REPÚBLICA DE MOÇAMBIQUE

AUTORIDADE REGULADORA DE AVIAÇÃO CIVIL DE

Technical circular

CT 139-012

SUBJECT: **PROCEDURE FOR INSPECTING AERODROME LIGHTING (Aerodrome Ground Lighting - AGL)**

Rev. 00 – 23 de Março de 2026

1. Authority

This technical circular is issued under the authority of the Chairman of Board of Directors of the Mozambique Civil Aviation Authority in pursuance of powers vested in him under Article 19 of Law number 05/2016 of 14 June and Article 12 of Resolution 19/2011 of 30 November.

2. Purpose:

This technical circular (CT) provides information on the procedures for inspecting Airport Lighting to ensure essential lighting capacity for runways, taxiways, and movement areas of the airport that support crucial airport services in case of low visibility. This Circular provides basic guidelines on the lines of responsibility for the daily provision of Aeronautical Ground Lighting (AGL). This Circular provides basic guidance for lines of responsibility for the day-to-day provision of Aeronautical Ground Lighting (AGL).

3. Applicability

The operators, who intend to conduct aeronautical studies and risk assessments for their equipment, infrastructure, aerodromes, systems, procedures or services

4. References:

4.1 ICAO Annex 14 – Volume I, 9th edition, 2022.

4.2 ICAO doc 9157 – Part 4 (Light Characteristics for Runways and Taxiways Used in Low Visibility Conditions).

4.3 MOZCAR 139 – 2rd Edition.

4.4 https://skybrary.aero>articles>aerodrome-lighting.

5. Changes

This is an original technical circular.

6. Aerodrome Lighting

Description

All aerodromes intended to operate under Low visibility shall have some type of lighting to identify and mark taxiways and runways and to control movements of aircraft and vehicles. The variety and type of lighting systems depends on the volume and complexity of operations at an aerodrome. Airport lighting is standardized so that airports use the same light colors for runways and taxiways.

6.1 Colors Code in Aerodromes

Yellow	Yellow lights are often advanced approach lighting system. They have more complicated structure and includes lights of few colors – white, yellow, and red. Such system is placed at huge air hubs used to indicate the route to be followed by an aircraft or vehicle. Runway edge lights are type of this lights.

White	White lights are often advanced approach lighting system, just like Precision Approach Path Indicator. Each PAPI light usually consists of four lighting fixtures (4 x Light House Assemblies). Each lighting unit can provide red or white light output. If aircraft is too low to the ground, all four lights will be of red color. If aircraft is too high, all 4 lights will be of white color. So, the correct path is when two lights are white and two lights are red.
RED	RED lights ahead of an aircraft or vehicle mean: it is unsafe to proceed beyond the RED lights. This is the case regardless of whether the lights are fixed, alternating or flashing and is independent of an ATC clearance. RED means stop.
AMBER	AMBER lights are used to convey a similar but less distinct message. They indicate that a potential hazard exists beyond the lights, but that in conjunction with an appropriate ATC clearance it will be safe to proceed.
GREEN	GREEN lights are often used to indicate the route to be followed by an aircraft or vehicle, particularly at night or in periods of reduced visibility. In all cases green lights are a routing aid and must only be followed in conjunction with an ATC clearance.
BLUE	BLUE lights are often used to indicate the route to be followed by an aircraft or vehicle in taxiway, particularly at night or in periods of reduced visibility. In all cases Blue lights are a routing aid and must only be followed in conjunction with an ATC clearance.

