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Australian Government
Civil Aviation Safety Authority

MULTI-PART ADVISORY CIRCULAR
AC 91-32 AND AC 139-22 v1.0

Global reporting format – Runway surface condition

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Advisory circulars are intended to provide advice and guidance to illustrate a means, but not necessarily the only means, of complying with the Regulations, or to explain certain regulatory requirements by providing informative, interpretative and explanatory material.

Advisory circulars should always be read in conjunction with the relevant regulations.

Audience

This advisory circular (AC) applies to:

- aerodrome operators
- airlines
- air transport operators
- pilots
- air traffic service providers
- aeronautical information service providers.

Purpose

This AC provides guidance on implementation of the Global Reporting Format (GRF). The GRF provides a internationally harmonised and standardised method of assessing and reporting runway surface conditions which impact on flight operations.

For further information

For further information, contact CASA's Personnel Licensing, Aerodromes and Air Navigation Standards (telephone 131 757).

Status

This version of the AC is approved by the Branch Manager, Flight Standards.

Version	Date	Details
v1.0		Initial AC.

Unless specified otherwise, all subregulations, regulations, Divisions, Subparts and Parts referenced in this AC are references to the *Civil Aviation Safety Regulations 1998 (CASR)*.

Contents

Acknowledgement of country

The Civil Aviation Safety Authority (CASA) respectfully acknowledges the Traditional Custodians of the lands on which our offices are located and their continuing connection to land, water and community, and pays respect to elders past, present and emerging.

Artwork: James Baban.

1 Reference material

1.1 Acronyms

The acronyms and abbreviations used in this AC are listed in the table below.

Acronym	Description
AC	advisory circular
AFM	aircraft flight manual
AIREP SPECIAL	special air-report
AIS	Aeronautical Information Service
ATC	air traffic control
ATIS	automatic terminal information service
CA/GRS	Certified air/ground radio service
CAR	*Civil Aviation Regulations 1988*
CASA	Civil Aviation Safety Authority
CASR	*Civil Aviation Safety Regulations 1998*
FMS	Flight Management System
GRF	Global Reporting Format
ICAO	International Civil Aviation Organization
MCDU	Multi-Function Control and Display Unit
NOTAM	Notice to Airmen
RCAM	runway condition assessment matrix
RCR	runway condition report
RWYCC	runway condition code
UNICOM	universal communications

1.2 Definitions

Terms that have specific meaning within this AC are defined in the table below. Where definitions from the civil aviation legislation have been reproduced for ease of reference, these are identified by 'grey shading'. Should there be a discrepancy between a definition given in this AC and the civil aviation legislation, the definition in the legislation prevails.

Term	Definition
Aeronautical information service (AIS)	A service established within the defined area of coverage responsible for the provision of aeronautical data and aeronautical information necessary for the safety, regularity and efficiency of air navigation.
Air traffic control (ATC)	Air Traffic Services in its capacity as a provider of air traffic control services.

Term	Definition
air traffic service (ATS)	A generic term meaning variously, flight information service, alerting service, air traffic advisory service, air traffic control (ATC) services such as area control service, approach control service or aerodrome control service.
automatic terminal information service (ATIS)	The provision of current, routine information to arriving and departing aircraft by means of continuous and repetitive broadcasts during the hours when the unit responsible for the [air traffic] service is in operation.
CA/GRS	An aerodrome radio information service that provides aircraft operating in the vicinity of an aerodrome with the services and information specified in Chapter 22 of the Part 139 Manual of Standards (MOS).
contaminant	Matter present on the surface of a runway including, compacted snow, dry snow, frost, ice, slush, standing water, wet ice or wet snow.
Contaminated runway	A runway is contaminated if more than 25% of the surface area required for a take-off or landing is covered by any of the following: (a) water or slush more than 3 mm deep; (b) loose snow more than 20 mm deep; (c) compacted snow or ice.
Dry runway	A runway is dry if the surface area required for a take-off or landing: (a) has no visible moisture; and (b) is not contaminated.
NOTAM	A notice issued by the NOTAM Office containing information or instructions concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to persons concerned with flight operations
reduced braking action	Based on pilot observations that braking deceleration and directional control is worse than expected.
runway	A defined rectangular area on a land aerodrome prepared for the landing and take-off of aircraft.
Runway condition assessment matrix (RCAM)	A matrix for assessing the runway condition code from a set of observed runway surface conditions and the pilot in command's report on braking action.
Runway condition code (RWYCC)	The number used in a runway condition report to describe the runway surface condition.
Runway condition report (RCR)	A comprehensive standardised report relating to runway surface conditions, and their effect on aeroplane landing and take-off performance.
Runway surface condition descriptors	See definition of 'contaminant' above.
Slippery wet runway	A wet runway where the surface friction characteristics of a significant portion of the runway show that the runway is degraded.
SNOWTAM	A special series NOTAM given in a standard format providing a surface condition report notifying the presence or cessation of hazardous conditions due to snow, ice, slush, frost, standing water or water associated with snow, slush, ice or frost on the movement area.
Special Air-Report (AIREP Special)	An AIREP containing the report of special meteorological conditions, i.e. SIGMET phenomenon, or any other MET phenomenon which is likely to affect the safety or efficiency of other aircraft.

Term	Definition
Wet runway	A runway is wet if the surface area required for a take-off or landing: (a) is not dry; and (b) is not contaminated.
UNICOM	A non-air traffic control communication facility operated to provide an advisory service to enhance the value of information normally available at a non-controlled aerodrome.

1.3 References

Legislation

Legislation is available on the Federal Register of Legislation website https://www.legislation.gov.au/

Document	Title
Volume 5 of CASR	Dictionary
Part 121 of CASR	Australian air transport operations—larger aeroplanes
Part 135 of CASR	Australian air transport operations—smaller aeroplanes
Part 172 of CASR	Air Traffic Service Providers
Part 175 of CASR	Aeronautical information management
Part 91 Manual of Standards	Part 91 (General Operating and Flight Rules) Manual of Standards 2020
Part 139 Manual of Standards	Part 139 (Aerodromes) Manual of Standards Amendment Instrument 2020 (No. 1)

International Civil Aviation Organization documents

International Civil Aviation Organization (ICAO) documents are available for purchase from http://store1.icao.int/

Many ICAO documents are also available for reading, but not purchase or downloading, from the ICAO eLibrary (https://elibrary.icao.int/home).

Document	Title
Annex 3	Meteorological Service for International Air Navigation
Annex 6 Part I	International Commercial Air Transport — Aeroplanes
Annex 8	Airworthiness of Aircraft
Annex 14 Volume I	Aerodrome Design and Operations
Annex 15	Aeronautical Information Services
Doc 9981	PANS-Aerodromes
Doc 10066	PANS-Aeronautical Information Management
Doc 4444	PANS-Air Traffic Management
Doc 10064	Aeroplane Performance Manual

Document	Title
Doc 9137	Airport Services Manual Part 2 — Pavement Surface Conditions Part 8 — Airport Operational Services Part 9 — Airport Maintenance Practices
Circular 355	Assessment, Measurement and Reporting of Runway Surface Conditions

Advisory material

CASA's advisory materials are available at https://www.casa.gov.au/publications-and-resources/guidance-materials

Document	Title
AC 91-02	Guidelines for aeroplanes with MTOW not exceeding 5 700 kg - suitable places to take off and land
AC 139.C-03	Serviceability Inspections
AC 139.C-06	Skid resistance of aerodrome pavements

2 Introduction

Runway safety, particularly runway excursions, remains one of the top aviation safety priorities of the International Civil Aviation Organization (ICAO). The Flight Safety Foundation echoed these concerns and indicated that the third most common landing excursion risk factor is ineffective braking action, due to contamination on the runway such as snow, ice, slush or water. This trend was also confirmed by the main aircraft manufacturers.

Figure 1 below is from a US National Transport Safety Board (NTSB) investigation into a runway excursion in Jacksonville, Florida USA in 2019. the investigation determined that the probable cause was ‘an extreme loss of braking friction due to heavy rain and the water depth on the ungrooved runway, which resulted in viscous hydroplaning'.

Figure 1: Runway Excursion (source: US NTSB report - DCA19MA143)

To address the issue, the ICAO Friction Task Force developed a new global reporting system for assessing and reporting runway surface conditions, known as the Global Reporting Format (GRF), to enable the harmonised assessment and reporting of runway surface conditions.

The GRF provides uniformity and consistency in the assessment and reporting of runway surface conditions. Assessing and reporting the condition of the movement area and, in particular, the runway is necessary 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.

According to ICAO Annex 14 Volume I:

> '..movement areas are exposed to a multitude of climatic conditions and consequently a significant difference in the condition to be reported. The runway condition report (RCR) describes a basic methodology applicable for all these climatic variations and is

structured in such a way that States can adjust them to the climatic conditions applicable for that State or region'.

These harmonised procedures are reflected in a runway condition assessment matrix (RCAM) which correlates the runway condition code (RWYCC), runway surface condition and the aircraft braking action which the flight crew should expect for each value of the RWYCC. The introduction of the RCR based on the runway surface condition and RWYCC, in conjunction with new or existing aeroplane performance data, establishes a clear link between the observation, reporting and accounting of runway surface conditions in aeroplane performance.

