ICAO

Doc 9981

PROCEDURES FOR AIR NAVIGATION SERVICES

Aerodromes

Second Edition, 2016

This edition supersedes, on 10 November 2016, all previous editions of Doc 9981.

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INTERNATIONAL CIVIL AVIATION ORGANIZATION

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AMENDMENTS

Amendments are announced in the supplements to the *Products and Services Catalogue;* 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			
No.	Date applicable	Date entered	Entered by
Amendment 1 incorporated in this edition.			

CORRIGENDA			
No.	Date of issue	Date entered	Entered by

TABLE OF CONTENTS

PART II — AERODROME OPERATIONAL MANAGEMENT

FOREWORD

1. HISTORICAL BACKGROUND

1.1 The first edition of the *Procedures for Air Navigation Services — Aerodromes* (PANS-Aerodromes) was prepared by the PANS-Aerodromes Study Group (PASG) and contains material that provides for the suitable and harmonized application of aerodrome Standards and Recommended Practices (SARPs) and operational procedures found in Annex 14 — *Aerodromes*, Volume I — *Aerodrome Design and Operations*.

1.2 The Air Navigation Commission, during its final review of Amendment 10 to Annex 14, Volume I, in June 2008, expressed the view that Annex 14, Volume I, was primarily a design document, and the SARPs therein were appropriate for designing new aerodromes. At existing aerodromes where full compliance with Standards cannot be achieved, alternative measures may be required in order to accommodate a specific type of aeroplane. It was suggested that a PANS-Aerodromes was needed which would include procedures on how to address such operational issues.

1.3 The Air Navigation Commission, during the seventh meeting of its 180th session on 26 February 2009, agreed to develop PANS-Aerodromes to complement Annex 14, Volume I.

2. SCOPE AND PURPOSE

2.1 Annex 14 contains specifications applicable to aerodromes, as well as certain facilities and technical services normally provided at them. To a great extent, the specifications for individual facilities have been interrelated by a reference code system as described in Annex 14, Volume I, in accordance with the characteristics of the aeroplane for which an aerodrome is intended. It is not intended that those specifications limit or regulate the operation of an aircraft. Those matters related to the possible use of the aerodrome by more demanding aircraft and related applicable approvals are left to appropriate authorities to evaluate and take into account for appropriate measures to be implemented as necessary for each particular aerodrome in order to maintain an acceptable level of safety during operations.

2.2 The PANS-Aerodromes are complementary to the SARPs contained in Annex 14, Volume I.

2.3 The PANS-Aerodromes specify, in greater detail than the SARPs, operational procedures to be applied by aerodrome operators to ensure aerodrome operational safety. PANS-Aerodromes specify procedures to be applied by both aerodrome regulators and operators for initial aerodrome certification and continuing aerodrome safety oversight as well as aerodrome compatibility studies, in particular, where full compliance with the SARPs in Annex 14, Volume I, cannot be achieved.

2.4 The PANS-Aerodromes do not substitute nor circumvent the provisions contained in Annex 14, Volume I. It is expected that infrastructure on an existing aerodrome or a new aerodrome will fully comply with the requirements in Annex 14, Volume I. The contents of PANS-Aerodromes are designed to enable the use of the procedures and methodologies described in the document to assess the operational issues faced by existing aerodromes in a changing and challenging environment and to address those issues to ensure the continued safety of aerodrome operations.

2.5 The PANS-Aerodromes focus on the priority areas identified by the ICAO Universal Safety Oversight Audit Programme in the domains of certification of aerodromes, safety assessment and operational procedures at existing aerodromes (aerodrome compatibility). Future editions will include topics that are relevant to the provision of uniform and harmonized procedures in aerodrome operations. This edition also deals with the operational requirements of fixed-wing aircraft and therefore the term "aeroplane" is deliberately used throughout the document to indicate it does not include operational requirements for helicopters.

2.6 The procedures in this document are directed mainly towards aerodrome operators and consequently do not include procedures for aerodrome control service provided by the air traffic service (ATS), which are already covered in the *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM, Doc 4444).

3. STATUS

3.1 The PANS do not have the same status as SARPs. While SARPs are *adopted* by the Council in pursuance of Article 37 of the Convention on International Civil Aviation and are subject to the full procedure of Article 90, the PANS are *approved* by the Council and recommended to Contracting States for worldwide application.

3.2 While the PANS may contain material that may eventually become SARPs when it has reached the maturity and stability necessary for adoption as such, they may also comprise material prepared as an amplification of the basic principles in the corresponding SARPs and designed particularly to assist the user in the application of those SARPs.

3.3 Appendices are comprised of material grouped separately for convenience but form part of the *Procedures* approved by the Air Navigation Commission.

3.4 Attachments are comprised of material supplementary to the *Procedures* or included as a guide to their application.

4. IMPLEMENTATION

The implementation of procedures is the responsibility of Member States; they are applicable to actual operations only in so far as States have enforced them. However, with a view to facilitating their processing towards implementation by States, they have been prepared in a language that will permit direct use by aerodrome and State personnel to certify, oversee and manage the operational activities of aerodromes.

5. PUBLICATION OF DIFFERENCES

The PANS do not carry the status afforded to SARPs adopted by the Council as Annexes to the Convention and therefore do not fall under the obligation imposed by Article 38 of the Convention to notify differences in the event of non-implementation. However, attention of States is drawn to the provision in Annex 15 — *Aeronautical Information Services*, related to the publication in their aeronautical information publication (AIP) of lists of significant differences between their procedures and the related ICAO procedures.

6. CONTENTS OF THE DOCUMENT

6.1 The PANS-Aerodromes consists of two parts as follows:

Part I — *Aerodrome certification, safety assessments and aerodrome compatibility*
Part II — *Aerodrome operational management*

6.2 **Part I — *Aerodrome certification, safety assessments and aerodrome compatibility*** describes procedures for the certification of an aerodrome, how to conduct a safety assessment and methods required to assess the compatibility of an aerodrome to accept a proposed change in operation. Part I provides the basic guidelines to States, and those operators and organizations certificating and managing aerodromes.

6.3 **Part II — *Aerodrome operations management*** provides operational procedures for the operation and management of aerodromes and related aerodrome activities. The requirements contained in this part may be applicable to the aerodrome operator and/or other relevant entities operating on the aerodrome. The procedures described in this part provide an overall framework to allow for a standardized approach to aerodrome operations.

6.4 Both parts present coverage of operational practices that are beyond the scope of Standards and Recommended Practices (SARPs) but with respect to which a measure of international uniformity is desirable.

PART I — AERODROME CERTIFICATION, SAFETY ASSESSMENTS AND AERODROME COMPATIBILITY

6.5 Part I, Chapter 1 — Definitions

Part I, Chapter 1 contains a list of terms and their technical meanings as used in this document.

6.6 Part I, Chapter 2 — Certification of aerodromes

6.6.1 Part I, Chapter 2 outlines the general principles and procedures to be followed through all of the suggested stages of certifying an aerodrome operator: the initial meeting between the State and the aerodrome operator, technical inspections of the aerodrome, approval/acceptance of all or relevant portions of the aerodrome manual, on-site verification of aerodrome operational aspects including the safety management system (SMS) of the operator, analysis of the deviations from regulatory requirements and issuance of the verification report, assessment of the corrective action plan, issuance of the certificate and continued safety oversight.

6.6.2 Appendix 1 to Part I, Chapter 2 contains a list of the main items to be inspected and/or audited in each of the technical and operational areas including the SMS of the operator. Appendix 2 concerns critical data related to safety occurrences. The attachments to Part I, Chapter 2 contain a list of possible subjects for an aerodrome manual, guidance on initial certification process and a checklist that can be used by the State to assess the acceptance of an aerodrome manual and initial certification of an aerodrome. It is appreciated that these will differ according to the legal basis of the State, but some States might find these helpful.

6.7 Part I, Chapter 3 — Safety assessments for aerodromes

Part I, Chapter 3 outlines the methodologies and procedures to be followed when undertaking a safety assessment. It includes a brief description of how a safety assessment fulfils an element of the overall aerodrome operator's SMS. An aerodrome operator's SMS should enable the aerodrome operator to manage the safety risks it is exposed to as a consequence of the hazards it must face during the operations of the aerodrome.

6.8 Part I, Chapter 4 — Aerodrome compatibility

6.8.1 Part I, Chapter 4 outlines a methodology and procedure to assess the compatibility between aeroplane operations and aerodrome infrastructure and operations when an aerodrome accommodates an aeroplane that exceeds the certificated characteristics of the aerodrome.

6.8.2 This chapter addresses situations where compliance with the design provisions stipulated in Annex 14, Volume I, is either impractical or physically impossible. Where alternative measures, operational procedures and operating restrictions have been developed, these should be reviewed periodically to assess their continued validity.

6.8.3 The attachments to Part I, Chapter 4 contain selected aeroplane characteristics data. They are provided for convenience to allow the aerodrome operator to easily compare the characteristics of various commonly operated aeroplanes. However, the data will be subject to change, and accurate data should always be obtained from the aircraft manufacturers' documentation prior to any official assessment of compatibility.

PART II — AERODROME OPERATIONAL MANAGEMENT

6.9 The structure of each chapter within Part II is set up with three specific sections including a general part, the objectives to be achieved, and the operating practices related to these objectives.

6.9.1 The "general" section of the chapter includes an introduction to each of the topics covered in the subsequent chapter. It also provides an overview of the general principles in order to understand the procedures that follow.

6.9.2 The "objectives" section contains the basic principles that have been defined for the topic. These basic principles have been formulated as required for global uniform application. The "objectives" cover the whole subject matter and are not broken down into the individual subsections.

6.9.3 The "operational practices" section covers the specific operational practices and the ways in which they are applied in order to achieve the basic principles defined in "objectives".

6.9.4 Part II, Chapter 1 contains provisions and procedures applicable for assessing and reporting the condition of a runway.

6.9.5 Part II, Chapter 2 (*Airside inspections: to be developed*)

6.9.6 Part II, Chapter 3 (*Work in progress: to be developed*)

6.9.7 Part II, Chapter 4 (*Foreign object debris (FOD): to be developed*)

6.9.8 Part II, Chapter 5 (*Wildlife hazard management: to be developed*)

Table A. Amendments to the PANS-Aerodromes

Amendment	*Source(s)*	*Subject(s)*	*Approved* *Applicable*
1st Edition (2015)	PANS-Aerodromes Study Group (2009)	Procedures for Air Navigation Services — Aerodromes (PANS-Aerodromes)	20 October 2014 10 November 2016
2nd Edition (2016)	Friction Task Force (FTF) of the Aerodrome Design and Operations Panel (ADOP) (formerly the Aerodromes Panel (AP))	Amendment concerning the use of an enhanced global reporting format for assessing and reporting runway surface condition.	20 April 2016 10 November 2016; 5 November 2020

ACRONYMS

ACN	Aircraft classification number
AHWG	Ad hoc working group
AIP	Aeronautical information publication
AIS	Aeronautical information service
APAPI	Abbreviated precision approach path indicator
A-SMGCS	Advanced surface movement guidance and control system
ATIS	Automatic terminal information service
ATS	Air traffic service
AVOL	Aerodrome visibility operational level
CAA	Civil aviation authority
CAD	Common agreement document
CDM	Collaborative decision-making
CFIT	Controlled flight into terrain
FOD	Foreign object debris/damage
IAIP	Integrated aeronautical information package
IFR	Instrument flight rules
ILS	Instrument landing system
LDA	Landing distance available
LVP	Low visibility procedures
NAVAID	Aid to air navigation
NLA	New larger aeroplane
OFZ	Obstacle free zone
OLS	Obstacle limitation surfaces
PAPI	Precision approach path indicator
PASG	PANS-Aerodromes Study Group (PASG)
PCN	Pavement classification number
PRM	Precision runway monitor
QFU	Magnetic orientation of runway
RESA	Runway end safety area
RFF	Rescue and fire fighting
RVR	Runway visual range
SARPs	Standards and Recommended Practices
SMS	Safety management system
SSP	State safety programme
VASIS	Visual approach slope indicator system
VFR	Visual flight rules
WGS-84	World Geodetic System — 1984

PART I — AERODROME CERTIFICATION, SAFETY ASSESSMENTS AND AERODROME COMPATIBILITY

Chapter 1

DEFINITIONS

When the following terms are used in this document, they have the following meanings:

Advanced surface movement guidance and control system (A-SMGCS). A system providing routing, guidance and surveillance for the control of aircraft and vehicles in order to maintain the declared surface movement rate under all weather conditions within the aerodrome visibility operational level (AVOL) while maintaining the required level of safety (Doc 9830 — *Advanced Surface Movement Guidance and Control Systems (A-SMGCS) Manual*).

Aerodrome infrastructure. Physical elements and related facilities of the aerodrome.

Applicable regulation. Regulations applicable to the aerodrome and to the aerodrome operator that are transposed from international specifications and other relevant regulations.

Compatibility study. A study undertaken by the aerodrome operator to address the impact of introducing an aeroplane type/model new to the aerodrome. A compatibility study may include one or several safety assessments.

Critical aeroplane. The type of aeroplane which is the most demanding for the relevant elements of the physical infrastructure and the facilities for which the aerodrome is intended.

Mobile object. A movable device moving under the control of an operator, driver or pilot.

Obstacle. All fixed (whether temporary or permanent) and mobile objects, or parts thereof, that:

a) are located on an area intended for the surface movement of aircraft; or

b) extend above a defined surface intended to protect aircraft in flight; or

c) stand outside those defined surfaces and that have been assessed as being a hazard to air navigation (Annex 14 — *Aerodromes*, Volume I — *Aerodrome Design and Operations*).

Promulgation. The act of formally notifying official information to the aviation community.

Runway incursion. Any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and take-off of aircraft (Doc 9870 — *Manual on the Prevention of Runway Incursions).*

Runway/taxiway excursion. Any occurrence at any aerodrome involving the departure, wholly or partly, of an aircraft from the runway/taxiway in use during take-off, a landing run, taxiing or manoeuvring.

Safety assessment. An element of the risk management process of an SMS that is used to assess safety concerns arising from, inter alia, deviations from standards and applicable regulations, identified changes at an aerodrome or when any other safety concerns arise.

Safety management system (SMS). A systematic approach to managing safety, including the necessary organizational structures, accountabilities, policies and procedures (Annex 19 — *Safety Management*).

Safety manager. The responsible individual and focal point for the implementation and maintenance of an effective SMS. The safety manager directly reports to the accountable executive.

State safety programme (SSP). An integrated set of regulations and activities aimed at improving safety *(*Annex 19 — *Safety Management*).

Technical inspection. Visual and/or instrumental verification of compliance with technical specifications related to aerodrome infrastructure and operations.

———————————

Chapter 2

CERTIFICATION OF AERODROMES

2.1 GENERAL

2.1.1 Introduction

This chapter contains provisions with regard to the initial certification process and to continued oversight. General principles and procedures to be followed have been developed to assist States and aerodrome operators to meet their safety obligations.

2.1.2 Scope of certification

2.1.2.1 The scope of certification covers all relevant specifications established through the regulatory framework applicable to the aerodrome.

Note.— The relevant specifications stem from Annex 14, Volume I, Standards and Recommended Practices (SARPs), as well as other relevant additional requirements.

2.1.2.2 The scope of certification includes at least the subjects below:

a) compliance of the aerodrome infrastructure with the applicable regulations for the operations the aerodrome is intended to serve;

b) the operational procedures and their day-to-day application, when applicable, concerning:

1) aerodrome data and reporting;

2) access to the movement area;

3) aerodrome emergency plan;

4) rescue and fire fighting (RFF);

5) inspection of the movement area;

6) maintenance of the movement area;

7) snow and ice control, and other hazardous meteorological conditions;

8) visual aids and aerodrome electrical systems;

9) safety during aerodrome works;

10) apron management;

11) apron safety;

12) vehicles on the movement area;

13) wildlife hazard management;

14) obstacles;

15) removal of a disabled aeroplane;

16) low visibility operations; and

17) compliance of the safety management system (SMS) with applicable regulations.

Note 1.— Provisions on reporting aerodrome information in 2.1.2.2 b) 1) can be found in Annex 15 and the Manual on Certification of Aerodromes *(Doc 9774).*

Note 2.— Provisions related to the above operational procedures will be developed in subsequent editions of PANS-Aerodromes.

2.1.2.3 The aerodrome manual describes all the information, for each certified aerodrome, pertaining to the above scope of certification concerning the aerodrome site, facilities, services, equipment, operating procedures, organization and management, including its SMS.

Note.— The complexity and size of the aerodrome may necessitate the SMS to be included in a separate manual.

2.1.3 Continued oversight

Once the State has completed a thorough review of the compliance of an aerodrome with the applicable certification requirements, leading to the granting of the certificate to the aerodrome operator, continued oversight should be established by the State in order to ensure that compliance with regard to certification conditions and ongoing additional requirements is maintained.

2.1.4 Shared responsibilities and interfaces

Depending on the requirements of the State, the aerodrome operator may not be responsible for some of the subjects detailed in the above scope of certification. In this case, the aerodrome manual should clearly define, for each of these items, which coordination and procedures have been put into place in the case of multiple responsible stakeholders.

Note.— Where the aerodrome operator implements specific procedures related to other Annexes, these may be described in the aerodrome manual.

2.2 AERODROME MANUAL

2.2.1 Use of the aerodrome manual

2.2.1.1 *Introduction*

An application for an aerodrome certificate shall be accompanied by an aerodrome manual produced in accordance with the applicable regulation. Once granted a certificate, the aerodrome operator is required to maintain the aerodrome manual in conformity with the applicable regulation and enable all aerodrome operating staff to have access to the relevant parts of the manual.

Note 1.— The term "operating staff" refers to those persons, whether or not they are employed by the aerodrome operator, whose duties are concerned either with ensuring safety of aerodrome operations or require them to have access to the aerodrome movement areas and all other areas within the aerodrome perimeter.

Note 2.— When considered suitable for security or management reasons, the aerodrome operator may restrict the access of some operating staff to parts of the aerodrome manual, if they are suitably briefed by other means to perform their duties adequately and this would not impair the safety of aerodrome operations.

2.2.1.2 *Scope of the aerodrome manual*

2.2.1.2.1 The aim and objectives of the aerodrome manual and how it is to be used by operating staff and other stakeholders should be stated in the manual.

2.2.1.2.2 The aerodrome manual contains all the relevant information to describe the management and operational structure. It is the means by which all aerodrome operating staff are fully informed as to their duties and responsibilities with regard to safety, including information and instructions related to those matters specified in the applicable regulation. It describes the aerodrome services and facilities, all operating procedures, and any restrictions in place.

2.2.1.3 *Ownership of the aerodrome manual*

2.2.1.3.1 The aerodrome operator is responsible for developing and maintaining the aerodrome manual, as well as providing appropriate personnel access to it.

2.2.1.3.2 It is the responsibility of the aerodrome operator to be satisfied with the appropriateness of each provision of the aerodrome manual to a particular operation and to make amendments and additions as necessary.

2.2.1.4 *Format of the aerodrome manual*

2.2.1.4.1 As part of the certification process, the aerodrome operator shall submit, for approval/acceptance by the State, an aerodrome manual containing, inter alia, information on how operational procedures and their safe management will be delivered.

2.2.1.4.2 The aerodrome manual accurately reflects the aerodrome's SMS and shows, in particular, how the aerodrome intends to measure its performance against safety targets and objectives.

2.2.1.4.3 All aerodrome safety policies, operational procedures and instructions are contained in detail or cross-referenced to other formally accepted or recognized publications.

Note.— At larger aerodromes, the size and complexity of operations and related procedures may imply that these procedures cannot be included in a single document. For example, the aerodrome operator may develop and maintain an SMS manual to communicate its approach to the management of safety throughout the aerodrome. In such circumstances it is acceptable to identify within the aerodrome manual references to such provisions. It is essential that any referenced information, documentation and procedures be subjected to exactly the same systems of consultation and promulgation as the aerodrome manual. A computerized database containing the referenced procedures and information could be suitable for that purpose. For many smaller aerodromes the aerodrome manual can be both simple and brief as long as it covers procedures essential for safe day-to-day operations.

2.2.2 Contents of the aerodrome manual

2.2.2.1 The aerodrome manual shall contain, as a minimum, the following sections, including some of their requirements:

a) a table of contents;

b) a list of the corrigenda/amendments: this section should log the updates and/or corrections made to the aerodrome manual;

c) a distribution list;

d) aerodrome administrative data: an organizational chart should be provided, as well as the aerodrome operator's safety responsibilities;

e) a description of the aerodrome: this includes maps and charts. The physical characteristics of the aerodrome should be documented, as well as the information regarding the RFF level, ground aids, primary and secondary electrical power systems and main obstacles. Sufficiently detailed charts of the aerodrome should also be included (showing the aerodrome's boundaries and different areas (manoeuvring area, apron, etc.). All deviations from the regulatory provisions authorized by the State should be listed together with their validity and references to the related documents (including any safety assessments);

f) a description of the intended operations, including:

   1) the critical aeroplanes the aerodrome is intended to serve;

   2) the category of runway(s) provided (non-instrument, instrument including non-precision and precision);

   3) the different runways and their associated levels of service;

   4) the nature of aviation activities (commercial, passenger, air transport, cargo, aerial work, general aviation);

   5) the type of traffic permitted to use the aerodrome (international/national, IFR/VFR, scheduled/non-scheduled); and

   6) the minimum RVR that aerodrome operations can be permitted;

g) a description of each of the aerodrome operator's procedures related to the safety of aeronautical operations at the aerodrome. For each procedure:

   1) the responsibilities of the aerodrome operator are clearly described;

   2) the tasks that are to be achieved by the aerodrome operator or its subcontractors are listed; and

3) the means and procedures required to complete these tasks are described or appended, together with the necessary details such as the frequency of application and operating modes; and

h) a description of the operator's SMS (see Note following 2.1.2.3):

1) the SMS section of the manual is developed, and the related procedures and documents are enclosed, as well as the safety policy of the aerodrome operator signed by the accountable executive;

Note.— Annex 19 specifies a framework for the implementation of an SMS at an aerodrome.

2) the aerodrome SMS should be commensurate with the size of the aerodrome and with the level and complexity of the services provided.

Note.— A list of other possible topics for inclusion in the manual is given in Attachment A to this chapter.

2.2.2.2 Responsibilities attributed to other aerodrome stakeholders should be clearly identified and listed.

2.2.3 Updating of the aerodrome manual

2.2.3.1 Responsibility for maintaining the accuracy of the aerodrome manual is clearly defined in the manual.

2.2.3.2 The manual is updated using a defined process and includes a record of all amendments, effective dates and amendment approvals.

2.2.3.3 The method of enabling all aerodrome operating staff to have access to the relevant parts of the manual is defined and can be demonstrated.

Note.— A method of tracking amendments and ensuring their receipt should be established when using an electronic means of distribution.

2.2.3.4 Any amendments or additions should be communicated to the State in accordance with the continued oversight requirements established by the State.

2.3 INITIAL CERTIFICATION

2.3.1 Points to be covered

2.3.1.1 When an aerodrome operator applies for initial certification, the State shall assess the compliance of that aerodrome with the applicable certification requirements described in 2.1.2. If the aerodrome is found to be compliant, a certificate is issued.

2.3.1.2 Compliance of the aerodrome is assessed through:

a) technical inspections of the infrastructure of the aerodrome and its equipment, as related to the requirements associated with the intended operations;

b) review of the aerodrome manual and supporting documentation and acceptance of its relevant safety parts; and

c) on-site verification of the aerodrome operator's procedures, its organization and its SMS based upon the contents of the aerodrome manual.

Note 1.— Guidance on the initial certification process, including timelines, is shown at Attachment B to this chapter.

Note 2.— Technical inspections are planned and conducted so that their results can be used for on-site verifications. Scope and methodologies for technical inspections and on-site verifications are detailed in Appendix 1 to this chapter.

2.3.2 Aerodrome technical inspections

2.3.2.1 The technical inspections of the aerodrome should include, as a minimum:

a) an inspection of the infrastructure, obstacle limitation surfaces (OLS), visual and non-visual aids and aerodrome equipment for the use of aeroplanes;

b) an inspection of the RFF services; and

c) an inspection of wildlife hazard management.

Note 1.— Several options to carry out these inspections are presented below.

Note 2.— The methodology for technical inspections is proposed in Appendix 1 to this chapter.

Option 1: full inspections by the State

2.3.2.2 At aerodromes where an SMS is not fully operational, full inspections should be conducted by the State.

2.3.2.3 Those inspections should be conducted using checklists developed by the State (see Appendix 1 for critical areas to be inspected).

2.3.2.4 If technical inspections have previously been conducted, and depending on the changes that occurred at the aerodrome since the last inspection, the State can undertake a follow-up inspection instead of a full inspection, which should consist of:

a) assessing that the conditions prevailing at the aerodrome that led to the conclusions of the previous technical inspections are still valid;

b) reviewing any new applicable regulation; and

c) reviewing the implementation of the previously accepted corrective action plan.

2.3.2.5 A report of the follow-up inspection should be produced, including any deviations or observations made during the follow-up inspection. Any immediate and corrective action can be taken, if needed, during follow-up inspections.

Option 2: demonstration of compliance by the operator

2.3.2.6 At aerodromes where an SMS has been fully implemented, the aerodrome operator should ensure that the requirements in the checklists provided by the State have been complied with.

Note.— According to the answers to the checklist, the aerodrome operator may need to undertake safety assessments and provide them, together with the completed checklists, to the State for acceptance.

2.3.2.7 The State should then analyse the documents completed by the applicant and conduct sample on-site checks according to this analysis.

Note.— The methodology that should be used for conducting on-site checks should be the same as the one used for other on-site inspections as described in Appendix 1.

2.3.3 Approval/acceptance of the aerodrome manual

2.3.3.1 Prior to on-site verification of the aerodrome (including procedures and SMS), the aerodrome manual is reviewed by the State.

Note 1.— As compliance of all safety-relevant procedures of the aerodrome operator is assessed during the on-site verification, acceptance at that stage consists of checking that all the information that should be contained in the aerodrome manual is provided.

Note 2.— The information required in the aerodrome manual is given in 2.2.

Note 3.— The checklist given in Attachment C to this chapter also shows the information required in the aerodrome manual and has been organized to follow the list of topics given in Attachment A to this chapter.

2.3.3.2 Prior to the approval/acceptance of the aerodrome manual, the State should verify that:

a) the operator has submitted an application;

b) the aerodrome manual submitted by the aerodrome operator contains all the required information; and

c) all the procedures related to aerodrome certification that will be assessed by the on-site verification team are provided in the aerodrome manual.

2.3.3.3 The State formally informs the aerodrome operator when the aerodrome manual is accepted.

2.3.3.4 The aerodrome operator should inform the State of any changes to the approved/accepted aerodrome manual between the time of the application for a certificate and the end of the on-site verification.

2.3.4 On-site verification

2.3.4.1 The scope of the on-site verification covers the subjects included in the aerodrome manual.

2.3.4.2 The on-site verification confirms that the aerodrome operations are carried out effectively in accordance with the applicable regulation and procedures described in the manual.

2.3.4.3 The on-site verification of the SMS is normally included at this stage of initial certification, but depending on the implementation status of the SMS at the aerodrome, a specific verification of the SMS can be conducted separately.

Note.— Because the aerodrome operator's SMS may not yet be fully operational, its effectiveness will be assessed during continued oversight and will constitute an important factor in deciding the continued oversight that will be carried out.

2.3.4.4 On-site verification of the SMS focuses explicitly on the components required for granting the certificate and, when applicable, covers all other requirements for an SMS.

Note 1.— The minimal SMS components that are to be in operation before the certificate can be granted are described in Appendix 1.

Note 2.— SMS requirements also apply to the aerodrome operator's subcontractors in the domains within the scope of certification.

2.3.4.5 When technical inspections have been previously conducted by the State, the on-site verification takes into account the results of the previous technical inspections and the associated corrective actions, if relevant.

2.3.4.6 If the on-site verification team notices any deviations from the technical inspection reports, they are included in the team's report.

2.3.4.7 If the aerodrome operator is not directly responsible for some of the activities within the scope of certification, the on-site verification ensures that there is appropriate coordination between the aerodrome operator and the other stakeholders.

Note 1.— The methodology used to conduct on-site verifications is available in Appendix 1.

Note 2.— Because the scope of certification is broad, a sampling method for verifying particular subjects may be used rather than the whole scope.

