1. PURPOSE

The purpose of this Advisory Circular (AC) is to provide guidance to aerodrome operators on the procedures and methods for controlling of obstacles at and in the vicinity of aerodromes in order to comply with the requirements of the Civil Aviation (Aerodromes) Regulations 2017.

2. REFERENCE

2.1. Civil Aviation (Aerodromes) Regulations 2017
2.2. Manual of aerodrome standards
2.3. ICAO Document 8168 - Aircraft Operations
2.4. ICAO Document 9137 - Airport Service Manual Part 6
2.5. ICAO Annex 4 - Aeronautical Charts
2.6. ICAO Annex 15 - Aeronautical Information Services
2.7. ICAO Annex 14 - Aerodromes

3. INTRODUCTION

3.1. The effective utilizations of an aerodrome may be influenced by natural features and manmade objects inside and outside the aerodrome boundary. Uncontrolled growth of such obstacles may result in limitations on the distance available for take-off and landing, higher weather minima for operations, restriction in the payload, restrictions on certain types of aircraft and possible closure of airports.

3.2. To ensure safety and efficiency of aircraft operations, 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 strip.

3.3. The criteria for controlling obstacles is be based on Obstacle Limitation Surfaces (OLS) and PANS OPS surfaces as detailed in Annex 14 and PANS OPS Document 8168 respectively.

4. CRITERIA FOR ASSESSMENT OF OBSTACLES USING ANNEX 14 OBSTACLE LIMITATION SURFACES

4.1. General

4.1.1. The broad purpose of the OLS is to define the volume of airspace that should ideally be kept free from obstacles in order to minimize the dangers presented by obstacles to aircraft, either during an entirely visual approach or during the visual segment of an instrument approach. The OLS are based on the aerodrome reference code and thus directly related to the critical aeroplane intended to operate at a particular aerodrome.

4.1.2. The OLS are intended to be of a permanent nature, and to be effective, they should be enacted in local Government laws. The surfaces established shall allow not only for existing operations, but also for the ultimate development envisaged for each aerodrome.

4.1.3. The OLS provided for the control of obstacles includes;

a) Outer Horizontal surface,
b) Inner Horizontal Surface,
c) conical surface,
d) approach surface,
e) transitional surfaces,
f) Inner Approach Surface,
g) Inner Transitional Surface, and
h) balked landing surface

4.2. Description of Annex 14 surfaces

4.2.1. Outer Horizontal Surfaces

4.2.1.1. Significant operational problems can arise from the erection of tall structures in the vicinity of airports beyond the areas currently recognized in Annex 14 as areas in which restriction of new construction may be necessary. The operational implications fall broadly under the headings of safely and efficiency.

4.2.1.2. In view of these potentially important operational considerations, airport operators are required to 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.

4.2.1.3. 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 30 m above local ground level, and higher than 150 m above aerodrome elevation within a radius of 15 000 m 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.

4.2.2. Inner Horizontal Surface and Conical Surfaces

4.2.2.1. 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.

4.2.2.2. 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 and use circular arcs centered on runway strip ends joined tangentially by straight lines. To protect two or more widely spaced runways, a more complex pattern could become necessary, involving four or more circular arcs.

4.2.2.3. To satisfy the intention of the inner horizontal surface, the airport operator shall select a datum elevation from which the top elevation of the surface is determined. Selection of the datum shall take account of;

a) the elevations of the most frequently used altimeter setting datum points;
b) minimum circling altitudes in use or required; and
c) the nature of operations at the airport

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

4.2.3. Approach and Transitional Surfaces

4.2.3.1. Approach and Transitional Surfaces define the volume of airspace that should be kept free from obstacles to protect an aeroplane in the final phase of the approach-to-land manoeuvre.

4.2.3.2. The slopes and dimensions of approach and transitional surfaces will vary with the aerodrome reference code and whether the runway is used for visual, non-precision or precision approaches.

