International Civil Aviation Organization

The Fourth Meeting of the Asia/Pacific Aerodrome Design and Operations Task Force (AP-ADO/TF/4)

Hybrid Meeting, Chiang Rai, Thailand, 10 to 13 January 2023

Agenda Item 2: Planning, Design and Construction of Aerodromes

RUNWAY TURN PAD SPECIFICATIONS

(Presented by India)

SUMMARY

This paper presents discrepancies on the specifications of Runway Turn Pads as provided in Annex 14 Volume I, Aerodrome Design Manuals Part 1 and 2.

1. INTRODUCTION

1.1 During the inspection of an aerodrome, it was observed that the aerodrome operator has provided runway turn pads with non-compliant markings. The explanations offered by the operator led to the verification of the specifications in National Regulations and thereafter ICAO Annex 14 Volume I (Aerodrome Design and Operations).

1.2 On verifications in ICAO Annex 14 Volume I and Aerodrome Design Manuals Part 1 and Part 2, certain other aspects were identified. This paper collates all these divergences and presents to the meeting for discussion.

2. DISCUSSION

Definition

2.1 The runway turn pad was first introduced in Annex 14 Volume I, 4th Edition in 2004. Subsequently Table 1-1 was amended in Annex 14 Volume I, 8th Edition in 2018 and the turn pad concept was aligned with OMGWS.

2.2 The runway turn pad is defined as *"A defined area on a land aerodrome adjacent to a runway for the purpose of completing a 180-degree turn on a runway"*. The runway turn pad design guidance is available in ICAO Aerodrome Design Manual Part 1, however the runway turn pad is shown as taxiway turnaround in ICAO Aerodrome Design Manual Part 2 in Figure 1-3.

Specification

2.3 Initially runway turn pad was based on the Aerodrome reference code in accordance with Annex 14, Volume I, Table1-1, later in 2018, with the introduction of OMGWS and amendment to Annex 14, Volume I, Table1-1 in 2018, the turn pad should have been delinked from Aerodrome Reference Code (ARC), however the existing SARPs 3.3.1 and 3.3.2 are still aligned with the ARC. The texts are reproduced in **Appendix A.**

2.4 The design consideration for the runway turn pad are provided in Aerodrome Design Manual Part 1, chapter 3; examples of the pavement required for a Code letter "A to F" aircraft to complete a 180-degree turn on are given in Figures A4-2 to A4-7. Even though the code letters are mentioned in the figures A4-2 to A4-7 for design criteria, the design is predominantly based on OMGWS and wheel base. Therefore, the linking of runway turn pad should be reviewed with respect to ARC

Markings

2.5 Annex 14, Volume I, Recommendation 5.2.9.3 requires that runway turn pad marking should extended parallel to the runway centre line marking for a distance of at least 60 m beyond the point of tangency where the code number is 3 or 4, and for a distance of at least 30 m where the code number is 1 or 2. However, the figure 1-3 of the Aerodrome Design Manual Part 2 depicts the runway turn pad marking as stripe-gap combination and overlapping with the runway centerline marking. (Aerodrome operator painted the incorrect markings accordingly)

2.6 Annex 14, Volume I, Standards 5.2.9.7 requires that runway turn pad marking shall be at least 15 cm in width and continuous in length. However, figure 4-1 in Aerodrome Design Manual Part 1 depicts the marking as stripe-gap combination. (Aerodrome operator painted the incorrect markings accordingly)

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper;

b) review and discuss on a Draft Conclusion appended below; and

c) discuss any relevant matters as appropriate.

— — — — — — — —

Draft Conclusion AP-ADO/TF/4 – X: Runway Turn Pad Design and Marking	
What: That, the design of runway and taxiway widths is linked to the outer main gear wheel span (OMGWS) of the design aircraft and the size of the runway turn pad depends on aircraft wheel base, OMGWS and maximum nose wheel steering angle. On the other hand, SARPs on runway turn pad markings are linked to aerodrome reference code (ARC) numbers (5.2.9 of Annex 14, Volume I refer). Therefore, ICAO is requested to review: 1) Annex 14, volume I SARPs 3.3.1 & 3.3.2, where they have provided reference to ARC (code letters); 2) Figure 1-3 of Aerodrome Design Manual (ADM), Part 2 and Figure 4-1 of Aerodrome Design Manual, Part 1 for consistency with Annex 14, Volume I SARPs as specified in 5.2.9 (5.2.9.3 & 5.2.9.7 refer) regarding the runway turn pad marking.	Expected impact: ☒ Political / Global ☐ Inter-regional ☐ Economic ☐ Environmental ☒ Ops/Technical