2.3.4.8 At the end of an on-site verification, a preliminary list of findings is given to the aerodrome operator.

2.3.4.9 An on-site verification report is also sent to the aerodrome operator after the classification of findings by the State.

2.3.5 Analysis of the findings and monitoring of the related corrective action plans

2.3.5.1 In case of findings, the State should require the operator to develop a corrective action plan proposing ways to eliminate or mitigate the findings, with deadlines for each subsequent action.

2.3.5.2 The State may impose immediate appropriate measures on the aerodrome operator, if necessary, until actions have been taken to remove or mitigate the findings.

2.3.6 Issuance of the certificate

2.3.6.1 When no findings are reported or once the corrective action plans are accepted, and mitigation measures are agreed upon, the State grants the aerodrome certificate to the applicant. An appendix may be attached to the certificate describing the essential conditions prevailing at the aerodrome, which may include:

a) the aerodrome reference code;

b) critical aeroplane type;

c) the operational conditions for the accommodation of critical aeroplanes for which the facility is provided;

d) RFF category;

e) the operational restrictions at the aerodrome; and

f) the authorized deviations related to aerodrome compatibility described in Chapter 4, their inherent operational conditions/restrictions and validity.

Note.— In determining the duration of validity of the certificate, account may be taken of the number of technical staff required for the inspection activities, the complexity of the inspection activities to be performed including the number of aerodromes to be inspected and the maturity of the aerodrome operator's safety management system.

2.3.6.2 The State may accept a deviation on the basis of a safety assessment if permitted by the State's regulatory framework.

Note 1.— A methodology for conducting safety assessments is available in Chapter 3.

Note 2.— Accepted deviations are listed in the aerodrome manual (see 2.2.2.1 e)).

2.3.6.3 As long as the granting conditions are maintained, the validity of the certificate is either limited in time or unlimited.

Note.— Unavailability or downgrading of an infrastructure, facility or service, of a temporary nature, may not necessarily invalidate the certificate of an aerodrome.

2.3.6.4 During the period of validity of the certificate, the State monitors the timely implementation of the corrective action plans within the continued oversight developed in 2.5.

2.3.7 Promulgation of the status of certification

2.3.7.1 The State shall promulgate the status of certification of aerodromes in the aeronautical information publication, including:

a) aerodrome name and ICAO location indicator;

b) date of certification and, if applicable, validity of certification; and

c) remarks, if any.

2.3.7.2 Where safety concerns have been observed on the aerodrome, special conditions or operational restrictions may be attached to the certificate and published in the aeronautical information publication (AIP) or by NOTAM until completion of the corrective action plan. In this case, validity may be shortened to be consistent with the duration and content of the corrective action plan. Other possible measures that may be taken by the State include suspension and revocation of the certificate.

2.4 AERODROME SAFETY COORDINATION

2.4.1 Introduction

This section specifies the role of the State in the coordination process and the interaction between the aerodrome operator and other stakeholders which is necessary for the safety of operations at the aerodrome.

2.4.2 Coordination affecting aerodrome safety

2.4.2.1 The State verifies that coordination exists between the aerodrome operator, aeroplane operators, air navigation service providers and all other relevant stakeholders to ensure the safety of operations.

2.4.2.2 The aerodrome operator should ensure that all users of the aerodrome, including ground-handling agencies and other organizations that perform activities independently at the aerodrome in relation to flight or aircraft handling, comply with the safety requirements of the aerodrome operator. The aerodrome operator monitors such compliance.

2.4.3 State's feedback on occurrences

2.4.3.1 Aerodrome operators are required to report safety occurrences at their aerodromes to their State in accordance with the applicable regulation.

2.4.3.2 Aerodrome operators shall report accidents and serious incidents, including:

a) runway excursions;

b) undershoots;

c) runway incursions;

d) landing or take-off on a taxiway; and

e) wildlife strike-related events.

2.4.3.3 In addition to accidents and serious incidents, aerodrome operators should report safety occurrences of the following types:

a) foreign object debris/damage- (FOD) related event;

b) other excursions (i.e. from a taxiway or apron);

c) other incursions (i.e. on taxiway or apron); and

d) ground collisions.

Note.— Appendix 2 details the list of safety occurrences types and related critical data which should be reported at an aerodrome. The related tasks for reporting these occurrences and to feed the data when required are shared and coordinated between the various aerodrome stakeholders.

2.4.3.4 Aerodrome operators should ensure that analysis of safety occurrences at the aerodrome is performed by competent personnel who have been trained to perform these tasks.

2.4.3.5 Aerodrome operators should coordinate with all users of the aerodrome, including aircraft operators, ground-handling agencies, air navigation service providers and other stakeholders to improve the completeness and accuracy of the collection of safety occurrences and their related critical data.

2.4.3.6 The State should review and analyse the information provided by the operator in the occurrences reports to ensure that:

a) all occurrences in 2.4.3.2 and 2.4.3.3 are adequately analysed by the aerodrome operator;

b) significant trends are identified (either on a specific aerodrome or at a national level). Further in-depth analysis on the subject should be carried out if required so that the appropriate actions can be taken; and

c) the most serious/significant occurrences should be carefully followed up by the State.

2.4.3.7 The output of these analyses can be used as input for the planning of continued oversight.

Note.— Variations in the frequency of occurrences reports on a specific aerodrome, other than those occurring as a result of seasonal variations in the types and/or levels of operations, could be considered to be an indicator of a potential problem in the reporting culture on the aerodrome or a specific danger that should have been studied by the aerodrome operator. The continued oversight of the reporting processes or subjects with a high frequency of occurrence should be reinforced.

2.4.4 Management of change

2.4.4.1 As part of their SMS, aerodrome operators should have in place procedures to identify changes and to examine the impact of those changes on aerodrome operations.

Note 1.— Changes on an aerodrome can include changes to procedures, equipment, infrastructures and special operations.

Note 2.— Further guidance on the management of change can be found in Doc 9859 — Safety Management Manual (SMM).

2.4.4.2 A safety assessment will be carried out to identify hazards and propose mitigation actions for all changes that are found to have an impact on the aerodrome operations.

Note 1.— Depending on the scope of the envisaged change as well as the level of the impact on operations, the methodology and level of detail required to carry out the required safety assessment may vary.

Note 2.— The types of changes that have to be assessed are described in 2.4.4.3, and the key principles on safety assessments are available in Chapter 3 — Safety Assessments for Aerodromes*.*

2.4.4.3 *Need for a safety assessment according to the category of changes*

2.4.4.3.1 *Routine tasks*. Changes related to routine tasks do not have to be assessed using the safety assessment methodology developed in Chapter 3 because these tasks are established and managed through specific procedures, training, feedback and reviews.

Note.— Routine tasks can be described as the actions related to an activity or service that are detailed in formal procedures, which are subject to periodic review, and for which the personnel in charge are adequately trained. These tasks may include movement area inspections, grass cutting on runway strips, sweeping of apron areas, regular and minor maintenance of runways, taxiways, visual aids, radio navigation and electrical systems.

2.4.4.3.1.1 The actions resulting from the regular assessment, feedback and review process related to these tasks should ensure that any changes related to them are managed, thus ensuring the safety of the specific task. However, a change related to a routine task for which feedback is not yet sufficient cannot be considered as sufficiently mature. Therefore, a safety assessment using the methodology developed in Chapter 3 should be carried out.

2.4.4.3.2 *Specific changes.* Impact on the safety of aerodrome operations may result from:

a) changes in the characteristics of infrastructures or the equipment;

b) changes in the characteristics of the facilities and systems located in the movement area;

c) changes in runway operations (e.g. type of approach, runway infrastructure, holding positions);

d) changes to the aerodrome networks (e.g. electrical and telecommunication);

e) changes that affect conditions as specified in the aerodrome's certificate;

f) long-term changes related to contracted third parties;

g) changes to the organizational structure of the aerodrome; and

h) changes to the operating procedures of the aerodrome.

Note.— When the change involves an aeroplane type/model new to the aerodrome, a compatibility study, as specified in Chapter 4, is conducted.

2.4.4.3.2.1 For any change in aerodrome operations as defined above, a safety assessment should be conducted.

2.4.5 Obstacle control

2.4.5.1 Obstacle control raises an issue for each State in regard to the responsibilities of each potential party involved. The responsibilities of those parties have to be clearly defined as follows:

a) who is responsible for obstacle surveys;

b) who is responsible for the surveillance of the emergence of new obstacles; and

c) when obstacles are identified, who is responsible for taking action (i.e. removal, marking, lighting, displacement, instrument procedures) and enforcing that action.

2.4.5.2 Once the responsibilities have been defined, appropriate authority should be given to the entity responsible for the enforcement action required.

Note.— Guidance on the control of obstacles, roles and responsibilities of stakeholders and the practices of certain States can be found in Doc 9137 — Airport Services Manual, *Part 6 —* Control of Obstacles.

2.4.6 Oversight of third parties

Compliance of third parties with the safety provisions established by the aerodrome operator as specified in 2.4.2.2 should be monitored using the appropriate means.

2.5 CONTINUED AERODROME SAFETY OVERSIGHT

2.5.1 General

2.5.1.1 The scope of initial certification is described in 2.3. This section describes the procedures for continued aerodrome safety oversight. Continued oversight actions may not need to be as exhaustive but should be based on principles ensuring that compliance is maintained throughout the planning of adequate oversight actions.

2.5.1.2 Specific and targeted actions, in addition to the planned activities, may be carried out by the State, for example, in relation to changes, analysis of occurrences, safety of aerodrome works, monitoring of corrective action plans, or those related to the State safety plan. States may also have to address other issues regarding aerodrome safety depending on the aerodrome organization, such as obstacle control or oversight of ground handlers.

Note.— In order to have a complete perspective on aerodrome compliance, the results of those technical inspections undertaken during initial certification should be available for the team verifying the aerodrome operational procedures on site.

2.5.2 Continued oversight principles

2.5.2.1 The State should plan continued oversight actions in such a way as to ensure that each subject covered by the scope of certification is subject to oversight (see 2.1.2).

Note.— The planning of continued oversight actions by the State may take into account the aerodrome safety performance and risk exposure (see 2.5.4).

2.5.2.2 The development and operation of an aerodrome's SMS should ensure that the aerodrome operator takes appropriate actions regarding the safety on the aerodrome.

Note.— When an aerodrome has a fully developed and operational SMS, the continued oversight of the aerodrome does not have to be as exhaustive as for one with a developing SMS. Oversight activities in this case should focus on the SMS itself in order to ensure that the aerodrome SMS is operating continuously and adequately.

2.5.2.3 Sample checks of the aerodrome's compliance with certification requirements and specifications should be carried out in order to ensure the SMS has identified all deviations, if any, and adequately managed them. This also provides an indication on the level of maturity of the SMS. Consequently, a periodic audit cycle should be developed which consists of:

a) at least one audit of the SMS; and

b) sample checks on specific subjects.

2.5.2.4 If the SMS of the aerodrome operator is not fully implemented, specific oversight actions should target the SMS to ensure it is developing adequately and at a normal pace. In this case, the SMS should be audited as appropriate until it is considered to be sufficiently mature.

Note.— The maturity of the SMS is determined by the results of the oversight actions, according to the criteria developed in Appendix 1.

2.5.3 Audit of selected items

2.5.3.1 After initial certification has taken place, continued oversight actions of a subject may not require complete audit of all subject items and may instead be on the basis of sample assessment of selected items based on risk profile.

Note.— An aerodrome can be assessed through an analysis of the safety occurrences at the aerodrome, including any significant development, change or other known information that may highlight subjects of concern.

2.5.3.2 The audit of the selected items should consist of:

a) a desk-based review of the appropriate documents, and

b) an on-site verification.

2.5.3.3 The same checklists as those used for initial certification of the subject items should be used, but if a sampling item selection is made, only the selected checklist items should be audited.

2.5.4 Influence of aerodrome safety performance and risk exposure

2.5.4.1 The number of audits of the SMS during the period should be determined taking into account the following criteria:

a) the regulator’s confidence in the operator’s SMS. This confidence is evaluated using the results of the SMS audits or other oversight actions. For example, feedback on the operator’s occurrence reporting and management system might indicate that the analyses of the safety occurrences are not carried out as adequately as desired, or that a significant number of incidents have arisen on the aerodrome; and

b) other factors contributing to the level of risk at the aerodrome, for example, the complexity of the aerodrome, the aerodrome's infrastructure or organization, the density of traffic, type of operations and other specific conditions.

Note.— The content of an SMS audit may be developed using the criteria in Appendix 1.

2.5.4.2 For aerodromes with a fully implemented SMS, in addition to the audit of the SMS, some sample subjects should be checked to ensure that the SMS has identified all safety-critical issues. This also helps to ensure that the SMS is operating adequately. The selection of these subjects should be determined taking into account:

a) an analysis of the safety occurrences on the aerodrome;

b) known information related to safety at the aerodrome that may highlight subjects of concern;

c) specific subjects most significant for safety;

d) the complexity of the aerodrome;

e) any significant development or change to aerodrome infrastructure; and

f) the subjects previously selected in order to cover all within a certain number of oversight cycles.

2.5.5 Continued oversight plans and programmes

2.5.5.1 Following the above principles, an oversight plan should be determined by the State, for each certified aerodrome and communicated to the aerodrome operator. This plan should ensure that:

a) for aerodromes where an SMS is not fully functional:

1) each subject within the scope of certification appears at least once and is subject to specified oversight actions; and

2) the SMS is audited as appropriate;

Note 1.— The development of an SMS may be phased. During a phased implementation, only the elements under development within a specific phase will be assessed and reviewed.

Note 2.— It may be appropriate to audit an immature SMS at least once a year.

b) for the aerodromes with a fully functional SMS:

1) the SMS is audited at least once; and

2) other oversight actions on selected subjects are conducted as appropriate.

2.5.5.2 The plan and programme should be updated annually to show the oversight actions that have actually been carried out, including observations on certain actions that have not been undertaken as planned.

2.5.6 Unannounced inspections

2.5.6.1 Planning of the aerodrome audit is intended to assist the regulator and aerodrome in planning resources and manpower and in ensuring a consistent and adequate level of oversight. However, it does not prevent the State from carrying out unannounced inspections, if deemed necessary.

2.5.6.2 These inspections follow the same methodology as the scheduled audit or technical inspection as appropriate and may be carried out using the same checklists or could be aimed at a specific subject of concern.

2.5.7 Monitoring of corrective actions plans

2.5.7.1 Corrective actions plans resulting either from initial certification or from continued oversight audits or technical inspections should be monitored by the State until all items are closed to ensure that mitigating actions are carried out to the standard and timescale agreed.

2.5.7.2 The State should regularly review the status of each pending action.

2.5.7.3 When a deadline has been reached, the State should verify that the related corrective actions have been adequately implemented.

2.5.7.4 Where a corrective action plan does not result in appropriate action being taken within acceptable timelines, increased oversight can be taken by the State.

2.5.8 Increased oversight

2.5.8.1 When an aerodrome's corrective action plan does not ensure that appropriate corrective action has been taken within acceptable timelines, and after coordination between the State and the operator, the State may decide that increased oversight of this operator is necessary. The scope of increased oversight may cover specific subjects or be all-encompassing.

2.5.8.2 The State should notify the aerodrome operator in writing:

a) that it is being placed under increased oversight and outline the subjects concerned and from which date;

b) the reasons for the increased oversight and what it consists of; and

c) what actions are required by the aerodrome.

2.5.8.3 When an aerodrome is placed under increased oversight, the State should:

a) carry out appropriate oversight actions on the subjects concerned;

b) follow very carefully the implementation of the corrective actions plan; and

c) allocate sufficient time/resources to the oversight of the concerned aerodrome.

2.5.8.4 The oversight actions carried out under increased oversight are the same as those carried out normally, but are more exhaustive and address all the subjects concerned.

2.5.8.5 When increased oversight is concluded on an aerodrome for a specific subject, the State should advise the aerodrome operator in writing, stating the end of the procedure and the reason.

2.5.8.6 The aerodrome certificate can be amended, suspended or revoked according to the outcome of the increased oversight.

Appendix 1 to Chapter 2

TECHNICAL INSPECTIONS AND ON-SITE VERIFICATIONS

1. INTRODUCTION

1.1 The aim of this section is to list the main items to be reviewed during the initial certification.

1.2 The following list may be expanded in accordance with applicable certification requirements.

1.3 By following these lists, States should base their checks on the same items while adapting their checklists to the applicable regulation, thus harmonizing their inspections.

1.4 The oversight audit checklist can be based on the same lists.

2. TECHNICAL INSPECTIONS

2.1 Infrastructure and ground aids

Initial certification of the infrastructure and ground aids includes:

a) Obstacle restrictions:

1) OLS:

i) the surfaces are defined;

ii) as few objects as possible penetrate the OLS;

iii) any obstacles that do penetrate the OLS are appropriately marked and lit. Operational restrictions may apply as appropriate;

2) obstacle free zone (OFZ):

i) these surfaces are defined when required;

ii) no object penetrates the OFZ unless essential for the safety of air navigation and is frangible;

3) objects on the areas near the runway or the taxiways (runway strips, clearway, stop way, runway end safety area, taxiway strips, radio altimeter operating area, pre-threshold area) comply with the requirements;

b) Physical characteristics:

1) in order to facilitate the verification of compliance of the physical characteristics of the aerodrome, States may use the reference code method developed in Annex 14, Volume I. The reference code provides a simple method for interrelating the numerous specifications concerning the characteristics of aerodromes so as to provide a series of aerodrome facilities that are suitable for the aeroplanes that are intended to operate at the aerodrome;

2) the aerodrome operator may indicate in its aerodrome manual the reference code chosen for each element of the movement area so that the State can check compliance of the runways and taxiways and their associated characteristics against the requirements of the reference code as well as other specifications (bearing strength, surface characteristics, slopes);

3) runways:

i) the physical characteristics:

— are compliant with the applicable regulation and the reference code;

— characteristics are adequately and regularly measured;

ii) the published declared distances are in accordance with the situation on site;

iii) the areas near the runway (runway shoulders, runway strips, clearway, stopway, runway end safety area, radio altimeter operating area, pre-threshold area) are compliant with the applicable regulation and the reference code in terms of width, length, type of surface, resistance, slopes, grading and objects on them;

iv) the relevant separation distances are compliant with the applicable regulation and the reference code;

4) taxiways:

i) the physical characteristics (width, curve radius, extra taxiway width, longitudinal and transverse slopes, radius of turn-off curve for rapid exit taxiways, surface type, bearing strength) are compliant with the published reference code for each taxiway;

ii) the taxiway shoulders and strips are compliant with their reference code in terms of width, type of surface, slopes and objects on them;

iii) the taxiways on bridges are compliant with their reference code in terms of width;

iv) the relevant separation distances are compliant with applicable regulations and the reference code;

5) service roads:

i) road-holding positions are established at the intersection of a road and a runway at a distance compliant with the reference code;

6) holding bays, runway-holding positions and intermediate holding positions:

i) the holding bays, runway-holding positions and intermediate holding positions are located in accordance with the applicable reference code;

c) Electrical systems:

1) adequate primary power supply is available;

2) the switch-over time meets the requirements;

3) when required, a secondary power supply is available;

4) the air traffic service (ATS) has feedback on the status of ground aids when required;

d) Visual aids:

1) markings:

i) all the markings:

— are in place where required;

— are located as required and in the required number;

— have the dimensions and colours required;

ii) this includes, when required:

— the runway markings (runway designation marking, threshold marking, runway centre line marking, runway side stripe marking, aiming point marking, touchdown zone marking, runway turn pad marking);

— the taxiway markings (taxiway centre line and enhanced taxiway centre line marking, taxiway side stripe marking, runway-holding position marking, intermediate holding position marking);

— the apron markings;

— the mandatory instruction markings;

— the information markings (that do not have to be displayed but are to be compliant when displayed);

— a road-holding position marking (that is compliant with the applicable regulation);

— a VOR aerodrome checkpoint marking;

— a non-load bearing surface marking;

2) signs:

i) all the signs:

— are in place where required;

— are located as required;

— have the dimensions and colours required;

— have an adequate lighting system when required;

— are frangible when required;

ii) this includes when required;

— mandatory instruction signs (runway designation signs, runway-holding position signs, Category I, II and III holding position signs, no entry signs);

— information signs (direction signs, location signs, runway vacated signs, runway exit signs, intersection take-off signs, destination signs, road-holding position signs, VOR checkpoint signs, aerodrome identification sign);

3) lights:

i) there should not be any non-aeronautical lights that might endanger the safety of an aeroplane;

ii) all the aeronautical lights:

— are displayed when required;

— located as required and in the required number;

— have the required colours and intensity levels;

— comply with their serviceability levels or maintenance objectives;

— are frangible when elevated as required;

iii) this includes, when required:

— the approach lighting system;

— the runway lead-in lighting systems;

— the visual approach slope indicator system (VASIS or PAPI);

— the runway lights (runway centre line lights, runway edge lights, runway threshold identification lights, runway end lights, runway threshold and wing bar lights, runway touchdown zone lights, stopway lights, runway turn pad lights);

— the taxiway lights (taxiway centre line lights, taxiway edge lights, stop bars, no-entry bars, intermediate holding position lights, rapid exit taxiway indicator lights);

— de-icing/anti-icing facility exit lights;

— runway guard lights;

— road-holding position lights;

— unserviceability lights;

— aeronautical beacons;

— obstacle lights;

4) markers:

   i) all the markers:

      — are in place where required;

      — are located as required and in the required number;

      — have the required colours;

      — are frangible;

   ii) this includes, when required:

      — the taxiway markers (taxiway edge markers, taxiway centre line markers);

      — the unpaved runway edge markers;

      — the boundary markers;

      — the stopway edge markers;

      — the edge markers for snow-covered runways;

      — unserviceability markers;

5) indicators:

   i) a wind direction indicator:

      — is provided in the correct location;

      — complies with the location and characteristics requirements;

      — is illuminated at an aerodrome intended for use at night.

2.2 RFF services

Initial certification of RFF services includes:

a) Level of protection:

   1) the level of protection is promulgated in the AIP;

   2) the aerodrome operator has a procedure to regularly reassess the traffic and update the level of protection including unavailability;

   3) the aerodrome operator has made arrangements with the aeronautical information services, including ATS, to provide up-to-date information in case of any change in the level of protection;

b) RFF personnel:

1) the number of RFF personnel is consistent with the level of protection appropriate to the aerodrome RFF category;

Note.— Guidance on the use of a task resource analysis in determining the minimum number of RFF personnel required can be found in the Airport Services Manual *(Doc 9137), Part 1 —* Rescue and Fire Fighting.

2) the training of all RFF personnel is adequate and monitored;

3) the training facilities, which may include simulation equipment for training on aeroplane fires, are available;

4) the procedures that RFF personnel follow are kept up to date;

c) Response:

1) the RFF service is provided with an up-to-date map of its response area, including the access roads;

2) the response time complies with the applicable regulation and is regularly tested. This check should be formalized in the RFF procedures;

3) the RFF service has procedures that describe this response and ensure that in case of an incident/accident a report is written and filed;

4) a communication and alerting system is provided between the fire station, the control tower and the RFF vehicles;

d) Rescue equipment:

1) the number of RFF vehicles is consistent with the applicable regulation;

2) the RFF service has a procedure describing the maintenance of the RFF vehicles and ensuring that this maintenance is formally monitored;

3) the types and quantities of the extinguishing agents, including the reserve supply, are consistent with the applicable regulation;

4) the protective clothing and respiratory equipment provided are consistent in quality and quantity in accordance with the applicable regulation, and the respiratory equipment is properly checked and their quantities formally monitored;

5) specific rescue equipment is provided in adequate number and type when the area to be covered by the RFF service includes water;

6) any other equipment required by the applicable regulation is provided in sufficient number.

2.3 Wildlife hazard management

The following checks on wildlife hazard management can either be a technical inspection or included in the audit of the aerodrome operator’s procedures:

a) The required equipment is provided;

b) Fences are provided as required;

c) The aerodrome operator has a procedure describing the actions taken for discouraging the presence of wildlife, including:

1) who is in charge of those actions and what their training is;

2) how and when these actions are carried out, including reporting and filing of these actions;

3) what equipment is used to conduct these actions;

4) analyses of the aerodrome vicinity and the preventive actions to be taken subsequently to discourage wildlife;

5) monitoring of these actions, including, where applicable, the conduct of appropriate wildlife assessments;

6) coordination with ATS;

d) The aerodrome operator has a procedure to:

1) record and analyse the incidents involving wildlife;

2) collect the wildlife's remains;

3) monitor the corrective actions to be taken subsequently; and

4) report to the State incidents involving wildlife.