4.2.4. Inner Approach, Inner Transitional and Balked Landing Surfaces

4.2.4.1. Together, these surfaces 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 frangible 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 I1 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.

4.2.4.2. 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 60 m on a precision approach below a height of 30 m having been correctly aligned with the runway at that height, to climb at a gradient of 3.33 per cent and diverge from the runway centre line at a splay no greater than 10 per cent. The gradient of 3.33 per cent is the lowest permitted for an all-engine-operating balked landing. A horizontal distance of 1 800 m 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 900 m which is equivalent to a maximum time of about 15 seconds. A slope of 33.33 per cent for the inner transitional surfaces results from a 3.33 per cent climb gradient with a splay of' I0 per cent.

4.2.5. Take off Climb Surfaces

4.2.5.1. The take off and climb surface provides protection for an aircraft on take-off by indicating which obstacles should be removed if possible and marked or lighted if removal is impossible.

4.2.5.2. The slopes and dimensions of dimensions and slopes will vary with the aerodrome reference code.

4.3. **Establishment of obstacle limitation surfaces**

4.3.1. The Airport operators shall establish the obstacle limitation surfaces and provide the CAA and local planning bodies (for use in developing height zoning limits) with pertinent information about the airport, including:

a) location, orientation, length and elevation of all runways;
b) locations and elevations of all reference points used in establishing obstacle limitation surfaces;
c) proposed categories of runway use - non-instrument, non-precision approach or precision approach (category I, II or III)
d) plans for future runway extension or change in category

4.3.2. It would be desirable to base all obstacle limitation surfaces on the most critical airport design features anticipated for future development, since it is always easier to relax a strict standard than to increase a requirement of a lesser standard if plans are changed. Some major airport make a practice of attempting to protect ail runways to the standards required for category III precision approaches, to maintain maximum flexibility for future development.

5. CRITERIA FOR ASSESSMENT OF OBSTACLES USING PANS OPS SURFACES

5.1. **General**

5.1.1. The PANS OPS surfaces are intended for use by procedure designers in the construction of instrument flight procedures and for specifying minimum safe altitudes/heights in order to safeguard aeroplanes from collision with obstacles when flying on instruments

5.1.2. The PANS OPS surfaces specify areas used by aircraft in holding, approach, visual circling and missed approach and enable airport operators to institute obstacle control measures beyond the Annex 14 surfaces in order to accommodate current and future demands in instrument approach operations.

5.1.3. The PANS OPS surfaces include the procedure design areas for the following instrument approach segments;

a) Holding procedure
b) Arrival,
c) Initial approach,
d) Intermediate Approach,
e) Final Approach,

f) Visual circling; and
g) Missed Approach

5.2. Descriptions of the PANS OPS surfaces

5.2.1. Minimum safe Altitude (Height)

5.2.1.1. In designing instrument approach procedures, the designer will determine areas (horizontally) needed for various segments as required for obstacle assessment. Based on the obstacle assessment, the minimum safe altitudes/heights for each segment of the procedure is established. The minimum safe altitude/height specified for the final approach phase of a flight is called Obstacle Clearance Altitude/Height (OCA/H). Close coordination between airport operators, ANSPs and the Authority is necessary to ensure that the descent minima are not infringed.

5.2.1.2. The size and dimensions of the obstacle-free airspace needed for the approach, for the missed approach initiated at or above the OCA/H and for the visual manoeuvring (circling) procedure are specified in PANS-OPS Document 8168.

5.2.1.3. The airspace required for an approach (including missed approach and visual circling) is bounded by surfaces which do not usually coincide with the obstacle limitation surfaces specified in Annex 14.

5.2.2. Basic ILS surfaces

5.2.2.1. The "basic ILS surfaces" defined in PANS-OPS Document 8168 represent the simplest form of protection for ILS operations. These surfaces are extensions of certain Annex 14 surfaces, referenced to threshold level throughout and modified after threshold to protect the instrument missed approach.

