

# **LIBERIA CIVIL AVIATION AUTHORITY**



## **Guidance Material on Obstacle Control**

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## **CHAPTER 1: INTRODUCTION**

### **1.1 Background**

This guidance material contains guidance for compliance with the Part 13 of the Liberian Civil Aviation Regulations (LCAAR) requirements for obstacle limitation surfaces at certificated/licensed aerodromes and operators of non-certificated aerodrome to ensure that the use of the aerodrome is not affected by obstacles. This Guidance Material can also be used by individuals and institutions whose actions may influence the Obstacle Zone of an aerodrome. Obstacle limitation surfaces are specified in ICAO Annex 14 and Airport Services Manual (Doc 9137) Part 6. The maintenance of the obstacle free surface is particularly critical to protect the minimum Descent, Takeoff and Circling altitudes established, for the regularity of aircraft movements.

This guidance material is not exhaustive in addressing the control of obstacles, particularly the wider spectrum of the ICAO PANS-OPS surfaces and obstruction charts. There are several publications available, which address the control of obstacles, and the production of obstruction charts, in detail. They should be referred to by operators of aerodromes.

### **1.2 General**

Pursuant to the Liberia Civil Aviation Act 2006, Sub-Chapter VII and LCAAR Part 13, the Authority is authorized to ensure that complete safety exists in the Liberian Airspace.

Therefore, this Guidance Material (GM) contains information about standards, practices and procedures that the Authority has found to be acceptable for compliance with the associated regulations. Consideration will be given to other methods of compliance which may be presented to the Authority. When new standards, practices or procedures are found to be acceptable they will be added to the appropriate guidance material.

Shown below is a list of publications, which can be referred to as applicable standards and practices and for further information and guidance:

- ICAO Annex 14: Aerodromes
- ICAO Annex 4: Aeronautical Charts
- ICAO Doc 9137-AN/898 Airport Services Manual Part 6: Control of Obstacles
- ICAO Doc 9137-AN/898 Airport Services Manual Part 8: Airport Operational Services

### **1.3 Purpose**

This Guidance material (GM) provides methods acceptable to the Authority for showing compliance with the requirements for continuing to meet the aerodrome design standards for the obstacle limitation surfaces in LCAAR Part 13.

### **1.4 Focus**

This material is intended for the holder of an aerodrome operating certificate issued under Part 13 of the Civil Aviation Regulations, and any other aerodrome operator who promulgates aerodrome data and information for the Aeronautical Information Publication (AIP).

This material shall apply to existing and proposed man-made objects of permanent or temporary construction or alteration and apparatus of a permanent or temporary nature or any alteration thereto, objects of natural growth and terrain. The standards shall apply to the use of navigable airspace by aircraft and to existing or proposed air navigation facilities, licensed aerodromes, air traffic services routes including approach and departure routes to and from instrument and other runways.

## 1.5 Definition

**"AIP"** means the Aeronautical Information Publication for Robert Flight Information Region required by Annex 15 to the Chicago Convention to be published by each ICAO member state providing various aeronautical data;

**"the Authority"** means the Liberia Civil Aviation Authority;

**"the Act"** means the Liberia Civil Aviation Authority Act of 2006

**"Aerodrome"** has the meaning ascribed to it in the ICAO Annex 14

**"Aerodrome licensee"** means the person responsible for a licensed aerodrome to whom the license for that aerodrome has been issued;

**"Aerodrome reference point"** means the designated geographical location of an aerodrome and is a point near the initial or planned geometric centre of the aerodrome;

**"Aeronautical study"** means a safety analysis associated with the operation of aircraft;

**"the Convention"** means the Chicago Convention;

**"en-route obstacle"** means an object outside the airspace defined by aerodrome obstacle limitation surfaces, extending to a height of 90 meters or more above ground level at the site of the object, thereby having significance for the en-route operation of aircraft;

**"Instrument runway"** means a runway intended for the operation of aircraft using instrument approach procedures;

**"Licensed aerodrome"** means an aerodrome in respect of which a license under the Liberia Civil Aviation Authority regulations are enforced