3. ON-SITE VERIFICATION OF THE OPERATOR'S PROCEDURES AND SMS

3.1 On-site verification of the operator's procedures

On-site verification of the aerodrome operator's procedures should include the following:

a) Aerodrome data and reporting:

1) completeness, correctness and integrity of the data reported in accordance with the AIP including:

i) data collection, including the status of the movement area and its facilities;

ii) data validity checks;

iii) data transmission;

iv) changes to published data, whether permanent or not;

v) checks of the information once published;

vi) information update after construction works;

2) formal coordination with ATS;

3) formal coordination with the aeronautical information services;

4) publication of the required information in the aeronautical publication;

5) information published in accordance with the situation on site;

b) Access to the movement area:

1) an up-to-date plan clearly showing all the access points to the movement area;

2) a procedure describing the inspection of access points and fences;

Note.— Procedures for access to the manoeuvring areas are often markedly different from those for the apron areas.

c) Aerodrome emergency plan:

1) an up-to-date aerodrome emergency plan;

2) regular exercises in relation to the emergency plan;

3) a procedure describing the tasks in the emergency plan;

4) the aerodrome operator regularly verifies the information in the emergency plan, including keeping an up-to-date list of the persons and contact details in the emergency plan;

5) a procedure describing its roles and responsibilities during emergencies;

6) a procedure describing the involvement of, and coordination with, other agencies during emergencies;

7) the required minimum emergency equipment is available, including an adequately equipped emergency operation centre and mobile command post;

d) RFF:

1) a technical inspection of the various elements of the RFF services in 2.2 b) is held prior to the audit;

2) the checks that are to be done during the aerodrome operator's on-site verification consist only of verifying the timely implementation of the corrective action plan subsequent to the technical inspection;

3) if on-site verification reveals new deviations, they should be included in the on-site verification report;

e) Inspection of the movement area:

1) a procedure to ensure there is coordination with ATS for the inspection of the movement area;

2) describe the inspections, if performed by the aerodrome operator, including:

i) frequency and scope;

ii) reporting, transmission and filing;

iii) actions to be taken and their monitoring;

3) assess, measure and report runway surface characteristics when the runway is wet or contaminated and their subsequent promulgation to ATS;

f) Maintenance of the movement area:

1) a procedure to periodically measure the runway surface friction characteristics, assessing their adequacy and any action required;

2) ensure there is a long-term maintenance plan, including the management of the runway surface friction characteristics, pavement, visual aids, fencing, drainage systems and electrical systems and buildings;

g) Snow and ice control, and other hazardous meteorological conditions:

1) at aerodromes subjected to snow and icing conditions:

i) the aerodrome operator has a snow and ice control plan, including the means and procedures used as well as the responsibilities and criteria for closing and reopening the runway;

ii) there should be formal coordination for snow and ice removal between the aerodrome operator and ATS;

2) for other hazardous meteorological situations that may occur at the aerodrome (such as thunderstorms, strong surface winds and gusts, sandstorms), the aerodrome operator should have procedures describing the actions that have to be taken and defining the responsibilities and criteria for suspension of operations on the runway;

3) the aerodrome operator has formal coordination with the meteorological service provider in order to be advised of any significant meteorological conditions;

h) Visual aids and aerodrome electrical systems:

1) if the aerodrome operator is responsible for the maintenance of visual aids and electrical systems, procedures exist describing:

i) the tasks — routine and emergency ones, including inspections of luminous and non-luminous aids and their frequency and power supply maintenance;

ii) reporting, transmission and filing of reports;

iii) monitoring of subsequent actions;

iv) coordination with ATS;

2) if the aerodrome operator is not in charge of maintenance of visual aids and electrical systems, the organization in charge needs to be clearly identified, ensuring there are formal coordination procedures with the aerodrome operator, including agreed objectives;

3) obstacle marking is taken into account;

i) Operational safety during aerodrome work:

1) when executing work on the aerodrome:

i) a procedure describing the necessary notification to the different stakeholders;

ii) risk assessment of the aerodrome work;

iii) roles and responsibilities of the various parties, including their relationship and the enforcement of safety measures;

iv) safety monitoring during the work;

v) reopening of facilities, where relevant;

vi) necessary coordination with ATS;

j) Apron management. When an apron management service is provided:

1) a procedure to ensure coordination with ATS;

2) the use of acceptable aeroplanes for each parking stand formally identified;

3) a compliant apron safety line is provided;

4) general safety instructions for all the agents on the apron area;

5) the placement and pushback of the aeroplane;

k) Apron safety management:

1) a procedure for the inspection of the apron area (see j));

2) there is coordination with other parties accessing the apron, such as fuelling companies, de-icing companies and other ground handling agencies;

l) Vehicles on the movement area:

1) a procedure to ensure the vehicles on the movement area are adequately equipped;

2) the drivers have followed the appropriate training;

3) if the aerodrome operator is responsible for the training of vehicular drivers on the manoeuvring area, an appropriate training plan, including recurrent training and awareness actions, is available;

4) if the aerodrome operator is not in charge of this training or some of this training, the service provider is clearly identified and there is formal coordination between them;

Note.— Guidance on the knowledge required by operators of vehicles can be found in Annex 14, Volume I, Attachment A, section 19.

m) Wildlife hazard management. Checks on wildlife hazard management can either be a technical inspection or included in the on-site verification of the operator’s procedures:

1) if the domain has not been inspected during the technical inspections, the on-site verification team should check the points listed in 2.3 c);

2) if a technical inspection has been carried out prior to the on-site verification, the latter consists in checking the timely implementation of the corrective action plan subsequent to the technical inspection;

3) if the on-site verification reveals new deviations, these have to be included in the on-site verification report;

n) Obstacles:

1) a procedure to ensure that there is an obstacle chart;

2) a procedure for obstacle monitoring describing the checks, their frequency, filing and follow-up actions;

3) a procedure to ensure that the obstacles do not represent a danger for safety and that appropriate action is taken when required;

o) Removal of a disabled aeroplane:

1) there is a plan for the removal of a disabled aeroplane describing the role and responsibility of the aerodrome operator, including the necessary coordination with other agencies and the means available or that can be made available;

p) Low visibility operations:

1) there is coordination between the aerodrome operator and ATS, including awareness of the status of both low visibility procedures (LVP) and the deterioration of visual aids;

2) a procedure describing the actions to be taken when LVP is in process (vehicle control, visual range measurement if necessary);

3.2 On-site verification of the SMS

a) As a minimum, the items to be in place when granting the initial certification are:

1) safety policy: a safety policy has been endorsed by the accountable executive to reflect the organization's commitments regarding safety;

2) operator's organizational structure: the aerodrome operator has appointed an accountable executive and a safety manager;

b) The safety manager should be independent from any operational task regarding aerodrome safety. The criteria for assessing the operator's SMS structure might be tailored to the size of the operator, notably concerning the independence of the safety manager;

c) The capability and competence of the aerodrome operator should be assessed so as to ensure sufficient management commitment to and responsibility for safety at the aerodrome. This is usually achieved through the competence of the accountable executive;

1) responsibilities and assignments: the aerodrome operator has formally defined the responsibilities of each staff member regarding safety as well as the lines of responsibility;

2) training: the aerodrome operator formally monitors the staff's and subcontractors' training, ensuring that it is adequate, and takes action when necessary;

3) accident and incident reporting: the aerodrome operator has a procedure ensuring that:

   i) incidents are reported by staff and subcontractors, including a description of the actions in place in order to be able to report them;

   ii) incidents are promptly analysed and the actions to be subsequently taken are monitored;

   iii) the reports and analyses of the incidents are filed;

   iv) incidents are reported to the State;

   v) coordination is in place with other stakeholders;

4) existing hazards at the aerodrome: a procedure in order to identify, analyse and assess hazards to the safe operation of aeroplanes and to put in place suitable mitigating measures;

5) risk assessment and mitigation of changes: a procedure ensuring that for any change at the aerodrome, its impact on safety is analysed, listing the subsequent hazards that could be generated. This procedure describes who conducts the analysis, when and how the hazards are monitored, what actions are subsequently taken, and the criteria leading to the analysis. These assessments are filed;

6) safety indicators: the aerodrome operator sets and monitors its own safety indicators that illustrate its safety criteria, in order to be able to analyse the potential deficiencies;

Note.— Ensure coordination with previous safety indicators as set by the State.

7) safety audits: the aerodrome operator has a safety audit programme in place which includes a training programme for those involved;

8) safety promotion: the aerodrome operator should have a process to promote safety-related information.

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Appendix 2 to Chapter 2

CRITICAL DATA RELATED TO SAFETY OCCURRENCES REPORTED AT AERODROMES FOR THE MONITORING OF SAFETY

Note.— The provisions in this appendix do not override the requirements in Annex 13 — Aircraft Accident and Incident Investigation, *concerning the mandatory reporting of certain types of accidents/serious incidents and the responsibilities of the various parties involved.*

When safety occurrences of the following types are reported, the following critical data should be collected when relevant and feasible. This may require a collaborative effort from the aerodrome operator, ANSP or other involved parties commensurate with the severity of the potential risk attached to each occurrence.

1. Runway excursions

a) type of event (lateral veer-off, overrun);

b) landing/take-off;

c) type of approach if it is a landing event (local time or UTC);

d) date and time (local time or UTC);

e) aeroplane type;

f) runway:

   1) dimensions (width/length);

   2) slopes;

   3) displaced threshold (yes/no, and if so, distance between the runway threshold and the runway edge);

   4) runway end safety area (RESA) (yes/no, and if so, orientation, dimensions and structure);

   5) contaminated runway (yes/no, and if so, contaminant type (slush, snow, ice, water, other (to be specified), contaminant depth);

g) wind (direction and speed);

h) visibility;

i) details of the exit:

1) exit speed or estimation;

2) aeroplane angle with the runway edge;

3) distance between the touchdown and the exit;

4) description of the trajectory of the aeroplane once on the runway strip and/or RESA;

j) details of the location of the aeroplane once stopped.

Note 1.— For overruns, information to be reported includes longitudinal position in relation to the threshold location and/or end of runway surface and lateral position in relation to runway lateral edge or runway centre line.

Note 2.— Runway excursions are serious incidents, if not accidents, according to Annex 13, Attachment C. This would normally imply that the State's accident/incident investigation authority needs to become involved, and coordination with the relevant authorities is therefore required.

2. Undershoot (land short of runway)

a) type of event (land short, undershoot);

b) type of approach;

c) ground-based vertical guidance available and operational (instrument landing system (ILS), precision approach path indicator (PAPI), abbreviated precision approach path indicator (APAPI));

d) date and time (local time or UTC);

e) wind speed (including gusts), description (calm/variable) and direction;

f) visibility;

g) aeroplane type;

h) runway:

1) dimensions (width/length);

2) slopes;

3) displaced threshold (yes/no, and if so, distance between the runway threshold and the runway edge);

4) RESA (yes/no, and if so, magnetic orientation of runway (QFU), dimensions and structure);

5) contaminated runway (yes/no, and if so, contaminant type (slush, snow, ice, water, other (to be specified), contaminant depth);

i) details of the undershoot (aeroplane speed at touchdown, distance between the touchdown and the runway edge, causes of the event):

1) description of the trajectory of the aeroplane after touchdown.

Note.— Undershoots are serious incidents, if not accidents, according to Annex 13, Attachment C. This would normally imply that the State's accident/incident investigation authority needs to become involved, and coordination with the relevant authorities is therefore required.

3. Runway incursion

a) entities involved (aeroplane/vehicle; aeroplane/aeroplane; aeroplane/person);

b) date and time (local time or UTC);

c) aeroplane type, landing/take-off, type of approach;

d) vehicle type, location;

e) runway:

1) dimensions (width/length);

2) slopes/line of sight;

3) displaced threshold (yes/no, and if so, distance between the runway threshold and the runway edge);

4) rapid exits;

5) wind;

6) visibility;

f) details of the incursion:

1) description of the trajectories and speeds of both vehicles/aeroplanes;

2) estimated distances (horizontal and vertical) between the entities involved;

3) contaminated operational surfaces in the incursion area (yes/no, and if so, contaminant type (slush, snow, ice, water, other (to be specified), contaminant depth).

Note 1.— Runway incursions classified with severity A are serious incidents according to Annex 13, Attachment C. This would normally imply that the State's accident/incident investigation authority needs to become involved, and coordination with the relevant authorities is therefore required.

Note 2.— Guidance on prevention of runway incursions, including severity classification, is available in Doc 9870 — Manual on the Prevention of Runway Incursions).

4. Landing or take-off on a taxiway

a) landing/take-off;

b) type of approach when relevant;

c) date and time (local time or UTC);

d) wind;

e) visibility;

f) aeroplane type;

g) taxiway:

1) dimensions (width/length);

2) slopes;

h) details of the event:

1) possible contributing factors (e.g. inadequate lighting, procedure not applied, works, inadequate or misleading marking).

Note.— Landing and take-off on taxiways are serious incidents according to Annex 13, Attachment C. This would normally imply that the State's accident/incident investigation authority needs to become involved, and coordination with the relevant authorities is therefore required.

5. FOD-related events

a) type of event;

b) location (runway, orientation, or taxiway, stand), location of FOD, including where possible lateral and longitudinal positions;

c) date and time (local time or UTC);

d) FOD description:

1) name (if possible);

2) shape and dimensions;

3) material;

4) colour;

5) origin (if known: lighting, infrastructure, works, animals, aeroplane, environment (wind, etc.)).

6. Other excursions (i.e. from the taxiway or apron)

a) type of event;

b) location;

c) date and time (local time or UTC);

d) aeroplane type;

e) taxiway:

1) dimensions (width/length);

2) slopes;

3) if in a curved section: fillets (yes/no, and characteristics);

4) contaminated taxiway (yes/no, and if so, contaminant type (slush, snow, ice, water, other (to be specified) and contaminant depth);

f) wind (direction and speed);

g) details of the exit (exit speed or estimation, aeroplane angle with the taxiway edge, in a straight or a curved section, causes of the event);

h) details of the location of the aeroplane once stopped.

7. Other incursions (i.e. on taxiway or apron)

Same data as for item 2 (undershoot).

8. Birds/wildlife strike-related events

To be conducted in accordance with ICAO bird strike information system (IBIS) data (ingestion, collision). If there has been no collision, and the animal was avoided, it is important to know the location of the animal at the time the avoided collision occurred.

9. Ground collisions

a) type of event (ground collision);

b) location:

1) apron;

2) manoeuvring area;

3) runway, taxiway;

4) contaminant (if relevant: type and depth);

5) wind (if relevant);

c) date and time (local time or UTC);

d) phase of flight (e.g. taxi out, departure roll, engine start/pushback);

e) aeroplane(s) involved;

1) type of aeroplane and trajectory;

f) vehicle(s) involved;

1) type of vehicle and trajectory;

g) material damages (to both aeroplane(s) and/or vehicle(s))/human damages and location of the damages;

h) phase of operation, if ground handling is involved;

i) description of the collision:

1) estimated speed of both vehicle(s) and/or aeroplane(s);

2) description of the trajectories of the aeroplane(s) and/or the vehicle(s).

Note 1.— Ground collisions involving aeroplanes can be incidents, serious incidents or accidents. If classified as an incident, they are normally investigated as part of the aerodrome's SMS. If classified as a serious incident or accident, this would normally imply that the State's accident/incident investigation authority needs to become involved, and coordination with the relevant authorities is therefore required.

Note 2.— Ground collisions not involving aeroplanes can be an incident and investigated as part of the aerodrome's SMS.

Attachment A to Chapter 2

LIST OF POSSIBLE SUBJECTS COVERED IN AN AERODROME MANUAL

The contents of an aerodrome manual include:

a) List of updates;

b) Aerodrome administrative data;

c) Description of the aerodrome, including dimensions and related information;

d) List of authorized deviations;

e) Duties, means and procedures of the applicant to ensure safety in each area include:

1) aerodrome data and reporting;

2) access to the movement area;

3) aerodrome emergency plan;

4) RFF;

5) inspection of the movement area;

6) maintenance of the movement area;

7) snow and ice control, and other hazardous meteorological conditions;

8) visual aids and aerodrome electrical systems;

9) apron management;

10) apron safety management;

11) vehicle control on the movement area;

12) wildlife hazard management;

13) obstacles;

14) removal of disabled aeroplanes;

15) dangerous goods;

16) low visibility operations;

17) protection of sites for radar, navigational aids and meteorological equipment;

f) SMS.

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Attachment B to Chapter 2

INITIAL CERTIFICATION PROCESS

1. AERODROME CERTIFICATION SCHEME

It may not be possible to certify all aerodromes at the same time since it depends on the number of aerodromes in the State. Therefore, a programme for the certification of aerodromes in the State, including the schedule, has to be prepared. The State plans a certification programme, taking into account the number of trained oversight personnel within the State, according to the following main parameters.

1.1 Scope of operations and traffic

1.1.1 An important consideration to be taken into account is the level of commercial operations. For States having a large number of aerodromes, different deadlines for certification may be established based on traffic thresholds. These criteria allow the State to certify higher traffic aerodromes with priority.

1.1.2 The number of aircraft movements may be an important parameter. This is partly taken into account with the passenger volume, but the types of aeroplanes used can have an impact on the criteria used for certification. This impact is taken into account when needed through the applicable regulation itself as some specifications may or may not apply, depending on the number of movements (e.g. RFF service).

1.2 Complexity of infrastructure design

1.2.1 The inspection of infrastructure and ground aids is often the first step of the initial certification process and contributes to the assessment of the conformity of the infrastructure, taking into account its complexity. Periodic infrastructure and ground aids inspections are also an important part of the continued oversight.

1.2.2 Issues arising from complex aerodrome design will also be dealt with through feedback obtained through the reporting of accidents/incidents occurring on the aerodrome as part of the aerodrome's SMS.

1.3 Level/maturity of SMS implementation

1.3.1 Because the SMS requirements for the certification of the aerodrome operators may be new, this aspect of the operation may require major efforts by the aerodrome operator to achieve compliance.

1.3.2 For an aerodrome which is already certified or being certified, for which the SMS is in its initial phase, the level/maturity of SMS implementation can be expected to be effective only after a certain period of time. Consequently, initial certification of the operator's SMS may need to be tailored to the size of the operator and the maturity of its SMS. Specific attention to the SMS during on-site verification is therefore necessary.

2. SUMMARY OF THE CERTIFICATION PROCESS

2.1 The certification process for an aerodrome that is already operational can be summarized as follows:

a) as soon as an aerodrome meets the legal criteria for certification, a meeting is held between the State and the aerodrome operator;

b) during this meeting, the State presents the certification process and deadlines to the aerodrome operator. The aerodrome operator develops the aerodrome manual as soon as it enters the initial certification process, so as to submit it no later than six months after the meeting;

c) during this six-month period the State:

1) completes the technical inspections so that the results are available for the on-site verification; and

2) assembles the on-site verification team at least two months before the deadline for submission of the aerodrome manual and informs the aerodrome operator of the team members.

Note.— The main items subject to technical inspections and the minimal checks to be performed are listed in Appendix 1.

2.2 When all the conditions have been met, the aerodrome manual is accepted/approved no later than three months after it was first submitted. This period includes any exchange of communication between the aerodrome operator and the State if needed – some information may be lacking at the beginning, thus preventing the State from accepting the manual at first.

2.3 During this period, the on-site verification team, together with the aerodrome operator, plans the time and dates of the on-site verification with the objective of allowing the aerodrome operator a four-month period to mitigate any deviations before the certification deadline.

2.4 As soon as the aerodrome manual is accepted, it is sent to the on-site verification team with all the procedures enclosed. The on-site verification and inspection reports should be sent by the State to the aerodrome operator no later than one month after the on-site verification/inspection closing meeting.

2.5 The aerodrome operator submits to the State corrective action plans no later than two months after having received the certification/inspection reports. The State and the aerodrome operator require two months minimum after the last report to agree to the corrective action plans before granting the certificate.

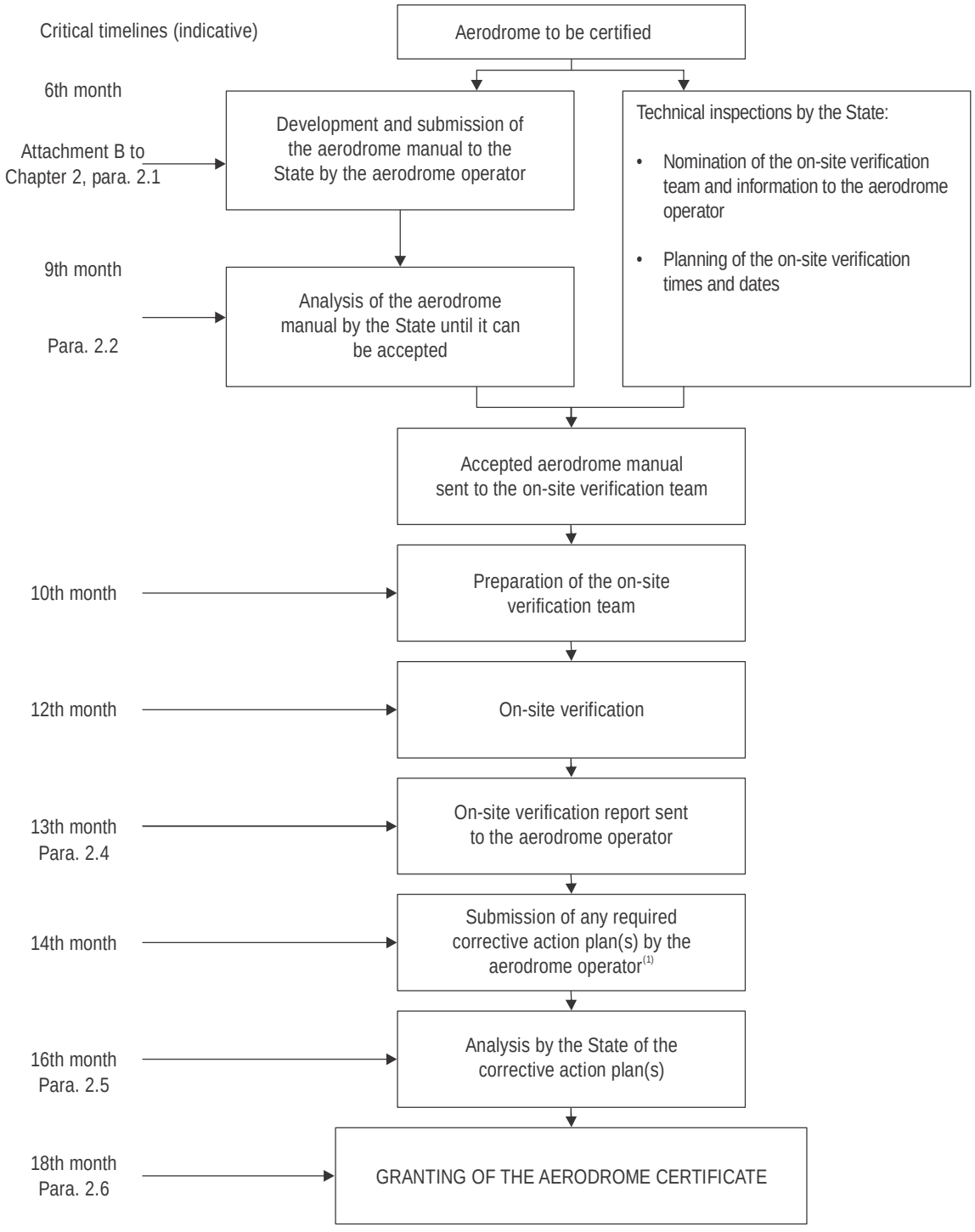
2.6 For aerodromes already operating, the overall process, until delivery of the certificate, could consequently last 18 months.

Note.— The SMS on-site verification can be disconnected from the aerodrome operator's on-site verification in regard to compliance with its operational procedures and in this case:

— *the deadline for the submission of the SMS part of the aerodrome manual can be longer, but will nevertheless not exceed six additional months;*

— *the deadline for the SMS on-site verification can be longer, but the SMS on-site verification will nevertheless be conducted at least three months before the certification deadline to be in line with the required period of two months for the operator and the State to define an accepted corrective action plan.*

2.7 A flow chart on the certification process is given in Figure I-2-Att B-1.



(1) This corrective action plan covers the on-site verification of the operator's certification and can be combined with the corrective action plans related to the technical inspections and initial SMS on-site verification that follow the same methodology and which could have been sent before.

Figure I-2-Att B-1. The certification process

Attachment C to Chapter 2

CHECKLIST OF THE COMPONENTS OF AN AERODROME MANUAL

		YES	NO
1.	**Introduction**		
a)	Purpose of the aerodrome manual.		
b)	Legal position regarding aerodrome certification as contained in the applicable regulation.		
c)	Distribution of the aerodrome manual.		
d)	Procedures for distributing and amending the aerodrome manual and the circumstances in which amendments may be needed.		
e)	Checklist of pages.		
f)	Preface by licence holder.		
g)	Table of contents.		
h)	Glossary of terms.		
	Note.— This section will contain a short explanation of the general terms used in the aerodrome manual including job titles and abbreviations.		
2.	**Technical administration**		
a)	Name and address of the aerodrome.		
b)	Name and address of the aerodrome operator.		
c)	The name of the accountable executive.		

	YES	NO
3. Description of the aerodrome (aerodrome characteristics)		
a) Details of the following:		
1) latitude and longitude of the aerodrome reference point in World Geodetic System — 1984 (WGS-84) format;		
2) elevations of:		
• aerodrome		
• apron		
b) Plans showing the position of the aerodrome reference point, layout of the runways, taxiways and aprons; the aerodrome markings and lighting (including the precision approach path indicator (PAPI), the visual approach slope indicator system (VASIS) and obstruction lighting); and the siting of navigation aids within the runway strips. It will not be necessary for these plans or the information called for in subparagraphs c) to f) below to accompany all copies of the aerodrome manual, but they are to be appended to the licence holder's master copy and to the copy kept with the State regulator. Operating staff are to be provided with scaled–down copies or extracts of plans relevant to their duties.		
c) Description, height and location of obstacles that infringe upon the standard protection surfaces, whether they are lighted and if they are noted in the aeronautical publications.		
d) Procedures for ensuring that the plans are up to date and accurate.		
e) Data for, and the method used to calculate, declared distances and elevations at the beginning and end of each declared distance.		
f) Details of the surfaces, dimensions and classification or bearing strengths of runways, taxiways and aprons.		
4. List of authorized deviations, if any.		
5. Operational procedures for:		
5.1 Promulgation of aeronautical information		
The system of aeronautical information service available and the system that the certificate holder uses to promulgate AIP requirements.		

		YES	NO
5.2	**Control of access**		
	Control of access to the aerodrome and its operational areas, including the location of notice boards, and the control of vehicles in the operational areas.		
5.3	**Emergency planning**		
a)	The aerodrome operator's arrangements in response to an emergency. These arrangements should take account of the complexity and size of the aeroplane operations.		
b)	Description of actions to be taken by the aerodrome operator as part of plans for dealing with different emergencies occurring at the aerodrome or in its vicinity.		
c)	Contact list of organizations, agencies and persons of authority.		
d)	Procedures for the appointment of an on-scene commander for the overall emergency operation and description of responsibilities for each type of emergency.		
e)	Reporting mechanism in the event of emergency.		
f)	Details of tests of aerodrome facilities and equipment to be used in emergencies, including the frequency of those tests.		
g)	Details of the exercises to test emergency plans, including the frequency of those exercises.		
h)	Arrangements for personnel training and preparation for dealing with emergencies.		
5.4	**Rescue and fire fighting (RFF) services**		
a)	Policy statement on the RFF categories to be provided.		
b)	Where the senior aerodrome fire officer or designated fire watch officers have specific safety accountabilities, these should be included in the relevant chapter of the aerodrome manual.		
c)	Policy and procedures indicating how depletion of the RFF service is to be managed. This should include the extent to which operations are to be restricted, how pilots are to be notified and the maximum duration of any depletion.		
d)	At aerodromes where a higher category of RFF is available by prior arrangement, the aerodrome manual should clearly state the actions necessary to upgrade the facility. Where necessary, this should include actions to be taken by other departments.		
e)	The aerodrome operator's objectives for each RFF category provided should be defined, including a brief description of:		

	YES	NO
1) amounts of extinguishing agents provided;		
2) discharge rates;		
3) number of foam-producing appliances;		
4) manning levels;		
5) levels of supervision.		
f) Procedures for:		
1) monitoring the aeroplane movement areas for the purpose of alerting RFF personnel;		
2) indicating how the adequacy of the response time capability of the RFF services throughout their functions and locations is monitored and maintained;		
3) indicating how RFF personnel engaged in extraneous duties are managed to ensure that response capability is not affected.		
g) Where the aerodrome provides specialist equipment such as rescue craft, emergency tenders, hose layers, and appliances with aerial capability, details should be included in the aerodrome manual. Procedures to be followed if these facilities are temporarily unavailable should also be included.		
h) Where the aerodrome is reliant upon other organizations to provide equipment which is essential for ensuring the safe operation of the aerodrome (perhaps water rescue), policies or letters of agreement should be included in the aerodrome manual. Where necessary, contingency plans in the event of non-availability should be described.		
i) A statement describing the process by which aerodrome operators ensure the initial and continued competence of their RFF personnel, including the following:		
1) realistic fuel fire training;		
2) breathing apparatus training in heat and smoke;		
3) first aid;		
4) low visibility procedures (LVP);		
5) any legal requirements;		
6) health and safety policy with regard to training of personnel in the use of respiratory protection equipment and personal protection equipment.		

		YES	NO
j)	Procedures indicating how accidents in the immediate vicinity of the aerodrome are to be accessed. Where difficult environs exist, the aerodrome manual should indicate how these are to be accessed.		
k)	Where local authorities or the aerodrome operator expects the RFF facility to respond to domestic fires or special services, procedures for managing their impact upon normal aeroplane RFF responses should be included.		
l)	Where the aerodrome operator expects the RFF facility to respond to aeroplane accidents landside, the policy should be clearly described, including procedures to manage the effects on continued aeroplane operations.		
m)	The availability of additional water supplies should be described.		
n)	Aerodrome operator's arrangements for ensuring the adequacy of responses in abnormal conditions, i.e. LVP.		
5.5	**Inspections of the movement area**		
a)	Routine aerodrome inspections, including lighting inspections, and reporting, including the nature and frequency of these inspections.		
b)	Inspecting the apron, runways and taxiways following a report of debris on the movement area, an abandoned take-off due to engine, tire or wheel failure, or any incident likely to result in debris being left in a hazardous position.		
c)	Sweeping of runways, taxiways and aprons.		
d)	Measurement and promulgation of water, slush and other contaminants including depths on runways and taxiways.		
e)	Assessment and promulgation of runway surface conditions:		
	1) details of inspection intervals and times;		
	2) completion and effective use of an inspection checklist;		
	3) arrangements and methods for carrying out inspections on FOD, lighting, pavement surface, grassing;		
	4) arrangements for reporting the results of inspections and for follow-up;		
	5) arrangements and means of communication with air traffic control during an inspection;		
	6) arrangements for keeping an inspection logbook and the location of the logbook.		

		YES	NO
5.6	**Maintenance of the movement area**		
a)	Promulgation of information on the aerodrome operational state, temporary withdrawals of facilities, runway closures, etc.:		
	1) arrangements for maintaining the paved areas, including the runway friction assessments;		
	2) arrangements for maintaining the unpaved runways and taxiways;		
	3) arrangements for maintaining the runway and taxiway strips;		
	4) arrangements for maintaining aerodrome drainage;		
	5) arrangements for maintaining the visual aids, including the measurement of intensity, beam spread and orientation of lights;		
	6) arrangements for maintaining the obstacle lighting;		
	7) arrangements for reporting and action taken in the event of failure or unsafe occurrence.		
5.7	**Snow and ice control, and other hazardous meteorological conditions**		
	Description of the procedures.		
5.8	**Visual aids**		
a)	Responsibilities with respect to the aerodrome ground lighting system.		
b)	A full description of all visual aids available on each approach, runway, taxiway and apron, including signs, markings and signals.		
c)	Procedures for operational use and brilliancy settings of the lighting system.		
d)	Standby and emergency power arrangements, including operating procedures both in LVP and during main power failure situations.		
e)	Procedures for routine inspection and photometric testing of approach lights, runway lights, VASIS and PAPIs.		
f)	The location of and responsibility for obstacle lighting on and off the aerodrome.		
g)	Procedures for recording inspection and maintenance of visual aids and actions to be taken in the event of failures.		
h)	The control of work, including trenching and agricultural activity, which may affect the safety of the aeroplane.		

