

## Section 9.4: Obstacle Lighting

### 9.4.1 General

- 9.4.1.1 Under the Civil Aviation Regulations, CASA may determine that an object or a proposed object which intrudes into navigable airspace requires, or will be required to be provided with, obstacle lighting. Responsibility for the provision and maintenance of obstacle lighting on a building or structure rests with the owner of the building or structure. Within the limits of the obstacle limitation surfaces of an aerodrome, responsibility for the provision and maintenance of obstacle lighting on natural terrain or vegetation, where determined necessary for aircraft operations at the aerodrome, rests with the aerodrome operator.
- 9.4.1.2 In general, an object in the following situations would require to be provided with obstacle lighting unless CASA, in an aeronautical study, assesses it as being shielded by another lit object or that it is of no operational significance:
- (a) for a runway intended to be used at night:
    - (i) if the object extends above the take-off climb surface within 3000 m of the inner edge of the take-off climb surface;
    - (ii) if the object extends above the approach or transitional surface within 3000 m of the inner edge of the approach surface;
    - (iii) if the object extends above the applicable inner, conical or outer horizontal surfaces;
    - (iv) if the object extends above the obstacle protection surface of the T-VASIS or PAPI installed at the aerodrome;
    - (v) a vehicle or other mobile objects, excluding aircraft, on the movement area, except aircraft service equipment and vehicles used only on aprons;
    - (vi) obstacles in the vicinity of taxiways, apron taxiways or taxilanes, except that obstacle lights are not to be installed on elevated ground lights or signs in the movement area.
  - (b) outside the obstacle limitation surfaces of an aerodrome, if the object is or will be more than 110 m above ground level.
- 9.4.1.3 Owners of tall buildings or structures below the obstacle limitation surfaces, or less than 110 m above ground level, may, of their own volition, provide obstacle lighting to indicate the presence of such buildings or structures at night. To ensure consistency and avoid any confusion to pilots, the obstacle lighting provided needs to conform with the standards specified in this Chapter.
- 9.4.1.4 In circumstances where the provision of obstacle marking is impracticable, obstacle lighting may be used during the day in lieu of obstacle marking.

## 9.4.2 Types of Obstacle Lighting and Their Use

- 9.4.2.1 Three types of lights are used for lighting obstacles. These are low intensity, medium intensity and high intensity lights, or a combination of such lights.
- 9.4.2.2 Low intensity obstacle lights are steady red lights and are to be used on non-extensive objects whose height above the surrounding ground is less than 45 m.

**Note:** A group of trees or buildings is regarded as an extensive object.

- 9.4.2.3 Medium intensity obstacle lights are to be used either alone or in combination with low intensity lights, where:
- the object is an extensive one;
  - the top of the object is 45 m or more above the surrounding ground; or
  - CASA determines that early warning to pilots of the presence of the object is desirable.
- 9.4.2.4 There are three types of medium intensity obstacle lights:
- Flashing white light. Likely to be unsuitable for use in environmentally sensitive locations, and near built-up areas. May be used in lieu of obstacle markings during the day to indicate temporary obstacles in the vicinity of an aerodrome, for example construction cranes, etc. and are not to be used in other applications without specific CASA agreement.
  - Flashing red light, also known as a hazard beacon. Is suitable for all applications, and is extensively used to mark terrain obstacles such as high ground.
  - Steady red light. May be used where there is opposition to the use of a flashing red light, for example in environmentally sensitive locations.
- 9.4.2.5 High intensity obstacle lights are flashing white lights used on obstacles that are in excess of 150 m in height. As high intensity obstacle lights have a significant environmental impact on people and animals, it is necessary to consult with interested parties about their use. High intensity obstacle lights may also be used during the day, in lieu of obstacle markings, on obstacles that are in excess of 150 m in height, or are difficult to be seen from the air because of their skeletal nature, such as towers with overhead wires and cables spanning across roads, valleys or waterways.