The intent of the RCR is to put into place a common language between all runway safety participants and is based on the impact of runway surface conditions on aeroplane performance. Therefore, it is necessary that all participants, from aerodrome operators to pilots and aeroplane operators, have been given appropriate training. Training content for both aerodrome personnel and pilots may be based on information in this AC, among other sources. An outline of the suggested training for aerodrome personnel and pilots can be found in Appendix B and C of this document.

2.1 GRF implementation in Australia

2.1.1 Weather conditions in Australia

2.1.1.1 Australia has relatively benign weather conditions but does experience wet seasons, tropical storms, thunderstorms and extensive periods of rain. However, there are a relatively small number of certified aerodromes which may experience frost or snow conditions. Therefore, the majority of runway, or contaminated runway reporting, will be in relation to 'wet' or 'standing water'. There is also another category of runway surface friction reporting which is 'slippery wet' runways; however, these are not defined as contaminated but have runway surface friction impacted through a combination of deposits (e.g., rubber) on the runway and water, usually rain). We have implemented the ICAO runway surface conditions associated with the GRF but have separated them into: 'dry' and 'wet' surface conditions; 'slippery wet' surface conditions; and 'snow' and 'ice' surface conditions. This allows an aerodrome operator, or pilots and aircraft operators, to quickly be able to locate the regulatory requirements for reporting the relevant runway surface conditions applicable.

2.1.2 Mandatory RCR elements

2.1.2.1 The RCR has an aeroplane performance calculation section and a situational awareness section. The situational awareness is mainly beneficial in colder climates where there can be significant levels and different types of contaminants on the movement area. Australia has determined the core runway surface condition reporting elements from the aeroplane performance section of the RCR. Figure 2 shows the effect and impact of water on the runway during aeroplane operations.

Figure 2: Aircraft operations on a wet runway

2.1.2.2 According to ICAO, in the data-gathering process, almost all runway information can typically be gathered from visual observations. If information is gathered from measuring devices or instruments, ICAO states they must be calibrated and operated within their limitations and in compliance with standards set or agreed by the State. Automated systems are becoming available to provide a remote indication of runway surface conditions, while others are still under development. At present, these systems are not in widespread use, and systems that provide an accurate indication of braking action seem a long way off. This unavailability strongly affects the related implementation and communication process.

2.1.2.3 Australia does not require aerodrome operators to install sophisticated measuring or modelling equipment; however aerodrome operators may wish to employ this technology to offset the number of aerodrome personnel required to conduct inspections, assessment and reporting during and after weather events. The most labour-intensive aspect of runway surface assessment and reporting is as a wet runway becomes completely dry.

2.1.2.4 Consequently, aerodrome operators need to gather relevant data, process the related information using manual systems and make information available to users using conventional ways. This requires a considerable amount of time in addition to the need to obtain access to runways, which is often difficult, particularly at busy aerodromes. It is not necessarily safe to require aerodrome personnel to access an active or operational runway and take numerous measurements. It is for this reason, and to keep the assessment and reporting system simple, that Australia has decided to implement the RWYCC, surface description elements of the RCR and some percentage and depth reporting.

2.1.2.5 Additionally, at controlled aerodromes air traffic controllers (ATCs) are trained under the Part 172 MOS to determine if the runway is completely dry or wet in selection of the runway to be used. Therefore, if there is an agreement in place between the aerodrome operator and ATC (Airservices Australia), then ATC can conduct the assessment and reporting for wet runways only, during the control tower hours of operation. In any case, ATC generally provide automated broadcasts via the Automatic Terminal Information Service (ATIS) and not directly to each pilot.

2.1.2.6 As wet runways are the predominant hazard associated with impact of weather, aerodrome operators should report wet runways directly to pilots at non-controlled certified aerodromes if possible. Braking action for wet runways is still GOOD, however there could still be requirements for additional landing or take-off distance. This is not mandatory and may be achieved if an aerodrome provides a UNICOM service or CA/GRS, or has another direct means of communication, for example, mining sites with a single aircraft operator or aerodrome reporting officers equipped with VHF radios. Under the Part 139 MOS, operators of airside vehicles and certified air/ground radio operators (CA/GROs) need to qualify under Part 64 of CASR for the use of radios.

2.1.2.7 The elements of the RCR adopted by Australia are:

- lower runway designator number
- RWYCC for each runway third
- runway surface condition description for each runway third
- if 25% or less of a runway third has standing water or is otherwise contaminated it is to be assigned a RWYCC of 5 and surface description of WET (noting that ICAO treats these conditions the same as a DRY runway)
- if the depth of standing water or other contaminants are available, they are to be reported.

2.1.2.8 The RCR has been developed for automated processing by NOTAM systems and for aeroplanes with FMS capable of inputting the RWYCC. This has limitations for use by all pilots and the plain-English runway surface descriptions are designed to provide this explanation of the runway surface condition.

2.1.2.9 The RCR format does not require 'RWY' to be inserted in front of the runway number, however a string of numbers separated by obliques may be confusing to pilots from a human factor's perspective. Additionally, automated NOTAM processing systems may benefit from being able to search on the keyword 'RWY' to filter the most safety critical NOTAMs. Therefore, the RCR in Australia includes 'RWY' preceding the runway number.

2.1.2.10 Under the GRF, the RWYCC for 'slippery wet' runways is '3' however the surface description is described as 'WET', the same as for a normal rain affected runway with a braking condition of 'GOOD'. From a human factor's perspective, a pilot with an aeroplane FMS not capable of direct inputting of the RWYCC number, may not be able to discern the difference between a 'WET' and 'slippery wet' runway simply based on the surface description, if unfamiliar with the meaning of the RWYCCs. Additionally, a pilot may be unaware that the braking action had deteriorated from 'GOOD' to ' MEDIUM'. Therefore, in Australia, we require the RCR to include the full runway surface description of 'SLIPPERY WET' for these conditions along with the relevant RWYCC.

2.1.2.11 Introduction of the GRF by ICAO also included amendments to the definitions of contaminated, dry and wet runways. These changes will require amendments to the relevant definitions in the CASR Dictionary. Until the CASR Dictionary can be amended the current definitions are still consistent with Australia's implementation. The current definition of contaminated runway is:

> **contaminated**: a runway is **contaminated** if more than 25% of the surface area required for a take-off or landing is covered by any of the following:
>
> (a) water or slush more than 3 mm deep;
>
> (b) loose snow more than 20 mm deep;
>
> (c) compacted snow or ice.

Australia requires reporting of thirds of runways (33.33%) when they are contaminated which meets the trigger of 25% under the current definition. Water and slush depth is consistent with the RCR values and aerodrome operators will report depth of snow if it is available, noting this will be a rare circumstance for aerodromes in Australia. Loose snow is not referred to in the RCR but rather dry or wet snow. Pilots need to take into account the reported runway surface conditions, including contaminants, and associated impact on landing and take-off performance.

2.1.3 Applicability of GRF to all certified aerodromes

2.1.3.1 Prior to the introduction of the GRF, MOS Parts 121 and 135 for air transport operations, required pilots to take into account the Aircraft Flight Manual (AFM) or aircraft manufacturers' data in relation to **runway surface condition** for take-off and landing performance. Part 121 MOS has specific requirements for landing on dry, wet, or contaminated runways. Part 91 MOS for general operations also requires pilots to take into account the AFM or the manufacturer's data in relation to take-off and landing performance and now also requires **runway surface conditions**, if known, to be taken into account.

2.1.3.2 Due to the need for all pilots to be informed of runway surface conditions, the applicability of the GRF is to all certified aerodromes. Part 91 operations may be to aerodromes that are not certified and an RCR is unavailable therefore it is not mandatory to be taken into account under the Part 91 MOS.

2.1.3.3 It is important to note that runway surface condition inspection, assessment and reporting is only required when aeroplane operations are scheduled, anticipated or ongoing, specifically there is no requirement for runway surface condition reporting if there are no scheduled, anticipated or ongoing aeroplane operations during the duration of the runway surface conditions.

2.1.4 Runway serviceability inspections

2.1.4.1 Under Part 139 MOS the aerodrome operator is required to carry out a serviceability inspection 'after a severe wind event, a severe storm or a period of heavy or prolonged rainfall'. These are the most likely weather conditions to cause runways to become contaminated with standing water or snow. It is important to note that aerodrome personnel are not required to carry out serviceability inspections if the weather conditions cause a work, health and safety hazard, for example, lightning in the area and WHS procedures require all aerodrome and aircraft personnel to vacate the movement area.

2.1.4.2 Aerodrome serviceability inspections are also required to be carried out due to meteorological conditions that may cause the RWYCC to change e.g., from '5' to '2' or if the runway surface contaminant changes, for example, from 'wet' to 'standing water'. This situation is representative of runway surface conditions deteriorating.

