SIERRA LEONE CIVIL AVIATION AUTHORITY

ADVISORY CIRCULAR

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Runway Surface Condition Assessment and Reporting

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1 GENERAL

The Sierra Leone Civil Aviation Authority's Advisory Circulars contains information about standards, practices and procedures that the Authority has found to be an Acceptable Means of Compliance (AMC) with the associated Regulations.

An AMC is not intended to be the only means of compliance with a Regulation, and consideration will be given to other methods of compliance that may be presented to the Authority

Information considered directive in nature is described in this AC in terms such as "shall" and "must", indicating the actions are mandatory. Guidance information is described in terms such as "should" and "may" indicating the actions are desirable or permissive, but not mandatory.

1.1 Purpose

This Advisory Circular (AC) provides the relevant tools and information necessary for assessing and reporting the conditions of the surface friction characteristics of the movement area pavement and related facilities. It introduces the global reporting format - the runway condition report (RCR) and its related indicator - the runway condition code (RWYCC) which is obtained by the use of the runway condition assessment matrix (RCAM).

1.2 Applicability

This AC is designed to give guidance to aerodrome operators and other operators involved in the monitoring, assessment and reporting of runway surface conditions.

1.3 Description of Changes

This AC is the first to be issued on this subject

1.4 References

(a) SLCAR, Part 14A - Aerodromes Design and Operations

(b) SLCAR Parts 6A and 6B - Operations of Aircraft

(c) SLCAR Part 8A - Airworthiness of Aircraft

(d) SLCAR Part 3 - Metrological Services for International Air Navigation

(e) SLCAR Part 15 - Aeronautical Information Services

(f) SLCAA-AC-AGA015 Rev01 - Aerodrome Inspection Programme

(g) ICAO Doc 9981 - PANS Aerodromes

(h) ICAO Doc 9137 Part 2 - Pavement Surface Conditions

(i) ICAO Doc 9157 Part 3 - Pavements

(j) ICAO Doc 9157 Part 1 - Runways

(k) ICAO Doc 10066 - PANS AIM

(l) ICAO Doc 4444 - PANS ATM

(m) ICAO Circular 355 - Assessment, Measurement and Reporting of Runway Surface Conditions

1.5 Cancelled Documents

Not Applicable

1.6 Definitions

Contaminant: a deposit (such as standing water, mud, dust, sand, oil and rubber) on an airport pavement, the effect of which is detrimental to the friction characteristics of the pavement surface

Debris: fragments of loose material (sand, stone, paper, wood, metal and fragments of pavements) that are detrimental to aeroplane structures or engines or that might impair the operations of aeroplane systems if they strike the structure or are ingested into engines.

Note - Damage caused by debris is also known as FOD (foreign Object Damage)

Friction: a resistive force along the line of relative motion between two surfaces

Runway condition assessment matrix (RCAM): A matrix allowing the assessment of the runway condition code, using associated procedures, from a set of observed runway surface condition(s) and pilot report of braking action.

Runway condition code (RWYCC): A number describing the runway surface condition to be used in the runway condition report.

Runway condition report (RCR): A comprehensive standardized report relating to runway surface conditions and its effect on the aeroplane landing and take-off performance.

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

(a) ***Dry runway:*** a runway is considered dry if its surface is free of visible moisture and not contaminated within the area intended to be used.

(b) ***Wet runway:*** the runway surface is covered by any visible dampness or water up to and including 3mm deep within the intended area of use.

(c) ***Slippery wet runway:*** A wet runway where the surface friction characteristics of a significant portion of the runway have been determined to be degraded.

(d) ***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 substances listed in the runway surface condition descriptors.

(e) ***Runway condition descriptors:*** an element on the surface of the runway:

- ***Standing water:*** water of depth greater than 3mm.

  Note: running water of depth greater 3mm is reported as standing water by convention.

Skid resistant: a runway surface that is designed, constructed and maintained to have good water drainage, which minimizes the risk of hydroplaning when the runway is wet and provides aircraft braking performance shown to be better than that used in the airworthiness standards for a wet, smooth runway.

The Authority: The Authority referred to in this AC shall be the Sierra Leone Civil Aviation Authority (SLCAA).

2 INTRODUCTION

2.1 General

(a) As required by the SLCAR Part 14A - Paragraph 2.9.2, the Aerodrome Operator shall be responsible for assessing and reporting the conditions of the movement area and related facilities in order to provide the flight crew with the information needed for safe operations of the airplane. The SLCAR Part 14A, contains Standards related to the assessment and reporting of runway surface conditions. Associated objectives and operational practices are described in section 2.2 and chapter 4 of this AC.

(b) The adequacy of the available friction between the aeroplane tires and the runway surface under certain operating conditions, such as when there is water on the runway and particularly when aeroplane take-off or landing speeds are high, is a concern to the Authority. It is essential that adequate information on the runway surface friction characteristics/aeroplane braking performance be made available to pilots and operations personnel in order to allow them to adjust operating techniques and apply performance corrections. If the runway is contaminated with water and the runway becomes slippery when wet, the pilot should be made aware of the potentially hazardous conditions.

(c) The goal of the airport operator should be the removal of all contaminants as rapidly and completely as possible and elimination of any other conditions on the runway surface that would adversely affect aeroplane performance.

(d) The global reporting system for assessing and reporting runway surface conditions involves all stakeholders involved in collecting data, converting the data into structured operational information and bringing the structured information to the end users, and the end users using the structured information.

(e) The revised scale GOOD, GOOD TO MEDIUM, MEDIUM, MEDIUM TO POOR, POOR and LESS THAN POOR is used by the flight crew to characterize perceived braking action and lateral control of the aeroplane during landing roll. RWYCCs 0 through 5 are mapped to this terminology in the runway condition assessment matrix (RCAM) and describe a consistent runway surface condition in relation to its effect on aircraft braking performance and lateral control.

(f) Another fundamental change is that WET runway conditions are included in the Runway Condition Report (RCR) on a regular basis. The RCR is used for reporting assessed information. The global reporting system and format has been designed to cover all of the world’s climatic zones.

(g) Use of the global reporting format requires the application of equipment, processes and procedures for the removal of contaminants and treatments, and most crucially, requires the involvement of competent personnel in maintenance activities as well as assessment and reporting activities. Personnel need to be competent to perform their duties, and training must be adjusted to the environment in which they operate.

(h) The idea of the RCR is that the aerodrome operator assesses the runway surface conditions whenever water is present on an operational runway. From this assessment, a runway condition code (RWYCC) and a description of the runway surface are reported which can be used by the flight crew for airplane performance calculations. This format, based on the depth of the standing water, is the best assessment of the runway surface condition by the aerodrome operator; however, all other pertinent information will be taken into consideration and be kept up to date and changes in conditions reported without delay.

(i) The RWYCC reflects the runway braking capability as a function of the surface conditions. With this information, the flight crew can derive from the performance information provided by the airplane manufacturer, the necessary stopping distance of an aircraft on the approach under the prevailing conditions.

(j) The friction issues discussed in this AC are those related to the safe operations of an aircraft as well as those that are relevant to the aerodrome operator. More specifically, these issues relate to aircraft/runway interaction that depends on the critical tire-to-ground contact area. At this critical tire-to-ground contact area, two distinct aspects of friction issues meet;

  (i) The design, construction and maintenance of the pavement surface and its inherent friction characteristics; and
  (ii) Aircraft operations on the pavement surface and the contaminants present

(k) Both these aspects have through time, developed their own terminologies that relate to friction, and it is essential to distinguish the following aspects

  (i) Skid resistance - the ability of the travelled surface to prevent the loss of tire traction. It relates to the design, construction and maintenance of pavements
  (ii) Braking action represents the pilot's characterization of the deceleration associated with the wheel braking effort and directional controllability of the aircraft. The term is used in air-reports (AIREPs). Braking action in the context of reporting is used to define the stopping capability of an aircraft using wheel brakes and is related to pilot report of runway braking action; and
  (iii) RWYCC is a number generated by a trained and competent aerodrome personnel's assessment of the runway surface conditions. The RWYCC permits an operational aeroplane landing performance calculation by the flight crew.

(l) The ICAO SNOWTAM format uses the term "runway condition code" (RWYCC) and should be understood as the total assessment of the slipperiness of the surface as judged by the trained and competent aerodrome personnel based on given procedures and all information available. RWYCC and runway braking actions are mapped against each other in the RCAM.

(m) The operational requirements in 2.1(i), stems from the SLCAR Part 6 - *Operation of Aircraft*, Part 1 - *International Commercial Air Transport - Airplanes* and the SLCAR Part 8 - *Airworthiness of Aircraft* with the objective of achieving the desired level of safety for the airplane operations.

(n) The operational practices are intended to provide the information needed to fulfil the syntax requirements for dissemination and promulgation specified in the SLCAR Part 15 - *Aeronautical Information Services* and the *Procedures for Air Navigation Services - Air Traffic Management* (PANS-ATM, Doc 4444).

(o) When the runway is wholly or partly contaminated by standing water or is wet, the runway condition report shall be disseminated through AIS and ATS. When the runway is wet, not associated with the presence of standing water, the assessed information shall be disseminated using the runway condition report through ATS only.

***Note - Operationally relevant information concerning taxiways and aprons are covered in the situational awareness section of the RCR*.**

(p) The operational practices describe procedures to meet the operationally needed information for the flight crew and dispatchers for the following sections:

(i) airplane take-off and landing performance calculations;

(ii) dispatch - pre-planning before commencement of flight;

- take-off from a runway; and
- landing on a destination aerodrome or an alternate aerodrome;

(iii)in flight - when assessing the continuation of flight;

- before landing on a runway; and

(iv)situational awareness of the surface conditions on the taxiways and aprons.

2.2 Objectives

(a) The RWYCC shall be reported for each third of the runway assessed.

(b) The assessment process shall include:

(i) assessing and reporting the conditions of the movement area;

(ii) providing the assessed information in the correct format; and

(iii)reporting significant changes without delay.

(c) The information to be reported shall be compliant with the RCR which consists of:

(i) airplane performance calculation section; and

(ii) situational awareness section.

(d) The information shall be included in an information string in the following order using only AIS-compatible characters:

(i) airplane performance calculation section:

(1) aerodrome location indicator;

(2) date and time of assessment;

(3) lower runway designation number;

(4) RWYCC for each runway third;

(5) per cent coverage contaminant for each runway third;

(6) depth of loose contaminant for each runway third;

(7) condition description for each runway third; and

(8) Width of runway to which the RWYCCs apply if less than published width.

