ADVISORY CIRCULAR

CAA-AC-AGA307

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CALCULATING DECLARED DISTANCES

1. PURPOSE

The purpose of this AC is to provide supplementary guidance to aerodrome operators on the calculation of declared distances for each runway direction at a certified aerodrome for safe use of runway and promulgation of aeronautical data to the aeronautical information service.

2. REFERENCES.

2.1 The Civil Aviation (Aerodrome) Regulations

2.2 ICAO Annex 14 Vol. 1, Aerodrome Design and Operations

2.3 ICAO Doc 9157 Part I- Aerodrome Design Manual

3. APPLICABILITY

This AC applies to all aerodromes certified and licensed as per Civil Aviation (Aerodromes) Regulations.

4. INTRODUCTION

Declared distances for an aerodrome runway constitute the relevant distances for the application of the weight and performance requirements in respect of aircraft flying for the purpose of Public Transport.

They are specific lengths of runway that are published for aircraft operations, specifically when taking off or landing, and are defined for pilots to understand their allowable take-off and landing weights and speeds. Declaration of these distances is essential for safe landing and takeoff of aircraft.

5. OBJECTIVE

The objective of measuring and providing information on declared distances is to allow pilots to determine the allowable aircraft loading based on aircraft performance requirements.

6. CALCULATION OF DECLARED DISTANCES

6.1 Definitions

To calculate each declared distance, it's important to understand what is meant by a clearway, stop way, and displaced threshold.

a) **Clearway (CWY)** – A defined rectangular area on the ground or water under the control of the appropriate authority selected or prepared as a suitable area over which an airplane may make a portion of its initial climb to a specified height.

b) **Stop way (SWY)** – A defined rectangular area on the ground at the end of take-off run available prepared as a suitable area in which an aircraft can be stopped in the case of an abandoned take-off.

c) **Displaced threshold** – A threshold not located at the extremity of a runway.

The definitions of each declared distance are also presented below:

a) **Take Off Run Available (TORA)** – The length of runway declared available and suitable for the ground run of an aircraft taking off.

b) **Take Off Distance Available (TODA)** – The length of TORA plus length of the CWY, if provided.

c) **Accelerate Stop Distance Available (ASDA)** – The length of TORA plus the length of the SWY, if provided.

d) **Landing Distance Available (LDA)** – The length of the runway declared available and suitable for the ground run of an aircraft landing. (The length of the TORA minus the length of the displaced threshold).

6.2 Calculations

i. The distances should be calculated to the nearest metre for a runway intended for use by international commercial air transport

ii. Where a runway is not provided with a stopway or clearway and the threshold is located at the extremity of the runway, the threshold is the start of that part of a runway that is declared as available for landing. In such a case the runway extremity, illustrated in Figure A-1 below is the end of TORA, ASDA and LDA. It would be the start of TORA, ASDA and TODA in the reciprocal direction, and also the LDA subject to the availability of an acceptable obstacle free approach surface.