2.1.4.3 For any non-weather related aerodrome serviceability inspections a check must also be carried out for visible dampness (to indicate a 'wet' runway), standing water, snow, slush, ice, or frost on an operational runway. However, it is unlikely that these runway surface conditions or contaminants will be present on a runway without a preceding weather event.

2.1.5 Ponding and poor drainage of water on runways

2.1.5.1 It is important to note, in accordance with the Part 139 MOS, that the design of runway and taxiway transverse slopes are such that water is not permitted to pond or pool, thus reducing the likelihood of standing water. Additionally, as part of the GRF standards introduced by ICAO, there was new requirement that aerodrome operators should visually assess a runway under natural or simulated rain conditions for ponding or poor drainage and to take corrective maintenance action. The requirement under the Part 139 MOS for the aerodrome operator to carry out a serviceability inspection 'after a severe wind event, a severe storm or a period of heavy or prolonged rainfall' provides an appropriate opportunity for an aerodrome operator to undertake corrective maintenance action if pooling, ponding or poor drainage of water is observed following such a weather event. However, it is not expected that the aerodrome operator will be a required to undertake a runway surface overlay, resurfacing or replacement, but rather maintenance action must be taken to address the formation of depressions or surface irregularities that allow water to pond.

2.2 Aircraft operator and pilot

2.2.1 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 data provided by the aeroplane manufacturer, normally through the AFM, the necessary stopping distance of an aircraft on the approach under the prevailing conditions, or the required take-off distance.

2.2.2 Aeroplane performance can be impacted whenever the coverage of any water-based contaminant on any runway third exceeds 25%, however also refer to paragraph 2.1.2.7 for reporting 25% or less of a runway third. The intent of the assessment and reporting procedures is to communicate the runway surface conditions impacted by any contamination to the aeroplane operators in a way consistent with the effect on aeroplane performance.

2.2.3 The flight crew needs information relevant for the safe operation of the aircraft, as far as it is relevant to the conditions of the runway surface, obtained using the RCR.

2.2.4 The RCR contains all the necessary information for the determination of the relevant runway condition for the performance assessment by the flight crew. This information is required at several stages of the flight, in particular during dynamic weather event conditions. The flight crew may need updates throughout the flight.

Note: The flight crew's ability to receive the RCR in the various phases of flight is dependent upon the technology made available to them and, as a consequence, such ability will vary between aeroplane operators.

2.2.5 Pilots can use the RWYCC to determine their aircraft's performance by correlating the code with performance data provided by their aircraft's manufacturer. This can be performed, using an On-board Performance Tool, or equivalent, for example, Multi-Function Control and Display Unit (MCDU) as shown in Figure 3; or using performance manuals. This will help pilots to correctly carry out their landing and take-off performance calculations for wet or contaminated runways. For aeroplanes, where Flight Management Systems (FMS) are not GRF-capable, landing and take-off distance safety factors for wet and contaminated runways can be used. These are included in the AFM specific to the aeroplane or generic performance tables. For further information, refer to AC 91-02 - Guidelines for aeroplanes with MTOW not exceeding 5 700 kg - suitable places to take off and land.

Figure 3: Honeywell MCDU with braking action, associated RWYCC and landing distance factor

2.3 Aerodrome operator

2.3.1 It is recognised that information provided by the aerodrome's personnel assessing and reporting runway surface condition is crucial to the effectiveness of RCR. A misreported runway condition alone should not lead to an accident or incident. Operational margins should cover for a reasonable error in the assessment, including unreported changes in the runway condition. A misreported runway condition can mean that the margins are no longer available to cover for other operational variance, such as unexpected tailwind, high and fast approach above threshold or long flare.

2.3.2 It is important to follow standard procedures when providing assessed information on the runway surface conditions to ensure that safety is not compromised when aeroplanes use wet or contaminated runways. Personnel should be trained in the relevant fields of competence. A sample training syllabus is provided at Appendix B for ' Runway Surface Condition Assessment and Reporting'.

2.3.3 The methodology 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 RWYCC is assigned and 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.

2.3.4 Visually inspecting the runway to assess the surface condition is the core method for determining an RWYCC. However, an overall assessment does imply more than just this activity is required. Continuously monitoring the development of the situation and prevailing weather condition is essential to ensuring safe flight operations. Other information that might influence the assessment result includes the control and deceleration of the inspection vehicle, pilot reports of runway braking action, friction readings (continuous friction measuring device or decelerometer), weather forecast, etc. Due to the interaction between all these factors, it is not possible to define a precise method for determining how they affect the RWYCC to be reported.

2.3.5 Aerodrome personnel should use their best judgement and experience to determine an RWYCC that best reflects the prevailing situation. Reporting, in compliance with the RCR, commences when a significant change in runway surface condition occurs due to water, snow, slush, ice or frost.

2.3.6 Reporting of the runway surface condition should continue to reflect significant changes until the runway is no longer contaminated. A change in the runway surface condition used in the runway condition report is considered significant whenever there is:

- any change in the RWYCC
- any change in contaminant type
- any other relevant information, for example pilot reports of reduced runway braking action is known to be significant.

2.4 Air traffic services

2.4.1 For controlled aerodromes when the runway is wet (RWYCC 5), the assessed information shall be reported by RCR and disseminated via ATC only. Assessment and reporting for WET and DRY conditions will be provided by the aerodrome operator at controlled aerodromes unless there is an agreement in place between the aerodrome operator and ATC for ATC to provide the assessment and report. There is significant workload for aerodrome personnel to assess and report a wet runway as it is drying, therefore it is preferable that there is an agreement with ATC to report these conditions. Additionally, ATCs have the best vantage point from the control tower to assess when a runway is completely dry as shown in Figure 4.

Figure 4: View from control tower during wet runway operations

2.4.2 The purpose of reporting to ATC is so that this information can be passed on to pilots using standard phraseology or communicating the RCR via automated means such as on the ATIS.

2.4.3 If ATCs receive an AIREP SPECIAL concerning braking action that is found not to be as good as that reported for a runway. For example, a 'WET' runway normally has a braking action of 'GOOD' but if pilots report it as 'MEDIUM; this indicates a 'SLIPPERY WET' runway, they will forward the AIREP without delay to other pilots and the aerodrome operator. This is a prerequisite for using the AIREP for downgrading purposes when assessing the RWYCC.

2.4.4 When ATC report a runway as being wet or thirds being wet the RCR is made using the active runway number rather than the lower runway number i.e. if runway 30 is in use, ATC will report runway 30 instead of runway 12.

2.5 Aeronautical information management

2.5.1 Any 'SLIPPERY WET' or contaminated runway is to be reported by the aerodrome operator to the AIS (NOTAM Office) using the RCR. The required reporting format is in Section 3.2 of this AC. The RCR should continue to be reported until the runway surface condition is 'DRY', including changes to the RWYCC or runway surface description. While PANS-Aerodromes expects a RCR to be issued when the runway is dry, Australia only requires the RCR NOTAM to be cancelled which indicated to pilots that the runway has returned to normal dry conditions.

2.5.2 Due to technical limitations with Australia's NOTAM system (National Aeronautical Information Processing System (NAIPS)), SNOWTAM cannot currently be issued within Australia. A RCR NOTAM will be issued with the relevant and necessary runway surface condition elements in Field E). For further information refer to paragraph 3.2.2.

3 Runway surface condition assessment and reporting

3.1 Assessment

3.1.1 RCAM

3.1.1.1 The RCAM supports the classification of runway surface conditions according to their effect on aeroplane braking performance using a set of criteria identified and quantified based on the best industry knowledge, built on dedicated flight testing and in-service experience. The agreed thresholds at which a criterion changes the classification of a surface condition are intended to be reasonably conservative, without being excessively pessimistic.

3.1.1.2 Initial assignment of a RWYCC is based on the runway surface description. The RCAM enables aerodrome personnel to revise an initial assessment based on visual observation of contaminants on the runway surface, specifically the contaminant type, depth and coverage. Downgrading and upgrading is an integral part of the assessment process and is essential to making relevant reports of the prevailing runway surface conditions. When all other observations, experience and local knowledge indicate to trained aerodrome personnel that the primary assignment of the RWYCC does not accurately reflect the prevailing conditions, a downgrade or upgrade can be made.

