Civil Aviation Authority of Fiji

GUIDANCE MATERIAL

GRF for Aerodrome Operators

1st Edition
3rd May 2021

Published by:
Civil Aviation Authority of Fiji
Private Mail Bag, NAP 0354
Nadi International Airport
Fiji

www.caaf.org.fj

PREFACE

This Guidance Material (GM) is published by the CAAF for the purposes of promulgating supplementary material to that published in the Authority's Standard Document.

Fiji as a Contracting State to the Convention on International Civil Aviation has an obligation to the international community to ensure that civil aviation activities under its jurisdiction are carried out in strict compliance with the Standards and Recommended Practices contained in the nineteen Annexes to the Convention on International Civil Aviation to maintain the required aviation standards.

As per the standards of Annex 14 to the Convention, States are required to Implement the Global Reporting format (GRF). Hence, the CAA Fiji Ground Safety Department has developed this Guidance Material to introduce and explain the essentials of the International Civil Aviation Organization (ICAO) Global Reporting Format (GRF) for runway condition reporting. It is expected of the concerned aerodrome operators to take this GM as a reference/guide to comply with the required regulations and standards for the implementation of GRF. Moreover, all aerodrome personnel involved directly or indirectly with runway condition assessment should also be aware of it and are encouraged to utilize this GM in their specific operations.

This GM explains certain regulatory requirements by providing interpretive and explanatory material.

....

THERESA LEVESTAM
ACTING CHIEF EXECUTIVE

Civil Aviation Authority of Fiji

RECORD OF AMENDMENTS

After amending this Guidance Material, a record shall be entered in the appropriate columns below-showing amendments number, date, part or section amended, description of changes, signatures and entry date.

Amendment No	Amendment Date	Amended Section/Part	Amended Description	Signature and Entry Date

Table of Contents

Chapter 1: General Overview

1.1 Introduction

We have been reporting the runway surface condition in terms of measured friction co-efficient but the Friction Task Force (FTF), established by ICAO, inferred that there is no correlation between runway friction values and aircraft braking performance, thereby potentially causing safety events especially runway excursion, which we, too, are the victim of. Besides, a poor reporting system which is not consistent across States and airport operators has also been attributed to contributing to such event.

To improve safety level in such area, International Civil Aviation Organization (ICAO) has developed an updated and harmonized procedure, known as Global Reporting Format (GRF), for assessment and reporting of runway surface conditions. This new concept eliminates most of the shortfalls in accuracy and timeliness of current procedures through effective communication among all concerned stakeholders like aerodrome operator, aircraft operator, pilot etc., of relevant and reliable information on runway surface condition concerning the nature of contaminants, the depth and coverage of contamination and their effect on friction between the runway and the aircraft's wheels.

Considering the various constraints in normalizing operations in airports like ours with limited resources, our airports must implement GRF so that the risk of occurrence of a safety event like runway excursion is further reduced thereby averting untoward consequences in an airport. Thus, this Guidance Material, which is hereby issued to prepare for GRF, be followed sooner than later so that GRF is implemented no later than 4 November 2021, the target date for the same as per ICAO.

1.2 Objective

The purpose of this document is to introduce and provide information pertinent to the implementation of Global Reporting Format (GRF) for assessment and reporting of runway surface conditions so that all the concerned stakeholders viz., aerodrome operators, airlines operators apply it to their respective operations.

1.3 Scope

This Guidance Material applies to the aerodromes that are not exposed to Ice or Snow and are affected with only water as the contaminant.

1.4 Expected benefits of the GRF

1.4.1 Reporting of Runway surface condition in a standardized manner

1.4.2 Establish a common language between all actors in the system: aerodrome operators, aircraft operators, pilots, ANSPs (ATCs), AIM, MET, aircraft manufacturers, etc.

1.4.3 Allow pilots to accurately determine aeroplane take-off and landing performance.

1.5 Definitions and Abbreviations

The following definitions are used in this document:

Contaminant: Material that collects on a surface, including standing water, snow, slush, compacted snow, ice, frost, sand, and ice control chemicals.

Contaminated runway: A runway is contaminated when a significant portion of the runway surface area (whether in isolated areas or not) within the length and width being used is covered by one or more of the following substances: compacted snow, dry snow, frost, ice, slush, standing water, wet ice or wet snow.

Dry: A surface condition that is free of visible moisture, and has no observed contaminants.

Dry snow: Snow that does not contain sufficient water to allow the crystals to stick together or bond to a surface. (Dry snow, when compressed, falls apart, and a snowball cannot readily be made from it.)

Frost: Ice crystals formed from airborne moisture on a surface whose temperature is below freezing. Frost differs from ice in that the frost crystals grow independently and therefore have a more granular texture.

Ice: Water that has frozen on a surface and includes the condition commonly known as black ice and the condition in which compacted snow has turned into a polished ice surface.

Paved surface: A surface of asphaltic concrete (flexible) or Portland cement concrete (rigid).

Per cent coverage of contaminant: The estimated amount of contaminant present on the surface of the runway and reported as a percentage of the assessed surface.

Runway Condition Assessment Matrix: A matrix allowing for the assessment of runway condition code, using associated procedures, from a set of observed runway surface condition(s).

Runway Condition Code: A number describing the runway surface condition.

Runway Surface Condition: A description of the condition(s) of the runway surface used in the runway condition report establishes the basis for the determination of the runway condition code for aeroplane performance purposes.

Sand: Small particles of crushed angular mineral aggregates or natural sand material used to improve runway surface friction levels.

Significant change: A change in the magnitude of a hazard, which leads to a change in the safe operation of the aircraft.

Slippery (when) wet runway: A wet runway where the surface friction characteristics of the runway have been determined to be degraded.

Slush: Snow that is so water-saturated that water will drain from it when a handful is picked up or will splatter if stepped on forcefully.

Snowdrift: A heap or mound of snow created by the action of the wind.

Standing water: Water of depth greater than 3 mm.

Wet: A surface condition where there is any visible dampness or water up to and including 3 mm deep.

Wet ice: Ice with water on top of it or ice that is melting.

Wet snow: Snow that will stick together when compressed but will not readily allow water to flow from it if squeezed. (Wet snow contains enough water to be able to make a well-compacted, solid snowball, but water will not squeeze out.)

The following abbreviations are used in this document:

AIM: Aeronautical Information Manual

ANSP: Air Navigation Service Provider

ATC: Air Traffic Controller

FTF: Friction Task Force

GRF: Global Reporting Format

ICAO: International Civil Aviation Organization

MET: Meteorological

NOTAM: Notice to airman

RCAM: Runway Condition Assessment Matrix

RFI: Runway Friction Index

RWY: Runway

RWYCC: Runway Condition Code

TWY: Taxiway

NFFN: Nadi International Airport

NFNA: Nausori International Airport

Chapter 2: Assessment of Runway Surface Condition

2.1 Runway Condition Assessment Matrix (RCAM)

2.1.1 The Runway Condition Assessment Matrix (RCAM) (Table 2.1) is the method by which the aerodrome operator determines a Runway Condition Code (RWYCC) for each runway third, whenever water, snow, slush, ice or frost is present on the runway surface.