(ii) situational awareness section:

(1) reduced runway length;

(2) loose sand on the runway;

(3) chemical treatment on the runway;

(4) taxiway conditions;

(5) apron conditions;

(6) Authority-approved, and published use of, measured friction coefficient; and

(7) plain language remarks.

(e) The syntax for dissemination as described in the RCR template in ICAO Doc 10066, Appendix 4, is determined by the operational need of the flight crew and the capability of trained personnel to provide the information arising from an assessment.

(f) The syntax requirement in 2.2(e) above, shall be strictly adhered to when providing the assessed information through the RCR.

3 PAVEMENT

3.1 Functional Requirements

(a) A runway pavement considered as a whole, is required to fulfil three basic functions as follows;

(i) Provide adequate bearing strength;
(ii) Provide good riding qualities; and
(iii)Provide good surface friction characteristics

(b) Other requirements include;

(i) Longevity; and
(ii) Ease of maintenance

(c) The first criterion addresses the structure of the pavement, the second the geometric shape of the top of the pavement and the third the texture of the actual surface and drainage when it is wet, texture and slope being the most important friction characteristics of runway pavement. The fourth and fifth criteria address, in addition to the economic dimension, the availability of the pavement for aircraft operations.

3.1.1 Dry Runway

When in a dry and clean state, individual runways generally provide operationally insignificant difference in friction levels, regardless of the types of pavement and configuration of the surface. Moreover, the friction level available is relatively unaffected by the speed of the aircraft. Hence, operations on dry runway surfaces is satisfactorily consistent, and no particular engineering criteria for surface friction are needed for this case.

3.1.2 Wet Runway

(a) The problem of friction on runway surfaces affected by water can be expressed primarily as a generalized drainage problem consisting of three distinct criteria:

(i) Surface drainage (surface shape, slopes);

(ii) Tire/ground interface drainage (macrotexture); and

(iii) Penetration drainage (microtexture)

(b) These three criteria can be significantly influenced by engineering measures and it is important to note that all of them must be satisfied to achieve adequate friction in all possible conditions of wetness.

3.1.3 Contaminated Runway

(a) The problem of friction on runway surfaces affected by contaminants can be expressed primarily as a generalized maintenance problem consisting of improved interfacial drainage or removal of the contaminants. The most dominant of these are:

(i) Maintenance of improved interfacial drainage capability for pavements contaminated by water (more than 3mm in depth);

(ii) Removal of rubber deposits;

(iii) Removal of other deposits such as sand, dust, mud and oil

(b) These issues can be significantly influenced by the level of maintenance provided by the aerodrome operator

(c) The level of maintenance provided is the capability to remove contaminants as rapidly and completely as possible to avoid accumulation. The level of maintenance required is a function of exposure to those contaminants, the maintenance equipment available and the competence of the personnel operating the maintenance equipment

(d) Aerodrome operators may be exposed to a wet runway condition scenario.

3.2 Design

3.2.1 Texture

3.2.1.1 Surface Texture

(a) The most important aspect of the pavement surface relative to its friction characteristics is the surface texture. The effect of different surface material on the tire-to-ground coefficient of friction arises principally from differences in surface texture. Surfaces are normally designed by sufficient macrotexture to obtain a suitable water drainage rate in the tire-runway interface. The texture is obtained by suitable proportioning of the aggregates/mortar mix or by surface finishing techniques. Pavement surface texture is expressed in terms of macrotexture and microtexture; however, these are defined differently depending on the context and measuring techniques at hand. Further guidance on this subject is provided in ICAO Doc 9157 Part 3 - Pavements.

Texture is defined internationally through ISO Standards. These standards refer to texture measured by volume or by profile and expressed as mean texture depth (MTD) or mean profile depth (MPD). These standards define microtexture to be below 0.5MPD and macrotexture to be above 0.5MPD.

3.2.1.2 Microtexture

(a) Microtexture is the texture of the individual stones and is hardly detectable by the eye. Microtexture is considered a primary component in wet skid resistance at slow speeds. On a wet surface at higher speeds, a water film may prevent direct contact between the surface asperities and the tire due to lack of drainage from the tire-to-ground contact area.

(b) Microtexture is built-in quality of the pavement surface. By specifying crushed material that will withstand polishing, microtexture and drainage of thin water films are ensured for a longer period of time. Resistance against polishing is expressed through the polished stone value (PSV), which is in principle a value obtained from friction measurement in accordance with international standards.

(c) A major problem with microtexture is that it can change within short time periods without being easily detected. A typical example of this is the accumulation of rubber deposits in the touchdown area, which will largely mask microtexture without necessarily reducing macrotexture

3.2.1.3 Macrotexture

Macrotexture is the texture between the individual stones. This scale of texture maybe judged approximately by the eye. Macrotexture is primarily created by the size of aggregate used or by treatment of the surface. Grooving adds to the macrotexture, although how much it adds depends on width, depth and spacing. Macrotexture is the major factor influencing the tire/ground interface drainage capacity at high speeds.

3.2.2 Drainage

(a) Surface drainage is a basic requirement of utmost importance. It serves to minimize water depth on the surface. The objective is to drain water off the runway in the shortest path possible and particularly out of the area of the wheel path. Quite obviously, the longer the path that surface water has to take exit the runway, the greater the drainage problem will be.

(b) To promote the most rapid drainage of water, the runway surface should, if practicable, be cambered except where a single crossfall from high to low in the direction of the wind frequently associated with rain would ensure rapid drainage.

(c) The average surface texture depth of a new surface should be designed to provide adequate drainage in expected rainfall conditions. Macrotexture and microtexture should be taken into consideration in order to provide good surface friction characteristics. This may require some form of special measures.

(d) Drainage capabilities can in addition, be enhanced by special measures such as grooving and porous friction course (PFC), which drains water initially through voids of a specially treated wearing course.

(e) It should be clearly understood that special measures are not a substitute for good runway construction and maintenance. Special treatment is certainly one of the items that should be considered when deciding on the most effective method for improving the wet friction characteristics of an existing surface, but other items (drainage, surface material, slope) are the baseline for appropriate wet runway surface friction characteristics.

(f) When there is reason to believe that the drainage characteristics of a runway or portions thereof, are poor due to slopes or depressions, then the runway surface friction characteristics should be assessed under natural or simulated conditions that are representative of local rainfall rates. Corrective maintenance actions to improve drainage should be taken if found necessary.

3.2.2.1 Drainage Characteristics of the movement and adjacent areas

(a) Rapid drainage of surface water is a primary safety consideration in the design, construction and maintenance of pavements and adjacent areas. It serves to minimize the water depth on the surface in particular, area of the wheel path. The objective is to drain water off the runway in the shortest path possible and particularly out of the area of the wheel path. There are two distinct drainage processes;

(i) Natural drainage of the surface water from the top of the pavement surface; and

(ii) Dynamic drainage of the surface water trapped under a moving tire until it reaches outside the tire-to-ground contact area.

(b) Both processes can be controlled through;

(i) Design;

(ii) Construction; and

(iii)Maintenance

of the pavements in order to prevent accumulation of water on the pavement surface.

3.2.2.2 Design and Maintenance of Pavement for drainage

(a) Natural drainage is achieved through the design of slopes on the various parts of the movement area allowing the surface water to flow away from the pavement to the recipient as surface water or through a subsurface drainage system. The resulting combined longitudinal and transverse slope is the path of the natural drainage run-off. This path can be shortened by adding transverse grooves.

(b) Dynamic drainage is achieved by providing texture in the pavement surface. The rolling tire builds up water pressure and squeezes the water out the escape channels provided by the texture. The dynamic drainage of the tire-to-ground contact area is improved by adding transverse grooves.

(c) The drainage characteristics of a surface are built into the pavement. These surface characteristics are;

(i) Slope; and

(ii) Texture, including microtexture and macrotexture.

3.2.2.3 Slope

Adequate surface drainage is provided primarily by an appropriately sloped surface in both the longitudinal and transverse directions, and surface evenness. The maximum slope allowed for the various runway classes and various parts of the movement area is given in the SLCAR Part 14A. Further guidance can be found in ICAO Doc 9157 Part 1 - Runways and ICAO Doc 9157 Part 3 - Pavements.

3.2.2.4 Macrotexture (drainage)

(a) The objective is to achieve high water-discharge rates under the tire with a minimum of dynamic pressure build-up, and this can be achieved only by providing a surface with an open macrotexture.

(b) Interface drainage is actually a dynamic process highly correlated with the square of speed. Therefore, macrotexture is particularly important for the provision of adequate friction in the high-speed range. From the operational aspect this is most significant because it is in this speed range where lack of adequate friction is most critical with respect to stopping distance and directional control capability.

(c) In this context, it is worthwhile to make a comparison between the textures applied in road construction and runways. The smoother textures provided by road surfaces can achieve adequate drainage of the footprint of an automobile tire because of the patterned tire treads, which significantly contribute to interface drainage. Aircraft tires, however, cannot be produced with similar patterned treads and have only a number of circumferential grooves, which contribute substantially less to interface drainage. Their effectiveness diminishes relatively quickly with tire wear.

(d) SLCAR Part 14A, requires a macrotexture of no less than 1mm MTD. Coincidentally, this happens to be consistent with the texture depth of the surface on the ESDU (Engineering Sciences Data Unit) scale that is used in determining the certified performance data for a wet, grooved or PFC surface.

3.2.2.5 Macrotexture (drainage)

(a) The interface drainage between the individual aggregate and the tire is dependent upon the fine texture on the surface of the aggregate. At lower speeds, water can escape as the pavement and tire come into contact. Aggregate susceptible to polishing can lessen this microtexture.

(b) It is of utmost importance to choose crushed aggregates, which can provide a harsh microtexture that will withstand polishing.

3.2.3 Rainfall

(a) Rainfall brings moisture to the runway, which will have an effect on aircraft performance. Flight test data show that even small amounts of water may have a significant effect on aircraft performance, e.g. damp runways effectively reduce aircraft braking action below that of a clean and dry runway.

(b) Rainfall on a smooth runway surface affects aircraft performance more than rainfall on a runway surface with good texture. Rainfall on runway surfaces with good drainage has a lesser effect on aircraft performance. Grooved runways and runways with PFC surfaces fall into this category; however, there comes a time when the drainage capabilities of any runway exposed to heavy or torrential rain can be overwhelmed by water.