6.2 Lights and Their Meanings at Runway Entrances

Entry Lighting	Runway Lighting	Taxiway Lighting	Instruction and Signal Lighting	Other Lighting
1. Runway Taxiway Lights (RLLS)	6. Runway End Lights (RTHL)	16. Taxiway Lights (TEDL)	27. Airfield Lighthous e (ABL)	31. Visual Period Guidance System (VDGS)
2. Turning Light (CGL)	7. Runway Threshold Extension, etc. (WBAR)	17. Taxiway Center Line Lights (TCLL)	28. Wind direction indicator (IWDI)	32. Apron lighting (FLO)
3. Approach Light System (ALS)	8. Runway Lights (REDL)	18. Stop line lights (SBL)	29. Turn signal lights(SIGL)	33. Road stop location, etc. (RHP)
4. Approach Angle Indicator (PAPI)	9. Runway Center Line Lights (RCLL)	19. Taxiway guidance Signs (TGS)	30. Landing direction indication lights (LDI)	34. Prohibited areas, etc. (USBL)
5. Runway End Identification Light (RTIL)	10. Runway End Lights (RENL)	20. Temporary stop position lights (IHPL)		35. Main decoration star sign etc. (ASIS)
	11. Earthing Zone Lights (TDZL)	21. Runway Warning Lights (RGL)		
	12. Simple grounding area, etc. (S-TDZL)	22. High-speed exit taxiway instruction etc. (RETL)		
	13. Runway distance light (DMS)	23. De-icing facility exit, etc.(DIEL)		
	14. Stop Road Lights (STWL)	24. Aircraft Stand Guidance Lights(SMGL)		
	15. Runway turn pad lights (RTPL)	25. No Entry Line, etc.		
		26. Runway Condition Lights		

6.3 Control of Aerodrome Lighting

Airport lighting must be controlled by air traffic controllers (ATCOs) at towered airports. At non-towered airports, the lights may be on a timer, or where a Flight Service Station (FSS) is located at an airport, the FSS personnel may control the lighting. At selected non-towered airports, an **ARCAL** (**A**ircraft **R**adio **C**ontrol of **A**erodrome **L**ighting) system shall be installed to allow the pilot to control the lighting by using the aircraft radio.

6.4 Character of Aerodrome Lighting System (The four Cs)

The aerodrome operator shall consider the four main elements that comprise the character of the complete airport lighting system. These elements are conveniently referred to as the "four Cs"— **configuration**, **color**, **candelas** and **coverage**.

1. Both **configuration** and **color** provide information essential to dynamic three-dimensional orientation. Configuration provides guidance information, and color informs the pilot of the aircraft's location within the system.
2. **Candelas** and **coverage** refer to light characteristics essential to the proper functioning of configuration and color.

7. OPERATING REQUIREMENTS OF VISUAL GROUND AIDS

The operating requirements for visual aids shall vary according to the type of aircraft being flown, the meteorological conditions, the type of navigation aid used for the approach, the physical characteristics of the runway and taxiways, and whether or not landing information is made available through radio communications.

7.1 Small Aerodromes

Airports designed for small single-engine and light-twin aircraft below 5 700 kg are often not provided with instrument approach aids or air traffic control facilities. The operating requirements are:

a) Airport location;

b) Airport identification;

c) Landing information:

- Wind direction and speed;
- Runway status — closed or usable;
- Runway designation;

d) Circling guidance;

e) Final approach guidance to touchdown:

- Runway edge and threshold delineation;
- Approach slope guidance;

(3) Aiming point guidance;

(4) Runway centre line delineation;

f) Roll-out guidance:

- Runway centre line delineation
- Runway edge delineation;
- Exit taxiway location;

(4) Exit taxiway edge and centre line delineation;

(5) Runway end indication;

g) Taxiing guidance:

- Taxiway edge and/or centre line delineation;
- Information signs to parking and servicing areas;
- Mandatory instruction signs;

h) Departure information;

i) Take-off guidance:

- Runway centre line delineation (see note under e) 4));
- Runway edge delineation;
- Runway end indication.

7.2 Large airports

Large airports shall be provided with radio navigation aids and air traffic control facilities requiring radio communications. When used in visual meteorological conditions (VMC) without these aids, the requirements for ground visual aids are the same as those stated for small airports.

Flights conducted in instrument meteorological conditions (IMC) require visual aids in addition to those listed above for small airports.

8. Lighting aerodrome Category

Aerodrome lighting shall take in consideration the category, as follow:

1) *Non-precision approach runway*

Final approach guidance to touchdown:

- Centre line alignment guidance for a distance of at least 420 m before the threshold. — An indication of distance 300 m before the threshold.

2) *Precision approach runway — Category I*

Final approach guidance to touchdown:

- Centre line alignment guidance for a distance of 900 m before the threshold.
- An indication of distance 300 m before the threshold.
- Touchdown zone guidance.

3) *Precision approach runway — Category II*

Final approach guidance to touchdown:

- Centre line alignment guidance for a distance of 900 m before the threshold.
- Indications of distance 300 m and 150 m before the threshold.
- -Touchdown zone alignment guidance for a distance of 300 m before the threshold.
- Touchdown zone guidance.