**“Navigable airspace”** means, for the purposes of this Order, airspace above the territory of the State which is available for the flight of aircraft;

**“Obstacle”** means any fixed (whether temporary or permanent) or mobile object or a part thereof that extends above a defined surface intended to protect aircraft in flight or exceeds a specific height above ground level;

**“Obstacle clearance”** means, in relation to an obstacle in the vicinity of an aerodrome, the lowest height or altitude above the elevation of the relevant runway threshold or the aerodrome elevation, as applicable, used in establishing compliance with the appropriate clearance criteria above an obstacle for an aircraft in flight;

**“Obstacle limitation surfaces”** means a series of imaginary surfaces in space, the dimensions and gradients of which are provided in Annex 14, which define the limits to which objects may project vertically into the airspace surrounding an aerodrome so as to permit aircraft to be operated safely. These surfaces are defined in Chapter 4 of Annex 14;

**“Obstacle protection surface”** means an inclined plane preceding a runway served by a visual approach slope indicator system as defined in Chapter 5 of Annex 14;

**“Potential en route air navigation obstacle”** means an object extending to a height of 45m above ground level at the site of the object and which thereby may have significance for the en-route operation of aircraft;

**“Precision approach runway”** means an instrument runway served by an instrument landing system;

**“Reference code number”** means a number assigned as part of an aerodrome reference code delineating the runway length range in accordance with the criteria of Chapter 1 of Annex 14;

**“safeguarding map”** means a map prepared by or on behalf of an aerodrome licensee showing the obstacle limitation surfaces for each runway or proposed runway of a particular aerodrome or proposed aerodrome or in respect of those surfaces for any development proposed to an existing runway or aerodrome for the purposes of safeguarding the aerodrome against developments which would have an adverse effect for aircraft operations;

**“take-off flight path area”** means a quadrilateral area on the surface of the earth lying directly below and symmetrically disposed about the take-off flight path from a runway.

## **CHAPTER 2 —OBSTACLE LIMITATION SURFACES**

### **2.1 General**

The effective utilizations of an aerodrome may be influenced by natural features and man-made 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,
- d) Or all the above.

### **2.2 Obstacle limitation surfaces**

2.2.1. Obstacle limitation surfaces exist to protect the operations of aircrafts into and out of an aerodrome. The followings are the essential elements obstacle limitation surfaces:

- Take-off climb surface
- Approach surface
- Transitional side surface
- Inner horizontal surface
- Conical surface

2.2.2. The aerodrome design specifications requires that all existing objects penetrating the obstacle limitation surfaces should, as far as practicable, be removed unless they are shielded by existing immovable objects. Detailed specifications and recommendations about the marking and lighting of obstacles are contained in the ICAO Annex 14 and Airport Services Manual (Doc 9137) Part 6.

### **2.3 Aerodrome obstacle chart Type “A”**

2.3.1. The aerodrome obstacle Chart Type “A” represents a profile of the take-off obstruction environment on departure from a specific runway. The basic slope shown on the chart is 1.2 percent which is below the slope of the protected take-off climb surface established for a runway intended for use by Group A aircraft.

2.3.2. Although objects may penetrate the 1.2 percent (1:83.3) slope, there is no need to remove any which are beneath the aerodrome design take-off climb surface (Annex 14). However, all objects shown are accountable in the calculation of the aircraft take-off performance and in some instances may affect the payload of a particular aircraft type. The extent of this limitation depends on individual circumstances, but it is possible to significantly reduce the payload penalty by judicious obstacle removal close to the

aerodrome. Conversely, it may be that an obstacle several kilometers from the aerodrome is the limiting factor.

## 2.4 ICAO PANS-OPS surfaces

2.4.1. The PANS-OPS surfaces are used in the construction of instrument flight procedures. They are designed to safeguard an aircraft from collision with obstacles when flying on instruments. Pilots use minimum safe altitudes, established for each segment of the instrument procedures, which are based on obstacle clearances in the procedure areas.

2.4.2. Instrument flight procedure obstacle free surfaces sizes and dimensions do not usually coincide with the aerodrome design obstacle limitation surfaces. Look in PANS-OPS, Doc 8168, Volume 2 for the obstacle free surfaces needed for instrument flight approach, for missed approach procedures, and for visual maneuvering (circling) procedures.

