SIERRA LEONE CIVIL AVIATION AUTHORITY

ADVISORY CIRCULAR

SLCAA-AC-AGA011-Rev. 01

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Control of Obstacles

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1 GENERAL

The Sierra Leone Civil Aviation Authority's Advisory Circulars contains information about standards, practices and procedures that the Authority has found to be an Acceptable Means of Compliance (AMC) with the associated Regulations.

An AMC is not intended to be the only means of compliance with a Regulation, and consideration will be given to other methods of compliance that may be presented to the Authority

Information considered directive in nature is described in this AC in terms such as "shall" and "must", indicating the actions are mandatory. Guidance information is described in terms such as "should" and "may" indicating the actions are desirable or permissive, but not mandatory

1.1 Purpose

This Advisory Circular provides guidance on the control of obstacles in the vicinity of aerodromes in compliance with the requirements of the SLCAR Part 14A.

1.2 Description of Changes

This AC is the second to be issued on this subject

1.3 Reference

(a) SLCAR, Part 14A - Aerodrome Design and Operation
(b) SLCAR Part 10A - Aeronautical Telecommunications
(c) ICAO Doc 9137, Part 6 - Control of Obstacles

1.4 Cancelled Documents

This document repeals and replaces the previous guidance prescribed in **SLCAA-AC-AATNS011 - CONTROL OF OBSTACLES.**

2 AERODROME OBSTACLE LIMITATION SURFACES

2.1 Introduction

The effective utilisation of an aerodrome may be influenced by natural features and manmade objects inside and outside the aerodrome boundary. These may result in:

(a) Limitations on the distance available for aircraft take-off and landings;
(b) The range of meteorological conditions in which take-off and landings can be undertaken; or
(c) A reduction in the payload of some aircraft types; or all the above.

For these reasons, certain areas of the local airspace must be regarded as integral parts of the aerodrome environment. The degree of freedom from obstacles in these areas is as important to the safe and efficient use of the aerodrome as are the more obvious physical requirements of the runways and their associated strips.

2.2 Definition of Obstacles

Objects defined as obstacles are as follows:

(a) Fixed objects, whether temporary or permanent, and mobile objects, or parts thereof, that are located on an area intended for the surface movement of aircraft are obstacles.
(b) Fixed objects, whether temporary or permanent, that are extended above defined surfaces intended to protect aircraft in flight are obstacles.
(c) Objects that penetrate the obstacle limitation surfaces are obstacles.
(d) Objects that extend to a height of 100 meters or more above ground elevation are obstacles in areas beyond the limits of obstacle limitation surfaces [outside 15,000 meters radius of the Aerodrome Reference Point]
(e) Overhead wires and cables crossing a river, valley or highway, and their supporting towers, are obstacles if an aeronautical study indicates that the wires or cables could constitute a hazard to aircraft.

2.3 Types of Obstacles at Aerodrome

(a) Certain aerodrome equipment and installations, although they are identified as obstacles, but because of their air navigation functions, must inevitably be so located and/or constructed on a runway strip, a runway end safety area, a taxiway strip or within the taxiway clearance distance or on a clearway.
(b) Equipment and installations other than those listed in 4.1 and does not qualify under 3.5 shall not be permitted to be obstacles.
(c) Aerodrome vehicles, maintenance or service equipment are generally temporary obstacles.

2.4 Obstacle Limitation Surfaces

(a) Of the aerodrome design obstacle limitation surfaces, the following are the essential elements;

    (i) Take-off climb surface

    (ii) Approach surface

(iii)Transitional side surface

(iv)Inner horizontal surface

(v) Conical surface

(b) The figure below gives a clear illustration about obstacle limitation surfaces. The aerodrome design specifications state that all existing objects penetrating the obstacle limitation surfaces shall as far as practicable, be removed unless they are shielded by existing immovable objects. Detailed specifications about the marking and lighting of obstacles are contained in section 4 of the SLCAR Part 14A.

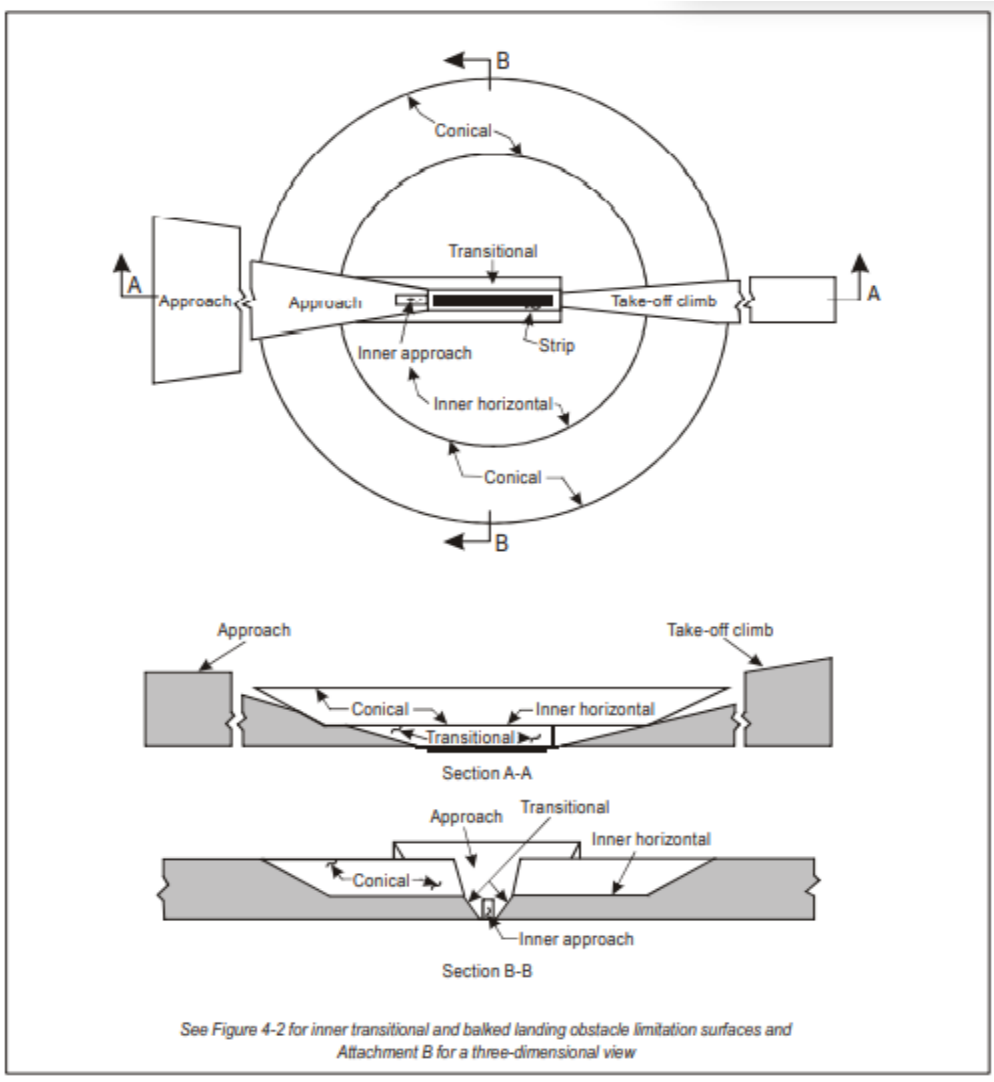


Figure 2-1: Obstacle Limitation Surfaces

2.5 Function of the surfaces

The following paragraphs describe the function of the various surfaces and in certain instances, includes additional information concerning their characteristics. Several illustrations of the obstacle limitation surfaces are included in Appendix 1.

2.5.1 *Outer horizontal surface*

(a) Significant operational problems can arise from the erection of tall structures in the vicinity of airports beyond the areas currently recognized in SLCAR Part 14A, as areas in which restriction of new construction may be necessary. The operations; implications fall broadly under the headings of safety and efficiency

(b) Safety implications - it is particularly desirable to review carefully any proposal to erect high mast or other skeletal structures in areas which would otherwise be suitable for use by aircraft on wide visual circuits, on arrival routes towards the airport or circuit, or on departure or missed approach climb-paths. Avoidance by marking or lighting cannot be relied upon in view of the relatively inconspicuous character of these structures, especially in conditions of reduced visibility, and notification of their existence will similarly not always guarantee avoidance.

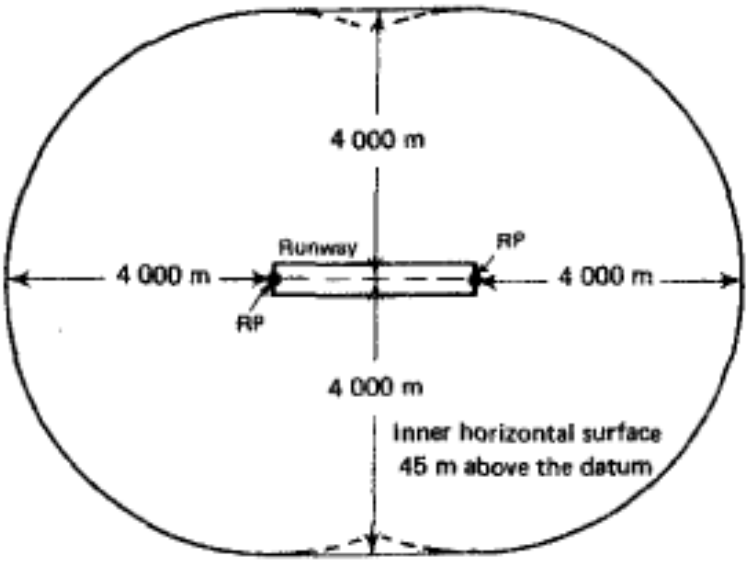


Figure 2-2: Inner horizontal surface for a single runway (where the runway code number is 4)

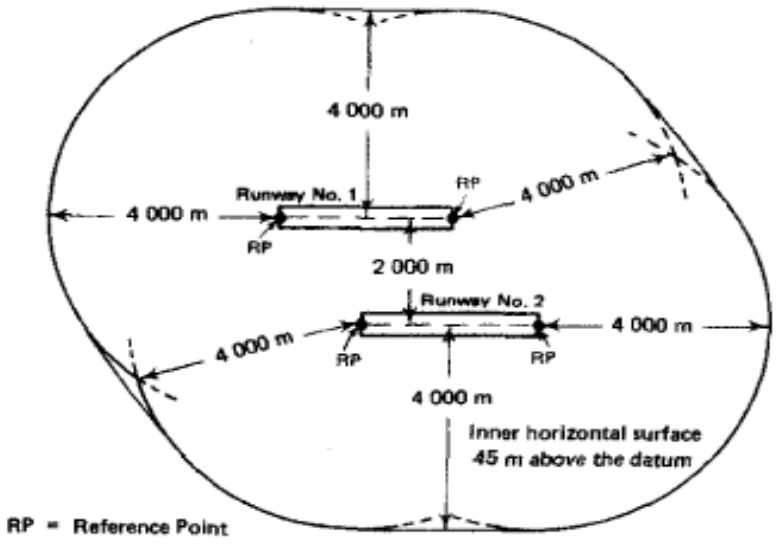


Figure 2-3: Composite inner horizontal surface for two parallel runways (where the runway code number is 4).

(c) Efficiency implications - if tall structures are erected in or near areas otherwise suitable for instrument approach procedures, increased procedure heights may need to be adopted, with consequent adverse effects on regularity and on the duration of the approach procedure, such as the denial of useful altitude allocations to aircraft in associated holding patterns. Such structures may furthermore limit desirable flexibility for radar vectored initial approaches and the facility to turn en-route during the departure climb or missed approach

(d) In view of these potentially important operational considerations, the operator shall adopt measures to ensure that they have advance notice of any proposals to erect tall structures. This will enable them to study the aeronautical implications and take such action as may be at their disposal to protect aviation interests. In assessing the operational effect of proposed new construction, tall structures would not be of immediate significance if they are proposed to be located in:

(i) an area already substantially obstructed by terrain or existing structures of equivalent height; and

(ii) an area which would be safely avoided by prescribed procedures associated with navigational guidance when appropriate.

(e) As a broad specification for the outer horizontal surface, tall structures can be considered to be of possible significance if they are both higher than 30m above local ground level, and higher than 150m above aerodrome elevation within a radius of 15,000m of the centre of the airport where the runway code number is 3 or 4. The area of concern may need to be extended to coincide with the obstacle-accountable areas of PANS-OPS for the individual approach procedures at the airport under consideration.

2.5.2 *Inner horizontal surfaces and conical surface*

(a) The purpose of the inner horizontal surface is to protect airspace for visual circling prior to landing, possibly after a descent through cloud aligned with a runway other than that in use for landing.

(b) In some instances, certain sectors of the visual circling areas will not be essential to aircraft operations and, provided procedures are established to ensure that aircraft do not fly in these sectors, the protection afforded by the inner horizontal surface need not extend into those sectors. Similar discretion can be exercised by the appropriate authorities when procedures have been established and navigational guidance provided to ensure that defined approach and missed approach paths will be followed.

(c) Whilst visual circling protection for slower aircraft using shorter runways may be achieved by a single circular inner horizontal surface, with an increase in speed it becomes essential to adopt a race-track pattern (similar to PANS-OPS) and use circulars arcs centred on runway ends joined tangentially by straight lines. To protect two or more widely spaced runways, a more complex pattern could become necessary, invoking four or more circular arcs. These situations are illustrated at Figures 2-2 and 2-3 respectively.

(d) Inner horizontal surface – elevation datum. To satisfy the intention of the inner horizontal surface described above, it is desirable that authorities select a datum elevation from which the top elevation of the surface is determined. Selection of the datum should take account of:

(i) the elevations of the most frequently used altimeter setting datum points;

(ii) minimum circling altitudes in use or required; and

(iii)the nature of operations at the airport.

(e) For relatively level runways the choice of datum is not critical, but when the thresholds differ by more than 6m, the datum selected should have particular-regard to the factors above. For complex inner horizontal surfaces (Figure 2-3) a common elevation is not essential, but where surfaces overlap the lower surface should be regarded as dominant.

2.5.3 *Approach and transitional surfaces*

These surfaces define the volume of airspace that must be kept free from obstacles to protect an aeroplane in the final phase of the approach-to-land manoeuvre. Their slopes and dimensions will vary with the aerodrome reference code and whether the runway is used for visual, non-precision or precision approaches

2.5.4 *Take off climb surface*

This surface provides protection for an aircraft on take-off by indicating which obstacles shall be removed if possible, and marked or lighted if removal is impossible. The dimensions and slopes also vary with the aerodrome reference code.

2.5.5 *The inner approach, inner transitional and balked landing surfaces*

(a) Together, these surfaces (see Figure. 2-4) define a volume of airspace in the immediate vicinity of a precision approach runway which is known as the obstacle-free zone (OFZ). This zone shall be kept free from fixed objects, other than lightweight frangibility mounted aids to air navigation which must be near the runway to perform their function, and from transient objects such as aircraft and vehicles when the runway

is being used for category II or III ILS approaches. When an OFZ is established for a precision approach runway category I, it shall be clear of such objects when the runway is used for category I ILS approaches.