Roll-out guidance:

- Distance remaining information.

Taxiing guidance:

- Exit taxiway guidance including edge and centre line delineation.
- Taxiway centre line delineation with change-of direction coding.

4) *Precision approach runway — Category III*

The operating requirements for visual aids in Category III meteorological conditions are, from the standpoint of configuration for approach and landing, the same as those provided for Category II meteorological conditions. Photometric characteristics of lights adequate for Category I and II operations need to be modified to provide increased vertical coverage, especially for large "eye-to-wheel height" aircraft.

Table 8-1: **Specifications for precision approach runway**

Runway Rating		RVR or Visibility	Decision Height (DH)
CAT-I		RVR 550m and above Visibility of 800 m or more	Over 60m
CAT-Ⅱ		RVR 300m or more ~ less than 550m	Over 30m
CAT-Ⅲ	A	RVR 175m or more ~ less than 300m	Over 15m
	B	RVR 50m or more ~ less than 175m	Less than 15m
	C	RVR less than 50m	-

Table 8-2 Installation standards for air navigation safety radio facilities and meteorological facilities for each runway operating class

Type	Emergency Airstrip	Imprecise Airstrip	Precision Runway		
			CAT-I	CAT-Ⅱ	CAT-Ⅲ
Wireless facilities					
- VOR		O	O	O	O
- LLZ		O	O	O	O
- DME		O	O	O	O
- GP			O	O	O
- IM				O	O

- ASDE			O
Meteorological Facilities			
- RVR	1 unit	2 to 3 units	3 units

Table 8-3 Minimum Installation Standards for Aviation Lights by Runway Operating Category

KINDS OF LIGHTINGS	NON-INS.	NON-PRE C.	CAT - I	CAT - II	CAT - III
APPROACH		○	○	○	○
PRECISION APPROACH PATH INDICTOR	○	○	○	○	○
RUNWAY EDGE	○	○	○	○	○
RUNWAY THRESHHOLD	○	○	○	○	○
RUNWAY END	○	○	○	○	○
RUNWAY CENTERLINE				○	○
RUNWAY TOUCH DOWN ZONE				○	○
STOP BAR				○	○
TAXIWAY	○	○	○	○	○
OBSTRUCTION	○	○	○	○	○

8.5 Minimum Lighting Ratio of Aviation Lights

1. CAT-II/III Precision Approach Runways

- 95%: Runway Centerline Lights, Runway Lights, Runway Threshold Lights, Approach Light System (up to 450m), Touchdown Area Lights:
- 85 %: Approach Light System (after 450m)
- 75%: Runway End Lights

2. CAT-I Precision Approach Runway

- 85%: Approach Light System, Runway Lights, Runway Threshold Lights, Runway End Lights

3. Runways for Takeoffs below

- 95%: Runway Centerline Lights and Runway Lights
- 75%: Runway End Lights

4. Runways for Takeoffs above

- 85%: Runway Lights and Runway End Lights

8.6 Electrical System

Runway lighting (runway lights) and taxiway lighting (taxi road lights) must be interlocked so that they do not operate simultaneously.

8.7 Surveillance

1. Airports that use lighting facilities for aircraft control purposes shall establish an automatic monitoring system that automatically relays failure information to air traffic control agencies in the event of a control function failure.

2. The monitoring system displays the stop line lights within 2 seconds at the runway stop position and within 5 seconds for other lighting facilities.

3. Runways used in meteorological conditions with an RVR of less than 550m:

- If aviation lights are turned on below the minimum lighting rate, the information shall be provided to maintenance personnel and air traffic control establishment of a surveillance system that can be recognized by business institutions.

8.8 Taxiway Lights

1 Function

Informing aircraft on the ground of the edges of taxiways and aprons lights.

2 Application

- Runway rotation pad, de-icing / anti- icing facilities, waiting area, apron area.
- Taxiway without taxiway centerline lights (if there is a taxiway centerline light in a straight section, it is replaced with a sign)
- A runway forming part of a standard taxiway on a runway without a taxiway centerline light.