# CHAPTER 3 — CONTROL OF OBSTACLES

## 3.1 Definition of an Obstacle

3.1.1 An existing object, including a mobile object, is and a future object would be, an obstacle to air navigation if it is of greater height than any of the following heights or surfaces:-

(a) A height of 45 meters (136.8 ft) above ground level at the site of the object or an object which otherwise constitutes an en-route obstacle or a potential en-route obstacle, in accordance with Annex 14 and LCAAR Part 13.

(b) A height within a runway approach area, a runway departure area or a circling approach area, which would result in the vertical distance between any point on the object and the established minimum instrument flight altitude or height as specified for the aerodrome concerned in the "AIP" within that area to be less than the required obstacle clearance. The analysis of the significance of such obstacles may have to be determined by an aeronautical study in accordance with LCAAR Part 13;

(c) The surface of an obstacle limitation surface as defined in Chapter 4 of Annex 14 to the Convention;

(d) The surface of an obstacle protection surface as defined in Chapter 5 of Annex 14 to the Convention;

(e) An inclined plane surface, with a slope of either 1.2 per cent or 1.0 per cent, superimposed on a take-off flight path area and extending either to 10 kilometers or 12 kilometers respectively from the end of the runway concerned as specified in Chapter 3 of Annex 4.

3.1.2 The surfaces specified in paragraph (1) above may also be defined in relation to a specific aerodrome on a safeguarding map prepared by or on behalf of the aerodrome licensee and lodged with the local Authority responsible for planning in the vicinity of that aerodrome.

3.1.3 The dimensions, orientation and characteristics of these surfaces are defined in Annexes 4 and 14 to the Convention as appropriate in relation to runway size and use at the aerodrome concerned.

**NB.** *Height of a structure that may constitute an obstruction depends upon its location in relation to the aerodrome, runway or an aeronautical facility.*

## 3.2 Control of Obstacles

When controlling obstacles the following should not be overlooked:

3.2.1 Objects which penetrate the approach surface are critical since they represent an erosion of the clearance between the final approach path, and fixed or mobile obstacles on the ground. 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.

3.2.2 Penetration of the transitional surfaces by an obstacle results in the reduction in the clearance available whilst carrying out an approach to land or during a missed approach procedure. Such obstacles may have an adverse effect on the aerodrome meteorological minima and may need marking and lighting.

3.2.3 Aircraft performance requirements, applicable to take-off and climb, require all aircraft to clear all obstacles by a minimum specified margin. Objects which penetrate approach and take-off climb surfaces may impose significant payload penalties on aircraft taking off.

3.2.4 The inner horizontal surface is more significant for VFR operations. It also provides protection for circling 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.

3.2.5 The conical surface represents the obstacle limiting surface some distance from the aerodrome. It is often not practical to control obstacles which penetrate this surface, although it does usually provide a limit to new construction.

3.2.6 Controlling of obstacles is to maintain or improve the Aerodrome Obstacle Chart - Type "A" obstacle profile, 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.

3.2.7 Any obstacles which are allowed to penetrate the established PANS-OPS surfaces could raise the minimum safe altitudes of the aerodrome instrument flight procedures. This could have an adverse effect on the regularity of aircraft operations.

## 3.3 Identifying obstacles

3.3.1 Identification of obstacles requires a complete engineering survey of all areas beneath the aerodrome obstacle limitation surfaces.

- 3.3.2 The initial survey should produce a chart presenting a plan view of the entire aerodrome and its environs. The scope of the chart should 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 should be identified in both plan and profile with its description and height above the datum, which should 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.
- 3.3.3 The survey specification for the aerodrome obstacle chart Type "A" is contained in ICAO Annex 4; Aeronautical Charts, as it is data and information that is required to be provided for runways.
- 3.3.4 Periodic surveys should be conducted to ensure the validity of the information in the initial survey. The aerodrome 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 control program is contemplated. Following completion of an obstacle control program, the area should be resurveyed to provide corrected data on the presence or absence of obstacles. Similarly, revision surveys should 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 Aeronautical Information Service (AIS) as soon as practicable for promulgation to the aircraft operators.