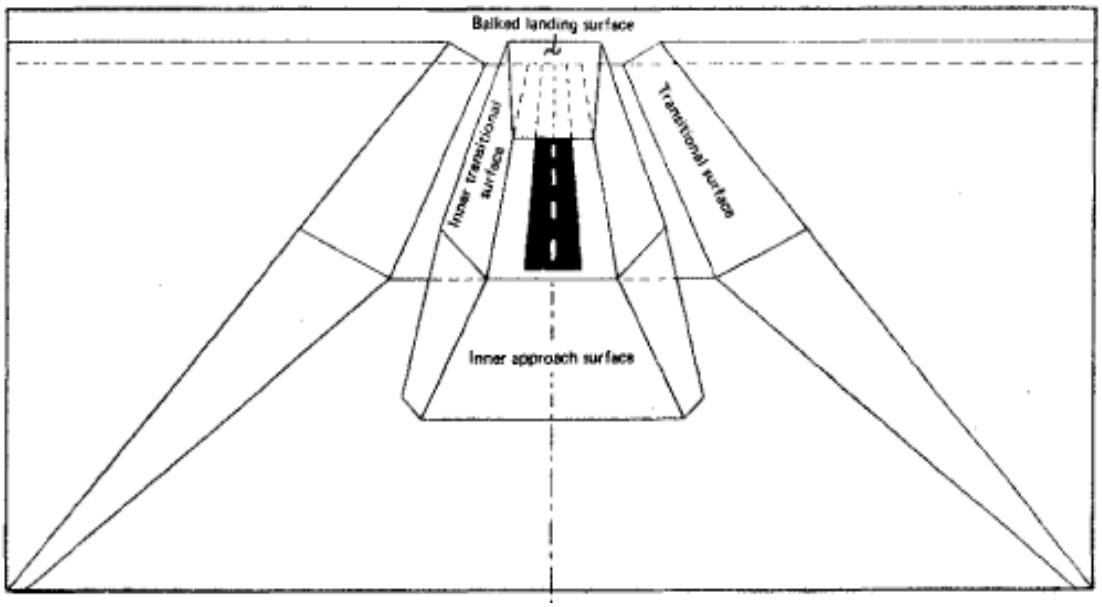


Figure 2-4: Surfaces in the OFZ

(b) The OFZ provided on a precision approach runway where the code number is 3 or 4 is designed to protect an aeroplane with a wingspan of 60m on a precision approach below a height of 30m having been correctly aligned with the runway at that height, to climb at a gradient of 3.33% and diverge from the runway centreline at a splay no greater than 10%. The gradient of 3.33% is the lowest permitted for an all-engine-operating, balked landing. A horizontal distance of 1,800m from threshold to the start of the balked landing surface assumes that the latest point for a pilot to initiate a balked landing is the end of the touchdown zone lighting, and that changes to aircraft configuration to achieve a positive climb gradient will normally require a further distance of 900m which is equivalent to a maximum time of about 15secs. Slope of 33.33% for the inner transitional surfaces result from a 3.33% climb gradient with a splay of I0 per cent.

(c) The OFZ for a precision approach runway category I where the code number is 1 or 2 is designed to protect an aeroplane with a wing span of 30m to climb at a gradient of 4% and diverge from the runway centre line at a splay no greater than 10%. The gradient of 4% is that of the normal take-off climb surface for these aeroplanes. When allied to a 10% splay, it results in a slope for the inner transitional surfaces of 40%. The balked landing surface originates at 60m beyond the far end of the runway from threshold and is coincident with the take-off climb surface for the runway.

2.6 Notification of Proposed Obstacle

(a) Any development that may penetrate the obstacle limitation surfaces, including construction, establishment or erection of objects that may be regarded as obstacles at an aerodrome, shall be referred to the Authority for review. The review would examine the effect of the envisaged construction on air navigation and on operational procedures in use.
(b) In considering proposed construction, account shall be taken of possible future development at the aerodrome and consequent requirement for more stringent obstacle limitation surfaces.
(c) The obligation to notify of any proposed construction, or part thereof, which may constitute or generate obstacles, shall rest with the local authority, the developer or the property owner.
(d) Notification of construction, establishment or erection of objects that may constitute as obstacles shall be submitted to the Authority for approval using the form given in Appendix 2.
(e) Where an obstacle is to be located on the aerodrome, the aerodrome operator is responsible for notifying of such construction.
(f) The Authority may permit the proposed construction under certain terms and conditions to ascertain continued safety of air navigation.

3 OBSTACLE CONTROL

3.1 General

When considering obstacle control, the following shall not be overlooked as they could have an adverse effect on the regularity of aircraft operations:

(a) Objects which penetrate the approach surface are critical since they represent an erosion of the clearance between the final approach path, usually 3 degrees and fixed or mobile obstacles on the ground.
(b) On an approach where the approach surface is significantly obstructed, the safe operation of aircraft is ensured by raising the aerodrome approach meteorological minima. If the object penetrates into the approach surface, the landing threshold is displaced, effectively reducing the available landing distance. This can have an adverse effect on the regularity of aircraft operations and could impose payload penalties on landing aircraft.
(c) The transitional surfaces are adjacent to the runway strip and approach surface. Penetration of them by an obstacle results in the reduction in the clearance available whilst carrying out an approach to land or during a missed approach procedure.
(d) Such obstacles may have an adverse effect on the aerodrome meteorological minima and may need marking and lighting.
(e) Aircraft performance requirements applicable to take-off and climb, require all aircraft to clear all obstacles by a minimum specified margin.

(f) For a multi-engine aircraft, that requirement includes the climb following failure of the critical engine. Objects which penetrate approach and take-off climb surfaces do not represent a degradation of safety standards but they may impose significant payload penalties on aircraft taking off.

(g) The inner horizontal surface is more significant for VFR operations.

(h) It also provides protection for circuiting aircraft following an instrument approach. It does not usually represent a critically limiting surface around a large aerodrome handling IFR traffic, except in so far that it extends beneath the approach surface.

(i) The conical surface represents the obstacle limiting surface some distance from the aerodrome.

(j) It is often not practical to control obstacles which penetrate this surface, although it does usually provide a limit to new construction.

(k) Obstacle control, to maintain or improve the ICAO Aerodrome Obstacle Chart - Type A (Type A Chart) obstacle profile, shall be based on the clear understanding of the performance requirements of the aircraft regularly using the aerodrome or those proposed to be brought into regular use.

(l) Any obstacles which are allowed to penetrate the established PANS-OPS surfaces could raise the minimum safe altitudes of the aerodrome instrument flight procedures.

3.2 Identifying Obstacles

(a) Identification of obstacles requires a complete engineering survey of all areas beneath the aerodrome obstacle limitation surfaces. Such surveys are generally conducted by governmental authorities with the co-operation of the aerodrome operator. In the absence of a governmental authority, the aerodrome operator must conduct the necessary survey with his own staff or with the assistance of a consultant or local/foreign operators.

(b) The initial survey shall produce a chart presenting a plan view of the entire aerodrome and its environs. The scope of the chart shall be to the outer limit of the conical, approach and take-off climb surfaces. It will need to include profile views of all obstacle limitation surfaces. Each obstacle shall be identified in both plan and profile with its description and height above the datum, which shall be specified on the chart. Engineering field surveys can be supplemented by aerial photographs and photogrammetry to identify possible obstacles not readily visible from the aerodrome.

(c) Notification of aerodrome data and information that is required to be provided for promulgation by Aeronautical Information Service (AIS).

(d) Periodic surveys shall be conducted to ensure the validity of the information in the initial survey. The aerodrome operator shall make frequent visual observations of surrounding areas to determine the presence of new obstacles. Follow-up surveys shall be conducted whenever significant changes occur. A detailed survey of a specific area may be necessary when the initial survey indicates the presence of obstacles for which a control programme is contemplated. Following completion of an obstacle control

programme, the area shall be resurveyed to provide corrected data on the presence or absence of obstacles. Similarly, revision surveys shall be conducted if changes are made, or planned, to the aerodrome characteristics such as runway length, elevation or orientation. No firm rule can be set down for the frequency of periodic surveys, but constant vigilance is required. Changes in obstacle data arising from surveys are to be notified to the AIS in accordance with established process as soon as practicable for promulgation to the aircraft operators.

3.3 Methods of Control

The viability and safety of aerodrome use by aircraft operators can be assured by establishing effective obstacle control to maintain the obstacle limitation surfaces. Control can be achieved, in a number of ways, by:

(a) Enactment of height zoning protection by the local authority;
(b) Establishing an effective obstacle monitoring and removal programme; or
(c) Purchasing of easement or property rights, or all of these.

3.3.1 Height Zoning

(a) The objective of height zoning is to protect the aerodrome obstacle limitation surfaces from intrusion by manmade objects and natural growth such as trees.
(b) This is done by the enactment of ordinances identifying height limits underneath the aerodrome obstacle limitation surfaces. The responsibility for the enactment of such an ordinance is a matter between the aerodrome operator and the local authority.
(c) To give effect to height-zoning a zoning map shall be prepared for the guidance of the responsible local authority. The map is a composite, relating all zoning criteria to the ground level around the aerodrome. It shall cover the aerodrome design obstacle limitation surfaces and, where applicable, the take-off flight path for the Type A Chart and any PANS-OPS surfaces.
(d) Typical zoning ordinances include a statement of the purpose of, or necessity for, the action. They include a description of the obstacle limitation surfaces which shall conform to the aerodrome design surfaces and, if applicable, the Type A Chart and the PANS-OPS surfaces. They also contain a statement of allowable heights which shall conform to the specifications for these surfaces. Provisions are made, in the ordinances, for a maximum allowable height, for existing non-conforming uses, for marking and lighting of obstacles and for appeals from the provision of the ordinance. The matter of bird control could also be addressed at the same time by defining areas which the siting of gravel pits, refuse dumps, sewage outfalls and other features, which attract birds, may be subjected to restriction in the interests of aviation safety.

3.3.2 Obstacle Removal

(a) When obstacles have been identified, the airport operator with the assistance of local community agencies should make every effort to have them removed or reduced in

height so that they no longer constitute an obstacle. This will require negotiation with the owner of the property. If the obstacle is a single object such as a tree, a television antenna or a chimney, it may be possible to reach agreement to reduce height to acceptable limits without adverse effect. In other cases, such as a building, it may be necessary to arrange for removal of the entire structure. This will in all probability, require purchase or condemnation of the property. In either case, the airport operator must be prepared to compensate the property owner for any loss of value

(b) Where agreement can be reached for the reduction in height of an existing obstacle, the agreement should include a written aviation easement limit future heights over the property to specific levels which conform to the pertinent obstacle limitation surfaces, unless effective height zoning has been established

(c) Tree: In the case of trees which are trimmed, agreement should be reached in writing with the property owner to ensure that future growth will not create new obstacles. Property owners can give such assurance by agreeing to trim tress when necessary or by permitting access to the premises for the purpose of having such trimming done by representatives of the airport operator.

(d) Some aids to navigation, both electronic (such as ILS components) and visual (such as approach and runway lights), constitute obstacles which cannot be removed. Such objects should be frangibly designed and constructed, and mounted on frangible couplings so that they will fail on impact without damage to an aircraft. Guidance on the frangibility requirements of visual and non-visual aids to navigation is contained in section 3.7 of this AC. Where necessary, such object should be marked and/or lighted.

3.3.3 Easements or Property Rights

(a) In those areas where zoning is inadequate, the aerodrome operator may take steps to protect the obstacle limitation surfaces by other means. Examples of zoning inadequacies might be locations close to runway ends or where obstacles exist. Examples of other means might be such as gaining easements or property rights. They shall include removal or reduction in height of existing obstacles and measures to ensure that no new obstacles may be erected in the future.

(b) Where agreement can be reached, for the reduction in height of an obstacle, the agreement shall include a written aviation easement limiting heights over the property to specific levels unless effective height zoning has been established.

3.3.4 Marking and Lighting of Obstacles

(a) Where it is impractical to eliminate an obstacle, it should be appropriately marked or lighted, or both, to be clearly visible to pilots in all weather and visibility conditions. SLCAR Part 14A, section 6 contains detailed specifications about the marking and lighting of obstacles.

(b) Note that the marking and lighting of obstacles is intended to reduce hazards to aircraft by indicating the presence of obstacles. It does not necessarily reduce operating

limitations which may be caused by the obstacle. SLCAR Part 14A specifies that obstacles be marked and, if the aerodrome is used at night, lighted, except that:

(i) Lighting and marking may be omitted when the obstacle is shielded by another obstacle; and

(ii) The marking may be omitted when the obstacle is lighted by high intensity obstacle lights by day.

(c) Vehicles and other mobile objects, excluding aircraft on movement areas of aerodromes shall be marked and lighted, unless they are used on apron areas only.

3.3.5 Obstacle Shielding

(a) The principle of shielding is employed to permit a more logical approach to restricting new construction and prescribing obstacle marking and lighting. It also reduces the number of cases of new construction requiring review by Authorities. Shielding principles are employed when some objects, an existing building or natural terrain, already penetrates above one of the obstacle limitation surfaces described in SLCAR Part 14A. If such is considered that the nature of an object is such that its presence may be described as permanent, then additional objects within a specified area around it may be permitted to penetrate the surface without being considered as obstacles. The original obstacle is considered as dominating or shielding the surrounding area.

(b) the formula for shielding should be based on a horizontal plane projected from the top of each obstacle away from the runway and a plane with negative slope of 10% towards the runway. Any object which is below either of the two planes would be considered shielded. The permission to allow objects to penetrate an obstacle limitation surface under the shielding principle should, however, be qualified by reference to the need for an aeronautical study in all cases.

(c) The shielding effect of immovable obstacles laterally in approach and take-off climb areas is more uncertain. In certain circumstances, it may be advantageous to preserve existing unobstructed cross-section areas, particularly when the obstacle is close to the runway. This would guard against future changes in either approach or take-off climb area specifications or the adoption of turned take-off procedure.

(d) The permanency of the immovable obstacle which is to be considered as shielding an area should be given very careful review. An object should be classed as immovable only if, when taking the longest view possible, there is no prospect of removal being practicable, possible or justifiable, regardless of how the pattern, type or density of air operations might change.

(e) In use, the methods for determining the extent of area shielded by a permanent obstacle and permissible height limits around it vary. Generally an aeronautical study is carried out to review the exact effect the construction of a new object will have.

3.4 Reporting of Obstacles

(a) Aerodrome operator(s) shall make frequent observations of surrounding areas to determine the presence of new obstacles. Whenever an obstacle is identified, it shall be reported promptly to the Authority.
(b) Local authorities, developer or property owners shall report of new construction that may constitute new obstacles.
(c) The Authority shall notify and publish changes in the obstacle data in the appropriate Aeronautical Information Services publications.

3.5 Obstacles at Aerodromes

Objects regarded as obstacles are as follows:

(a) Fixed objects, whether temporary or permanent, or parts thereof, that are located on an area intended for the surface movement of aircraft are obstacles.
(b) Mobile objects, whether temporary or permanent, or parts thereof, that are located on an area intended for the surface movement of aircraft are obstacles.
(c) Fixed objects, whether temporary or permanent, that are extended above defined surfaces intended to protect aircraft in flight are obstacles.
(d) Fixed or mobile objects that penetrate the obstacle limitation surfaces are obstacles.