TABLE 2.1

RUNWAY CONDITION ASSESSMENT MATRIX (RCAM)			
Assessment Criteria		Downgrade assessment criteria	
Runway Condition Code (RWYCC)	Runway surface description	Aeroplane deceleration or directional control observation	Pilot report of runway braking action
6	DRY	---	---
5	WET (the runway surface is covered by any visible dampness or water up to and including 3 mm depth)	Braking deceleration is normal for the wheel braking effort applied and directional control is normal.	GOOD
4	N/A	Braking deceleration OR directional control is between Good and Medium.	GOOD TO MEDIUM
3	WET (“slippery wet” runway)	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:** STANDING WATER	Braking deceleration OR directional control is between Medium and Poor	MEDIUM TO POOR
1	N/A	Braking deceleration is significantly reduced for the wheel braking effort applied OR directional control is significantly reduced	POOR
0	N/A	Braking deceleration is minimal to non-existent for the wheel braking effort applied OR directional control is uncertain.	LESS THAN POOR

2.1.2 The RCAM applies only to paved (asphalt and concrete) runway surfaces, and does not apply to unpaved or partially paved surfaces.

2.1.3 When runway condition information is reported in thirds, a RWYCC is to be reported. Conversely, if the runway condition information is not entered for each runway third, then the RWYCC will not be reported.

2.1.4 The first column of RCAM is for Assessment Criteria that consists of a Runway Surface Description and a Runway Condition Code. The Runway Surface Descriptions in each category are linked to the corresponding Runway Condition Code based on their effect on aeroplane braking performance.

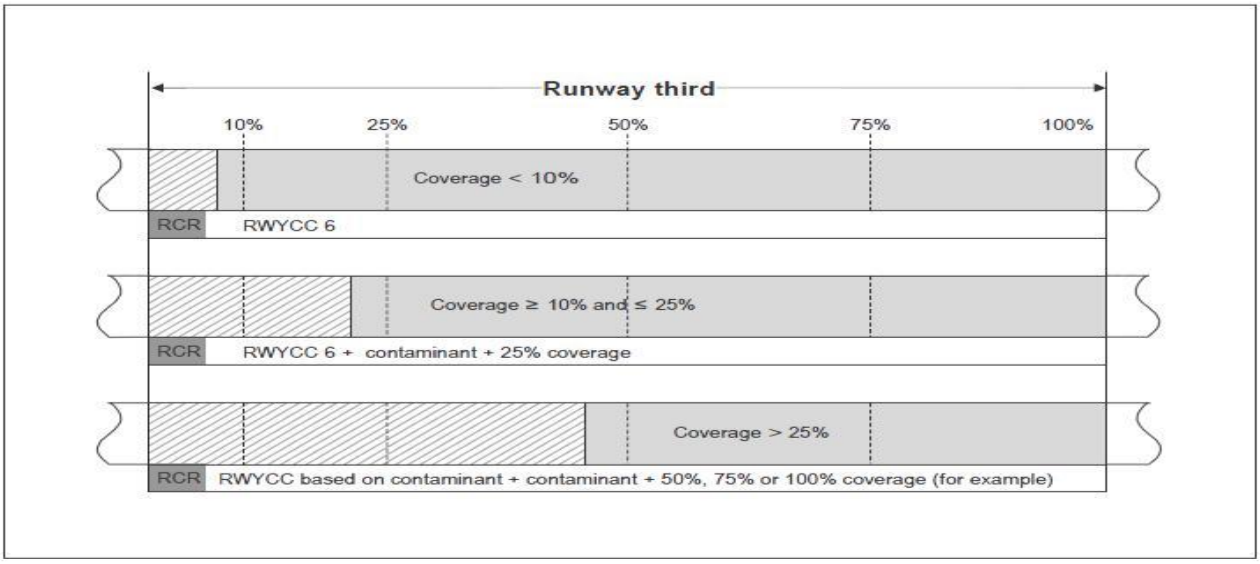
2.1.5 The Runway Surface Description column lists contaminants that are directly correlated to aeroplane landing performance. The description sections, ranging in terms of slipperiness, are categorized based on type and depth of contaminant and outside air temperature.

2.1.6 Runway Condition Codes in RCAM represent the runway condition description based on defined terms and increments. The use of these codes harmonizes with ICAO Annex 14, providing a standardized “shorthand” format for reporting runway condition, which can be used by pilots to determine landing performance parameters.

2.1.7 A RWYCC is determined using the RCAM based on type and depth of contaminant, percentage coverage and outside air temperature. When available, the runway surface temperature should be used.

2.2 Determination of RWYCC:

When the runway third contains a single contaminant, the RWYCC for that third is based directly on that contaminant in the RCAM (Table 2.1) as follows:



2.2.1 If the contaminant coverage for that third is less than 10 per cent, a RWYCC of 6 is to be generated for that third and no contaminant is to be reported. If all thirds have less than 10 per cent contaminant coverage, no report is generated; or

2.2.2 If the per cent contaminant coverage for that third is greater than or equal to 10 per cent and less than or equal to 25 per cent, a RWYCC of 6 is to be generated for that third and the contaminant reported at 25 per cent coverage; or

2.2.3 If the per cent contaminant coverage for that third is greater than 25 per cent, the RWYCC for that third shall be based on the contaminant present;

2.3 Downgrade Assessment Criteria

2.3.1 The RWYCC is initially determined through the use of the RCAM.

2.3.2 The aerodrome operator should consider downgrading an RWYCC when RFI measurements (if available), pilot reports or other observations reveal that the runway surface is more slippery than the RWYCC that was initially determined.

2.3.3 The aerodrome operator should exercise vigilance and downgrade the RWYCC when appropriate so that flight crews are provided with an RWYCC that best reflects the actual slipperiness of the runway.

2.3.4 A pilot report of braking action should be taken into consideration for downgrading purposes

2.3.5 When previous pilot braking action reports have indicated GOOD or MEDIUM braking action, two consecutive pilot braking action reports of POOR indicates that surface conditions may be deteriorating. In this situation, the airport or aerodrome operator should conduct a runway assessment before the next operation.

2.4 Upgrade Assessment Criteria

2.4.1 Given the variability of certain contaminants, there are circumstances when an RWYCC of 0 or 1 may not be as slippery as the RWYCC generated by the RCAM.

2.4.2 An assigned RWYCC of 5, 4, 3, or 2 cannot be upgraded.

2.4.3 The airport or aerodrome operator may upgrade an RWYCC of 0 or 1 up to but no higher than an RWYCC of 3.

Note: *Since the aerodromes at TIA, BIR and KEP are not exposed to Ice or Snow, upgrading of RWYCC cannot be done there*.

Chapter 3: Runway Condition Reporting – RCR

The Runway condition Reporting comprises of two sections: (i) Aeroplane Performance Calculation Section (ii) Situational awareness section

3.1 Aeroplane Performance Calculation Section

This section consists of eight elements that are described by the block diagram as shown in Figure 3.1 where M, C and O stand for Mandatory, Conditional and Optional.

