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AVIATION LIGHTING COMMITTEE



2019 IES Aviation Lighting Committee  
Technology Meeting  
Monterey, CA



## ***Apron Floodlighting Updates***

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October 24, 2019



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INFRASTRUCTURE

MINING & METALS

NUCLEAR, SECURITY & ENVIRONMENTAL

OIL, GAS & CHEMICALS





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# Agenda for today

- A. Background
- B. Standards
- C. Updated MoS 139
- D. Evaluation practice and challenges
- E. Recommended methodology
- F. CASA Advisory Circular





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## Background

- Continual inconsistent design process
- Continual inconsistent lighting level measurement procedures
- Incorrect interpretation of results
- Misalignment between design and installation
- Compliance issue





## Governing Standards

- ICAO Annex 14
- MoS 139 Chapter 9
- AS/NZS 3827.1 – Lighting System performance – Accuracies and tolerances Part 1: Overview and general recommendations
- AS/NZS 3000 – Wiring Rules

## Relevant Standards

- AS 1680.5 – Outdoor Workplace Lighting
- European Standard EN 12464 -2 – Lighting of work places – Part 2: Outdoor work places
- AS 2560.1 – Sports Lighting General Principles
- CIBSE SLL Code of Lighting 2012
- CIE 67- Guide for the Photometric Specification and Measurement of Sports Lighting Installations
- IESNA RP37 – Outdoor Lighting



## Manual of Standards 139 (before Sept 2019) Chapter 9 – two tiers requirements

### At aprons used by large aircraft

- Aircraft parking position
  - Horizontal ave illuminance: 20 lux,  $U < 4$
  - Vertical ave illuminance: 20 lux at 2m high in the relevant parking direction, parallel to the aeroplane centreline
- At other apron areas: 50% of the horizontal illuminance shown above and  $U < 4$

### At aprons used by smaller aircraft

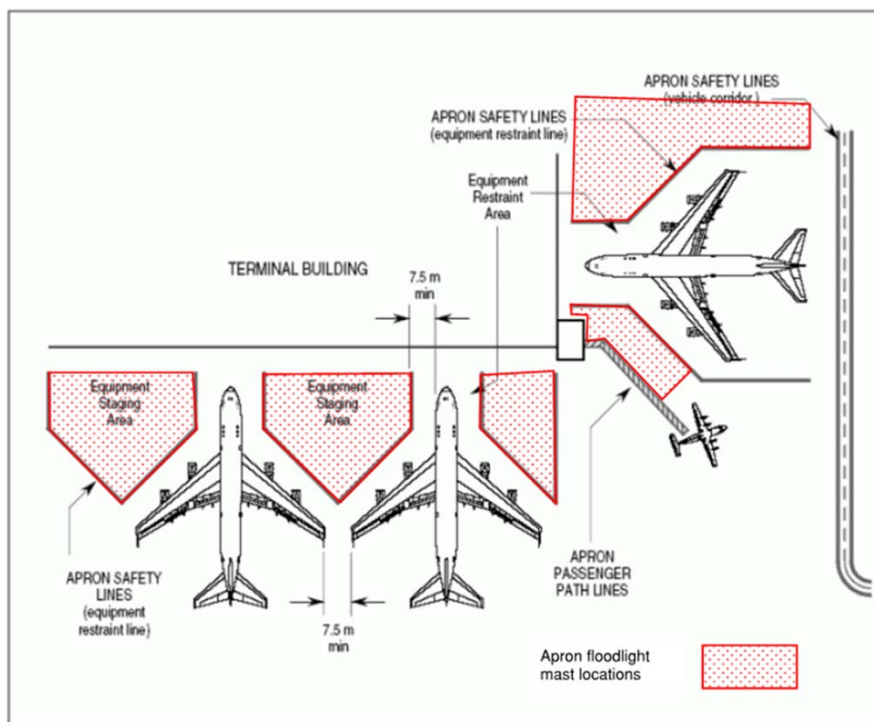
- Aircraft parking position
  - Horizontal ave illuminance: 5 lux,  $U < 4$
  - Vertical ave illuminance: 5 lux at 2m high in the relevant parking direction, parallel to the aeroplane centreline
- At other apron areas: 1 lux at apron extremities or 2 lux with no taxiway lights





