


**ADDENDUM NO. 1 REVISION 1
TO
L-S20 : SPECIFICATION FOR ROAD
LIGHTING INSTALLATION
(August 1999)**

SECTION A2.0: ROAD LIGHTING LUMINAIRES – LED

This addendum is additional to Section 2.0 of L-S20 :
SPECIFICATION FOR ROAD LIGHTING INSTALLATION (August 1999)
and shall be read together with the complete specifications.

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A2.1 General

Luminaires utilising Light Emitting Diode (LED) as light source are also known as Solid State Lighting (SSL).

Solid State Lighting (SSL) i.e LED luminaire system shall be complete with electronic control gear (driver), thermal management unit, surge & overvoltage protection and design for side entry suitable for supply voltage of 230 Volt, +10%, -6%, 50 Hz.


Computer simulation for lighting level calculation shall be supplied (prepared and submitted) to meet the design criteria and lighting class required (APPENDIX D1 – 1.1A) in accordance with MS 825: Code of Practice for the Design of Road Lighting. The simulation shall be generated using internationally recognised design software. (e.g. Dialux, Calculux, Ulysee etc.)

A2.2 Conformity With Standards


All products proposed must have product certification from accredited certification bodies.

LED luminaire shall be tested to comply with the current prevailing standards as below and of latest version:-

No.	Item	Relevant IEC Standards	Name of standard
1.0	Luminaire		
1.1	Safety	MS IEC 60598-2-3	Luminaires - Part 2-3: Particular Requirements – Section 3: Luminaires for Road and Street Lighting
1.2	Performance	MS 62722-1	Luminaire Performance – part 2-1 : Particular Requirement for LED Luminaires
1.3	Performance	IES LM-79-08	Approved Method: Electrical and Photometric Measurements of Solid State Lighting Products
1.4	Performance	IES TM 21-11	Projecting Long Term Lumen Maintenance of LED Light Sources
2.0	Control Gear (LED Driver)		
2.1	Safety	MS IEC 61347-2-13 IEC 61347-2-13	Lamp Control Gear – Part 2-13 – Particular Requirement for DC

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No.	Item	Relevant IEC Standards	Name of standard
			or AC supplied Electronic Control Gear for LED Modules.
2.2	Performance	MS IEC 62384 IEC 62384 ed 1.1	DC or AC supplied Electronic Control Gear for LED Modules – Performance Requirements
3.0	Lamp Holder		
	Safety	MS IEC 60838-2-2 (IEC 60838-2)	Miscellaneous lampholders – Part2-2 – Particular Requirements – Connectors for LED Modules.
4.0	LED		
4.1	Term & Defination	MS IEC 62504 IEC 62504 (Ed. 1)	General Lighting: LEDs and LED Modules – Terms and Defination.
4.2	Performance (General)	IEC / PAS 62707 Ed. 1	LED – Binning – Part 1: General Requirements and White Grid
4.3	Performance (Modules)	MS 62717	LED Modules for General Lighting – Safety Requirements
4.4	Peformance (Lamps)	IEC/TR 61341	Method of Measurement of Centre Beam Intensity and Beam Angle (s) of Reflector Lamps
4.5	Performance (Light Source)	IES LM-80-08	Approved Method: Measuring Lumen Maintenance of LED Light Sources
4.6	Safety (Modules)	MS IEC 62031 IEC 62031(Edition 1.0) AMD.1.ed 1	LED Modules for General Lighting – Safety Specifications
4.7	Safety (Lamps)	IEC 61231	International Lamps Coding Systems
4.8	Safety (Eye Protection)	IEC 62471 ed 1.0	Photobiological Safety of Lamps and Lamp Systems
4.9	Safety (Eye Protection)	IEC/TR 62471-2	Photobiological Safety of Lamps and Lamp Systems – Part 2:Guidance on Manufacturing Requirements Relating to Non-Laser Optical Radiation Safety
10.0	Connector		
	Safety	IEC 61984	Connectors – Safety Requirement and Test