## 9.4.3 Location of Obstacle Lights

- 9.4.3.1 One or more obstacle lights are to be located as close as practicable to the top of the object. The top lights are to be arranged so as to at least indicate the points or edges of the object highest above the obstacle limitation surface.
- 9.4.3.2 In the case of a chimney or other structure of like function, the top lights are to be placed sufficiently below the top (nominally 1.5 m to 3 m) so as to minimise contamination by smoke, etc.

- 9.4.3.3 In the case of a tower or antenna structure to be provided with high intensity obstacle lights, and the structure has an appurtenance such as a rod or antenna extending greater than 12 m above the structure, and it is not practicable to locate the high intensity obstacle light on top of the appurtenance, the high intensity obstacle light is to be located at the highest practicable point and, if practicable, have a medium intensity obstacle light (flashing white) mounted on the top.
- 9.4.3.4 In the case of an extensive object or a group of closely spaced objects, top lights are to be displayed at least on the points or edges highest in relation to the obstacle limitation surfaces, so as to indicate the general definition and extent of the objects. If two or more edges are at the same height, the edge nearest the runway threshold is to be lit. Where low intensity lights are used, they are to be spaced at longitudinal intervals not exceeding 45 m. Where medium intensity lights are used, they are to be spaced at longitudinal intervals not exceeding 900 m, and at least three are to be displayed on one side of the extensive obstacle to indicate a line of lights.
- 9.4.3.4A In the case of a wind farm whose wind turbines must have obstacle lighting, medium intensity lights are to be installed as follows:
- (a) if any part of the wind turbine, including the rotating blades, penetrates the obstacle limitation surface (OLS) of an aerodrome, top lights must mark the highest point reached by the rotating blades;

**Note:** Because it is not practicable to install obstacle lights at the tip of the blades, these lights may be located on a separate structure, adjacent to the wind turbine, at a height that corresponds to the highest point of the rotating blade of the turbine.

- (b) if the rotating blades do not penetrate the OLS, the top lights must be placed on top of the generator housing;
- (c) obstacle lights must be provided on a sufficient number of individual wind turbines to indicate the general definition and extent of the wind farm, with intervals between lit turbines not exceeding 900 m;
- (d) all of the obstacle lights on a wind farm must be synchronised to flash simultaneously;
- (e) the downward component of obstacle lighting may be shielded to the extent mentioned in either or both of the following sub-subparagraphs:
- (i) so that no more than 5% of the nominal light intensity is emitted at or below  $5^\circ$  below horizontal;
- (ii) so that no light is emitted at or below  $10^\circ$  below horizontal;
- (f) to prevent obstacle light shielding by the rotating blades, 2 lights must be provided on top of the generator housing in a way that allows at least 1 of the lights to be seen from every angle in azimuth.

- 9.4.3.5 When the obstacle limitation surface concerned is sloping and the highest point above the obstacle limitation surface is not the highest point of the object, additional obstacle lights are to be placed on the highest part of the object.
- 9.4.3.6 When the top of the obstacle is more than 45 m above the level of the surrounding ground or the elevation of the tops of nearby buildings (when the obstacle is surrounded by buildings), the top lights are to be medium intensity lights. Additional low intensity lights are to be provided at lower levels to indicate the full height of the structure. These additional lights are to be spaced as equally as possible, between the top lights and ground level or the level of tops of nearby buildings, as appropriate. The spacing between the lights is not to exceed 45 m.
- 9.4.3.7 Where high intensity obstacle lights are used on an object other than a tower supporting overhead wires or cables, the spacing between the lights is not to exceed 105 m. Where the high intensity obstacle lights are used on a tower supporting wires or cables, they are to be located on three levels:
- (a) at the top of the tower;
  - (b) at the lowest level of the catenary of the wires or cables; and
  - (c) at approximately midway between the two levels.