## Location of masts

- Masts located outside the separation distance
- Generally within the GSE area





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## Non RPT aprons

- General Aviation
- Defence military / flying doctors / rescue helicopter
- Only horizontal lighting level and uniformity criteria
- Generally smaller size aircraft





## Definition of lighting levels

### Horizontal lighting level

- measure of light reaching the horizontal plane of aircraft parking position

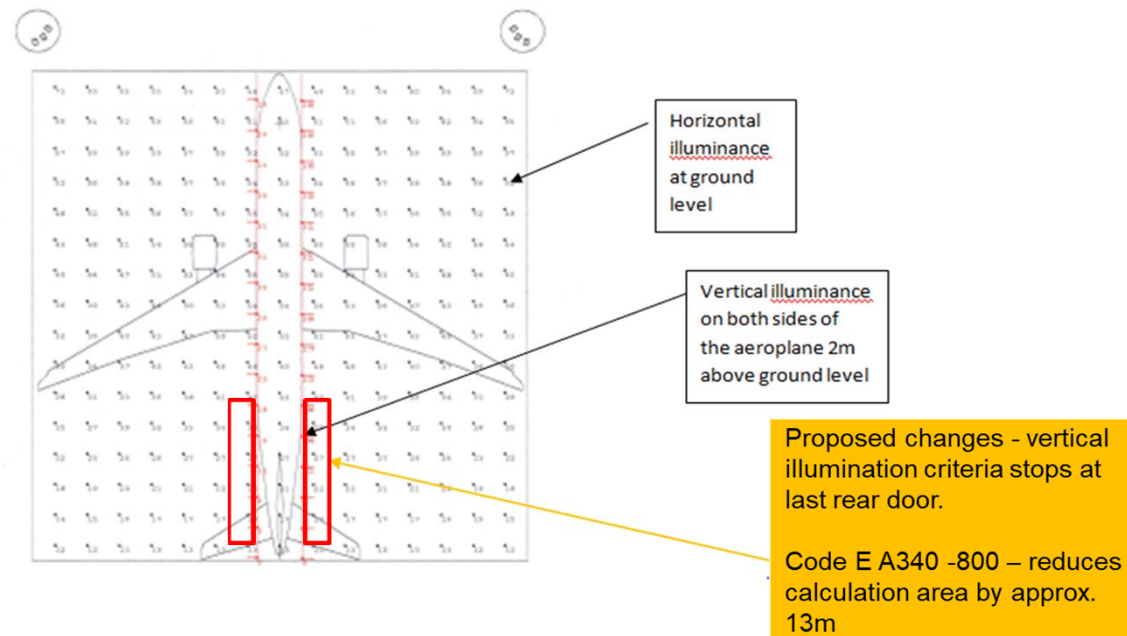
### Vertical lighting level

- amount of light reaching the vertical surface of the aircraft fuselage





## Interpretation of MoS 139 / ICAO calculation areas





# Updated MoS 139 changes

ITEM	DESCRIPTION	V1.14 MoS	UPDATED MoS
1	Apron floodlight	9.16.1.1 - 2 tiers system	9.113 - 3 tiers system - lower standard for non-RPT aprons.
2	Location of apron floodlighting	no reference	9.115(1) - Apron floodlighting located outside the separation distance on apron.
3	Characteristics of apron floodlight	9.16.4.3(a)(ii) - Vertical illumination - 20 lux at a height of 2m above the apron in the relevant parking direction, parallel to the aeroplane centreline	9.116(3)(a)(ii) - a minimum average illuminance in accordance with Table 9.116(3) at a height of 2m above the apron...along the centreline until the point where the rearmost passenger or cargo door of the intended aircraft is reached.
4	Characteristics of apron floodlight	no reference	9.116(3)(b) - non-RPT apron - horizontal illumination requirement and uniformity requirement. No vertical illuminance requirement.
5	Characteristics of apron floodlight	9.16.4.3 & 9.16.4.4 average illumination of apron for large and small aircraft	Table 9.116(3) refer to aerodrome code for specific illumination requirements.
6	Characteristics of apron floodlight	9.16.4.3(b) - other apron areas - 50% illuminance of the average illuminance	9.116(3)(c) - 50% of minimum average illuminance for the highest aerodrome code for the associated parking positions on the apron.
7	Characteristics of apron floodlight	9.16.4.9 - minimum illuminance is maintained and must be fall below...	Note below 9.116(10) - each floodlight design should meet a target value which allows lighting to still meet illuminance requirement in the event of commonly occurring outages. The floodlight designer may choose the factor, provided it is appropriate for the particular floodlighting system.



