



TTCAA Advisory Circular

Subject: CONTROL OF OBSTACLES
TTCAA Advisory Circular TAC-AD003
Date: 07/01/04

PURPOSE

1. (1) The purpose of this TTCAA Advisory Circular (TAC) is to provide guidance to aerodrome operators on methods acceptable to the Authority for showing compliance with the requirements for control of obstacles at aerodromes.
- (2) This amendment arises because of a change in the numbering system for TACs in which the numbering of aerodrome TACs now have the identifier “AD” before the TAC number. This TAC replaces and supercedes TAC-AGA042 which is cancelled and should be destroyed.

INTRODUCTION

2. (1) This TAC contains guidance for compliance with TTCAR No.12 and the requirements in the Manual of Aerodrome Standards for obstacles limitation surfaces at licensed aerodromes.
- (2) Under TTCAR No.12:Part V, an aerodrome operator is required to monitor the airspace around the aerodrome for infringement of the obstacle limitation surfaces by any object, building or structure. The aerodrome operator must take all reasonable measures to ensure that obstacles at or within the vicinity of the aerodrome are detected as quickly as possible. The aerodrome operator is required to inform the Authority immediately he becomes aware of the presence of an obstacle, giving details of its height and location and amended declared distances and gradients where applicable. In addition, where the aerodrome operator becomes aware of any development or proposed construction near the aerodrome that is likely to create an obstacle, he must inform the Authority as soon as practicable, giving all details of the likely obstacle.
- (3) The method of assessing the significance of any existing or proposed object within the aerodrome boundary or in the vicinity of the aerodrome is to establish defined obstacle limitation surfaces particular to the runway and its intended use. Obstacles which penetrate the obstacle limitation surfaces may in certain circumstances cause an increase in the obstacle clearance altitude or obstacle clearance height for an instrument approach procedure or any associated visual circling procedure. In ideal circumstances all the surfaces will be free from obstacles, but when a surface is infringed, any safety measures required by the TTCAA will give consideration to the following:

- (a) The nature of the obstacle and its location relative to the surface origin, to the extended centreline of the runway or normal approach and departure paths and to existing obstructions;

- (b) The amount by which the surface is infringed;
 - (c) The gradient presented by the obstacle to the surface origin;
 - (d) The type of air traffic at the aerodrome; and
 - (e) The instrument approach procedures published for the aerodrome.
- (4) Safety measures could be as follows:
- (a) Promulgation in the AIP of appropriate information;
 - (b) Marking and/or lighting of the obstacle;
 - (c) Variation of the runway distances declared as available;
 - (d) Limitation of the use of the runway to visual approaches only; and
 - (e) Restrictions on the type of traffic.
- (5) Particular attention should also be given to the security of the movement area and access denied to unauthorized persons and/or vehicles.

AERODROME OBSTACLE LIMITATION SURFACES

General

3. The effective utilization 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, or all the above.

Essential Elements of Obstacle Limitation Surfaces

4. (1) The requirements for obstacle limitation surfaces are specified on the basis of the intended use of the runway with respect to take off or landing and type of approach, and are intended to be applied when such use is made of the runway. In cases where operations are conducted to or from both directions of a runway, then the function of certain obstacle limitation surfaces may be nullified because of more stringent requirements of another lower surface.

- (2) The following are essential elements of the aerodrome design obstacle limitation surfaces:
- (a) Take-off climb surface;
 - (b) Approach surface;
 - (c) Transitional side surface;
 - (d) Inner horizontal surface;
 - (e) Conical surface.

(3) The aerodrome design specifications state that all existing objects penetrating the obstacle limitation surfaces should, as far as practical, be removed unless they are shielded by existing immovable objects. Detailed specifications about the marking and lighting of obstacles are contained in the Manual of Aerodrome Standards.

The Take-off Climb Surface

5. (1) A take-off climb surface is an inclined plane located beyond the end of the take-off run available or at the end of the clearway where one is provided.

(2) A take-off climb surface is established for each runway direction intended to be used for take-off.

Approach Surface

6. (1) An approach surface is an inclined plane or combination of planes preceding the threshold.

(2) An approach surface is established for each runway direction intended to be used for the landing of aircraft.

Transitional Surface

7. (1) The transitional surface is a complex surface along the side of the runway strip and from part of the side of the approach surface that slopes upwards and outwards to the inner horizontal surface.

(2) Transitional surfaces are established for every runway intended to be used for landing.

(3) The transitional surface along the strip will be curved if the runway profile is curved, or a plane if the runway profile is a straight line. The intersection of the transitional surface with the inner horizontal surface will also be curved or a straight line, depending on the runway profile.

Inner Horizontal Surface

8. (1) An inner horizontal surface is a horizontal plane located above an aerodrome and its environs. It represents the level above which consideration needs to be given to the control of new obstacles and the removal or marking of existing obstacles to ensure safe visual manoeuvring of airplanes in the vicinity of the aerodrome.

(2) An inner horizontal surface is established for every aerodrome.

Conical Surface

9. (1) A conical surface is a surface sloping upward and outward from the periphery of the inner horizontal surface. It represents the level above which consideration needs to be given to the control of new obstructions and the removal or marking of existing obstructions so as to ensure safe visual manoeuvring in the vicinity of an aerodrome.

(2) A conical surface is established for every aerodrome.

Outer Horizontal Surface

10. (1) An outer horizontal surface is a specified portion of a horizontal plane around an aerodrome beyond the limits of the conical surface. It represents the level above which consideration needs to be given to the control of new obstacles in order to facilitate practicable and efficient instrument approach procedures, and together with the conical and inner horizontal surfaces to ensure safe visual manoeuvring in the vicinity of an aerodrome.