**Note:** In some cases this may require the bottom and middle lights to be located off the tower.

- 9.4.3.8 The number and arrangement of lights at each level to be marked is to be such that the obstacle is indicated from every angle of azimuth. Where a light is shielded in any direction by an adjacent object, the light so shielded may be omitted but additional lights may be required in such a way so as to retain the general definition of the obstacle.

9.4.3.9 Illustrations of typical lighting of obstacles are shown below.

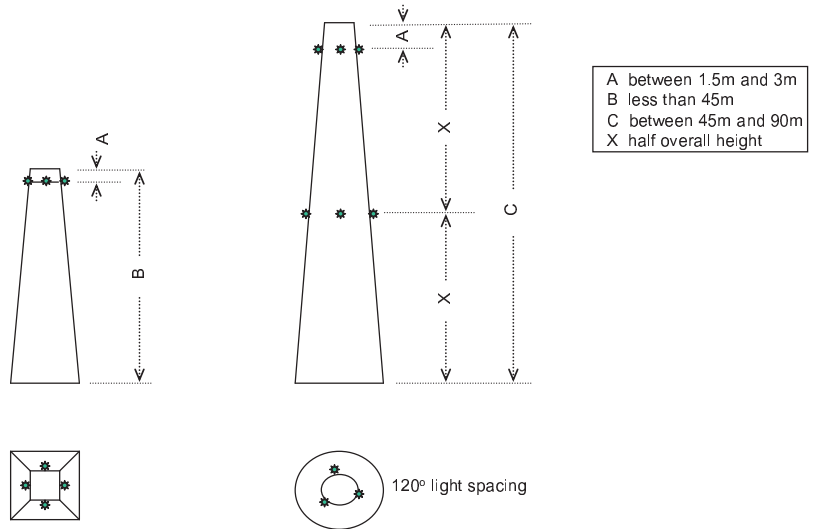


Figure 9.4-1: Typical lighting of tall obstructions

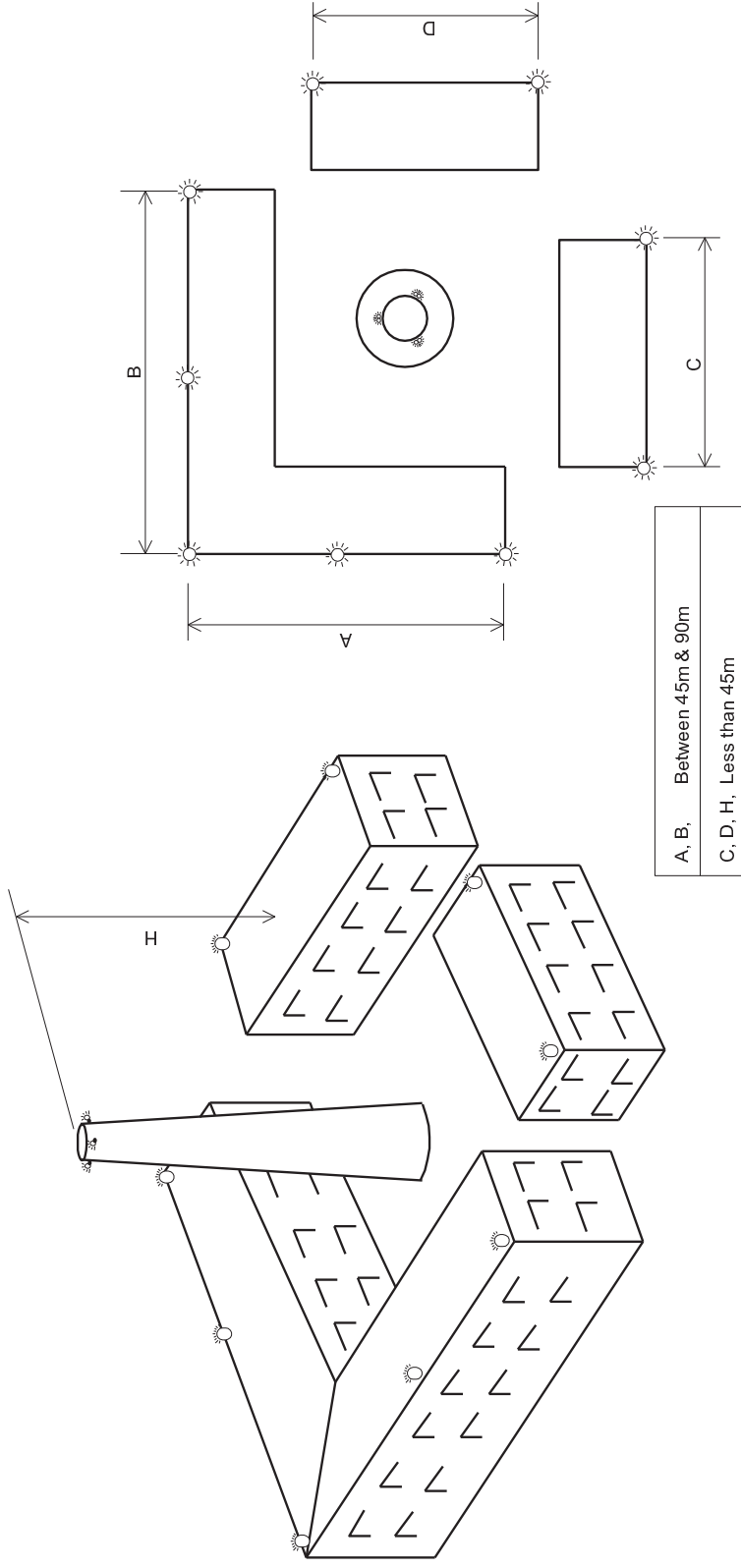


Figure 9.4-2: Typical lighting of a group of obstructions

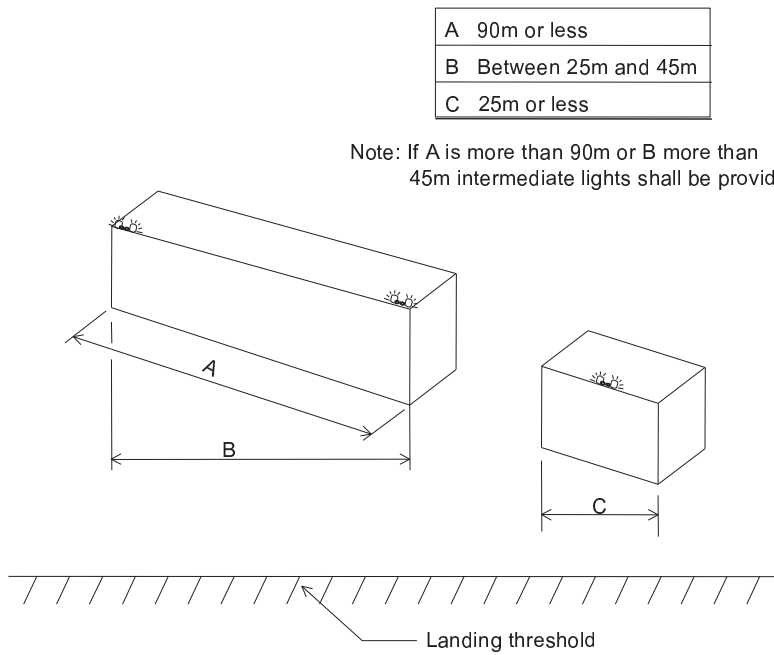


Figure 9.4-3: Typical lighting of horizontally extended obstructions