3 Characteristics

- Location: Within 3m outside of the edge of taxiway, mooring, etc.
- Interval: 60m or less (curved section is installed according to the radius of the curve)
- Runway turn pad area: 30m or less
- Light: Blue

Aerodromes shall have omnidirectional taxiway lights to outline the edges of the taxiway blue in color. At many airports, these edge lights may have variable intensity settings that may be adjusted by an air traffic controller when deemed necessary or when requested by the pilot. For those aerodromes which taxiway has centerline lights will be green in color.

8.9 Approach Light Systems

As defined in MOZCATS 139, Volume I, Chapter 5, elevated approach lights and their supporting structures shall be frangible except that, in that portion of the approach lighting system beyond 300 m from the threshold:

a) Where the height of a supporting structure exceeds 12 m, the frangibility requirement shall apply to the top 12 m only; and

b) Where a supporting structure is surrounded by non-frangible objects, only that part of the structure that extends above the surrounding objects should be frangible.

c) When an approach light fixture or supporting structure is not in itself sufficiently conspicuous, it shall be suitably marked.

8.9.1 ***Jet blast.*** The typical location of elevated approach lights and their supporting structures is such that jet blast loads shall not exceed the environmental loads. Aerodromes shall assess the specific local need for lighting structures that may be affected by jet blast.

8.9.2 ***Deflection.*** The deflection of the light beam should be no more than ±2 degrees in the vertical axis and no more than ±5 degrees in the horizontal axis when the structure is subjected to a wind velocity of 100 km/h (54 kt) and coated with 12.5 mm of ice on all surfaces.
Any approach lighting structure required to be frangible shall be designed to withstand the static and operational/survival wind loads with a suitable factor of safety but should break, distort or yield readily when subjected to the sudden collision forces of a 3 000-kg aircraft airborne and

travelling in any direction at 140 km/h (75 kt). After a collision, the structure shall not become entangled with the aircraft in a manner that will prevent the aircraft from manoeuvring safely either in flight or on the ground. Approach lights and associated wiring supported by the structure shall be considered part of the structure for frangibility purposes.

Table: 8-4

Division	Type			Length
ICAO	Simplicity	SALS	Barrett	300/420m
			Street sign	
	Standard Formula	CAT-I Lighting System	Barrett	720/900m
			Street sign	
		CAT-II/III lighting system	Barrett	900m
			Street sign	
FAA	Simplicity	SSALS etc.	Barrett	420/720m
	Standard Formula	ALSF1		720/900m
		ALSF2		

8.9.3 Simple Approach Light System (SALS)

1 Application

- Scaffolding with classification number 3 or 4 and non-precision approach runway.

2 Length

- Standard : 420m

3 Centerline Light

- Length: 420m (minimum 300m)
- Spacing: 30m or 60m

- Error: 60±6m, 300±30m, 420+30m/-0m.
- Width: 4.5 m (4 lights at 1.5 m intervals)
- Color: White.

4 Crossline Light

- Location: 300m section (300m SALS: 150m and 300m section)
- Width: 18m/30m (including center line indicator)
- 18m: Install 5 lights symmetrically on both sides
- 30m: Install 8 lights symmetrically on both sides
- Color: White

5 Flash Light

- Center of each barret (if there is a paved stop road : installed from 300m)
- Installed on the runway center extension line;
- Sequential flashes in the direction of runway threshold.

8.9.4 Precise Approach CAT-I Lighting System

1 Application

- CAT-I precision approach runway

2 Length

- Standard: 900m

3 Crossline Light

- Location: 300m section
- Width: 30m (including center line indicator)
- Install 8 lights symmetrically on both sides
- Color: White

4 Flash light

- Center of each barret (if there is a paved stop road: installed from 300m)
- Installed on the runway center extension line;

- Sequential flashes in the direction of runway threshold.

8.9.5 Precise Approach CAT-II/III Lighting System

1 Application

- CAT-II/III precision approach runways

2 Length

- Standard : 900m

3 Measurement Light

- Length : 270m (at 30m intervals)
- Interval between each barrett of measurement indicator : 18m
- (same as the interval between barrets such as grounding area)
- Width (same as barrett such as grounding area) : 3m/4,5m
- (3rd /4th at 1.5m intervals)
- Color : Red

4 Crossline Light

- Location : 150m and 300m section
- Width : 15.3m/30m (including centerline indicator)
- 150m section : 15.3m (installed on both sides of 4 lights at 1.35m intervals)
- 300m section : 30m (8 lights at 1.5m intervals, installed on both sides)
- Color : White

5 Flash light

- Installed in the center of each barrett from
- Installed on the runway center extension line
- Sequential flashes in the direction of runway threshold

6 Characteristics

- Gradient
- SALS and CAT-I lighting system
- Support structure
- 300m from the starting point: fragile structure;

- After 300m: If it exceeds 12m, it is applied up to 12m.

