RA 3535 - Helicopter Landing Site - Lighting

Rationale

In dusk or poor visibility conditions by day, lighting can be more effective than marking. Aeronautical Ground Lights (AGL) provide clear and consistent information and guidance to the operational community under all operating conditions.

Contents

Regulation 3535(1)

Permanent Helicopter Landing Site - Lighting

3535(1) Heads of Establishments (HoEs) and Aviation Duty Holder-Facing Organizations (ADH-Facing Organizations) **shall** ensure that lighting installations on a Permanent Helicopter Landing Site (HLS) provide unambiguous guidance and **shall not** present a Hazard to other users in the vicinity of the Aerodrome.

Acceptable Means of Compliance 3535(1)

Permanent Helicopter Landing Site - Lighting

1. Apron, taxiway and obstacle lighting, on an HLS, **should** be in accordance with (iaw) RA 3515[1].

Dangerous or Confusing Lights.

2. A non-AGL which, due to its intensity, configuration or colour, might prevent or cause confusion in the clear interpretation of AGL **should** be extinguished, screened or otherwise modified to eliminate such a possibility.

3. In the case of HLS located near navigable waters, consideration **should** be given to ensuring that AGL do not cause confusion to mariners.

Beacons.

4. A Permanent HLS acquisition beacon **should**:

   a. Be located on or adjacent to the Permanent HLS preferably at an elevated position and so that it does not dazzle a pilot at short range;

   b. Be located such that the beacon is not shielded by objects in significant directions and does not dazzle a pilot approaching to land;

   c. Flash a coloured sequence of lights as follows: double peak white flash and a single peak green and yellow;

   d. Have a flash rate of 10-15 sequences of flashes per minute and the time between each colour **should** be one third of the total sequence time;

[1] Refer to RA 3515 – Permanent Fixed Wing Aerodrome - Lighting.

Acceptable Means of Compliance 3535(1)

e. Be visible for 1.6 km, in Visual Meteorological Conditions (VMC) daylight, and 4.8 km, in VMC at night, both from an altitude of 915 m above ground level;

f. Be installed more than 1.6 km from any existing airport heliport beacon;

g. Be mounted a minimum of 15 m above the Permanent HLS surface and **should** be no closer than 122 m and no further than 1067 m from the Permanent HLS and **should not** be located between any control tower and the Permanent HLS; and

h. Have its main beam of light aimed a minimum of 5° above the horizontal and **should not** produce light below the horizontal in excess of 1000 cd.

Guidance Material 3535(1)

Permanent Helicopter Landing Site - Lighting

5. Light shields may be used to reduce the intensity below the horizontal to prevent dazzle to pilots.

6. An identification beacon may be installed at a Rotary Wing Permanent Base as well as an Acquisition Beacon, iaw RA 3515[1].

Civil Equivalence.

7. This Regulation is in line with International Civil Aviation Organization (ICAO) Annex 14 Vol II para 5.3.

Regulation 3535(2)

Permanent Helicopter Landing Site - Approach Lights

3535(2) HoEs and ADH-Facing Organizations **shall** ensure that an approach lighting system is provided at a Permanent HLS where there is a requirement to indicate a preferred approach direction. Additionally, a flight path alignment guidance lighting system(s) **shall** be provided at a HLS where there is a requirement to indicate available approach and / or departure path direction(s).

Acceptable Means of Compliance 3535(2)

Permanent Helicopter Landing Site - Approach Lights

Approach Lighting System.

8. An Approach Lighting System **should**:

a. Be in a straight line along the preferred direction of approach;

b. Consist of a row of three lights spaced uniformly at 30 m intervals and of a crossbar 18 m in length at a distance of 90 m from the perimeter of the Final Approach and Take Off (FATO) as shown in Figure 1;

c. Have the lights that form the crossbar situated as closely as practicable in a horizontal straight line at right angles to, and bisected by, the line of the centre-line lights and spaced at 4.5 m intervals;

d. Have additional lights spaced uniformly at 30 m intervals beyond the crossbar where there is the need to make the final approach course more conspicuous;