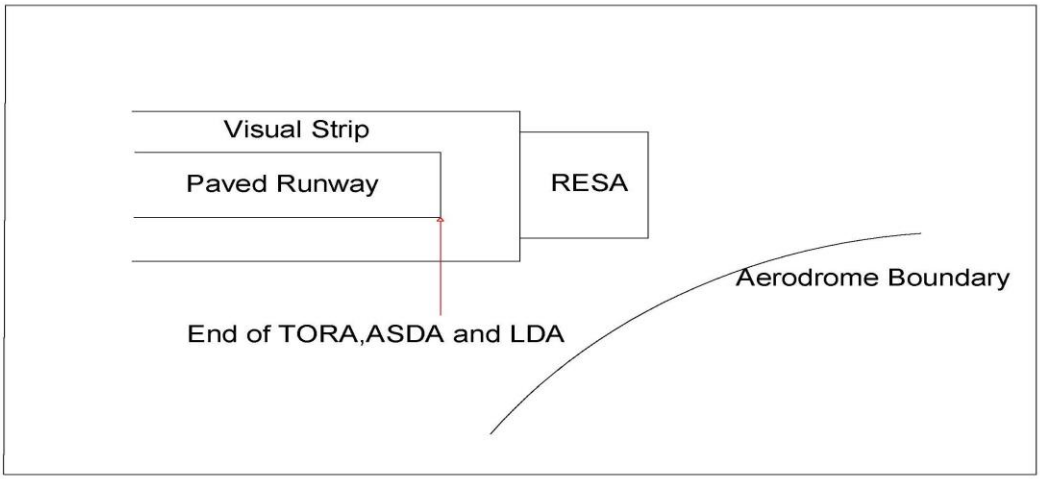


Figure 1

In this case, the four declared distances should normally be equal to the length of the runway, as shown in Figure A-3 (A).

iii. Where a runway is provided with a clearway (CWY), then the TODA will include the length of clearway, as shown in Figure A-3 (B). The origin of a clearway is at the end of the TORA, hence TODA is calculated by adding length of clearway to TORA.

iv. Where a runway is provided with a stop way (SWY) as shown in figure A-2, then the ASDA will include the length of stop way, as shown in Figure A-3 (C). A stop way is located at the end of the TORA, hence the ASDA is calculated by adding the length of the stop way to the TORA. End of the ASDA is indicated in the figure below;