5.2.3. Obstacle assessment surfaces

5.2.3.1. The obstacle assessment surfaces (OAS) establish a volume of airspace, inside which it is assumed the flight paths of aeroplanes making ILS approaches and subsequent missed approaches will be contained with sufficiently high probability. Accordingly, aeroplanes need normally only be protected from those obstacles that penetrate this airspace; objects that do not penetrate it usually present no danger to ILS operations. However, if the density of obstacles below the OAS is very high, these obstacles will add to the total risk and may need to be evaluated.

5.2.3.2. The difference between the basic ILS surfaces and the OAS is that the dimensions of the latter are based upon a collection of data on aircraft ILS precision approach performance during actual instrument meteorological conditions, rather than existing Annex 14 surfaces.

5.2.4. ILS Collision Risk Model (CRM)

5.2.4.1. The Collision Risk Model (CRM) is a computer programme that calculates the probability of collision with obstacles by an aeroplane on an ILS approach and subsequent missed approach.

5.2.4.2. The CRM may be used to assist in

a) Aerodrome planning during evaluation of possible location of new runways in a given geographical and obstacle environment
b) Deciding whether or not an existing obstacle should be removed
c) Deciding whether or not a particular new construction will result in an increase in OCA/H

5.2.5. Visual manoeuvring (circling procedure)

5.2.5.1. Visual manoeuvring described in the PANS-OPS, is a visual extension of an instrument approach procedure. The size of the area for a visual manoeuvring varies with the speed of aircraft. It is permissible to eliminate from consideration a particular sector where a prominent obstacle exists by establishing appropriate operational procedures.

5.2.5.2. In many cases, the size of the area will be considerably larger than that covered by the Annex 14 inner horizontal surface. Therefore circling altitudes/heights calculated according to PANS-OPS for actual operations may be higher than those based only on obstacles penetrating the inner horizontal surface area.

Note 1: It must be stressed that a runway protected only by the obstacle limitation surfaces of Annex 14 will not necessarily allow the achievement of the lowest possible operational minima if it does not, at the same time, satisfy the provisions of the PANS-OPS.

Note 2: Consideration needs to be given to objects which penetrate the PANS-OPS surfaces, regardless of whether or not they penetrate an Annex 14 obstacle limitation surface, and such obstacles may result in an operational penalty.

6. CONTROLLING OBSTACLES AT AN AIRPORT

6.1. Background

6.1.1. When buildings encroach on the airspace needed for aircraft operations a conflict of interest arises between property owners and airport operators. If such differences cannot be resolved it can be necessary for the Authority to establish restrictions limiting operations in the interest of safety. Such restrictions might take the form of requiring displaced thresholds (resulting in a reduction in effective runway length), higher weather minima for operations, reductions in authorized aircraft masses and possibly restrictions of certain aircraft types. Any of these actions could seriously affect orderly and efficient air transportation to an airport and adversely affect the economy of the communities served by the airport

6.1.2. Control of obstacles in the vicinity of airports is, therefore, a matter of interest and concern to Authority, airport operators, local governments and communities and property owners. There are severe legal, economic, social and political limitations to what can be achieved by any of these interests with respect to an existing airport where obstacles already exist. Every effort should be exerted by all interested parties to prevent erecting of future obstacles and to remove or lower existing obstacles.

6.2. Legal authority and responsibility

6.2.1. Pursuant to the Civil Aviation Act and the Civil Aviation (aerodromes) Regulations, the Authority may impose prohibitions or restrictions on the use of any area of land or water in the vicinity of aerodromes as may be necessary to ensure safe and efficient aircraft operations.

6.2.2. The ultimate responsibility for limitation and control of obstacles must, rest with the airport operator. This includes the responsibility for controlling obstacles on airport property and for arranging the removal or lowering of existing obstacles outside the airport boundaries. The latter obligation can be met by negotiations leading to purchase or condemnation where authorized.