(c) At sufficiently high rates, water will rise above the texture depth. Standing water will occur, leading to equally hazardous situations as might occur on smooth runways. Improved performance at such rainfall rates should not be used anymore. For example, a grooved or PFC runway subject to torrential rainfall might perform worse than a regular smooth, wet runway.

3.2.4 Reporting Practices

(a) A runway surface condition is reported using terms DRY, WET or STANDING WATER and is associated with RWYCC. Additionally, a notice to airmen (NOTAM) should be issued whenever a significant portion of a runway drops below the minimum friction level set or agreed by the Authority.

(b) STANDING WATER conditions have contributed to several accidents worldwide. Obviously the frequency of STANDING WATER conditions will be higher for poor drainage runways.

3.3 Construction

3.3.1 Selection of Aggregates and Surface Improvement Methods

(a) Crushed aggregates exhibit a good microtexture, which is essential in obtaining good friction characteristics.

(b) Portland Cement Concrete (PCC): The friction characteristics of PCC are obtained by transversal texturing of the surface of the concrete under construction in the plastic physical state to give the following finishes;

(i) Brush or broom;

(ii) Burlap drag finish; and

(iii)Saw-cut grooving

(c) For existing pavements (or new brand-hardened pavements), the saw-cut technique is typically used.

(d) The first two techniques provide rough surface texture, whereas the saw-cut groove technique provides a good surface drainage capacity.

(e) Hot-mix asphalt (HMA). Bituminous concrete must have good waterproofing with high structural performance. Specification of mixture depends on different factors, such as local guidelines, type and function of surfaces, types and intensity; raw materials and climate.

(f) With a selection of crushed aggregates of good shape and a well-graded asphalt mix design rating combined with standard mechanical characteristics (e.g. adhesion of binder to aggregates, stiffness, resistance to permanent deformation, resistance to fatigue/crack initiation, resistance to abrasion), the expected macrotexture will normally reach 0.7 to 0.8mm with an 11 to 14 mm size aggregate.

(g) Grooving and PFC. Two methods which have had significant influence on improved friction characteristics for runway pavements are grooving and the open-graded, thin, HMA surface called PFC.

(h) Additional guidance on grooving of pavements and the use of PFC is contained in ICAO Doc 9157, Part 3.

3.3.2 Grooving

(a) The primary purpose of grooving a runway surface is to enhance surface drainage and tire/ground interface drainage. Natural drainage can be slowed texture, but can be improved by grooving, which provides a shorter drainage path with more raid drainage. Grooving add to texture in the tire/ground interface and provides escape channels for dynamic drainage.

(b) Runway grooving has been recognised as an effective measure that reduces the danger of hydroplaning for an aircraft landing on a wet runway. The grooves provide escape paths for water in the tire-ground contact area during the passage of the tire over the runway. Grooving can be used on PCC and HMA surfaces designed for runways.

(c) In addition, the isolated puddles that are likely to be formed on non-grooved surfaces because of uneven surface profile are generally reduced in size or eliminated when the surface is grooved. This advantage is particularly significant in regions where large ambient temperature variations may cause low-magnitude undulations in the runway surface.

(d) Construction methods: Grooves are saw-cut by diamond-tipped rotary blades. The end-product quality of the grooves produced can vary from operator to operator.

(e) Tolerances: In order for a wet, grooved runway surface to be considered for aircraft performance, the saw-cut grooves must meet tolerance set by the Authority for alignment, depth, width and centre-to-centre spacing

(f) Clean-up: Clean-up of waste material must be continuous during a grooving operation. All debris, waste and by-products generated by the operation must be removed from the movement area and disposed of in an approved manner in compliance with operators SOPs and SLCARs.

(g) Maintenance: a system must be established for securing the functional purpose of maintaining clean grooves (rubber removal) and preventing or repairing collapsed grooves.

(h) The macrotexture of the runway surface can be sufficiently increased by grooving, and this is applicable to asphalt and concrete surfacing. The macrotexture of ungrooved, continuously graded asphalt is typically in the range of 0.5 to 0.8mm and slightly higher for stone mastic asphalt. In service, grooves wear down with traffic, and this has the effect of reducing macrotexture over time.

(i) The effect of grooving on macrotexture can be calculated for any groove geometry and surfacing macrotexture using the following equation, which is applicable to rectangular/square grooves;

$$M_g = \frac{WD + Mu(S-W)}{S}$$

Where: M_g = grooved macrotexture

W = groove width

D = groove depth

M_u = ungrooved macrotexture

S = groove spacing

(j) In service, the grooves wear down with traffic and partly fill with rubber in the touchdown areas. Although this wear and clogging affect only parts of the runway, and the average texture is still mainly determined by the unworn and unclogged grooves on the rest of runway. It is usual to aim for a macrotexture of more than 1.0mm during construction.

(k) Grooving has its limits. It will not totally cope with standing water due to ruts and ponding in the runway, deep standing water due to heavy precipitation and standing water due to the grooves and texture being filled with accumulation of rubber. However, grooving does make a difference to the grip on a wet runway as the water gets deeper on the runway.

(l) Two main difficulties that relate to skid resistance that can appear when using PFC are:

(i) Rubber deposits, which must be monitored and must be removed before they fill up the structural void spaces. The functional effectiveness of PFC becomes nil if the removal is performed too late; and

(ii) Contamination, which may also fill void spaces and reduce this drainage efficiency.

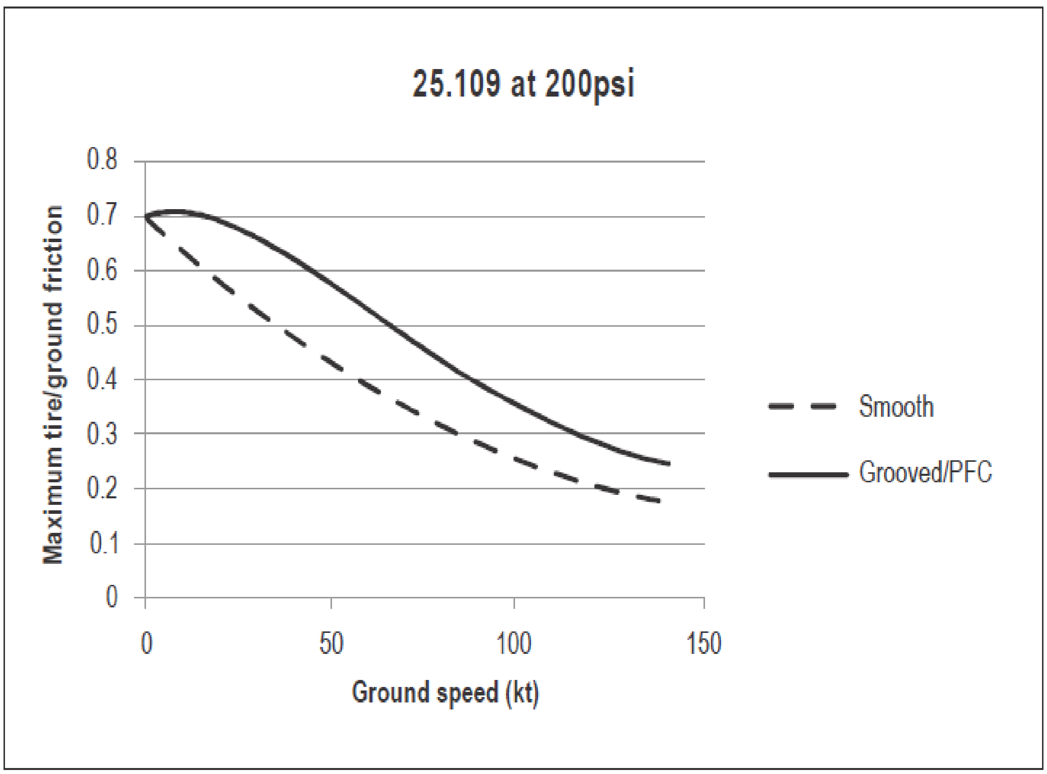


Figure 3.1 - The effect of macrotexture and additional drainage on maximum tire/ground friction

3.4 Maintenance

(a) An appropriate maintenance programme should ensure adequate drainage, rubber removal and clearing of runway contaminants.

(b) The monitoring of surface friction characteristics trends is referred to in SLCAR Part 14A and SLCAA-AC-AGA015 Rev01 (Aerodrome Inspection Programme). A trend monitoring concept for runway surface friction characteristics is shown below:

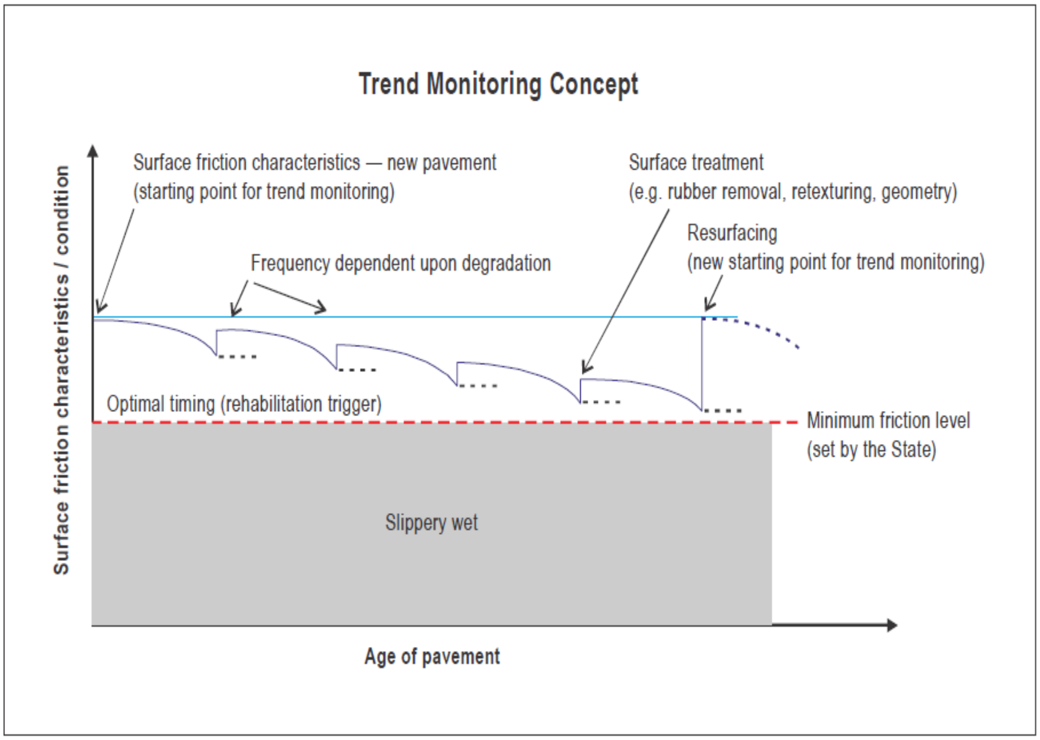


Figure 3.2 - Trend Monitoring Concept

(c) The objective is to ensure that the surface friction characteristics for the entire runway remain at or above the minimum friction level specified by the Authority

(d) The trend of degradation of surface friction characteristics of a pavement is monitored in compliance with criteria specified by the Authority. Degradation is typically caused by:

(i) Rubber deposits, which can be managed through a rubber removal programme

(ii) Surface polishing, which can be managed by monitoring loss of sharpness and a retexturing/resurfacing programme; and

(iii) Poor drainage, which can be managed by monitoring changes in geometry and blocking of drainage channels and a reshaping programme.

