lighting for:

- Average carriageway luminance
- Overall uniformity
- Longitudinal uniformity
- Threshold increment
- Surround verge illuminance
- Point horizontal illuminance
- Illuminance (horizontal) uniformity
- Upward waste light ratio

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

Table 2.6 provides values of light technical parameters and permissible luminaire types for roads in local areas and for pathways

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

Table 2.7 provides values of light technical parameters and permissible luminaire types for public activity areas with the exclusion of car parks

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

Table 2.8 provides values of light technical parameters and permissible luminaire types for connecting elements

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

Table 2.9 provides values of light technical parameters and permissible luminaire types for outdoor car parks (including roof-top car parks).

4.2.4 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.

Use of the specific software application “SAA STAN” is mandatory for the calculation of the luminance based LTPs for the category V straight road elements. This can be achieved using either the software “STANSHELL” (normally supplied with the hard copy version of AS/NZS

1158.2), or another shell program (such as “Perfect Lite”) that is built around “SAA STAN” and which can be demonstrated to reproduce the values of all LTPs provided by “STANSHELL”.

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

4.2.5 Maintenance Factor

A suitable design maintenance factor (MF) shall be applied to the calculations to account for the combined light losses resulting from depreciation in both the lamp and luminaire output over the nominated maintenance period.

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

(a) Luminaire maintenance factor (LMF):
The factor shall be 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.

(b) Lamp lumen depreciation factor (LDF):
The amount of light (lumen output) available at the end of the nominated maintenance period, as a proportion of the initial lumen output (when the lamp was new), expressed as a decimal fraction. Typical lamp lumen depreciation data for various luminaires are provided in Appendix E of AS/NZS 1158.1.2, however the LDF used to determine the design MF shall be obtained from the luminaire/lamp supplier.

So the design MF can be calculated as follows: MF = LMF x LDF

However, 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

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 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) Lamp replacement strategy.
(d) Maximum allowable lumen depreciation.
(e) Allowable lamp mortality.

Although the designer is required to supply the information relating to the MF used in the calculations it is the responsibility of the FRA 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.

The above requirements for establishing the correct MF is only applicable to luminaires with High Intensity Discharge (HID) lamps. For Light Emitting Diode (LED) luminaires the correct MF shall be obtained from the LED supplier.

4.2.6 Design Output Deliverables

The designer shall submit the following design documents for approval by the FRA before commencement of the installation works. Work shall not be started until the design documents have been approved by the FRA. 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.

Layout Drawings

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

(a) Locations of all poles (dedicated lighting poles and/or overhead power poles) where the luminaires are installed.
(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, mounting arrangements, poles and outreach arms.
(d) The drawings are required to be signed by the designer/drawer and checker/reviewer.

Design Report

The design report shall provide 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. As a minimum the design report shall include the following:

(a) The applicable categories and subcategories for each road.
(b) A list of the design methods employed and the presentation of the modelling results. This can be a list of tabulated calculation results with suitable printouts from the lighting software used.
(c) Details of the lighting arrangement (single sided, staggered, opposite, etc.) and geometry (spacing, mounting height, overhang, up cast angle).
(d) Details of the lighting columns including type, size, material, finish and any particular mounting requirements (frangible, shear based, etc.).
(e) Luminaire details including luminaire name, description, lamp size/type, optical setting and IP rating.
(f) The origin of the photometric file (used in the design modelling) for the luminaires and lamps.
(g) The name and source of the computer software used.
(h) The MF used and the basis for the MF selection (refer to section 4.2.5).

5 Equipment Selection and Installation Requirements

All equipment specified by the designer shall be subject to final approval by the FRA.

The design life and durability performance shall be 20 years for all luminaires and 50 years for all other equipment

5.1 Environmental Conditions

All equipment selected for use in Fiji shall have to cope with particular climatic and environmental conditions including extreme weather events such as heavy rains and cyclones.

The following environmental conditions are based on typical (normal) weather events:

Temperature (1)

Over the course of a year, the temperature typically varies from 20°C to 31°C and is rarely below 18°C or above 32°C.

Humidity (1)

The relative humidity typically ranges from 66% (mildly humid) to 99% (very humid) over the course of the year, rarely dropping below 55% (mildly humid) and reaching as high as 100% (very humid).

Wind Speed (1)

Over the course of a typical year wind speeds vary from 0 m/s to 6 m/s (calm to moderate breeze), rarely exceeding 8 m/s (fresh breeze).

Footnote (1): Temperature, humidity and wind speed data sourced from **weatherspark.com**:

http://weatherspark.com/averages/32711/Suva-Central-Division-Fiji

Note that the above climatic data is based on typical yearly fluctuations, however there may be extreme weather events including torrential rain and cyclonic winds that may exceed 56 m/s (200 km/h), and these environmental issues will need to be discussed between the designer and the FRA before final selection approval is granted.