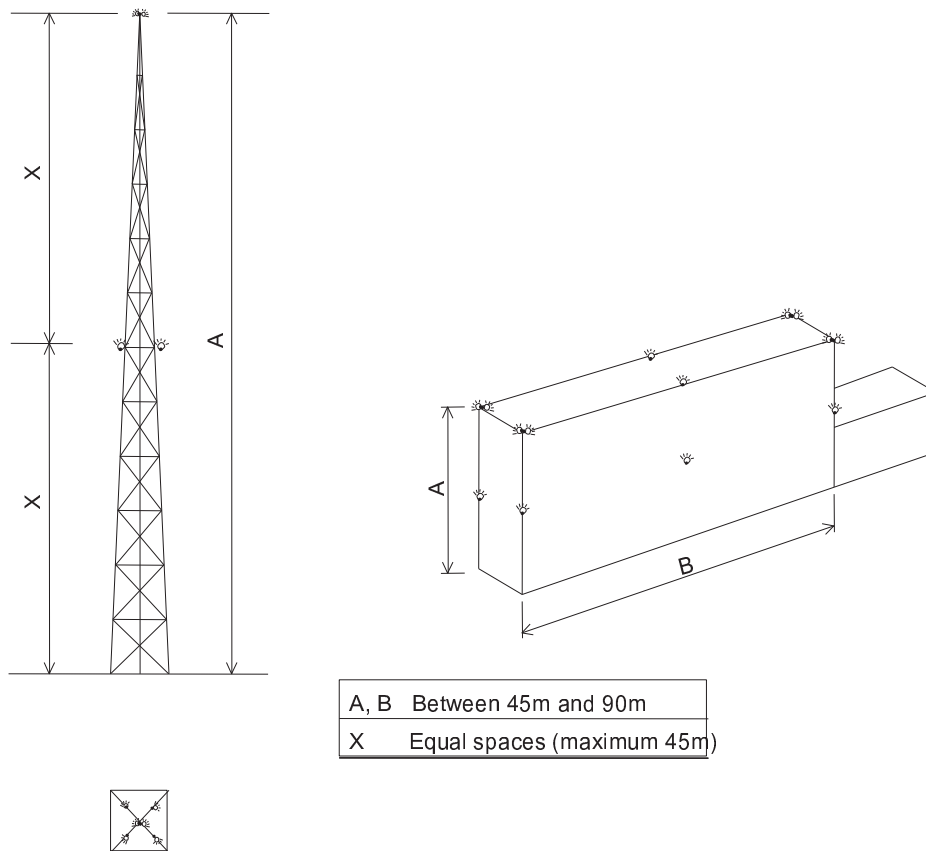


Figure 9.4-4: Typical lighting of towers and large obstructions

#### 9.4.4 Natural Obstacles

- 9.4.4.1 Natural obstacles such as terrain and vegetation are normally extensive and the need for obstacle lighting will be assessed by CASA on an individual case basis. Where required, obstacle lights are to be provided as follows:
- (a) if the obstacle is located within the approach area, the portion of the obstacle which is within the approach area is to be treated in the same manner as man-made obstacles for the provision of obstacle lights;
  - (b) if the obstacle is located outside the approach area, it is to be marked by sufficient number of lights on the highest and most prominent features, so placed that the obstacle can be readily identified.

#### 9.4.5 Temporary Obstacles

- 9.4.5.1 At night and in poor visibility conditions, temporary obstacles in the approach area or on the movement area are to be marked with permanent or temporary red obstacle lights. The lights are to be so arranged that they clearly mark the height, limits and extent of the obstacle.

#### 9.4.6 Characteristics of Low Intensity Obstacle Lights

- 9.4.6.1 Low intensity obstacle lights, for general applications, are to have the following characteristics:
- (a) fixed lights showing red;
  - (b) a horizontal beam spread that results in 360° coverage around obstacle;
  - (c) a peak intensity of 100 cd minimum;
  - (d) a vertical beam spread (to 50% of peak intensity) of 10°;
  - (e) a vertical distribution with 100 cd minimum at +6° and +10° above the horizontal; and
  - (f) not less than 10 cd at all elevation angles between -3° and +90° above the horizontal.