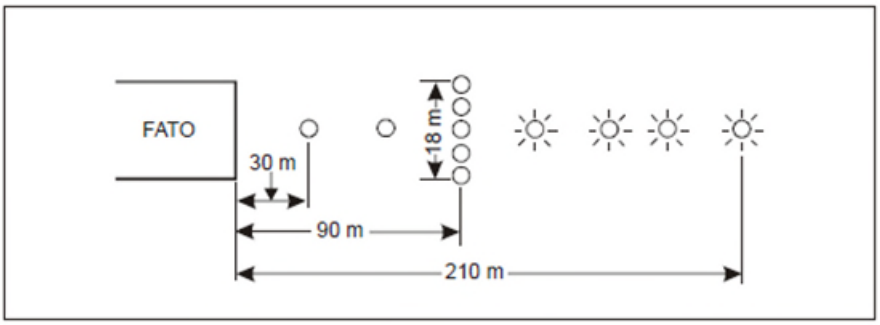
e. For both steady and sequenced flashing lights, be omnidirectional white lights;

f. If flashing lights are used, have a flash frequency of one per second with the flash sequence commencing from the outermost light and progressing towards the crossbar; and

g. Have a suitable brilliancy control incorporated to allow for adjustment of light intensity to meet the prevailing conditions.

Acceptable Means of Compliance 3535(2)

Figure 1. Approach Lighting System



Flight Path Alignment Guidance Lighting System.

9. A Flight Path Alignment Guidance System **should**:

a. Be in a straight line along the directions of approach and / or departure path on one or more of the Touchdown and Lift Off (TLOF), FATO, Safety Area or any suitable surface in the immediate vicinity of the FATO, TLOF or Safety Area;

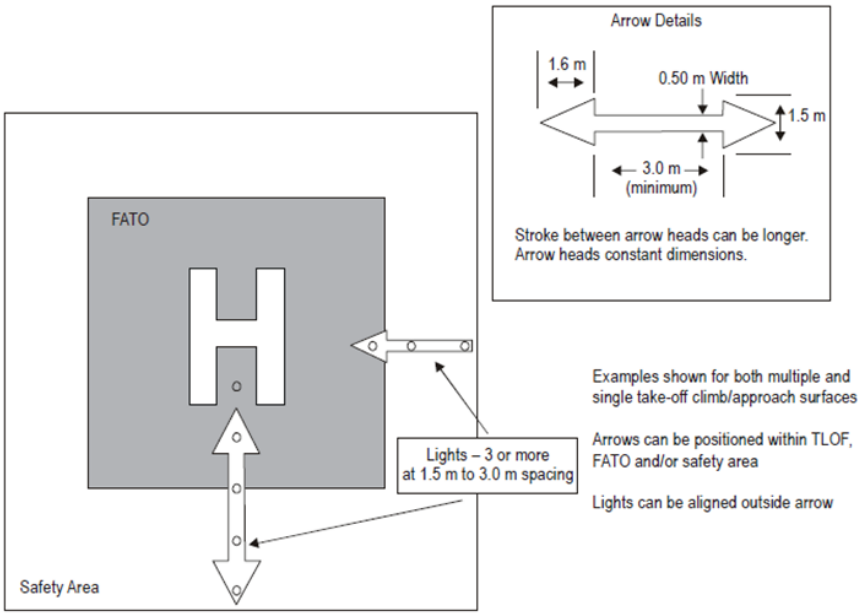
b. If combined with a flight path alignment guidance marking, as far as is practicable be located inside the “arrow” markings;

c. Consist of a row of three or more lights spaced uniformly a total minimum distance of 6 m as per Figure 2. Intervals between lights **should** be greater than 1.5 m but no more than 3 m;

d. Have steady omnidirectional inset white lights; and

e. Have a suitable brilliancy control incorporated to allow for adjustment of light intensity to meet the prevailing conditions.

Figure 2. Flight path alignment guidance markings and lights



Guidance Material 3535(2)

Permanent Helicopter Landing Site - Approach Lights

10. The lights beyond the crossbar may be steady or sequenced flashing, depending upon the environment. Sequenced flashing lights may be useful where identification of the approach lighting system is difficult due to surrounding lights.

11. The following intensity settings have been found suitable:

Guidance Material 3535(2)

a. Steady lights - 100%, 30% and 10%; and

b. Flashing lights - 100%, 10% and 3%.

12. When operationally justified a NATO 'T' may be provided iaw STANAG 2999[2] (the NATO 'T' can be used for trooping and underslung loads without further lights or approach aids, but normally, only a single Air System can use the NATO 'T' at any one time.) The light units need to show variable white light with a minimum two stages of brilliancy. They need to show in all angles of azimuth and elevation necessary to provide guidance to a pilot landing or lifting-off and with an intensity adequate for the conditions of visibility and ambient light in which use of the 'T' is intended.