To help mitigate any extreme weather conditions all equipment (luminaires, poles, arms and mounting hardware) shall be required meet the following minimum performance requirements:

(a) Temperature range from -10°C to 40°C.
(b) Solar radiation up to 1000 W/m2.
(c) Wind velocity up to 67 m/s (241 km/h).
(d) Relative humidity up to 100%.

5.2 Luminaires

The luminaires (including the housings, reflectors, visors, lamps and control gear) shall be manufactured and tested in accordance with all the requirements of AS/NZS 1158.6, and in particular the following sections.

5.2.1 Ingress Protection (IP Rating)

Due to the possibility of severe weather events in Fiji the use of IP66 luminaires are mandatory. This IP rating shall apply to the lamp chamber and control gear chamber.

5.2.2 Impact Resistance (IK Rating)

The luminaires shall achieve a rating of resistance to external impact (in accordance with IEC 62262) of not less than IK08.

5.3 Lamps

High intensity discharge (HID) lamps shall have a design life of 20,000 hours and the following list provides the standard HID types and sizes:

(a) High pressure sodium (HPS), standard sizes: 50W, 70W, 100W, 150W, 250W and 400W
(b) Ceramic Metal halide (MH), standard sizes: 50W, 70W, 100W, 150W, 250W and 400W
(c) CosmoPolis (new generation ceramic metal halide), standard sizes: 45W, 60W, 90W and 140W

The preferred lamp type for most road lighting applications is HPS due to its high luminous efficacy (lm/W rating) and long service life; however HPS does have a disadvantage to MH lamps with regard to the quality of light. HPS lamps produce yellow light with relatively poor colour rendering properties, whereas MH lamps have a slightly shorter life but they produce white light with very good colour rendering properties.

In certain areas such as city centres, areas of significance (tourist, amusement or historical places), public transport facilities and high risk pedestrian areas (where CCTV coverage is required), white light luminaires are preferred, however this shall be subject to FRA approval.

The following table specifies the minimum initial rated lumens that shall be used for all street lighting designs involving HID lamps.

Lamp Source / Watts		Initial Lumen Output	Comments
High Pressure Sodium	50	4400	
	70	6600	
	100	10700	
	150	17500	
	250	33200	
	400	56500	
Metal Halide	50	5000	GE Streetwise lamp
	70	7640	GE Streetwise lamp
	100	10900	GE Streetwise lamp
	150	16300	GE Streetwise lamp
	250	25000	GE TT
	400	41000	GE TT
CosmoPolis	45	4725	
	60	6800	
	90	10450	
	140	16500	

Note that the lamp manufacturers in the above table have been provided as a guide only and alternative suppliers may be used provided their lamps meet all of the performance requirements contained in this section.

5.4 LEDs

On category V roads, category P roads and other category P public activity areas LED technology is preferred, however the designer shall be responsible for demonstrating full compliance with the FRA and AS/NZS 1158 standards and obtain FRA approval.

Although LEDs are energy efficient they tend to be heavier than equivalent HID luminaires, and the LED arrays need to be adequately cooled (the body acts as a heat sink), therefore any environmental issues (excessive heat, humidity and cyclonic winds) will need to be carefully considered.

5.4.1 Whole of Life Comparison

The capital costs of LED luminaires tend to be higher than HID luminaires especially those used on category V roads, therefore the designer (in conjunction with the LED supplier) may be required to provide an economic evaluation of the whole of life costs comparing LEDs with equivalent HIDs to demonstrate that the LED being proposed will have a payback period (when the larger initial investment is paid back) of not more than 7 years based on a 20 year service life.

5.4.2 LED Chip Manufacturers

The preferred road lighting LED chip manufactures are Cree, Philips, Orem and Nichia, who are currently recognised as being world leaders in LED technology. The use of alternative LED chips shall require FRA approval.

5.4.3 Warranty and Performance

All LED suppliers/manufacturers shall be required to provide a minimum 10 year performance warranty and the luminaires shall have a rated life of not less than 85,000 hours or 20 years.

The Correlated Colour Temperature (CCT) of all LED luminaires shall be within the general range of 3000°K to 4000°K but shall not exceed 4300°K.

Integral surge protection of not less than 10kV/10kA shall be included within the electronic control compartment of all LED luminaires.

5.5 Poles

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

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

All new poles (and mounting hardware) shall comply with the relevant structural standards and the performance and durability requirements of NZTA M26:2012 (refer section 3) in addition to any local environmental conditions such as high cyclonic winds and poor ground conditions.

5.5.1 New Poles

The new lighting columns shall be octagonal steel (hot dip galvanised) ground planted, shear or flange based poles complete with curved outreach arms.