3.1.1.3 In Australia, climactic conditions are temperate for the overwhelming majority of our approximately 330 certified aerodromes. For this reason we have split the RCAM into 'WET and DRY only' and 'SNOW and ICE only'. This allows aerodrome operators to quickly review the GRF aspects relevant to the surface conditions at the aerodrome and impacts on aircraft performance. The 'SNOW and ICE only' RCAM is useful for the very few aerodromes that may need to issue an RCR for 'FROST' or 'SNOW'. The relevant RCAM Tables 1 and 2 are below:

Table 1: Runway condition assessment matrix (RCAM - Wet and dry only)

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 (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
3	WET (“slippery wet” runway)	Braking deceleration is noticeably reduced for the wheel braking effort applied OR directional control is noticeably reduced.	MEDIUM

Assessment criteria		Downgrade assessment criteria	
2	More than 3 mm depth of water: STANDING WATER	Braking deceleration OR directional control is between Medium and Poor.	MEDIUM TO POOR

Table 2: Runway condition assessment matrix (RCAM – Snow and ice only)

Assessment criteria		Downgrade assessment criteria	
Runway Condition Code (RWYCC)	**Runway surface description**	**Aeroplane deceleration or directional control observation**	**Pilot report of runway braking action**
5	FROST **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	**More than 3 mm depth:** DRY SNOW WET SNOW DRY SNOW or WET SNOW (any depth) ON TOP OF COMPACTED SNOW **Higher than −15ºC outside air temperature1:** 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:** SLUSH	Braking deceleration OR directional control is between Medium and Poor.	MEDIUM TO POOR
1	ICE	Braking deceleration is significantly reduced for the wheel braking effort applied OR directional control is significantly reduced	POOR

Assessment criteria		Downgrade assessment criteria	
0	WET ICE WATER ON TOP OF COMPACTED SNOW DRY SNOW or WET SNOW ON TOP OF ICE	Braking deceleration is minimal to non-existent for the wheel braking effort applied OR directional control is uncertain.	LESS THAN POOR

3.1.1.4 ICAO Cir 355 provides guidance to aerodrome operators in relation to the process for assessing a runway surface and assigning a RWYCC. Figures 5 to 7 below outline the process to be followed to assess and report runway surface conditions:

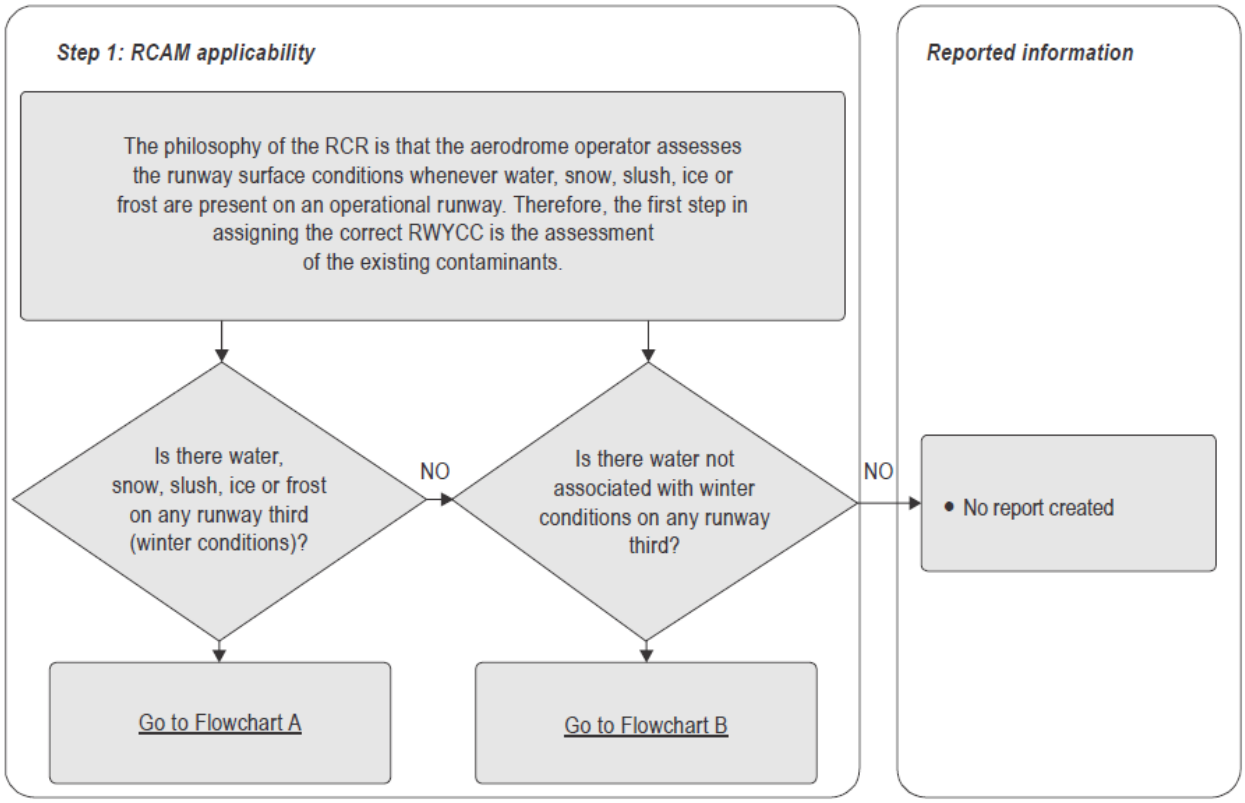


Figure 5: The basic RCAM flowchart process (ICAO Cir 355)

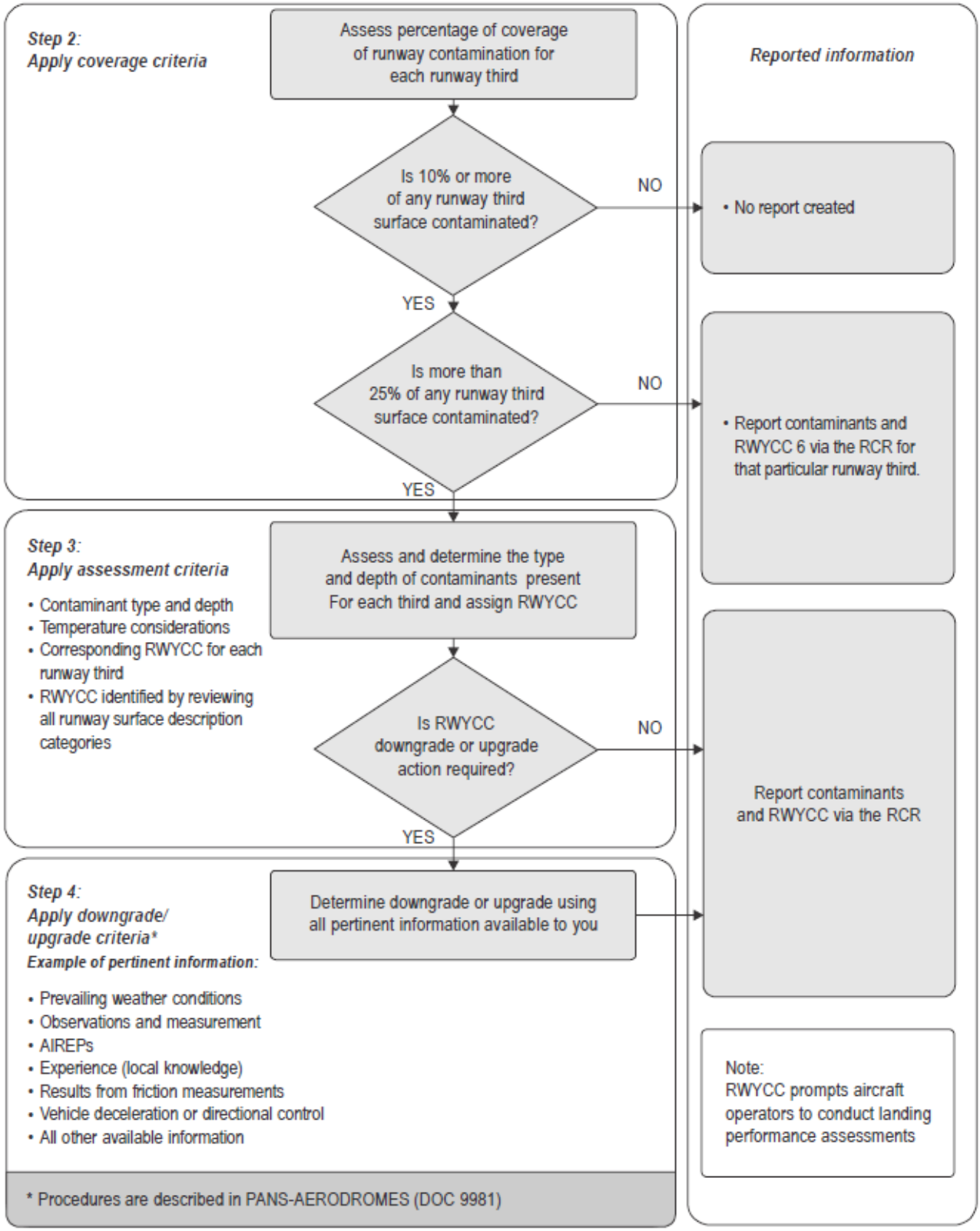


Figure 6: Flowchart A - Winter conditions (ICAO Cir 355)