		YES	NO
5.9	**Apron management**		
a)	Arrangements between air traffic control, the aerodrome operator and the apron management unit.		
b)	Arrangements for allocating aeroplane stands.		
c)	Arrangements for initiating engine start and ensuring clearance of aeroplane pushback.		
5.10	**Apron safety management**		
a)	Means and procedures for jet blast protection.		
b)	Arrangements of safety precautions during aeroplane refuelling operations.		
c)	Arrangements for apron sweeping and cleaning.		
d)	Arrangements for reporting incidents and accidents on an apron.		
e)	Arrangements for assessing the safety compliance of all personnel working on the apron.		
f)	Arrangements for the use of advanced visual docking systems, if provided.		
5.11	**Vehicles on the movement area**		
a)	Details of the applicable traffic rules (including speed limits and the means of enforcing the rules).		
b)	Method and criteria for allowing drivers to operate vehicles on the movement area.		
c)	Arrangements and means of communicating with air traffic control.		
d)	Details of the equipment needed in vehicles that operate on the movement area.		
5.12	**Wildlife hazard management**		
a)	Arrangements and method for dispersal of bird and other wildlife.		
b)	Measure to discourage birds and other wildlife.		
c)	Arrangements for assessing wildlife hazards.		
d)	Arrangements for implementing wildlife control programmes.		

		YES	NO
5.13	**Obstacles**		
a)	Arrangements for monitoring the height of buildings or structures within the boundaries of the obstacle limitation surfaces (OLS).		
b)	Arrangements for controlling new developments in the vicinity of aerodromes.		
c)	The reporting procedure and actions to be taken in the event of the appearance of unauthorized obstacles.		
d)	Arrangements for removal of an obstacle.		
5.14	**The removal of a disabled aeroplane**		
a)	Details of the capability for removal of a disabled aeroplane.		
b)	Arrangements for removing a disabled aeroplane, including the reporting and notifying procedures and liaison with ATC.		
5.15	**Dangerous goods**		
	Arrangements for special areas on the aerodrome to be set up for the storage of dangerous goods.		
5.16	**Low visibility operations**		
a)	Obtaining and disseminating meteorological information, including runway visual range (RVR) and surface visibility.		
b)	Protection of runways during LVP if such operations are permitted.		
c)	The arrangement and rules before, during and after low visibility operations, including applicable rules for vehicles and personnel operating in the movement area.		
5.17	**Protection of sites for radar, navigation aids and meteorological equipment**		
a)	Description of the areas to be protected and procedures for their protection.		
6.	**Safety management system (SMS)**		
a)	Safety policy.		
b)	Operator’s structure and responsibility. This should include:		
	1) the name, status and responsibilities of the accountable executive;		
	2) the name, status and responsibilities of the safety manager;		

		YES	NO
	3) the name, status and responsibilities of other senior operating staff;		
	4) the name, status and responsibilities of the official in charge of day-to-day operations;		
	5) instructions as to the order and circumstances in which the above-named staff may act as the official in charge or accountable executive;		
	6) an organizational chart supporting the commitment to the safe operation of the aerodrome as well as one simply showing the hierarchy of responsibility for safety management.		
c)	Training.		
d)	Complying with regulatory requirements relating to accidents, incidents and mandatory occurrence reporting.		
e)	Hazard analysis and risk assessment.		
f)	The management of change.		
g)	Safety criteria and indicators.		
h)	Safety audits.		
i)	Documentation.		
j)	Safety-related committees.		
k)	Safety promotion.		
l)	Responsibility for monitoring the contractors and third parties operating on the aerodrome.		

Chapter 3

SAFETY ASSESSMENTS FOR AERODROMES

Note 1.— The objective of a safety assessment, as part of the risk management process of an SMS, is described in 3.3.1.

Note 2.— Where alternative measures, operational procedures and operating restrictions have been developed arising from safety assessments, these should be reviewed periodically to assess their continued validity. The procedures in this chapter do not substitute or circumvent the provisions contained in Annex 14, Volume I. It is expected that infrastructure on an existing aerodrome or a new aerodrome will fully comply with the requirements in the Annex.

3.1 INTRODUCTION

3.1.1 A certified aerodrome operator implements an SMS acceptable to the State that, as a minimum.

a) identifies safety hazards;

b) ensures that remedial action necessary to maintain safety is implemented;

c) provides for continuous monitoring and regular assessment of the achieved safety; and

d) aims to make continuous improvement to the overall safety of the aerodrome.

Note 1.— Annex 19 — Safety Management *contains the framework for the implementation and maintenance of an SMS by a certified aerodrome. Annex 19, Appendix 2, contains a description of the four components comprising the framework, i.e. safety policy and objectives, safety risk management, safety assurance and safety promotion.*

Note 2.— Further guidance on SMS is available in Doc 9859, Safety Management Manual (SMM).

3.1.2 This chapter describes how a safety assessment can be undertaken as part of the aerodrome's SMS. By applying the methodology and procedures described here, the aerodrome operator can demonstrate compliance with the minimum requirements described in 3.1.1.

3.2 SCOPE AND APPLICABILITY

3.2.1 The following sections present, inter alia, a general methodology to conduct safety assessments on an aerodrome. Additional tools and particularly appropriate checklists, such as those found in Chapter 2, can help identify hazards, assess safety risks and eliminate or mitigate those risks when necessary. The suitability of the mitigation proposed and the need for alternative measures, operational procedures or operating restrictions for the specific operations concerned should be comprehensively evaluated. Section 3.4 details how the State will validate the conclusion of the safety assessment, when appropriate, to ensure safety is not compromised. Section 3.5 describes

procedures on the approval or acceptance of a safety assessment. Section 3.6 specifies how to promulgate appropriate information for use by the various aerodrome stakeholders and particularly by the pilots and aircraft operators.

3.2.2 The safety assessment process addresses the impact of a safety concern, including a change or deviation, on the safety of operations at the aerodrome and takes into consideration the aerodrome's capacity and the efficiency of operations, as necessary.

3.3 BASIC CONSIDERATIONS

3.3.1 A safety assessment is an element of the risk management process of an SMS that is used to assess safety concerns arising from, inter alia, deviations from standards and applicable regulations, identified changes at an aerodrome specified in 2.4.4, or when any other safety concerns arise.

Note.— Changes on an aerodrome can include changes to procedures, equipment, infrastructures, safety works, special operations, regulations, organization, etc.

3.3.2 When a safety concern, change or a deviation has an impact on several aerodrome stakeholders, consideration shall be given to the involvement of all stakeholders affected in the safety assessment process. In some cases, the stakeholders impacted by the change will need to conduct a separate safety assessment themselves in order to fulfil the requirements of their SMSs and coordinate with other relevant stakeholders. When a change has an impact on multiple stakeholders, a collaborative safety assessment should be conducted to ensure compatibility of the final solutions.

3.3.3 A safety assessment considers the impact of the safety concern on all relevant factors determined to be safety-significant. The list below provides a number of items that may need to be considered when conducting a safety assessment. The items in this list are not exhaustive and in no particular order:

a) aerodrome layout, including runway configurations; runway length; taxiway, taxilane and apron configurations; gates; jet bridges; visual aids; and the RFF services infrastructure and capabilities;

b) types of aircraft, and their dimensions and performance characteristics, intended to operate at the aerodrome;

c) traffic density and distribution;

d) aerodrome ground services;

e) air-ground communications and time parameters for voice and data link communications;

f) type and capabilities of surveillance systems and the availability of systems providing controller support and alert functions;

g) flight instrument procedures and related aerodrome equipment;

h) complex operational procedures, such as collaborative decision-making (CDM);

i) aerodrome technical installations, such as advanced surface movement guidance and control systems (A-SMGCS) or other air navigation aids;

j) obstacles or hazardous activities at or in the vicinity of the aerodrome;

k) planned construction or maintenance works at or in the vicinity of the aerodrome;

l) any local or regional hazardous meteorological conditions (such as wind shear); and

m) airspace complexity, ATS route structure and classification of the airspace, which may change the pattern of operations or the capacity of the same airspace.

Note.— Chapter 4 outlines the methodology and procedures to assess the adequacy between aeroplane operations and aerodrome infrastructure and operations.

3.3.4 Subsequent to the completion of the safety assessment, the aerodrome operator is responsible for implementing and periodically monitoring the effectiveness of the identified mitigation measures.

3.3.5 The State reviews the safety assessment provided by the aerodrome operator and its identified mitigation measures, operational procedures and operating restrictions, as required in 3.4, and is responsible for the subsequent regulatory oversight of their application.

Note.— A list of references to existing studies that may assist aerodrome operators in developing their safety assessments is available in Appendix B to Circular 305 — Operation of New Larger Aeroplanes at Existing Aerodromes. *New and updated references will be included in other appropriate documents as they become available. However, it is to be noted that each study is specific to a particular deviation or change; hence, caution should be exercised in considering applicability to other situations and locations. Inclusion of these references does not imply ICAO endorsement or recognition of the outcome of the studies, which remains the ultimate responsibility of the State in accordance with the Convention on International Civil Aviation.*

3.4 SAFETY ASSESSMENT PROCESS

3.4.1 Introduction

Note.— Guidance on continuous improvement of the SMS as part of the safety assurance component of the SMS framework is available in Doc 9859.

3.4.1.1 The primary objective of a safety assessment is to assess the impact of a safety concern such as a design change or deviation in operational procedures at an existing aerodrome.

3.4.1.2 Such a safety concern can often impact multiple stakeholders; therefore, safety assessments often need to be carried out in a cross-organizational manner, involving experts from all the involved stakeholders. Prior to the assessment, a preliminary identification of the required tasks and the organizations to be involved in the process is conducted.

3.4.1.3 A safety assessment is initially composed of four basic steps:

a) definition of a safety concern and identification of the regulatory compliance;

b) hazard identification and analysis;

c) risk assessment and development of mitigation measures; and

d) development of an implementation plan for the mitigation measures and conclusion of the assessment.

Note 1.— A safety assessment process flow chart applicable for aerodrome operations is provided in Attachment A to this chapter; a generic safety risk management process can be found in Doc 9859.

Note 2.— Certain safety assessments may involve other stakeholders such as ground handlers, aeroplane operators, air navigation service providers (ANSPs), flight procedure designers and providers of radio navigation signals, including signals from satellites.

3.4.2 Definition of a safety concern and identification of the regulatory compliance

3.4.2.1 Any perceived safety concerns are to be described in detail, including timescales, projected phases, location, stakeholders involved or affected as well as their potential influence on specific processes, procedures, systems and operations.

3.4.2.2 The perceived safety concern is first analysed to determine whether it is retained or rejected. If rejected, the justification for rejecting the safety concern is to be provided and documented.

3.4.2.3 An initial evaluation of compliance with the appropriate provisions in the regulations applicable to the aerodrome is conducted and documented.

3.4.2.4 The corresponding areas of concern are identified before proceeding with the remaining steps of the safety assessment, with all relevant stakeholders.

Note.— It may be useful to review the historical background of some regulatory provisions to gain a better understanding of the safety objective of those provisions.

3.4.2.5 If a safety assessment was conducted previously for similar cases in the same context at an aerodrome where similar characteristics and procedures exist, the aerodrome operator may use some elements from that assessment as a basis for the assessment to be conducted. Nevertheless, as each assessment is specific to a particular safety concern at a given aerodrome the suitability for reusing specific elements of an existing assessment is to be carefully evaluated.

3.4.3 Hazard identification

3.4.3.1 Hazards related to infrastructure, systems or operational procedures are initially identified using methods such as brain-storming sessions, expert opinions, industry knowledge, experience and operational judgement. The identification of hazards is conducted by considering:

a) accident causal factors and critical events based on a simple causal analysis of available accident and incident databases;

b) events that may have occurred in similar circumstances or that are subsequent to the resolution of a similar safety concern; and

c) potential new hazards that may emerge during or after implementation of the planned changes.

3.4.3.2 Following the previous steps, all potential outcomes or consequences for each identified hazard are identified.

Note.— Further guidance on the definition of risk can be found in Doc 9859.

3.4.3.3 The appropriate safety objective for each type of hazard should be defined and detailed. This can be done through:

a) reference to recognized standards and/or codes of practices;

b) reference to the safety performance of the existing system;

c) reference to the acceptance of a similar system elsewhere; and

d) application of explicit safety risk levels.

3.4.3.4 Safety objectives are specified in either quantitative terms (e.g. identification of a numerical probability) or qualitative terms (e.g. comparison with an existing situation). The selection of the safety objective is made according to the aerodrome operator's policy with respect to safety improvement and is justified for the specific hazard.

3.4.4 Risk assessment and development of mitigation measures

3.4.4.1 The level of risk of each identified potential consequence is estimated by conducting a risk assessment. This risk assessment will determine the severity of a consequence (effect on the safety of the considered operations) and the probability of the consequence occurring and will be based on experience as well as on any available data (e.g. accident database, occurrence reports).

3.4.4.2 Understanding the risks is the basis for the development of mitigation measures, operational procedures and operating restrictions that might be needed to ensure safe aerodrome operations.

3.4.4.3 The method for risk evaluation is strongly dependent on the nature of the hazards. The risk itself is evaluated by combining the two values for severity of its consequences and probability of occurrence.

Note.— A risk categorization tool in the form of a safety risk (index) assessment matrix is available in Doc 9859.

3.4.4.4 Once each hazard has been identified and analysed in terms of causes, and assessed for severity and probability of its occurrence, it must be ascertained that all associated risks are appropriately managed. An initial identification of existing mitigation measures must be conducted prior to the development of any additional measures.

3.4.4.5 All risk mitigation measures, whether currently being applied or still under development, are evaluated for the effectiveness of their risk management capabilities.

Note.— The exposure to a given risk (e.g. duration of a change, time before implementation of corrective actions, traffic density) is taken into account in order to decide on its acceptability.

3.4.4.6 In some cases, a quantitative approach may be possible, and numerical safety objectives can be used. In other instances such as changes to the operational environment or procedures, a qualitative analysis may be more relevant.

Note 1.— An example of a qualitative approach is the objective of providing at least the same protection as the one offered by the infrastructure corresponding to the appropriate reference code for a specific aeroplane.

Note 2.— Chapter 4 provides a list of typical challenges related to each part of the aerodrome infrastructure and the potential solutions proposed.

3.4.4.7 States should provide suitable guidance on risk assessment models for aerodrome operators.

Note 1.— Risk assessment models are commonly built on the principle that there should be an inverse relationship between the severity of an incident and its probability.

Note 2.— Methodologies for risk management can be found in Attachment B to this chapter.

3.4.4.8 In some cases, the result of the risk assessment may be that the safety objectives will be met without any additional specific mitigation measures.

3.4.5 Development of an implementation plan and conclusion of the assessment

3.4.5.1 The last phase of the safety assessment process is the development of a plan for the implementation of the identified mitigation measures.

3.4.5.2 The implementation plan includes time frames, responsibilities for mitigation measures as well as control measures that may be defined and implemented to monitor the effectiveness of the mitigation measures.

3.5 APPROVAL OR ACCEPTANCE OF A SAFETY ASSESSMENT

Note.— The safety assessment conducted by the aerodrome operator is a core SMS function. Management approval and implementation of the safety assessment, including future updates and maintenance, are the responsibility of the aerodrome operator. The State may, for specific reasons, require the submission of the specific safety assessment for approval/acceptance.

3.5.1 The State establishes the type of safety assessments that are subject to approval or acceptance and determines the process used for that approval/acceptance.

3.5.2 Where required in 3.5.1, a safety assessment subject to approval or acceptance by the State shall be submitted by the aerodrome operator prior to implementation.

3.5.3 The State analyses the safety assessment and verifies that:

a) appropriate coordination has been performed between the concerned stakeholders;

b) the risks have been properly identified and assessed, based on documented arguments (e.g. physical or Human Factors studies, analysis of previous accidents and incidents);

c) the proposed mitigation measures adequately address the risk; and

d) the time frames for planned implementation are acceptable.

Note.— It is preferable to work with a team of the State's operational experts in the areas considered in the safety assessment.

3.5.4 On completion of the analysis of the safety assessment, the State:

a) either gives formal approval or acceptance of the safety assessment to the aerodrome operator as required in 3.5.1; or

b) if some risks have been underestimated or have not been identified, coordinates with the aerodrome operator to reach an agreement on safety acceptance; or

c) if no agreement can be reached, rejects the proposal for possible resubmission by the aerodrome operator; or

d) may choose to impose conditional measures to ensure safety.

3.5.5 The State should ensure that the mitigation or conditional measures are properly implemented and that they fulfil their purpose.

3.6 PROMULGATION OF SAFETY INFORMATION

3.6.1 The aerodrome operator determines the most appropriate method for communicating safety information to the stakeholders and ensures that all safety-relevant conclusions of the safety assessment are adequately communicated.

3.6.2 In order to ensure adequate dissemination of information to interested parties, information that affects the current integrated aeronautical information package (IAIP) or other relevant safety information is:

a) promulgated in the relevant section of the IAIP or automatic terminal information service (ATIS); and

b) published in the relevant aerodrome information communications through appropriate means.

Attachment A to Chapter 3

SAFETY ASSESSMENT FLOW CHART

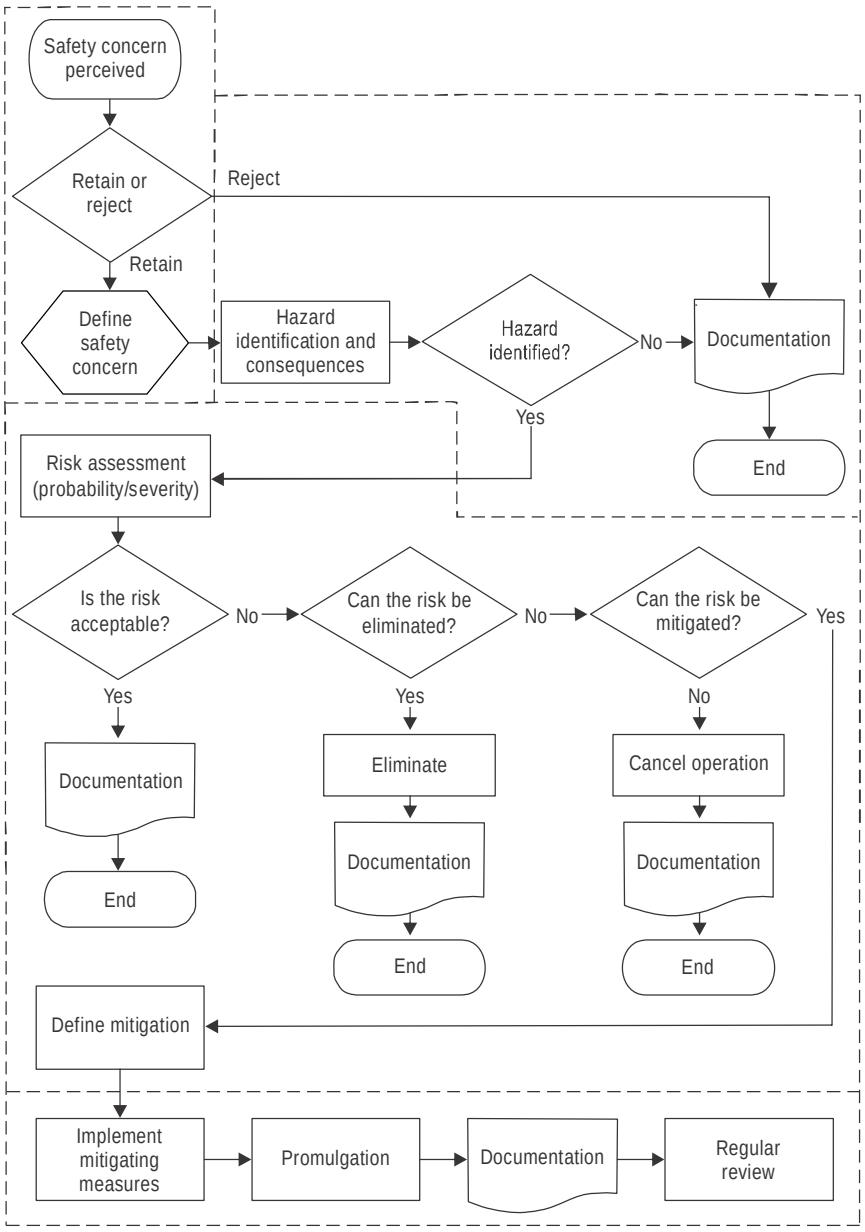


Figure I-3-Att A-1. Flow chart to be used for the conduct of a safety assessment

Attachment B to Chapter 3

SAFETY ASSESSMENT METHODOLOGIES FOR AERODROMES

Note.— Further guidance on safety risk probability, severity, tolerability and assessment matrix can be found in Doc 9859 — Safety Management Manual (SMM).

1. *Depending on the nature of the risk, three methodologies can be used to evaluate whether it is being appropriately managed:*

a) *Method type "A"*. For certain hazards, the risk assessment strongly depends on specific aeroplane and/or system performance. The risk level is dependent upon aeroplane/system performance (e.g. more accurate navigation capabilities), handling qualities and infrastructure characteristics. Risk assessment, then, can be based on aeroplane/system design and validation, certification, simulation results and accident/incident analysis;

b) *Method type "B"*. For other hazards, risk assessment is not really linked with specific aeroplane and/or system performance but can be derived from existing performance measurements. Risk assessment, then, can be based on statistics (e.g. deviations) from existing operations or on accident analysis; development of generic quantitative risk models can be well adapted;

c) *Method type "C"*. In this case, a "risk assessment study" is not needed. A simple logical argument may be sufficient to specify the infrastructure, system or procedure requirements, without waiting for additional material, e.g. certification results for newly announced aeroplanes or using statistics from existing aeroplane operations.

Risk assessment method

2. The risk assessment takes into account the probability of occurrence of a hazard and the severity of its consequences; the risk is evaluated by combining the two values for severity and probability of occurrence.

3. Each identified hazard must be classified by probability of occurrence and severity of impact. This process of risk classification will allow the aerodrome to determine the level of risk posed by a particular hazard. The classification of probability and severity refers to potential events.

4. The severity classification includes five classes ranging from "catastrophic" (class A) to "not significant" (class E). The examples in Table I-3-Att B-1, adapted from Doc 9859 with aerodrome-specific examples, serve as a guide to better understand the definition.

5. The classification of the severity of an event should be based on a "credible case" but not on a "worst case" scenario. A credible case is expected to be possible under reasonable conditions (probable course of events). A worst case may be expected under extreme conditions and combinations of additional and improbable hazards. If worst cases are to be introduced implicitly, it is necessary to estimate appropriate low frequencies.

Table I-3-Att B-1. Severity classification scheme with examples

(adapted from Doc 9859 with aerodrome-specific examples)

Severity	*Meaning*	*Value*	*Example*
Catastrophic	– Equipment destroyed – Multiple deaths	A	– collision between aircraft and/or other object during take-off or landing
Hazardous	– A large reduction in safety margins, physical distress or a workload such that the operators cannot be relied upon to perform their tasks accurately or completely – Serious injury – Major equipment damage	B	– runway incursion, significant potential for an accident, extreme action to avoid collision – attempted take-off or landing on a closed or engaged runway – take-off/landing incidents, such as undershooting or overrunning
Major	– A significant reduction in safety margins, a reduction in the ability of the operators to cope with adverse operating conditions as a result of an increase in workload or as a result of conditions impairing their efficiency – Serious incident – Injury to persons	C	– runway incursion, ample time and distance (no potential for a collision) – collision with obstacle on apron/ parking position (hard collision) – person falling down from height – missed approach with ground contact of the wing ends during the touchdown – large fuel puddle near the aircraft while passengers are on-board
Minor	– Nuisance – Operating limitations – Use of emergency procedures – Minor incident	D	– hard braking during landing or taxiing – damage due to jet blast (objects) – expendables are laying around the stands – collision between maintenance vehicles on service road – breakage of drawbar during pushback (damage to the aircraft) – slight excess of maximum take-off weight without safety consequences – aircraft rolling into passenger bridge with no damage to the aircraft needing immediate repair

Severity	*Meaning*	*Value*	*Example*
			– forklift that is tilting – complex taxiing instructions/procedures
Negligible	– Few consequences	E	– slight increase in braking distance – temporary fencing collapsing because of strong winds – cart losing baggage

6. The probability classification includes five classes ranging from “extremely improbable” (class 1) to “frequent” (class 5) as shown in Table I-3-Att B-2.

7. The probability classes presented in Table I-3-Att B-2 are defined with quantitative limits. It is not the intention to assess frequencies quantitatively; the numerical value serves only to clarify the qualitative description and support a consistent expert judgement.

Table I-3-Att B-2. Probability classification scheme

Probability class	*Meaning*
5 Frequent	Likely to occur many times (has occurred frequently)
4 Reasonably probable	Likely to occur sometimes (has occurred infrequently)
3 Remote	Unlikely to occur (has occurred rarely)
2 Extremely remote	Very unlikely to occur (not known to have occurred)
1 Extremely improbable	Almost inconceivable that the event will occur

8. The classification refers to the probability of events per a period of time. This is reasoned through the following:

a) many hazards at aerodromes are not directly related to aircraft movements; and

b) the assessment of hazards occurrence probabilities can be based on expert judgement without any calculations.

9. The aim of the matrix is to provide a means of obtaining a safety risk index. The index can be used to determine tolerability of the risk and to enable the prioritization of relevant actions in order to decide about risk acceptance.

10. Given that the prioritization is dependent on both probability and severity of the events, the prioritization criteria will be two-dimensional. Three main classes of hazard mitigation priority are defined in Table I-3-Att B-3:

a) hazards with high priority — intolerable;

b) hazards with mean priority — tolerable; and

c) hazards with low priority — acceptable.

11. The risk assessment matrix has no fixed limits for tolerability but points to a floating assessment where risks are given risk priority for their risk contribution to aircraft operations. For this reason, the priority classes are intentionally not edged along the probability and severity classes in order to take into account the imprecise assessment.

Table I-3-Att B-3. Risk assessment matrix with prioritization classes

		Risk severity				
Risk probability		*Catastrophic A*	*Hazardous B*	*Major C*	*Minor D*	*Negligible E*
Frequent	5	5A	5B	5C	5D	5E
Occasional	4	4A	4B	4C	4D	4E
Remote	3	3A	3B	3C	3D	3E
Improbable	2	2A	2B	2C	2D	2E
Extremely Improbable	1	1A	1B	1C	1D	1E

Chapter 4

AERODROME COMPATIBILITY

4.1 INTRODUCTION

4.1.1 This chapter outlines a methodology and procedure to assess the compatibility between aeroplane operations and aerodrome infrastructure and operations when an aerodrome accommodates an aeroplane that exceeds the certificated characteristics of the aerodrome.

4.1.2 A compatibility study should be performed collaboratively between affected stakeholders which includes the aerodrome operator, the aeroplane operator, ground handling agencies as well as the various air navigation service providers (ANSPs).

4.1.3 The following steps describe the arrangement, to be appropriately documented, between the aeroplane operator and aerodrome operator for the introduction of an aeroplane type/subtype new to the aerodrome:

a) the aeroplane operator submits a request to the aerodrome operator to operate an aeroplane type/subtype new to the aerodrome;

b) the aerodrome operator identifies possible means of accommodating the aeroplane type/subtype including access to movement areas and, if necessary, considers the feasibility and economic viability of upgrading the aerodrome infrastructure; and

c) the aerodrome operator and aircraft operator discuss the aerodrome operator's assessment, and whether operations of the aeroplane type/subtype can be accommodated and, if permitted, under what conditions.

4.1.4 The following procedures should be included in the aerodrome compatibility study:

a) identify the aeroplane's physical and operational characteristics (see Attachments A, B and D to this chapter);

b) identify the applicable regulatory requirements;

c) establish the adequacy of the aerodrome infrastructure and facilities vis-à-vis the requirements of the new aeroplane (see the appendix to this chapter);

d) identify the changes required to the aerodrome;

e) document the compatibility study; and

f) perform the required safety assessments identified during the compatibility study (see Chapter 3 on safety assessment).