(e) The trend monitoring concept is described in ICAO Doc 9157, Part 3, and is used to ensure that the degradation of surface friction characteristics is above the minimum friction level specified by the Authority

(f) In the construction of new runways or resurfacing of existing runways, the construction of surfaces with adequate slopes and aggregate of angular fragments from crushed gravel or stone to provide a sharp texture will be essential to ensuring surface friction characteristics that provide good braking action in wet conditions. The surface friction characteristics of a newly constructed or resurfaced runway surface establish the normal starting point for trend monitoring; however, trend monitoring can also start at any given time through the lifespan of a pavement.

(g) The States criteria for surface friction characteristics and output from national-set or agreed assessment methods, form the reference for performing and evaluating trend monitoring. This reference should ensure that the friction forces that aeroplane certification regulations assume to be available on wet pavement can be provided by the runway surface.

(h) The determination that a runway or portion thereof is slippery when wet stems from various methods. The criteria specified by the Authority may include methods of assessing runway surface conditions described in PANS-Aerodromes (ICAO Doc 9981). In addition, sub-standard runways or portions thereof can be identified through repeated reports by aircraft operators based on flight crew experience or through analysis of aeroplane stopping performance. When such reports are received, it is an indication that the surface friction characteristics are likely to be severely degraded and immediate remedial action is necessary.

3.4.1 Removal of Rubber

(a) The overarching purpose of rubber removal is to restore the inherent friction characteristics and unmask covered, painted runway markings. Every aircraft landing creates rubber deposits. Over time, rubber deposits accumulate, primarily in the touchdown area of a runway. As a result, the texture is progressively reduced and the painted area is covered.

(b) There are four methods of removing runway rubber:

(i) Water blasting;

(ii) Chemical method;

(iii) Shot blasting; and

(iv) Mechanical means

(c) No single method of removal is superior to any other or for a given pavement type. Methods can be combined. The chemical method can be used to pre-treat or soften the rubber deposit before water blasting. Additional guidance on removal of rubber and other surface contaminants can be found in ICAO Doc 9137, Part 2 - Pavement Surface Conditions and Part 9 - Airport Maintenance Practices.

(d) Damage to surface and installations: One concern with rubber removal is not to damage the underlying surface. Experienced operators who are familiar with their equipment should be able to remove the required amount of rubber without causing unintended damage to the surface. Less experienced or less diligent operators using the same equipment can inflict a great deal of damage to the surface, grooves, joints sealant materials and ancillary items such as painted areas and runway lighting merely by lingering too long in one area or failing to maintain a proper forward speed.

(e) Most damage appears to be associated with water blasting, so only experienced operators should be used. The least damage appears to be associated with chemical removal.

(f) Retexturing: The removal of rubber with shot blasting can have the advantage of retexturing a polished pavement surface.

3.5 Skid Resistance

3.5.1 Loss of Skid Resistance

(a) The factors that cause loss of skid resistance can be grouped into two categories:

(i) Mechanical wear and polishing action from rolling, braking of aircraft tires or tools used for maintenance; and

(ii) Accumulation of contaminants

(b) These two categories directly relate to the two physical friction characteristics of runway pavements that generate friction when in contact and relative motion with the aircraft tire;

(i) Microtexture; and

(ii) Macrotexture

3.5.2 Microtexture (Skid Resistance)

(a) Microtexture can be lost when exposed to mechanical wear of the aggregate. The susceptibility for mechanical wear of the aggregates in the pavement is a built-in quality usually referred to as the PSV. The PSV is a measure of an aggregate's resistance to polishing under traffic and determines an aggregate's suitability where skid resistance requirements vary.

(b) The PSV test involves subjecting a sample of similar sized aggregate particles to a standard amount of polishing and then measuring the skid resistance of the polished specimen. Once polished, the specimens are soaked and then skid resistance with a British pendulum. Thus, the PSV is in fact a friction measurement in accordance with International Standards.

(c) Microtexture is reduced by wear and polishing.

3.5.3 Macrotexture (Skid Resistance)

(a) Because macrotexture affects the high-speed tire braking characteristics, it is of most interest when looking at runway characteristics for friction when wet. Simply put, a rough macrotexture surface will result in greater tire/ground friction when wet, than a smoother macrotexture surface. Surfaces are normally designed with a sufficient macrotexture to obtain suitable water drainage in the tire/pavement interface.

(b) It is preferable to develop programmes aimed at improving surface friction and drainage characteristics of runways such that safety is improved.

(c) Macrotexture is reduced and lost as the voids between the aggregates become filled with contaminants. This can be a persistent condition, such as with the accumulation of rubber deposits.

3.5.4 Surface Dressing

(a) The skid resistance of pavement surfaces can be improved by surface dressing using high-quality crushed aggregates and modified polymer blinder for better adhesion of granularities on the surface and for minimizing loose aggregates. The size of aggregates is limited to 5mm. Nevertheless, this kind of product exhibits high texture depth and may potentially damage aircraft tires through wear. The application of these techniques may only be considered on pavements which present good structural and surface conditions.

(b) Comprehensive guidance on methods for improving the runway surface texture is available in ICAO Doc 9157 Part 3.

4 OPERATIONAL PRACTICES

(a) Reporting, in compliance with the runway condition report, shall commence when a significant change in runway surface condition occurs due to the presence of standing water.

(b) Reporting of the runway surface condition shall continue to reflect significant changes until the runway is no longer contaminated. When this situation occurs, the aerodrome operator shall issue a runway condition report that states the runway is wet or dry as appropriate.

(c) A change in the runway surface condition used in the runway condition report is considered significant whenever there is:

(i) any change in the RWYCC;

(ii) any change in contaminant type;

(iii) any change in reportable contaminant coverage according to Appendix 1;

(iv) any change in contaminant depth according to Appendix 2 and

(v) any other information, for example a pilot report of runway braking action, which according to assessment techniques used, are known to be significant.

4.1 Runway Surface Conditions and Descriptors

4.1.1 Runway Surface Conditions

There are four defined runway surface conditions;

(i) Dry Runway;

(ii) Wet Runway;

(iii) Slippery when wet Runway; and

(iv) Contaminated Runway

4.1.1.1 Dry Runway

A runway that is neither wet, nor contaminated is considered to be dry. When the coverage of a runway surface is less than 25% of visible moisture or contaminant, such runway can be classified as a dry runway.

4.1.1.2 Wet Runway

When the surface of a runway is not dry but with no contaminant present, such runway is considered to be wet. Wet runway is when more than 25% of the runway surface is covered by any visible dampness or water that is 3mm or less.

4.1.1.3 Slippery when wet Runway

This is a wet runway where the surface friction characteristics of a significant portion of the runway have been determined to be degraded. This can be identified utilising friction measuring devices.

4.1.1.4 Contaminated Runway

A runway of which a significant portion of its surface area within the length and width being used is covered by one or more of the substances listed in section 4.1.2 below.

4.1.2 Types of Contaminants on a Runway

The following are types of contaminants that can be found on a runway that is considered to be contaminated.

(i) Standing Water (water with a depth greater than 3mm)

(ii) Mud

(iii) Oil

(iv) Ash

(v) Sand etc.

4.1.3 Runway Surface Descriptors

The following terms will be used, as applicable, to describe the runway surface condition for each runway third or for the full length of the runway;

(i) Dry

(ii) Slippery when wet

(iii) Standing water

(iv) Wet

4.2 Runway Condition Report - Airplane performance calculation section

(a) The airplane performance calculation section is a string of grouped information separated by a space “” and ends with a return and two line feed “«≡”. This is to distinguish the airplane performance calculation section from the following situational awareness section or the following airplane performance calculation section of another runway.

(b) The information to be included in this section consists of the following:

(i) **Aerodrome location indicator:** a four-letter ICAO location indicator in accordance with ICAO Doc 7910 - Location Indicators.

This information is mandatory.

Format: nnnn

Example: ENZH

(ii) **Date and time of assessment:** date and time (UTC) when the assessment was performed by the trained personnel.

This information is mandatory.

Format: MMDDhhmm

Example: 09111357

(iii) **Lower runway designation number:** a two or three character number identifying the runway for which the assessment is carried out and reported.

This information is mandatory.

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

Example: 09L

(iv) **Runway condition code for each runway third:** a one-digit number identifying the RWYCC assessed for each runway third. The codes are reported in a three-character group separated by a **"/"** for each third. The direction for listing the runway thirds shall be in the direction as seen from the lower designation number.

(1) This information is mandatory.

(2) When transmitting information on runway surface conditions by ATS to flight crews, the sections are however, referred to as the first, second or third part of the runway. The first part always means the first third of the runway as seen in the direction of landing or take-off as illustrated in Appendix 8 and 9, are detailed in PANS-ATM (Doc 4444).

Format: n/n/n

Example: 5/5/2

Note - A change in RWYCC from, say, 5/5/2 to 5/5/3 is considered significant. A change in RWYCC requires a complete assessment taking into account all information available. Procedures for assigning a RWYCC are available in 4.4(d) to (p) of this AC.