7 Equalization plane

- Obstacles taller than ALS removed (ILS, a navigational safety facility, is regarded as an obstacle and installation of aviation obstruction lights and daytime signs)
- Road Height: At least 4.8m lower than the equalization plane;
- Rail (railroad) height: At least 5.4 m below the leveling plane;

8.9.6 PAPI (Precision Approach Path Indicator)

1 Function

- Lights to inform whether the landing angle of the aircraft is appropriate

2Location

- Left side of the runway
- When the ALS length is 420m or less : left / right side of the runway

Table: 8-5 Approach Angle Indicators

Location	Standard Angle	
	If you do not have GP	If you have GP
First Luminaire (D)	3° 30′	3° 35′
Second Luminaire (C)	3° 10′	3° 15′
Third Luminaire (B)	2° 50′	2° 45′
Fourth Luminaire (A)	2° 30′	2° 25′

8.9.7. REDL (Runway Edge Lights)

1 Function

- Lights to indicate runway edge

2 Characteristics

- Location : Within
- Spacing : 60m or less, equally spaced (non-gauge 100m or less)
- Lights : White and yellow
- Yellow is the last 600m of the runway or 1/3 of the runway length, whichever is shorter.

3 The section where the runways intersect

- Non-instrumental / non-precision approach and CAT-I precision approach runways: max. 120m (can omit inset runway lights)
- CAT-II/III precision approach runway : Installation of inset runway lights at equal intervals of 60m

8.9.7 RTHL (Runway Threshold Lights)

1Function

- Lights to indicate the starting point of the runway

2 Characteristics

- Location : 3m or less
- Interval :
  - Non-instrumental and imprecise: More than 6 lights (equal arrangement / center line symmetry (less than ½ between runway ranks) arrangement / same arrangement as the touchdown area mark)
  - CAT- Ⅰ precision approach runway: 3m
  - CAT- Ⅱ/Ⅲ precision approach runway: within 3m

3 In case the runway threshold is relocated

- Arrange 3 or more lights at 3m intervals outside starting from the runway lights / To be installed at the runway threshold area in case of landfill installation
- Light : Green

8.9.8 RTHL (Runway Threshold Wingbar Lights)

1 Function

- Lights to assist the function of runway threshold lights

2 Characteristics

- Spacing: Install more than 5 lights starting at the intersection of the runway lights and runway threshold lights and extending 10m or more outward.
- Light : Green

8.9.9 RENL (Runway End Lights)

1 Function

- Lights to indicate the end of the runway

2 Characteristics

- Location : Within 3m outside the end of the runway
- Interval :
  - Non-Instrument, Non-Precision, CAT-I/II: 6th or higher/ 2 groups (3rd or higher); placed symmetrically along the runway centerline;
  - CAT-Ⅲ: Within 6m
- Light : Red.

8.9.10 RTIL (Runway Threshold Identification Lights)

1 Function

- The front end of the runway to the pilot of the landing aircraft lights to indicate location

2 Application

- Relocation of runway threshold / without ALS or less than 420m

3 Characteristics

- Location : On the extension line of the threshold of the runway (approximately 10m from the runway level to the outside (maximum 22.5m))
- Light : White flashing light
- Cycle: 60 to 120 times per minute

8.9.11 RCLL (Runway Centerline Lights)

1 Function

- Lights to indicate the centerline of the runway

2 Application

- CAT-II/III Precision Approach Runways
- Even on a CAT-I precision approach runway, it can be installed when using high-speed
- Aircraft/when the width between runway ranks is 50m or more
- Take-off runway less than 400m
- Can be installed when using an aircraft with a RVR of 400m or more and a fast take-off speed / when the width between runway ranks is 50m or more

3 Characteristics

- Location : Runway centerline (If it is difficult to install on the centerline, install it within 60cm to the left and right of the runway centerline)
- Spacing : 15m (RVR less than 350m), 30m (RVR more than 350m)
- Light : White or red

