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Technical Specifications

The supply and delivery of telemanagement ready LED luminaires with training

Project for

Dr Beyers Naude Municipality, Eastern Cape Province
Ekurhuleni Metropolitan Municipality, Gauteng Province
iLembe District Municipality, Kwazulu-Natal Province
South Africa

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1. Acronyms and Definitions

For the purposes of this document, the acronyms and definitions in standards referred to in **4.4 Normative References** of this compulsory specification, shall apply.

In addition, the following acronyms and definitions shall apply in **Table 1** below.

Table 1: Acronyms and Definitions

Acronyms and Definitions	
Ambient Performance Temperature, Tq	The maximum ambient temperature, Ta, at which a luminaire reaches the operational performance values for luminous flux and rated service life.
Ambient Temperature (Ta)	Temperature assigned to a luminaire by the manufacturer to indicate the highest sustained temperature in which the luminaire may be operated under normal conditions.
Area Lighting	The lighting required to illuminate large areas through the use of high mast flood lighting installations or similar installations. Area lighting includes the lighting of developed areas, such as residential or industrial areas, stadiums, parks, recreational facilities, parking areas and other public areas.
CCT	Correlated Colour Temperature
CRI	Colour Rendering Index
E	Earth terminal / conductor
HID Lamp	High Intensity Discharge Lamp
HPS Lamp	High Pressure Sodium Lamp
L	Live terminal / conductor
LED	Light Emitting Diode
LLF (MF)	Light Loss Factor (Maintenance Factor) This is the factor that is used to calculate the level of illumination after a given period of time and under given conditions, taking into account temperature and voltage variations, dirt accumulation, maintenance procedures and atmospheric conditions.
Luminaire Life	The total time for which a luminaire has been operated before it becomes useless or is considered to be so according to specified criteria. Note: Luminaire life is usually expressed in hours.

Acronyms and Definitions	
Luminous efficacy	Ratio of luminous flux of a lamp (in lumens) to the total electric power consumed (in watts).
Luminous flux	The rate of flow of luminous energy (lumens)
Luminous intensity	The luminous flux per unit solid angle in a given direction.
LOR	Light Output Ratio
Lumen (lm)	An SI unit of luminous flux which is emitted in unit solid angle (steradian) by a uniform point source having a luminous intensity of 1 candela. It indicates the amount of light the light source provides.
Luminaire	An apparatus which distributes, filters or transforms the light transmitted from one or more light sources and which includes, except the light source themselves, all the parts necessary for fixing and protecting the lamps and, where necessary, circuit auxiliaries together with the means for connecting them to the electric supply.
MH	Metal Halide Lamp
N	Neutral terminal / conductor
PF	Fundamental Power Factor
THD	Total Harmonic Distortion
Street Lighting	Refers to the lighting of public thoroughfares including motorways, arterial routes, residential roads, town and city centres and pedestrian-orientated areas.
Uniformity ratio Emin/Eav	This is the variation of illuminance from the lowest value to the average value measured at a specified number of points spread evenly over an illuminated area on a given surface, and expressed as a ratio.
Uo	Overall luminance uniformity, the ratio of the minimum to the average luminance on the road surface of the carriageway within the calculation area.
W	Watts

Where definitions and acronyms are not listed above, the definitions and acronyms given in SANS/IEC 60598-1, SANS/IEC 60598-2-5, and SANS 475, SANS 10098-1, SANS 10389-1 or equivalent shall apply unless otherwise specifically defined within this document. The document shall take preference.

2. Scope of Works

Task 1: Supply and Deliver

The Bidder is hereby invited to submit a binding quote in relation to the supply and delivery of telemanagement ready, energy efficient high mast flood lighting LED luminaires and providing a skills transfer service.

180 LED street lighting luminaires and **18** LED flood lighting luminaires are to be supplied and delivered to the Dr Beyers Naude Municipality, Eastern Cape Province, South Africa.

250 LED street lighting luminaires are to be supplied and delivered to the Ekurhuleni Metropolitan Municipality, Gauteng Province, South Africa.

32 LED flood lighting luminaires are to be supplied and delivered to the Mandeni Local Municipality, Kwazulu-Natal, South Africa.

Task 2: Training

Skills transfer services are to be provided to the installation, operation and maintenance teams. The skills transfer services shall pertain to how the LED luminaires are to be correctly handled, installed, operated, maintained, and repaired. The works (excluding skills transfer) relating to the installation of these luminaires on site are excluded from this Scope of Works.

The reliability, performance and safety of these luminaires have a direct impact on the energy consumption performance and on the standard of functional lighting to be provided.

3. Background

Dr Beyers Naude Local Municipality, Ekurhuleni Metropolitan Municipality, and iLembe District Municipality, South Africa, are three of the 5 municipalities participating in this Energy Efficient Street Lighting Retrofit Project (EEStLRP) and have been considered for Phase 2 of the project. GIZ and the above-mentioned municipalities conducted a quantitative and partial technical audit and structural analysis of 6 high masts and 430 street light poles. These **6** high masts and **430** street light poles have been identified for replacement with energy efficient LED luminaires. The identified **6** high masts and **430** street light poles are considered for luminaire replacement as follows:

Dr Beyers Naude Municipality

Approximately **2** high masts with a height of 30m and **180** street light poles with a height of 10m are installed within Dr Beyers Naude Local Municipality.

Type of High Mast / Street Light Pole	No. of High Masts / Street Light Pole	No. of Luminaires
Graaff Reinet		
30m High Mast	2	18 (9 per mast)
10m Pole	180	180 (1 per pole)
TOTAL:	**182**	**198**

Each high mast is currently fitted with 9 x 400W MV (30m masts), flood lighting luminaires, amounting to a total of **18** existing flood lighting luminaires to be replaced. Additionally, each street light pole is currently fitted with one or two 150W HPS/MV street lighting luminaires, amounting to a total of **180** existing street lighting luminaires to be replaced.

Ekurhuleni Metropolitan Municipality

Approximately 250 street light poles with a height of 9,25m are installed within Ekurhuleni Metropolitan Municipality (Benoni CBD).

Type of Pole	No. of Poles	No. of Luminaires
Benoni CBD		
Zone G2		
9.25m Pole	250	250 (1 per pole)
TOTAL:	**250**	**250**

Each street light pole is currently fitted with 400W HPS or MH street lighting luminaires, amounting to a total of **250** existing street lighting luminaires to be replaced.

iLembe District Municipality

The Mandeni Local Municipality has a soccer field with 4 high masts with a height of 40m installed.

Type of High Mast	No. of High Masts	No. of Luminaires
Mandeni Soccer Field		
40m High Mast	4	32 (8 per mast)
TOTAL:	**4**	**32**

Each high mast is currently fitted with 8 x 2000W MW flood lighting luminaires, amounting to a total of **32** existing flood lighting luminaires to be replaced.

Information regarding the streetlights and high masts selected for luminaire replacement are detailed in the following annexures:

- Annexure A – List of Infrastructure Dr Beyers Naude Municipality, Ekurhuleni Metropolitan Municipality, and iLembe District Municipality

Consequently, a total of **480** energy efficient LED luminaires are required to replace these existing luminaires on the streetlight and high masts identified within the Dr Beyers Naude Municipality, Ekurhuleni Metropolitan Municipality, and iLembe District Municipality.

4. Technical Specifications of the LED Luminaire

4.1 Scope

This specification covers the requirements for the manufacture, testing, supply and delivery of LED luminaires.

4.2 General Requirements

The LED luminaire offered by the Bidder shall comply with the requirements of SANS/IEC 60598 (Safety requirements), SANS 475 (Performance requirements) and normative references indicated below or equivalent.

Only certified luminaires for exterior lighting shall be accepted.

Compliance to these requirements shall be supported by documentary evidence in the form of type test reports / product certification to be submitted with the bid. The test reports and certification shall be specific to the luminaire family proposed, inclusive of the luminaire proposed. Measurements are to be traceable to international measurement standards.

The Bidder shall, upon request by the purchaser, be required to submit a sample(s) of the luminaire proposed. As part of the bid evaluation process, the luminaire sample(s) may undergo destructive testing to verify compliance to standards and comparison to bid type test reports submitted. The cost of the luminaire samples shall be for the Bidder's own account. Upon request, the Bidder shall submit the luminaire sample(s) within two (weeks) to the purchaser. Should the samples not be delivered on the due date indicated, the bid may be considered ineligible by the purchaser.

The proposed LED luminaire should be manufactured by an ISO 9001 accredited manufacturer, inclusive of the facility/ies in which the luminaire is manufactured, for which certification shall be valid upon bid closing date.

The LED luminaire shall be supplied and delivered as a complete unit, ready for use with all components fully assembled, including the luminaire housing, driver, control gear, LED modules, lenses, reflectors, wiring, mounting brackets, etc.