(v) **Percentage coverage contaminant for each runway third:** a number identifying the percentage coverage. The percentages are to be reported in an up-to-nine-character group separated by a **"/"** for each runway third. The assessment is based upon an even distribution within the runway thirds using the guidance in Appendix 1.

(1) This information is conditional. It is not reported for one runway third if it is dry or covered with less than 10 per cent.

Format: [n]nn/[n]nn/[n]nn

Example: 25/50/100

(2) NR/50/100 if contaminant coverage is less than 10% in the first third 25/NR/100 if contaminant coverage is less than 10% in the middle third 25/50/NR if contaminant coverage is less than 10% in the last third

(3) With uneven distribution of the contaminants, additional information is to be given in the plain language remark part of the situational awareness section of the runway condition report. Where possible, a standardized text shall be used.

Note - when no information is to be reported, insert "NR" at its relevant position in the message to indicate to the user that no information exists (/NR/).

(vi) **Depth of loose contaminant: standing water for each runway third:** a two- or three-digit number representing the assessed depth (mm) of the contaminant for each runway third. The depth is reported in a six to nine-character group separated by a **"/"** for each runway third as defined in Appendix 2. The assessment is based upon an even distribution within the runway thirds as assessed by trained personnel. If measurements are included as part of the assessment process, the reported values are still reported as assessed depths, as the trained personnel have placed their judgment upon the measured depths to be representative for the runway third.

Format: [n]nn/[n]nn/[n]nn

Examples: 04/06/12 [*STANDING WATER]*

This information is conditional. It is reported only for STANDING WATER.

(1) ***Example of reporting depth of contaminant whenever there is a significant change***

a) After the first assessment of runway condition, a **first runway condition report** is generated. The initial report is:

5/5/5 100/100/100 02/02/02 WATER/WATER/WATER

Note - The full information string is not used in this example.

b) With continuing precipitation, a new runway condition report is required to be generated as subsequent assessment reveals a change in the runway condition code. A **second runway condition report** is therefore created as:

2/2/2 100/100/100 03/03/03 WATER / WATER / WATER

c) With even more precipitation, further assessment reveals the depth of precipitation has increased from 3mm to 5mm along the entire length of the runway. However, a new runway condition report **is not** required because the runway condition code has not changed (change in depth is less than the significant change threshold of 3mm).

d) A final assessment of the precipitation reveals that the depth has increased to 7mm. A new runway condition code is required because the change in depth from the last runway condition report (**second runway condition code**) i.e. from 3mm to 7mm is greater than the significant change threshold of 3mm. A **third runway condition report** is thus created as below:

2/2/2 100/100/100 07/07/07

e) For contaminants other than STANDING WATER, the depth is not reported. The position of this type of information in the information string is then identified by **/NR/**.

f) When the depth of the contaminants varies significantly within a runway third, additional information is to be given in the plain language remark part of the situational awareness section of the runway condition report.

(vii) **Condition description for each runway third:** to be reported in capital letters using terms specified in 2.9.5 of SLCAR Part 14A. These terms have been harmonized with the terms used in the Standards in SLCAR's Part 6, 8, 11 and 15. The condition type is reported by any of the following condition type descriptions for each runway third and separated by an oblique stroke **"/"**.

This information is mandatory.

DRY

STANDINGWATER

WET

Format: nnnn/nnnn/nnnn

(viii) **Width of runway to which the RWYCCs apply if less than published width** is the two-digit number representing the width of cleared runway in metres.

This information is optional.

Format: nn

Example: 30

If the cleared runway width is not symmetrical along the centre line, additional information is to be given in the plain language remark part of the situational awareness section of the runway condition report.

4.3 Runway condition report - Situational awareness section

(a) All individual messages in the situational awareness section end with a full stop sign. This is to distinguish the message from subsequent message(s).

(b) The information to be included in this section consists of the following:

(i) Reduced runway length

This information is conditional when a NOTAM has been published with a new set of declared distances affecting the LDA.

Format: Standardized fixed text

RWY nn [L] *or* nn [C] *or* nn [R] LDA REDUCED TO [n]nnn

Example: RWY 22L LDA REDUCED TO 1450.

(ii) Loose sand on the runway

This information is optional.

Format: RWY nn [L] *or* nn[C] *or* nn[R] LOOSE SAND

Example: RWY 02R LOOSE SAND.

(iii) Chemical treatment on the runway

This information is mandatory.

Format: RWY nn [L] *or* nn[C] *or* nn[R] CHEMICALLY TREATED

Example: RWY 06 CHEMICALLY TREATED.

(iv) Taxiway conditions

This information is optional.

Format: TWY [nn] n POOR

Example: TWY B POOR.

(v) Apron conditions

This information is optional.

Format: APRON [nnnn] POOR

Example: APRON NORTH POOR.

(vi) Authority-approved and published use of measured friction coefficient

This information is optional.

Format: *[Authority set format and associated procedures]*

Example: *[Function of Authority set format and associated procedures]*.

(vii) Plain language remarks using only allowable characters in capital letters

Where possible standardized text should be developed

This information is optional.

Format: Combination of allowable characters where use of full stop **«.»** marks the end of the message.

Allowable characters:

ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789

[Oblique stroke] "." [Period] "" [space]

Note: Runway conditions are reported using the RCR given in Appendix 6

4.4 Assessing a runway and assigning a runway condition code

(a) The assessed RWYCC to be reported for each third of the runway is determined by following the procedure described in 4.4(d) to (p).

Note - Guidance on methods of assessing runway surface condition, including the determination of a slippery wet runway, is given in Appendix 10 of this AC.

(b) If 25 per cent or less area of a runway third is wet or covered by contaminant, a RWYCC 6 shall be reported (see appendix 7).

(c) If the distribution of the contaminant is not uniform, the location of the area that is wet or covered by the contaminant is described in the plain language remarks part of the situational awareness section of the runway condition report.

(d) A description of the runway surface condition is provided using the contamination terms described in capital letters in Appendix 3 - *Assigning a runway condition code (RWYCC)*.

(e) If multiple contaminants are present where the total coverage is more than 25 per cent but no single contaminant covers more than 25percent of any runway third, the

RWYCC is based upon the judgment by trained personnel, considering what contaminant will most likely be encountered by the airplane and its likely effect on the airplane's performance.

(f) If multiple contaminants are present where the total coverage is more than 25percent, and with more than one contaminant covering more than 25percent of any runway third, only the two most prevalent are reported.

(g) The RWYCC is determined using Appendix 3.

(h) The variables, in Appendix 3, that may affect the runway condition code are:

(i) type of contaminant;

(ii) depth of contaminant; and

(iii) outside air temperature (where available the runway surface temperature shall preferably be used.)

(i) An assigned RWYCC 5, 4, 3 or 2 shall not be upgraded.

(j) An assigned RWYCC 1 or 0 can be upgraded using the following procedures (but see also 4.4(k):

(i) if a properly operated and calibrated Authority-approved measuring device and all other observations support a higher RWYCC as judged by trained personnel;

(ii) the decision to upgrade RWYCC 1 or 0 cannot be based upon one assessment method alone. All available means of assessing runway slipperiness are to be used to support the decision;

(iii) when RWYCC 1 or 0 is upgraded, the runway surface is assessed frequently during the period the higher RWYCC is in effect to ensure that the runway surface condition does not deteriorate below the assigned code; and

(iv) variables that may be considered in the assessment that may affect the runway surface condition, include but are not limited to:

(1) any precipitation conditions;

(2) changing temperatures;

(3) effects of wind;

(4) frequency of runway in use; and

(5) type of airplane using the runway.

(k) Upgrading of RWYCC 1 or 0 using the procedures in 4.4(j) shall not be permitted to go beyond a RWYCC 3.

(l) If sand or other runway treatments are used to support upgrading, the runway surface is assessed frequently to ensure the continued effectiveness of the treatment.

(m) The RWYCC determined from Appendix 3 shall be appropriately downgraded considering all available means of assessing runway slipperiness, including the criteria given in Appendix 4.

(n) Where available, the pilot reports of runway braking action shall be taken into consideration as part of the ongoing monitoring process, using the following principle:

(i) a pilot report of runway braking action is taken into consideration for downgrading purposes; and

(ii) a pilot report of runway braking action can be used for upgrading purposes only if it is used in combination with other information qualifying for upgrading.

Note 1 - The procedures for making special air -reports regarding runway braking action are contained in the Procedures for Air Navigation Services - Air Traffic Management (PANS-ATM, Doc 4444), Chapter 4, and Appendix 1, Instructions for air-reporting by voice communication.

Note 2 - Procedures for downgrading reported RWYCC can be found in 4.4(r) including the use of Appendix 5 runway condition assessment matrix (RCAM).

(o) Two consecutive pilot reports of runway braking action of POOR shall trigger an assessment if an RWYCC of 2 or better has been reported.

(p) When one pilot has reported a runway braking action of LESS THAN POOR, the information shall be disseminated, a new assessment shall be made and the suspension of operations on that runway shall be considered.

Note 1 - If considered appropriate, maintenance activities may be performed simultaneously or before a new assessment is made.

Note 2 - Procedures for the provision of information to arriving aircraft are contained in Procedures for Air Navigation Services - Air Traffic Management (PANS-ATM, Doc 4444), Section *6.6.*

(q) Appendix 4 shows the correlation of pilot reports of runway braking action with RWYCCs.

(r) Appendix 3 and Appendix 4 combined form the runway condition assessment matrix (RCAM) in Appendix 5. The RCAM is a tool to be used when assessing runway surface conditions. It is not a stand-alone document and shall be used in compliance with the associated procedures of which there are two main parts:

(i) assessment criteria; and

(ii) down-grade assessment criteria.

APPENDIX 1 - PERCENTAGE OF COVERAGE FOR CONTAMINANTS

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

APPENDIX 2 – DEPTH ASSESSMENT FOR CONTAMINANTS

Contaminant	*Valid values to be reported*	*Significant change*
STANDING WATER	04, then assessed value	3 mm up to and including 15 mm

Note - For STANDING WATER, 04 (4mm) is the minimum depth value at and above which the depth is reported (From 3mm and below, the runway third is considered WET).

APPENDIX 3 - ASSIGNING A RUNWAY CONDITION CODE (RWYCC)

Runway condition description	*Runway condition code (RWYCC)*
DRY	**6**
WET (the runway surface is covered by any visible dampness or water up to and including 3 mm deep)	**5**
WET (“Slippery wet” runway)	**3**
STANDING WATER (more than 3 mm depth)	**2**

APPENDIX 4 - CORRELATION OF RUNWAY CONDITION CODE AND PILOT REPORTS OF RUNWAY BRAKING ACTION.