6.2.3. The aerodrome operators, local governments, planning agencies and construction licensing authorities should develop height zoning regulations based on appropriate obstacle limitation surfaces, and limit future developments accordingly. The airport operators shall require property owners or developers to give formal notice of any proposed structure which may penetrate an obstacle limitation surface. Local bodies should co-operate closely with airport operators to ensure that the measures taken provide the greatest possible degree of safety and efficiency for aircraft operations, the maximum economic benefits to neighboring communities and the least possible interference with the rights of property owners

6.2.4. Each airport operator shall designate a member of his staff to be responsible for monitoring the growth of obstacles at and in the vicinity of aerodromes and coordinate with local authorities prevent unauthorized growth of obstacles.

6.2.5. In order to fulfill these obligations, the airport operator should establish a programme of regular and frequent visual inspections of all areas around the airport in order to be sure that any construction activity or natural growth (i.e. trees) likely to infringe any of the obstacle limitation surfaces is discovered before it may become a problem.

6.3. **Methods of control**

6.3.1. **Height zoning** The objective of height zoning is to protect the aerodrome obstacle limitation surfaces from intrusion by man-made objects and natural growth such as trees. Height zoning may provide for a minimum allowable height for land use in the vicinity of the aerodrome. Land use zoning is also a means of preventing erection of new obstacles.

6.3.2. **Obstacle Removal**

6.3.2.1. When obstacles have been identified, the aerodrome operator should make every effort to have them removed, or reduced in height so that they are no longer obstacles. If the obstacle is a single object it may be possible to reach agreement with the owner of the property to reduce the height to acceptable limits without adverse effect.

6.3.2.2. 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 the trees when necessary, or by permitting access to the premises to have the trimming done by the aerodrome operator’s representative.

6.3.2.3. 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 significant damage to and aircraft. Where necessary, such objects should be marked and/or lighted.

6.3.3. **Purchase of Easements and Property Rights**

6.3.3.1. In those areas where zoning is inadequate the aerodrome operator may take steps to protect the obstacle limitation surfaces by other means. Examples of other means might be such as gaining easements or property rights. They should include removal or reduction in height of existing obstacles and measures to ensure that no new obstacles are allowed to be erected in future.

6.3.3.2. An aerodrome authority could achieve these objectives either by purchase of easements or property rights. Of these two alternatives, the purchase of easements would often prove to be more simple and economical. In this case, the aerodrome authority secures the consent of the owner (after paying suitable compensation) to lower the height of the obstacle in question. This may be done by direct negotiation with the property owner. Such an agreement should also include a provision to prevent erection of future obstacles, if height zoning limits are not in effect or are inadequate to protect obstacle limitation surfaces.

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

6.3.4. **Obstacle shielding**

6.3.4.1. The principle of obstacle shielding is employed to permit a more logical approach to restricting new construction and to prescribing obstacles marking and lighting. Shielding principles are employed when some object, an existing building or natural terrain, already penetrates above one of the aerodrome limitation surfaces. If it 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.

6.3.4.2. The shielding effect of immovable obstacle 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 a turned take-off procedure. 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.

6.4. **Marking and lighting of obstacle**

6.4.1. Where it is impractical to eliminate an obstacle, it should be appropriately marked and/or lighted so as to be clearly visible to pilots in all weather and visibility conditions. The Manual of Aerodrome Standards contains detailed requirements concerning marking and/or lighting of obstacles.

6.4.2. It should be noted that the marking and lighting of obstacles is intended to reduce hazards to aircraft by indicating the presence of the obstacles. It does not necessarily reduce operating limitations which may be imposed by the obstacle. The Manual of Aerodrome Standards specifies that obstacles be marked and, if the aerodrome is used at night, lighted, except that:

a) Such marking and lighting may be omitted when the obstacle is shielded by another obstacle; and

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

6.4.3. Vehicles and other mobile objects, excluding aircraft, on movement areas of aerodromes should be marked and lighted, unless used only on apron areas.