The Bidder shall ensure that all **Schedule 1: Returnable Documents** and that all relevant supporting documents referenced in the Schedules are completed in full. These documents are to form part of the bid submission data package.

The LED luminaire offered by the Bidder shall meet or exceed the requirements specified in

- **Schedule 2: Schedule of Technical Data;** and
- **Schedule 3: Lighting Design Data – Area Flood Lighting.**

Both schedules form part of this bid document and must be completed by the Bidder and included as part of the bid submission data package.

4.3 Geographical Site Operational Conditions

The proposed LED luminaire shall maintain design operational output performance when subjected to the following conditions:

Operational Description	Operational Condition		
	Dr Beyers Naude	Ekurhuleni	iLembe
Nominal Supply Voltage	230V AC (±10%)	230V AC (±10%)	230V AC (±10%)
Nominal Supply Frequency	50Hz (±10%)	50Hz (±10%)	50Hz (±10%)
Climate	Hot Dry (Inland)	Cold Interior – Inland	Coastal
Altitude	0m up to 1200m	1500m up to 1600m	0m up to 1200m
Ambient Operating Temperature, T_a	-10°C to +35°C	-7°C to +35°C	-10°C to +35°C
Solar Radiation	>1000 W/m^2	>1000 W/m^2	>1000 W/m^2
Relative Humidity	20% – 90%	45% – 70%	20% – 90%
Average Annual Rainfall	460mm per annum	726mm per annum	460mm per annum
Lightning Ground Flash Density	Low (1 flashes/km2/year) to Medium (5 flashes/km2/year)	Medium (5 flashes/km2/year), High (>8 flashes/km2/year)	Medium (5 flashes/km2/year), High (>8 flashes/km2/year)
Air Pollution	Heavy atmospheric pollution	Heavy atmospheric pollution	Heavy atmospheric pollution
Prescribed Minimum Cleaning Cycle	3 years	3 years	3 years

4.4 Normative References

The latest issue of the following standards contain provision that, whether referenced in the text or not, shall constitute requirements for this specification.

Standard	Description
ANSI C78-377A	Specifications for the Chromaticity of Solid-State Lighting (SSL) Products
ARP 035	Guidelines for the installation and maintenance of streetlighting
EN 55015	Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment
IEC 62471	Photo biological safety of lamps and lamp systems
IEC TR 61547-1	Equipment for general lighting purposes - EMC immunity requirements - Part 1: An objective light flickermeter and voltage fluctuation immunity test method
IEC TR 63518	Equipment for general lighting purposes - Objective test method for stroboscopic effects of lighting equipment
IES LM-79-19	Optical and Electrical Measurements of Solid-State Lighting Products
IES LM-80-08	Measuring Lumen Maintenance of LED Light Sources
IES LM-80-15	Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules
IES TM 21-11	Projecting Long Term Lumen Maintenance of LED Light Sources
ISO 9001: 2008	Quality management systems (Optional)
SANS 121	Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods
SANS 215	Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment
SANS 475	Luminaires for interior lighting, street lighting and floodlighting — Performance requirements
SANS 529	Heat-resisting wiring cables
SANS 1088	Luminaire entries and spigots
SANS 1091	National Colour Standard
SANS 10098-1	Public lighting Part 1: The lighting of public thoroughfares

Standard	Description
SANS 10098-2	Public lighting Part 2: Lighting of certain specific areas of street and highways
SANS 10389-1	Artificial lighting of exterior areas for work and safety
SANS 10389-2	Exterior security lighting
SANS 10389-3	Guide on the limitation of the effects of obtrusive light from outdoor lighting installations
SANS/IEC 51706	Aluminium and aluminium alloys – Castings – Chemical composition and mechanical properties
SANS/IEC 60529	Degrees of Protection provided by Enclosures (IP Code)
SANS/IEC 60598-1	Luminaires: Part 1. General Requirements and Tests
SANS/IEC 60598-2-3	Luminaires Part 2-3: Particular requirements - Luminaires for road and street lighting
SANS/IEC 60598-2-5	Luminaire: Particular requirements – luminaires for Floodlights
SANS/IEC 61000-3-2	Electromagnetic compatibility (EMC) Part 3-2: Limits — Limits for harmonic current emissions
SANS/IEC 61000-3-3	Electromagnetic compatibility (EMC) Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flickering public low-voltage supply systems
SANS/IEC 61000-4-5	Surge immunity test – Testing and measurement
SANS/IEC 61347-1	Lamp control gear Part 1: General and safety requirements
SANS/IEC 61347-2-13	Lamp control gear Part 2-13: Particular requirements for d.c. or a.c. supplied electronic control gear for LED modules
SANS/IEC 61547	Equipment for general lighting purposes – EMC immunity requirements
SANS/IEC 62262	Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)
SANS/IEC 62384	DC or AC supplied electronic control gear for LED modules - Performance requirements

Note that the International (IEC) equivalence of SANS standards are generally the same but may include specific variations to be taken into account. Information on currently valid national and international standards can be obtained from the South African Bureau of Standards (https://www.sabs.co.za/).

4.5 Safety Requirements

The safety requirements of the luminaire shall comply with the minimum requirements stipulated in SANS/IEC 60598 for the respective type of luminaire.

The luminaire safety requirements should additionally comply to:

- IEC 62471, Photo biological safety of lamps and lamp systems;
- IEC TR 61547-1, Equipment for general lighting purposes – EMC immunity requirements– Part 1: An objective light flickermeter and voltage fluctuation immunity test method. This is to determine the Short-term Flicker indicator (PstLM) of the luminaire; and
- IEC TR 63518, Equipment for general lighting purposes – Objective test method for stroboscopic effects of lighting equipment. This is to determine the Stroboscopic effect Visibility Measure (SVM) of the luminaire.

The Bidder shall submit a valid SANS/IEC 60598 test report and certificate for each luminaire offered.

4.6 Photometric Performance Requirements

4.6.1 Luminous flux

It is the nominal luminous flux output of the luminaire provided at T_a of 25 ^{0}C once the luminaire and the luminous flux output has reached operational stabilisation after being energised.

A luminous flux derating factor of the nominal flux shall be provided to obtain the luminous flux at the maximum operational temperature condition specified.

The SI unit of luminous flux is the lumen (lm).

4.6.2 Luminous Efficacy

The total system efficiency shall comply with the minimum total system luminous efficacy requirements in **Table 2**, as relevant.

The value of total system luminous efficacy to be stated in **Schedule 2: Schedule of Technical Data** is to be calculated as follows:

$$total\ system\ luminous\ efficacy = \frac{source\ \ nominal\ luminous\ flux\ output\ \times LOR\ [lm]}{total\ system\ power\ consumption\ [W]}$$

Where,

- The total system power consumption is the total power consumed by the luminaire as whole, inclusive of control gear and light source.

- LOR refers to the ratio between the luminous flux emitted by the luminaire, measured at ambient operating temperature (T_a) and the nominal luminous flux of the light source (this would refer to the nominal luminous flux emitted from the LED).

Table 2: Minimum luminous efficacy at T_a of 25 ^0C

Product Type	Minimum luminous efficacy (lm/W)	Year Applicable
All Types LED Luminaire	100 With depreciative luminous flux output	< 2025
	130 With depreciative OR constant luminous flux output	2025 ≤ t < 2028
	160 With constant luminous flux output	≥ 2025

A luminous efficacy derating factor shall be provided to obtain the total system efficiency at the maximum operational temperature condition specified.

4.6.3 Colour Rendering

The colour rendering index, CRI, shall be equal to or greater than 70.

The CRI shall not be obtained via colour saturation of specific colour wavelengths but shall as far as technologically possible be saturated evenly across the light colour spectrum.

The Bidder is to submit a light spectral graph for the proposed luminaire as verification.

4.6.4 Colour Temperature

The average maintained correlated colour temperature (CCT) of the luminaire shall comply with the recommended CCT indicated in **Table 3**, as relevant.

Table 3: Correlated colour temperature

Product Type	Correlated colour temperature (K)	Recommendation
All Types LED Luminaire	3000	Residential areas, recreational and residential area lighting
	4000	Freeways, main roadways, industrial areas, parking areas, security lighting
Note:	Sensitive areas (e.g., ecologically sensitive areas such as lagoons, nature reserves, parks) may require a specific CCT	

The LED modules shall have a colour consistency variation of chromaticity coordinates within a five-step SDCM (standard deviation of colour matching).

The variation in the correlated colour temperature of the LEDs shall be restricted in accordance with ANSI C78-377A or equivalent with the variation limited to within 250K of the nominal average correlated colour temperature.

4.6.5 Lumen maintenance

The lumen maintenance of the LED modules shall be measured in accordance with IES LM-80-08 and LM-80-15 or equivalent. The measured data shall be extrapolated to L70 using the method of IES TM-21-11 or equivalent.