13. AGL for Helicopter Night Landing Training.

a. Where helicopter night landing training is conducted at a Permanent HLS a six-light proportional T may be provided. The lights of the proportional T need to be omnidirectional, preferably white and useable from a distance of 4 nm.

b. When positioned on an aerodrome with a fixed wing Runway also in use, the proportional T needs to be sited to permit safe parallel approaches, to avoid obstructions and to minimize noise nuisance.

c. Procedures for the use of the proportional T need to be included in relevant aeronautical publications.

14. The flight path alignment guidance lighting can be combined with flight path alignment guidance markings described in RA 3534[3].

15. The number of lights and spacing between these lights may be adjusted to reflect the space available, however 5 lights is considered the optimum number. If more than one flight path alignment system is used to indicate available approach and / or departure path directions, the characteristics for each system are typically kept the same.

Civil Equivalence.

16. This Regulation is in line with ICAO Annex 14 Vol II para 5.3.

Regulation 3535(3)

Permanent Helicopter Landing Site - Approach Guidance Systems

3535(3) HoEs and ADH-Facing Organizations **shall** ensure that additional guidance systems are provided to serve the approach to a Permanent HLS where one or more of the following conditions exist, especially at night: obstacle clearance, noise abatement or traffic control procedures which require a specific approach direction to be flown, the environment of the HLS provides few visual surface cues, and if it is physically impracticable to install an approach lighting system.

Acceptable Means of Compliance 3535(3)

Permanent Helicopter Landing Site - Approach Guidance Systems

Visual Alignment Guidance System.

17. A Visual Alignment Guidance System (VAGS) **should**:

a. Be located such that a helicopter is guided along the prescribed track towards the FATO, ideally on the downwind edge of the FATO and aligned along the preferred approach direction;

b. Have light units that are frangible and mounted as low as possible;

c. Where the light sources are required to be discrete sources, have light sources located such that at the extremes of system coverage, the angle subtended between units as seen by the pilot is no less than 3 minutes of arc;

[2] Refer to STANAG 2999 – Use of Helicopters in Land Operations Doctrine.
[3] Refer to RA 3534 – Helicopter Landing Site - Markings.

Acceptable Means of Compliance 3535(3)

d. Have the angles subtended between light units of the system and other units of comparable or greater intensities no less than 3 minutes of arc;

e. Have a signal format that:

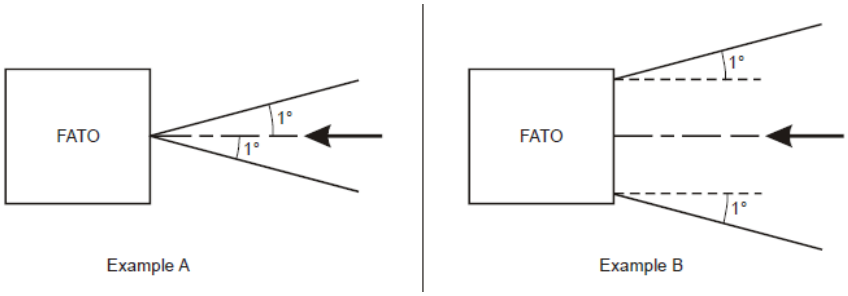
(1) Includes a minimum of three discrete signal sectors providing "offset to the right", "on track" and "offset to the left" signals;

(2) Ensures that there is no possibility of confusion between the system and any associated visual approach slope indicator or other visual aids; and

(3) Ensures that the system is unique and conspicuous in all operational environments.

f. Have the divergence of the "on track" sector as shown in Figure 3;

Figure 3. Divergence of the "on track" sector



g. Avoid the use of the same coding as any associated visual approach slope indicator;

h. Have no significant increase on pilot workload;

i. Have a usable coverage equal to or better than that of the visual approach slope indicator system with which it is associated;

j. Have a suitable intensity control to allow adjustment to meet the prevailing conditions and to avoid dazzling the pilot during approach and landing;

k. Be capable of adjustment in azimuth to within ±5 minutes of arc of the desired approach path;

l. Have the angle of its azimuth guidance system set such that, during an approach, the pilot of a helicopter at the boundary of the "on track" signal, clears all objects in the approach area by a safe margin;

m. Have the requirements of the obstacle protection surface specified in RA 3532[4] applied to the system;

n. Automatically switch of the system in the event of the failure of any component affecting the signal format; and

o. Be designed such that deposits of condensation, ice, dirt, etc, on optically transmitting or reflecting surfaces interfere to the least possible extent with the light signal and do not cause spurious or false signals to be generated

Visual Approach Slope Indicator.