Pilot report of runway braking action	*Description*	*Runway condition code (RWYCC)*
N/A	-	6
GOOD	Braking deceleration is normal for the wheel braking effort applied AND directional control is normal.	5
GOOD TO MEDIUM	Braking deceleration OR directional control is between good and medium.	4
MEDIUM	Braking deceleration is noticeably reduced for the wheel braking effort applied OR directional control is noticeably reduced.	3
MEDIUM TO POOR	Braking deceleration OR directional control is between medium and poor.	2
POOR	Braking deceleration is significantly reduced for the wheel braking effort applied OR directional control is significantly reduced.	1
LESS THAN POOR	Braking deceleration is minimal to non-existent for the wheel braking effort applied OR directional control is uncertain.	0

APPENDIX 5 - RUNWAY CONDITION ASSESSMENT MATRIX (RCAM)

Runway condition assessment matrix (RCAM)			
Assessment criteria		Downgrade assessment criteria	
Runway condition code	Runway surface description	Airplane 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
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

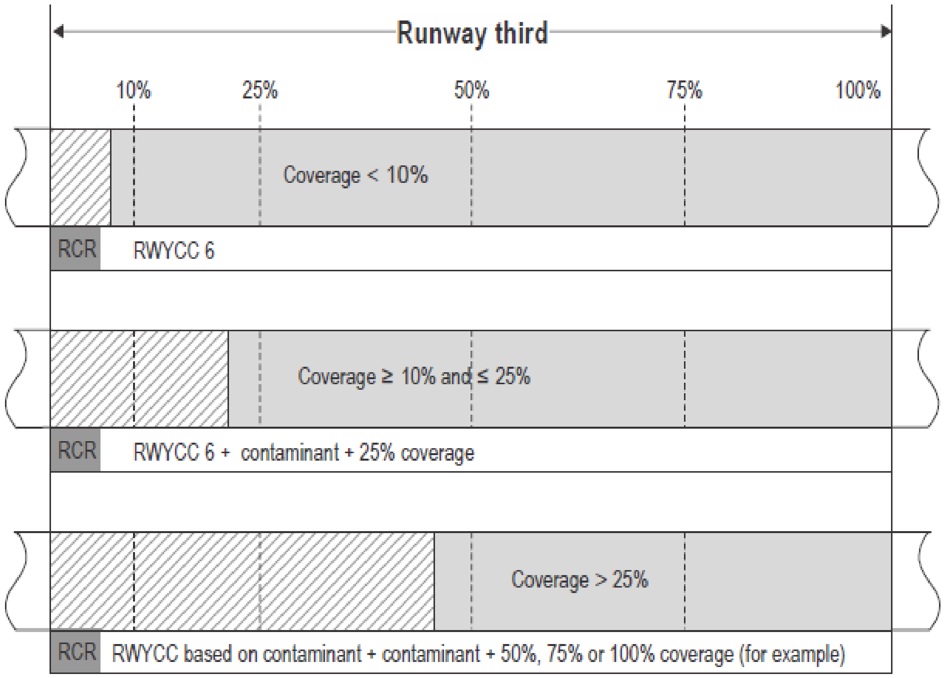
Runway surface temperature shall preferably be used where available.

The aerodrome operator may assign a higher runway condition code (but no higher than code 3) for each third of the runway, provided the procedure in 4.4(k) is followed.

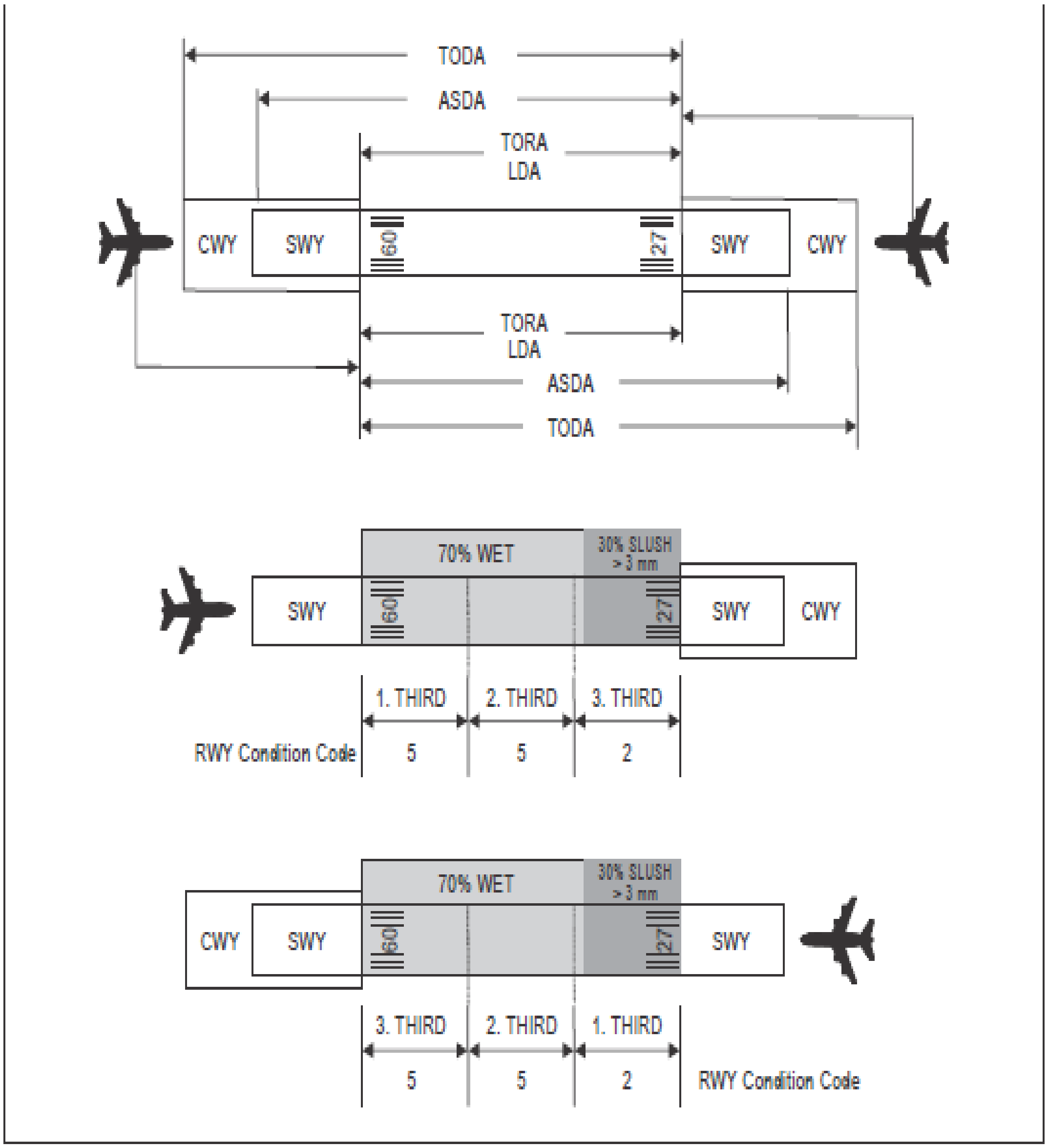
APPENDIX 6 - RUNWAY CONDITION REPORT

RUNWAY CONDITION REPORT (RCR)	
Aeroplane performance calculation section	
Information	*Source*
Aerodrome location indicator	Doc 7910, *Location Indicators*
Date and time of assessment	UTC time
Lower runway designation number	Actual runway
RWYCC for each runway third	Assessment based on the RCAM and associated procedures
Per cent coverage contaminant for each runway third	Visual observation for each runway third
Depth of loose contaminant for each runway third	Visual observation assessed for each runway third, confirmed by measurements when appropriate
Condition description (contaminant type) for each runway third	Visual observation for each runway third
Width of runway to which the RWYCCs apply if less than published width	Visual observations while at the runway and information from local procedures/snow plan
Situational awareness section	
Reduced runway length	NOTAM
Drifting snow on the runway	Visual observation while at the runway
Loose sand on the runway	Visual observation while at the runway
Chemical treatment on the runway	Known application of the treatment. Visual observation of residual chemicals on the runway.
Snowbanks on the runway	Visual observations while at the runway
Snowbanks on taxiway	Visual observations while at the taxiway
Snowbanks adjacent to the runway penetrating level/profile set in the aerodrome snow plan	Visual observations while at the runway, confirmed by measurements when appropriate
Taxiway conditions	Visual observations, AIREPs, reports by other aerodrome personnel, etc.
Apron conditions	Visual observations, AIREPs, reports by other aerodrome personnel, etc.