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No.	Item	Relevant IEC Standards	Name of standard
11.0	EMC		
11.1	Performance	IEC 61547 Edition 2.0	Equipment for General Lighting Purposes – EMC Immunity Requirements
11.2	Performance	IEC 61000-3-2 Edition 3.2	Electromagnetic Compatibility (EMC) – Part 3-2: Limits – Limits for Harmonic Current Emissions (Equipment Input Current ≤ 16 A per phase)
11.3	Performance	CISPR 15:2005 (BS EN 50015)	Limits and Methods of Measurement of Ratio Disturbance Characteristics of Electrical Lighting and Similar Equipment
12.0	Lighting Design		
12.1	Performance	MS 825	Code of Practice for The Design of Road Lighting

A2.3 Construction And Components


- a) The luminaire shall be so designed and constructed that it is capable of providing the service for which it is intended. Sound engineering principles shall be adopted throughout and the luminaire shall be designed to enable ease of maintenance and replacement of light source, optical lens, electronic control gear, thermal management unit, reflector and holder without the use of special tools.
- b) The main supporting structure of the luminaire shall be constructed from die-cast aluminium alloy material such that no undue deterioration in its safety, performance or appearance during normal life when operating in all climatic conditions prevailing in a tropical country such as heavy rains, strong winds, high humidity and hot day-time temperatures. It shall be robustly constructed to withstand vibration in normal use.
- c) The luminaire shall be designed so that condensation shall not fall on any operating part which may fail or deteriorate the performance of luminaire.

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- d) All luminaires shall be new, totally enclosed and protected against contact with live or moving parts inside the enclosure. Ingress Protection Index (IP) of LED luminaire shall be minimum IP65. Full details of the IP system can be referred to in MS IEC 60529.
- e) The compartment for electronic control gear and light module shall preferably be separated. Access to the electronic control gear (driver) compartment shall preferably be from the top.
- f) Material used for the construction of the luminaire shall be recyclable.
- g) Hinges, screws and clips if used, shall be robust and made of stainless steel, simple to operate and shall not be liable to accidental detachment during installation or maintenance.
- h) In the open position, it shall be attached in such a way that there is no likelihood of it becoming accidentally detached and thereby damaging any part of the luminaire, the bracket or the column.
- i) Attachment of the luminaire to its bracket arm shall be by means of clamps or jam bolts and designed to accommodate spigot size of the luminaires. A minimum of two (2) locking bolts / jam screws shall be provided.
- j) The minimum penetration depth of the bracket arm is 100mm. The mounting arrangement and attachment of the luminaire shall be such as to withstand a windspeed of 42 m/s on the projected surface of the assembly without due deflection.
- k) All parts which carry the weight of the luminaire and internal accessories shall be provided with suitable locking devices to prevent the dislodgement of any part of the luminaire by vibration either in service or during maintenance.
- l) All parts shall operate well within the ratings with due consideration for the local conditions (high humidity of 80% RH, hot (live) ambient temperature of 35°C).
- m) Interchangeability of consumable components is preferred for maintenance purposes.

A2.3.1 Light Source

- a) The light source for LED luminaires shall be of high powered LED type. The LED light module shall not be driven more than the rated LED drive current.

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- b) The lumen output of LED luminaires (system efficacy) shall be minimum 90 lm/W. The usable lifetime of LED (lumen maintenance) at 36,000 hours shall not be less than 80% (L80 @ 36,000 hours). The system efficiency shall take into consideration the LED efficacy, driver efficiency, optical efficiency and thermal efficiency and shall not be less than 80%.
- c) The Correlated Colour Temperature (CCT) for LED luminaire shall range between 2500K to 3500K.
- d) Photobiological safety of LED module or LED luminaires shall not be more than Risk Group 1 (as per IEC 62471).