3.6 Obstacle Restriction Rules

No fixed objects or mobile objects that may constitute as obstacles shall be permitted -

(a) to be located and/or constructed
    (i) on a runway strip;
    (ii) on a runway end safety area;
    (iii) on a taxiway strip;
    (iv) within a taxilane clearance distance;
    (v) adjacent to aircraft stand; and
    (vi) on a clearway.
(b) to be located and/or constructed within
    (i) ILS Localizer critical areas; and
    (ii) ILS Glide Path sensitive and critical areas
(c) to be extended into the Obstacle Protection Surfaces;
(d) to be extended into the Obstacle Free Zone; and
(e) to be extended above the Obstacle Limitation Surface.

Except when such fixed objects or mobile objects satisfies conditions specified under the following paragraphs:

3.6.1 Obstacles on Runway Strips

a) No fixed objects or mobile objects that may constitute as obstacles shall be permitted to be located and/or constructed on a runway strip, other than equipment and installations required for air navigation purposes and shall be frangible and mounted as low as possible.
b) Fixed objects or mobile objects satisfying conditions specified above, shall be restricted as follows;
    (i) Zone I:

Only visual aids required for air navigation purposes, except wind direction indicator, are allowed in areas defined within -

(1) 75 m of the runway centre line where the code number is 3 or 4 and the code letter is F; or
(2) 45 m of the runway centre line where the code number is 1 or 2.

(ii) Zone II:
Other navigational aids, including wind direction indicator, are allowed in areas beyond –
(1) 75 m of the runway centre line where the code number is 4 and the code letter is F; or
(2) 45 m of the runway centre line where the code number is 1 or 2.

(iii) Zone III:
Any other objects, including supporting equipment and installations for navigational aids, shall be located outside runway strips.

3.6.2 Obstacles on Runway End Safety Area (RESA)

(a) No fixed objects or mobile objects that may constitute as obstacles shall be permitted to be located and/or constructed on a RESA, other than equipment and installations required for air navigation purposes and shall be frangible and mounted as low as possible.
(b) Fixed objects or mobile objects satisfying conditions specified above, shall be restricted as follows -
(i) For a precision approach runway category I, II and III:

Only aids required for air navigation purposes are allowed in areas within 240 m from the end of runway strip and within -

(1) 60 m of the extended runway centre line where the code number is 3 or 4; or
(2) 45 m of the extended runway centre line where the code number is 1 or 2.

(ii) For a non-precision approach runway :

Only aids required for air navigation purposes are allowed on a runway end safety area.

(iii) For a non-instrument runway with code number 1 or 2, and where a runway end safety area is provided :

Only aids required for air navigation purposes are allowed on a runway end safety area.

(iv) No other objects, including supporting equipment and installations for navigational aids, shall be located outside runway end safety areas.

3.6.3 Obstacles on Taxiway Strips

(a) No fixed objects or mobile objects that may constitute as obstacles shall be permitted to be located and/or constructed on a taxiway strip, other than equipment and installations required for air navigation purposes and mounted as low as possible.
(b) Other objects shall be restricted as follows -

Table 3-1: Taxiway Clearance Distances

Code Letter	Between taxiway centerline to object [meters]
A	15.5
B	20
C	26
D	37
E	43.5
F	51

3.6.4 Obstacles within Taxilane Clearance Distance

(a) No fixed objects or mobile objects that may constitute as obstacles shall be permitted to be located and/or constructed within a taxilane clearance distance, other than equipment and installations required for air navigation purposes and mounted as low as possible.

(b) Other objects shall be restricted as follows –

Table 3-2: Taxilane Clearance Distances

Code Letter	**Between taxilane centerline to object [meters]**
A	12
B	16.5
C	22.5
D	33.5
E	40
F	47.5

3.6.5 Obstacles in Proximity of Aircraft Stands

(a) No fixed objects or mobile objects that may constitute as obstacles shall be permitted to be located and/or constructed adjacent to an aircraft stand provided that a minimum clearance is established between an aircraft using the stand and any obstacle, including buildings, vehicles and aircraft on another stand, as follows;

Table 3-3: Clearances between aircrafts on stand

Code Letter	**Clearance distance [meters]**

A	3
B	3
C	4.5
D	7.5
E	7.5
F	**7.5**

(b) To ensure the minimum clearance between an aircraft using the stand and objects on the apron, safety lines shall be provided so as to define areas intended for use by vehicles and other aircraft servicing facilities.

3.6.6 Obstacles on Clearway

(a) No fixed objects or mobile objects that may constitute as obstacles shall be permitted to be located and/or constructed on a clearway, other than equipment and installations required for air navigation purposes and shall be frangible and mounted as low as possible.
(b) Notwithstanding the above, a clearway shall end at the first upstanding obstacle.

3.6.7 Obstacles on Localizer Critical and Sensitive Areas

(a) No fixed objects or mobile objects that may constitute as obstacles shall be permitted to be located and/or constructed on the ILS localizer critical and sensitive areas.
(b) The localizer critical area is defined as -
  (i) an area of 75 m radius behind the localizer antenna; and
  (ii) a rectangular area with a width of 60 m on either side of the antenna and extending to at least 300m forward from the antenna or the near runway end, whichever is nearer.

(c) The localizer critical and sensitive area is defined as in Table 3-4 below;

Table 3-4: Typical localizer critical and sensitive area sizes

Aircraft/vehicle height	H ≤ 6 m (see Note 1) Ground vehicle			6 m < H ≤ 14 m Medium aircraft			14 m < H ≤ 20 m Large aircraft		20 m < H ≤ 25 m Very large aircraft	
Antenna aperture (see Note 3)	Small	Medium	Large	Small	Medium	Large	Medium	Large	Medium	Large
Critical area CAT I X_C	180 m	65 m	45 m	360 m	200 m	150 m	500 m	410 m	660 m	580 m
Z_C	10 m	10 m	10 m	35 m	35 m	35 m	50 m	50 m	60 m	60 m
(see Note 10) Y_C	50 m	15 m	20 m	110 m	25 m	25 m	50 m	30 m	55 m	40 m
Sensitive area CAT I X_S	200 m	No sensitive area		500 m	No sensitive area		No sensitive area		1 300 m	1 100 m
Y_1	40 m			90 m					90 m	50 m
Y_2	40 m			90 m					90 m	50 m
Z_{S1}	15 m			35 m					60 m	60 m
(see Note 7) Z_{S2}	15 m			35 m					60 m	60 m

Aircraft/vehicle height	H ≤ 6 m (see Note 1) Ground vehicle		6 m < H ≤ 14 m Medium aircraft		14 m < H ≤ 20 m Large aircraft		20 m < H ≤ 25 m Very large aircraft	
Antenna aperture (see Note 3)	Medium	Large	Medium	Large	Medium	Large	Medium	Large
Critical area CAT II X_C	75 m	55 m	200 m	200 m	500 m	475 m	750 m	675 m
Z_C	10 m	10 m	35 m	35 m	50 m	50 m	60 m	60 m
(see Note 10) Y_C	15 m	20 m	25 m	25 m	50 m	30 m	70 m	50 m
Sensitive area CAT II X_S	75 m	No sensitive area	500 m	No sensitive area	2 100 m	1 400 m	Localizer to threshold distance	Localizer to threshold distance
Y_1	15 m		50 m		125 m × K	60 m × K	180 m × K	100 m × K
Y_2	15 m		50 m		125 m × K	60 m × K	180 m × K	125 m × K
Z_{S1}	15 m	15 m	35 m	35 m	60 m	60 m	70 m	70 m
(see Note 7) Z_{S2}	15 m	15 m	45 m	45 m	160 m	160 m	250 m	250 m

Aircraft/vehicle height	H ≤ 6 m (see Note 1) Ground vehicle		6 m < H ≤ 14 m Medium aircraft		14 m < H ≤ 20 m Large aircraft		20 m < H ≤ 25 m Very large aircraft	
Antenna aperture (see Note 3)	Medium	Large	Medium	Large	Medium	Large	Medium	Large
Critical area CAT III X_C	75 m	55 m	200 m	200 m	500 m	475 m	750 m	675 m
Z_C	10 m	10 m	35 m	35 m	50 m	50 m	60 m	60 m
(see Note 10) Y_C	15 m	20 m	25 m	25 m	50 m	30 m	70 m	50 m
Sensitive area CAT III X_S	100 m	No sensitive area	900 m	No sensitive area	3 100 m	3 100 m	Localizer to Threshold distance	Localizer to Threshold distance
Y_1	15 m		50 m		140 m × K	120 m × K	180 m × K	150 m × K
Y_2	15 m		50 m		160 m × K	120 m × K	260 m × K	180 m × K
Z_{S1}	15 m	15 m	35 m	35 m	60 m	60 m	70 m	70 m
(see Note 7) Z_{S2}	15 m	15 m	45 m	45 m	160 m	160 m	250 m	250 m

Further guidance can be found in ATT C-11 and C-12 of the ICAO Annex 10, Vol. 1 – Aeronautical Telecommunications.

3.6.8 Obstacles on Glide Path Critical/Sensitive Areas

(a) No fixed objects or mobile objects that may constitute as obstacles shall be permitted to be located and/or constructed on the ILS glide path critical and sensitive areas.

(b) The glide path critical area is defined as -

(i) an area of 100m radius behind the glide path antenna; and

(ii) a rectangular area extending to at least 250m forward from the antenna with a width being the distance between the antenna and the runway edge and extending to at least 30m to the other side of the antenna.

(c) The glide path critical and sensitive area is defined as in Table 3-5 and Table 3-6 below;

Table 3-5: Glide Path critical and sensitive area dimensions for parallel and perpendicular orientations

Aircraft/vehicle height	Ground vehicle		Medium aircraft		Large aircraft		Very large aircraft	
	H ≤ 6 m		6 m < H ≤ 14 m		14 m < H ≤ 20 m		20 m < H ≤ 25 m	
Glide path type	M-array	Null-ref	M-array	Null-ref	M-array	Null-ref	M-array	Null-ref
CAT I critical area								
X	299 m	191 m	329 m	829 m	467 m	1 117 m	610 m	1 360 m
Y	29 m	29 m	20 m	20 m	22 m	22 m	15 m	15 m
CAT I sensitive area								
X	299 m	399 m	279 m	529 m	417 m	717 m	510 m	760 m
Y	29 m	15 m	20 m	20 m	22 m	16 m	15 m	15 m
CAT II/III critical area								
X	299 m	449 m	329 m	829 m	567 m	1 267 m	660 m	1 410 m
Y	29 m	29 m	20 m	20 m	22 m	22 m	15 m	15 m
CAT II/III sensitive area								
X	299 m	449 m	429 m	629 m	517 m	767 m	560 m	1 010 m
Y	29 m	29 m	20 m	20 m	22 m	22 m	15 m	15 m

Table 3-6: Glide Path critical and sensitive area dimensions for other orientations

Aircraft/vehicle height	Ground vehicle		Medium aircraft		Large aircraft		Very large aircraft	
	H ≤ 6 m		6 m < H ≤ 14 m		14 m < H ≤ 20 m		20 m < H ≤ 25 m	
Glide path type	M-array	Null-ref	M-array	Null-ref	M-array	Null-ref	M-array	Null-ref
CAT I critical area								
X	298 m	191 m	297 m	829 m	444 m	**1 167 m**	591 m	1 360 m
Y	24 m	15 m	**39 m**	**39 m**	**35 m**	**55 m**	**34 m**	**55 m**
CAT I sensitive area								
X	298 m	394 m	**297 m**	**537 m**	**444 m**	717 m	**541 m**	710 m
Y	24 m	**24 m**	**39 m**	**39 m**	**25 m**	**18 m**	**24 m**	**24 m**
CAT II/III critical area								
X	298 m	443 m	**347 m**	829 m	544 m	1 267 m	**672 m**	1 410 m
Y	24 m	25 m	**39 m**	**39 m**	**35 m**	**55 m**	**34 m**	**55 m**
CAT II/III sensitive area								
X	298 m	445 m	297 m	**829 m**	**528 m**	**817 m**	**610 m**	1 010 m
Y	24 m	24 m	**39 m**	**39 m**	**25 m**	**25 m**	**24 m**	**24 m**

Further guidance can be found in ATT C-14, ATT C-15 and C-16 of the ICAO Annex 10, Vol. 1 – Aeronautical Telecommunications.

3.6.9 Obstacles within Obstacle Free Zone

(a) No fixed objects that may constitute as obstacles shall be permitted to be extended into the obstacle free zone, except visual aids required for air navigation purposes and shall be frangible and mounted as low as possible.
(b) Mobile objects shall not be permitted to be in the obstacle free zone during the use of runway for landing.
(c) The obstacle free zone is the airspace defined by -

(i) Inner approach surface

Description

A rectangular portion of the approach surface immediately preceding the threshold

Characteristics

The limits of the inner approach surface shall comprise –

(1) an inner edge coincident with the location of inner edge of the approach surface but of its own specified length;
(2) two sides originating at the ends of the inner edge and extending parallel to the vertical plane containing the centreline of the runway; and
(3) an outer edge parallel to the inner edge.

The slopes and dimension of the inner approach surface shall be as follows;

	Precision category I Code number		**Precision category II or III Code number**
	1, 2	3, 4	3,4
Width	90m	120m*	120m*
Distance from threshold	60m	60m	60m
Length	900m	900m	900m
Slope	2.5%	2%	2%

(ii) Inner transitional surface

Description

A surface similar to the transitional surface but closer to the runway

Characteristics

The limits of an inner transitional surface shall comprise -

(1) a lower edge beginning at the end of the inner approach surface and extending down to the side of the inner approach surface to the inner edge of the surface, from there along the strip parallel to the runway centerline to the inner edge of the balked landing surface and from there up the side of the balked landing surface to the point where the side intersects the inner horizontal surface; and
(2) An upper edge located in the plane of the inner horizontal surface.
(3) The elevation of a point on the lower edge shall be -
   a) along the side of the inner approach surface and balked landing surface - equal to the elevation of the particular surface at that point; and
   b) Along the strip - equal to the elevation of the nearest point on the centerline of the runway or its extension.

The slopes of the inner transitional surface shall be as follows –

	Precision category I		**Precision category II or III**
	Code number		**Code number**
	1, 2	3, 4	3, 4
Slope	40%	33.3%	33.3%

(iii)Balked landing surface

Description

An inclined plane located at a specified distance after the threshold, extending between the inner transitional surfaces.

Characteristics

The limits of the balked landing surface shall comprise –

(1) an inner edge horizontal and perpendicular to the centreline of the runway and located at a specified distance after the threshold;
(2) two sides originating at the ends of the inner edge and diverging uniformly at a specified rate from the vertical plane containing the centreline of the runway; and
(3) an outer edge parallel to the inner edge and located in the plane of the inner horizontal.
   a) The elevation of the inner edge shall be equal to the elevation of the runway centreline at the location of the inner edge.
   b) The slope of the balked landing surface shall be measured in a vertical plane at right angles to the centreline of the runway.

The slopes and dimension of the balked landing surface shall be as follows -

	Precision category I Code number		Precision category II or III Code number
	1,2	3,4	3,4
Length of inner edge	90m	120m*	120m*
Distance from threshold	**	1800m	1800m
Divergence [each side]	10%	10%	10%
Slope	4%	3.33%	3.33%

*where code letter is F, the width shall be increased to 140m

**distance to the end of strip

Note: see Appendix 3 of this AC.