(2) An outer horizontal surface is established for every aerodrome where the main runway is 1100 metres or more in length.

Characteristics of Aerodrome Obstacle Limitation Surfaces

11. Characteristics of aerodrome obstacle limitations surfaces are detailed in Chapter 4 of the manual of Aerodrome Standards.

Aerodrome Obstacle Chart - Type “A”

12. (1) Significant obstacles in the take off flight path area of runways regularly used by international aviation must be published in the AIP. The aerodrome operator is responsible for providing or arranging for the provision of necessary surveyed aerodrome obstacle data to the AIS. The aerodrome operator must notify the AIS of any significant obstacles in the take off flight path area of the runway.

(3) 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.

(4) 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. 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 kilometres from the aerodrome is the limiting factor.

ICAO PANS-OPS surfaces

13. (1) The PANS-OPS surfaces are used in the construction of instrument flight procedures. They are designed to safeguard an aeroplane 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) Instrument flight procedure obstacle free surfaces sizes and dimensions do not usually coincide with the aerodrome design obstacle limitation surfaces. Aerodrome operators should refer to PANSOPS, Doc 8168, Volume 2 for the obstacle free surfaces needed for instrument flight approach, for missed approach procedures, and for visual manoeuvring (circling) procedures.

OBSTACLE CONTROL

General

14. (1) Ultimate responsibility for limitation and control of obstacles, must in practice, rest with the aerodrome operator. This includes the responsibility for controlling obstacles on aerodrome property and for arranging the removal or lowering of existing obstacles outside the aerodrome boundaries.

(2) Each aerodrome operator should designate a member of his staff to be responsible for the continuing process of ensuring that aerodrome approach, departure and maneuvering areas remain clear of obstacles which may jeopardize safety. The aerodrome operator must maintain constant vigilance to prevent erection of obstacles around his aerodrome. The aerodrome operator should establish a programme of regular and frequent visual inspections of all areas around the aerodrome in order to be sure that construction activity or natural growth likely to infringe any of the obstacle limitation surfaces is discovered before it becomes a problem. This inspection programme should also include a daily observation of all obstacle lights, both on and off the aerodrome, and corrective action taken in event of light failure.

- (3) When considering obstacle control the following should not be overlooked:
- (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. 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;
 - (b) 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. Such obstacles may have an adverse effect on the aerodrome meteorological minima and may need marking and lighting;
 - (c) Aircraft performance requirements, applicable to take-off and climb, require all aircraft to clear all obstacles by a minimum specified margin. 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;
 - (d) The inner horizontal surface is more significant for VFR operations. 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;
 - (e) 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;
 - (f) Obstacle control, to maintain or improve the Aerodrome Obstacle Chart - Type "A" obstacle profile, should 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;
 - (g) 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.

Identifying obstacles

15. (1) Identification of obstacles requires a complete engineering survey of all areas beneath the aerodrome obstacle limitation surfaces.

(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) Constant vigilance is required to ensure the control of obstacles. 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 programme is contemplated. Following completion of an obstacle control programme, 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. Changes in obstacle data arising from surveys are to be notified to the Aeronautical Information Service (AIS) as soon as practicable for promulgation to aircraft operators.

METHODS OF CONTROL

16. (1) 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 government authority;
- (b) Establishing an effective obstacle removal programme; or
- (c) Purchasing of easement or property rights, or all of these.

Height Zoning

17. (1) The objective of height zoning is to protect the aerodrome obstacle limitation surfaces from intrusion by manmade objects and natural growth such as trees.

(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 government authority.

Obstacle Removal

18. (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. 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 aerial or a cell phone tower.

(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. 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 next due for survey.

(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.

Easements Or Property Rights

19. (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 are allowed to be erected in the future.

(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.

Marking and Lighting of Obstacles

20. (1) 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. Chapter 6 of the manual of Aerodrome Standards contains detailed requirements on marking and lighting of obstacles.

(2) 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. The Manual of Aerodrome Standards 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 high intensity obstacle lights by day.

(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.

(4) 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.

Obstacle Shielding

21. 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.

OBSTACLE CONTROL PROCEDURES IN THE AERODROME MANUAL

22. (1) Details of the procedures for inspection of the aerodrome movement area and obstacle limitation surface and for obstacle control at an aerodrome are required to be presented in Part 4 of the aerodrome manual in accordance with TTCAR No.12:Schedule 1, Part 4.

(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) Arrangements and means of communicating with ATC during an inspection;
- (c) Arrangements for keeping an inspection logbook and the location of the logbook;
- (d) Details of inspection intervals and times;
- (e) Inspection checklist;

- (f) Arrangements for reporting the results of inspections and for taking prompt follow-up actions to ensure correction of unsafe conditions; and
- (g) The names and roles of persons responsible for carrying out inspections and their contact numbers during and after working hours.

(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.

REFERENCES FOR ADDITIONAL INFORMATION AND GUIDANCE

23. This TAC is not exhaustive in addressing the control of obstacles, particularly the wider spectrum of the ICAO PANS-OPS surfaces and obstruction charts. The following is a list of publications which should be referred to for further information and guidance.

- (a) ICAO Annex 4, Aeronautical Charts;
- (b) ICAO Doc 9137-AN/898 Airport Services Manual, Part 6 - Control of Obstacles;
- (c) ICAO Doc 9137-AN/898 Airport Services Manual Part 8, Airport Operational Services;
- (d) ICAO Doc 8168-OPS/611 PANS-OPS Volume 2.

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