A2.3.2 The Optical System

The optical system shall comprise of optical lens, reflector (if any) and luminaire cover.

a) Optical Lens

The optical lens shall be made of UV resistant material (eg. poly methyl methacrylate (PMMA), UV stabilized polycarbonate, silicon, etc) and shall be stabilised against deformation, deterioration or discolouration due to the lamp and/or solar radiation (UV).

b) Reflector


The reflector if any shall be made of at least 99.85% pure aluminium with a minimum thickness of 1 mm, be electrically brightened, anodised and chemically treated to give high reflectance.

c) Luminaire Cover (Secondary Optics)

Luminaire cover shall be provided to protect the optical lens from accumulation of dust and for easy cleaning of the luminaire. It shall be made UV resistant material suitable for outdoor used (in accordance with standard UL746C or equivalent).

For covers that is designed as light diffuser/disperser, it shall be made of clear tempered glass.

- d) The gasket used shall be silicone, one piece weather resistant type that will not cause crazing of the luminaire cover. The gasket shall form an integral part of the luminaire cover such that any cover change will necessitate a change of the gasket.

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A2.3.3 Thermal Management Unit

The luminaire shall be provided with suitable thermal management unit to effectively dissipate heat generated from LED.

A2.3.4 Electronic Control Gear (LED Driver)

- Electronic control gear (LED driver) shall comprise of electronic circuit board, converter, built-in power factor correction unit (≥ 0.9), internal surge protective device (SPD) and THD $< 20\%$. The driver shall be able to withstand short circuit current, overload, over voltage and over temperature. The driver shall have self cooling system. LED driver shall be placed close to LED where possible to reduce electromagnetic interference.
- The input range of the driver shall function correctly at the supply voltage and shall allow for normal variation and surges (230V, +10%, -6%, 50 Hz).
- The working temperature for the driver shall suit the local condition.
- Ingress Protection Index (IP) of the driver shall be minimum IP65 as per MS IEC 60529.

A2.3.5 Surge Protective Device (SPD)

- Internal/Built-In SPD


The driver shall be protected against lightning surge with an internal surge protector devices (SPD) of not less than 15kA with a let-through voltage of less than 350V test at 2kV, 1.2/50 μ Sec open circuit and 1kA, 8/20 μ Sec short circuit.

- External SPD

To enhance the driver life span and prolong the internal SPD performance, the external SPD may be installed within the column after the modular termination box for safety and ease of maintenance.

If required, the external SPD shall be rated not less than 20kA with a let-through voltage of less than 850V tested at 6kV, 1.2/50 μ Sec open circuit test and 3kA, 8/20 μ Sec short circuit test.

The SPD shall be Full Mode (L-N, L-E, N-E) protection with a working voltage of 275Vac series connection and complete with LED indicator.

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A 2.3.6 Internal Wiring and Earthing Terminal

2.3.6.1 Internal Wiring

- a) The luminaire shall be completely pre-wired, requiring only the connection of the electrical power supply cables to the terminal and the earth continuity conductor to the earthing terminal.

2.3.6.2 Earthing Terminal


- a) A separate terminal for the connection of an earth continuity conductor, clearly and permanently marked shall be provided. The installation shall comply to MS 60364.
- b) All exposed metal parts and other parts accessible when the luminaire is opened for maintenance and liable to become live in the event of an insulation fault shall be permanently and reliably connected to this earthing terminal.

A2.4 Computer Simulation for Lighting Level Calculation

2.4.1 Computer simulation for lighting level calculation shall include Photometric Data which comprises of the following:

- i) Isolux Diagram
- ii) Utilization Factor Curves
- iii) Polar Curves of the following C-Planes : 0°/180°; 90°/270°; maximum intensity plane
- iv) Downward Light Output Ratio
- v) Downward and Upward Flux Fractions

Tender documents submitted without the appropriate Computer Simulation will be disqualified.