18. The standard visual approach slope indicator systems for helicopter operations **should** consist of one of the following:

a. A Precision Approach Path Indicator (PAPI) system conforming to the specifications contained in RA 3515(8)[5], except the on-slope section **should** be increased to 45 minutes;

b. An Abbreviated Precision Approach Path Indicator (APAPI) system; or

[4] Refer to RA 3532 – Helicopter Landing Site - Obstacle Environment.
[5] Refer to RA 3515(8): Approach Lighting – Precision Approach Path Indicator.

Acceptable Means of Compliance 3535(3)

c. A Helicopter Approach Path Indicator (HAPI) system.

19. A visual approach slope indicator **should**:

a. Be located such that a helicopter is guided to the desired position within the FATO and to avoid dazzling the pilot during final approach and landing;

b. Be located adjacent to the nominal aiming point and aligned in azimuth with the preferred approach direction;

c. Have light units that are frangible and mounted as low as possible; and

d. Have the requirements of the obstacle protection surface specified in RA 3532[4] applied to the system.

Abbreviated Precision Approach Path Indicator.

20. An APAPI System **should** be installed where there is a requirement to fit a Visual Approach Slope Indicator and there is no existing PAPI or HAPI installation.

21. An APAPI **should**:

a. Consist of 2 PAPI light units positioned on the left side of the TLOF on the lateral centre-line of the TLOF at 90° to the approach direction;

b. Have the inner light unit positioned at 10 m from the TLOF left edge, and the outer unit at 6 m from the inner unit;

c. Be constructed and mounted as low as possible, with a tolerance of plus or minus 30 cm, within the centre of the helipad elevation;

d. Be light in weight and on frangible mounts;

e. Have a suitable brilliancy control incorporated to allow for adjustment of light intensity to meet the prevailing conditions.

f. Conform to the specifications contained in RA 3515(8) other than where amended by RA 3535 and except that the on-slope sector of the system **should** be increased to 45 minutes; and

g. Conform with the vertical colour sectors for a 6° approach slope, as follows:

(1) Above course (6.5° or more): WHITE / WHITE;

(2) On course (6°): RED / WHITE; and

(3) Below course (5.5° or less): RED / RED.

Helicopter Approach Path Indicator.

22. A HAPI System **should** be installed where there is a requirement to fit a Visual Approach Slope Indicator and there is no existing PAPI or APAPI installation.

23. A HAPI **should**:

a. Have a signal format:

(1) That includes four discrete signal sectors, providing an “above slope”, an “on slope”, a “slightly below” and a “below slope” signal;

(2) As shown in Figure 4;

(3) With a signal repetition rate of the flashing sector of the HAPI of at least 2 Hz, with an on-to-off ratio of the pulsing signals set at 1 to 1, and the modulation depth of at least 80%;

(4) With an angular size of the “on-slope” sector of 45 minutes; and

(5) With an angular size of the “slightly below” sector of 15 minutes.

b. Have light intensity distribution in red and green colours as described in RA 3535(6);

c. Have a colour transition of the HAPI in the vertical plane appear to an observer, at a distance of not less than 300 m, to occur within a vertical angle of not more than 3 minutes;

Acceptable Means of Compliance 3535(3)

d. Have a transmission factor of a red or green filter not less than 15% at the maximum intensity setting;

e. At full intensity, have a Y-coordinate of the red light not exceeding 0.320, and the green light within the boundaries specified RA 3535(6);

f. Have a suitable intensity control provided to allow adjustment to meet the prevailing conditions and to avoid dazzling the pilot during approach and landing;

g. Be capable of adjustment in elevation at any desired angle between 1° and 12° above the horizontal with an accuracy of ±5 minutes of arc;

h. Have the angle of elevation setting of HAPI such that during an approach, the pilot of a helicopter observing the upper boundary of the "below slope" signal will clear all objects in the approach area by a safe margin;