# Updated MoS 139 Table 9.116 (3)

**Table 9.116 (3) Minimum parking position illuminance**

<b>Aerodrome reference code letter for parking position</b>	<b>Minimum parking position average illuminance for aprons intended for air transport operations</b>	<b>Minimum parking position average illuminance for aprons not intended for air transport operations</b>
A	10 lux	5 lux
B	10 lux	5 lux
C	20 lux	10 lux
D	20 lux	10 lux
E	20 lux	10 lux
F	20 lux	10 lux



## What affects light outputs

- Lamp lumen depreciation
- Lamps interaction with control gear / LED driver
- Supply voltage variations
- Dirt or dust on the lamp / LED modules
- Ambient temperature in the fixture
- Quality assurance of the lamp manufacturers





## Accuracy of apron lighting measurement

- AS/NZS 3827.1 defines the accuracies and tolerances of measurement
  - Section 9.5.2 Sources of uncertainty states “Any meaningful measurement has to be based on the premise that the grid used for measurement and the grid used for the design are comparable (See Clause 7.3.2). If this does not occur, the measurements will be meaningless, since no estimate of uncertainty can be assigned to this source of error.”





## Industry practice

- Designers use random grid size in calculations
- Incorrect assumptions on light loss factor
- Grid size used in measurement during commissioning and maintenance different to the grid size in calculations
- Voltage at light source not recorded
- Lamp lumen depreciation cycle not recorded
- Luminaires cleaning cycle and method not recorded





## Challenges of measuring apron lighting



Limited window due to operation constraints



Survey of measuring grid takes a long time



Calculation grid size unknown to the contractor doing the site measurements



Waiting time for the lamps to stabilise



MoS does not make reference to creditable lighting standards for measuring procedures