3.6.10 Obstacles within Obstacle Limitation Surfaces

(a) No fixed objects or mobile objects that may constitute as obstacles shall be permitted to be extended into the obstacle limitation surfaces, except when, in the opinion of the Authority;
   (i) the obstacle would be shielded by an existing immovable object; or
   (ii) following an aeronautical study that the object would not adversely affect the safety or significantly affect the regularity of operations of aircraft.

(b) The obstacle limitation surfaces at and in vicinity of an aerodrome are -

(i) Approach surface

Description

An inclined plane or combination of planes preceding the threshold

Characteristics

The limits of the approach surface shall comprise –

(1) an inner edge of specified length, horizontal and perpendicular to the extended centreline of the runway and located at a specified distance from the threshold;
(2) two sides originating at the ends of the inner edge and diverging at a specified rate from the extended centreline of the runway; and
(3) an outer edge parallel to the inner edge.
   a) The elevation of the inner edge shall be equal to the elevation of the mid-point of the threshold.

b) The slope(s) of the approach surface shall be measured in the vertical plane containing the centreline of the runway.

(ii) Transitional surface

Description

A complex surface along the side of the strip and part of the side of the approach surface, that slope upwards and outwards to the inner horizontal.

Characteristics

The limits of the transitional surface shall comprise –

(1) a lower edge beginning at the intersection of the side of the approach surface with the inner horizontal surface and extending down the side of the approach surface to the inner edge of the approach surface and from there along the length of the strip parallel to the runway centreline; and
(2) an upper edge located in the plane of the inner horizontal surface.

The elevation of a point on the lower edge shall be;

a) along the side of the approach surface - equal to the elevation of the approach surface at that point; and
b) along the strip - equal to the elevation of the nearest point on the centreline of the runway or its extension.
c) The slope of the transitional surface shall be measured in a vertical plane at right angles to the centreline of the runway.

(iii)Inner horizontal surface

Description

A surface located in a horizontal plane above an aerodrome and its environs.

Characteristics

(1) The radius or outer limits of the inner horizontal surface shall be measured from the aerodrome reference point, for a single circular surface, or the thresholds of the runway, for racetrack surface. The shape of the inner horizontal surface, therefore, need not necessarily be circular.
(2) The height of the inner horizontal surface shall be measured above the lowest runway threshold elevation.

(iv)Take-off climb surface

Description

An inclined plane or other specified surface beyond the end of a runway or clearway.

Characteristics

The limits of the take-off climb surface shall comprise –

(1) an inner edge horizontal and perpendicular to the centreline of the runway and located either at a specified distance beyond the end of the runway or at the end of the clearway when such is provided and its length exceeds the specified distance;
(2) two sides originating at the ends of the inner edge and diverging uniformly at a specified rate from the take-off track to a specified final width and continuing thereafter at that width for the remainder of the length of the take-off climb surface; and
(3) an outer edge horizontal and perpendicular to the specified take-off track.
(4) The elevation of the inner edge shall be equal to the highest point on the extended runway centreline between the end of the runway and the inner edge, except when a clearway is provided the elevation shall be equal to the highest point on the ground on the centreline of the clearway.
(5) In the case of a straight take-off path, the slope of the take-off climb surface shall be measured in the vertical plane containing the centreline of the runway.
(6) In the case of a take-off flight path involving a turn, the take-off climb surface shall be a complex surface containing the horizontal normals to its centreline, and the slope of the centreline shall be the same as that for a straight take-off flight path.

3.7 Frangibility

(a) The frangibility of an object is its ability to retain its structural integrity and stiffness up to a desired maximum load, but on impact from greater load, to break, distort or yield in such a manner as to present minimum hazard to aircraft.
(b) The frangibility characteristics shall be proven either by means of full-scale tests or by computer evaluation using appropriate software code for structural analysis.
(c) Elevated runway edge, threshold, end, stopway and taxiway edge light
  (i) These lights shall be capable of withstanding –
    (1) where the runway code number is 3 and 4 or code letter C, D or E, a blast effect of 300 kt.
    (2) where the runway code number is 1 and 2 or code letter A or B, a blast effect of 200 kt.
  (ii) These shall be mounted on frangible mounting devices. The impact load required to cause failure at the break point shall not exceed 5 kg/m and a static load to cause failure shall not exceed 230kg applied horizontally 30 cm above the break point of the mounting device.
(d) Approach lights
  (i) These lights shall be capable of withstanding –
    (1) for lights within 90m of the runway threshold, 200kt. blast effect.
    (2) for lights further out, 100kt. blast effect.
  (ii) These lights and their supporting structure shall be frangible except that, in the portion of the approach lighting system beyond 300m from threshold –
    (1) where the height of the supporting structure exceeds 12m, the frangibility requirement shall apply to the top 12m only; and
    (2) where a supporting structure is surrounded by non-frangible objects, only that part of the structure that extends above the surrounding object shall be frangible.

(iii) The impact load required causing failure of the unit and support shall not exceed 5kg/m and a static load to cause failure shall not exceed 230kg. Applied horizontally 30cm above the break point of the structure.

(iv) The structure shall not wrap around the aircraft but shall crumble or collapse on impact.

(e) Other visual aids

(i) PAPI, signs and markers shall be of low mass.

(ii) These aids shall be able to retain their structural integrity when subjected to the most severe environmental conditions. However, when subjected to aircraft impact in excess of the foregoing conditions, the aids will break or distort in a manner which will cause minimum or no damage to aircraft.

(iii) The light support base for these aids shall not protrude above the ground but rather terminates below ground so as to cause minimum or no damage to aircraft overrunning them. However, the frangible coupling shall be always above ground level.

3.8 Height Limitations

(a) Elevated runway edge, threshold, end, stopway and taxiway edge lights

(i) The desirable maximum height of light units and frangible coupling is 36 cm above ground.

(ii) Light units exceeding 36cm above ground will require higher breaking characteristics for the frangible mounting.

(b) Approach lights

(i) Where approach lights are installed on displaced threshold of a runway or a stopway, the lights shall be inset.

(ii) Otherwise, elevated approach lights shall meet the criteria for frangibility agreed for lights installed beyond the runway end.

(c) Other visual aids

PAPI, signs and markers shall be located as far as practicable from the edges of runway, taxiway and apron as is compatible with their functions.

4 TYPES OF AIRPORT EQUIPMENT AND INSTALLATIONS WHICH MAY CONSTITUTE OBSTACLES

4.1 General

(a) There are many types or airport equipment and installations which, because of their particular air navigation functions, must be so located that they constitute obstacles. Such airport equipment and installations include:

(i) ILS glide path antennas;
(ii) ILS Inner marker beacon;
(iii) ILS localizer antennas;
(iv) wind direction indicators;
(v) landing direction indicators;
(vi) anemometers;
(vii) ceilometers;
(viii) transmission meters;

(ix) elevated runway edge, threshold, end and stopway lights;
(x) elevated taxiway edge tights;
(xi) approach lights;
(xii) Precision approach path indicator system (PAPI) lights;
(xiii) signs and markers;
(xiv) components of the microwave landing system (MLS);
(xv) certain radar and other electronic installations and other devices not itemized above
(xvi) VOR or VOR/DME when located on aerodromes;
(xvii) precision approach radar systems or elements;
(xviii) VHF direction finders; and
(xix) airport maintenance equipment, e.g. trucks, tractors.

(b) There is wide variation in the structural characteristics of these aids currently in use. Requirements of the structural nature of ILS antennas and transmission meters can be found in SLCAR Part 10A. Further guidance can be found in ICAO DOC 9137, Part 6.

4.2 Elevated runway edge, threshold, end, stopway and taxiway edge lighting

(a) The height of these lights shall be sufficiently low to ensure propeller and engine pod clearance. Wing flexes and strut compression under dynamic loads can bring the engine pods of some aircraft to near ground level. Only a small height can be tolerated, and a maximum height of 36cm is advocated.
(b) These aids shall be mounted on frangible mounting devices. The impact load required to cause failure at the break point shall not exceed 5kg/m and a static load required to cause failure shall not exceed 230kg applied horizontally 30cm above the break point of the mounting device. The desirable maximum height of light units and frangible coupling is 36cm above ground. Units exceeding this height limitation may require higher breaking characteristics for the frangible mounting device, but the frangibility shall be such that, should a unit be hit by an aircraft, the impact would result in minimum damage the aircraft.
(c) In addition, all elevated lights installed on runways of code letters A and B shall be capable of withstanding a jet engine exhaust velocity of 300kt, and lights on runways of code letters C, D and E, a lower velocity of 200kt. Elevated taxiway edge lights shall be able to withstand an exhaust velocity of 200kt.

4.3 Approach lighting system

(a) Guidance on the frangibility of approach tights is more difficult to develop, as there is a greater variation in their installation. Conditions surrounding installations close to the threshold are different from those near the beginning of the system: for example, lights within 90m of the threshold or runway end are required to withstand 200kt blast effect. Whereas lights further out need only withstand I00kt blast or the natural environmental wind load. Also the terrain close to the threshold can be expected to be near the same elevation as the threshold, thus permitting the lights to be mounted on short structures. Farther from the threshold, support structures of considerable height may be required to minimize the hazard to aircraft that may strike them, approach lights shall have a frangible device, or their supports are of a frangible design.

(b) Where the terrain requires light fittings and their supporting structure to be taller than approximately 1.8m and they constitute the critical hazard, it is considered that it is not practicably required that the frangible mounting device be at the base of the structure. The frangible portion may be limited to the top 1.8m of the structure, except if the structure itself is frangible. Though there is some question of the need to provide frangibility for approach lights installed beyond 300m before the threshold (as these lights are required to be below the approach surface), it is recognized that protection needs to be provided for aircraft that might descend below the approach or take-off surfaces. A frangible top portion of 1.8m is considered to be a minimum specification, and a longer frangible top portion shall be provided where possible.

(c) In all cases, the unit and supports of the approach lighting system should fail when an impact load of not more than 5kg/m and a static load of not less than 230kg is applied horizontally at 30cm above the break point of the structure.

(d) Where it is necessary for approach lights to be installed in stopway, the lights shall be inset in the surface when the stopway is paved. When the stopway is not paved, they shall either be inset or, if elevated, meet the criteria for frangibility agreed for lights installed beyond the runway end.

4.4 Other aids for example signs and markers

(a) These aids shall be located as far as practicable from the edges of runways, taxiways and aprons as is compatible with their function. Every effort shall be made to ensure that the aids will retain their structural integrity when subjected to the most severe environmental conditions. However, when subjected to aircraft impact in excess of the foregoing conditions, the aids will break or distort in a manner which will cause minimum or no damage to the aircraft.

(b) Caution should be taken, when installing visual aids in the movement area, to ensure that the light support base does not protrude above ground, but rather terminates below ground as required by environmental conditions so as to cause minimum or no damage to the aircraft overrunning them. However, the frangible coupling shall always be above ground level.

5 OBSTACLE LIGHTING AND MARKING

5.1 Introduction

a) This specification further explains the Authority's requirements for various obstructions lighting systems/equipment and marking/painting used to increase conspicuity of structures to permit early obstruction recognition by pilots. Lighting standards in this circular are the minimum necessary for aviation safety. The lights should be positioned to ensure that a pilot has an unobstructed view of at least one light at each level.

b) Air accidents cause immense loss to human life and property. Accidents can however be avoided by little precautions. Among various measures in place, visual aids are of immense importance in creating safer skies. Structures such as crane chimneys, tall buildings, extensive buildings, television, radio and telecommunications towers, flares stacks, electricity transmission lines, bridges, wind turbines and military radar require lighting and marking.

5.2 Lighting

(a) High-rising structures and other geographical obstructions are hazardous to aviation safety because of their heights and location. Due to the numerous threat pose to airplanes in poor visibility, high-rising structures shall be illuminated with obstruction lights. Table 5-2 provides classification of obstruction lighting and compatible light units. Characteristics/description of each light unit is also provided in Table 5-1.

(b) Obstruction light, defined as light indicating the presence of an object which is dangerous to an aircraft in flight. All tall structures must be lit at the topmost point of the structure and the light units must show at all radials throughout the omni-directional 360degrees. Obstruction light combinations and levels to be installed on structures as given in Table 5-3.

5.2.1 Lighting Requirements

In accordance with section 6 of the SLCAR Part 14A, the following objects shall be lighted;

(a) any structure which is not less than 10m above an aerodrome and located within 2km from the closest edge of a runway or helipad;

(b) any structure which is not less than 20m above an aerodrome and is located within 6km from the closest edge of a runway or helipad;

(c) any structure which is not less than 30m above an aerodrome and is located within 10km from the closest edge of a runway or helipad;

(d) any structure which is not less than 45m above ground at its location.

5.2.2 Placement Factors

(a) Depending on the height of the tower and other factors, the installation on towers and antennas may vary. The lights shall be positioned to ensure that a pilot has an unobstructed view of at least one light at each level.

(b) In the case of an extensive/solid structure such as building, the top lights shall be so arranged to indicate the points or edges of the structure, and lights shall be visible when approaching the structure from any direction (**see** Figure 5-2 (b)). In the case of a chimney or other structure of like function, the top lights shall be placed sufficiently below the top of the structure (**see** chimney in figure 5-1(b)) so as to minimize contamination by smoke, etc.

(c) The overall height of the structure including all appurtenances such as rods, antennas, obstruction lights, etc., above ground level determines the number of light levels. The light levels may be adjusted slightly, but not to exceed 10 feet (3m), when necessary to accommodate guy wires and personnel who replace or repair light fixtures.

(d) For tall structures above 45m, there is the need for additional intermediate lights which shall be spaced as equal as practicable between the top lights and ground level. At middle levels, obstruction lights shall be displayed for each 45m or fraction thereof. The position of these lights on the vertical plane shall be equidistant between the top lights and the ground level as the shape and type of obstruction will permit.

(e) Non Flashing obstruction red lights shall be mounted at the top of a high rise building. One such light shall be displayed at the outside corner on each level with the remaining lights evenly spaced between the corner lights.

(f) The spacing between lights at the same level or different level shall not exceed 45m. See Figure 5-2(a) and use the simple formula to determine:

(i) Number of levels required as structure height increases;
(ii) Determine the spacing between lights up to the top; and
(iii)The number of lights required at a level edge.

(1) Obstruction lights are broadly divided into three types of (low, medium and high intensities). Most manufacturers of obstacle lights provide lighting specifications meeting ICAO type ratings (see Tables 5-1 &5-2).
(2) The selection of a particular type of lighting depends on the height and the nature of the structure. Tables 5-3 provide types of obstacle lighting and their applications.

5.3 Operations and Maintenance of Obstruction Lightings

(a) Light units must be maintained and lit in poor visibility conditions at all times. Lighting shall be auto operational from dusk to dawn by a photocell or light controller (photo sensing device) and an optional transfer relay that powers the standby light if main light fails.

There must be a tower light monitoring systems to alert;

(i) a failed day/night photocell
(ii) an open tower lighting circuit breaker or utility power failure

(b) Lights are to be operational at nights and in low visibility weather conditions. The intensity variations/step changing for the types of lights under various visibility conditions are given in section 5.4.1.
(c) To allow maintenance planning and execution, mast operators are advised to consider the use of double light. Double light is integrated by 2 single lights (working + stand - by). If works with control box, it will auto-switch the "stand-by" light on when the "working" light fails, which makes sure that there is always a light working at the top of the tower.