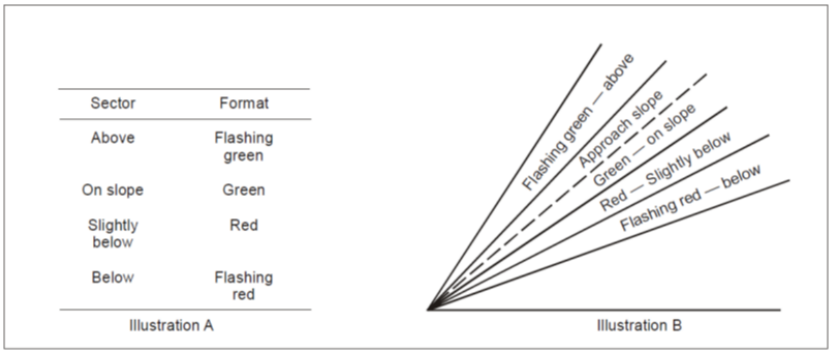
i. Have a light system designed that:

(1) In the event the vertical misalignment of a unit exceeds ±0.5° (±30 minutes), the system will switch off automatically; and

(2) If the flashing mechanism fails, no light will be emitted in the failed flashing sectors.

j. Be so designed that deposits of condensation, snow, ice, dirt, etc., on optically transmitting or reflecting surfaces interfere to the least possible extent with the light signals and **should not** affect the contrast between the red and white signals and the elevation of the transition sector.

Figure 4. Helicopter Approach Path Indicator



Guidance Material 3535(3)

Permanent Helicopter Landing Site - Approach Guidance Systems

24. An example of where obstacle criteria may drive the need for a VAGS is where an aeronautical study indicates that an existing object extending above an obstacle protection surface could adversely affect the Safety of operations of helicopters and one of the following options is not practicable:

a. Raising the approach slope of the system;

b. Reducing the azimuth spread of the system so that the object is outside the confines of the beam;

c. Displacing the axis of the system and its associated obstacle protection surface by no more than 5°; and

d. Displacing the FATO.

25. The requirements of sub-paras c. and d. above can be met for lights on a line normal to the line of sight if the light units are separated by 1 m for every km of viewing range.

26. This RA applies to PAPI installation for HLS, APAPI and HAPI installations. The following specifications apply to PAPI, APAPI and HAPI:

a. An obstacle protection surface needs to be established when it is intended to provide a visual approach slope indicator system.

Guidance Material 3535(3)

b. New objects or extensions of existing objects need not be permitted above an obstacle protection surface except when, in the opinion of the appropriate authority, the new object or extension would be shielded by an existing immovable object. (Note: Circumstances in which the shielding principle may reasonably be applied are described in the Airport Services Manual, Part 6 (Doc 9137)).

27. Existing Objects:

a. Existing objects above an obstacle protection surface need to be removed except when, in the opinion of the appropriate authority, the object is shielded by an existing immovable object, or after aeronautical study it is determined that the object would not adversely affect the Safety of operations of helicopters.

b. Where an aeronautical study indicates that an existing object extending above an obstacle protection surface could adversely affect the Safety of operations of helicopters, one or more of the following measures need to be taken:

(1) Suitably raise the approach slope of the system;

(2) Reduce the azimuth spread of the system so that the object is outside the confines of the beam;

(3) Displace the axis of the system and its associated obstacle protection surface by no more than 5°;

(4) Suitably displace the FATO; and / or

(5) Install a visual alignment guidance system specified in RA 3535(3).

28. The lateral spacing between APAPI units may be increased to 9 m (±1 m) if greater range is required or later conversion to a full PAPI is anticipated. In the latter case, the inner APAPI unit needs to be located 15 m (±1 m) from the runway edge.

29. Care is required in the design of the units to minimize spurious signals between the signal sectors and at the azimuth coverage limits.

Civil Equivalence.

30. This Regulation is in line with ICAO Annex 14 Vol II para 5.3.

Regulation 3535(4)

Permanent Helicopter Landing Site - Helipad Lights

3535(4) HoEs and ADH-Facing Organizations **shall** ensure that, where a Permanent HLS is intended for use at night, lights are provided for the FATO, TLOF and Aiming point.

Acceptable Means of Compliance 3535(4)

Permanent Helicopter Landing Site - Helipad Lights

FATO Lights.