Note 1.— A compatibility study may require a review of the obstacle limitation surfaces at an aerodrome as specified in Chapter 4, Annex 14, Volume I. Further guidance on the function of these surfaces is given in Doc 9137, Part 6 — Control of Obstacles. *Where required, reporting of obstacles is prescribed in Annex 4 —* Aeronautical Charts *and Annex 15 —* Aeronautical Information Services.

Note 2.— For aerodrome operations in low visibility conditions, additional procedures may be implemented in order to safeguard the operation of aeroplanes. Further guidance on operations in low visibility conditions are available in Doc 9137 — Airport Services Manual, *Part 8 —* Airport Operational Services, *Doc 9476 —* Manual of Surface Movement Guidance and Control Systems (SMGCS); *and Doc 9830 —* Advanced Surface Movement Guidance and Control Systems (A-SMGCS) Manual.

Note 3.— Additional processes that ensure suitable measures are in place to protect the signal produced by the ground-based radio navigation equipment may be necessary at aerodromes with precision instrument approaches.

4.1.5 The result of the compatibility study should enable decisions to be made and should provide:

a) the aerodrome operator with the necessary information in order to make a decision on allowing the operation of the specific aeroplane at the given aerodrome;

b) the aerodrome operator with the necessary information in order to make a decision on the changes required to the aerodrome infrastructure and facilities to ensure safe operations at the aerodrome with due consideration to the harmonious future development of the aerodrome; and

c) the State with the information which is necessary for its safety oversight and the continued monitoring of the conditions specified in the aerodrome certification.

Note 1.— Each compatibility study is specific to a particular operational context and to a particular type of aeroplane.

Note 2.— See Annex 6 — Operation of Aircraft, *Part I —* International Commercial Air Transport — Aeroplanes, *Chapter 4, regarding the obligation of the aeroplane operator.*

Note 3.— Information resulting from the compatibility study that is considered to be of operational significance is published in accordance with Annex 14, Volume I, 2.13.1, and Annex 15.

4.2 IMPACT OF AEROPLANE CHARACTERISTICS ON THE AERODROME INFRASTRUCTURE

4.2.1 General

4.2.1.1 Introducing new types of aeroplanes into existing aerodromes may have an impact on the aerodrome facilities and services, in particular, when the aeroplane characteristics exceed the parameters that were used for planning the aerodrome.

4.2.1.2 The parameters used in aerodrome planning are defined in Annex 14, Volume I, which specifies the use of the aerodrome reference code determined in accordance with the characteristics of the aeroplane for which an aerodrome facility is intended. The aerodrome reference code provides a starting point for the compatibility study and may not be the sole means used to conduct the analysis and to substantiate the aerodrome operator’s decisions and the State’s safety oversight actions.

Note.— The individual facilities required at an aerodrome are interrelated by the aerodrome reference code. The design of these facilities, including a description of the aerodrome reference code, can be found in Annex 14, Volume I, and are transposed by States into national regulations.

4.2.2 Consideration of the aeroplane's physical characteristics

The aeroplane's physical characteristics may influence the aerodrome dimensions, facilities and services in the movement area. These characteristics are detailed in Attachment A to this chapter.

4.2.3 Consideration of the aeroplane's operational characteristics

In order to adequately assess aerodrome compatibility, aeroplane operational characteristics should be included in the evaluation process. The operational characteristics can include the infrastructure requirements of the aeroplane as well as ground servicing requirements. These characteristics are detailed in Attachment B to this chapter.

4.3 PHYSICAL CHARACTERISTICS OF AERODROMES

In order to adequately assess the aeroplane's compatibility, aerodrome physical characteristics should be included in the evaluation process. These characteristics are detailed in the Appendix to this chapter.

Appendix to Chapter 4

PHYSICAL CHARACTERISTICS OF AERODROMES

1. INTRODUCTION

Each paragraph within this section is structured as follows:

Introduction

This section provides the rationale, including the basis and objectives for the various elements of the physical infrastructure required in Annex 14, Volume I, Chapter 3. References are made, where necessary, to other ICAO documents.

Challenges

This section identifies possible challenges based on experience, operational judgement and analysis of hazards linked to an infrastructure item in relation to ICAO provisions. Each compatibility study should determine the challenges relevant for the accommodation of the planned aeroplane at the existing aerodrome.

Potential solutions

This section presents possible solutions related to the identified problems. Where it is impracticable to adapt the existing aerodrome infrastructure or operations in accordance with the applicable regulation, the compatibility study or, where necessary, safety assessment, determines the appropriate solutions or possible risk mitigation measures to be implemented.

Note 1.— Where possible solutions have been developed, these should be reviewed periodically to assess their continued validity. These possible solutions do not substitute or circumvent the provisions contained in Annex 14, Volume I.

Note 2.— Procedures on the conduct of a safety assessment can be found in Chapter 3.

2. RUNWAYS

2.1 Runway length

Note 1.— Runway length is a limiting factor on aeroplane operations and should be assessed in collaboration with the aeroplane operator. Information on aeroplane reference field length can be found in Attachment D to this chapter.

Note 2.— Longitudinal slopes can have an effect on aeroplane performance.

2.2 Runway width

Introduction

2.2.1 For a given runway width, factors affecting aeroplane operations include the characteristics, handling qualities and performance demonstrated by the aeroplane. It may be advisable to consider other factors of operational significance in order to have a safety margin for factors such as wet or contaminated runway pavement, crosswind conditions, crab angle approaches to landing, aeroplane controllability during aborted take-off, and engine failure procedures.

Note.— Guidance is given in the Aerodrome Design Manual *(Doc 9157), Part 1 —* Runways.

Challenges

2.2.2 The main issue associated with available runway width is the risk of aeroplane damage and fatalities associated with an aeroplane veering off the runway during take-off, rejected take-off or during the landing.

2.2.3 The main causes and accident factors are:

a) for take-off/rejected take-off:

1) aeroplane (asymmetric spin-up and/or reverse thrust, malfunctioning of control surfaces, hydraulic system, tires, brakes, nose-gear steering, centre of gravity and powerplant (engine failure, foreign object ingestion));

2) temporary surface conditions (standing water, snow, dust, residuals (rubber), FOD, damage to the pavement and runway friction coefficient);

3) permanent surface conditions (horizontal and vertical slopes and runway friction characteristics);

4) meteorological conditions (e.g. heavy rain, crosswind, strong/gusty winds, reduced visibility, snow); and

5) Human Factors (crew, maintenance, balance, payload security);

b) for landing:

1) aeroplane/airframe (malfunction of the landing gear, control surfaces, hydraulic system, brakes, tires, nose-gear steering and powerplant (reverse and thrust lever linkage));

2) temporary surface conditions (standing water, snow, dust, residuals (e.g. rubber), FOD, damage to the pavement and applying runway friction coefficient);

3) permanent surface conditions (horizontal and vertical slopes and runway friction characteristics);

4) prevailing meteorological conditions (heavy rain, crosswind, strong/gusty winds, thunderstorms/wind shear, reduced visibility);

5) Human Factors (i.e. hard landings, crew, maintenance);

6) ILS localizer signal quality/interference, where autoland procedures are used;

7) any other localizer signal quality/interference of approach aid equipment;

8) lack of approach path guidance such as VASIS or PAPI; and

9) approach type and speed.

Note.— An analysis of lateral runway excursion reports shows that the causal factor in aeroplane accidents/incidents is not the same for take-off and landing. Mechanical failure is, for instance, a frequent accident factor for runway excursions during take-off, while hazardous meteorological conditions such as thunderstorms are more often associated with landing accidents/incidents. Engine reverse thrust system malfunction and/or contaminated runway surfaces have also been a factor in a significant number of veer-offs during landing (other subjects are relevant to the aeroplane such as brake failures and high crosswinds).

Potential solutions

2.2.4 The lateral runway excursion is linked to specific aeroplane characteristics, performance/handling qualities, controllability in response to such events as aeroplane mechanical failures, pavement contamination, winter operations and crosswind conditions. Runway width is not a required specific certification limitation. However, indirectly related is the determination of minimum control speed on the ground (Vmcg) and the maximum demonstrated crosswind. These additional factors should be considered as key factors in order to ensure that this kind of hazard is adequately addressed.

2.2.5 For a specific aeroplane, it may be permissible to operate on a runway with a narrower width if approved by the appropriate authorities for such operations.

Note.— The maximum demonstrated crosswind is included in the aircraft flight manual.

2.2.6 Potential solutions can be developed by applying the following measures, alone or in combination with other measures. The following list is not in any particular order and is not exhaustive:

a) paved inner shoulders of adequate bearing strength to provide an overall width of the runway and its (inner) shoulders of the recommended runway width according to the reference code;

b) paved/unpaved outer shoulders with adequate bearing strength to provide an overall width of the runway and its shoulder according to the reference code;

c) additional runway centre line guidance and runway edge markings; and

d) increased full runway length FOD inspection, when required or requested.

2.2.7 Aerodrome operators should also take into account the possibility that certain aeroplanes are not able to make a 180-degree turn on narrower runways. When there is no proper taxiway at the end of the runway, providing a suitable runway turn pad is recommended.

Note.— Particular care should be given while manoeuvring on runways having a width less than recommended to prevent the wheels of the aeroplane from leaving the pavement, while avoiding the use of large amounts of thrust that could damage runway lights and signs and cause erosion of the runway strip. For affected runways a close inspection, as appropriate, is generally considered to detect the presence of debris that may be deposited during 180-degree turns on the runway after landing.

2.2.8 Snow removal should be provided at least up to the position of the outboard engine’s intake section area to avoid snow ingestion unless specific aeroplane characteristics/procedures exist to avoid snow ingestion (significant ground clearance of the engines preventing snow ingestion, specific take-off procedure).

Note.— Guidance is given in Doc 9137, Part 2 — Pavement Surface Conditions*.*

2.2.9 Aerodromes which use embedded (inset) runway edge lights should take into account additional consequences such as:

a) more frequent cleaning intervals for the embedded lights, as dirt will affect the function more quickly compared to elevated runway edge lights;

b) earlier execution of snow removal operations, as the inset lights are likely to be affected by snow more quickly; and

c) in addition, bi-directional inset lights can facilitate snow removal procedures on a wider range.

2.2.10 Location and specifications for runway signs should be considered due to the increased size of the aeroplane's wingspan (engine location) as well as the increased thrust rating from the aeroplane's engines.

2.3 Runway shoulders

Introduction

2.3.1 The shoulders of a runway should be capable of minimizing any damage to an aeroplane veering off the runway. In some cases, the bearing strength of the natural ground may be sufficient without additional preparation to meet the requirements for shoulders. The prevention of ingestion of objects from jet engines should always be taken into account particularly for the design and construction of the shoulders. In case of specific preparation of the shoulders, visual contrast, such as the use of runway side-stripe markings, between runway and runway shoulders, may be required.

Note.— Guidance is given in Doc 9157, Part 1.

Challenges

2.3.2 Runway shoulders have three main functions:

a) to minimize any damage to an aeroplane running off the runway ;

b) to provide jet blast protection and to prevent engine FOD ingestion; and

c) to support ground vehicle traffic, RFF vehicles and maintenance vehicles.

Note.— Inadequate width of existing runway bridges is a special topic that needs careful evaluation.

2.3.3 Potential issues associated with runway shoulder characteristics (width, soil type, bearing strength) are:

a) aeroplane damage that could occur after excursion onto the runway shoulder due to inadequate bearing capacity;

b) shoulder erosion causing ingestion of foreign objects by jet engines due to unsealed surfaces; consideration should be given to the impact of FOD on aeroplane tires and engines as a potentially major hazard; and

c) difficulties for RFF services to access a damaged aeroplane on the runway due to inadequate bearing strength.

2.3.4 Factors to be considered are:

a) runway centre line deviations;

b) powerplant characteristics (engine height, location and power); and

c) soil type and bearing strength (aeroplane mass, tire pressure, gear design).

Potential solutions

2.3.5 Possible solutions can be developed by applying the following measures, alone or in combination with other measures. The following list is not in any particular order and is not exhaustive:

a) *Excursion onto the runway shoulder*. Provide the suitable shoulder as detailed in 2.3;

b) *Jet blast*. Information about outer engine position, jet blast velocity contour and jet blast directions at take-off is needed to calculate the required width of shoulders that has to be enhanced for protection against jet blast. Lateral deviation from the runway centre line should also be taken into account;

Note 1.— Jet blast velocity data may be available from the aircraft manufacturers.

Note 2.— Relevant information is typically available in the aircraft characteristics for airport planning manual of aircraft manufacturers.

c) *RFF vehicles*. Operational experience with aeroplanes currently operated on existing runways suggests that an overall width of the runway and its shoulders which is compliant with the requirements is adequate to permit intervention on aeroplanes by occasional RFF vehicle traffic. However, longer upper-deck escape chutes may reduce the margin between the shoulder edge and the extension of escape slides and reduce the supporting surface available to rescue vehicles; and

d) *Additional surface inspections*. It may be necessary to adapt the inspection programme for FOD detection.

2.4 Runway turn pads

Introduction

2.4.1 Turn pads are generally provided when an exit taxiway is not available at the runway end. A turn pad allows an aeroplane to turn back after landing and before take-off and to position itself correctly on the runway.

Note.— Guidance on typical turn pads is given in Doc 9157, Part 1, Appendix 4. In particular, the design of the total width of the turn pad should be such that the nose-wheel steering angle of the aeroplane for which the turn pad is intended will not exceed 45 degrees.

Challenges

2.4.2 For minimizing the risk of a turn pad excursion, the turn pad should be designed sufficiently wide to permit the 180-degree turn of the most demanding aeroplane that will be operated. The design of the turn pad generally assumes a maximum nose landing gear steering angle of 45 degrees, which should be used unless some other condition applies for the particular type of aeroplane, and considers clearances between the gears and the turn pad edge, as for a taxiway.

2.4.3 The main causes and accident factors of the aeroplane veering off the turn pad pavement are:

a) aeroplane characteristics that are not adequate and aeroplane failure (ground manoeuvring capabilities, especially long aeroplanes, malfunctioning of nose-gear steering, engine, brakes);

b) adverse surface conditions (standing water, loss of control on ice-covered surfaces, friction coefficient);

c) loss of the turn pad visual guidance (markings and lights covered by snow or inadequately maintained); and

d) Human Factors, including incorrect application of the 180-degree procedure (nose-wheel steering, asymmetric thrust, differential breaking).

Note.— No turn pad excursions with passenger injuries have so far been reported. Nevertheless, an aeroplane disabled on a turn pad can have an impact on runway closure.

Potential solutions

2.4.4 The ground maneuvering capabilities available from aircraft manufacturers are one of the key factors to be considered in order to determine whether an existing turn pad is suitable for a particular aeroplane. The speed of the manoeuvring aeroplane is also a factor.

Note.— Relevant information is typically available in the aircraft characteristics for airport planning manual of aircraft manufacturers.

2.4.5 For a specific aeroplane, it may be permissible to operate on a runway turn pad not provided in accordance with Annex 14, Volume I, specifications, considering:

a) the specific ground manoeuvring capability of the specific aeroplane (notably the maximum effective steering angle of the nose landing gear);

b) the provision for adequate clearances;

c) the provision for appropriate marking and lighting;

d) the provision of shoulders;

e) the protection from jet blast; and

f) if relevant, protection of the ILS.

In this case, the turn pad can have a different shape. The objective is to enable the aeroplane to align on the runway while losing the least runway length as possible. The aeroplane is supposed to taxi at slow speed.

Note.— Further advisory material on turn pads may be available from the aircraft manufacturers.

2.5 RUNWAY STRIPS

2.5.1 Runway strip dimensions

Introduction

2.5.1.1 A runway strip is an area enclosing a runway and any associated stopway. Its purpose is to:

a) reduce the risk of damage to an aeroplane running off the runway by providing a cleared and graded area which meets specific longitudinal and transverse slopes, and bearing strength requirements; and

b) protect an aeroplane flying over it during landing, balked landing or take-off by providing an area which is cleared of obstacles, except for permitted aids to air navigation.

2.5.1.2 Particularly, the graded portion of the runway strip is provided to minimize the damage to an aeroplane in the event of a veer-off during a landing or take-off operation. It is for this reason that objects should be located away from this portion of the runway strip unless they are needed for air navigation purposes and are frangibly mounted.

Note.— The dimensions and characteristics of the runway strip are detailed in Annex 14, Volume I, Chapter 3, 3.4 and Attachment A.

Challenges

2.5.1.3 Where the requirements on runway strips cannot be achieved, the available distances, the nature and location of any hazard beyond the available runway strip, the type of aeroplane and the level of traffic at the aerodrome should be reviewed. Operational restrictions may be applied to the type of approach and low visibility operations that fit the available ground dimensions, while also taking into account:

a) runway excursion history;

b) friction and drainage characteristics of the runway;

c) runway width, length and transverse slopes;

d) navigation and visual aids available;

e) relevance in respect of take-off or aborted take-off and landing;

f) scope for procedural mitigation measures; and

g) accident report.

2.5.1.4 An analysis of lateral runway excursion reports shows that the causal factor in aeroplane accidents/incidents is not the same for take-off and for landing. Therefore, take-off and landing events may need to be considered separately.

Note.— Mechanical failure is a frequent accident factor in runway excursions during take-off, while hazardous meteorological conditions such as thunderstorms are more often present with landing accident/incidents. Brake failures or engine reverse thrust system malfunctions have also been factors in a significant number of landing veer-offs.

2.5.1.5 Lateral deviation from the runway centre line during a balked landing with the use of the digital autopilot as well as manual flight with a flight director for guidance have shown that the risk associated with the deviation of specific aeroplanes is contained within the OFZ.

Note.— Provisions on OFZ are given in Annex 14, Volume I, and in Cir 301, New Larger Aeroplanes — Infringement of the Obstacle Free Zone: Operational Measures and Aeronautical Study.

2.5.1.6 The lateral runway excursion hazard is clearly linked to specific aeroplane characteristics, performance/ handling qualities and controllability in response to such events as aeroplane mechanical failures, pavement contamination and crosswind conditions. This type of hazard comes under the category for which risk assessment is mainly based on flight crew/aeroplane performance and handling qualities. Certified limitations of the specific aeroplane is one of the key factors to be considered in order to ensure that this hazard is under control.

Potential solutions

2.5.1.7 Potential solutions can be developed by applying the following measures, alone or in combination with other measures. The following list is not in any particular order and is not exhaustive:

a) improving runway surface conditions and/or the means of recording and indicating rectification action, particularly for contaminated runways, having knowledge of runways and their condition and characteristics in precipitation;

b) ensuring that accurate and up-to-date meteorological information is available and that information on runway conditions and characteristics is passed to flight crews in a timely manner, particularly when flight crews need to make operational adjustments;

c) improving the aerodrome operator’s knowledge of recording, prediction and dissemination of wind data, including wind shear, and any other relevant meteorological information, particularly when it is a significant feature of an aerodrome’s climatology;

d) upgrading the visual and instrument landing aids to improve the accuracy of aeroplane delivery at the correct landing position on runways; and

e) in consultation with aeroplane operators, formulating any other relevant aerodrome operating procedures or restrictions and promulgating such information appropriately.

2.5.2 Obstacles on runway strips

Introduction

2.5.2.1 An object located on a runway strip which may endanger aeroplanes is regarded as an obstacle, according to the definition of “obstacle” and should be removed, as far as practicable. Obstacles may be either naturally occurring or deliberately provided for the purpose of air navigation.

Challenges

2.5.2.2 An obstacle on the runway strip may represent either:

a) a collision risk for an aeroplane in flight or for an aeroplane on the ground that has veered off the runway; and

b) a source of interference to navigation aids.

Note 1.— Mobile objects that are beyond the OFZ (inner transitional surface) but still within the runway strip, such as vehicles and holding aeroplanes at runway-holding positions, or wing tips of aeroplanes taxiing on a parallel taxiway to the runway, should be considered.

Note 2.— Provisions on OFZ are given in Annex 14, Volume I, and in Circular 301.

Potential solutions

2.5.2.3 Potential solutions can be developed by applying the following measures, alone or in combination with other measures. The following list is not in any particular order and is not exhaustive:

a) a natural obstacle should be removed or reduced in size wherever possible; alternatively, grading of the area allows reduction of the severity of damage to the aeroplane;

b) other fixed obstacles should be removed unless they are necessary for air navigation, in which case they should be frangible and should be so constructed as to minimize the severity of damage to the aeroplane;

c) an aeroplane considered to be a moving obstacle within the runway strip should respect the requirement on the sensitive areas installed to protect the integrity of the ILS and should be subject to a separate safety assessment; and

Note.— Provisions on ILS critical and sensitive areas are given in Annex 10 — Aeronautical Telecommunications, *Volume I —* Radio Navigation Aids.

d) visual and instrument landing aids may be upgraded to improve the accuracy of aeroplane delivery at the correct landing position on runways, and in consultation with aeroplane operators, any other relevant aerodrome operating procedures or restrictions may be formulated and such information promulgated appropriately.

3. RUNWAY END SAFETY AREA (RESA)

Introduction

3.1 A RESA is primarily intended to reduce the risk of damage to an aeroplane undershooting or overrunning the runway. Consequently, a RESA will enable an aeroplane overrunning to decelerate, and an aeroplane undershooting to continue its landing.

Challenges

3.2 Identification of specific issues related to runway overruns and undershoots is complex. There are a number of variables that have to be taken into account, such as prevailing meteorological conditions, the type of aeroplane, the load factor, the available landing aids, runway characteristics, the overall environment, as well as Human Factors.

3.3 When reviewing the RESA, the following aspects have to be taken into account:

a) the nature and location of any hazard beyond the runway end;

b) the topography and obstruction environment beyond the RESA;

c) the type of aeroplanes and level of traffic at the aerodrome and actual or proposed changes to either;

d) overrun/undershoot causal factors;

e) friction and drainage characteristics of the runway which have an impact on runway susceptibility to surface contamination and aeroplane braking action;

f) navigation and visual aids available;

g) type of approach;

h) runway length and slope, in particular, the general operating length required for take-off and landing versus the runway distances available, including the excess of available length over that required;

i) the location of the taxiways and runways;

j) aerodrome climatology, including predominant wind speed and direction and likelihood of wind shear; and

k) aerodrome overrun/undershoot and veer-off history.

Potential solutions

3.4 Potential solutions can be developed by applying the following measures, alone or in combination with other measures. The following list is not in any particular order and is not exhaustive:

a) restricting the operations during adverse hazardous meteorological conditions (such as thunderstorms);

b) defining, in cooperation with aeroplane operators, hazardous meteorological conditions and other factors relevant to aerodrome operating procedures and publishing such information appropriately;

c) improving an aerodrome's database of operational data, detection of wind data, including wind shear and other relevant meteorological information, particularly when it is a significant change from an aerodrome's climatology;

d) ensuring that accurate and up-to-date meteorological information, current runway conditions and other characteristics are detected and notified to flight crews in time, particularly when flight crews need to make operational adjustments;

e) improving runway surfaces in a timely manner and/or the means of recording and indicating necessary action for runway improvement and maintenance (e.g. friction measurement and drainage system), particularly when the runway is contaminated;

f) removing rubber build-up on runways according to a scheduled time frame;

g) repainting faded runway markings and replacing inoperative runway surface lighting identified during daily runway inspections;

h) upgrading visual and instrument landing aids to improve the accuracy of aeroplane delivery at the correct landing position on runways (including the provision of ILSs);

i) reducing declared runway distances in order to provide the necessary RESA;

j) installing suitably positioned and designed arresting systems as a supplement or as an alternative to standard RESA dimensions when necessary (see Note 1);

k) increasing the length of a RESA and/or minimizing the potential obstruction in the area beyond the RESA; and

l) publishing provisions, including the provision of an arresting system, in the AIP.

Note 1.— Further guidance on arresting systems can be found in Annex 14, Volume I, Attachment A.

Note 2.— In addition to the AIP entry, information/instructions may be disseminated to local runway safety teams and others to promote awareness in the community.

4. TAXIWAYS

4.1 General

Introduction

4.1.1 Taxiways are provided to permit the safe and expeditious surface movement of aeroplanes.

4.1.2 A sufficiently wide taxiway permits smooth traffic flow while facilitating aeroplane ground steering.

Note 1.— Guidance material is given in Doc 9157, Part 2 — Taxiways, Aprons and Holding Bays*; Section 1.2 and Table 1-1 provide the formula for determining the width of a taxiway.*

Note 2.— Particular care should be taken while manoeuvring on taxiways having a width less than that specified in Annex 14, Volume I, to prevent the wheels of the aeroplane from leaving the pavement, while avoiding the use of large amounts of thrust that could damage taxiway lights and signs and cause erosion of the taxiway strip. Affected taxiways should be closely inspected, as appropriate, for the presence of debris that may be deposited while taxiing into position for take-off.

Challenges

4.1.3 The issue arises from a lateral taxiway excursion.

4.1.4 Causes and accident factors can include:

a) mechanical failure (hydraulic system, brakes, nose-gear steering);

b) adverse surface conditions (standing water, loss of control on ice-covered surfaces, friction coefficient);

c) loss of the taxiway centre line visual guidance (markings and lights covered by snow or inadequately maintained);

d) Human Factors (including directional control, orientation error, pre-departure workload); and

e) aeroplane taxi speed.

Note.— The consequences of a taxiway excursion are potentially disruptive. However, consideration should be given to the greater potential impact of deviation of a larger aeroplane in terms of blocked taxiways or disabled aeroplane removal.

4.1.5 Pilot precision and attention are key issues since they are heavily related to the margin between the outer main gear wheel and the taxiway edge.

4.1.6 Compatibility studies related to taxiway width and potential deviations can include:

a) the use of taxiway deviation statistics to calculate the taxiway excursion probability of an aeroplane depending on taxiway width. The impact of taxiway guidance systems and meteorological and surface conditions on taxiway excursion probability should be assessed whenever possible;

b) view of the taxiway from the cockpit, taking into account the visual reference cockpit cut-off angle and pilot eye height; and

c) the aeroplane outer main gear wheel span.

Potential solutions

4.1.7 Potential solutions can be developed by applying the following measures, alone or in combination with other measures. The following list is not in any particular order and is not exhaustive:

a) the provision of taxiway centre line lights;

b) conspicuous centre line marking;

c) the provision of on-board taxi camera systems to assist taxi guidance;

d) reduced taxi speed;

e) the provision of taxi side-stripe markings;

f) taxiway edge lights (inset or elevated);

g) reduced wheel-to-edge clearance, using taxiway deviation data;

h) enhanced snow bank clearance (engine positions);

i) snow and ice control surface measures implemented on taxiway entrances to the runway, especially high-speed taxiway exits;

j) the use of alternative taxi routes; and

k) the use of marshaller services (follow-me guidance).

Note 1.— Taxi cameras are designed to ease the taxi and can assist the flight crew in preventing the wheels of the aeroplane from leaving the full-strength pavement during normal ground manoeuvring.

Note 2.— Taxiways that are not provided with suitable shoulders may be restricted in operation.

4.1.8 Special attention should be given to the offset of centre line lights in relation to centre line markings, especially during winter conditions when distinguishing between markings and offset lights can be difficult.

4.1.9 Location and specifications for taxiway signs should be considered due to the engine location as well as the increased thrust in the aeroplane engines.

4.2 Taxiway curves

Introduction

4.2.1 Annex 14, Volume I, 3.9.5, contains provisions on taxiway curves. Additional guidance is included in Doc 9157, Part 2.

Challenges

4.2.2 Any hazard will be the result of a lateral taxiway excursion on a curved section.

4.2.3 The main causes and accident factors are the same as for a taxiway excursion on a straight taxiway section. The use of the cockpit-over-centreline steering technique on a curved taxiway will result in track-in of the main landing gear from the centre line. The amount of track-in depends on the radius of the curved taxiway and the distance from the cockpit to the main landing gear.

4.2.4 The consequences are the same as for lateral taxiway excursions on straight sections.

4.2.5 The required width of the curved portions of taxiways is related to the clearance between the outer main wheel and the taxiway edge on the inner curve. The hazard is related to the combination of the outer main gear wheel span and the distance between the nose gear/cockpit and the main gear. Consideration should be given to the effect on airfield signs and other objects nearby of jet blast from a turning aeroplane.