6.4.4. Installation and maintenance of required marking and lighting may be done by the property owner, by community authorities or by the aerodrome operator. The aerodrome operator should make a daily visual inspection of all obstacle lights on and around the aerodrome, and take steps to have inoperative lights repaired. Aerodrome operators may find it helpful to use dual light fixtures with an automatic switch to the second light fixture in case the first one fails. Such an arrangement provides greater assurance of continued obstacle lighting and reduces the number of visits to replace inoperative lamps

6.5. **Notification of proposed construction**

6.5.1. One of the difficult aspects of obstacle control is the problem of anticipating new construction which may penetrate obstacle limitation surfaces. Airport operators have no direct means of preventing such developments. As noted above, they should conduct frequent inspections of the airport environs to learn of any suck projects. Although there is no legal obligation for airport operators to report proposed constructions when they become aware of it, their own self-interest and the need to protect the airport indicate the wisdom of bringing such matters to the attention of the Authority. Of course where an obstacle is to be located on airport property, such as electronic or visual aids, the airport operator is responsible for reporting such projects.

6.5.2. Notification of new construction shall be made through aeronautical charts or Aeronautical Information Publication (AIP).

7. OBSTACLE SURVEYS

7.1. General

7.1.1. Airport obstacle surveys are conducted in order to enable the airport operators to determine the location and elevation of objects that may constitute infringements of the both PANS OPS and Annex 14 obstacle control surfaces. The surveys include the approach area and surface, take-off climb area and surface, transitional, horizontal and conical surfaces at both proposed and existing airports. In the case of a precision approach runway or a runway on which a precision approach aid is likely to be installed, the survey should cover the additional horizontal surface associated with this aid.

7.1.2. The airport obstacle survey must supply principally:

a) the airport elevation;
b) runway profile elevations;
c) the latitude and longitude of the airport reference point (ARP);
d) the width and length of each runway;
e) the azimuth of each runway;
f) the planimetry at the airport; and
g) the location and elevation of each obstacle in the area covered by the chart.

7.2. Obstacle survey practices

7.2.1. The complexity of each survey and the number of charts maintained will vary from State to State. ICAO Document 9137 gives additional guidance on obstacle survey practices.

7.2.2. The methods for survey include:

a) use of photography during the survey
b) photogrammetric compilation processes and /or
c) field methods

7.2.3. The field survey is considered in a series of steps or processes as follows:

7.2.3.1. **Initial survey**: The initial survey should produce a chart presenting a plan view of the entire airport and its environs to the outer limit of the conical surface (and the outer horizontal surface where established), together with profile views of all obstacle limitation surfaces. Each obstacle should be identified in both plan and profile with its description and height above the datum which should be specified in the chart. More detailed requirements are contained in chapter 3 and 4 of Annex 4, describing aerodrome obstruction chart. Engineering field surveys may be supplemented by aerial photographs and photogrammetric to identify possible obstacles not readily visible from the airport

7.2.3.2. **Periodic survey:** The airport operator should make frequent visual observations of surrounding areas to determine the presence of new obstacles. Follow up surveys should 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 removal programme is contemplated. Following a completion of an obstacle removal programme, the area should be resurveyed to provide corrected data on the presence or absence of obstacles. Similarly, revision surveys should be made if changes are made (or planned) in airport chrematistics such as runway length, elevation or orientation. No firm rule can be set down for the frequency of periodic survey, but constant vigilance is required. Changes in obstacle data arising from such surveys should be reported to the aviation community in accordance with the provisions of Annex 15.

7.2.3.3. **Revision survey** - A thorough field examination of the existing obstacle chart is made and all the field survey data required is supplied to update the chart to conform to the current requirements. The kind and volume of the field work required for revision survey will vary considerably depending upon the age of the chart.