Open to interpretations by contractors or airport operators



## Current survey practice

Use of concrete pavement joints as point of measurement

Survey one line at apron extremities and eyeballing the rest

10m grid is commonly used

Do not reflect design grid cell sizes

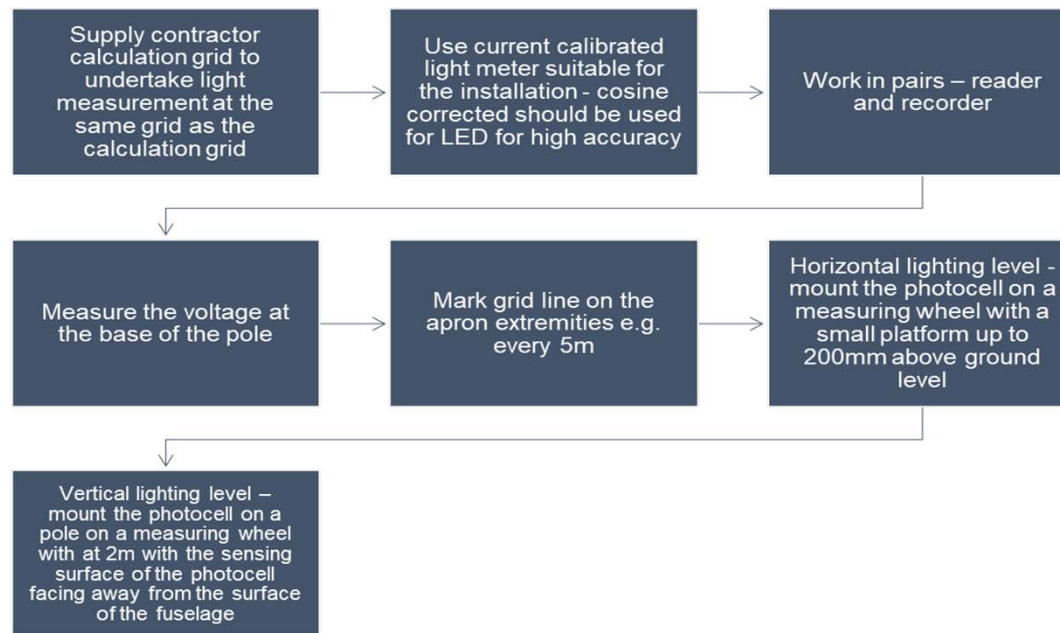
Do not reflect calculation grid points

Current survey methods are crude and inaccurate





## Recommended measurement methodology





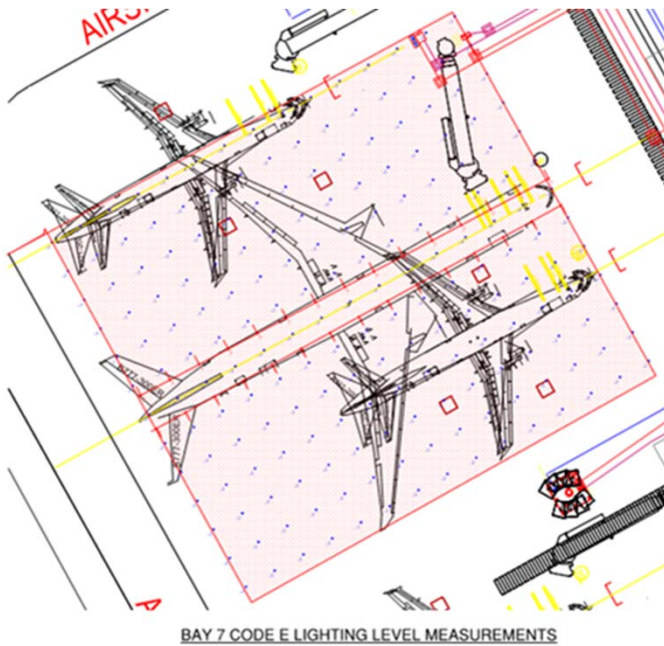
## Match measurement points with calculation points

- - Horizontal lighting level measurement points
- - Vertical lighting level measurement points 2m above ground level, light meter photocell facing parallel and away from centerline of fuselage