The Bidder shall provide lumen depreciation graphs as part of the returnable documents in this bid. The documents should indicate the time it takes for the LED luminaire to reach L90, L80, L70 and L50 at T_a of 25°C.

4.6.6 Rated Life

The useful rated life of the luminaire shall be stated as the operating hours between the start of the complete luminaire system (not the LEDs only) use and the moment when for 10% of a population of luminaires the light output has gradually degraded to a value below 70% (L70) of the initial luminous flux at the performance ambient temperature specified.

This is also referred to as the L70B10 rated lifetime at T_a of 25°C.

4.7 Electrical Performance Requirements

4.7.1 Power Consumption

The LED luminaire offered should achieve as a minimum a 40% energy savings when replacing the existing luminaire. The maximum total system power rating of the LED luminaire should therefore not minimise the energy savings offered.

A ±10% tolerance of the energy savings is allowed for, such that luminaires providing 30% to 50% energy savings or more are deemed acceptable.

The Bidder shall indicate the total system nominal power rating consumption in **Schedule 2: Schedule of Technical Data**, supported by the Product Technical Datasheet.

4.7.2 Operating Frequency

The LED luminaire shall be subjected to an operational Frequency of 50Hz ±10%.

4.7.3 Operating Voltage

The LED luminaire performance shall remain constant when subjected to operational nominal voltages inclusive of tolerance that shall comply with the requirements in **Table 4**, as relevant.

Table 4: Nominal Operational voltages

Product Type	Rated Operating Voltage (V)	Tolerance (%)	Year Applicable
All Types LED Luminaire	230	±10.00	< 2025
	220, 230 & 240	±10.00	≥ 2025

Where the minimum and maximum operational voltages are defined as:

- Minimum Operational Voltage = Lowest Rated Operating Voltage less tolerance (e.g. 220V – 10% tolerance = 198V minimum operational voltage)

- Maximum Operational Voltage = Highest Rated Operating Voltage less tolerance (e.g. 240V + 10% tolerance = 264V maximum operational voltage)

4.7.4 Power Factor and Total Harmonic Distortion

The power factor is defined as the minimum fundamental power factor (displacement power factor), PF. It quantifies the displacement (phase-shift) between the fundamental current and

voltage waveforms by calculating the cosine of the phase-shift angle. The fundamental power factor is a more detailed measure to quantify the displacement of the current and its effect on the power supply network.

The total harmonic distortion is defined as the measurement of the harmonic distortion present in a signal and is defined as the ratio of the sum of the powers of all harmonic components to the power of the fundamental frequency.

The minimum fundamental power factor and total harmonic distortion of the luminaire shall comply with the requirements in **Table 5,** as relevant.

Table 5: Minimum fundamental power factor and total harmonic distortion

Product Type	Fundamental power factor (PF) & Total Harmonic Distortion (THD)	Year Applicable
Non-Dimmable LED Luminaire	PF ≥ 0.90 for 100% load factor with maximum harmonic distortion levels limited to 10%.	< 2025
Dimmable LED Luminaire	PF ≥ 0.90 for 100% load factor with maximum harmonic distortion levels limited to 10%. AND PF ≥ 0.70 for 50% load factor (50% dimming of luminaire) with maximum harmonic distortion levels limited to 20%.	
Non-Dimmable LED Luminaire	PF ≥ 0.98 for 100% load factor with maximum harmonic distortion levels limited to 10%.	≥ 2025
Dimmable LED Luminaire	PF ≥ 0.98 for 100% load factor with maximum harmonic distortion levels limited to 10%. AND PF ≥ 0.80 for 50% load factor (50% dimming of luminaire) with maximum harmonic distortion levels limited to 15%.	

These limits are imposed to reduce interference on the electrical network.

4.7.5 Surge Protection

A surge protection device shall be provided to protect the driver and the LED modules. The surge protection device shall be mounted inside the control gear compartment, and shall be easily replaceable. The surge protection device shall be capable to withstand the following minimum surge requirements:

1. Open Circuit Voltage Peak, 1.2/50µs, of 10kV; and
2. Short Circuit Current Peak, 8/20µs, of 10kA.

The Bidder shall provide a Technical Data Sheet of the surge protection device that is integrated into the offered luminaire.

4.7.6 Electronic Driver

The electronic driver shall comply with the requirements, or equivalent thereof, of:

1. SANS/IEC 61000-3-2;
2. SANS/IEC 61000-3-3;
3. SANS/IEC 61000-4-5;
4. SANS/IEC 61347-1;
5. SANS/IEC 61347-2-13;
6. SANS/IEC 61547; and
7. SANS/IEC 62384.

The driver shall be mounted inside the control gear compartment of the luminaire, and shall be easily replaceable.

The driver shall be fully enclosed with an IP Rating of 65 or better with safety class of one (1).

The minimum electronic driver functionality shall comply with the requirements in **Table 6,** as relevant.

The Bidder shall provide additional technical information relating to optimal dimming functionality of the driver for the offered LED luminaire.

The luminaires shall be dimmable LED luminaires.

Table 6: Minimum electronic driver functionality

Product Type	Driver Functionality	Year Applicable
Non-Dimmable LED Luminaire	Shall not be dimmable. AND Cold starting driver. AND The driver shall have an efficiency of at least 85%.	< 2025
Dimmable LED Luminaire	The dimming function shall perform optimally through DALI, 1-10V or PWM dimming methods. The dimming range shall be at least between 20 – 100% load. AND Cold starting driver. AND The driver shall have an efficiency of at least 85%, SANS/IEC 62384. AND May be connected to and controlled by a telemanagement device.	
Non-Dimmable LED Luminaire	Shall not be dimmable. AND Ramp, soft starting or zero crossing detection driver with limited inrush current. AND The driver shall have an efficiency of at least 90%, SANS/IEC 62384.	2025≤t<2028

Product Type	Driver Functionality	Year Applicable
Dimmable LED Luminaire	The dimming function shall perform optimally through DALI and 1-10V dimming method functionality. The dimming range shall be at least between 10 – 100% load. AND Shall be flicker free for dimming range at least between 60 – 100% load. AND Ramp, soft starting or zero current detection driver with limited inrush current. AND The driver shall have an efficiency of at least 90%, SANS/IEC 62384. AND May be connected to and controlled by a telemanagement device. The driver would be able to provide the telemanagement system with the following minimum operational information: 1. Operational Power Consumption; 2. Operational Voltage; 3. Operational Current; 4. Power Factor; 5. Operational Temperature; and 6. Hours Operated.	2024≤t<2028
Non-Dimmable LED Luminaire	Shall be replaced with a dimmable LED Luminaire	≥2024

Product Type	Driver Functionality	Year Applicable
Dimmable LED Luminaire	The dimming function shall perform optimally through DALI or advanced communication dimming method functionality. The dimming range shall be at least between 10 – 100%. AND Shall be flicker free throughout dimming range of load. AND Shall be a ramp, soft starting or zero crossing detection driver with limited inrush current. AND Shall have an efficiency of at least 90%, SANS/IEC 62384. AND May be connected to and communicate with a telemanagement device. The driver shall have integrated writeable data storage capability. The driver would be able to provide the telemanagement system with the following minimum operational information: 1. Operational Power Consumption; 2. Operational Voltage; 3. Operational Current; 4. Power Factor; 5. Operational Temperature; 6. Hours Operated; 7. GPS location; 8. Driver product name, manufacturer, serial number, part ordering number; 9. Luminaire product name, manufacturer, serial number, part ordering number; 10. Brochures, certificates and technical datasheet of driver and luminaire; Should the driver be replaced, the new driver shall integrate autonomously with the telemanagement system and obtain the operational history and data of the luminaire from the telemanagement system so as to maintain autonomous operational procedures.	≥2024

4.7.7 Wiring

The wiring shall comply with the requirements of SANS/IEC 60598-1 and SANS 529 or equivalent. The wiring of the luminaire shall be flexible and suitably insulated to withstand the maximum voltage and maximum temperatures to which it will be subjected to during operation.

The terminal blocks of the incoming supply cable shall be fixed independently, fastened, and housed inside the control gear compartment within the body of the luminaire. The terminal shall be indelibly marked either by means of standardised colour coding for the respective terminals or by the letters L, N & E (Live, Neutral and Earth terminals respectively).

4.7.8 Provision for Earthing

The luminaire shall be earthed in accordance with the clause 13 of the Electrical Machinery Regulations of the Occupational Health and Safety (OSH) Act (Act 85 of 1993) or equivalent.

The Earthing of the luminaire shall comply with SANS/IEC 60598-1 or equivalent. All parts of an earth terminal shall be made of brass or other corrosion resistant and galvanic reaction resistant metal. The earthing contact surface of the luminaire shall be bare metal and shall not be painted or varnished surfaces.