8. AERODROME EQUIPMENT AND INSTALLATIONS WHICH MAY CONSTITUTE OBSTACLES

8.1. General

8.1.1. All fixed and mobile objects, or parts thereof, that are located on an area intended for the surface movement of aircraft or that extends above 300ft above ground level are obstacles. Certain aerodrome equipment and installations, because of their air navigation functions, must inevitably be so located and/or constructed that they constitute obstacles. Equipment or installations other than these should not be permitted. This section discusses the sitting and construction of aerodrome equipment and installations which of necessity must be located on a runway strip; a runway end safety area; a taxiway strip; or within the taxiway clearance distance specified in the Manual of Aerodromes Standards; or on a clearway, if it would endanger an aircraft in the air.

8.1.2. When aerodrome equipment, such as a vehicle or plant is an obstacle, it is generally considered to be temporary obstacle. However, when aerodrome installations such as visual aids, radio aids and meteorological installations are obstacles, they are generally considered to be permanent obstacles.

8.1.3. Any equipment or installation which is situated on an aerodrome and which is an obstacle should be of minimum practicable mass and height and be sited in such a manner as to reduce the hazard to aircraft to a minimum. Additionally, any such equipment or installation which is fixed at its base should incorporate frangible mounting.

8.1.4. The degree to which equipment and installations can be made to conform to the desired construction characteristics is often dependent on the performance requirements of the equipment or installation concerned.

8.1.5. Many factors must be considered in the selection of aid fixtures and their mounting devices to ensure that the reliability of the aids is maintained and that the hazard to aircraft in flight or manoeuvring on the ground is minimal. It is therefore important that the appropriate structural characteristics of all aids which may be obstacles be specified and published. Some guidance material on the frangibility requirements of aerodrome equipment and installations are contained in Section 25 of this AC.

8.2. Types of aerodrome equipment and installations which may constitute obstacles

8.2.1. There are many types of aerodrome 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:

a) ILS glide path antennas;
b) ILS inner marker beacons;
c) ILS localizer antennas;
d) Wind direction indicators;
e) Landing direction indicators;
f) Anemometers;

g) Ceilometers;
h) Transmissometers;
i) Elevated runway edge, threshold, end and stopway lights;
j) Elevated taxiway edge lights;
k) Approach lights;
l) Visual approach slope indicator systems/precision approach slope indicator systems;
m) Signs and markers;
n) Components of the microwave landing system (MLS);
o) Certain radar and other electronic installations and other devices;
p) VOR or VOR/DME when located on aerodrome;
q) Precision approach radar system or elements;
r) VHF direction finders; and
s) Airport maintenance equipment, e.g. tracks, tractors.

There is wide variation in the structural characteristics of these aids currently in use. Some guidance is provided below on appropriate structural characteristics of these aids for guidance of designers.

8.2.2. **ILS Glide Path Antennas**

8.2.2.1. The ILS glide path antenna masts may consist of thin walled large-diameter tubes which are slightly cone-shaped and made from fibre-glass material with short glass fibres. These masts can resist considerable wind loadings but they will break with the application of a load such as would be imposed in the event of impact by an aircraft.

8.2.3. **ILS Localizer antennas**

8.2.3.1. ILS localizer antenna supports may consist of thin-walled tubes made from fibre glass material with short glass fibres. The maximum height of the installation may be about 3 m. The reflectors of the localizer antennas may be rods approximately 2.5m long, held by springs only. When exposed to loads in excess of the design load, they jump out of their supports and thus minimize the hazard to an aircraft overrunning the runway. Alternatively, the localizer antenna could comprise aluminium-clad balsa wood spars supported by aluminium tubing where the supporting structure incorporates shear pins at critical points to allow the structure to collapse under impact.

8.2.4. **Transmissometers**

8.2.4.1. The structure on which the transmissometer is placed may be constructed of hollow aluminium tubes that, although sufficiently strong by themselves, bend or break easily should an aircraft collide with them. The structure is attached to sunken concrete foundation by means of breakable bolts.