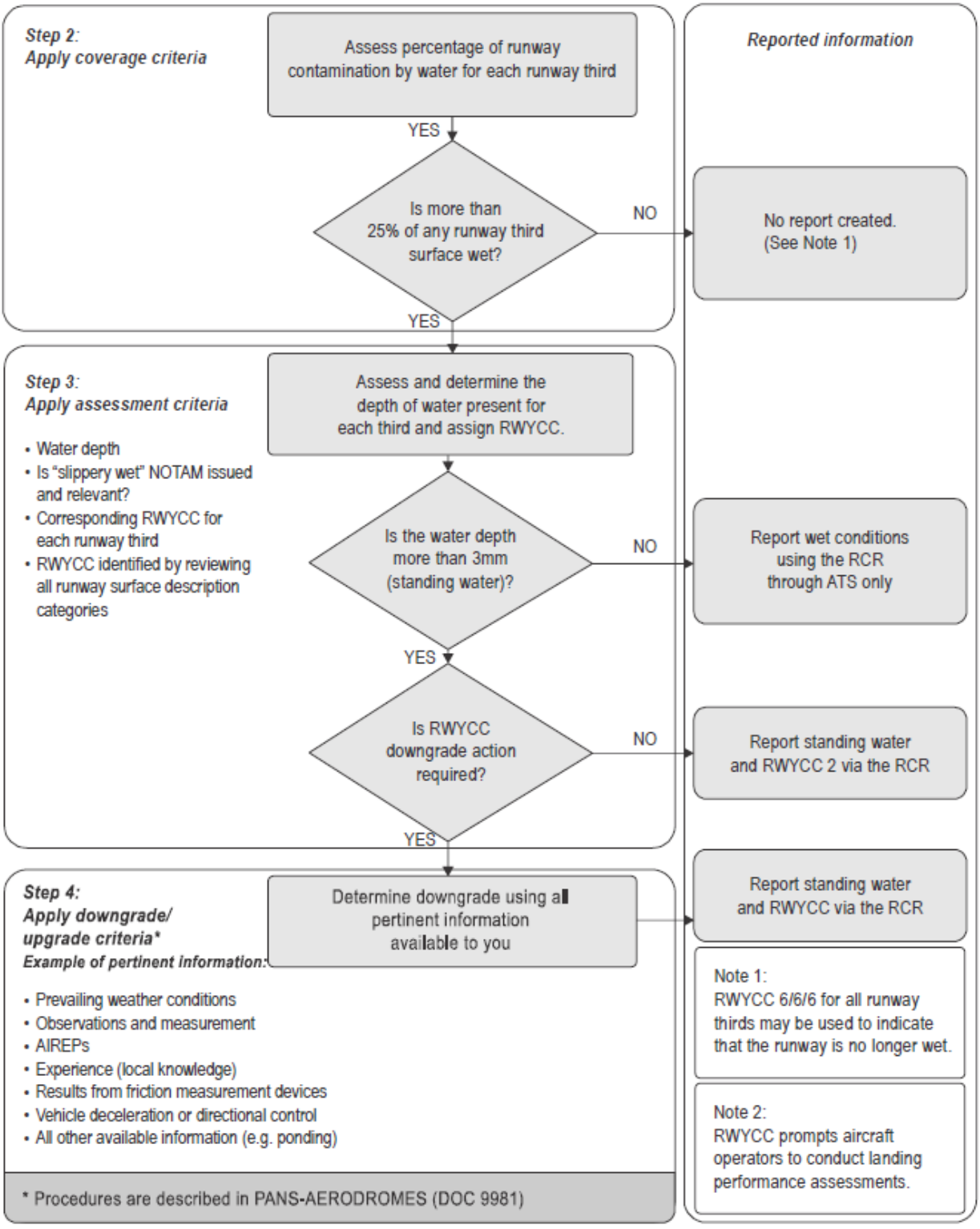


Figure 7: Flowchart B - WET runways only (ICAO Cir 355)

3.1.2 Assigning a RWYCC

3.1.2.1 Wet and dry runways

3.1.2.2 Due to the prevalence of 'wet only' conditions in Australia, the RWYCC assignment tables in the Part 139 MOS have been spilt into two sections i.e. 'dry, wet, slippery wet and standing water' and 'other contaminants' for the convenience of aerodrome operators.

3.1.2.3 In order to create an RCR, aerodrome operators must first assign a RWYCC. This is done by assessing the surface condition description of the runway and allocating the corresponding code number in accordance with Table 3 below. For example, a runway with 'standing water' on it would be allocated an RWYCC of '2'.

Table 3: Using a runway surface description to assign a RWYCC (WET and DRY only)

For a runway surface description	Applicable RWYCC
DRY	6
WET (The runway surface is covered by any visible dampness or water up to and including 3 mm depth)	5
WET (“slippery wet” runway)	3
STANDING WATER (depth of more than 3 mm)	2

3.1.2.4 Once the RWYCC has been determined, the aerodrome operator needs to make an assessment of which thirds of the runway have been affected. Australia does not require an aerodrome operator to purchase sophisticated and expensive equipment to determine runway thirds. There may be natural infrastructure markers associated with a runway such as taxiway or runway intersections with the affected runway and, in any case, certified aerodrome operators are required to establish obstacle limitation surfaces (OLS) for their runways so should be able to **approximate** the thirds of a runway length. Figure 8 provides and example.

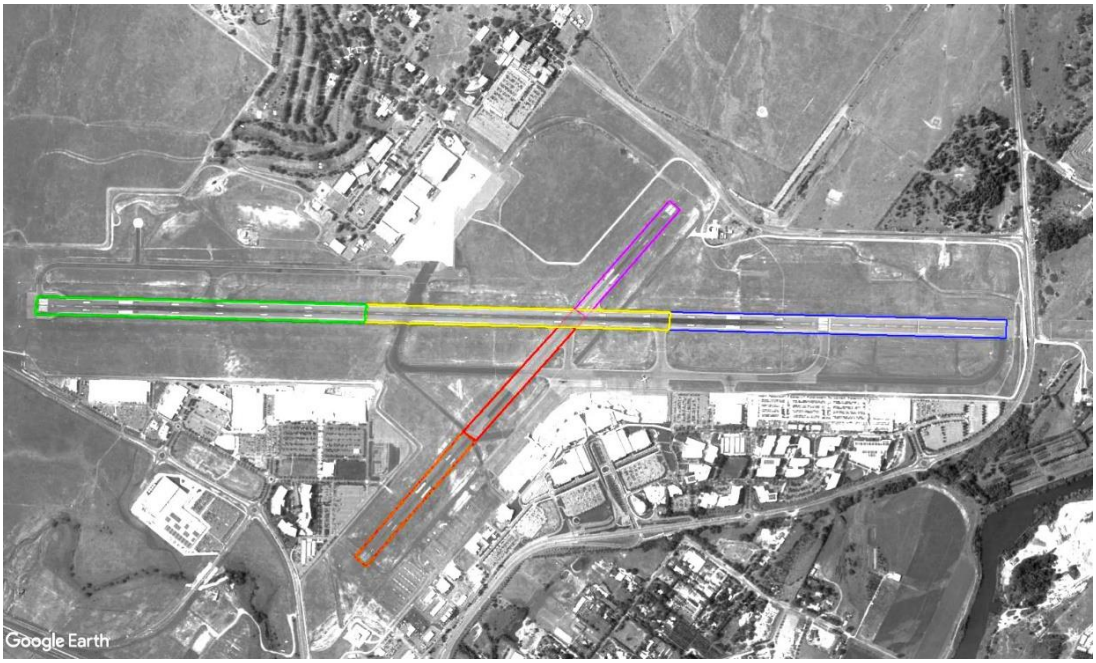


Figure 8: Depiction of Runway Thirds

3.1.2.5 If a runway third has 25% or less standing water on its surface it is to be reported as RWYCC 5 and runway surface of description of 'WET'. This indicates to pilots that the surface is not contaminated but that it isn't completely dry either (refer Figure 9 below).