4.2.6 Certain aeroplanes may require wider fillets on curved sections or taxiway junctions.

Potential solutions

4.2.7 Potential solutions can be developed by applying the following measures, alone or in combination with other measures. The following list is not in any particular order and is not exhaustive:

a) the widening of existing fillets or the provision of new fillets;

b) reduced taxi speed;

c) the provision of taxiway centre line lights and taxi side-stripe markings (and inset taxiway edge lights);

d) reduced wheel-to-edge clearance, using taxiway deviation data;

e) pilot judgemental oversteering; and

f) publication of provisions in the appropriate aeronautical documentation.

Note 1.— Taxi cameras are designed to ease the taxi and can assist the flight crew in preventing the wheels of the aeroplane from leaving the full-strength pavement during normal ground manoeuvring.

Note 2.— Operations on taxiway curves that are not provided with suitable taxiway fillets should be restricted.

4.2.8 Special attention should be given to the offset of centre line lights in relation to centre line markings.

4.2.9 Location and specifications for taxiway signs should be considered due to the increase in the size of aeroplanes as well as the increased thrust in aeroplane engines.

5. RUNWAY AND TAXIWAY MINIMUM SEPARATION DISTANCES

Introduction

5.1 A minimum distance is provided between the centre line of a runway and the centre line of the associated parallel taxiway for instrument runways and non-instrument runways.

Note 1.— Doc 9157, Part 2, section 1.2, and Table 1-5, clarify that the runway/taxiway separation is based on the principle that the wing tip of an aeroplane taxiing on a parallel taxiway should be clear of the runway strip.

Note 2.— It is permissible to operate with lower separation distances at an existing aerodrome if a safety assessment indicates that such lower separation distances would not adversely affect the safety or significantly affect the regularity of operations of aeroplanes. See Note 2 to Table 3-1, and Notes 2, 3 and 4 to 3.9.7 of Annex 14, Volume I.

Note 3.— Doc 9157, Part 2, has related guidance in 1.2.46 to 1.2.49. Furthermore, attention is drawn to the need to provide adequate clearance at an existing aerodrome in order to operate an aeroplane with the minimum possible risk.

Challenges

5.2 The potential issues associated with runway/parallel taxiway separation distances are:

a) the possible collision between an aeroplane running off a taxiway and an object (fixed or mobile) on the aerodrome;

b) the possible collision between an aeroplane leaving the runway and an object (fixed or mobile) on the aerodrome or the risk of a collision of an aeroplane on the taxiway that infringes on the runway strip; and

c) possible ILS signal interference due to a taxiing or stopped aeroplane.

5.3 Causes and accident factors can include:

a) Human Factors (crew, ATS);

b) hazardous meteorological conditions (such as thunderstorms and wind shear);

c) aeroplane mechanical failure (such as engine, hydraulic system, flight instruments, control surfaces and autopilot);

d) surface conditions (standing water, loss of control on ice-covered surfaces, friction coefficient);

e) lateral veer-off distance;

f) aeroplane position relative to navigation aids, especially ILS; and

g) aeroplane size and characteristics (especially wingspan).

Note.— Common accident/incident databases deal with lateral runway excursions but do not include accident reports relative to in-flight collisions and ILS signal interference. Therefore, the causes and accident factors specific to the local environment and identified above for runway separation issues are mainly supported by local aerodrome experience. The huge variety and complexity of accident factors for collision risk should be emphasized.

Potential solutions

5.4 Potential solutions can be developed by applying the following measures, alone or in combination with other measures. The following list is not in any particular order and is not exhaustive:

a) place a restriction on the wingspan of aeroplanes using the parallel taxiway or on the runway, if continued unrestricted taxiway or runway operation is desired;

b) consider the most demanding length of aeroplane that can have an impact on runway/taxiway separation and the location of holding positions (ILS);

c) change taxiway routing so that the required runway airspace is free of taxiing aeroplanes; and

d) employ tactical control of aerodrome movements.

Note.— When A-SMGCS is available, it can be utilized as a supporting means to the proposed solutions especially in low visibility conditions.

6. TAXIWAY AND TAXILANE MINIMUM SEPARATION DISTANCES

Introduction

Taxiway to object separation

6.1 The taxiway minimum separation distances provide an area clear of objects that may endanger an aeroplane.

Note 1.— See Annex 14, Volume I, 3.9.

Note 2.— Additional guidance material on minimum separation distances is included in Doc 9157, Part 2.

Parallel taxiway separation

6.2 The minimum separation distance is equal to the wingspan plus maximum lateral deviation plus increment.

Note 1.— Information is given in Doc 9157, Part 2.

Note 2.— If the minimum required distance between the centre lines of two parallel taxiways is not provided, it is permissible to operate with lower separation distances at an existing aerodrome if a compatibility study, which may include a safety assessment, indicates that such lower separation distances would not adversely affect the safety or significantly affect the regularity of aeroplane operations.

Challenges

Taxiway to object separation

6.3 The separation distances during taxiing are intended to minimize the risk of a collision between an aeroplane and an object (taxiway/object separation, taxilane/object separation).

Note.— Taxiway deviation statistics can be used to assess the risk of a collision between two aeroplanes or between an aeroplane and an object.

6.4 The causes and accident factors can include:

a) mechanical failure (hydraulic system, brakes, nose-gear steering);

b) conditions (standing water, loss of control on ice-covered surfaces, friction coefficient);

c) loss of the visual taxiway guidance system (markings and lights covered by snow); and

d) Human Factors (directional control, temporary loss of orientation resulting in aeroplanes being incorrectly positioned, etc.).

Parallel taxiway separation

6.5 The potential issues associated with parallel taxiway separation distances are:

a) the probable collision between an aeroplane running off a taxiway and an object (aeroplane on parallel taxiway); and

b) an aeroplane running off the taxiway and infringing the opposite taxiway strip.

6.6 Causes and accident factors can include:

a) Human Factors (crew, ATS);

b) hazardous meteorological conditions (such as reduced visibility);

c) aeroplane mechanical failure (such as engine, hydraulic system, flight instruments, control surfaces, autopilot);

d) surface conditions (standing water, loss of control on ice-covered surfaces, friction coefficient);

e) lateral veer-off distance; and

f) aeroplane size and characteristics (especially wingspan).

Potential solutions

Taxiway to object separation

6.7 Potential solutions can be developed by applying the following measures, alone or in combination with other measures. The following list is not in any particular order and is not exhaustive:

a) the use of reduced taxiing speed;

b) the provision of taxiway centre line lights;

c) the provision of taxi side-stripe markings (and inset taxiway edge lights);

d) the provision of special taxi routing for larger aeroplanes;

e) restrictions on aeroplanes (wingspan) allowed to use parallel taxiways during the operation of a specific aeroplane;

f) restrictions on vehicles using service roads adjacent to a designated aeroplane taxi route;

g) the use of "follow-me" guidance;

h) the provision of reduced spacing between taxiway centre line lights; and

i) the provision of straightforward taxiway naming and ground routings with respect to the hazard of taxiway veer-offs.

Note.— Special attention should be given to the offset of centre line lights in relation to centre line markings. Especially during winter conditions, distinguishing between markings and offset lights can be difficult.

Parallel taxiway separation

6.8 Potential solutions can be developed by providing the following facilities, alone or in combination with other measures. The following list is not in any particular order and is not exhaustive:

a) place a restriction on the wingspan of aeroplanes using the parallel taxiway if continued unrestricted taxiway operation is desired;

b) consider the most demanding length of aeroplane that can have an impact on a curved taxiway section;

c) change taxiway routing;

d) employ tactical control of aerodrome movements;

e) use of reduced taxiing speed;

f) provision of taxiway centre line lights;

g) provision of taxi side-stripe markings (and inset taxiway edge lights);

h) use of "follow-me" guidance;

i) provision of reduced spacing between taxiway centre line lights; and

j) provision of straightforward taxiway naming and ground routings with respect to the hazard of taxiway veer-offs.

Note.— When A-SMGCS is available, it can be utilized as a supporting means to the proposed solutions especially in low visibility conditions.

7. TAXIWAYS ON BRIDGES

Introduction

7.1 The width of that portion of a taxiway bridge capable of supporting aeroplanes, as measured perpendicularly to the taxiway centre line, is normally not less than the width of the graded area of the strip provided for that taxiway, unless a proven method of lateral restraint is provided which is not hazardous for aeroplanes for which the taxiway is intended.

Note.— Annex 14, Volume I, section 3.9, and Doc 9157, Part 2, provide information on taxiways on bridges.

7.2 Access is to be provided for RFF vehicles to intervene, in both directions within the specified response time, with the largest aeroplane for which the taxiway is intended.

7.3 If aeroplane engines overhang the bridge structure, it may be necessary to protect the adjacent areas, below the bridge, from engine blast.

Challenges

7.4 The following hazards are related to the width of taxiway bridges:

a) landing gear leaving the load-bearing surface;

b) deployment of an escape slide beyond the bridge, in case of an emergency evacuation;

c) lack of manoeuvring space for RFF vehicles around the aeroplane;

d) jet blast to vehicles, objects or personnel below the bridge;

e) structural damage to the bridge due to the aeroplane mass exceeding the bridge design load; and

f) damage to the aeroplane due to insufficient clearance of engines, wings or fuselage from bridge rails, lights or signs.

7.5 The causes and accident factors can include:

a) mechanical failure (hydraulic system, brakes, nose-gear steering);

b) surface conditions (standing water, loss of control on ice-covered surfaces, friction coefficient);

c) loss of the visual taxiway guidance system (markings and lights covered by snow);

d) Human Factors (directional control, disorientation, pilot’s workload);

e) the position of the extremity of the escape slides; and

f) undercarriage design.

7.6 The main causes of and accident factors for jet blast effect below the bridge are:

a) powerplant characteristics (engine height, location and power);

b) bridge blast protection width; and

c) taxiway centre line deviation factors (see taxiway excursion hazard in 4.1.4).

7.7 In addition to the specifications of Chapter 3, Safety Assessments for Aerodromes, hazard prevention mechanisms should be based on the critical dimensions of the aeroplane in relation to the bridge width.

Potential solutions

7.8 Potential solutions can be developed by applying the following measures, alone or in combination with other measures. The following list is not in any particular order and is not exhaustive:

a) where feasible, strengthen existing bridges;

b) provide a proven method of lateral restraint to prevent the aeroplane from veering off the full bearing strength of the taxiway bridge;

c) provide an alternative path/bridge for RFF vehicles or implement emergency procedures to taxi the aeroplane away from such taxi bridges;

d) implement jet blast procedures to reduce the effects of jet blast on the undercroft; and

e) use the vertical clearance provided by high wings.

7.9 The RFF vehicles need to have access to both sides of the aeroplane to fight any fire from the best position, allowing for wind direction as necessary. In case the wingspan of the considered aeroplane exceeds the width of the bridge, another bridge nearby can be used for access to the "other" side of an aeroplane rather than an increased bridge width; in this case the surface of the bypass routes are at least stabilized where it is unpaved.

Note.— The use of another bridge as mentioned in 7.9 is practicable only where bridges are paired (parallel taxiways) or when there is a service road in the surrounding area. In any case, the bridge strength is to be checked, depending on the aeroplane planning to use it.

7.10 The protection from jet blast of vehicular traffic under/near the bridge is to be studied, consistent with the overall width of the taxiway and its shoulders.

7.11 The bridge width should be compatible with the deployment of escape slides. If this is not the case, a safe and quick escape route should be ensured.

Note.— Curved centre lines should be avoided leading up to, on and when leaving the bridge.

8. TAXIWAY SHOULDERS

Introduction

8.1 Taxiway shoulders are intended to protect an aeroplane operating on the taxiway from FOD ingestion and to reduce the risk of damage to an aeroplane running off the taxiway.

8.2 The taxiway shoulder dimensions are based on current information regarding the width of the outer engine exhaust plume for breakaway thrust. Furthermore, the surface of taxiway shoulders is prepared so as to resist erosion and ingestion of the surface material by aeroplane engines.

Note.— Guidance material is contained in Doc 9157, Part 2.

Challenges

8.3 The factors leading to reported issues are:

a) powerplant characteristics (engine height, location and power);

b) taxiway shoulder width, the nature of the surface and its treatment; and

c) taxiway centre line deviation factors, both from the expected minor wander from tracking error and the effect of main gear track-in in the turn area while using the cockpit-over-centre line-steering technique.

Potential solutions

8.4 Potential solutions can be developed by applying the following measures, alone or in combination with other measures. The following list is not in any particular order and is not exhaustive:

a) *Excursion on the taxiway shoulder*. The thickness and composition of shoulder pavements should be such as to withstand the occasional passage of the aeroplane operating at the aerodrome that has the most demanding impact on pavement loading, as well as the full load of the most demanding aerodrome emergency vehicle. The impact of an aeroplane on pavements should be assessed and, if required, existing taxiway shoulders (if allowed to be used by these heavier aeroplanes) may need to be strengthened by providing a suitable overlay.

Note.— Surface materials of an asphalt paved shoulder of 10 to 12.5 cm thick (the higher thickness where widebodied aircraft jet blast exposure is likely) and firmly adhering to the underlying pavement layers (by way of a tack coat or other means that assures a well-bonded interface between the surface layer and the underlying strata) is generally a suitable solution.

b) *Jet blast*. Information on engine position and jet blast velocity contour at breakaway thrust mode is used to assess jet blast protection requirements during taxiing operations. A lateral deviation from the taxiway centre line should be taken into account, particularly in the case of a curved taxiway and the use of the cockpit-over-centre-line steering technique. The effect of jet blast can also be managed by the use of thrust management of the engines (in particular for four-engine aircraft).

Note.— Further information concerning aeroplane characteristics including the margins between the outer engine axis and the edge of the shoulder, and the distance from the outer engine to the ground can be found in the manufacturer's aircraft characteristics for airport planning manual.

c) *RFF vehicles*. Operational experience with current aeroplanes on existing taxiways suggests that a compliant overall width of the taxiway and its shoulders permits the intervention of aeroplanes by occasional RFF vehicle traffic.

Note 1.— For NLA, the longer upper-deck escape chutes may reduce the margin between the shoulder edge and the extremity of these escape slides and reduce the supporting surface available to rescue vehicles.

Note 2.— In some cases, the bearing strength of the natural ground may be sufficient, without special preparation, to meet the requirements for shoulders. (Doc 9157, Part 1, provides further design criteria).

9. CLEARANCE DISTANCE ON AIRCRAFT STANDS

Introduction

9.1 Annex 14, Volume I, 3.13.6, recommends the minimum distance between an aeroplane using the stand and an obstacle.

Note.— Doc 9157, Part 2, provides additional guidance on this subject.

Challenges

9.2 The possible reasons for collision between an aeroplane and an obstacle on the apron or holding bay can be listed as:

a) mechanical failure (e.g. hydraulic system, brakes, nose-gear steering);

b) surface conditions (e.g. standing water, ice-covered surfaces, friction coefficient);

c) loss of the visual taxi guidance system (docking system out of service); and

d) Human Factors (directional control, orientation error).

9.3 The probability of a collision during taxiing depends more on Human Factors than on aeroplane performance. Unless technical failure occurs, aeroplanes will respond reliably to directional inputs from the pilot when taxiing at the usual ground speed. Nevertheless, caution should be exercised with regard to the impact of aeroplanes with larger wingspans.

Potential solutions

9.4 Potential solutions can be developed by applying the following measures, alone or in combination with other measures. The following list is not in any particular order and is not exhaustive:

a) appropriate condition of marking and signage;

b) apron stand lead-in lights;

c) azimuth guidance as a visual docking system;

d) appropriate training of operating and ground personnel should be ensured by an aerodrome operator;

e) operational restrictions (e.g. adequate clearances before and behind parked or holding aeroplanes due to the increased length of aeroplanes);

f) temporarily downgraded adjacent aircraft stands;

g) towing the aeroplane on/from the stand;

h) use of remote/cargo stands or "roll-through" parking positions for handling the aeroplane;

i) publication of procedures in the appropriate aeronautical documentation (i.e. closing or rerouting of taxilanes behind parked aeroplanes);

j) advanced visual guidance system;

k) marshaller guidance;

l) enhancing apron lighting levels in low visibility conditions; and

m) use of the vertical clearances provided by high wings.

10. DE-ICING/ANTI-ICING FACILITIES

Introduction

10.1 Aeroplane de-icing/anti-icing facilities supported by appropriate procedures are provided at an aerodrome where icing conditions are expected to occur.

Note.— Safe and efficient aeroplane operations are of primary importance in the development of an aeroplane de-icing/anti-icing facility. (See Annex 14, Volume I, Chapter 3, section 3.15, on provisions for de-icing/anti-icing facilities.)

Challenges

10.2 The challenge is to provide adequately designed and well-located de-icing/anti-icing treatment facilities for the collection and safe disposal of fluids in an environmentally safe manner. The facility must not infringe the OLS, not cause interference with radio navigation aids and be clearly visible from the air traffic control tower. In addition the facility should provide the following:

a) pads of sufficient space to accommodate the aeroplane and de-icing vehicles;

b) protection from jet blast;

c) drainage;

d) removal of contaminants; and

e) lighting capability for adequate deicing/anti-icing of aircraft under low visibility or night-time operations.

Potential solutions

10.3 Potential solutions can be developed by applying the following measures, alone or in combination with other measures. The following list is not in any particular order and is not exhaustive:

a) adequate space on the pad to ensure a clear paved area around the aeroplane to facilitate the movement of de-icing/anti-icing vehicles;

b) sufficient clearance between the pad and the adjacent manoeuvring areas taking the dimensions of aeroplanes into consideration;

c) surface markings to ensure wing tip clearance of obstructions and other aeroplanes, especially if another aeroplane is also to be accommodated on the pad;

d) the load bearing capacity of the existing structure;

e) the requirement for greater quantities of de-icing/anti-icing agents;

f) containment of excess run-off of de-icing/anti-icing agents;

g) turning circle capabilities of specific aeroplanes;

h) jet blast implications, especially in static breakaway and turns while exiting the facility, including the hazard to smaller aeroplanes nearby of possible degradation of agents; and

i) revision of pad management procedures in terms of the positioning and exiting of aeroplanes versus smaller aeroplane types.

11. PAVEMENT DESIGN

Introduction

11.1 To facilitate flight planning, various aerodrome data are required to be published, such as data concerning the strength of pavements, which is one of the factors required to assess whether the aerodrome can be used by an aeroplane of a specific all-up mass.

Note.— The aircraft classification number/pavement classification number (ACN/PCN) method is used for reporting pavement strength. Requirements are given in Annex 14, Volume I, section 2.6, and Attachment A, section 20. Doc 9157, Part 3 — Pavements*, contains guidance on reporting pavement strength using the ACN/PCN method.*

11.2 The increased mass and/or gear load of the aeroplanes may require additional pavement support. Existing pavements and their maintenance will need to be evaluated for adequacy due to differences in wheel loading, tire pressure, and undercarriage design. Bridge, tunnel and culvert load-bearing capacities are a limiting factor, requiring some operational procedures.

Potential solutions

11.3 Potential solutions can be developed by applying the following measures, alone or in combination with other measures. The following list is not in any particular order and is not exhaustive:

a) restrictions on aeroplanes with higher ACNs on specific taxiways, runway bridges or aprons; or

b) adoption of adequate pavement maintenance programmes.

Attachment A to Chapter 4

AEROPLANE
PHYSICAL CHARACTERISTICS

This attachment lists aeroplane characteristics that may have an impact on the relevant aerodrome characteristics, facilities and services in the movement area.

1. FUSELAGE LENGTH

The fuselage length may have an impact on:

a) the dimensions of the movement area (taxiway, holding bays and aprons), passenger gates and terminal areas;

b) the aerodrome category for RFF;

c) ground movement and control (e.g. reduced clearance behind a longer aeroplane holding at an apron or a runway/intermediate holding position to permit the passing of another aeroplane);

d) de-icing facilities; and

e) clearances at the aircraft stand.

2. FUSELAGE WIDTH

The fuselage width is used to determine the aerodrome category for RFF.

3. DOOR SILL HEIGHT

The door sill height may have an impact on:

a) the operational limits of the air bridges;

b) mobile steps;

c) catering trucks;

d) persons with reduced mobility; and

e) dimensions of the apron.

4. AEROPLANE NOSE CHARACTERISTICS

The aeroplane nose characteristics may have an impact on the location of the runway-holding position of the aeroplane which should not infringe the OFZ.

5. TAIL HEIGHT

The tail height may have an impact on:

a) the location of the runway-holding position;

b) ILS critical and sensitive areas: In addition to the tail height of the critical aeroplane, tail composition, tail position, fuselage height and length can have an effect on ILS critical and sensitive areas;

c) the dimensions of aeroplane maintenance services;

d) de-icing/anti-icing facilities;

e) aeroplane parking position (in relation to aerodrome OLS);

f) runway/parallel taxiway separation distances; and

g) the clearance of any aerodrome infrastructure or facilities built over stationary or moving aeroplanes.

6. WINGSPAN

The wingspan may have an impact on:

a) taxiway/taxilane separation distances (including runway/taxiway separation distances);

b) the dimensions of the OFZ;

c) the location of the runway-holding position (due to the impact of the wingspan on OFZ dimensions);

d) the dimensions of aprons and holding bays;

e) wake turbulence;

f) gate selection;

g) aerodrome maintenance services around the aeroplane;

h) equipment for disabled aeroplane removal; and

i) de-icing.

7. WING TIP VERTICAL CLEARANCE

The wing tip vertical clearance may have an impact on:

a) taxiway separation distances with height-limited objects;

b) apron and holding bay clearances with height-limited objects;

c) aerodrome maintenance services (e.g. snow removal);

d) airfield signage clearances; and

e) service road locations.

8. COCKPIT VIEW

The relevant geometric parameters to assess the cockpit view are cockpit height, cockpit cut-off angle and the corresponding obscured segment. The cockpit view may have an impact on:

a) runway visual references (aiming point);

b) runway sight distance;

c) taxiing operations on straight and curved sections;

d) markings and signs on runways, turn pads, taxiways, aprons and holding bays;

e) lights: in low visibility conditions, the number and spacing of visible lights when taxiing may depend on the cockpit view; and

f) calibration of PAPI/VASIS (pilot eye height above wheel height on approach).

Note.— Cockpit view with reference to the obscured segment is also affected by the attitude of the aeroplane on approach.

9. DISTANCE FROM THE PILOT'S EYE POSITION TO THE NOSE LANDING GEAR

The design of taxiway curves is based on the cockpit-over-centre-line concept. The distance from the pilot's eye position to the nose landing gear is relevant for:

a) taxiway fillets (wheel track);

b) the dimensions of aprons and holding bays; and

c) the dimensions of turn pads.

10. LANDING GEAR DESIGN

The aeroplane landing gear design is such that the overall mass of the aeroplane is distributed so that the stresses transferred to the soil through a well-designed pavement are within the bearing capacity of the soil. The landing gear layout also has an effect on the manoeuvrability of the aeroplane and the aerodrome pavement system.

11. OUTER MAIN GEAR WHEEL SPAN

The outer main gear wheel span may have an impact on:

a) runway width;

b) the dimensions of turn pads;

c) taxiway width;

d) taxiway fillets;

e) the dimensions of aprons and holding bays; and

f) the dimension of the OFZ.

12. WHEELBASE

The wheelbase may have an impact on:

a) the dimensions of turn pads;

b) taxiway fillets;

c) the dimensions of aprons and holding bays; and

d) terminal areas and aeroplane stands.

13. GEAR STEERING SYSTEM

The gear steering system may have an impact on the dimensions of turn pads and the dimensions of aprons and holding bays.

14. MAXIMUM AEROPLANE MASS

The maximum mass may have an impact on:

a) the mass limitation on existing bridges, tunnels, culverts and other structures under runways and taxiways;

b) disabled aeroplane removal;

c) wake turbulence; and

d) arresting systems when provided as an element of kinetic energy.

15. LANDING GEAR GEOMETRY, TIRE PRESSURE AND AIRCRAFT CLASSIFICATION NUMBER (ACN) VALUES

Landing gear geometry, tire pressure and ACN values may have an impact on the airfield pavement and associated shoulders.

16. ENGINE CHARACTERISTICS

16.1 The engine characteristics include engine geometry and engine airflow characteristics, which may affect aerodrome infrastructure as well as ground handling of the aeroplane and operations in adjacent areas which are likely to become affected by jet blast.

16.2 The engine geometry aspects are:

a) the number of engines;

b) the location of engines (span and length);

c) the vertical clearance of engines; and

d) the vertical and horizontal extent of possible jet blast or propeller wash.

16.3 The engine airflow characteristics are:

a) idle, breakaway and take-off thrust exhaust velocities;

b) thrust reverser fitment and flow patterns; and

c) inlet suction effects at ground level.

16.4 The engine characteristics may be relevant for the following aerodrome infrastructure and operational aspects:

a) runway shoulder width and composition (jet blast and ingestion issues during take-off and landing);

b) shoulder width and composition of runway turn pads;

c) taxiway shoulder width and composition (jet blast and ingestion issues during taxiing);

d) bridge width (jet blast under the bridge);

e) the dimensions and location of blast protection fences;

f) the location and structural strength of signs;

g) the characteristics of runway and taxiway edge lights;

h) the separation between aeroplanes and adjacent ground service personnel, vehicles or passengers;

i) snow removal procedures;

j) the design of engine run-up areas and holding bays;

k) the design and use of functional areas adjacent to the manoeuvring area;

l) the design of air bridges; and

m) the location of refuelling pits on the aircraft stand.

17. MAXIMUM PASSENGER- AND FUEL-CARRYING CAPACITY

Maximum passenger- and fuel-carrying capacity may have an impact on:

a) terminal facilities;

b) fuel storage and distribution;

c) aerodrome emergency planning;

d) aerodrome rescue and fire fighting; and

e) air bridge loading configuration.

18. FLIGHT PERFORMANCE

Flight performance may have an impact on:

a) runway width;

b) runway length;

c) the OFZ;

d) runway/taxiway separation;

e) wake turbulence;

f) noise; and

g) aiming point marking.

Attachment B to Chapter 4

AEROPLANE GROUND SERVICING REQUIREMENTS

The following list of aeroplane ground servicing characteristics and requirements may affect the available aerodrome infrastructure. This list is not exhaustive; additional items may be identified by the stakeholders involved in the compatibility assessment process:

a) ground power;

b) passengers embarking and disembarking;

c) cargo loading and unloading;

d) fuelling;

e) pushback and towing;

f) de-icing;

g) taxiing and marshalling;

h) aeroplane maintenance;

i) RFF;

j) equipment areas;

k) stand allocation; and

l) disabled aircraft removal.

Attachment C to Chapter 4

LIST OF REFERENCES

Annex 4 — *Aeronautical Charts*

Annex 6 — *Operation of Aircraft*
Part I — *International Commercial Air Transport — Aeroplanes*

Annex 10 — *Aeronautical Telecommunications*
Volume I — *Radio Navigation Aids*

Annex 13 — *Aircraft Accident and Incident Investigation*

Annex 14 — *Aerodromes*
Volume I — *Aerodrome Design and Operations.*

Annex 15 — *Aeronautical Information Services*

Annex 19 — *Safety Management*

Procedures for Air Navigation Services — Air Traffic Management (PANS-ATM) (Doc 4444)

Airport Services Manual (Doc 9137)
Part 1 — *Rescue and Fire Fighting*
Part 2 — *Pavement Surface Conditions*
Part 6 — *Control of Obstacles*
Part 8 — *Airport Operational Services*

Aerodrome Design Manual (Doc 9157)
Part 1 — *Runways*
Part 2 — *Taxiways, Aprons and Holding Bays*
Part 3 — *Pavements*

Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476)

Manual on Certification of Aerodromes (Doc 9774)

Advanced Surface Movement Guidance and Control Systems (A-SMGCS) Manual (Doc 9830)

Safety Management Manual (SMM) (Doc 9859)

Manual on the Prevention of Runway Incursions (Doc 9870)

New Larger Aeroplanes — Infringement of the Obstacle Free Zone: Operational Measures and Aeronautical Study (Cir 301)

Operation of New Larger Aeroplanes at Existing Aerodromes (Cir 305)

Attachment D to Chapter 4

SELECTED AEROPLANE CHARACTERISTICS

Data are provided for convenience, are subject to change and should be used only as a guide. Accurate data should be obtained from the aircraft manufacturer's documentation. Many aeroplane types have optional weights and different engine models and engine thrusts; therefore pavement aspects and reference field lengths will vary, in some cases enough to change the aeroplane category. Reference field length should not be used for the design of aerodrome runway length, as the required length will vary depending on various factors such as aerodrome elevation, reference temperature and runway slope.