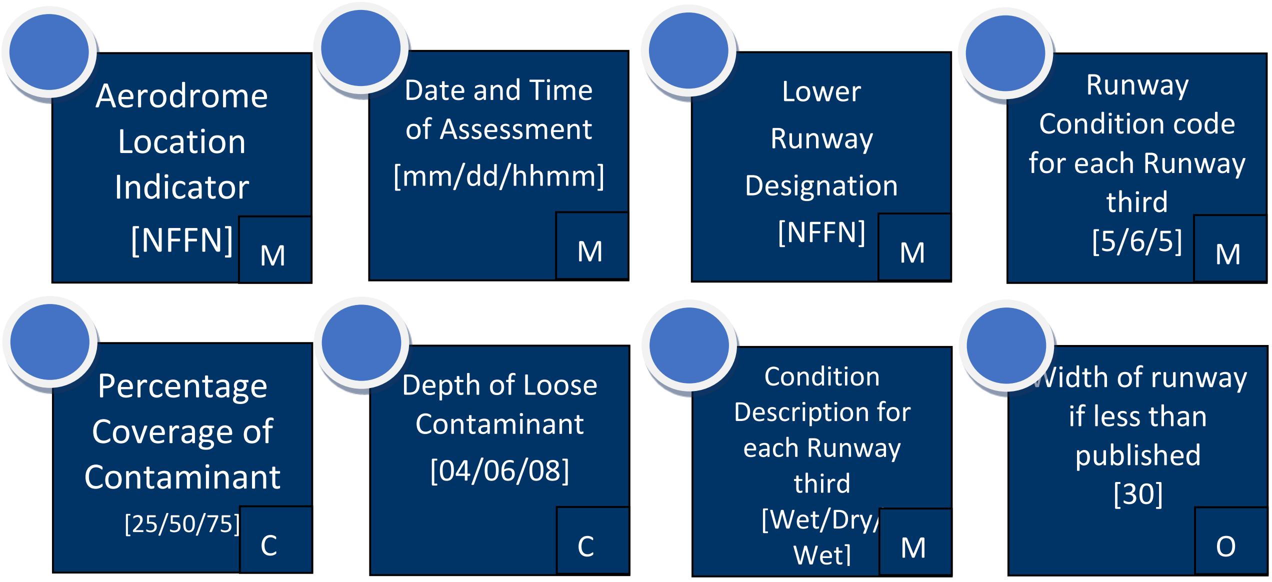


Figure 3.1

3.1.1 Aerodrome Location Indicator

This is the first element of RCR that specifies the Aerodrome for which the RCR is prepared. A four-letter ICAO location indicator assigned to the aerodrome is provided to this element of RCR. For example, NFFN and NFNA shall be required to be provided to this element for Nadi International Airport, Nausori International Airport.

3.1.2 Date and time of Assessment

This is the second element of RCR to which Coordinated Universal Time (UTC) is provided complying with the time frame ‘mm/dd/hhmm’. For example, if the Runway Condition is assessed at 8:30 am on July 12 at NFFN, the corresponding RCR up to 2nd element shall be as follows:

RCR NFFN 07120245

Note: Fiji time is 12 hours ahead of UTC. The date shall be corresponding to UTC.

3.1.3 Lower Runway Designation

The Runway shall be considered to be of three equal segments and the runway condition shall be assessed for each third of the runway considering the assessment from the lower runway designation side.

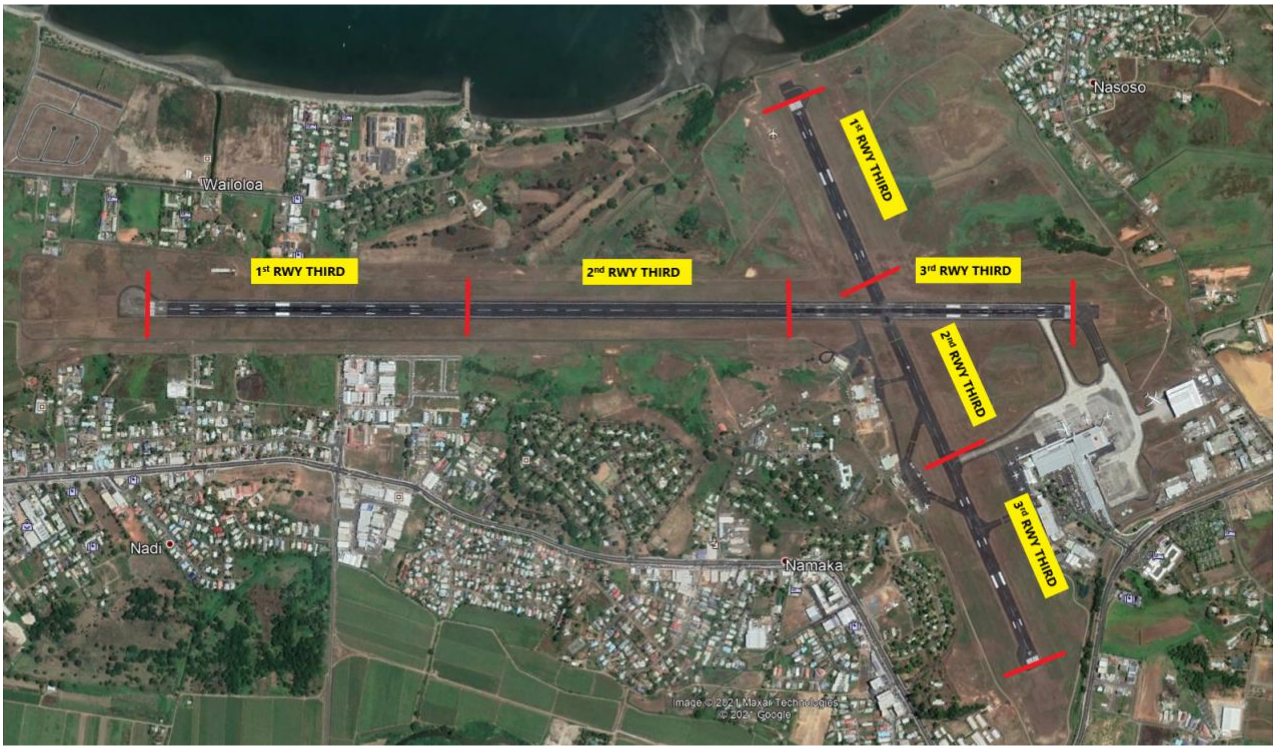


Figure 3.2

For example, the assessment of runway condition at NFFN should be carried out from the lower designation side 'RWY 02' as shown above in Figure 3.2. This is the third element of RCR to which 02, 20, 09 and 27 shall be required to be provided by the airport operator for Nadi airport.

3.1.4 Runway Condition Code for each Runway Third

After assessment of condition for each runway third, a corresponding Runway Condition code (RWYCC) shall be assigned to them from Runway Condition Assessment Matrix (RCAM) and shall be separated by slash '/'. For example, if 1st, 2nd and 3rd Runway third from lower designation are dry, wet and slippery wet, this element of RCR shall be described as 6/5/3.