4 Arrangement

- Runway length greater than 1,800m
- End of the runway ~ 300m (red), 300m ~ 900m from the end (red / white), after 900m from the end (white)
- Runway length less than 1,800m
- End of the runway ~ 300m (red), 300m from the end to the middle (red / white), after the middle (white)
- In case the runway threshold is relocated
- (Landing) End ~ 300m (Red), 300 ~ Middle (Red / White), Transfer point in the middle (White), Transfer point to start point (shielding)
- (Landing on the opposite side) same as the arrangement of runway centerline lights on a normal runway (However, it is arranged so that it does not overlap with ALS centerline lights)

8.9.12. RDML (Runway Distance Marker Lights)

1 Function

- Lights indicating the remaining distance to the end of the runway

2 Characteristics

- Location : 15 to 22.5 m outward from the edge of the pavement

- Interval : 300±15m
- Height: Max. 152 cm (characters 100 cm, side 120 cm)

8.9.13 RTZL (Runway Touch-down Zone Lights)

1 Function

- Lights indicating the grounding area

2 Application

- CAT-II/III Precision Approach Runways
- Can be installed on CAT-I precision approach runways equipped with runway centerline lights

3 Characteristics

- Location : runway threshold up to 900m
- Interval : 30m (CAT-I : 60m)
- Install the barret symmetrically with the centerline of the runway, but the innermost back shoulder 18m

(Same as the inner spacing of the grounding zone mark)

- Barrett width: 3 ~ 4.5m, 3rd or 4th light installation (same as ALS measurement indicator)
- Light : White

8.9.14 STBL (Stop Bar Lights)

1 Function: A light to indicate an area where the aircraft can be stopped if the pilot abandons the takeoff.

- Application : When there is a stop road used at night
- Location : 3m or less from the runway edge (same as runway leveling)
- Light : Red (unidirectional)

8.10 Airport Beacon

1 Function

- Lights to indicate the location of the aerodrome

Type

- Aerodrome Beacon and Aerodrome Identification Beacon

2 Airfield Lighthouse

Location: In or near the airfield

Elevation angle: 1° ~ 10°

- The light should not be obscured by obstacles and prevent glare to the controller
- **Color**: Green and white flashing light or white flashing light
- Number of flashes: 20 to 30 times

3 Flight Decoration Star Lighthouse

- **1 Location**: in or near the airfield
- **3 Color**: Green strobe light
- Transmitting identification characters according to the international Morse code:
- 6 ~ 8 characters per minute (3 or 4 English alphabets per character)

4 The beacon shall be an omnidirectional capacitor-discharge device, or it may rotate at a constant speed, which produces the visual effect of flashes at regular intervals. The combination of light colors from an airport beacon will indicates the type of airport. Some of the most common beacons are:

- Flashing white and green for civilian land airports;
- Flashing white and yellow for a water airport;
- Flashing white, yellow, and green for a heliport; and
- Two quick white flashes alternating with a green flash identifying a military airport.

8.11 Circling Guidance Lights (turning lights)

For a circling approach the following guidance shall be provided:

1) Adequate indication of the direction or location of the runway. This would enable a pilot to join the downwind leg or align and adjust the track to the runway;
2) A distinct indication of the threshold so that a pilot can distinguish the threshold in passing; and

3) Adequate indication of the extended runway centre line in the direction of the approach and compatible with the threshold indication to enable a pilot to judge the turn onto base leg and final approach.

8.12 Characteristics of circling guidance lights (Turning lights)

1. **Location**: 40m from the edge of the runway:

- Up to 900m at 150m intervals in the direction of the runway from the threshold
- In the first class, 3 lights are installed at 30m intervals outside the runway

2. **Light**: White flashing light or white fixed light

8.13 Apron Flood lighting

1. Apron floodlighting should be provided on an apron, on a designated isolated aircraft parking position intended to be used at night.

2. Apron floodlights should be located so as to provide adequate illumination on all apron service areas, with a minimum of glare to pilots of aircraft in flight and on the ground, aerodrome and apron controllers and personnel on the apron. The arrangement and aiming of floodlights should be such that an aircraft stand receives light from two or more directions to minimize shadows.