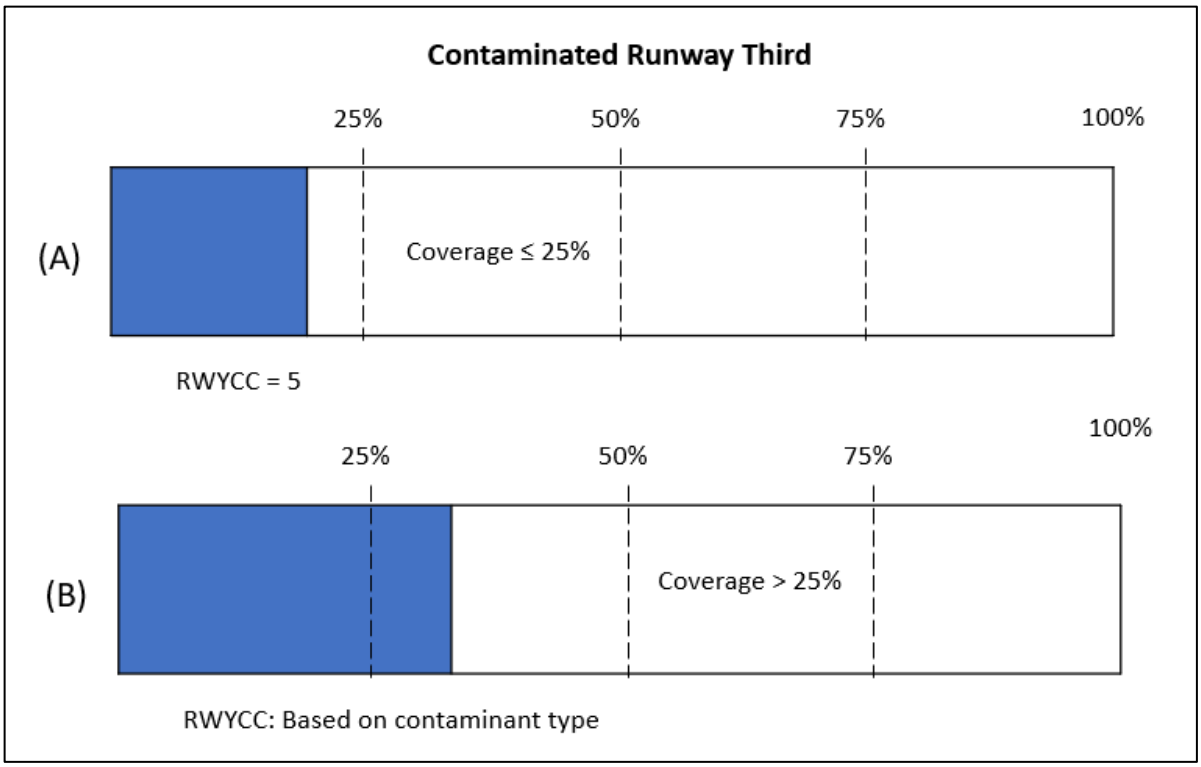


Figure 9: Depiction of 25% of a Contaminated Runway Third

3.1.2.6 If the depth of the standing water is available that is to be reported as well. For example when a runway is not in use and there is previous instances of water pooling following periods of rain, the aerodrome operator could measure the depth of water and record it in their aerodrome manual and report it during the next occasion when water is pooling and an RCR is required to be provided.

3.1.2.7 'Slippery wet' runways

3.1.2.8 The surface friction characteristics of a runway, or a portion of it, can become degraded due to rubber deposits (e.g. in the touchdown zone), surface polishing, poor drainage or other factors. The determination that a runway is 'slippery wet' stems from various methods used solely or in combination. These methods may include functional friction measurements or using a continuous friction measuring device which are available to the aerodrome operator. Other ways for the aerodrome operator to become aware that a runway is 'slippery wet' is by receiving pilot reports or relayed reports from ATC of a reduced braking action for a 'wet' runway that is 'MEDIUM' instead of 'GOOD'.

3.1.2.9 If ATC receive an AIREP by voice communications concerning braking action that is found not to be as good as that reported, they will forward the AIREP without delay to the aerodrome operator. This is a prerequisite for using the AIREP for downgrading purposes when assessing the RWYCC. The distribution of AIREPs to aerodrome operators should be subject to an agreement between ATC and the aerodrome operator or between the aircraft operator and the aerodrome operator.

3.1.2.10 AIREPs may be generated by automated systems processing aeroplane data recorded during the deceleration phase. Such reports are less subjective than those generated based on the flight crew's perception alone and may provide additional information. It is therefore encouraged to discriminate between the two types of report origins.

3.1.2.11 According to the RCAM, the RWYCC associated with a 'slippery wet' runway is '3'. However, there may be circumstances (e.g. during extremely heavy rainfall periods) when a wet runway may have even worse braking action than 'MEDIUM'. Table 4 below allows for downgrading of the RWYCC, for example, from '3' to '2', based on braking actions reported by the pilot or relayed by ATC:

Table 4: Correlation of runway condition code and pilot reports of runway braking action

Pilot report of runway braking action	Description	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

3.1.2.12 Various methods are available to aerodrome operators to assess runway surface friction from visual observation to continuous friction measuring devices. Appendix A provides guidance to aerodrome operators on various methods to assess changes to the surface friction characteristics of runways.

3.1.2.13 A 'slippery wet' runway is required to be assessed in thirds as with wet and contaminated runways. Due to the particular hazards associated with the reduced surface friction the percentage of each runway third is to be reported in increments of 25% (25%, 50%, 75% or 100%).

3.1.2.14 Other contaminated runways

3.1.2.15 There are a limited number of aerodromes that may experience conditions in winter leading to 'frost' or 'snow' on a runway. These will be rare events as there will be a likelihood that these contaminants will not be present on a runway for long periods of time. Even so, an RCR must be issued if there are aeroplanes operating during these conditions. Due to the limited use of the RCR in these circumstances the Part 139 MOS table for assigning the RWYCC has been

separated for ease of use by affected aerodromes. Refer to Table 5 below to assign a RWYCC for other contaminated runways.

3.1.2.16 Other contaminated runways are also required to be reported in thirds of a runway, along with the depth of the contaminant if available.

3.1.2.17 If a runway third has 25% or less contaminants on its surface it is to be reported as RWYCC 5 and runway surface of description of 'WET'. This indicates to pilots that the surface is not contaminated but that it isn't completely dry either a shown at Figure 4.

Table 5: Using a runway surface description to assign a RWYCC for other contaminants

For a runway surface description	Applicable RWYCC
FROST 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
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
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

3.2 Reporting

3.2.1 RCR - elements

3.2.1.1 The RWYCC is reported for each third of the runway assessed. The RCR includes:

- aerodrome location indicator
- date and time of assessment
- lower runway designation number
- RWYCC for each runway third
- If 25% or less of a runway third has standing water or is otherwise contaminated it is to be assigned a RWYCC of 5 and surface description of WET
- percentage coverage of each runway third for slippery wet runways
- contaminant depth, if available
- surface description for each runway third.

3.2.1.2 The sources of information for each element of the RCR are in Table 6 below:

Table 6: Runway condition report (RCR) - Aeroplane performance calculation section

Information	Source
Aerodrome location indicator	AIP-ERSA
Date and time of assessment	UTC/Local time
Lower runway designation number	Actual runway
RWYCC for each runway third	Assignment based on runway surface description
Percentage coverage of runway third	Visual observation for each runway third
Depth of contaminant for each runway third	Visual observation for each runway third, confirmed by measurements when appropriate
Runway surface description for each runway third	Visual observation for each runway third

3.2.2 RCR — format

3.2.1.1 The format of the information to be included in RCR is as follows:

a. Aerodrome Y-code location indicator

Format: nnnn

Example: YXXX

a. Date and time of assessment: date and time (UTC or local time)

Format: MMDDhhmm

Example: 07151357

b. Lower runway designation number: a two- or three-character number identifying the runway for which the assessment is carried out and reported

Format: RWY nn[L] or nn[C] or nn[R] or nn

Example: RWY 09L

Note: The ICAO RCR format does not require 'RWY' to be inserted in front of the runway number, however due to the infrequent usage expected in Australia, a string of numbers separated by obliques may be confusing to pilots from a human factor's perspective. Additionally, automated NOTAM processing systems may benefit from being able to search on the key word 'RWY'.

c. RWYCC 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.

Format: n/n/n

Example: 5/5/2

b. Percentage coverage of a SLIPPERY WET runway separated by an oblique stroke “/” For runway thirds that are not affected they are reported as 'NR' for 'not reported'.

Format: nn/nn/nn

Example: 25/NR/NR

d. Depth of STANDING WATER or contaminant (if available) separated by an oblique stroke “/” For runway thirds that are not affected they are reported as 'NR' for 'not reported'.

Format: nn/nn/nn

Example: 05/07/NR

e. Surface description for each runway third: to be reported in capital letters. The condition type is reported by any of the following condition type descriptions for each runway third and separated by an oblique stroke “/”.

Format: aaa/aaa/aaa

Example: WET/WET/STANDING WATER

3.2.3 Wet or standing water reports

3.2.3.1 Runways that are 'wet' only need to be reported to ATC, and not to AIS. This is only the case when ATC are present in the control tower as some towers do not operate 24 hr/7 days a week. If it is possible to communicate directly with pilots (refer paragraph 3.2.3.6) at non-controlled aerodromes or when ATC services are not provided, aerodrome operators should provide reports of 'wet' runways (refer Table 7).

3.2.3.2 ATC can provide the RCR via the ATIS or through voice communications to pilots using standard phraseologies.

3.2.3.3 An ATIS presents a very important means of transmitting information, relieving operational personnel from the routine duty of transmitting runway conditions and other relevant information to the flight crew. In addition to normal operational and weather information, the following information about the runway surface condition should be mentioned whenever the runway is not dry (RWYCC 6):

a. operational runway in use at time of issuance

a. RWYCC for the operational runway, for each runway third in the operational direction; and

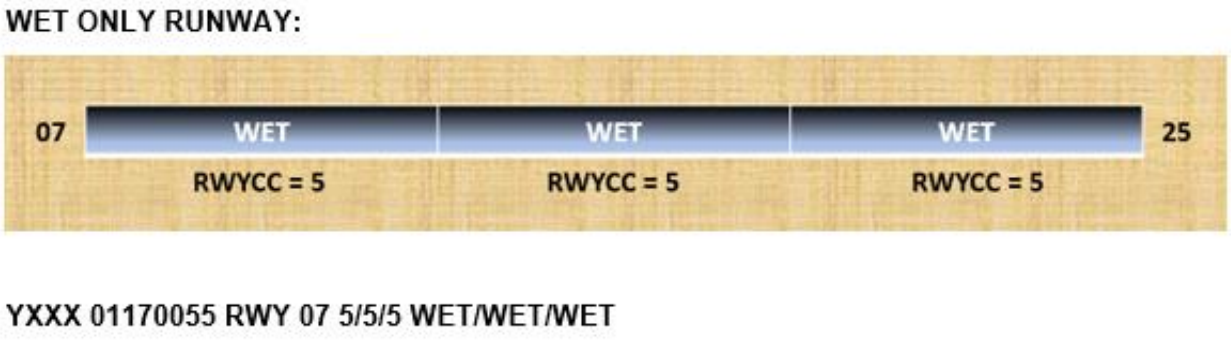
b. Surface condition description, for each third

3.2.3.4 When transmitting information on runway surface conditions by ATS to flight crews, the sections are 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. This is different to reporting to AIS which is the lower runway number being reported first, as operational direction will not necessarily be known by the aerodrome operator.