Why: To review Annex 14, Volume I SARPs 3.3.1 & 3.3.2 and Figure 4-1 of ADM, Part 2 and Figure 1-3 of ADM, Part 1 by ICAO Aerodrome Design Group of Aerodrome Design and Operation Panel	Follow-up: ☐Required from States
When: 13-Jan-23	Status: Draft to be adopted by PIRG
Who: ☒Sub groups ☐APAC States ☒ICAO APAC RO ☒ICAO HQ ☐Other: XXXX	

— — — — — — — —

APPENDIX A

ICAO ANNEX 14 VOLUME I

3.3 Runway turn pads
General

3.3.1 Where the end of a runway is not served by a taxiway or a taxiway turnaround and where the code letter is D, E or F, a runway turn pad shall be provided to facilitate a 180-degree turn of aeroplanes.

3.3.2 Recommendation. — Where the end of a runway is not served by a taxiway or a taxiway turnaround and where the code letter is A, B or C, a runway turn pad should be provided to facilitate a 180-degree turn of aeroplanes.

Note 1.— Such areas may also be useful if provided along a runway to reduce taxiing time and distance for aeroplanes which may not require the full length of the runway.

Note 2.— Guidance on the design of the runway turn pads is available in the Aerodrome Design Manual (Doc 9157), Part 1. Guidance on taxiway turnaround as an alternate facility is available in the Aerodrome Design Manual (Doc 9157), Part 2.

3.3.6 The design of a runway turn pad shall be such that, when the cockpit of the aeroplane for which the turn pad is intended remains over the turn pad marking, the clearance distance between any wheel of the aeroplane landing gear and the edge of the turn pad shall be not less than that given by the following tabulation:

	OMGWS			
	Up to but not including 4.5 m	4.5 m up to but not including 6 m	6 m up to but not including 9 m	9 m up to but not including 15 m
Clearance	1.50 m	2.25 m	3 m[a] or 4 m[b]	4 m

a. *If the turn pad is intended to be used by aeroplanes with a wheel base less than 18 m.*
b. *If the turn pad is intended to be used by aeroplanes with a wheel base equal to or greater than 18 m.*

5.2.1.5 Taxiway markings, runway turn pad markings and aircraft stand markings shall be yellow.

5.2.9 Runway turn pad marking

Application

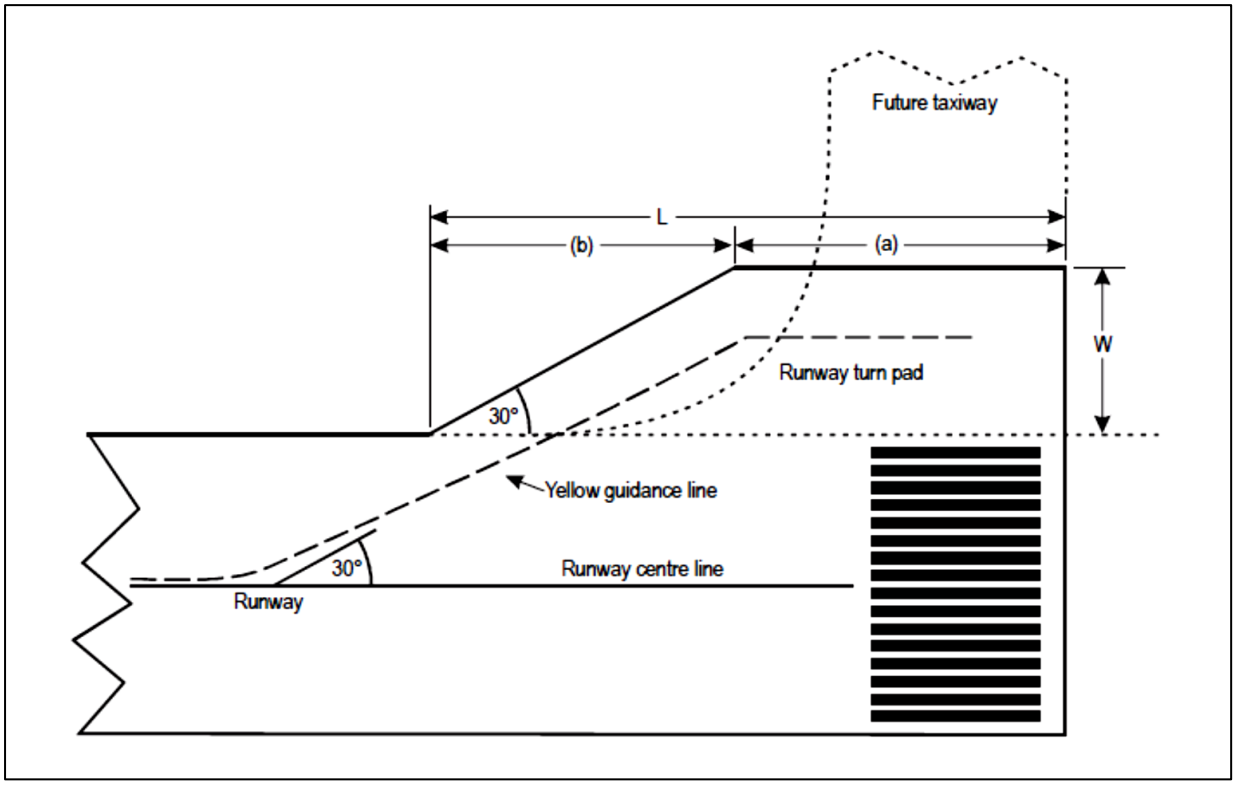
5.2.9.1 Where a runway turn pad is provided, a runway turn pad marking shall be provided for continuous guidance to enable an aeroplane to complete a 180-degree turn and align with the runway centre line.