"All objects (tower, masts, buildings, trees, water tanks, equipment etc.) within and outside the specified radius of the aerodrome, shall be lighted in accordance with the applicable SLCARs."

5.4 Monitoring

(a) Obstruction lighting systems shall be closely monitored by the aerodrome operator either by visual or automatic means. It is extremely important to visually inspect obstruction lighting in all operating intensities at least once every 24 hours on systems without automatic monitoring.
(b) Each light unit must be monitored for FLASH/FAIL status. FLASH/FAIL status is defined as either of the following conditions:
(i) unit misses four or more consecutive flashes;
(ii) unit flashes at wrong intensity step during day operation;
(iii)outage of any lamp
(c) Monitoring must be fail/safe (i.e., active signals for FLASH and absence of signals for FAIL). There must be a provision to permit connection to a remote alarm device, (supplied by others or as an option), to indicate the system and individual light unit FLASH/FAIL status.

(d) In the event a structure is not readily accessible for visual observation, a properly maintained automatic monitor shall be used. This monitor shall be designed to register the malfunction of any light on the obstruction regardless of its position or color.
(e) When using remote monitoring devices, the communication status and operational status of the system should be confirmed at least once every 24 hours. The monitor (aural or visual) should be located in an area generally occupied by responsible personnel. In some cases, this may require a remote monitor in an attended location. For each structure, a log should be maintained in which daily operations status of the lighting system is recorded. Beacon lenses should be replaced if serious cracks, crazing, dirt build up, etc., has occurred.

5.4.1 Intensity Step Changing

(a) Obstruction lights shall be operated by satisfactory photocell (control device) adjusted so that the lights will be turned on when the sky illuminance reaching a vertical surface falls below a level of 60 foot-candles (645.8 lux) but before reaching a level of 35 foot-candles (367.7 lux).
(b) The control device shall turn the lights off when the northern sky illuminance rises to a level of not more than 60 foot-candles (645.8 lux). The lights may also remain on continuously.
(c) The Intensity Step changing given in Table 5-1 will depend on the ambient light intensity. The ambient intensity is the light available in the environment. There is no particular direction to the light source.
(d) In contrast, the light intensity is the effect of a simulated light source placed at the viewer's line of sight. The light intensity affects the intensity of the highlights and shadows, while the ambient intensity affects the brightness of the objects in the overall scene.
(e) The following is the ambient background lighting conditions:

Day: >500 candles/m²

Twilight: =50 – 500 candles/m²

Night: < 50 candles/m²

5.4.2 White Obstruction Lights

Steady white light must not be used for obstruction lighting purposes. White obstruction lights shall automatically change intensity steps when the ambient light changes as follows:

(a) From **day to twilight** intensity when the illumination is 60-35 foot-candles
(b) From **twilight to night** intensity when the illumination decreases 5-2 foot candles.
(c) From **night to twilight** intensity when the illumination increases 5-2 foot candles.
(d) From **twilight to day** intensity when the illumination increases above 60-35 foot-candles.

Note:

L [lx] = 2.5 x $2^{EV(Exposure\ condition)}$

1 foot-candle = about 10.764 lux;

EV 1 approx. equals to 0.46 foot candle or 5 lux.

5.4.3 Red Obstruction Lights

If automatic control is utilized, the light unit shall turn on when the ambient light decreases to not less than 35 foot-candles and turn off when the ambient light increases to not more than 60 foot-candles. Single L-810 light units are controlled in a manner compatible with the particular installation. The use of double steady red obstruction lighting1 is not mandatory. It is however recommended for maintenance planning purposes to allow time for defective light to be changed.

5.4.4 Red & White (Dual) Obstruction Lighting System

(a) Normally, dual obstruction lights[2] are used for enhancing the conspicuity of very high structures during day and night. White obstruction lights shall turn off and red obstruction lights shall turn on when ambient light changes from twilight to night when the illumination is 5-2 foot-candles.

(b) Red obstruction lights shall turn off and white obstruction lights shall turn on when ambient light changes from night to twilight when the illumination increases 2-5 foot-candles.

5.4.5 Light Units

(a) The light unit must be designed for easy servicing and lamp (or flashtube) replacement. Each unit must be an independent unit and must flash at the specified intensity where applicable, or at its highest intensity when control signals are absent.
(b) For safe maintenance purposes, the installation of double lights units at each required point is encouraged for one to provide continuous service when preparations are being done to replace a burnt out light.

Table 5-1: Types of Light Units

Type	Description	Intensities Step Requirements
L-810	Steady-burning Red Obstruction Light	Intensity 2,000 ± 25%
L-856	High Intensity Flashing White Obstruction Light (40FPM)	Day -200,000 ± 25%
		Twilight -20,000 ± 25%
		Night -2,000 ± 25%
L-857		Day -200,000 ± 25%

	High Intensity Flashing White Obstruction Light (60 FPM)	Twilight -20,000 ± 25%
		Night -2,000 ± 25%
L-864	Flashing Red Obstruction Light (20-40 FPM)	Single Intensity 2,000 ± 25%
L-865	Medium Intensity Flashing White Obstruction Light (40 FPM)	Day/ Twilight 20,000 ± 25%
		Night -2,000 ± 25%
L-866	Medium Intensity Flashing White Obstruction Light (60 FPM)	Day/Twilight 20,000 ± 25%
		Night -2,000 ± 25%
L-885	Flashing Red Obstruction Light (60 FPM)	Single Intensity 2,000 ± 25%
FPM = ***Flashes Per Minute***		

1 Double obstruction light is assembly of two steady red lights units

2 Dual obstructions light is a combination of steady red and flashing white lights

Note - The requirements for L-866 are the same as the L-865 light unit, except the flash rate. The requirements for L-885 are the same as the L-864 light unit, except the flash rate.

Table 5-2: Calculation of Obstruction Light

Obstruction Lights	**ICAO Type**			
	A	**B**	**C**	**D**
Low Intensity Less extensive objects height<**45m**.	**Steady Red** lights (for fixed obstacle) **Compatible Light Units** L-810 **Intensity Step Changing** Night ≥ 10 candelas	**Steady Red** lights (for fixed obstacle) **Compatible Light Units** L-810 **Intensity Step Changing** Night≥ 32 candelas	**Flashing Yellow/Blue** lights (60-90 fpm) (for mobile obstacle) **Compatible Light Units Intensity Step Changing** ≥ 40 candelas	**Flashing Yellow** lights (6090fpm) (for "Follow-me" Vehicles) **Compatible Light Units Intensity Step Changing** ≥ 200 candelas
Medium Intensity Extensive objects or height >**45m**.	**Flashing White** lights (20-60 fpm) **Compatible Light Units** L-865; 40FPM L-866; 60FPM **Intensity Step Changing** Day ≥ 20,000 cd Twilight ≥ 20,000 cd Night ≥ 2000 cd	**Flashing Red** lights (20-60fpm) **Compatible Light Units** L-864; 20-40 FPM L-885; 60FPM **Intensity Step Changing** Night ≥ 2000 candelas	**Steady Red** lights **Compatible Light Units** L-810 **Intensity Step Changing** Night ≥ 2000 candelas	
High Intensity (Object height >**150m**)	**Flashing White** lights (40-60 fpm) **Compatible Light Units** L-856; 40FPM L-857; 60FPM **Intensity Step Changing** Day ≥ 200,000 cd Twilight ≥ 20,000 cd Night ≥ 2,000 cd			

Table 5-3: Structure Height & Light Units Application/Combinations

HEIGHT OF STRUCTURE ABOVE SURROUNDING GROUND	MARKED	OBSTRUCTION LIGHTING
<45m	YES	At night/low visibility conditions **Low Intensity Type-A/B -**
>45m<105m	YES	At night/low visibility conditions **Low Intensity Type-A/B -** (Lower level) &**Medium Intensity Light Type-B/C -**(Upper level)
>45m<105m	YES	At night/low visibility conditions **Medium Intensity Light Type-A**
>105m <150m	YES	Night/low visibility conditions **Low Intensity Obstruction Type-A/B -**(Lower level) **& Medium Intensity Light Type-B/C -**(Upper level)
>105m <150m	YES	At Night/low visibility conditions **Medium Intensity Light Type-A**
>150m	YES	At Night/low visibility conditions **Low Intensity Obstruction Type-A/B -**(At multiple lower levels) &**Medium Intensity Light Type-B/C -**(Upper level)
>150m	YES	Day & Night/low visibility conditions **Medium Intensity Light Type-A** (At multiple levels)
>150m	YES	Day & Night/low visibility conditions **High Intensity Obstruction Light Type-A -**(At multiple levels)

5.5 Marking of Structures

(a) Low flying aircraft, in spite of the modern navigational facilities on board, need prominent obstruction markings in their flight paths. These markings shall be visible enough to attract the pilot's attention.

(b) Obstructions are generally marked using a combination of two of three basic colours.

(i) The structure should be marked/painted to show alternating equal bands of **Aviation Orange/Red and White**.

(ii) Coloured patterns used to mark objects shall consist of rectangles of not less than 1.5m and not more than 3m on a side, the corners being of the darker colour. This applies to skeletal types of structure as well. The bands shall be perpendicular to the longest dimension of the structure (See Figures 5-1(a) & (b)).

(iii)The width of each band depends upon the total height of the particular structure.

Table 5-4 provides the bandwidth applicable to the differing structure heights.

5.5.1 Calculation of Width of Marking Band

Example (A): Structure 60m high.

Width of Band – since structure is greater than 1.5m but not exceeding 210m, Band width is 1/7 of 60m = 8.75m **(See Table 5-4)**

Table 5-4: Marking band widths

Longest Dimension Greater than	Not exceeding	Band Width
210m	270m	1/9 of longest dimension
270 m	330m	1/11 of longest dimension
330m	390m	1/13 of longest dimension
390m	450m	1/15 of longest dimension
450m	510m	1/17 of longest dimension
510m	570m	1/19 of longest dimension
570m	630m	1/21 of longest dimension

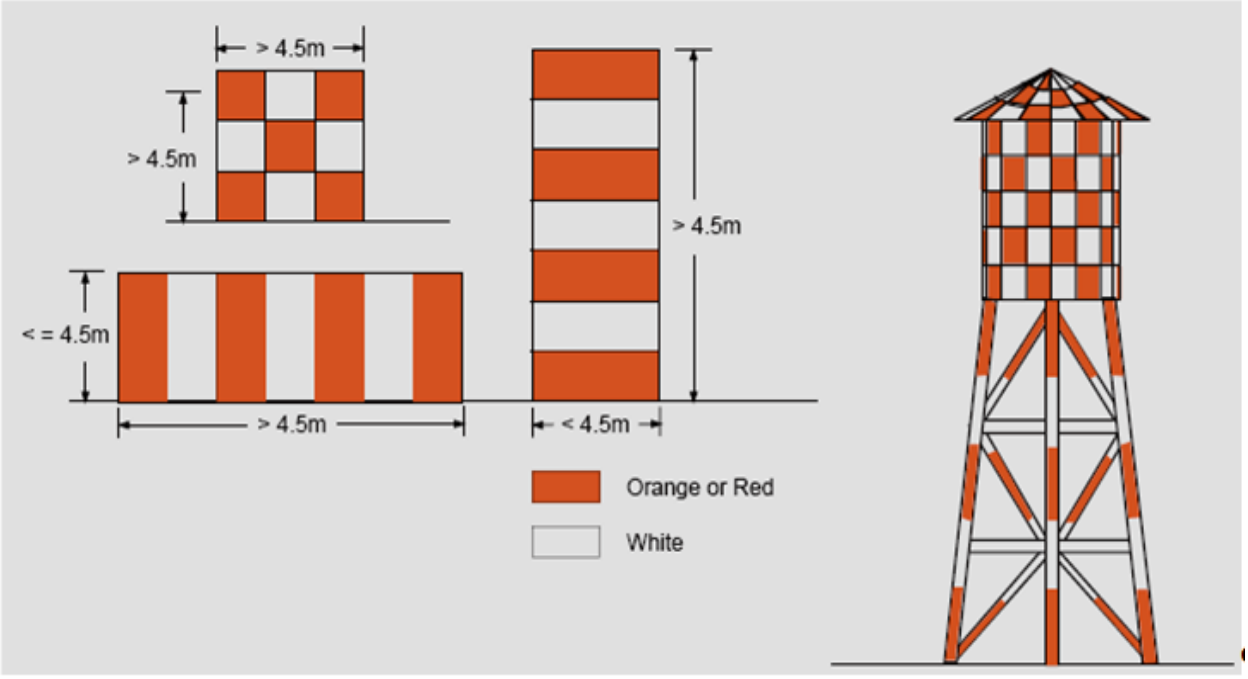
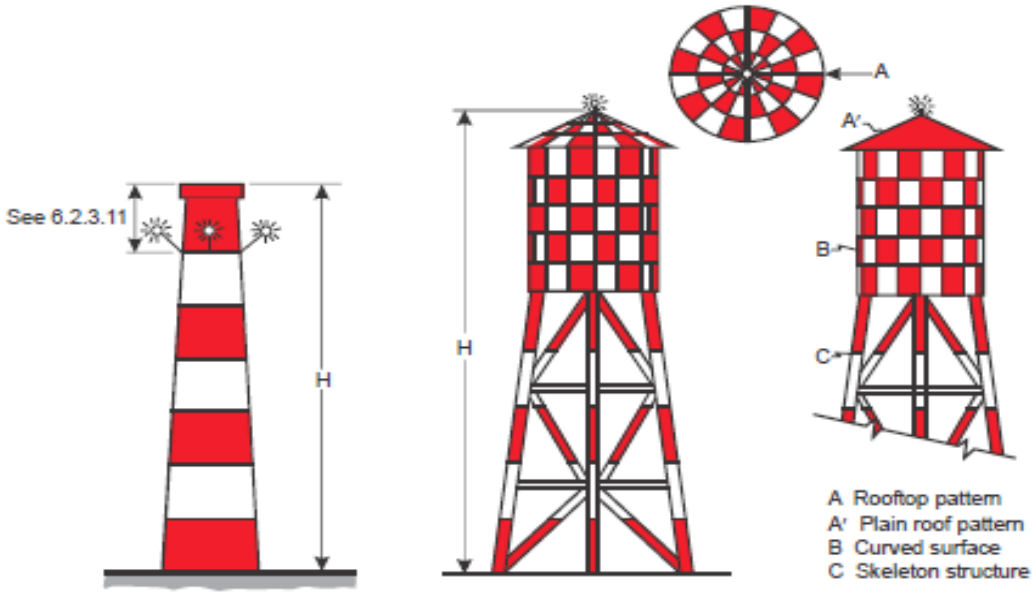
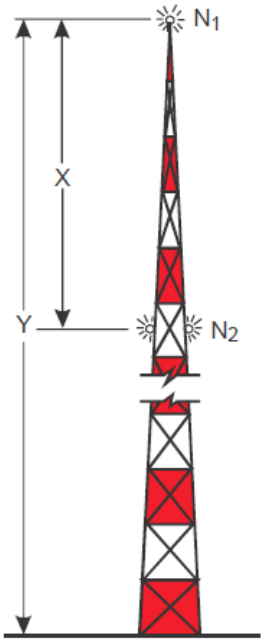


Figure 5-1 (a): Basic marking patterns



Note.— H is less than 45 m for the examples shown above.
For greater heights intermediate lights must be added as shown below.