**Notes:**

1. The intensity level is higher than ICAO standards because in Australia only obstacles assessed as significant to aircraft operations are required to be provided with obstacle lighting.
2. Currently the intensity requirement is normally met by a double-bodied light fitting which also provides a degree of redundancy.
3. Double-bodied light fittings should be orientated so that they show the maximum illuminated surface towards the predominant, or more critical, direction of aircraft approach.



**Notes: (Contd.)**

4. For objects that do not infringe the obstacle limitation surfaces, and where CASA has not determined that obstacle lights are required, if the object owner wishes, of their own volition, to provide obstacle lights, it is sufficient for these low intensity obstacle lights to have the following intensity distribution: peak intensity 32 cd minimum, vertical beam spread of 10°, and 32 cd minimum at +6° and +10° elevation.

- 9.4.6.2 Low intensity obstacle lights, used to indicate taxiway obstacles or unserviceable areas of the movement area, are to have a peak intensity of 10 cd minimum.

**9.4.7 Characteristics of Medium Intensity Obstacle Lights**

- 9.4.7.1 Medium intensity obstacle lights are to be flashing or steady red lights or flashing white lights, visible in all directions in azimuth.
- 9.4.7.2 The frequency of flashes is to be between 20 and 60 flashes per minute.
- 9.4.7.3 The peak effective intensity is to be  $2,000 \pm 25\%$  cd with a vertical distribution as follows:
- (a) vertical beam spread is to be 3° minimum (beam spread is defined as the angle between two directions in a plane for which the intensity is equal to 50% of the lower tolerance value of the peak intensity);
  - (b) at -1° elevation, the intensity is to be 50% minimum and 75% maximum of lower tolerance value of the peak intensity; and
  - (c) at 0° elevation, the intensity is to be 100% minimum of the lower tolerance value of the peak intensity.
- 9.4.7.4 Where the flashing white light is used in lieu of obstacle marking during the day to indicate temporary obstacles in the vicinity of an aerodrome, in accordance with Paragraph 9.4.2.4(a), the peak effective intensity is to be increased to  $20,000 \pm 25\%$  cd when the background luminance is 50 cd/m<sup>2</sup> or greater.

**9.4.8 Characteristics of High Intensity Obstacle Lights**

- 9.4.8.1 High intensity obstacle lights are flashing white lights.
- 9.4.8.2 The effective intensity of a high intensity obstacle light located on an object other than a tower supporting overhead wires or cables is to vary depending on background luminance as follows:
- (a)  $200,000 \pm 25\%$  cd effective intensity at a background luminance of above 500 cd/m<sup>2</sup> (day);
  - (b)  $20,000 \pm 25\%$  cd effective intensity at a background luminance of between 50-500 cd/m<sup>2</sup> (dusk or dawn);

- (c)  $2,000 \pm 25\%$  cd effective intensity at a background luminance of below  $50 \text{ cd/m}^2$  (night).
- 9.4.8.3 The effective intensity of a high intensity obstacle light located on a tower supporting overhead wires or cables is to vary depending on background luminance as follows:
- (a)  $100,000 \pm 25\%$  cd effective intensity at a background luminance of above  $500 \text{ cd/m}^2$  (day);
- (b)  $20,000 \pm 25\%$  cd effective intensity at a background luminance of between  $50\text{-}500 \text{ cd/m}^2$  (dusk or dawn);
- (c)  $2,000 \pm 25\%$  cd effective intensity at a background luminance of below  $50 \text{ cd/m}^2$  (night).
- 9.4.8.4 High intensity obstacle lights located on an object other than a tower supporting overhead wires or cables are to flash simultaneously at a rate between 40-60 flashes per minute.
- 9.4.8.5 High intensity obstacle lights located on a tower supporting overhead wires or cables are to flash sequentially; first the middle light, second the top light, and last the bottom light. Cycle frequency is to be 40 - 60 per minute and the intervals between flashes of lights are to approximate the following ratios:

Table 9.4-1

Flash interval between:	Ratio of cycle time
middle and top light	1/13
top and bottom light	2/13
bottom and middle light	10/13