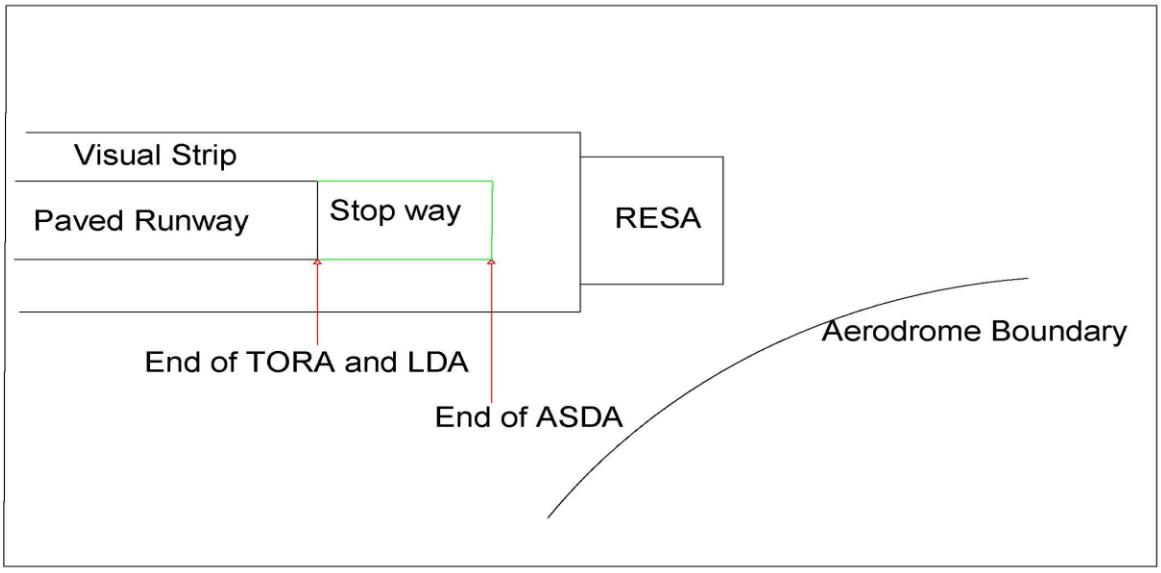
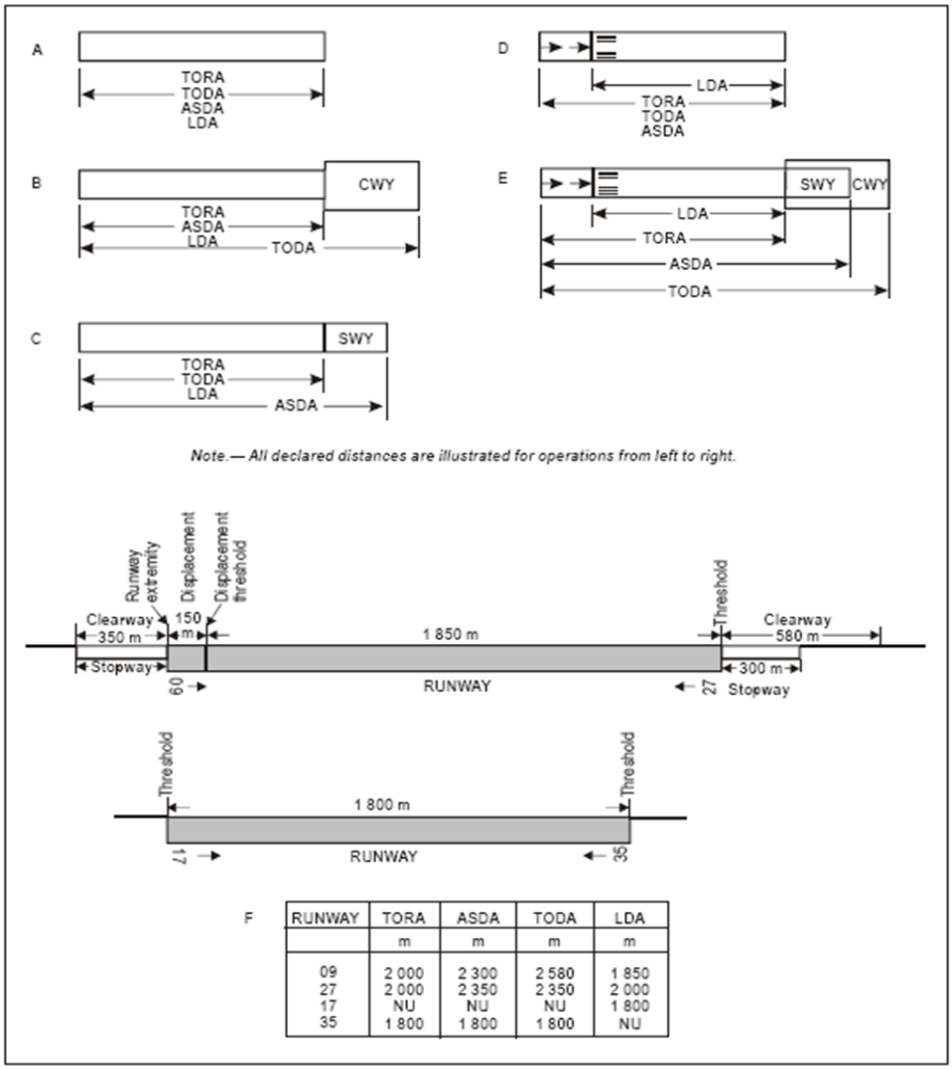


Figure 1

v. Where a runway has a displaced threshold, then the LDA will be reduced by the distance the threshold is displaced, as shown in Figure A-3 (D). A displaced threshold affects only the LDA for approaches made to that threshold; all declared distances for operations in the reciprocal direction are unaffected.

vi. Figures A-3 (B) through A-3 (D) illustrate a runway provided with a clearway or a stopway or having a displaced threshold. Where more than one of these features exist, then more than one of the declared distances will be modified - but the modification will follow the same principle illustrated. An example showing a situation where all these features exist is shown in Figure A-3 (E).

vii. A suggested format for providing information on declared distances is given in Figure A-3 (F). If a runway direction cannot be used for take-off or landing, or both, because it is operationally forbidden, then this should be declared and the words "not usable" or the abbreviation "NU" entered.