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2.4.2 Tenderers are required to furnish comprehensive information and technical particulars as stipulated in:-

- i) APPENDIX D1 – Computer Calculation Format for Road Lighting Installation
(To be submitted for Road 1 and Road 2 as given in **Attachment A**)
- ii) APPENDIX D2 – Tabulated Summary of Lighting Level Calculation / Data For Road Lighting Installation


The computer plots shall also be attached.

All the above plots and data shall be certified by the respective manufacturer.

A2.5 Schedule and Technical Information on LED Luminaires

- 2.5.1 Tenderers are required to furnish comprehensive information and technical particulars as stipulated in **Attachment B (Product Features)**.
- 2.5.2 The information required in the attachment shall be completed fully and correctly. All technical data entered therein shall be substantiated with relevant pamphlets and test certificates from the manufacturers or the recognized testing authorities.

Failure to fulfill the above requirements shall result in the disqualification of the tender.

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A2.6 Warranty

2.6.1 System Warranty

The manufacturer / distributor shall provide a 5 year warranty certificate for the complete luminaire system to guarantee the longlife expectancy and maintenance free luminaire. **Warranty declaration** shall be filled and duly signed by distributor / manufacturer as per **Attachment C**. Failure in the functioning and operation of the LED luminaire within the warranty period will result in the replacement of the whole luminaire or required components by the manufacturer/distributor at no cost to the government.

2.6.2 Performance Warranty

Luminance and illuminance test shall be carried out every six (6) months during defect liability period, to ensure the performance of the installed system conform to designed requirement. These tests will also confirm the lumen maintenance of the luminaire.

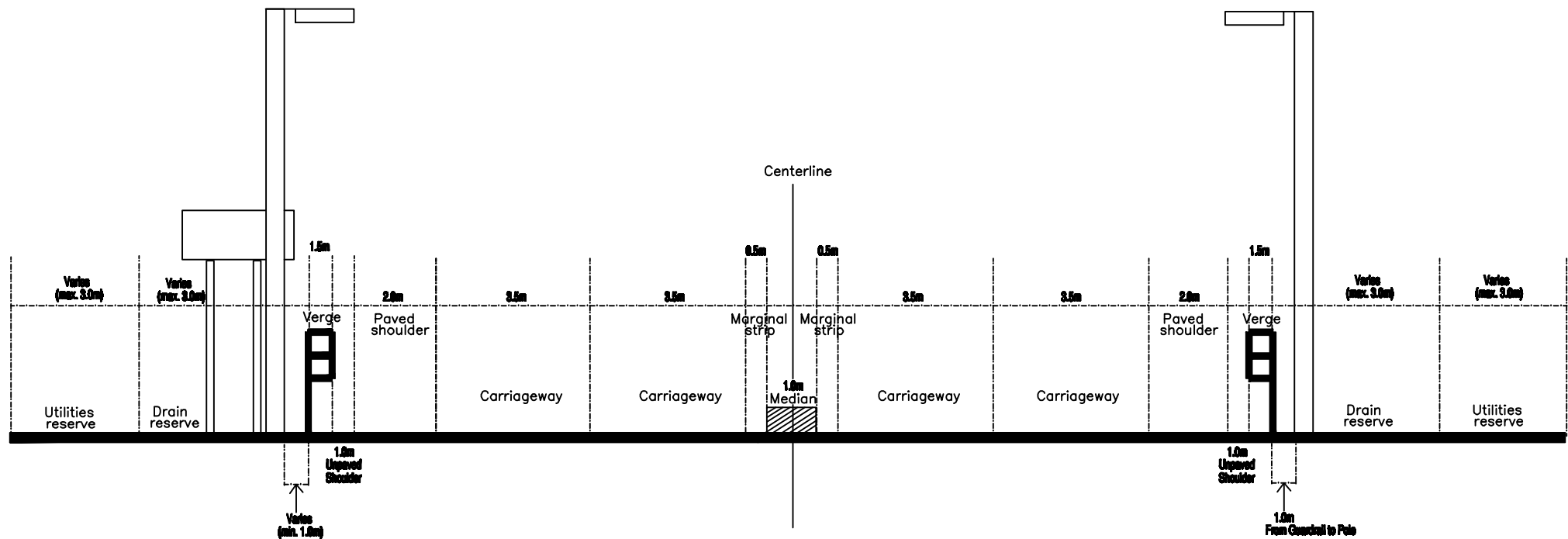
The contractor together with luminaire supplier shall carry out the above test and the result must meet the design criteria as submitted in the computer simulation.