3. The average illuminance shall be at least the following:

Aircraft stand:

a) horizontal illuminance — 20 lux with a uniformity ratio (average to minimum) of not more than 4 to 1; and
b) Vertical illuminance — 20 lux at a height of 2 m above the apron in relevant directions.
c) Other apron areas.
d) Horizontal illuminance — 50 per cent of the average illuminance on the aircraft stands with a uniformity ratio (average to minimum) of not more than 4 to 1.

9. Light Characteristics for Runways and Taxiways used in Low Visibility Conditions

9.1 Factors Determining Required Light Distribution

The required light distribution shall be dependent on four main factors:

a) The extent to which the aircraft may be expected to deviate from its nominal or ideal flight path during its approach for landing. Such deviations are contained within what is called the "flight path envelope";

b) The range of "eye-to-wheel" and "eye-to-aerial" heights of aircraft for current and planned operations;

c) The distance up to which the lights must be visible at any particular stage of the approach, touchdown, roll-out, take-off and taxiing phases and the visibility conditions in which the lights must provide guidance;

d) The available downward view in front of the aircraft; and

e) The extent to which the aircraft may be expected to deviate from the taxiway centre line when taxiing.

9.2 Flight Path Envelopes

Categories I and II

Flight path envelopes used in designing the lighting for approaches and the ground roll on the runway shall be based on 99 per cent is probability values from Obstacle Clearance Panel (OCP) data for points at distances of 600 m and 1 200 m from the runway threshold.

The upper boundaries take into account the height of the pilot's eyes above the ILS/MLS receiver *4-1* antenna on the aircraft. The Category I and II boundaries based on these data are terminated at the respective minimum decision heights.

Below these heights the flight envelopes are defined by the limits of the flight paths which would result in a satisfactory landing in visual conditions. The lower boundary of the Category I envelope has been set at two degrees elevation with an origin at the outermost approach light to cater for non-precision approaches in good visibilities.

10. Operating Procedures in RVR Less Than 350 m

1. Taxiing

Pilots taxiing aircraft in low visibility conditions are guided by visual reference to medium/high-intensity lights. In these conditions the "see-and-be seen" principle will not always be effective in maintaining safe separation between aircraft. To safeguard aircraft approaching taxiway and runway intersections and to prevent taxiing aircraft from infringing on ILS/MLS critical/sensitive areas while other aircraft are approaching to land, stop bars are needed to regulate aircraft at recognized holding points.

2. Take-off

The runway centre line markings are the primary visual cues used by the pilot to provide directional guidance until the aircraft is rotated. (Runway edge lights have a role in take-off or landing if the aircraft starts to deviate significantly from the runway centre line.)

From this point the pilot completes the take-off by reference to flight instruments. If the take-off is abandoned before rotation speed is reached, the pilot continues to refer to the centre line markings until the aircraft is brought to rest, or taxied from the runway.

3. Landings

In all Category III operations the non-visual guidance systems are designed to deliver the landing aircraft to a position over the runway from which a safe landing can be made. If the aircraft is not delivered to the prescribed position in space within closely defined limits, then the missed approach procedure is initiated. Landings in Category IIIA conditions are made when the pilot is satisfied, by reference to the runway lights or markings, that the aircraft's position is within the overall width of the touchdown zone and that the aircraft is tracking satisfactorily in azimuth. For operations in Category IIIB minima, the approach, flare and initial roll-out are entirely automatic.

4 Analysis of Lighting Design

1. In deriving the light characteristics, the following principles and procedures shall be applied:

a) The fog is of uniform density;
b) The overall lighting system should be balanced in the sense that the visual segment seen by the pilot generally increases continuously; and
c) For a given meteorological visibility, the length of the visual segment seen after initial contact should be the same for all approach paths within the approach envelopes.

2. Aircraft are assumed to follow the boundaries. The visual range, the elevation angles and the azimuth angle between the aircraft and representative light positions in the approach and runway lighting patterns at positions along the boundaries are calculated for a number of values of visual segment.

3. The corresponding values of the intensity needed to meet the visual range requirement are calculated for each case, using Allard's Law, for a range of values of the equivalent meteorological visibility appropriate to the three ICAO categories of low visibility operation for daylight values of the pilot's illuminance threshold (10–4 to 10–3 lux).