F

RUNWAY	TORA	ASDA	TODA	LDA
	m	m	m	m
09	2 000	2 300	2 580	1 850
27	2 000	2 350	2 350	2 000
17	NU	NU	NU	1 800
35	1 800	1 800	1 800	NU

Figure 3

7. Re-declaration of declared distances

When the individual requirements for strip width and length, and runway end safety area are met, the threshold will normally be located at the start of the runway. However, it may be necessary to account for any of those physical characteristics or an obstacle that cannot be removed and extends above the approach surface by displacement of the threshold from the runway end. Temporary obstacles can also cause temporary displacement of the threshold and this would require re-declaration of distances.

The amount by which the threshold is displaced will vary with the individual circumstances of each situation, regards being given to;

- The nature and type of traffic;
- Whether the runway is an instrument runway or a visual runway, and if it is an instrument runway whether it is a precision approach runway or non precision approach runway;
- The position of any obstacle that either affects the RESA or infringes the approach surface, in relation to the threshold and extended centerline of the runway;
- The amount by which the obstacle penetrates the approach surface and its significance in the calculation of the obstacle clearance height;
- The angle of the glide path or nominal glide path for an instrument approach procedure and the calculated obstacle clearance height; and
- The limited visibility and cloud base conditions under which the runway will be used.

8. Re-declaring runway distances due to temporary obstacles within runway strip

The aerodrome operators should ensure robust procedures are in place for calculating reduced runway declared distances. When reduced declared distances are in operations, the aerodrome operators should ensure that the temporary markings, lighting and signs are accurately positioned and portray the reduced distances and that they are well communicated, to the aeronautical information services for promulgation via NOTAM or AIP.

The reduced runway distances need to be carefully determined by aerodrome operators as they are used in aircraft performance calculations by the aircraft operators.

8.1 Reduced runway length operations decision

The Airport Operation Manager is responsible for the reduced runway length operations. Operating with reduced runway distances including aircraft landing and taking-off to overfly active works on a closed section of runway can affect operational safety margins. The decision to operate runway with re-declared distances should be taken jointly by the Accountable Manager with the relevant Airport Operations Managers.

8.2 Calculation of reduced runway declared distances

The Airport Operations Manager is responsible for the correct calculation of reduced runway distances in the event of an incident or due to work in progress on the runway. A preliminary examination may show whether any obstruction can be moved within an acceptable period of time. If it is likely to take longer, the Airport Operations Manager will consider reducing the runway declared distances.

a. As a first step, it is necessary to establish the precise location of the obstruction by measuring the distance (in metres) from the runway threshold and runway end to the nearest part of the obstruction and the distance from the runway centerline. The height should also be measured – however it may be necessary to measure the height in more than one place if the obstruction is large, e.g. B777 aircraft, and should safeguarding slopes be affected.

b. Once the location is established, it is then possible to determine whether any useful runway distances remain. It is better, as a general rule, to use the obstructed runway for take-offs away from the obstruction or land towards the obstruction when conditions permit (although in this case the instrument landing system may be affected). If possible, landing aircraft over an obstruction is to be avoided as it takes longer to prepare the shortened runway for service, since this involves marking/lighting a temporary displaced threshold.

8.3 Use of runway when the obstruction is to the side

If the obstruction is:-

a. Within a distance of 75m measured at right angles from the runway centerline.

The runway cannot be used, unless declared distances are reduced, as the obstruction is within the visual strip.

b. Outside 75m but within 105m.

The runway may be used as a visual strip for take-offs/landing provided that the position and height of the obstruction are the subject of a Class 1 NOTAM.

c. Outside 105m but within 150m

The runway can be used as an instrument runway but Obstacle Clearance Limits (OCLs) must be checked, National Air Navigation/Traffic Services consulted as to whether the Instrument Landing System is affected, and a Class 1 NOTAM issued.

d. Outside 150m i.e. Full Strip Width

Unrestricted use, unless there is a penetration of the transitional surface, but OCLs and ILS should be checked as CAT I/II/III operations could be affected if the obstruction penetrates the Obstacle Free Zone (OFZ). A Class 1 NOTAM will also be required.