3.1.5 Percent Coverage Contaminant for each Runway Third

For assessed per cent of coverage of contamination for each runway third, a corresponding value in column B of Table 3.1 shall be reported to this fifth element of RCR. The value for each Runway Third shall be separated by slash '/'

Table 3.1

Assessed per cent	Per cent to be Reported	RWYCC
≤9	NR	6
10-25	25	6
26-50	50	Based on contaminant/Descriptor
51-75	75	
76-100	100	

3.1.6 Depth of Loose Contaminants

The depth in millimetre (mm) of any loose contaminant is required to be provided for each Runway third. Such values shall be expressed in two-digit form and be separated from each other by slash '/'. Table 3.2 describes the contaminant applicable for RCR to the RCAM.

Table 3.2

Contaminant	Valid values to be reported	Significant change
	Any assessed value rounded to	
STANDING WATER	nearest integer and higher than	3 mm up to and including 15mm
	03.	

Note: The significant change shows the depth when standing water becomes a hazard and reporting with reassessment is to be done again.

3.1.7 Condition Description for each Runway third

The surface condition of each Runway Third is required to be provided to this element of RCR in terms of various surface descriptors given in RCAM like DRY, WET, STANDING WATER. They shall be in capital letter and be separated by slash '/'

3.1.8 Width of Runway to which the RWYCC apply

If the width of the runway to which the RWYCC applies is less than the published width, it should be provided through this element of RCR.

3.1.9 RCR Information String

RCR information string that consists of all eight elements as described above is expressed as below:

RCR ____	________	_ _	_/_/_	__/___/___	_/_/_	…./…/…	….
Aerodrome	Date &Time	RWY	RWYCC	%Coverage of Contaminant	Depth	Contaminant type	Reduced RWY Width

EXAMPLE:

Runway assessment done at 8 am on 12 July 2020 at NFFN shows that First Third is 20% Wet, Second Third is 5% Wet and Third Third has 40% water of maximum 5mm depth.

ICAO Location Indicator for TIA: NFFN

UTC timeframe for 8 am: month 07, day 12, time 02h 15m

Lower Runway Designation: RWY 02

Referring to the table, 20% damp is to be reported as 25% WET and RWYCC is assigned as 6 for First Third, 5% damp is not required to be reported thereby reported as NR and RWYCC is assigned as 6 for Second Third. And 40% water is to be reported as 50% STANDING WATER and RWYCC is assigned as 2 for Third Runway Third.

Since the depth of contaminant like STANDING WATER only above 3mm is to be reported, the reporting of the same shall be **NR** for the First and Second Runway Third. Hence, the RCR for this case will be as follows:

RCR VNKT 07120215 02 6/6/2 25/NR/50 NR/NR/5 WET/DRY/STANDING WATER

3.2 Situational Awareness Section

This section provides information on various eleven elements that have been shown in Table 3.3 below. The information to be provided must be in the order of listed eleven elements.

Table 3.3

Situational Awareness Section		
1	Reduced Runway length	C
2	Drifting snow on the runway	O
3	Loose sand on the runway	O
4	Chemical treatment on the runway	M
5	Snowbanks on the runway	O
6	Snowbanks on the taxiway	O
7	Snowbanks adjacent to the runway	O
8	Taxiway conditions	O
9	Apron conditions	O
10	State-approved and published use of measured friction	O
11	Plain language remarks	O

Note: Aerodromes at TIA, BIR, KEP are not exposed to ice or snow and, therefore, may consider only Taxiway conditions and Apron conditions for reporting. The reporting format shall be as follows:

Situational Awareness Format: TWY <u>name</u> POOR. APRON <u>name</u> POOR

<u>**Example**</u>

TWY A POOR. APRON NORTH POOR

Chapter 4: Training

4.1 Requirement

4.1.1 Aerodrome operators shall ensure that their personnel are adequately trained to perform their duties.

4.1.2 It is recommended that aerodrome operators develop a training program for all personnel who will assess and report runway conditions. This training program should include: i) Initial Training ii) Annual Recurrent training

4.2 Initial Training

4.2.1 For Initial Training, aerodrome operators should utilize the information in this GM to develop and conduct training which includes both:

4.2.1.1 a review of the theoretical concepts; and

4.2.1.2 practical exercises

4.2.2 Initial training should include, but not limited to the following topics:

4.2.1.1 Aerodrome familiarization, including aerodrome markings, signs and lightings

4.2.1.2 Aerodrome procedures as described in the aerodrome manual

4.2.1.3 Aerodrome emergency plan

4.2.1.4 NOTAM initiation procedures

4.2.1.5 Aerodrome driving rules

4.2.1.6 Air traffic control procedures on the movement area

4.2.1.7 Radiotelephone operating procedures

4.2.1.8 Phraseology used in aerodrome control, including the ICAO spelling alphabet

4.2.1.9 Aerodrome inspection procedures and techniques

4.2.1.10 Assessment and reporting of runway surface friction characteristics

4.2.1.11 Calibration, maintenance and use of runway friction measurement device

4.2.1.12 Low visibility procedures

4.2.1.13 Basics of the Global Reporting Format (GRF)

4.2.1.14 Runway Condition Assessment Matrix Components (RCAM)

4.2.1.15 Determination along with Downgrade and Upgrade of RWYCC

4.2.1.16 Runway Condition Reporting (RCR)

4.2.1.17 Measurement technique and assessment

Note: The aforementioned topics which are in the bold letter are mandatorily required to be provided to the concerned personnel involved.

4.3 Annual Recurrent Training

For Annual Recurrent Training, aerodrome operators should utilize the information in this GM to develop and conduct appropriate training for their personnel which:

4.3.1 focuses primarily on the practical aspects of runway condition assessment and reporting; and

4.3.2 incorporates "lessons learned" from the previous year(s) operations.

Chapter 5: Safety, Human Factors and Hazards

5.1 Safety

Evolution of Safety

5.1.1 In retrospect, the historical progress of aviation safety can be divided into three distinct eras:

a) the fragile system (1920s to 1970s);

b) the safe system (1970s to mid-1990s); and

c) the ultra-safe system (mid-1990s onwards).

5.1.2 Future ATM will rely on advanced data exchange and data-sharing services that will communicate aeronautical information. As a prerequisite, all information has to be supplied in digital format rendering it suitable for automatic processing without human intervention. A “digital NOTAM” or RCR can be defined as a structured data set that contains the information currently distributed by text NOTAM messages.

5.1.3 The focus is on correct, complete and up-to-date data. The NOTAM and RCR messages will continue to be issued, but the messages will be based on conversion of the digital aeronautical data, which will become the reference.

5.1.4 In short, provisions developed during the fragile system and revised in the safe system now need to be updated in the ultra-safe system using digital, up-to-date data, as shown in Figure 5.1.