11. Surface Movement Guidance and Control Systems

a) The term "surface movement guidance and control (SMGC) system" stands for a system of aids, facilities and procedures designed to meet the requirements for guidance and control of surface traffic consistent with the particular operational conditions at a particular aerodrome. All aerodromes shall have some form of SMGC system.

b) An SMGC system shall comprises an appropriate combination of visual aids, non-visual aids, radiotelephony communications, procedures and control and information facilities.

11.1 Operational requirements

1. The level of the SMGC system that is provided at an aerodrome shall be related to the operational conditions under which it is intended that the system shall operate. It is important to recognize that a complex SMGC system is not needed and is uneconomic at aerodromes where visibility, aerodrome layout complexity and traffic density, separately or in combination, do not at present cause problems for the ground movement operations of aircraft and vehicles. However,

failure to provide an SMGC system with a capacity properly matched to the operational demands at an aerodrome will restrict the movement rate and may affect safety.

2. All SMGC systems have four basic functions:

a) *Guidance*, which consists of the facilities, information and advice that are necessary to provide continuous, unambiguous and reliable information to pilots of aircraft and drivers of vehicles to keep their aircraft or vehicles on the surfaces and assigned routes intended for their use;

b) *Routing*, which is the planning and assignment of a route to individual aircraft and vehicles to provide safe, expeditions and efficient movement from the current position to the intended position;

c) *Control*, which is the application of measures to prevent collisions and runway incursions thereby ensuring safe, expeditious and efficient ground movements; and

d) *Surveillance*, which provides identification and accurate positional information on aircraft, vehicles and other objects.

11.2 The role of visual aids

Visual aids have a role in the guidance, routing and control functions of SMGC systems. There are a number of high-level goals in the design of any system that relate specifically but not always exclusively to the provision of visual aids. These are:

a) An SMGC system should be able to accommodate all aircraft and authorized vehicles;
b) The guidance function shall support safe operations on the aerodrome considering the visibility conditions, traffic density and aerodrome layout;
c) Pilots and vehicle drivers shall be able to follow their assigned routes in a continuous, unambiguous and reliable way;
d) Visual aids shall be an integral component of the surface movement system; and
e) An SMGC system shall be implemented in a modular form to allow for system growth as the operational situation changes.

11.3 Visual aid components of an SMGC system

a) Visual aids for guidance
b) Visual aids for routing

c) Visual aids for control

d) Taxiway centre line lights for Cataegory II and III

e) Stop bars

f) Elevated and in-pavement runway guard lights

g) Road-holding position lights

12. Signs Evaluation Procedures

To evaluate the physical characteristics of a sign, the following procedures shall be applied:

a) Assess the category of operation for which the sign is to be used;

b) Measure the height and width of the sign face, excluding the holder frame where applicable;

c) Measure the height of all characters;

d) Measure the stroke width of each character and ensure that the stroke width is consistent around the characters, particularly those that contain curved components;

e) Measure the width of each character;

f) Measure the space around the characters, top, bottom, right and left;

g) Measure the border width where applicable;

h) Measure the space between words where applicable;

i) Where two types of signs are in one unit (e.g. taxiway mandatory and information signs), measure the separation between the signs; and

j) Compare the measured dimensions and spacings with the recommendations given in MOZCATS 139, Volume I

13. Lights which may cause confusion

A non-aeronautical ground light which, by reason of its intensity, configuration or colour, might prevent, or cause confusion in, the clear interpretation of aeronautical ground lights shall be extinguished, screened or otherwise modified so as to eliminate such a possibility. In particular, attention shall be directed to a non-aeronautical ground light visible from the air within the areas described hereunder:

a) Instrument runway — code number 4:

Within the areas before the threshold and beyond the end of the runway extending at least 4 500 m in length from the threshold and runway end and 750 m either side of the extended runway centre line in width.

b) Instrument runway — code number 2 or 3:

As in a), except that the length should be at least 3 000 m.

c) Instrument runway — code number 1; and

d) Non-instrument runway:

Within the approach area.

14. Maintenance of Lighting Performance

Aerodrome Operator shall provide maintenance of lighting performance for guidance on the system of preventive maintenance to be employed for approach and runway lighting systems intended to support operations in Category I, II and III conditions.

The maintenance environment shall comprise:

- maintenance requirements
- monitoring of light output
- demonstration of conformance

INSTITUTE OF CIVIL AVIATION OF MOZAMBIQUE

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