Aerodrome Design Manual

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Aerodrome Design Manual

Part 2
Taxiways, Aprons and Holding Bays

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AMENDMENTS

Amendments are announced in the supplements to the *Catalogue of ICAO Publications;* the Catalogue and its supplements are available on the ICAO website at www.icao.int. The space below is provided to keep a record of such amendments.

RECORD OF AMENDMENTS AND CORRIGENDA

AMENDMENTS		
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FOREWORD

In accordance with the provisions in Annex 14, Volume I, States must provide taxiways at an aerodrome. The Annex also recommends the provision of holding bays when the traffic volume is high and the provision of aprons where necessary to permit the on- and off-loading of passengers, cargo or mail as well as the servicing of aircraft without interfering with the aerodrome traffic. The purpose of the following material is to assist States in the implementation of these specifications and thereby help to ensure their uniform application.

With respect to taxiways, the manual includes material on the general layout and description of the design criteria for taxiway physical characteristics, including the shoulder and strips. Several studies have been undertaken on configuration and location of rapid exit taxiways. The existing material on rapid exit taxiways has been updated as a result of studies undertaken by the Secretariat. Additional material on this subject has been added at Appendix 5. The material on fillets describes some methods for fillet design, and detailed information on fillet design has also been included in an appendix. The manual also contains illustrations of diagrams of the impact of newer generation, larger aircraft at existing aerodromes. Additionally, new charts to facilitate deriving of the aircraft wing tip clearances needed in taxiway/taxilane turning manoeuvres by modern wide body aeroplanes have been added.

The material on holding bays and dual or multiple taxiways, which describes the advantages and disadvantages of the different configurations, is aimed at providing aerodrome controllers with greater flexibility in adjusting the take-off sequence to overcome undue delays. The material concerning aprons describes, inter alia, basic apron layouts, design requirements and the area required for a particular apron layout.

The manual also includes material dealing with segregation of traffic on the movement area. This material describes considerations which should be taken into account when designing aerodrome facilities in order to achieve the maximum practical segregation of aircraft and ground vehicular traffic.

It is intended that the manual be kept up to date. Future editions will most likely be improved on the basis of experience gained and of comments and suggestions received from users of this manual, and readers are therefore invited to give their views, comments and suggestions on this edition. These should be directed to the Secretary General of ICAO.

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Chapter 1

TAXIWAYS

1.1 TAXIWAY SYSTEMS

Functional requirements

1.1.1 Maximum capacity and efficiency of an aerodrome are realized only by obtaining the proper balance between the need for runways, passenger and cargo terminals, and aircraft storage and servicing areas. These separate and distinct aerodrome functional elements are linked by the taxiway system. The components of the taxiway system therefore serve to link the aerodrome functions and are necessary to develop optimum aerodrome utilization.

1.1.2 The taxiway system should be designed to minimize the restriction of aircraft movement to and from the runways and apron areas. A properly designed system should be capable of maintaining a smooth, continuous flow of aircraft ground traffic at the maximum practical speed with a minimum of acceleration or deceleration. This requirement ensures that the taxiway system will operate at the highest levels of both safety and efficiency.

1.1.3 For any given aerodrome, the taxiway system should be able to accommodate (without significant delay) the demands of aircraft arrivals and departures on the runway system. At low levels of runway utilization the taxiway system can accomplish this with a minimum number of components. However, as the runway acceptance rate increases, the taxiway system capacity must be sufficiently expanded to avoid becoming a factor which limits aerodrome capacity. In the extreme case of runway capacity saturation, when aircraft are arriving and departing at the minimum separation distances, the taxiway system should allow aircraft to exit the runway as soon as practical after landing and to enter the runway just before take-off. This enables aircraft movements on the runway to be maintained at the minimum separation distance.

Planning principles

1.1.4 Runways and taxiways are the least flexible of the aerodrome elements and must therefore be considered first when planning aerodrome development. Forecasts of future activity should identify changes in the rate of aircraft movements, the nature of the traffic, type of aircraft and any other factors affecting the layout and dimensioning of the runway and taxiway systems. Care should be taken not to place so much attention on the present needs of the system that later phases of development that have equal or greater importance are neglected. For example, if an aerodrome is forecast to serve a higher category of aircraft type in the future, the current taxiway system should be designed to accommodate the greatest separation distances that ultimately will be required (see Table 1-1).

1.1.5 In planning the general layout of the taxiway system, the following principles should be considered:

a) taxiway routes should connect the various aerodrome elements by the shortest distances, thus minimizing both taxiing time and cost;

b) taxiway routes should be as simple as possible in order to avoid pilot confusion and the need for complicated instructions;

c) straight runs of pavement should be used wherever possible. Where changes in direction are necessary, curves of adequate radii, as well as fillets or extra taxiway width, should be provided to permit taxiing at the maximum practical speed (see Section 1.4 and Appendix 1);

d) taxiway crossings of runways and other taxiways should be avoided whenever possible in the interests of safety and to reduce the potential for significant taxiing delays;

e) taxiway routings should have as many one-way segments as possible to minimize aircraft conflicts and delay. Taxiway segment flows should be analysed for each configuration under which runway(s) will be used;

f) the taxiway system should be planned to maximize the useful life of each component so that future