4.8 Mechanical Performance Requirements

4.8.1 Construction

The luminaire housing shall be robustly constructed from non-corrosive aluminium material to SANS/IEC 51706 or equivalent; and shall be weatherproof, hail proof, insect proof, corrosion proof, ultra-violet light resistant, debris and particulate accumulation resistant and vandal resistant with a securing device to prevent unauthorised removal or access into the luminaire.

The LED luminaire offered to be installed on the identified high mast shall not result in the present structural loading of the high mast being exceeded.

The luminaire shall be constructed from light weight durable materials which for all parts shall be compatible and failure or deterioration shall not occur due to electrolytic action or by differential thermal expansion.

Should the luminaire housing be coated, the coating shall provide additional weathering protection to the housing material and shall not be used as a corrosion protection replacement for the non-corrosive aluminium material housing. The Bidder shall provide in the Product Technical Datasheet of the luminaire the list of colour codes options available for the coating that comply with SANS 1091 or equivalent.

All metal components shall be suitably treated against corrosion. Ferrous components shall be hot-dip galvanised to SANS/IEC 121 or equivalent. Hinge pins, clips, clamps, set screws, bolts, nuts and washers shall be manufactured from an appropriate grade of stainless steel (grade 304 or better).

The luminaire shall have successfully passed an accelerated ageing test.

The luminaire shall be tilt adjustable relative to the horizontal plane. The luminaire shall be supplied with all necessary mechanical accessories (bolts, nuts, brackets, etc.) to be securely fitted for:

1. Flood lighting flat horizontal or vertical surfaces.

The Bidder shall provide the instructional installation manual as part of the returnable documents in this bid.

The optical compartment of the luminaire shall be completely enclosed with a clear flat tempered glass protector or similar impact resistant non-degrading, ultraviolet resistant material to a minimum of IP65 tightness to maintain optimal photometric performance over its lifetime.

The LED luminaire shall be so designed and constructed that there is sufficient space to permit easy repairs / replacement of components and reassembly without difficulty, and without removal of the luminaire from its mounting position.

Due attention shall be paid to the accessibility of parts and to other requirements necessary for efficient maintenance and cleaning. This shall include but not limited to:

1. How secure, yet accessible the control gear compartment is;
2. Replaceable control gear components and the ease at which these components can be removed and replaced;
3. The ease with which the optical compartment protector can be cleaned and replaced if damaged;
4. The ease with which the entire luminaire can be cleaned; and
5. The ease with which the luminaire can be installed and replaced if damaged.

4.8.2 Ingress Protection and Impact Rating

a) Ingress Protection

The complete LED luminaire shall have a minimum IP rating of 65 or better in accordance with SANS/IEC 60529 or equivalent.

Should a telemanagement device be included with the luminaire, the device shall have a minimum IP rating of 65 or better in accordance with SANS/IEC 60529 such that it does not diminish the IP rating of the whole luminaire.

b) Impact Rating

The complete LED luminaire shall have a minimum IK rating of 08 or better in accordance with SANS/IEC 62262 or equivalent.

4.8.3 Control Gear Compartment

The electronic driver, surge protection device and terminal block shall be housed within the luminaire's control gear compartment and shall comply with the required luminaire minimum IP rating of IP65.

The control gear compartment may either form part of the complete luminaire or be attached to the luminaire.

4.9 Thermal Management requirements

The LED luminaire shall contain a passive cooling device (such as a heatsink). Active cooling devices (such as a fan) shall not be accepted. The design of the luminaire and the passive cooling device shall ensure continuous effective thermal management of all components of the luminaire to ensure that the operational performance of the luminaire in its entirety shall remain constant at the prescribed ambient operational temperature.

The rated ambient performance temperature, T_q, is defined as the maximum ambient temperature, T_a, at which a luminaire reaches the operational performance values for luminous flux and rated service life. Thus, the rated ambient performance temperature T_q shall be 25°C minimum.

The constant operational performance of the luminaire at the prescribed ambient operational temperature, T_a, may vary from the nominal operational performance of the luminaire operating at the nominal ambient performance temperature, T_q of 25°C.

The design of the luminaire and the passive cooling device should mitigate the possibility of debris being lodged in the passive cooling device that would otherwise depreciate thermal management capabilities.

The electronic driver should incorporate a thermal switch to prevent thermal generation during operation exceeding the case temperature of the electronic driver for the maximum lifetime of the luminaire.

The Bidder shall include with this bid submission a detailed temperature testing report indicating how the luminaire manages its temperature and the effect it has on lumen maintenance and luminaire performance. The test report shall also indicate the behaviour of the LED junction temperature, T_j, when driven at the manufacturer specified drive current.

The LED luminaire operational performance shall remain constant at the minimum and maximum ambient operational temperatures when subjected to these temperatures for a prescribed duration that shall comply with the requirements in **Table 7**, as relevant, prior to thermal protection devices being activated (if thermal protection devices are present in the luminaire).

The operation of the LED luminaire during the minimum and maximum ambient operational temperatures for the prescribed duration shall not reduce the rated life of the luminaire.

Table 7: Ambient Operational Temperatures

Product Type	Ambient Operational Temperature, T_a	Maximum Duration	Year Applicable
All Types LED Luminaire	Minimum: -10°C Maximum: +35°C	As per clause 4.4 of SANS 475 (10 days)	≥ 2024

4.10 Telemanagement requirements

Although telemanagement systems do not form part of this bid, the LED luminaire shall be designed, manufactured, tested and certified as a luminaire that shall incorporate the minimum telemanagement requirements prescribed in **Table 8**.

The minimum requirements for telemanagement integration with the luminaire shall comply with the requirements in **Table 8**, as relevant.

Table 8: Minimum telemanagement requirements

Product Type	Telemanagement Readiness	Year Applicable
Non-Dimmable LED Luminaire	No allowance shall be made for telemanagement readiness. OR May incorporate an ANSI C136.10 twist-lock photocell receptacle (3-Pin NEMA socket) that is to be used with an ANSI C136.10 compliant photocell with IP65 rating or higher.	< 2024
Dimmable LED Luminaire	Shall incorporate a 7-Pin ANSI C136.41 twist-lock receptacle (7-Pin NEMA socket) that is to be used with an ANSI C136.10 compliant photocell or ANSI C136.41 compliant telemanagement device with IP65 rating or higher. Only the three power terminals shall be wired into the luminaire control gear to allow control by photocell. An ANSI C136.10 compliant shorting cap with IP65 rating or higher shall be supplied and attached to the 7-Pin ANSI C136.41 twist-lock receptacle. The shorting cap shall allow the luminaire to operate normally without control.	
Non-Dimmable LED Luminaire	No allowance shall be made for telemanagement readiness. OR May incorporate an ANSI C136.10 twist-lock photocell receptacle (3-Pin NEMA socket) that is to be used with an ANSI C136.10 compliant photocell with IP65 rating or higher.	2021 ≤ t < 2024
Dimmable LED Luminaire	Shall incorporate a 7-Pin ANSI C136.41 twist-lock receptacle (7-Pin NEMA socket) that is to be used with an ANSI C136.10 compliant photocell or ANSI C136.41 compliant telemanagement device with IP65 rating or higher. All terminals shall be wired into the luminaire control gear to allow control by photocell or telemanagement device.	

Product Type	Telemanagement Readiness	Year Applicable
	An ANSI C136.10 compliant shorting cap with IP65 rating or higher shall be supplied and attached to the 7-Pin ANSI C136.41 twist-lock receptacle. The shorting cap shall allow the luminaire to operate normally without control. Electronic information about the luminaire shall be contained either on the electronic driver, RF tag or by other data storage means. This shall enable the telemanagement device to transmit information about the luminaire to the telemanagement system. The minimum information provided shall be: 1. Driver product name, manufacturer, serial number, part ordering number; and 2. Luminaire product name, manufacturer, serial number, part ordering number.	2021 $\leq$ t < 2024
Non-Dimmable LED Luminaire	Shall be replaced with a dimmable LED Luminaire that shall have telemanagement capability as prescribed below.	
Dimmable LED Luminaire	Shall incorporate a 7-Pin ANSI C136.41 twist-lock receptacle (7-Pin NEMA socket) that is to be used with an ANSI C136.10 compliant photocell or ANSI C136.41 compliant telemanagement device with IP65 rating or higher. All terminals shall be wired into the luminaire control gear to allow control by photocell or communication between the electronic driver and the telemanagement device and system. An ANSI C136.10 compliant shorting cap with IP65 rating or higher shall be supplied and attached to the 7-Pin ANSI C136.41 twist-lock receptacle. The shorting cap shall allow the luminaire to operate normally without control. Electronic information and data about the luminaire and electronic driver shall be contained on the electronic driver. This shall enable the telemanagement device to transmit and receive	$\geq$ 2024

Product Type	Telemanagement Readiness	Year Applicable
	information about the luminaire to/from the telemanagement system to the electronic driver. The minimum information and data provided shall be: 1. Driver product name, manufacturer, serial number, part ordering number; 2. Luminaire product name, manufacturer, serial number, part ordering number; 3. Brochures, certificates and technical datasheet of driver and luminaire; and 4. GPS Location.	≥ 2024

The ANSI C136.XX receptacles and nodes can be interchangeable with equivalent Zhaga Book 18, Smart interface between outdoor luminaires and sensing/communication nodes, receptacles and nodes. Adaptors shall be available from the bidder to allow ANSI C136.XX receptacles and nodes to be connected with Zhaga Book 18 receptacles and nodes and vice versa.