Aircraft model	*Take-off weight (kg)*	*Code*	*Reference field length (m)**	*Wingspan (m)*	*Outer main gear wheel span (m)*	*Nose gear to main gear distance (wheel base) (m)*	*Cockpit to main gear distance (m)*	*Fuselage length (m)*	*Overall (maximum) length (m)*	*Maximum tail height (m)*	*Approach speed (1.3×Vs) (kt)*	*Maximum evacuation slide length (m)******
AIRBUS A318-100	68 000	3C	1 789	34.1	8.9	10.3	15.3	31.5	31.5	12.9	124	7.2
A319-100	75 500	4C	1 800	34.1	8.9	11.4	16.5	33.5	33.5	12.2	128	7.2
A320-200	77 000	4C	2 025	34.1	8.9	12.6	17.7	37.6	37.6	12.2	136	7.5
A321-200	93 500	4C	2 533	34.1	8.9	16.9	22.0	44.5	44.5	12.1	142	6.2
A300B4-200	165 000	4D	2 727	44.8	11.1	18.6	25.3	53.2	54.1	16.7	137	9.0
A300-600R	170 500	4D	2 279	44.8	11.1	18.6	25.3	53.2	54.1	16.7	135	9.0
A310-300	164 000	4D	2 350	43.9	11.0	15.2	21.9	45.9	46.7	16.0	139	6.9
A330-200	233 000	4E	2 479	60.3	12.6	22.2	28.9	57.3	58.4	18.2	136	11.5
A330-300	233 000	4E	2 490	60.3	12.6	25.4	32.0	62.6	63.7	17.2	137	11.5
A340-200	275 000	4E	2 906	60.3	12.6	22.2	28.9	58.3	59.4	17.0	136	11.0
A340-300	276 500	4E	2 993	60.3	12.6	25.4	32.0	62.6	63.7	17.0	139	11.0
A340-500	380 000	4E	3 023	63.4	12.6	28.0	34.5	66.0	67.9	17.5	142	10.9
A340-600	380 000	4E	2 864	63.4	12.6	33.1	39.8	73.5	75.4	17.9	148	10.5
A380-800	560 000	4F	2 779	79.8	14.3	29.7	36.4	70.4	72.7	24.4	138	15.2
ANTONOV An-2	5 500	1B	500	18.2	3.4	8.3	–0.6	12.7	12.4	4.1	62	
An-3	5 800	1B	390	18.2	3.5	8.3	–0.6	14.0	13.9	4.9	65	
An-28	6 500	1B	585	22.1	3.4	4.4	3.1	12.7	13.1	4.9	89	
An-38-100	9 500	2B	965	22.1	3.4	6.2	4.9	15.3	15.7	5.5	108	
An-38-200	9 930	2B	1 125	22.1	3.4	6.2	4.9	15.3	15.7	5.5	119	

Aircraft model	*Take-off weight (kg)*	*Code*	*Reference field length (m)**	*Wingspan (m)*	*Outer main gear wheel span (m)*	*Nose gear to main gear distance (wheel base) (m)*	*Cockpit to main gear distance (m)*	*Fuselage length (m)*	*Overall (maximum) length (m)*	*Maximum tail height (m)*	*Approach speed (1.3×Vs) (kt)*	*Maximum evacuation slide length (m)*****
An-24	21 000	3C	1 350	29.2	7.9	7.9	7.6	23.8	23.8	8.6	119	
An-24PB	22 500	3C	1 600	29.2	7.9	7.9	7.6	23.8	23.8	8.6	119	
An-30	22 100	3C	1 550	29.2	7.9	7.4	7.6	24.3	24.3	8.6	113	
An-32	27 000	3C	1 600	29.2	7.9	7.9	7.6	23.7	23.7	8.8	124	
An-72	31 200	3C	1 250	31.9	4.1	8.0	8.5	28.1	28.1	8.7	108	
An-148-100A	38 950	3C	1 740	28.9	4.6	10.6	10.6	26.1	29.1	8.2	124	
An-70	139 000	3D	1 610	44.1	5.9	14.0	14.9	39.7	40.6	16.4	151	
An-26	24 000	4C	1 850	29.2	7.9	7.7	7.6	23.8	23.8	8.8	124	
An-26B	25 000	4C	2 200	29.2	7.9	7.7	7.6	23.8	23.8	8.8	124	
An-32B-100	28 500	4C	2 080	29.2	7.9	7.9	7.6	23.7	23.7	8.8	127	
An-74	34 800	4C	1 920	31.9	4.1	8.0	8.5	28.1	28.1	8.7	108	
An-74TK-100	36 500	4C	1 920	31.9	4.1	8.0	8.5	28.1	28.1	8.8	108	
An-74T-200	36 500	4C	2 130	31.9	4.1	8.0	8.5	28.1	28.1	8.8	108	
An-74TK-300	37 500	4C	2 200	31.9	4.1	8.0	8.5	28.1	28.1	8.7	116	
An-140	21 000	4C	1 880	24.5	3.7	8.1	7.8	21.6	22.6	8.2	124	
An-140-100	21 500	4C	1 970	25.5	3.7	8.1	7.8	21.6	22.6	8.2	124	
An-148-100B	41 950	4C	2 020	28.9	4.6	10.6	10.6	26.1	29.1	8.2	124	
An-148-100E	43 700	4C	2 060	28.9	4.6	10.6	10.6	26.1	29.1	8.2	124	
An-158***	43 700	4C	2 060	28.6	4.6	11.7	11.8	27.8	30.8	8.2	126	
An-168***	43 700	4C	2 060	28.9	4.6	10.6	10.6	26.1	29.1	8.2	124	
An-12	61 000	4D	1 900	38.0	5.4	9.6	11.1	33.1	33.1	10.5	151	
An-22	225 000	4E	3 120	64.4	7.4	17.3	21.7	57.8	57.8	12.4	153	
An-124-100	392 000	4F	3 000	73.3	9.0	22.8	25.6	69.1	69.1	21.1	154	
An-124-100M-150	402 000	4F	3 200	73.3	9.0	22.8	25.6	69.1	69.1	21.1	160	
An-225	640 000	4F	3 430	88.40	9.01	29.30	16.27	76.62	84.00	18.10	167	
BOEING 707-320C	152 407	4D	3 079	44.4	8.0	18.0	20.9	44.4	46.6	13.0	137	6.6
717-200	54 885	3C	1 670	28.4	5.9	17.6	17.0	34.3	37.8	9.1	139	5.3
727-200	95 254	4C	3 176	32.9	7.1	19.3	21.4	41.5	46.7	10.6	136	6.1
727-200/W	95 254	4C	3 176	33.3**	7.1	19.3	21.4	41.5	46.7	10.6	136	6.1
737-200	58 332	4C	2 295	28.4	6.4	11.4	13.0	29.5	30.5	11.2	133	5.8
737-300	62 823	4C	2 170	28.9	6.4	12.4	14.0	32.2	33.4	11.2	133	7.0
737-300/W	62 823	4C	2 550	31.2**	6.4	12.4	14.0	32.2	33.4	11.2	133	7.0

Aircraft model	*Take-off weight (kg)*	*Code*	*Reference field length (m)**	*Wingspan (m)*	*Outer main gear wheel span (m)*	*Nose gear to main gear distance (wheel base) (m)*	*Cockpit to main gear distance (m)*	*Fuselage length (m)*	*Overall (maximum) length (m)*	*Maximum tail height (m)*	*Approach speed (1.3×Vs) (kt)*	*Maximum evacuation slide length (m)*****
737-400	68 039	4C	2 550	28.9	6.4	12.4	15.9	35.2	36.4	11.2	139	7.0
737-500	60 555	4C	2 470	28.9	6.4	11.1	12.7	29.8	31.0	11.2	128	7.0
737-500/W	60 555	4C	2 454	31.1**	6.4	11.1	12.7	29.8	31.0	11.2	128	7.0
737-600	65 091	3C	1 690	34.3	7.0	11.2	12.8	29.8	31.2	12.7	125	7.0
737-600/W	65 544	3C	1 640	35.8**	7.0	11.2	12.9	29.8	31.2	12.7	125	7.0
737-700	70 080	3C	1 600	34.3	7.0	12.6	14.2	32.2	33.6	12.7	130	7.0
737-700/W	70 080	3C	1 610	35.8**	7.0	12.6	14.2	32.2	33.6	12.7	130	7.0
737-800	79 016	4C	2 090	34.3	7.0	15.6	17.2	38.0	39.5	12.6	142	7.0
737-800/W	79 016	4C	2 010	35.8**	7.0	15.6	17.2	38.0	39.5	12.6	142	7.0
737-900	79 016	4C	2 240	34.3	7.0	17.2	18.8	40.7	42.1	12.6	141	7.0
737-900ER/W	84 912	4C	2 470	35.8**	7.0	17.2	18.8	40.7	42.1	12.6	141	7.0
747-SP	318 875	4E	2 710	59.6	12.4	20.5	22.9	53.9	56.3	20.1	140	14.3
747-100	341 555	4E	3 060	59.6	12.4	25.6	28.0	68.6	70.4	19.6	144	11.8
747-200	379 203	4E	3 150	59.6	12.4	25.6	28.0	68.6	70.4	19.6	150	11.8
747-300	379 203	4E	3 292	59.6	12.4	25.6	28.0	68.6	70.4	19.6	152	14.3
747-400ER	414 130	4E	3 094	64.9	12.6	25.6	27.9	68.6	70.7	19.6	157	14.3
747-400	396 893	4E	3 048	64.9	12.6	25.6	27.9	68.6	70.7	19.5	157	14.3
747-8	442 253	4F	3 070	68.4	12.7	29.7	32.0	74.2	78.0	19.2	150***	15.7
747-8F	442 253	4F	3 070	68.4	12.7	29.7	32.0	74.2	78.0	19.2	159***	11.7
757-200	115 666	4D	1 980	38.1	8.6	18.3	22.0	47.0	47.3	13.7	137	9.3
757-200/W	115 666	4D	1 980	41.1**	8.6	18.3	22.0	47.0	47.3	13.7	137	9.3
757-300	122 470	4D	2 400	38.1	8.6	22.3	26.0	54.4	54.4	13.7	143	9.3
767-200	163 747	4D	1 981	47.6	10.8	19.7	24.3	47.2	48.5	16.1	135	8.7
767-200ER	179 623	4D	2 743	47.6	10.8	19.7	24.3	47.2	48.5	16.1	142	8.7
767-300	163 747	4D	1 981	47.6	10.9	22.8	27.4	53.7	54.9	16.0	140	8.7
767-300ER	186 880	4D	2 540	47.6	10.9	22.8	27.4	53.7	54.9	16.0	145	8.7
767-300ER/W	186 880	4D	2 540	50.9**	10.9	22.8	27.4	53.7	54.9	16.0	145	8.7
767-400ER	204 117	4D	3 140	51.9	11.0	26.2	30.7	60.1	61.4	17.0	150	9.7
777-200	247 208	4E	2 380	60.9	12.9	25.9	28.9	62.9	63.7	18.7	136	12.0
777-200ER	297 557	4E	2 890	60.9	12.9	25.9	28.9	62.9	63.7	18.7	139	12.0
777-200LR	347 815	4E	3 390	64.8	12.9	25.9	28.9	62.9	63.7	18.7	140	12.0
777-300	299 371	4E	3 140	60.9	12.9	31.2	32.3	73.1	73.9	18.7	149	12.6

Aircraft model	*Take-off weight (kg)*	*Code*	*Reference field length (m)**	*Wingspan (m)*	*Outer main gear wheel span (m)*	*Nose gear to main gear distance (wheel base) (m)*	*Cockpit to main gear distance (m)*	*Fuselage length (m)*	*Overall (maximum) length (m)*	*Maximum tail height (m)*	*Approach speed (1.3×Vs) (kt)*	*Maximum evacuation slide length (m)*****
777-300ER	351 534	4E	3 060	64.8	12.9	31.2	32.3	73.1	73.9	18.8	149	12.6
B787-8	219 539	4E	2 660	60.1	11.6	22.8	25.5	55.9	56.7	16.9	140***	11.1
MD-81	64 410	4C	2 290	32.9	6.2	22.1	21.5	41.6	45.0	9.2	134	5.3
MD-82	67 812	4C	2 280	32.9	6.2	22.1	21.5	41.6	45.0	9.2	134	5.3
MD-83	72 575	4C	2 470	32.9	6.2	22.1	21.5	41.6	45.0	9.2	144	5.3
MD-87	67 812	4C	2 260	32.9	6.2	19.2	21.5	36.3	39.8	9.5	134	5.3
MD-88	72 575	4C	2 470	32.9	6.2	22.1	21.5	41.6	45.0	9.2	144	5.3
MD-90	70 760	3C	1 800	32.9	6.2	23.5	22.9	43.0	46.5	9.5	138	5.3
MD-11	285 990	4D	3 130	51.97	12.6	24.6	31.0	58.6	61.6	17.9	153	9.8
DC8-62	158 757	4D	3 100	45.2	7.6	18.5	20.5	46.6	48.0	13.2	138	6.7
DC9-15	41 504	4C	1 990	27.3	6.0	13.3	12.7	28.1	31.8	8.4	132	5.3
DC9-20	45 813	3C	1 560	28.4	6.0	13.3	12.7	28.1	31.8	8.4	126	5.3
DC9-50	55 338	4C	2 451	28.5	5.9	18.6	18.0	37.0	40.7	8.8	135	5.3
BOMBARDIER CS100****	54 930	3C	1 509	35.1	8.0	12.9	13.7	34.9	34.9	11.5	127	
CS100 ER****	58 151	3C	1 509	35.1	8.0	12.9	13.7	34.9	34.9	11.5	127	
CS300****	59 783	4C	1 902	35.1	8.0	14.5	15.3	38.1	38.1	11.5	133	
CS300 XT****	59 783	3C	1 661	35.1	8.0	14.5	15.3	38.1	38.1	11.5	133	
CS300 ER****	63 321	4C	1 890	35.1	8.0	14.5	15.3	38.1	38.1	11.5	133	
CRJ200ER	23 133	3B	1 680	21.2	4.0	11.4	10.8	24.4	26.8	6.3	140	
CRJ200R	24 040	4B	1 835	21.2	4.0	11.4	10.8	24.4	26.8	6.3	140	
CRJ700	32 999	3B	1 606	23.3	5.0	15.0	14.4	29.7	32.3	7.6	135	
CRJ700ER	34 019	3B	1 724	23.3	5.0	15.0	14.4	29.7	32.3	7.6	135	
CRJ700R****	34 927	4B	1 851	23.3	5.0	15.0	14.4	29.7	32.3	7.6	136	
CRJ900	36 514	3B	1 778	23.3	5.0	17.3	16.8	33.5	36.2	7.4	136	
CRJ900ER	37 421	4C	1 862	24.9	5.0	17.3	16.8	33.5	36.2	7.4	136	
CRJ900R	38 329	4C	1 954	24.9	5.0	17.3	16.8	33.5	36.2	7.4	137	
CRJ1000****	40 823	4C	1 996	26.2	5.1	18.8	18.3	36.2	39.1	7.5	138	
CRJ1000ER****	41 640	4C	2 079	26.2	5.1	18.8	18.3	36.2	39.1	7.5	138	
DHC-8-100	15 650	2C	890	25.9	7.9	8.0	6.1	20.8	22.3	7.5	101	
DHC-8-200	16 465	2C	1 020	25.9	8.5	8.0	6.1	20.8	22.3	7.5	102	
DHC-8-300	18 643	2C	1 063	27.4	8.5	10.0	8.2	24.2	25.7	7.5	107	
DHC-8-400	27 987	3C	1 288	28.4	8.8	14.0	12.2	31.0	32.8	8.3	125	

Aircraft model	*Take-off weight (kg)*	*Code*	*Reference field length (m)**	*Wingspan (m)*	*Outer main gear wheel span (m)*	*Nose gear to main gear distance (wheel base) (m)*	*Cockpit to main gear distance (m)*	*Fuselage length (m)*	*Overall (maximum) length (m)*	*Maximum tail height (m)*	*Approach speed (1.3×Vs) (kt)*	*Maximum evacuation slide length (m)*****
EMBRAER ERJ 170-100 STD	35 990	3C	1 439	26.0	6.2	10.6	11.5	29.9	29.9	9.7	124	
ERJ 170-100 LR, SU and SE	37 200	3C	1 532	26.0	6.2	10.6	11.5	29.9	29.9	9.7	124	
ERJ 170-100 + SB 170-00-0016	38 600	3C	1 644	26.0	6.2	10.6	11.5	29.9	29.9	9.7	125	
ERJ 170-200 STD	37 500	3C	1 562	26.0	6.2	11.4	12.3	31.7	31.7	9.7	126	
ER 170-200 LR and SU	38 790	3C	1 667	26.0	6.2	11.4	12.3	31.7	31.7	9.7	126	
ERJ 170-200 + SB 170-00-0016	40 370	4C	2 244	26.0	6.2	11.4	12.3	31.7	31.7	9.7	126	
ERJ 190-100 STD	47 790	3C	1 476	28.7	7.1	13.8	14.8	36.3	36.3	10.6	124	
ERJ 190-100 LR	50 300	3C	1 616	28.7	7.1	13.8	14.8	36.3	36.3	10.6	124	
ERJ 190-100 IGW	51 800	3C	1 704	28.7	7.1	13.8	14.8	36.3	36.3	10.6	125	
ERJ 190-200 STD	48 790	3C	1 597	28.7	7.1	14.6	15.6	38.7	38.7	10.5	126	
ERJ 190-200 LR	50 790	3C	1 721	28.7	7.1	14.6	15.6	38.7	38.7	10.5	126	
ERJ 190-200 IGW	52 290	4C	1 818	28.7	7.1	14.6	15.6	38.7	38.7	10.5	128	

* Reference field length reflects the model/engine combination that provides the shortest field length and the standard conditions (maximum weight, sea level, std day, A/C off, runway dry with no slope).

** Span includes optional wiinglets.

*** Preliminary data.

**** Preliminary data — aircraft not yet certified.

***** Longest deployed slide lengths, including upper deck slides, referenced from aircraft centre line as measured horizontally. Data are based primarily on aircraft rescue fire fighting charts.

MAXIMUM LENGTH(1) OF EVACUATION SLIDES

Model	*Deployed length (2) (metres)*	*Model*	*Deployed length (2) (metres)*
737-600/-700/-800/-900	7.0	A300-600	9.0
747-100/-200 (upper deck)	11.8	A310	6.9
747-100/-200 (lower deck)	11.5	A318	7.2
747-300/-400 (upper deck)	14.3	A319	7.2
747-300/-400 (lower deck)	11.5	A320	7.5
757-200/-300	9.3	A321	6.2
767-200/-300	8.7	A330-200/-300	11.5
767-400	9.7	A340-200/-300	11
777-200/-200ER/-200LR/-200F	12.0	A340-500	10.9
777-300/-300ER	12.6	A340-600	10.5
		A380	15.2

No data available for 787 or 747-8 at this time.

(1) Due to the variety of slides and slide manufacturers only the longest slides and average lengths are indicated here.

(2) Deployed lengths referenced are from the aircraft centre line as measured horizontally. Data are based primarily on aircraft rescue and fire fighting charts.

PART II – AERODROME OPERATIONAL MANAGEMENT

Chapter 1

(applicable on 5 November 2020)

REPORTING FORMAT USING STANDARD RUNWAY CONDITION REPORT

1.1 RUNWAY SURFACE CONDITION ASSESSMENT AND REPORTING

1.1.1 General

Note.— This section includes an introduction to each of the topics covered in subsequent sections. It also provides an overview of the general principles in order to understand the procedures that follow.

1.1.1.1 Assessing and reporting the condition of the movement area and related facilities is necessary in order to provide the flight crew with the information needed for safe operation of the aeroplane. The runway condition report (RCR) is used for reporting assessed information.

1.1.1.2 On a global level, movement areas are exposed to a multitude of climatic conditions and consequently a significant difference in the condition to be reported. The RCR describes a basic structure applicable for all these climatic variations. Assessing runway surface conditions rely on a great variety of techniques and no single solution can apply to every situation.

Note.— Guidance on methods of assessing runway surface condition is given in Attachment A to this chapter.

1.1.1.3 The philosophy of the RCR is that the aerodrome operator assesses the runway surface conditions whenever water, snow, slush, ice or frost are present on an operational runway. From this assessment, a runway condition code (RWYCC) and a description of the runway surface are reported which can be used by the flight crew for aeroplane performance calculations. This format, based on the type, depth and coverage of contaminants, is the best assessment of the runway surface condition by the aerodrome operator; however, all other pertinent information will be taken into consideration and be kept up to date and changes in conditions reported without delay.

1.1.1.4 The RWYCC reflects the runway braking capability as a function of the surface conditions. With this information, the flight crew can derive, from the performance information provided by the aeroplane manufacturer, the necessary stopping distance of an aircraft on the approach under the prevailing conditions.

1.1.1.5 The operational requirements in 1.1.1.3 stem from Annex 6 — *Operation of Aircraft*, Part I — *International Commercial Air Transport — Aeroplanes* and Annex 8 — *Airworthiness of Aircraft* with the objective of achieving the desired level of safety for the aeroplane operations.

1.1.1.6 Annex 14, Volume I contains high-level SARPs related to the assessment and reporting of runway surface condition. Associated objectives and operational practices are described in 1.1.2 and 1.1.3.

1.1.1.7 The operational practices are intended to provide the information needed to fulfil the syntax requirements for dissemination and promulgation specified in Annex 15 — *Aeronautical Information Services* and the *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM, Doc 4444).

Note.— For practical reasons, the RCR information string has been provisionally incorporated in Annex 15 as a revision of the SNOWTAM format.

1.1.1.8 When the runway is wholly or partly contaminated by standing water, snow, slush, ice or frost, or is wet associated with the clearing or treatment of snow, slush, ice or frost, the runway condition report should be disseminated through the AIS and ATS services. When the runway is wet, not associated with the presence of standing water, snow, slush, ice or frost, the assessed information should be disseminated using the runway condition report through the ATS only.

Note.— Operationally relevant information concerning taxiways and aprons are covered in the situational awareness section of the RCR.

1.1.1.9 The operational practices describe procedures to meet the operationally needed information for the flight crew and dispatchers for the following sections:

a) aeroplane take-off and landing performance calculations:

   i) dispatch — pre-planning before commencement of flight:

      — take-off from a runway; and
      — landing on a destination aerodrome or an alternate aerodrome;

   ii) in flight — when assessing the continuation of flight; and

      — before landing on a runway; and

b) situational awareness of the surface conditions on the taxiways and aprons.

1.1.2 Objectives

Note.— This section contains the basic principles that have been defined for the topic and have been formulated as required for global uniform application. They cover the whole subject matter and are broken down into the individual subsections.

1.1.2.1 The RWYCC shall be reported for each third of the runway assessed.

1.1.2.2 The assessment process shall include:

a) assessing and reporting the condition of the movement area;

b) providing the assessed information in the correct format; and

c) reporting significant changes without delay.

1.1.2.3 The information to be reported shall be compliant with the RCR which consists of:

a) aeroplane performance calculation section; and

b) situational awareness section.

1.1.2.4 The information shall be included in an information string in the following order using only AIS-compatible characters:

a) aeroplane performance calculation section:

i) aerodrome location indicator;

ii) date and time of assessment;

iii) lower runway designation number;

iv) RWYCC for each runway third;

v) per cent coverage contaminant for each runway third;

vi) depth of loose contaminant for each runway third;

vii) condition description for each runway third; and

viii) width of runway to which the RWYCCs apply if less than published width.

b) situational awareness section:

i) reduced runway length;

ii) drifting snow on the runway;

iii) loose sand on the runway;

iv) chemical treatment on the runway;

v) snowbanks on the runway;

vi) snowbanks on the taxiway;

vii) snowbanks adjacent to the runway;

viii) taxiway conditions;

ix) apron conditions;

x) State-approved, and published use of, measured friction coefficient; and

xi) plain language remarks.

1.1.2.5 The syntax for dissemination as described in the RCR template in Annex 15, Appendix 2, is determined by the operational need of the flight crew and the capability of trained personnel to provide the information arising from an assessment.

Note.— For practical reasons, the RCR information string has been provisionally incorporated in Annex 15 — Aeronautical Information Services *as a revision of the SNOWTAM format.*

1.1.2.6 The syntax requirement in 1.1.2.5 shall be strictly adhered to when providing the assessed information through the RCR.

1.1.3 Operational practices

Note.— This section covers the specific operational practices and the ways in which they are applied in order to achieve the basic principles defined in 1.1.2 — Objectives.

1.1.3.1 Reporting, in compliance with the runway condition report, shall commence when a significant change in runway surface condition occurs due to water, snow, slush, ice or frost.

1.1.3.2 Reporting of the runway surface condition should continue to reflect significant changes until the runway is no longer contaminated. When this situation occurs, the aerodrome will issue a runway condition report that states the runway is wet or dry as appropriate.

1.1.3.3 A change in the runway surface condition used in the runway condition report is considered significant whenever there is:

a) any change in the RWYCC;

b) any change in contaminant type;

c) any change in reportable contaminant coverage according to Table II-1-1;

d) any change in contaminant depth according to Table II-1-2; and

e) any other information, for example a pilot report of runway braking action, which according to assessment techniques used, are known to be significant.

Runway Condition Report — Aeroplane performance calculation section

1.1.3.4 The aeroplane performance calculation section is a string of grouped information separated by a space " " and ends with a return and two line feed "≪≡". This is to distinguish the aeroplane performance calculation section from the following situational awareness section or the following aeroplane performance calculation section of another runway.

The information to be included in this section consists of the following.

a) **Aerodrome location indicator:** a four-letter ICAO location indicator in accordance with Doc 7910, *Location Indicators*.

This information is mandatory.

Format: nnnn
Example: ENZH

b) **Date and time of assessment:** date and time (UTC) when the assessment was performed by the trained personnel.

This information is mandatory.

Format: MMDDhhmm
Example: 09111357

c) **Lower runway designation number:** a two- or three-character number identifying the runway for which the assessment is carried out and reported.

This information is mandatory.

Format: nn[L] *or* nn[C] *or* nn[R]
Example: 09L

d) **Runway condition code for each runway third:** a one-digit number identifying the RWYCC assessed for each runway third. The codes are reported in a three-character group separated by a "/" for each third. The direction for listing the runway thirds shall be in the direction as seen from the lower designation number.

This information is mandatory.

When transmitting information on runway surface conditions by ATS to flight crews, the sections are, however, referred to as the first, second or third part of the runway. The first part always means the first third of the runway as seen in the direction of landing or take-off as illustrated in Figures II-1-1 and II-1-2 and detailed in PANS-ATM (Doc 4444).

Format: n/n/n
Example: 5/5/2

Note 1.— A change in RWYCC from, say, 5/5/2 to 5/5/3 is considered significant. (See further examples below).

Note 2.— A change in RWYCC requires a complete assessment taking into account all information available.

Note 3.— Procedures for assigning a RWYCC are available in 1.1.3.12 to 1.1.3.16.

e) **Per cent coverage contaminant for each runway third:** a number identifying the percentage coverage. The percentages are to be reported in an up-to-nine character group separated by a "/" for each runway third. The assessment is based upon an even distribution within the runway thirds using the guidance in Table II-1-1.

This information is conditional. It is not reported for one runway third if it is dry or covered with less than 10 per cent.

Format: [n]nn/[n]nn/[n]nn
Example: 25/50/100
NR/50/100 if contaminant coverage is less than 10% in the first third
25/NR/100 if contaminant coverage is less than 10% in the middle third
25/50/NR if contaminant coverage is less than 10% in the last third

With uneven distribution of the contaminants, additional information is to be given in the plain language remark part of the situational awareness section of the runway condition report. Where possible, a standardized text should be used.

Note.— When no information is to be reported, insert "NR" at its relevant position in the message to indicate to the user that no information exists (/NR/).

f) **Depth of loose contaminant: dry snow, wet snow, slush or standing water for each runway third:** a two- or three-digit number representing the assessed depth (mm) of the contaminant for each runway third. The depth is reported in a six to nine character group separated by a "/" for each runway third as defined in Table II-1-2. The assessment is based upon an even distribution within the runway thirds as assessed by trained personnel. If measurements are included as part of the assessment process, the reported values are still reported as assessed depths, as the trained personnel have placed their judgment upon the measured depths to be representative for the runway third.