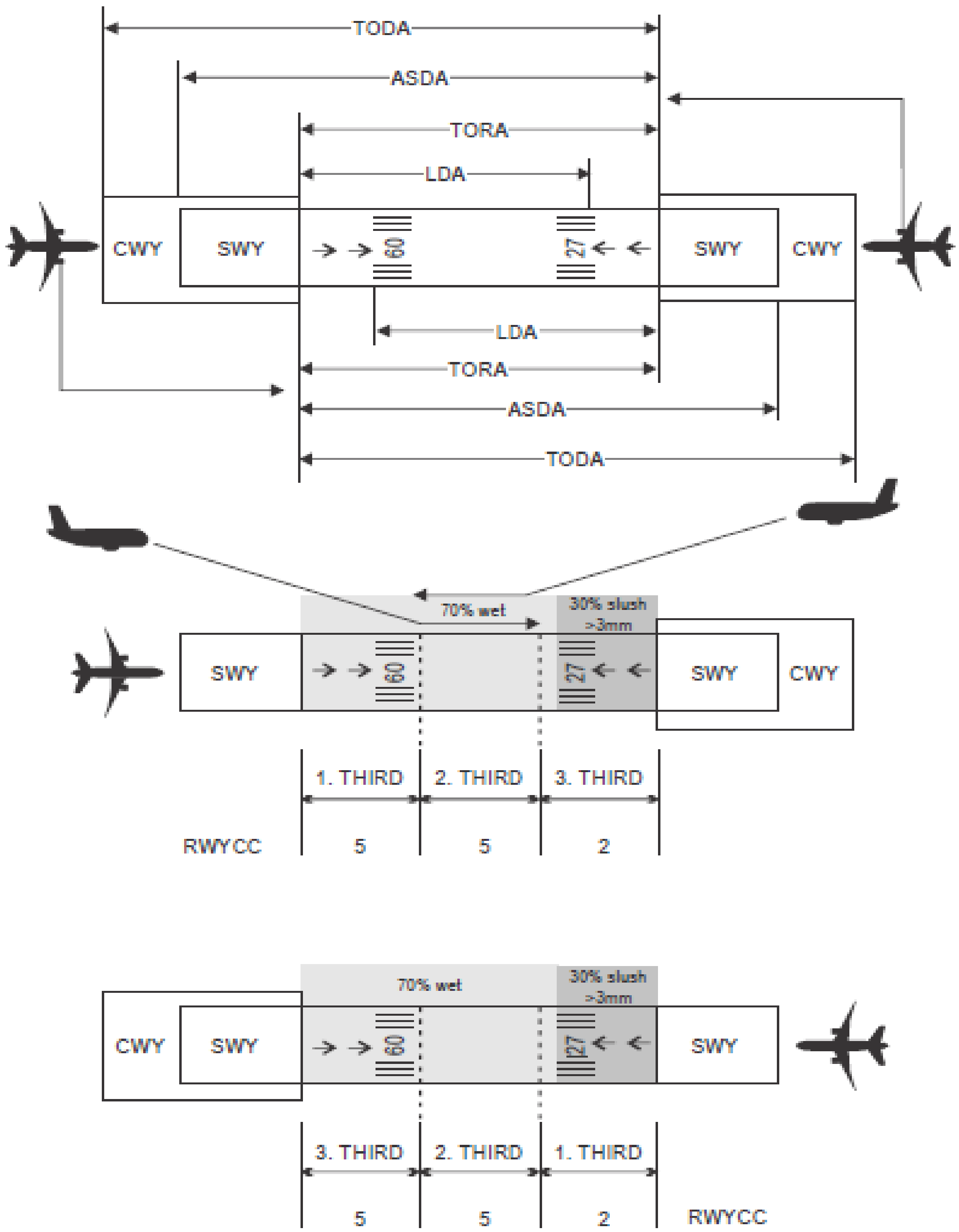
APPENDIX 7 - REPORTING SINGLE CONTAMINANT



APPENDIX 8 - REPORTING OF RUNWAY CONDITION CODE FROM ATS TO FLIGHT CREW FOR RUNWAY THIRDS



APPENDIX 9 - REPORTING OF RUNWAY CONDITION CODE FOR RUNWAY THIRDS FROM ATS TO FLIGHT CREW ON A RUNWAY WITH DISPLACED THRESHOLD



APPENDIX 10 - METHODS OF ASSESSING RUNWAY SURFACE CONDITION

		SLCAR Part 14A	***REMARK***
DESIGN AND CONSTRUCTION	Slope	3.1.13 Longitudinal slopes 3.1.19 Transverse slopes	
	Texture	3.1.26 The average surface texture depth of a new surface shall be not less than 1.0 mm.	
	Minimum friction level set by the Authority	3.1.23 A paved runway shall be so constructed or resurfaced as to provide surface friction characteristics at or above the minimum friction level set by the Authority.	The Authority set criteria for surface friction characteristics and output from Authority set or agreed assessment methods form the reference from which trend monitoring are performed and evaluated.
	Polishing	3.1.23 A paved runway shall be so constructed or resurfaced as to provide surface friction characteristics at or above the minimum friction level set by the Authority.	Polished Stone Value. (PSV-value) is a measure of skidding resistance on a small sample of stone surface, having being subjected to a standard period of polishing

			Rubber build-up	*Geometry change*	*Polishing*
ASSESSMENT METHODS FOR MONITORING TREND OF CHANGE TO	Visual − macrotexture	Visual assessment will only give a very crude assessment of the macrotexture. Extensive rubber build-up can be identified.	X		
	Visual − micro texture	Visual assessment will give a very crude assessment of the micro texture and to what degree the micro texture 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 − micro texture	Assessment by touch can identify if micro texture has been filled in/covered by rubber build-up.	X		
	Grease smear method (MTD)	Measure a volume – Mean Texture Depth (MTD) primarily by using the grease smear method, is the measurement method used for research purposes related	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) Laser – moving (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		

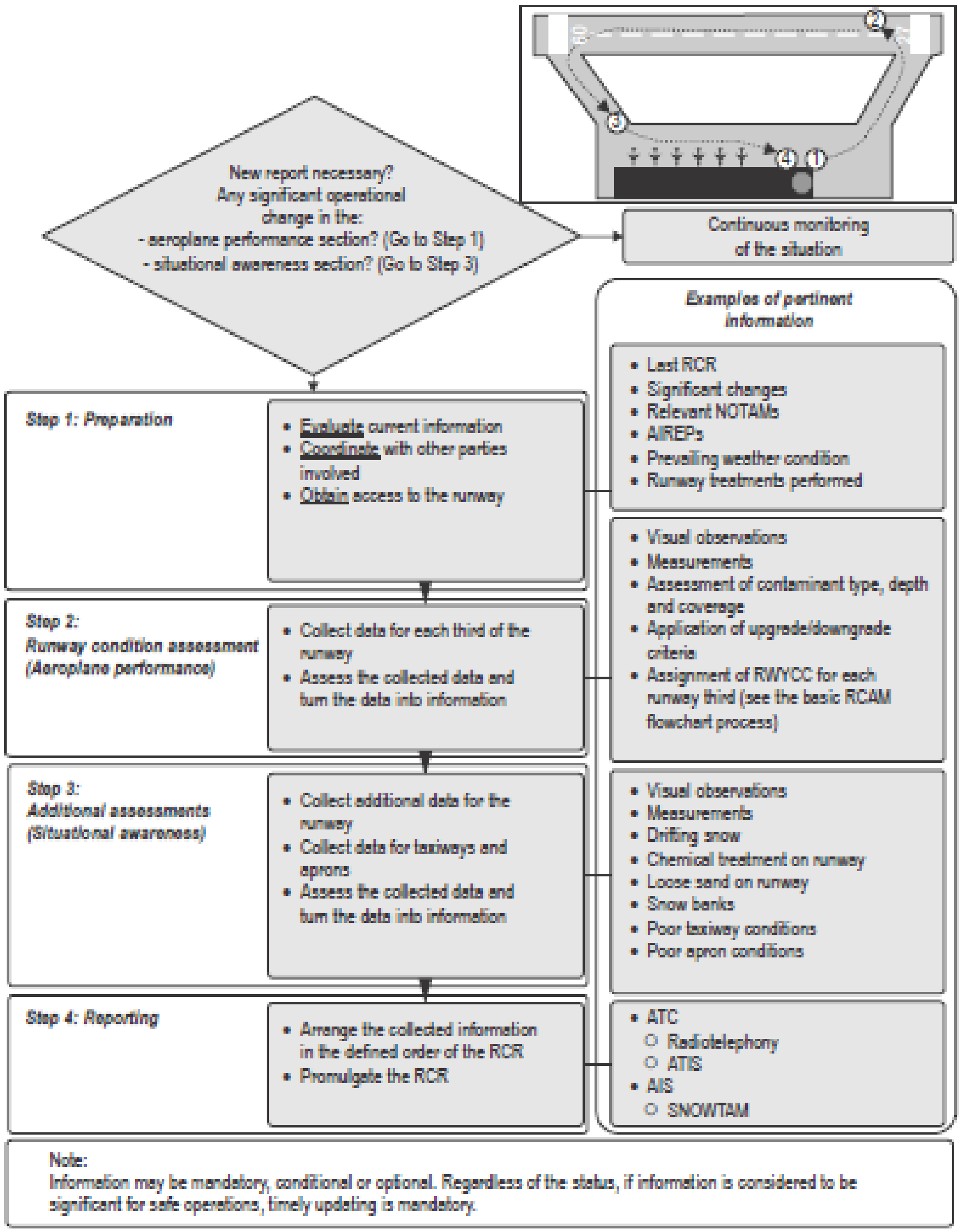
			Rubber build-up	*Geometry change*	*Polishing*
	Friction measurement – controlled applied water depth	A friction measurement is a system output which includes all the surface friction characteristics and characteristics of the measuring device itself. All other variables than those related to the surface friction characteristics must be controlled in order to relate the measured values to the surface friction characteristics. The system output is a dimensionless number which is related to the surface friction characteristics and as such is also a measure of macrotexture. (The system generated number needs to be paired with other information (assessment methods) to identify which surface friction characteristics significantly influence the system output.) It is recognized that there is currently no consensus within the aviation industry on how to control the uncertainty related to repeatability, reproducibility and time stability. It is paramount to keep this uncertainty as low as possible; consequently ICAO has tightened the Standards associated with use of friction measurement devices, including training of personnel who operate the friction measuring devices.	X		X
	Friction measurement – natural wet conditions	Friction measurements performed under natural wet conditions during a rain storm might reveal if portions of a runway are susceptible to ponding and/or to fall below Authority 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	

Personnel assessing and reporting runway surface conditions required in 2.9.2 and 2.9.5 of SLCAR Part 14A shall be trained and competent to perform their duties.