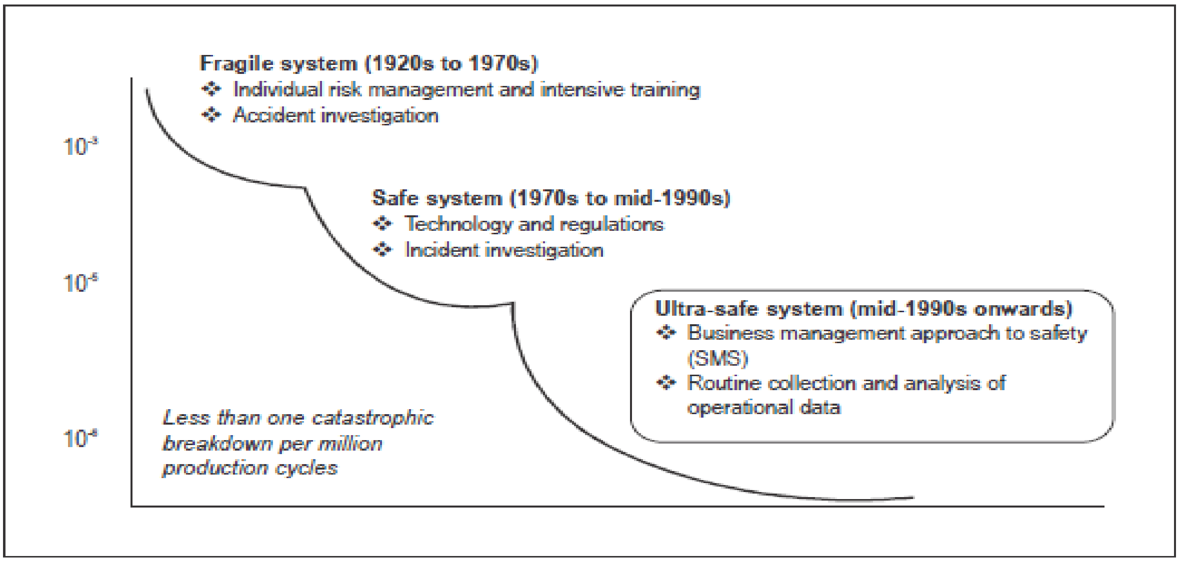


Figure 5.1 Historical evolution of aviation safety

Safety Margins

5.1.5 On the whole, to be on the safe side, the methodology used for aircraft performance assessments should be conservative. Some parameters that have an influence on aircraft performance are known beforehand with sufficient accuracy; other parameters have greater uncertainty or may change rapidly. For parameters that cannot be determined accurately, additional conservatism may need to be applied. This can be done by making conservative assumptions for the parameter itself as an input into the performance assessment or by adding operational margins to the result.

5.1.6 A double (and unnecessary) application of safety factors may lead to great economic penalties and unintended consequences, such as an ill-advised diversion, and the absence of a necessary safety factor may lead to unsafe situations. Therefore, all the actors involved should be aware of the uncertainty of relevant parameters. Aerodrome personnel should make the best attempt to accurately report runway surface conditions, rather than seeking a systematically conservative assessment.

5.2 Human Factors

Introduction

5.2.1 Human factors affect the gathering of information and how it is given to those who need it. Key participants in this process are the data gatherers, data transmitters and the users of the information. It is essential that the transmitter and receiver within the communication loop have a clear, unambiguous and common understanding of the terminology.

Problem Statement

5.2.2 The main human factors issue is that each action is part of a chain of events that requires cooperation between parties and that those actions must be executed in a particular order, each one dependent upon a successful outcome from the previous action. Although the "how to do it" part can be planned, written down as instructions and agreed in advance by all participants, team work, negotiation, communication and cooperation are required to achieve the end result.

Participants

5.2.3 Who are the main participants in these operations? Trained aerodrome personnel are responsible for gathering information on runway surface friction characteristics. From the aircraft operator, the flight crew is responsible for the safe management of the flight. Between these two is the air traffic controller (ATC) who, in this case, primarily passes along information about the runway to the aircraft and then acts upon responses that are generated from the cockpit as a result. Connected to this information flow is the airline's dispatch operations centre that uses the information gathered from the aerodrome operator, flight crew and ATC to plan or amend flight schedules accordingly.

Communication and teamwork

5.2.4 For over twenty years, much of the emphasis concerning flight deck human factors has been placed on team training and crew resource management (CRM) with the aim of training pilots to utilize all the resources available to them (including human resources) to operate safely. Many tasks involve an element of teamwork, and in such cases communication among team members is crucial. One of the questions often posed during the introductory phase of team training is "who is the team?" In answering this question, most people, at least initially, mention their colleagues in the immediate vicinity actually involved in the day-to-day tasks. Few will look outside of their immediate area of expertise and consider other players in the system with whom they come into contact. Failure to consider the extent of the "team" at best leads to poor communication and, at worst, can lead to mistrust, misunderstandings or even personality conflicts. In any event, the safety of the system is likely to suffer.

5.2.5 Communication is about more than just the human voice. While verbal communication may be fraught with problems, written communication can also be problematic. The handover of work at breaks or shift changes often involves written as well as verbal communication and has been shown to be a source of problems in many industries, not just aviation. Incomplete log entries, rushed and inadequate verbal exchanges or lack of a systematic means of conveying the status of a task all contribute to handover problems.

Standards and procedures

5.2.6 Some of the major sources of written communication are procedures and instructions, which are based on regulatory standards designed to assist in the correct performance of the task.

Conclusion

5.2.7 The study of human factors demands a methodical approach. Whenever error intrudes into human activity, disrupting objectives or even causing incidents or accidents, its causes must be identified. Such causes will often be a sequence of misunderstandings or inappropriate actions. Each of these might well be harmless in isolation, but together lead to failure. The human traits that lead to these mistakes require patient study if they are to be overcome.

5.2.8 The paragraphs above give some generic information about human factors but do not cover the whole topic. There are several ICAO documents that provide more detailed information about human factors.

5.3 Hazards

Safety risk management and runway surface friction characteristics

5.3.1 The application of safety management in the conduct of aircraft operations relative to the critical tire-toground contact area is complex.

5.3.2 No activity can be absolutely free of risk, but activities can be controlled to reduce risk to an acceptable level. If the risk remains unacceptably high, activities will have to be delayed or modified and a new risk assessment carried out. Often, a balance must be struck between the requirements of the task and the need to make the performance of the task safe. The balance may sometimes be difficult to achieve but should always be biased towards safety.

5.3.3 Guidance on safety management fundamentals and concepts, and practices applicable to the implementation of effective State safety programmes and implementation and oversight of safety management systems (SMS) by product and service providers can be found in the Safety Management Manual (SMM) (Doc 9859).

5.3.4 The safety risk management process may appear rather simple in concept, and indeed the process may be easily introduced for process-based industries that benefit from sufficient knowledge, time and planning capacity and that have firm control over their operations. However, aerodrome personnel and flight crew face a more complex process than a schematic model might suggest because of the variable nature of meteorological conditions. Exposure to hazards might be too short to gain experience. This stresses the importance of training.

5.3.5 Effective risk assessment first requires sound data to enable the identification of hazards. Appendices B through E of this document list some known hazards commonly associated with physical, functional and operational runway surface friction characteristics:

a) Appendix F — hazards related to surface friction characteristics and pavement;

b) Appendix G — hazards related to surface friction characteristics and aircraft;

c) Appendix H — hazards related to friction issues and reporting format; and

d) Appendix J — hazards related to surface friction characteristics and the atmosphere.