### 3.4 Reporting and Information in respect of Obstacles

- 3.4.1 A person, who proposes to erect or to construct an object, as defined in Article 3.1.1(a) of this Guidance Material, shall first notify the Authority in writing of that intention and shall provide such information as may be requested under paragraph (3.4.3) of this Article, apart from any permission required to be obtained for the right to construct.
- 3.4.2 A person who proposes to erect or construct an object as defined in Article 3 of this Material within a radius of 10 kilometers of a licensed aerodrome shall first notify the aerodrome licensee in writing of that intention and shall, where requested, provide such information to the Authority as may be required under paragraph (3.4.3) of this Material, apart from any permission required to be obtained for the right to construct.
- 3.4.3** The Authority may require the making available to it of information relating to an obstacle, including its geographic latitude and longitude, elevation and height. See application form in **Attachment I.**
- 3.4.4 The Authority may require the conduct of an aeronautical study for the purposes of paragraph (1)(b) of Article 3.1 of this Guidance Material or otherwise if it considers it necessary in a particular case.

### **3.5 Methods of Obstacle 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 republic;
- (b) Establishing an effective obstacle removal program; or
- (c) Purchasing of easement or property rights; or
- (d) All of these.

### **3.6 Height zoning of obstacle limitation surfaces**

3.6.1 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 in accordance with Annex 14 and LCAAR Part 13.

3.6.2 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.

3.6.3 To give effect to height-zoning, a zoning map should 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 should cover the aerodrome design obstacle limitation surfaces and, where applicable, the take-off flight path for the aerodrome obstacle chart Type "A" and any PANS-OPS surfaces.

3.6.4 Typical zoning ordinances shall include a statement of the purpose of, or necessity for, the action, a description of the obstacle limitation surfaces which should conform to the aerodrome design surfaces and, if applicable, the aerodrome obstacle chart Type "A" and the PANS-OPS surfaces. They should also contain a statement of allowable heights which should conform to the specifications for these surfaces. Provisions should be 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.

### **3.7 Easements or property rights**

3.7.1 In those areas where zoning is inadequate the aerodrome operator may take steps to protect the obstacle limitation surfaces by other means. Examples of 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 should include removal or reduction in height of existing obstacles and measures to ensure that no new obstacles may be erected in the future.

3.7.2 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.

### **3.8 Obstacle removal**

- 3.8.1 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 an obstacle as stipulated in LCAR Part 13. 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. Examples of such objects are a tree, a television or telecommunication aerial or a chimney.
- 3.8.2 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 contractor. It is important to assess the growth rate of trees and trim them low enough so that the ensuing growth will be below the obstacle surface until the surface is due for next survey.
- 3.8.3 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 an aircraft.

### **3.9 Marking and lighting of obstacles**

- 3.9.1 LCAR Part 13 requires that 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. ICAO Annex 14 and Airport Services Manual (Doc 9137) Part 6, contains detailed specifications about the marking and lighting of obstacles.
- 3.9.2 Note that the marking and lighting of obstacles is intended to reduce hazards to aircraft by indicating the presence of obstacles in clear conspicuity. It does not necessarily reduce operating limitations which may be caused by the obstacle. ICAO Annex 14 specifies that obstacles be marked and, if the aerodrome is used at night, lighted, except that:
- (a) Lighting and marking may be omitted when the obstacle is shielded by another obstacle; and
  - (b) The marking may be omitted when the obstacle is lighted by medium intensity obstacle lights by day.
- 3.9.3 Vehicles and other mobile objects, excluding aircraft, on movement areas of aerodromes should be marked and lighted, unless they are used on apron areas only.

### **3.10 Obstacle shielding**

The principle of obstacle shielding is employed to permit a more logical approach to restricting new construction and to the requirements for marking and lighting of obstacles. Shielding principles are employed when

some object, an existing building or natural terrain, already penetrates above one of the aerodrome design obstacle surfaces. If the obstacle is permanent, then additional objects within a specified area around it can penetrate the surface without being obstacles. The original obstacle dominates or shields the surrounding area. Further guidance material on the principle of obstacle shielding is contained in ICAO Doc 9137-AN/898, Airport Services Manual, Part 6, Control of Obstacles.