31. FATO lights **should**:

a. Be placed along the edge of the FATO;

b. Be uniformly spaced:

(1) For an area in the form of a square or rectangle, at intervals of not more than 50 m with a minimum of four lights on each side including a light at each corner; and

(2) For any other shaped area, including a circular area, at intervals of not more than 5 m with a minimum of ten lights.

c. Be fixed omnidirectional lights showing white. Where the intensity of the lights ►needs to◄ be varied, the lights **should** show variable white, with a minimum of 3 stages of brilliancy.

d. Have lighting characteristics iaw Figure 7; and

e. Be no higher than 25 cm and be inset when a light extending above the surface would endanger helicopter operations. Where a FATO is not meant for lift-off or touchdown, the lights **should not** exceed a height of 25 cm above ground or snow level.

Acceptable Means of Compliance 3535(4)

Aiming Point Lights.

32. Aiming Point Lights **should**:

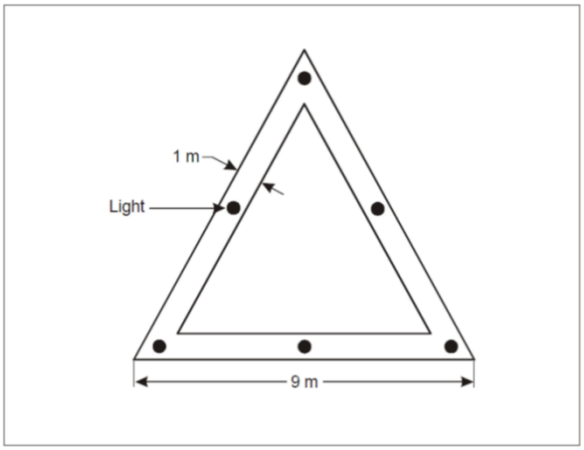
a. Be collocated with the aiming point marking;

b. Form a pattern of at least six omnidirectional white lights as shown in Figure 5;

c. Be inset when a light extending above the surface could endanger helicopter operations; and

d. Have lighting characteristics iaw RA 3535(6).

Figure 5. Aiming Point Marking with Lights



TLOF lights.

33. The TLOF lighting system **should** consist of one or more of the following:

a. Perimeter lights; or

b. Floodlighting; or

c. Arrays of segmented point source lighting (ASPSL) or luminescent panel (LP) lighting to identify the TLOF when perimeter lights and floodlighting are not practicable and FATO lights are available.

34. TLOF perimeter lights **should**:

a. Be placed along the edge of the area designated for use as the TLOF or within 1.5 m from the edge;

b. Where the TLOF is a circle:

(1) Be located on straight lines in a pattern which will provide information to pilots on drift displacement; and

(2) Where paragraph 33a is not practicable, be evenly spaced around the perimeter of the TLOF at the appropriate interval, except that over a sector of 45° the lights **should** be spaced at half spacing.

c. Be uniformly spaced at intervals of not more than 5 m with:

(1) A minimum of 5 lights per square or rectangular TLOF including a light at each corner; and

(2) A minimum of 14 lights for a circular TLOF.

d. Be fixed omnidirectional lights showing green; and

e. Be no greater than a height of 25 cm and inset when a light extending above the surface could endanger helicopter operations.

f. Be opposite each other when on opposite sides of the TLOF perimeter.

g. Have light distribution shown in Table 1.

Acceptable Means of Compliance 3535(4)

Table 1. Light Distribution of TLOF Lights (Azimuth +180° to -180°)

Elevation (E)	Intensity
$20^0 \leq E \leq 90°$	3 cd
$13^0 \leq E \leq 20°$	8 cd
$10^0 \leq E \leq 13°$	15 cd
$5^0 \leq E \leq 10°$	30 cd
$2^0 \leq E \leq 5°$	15 cd

35. TLOF floodlighting **should**:

a. Be located to avoid glare to pilots in flight or to personnel working on the area. The arrangement and aiming of floodlights **should** be such that shadows are kept to a minimum:

(1) Floodlights **should** have no upward component of light output; the entire light output being directed below the horizontal;

(2) Provision **should** be made for the adjustment of the elevation of the floodlight beam after installation. The adjustment **should** provide movement of the axis of the projected beam from 1° above the plane to 5° below the horizontal reference plane.

b. When located within the Safety Area of a HLS, be no greater in height than 25 cm;

c. Be marked and lit as obstacles;

d. Have a spectral distribution such that the surface and obstacle marking can be correctly identified; and

e. Have an average horizontal illuminance of at least 10 lux, with a uniformity ratio (average to minimum) of not more than 8:1 measured on the surface of the TLOF.