5.3.6 Persons involved should be trained to identify hazardous conditions and to follow established procedures and standards associated with the identified hazard. The processes involved in the critical tire-to-ground contact area necessitate sound assessment and judgement by those who identify the conditions at the movement area and those who operate on the movement area in the prevailing conditions.

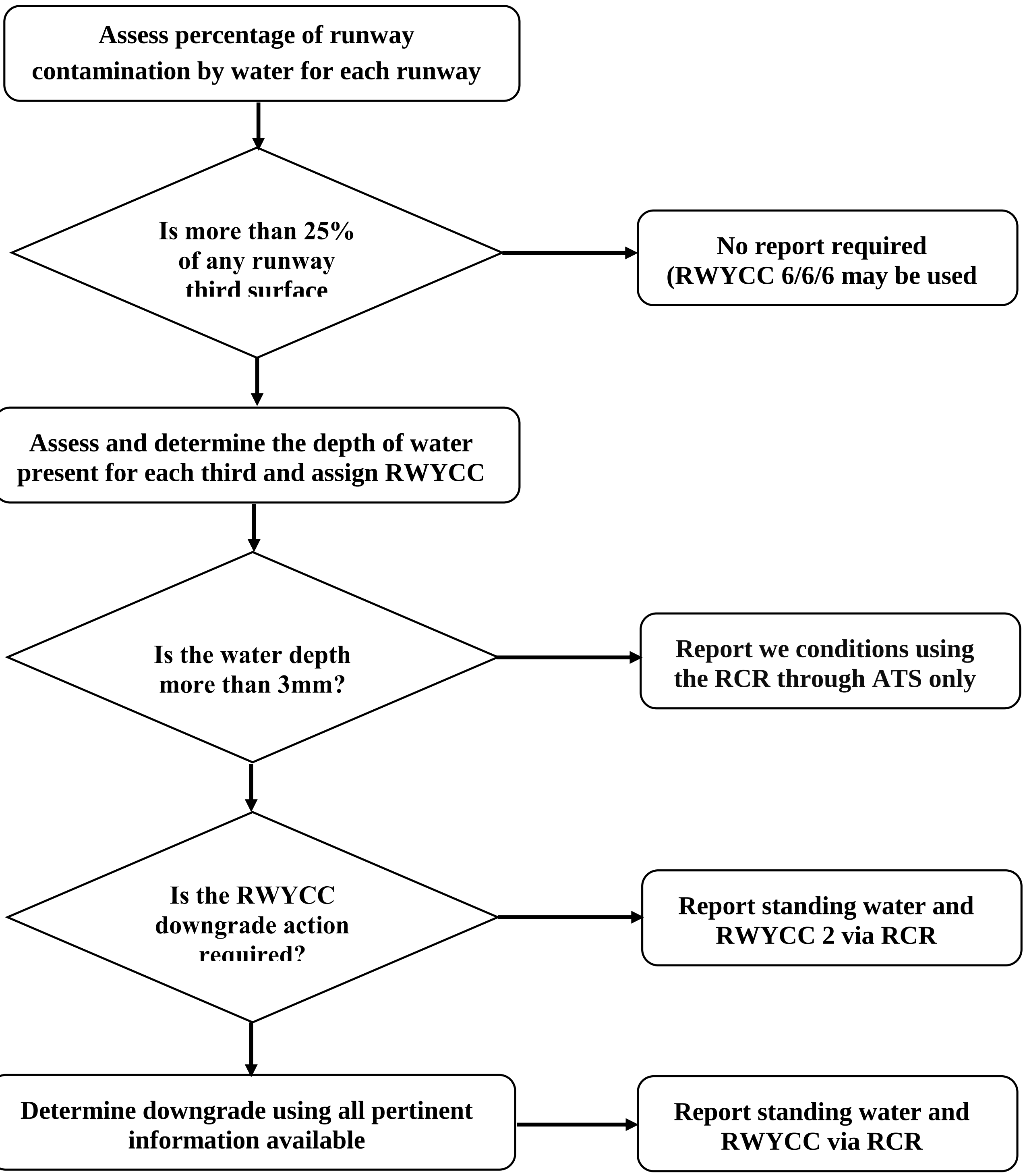
Runway safety team

5.3.7 The role of a runway safety team (RST) is to develop a runway safety action plan. This action plan should, as a minimum, facilitate the identification of runway safety hazards and the conduct of runway safety risk assessments, and recommend measures for hazard removal and mitigation of the residual risk. These measures may be developed based on local occurrences or combined with information collected elsewhere. Further information on RSTs can be found in PANS-Aerodromes (Doc 9981) and ICAO's Runway Safety Team Handbook, which is available on the ICAO website.

5.3.8 The RCAM and associated procedures have global application and have been produced with technical input from aircraft manufacturers. RSTs are therefore not in a position to alter them. However, the timeliness of reports or the related local procedures can be discussed. Any runway excursions or incursions that occur during wet or contaminated runway conditions may be reviewed by the RST.

APPENDIX A

Process Flowchart for Runway Surface Condition Assessment



APPENDIX B

Runway Condition Assessment Worksheet

Runway Condition Assessment Worksheet

Aerodrome

Date/Time (UTC) of assessment (MMDDhhmm)

Lower Runway Designator

Initials

Is **more than 25%** of any runway third surface wet or contaminated?

Yes - assign Runway Condition Codes for each third and complete RWY Condition Report (Blue Box)

No - No report created

Note: RWYCC 6/6/6 for all runway thirds may be used to indicate that the runway is no longer wet

1st RWY Third	2nd RWY Third	3rd RWY Third
For coverage 25% or **less** enter Code 6	For coverage 25% or **less** enter Code 6	For coverage 25% or **less** enter Code 6
- Identify % coverage if more than 25% of the RWY third - Identify depth (if applicable) - Identify Runway Condition Code - Record the most restrictive code in the box to the right RWYCC	- Identify % coverage if more than 25% of the RWY third - Identify depth (if applicable) - Identify Runway Condition Code - Record the most restrictive code in the box to the right RWYCC	- Identify % coverage if more than 25% of the RWY third - Identify depth (if applicable) - Identify Runway Condition Code - Record the most restrictive code in the box to the right RWYCC
Dry 6	Dry 6	Dry 6
Wet (Damp) 5 % Cov. 100 — Slippery Wet (Below Min Friction Level Classification) 3 % Cov. 100	Wet (Damp) 5 % Cov. 100 — Slippery Wet (Below Min Friction Level Classification) 3 % Cov. 100	Wet (Damp) 5 % Cov. 100 — Slippery Wet (Below Min Friction Level Classification) 3 % Cov. 100
Standing water 2 >3mm % Cov.	Standing water 2 >3mm % Cov.	Standing water 2 >3mm % Cov.
Depth: 4mm Assessed depth (mm): For Standing water 4mm depth have to be reported as Minimum	Depth: 4mm Assessed depth (mm): For Standing water 4mm depth have to be reported as Minimum	Depth: 4mm Assessed depth (mm): For Standing water 4mm depth have to be reported as Minimum

Situational Awareness Section / Notes

TWY .... Poor

Apron .... Poor

Other

State approved CFME Braking coefficient

Mμ not to be transmitted in RWY Condition Report

Adjusted RWYCC

ONLY if Downgrade/ Upgrade Assessments used

Downgrade/ Upgrade Criteria

AIREP CFME Other

RCR

Aerodrome — Date & Time — RWY — RWYCC ___/___/___ — % Coverage 100 / 100 / 100 — Depth in mm ___/___/___

Contaminant Type 1st third / Contaminant Type 2nd third / Contaminant Type 3rd third

Plain language remarks ....