Note :

1. System Efficacy = LED Efficacy X Driver Efficiency X Optical Efficiency X Thermal Efficiency
2. System Efficiency = $\frac{\text{System Efficacy (Luminaire Lumen Output)}}{\text{LED Efficacy (Light Source Lumen Output)}}$
3. Maintenance Factor = Lamp Lumen Maintenance Factor X Luminaire Maintenance Factor

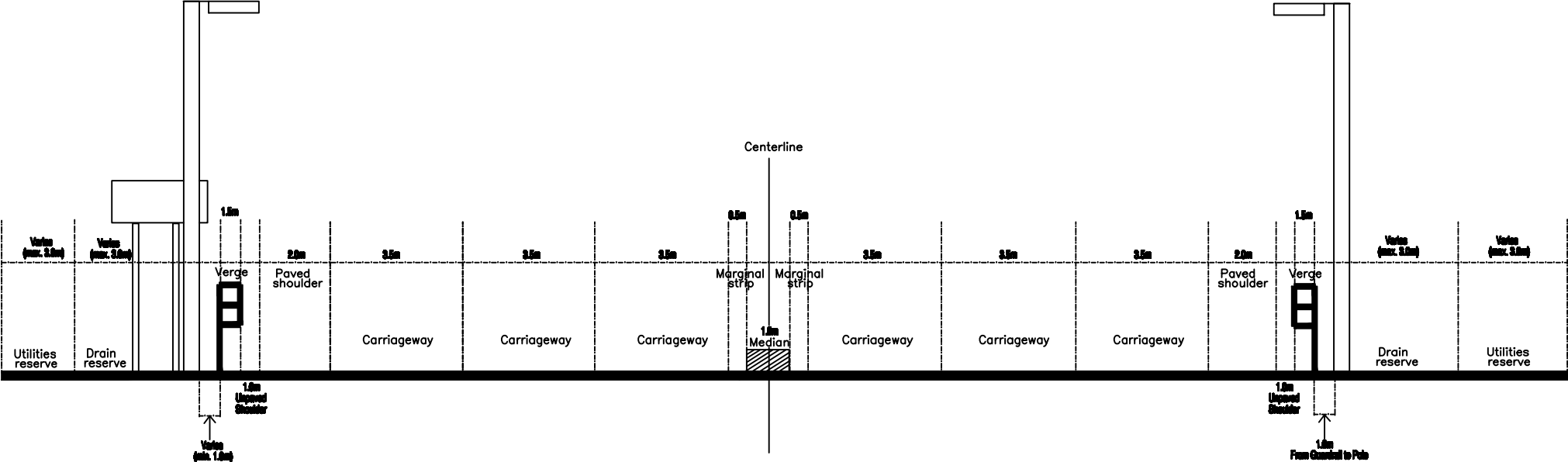
Road 1

ATTACHMENT A-1