Figure 5-1 (b): Marking and lighting of tall structures



Light spacing (X) in accordance with IS 6.1.1.4 of SLCAR Part 14A

$$\text{Number of levels of lights} = N = \frac{Y \text{ (metres)}}{X \text{ (metres)}}$$

Figure 5-2 (a): Lighting of tall structures (No. and Spacing)

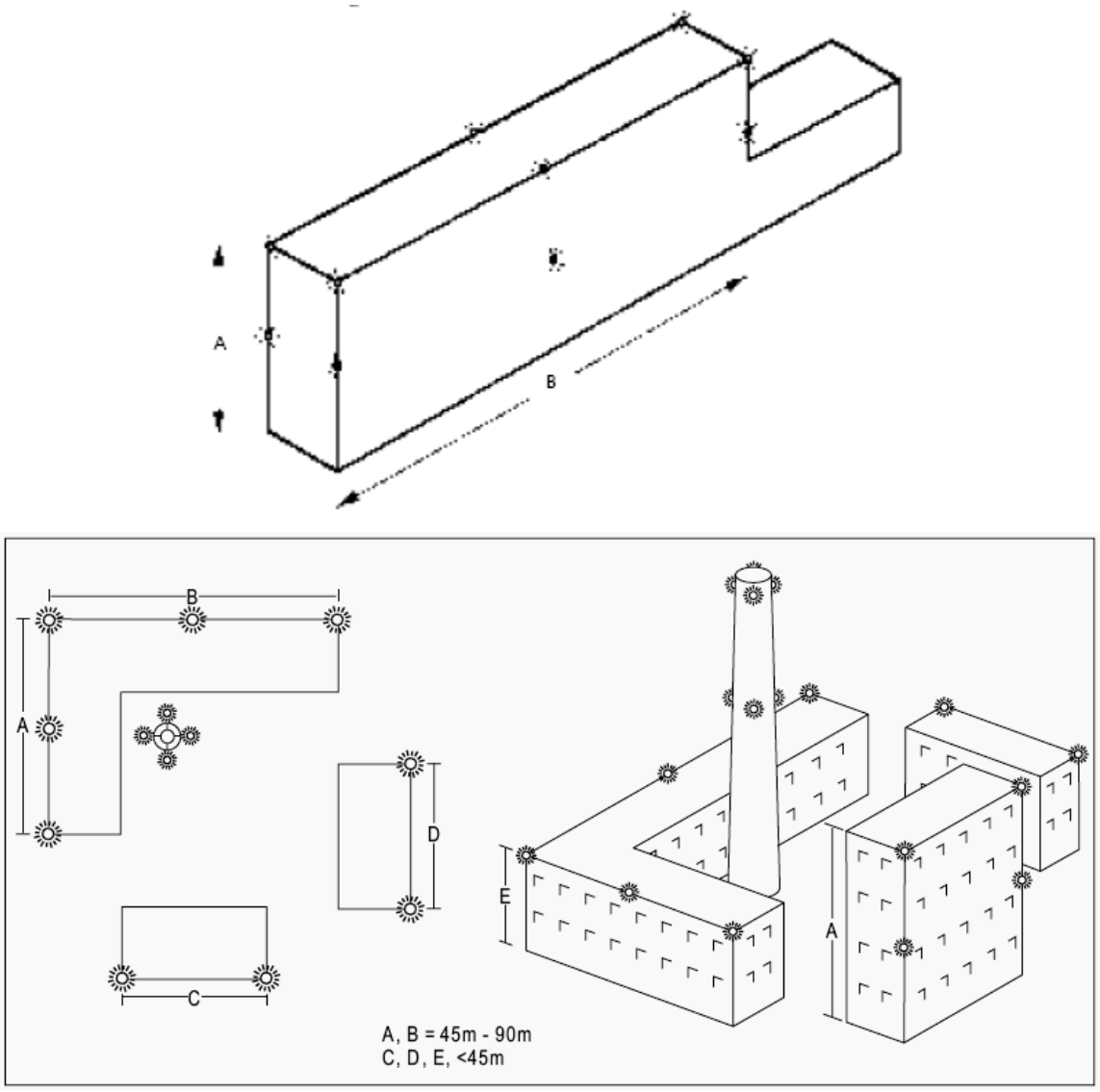


Figure 5-2(b): Lighting of buildings

5.5.2 Suspended Cable Span Markings

(a) Aerial/Obstruction warning is primarily meant to help pilots see the lines to avoid running into them.

(b) Aerial/obstruction marker balls shall be displayed on the following along the flight path to warn pilots during the day;
   (i) High-rise Power transmission Lines
   (ii) High slung Cable-car lines
   (iii) Ropeway cables
   (iv) Guy Wires

Note - The warning sphere shall conform to the specifications in the SLCAR Part 14A.

(c) When a smaller airport is located in the area, the balls help guide the pilots as they come in to land. Suspended cable spans, assessed as being hazardous to air navigation are normally marked with coloured balls suspended from a messenger cable between the top of the support towers.

(d) In addition to being used for airports, the red balls are used in other areas where aircraft frequent, and to delineate power lines that cross rivers, canyons or ravines. For instance, some larger hospitals offer helicopter transfer of patients. Since a hospital is not set up in the same way that an airport is, the balls may be installed on power lines near the hospital to help guide the pilot. If there are any areas where emergency medical evacuations are common, the balls may be used on lines in these areas as well.

(e) The support towers are obstruction painted. When painting the support towers is not practical, or to provide added warning, shore markers painted international orange and white will be displayed. In some cases, older marker panels that have not been updated are of a checkerboard design.

(f) An alternative method of marking is to use strobe lights on shore-based cable support towers. Normally three levels of lights are installed as follows: one light unit at the top of the structures to provide 360° coverage; two light units on each structure at the base of the arc of the lowest cable; and two light units at a point midway between the top and bottom levels with 180° coverage. The beams of the middle and lower lights are adjusted so that the signal will be seen from the approach direction on either side of the power line. The lights flash sequentially: middle lights followed by the top lights and then the bottom lights in order to display a "fly up" signal to the pilot. The middle light may be removed in the case of narrow power line sags; in this case the bottom lights will flash first then the top lights will flash in order to display a "fly up" signal to the pilot. When determined appropriate by an aeronautical study, medium-intensity white flashing omnidirectional lighting systems may be used on supporting structures of suspended cable spans lower than 150m (500ft) AGL.

5.5.3 Specifications for Aerial/Obstruction Marker Balls

(a) Obstruction markings on aerial cables (i.e., marker balls) that define aeronautical hazards are generally placed on the highest line for crossings where there is more than one cable.

(b) In this case, the marker balls are placed on the lowest power line and are displayed to water craft as a warning of low clearance between the water and an overhead cable. See Figure 5-3 for illustration.

(c) In accordance with the foregoing, pilots operating at low levels may expect to find power line crossings marked as either an aeronautical hazard. They may be unmarked if it has been determined by the SLCAA that it is not an aeronautical hazard. Pilots operating at low altitudes must be aware of the hazards and exercise extreme caution.

(d) Each ball shall be of a single solid colour. When installed, white and red, or white and orange markers shall be displayed alternately. The color selected shall contrast with the background against which it will be seen.

(e) Each ball shall not have a diameter less than 600mm. The spheres should be composed of two hemispheres provided with spring washers and lock nut which prevent the sphere from slipping.

(f) Drainage systems shall be provided in each of the hemisphere necessary to prevent water accumulation inside the sphere.

The spheres shall be either of the following colours;

(i) Orange
(ii) Red

Further guidance on subject, can be found in ICAO Doc 9137, Part 6 - Control of Obstacles.

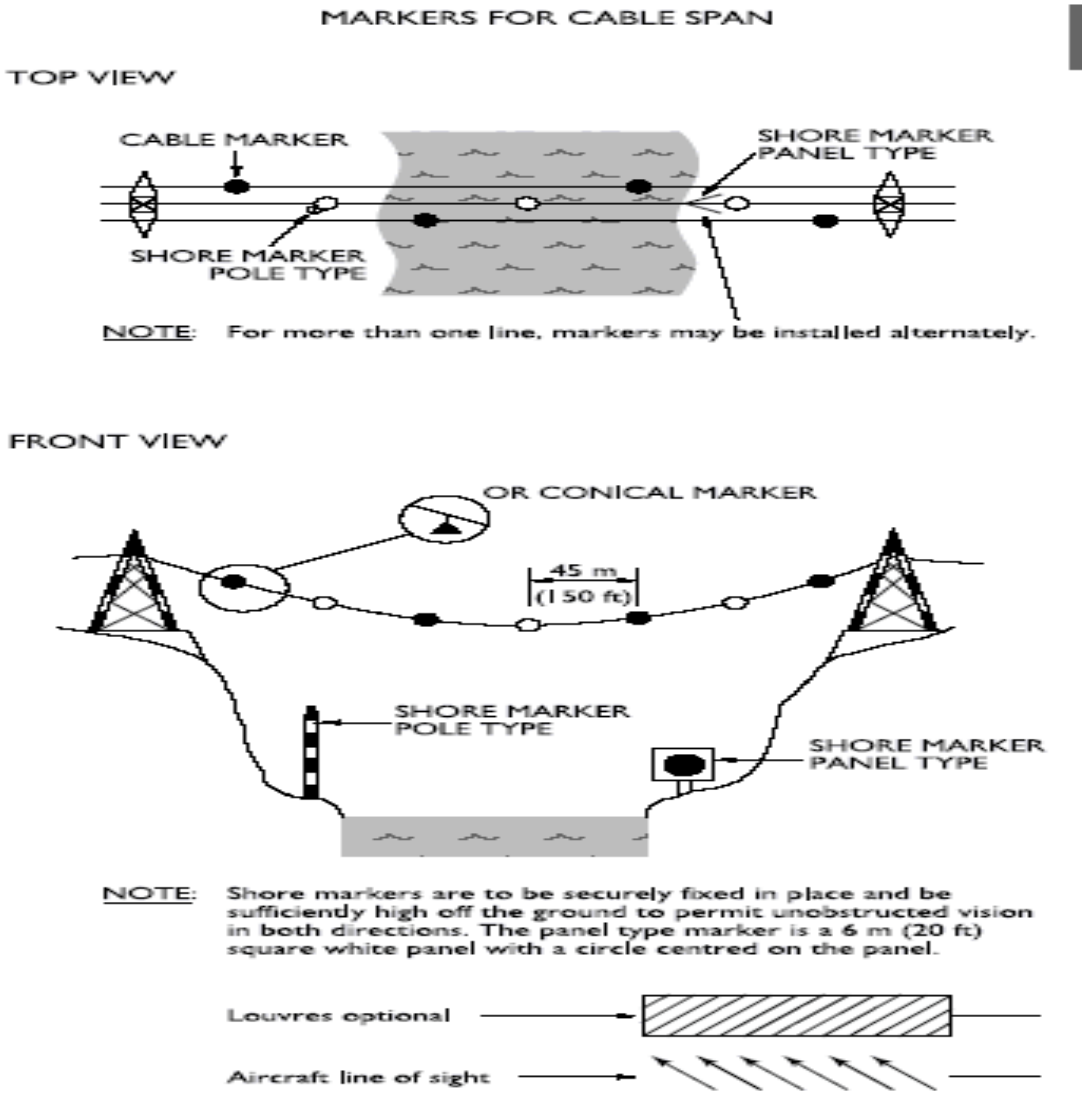


Figure 5-3: Marking of aerial cables

6 PROCEDURE FOR EVALUATING AERONAUTICAL EFFECTS OF PROPOSED CONSTRUCTION ON AIR NAVIGATION & AIRSPACE

6.1 General

(a) Airports have a unique need for operational safety that interacts with surrounding land uses. In particular, the need for runway approaches that are clear of obstructions is essential and should be the target of the aerodrome operators. The effective utilization of an aerodrome may be considerably influenced by natural features and man-made obstructions such as; towers, masts and high rising buildings within and outside its boundaries. The Airports operator should undertake to remove dangerous obstructions from the aerodrome and its vicinity.

(b) For the purposes of this section:

(i) Obstruction - Any structure, growth, or other object, including a mobile object, which exceeds a limiting height set forth by the SLCAR Part 14A.

(ii) Hazard to Air Navigation - An obstruction determined to have a substantial adverse effect on the safe and efficient utilization of the navigable airspace.

(c) Unauthorized high rise structures (Obstructions/Obstacles), may have negative impact on Aircraft Operations and may contribute to an air disaster. Obstructions may result in the limitation of the distance available for take-off and landing of an aircraft. Obstructions and other activities such as signal transmissions and laser projections may also affect air navigation.

(d) Structures located close to aeronautical installations at various locations countrywide may also distort signals received by aircraft from these installations and may create confusion for pilots. A degree of freedom from obstacles in these areas is very important in the retention of an aerodrome. For these and other reasons certain areas of the airspace is established as an integral part of the aerodrome's environment. Heights of structures must therefore be controlled in order not to penetrate these areas of the airspace.

(e) In the conduct of aeronautical studies, present and future IFR and VFR aeronautical operations and procedures are reviewed and any possible changes in those operations and procedures and in the construction proposal that would eliminate or alleviate the conflicting demands are ascertained.

6.2 Legislation and Regulatory Framework

(a) The Civil Aviation Act in force requires the Authority to be responsible for;
   (i) ensuring safety of air navigation and aircraft;
   (ii) minimizing or preventing interference with the use or effectiveness of apparatus used in connection with air navigation and for prohibiting or regulating the use of that apparatus and display of signs and lights likely to endanger aircraft;

(b) The Act provides for the efficient utilization of the navigable space, including the safe altitude of flights and the prevention of collision between aircraft, between aircraft and land or water, vehicles and any other objects and between aircraft airborne objects.

6.3 SLCAA Policy

(a) A structure is considered to have an adverse aeronautical effect if it first exceeds the obstruction standards of the SLCAR Part 14A, and/or is found to have physical or electromagnetic radiation effect on the operations of air navigation facilities.
(b) If a structure is found to have a significant adverse impact, a "hazard" determination will be issued. However, the aerodrome operator should work with the proponent until the conditions are met for a "no-hazard" determination.
(c) The Authority emphasizes the need for conserving the navigable airspace for aircraft operations; preserving the integrity of the national airspace system; and protecting air navigation facilities from either electromagnetic or physical encroachments that would preclude normal operation.
(d) The SLCAR Part 14A establishes standards for determining obstructions to air navigation. A structure that exceeds one or more of these standards is presumed to be a hazard to air navigation unless an obstruction evaluation study determines otherwise.

6.4 Notification of Proposed Construction or Alteration of Structures around the Vicinity of an Aerodrome

(a) Any development that may penetrate the obstacle limitation surfaces, including construction, establishment or erection of objects that may be regarded as obstacles at an aerodrome, shall be referred to the Authority for review. The review would examine the effect of the envisaged construction on air navigation and on operational procedures in use.
(b) In considering proposed construction, account shall be taken of possible future development at the aerodrome and consequent requirement for more stringent obstacle limitation surfaces.
(c) The obligation to notify of any proposed construction, or part thereof, which may constitute or generate obstacles, shall rest with the aerodrome operator, the developer or the property owner.
(d) Notification of construction, establishment or erection of objects that may constitute as obstacles shall be submitted to the Authority for approval using the form given in Appendix 2.
(e) Where an obstacle is to be located on the aerodrome, the aerodrome operator is responsible for notifying the Authority of such construction.
(f) The Authority may permit the proposed construction under certain terms and conditions to ascertain continued safety of air navigation.