Table 1-1. Design criteria for a taxiway

Physical characteristics	Code letter A	B	C	D	E	F
Minimum width of:						
taxiway pavement	7.5 m	10.5 m	18 m[a] 15 m[b]	23 m[c] 18 m[d]	23 m	25 m
taxiway pavement and shoulder	—	—	25 m	38 m	44 m	60 m
taxiway strip	32.5 m	43 m	52 m	81 m	95 m	115 m
graded portion of taxiway strip	22 m	25 m	25 m	38 m	44 m	60 m
Minimum clearance distance of outer main wheel to taxiway edge	1.5 m	2.25 m	4.5 m[a] 3 m[b]	4.5 m	4.5 m	4.5 m
Minimum separation distance between taxiway centre line and:						
centre line of instrument runway code						
number 1	82.5 m	87 m	—	—	—	—
number 2	82.5 m	87 m	—	—	—	—
number 3	—	—	168 m	176 m	—	—
number 4	—	—	—	176 m	182.5 m	190 m
centre line of non-instrument runway code						
number 1	37.5 m	42 m	—	—	—	—
number 2	47.5 m	52 m	—	—	—	—
number 3	—	—	93 m	101 m	—	—
number 4	—	—	—	101 m	107.5 m	115 m
taxiway centre line	23.75 m	33.5 m	44 m	66.5 m	80 m	97.5 m
object						
taxiway[e]	16.25 m	21.5 m	26 m	40.5 m	47.5 m	57.5 m
aircraft stand taxilane	12 m	16.5 m	24.5 m	36 m	42.5 m	50.5 m
Maximum longitudinal slope of taxiway:						
pavement	3%	3%	1.5%	1.5%	1.5%	1.5%
change in slope	1% per 25 m	1% per 25 m	1% per 30 m	1% per 30 m	1% per 30 m	1% per 30 m
Maximum transverse slope of:						
taxiway pavement	2%	2%	1.5%	1.5%	1.5%	1.5%
graded portion of taxiway strip upwards	3%	3%	2.5%	2.5%	2.5%	2.5%
graded portion of taxiway strip downwards	5%	5%	5%	5%	5%	5%
ungraded portion of strip upwards or downwards	5%	5%	5%	5%	5%	5%
Minimum radius of longitudinal vertical curve	2 500 m	2 500 m	3 000 m	3 000 m	3 000 m	3 000 m
Minimum taxiway sight distance	150 m from 1.5 m above	200 m from 2 m above	300 m from 3 m above	300 m from 3 m above	300 m from 3 m above	300 m from 3 m above

a. Taxiway intended to be used by aeroplanes with a wheel base equal to or greater than 18 m.
b. Taxiway intended to be used by aeroplanes with a wheel base less than 18 m.
c. Taxiway intended to be used by aeroplanes with an outer main gear wheel span equal to or greater than 9 m.
d. Taxiway intended to be used by aeroplanes with an outer main gear wheel span less than 9 m.
e. Taxiway other than an aircraft stand taxilane.

phases of development incorporate sections from the current system; and

g) ultimately, a taxiway system will perform only as well as its least adequate component. Therefore, potential bottlenecks should be identified and eliminated in the planning phase.

1.1.6 Other important considerations when planning a taxiway system include the following:

a) taxiway routes should avoid areas where the public could have easy access to the aircraft. Security of taxiing aircraft from sabotage or armed aggression should be of primary importance in areas where this is of particular concern;

b) taxiway layouts should be planned to avoid interference with navigation aids by taxiing aircraft or ground vehicles using the taxiway;

c) all sections of the taxiway system should be visible from the aerodrome control tower. Remote cameras can be used to monitor sections of taxiways shadowed by terminal buildings or other aerodrome structures if such obstructions cannot be practically avoided;

d) the effects of jet blast on areas adjacent to the taxiways should be mitigated by stabilizing loose soils and erecting blast fences where necessary to protect people or structures (see Appendix 2); and

e) the location of taxiways may also be influenced by ILS installations due to interferences to ILS signals by a taxiing or stopped aircraft. Information on critical and sensitive areas surrounding ILS installations is contained in Annex 10, Volume I, Attachment C.

1.1.7 There should be a sufficient number of entrance and exit taxiways serving a specific runway to accommodate the current demand peaks for take-offs and landings. Additional entrances and exits should be designed and developed ahead of expected growth in runway utilization. The following principles apply to the planning of these taxiway system components:

a) the function of exit taxiways is to minimize the runway occupancy time of landing aircraft. In theory, exit taxiways can be located to best serve each type of aircraft expected to use the runway. In practice, the optimum number and spacing are determined by grouping the aircraft into a limited number of classes based upon landing speed and deceleration after touchdown;

b) the exit taxiway should allow an aircraft to move off the runway without restriction to a point clear of the runway, thus allowing another operation to take place on the runway as soon as possible;

c) an exit taxiway can be either at a right angle to the runway or at an acute angle. The former type requires an aircraft to decelerate to a very low speed before turning off the runway, whereas the latter type allows aircraft to exit the runway at higher speeds, thus reducing the time required on the runway and increasing the runway capacity (details about the location and geometry of the acute angle type [called rapid exit taxiway] are presented in Section 1.3 and Appendix 5); and

d) a single runway entrance at each end of the runway is generally sufficient to accommodate the demand for take-offs. However if the traffic volume warrants, the use of bypasses, holding bays or multiple runway entrances can be considered (see Chapter 2).

1.1.8 Taxiways located on aprons are divided into two types as follows (see Figure 1-1):

a) apron taxiway is a taxiway located on an apron and intended either to provide a through taxi route across the apron or to gain access to an aircraft stand taxilane; and

b) aircraft stand taxilane is a portion of an apron designated as a taxiway and intended to provide access to aircraft stands only.

1.1.9 The requirements for apron taxiways regarding strip width, separation distances, etc., are the same as for any other type of taxiway. The requirements for aircraft stand taxilanes are also the same except for the following modifications:

a) the transverse slope of the taxilane is governed by the apron slope requirement;

b) the aircraft stand taxilane does not need to be included in a taxiway strip; and

c) the requirements for the separation distances from the centre line of the taxilane to an object are less stringent than those for other types of taxiways.