The receptables shall be mounted directly onto the luminaire or control gear compartment, ensuring that the IP rating of the luminaire or control gear compartment is maintained. No other interface platform and means of mounting between the luminaire and sensing/communication node shall be accepted.

4.11 Marking

Except as specified otherwise, the method of marking shall comply with SANS/IEC 60598-1, ANSI C136.15 – Luminaire Field Identification (Large Marker Type) or equivalent and shall be to the approval of the purchaser.

A UV-resistant, self-adhesive foil label shall be applied to the outside of the luminaire in a position readily visible and legible when the luminaire is mounted in position. The label shall identify the type and the power rating of the luminaire.

4.12 Luminaire Maintenance

The Bidder shall submit with this bid a luminaire maintenance method statement that shall respond to the Scope of Work and Site Information.

The method statement shall outline the Bidder's proposed luminaire maintenance plan and indicative luminaire testing and cleaning cycle periods.

The method statement should articulate what maintenance processes are to be implemented and adhered to in order to achieve and maintain the stated performances of the luminaire proposed.

The Bidder shall provide:

(a) The outline method statements for each major activity of the maintenance of the luminaire;

(b) An indicative maintenance, cleaning and testing schedule for the luminaire; and
(c) A description of the luminaire warranty accompanied by a warranty certificate. The period, conditions, exclusions for which the warranty is valid and means of claiming shall be stated.

The Bidder shall submit the methodology statement with their bid submission. The response shall not be more than three (3) pages (A4 size) in length, excluding supporting documentation.

4.13 Skills Transfer

The Bidder shall submit with this bid a skills transfer plan that shall respond to the Scope of Work and Site Information.

The method statement shall outline the Bidder's proposed skills transfer plan. The method statement should articulate the degree of skills transfer to be provided by the Bidder.

The Bidder shall provide:

(a) The outline method statements for each major activity of the skills transfer services;
(b) An indicative skills transfer schedule; and
(c) An indication of the type of qualifications or accreditation offered by the skills transfer services.

The Bidder shall submit the methodology statement with their bid submission. The response shall not be more than five (5) pages (A4 size) in length, excluding supporting documentation.

Schedule 1: Returnable Documents

Bidders must ensure that the following returnable documents are submitted as indicated in **Schedule 1** and that the schedule is marked clearly and submitted with the bid. Failure to submit any of the returnable documents may render the Bidder ineligible and shall not be evaluated further.

Schedule 1: Schedule of Returnable Documents

Item No.	Details	Submitted [Yes/No]
1	Schedule 2: Schedule of Technical Data	
2	Schedule 3: Lighting Design Data – Area Flood Lighting	
3	Luminaire maintenance method statement	
4	Skills Transfer method statement	
5	Manufacturer's ISO 9001 Registration Certificate	
6	Bidder project references	
7	SANS/IEC 60598-2-5 or equivalent product safety type test report	
8	SANS 475 or equivalent product performance type test report	
9	Photometric test reports	
10	LM-79-19 test report	
11	LM-80-08 test report	
12	LM-80-15 test report (if available)	
13	Lumen depreciation curves	
14	Endurance and thermal tests report	
15	Lighting Design Simulation for Luminaire offered	

Item No.	Details	Submitted [Yes/No]
16	IES and/or LDT files supplied in electronic format (USB Flash Drive or Compact Disc) for luminaire offered	
17	Product technical datasheet of luminaire	
18	Product technical datasheet of electronic driver	
19	Product technical datasheet of surge protection device	
20	Technical data sheet Optical compartment protector	
21	Technical data sheet of Reflector Material	
22	Technical data sheet of Lens (Optic) Material	
23	Technical data sheet of Diffuser Material	
24	List of Replaceable components	
25	Product luminaire instructional installation manual	
26	Warranty Certificate	
27	Description of the compatibility to a Telemanagement system	
28	Pricing Schedule *(to be submitted separately for financial evaluation)*	

Schedule 2: Schedule of Technical Data

LED luminaire – Equivalent replacement of the existing streetlighting and flood lighting luminaire.

Bidders shall fill in Part B and Part C.

A separate schedule shall be completed for each type of LED luminaire offered for street lighting and flood lighting.

Where “XXXXXXXXXX” is mentioned under Part A, the required specification has not been specified.

Under Part B, the Bidder shall state the details of the offered specification.

Under Part C, the Bidder shall reference the supporting documentation, including page number, where the details of the offered specification for each schedule item can be found.

Schedule 2: Schedule of Technical Data (Continued)

Item No.	Technical Details	Manda-tory	Unit	Part A	Part B	Part C
				Specified	Offered	Offered Document Referenced
1	**Bidder Details**					
1.1	Name of LED Luminaire Manufacturer			XXXXXXXXXX	e.g. Manufacturer	e.g. Manufacturer Registration Certificate, page 1
1.2	Manufacturer’s ISO 9001 Registration Certificate Number & Certificate (Optional)			XXXXXXXXXX	Yes / No	
1.3	Bidder project references with project value			XXXXXXXXXX		
1.4	Location of Luminaire Manufacture (Country)			XXXXXXXXXX		
1.5	Luminaire Type			LED Flood / Street Lighting		
1.6	Luminaire Model Name			XXXXXXXXXX		

Schedule 2: Schedule of Technical Data (Continued)

Item No.	Technical Details	Manda-tory	Unit	Part A	Part B	Part C
				Specified	Offered	Offered Document Referenced
2	**Photometric Specifications**					
2.1	Luminaire Nominal Flux at T_a 25°C		Lm	XXXXXXXXXX		
2.2	Derating factor of Flux for T_a 35°C		%	XXXXXXXXXX		
2.3	Is Luminaire Nominal Flux Depreciative to L70			XXXXXXXXXX	Yes / No	
2.4	Is Luminaire Nominal Flux Steady-State to L70			XXXXXXXXXX	Yes / No	
2.5	Light Output Ratio (LoR)		%	XXXXXXXXXX		
2.6	Luminaire Efficacy at T_a 25°C		Lm/W	Table 2		
2.7	Derating factor of Efficacy for T_a 35°C		%	XXXXXXXXXX		
2.8	Colour Rendering Index (CRI)			≥ 70		
2.9	Correlated Colour Temperature (CCT Average)		K	Table 3		
2.10	Maximum CCT Variance		K	±250		
2.11	SDCM colour consistency		Step	≤ 5		
2.12	Lumen Maintenance hours for L70 at T_a 25°C		hrs	≥ 50,000 hrs		
2.13	Derating factor of Lumen Maintenance for T_a 35°C		%	XXXXXXXXXX		
2.14	Rated Life at T_a 25°C			L70B10		

Schedule 2: Schedule of Technical Data (Continued)

Item No.	Technical Details	Manda-tory	Unit	Part A	Part B	Part C
				Specified	Offered	Offered Document Referenced
3	**Electrical Specifications**					
3.1	Luminaire Nominal Power Rating		W	XXXXXXXXXX		
3.2	Energy Savings		%	40 ± 10		
3.3	Rated Input Frequency		Hz	50 ± 10%		
3.4	Rated Input Voltage		V AC	Table 4		
3.5	Rated Input Current		A	XXXXXXXXXX		
3.6	Inrush Current Amplitude, I_{peak}		A	XXXXXXXXXX		
3.7	Inrush Current Period, T_{width}		µs	XXXXXXXXXX		
3.8	Power Factor					
	a) 100% load factor			Table 5		
	b) 50% load factor (50% dimmed)			Table 5		
3.9	Total Harmonic Distortion					
	a) 100% load factor		%	Table 5		
	b) 50% load factor (50% dimmed)		%	Table 5		
3.10	Efficiency		%	Table 6		
3.11	Safety Class			Class 1		
3.12	Electronic Driver Dimmable			Table 6	Yes / No	
3.13	Type of Dimming Control (DALI, 1-10V, PWM)			Table 6		

Schedule 2: Schedule of Technical Data (Continued)