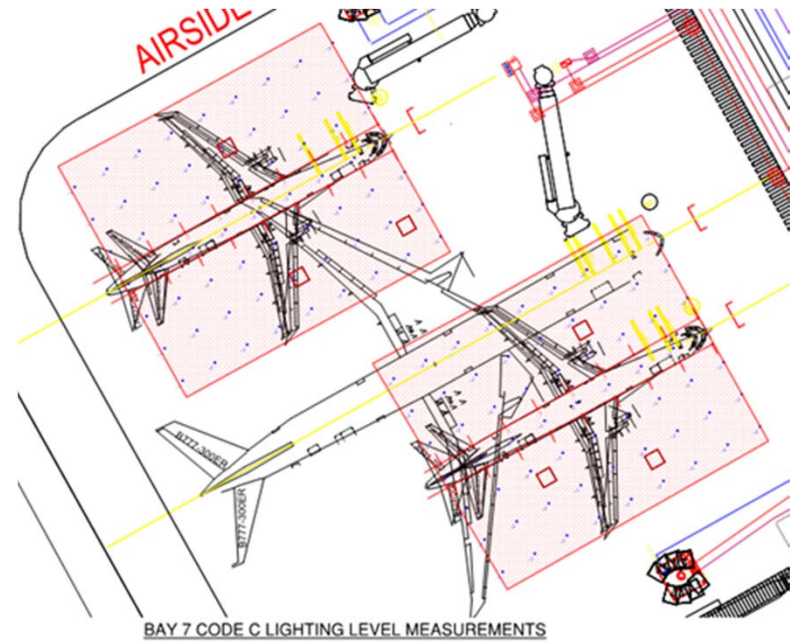




## Code E Parking (MARS)



## Code C Parking (MARS)





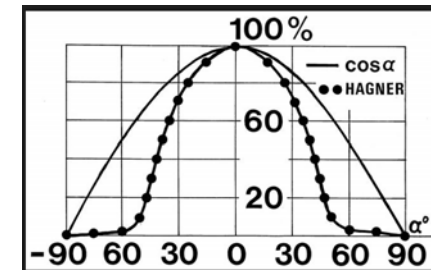
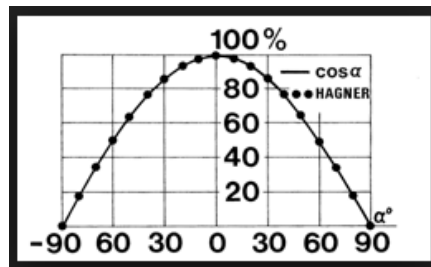
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## Calibrated colour & cosine corrected light meter



Cosine corrected measurement

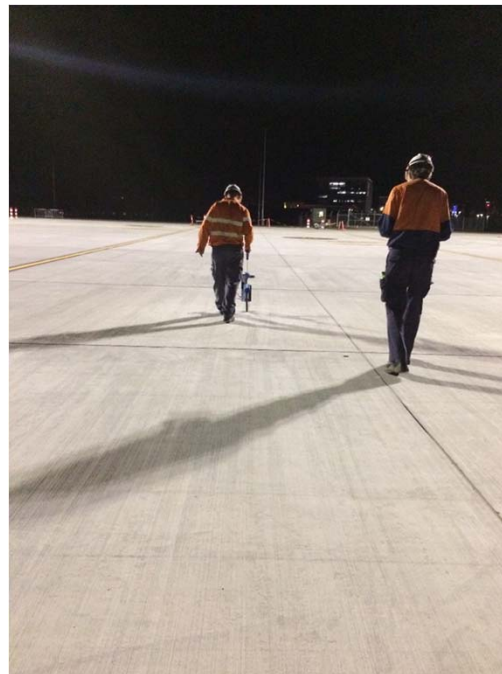




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## Work in pairs

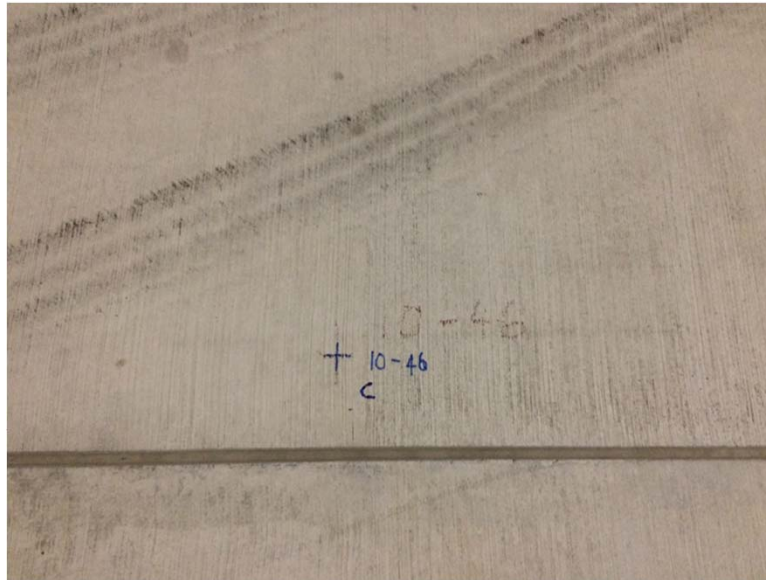




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## Mark measurement grid at aircraft parking position extremities