6.4.1 Notice Requirements for Construction or Alteration

(a) Each sponsor proposing any kind of construction or alteration of a structure, shall apply to the Authority for obstruction evaluation and grant of Airspace Safety Permits if:
    (i) The overall height of structure above ground is more than 10m in height above ground level at its site and is within 5000m radius of an existing or proposed aerodrome.
    (ii) The proposed Structure within 10nm (18,500m) radius of an existing or proposed aerodrome and beyond 5000m and is between 10 and 46m in height.

(iii) Beyond 10nm radius of an existing or proposed aerodrome any structure which is 46m or higher. (1nm=approx.1850m)
(iv) A structure on designated low level flying routes or close to major highways
(v) The object, construction or alteration would be in an instrument approach area.
(vi) The object, construction or alteration is to be located within the distances above from an existing airport, an airport under construction or planned airport that is the subject of a notice on file with the Authority, as at the time of the airspace permit application.
(vii) A highway, railroad, or other traverse way for mobile objects, of a height which, if adjusted upward 5m for any highway where over crossings are designed for a minimum of 5m vertical distance, 4m for any other public roadway, 3m or the height of the highest mobile object that would normally traverse the road, whichever is greater, for a private road, 7m for a railroad, and for any other traverse way not previously mentioned, an amount equal to the height of the highest mobile object that would normally traverse it, would exceed a standard of section 6.4.1 (i) and (v) above.

(b) Notices received from applicants provide basis for:
(i) Evaluating the effect of the construction or alteration on operational procedures and proposed operational procedure;
(ii) Determining the possible hazardous effect of the proposed construction or alteration on air navigation;
(iii) Determining the requirements for marking and lighting of constructions or alterations, in accordance with the SLCAR Part 14A;
(iv) Determining other appropriate measures to be applied for continued safety of air navigation; and;
(v) Charting and other notification to airmen (NOTAM) of the construction or alteration.

(c) A notice filed with the Authority does not relieve the sponsor of compliance with laws, Agreements or Directives of any other governmental entity. The Authority reserves the right to file a suit against any sponsor who fails to notify the Authority of a construction or alteration to remove the structure.

6.4.2 Construction or Alteration not requiring Notice

No sponsor is required to notify the Director General for any of the following construction or alteration:

(i) Any antennal structure of 10m or less in height outside 15000m of the airport.
(ii) Any air navigation facility, airport visual approach or landing aid, aircraft arresting device, or meteorological device, of a type approved by the DG,SLCAA the location and height of which is fixed by its functional purpose.

6.4.3 Obstruction Evaluation & Approval Procedure

(a) The sponsor shall obtain approval from the Authority by submitting a completed form of notice (see Appendix 2) to the DG, SLCAA at least 60 days prior to the proposed date of commencement of construction or alteration.

(b) The notice specifies the locations, coordinates (in WGS 84), heights, and the natural ground level above mean sea level of the construction or alteration for which notice is required as prescribed in the form and manner of the notice.
(c) The Authority acknowledges receipt of the notice submitted by a sponsor in writing, and provides appropriate quotation of fees subject to the SLCAA Scheme of Charges.
(d) Sponsor makes payment of fees to the Authority arranges for site inspection. SLCAA Safety Inspectors conduct site inspection together with applicant's representatives to verify site information (tower height, location, topography, etc.) provided by the proponent. This is a very important step considering that proposals submitted may contain errors. Applicant is required to provide transportation to and from the site.
(e) SLCAA conducts aeronautical study, to determine whether it would be a "hazard to air navigation or not".
(f) An obstruction evaluation study shall identify:
    (i) the effect the proposal would have:
        (1) On existing and proposed public-used airports and/or aeronautical facilities.
        (2) On existing and proposed visual flight rule (VFR)/instrument flight rule (IFR) aeronautical departure, arrival and en-route operations, procedures, and minimum flight altitudes.
        (3) Regarding physical, electromagnetic, or line-of-sight interference on existing or proposed air navigation, communications, radar, and control systems facilities.
        (4) On airport capacity, as well as the cumulative impact resulting from the structure when combined with the impact of other existing or proposed structures.
    (ii) the nature of marking and/or lighting

6.4.4 Evaluating Aeronautical Effect and Issuing a Determination

(a) The outcome of an evaluation of proposed construction or alteration may be one of the following:
    (i) object will exceed any standard and will not be a hazard to air navigation; or
    (ii) object will exceed a standard but will not be a hazard to air navigation; or
    (iii)object will exceed a standard and will be a hazard to air navigation
(b) The Authority upon conducting aeronautical studies may issue an AIRSPACE SAFETY PERMIT if the effect of the proposed development will not undermine the safe utilization of the navigable airspace.
(c) Where the Authority concludes that a clear and compelling showing has been made that it would not result in an inefficient utilization of the airspace and would not result in a hazard to air navigation, will a determination of no hazard be issued.
(d) A determination made by the Authority does not relieve the proponent of the responsibility for compliance with any local law, Directive, or any law of the State. Aeronautical studies and determinations do not consider environmental, land ownership or title issues or land use compatibility impacts. Studies conducted by the Authority specifically evaluate the effect the proposed structure may have on the safe and efficient use of the associated navigable airspace.

6.4.5 Objection from the Authority

The Authority may decline a permit in the following situations in relation to the construction or alteration of a structure:

(i) exceeds the obstruction standards outlined in the SLCAR Part 14A and/or have a physical and/or electromagnetic effect on air navigational facilities.
(ii) requires a change to an instrument procedure or minimum flight altitude.
(iii) restricts control tower line-of-sight; is close to a visual landmark such as a highway, mine, reservoir, or any other point commonly used as a visual reference for VFR pilots.
(iv) underlie terminal airspace, creating traffic compression increasing risk of a mid-air collision.
(v) lies in an area in which a high volume of Air training activities is conducted.
(vi) lies along commonly used VFR egress or ingress tracks to an airport.

6.4.6 Annual Information Report & Annual Review Fee

(a) A person granted an Airspace Permit for a period not less than 12 months shall submit annually to the Authority, a Telecommunications Facility Annual Information Report. The submission of the Annual Report shall include the tower owner's name(s), address(s), phone number(s), contact person(s) and the review fee as prescribed in the SLCAA Scheme of Charges.
(b) The tower owner shall supply the tower height and current occupancy. The tower owner shall certify that the tower is still being used. This information shall be submitted on a signed form, designated for such use, and shall become evidence of compliance.

6.4.7 Compliance

(a) It is the responsibility of the owners of structures issued permit under the Sierra Leone Civil Aviation Regulations to ensure that conditions of the permit are adhered to. Failure to do so will render the permit invalid in accordance with the Civil Aviation Act in-force.
(b) The airspace permit ceases to be in-force if:
  (i) The owner of the telecommunication tower site, service provider and/or tower owner fails to comply with the requirements of the Permit;
    (1) The permittee has failed to comply with the conditions of the approval imposed;
    (2) The facility has not been properly maintained with regards to lighting and marking.
  (ii) Any antenna or tower that is not operated for a continuous period of twelve (12) months shall be considered abandoned. In such circumstances, the following shall apply:
    (1) The owner of such site, structure and the property owner upon which the site is located shall remove the said structure within sixty days (60) days of receipt of notice from the Authority of such abandonment. If the removal does not occur within the specified period, the SLCAA may order its removal. If there are two or more users of a single tower (co-location), then this provision shall not become effective until all operations of the tower cease.

(2) The recipient of a Permit for a telecommunications facility shall notify the Authority within 30 days of when the facility is no longer in operations.

6.4.8 Inspection Authority

Owners of structures must allow the Authority to make inspections, including unannounced inspections to determine compliance with the applicable Standards of the SLCARs for the purpose of ensuring the safety of aircraft.

6.4.9 Marking/Painting & Lighting of Structures

Structures are to be marked and lit in accordance with specifications contained in the SLCAR Part 14A and provision in chapter 5 of this AC.

6.5 Notice of Use of Light or Laser

Each person proposing to operate a light or laser within 18,500 meters of an airport reference point and below 3000 meters Above Ground Level (AGL) shall notify and seek clearance from the Authority.

6.6 Notice of Use of Weapons

(a) Any appropriate authority proposing to allow the use of weapons around an aerodrome and its surrounding vicinity that will fire or launch a projectile that will have a trajectory higher than 60 m shall notify the Authority.
(b) The use of weapons is prohibited within 15,000 m from the airport reference point.

6.7 Notice of Use of Pyrotechnics

(a) Each person proposing to stage a pyrotechnics display that will involve the firing or launching of a projectile that will have a trajectory higher than 60m, beyond 15000m from the airport reference point, shall notify the Authority.
(b) Pyrotechnics displays that will involve the firing or launching of a projectile that will have a trajectory higher than 60 m are prohibited within 15,000 m from the airport reference point.

6.8 Additional Notice Requirements

(a) Each person who is required to give notice, shall notify the DG, SLCAA in writing that the construction or alteration has reached its greatest height, within 5 days of it doing so.
(b) The notice required in (a) above, shall include a registered surveyor's determination of structures height and position and proof of compliance with marking and lighting requirements as determined by the Authority.
(c) Each person who abandons a construction or alteration project that is the subject of a notice with the Authority, shall notify the DG, SLCAA in writing within 5 days after the project is abandoned.
(d) Each person who dismantles, removes or suffers the destruction of a structure that is the subject of a notice to the Authority, shall notify the DG, SLCAA in writing, within 5 days after the construction or alteration is removed, dismantled or destroyed.

6.9 Evaluating Effects on Air Navigation and Communication Facilities

(a) The information contained in this part represents the minimum standards normally required for the protection of navigational aids and other communications systems. Structures conforming to these standards may be acceptable; however, confirmation must be obtained from the Authority.

(b) Planners should also be aware that specific applications which contravene the standards contained herein may sometimes be approved, provided analysis indicates that such approvals will be on a non-interfering basis.

(c) Consultation with the Authority must take place at an early stage in the project in order to avoid costly redesign or undue pressure when seeking building and site approvals. It is recommended that consultation take place at the building concept stage, before site approval is sought.

(d) Airways facilities at an airport permit the safe navigation of aircraft within the airspace of an airway, and includes; navigation aids along the airway for approach and landing at aerodromes, communication facilities, meteorological facilities and ATC facilities.

(e) The airways facilities for the safe, efficient operation of aircraft in the terminal area surrounding an airport and on the airport manoeuvring area, need in most instances, to be located on or at the perimeter of the aerodrome. Some of these facilities, in particular the precision approach facilities, must be positioned in precise geometric relativity to runways or runway centreline extensions. Most facilities have associated site clearance areas surrounding the site location to ensure proper operations of the facility.

(f) Nothing should be permitted to derogate the signals generated by any existing or planned electronic NAVAID or an existing ATC facility.

(g) The siting criteria for these facilities define the minimum requirements for uncompromised performance of each facility. In situations where non-compliance or infringement does not result in the facility being unsafe or completely unserviceable, functions of it may be degraded. Such degradation may, however, necessitate the facilities removal from service.

(h) General requirements for airways facilities are a finite site for their physical installation, i.e. shelters, foundations, towers, antennae plus a reasonable service area around the physical features. In many instances, there is also a requirement for a clearance zone around this space, in some instances relatively extensive, for the purposed of ensuring transmission of electromagnetic waves without interference from extraneous sources, or for the purpose of unimpeded vision in the cases of ATC towers or RFFS stations.

(i) The location of the radio navigation aids is largely determined by the air route or approach path on which they are to be used; they cannot normally be moved without some consequential change to or restriction placed on the approach path or air route.

(j) There are a set of siting considerations that must be addressed when siting a NAVAID on airport property. These include consideration of runway-associated safety elements, system object clearance areas, the footprint of the system, critical area impact on airport operations, interference to/from other systems, and installation considerations.

(k) Except for NDBs, radio navigation aids are more complex in terms of the transmitting equipment, the antenna design and the electromagnetic fields which are created about them. The accuracy of the paths defined by a particular navigation aid is determined not only by the transmitting facility but is largely dependent on the reflection of its

signals from the objects about the facility; the terrain, vegetation, buildings, power lines, aircraft, other vehicles, fences, ditches, etc. In designing a facility, the position of these objects is taken into account. For example, sites are chosen so that these objects will provide least signal degradation; the vegetation is cleared, the ground levelled in key areas, and power lines may be moved or buried.

(l) For the facility to remain a useful part of the airways system, these environmental characteristics have to be maintained and any proposals for change need to be carefully examined.

(m) During evaluation of structures, factors that may adversely affect any portion or component of the Airspace System must be considered. Electromagnetic interference potential may create adverse effects as serious as those caused by a physical penetration of the airspace by a structure, those effects shall be identified and stated.

(n) Proposed structures must be evaluated to determine if the structure will affect the performance of existing or proposed airspace facilities. The study must also include any plans for future facilities, proposed airports, or improvements to existing airports.

(o) The physical presence of a structure and/or the electromagnetic signals emanating or reflecting there from may have a substantial adverse effect on the availability, or quality of navigational and communications signals, or on air traffic services needed for the safe operation of aircraft.

(p) Airways facilities at an aerodrome may include any or all of the following:
   (i) navigation aid facilities
      (1) ILS (instrument landing system)
      (2) DME (distance measuring equipment)
      (3) VOR (very high frequency omni-direction radio range)
      (4) NDB (non-direction beacon)
   (ii) air/ground and point-to-point communications systems including radio bearer systems and satellite communications sites
   (iii) fire stations and ATC towers.