Item No.	Technical Details	Manda-tory	Unit	Part A	Part B	Part C
				Specified	Offered	Offered Document Referenced
3.14	Dimming Range			Table 6		
	Electrical Specifications Continued					
3.15	Surge Protection					
	a) Open Circuit Voltage Peak, 1.2/50µs		kV	≥ 10		
	b) Short Circuit Current Peak, 8/20µs		kA	≥ 10		
3.16	Surge Protection Device Replaceable			XXXXXXXXXX	Yes / No	
3.17	Compatibility & Allowance for Telemanagement System			Table 8	Yes / No	
4	**Mechanical specifications**					
4.1	Luminaire Housing Material			Non-Corrosive Aluminium		
4.2	Hinge pins, clips, clamps, set screws, bolts, nuts			Stainless Steel (Grade 304)		
4.3	Is housing coated			XXXXXXXXXX	Yes / No	
	a) Colour codes available of coating			XXXXXXXXXX		
4.4	IP Rating of Luminaire without Telemanagement			≥ 65		
4.5	IP Rating of Luminaire with Telemanagement			≥ 65		
4.6	IP Rating of Optical Compartment			≥ 65		
4.7	IP Rating of Control Gear Compartment			≥ 65		

Schedule 2: Schedule of Technical Data (Continued)

Item No.	Technical Details	Manda-tory	Unit	Part A	Part B	Part C
				Specified	Offered	Offered Document Referenced
4.8	IP Rating of Electronic Driver			≥ 65		
4.9	IK Rating			≥ 08		
	Mechanical specifications Continued					
4.10	Luminaire Dimensions (L x W x H)		mm	XXXXXXXXXX		
	a) Length		mm	XXXXXXXXXX		
	b) Width		mm	XXXXXXXXXX		
	c) Height		mm	XXXXXXXXXX		
4.11	Total Luminaire Mass		Kg	XXXXXXXXXX		
4.12	Luminaire installation angle(s)		Deg	Design Data		
4.13	Luminaire includes mounting bracket for fitment onto mast			Required	Yes / No	
4.14	Luminaire tilt adjustable			Required	Yes / No	
4.15	Rake Angle Indicator			XXXXXXXXXX	Yes / No	
4.16	Mounting Type			Bracket/outreach		
4.17	Optical compartment protector material			XXXXXXXXXX		
4.18	Optical compartment protector externally exposed surface texture / gradient type			Flat		
4.19	Optical compartment protector UV resistant			Required	Yes / No	
4.20	Colour consistency / transparency degradation of optical compartment protector for L70 lifetime		%	XXXXXXXXXX		
4.21	Reflector Material			XXXXXXXXXX		
4.22	Lens (Optic) Material			XXXXXXXXXX		

Schedule 2: Schedule of Technical Data (Continued)

Item No.	Technical Details	Manda-tory	Unit	Part A	Part B	Part C
				Specified	Offered	Offered Document Referenced
4.23	Diffuser Material			XXXXXXXXXX		
4.24	All components easily replaceable			Required	Yes / No	
4.25	Securing device to prevent unauthorised access			Required	Yes / No *	
5	**Thermal Management Specification**					
5.1	Luminaire operating temperature range		°C	Table 7		
5.2	Rated operating temperature of control gear within control gear compartment for T_a of 35°C		°C	XXXXXXXXXX		
5.3	LED junction temperature at drive current, Tj (°C)		°C	XXXXXXXXXX		
5.4	Thermal cut-off temperature switch provided			XXXXXXXXXX	Yes / No	
5.5	Thermal degradation on lumen maintenance			XXXXXXXXXX	Yes / No	
5.6	Thermal operation test report			Required	Yes / No	
6	**Spare Parts Specifications**					
6.1	Electronic Driver Part Number			XXXXXXXXXX		
6.2	Electronic Driver Model Type (Name)			XXXXXXXXXX		
6.3	Electronic Driver Make (Manufacture Name)			XXXXXXXXXX		
6.4	LED Module Part Number			XXXXXXXXXX		
6.5	LED Chip Make (Manufacture Name)			XXXXXXXXXX		
6.6	Surge Protection Part Number			XXXXXXXXXX		

Schedule 2: Schedule of Technical Data (Continued)

Item No.	Technical Details	Manda-tory	Unit	Part A	Part B	Part C
				Specified	**Offered**	**Offered Document Referenced**
6.7	Surge Protection Device Model Type (Name)			XXXXXXXXXX		
6.8	Surge Protection Make (Manufacture Name)			XXXXXXXXXX		
7	**Supporting Technical Documents**		To be attached:			
7.1	*Manufacturer's ISO 9001 Registration Certificate*			Supporting Doc.	*Yes / No*	
7.2	LM-79-19 test report			For Evaluation	Yes / No	
7.3	LM-80-08 test report			For Evaluation	Yes / No	
7.4	LM-80-15 test report			If Available	Yes / No	
7.5	Lumen depreciation curves report of luminaire			For Evaluation	Yes / No	
7.6	SANS 475, SANS/IEC 60598-1, SANS/IEC 60598-2-5 Test Report			For Evaluation	Yes / No	
7.7	SANS 475, SANS/IEC 60598-1, SANS/IEC 60598-2-5 Test Certificate			For Evaluation	Yes / No	
7.8	Technical data sheet of Luminaire			For Evaluation	Yes / No	
7.9	Technical data sheet of Electronic Driver			Supporting Doc.	Yes / No	
7.10	Technical data sheet of Surge Protection Device			Supporting Doc.	Yes / No	
7.11	Technical data sheet on Telemanagement Compatibility			Supporting Doc.	Yes / No	
7.12	Accelerated aging rated life testing report of luminaire			Supporting Doc.	Yes / No	
7.13	Technical data sheet Optical compartment protector			Supporting Doc.	Yes / No	

Schedule 2: Schedule of Technical Data (Continued)

Item No.	Technical Details	Manda-tory	Unit	Part A	Part B	Part C
				Specified	Offered	Offered Document Referenced
7.14	Technical data sheet of Reflector Material			Supporting Doc.	Yes / No	
7.15	Technical data sheet of Lens (Optic) Material			Supporting Doc.	Yes / No	
7.16	Technical data sheet of Diffuser Material			Supporting Doc.	Yes / No	
7.17	Instructional Installation Manual			Supporting Doc.	Yes / No	
	Supporting Technical Documents Continued					
7.18	List of Replaceable components			Supporting Doc.	Yes / No	
7.19	Endurance and thermal tests report			For Evaluation	Yes / No	
7.20	Warranty Certificate			For Evaluation	Yes / No	
7.21	IES and/or LDT files (Electronic file)			For Evaluation	Yes / No	
7.22	Lighting Design Simulation			For Evaluation	Yes / No	
8	**Warranties**					
8.2	Luminaire Life Expectancy		hrs	50 000 (L70B10)		
8.3	Luminaire warranty		yrs	5		
9	**Delivery**					
9.1	Lead Time for Delivery of Samples (from date of samples request)		*days*	*14*		
9,2	Order Lead Time for Delivery (from date of order)		days	XXXXXXXXXX		

Schedule 3: Lighting Design Data – Area Flood Lighting

Compliant lighting simulations and simulation reports are to be compiled for the proposed luminaire. The design criteria for the simulations are indicated below.

The simulations shall be provided in DIALux V4.13, RELUX or later simulation software versions. Hard and soft copy simulation report are to be submitted along with the readable electronic lighting simulation file, *.DLX, and IES / LDT or equivalent photometric files. These shall all be attached to the bid submission for the proposed luminaire.

The high masts identified for replacement with LED luminaires are spaced at an average distance of **250m** in a triangular arrangement. The triangular arrangement shall form the perimeter of the area for evaluation. A horizontal reference plane is to be established for the evaluation area, which shall be located 0.50m above ground level. The luminaire mounting height shall be **30m and 40m** above ground level. An average light loss factor (LLF) or depreciation factor of 0.75 (including dirt and lumen depreciation) shall be used for design purposes. The optimal inclination angle of the LED luminaire will be determined by the Bidder but up to a maximum of 45^{o}. Light-pollution and civil aviation aspects are to be taken into consideration when stating the optimal inclination angle.

The LED luminaire offered to be installed on the identified high mast shall not result in the structural loading of the high mast being exceeded.

Information regarding the high masts selected for luminaire replacement are detailed in the following annexures:

1. Annexure A – List of Infrastructure Dr Beyers Naude Municipality, Ekurhuleni Metropolitan Municipality and iLembe District Municipality.

The minimum area flood lighting performance requirements shall be as follows:

1. Minimum Average Horizontal Illuminance (Eh_{ave}) shall be:
    a. For compliance: $\geq$ 5.00 Lux
    b. For acceptance: 2.00 Lux ≤ Eh_{ave} ≤ 5.00 Lux

    Where the horizontal reference plane is located 0.50m above ground level;

2. Minimum Horizontal Illuminance (Eh_{min}) shall be:
    a. For compliance: $\geq$ 2.00 Lux
    b. For acceptance: 0.40 Lux ≤ Eh_{min} ≤ 2.00 Lux

    Where the horizontal reference plane is located 0.50m above ground level;

3. Minimum Horizontal Illuminance Uniformity (Uo, Eh_{min}/ Eh_{ave}) shall be:
    a. For compliance: $\geq$ 0.40
    b. For acceptance: 0.20 ≤ Uo ≤ 0.40

    Where the horizontal reference plane is located 0.50m above ground level;

4. The dimensions of the horizontal reference plane are the same as that of the evaluation area, as indicated in **Figure 1** below.