36. ASPSL and LP lighting **should** be iaw ICAO Annex 14, Volume II, 5.3.9.

Guidance Material 3535(4)

Permanent Helicopter Landing Site - Helipad Lights

37. A suitable brilliancy control, where provided, will allow for adjustment of light intensity to meet the prevailing conditions.

Civil Equivalence.

38. This Regulation is in line with ICAO Annex 14 Vol II para 5.3.

Regulation 3535(5)

Permanent Helicopter Landing Site - Air Transit Route Lights

3535(5) HoEs and ADH-Facing Organizations **shall** ensure that, where an Air Transit Route is intended to be used at night or during periods of low visibility, lighting is provided.

Acceptable Means of Compliance 3535(5)

Permanent Helicopter Landing Site - Air Transit Route Lights

39. Air Transit Route lights **should**:

a. Be installed between the first and last points of surface movement (Figure 6);

b. Consist of a line of alternate green and yellow lights installed along the centre-line of the air transit route, commencing with green and terminating with yellow;

c. Have spacing of the lights of 15 m on curves and 30 m on straight routes;

d. Where an air transit route terminates at an apron or other area not intended for own power operation, be terminated with a terminating bar consisting of three unidirectional red lights spaced at 4.5 m centred on and perpendicular to

Acceptable Means of Compliance 3535(5

the air transit route centre-line. The terminating bar **should** be placed at the beginning of the apron area;

e. Be fixed omnidirectional lights showing green, yellow or red as applicable;

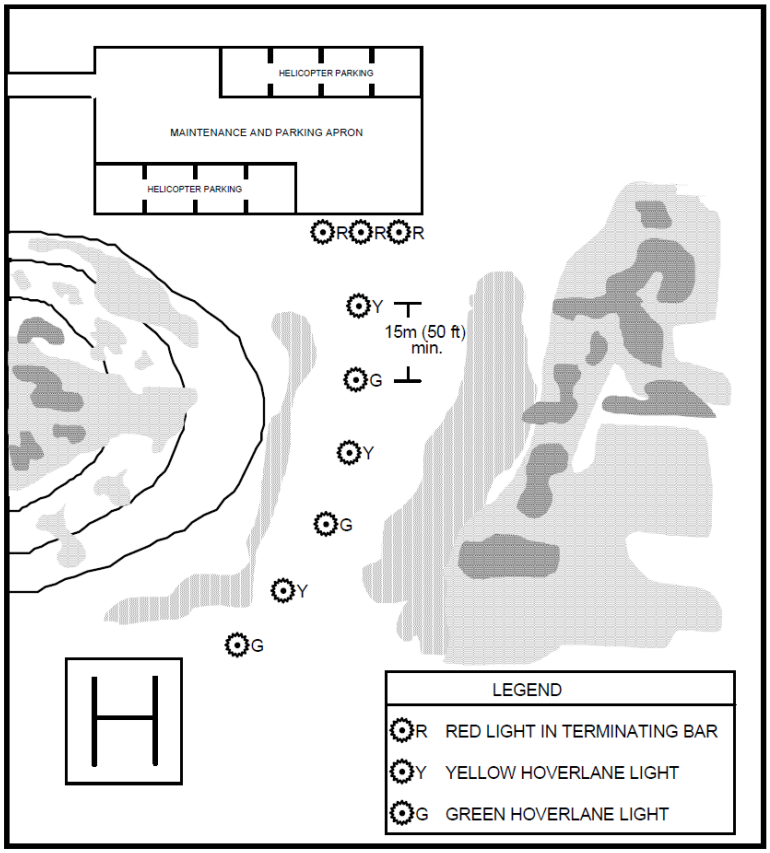
f. Have a suitable intensity control to allow adjustment to meet the prevailing conditions and to avoid dazzling the pilot;

g. Be mounted on frangible fittings located as near to the ground as possible;

h. Be no greater in height than 250 mm above ground level. Where elevated light fittings would endanger helicopter operations the air transit route lights **should** be inset; and

i. Have lighting characteristics iaw RA 3535(6).

Figure 6. Air Transit Route Lights



Guidance Material 3535(5)

Permanent Helicopter Landing Site - Air Transit Route Lights

40. Consideration may need to be given to selecting filter types or lamp sizes, which will provide the most consistent level of light output by the different coloured lights. The use of hoods that control the direction of light may be considered to avoid confusion with other HLS lights.