- 9.4.8.6 To minimise environmental impact, unless otherwise directed by CASA, the installation setting angles for high intensity obstacle lights are to be:

Table 9.4-2

Height of light unit above terrain	Angle of the peak of the beam above the horizontal
greater than 151 m AGL	0°
122 m to 151 m AGL	1°
92 m to 122 m AGL	2°
less than 92 m AGL	3°

## 9.4.9 Floodlighting of Obstacles

- 9.4.9.1 Where the installation of normal obstacle lights is deemed impracticable or undesirable for aesthetic or other reasons, floodlighting of obstacles may be an acceptable alternative. However, floodlighting is not to be used unless with the concurrence of the relevant CASA office.
- 9.4.9.2 In general, floodlighting is not suitable if:
- (a) the structure is skeletal as a substantially solid surface or cladding with satisfactory reflectance properties are required; or
  - (b) there is high background lighting level.
- 9.4.9.3 The floodlighting colour is to be white. Illumination of the obstacle is to cover all directions of azimuth over the full height portion of the obstacle which needs to be illuminated and is to be uniform around the circumferences of the obstacle.
- 9.4.9.4 The minimum level of luminance is to be 5 cd/m<sup>2</sup> at all points.

**Note:** Based on a reflectance factor of 50% for white paint, this would require illuminance of at least 10 lux. For concrete with typical reflectance factor of 40%, the required illuminance would be at least 12.5 lux. Materials with reflectance factors less than 30% are unlikely to be suitable for floodlighting.

- 9.4.9.5 The light fittings are to be spaced evenly around the structure, at not more than 120° with at least two fittings at each location. At each location the fittings are to be on separate circuits and separately fused.

## 9.4.10 Ongoing Availability of Obstacle Lights

- 9.4.10.1 It is important that obstacle lights provided are in working condition when they are required to be on. The owners of obstacle lights needs to establish a pro-active maintenance program to minimise light outage.
- 9.4.10.2 For obstacle lights located within the obstacle limitation surface area of the aerodrome, the aerodrome operator is to establish a monitoring program, which is to include:
- (a) visual observation of the obstacles lights at least once every 24 hours (see note); and
  - (b) where a medium or high intensity obstacle light is located such that it is not readily observable visually:
    - (i) establish a procedure whereby such a light would be visually monitored within every 24 hour period; or
    - (ii) install an automatic visual or audio alarm indicator at an aerodrome location generally occupied by aerodrome personnel.

**Note:** At smaller aerodromes with a low level of night aircraft operations, this period may be extended with the agreement of the relevant CASA office.

- 9.4.10.3 For an obstacle located within the OLS area of the aerodrome, the following requirements apply:
- (a) if there is an obstacle light outage, the aerodrome operator must:
    - (i) immediately request the NOTAM office to advise pilots of the details of the outage; and
    - (ii) as soon as practicable liaise with the owner of the obstacle light so that the outage is repaired as quickly as practicable;
  - (b) if the aerodrome has been notified by CASA that it must close upon the failure of a specified obstacle light considered by CASA to be essential for safety, the aerodrome operator must immediately notify CASA of the failure.

**Note:** Information on requesting NOTAM action is in Chapter 10, Section 10.3.

- 9.4.10.3A The aerodrome operator's Aerodrome Manual must include:
- (a) the procedures to be followed when an obstacle light outage occurs; and
  - (b) details of any CASA notification that the aerodrome must close upon the failure of a specified obstacle light considered by CASA to be essential for safety.
- 9.4.10.4 For obstacles located outside the obstacle limitation surface area of an aerodrome, the owners of the lights need to establish a program to monitor the lights and report light failures. The reporting point for obstacle light failure is normally the nearest CASA office. When an obstacle light is unserviceable, the matter needs to be reported immediately to the relevant CASA office so that a NOTAM warning pilots of the light outage can be initiated.