A lighting simulation is to be submitted for the offered luminaire. The simulation makes use of the luminaire's nominal flux at T_a 25^{o}C. The luminaire's derated luminous flux at T_a 35^{o}C shall be stated by the Bidder.

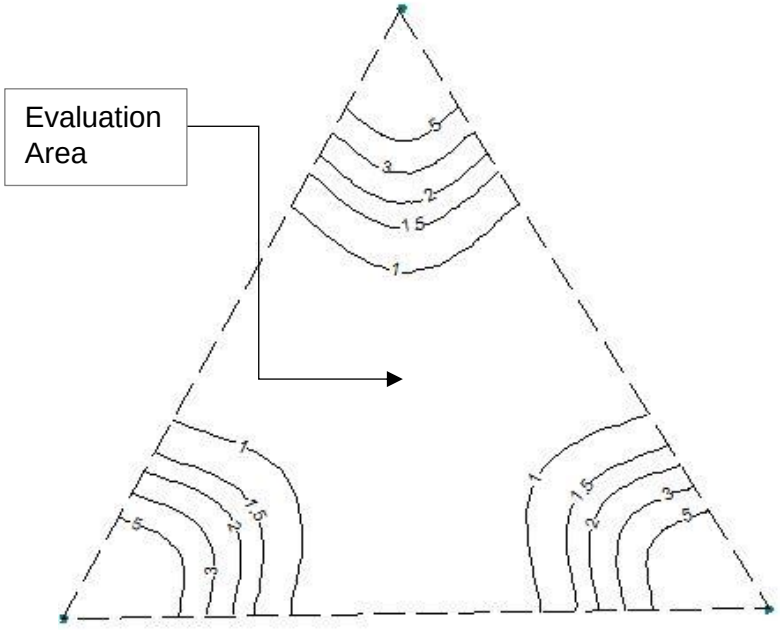


Figure 1. Typical Triangular Layout

A. Design Criteria

Description	Unit	Existing Installation	New Installation
Type of Luminaire		2000W & 400W HPS Floodlight	LED Flood lighting
Lighting Application		High Mast Lighting	High Mast Lighting
Number of Luminaires per Mast	No	8 & 9	XXXXXXXXXX
Total Rated System Wattage per Mast	W	3600	2160 + P_{RATED}x(±10%)
Mast spacing Arrangement		Triangular	Triangular
Average triangular Spacing between Masts	m	250	250
Mounting Height	m	40 & 30	30&40
Luminaire Arrangement		Circular Symmetry	Circular Symmetry
Maximum Inclination angle of Luminaire	Deg	XXXXXXXXXX	45
Distance from mast (Luminaire Ring Cage Radius)	m	XXXXXXXXXX	1.50
Light loss factor		XXXXXXXXXX	0.75
Minimum average horizontal Illuminance Eh_{ave}	lx	XXXXXXXXXX	5.00
Minimum horizontal Illuminance Eh_{min}	lx	XXXXXXXXXX	2.00
Minimum horizontal Illuminance Uniformity Eh_{min}/Eh_{ave}		XXXXXXXXXX	0.40

B. Design Results

Bidders shall complete the following table (in the attached Excel spreadsheet):

Lighting Design Simulation: Luminaire Nominal Luminous Flux at T_a 25ºC

Technical Details	Unit	Part A	Part B
		Specified	Offered
Rated System Wattage per Luminaire	W	XXXXXXXXXX	
Number of Luminaires per Mast	No	XXXXXXXXXX	
Total Rated System Wattage per Mast	W	XXXXXXXXXX	
Total Luminous Flux per luminaire	Lm	XXXXXXXXXX	
Total Luminous Flux per Mast	Lm	XXXXXXXXXX	
Inclination angle of Luminaires	Deg	Max 45º	
Minimum average horizontal illuminance	Lx		
Compliant		≥ 5.00	
Acceptable		2.00 < x < 5.00	
Poor		≤ 2.00	
Minimum horizontal illuminance	Lx		
Compliant		≥ 2.00	
Acceptable		1.00 < x < 2.00	
Poor		≤ 1.00	
Minimum horizontal illuminance uniformity, Uo			
Compliant		≥ 0.40	
Acceptable		0.20 < x < 0.40	
Poor		≤ 0.20	

Schedule 4: Lighting Design Data – Street Lighting

Compliant lighting simulations and simulation reports are to be compiled for the proposed luminaire. The design criteria for the simulations are indicated below.

The simulations shall be provided in DIALux V4.13, RELUX or later simulation software versions. Hard and soft copy simulation report are to be submitted along with the readable electronic lighting simulation file, *.DLX, and IES / LDT or equivalent photometric files. These shall all be attached to the bid submission for the proposed luminaire.

The street light poles identified for replacement with LED luminaires are spaced at an average distance of 40m and 80m (average distance between poles). The characteristic dimensions of positioning luminaires, the basic arrangement of luminaires and evaluation area shall be as defined as per SANS 10098-1:2007, represented in below.

The luminaire mounting height shall be 9.25, 10m to 13m above ground level.

An average light loss factor (LLF) or depreciation factor of 0.75 (including dirt and lumen depreciation) shall be used for design purposes.

The optimal inclination angle of the LED luminaire will be determined by the Bidder but up to a maximum of 15º. Light-pollution and civil aviation aspects are to be taken into consideration when stating the optimal inclination angle.

The LED luminaire offered to be installed on the identified street light pole shall not result in the structural loading of the street light pole being exceeded.

Information regarding the street light poles selected for luminaire replacement are detailed in the following annexures:

1. Annexure A – List of Infrastructure

The minimum road or street lighting performance requirements shall be as follows:

Lighting Category	Type of Street	Minimum Average Horizontal Illuminance (E_{have})	Minimum Horizontal Illuminance (Eh_{min})	Minimum Horizontal Illuminance Uniformity (Uo, Eh_{min}/ Eh_{ave})
B1	Residential	5 Lux	1 Lux	0.20

Lighting Category	Type of Road	Minimum Average Luminance (cd/m^2)	Overall Luminance Uniformity (U_o)	Longitudinal Luminance Uniformity (U_l)	Threshold Increment (%), maximum
A2	Major Road, ≤90 km/hr	1.50	0.40	0.70	20
A3	Urban Road, ≤ 60 km/hr	1.00	0.40	0.60	20
A4	Major Residential Road, ≤ 60 km/hr	0.75	0.40	0.50	20

A lighting simulation is to be submitted for the offered luminaire. The simulation makes use of the luminaire's nominal flux at T_a 25ºC. The luminaire's derated luminous flux at T_a 35ºC shall be stated by the Bidder.

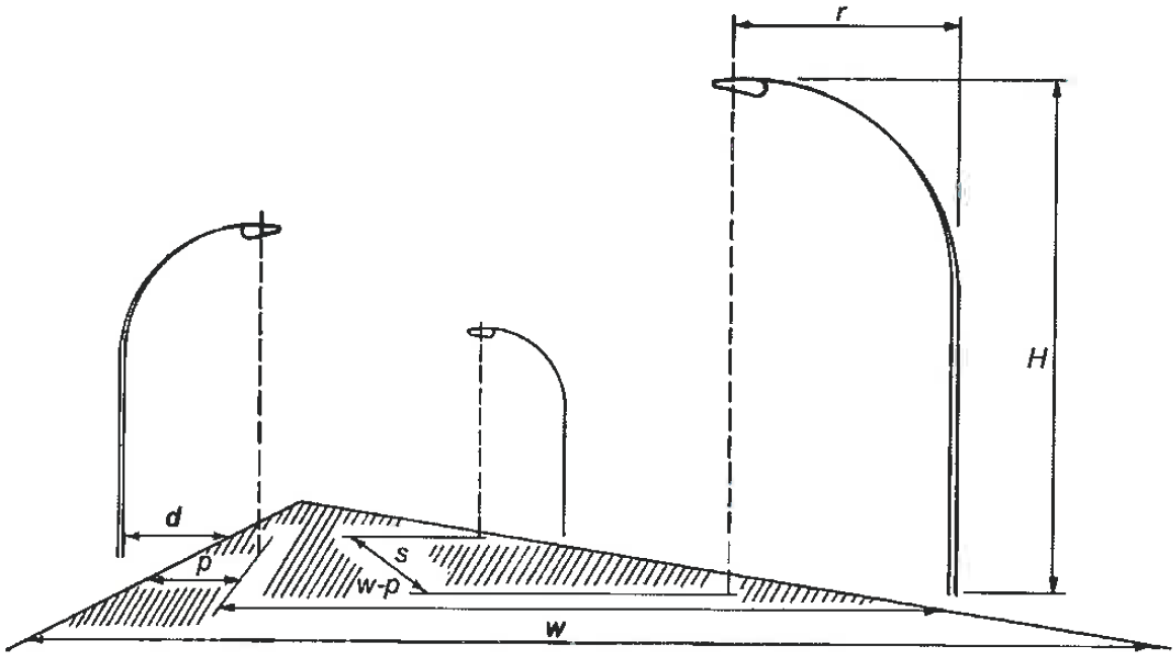


Figure 2. Characteristic Dimensions of Positioning Poles with Luminaires as per figure 1 of SANS 10098-1