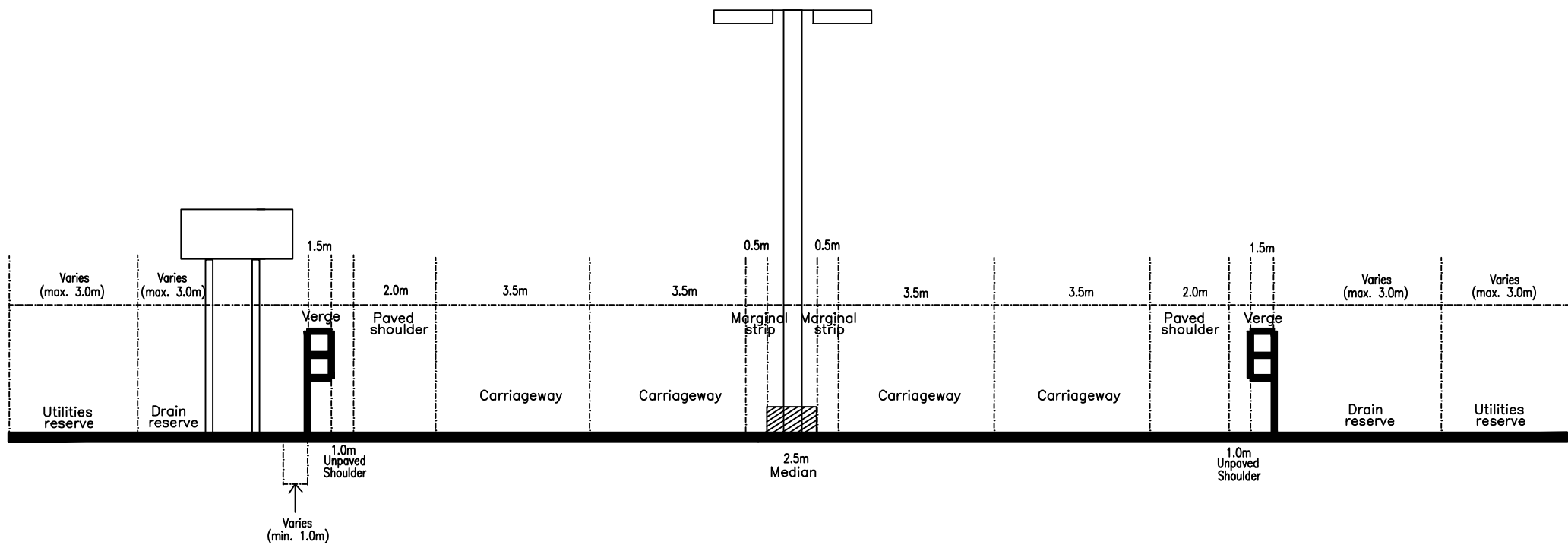
DESIGN REQUIREMENT : LIGHTING CLASS ME1 (MS825)

Average Luminaire (min. maintained), Lave (cd/m²)	Overall Uniformity, U ₀ (min%)	Longitudinal Uniformity, U _L (min%)	Threshold Increment, TI (max %) (Closely Glare)	SFI, Surround Ratio (min)	Lamp Maintenance factor
2.0	0.4	0.7	10	0.5	0.8



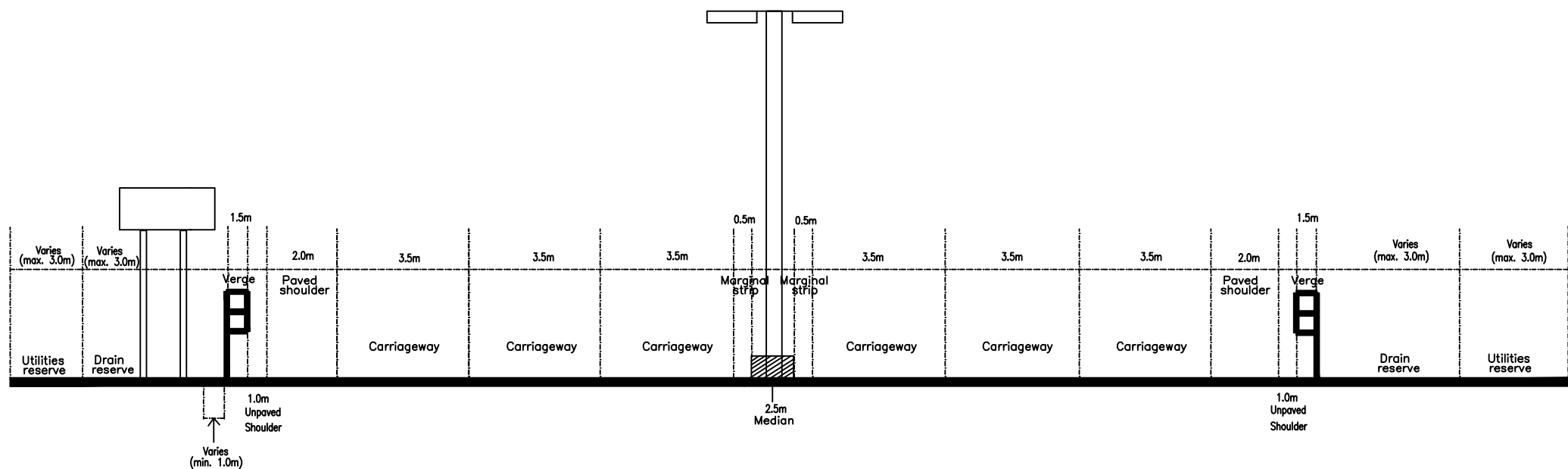
DESIGN REQUIREMENT : LIGHTING CLASS ME1 (MS825)