8.2.5. **Elevated runway edge, threshold, end, stopway and taxiway edge lighting**

8.2.5.1. The height of these lights should be sufficiently low to ensure propeller and engine pod clearance. Wings flex 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 36 cm is advocated.

8.2.5.2. These aids should be mounted on frangible mounting devices. The impact load required to cause failure at the break point should not exceed 5kg.m and a static load required to cause failure should not exceed 230 kg applied horizontally 30 cm above the break point of the mounting device. The desirable maximum height of light units and frangible coupling is 36 cm above ground. Units exceeding this height limitation may require higher breaking characteristics for the frangible mounting device, but the frangibility should be such that, should a unit be hit by an aircraft, the impact would result in minimum damage to aircraft.

8.2.5.3. In addition, all elevated light installed on runways of code letters A and B should 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 should be able to withstand an exhaust velocity of 200kt.

8.2.6. **Approach lighting system**

8.2.6.1. To minimize the hazard to aircraft that may strike them, approach light should have a frangible device, or their supports be of a frangible design.

8.2.6.2. Where the terrain requires light fittings and their supporting structure to be taller than approximately 1.8 m and they constitute the critical hazard, it is considered that it is not practicable to require that the frangible mounting devise be at the base of the structure. The frangible portion may be limited to the top 1.8 m 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 300 m before the threshold (as these light 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 1.8 m is considered to be a minimum specification, and a longer frangible top potion should be provided where possible.

8.2.6.3. 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 230 kg is applied horizontally at 30 cm above the break point of the structure.

8.2.6.4. Where it is necessary for approach lights to be installed in stop ways, the light should be inset in the surface when the stopway is paved. When the stopway is not paved, they should either be inset or, if elevated, meet the criteria for frangibility agreed for lights installed beyond the runway end.

8.2.7. **Other aids (e.g. VASIS, signs and markers)**

8.2.7.1. These aids should be located as far as practicable from the edges of runways, taxiways and aprons as is compatible with their function. Every effort should 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 aircraft.

8.2.7.2. 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 should always be above ground level.

9. OBSTACLE CONTROL PROCEDURES IN THE AERODROME MANUAL

9.1. Details of the procedures for inspection of the aerodrome movement area, obstacle limitation surface and for obstacle control at an aerodrome should be presented in the Aerodrome Manual.

9.2. Particulars in the aerodrome manual of the procedures for the inspection of the aerodrome movement area and obstacle limitation surface must include details of the following:

a) Arrangements for carrying out inspections, including runway friction and water depth measurement on runways and taxiways during and outside normal hours of aerodrome operations;
b)
c) Arrangements and means of communicating with ATC during an inspection;
d)
e) Arrangements for keeping an inspection logbook and the location of the logbook;
f)
g) Details of inspection intervals and times;
h) Inspection checklist;
i)
j) Arrangements for reporting the results of inspections and for taking prompt follow-up actions to ensure correction of unsafe conditions; and
k)
l) The names and roles of persons responsible for carrying out inspections and their contact numbers during and after working hours.

9.3. Particulars in the aerodrome manual for obstacle control must contain details setting out the procedures for –

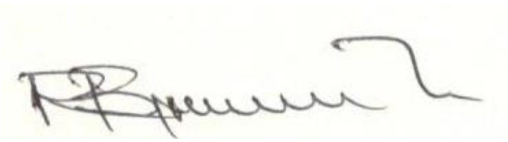
a) Monitoring the obstacle limitation surfaces and Type A chart for obstacle in the take-off surface;

b) Controlling obstacles within the authority of the aerodrome operator;

c) Monitoring the height of buildings or structures within the boundaries of the obstacle limitation surfaces;

d) Controlling new developments in the vicinity of the aerodrome;

e) Notifying the Authority of the nature and location of obstacles and any subsequent addition or removal of obstacles for action as necessary, including amendment of AIS publications.



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Tanzania Civil Aviation Authority