All new lighting poles shall be of the frangible type as a minimum requirement, however certain ground conditions (or safety issues) may require that the poles are shear or flange based (with either a stub base or concrete foundation). Specific design may also be required at locations that have particular environmental or physical constraints such as 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.

New lighting poles shall be designed and constructed to meet all of the structural and durability requirements (refer section 5.1) based on the luminaire mounting parameters, weights and sail areas specified in the following table.

Luminaire Mounting Height (m)	Maximum Bracket Outreach (m)	Maximum Luminaire Weight (kg)	Maximum Luminaire Sail Area (m2)
12.00	4	15	0.15
10.50	4	15	0.15
9.00	3	10	0.12
7.50	3	9	0.10

Where possible the above standard mounting heights shall be used, however there may be special circumstances where non-standard mounting heights and/or outreach lengths are required, and in

such cases compliance with the structural and durability requirements (as outlined in section 5.1) will need to be demonstrated in addition to obtaining FRA approval prior to pole selection.

Frangible poles shall be used within the road reserve wherever possible. Exceptions to this are included below.

Lighting poles shall not be placed immediately in front of a crash barrier and shall have appropriate clearance from barriers when placed behind.

When lighting poles are located between sections of concrete barrier, steel cover plates, that match the profile of the concrete barrier and the lighting pole, shall be used to cover the resulting gap between concrete barrier sections. The steel cover plate shall be designed to prevent the collection of debris and allow drainage of water at the bottom.

5.5.1.1 Set back zones on the outside of carriageways

Frangible lighting poles shall not be located within:

- 0.7m of the road carriageway in speed zones less than or equal to 60km/h.
- 1.5m of the road carriageway in speed zones greater than 60km/h and equal to or less than 80km/h.
- 3.0m of the road carriageway in speed zones greater than 80km/h.

However, adjacent to a sealed shoulder that is 3m or more in width, the set back zone for frangible poles may be reduced to 1.5m from the road pavement. Lighting poles shall not be placed within road shoulders.

Poles shall be set back as far as is practicable from the edge of the carriageway whilst retaining necessary overhang. Note: for the purpose of this clause, the edge of the road carriageway is defined as either the back of the kerb or the outer edge of a sealed or unsealed shoulder.

5.5.1.2 Poles - set back zones in medians

Frangible lighting poles should not be located in medians less than 1.4m in width (i.e. 0.7m setback distance), unless the lighting is part of a concrete crash barrier system.

In speed environments where speed is less than 80km/h and lighting cannot be installed on the outside of the carriageway, frangible poles may be located in medians as narrow as 1.2m in width.

In speed environments where speed is greater than or equal to 80km/h, frangible lighting poles should not be located in medians less than 2.0m in width. The longitudinal distance from the nose of a median or splitter island to a lighting pole should not be less than 8m, or 5m in extenuating circumstances. However, this may be reduced to 3m for gaps in medians for U-Turn slots and accesses to minor roads.

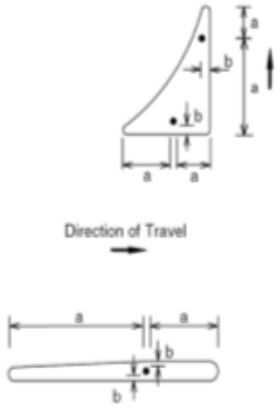
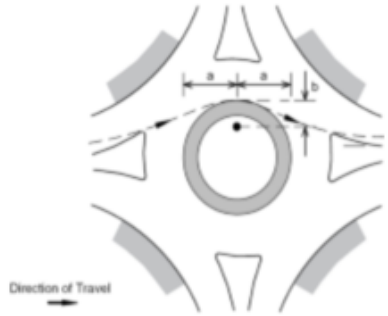
5.5.1.3 Frangible pole selection - mid blocks

In mid block locations, the selection of frangible pole type should be based on the following criteria.

- Slip-base poles should be used in high speed areas (80km/h), in medians 2m or greater in width, where there is adequate clearance to overhead conductors, etc and where pedestrian activity is low.
- Impact absorbing poles should be used in areas where there is risk of a secondary impact with a dislodged pole, where there is limited clearance to powerlines or where vehicle speeds are low (i.e. less than 80km/h) and pedestrian activity is expected. Areas where there is a risk of a secondary impact include:
    - narrow medians (i.e. less than 2m wide)
    - adjacent to railway tracks o on or adjacent to bridges.

5.5.1.4 Frangible pole selection - intersections

At intersections, the selection of frangible pole types is dependent upon a number of factors such as traffic speeds, pole offset, pedestrian activity and the likelihood of impacted poles being involved in secondary impacts. At signalised intersections, joint use poles should be utilised wherever possible to minimise the number of poles on the roadside. The following table provides guidance on the type of poles best suited to various situations.