Average Luminance (min. maintained, Lave (cd/m²))	Overall Uniformity, Uo (min/cd)	Longitudinal Uniformity, UL (min/cd)	Threshold Increment, TI (max %) (Contrast Class)	Glare Ratio, GR (min)	Lamp Maintenance factor
2.0	0.4	0.7	10	0.5	0.8



DESIGN REQUIREMENT : LIGHTING CLASS ME1 (MS825)

Average Luminance (min. maintained), Lave (cd/m ²)	Overall Uniformity, Uo (min)	Longitudinal Uniformity, UL (min)	Threshold Increment, TI (max %) (Disability Glare)	SR, Surround Ratio (min)	Lamp Maintenance factor
2.0	0.4	0.7	10	0.5	0.8



DESIGN REQUIREMENT : LIGHTING CLASS ME1 (MS825)

Average Luminance (min. maintained), Lave (cd/m ²)	Overall Uniformity, Uo (min)	Longitudinal Uniformity, UL (min)	Threshold Increment, TI (max %) (Disability Glare)	Surround Ratio, SR (min)	Lamp Maintenance factor
2.0	0.4	0.7	10	0.5	0.8

ROAD LIGHTING LUMINAIRE**PRODUCT FEATURES**

NO.	ITEM	BRAND:	
		MODEL FOR ROAD 1:	MODEL FOR ROAD 2:
1	Technical Specification		
1.1	Input Requirements		
	Voltage,Hz		
	Models available		
	Power Connection Type		
1.2	Output Parameters		
	Power Consumption (@120 VAC)		
	Power Factor ≥ 0.9		
	Total Harmonic Distortion $\leq 20\%$		
	Colour Rendering Index, CRI (Ra)		
	Luminous Intensity Distribution Provided?		
	Test Temperature that photometry is produced		
	Lighting Class (results from Computer Simulation)		
	Maintenance Factor (MF= LLMFxLMF)		
	Column Height (10m / 12m)		
	Column span / spacing		
2	Additional Information		
	Country of Manufacture		
	Product of:		
	Project reference		
3	ADDENDUM NO.1 to L-S20: Requirement on LED		
3.1	Construction And Components		
	Gross Weight		
	Materials Casing / Body		
	Ingress Protection (sealed with silicon gasket)	IP65	
	Jam bolts for clamping/securing/lock spigot to bracket arm		
	Operating Parameters		
	Operating Temperature	hot(live)/cold(lab)	
	Ambient Temperature	$T_a = 35^\circ\text{C}$	
	Working Humidity	RH> 80%	