Format: [n]nn/[n]nn/[n]nn
Examples: 04/06/12 *[STANDING WATER]*
02/04/09 *[SLUSH]*
02/05/10 *[WET SNOW or WET SNOW ON TOP OF ...]*
02/20/100 *[DRY SNOW or DRY SNOW ON TOP OF]*
NR/NR/100 *[DRY SNOW in the last third only]*

This information is conditional. It is reported only for DRY SNOW, WET SNOW, SLUSH and STANDING WATER.

Example of reporting depth of contaminant whenever there is a significant change

1) After the first assessment of runway condition, a **first runway condition report** is generated. The initial report is:

5/5/5 100/100/100 02/02/02 SLUSH/SLUSH/SLUSH

Note.— The full information string is not used in this example.

2) With continuing precipitation, a new runway condition report is required to be generated as subsequent assessment reveals a change in the runway condition code. A **second runway condition report** is therefore created as:

2/2/2 100/100/100 03/03/03 SLUSH/SLUSH/SLUSH

3) With even more precipitation, further assessment reveals the depth of precipitation has increased from 3 mm to 5 mm along the entire length of the runway. However, a new runway condition report **is not** required because the runway condition code has not changed (change in depth is less than the significant change threshold of 3 mm).

4) A final assessment of the precipitation reveals that the depth has increased to 7 mm. A new runway condition code is required because the change in depth from the last runway condition report (**second runway condition code**) i.e. from 3 mm to 7 mm is greater than the significant change threshold of 3 mm. A **third runway condition report** is thus created as below:

2/2/2 100/100/100 07/07/07 SLUSH/SLUSH/SLUSH

For contaminants other than STANDING WATER, SLUSH, WET SNOW or DRY SNOW, the depth is not reported. The position of this type of information in the information string is then identified by /NR/.
Example: /NR/

When the depth of the contaminants varies significantly within a runway third, additional information is to be given in the plain language remark part of the situational awareness section of the runway condition report.

Note.— In this context a significant variation in depth in the lateral direction is more than twice the depth indicated in column 3 of Table II-1-2. Further information is available in Circular 329 — Assessment, Measurement and Reporting of Runway Surface Conditions.

g) **Condition description for each runway third:** to be reported in capital letters using terms specified in 2.9.5 of Annex 14, Volume I. These terms have been harmonized with the terms used in the Standards and Recommended Practices in Annexes 6, 8, 11 and 15. The condition type is reported by any of the following condition type descriptions for each runway third and separated by an oblique stroke "/".

This information is mandatory.

COMPACTED SNOW
DRY
DRY SNOW
DRY SNOW ON TOP OF COMPACTED SNOW
DRY SNOW ON TOP OF ICE
FROST
ICE
SLUSH
STANDING WATER
WATER ON TOP OF COMPACTED SNOW
WET
WET ICE
WET SNOW
WET SNOW ON TOP OF COMPACTED SNOW
WET SNOW ON TOP OF ICE

Format: nnnn/nnnn/nnnn
Example: DRY SNOW ON TOP OF COMPACTED SNOW/WET SNOW ON TOP OF COMPACTED SNOW/WATER ON TOP OF COMPACTED SNOW

h) **Width of runway to which the RWYCCs apply if less than published width** is the two-digit number representing the width of cleared runway in metres.

This information is optional.

Format: nn
Example: 30

If the cleared runway width is not symmetrical along the centre line, additional information is to be given in the plain language remark part of the situational awareness section of the runway condition report.

Runway condition report — Situational awareness section:

1.1.3.5 All individual messages in the situational awareness section end with a full stop sign. This is to distinguish the message from subsequent message(s).

The information to be included in this section consists of the following:

a) **Reduced runway length**

This information is conditional when a NOTAM has been published with a new set of declared distances affecting the LDA.

Format: Standardized fixed text
RWY nn [L] *or* nn [C] *or* nn [R] LDA REDUCED TO [n]nnn
Example: RWY 22L LDA REDUCED TO 1450.

b) **Drifting snow on the runway**

This information is optional.

Format: Standardized fixed text
Example: DRIFTING SNOW.

c) **Loose sand on the runway**

This information is optional.

Format: RWY nn[L] *or* nn[C] *or* nn[R] LOOSE SAND
Example: RWY 02R LOOSE SAND.

d) **Chemical treatment on the runway**

This information is mandatory.

Format: RWY nn[L] *or* nn[C] *or* nn[R] CHEMICALLY TREATED
Example: RWY 06 CHEMICALLY TREATED.

e) **Snowbanks on the runway**

This information is optional.
Left or right distance in metres from centre line.

Format: RWY nn[L] *or* nn[C] *or* nn[R] SNOWBANK Lnn *or* Rnn *or* LRnn FM CL
Example: RWY 06L SNOWBANK LR19 FM CL.

f) **Snowbanks on taxiway**

This information is optional.
Left or right distance in metres from centre line.

Format: TWY [nn]n SNOWBANK Lnn *or* Rnn *or* LRnn FM CL
Example: TWY A SNOWBANK LR20 FM CL.

g) **Snowbanks adjacent to the runway penetrating level/profile set in the aerodrome snow plan.**

This information is optional.

Format: RWY nn[L] *or* nn[C] *or* nn[R] ADJACENT SNOWBANKS
Example: RWY 06R ADJACENT SNOWBANKS.

h) **Taxiway conditions**

This information is optional.

Format: TWY [nn]n POOR
Example: TWY B POOR.

i) **Apron conditions**

This information is optional.

Format: APRON [nnnn] POOR
Example: APRON NORTH POOR.

j) **State-approved and published use of measured friction coefficient**

This information is optional.

Format: *[State set format and associated procedures]*
Example: *[Function of State set format and associated procedures]*.

k) **Plain language remarks using only allowable characters in capital letters**

Where possible, standardized text should be developed.

This information is optional.

Format: Combination of allowable characters where use of full stop « . » marks the end of the message.

Allowable characters:
A B C D E F G H I J K LM N O P Q R S T U V W X Y Z
0 1 2 3 4 5 6 7 8 9
/ [oblique stroke] "." [period]" " [space]

Complete information string

1.1.3.6 An example of a complete information string prepared for dissemination is as follows:

[COM header and Abbreviated header] (Completed by AIS)
GG EADBZQZX EADNZQZX EADSZQZX
070645 EADDYNYX
SWEA0151 EADD 02170055
SNOWTAM 0151

[Aeroplane performance calculation section]
EADD 02170055 09L 5/5/5 100/100/100 NR/NR/NR WET/WET/WET
EADD 02170135 09R 5/4/3 100/50/75 NR/06/06 WET/SLUSH/SLUSH
EADD 02170225 09C 3/2/1 75/100/100 06/12/12 SLUSH/WET SNOW/WET SNOW

[Situational awareness section]
RWY 09L SNOWBANK R20 FM CL. RWY 09R ADJ SNOWBANKS. TWY B POOR. APRON NORTH POOR.

Assessing a runway and assigning a runway condition code

1.1.3.7 The assessed RWYCC to be reported for each third of the runway is determined by following the procedure described in 1.1.3.12 to 1.1.3.16.

Note.— Guidance on methods of assessing runway surface condition, including the determination of a slippery wet runway, is given in Attachment A to this chapter.

1.1.3.8 If 25 per cent or less area of a runway third is wet or covered by contaminant, a RWYCC 6 shall be reported.

1.1.3.9 If the distribution of the contaminant is not uniform, the location of the area that is wet or covered by the contaminant is described in the plain language remarks part of the situational awareness section of the runway condition report.

1.1.3.10 A description of the runway surface condition is provided using the contamination terms described in capital letters in Table II-1-3 — *Assigning a runway condition code (RWYCC).*

1.1.3.11 If multiple contaminants are present where the total coverage is more than 25 per cent but no single contaminant covers more than 25 per cent of any runway third, the RWYCC is based upon the judgment by trained personnel, considering what contaminant will most likely be encountered by the aeroplane and its likely effect on the aeroplane's performance.

1.1.3.12 The RWYCC is determined using Table II-1-3.

1.1.3.13 The variables, in Table II-1-3, that may affect the runway condition code are:

a) type of contaminant;

b) depth of contaminant; and

c) outside air temperature. Where available the runway surface temperature should preferably be used.

Note.— At air temperatures of plus 3 degrees Celsius and below, with a dew point spread of 3 degrees Celsius or less, the runway surface condition may be more slippery than indicated by the runway condition code assigned by Table II-1-3. The narrow dew point spread indicates that the air mass is relatively close to saturation which is often associated with actual precipitation, intermittent precipitation, nearby precipitation or fog.

This may depend on its correlation with precipitation but it may also, at least in part, depend on the exchange of water at the air-ice interface. Due to the other variables involved, such as surface temperature, solar heating and ground cooling or heating, a small temperature spread does not always mean that the braking action will be more slippery. The observation should be used by aerodrome operators as an indicator of slippery conditions but not as an absolute.

1.1.3.14 An assigned RWYCC 5, 4, 3 or 2 shall not be upgraded.

1.1.3.15 An assigned RWYCC 1 or 0 can be upgraded using the following procedures (but see also 1.1.3.16):

a) if a properly operated and calibrated State-approved measuring device and all other observations support a higher RWYCC as judged by trained personnel;

b) the decision to upgrade RWYCC 1 or 0 cannot be based upon one assessment method alone. All available means of assessing runway slipperiness are to be used to support the decision;

c) when RWYCC 1 or 0 is upgraded, the runway surface is assessed frequently during the period the higher RWYCC is in effect to ensure that the runway surface condition does not deteriorate below the assigned code; and

d) variables that may be considered in the assessment that may affect the runway surface condition, include but are not limited to:

i) any precipitation conditions;

ii) changing temperatures;

iii) effects of wind;

iv) frequency of runway in use; and

v) type of aeroplane using the runway.

1.1.3.16 Upgrading of RWYCC 1 or 0 using the procedures in 1.1.3.15 shall not be permitted to go beyond a RWYCC 3.

1.1.3.17 If sand or other runway treatments are used to support upgrading, the runway surface is assessed frequently to ensure the continued effectiveness of the treatment.

1.1.3.18 The RWYCC determined from Table II-1-3 should be appropriately downgraded considering all available means of assessing runway slipperiness, including the criteria given in Table II-1-4.

1.1.3.19 Where available, the pilot reports of runway braking action should be taken into consideration as part of the ongoing monitoring process, using the following principle:

a) a pilot report of runway braking action is taken into consideration for downgrading purposes; and

b) a pilot report of runway braking action can be used for upgrading purposes only if it is used in combination with other information qualifying for upgrading.

Note 1.— The procedures for making special air-reports regarding runway braking action are contained in the Procedures for Air Navigation Services — Air Traffic Management *(PANS-ATM, Doc 4444), Chapter 4, and Appendix 1, Instructions for air-reporting by voice communication.*

Note 2.— Procedures for downgrading reported RWYCC can be found in 1.1.3.23 including the use of Table II-1-5 runway condition assessment matrix (RCAM).

1.1.3.20 Two consecutive pilot reports of runway braking action of POOR shall trigger an assessment if an RWYCC of 2 or better has been reported.

1.1.3.21 When one pilot has reported a runway braking action of LESS THAN POOR, the information shall be disseminated, a new assessment shall be made and the suspension of operations on that runway shall be considered.

Note 1.— If considered appropriate, maintenance activities may be performed simultaneously or before a new assessment is made.

Note 2.— Procedures for the provision of information to arriving aircraft are contained in Procedures for Air Navigation Services — Air Traffic Management *(PANS-ATM, Doc 4444), Section 6.6.*

1.1.3.22 Table II-1-4 shows the correlation of pilot reports of runway braking action with RWYCCs.

1.1.3.23 Table II-1-3 and Table II-1-4 combined form the runway condition assessment matrix (RCAM) in Table II-1-5. The RCAM is a tool to be used when assessing runway surface conditions. It is not a standalone document and shall be used in compliance with the associated procedures of which there are two main parts:

a) assessment criteria; and

b) downgrade assessment criteria.

1.2 AERODROME MOVEMENT AREA MAINTENANCE

(Guidance on surface friction characteristics and States' responsibilities, including examples of States' good practices, are currently being developed.)

LIST OF TABLES AND FIGURES

Table II-1-1. Percentage of coverage for contaminants

Assessed per cent	*Reported per cent*
10 – 25	25
26 – 50	50
51 – 75	75
76 – 100	100

Table II-1-2. Depth assessment for contaminants

Contaminant	*Valid values to be reported*	*Significant change*
STANDING WATER	04, then assessed value	3 mm up to and including 15 mm
SLUSH	03, then assessed value	3 mm up to and including 15 mm
WET SNOW	03, then assessed value	5 mm
DRY SNOW	03, then assessed value	20 mm

Note 1.— For STANDING WATER, 04 (4 mm) is the minimum depth value at and above which the depth is reported. (From 3 mm and below, the runway third is considered WET).

Note 2.— For SLUSH, WET SNOW and DRY SNOW, 03 (3 mm) is the minimum depth value at and above which the depth is reported.

Note 3.— Above 4 mm for STANDING WATER and 3 mm for SLUSH, WET SNOW and DRY SNOW an assessed value is reported and a significant change relates to observed change from this assessed value.

Table II-1-3. Assigning a runway condition code (RWYCC)

Runway condition description	*Runway condition code (RWYCC)*
DRY	**6**
FROST **WET** (the runway surface is covered by any visible dampness or water up to and including 3 mm deep) **SLUSH** (up to and including 3 mm depth) **DRY SNOW** (up to and including 3 mm depth) **WET SNOW** (up to and including 3 mm depth)	**5**
COMPACTED SNOW (Outside air temperature minus 15 degrees Celsius and below)	**4**
WET (“Slippery wet” runway) **DRY SNOW** (more than 3 mm depth) **WET SNOW** (more than 3 mm depth) **DRY SNOW ON TOP OF COMPACTED SNOW** (any depth) **WET SNOW ON TOP OF COMPACTED SNOW** (any depth) **COMPACTED SNOW** (outside air temperature above minus 15 degrees Celsius)	**3**
STANDING WATER (more than 3 mm depth) **SLUSH** (more than 3 mm depth)	**2**
ICE	**1**
WET ICE **WATER ON TOP OF COMPACTED SNOW** **DRY SNOW OR WET SNOW ON TOP OF ICE**	**0**

Table II-1-4. Correlation of runway condition code and pilot reports of runway braking action

Pilot report of runway braking action	*Description*	*Runway condition code (RWYCC)*
N/A		6
GOOD	Braking deceleration is normal for the wheel braking effort applied AND directional control is normal	5
GOOD TO MEDIUM	Braking deceleration OR directional control is between good and medium	4
MEDIUM	Braking deceleration is noticeably reduced for the wheel braking effort applied OR directional control is noticeably reduced	3
MEDIUM TO POOR	Braking deceleration OR directional control is between medium and poor	2
POOR	Braking deceleration is significantly reduced for the wheel braking effort applied OR directional control is significantly reduced	1
LESS THAN POOR	Braking deceleration is minimal to non-existent for the wheel braking effort applied OR directional control is uncertain	0

Table II-1-5. Runway condition assessment matrix (RCAM)

Runway condition assessment matrix (RCAM)			
Assessment criteria		Downgrade assessment criteria	
Runway condition code	Runway surface description	Aeroplane deceleration or directional control observation	Pilot report of runway braking action
6	• DRY	---	---
5	• FROST • WET (The runway surface is covered by any visible dampness or water up to and including 3 mm depth) ***Up to and including 3 mm depth:*** • SLUSH • DRY SNOW • WET SNOW	Braking deceleration is normal for the wheel braking effort applied AND directional control is normal.	GOOD
4	***−15ºC and Lower outside air temperature***: • COMPACTED SNOW	Braking deceleration OR directional control is between Good and Medium.	GOOD TO MEDIUM
3	• WET (“slippery wet” runway) • DRY SNOW or WET SNOW (any depth) ON TOP OF COMPACTED SNOW ***More than 3 mm depth:*** • DRY SNOW • WET SNOW ***Higher than −15ºC outside air temperature***[1]: • COMPACTED SNOW	Braking deceleration is noticeably reduced for the wheel braking effort applied OR directional control is noticeably reduced.	MEDIUM
2	***More than 3 mm depth of water or slush:*** • STANDING WATER • SLUSH	Braking deceleration OR directional control is between Medium and Poor.	MEDIUM TO POOR
1	• ICE [2]	Braking deceleration is significantly reduced for the wheel braking effort applied OR directional control is significantly reduced.	POOR
0	• WET ICE [2] • WATER ON TOP OF COMPACTED SNOW [2] • DRY SNOW or WET SNOW ON TOP OF ICE [2]	Braking deceleration is minimal to non-existent for the wheel braking effort applied OR directional control is uncertain.	LESS THAN POOR

[1] Runway surface temperature should preferably be used where available.

[2] The aerodrome operator may assign a higher runway condition code (but no higher than code 3) for each third of the runway, provided the procedure in 1.1.3.15 is followed.

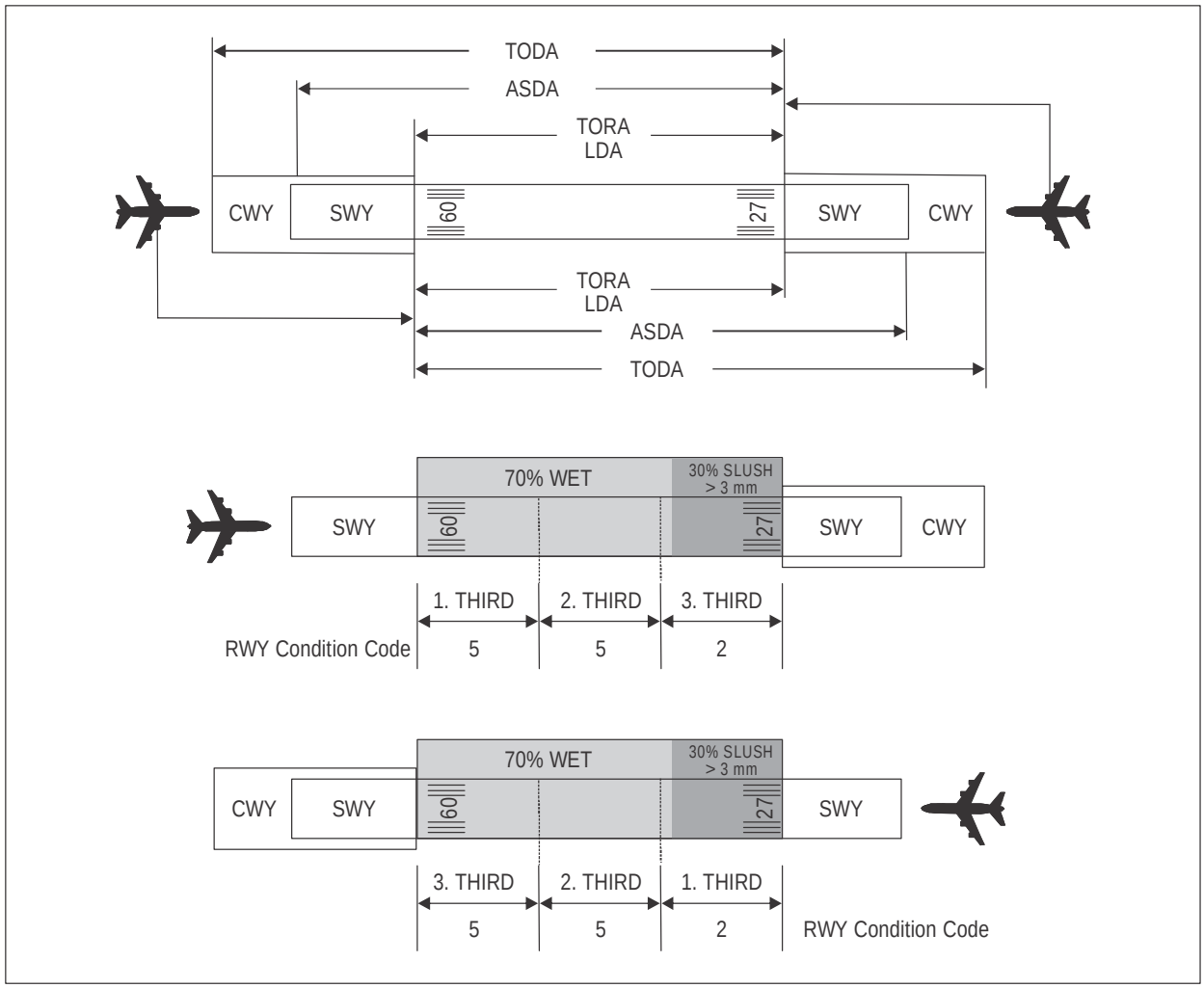


Figure II-1-1. Reporting of runway condition code from ATS to flight crew for runway thirds

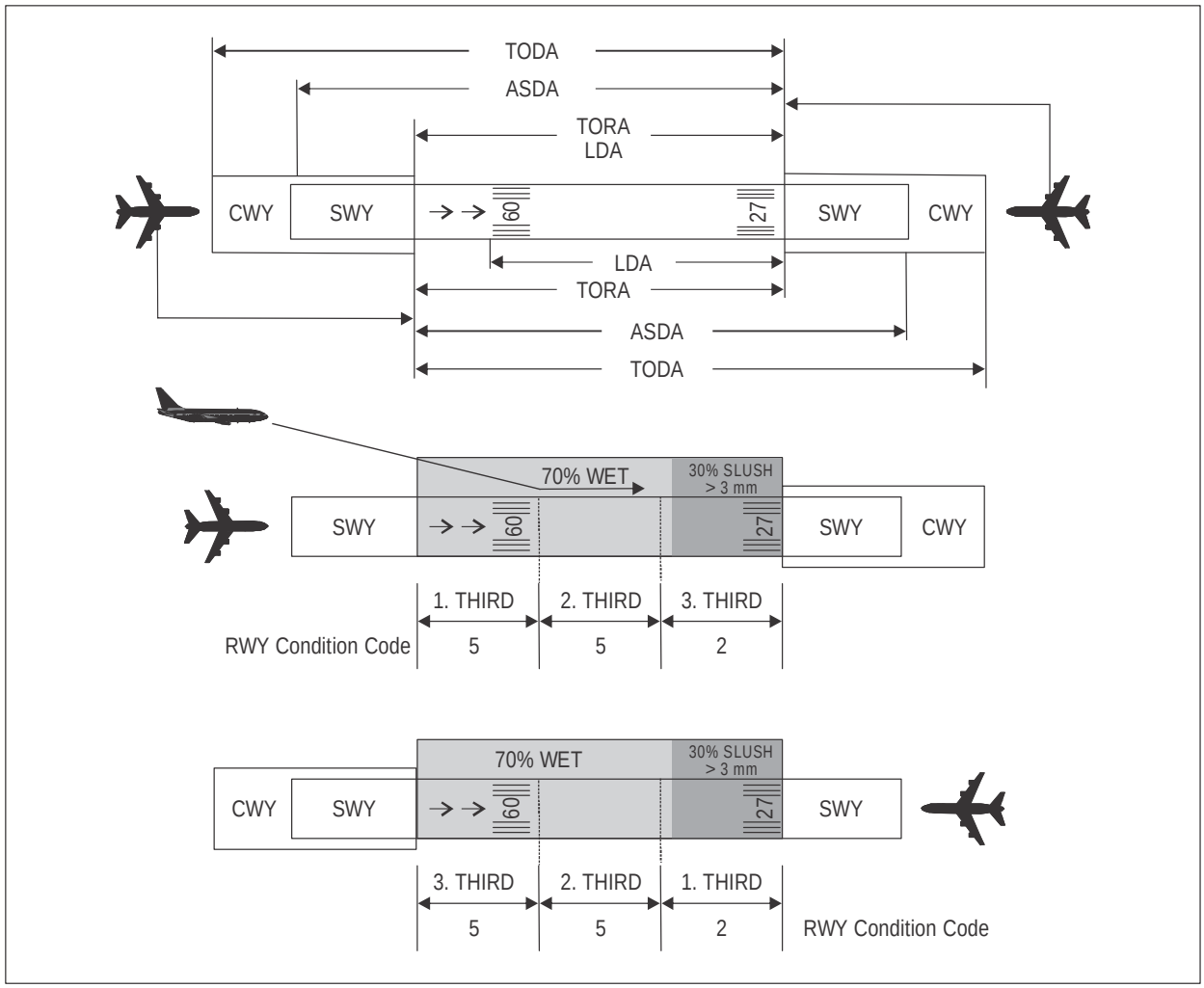


Figure II-1-2. Reporting of runway condition code for runway thirds from ATS to flight crew on a runway with displaced threshold

— — — — — — — —

Attachment A to Chapter 1
(applicable 5 November 2020)

METHODS OF ASSESSING RUNWAY SURFACE CONDITION

		ANNEX 14, Volume I, 7th Edition, July 2016	*REMARK*
DESIGN AND CONSTRUCTION	Slope	3.1.13 Longitudinal slopes 3.1.19 Transverse slopes	
	Texture	3.1.26 **Recommendation.—**The average surface texture depth of a new surface should be not less than 1.0 mm.	
	Minimum friction level set by the State	3.1.23 A paved runway shall be so constructed or resurfaced as to provide surface friction characteristics at or above the minimum friction level set by the State.	The State set criteria for surface friction characteristics and output from State set or agreed assessment methods form the reference from which trend monitoring are performed and evaluated.
	Polishing	3.1.23 A paved runway shall be so constructed or resurfaced as to provide surface friction characteristics at or above the minimum friction level set by the State.	Polished Stone Value. (PSV-value) is a measure of skidding resistance on a small sample of stone surface, having being subjected to a standard period of polishing.

			Rubber build-up	*Geometry change*	*Polishing*
ASSESSMENT METHODS FOR MONITIORING TREND OF CHANGE TO SURFACE FRICTION CHARACTERISTICS	Visual − macrotexture	Visual assessment will only give a very crude assessment of the macrotexture. Extensive rubber build-up can be identified.	X		
	Visual − microtexture	Visual assessment will give a very crude assessment of the microtexture and to what degree the microtexture has been filled and covered by rubber.	X		
	Visual – runway geometry (ponding)	Visual assessment during a rain storm and subsequent drying process of the runway will reveal how the runway drains and if there have been any changes to runway geometry causing ponding. Depth of any pond can be measured by a ruler or any other appropriate depth measurement method/tool.		X	
	By touch − macrotexture	Assessment by touch can differentiate between degree of loss of texture but not quantifying it.	X		
	By touch − microtexture	Assessment by touch can identify if microtexture has been filled in/covered by rubber build-up.	X		
	Grease smear method (MTD)	Measure a volume – Mean Texture Depth (MTD) primarily by using the grease smear method, is the measurement method used for research purposes related to aeroplane performance.	X		
	Sand (glass) patch method (MTD)	Measure a volume – Mean Texture Depth (MTD). The sand (glass) patch method is not identical to the grease smear method. There is at present no internationally accepted relationship between the two methods.	X		
	Laser – stationary (MPD)	Measure a profile – Mean Profile Depth (MPD). There is no established relationship between MTD and MPD. The	X		
	Laser – moving (MPD)				

			Rubber build-up	*Geometry change*	*Polishing*
		relationship must be established for the laser devices used and the preferred volumetric measurement method used.			
	Friction measurement – controlled applied water depth	A friction measurement is a system output which includes all the surface friction characteristics and characteristics of the measuring device itself. All other variables than those related to the surface friction characteristics must be controlled in order to relate the measured values to the surface friction characteristics. The system output is a dimensionless number which is related to the surface friction characteristics and as such is also a measure of macrotexture. (The system generated number needs to be paired with other information (assessment methods) to identify which surface friction characteristics significantly influence the system output.) It is recognized that there is currently no consensus within the aviation industry on how to control the uncertainty related to repeatability, reproducibility and time stability. It is paramount to keep this uncertainty as low as possible, consequently ICAO has tightened the Standards associated with use of friction measurement devices, including training of personnel who operate the friction measuring devices.	X		X
	Friction measurement – natural wet conditions	Friction measurements performed under natural wet conditions during a rain storm might reveal if portions of a runway are susceptible to ponding and/or to fall below State set criteria.	X	X	X
	Modelling of water flow and prediction of water depth	Emerging technologies based on the use of a model of the runway surface describing its geometrical surface (mapped) and paired with sensor information of water depth allow real-time information and thus a complete runway surface monitoring, and anticipation of water depths.		X	

— END —

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