Regulation 3535(6)

Permanent Helicopter Landing Site - Aeronautical Ground Lights Characteristics

3535(6) HoEs and ADH-Facing Organizations **shall** ensure that all AGL fittings are of such construction, intensity and colour so that their presence does not endanger helicopters and is sufficient to provide adequate and appropriate guidance to aircrew.

Acceptable Means of Compliance 3535(6)

Permanent Helicopter Landing Site - Aeronautical Ground Lights Characteristics

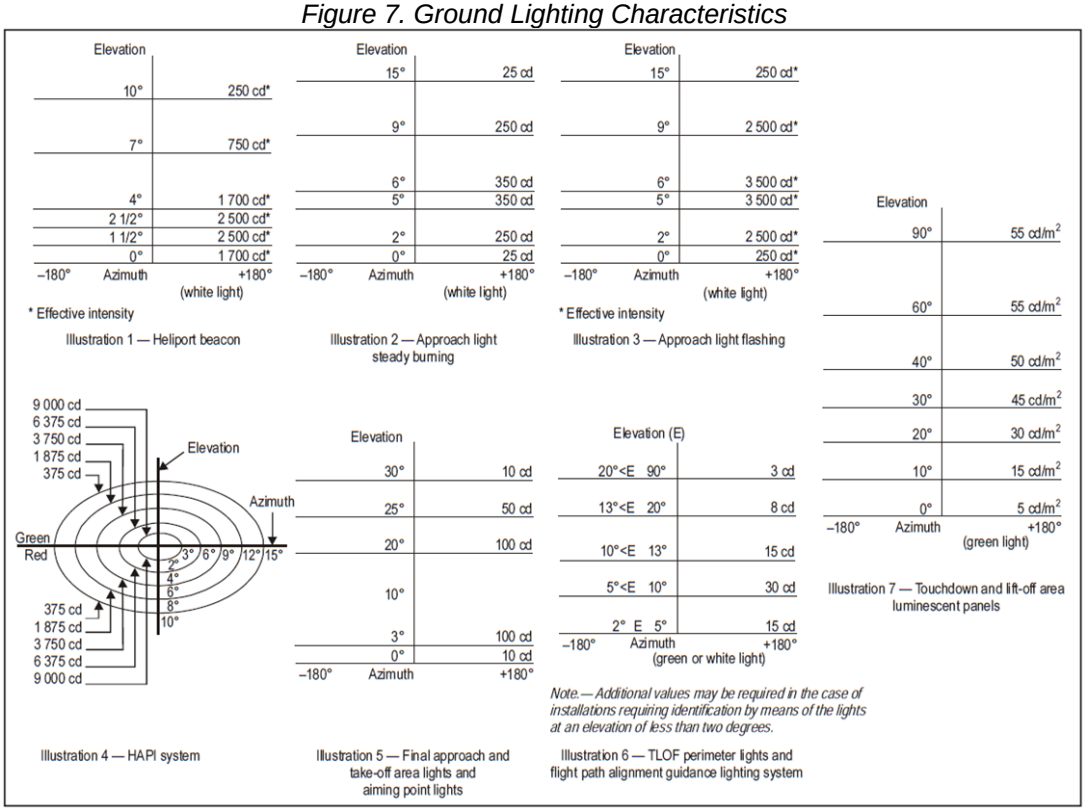
Construction.

41. AGL construction **should** be as per RA 3515(28)[6].

Intensity.

42. The intensity and distribution of AGL **should** be iaw Figure 7.

Figure 7. Ground Lighting Characteristics



Colour.

43. Colour requirements for all AGL **should** be as detailed in ICAO Annex 14, Vol I, Appendix 1.

Guidance Material 3535(6)

Permanent Helicopter Landing Site - Aeronautical Ground Lights Characteristics

44. Nil.

Regulation 3535(7)

Domestic Helicopter Landing Site - Lighting and Signalling

3535(7) ►Withdrawn – Incorporated into RA 3536(1): Domestic Helicopter Landing Sites – General Requirements.◄

Acceptable Means of Compliance 3535(7)

Domestic Helicopter Landing Site - Lighting and Signalling

45. ►Withdrawn – Incorporated into RA 3536(1): Domestic Helicopter Landing Sites – General Requirements.◄

Guidance Material 3535(7)

Domestic Helicopter Landing Site - Lighting and Signalling

46. ►Withdrawn – Incorporated into RA 3536(1): Domestic Helicopter Landing Sites – General Requirements.◄

[6] Refer to RA 3515(28): Aeronautical Ground Lights Characteristics – Construction.