3.2.3.5 'Standing water' RCRs are to be provided to both ATC and AIS in the format prescribed in paragraph 3.2.2.

3.2.3.6 Some aerodromes have UNICOM or CA/GRS services or have other means of direct communication with pilots or aircraft operators e.g. mining aerodromes or AROs with VHF radios. In these cases, if possible, the aerodrome operator should provide the RCR directly to the pilot, as well as AIS.

3.2.3.7 Figures 10 and 11 demonstrate a complete information string prepared for 'wet' or 'standing water' reports is as follows:



Note: At controlled aerodromes the RCR will be in the direction of the runway in use.

Figure 10: WET runway reporting format

Figure 11: STANDING WATER runway reporting format

3.2.3.8 Figure 12 demonstrates a complete information string prepared for 'standing water' reports, when depth of 'standing water' is available, is as follows:

Figure 12: STANDING WATER runway (depth available) reporting format

3.2.3.9 Figure 13 demonstrates a complete information string prepared for 'standing water' reports, when 25% or less of any runway third has 'standing water', is as follows:

YXXX 01170055 RWY 07 5/5/5 WET/WET/WET

Figure 13: STANDING WATER runway (with 25% or less of a runway third) reporting format

Table 7: Reporting Runway Surface Conditions (Wet only)

Applicable RWYCC	For a runway surface description	Report made available to
5	Wet	(a) ATC (if available) (b) if ATC is not available — pilots, but only where the aerodrome operator has available UNICOM, or CA/GRS, or another direct means of communication.
2	Standing water	(a) the NOTAM Office, and ATC (if available); and (b) if ATC is not available — pilots, but only where the aerodrome operator has available UNICOM, or CA/GRS, or another direct means of communication.

3.2.4 'Slippery wet' runway reports

3.2.4.1 As discussed in paragraph 3.1.2.5, 'slippery wet' runways are particularly hazardous to aircraft operations due to the nature of the runway surface providing less than the required or expected surface friction.

Note: In Australia, runway surface description 'SLIPPERY WET' will be included in the RCR to provide additional safety awareness of the risk to operations on a wet runway with a braking action of 'MEDIUM'.

3.2.4.2 'Slippery wet' RCRs are to be provided to both ATC and AIS in the format prescribed in paragraph 3.2.2. If it is possible to communicate directly with pilots (refer paragraph 3.2.3.6) at non-controlled aerodromes or when ATC services are not provided aerodrome operators should provide reports of 'other contaminated' runways (refer Table 9).

3.2.4.3 Some aerodromes have UNICOM or CA/GRS services or have other means of direct communication with pilots or aircraft operators e.g. mining aerodromes or AROs with VHF radios. In these cases, if possible, the aerodrome operator should provide the RCR directly to the pilot, as well as AIS.

3.2.4.4 The percentage of a runway third is to be assessed and reported as shown in Table 8:

Table 8: Assessing and reporting percentages of a runway third (Slippery wet only)

Assessed per cent	Reported per cent
10 - 25	25
26 - 50	50
51 - 75	75
76 - 100	100

3.2.4.5 Figure 14 demonstrates a complete information string prepared for 'slippery wet 'reports, along with percentage coverage, is as follows:

YXXX 01170055 RWY 07 3/5/5 25/NR/NR SLIPPERY WET/WET/WET

Note: The percentage reported of a runway third for SLIPPERY WET runways is the total percentage for the runway third i.e. 25%, 50%, 75% or 100%.

Figure 14: SLIPPERY WET runway (with percentages of runway thirds) reporting format

Table 9: Reporting Runway Surface Conditions (Slippery wet only)

Applicable RWYCC	For a runway surface description	Report made available to
3	Slippery wet	(a) the NOTAM Office, and ATC (if available); and (b) if ATC is not available — pilots, but only where the aerodrome operator has available UNICOM, or CA/GRS, or another direct means of communication.

3.2.5 Other contaminated runway reports

3.2.5.1 The remaining contaminated runway RCRs are to be provided to both ATC and AIS in the format prescribed in paragraph 3.2.2. If it is possible to communicate directly with pilots (refer paragraph 3.2.3.6) at non-controlled aerodromes or when ATC services are not provided aerodrome operators should provide reports of 'other contaminated' runways (refer Table 10).

3.2.5.2 Figure 15 demonstrates a complete information string prepared for 'frost' reports is as follows:

YXXX 01170055 RWY 09 5/5/5 FROST/FROST/FROST

Figure 15: Contaminated runway (FROST) reporting format

3.2.5.3 Figure 16 demonstrates a complete information string prepared for 'snow' reports is as follows:

YXXX 01170055 RWY 09 5/5/3 WET/WET/WET SNOW

Figure 16: Contaminated runway (WET SNOW) reporting format

3.2.5.4 Figure 17 demonstrates a complete information string prepared for 'snow' reports, when depth of snow' is available, is as follows:

YXXX 01170055 RWY 09 5/5/3 NR/NR/12 WET/WET/WET SNOW

Figure 17: Contaminated runway (with depth of contaminant available) reporting format

3.2.5.5 Figure 18 demonstrates a complete information string prepared for 'snow' reports, when 25% or less of any runway third has 'snow', is as follows:

YXXX 01170055 RWY 09 5/5/5 WET/WET/WET

Figure 18: Contaminated runway (with 25% or less of a runway third) reporting format

Table 10: Reporting Runway Surface Conditions (Other contaminants)

Item	For a runway surface description of:	Applicable RWYCC is:	Report made available to
1	FROST **Up to and including 3 mm depth:** SLUSH DRY SNOW WET SNOW	5	(a) the NOTAM Office, and ATC (if available); and (b) if ATC is not available — pilots, but only where the aerodrome operator has available UNICOM, or CA/GRS, or another direct means of communication.
2	**−15ºC and Lower outside air temperature:** COMPACTED SNOW	4	(a) the NOTAM Office, and ATC (if available); and (b) if ATC is not available — pilots, but only where the aerodrome operator has available UNICOM, or CA/GRS, or another direct means of communication.
3	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:** COMPACTED SNOW	3	(a) the NOTAM Office, and ATC (if available); and (b) if ATC is not available — pilots, but only where the aerodrome operator has available UNICOM, or CA/GRS, or another direct means of communication.
4	**More than 3 mm depth:** SLUSH	2	(a) the NOTAM Office, and ATC (if available); and (b) if ATC is not available — pilots, but only where the aerodrome operator has available UNICOM, or CA/GRS, or another direct means of communication.

Item	For a runway surface description of:	Applicable RWYCC is:	Report made available to
6	ICE	1	(a) the NOTAM Office, and ATC (if available); and (b) if ATC is not available — pilots, but only where the aerodrome operator has available UNICOM, or CA/GRS, or another direct means of communication.
7	WET ICE WATER ON TOP OF COMPACTED SNOW DRY SNOW or WET SNOW ON TOP OF ICE	0	(a) the NOTAM Office, and ATC (if available); and (b) if ATC is not available — pilots, but only where the aerodrome operator has available UNICOM, or CA/GRS, or another direct means of communication.