APPENDIX 1 - ILLUSTRATIONS OF OBSTACLE LIMITATION SURFACES OTHER THAN THOSE CONSTITUTING AN OBSTACLE-FREE ZONE

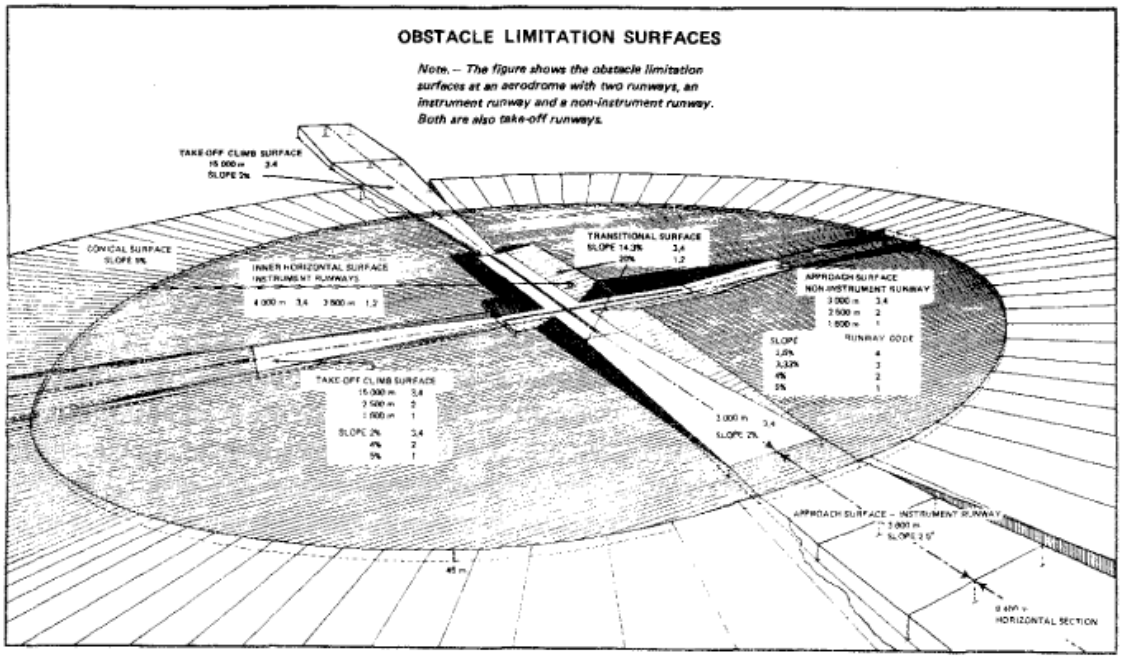


Figure A1-1

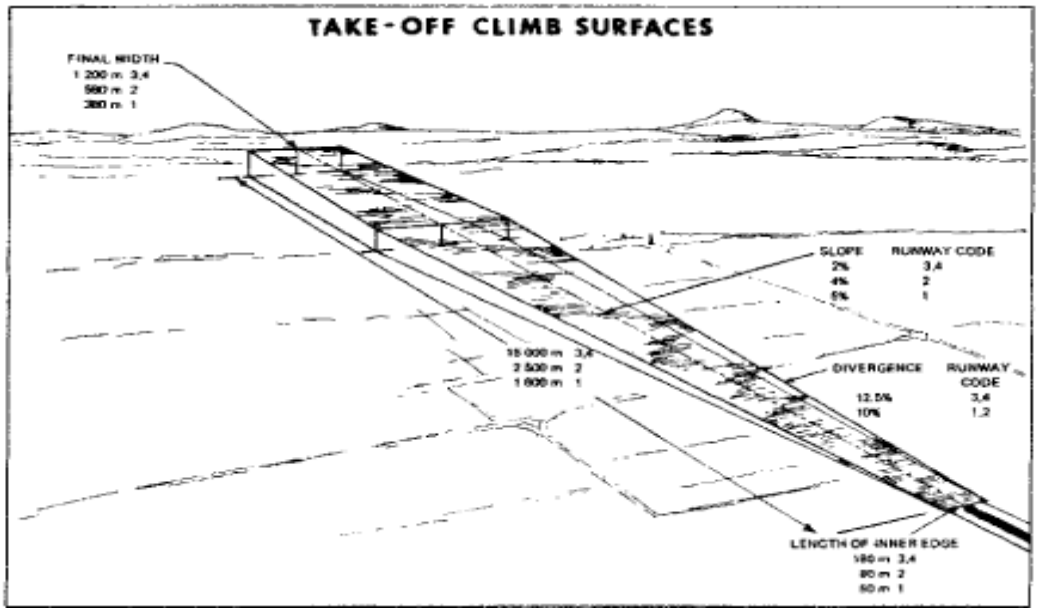
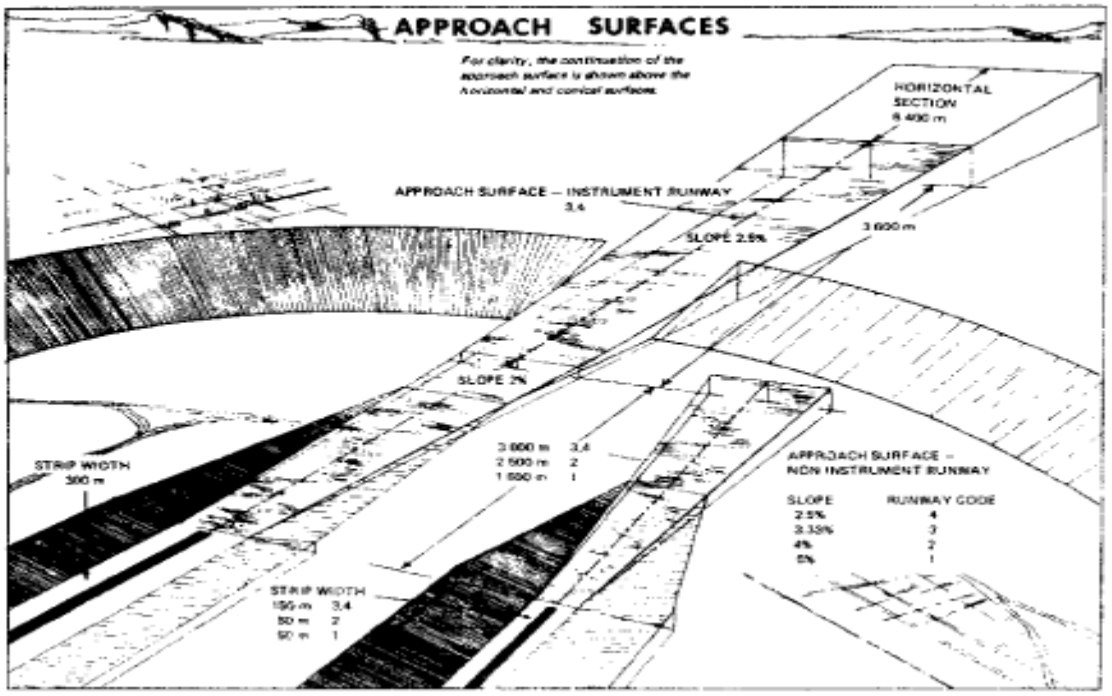
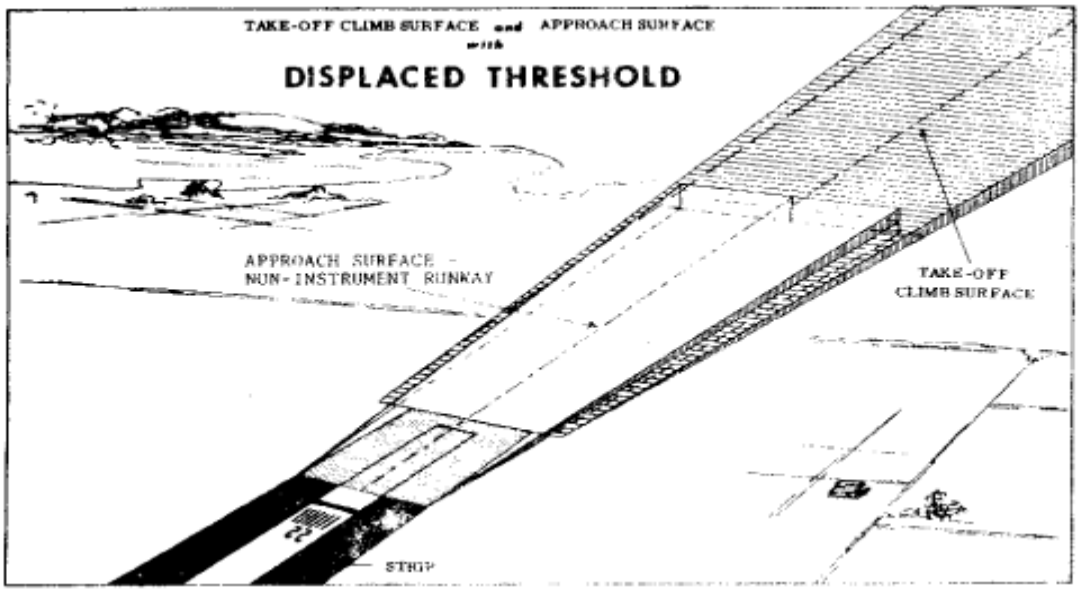


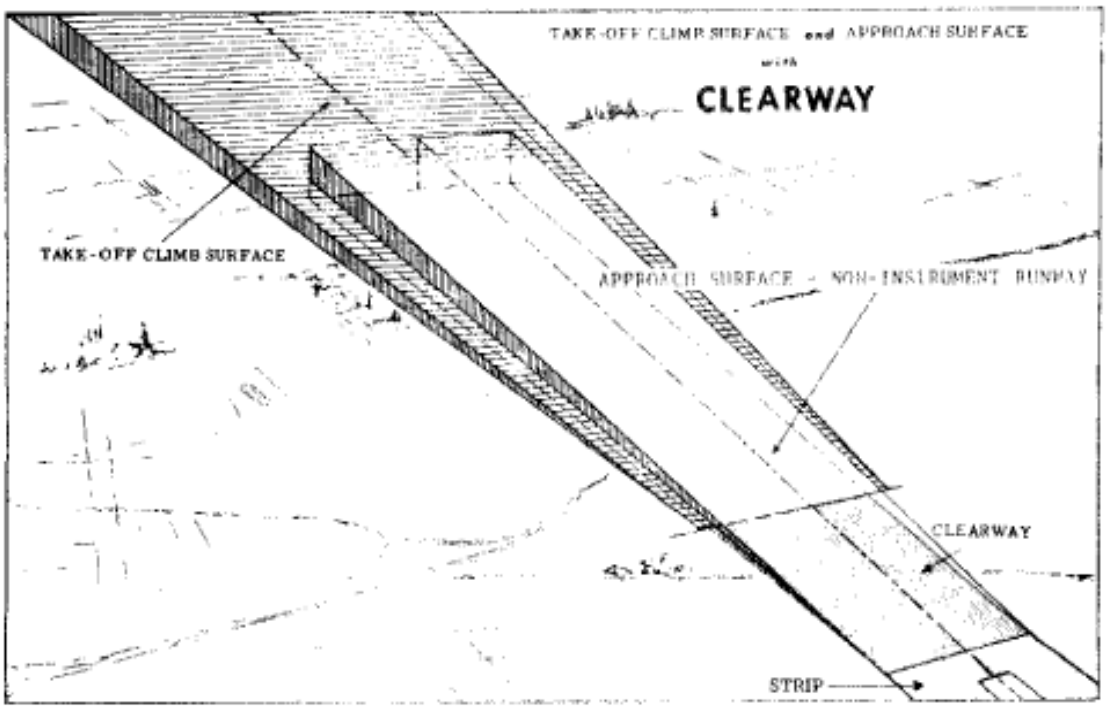
Figure A1-2



Appendix A1-3



Appendix A1-4



Appendix A1-5

APPENDIX 2 – FORM FOR THE NOTIFICATION OF CONSTRUCTION

SIERRA LEONE CIVIL AVIATION AUTHORITY

FORM FOR THE NOTIFICATION OF CONSTRUCTION

Form No: **AC-AGA011-Rev01**

Application form for the erection of an object in the vicinity of an aerodrome, to be filled by the applicant

PART 1: Particulars of the Applicant

1.1 Full Name:	
1.2 Trade Name:	
1.3 Full Business / Residential address:	
1.4 City/Town:	
1.5 Postal Address:	1.6 Email Address:
1.7 Telephone No:	1.8 Other contact:
1.9 Project owner / operator (if different from applicant):	
1.10 The applicant declares hereby that the particular provided in the application are true in every respect: ……. Signature	Date

PART 2: Particulars of the Structure to be erected

All coordinates shall conform to World Geodetic System 1984 (WGS-84) reference frame

2.1 Name of nearest aerodrome:
2.2 Total height of the proposed structure:
2.3 Elevation of the site above mean sea level:
2.4 Distance between the proposed structure to the nearest aerodrome reference point:
2.5 Geographical Coordinates of the proposed structure (WGS 84):
2.6 Proposed start date of construction:
2.7 Type of structure 2.7.1 Permanent ☐Building ☐Power line. Telephone line or overhead line ☐Other 2.7.2 Temporary ☐Crane ☐Other Description

PART 3: Documents to be submitted with the Application

3.1 Supporting Documents

Mark the appropriate block

☐Map showing the location of the proposed structure

☐Plan showing the total height of the structure

☐Letter of authorization if a third party is submitted the application on behalf of the project owner

☐Additional supporting document (specify)

Description

APPENDIX 3 - DIMENSIONS AND SLOPES OF OBSTACLE LIMITATION SURFACES - APPROACH RUNWAYS

	RUNWAY CLASSIFICATION									
	Non-instrument Code number				Non-precision approach Code number			Precision approach category I Code number		II or III Code number
Surface and dimensions[a]	1	2	3	4	1,2	3	4	1,2	3,4	3,4
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
CONICAL										
Slope	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Height	35 m	55 m	75 m	100 m	60 m	75 m	100 m	60 m	100 m	100 m
INNER HORIZONTAL										
Height	45 m	45 m	45 m	45 m	45 m	45 m	45 m	45 m	45 m	45 m
Radius	2 000 m	2 500 m	4 000 m	4 000 m	3 500 m	4 000 m	4 000 m	3 500 m	4 000 m	4 000 m
INNER APPROACH										
Width	—	—	—	—	—	—	—	90 m	120 m[e]	120 m[e]
Distance from threshold	—	—	—	—	—	—	—	60 m	60 m	60 m
Length	—	—	—	—	—	—	—	900 m	900 m	900 m
Slope								2.5%	2%	2%
APPROACH										
Length of inner edge	60 m	80 m	150 m	150 m	140 m	280 m	280 m	140 m	280 m	280 m
Distance from threshold	30 m	60 m	60 m	60 m	60 m	60 m	60 m	60 m	60 m	60 m
Divergence (each side)	10%	10%	10%	10%	15%	15%	15%	15%	15%	15%
First section										
Length	1 600 m	2 500 m	3 000 m	3 000 m	2 500 m	3 000 m	3 000 m	3 000 m	3 000 m	3 000 m
Slope	5%	4%	3.33%	2.5%	3.33%	2%	2%	2.5%	2%	2%
Second section										
Length	—	—	—	—	—	3 600 m[b]	3 600 m[b]	12 000 m	3 600 m[b]	3 600 m[b]
Slope	—	—	—	—	—	2.5%	2.5%	3%	2.5%	2.5%
Horizontal section										
Length	—	—	—	—	—	8 400 m[b]	8 400 m[b]	—	8 400 m[b]	8 400 m[b]
Total length	—	—	—	—	—	15 000 m	15 000 m	15 000 m	15 000 m	15 000 m
TRANSITIONAL										
Slope	20%	20%	14.3%	14.3%	20%	14.3%	14.3%	14.3%	14.3%	14.3%
INNER TRANSITIONAL										
Slope	—	—	—	—	—	—	—	40%	33.3%	33.3%
BALKED LANDING SURFACE										
Length of inner edge	—	—	—	—	—	—	—	90 m	120 m[e]	120 m[e]
Distance from threshold	—	—	—	—	—	—	—	c	1 800 m[d]	1 800 m[d]
Divergence (each side)	—	—	—	—	—	—	—	10%	10%	10%
Slope	—	—	—	—	—	—	—	4%	3.33%	3.33%

(a) All dimensions are measured horizontally unless specified otherwise.
(b) Variable length (see SLCAR Part 14A sections 4.2.9 or 4.2.17).
(c) Distance to the end of strip.
(d) Or end of runway whichever is less.
(e) Where the code letter is F, the width is increased to 140 m except for those aerodromes that accommodate a code letter F aeroplane equipped with digital avionics that provide steering commands to maintain an established track during the go-around manoeuvre.