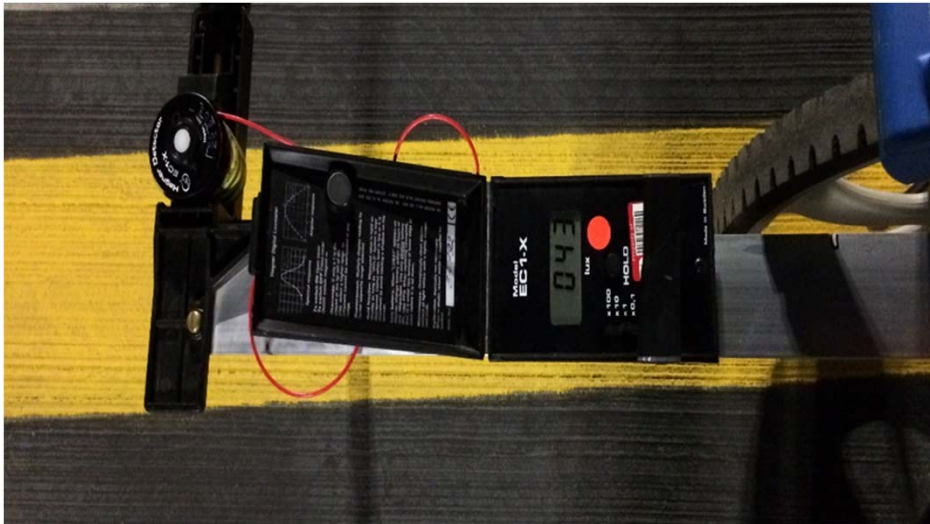




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## Horizontal light level measurement

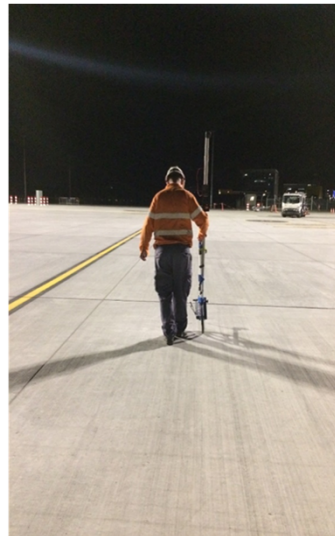




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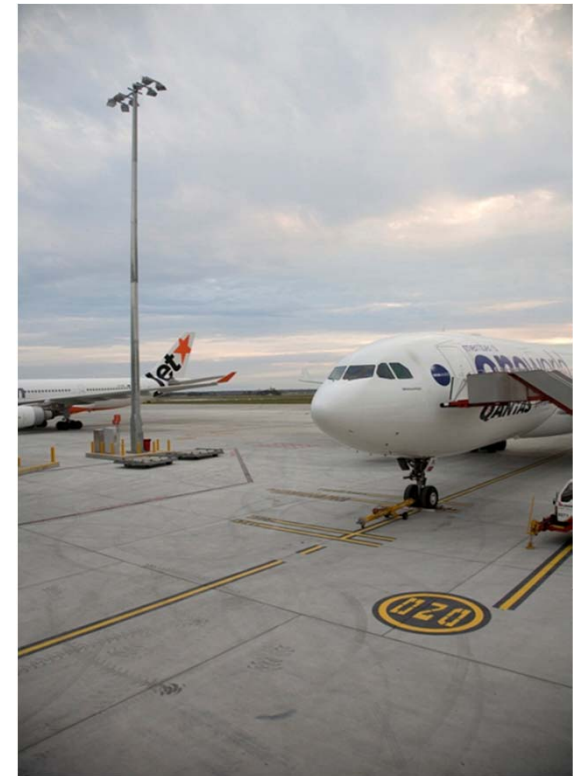
## Vertical lighting level measurement





## Interpretation of measurements

- Compliant – no further work required
- Non-compliant - Conversions to design conditions
  - Supply voltage variations correction
  - Calculation & measurement grid size review
  - Check aiming angles
  - Check control gear
  - Maintenance cycle correction
    - ❖ Clean fitting
    - ❖ Lamp replacement
    - ❖ Review maintenance strategy





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## Next step

- Transition to updated MoS 139
- RP37 – Outdoor Lighting standards update
- CASA Advisory Circular





# IES Standard – RP37 Outdoor Lighting

USA Illuminating Engineering Society lighting standards

Released 2017

Next update – 2022

Develop apron floodlight design criteria

Define functionality of apron floodlights

- Pilots parking
- Ramp services
- Suitable lighting levels for specific tasks
- Glare assessment
- Work Health Safety
- OSHA in USA



## CASA Advisory Circular

- Apron floodlighting requirements
- In planning phase
- [Advisory Circulars](#) (ACs) are for advice only and provide guidance to help you comply with the regulations or to explain particular regulatory requirements. They should always be read in conjunction with any referenced regulations.





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# ? Questions