ROAD LIGHTING LUMINAIRE**PRODUCT FEATURES**

NO.	ITEM		BRAND:	
			MODEL FOR ROAD 1:	MODEL FOR ROAD 2:
3.2	Light Source			
A.	Type of LED	High Powered LED		
	LED drive current			
B.	Brand of LED			
C.	Luminaire/System Efficacy (Lumen/w)	Min : 90 lm/W		
	LED Efficacy (lumen/W)			
D.	LED Lumen Maintenance L80@36,000 (Effective Burning Hours, Useable lifetime)	Max.lumen depreciation = 80% at 36,000hrs		
E.	Luminaire/System Efficiency (Luminaire lumens output : light source /LED lumens output)			
	Luminaire Lumens Output	LLO = Efficacy x (a x b x c) ≥ 80%		
	a) Electronic Control Gear (DRIVER) Efficiency			
	b) Optical Efficiency			
	c) Thermal Management Efficiency, T _j			
F.	The Correlated Colour Temperature (CCT)	2500K < CCT < 3500K		
3.3	The Optical System			
A.	Component of Optical System			
B.	Optical Lens			
	Material : Poly Methyl Methacrylate / UV stabilized polycarbonate / Silicon			
C.	Reflector			
	Material : 99.85% pure aluminium with a minimum thickness of 1mm			
D.	Luminaire Cover (secondary optics)			
	a. designed as light diffuser	Tampered Glass		
	b. designed as cover only	UV Resistant Material		
E.	Silicon Gasket	one piece weather resistant type		
3.4	Thermal Management Unit			
A.	Material Type			
B.	Heat sink thermal resistance	(W/°C)		

ROAD LIGHTING LUMINAIRE**PRODUCT FEATURES**

NO.	ITEM		BRAND:	
			MODEL FOR ROAD 1:	MODEL FOR ROAD 2:
3.5	Electronic Control Gear (LED Driver) System			
A.	Component of LED Driver			
B.	Protection features	withstand short circuit current, overload, over voltage and over temperature.		
		Surge Suppressor		
		Power Factor Correction		
C.	Cooling System of LED Driver	self-cooling		
D.	Input Range	(230V, +10%, -6%, 50 Hz).		
E.	DC Output Range			
F.	Working Temperature for LED Driver	to suit local condition		
G.	Ingress Protection Index (IP)	Min : IP65		
3.6	Internal Wiring and Earthing Terminal			
	Completely Pre-wired			
3.7	Warranty			
	System Warranty:			
	Warranty Period for the complete luminaire (LED Driver, Optical System, Housing, Thermal Management)	5 year warranty certificate		
3.8	Conformity With Standards			
A	Luminaire			
	MS62722-1			
	MS IEC 60598-2-3			
	IES LM-79-08			
	IES TM 21-11			
B	Control Gear (LED Driver)			
	MS IEC 61347-2-13			
	MS IEC 60838-2-2			

ROAD LIGHTING LUMINAIRE**PRODUCT FEATURES**

NO.	ITEM	BRAND:	
		MODEL FOR ROAD 1:	MODEL FOR ROAD 2:
C	Lamp Holder		
	MS IEC 60838-2-2		
D	LED		
	MS IEC 62504		
	IEC/PAS 62707 Ed. 1		
	MS 62717		
	IEC/TR 61341		
	IES LM-80-08		
	MS IEC 62031		
	IEC 61231		
	IEC 62471 Ed. 1		
	IEC/TR 62471-2		
E	Connector		
	IEC 61984		
F	Electromagnetic Compatibility (EMC)		
	IEC 61547		
	IEC 61000-3-2		
	BS EN 55015		

WARRANTY DECLARATION

PROJECT:

Declaration by Distributor/Manufacturer:

We hereby guarantee that the complete LED luminaire systems supplied is maintenance free and come complete with 5 years warranty. Should any of the LED luminaires fail to function at anytime within the warranty period we, the distributor/manufacturer, will duly replace the LED luminaire complete with necessary components at our own cost.

Signature of distributor/manufacturer:

Name of Authorized Personnel:

Official stamp:

Date:

* Warranty certificate is attached