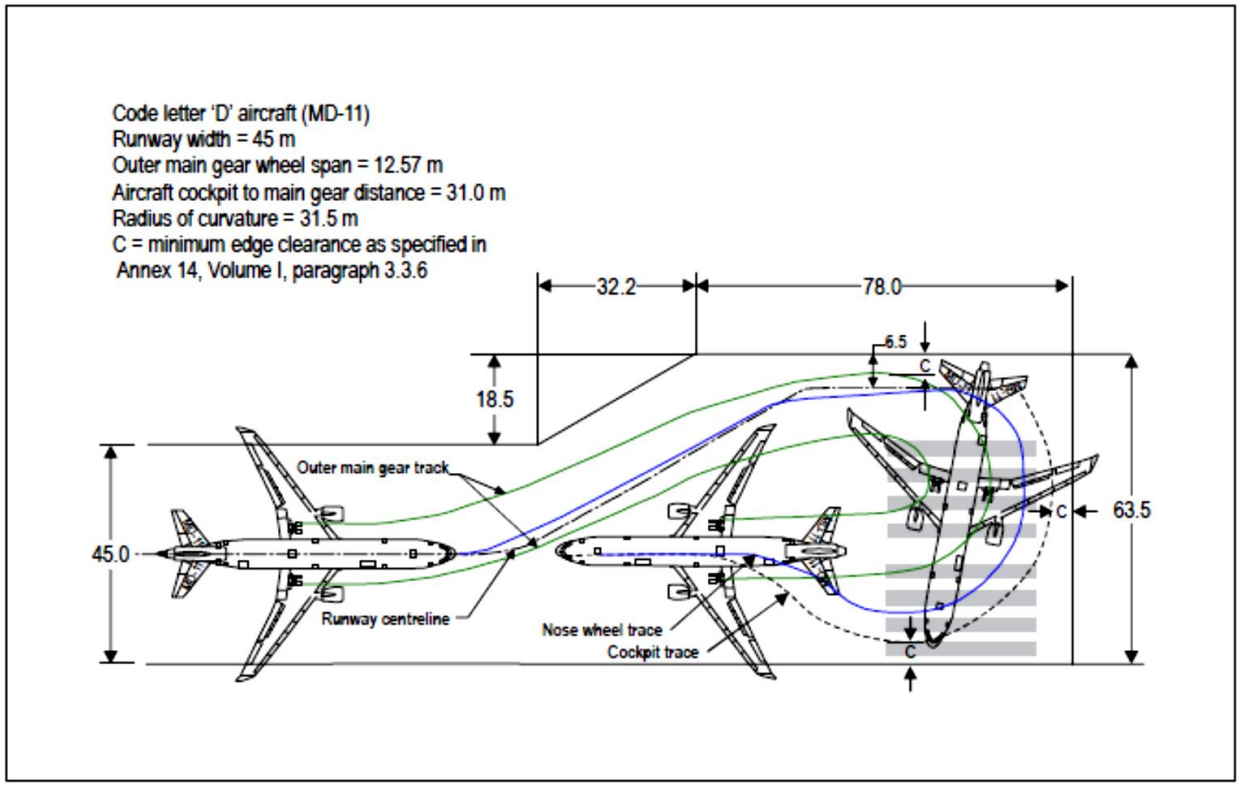
5.2.9.3 Recommendation. — The runway turn pad marking should be extended parallel to the runway centre line marking for a distance of at least 60 m beyond the point of tangency where the code number is 3 or 4, and for a distance of at least 30 m where the code number is 1 or 2.