Where

H = *Mounting height of luminaires*

s = *Spacing between poles*

W = *Width of carriageway surface (Kerb to kerb or edge of road surface)*

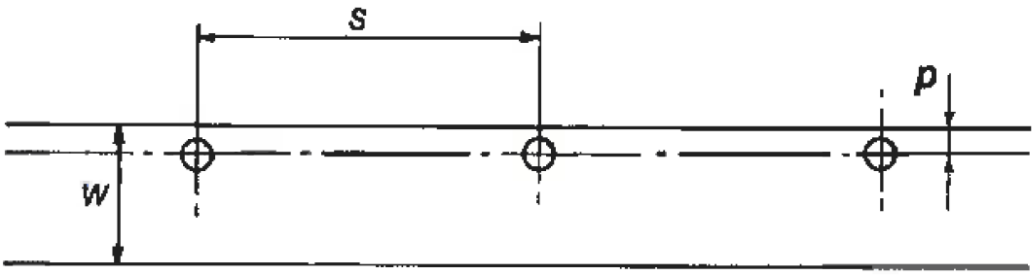
m = *Width of longitudinal space separating the carriageways on a dual carriageway road (not shown above)*

r = *Outreach*

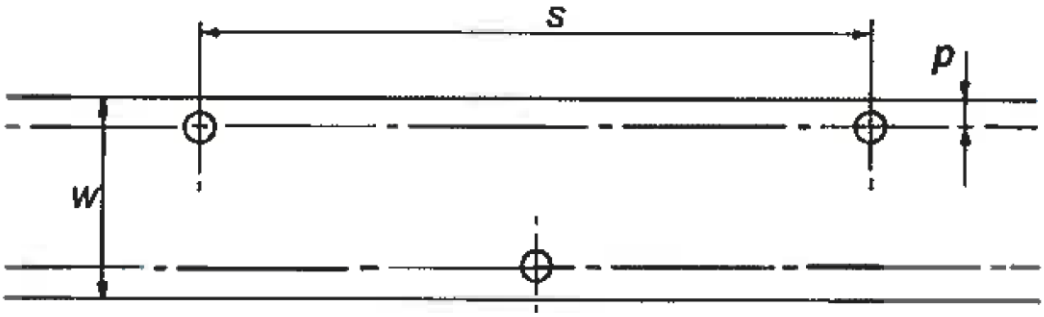
p = *Overhang, transverse distance (house side)*

W-p = *Transverse distance (street side)*

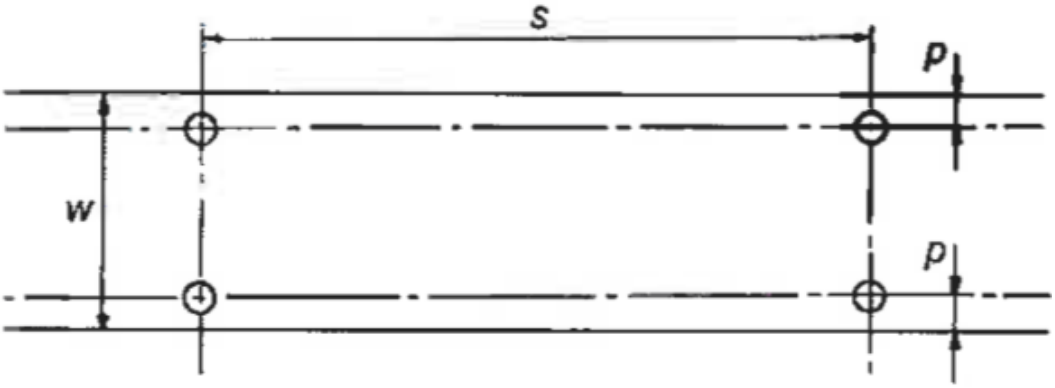
d = *Set-back from kerb line (edge of road surface)*



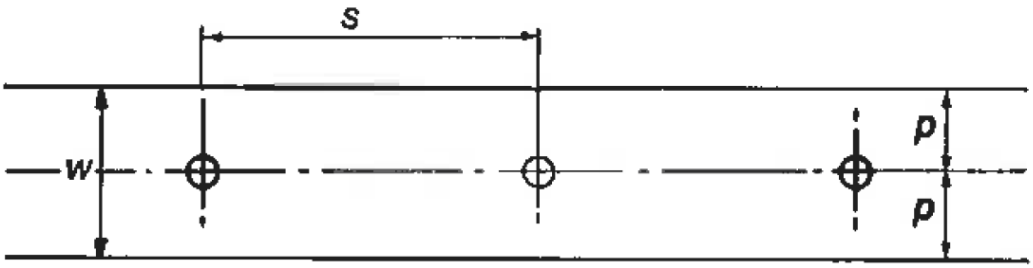
a) Single-side arrangement



b) Staggered arrangement



c) Opposite arrangement



d) Central arrangement with median of width m

Figure 3. The Basic Arrangement of Poles as extracted from figure 2 of SANS 10098-1

A. Design Criteria

Description	**Unit**	**Existing Installation**	**New Installation**
Type of Luminaire		150W & 400W HPS/MV Street Light	LED Street lighting
Lighting Application		Street Lighting	Street Lighting
Number of Luminaires per Pole	No	1	XXXXXXXXXX
Total Rated System Wattage per Pole	W	275	165 + P_{RATED}x(±10%)
Pole Arrangement		Single-side	Single-side
Mounting Height, H	m	9.25 & 10	9.25 & 10
Spacing between poles, s	m	40 & 80	40 & 80
Width of Carriageway (W)	m	10.30	10.30
Number of Lanes	No	2 & 4	2 & 4
Is median present		XXXXXXXXXX	~~Yes~~ / No
Width of median	m	-	-
Road surface		R3 q_o 0.070	R3 q_o 0.070
Outreach (r)	m	2.50	2.50
Set-back from kerb-line (d)	m	2.50	2.50

Maximum Inclination angle of Luminaire	Deg	XXXXXXXXXX	15
Light loss factor		XXXXXXXXXX	0.75
Lighting Category		XXXXXXXXXX	**A3**

Note: Design criteria above to be repeated and changed accordingly to the various types of road or street lighting arrangements as found within municipality.

B. Design Results

Bidders shall complete the following table (in the attached Excel spreadsheet):

Lighting Design Simulation: Luminaire Nominal Luminous Flux at T_a 25°C

Technical Details	Unit	Part A	Part B
		Specified	Offered
Rated System Wattage per Luminaire	W	XXXXXXXXXX	
Number of Luminaires per Pole	No	XXXXXXXXXX	
Total Rated System Wattage per Pole	W	XXXXXXXXXX	
Total Luminous Flux per luminaire	Lm	XXXXXXXXXX	
Total Luminous Flux per Pole	Lm	XXXXXXXXXX	
Inclination angle of Luminaires	Deg	Max 15°	

Lighting Design Simulation Results: Residential Street lighting

Lighting Category	Type of Street	Minimum Average Horizontal Illuminance (E_{have})	Minimum Horizontal Illuminance (Eh_{min})	Minimum Horizontal Illuminance Uniformity (Uo, Eh_{min}/ Eh_{ave})
Part A – Specified				
B1	Residential	5 Lux	1 Lux	0.20
Part B – Offered				
B1	Residential			

Lighting Design Simulation Results: Major, Urban, or Major Residential Roads

Lighting Category	Type of Road	Minimum Average Luminance, L (cd/m^2)	Overall Luminance Uniformity (U_o)	Longitudinal Luminance Uniformity (U_l)	Threshold Increment, TI (%), maximum
Part A – Specified					
A2	Major Road, ≤90 km/hr	1.50	0.40	0.70	20
A3	Urban Road, ≤ 60 km/hr	1.00	0.40	0.60	20
A4	Major Residential Road, ≤ 60 km/hr	0.75	0.40	0.50	20
Part B – Offered					

Note: Design results above to be completed for each various type of road or street lighting arrangement as found within municipality and specified in Design Criteria A above.