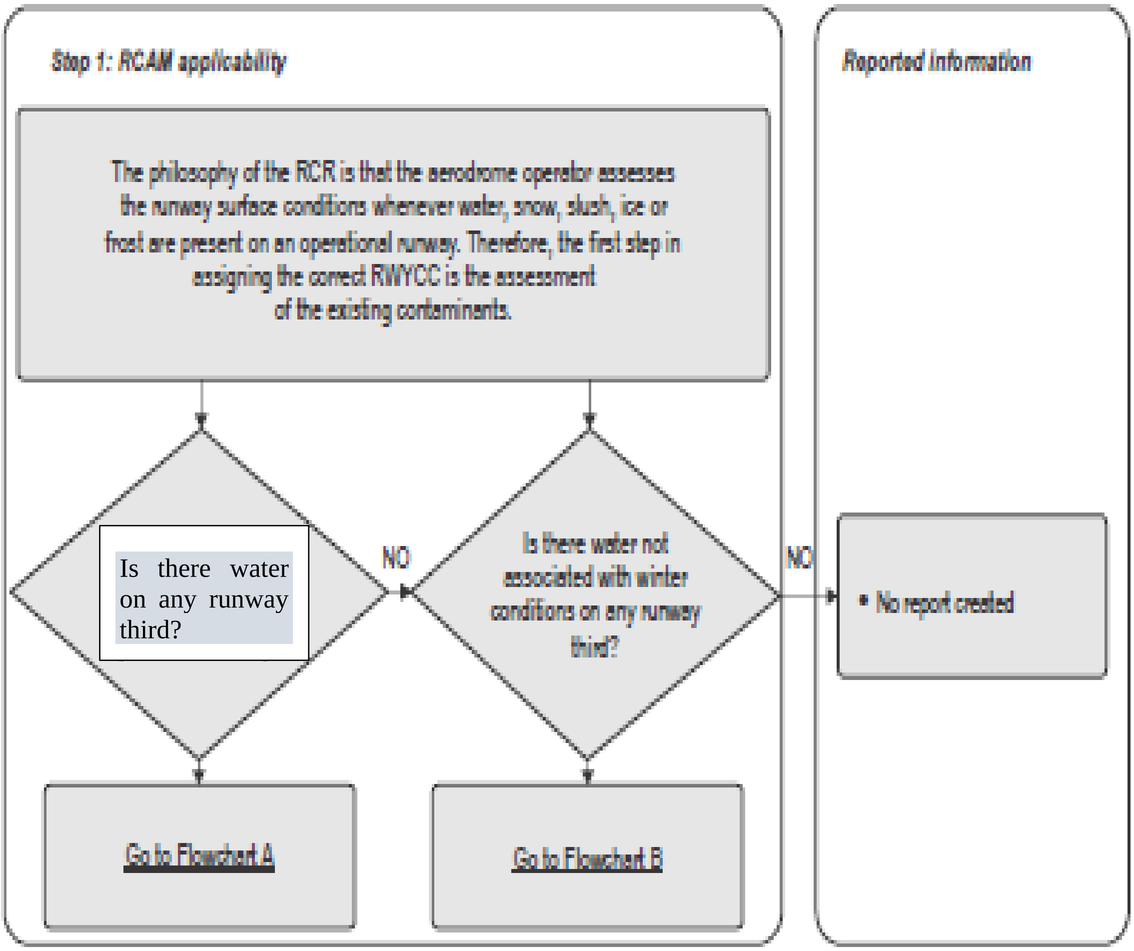
Note 1 - Guidance on the minimum competence requirement and training of personnel assessing and reporting runway surface condition is given in Table 2 of Appendix 2 of SLCAA-AC-AGA003 Rev01 Operational Personnel Competence Requirement and Assessment and Chapter 6 of SLCAA-AC-AGA043-Rev00 (Supplementary to SLCAR Part 14A) and.

Note 2 - Further Information on the training syllabus for personnel assessing and reporting runway surface conditions is available in Appendix 3 of SLCAA-AC-AGA003 Rev01 Operational Personnel Competence Requirement and Assessment.

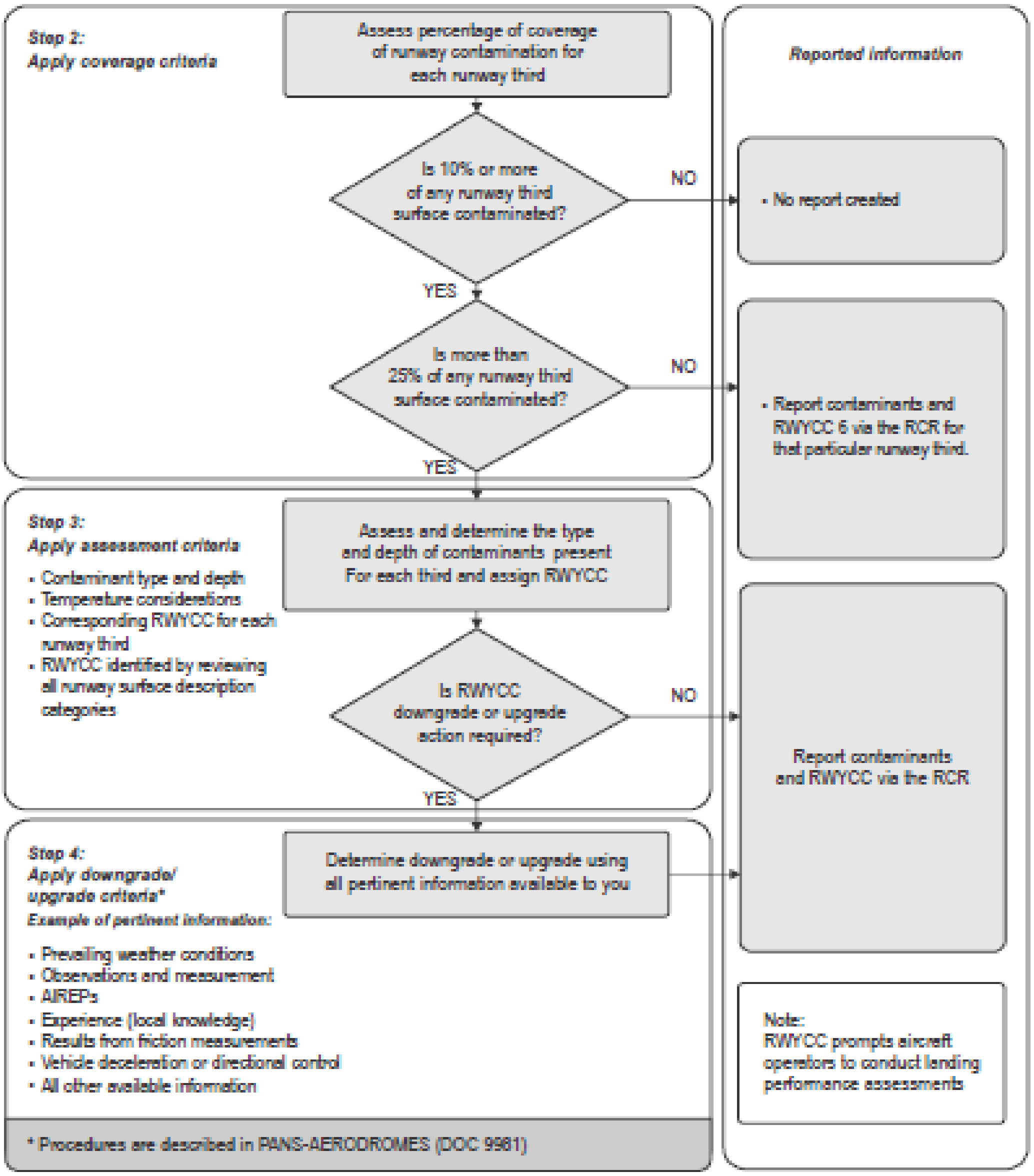
APPENDIX 11 - A GENERIC RUNWAY CONDITION ASSESSMENT PROCESS



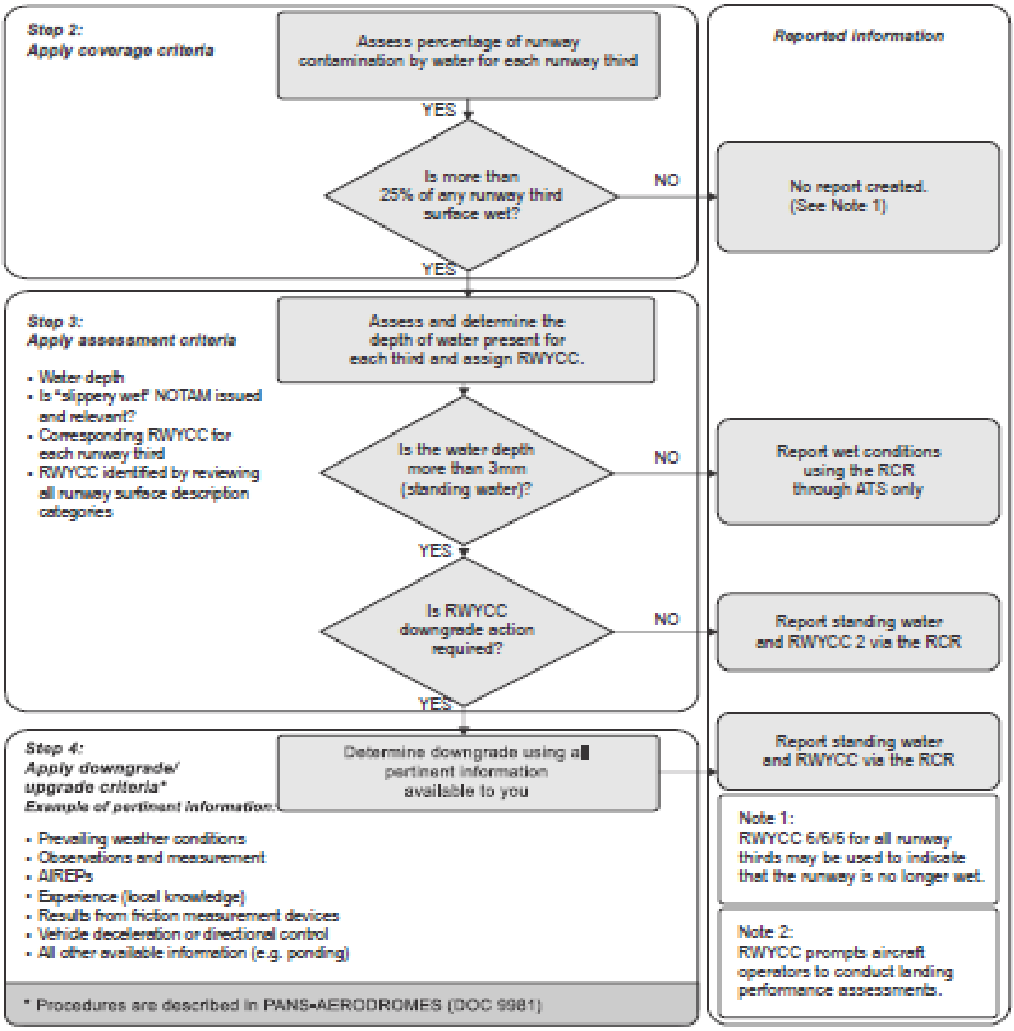
APPENDIX 12 - A BASIC RCAM FLOWCHART PROCESS



APPENDIX 13 - FLOWCHART A



APPENDIX 14 - FLOWCHART B



APPENDIX 15 - RCAM – WET AND DRY ONLY

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		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		Braking 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