## CHAPTER 4: REQUIREMENTS

This Guidance Material defines obstacles to aircraft in flight for the purpose of airspace protection in the republic, adjacent to and in the vicinity of aerodromes and elsewhere and specifies reporting and information requirements with respect thereto. In the interest of airspace protection in the republic, the Authority requires that any individual or institution who wishes to put up high rising structure in Liberia apply to the Authority in writing for the proposed structure to be evaluated for the determination of a Hazard or no Hazard to Air Navigation.

### 4.1 Guide

- 4.1.1. Any structure within 10nm (60760ft) radius of an existing or proposed aerodrome must be brought to the notice of the Authority for an aeronautical survey to be conducted prior to the construction.
- 4.1.2. Beyond 10nm radius of an existing or proposed aerodrome any structure which is 46m (150ft) or higher above ground level must be brought to the attention of the Authority for an aeronautical survey to be conducted prior to the construction.

### 4.2 Procedure

- 4.2.1. Applicant must apply to the Director General of the Authority in writing to:  

The Director General  
Liberia Civil Aviation Authority  
Harbel, Margibi County  
Liberia
- 4.2.2. Complete a form, see **Attachment I**. The completed form will provide the Authority with information required for evaluation.  

The following components will be required:

  - a. The height of the construction
  - b. The exact geographical co-ordinates of the proposed site (that is, Latitude and Longitude), according to WGS 84 Geodetic System
  - c. A topographical map indicating the location of the proposed structure on the map
  - d. Evaluation of the proposed site above mean sea level.
- 4.2.1 Upon receipt of the application the Authority will assess the application and provide the applicant with a quotation

- 4.2.3. The Authority shall inspect the proposed site
- 4.2.4. The findings will be communicated to the applicant by the Authority
- 4.2.5. The Authority will require an applicant to mark (paint) and light a structure in accordance with this Material Guidance, where necessary.
- 4.2.6. Upon completion, the applicant shall notify the Authority of final inspection
- 4.2.7. Approved structures shall be subjected to periodic inspections to ensure compliance with lighting, marking and maintenance requirements.

## Attachment I (Obstacle clearance application)

TO BE COMPLETED BY APPLICANT															
Operator's Name															
Operator's Address															
Operator's Telephone No.	Fax No.	Email Address													
Applicant's Name															
Applicant's Address															
Applicant's Telephone No.	Fax No.	Email Address													
Nearest City/Town to proposed facility															
Geographic Coordinates of structure		<input type="checkbox"/> NAD27 <input type="checkbox"/> NAD83 <input type="checkbox"/> WGS84													
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N Latitude			W Longitude												
0	.	"	0	.	"										
		Feet	Meters												
		<b>A</b> Height above ground													
		<b>B</b> Building height													
		<b>C</b> Ground elevation above sea level													
List any tall adjacent structures which may shield the proposed structure (Attach sketch)															
New structure <input type="checkbox"/> Yes <input type="checkbox"/> No	Add to existing struc.- include total height		Date of proposed construction												
TYPE OF STRUCTURE (description and function):															
Signature of Applicant		Date (DD/MM/YY)													
LIBERIA CIVIL AVIATION AUTHORITY USE ONLY															
AERONAUTICAL ASSESSMENT															
Site acceptable <input type="checkbox"/> Yes <input type="checkbox"/> No (If no, reason)															
Lighting required <input type="checkbox"/> Yes <input type="checkbox"/> No															
Painting required <input type="checkbox"/> Yes <input type="checkbox"/> No															
Temporary lighting required <input type="checkbox"/> Yes <input type="checkbox"/> No															
Advise Liberia Civil Aviation Authority 60 days before construction <input type="checkbox"/> When construction starts <input type="checkbox"/> and on completion <input type="checkbox"/> Valid to															
Civil Aviation Inspector Comment															
		Signature	Date (DD/MM/YY)												
Manager Aerodrome Safety															
		Signature	Date (DD/MM/YY)												