AERODROME DESIGN MANUAL PART -1 (Doc 9157 Part 1) RUNWAYS - 4TH Edition 2020
Appendix 4

RUNWAY TURN PADS
3. DESIGN CONSIDERATIONS

3.1 To facilitate the entry of aircraft onto the turn pad from the runway, the intersection angle of the turn pad with the runway should not exceed 30 degrees. The total width of the turn pad and runway should be such that the nose wheel steering angle of the aircraft for which the turn pad is intended will not exceed 45 degrees. The design of the runway turn pad should be such that when the cockpit of an aeroplane is over the turn pad marking, the wheel-to-pavement edge clearance distance should not be less than that specified in Annex 14, Volume I. An example of the pavement required for a Code letter "A" aircraft to complete a 180-degree turn on a 30 m wide runway is found in Figure A4-2. Examples of runway turn pad designs can be found in Figures A4-3 to A4-7.





AERODROME DESIGN MANUAL PART -2 (Doc 9157 Part 2) TAXIWAYS 5TH Edition 2020

TAXIWAYS

1.1 Taxiway Systems

Stages in taxiway system development (ADM-2)

1.1.12 To minimize current construction costs, an aerodrome's taxiway system should be only as complex as needed to support the near-term capacity needs of the runway. With careful planning, additional taxiway components can be added to the system in stages to keep pace with the growth in aerodrome demand. Different stages in taxiway system development are described in the following paragraphs (see Figure 1-3):

a) a minimum aerodrome taxiway system, supporting a low level of runway utilization, can consist of only turnaround pads or taxiway turnarounds at both ends of the runway and a stub taxiway from the runway to the apron;

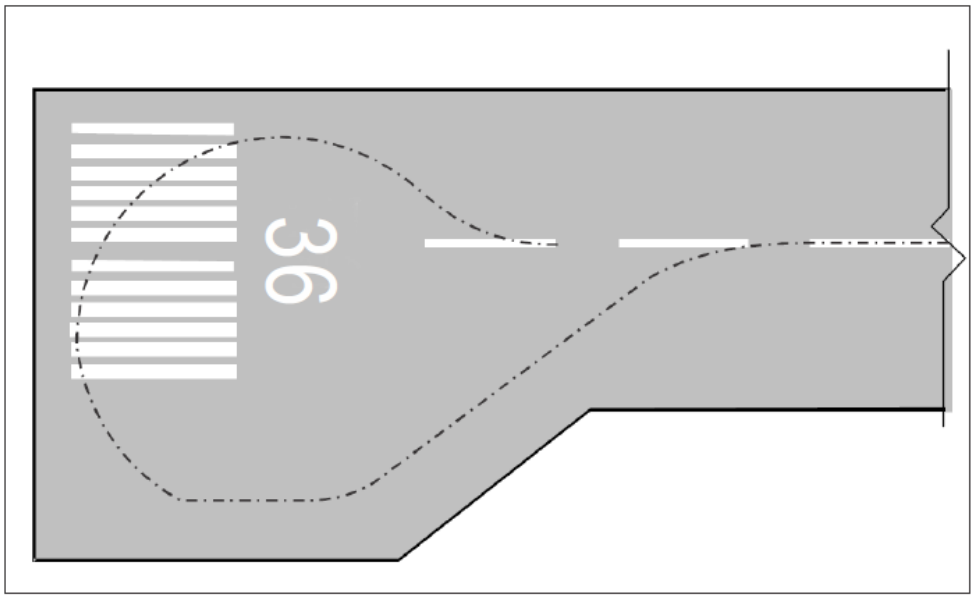


Figure 1-3. Turnarounds (cont.)

—END—