	Dimensions as per figure		Favoured Pole Types P = Preferred A = Acceptable	
	a (m)	b (m)	Slip-Base	Impact Absorbent
Left Turn and Splitter Islands 	< 8	any		P
	8 to 15	< 1.5		P
	8 to 15	> 1.5	P	A
	> 15	< 1.5		P
	> 15	> 1.5	P	A
Roundabouts 	< 8	any		P
	> 8	< 1.5		P
	> 8	> 1.5	P	A

Note for Roundabouts: It is preferable that poles not be placed in the area of a central island likely to be traversed by out-of-control vehicles (shown shaded on the diagram). In addition, dimensions a and b should be observed for selection of impact absorbing and slip-base poles at any location within the central island. The areas at the periphery of the roundabout, also shown shaded, are particularly vulnerable to out-of-control vehicles and likewise, should not have lighting poles installed where possible.

5.5.1.5 Rigid poles

Rigid poles shall only be used where:

- Joint use poles can be utilised.
- Necessary clearances to overhead powerlines cannot be achieved using an impact absorbing pole. In this situation, a crash barrier shall be provided to protect the rigid pole.
- A crash barrier is required for other purposes and lighting poles can be effectively located behind the barrier. Rigid lighting poles shall be used behind concrete barrier systems.
- Road lighting poles are incorporated into concrete crash barrier systems (e.g. narrow medians in freeways).
- Road lighting poles are located on the outside of or on top of bridge parapets. The bridge parapet is to be designed for the resultant load. No pole, rigid or otherwise, shall be placed in front of the parapet.
- Overhead power supply is required.

5.5.1.6 Centre-hinged poles

Centre-hinged poles shall be used in the following locations:

- In the central island of roundabouts.
- Within 10m from overhead transmission lines (measured from the nearest conductor, including an allowance for sway, to the nearest part of the pole, bracket or luminaire). However, the Design Consultant is to check these requirements with the relevant electricity Distribution Company. Where possible, symmetrical brackets should be used on hinged poles. Single brackets with an outreach up to 3m may be used, subject to manufacturer requirements.

5.5.2 Existing Power Poles

At locations where there are existing overhead power poles and it is not practical to install new street lighting poles, on the approval by FEA, the luminaires may be mounted onto the existing poles using suitable steel (hot dip galvanised) outreach arms. It is important to note that approval by FEA to use existing power poles is under review and confirmation should be obtained from them first before design work undertaken.

All new outreach arms (and mounting hardware) shall comply with the relevant structural standards and the steel performance and durability requirements of NZTA M26:2012 (refer section 3).

5.5.3 Traffic Poles

Where new lighting is required at signalised intersections involving the addition of new signal poles the luminaires shall be mounted on JUSP or JUMA poles.

6 Preferred Equipment and Suppliers

The following equipment and suppliers are deemed to meet the design, installation and maintenance requirements in Fiji, however this list is not final and alternative products may be offered subject to FRA approval, especially in new residential style (category P) subdivisions.

Any alternative products (poles and luminaires) offered shall comply with all of the performance requirements listed within this design guide.

6.1 HID Luminaires

Manufacturer	Model Number
AEC	Kaos 1 and 2
Schreder	Ambar 2 and 3

6.2 LED Luminaires

Manufacturer	Model Number
CREE Lighting	LEDway
CREE Lighting	SLM
CREE Lighting	Edge
CREE Lighting	XSP
AEC	Italo1
AEC	Italo2
AEC	LEDin
AEC	A2led
Schreder	Teceo
Schreder	Piano
Philips	RoadStar
Philips	Xceed

6.3 Octagonal Steel Lighting Poles

Manufacturer	Model Number
Spunlite	Octagonal pole c/w curved arm
Oclyte	Octagonal pole c/w curved arm
Coslee	Octagonal pole c/w curved arm
Ingal	Octagonal pole c/w curved arm

7 Power Supply and Control Requirements

7.1 Power Supply and Cabling Requirements

The local electricity supply networks in Fiji are owned and operated by the Fiji Electricity Authority (FEA) and any design and installation work, associated with providing power to new or upgraded 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 FEA, or directly by the FEA where no such contractor is available.

Prime Fiji Ltd, FRA's street light maintenance contractor is authorised by FEA to undertake work on the SLN. An alternative contractor (or contractors) may be engaged to carry out work on the SLN provided they are approved to do so by the FEA and/or the FRA.

Where outreach arms are required to be mounted onto existing power poles the contractor shall coordinate with the FEA and obtain the necessary approval prior to carrying out the installation works.

All work shall comply with AS/NZS 3000 (wiring rules), the Fiji Electricity Act and any specific FEA rules and procedures.

7.2 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) SCADA control using signals transmitted over a local network to turn groups of lights on or off via control relays and contactors.

The designer shall liaise with the FEA to establish the most economical and cost effective method of controlling the new lighting based on the availability of suitable infrastructure.