8.4 Calculation of reduced declared distance when the runway is blocked, or the obstruction is within 75m of the runway centreline

8.4.1 LDA (Landing Distance Available)

a. The runway end is determined by measuring from the threshold up to the obstruction and subtracting 150m. In practical terms, this takes into account 60m for strip end plus a further 90m for the RESA (Runway End Safety Area)

b. If aircraft are required to land over an obstruction, the position of the threshold for an instrument runway is established by measuring a slope of 1:50 from the highest point of obstruction down to a point on the runway centerline. A further 60m (strip end) is added and this establishes the position of the temporary threshold. Remember that a RESA is needed. If the obstruction is over 2m high then there is adequate space for the RESA under the 1:50 slope. In the unlikely event that the obstruction is less than 2m high, then a further 90m, or part thereof, will need to be included in the displacement.

c. In the case of landing over an obstruction for a non-instrument runway, a slope of 1:40 can be used instead of 1:50. However the choice of slope, i.e. 1:50 or 1:40 is left to the discretion of the Airport Operations Manager, depending upon the other factors at the time.

8.4.2 TORA (Take-off run available towards the obstruction)

To determine the end of the TORA, the height of the obstruction is measured and a slope of 1:50 measured back on to the runway centerline. To this point is added 60m (strip end) and the resultant point is the end of the TORA. A minimum of 90m will be required from the strip end to the obstruction (RESA).

8.4.3 TORA (Take-off run available away from the obstruction)

a. If the obstruction is off the actual runway then the start of TORA can be from abeam the obstruction.

b. If the obstruction is on the runway then sufficient displacement of start of TORA must be allowed in order to minimize the effects of engine blast on the obstruction and associated recovery workers. This is a matter for local judgement after considering the types of aircraft likely to be departing on the reduced TORA. The displacement could well be 300 to 500 metres where large aircraft are involved.

8.4.4 TODA (Take off Distance Available)

a. When taking-off away from the obstruction, the existing stopway and clearway are unchanged, therefore EDA and TODA are reduced by the same amount as TORA.

b. When taking-off towards the obstruction, there is no technical reason why TODA cannot be declared right up to the obstruction. However, it is recommended that EDA and TODA be redeclared to the same distance as the reduced TORA.

c. The position and height of the obstruction must be included in the Class 1 NOTAM.

9. Lighting and marking

It is vital that runway lighting and marking is considered as part of re-declaring distances. Any lighting scheme must agree with the new distances/layout and be checked to ensure that no false, or incorrect, visual information is given to the pilot. Such revisions may include:-

1. New lit, or marked, temporary threshold.
2. New end of LDA or TORA/TODA.
3. Removal of coded centerline lights.
4. Switching-off, or removal of, approach lighting/or PAPIs, associated systems etc.

NOTE – Aircraft movements normally require lit slope indicators for night operations but it is possible to offer the runway without these, as it is the pilot's decision whether to use the runway or not.

At displaced thresholds on both side of runway.

Black and white triangular box section marking displaced threshold.

10. Planning

A plan of the runway area, with accurate measured distances, should be available. And the aerodrome operator should bear in mind that re-declaring distances, and the removal of any obstruction, will always take much longer to achieve than originally anticipated.

11. Information to be reported to Aeronautical Information Services

The declared distances shall be calculated and reported by the aerodrome operator to Aeronautical Information Services (AIS). Such information should be subsequently made available to pilots via the Uganda Aeronautical Information Publication (AIP).

UGANDA CIVIL AVIATION AUTHORITY
DIRECTOR
SAFETY, SECURITY AND ECONOMIC REGULATION

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