Reduced RWY width in m (if applicable)

APPENDIX C

DIFFERENT RCAM LAYOUTS

Table C-1 illustrates an RCAM for an aerodrome which never experiences or reports snow or ice conditions

Table C-1. RCAM — WET and DRY only (based on PANS-Aerodromes (Doc 9981))

RUNWAY CONDITION ASSESSMENT MATRIX (RCAM)			
Assessment criteria		Downgrade assessment criteria	
Runway condition code (RCC)	Runway surface description	Aeroplane decelaration or directional control observation	Pilot report of runway braking action
6	• DRY	—	—
5	• WET (the runway surface is covered by any visible dampness or water up to and including 3 mm depth)	Braking deceleration is normal for the wheel braking effort applied AND directional control is normal	GOOD
4		Braking deceleration OR directional control is between Good and Medium	GOOD TO MEDIUM
3	• WET (“slippery wet”runway)	Braking deceleration is noticeably reduced for the wheel braking effort applied OR directional control is noticeably reduced	MEDIUM
2	***More than 3 mm depth water*** • STANDING WATER	Braking deceleration OR directional control is between Medium and Poor	MEDIUM TO POOR
1		Breaking deceleration is significantly reduced for the wheel braking effort applied OR directional control is significantly reduced.	POOR
0		Braking deceleration is minimal to non-existent for the wheel braking effort applied OR directional control is uncertain	LESS THAN POOR

Note.— An RWYCC 4, 4, 3 or 2 cannot be upgraded

APPENDIX D

Horizontal version of the RCAM

Runway condition assessment matrix (RCAM)

Runway surface condition	DRY	WET (any visible dampness)	WET ("slippery wet")	CONTAMINATED																
Runway surface condition descriptors				STANDING WATER	WATER[3]	FROST	SLUSH		DRY SNOW				WET SNOW				COMPACTED SNOW		ICE[2]	WET ICE[2]
Depth		Up to and including 3 mm		More than 3 mm			Up to and including 3 mm	More than 3 mm	Up to and including 3 mm	More than 3 mm			Up to and including 3 mm	More than 3 mm						
Runway surface condition descriptors continued					ON TOP OF COMPACTED SNOW[2]						ON TOP OF COMPACTED SNOW	ON TOP OF ICE[2]			ON TOP OF COMPACTED SNOW	ON TOP OF ICE[2]	-15°C and lower outside air temperature[1]	Higher than -15°C outside air temperature[1]	In cold and dry conditions	
RWYCC	6	5	3	2	0	5	5	2	5	3		0	5	3		0	4	3	1	0

Downgrade assessment criteria

Aeroplane deceleration or directional control observation	Braking deceleration is normal for the wheel braking effort applied AND directional control is normal	Braking deceleration OR directional control is between good and medium	Braking deceleration is noticeably reduced for the wheel braking effort applied OR directional control is noticeably reduced	Braking deceleration OR directional control is between medium and poor	Braking deceleration is significantly reduced for the wheel braking effort applied OR directional control is significantly reduced	Braking deceleration is minimal to non-existent for the wheel raking effort applied OR directional control is uncertain
AIREP	GOOD	GOOD TO MEDIUM	MEDIUM	MEDIUM TO POOR	POOR	LESS THAN POOR
RWYCC	5	4	3	2	1	0

1 Runway surface temperature should preferably be used where available.
2 The aerodrome operator may assign a higher RWYCC (but no higher than RWYCC 3) for each third of the runway, provided the procedure in PANS-Aerodromes (Doc 9981),1.1.3.15, is followed.
3 The runway surface condition descriptor is "WATER OF TOP OF COMPACTED SNOW". "WATER" is not reportable on its own.

APPENDIX E

SNOWTAM FORMAT

APPENDIX F

Hazards Related to Surface Friction Characteristics and Pavement

Hazard	Friction characteristics			Significant change
	Physical	*Functional*	*Slippery*	
Texture	Microtexture	Slippery	Slippery	Retexture
	Macrotexture	Wet, smooth		ESDU 71026
	macrotexture	Wet, skid resistant		ESDU 71026
No slope	Standing water	Poor drainage at tire/ground interface	Longer stopping distance	New design
		Hydroplaning	Loss of directional control	
Natural rounded aggregate	Susceptible to polishing	Slippery	Slippery wet	Retexture Repave
Rubber deposit on crushed aggregate	Cover texture	Reduced texture	No performance credit on wet, skid-resistant pavement	Remove rubbber deposists
		Slippery	Slippery	
Rubber deposit on natural, smooth aggregate	Cover texture	Reduced texture	Longer stopping distance	
		Slippery	Slippery	
Grooves	Closing due to deformation	Poor drainage at tire/ground interface	Longer stopping distance	Open grooves
			No performance credit on wet, skid-resistant pavement	
	Filled with contaminant	Poor drainage at tire/ground interface	Longer stopping distance	Remove contaminant
			No performance credit on wet, skid-resistant pavement	

APPENDIX G

Hazards related to surface friction characteristics and aircraft

Hazard	Friction chracteristics			Significant change
	Physical	Functional	Operational	
Tire wear	Tire tread depth	Drainage at tire/ground interface	Basic assumption for wet skid resistance	Basic assumption based on tire tread depth of 2 mm
Change in inflation pressure	Inflation pressure	Drainage capability at tire/ground interface	Basic assumption for wet skid resistance	Curves (e.g. equations) in harmonized certification specifications for 50, 100, 200 and 300 pounds per square inch (psi)

APPENDIX H

Hazards related to surface friction issues and reporting format

Hazard	Firction characteristics			Significant
	Physical	Functional	Operational	
Dry	Dry		Certification limited	
Damp			Wet performance data	
Wet	Wet	Reduced braking action	Wet performance data	3 mm up to and including 15 mm
Wet, skid resistant	Wet	Reduced braking action	Wet, skid-resistant performance data	3 mm up to and including 15 mm
Standing water	Wet	Aquaplaning susceptible		3 mm up to and including 15 mm
Frost covered	Thin layer; depth normally less than 1 mm			
Dry snow	Coverage Depth	Reduced braking action Drag force	Longer stopping distance Longer take-off distance	25 per cent 20 mm
Wet snow	Coverage Depth	Reduced braking action Drag force	Longer stopping distance Longer take-off distance	25 per cent 5 mm
Slush	Coverage Depth	Reduced braking action Drag force	Longer stopping distance Longer take-off distance	25 per cent 3 mm up to and including 15 mm
Wet ice Compacted snow Ice	Coverage	Reduced braking action	Longer stopping distance	25 per cent
Sand	Present	Reduced braking action	Longer stopping distance	
Mud	Present	Reduced braking action	Longer stopping distance	
Oil/fuel spillage	Present	Reduced braking action	Longer stopping distance	