3.2.6 Displaced thresholds

3.2.6.1 For runways with displaced thresholds, the thirds of the runway to be reported are thirds of the take-off run available (TORA). Also as stated in paragraph 2.4.4, when ATC provide the RCR they report the runway direction in use as indicated on the ATIS. Figure 19 depicts reporting of runways with displaced thresholds:

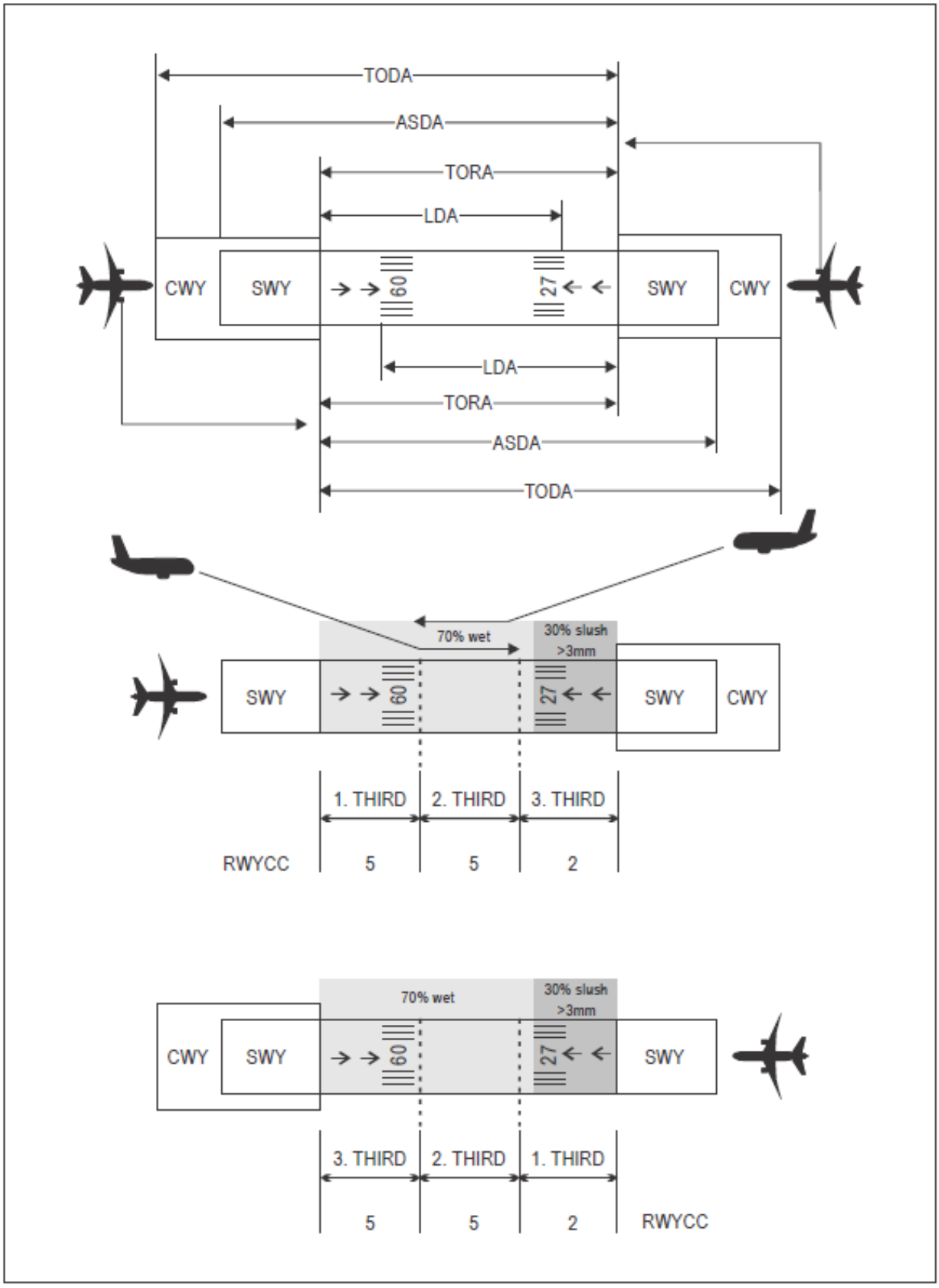


Figure 19: Reporting of RWYCC for runway thirds from ATS to flight crew on a runway with displaced threshold (ICAO Cir 355)

Appendix A

Assessment methods for monitoring runway surface friction characteristics

Table A1: Assessment methods for monitoring trend of change to surface friction characteristics

Inspection method	Assessment results	Rubber build-up	Geometry change	Polishing
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		
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 relationship must be established for the laser devices used and the preferred volumetric measurement method used.	X		
Laser – moving (MPD)				
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	X		X

Inspection method	Assessment results	Rubber build-up	Geometry change	Polishing
	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.			
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	

Appendix B

Training Syllabus - Runway surface condition assessment and reporting

B.1 Aerodrome operators

B.1.1 This appendix provides an example of a syllabus for training aerodrome operator personnel using the global reporting format. The examples are provided to support Part 139 MOS requirements for runway surface condition inspection, assessment and reporting.

B.1.2 Online courses are also available for aerodrome personnel through ICAO, in association with the Airports Council International (ACI):

The New Global Reporting Format for Runway Surface Conditions (icao.int)

B.2 Example list of subjects for training aerodrome operators on runway surface condition reporting

A.1.1 General

B.2.1.1 Background:

- ICAO SARPs, PANS and guidance (Circular 355)
- Part 139 MOS - Runway inspection and reporting
- Part 139 AC - GRF
- Aerodrome Manual procedures for runway inspections and reporting

B.2.1.2 Effect of friction on aeroplane performance:

- Circular 355 - Chapter 5 Aircraft Operations
- RWYCC and braking action (RCAM)
- Landing and take-off distance (dry, wet and contaminated runways)

B.2.2 Assigning RWYCC

B.2.2.1 Method:

- RWYCC
- Assessment
- Runway surface description
- Runway thirds
- Contamination definitions
- Visual assessment and local experience/conditions

B.2.3 RCR

B.2.3.1 Format and updating:

- Downgrade and upgrade criteria
- Aeroplane performance section
- Timeliness - significant changes
- Pilot report - AIREP Special
- "DRY and WET" or "SNOW and ICE" runway surface conditions

B.2.4 Reporting to

B.2.4.1 ATC**:**

- ATIS

B.2.4.2 AIM**:**

- NOTAM format (Field E)

B.2.4.3 Pilots**:**

- AFRU
- UNICOM
- CA/GRS
- Through aircraft operator

B.2.4.4 Coordination with ATC for:

- runway entry
- timing of inspections
- dissemination of results

B.2.5 “Slippery wet” runway

B.2.5.1 Assessment**:**

- Friction measuring devices
- Friction testing

B.2.5.2 Pilot report**:**

- Braking action
- Assigning RWYCC

B.2.5.3 AIM**:**

- "Slippery Wet" NOTAM

B.2.6 Documents and records

B.2.6.1 Recommended documentation:

- Aerodrome manual
- ICAO Circular 355 etc

Appendix C

Training Syllabus - Contaminated runway operations

C.1 Aircraft operators and pilots

C.1.1 This appendix provides an example of a syllabus for training flight crew using the global reporting format. The examples are provided to support Part 139 MOS requirements for runway surface condition inspection, assessment and reporting.

C.1.2 Online courses are also available for aircraft operators and flight crew through ICAO, in association with the International Air Transport Association (IATA):

The New Global Reporting Format for Runway Surface Conditions (icao.int)

C.1.3 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 their best judgement, taking different variables into account and cross-checking between sources when making decisions.

C.1.4 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 crew resource management (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.

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

C.2 Example list of subjects for training pilots on contaminated runway operations

C.2.1 General

C.2.1.1 Contamination:

- Definition*
- Contaminants that cause increased drag and therefore affect acceleration, and contaminants that cause reduced braking action and affect deceleration
- Slippery when wet: status*

C.2.1.2 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

C.2.1.3 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

C.2.1.4 RCR:

- Refer to Doc 10064

C.2.1.5 Aeroplane performance Manual):

- Availability*
- Validity*
- Performance and situational awareness*
- Decoding*
- Situational awareness (reference: Doc 10064)*

C.2.1.6 Aeroplane control in take-off and landing (refer Doc 10064 Aeroplane performance Manual):

- 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

C.2.1.7 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

C.2.1.8 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%)

C.2.1.9 ICAO differences in runway reporting**:**

- States that do not comply with ICAO*

C.2.2 Flight planning

C.2.2.1 Flight planning requirements:

- Dispatch/in-flight conditions
- MEL/configuration deviation list (CDL) items affecting take-off and landing performance
- Operator's policy on variable wind and gusts

C.2.2.2 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

C.2.3 Take-off

C.2.3.1 Take-off operations:

- Runway selection
- Take-off from a wet or contaminated runway

C.2.4 In-flight operations

C.2.4.1 Landing distance**:**

- Distance at time of landing calculations
  - Considerations for flight crew (reference: Doc 10064)*
  - Operator's policy

- Factors involved
- Runway selection for landing
- Safety margins

C.2.4.2 Use of aircraft systems:

- Brakes/autobrakes
- Difference between friction-limited braking and different modes of autobrakes
- Reversers
- Aeroplane as a friction-measuring and/or reporting system

C.2.5 Landing techniques

C.2.5.1 Procedures for conducting landings:

- Pilot procedures and flying techniques when landing on length-limited runway (reference: Doc 10064)
- Use of the Engineered Materials Arresting System (EMAS) in case of overrun

C.2.6 Safety considerations

C.2.6.1 Impacts on safety:

- Possible types of errors*
- Mindfulness principles necessary for high reliability*

C.2.7 Documents and records*

C.2.7.1 Recommended documentation:

- Aircraft Flight Manual
- ICAO Circular 355 etc

C.2.8 AIREP Specials

Reference: AIP ENR 1.1 Appendix 1

C.2.8.1 Requirements for reporting braking action:

- Assessment of braking action*
- Terminology*
- Possible automated AIREPs* (aeroplane as a friction-measuring and reporting system)
- Air safety reports if flight safety has been compromised**.**