APPENDIX J

Hazards related to surface friction issues characteristics and the atmosphere

Hazard	Firction characteristics			Significant
	Physical	Functional	Operational	
Precipitation	Contaminant	Influence on tire/surface interface	Reduced braking action	
Wind	Crosswind	Move aircraft	Loss of directional control	
Temperature	Freezing precipitation	Influence on anti-skid system	Reduced braking action	
Radiation	Freezing moisture on ground	Influence on anti-skid system	Reduced braking action	

APPENDIX K

Training Syllbus

This appendix provides an example of a syllabus for training aerodrome operator personnel and flight crews using the global reporting format. The examples are provided to support PANS-Aerodromes (Doc 9981), Part II, Chapter 1, applicable as of 5 November 2020. The syllabus provides guidance on the training that will be required for the successful roll-out of the global reporting format.

1. EXAMPLE OF A LIST OF SUBJECTS FOR TRAINING AERODROME OPERATORS ON RUNWAY SURFACE CONDITION REPORTING

   Note.—It should be assumed that drinving on the runway is permitted with appropriate ATC Permissions in all weather conditions

1. General	
Background	• FAA take-off and landing performance assessment (TALPA) Aviation Rulemaking Committee (ARC) recommendations • ICAO, ICAO Friction Task Force (FTF), SARPS, PANS and guidance • State, rule making
History of friction	• Accidents • Different countries, different methods
2. New reporting format – RWYCC *Note. — developed with major aircraft manufacturers involved in aircraft performance*	
Method	• RWYCC • Assessment • Runway Thirds
3. RCAM	
RCAM layout	
Contaminations definitions	
Assessment by eye and experience	
Runway length and width	
4. RCR	
Downgrade and upgrade criteria	
Aeroplane performance section	
Situational awareness section	
Timeliness – if significant	
Landing condiserations (crosswind also factored into pilot's decision)	
Take-off considerations (crosswind also factored into pilot's decision)	
Pilot report – AIREP feedback	
Type of erros	• Consequences • Safety margin
Reliability	• Consistency • Accuracy
5. Reporting to:	
ATC	• ATIS
AIM	• SNOWTAM
Coordination with ATC for: • Runway entry • Time of assessment; and • Dissemination of results	
6. Maintenance of "slippery wet"runway	

• Trend • NOTAM • RCR
7. Documents and records

2. EXAMPLE OF A LIST OF SUBJECTS FOR TRAINING PILOTS ON CONTAMINATED RUNWAY OPERATIONS

2.1 Training and actual operations should be based on the fact that the assessment of the runway condition, friction measurement and estimation of braking action are not an exact science. Pilots should understand that the actual safety margins get smaller when conditions get worse and, at the same time, the assessment of the runway condition becomes more difficult in deteriorating weather. Therefore, the RCAM, RWYCCs and braking action are adaptive tools in decision-making rather than operating norms or rules. For example, a calculated 1 m margin in landing distance does not necessarily mean that the landing will be safe; the pilot must use his or her best judgement, taking different variables into account and cross-checking between sources when making decisions.

2.2 It is also good airmanship to determine how small changes in runway and/or weather conditions affect operations, for instance, how the downgrading of the RWYCC by one level or a predetermined wind change affect operations. It is good CRM to make some predetermined decisions regarding deteriorating conditions. These “canned decisions” improve situational awareness, help in late-stage decision-making and improve workload management.

Items.— Items marked with an asterisk (*) are directly linked to runway surface condition reporting

1. General	
Contamination	• Definition • Contaminants that cause increased drag and therefore affect acceleration, and contaminanats that cause reduced braking action and affect deceleration • Slippery when wet status

Contaminated runway	• Runway surface condition descriptors*
	• Operational observations with friction devices*
	• Operator’s policy on the use of:
	  ○ reduced take-off thrust;
	  ○ runway thirds in take-off and landing performance calculations; and
	  ○ low visibility operations and autoland.
	• Stopway
	• Grooved runway

RWYCCs	• RCAM*
	  ○ Differences between those published for aerodromes and flight crew*
	  ○ Format in use*
	  ○ The use of runway friction measurements*
	  ○ The use of temperature*
	  ○ The concept of performance categories and ICAO runway surface condition codes*
	  ○ Interpretation of “slippery wet”
	  ○ Downgrade/upgrade criteria*
	  ○ Difference between a calculation and an assessment*
	• Braking action
	  ○ Reporting of LESS THAN POOR — no operations
	• Use of aircraft wind limit diagram with contamination

RCR (reference: Doc 10064)	• Availability • Validity • Performance and situational awareness • Decoding • Situtational awareness (reference: Doc 10064)
Aeroplane control in take-off and landing (reference: Doc 10064)	• Lateral control ○ Windcock effect ○ Effect of reversers ○ Cornering forces ○ Crosswind limitations ▪ Operations if cleared runway width is less than published width
	• Longitudinal control ○ V1 correction in correlation with minimum control speed on ground ○ Aquaplaning ○ Anti-skid ○ Autobrake
Take-off distance	• Acceleration and deceleration ○ Take-off performance limitations ○ Take-off distance models ○ Factors involved ○ Reason for using the type and depth of contaminant instead of RWYCC* ○ Safety margins
Landing distance	• Model for distance at time of landing • Factors involved • Safety margins ○ Minimum equipment list (MEL) does not include any additional margins (e.g. 15%)
ICAO's exceptions in runway reporting	• States that do not comply with ICAO*
2. Flight planning	
Dispatch/in-flight conditions	
MEL/configuration deviation list (CDL) items affecting take-off and landing performance	
Operator's policy on variable wind and gusts	
Landing performance at destination and alternates	• Selection of alternates if airport is not available due to runway conditions ○ En-route ○ Destination alternates • Number • Runway condition
	•

APPENDIX L

Reference Documents

1.4.1 ICAO Annex 6, 11th Edition, July 2018: Operation of Aircraft - Part I - International Commercial Air Transport – Aeroplanes

1.4.2 ICAO Annex 11, 15th Edition, July 2018: Air Traffic Services;

1.4.3 ICAO Annex 14, 8th Edition, July 2018 – Volume –I: Aerodrome Design and Operations;

1.4.4 ICAO Annex 15, 16th Edition, July 2018: Aeronautical Information Services;

1.4.5 ICAO Circular 355 AN/211: Assessment, Measurement and Reporting of Runway Surface Conditions;

1.4.6 ICAO Doc 9981: Procedures for Air Navigation Services – Aerodromes;

1.4.7 ICAO Doc 10066: Procedures for Air Navigation Services (PANS) — Aeronautical Information Management; and

1.4.8 ICAO Doc 4444: Procedures for Air Navigation Services (PANS) - Air Traffic Management