ICAO Global Reporting Format
Introducing Reporting of Runway Condition Relevant for Aircraft Performance

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GRF Workshop, Helsinki
28 January 2020
ICAO Friction Task Force Jobcard

**PART I**

<table>
<thead>
<tr>
<th>Category</th>
<th>Safety</th>
<th>Sustainability</th>
<th>Implementation</th>
<th>Reference: AP001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title</td>
<td>Assessment and reporting of runway surface conditions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proposed by</td>
<td>Secretariat/WG-PDP</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Problem Statement**

Runway surface conditions have contributed to many safety events and investigations have revealed shortfalls in the accuracy and timeliness of assessment and reporting methods currently provided for in ICAO provisions and guidance material.

**Specific Details (including impact statements)**

While techniques for the measurement of runway friction provide useful information for runway surface friction maintenance purposes, they are not suitable in all weather conditions where the runway is contaminated and the information used in reports could be misleading to pilots. Reports used by pilots need to be based on an understanding of the performance of the runway surface that is relevant to both airport operations and aircraft use. It is therefore necessary to incorporate current guidance to pilots.

**PART II**

<table>
<thead>
<tr>
<th>Rating</th>
<th>High</th>
</tr>
</thead>
</table>
| Rationale for acceptance/rejection | Current work program pending PANS-Aerodromes and PANS-ATM
| Action already in progress | Current work program pending PANS-Aerodromes and PANS-ATM
| Interdependencies/References | AN-WP/8571-PD
| Required Action | Proposed amendments to Annex 14 Volume 1 and other related Annexes. Proposed amendments to PANS-Aerodromes and PANS-ATM

**Timescales (for deliverable)**

- Q2/2014
- Q2/2015
- Q2/2015
- Q1/2016
- Q2/2015
- Q1/2016

...need reports that are directly related to the performance of the aircraft.
Effect of Runway Condition on Aircraft Performance

- Macrotexture
- Contamination
- Rutting
- Water accumulation
- Rubber
- Microtexture
Effects on Performance

Braking Performance reduced
- Wheel to ground friction
- Aquaplaning

Acceleration reduced
- Contaminant drag
Performance Relevant Reporting

The Operational Need
- What is on the runway?
- Does it cover a significant portion?
- How deep is it?
- Are in-built qualities of the surface deficient?

The Assessment and Reporting Method
- The essential information
- Updated according relevant criteria
- When there is a significant change
End to End System

Common Language
Contaminant Types
Runway Condition Codes
Direct Input to Performance Assessment

Performance Relevance
Depth Thresholds & Temperatures
Significant Changes
ICAO Provisions

Standards and Recommended Practices
• Annex 14, Volume 1: fundamental provisions for assessing and reporting runway surface conditions
• Annex 6, Parts I and II: assessment by the pilot-in-command of the landing performance and report of pilot observations
• Annex 8: information provided by the aircraft manufacturers;
• Annex 3: removal of the runway state group for METAR/SPECI
• Annex 15: syntax and format used for dissemination

Procedures
• PANS-Aerodromes: reporting procedures and RCAM
• PANS-ATM: phraseology and communication of special air-reports concerning runway braking
• PANS-AIM: report syntax

Guidance material
- Aeroplane Performance Manual (Doc 10064)
- Circular 355 Assessment, Measurement and Reporting of Runway Surface Conditions
Aerodromes – Annex 14

- New set of **Definitions**, including
  - Runway Condition Assessment Matrix (RCAM)
  - Runway Condition Code (RwyCC)
  - Runway Surface Descriptors
- Mandate reporting whenever significant conditions or changes thereof occur
  - List of contaminant restricted to those with known performance effect
  - Wet must be reported but may not use Special NOTAM
  - Slippery When Wet must be reported but continues to use NOTAM instead of ad-hoc
  - Winter runway treatment is reported for situational awareness only
  - Friction measurement may not be sole criterion for RwyCC and should not be reported
- Runway inspector training becomes Standard
- Quantitative information on functional and operational friction is deleted or becomes guidance
Aerodromes - PANS

- Reporting of Runway Condition Codes (RWCCs)
- Reporting of conditions by runway thirds
- Identification of contaminated conditions based on
  - Coverage: 25% of a runway third
  - 3mm or more for fluid contaminants
- Definition of significant changes
  - Change of RWYCC
  - Significant change in depth specified for each contaminant
- Definition of Information string and its format
- Runway Condition Assessment Matrix (RCAM)
- Identification of Situational Awareness items
  (reduced LDA, drifting snow, snow banks, treatment)
The Runway Condition Report

• Aircraft Performance Section (mandatory)
  – Airport Designator
  – Assessment Date and Time
  – Lower Runway Designator
  – RWYCC per third
  – Coverage per third
  – Depth of contamination per third
  – Contaminant type per third
  – Width for which assessment of RWYCC applies

• Situational Awareness Section (optional)
  – Reduced Runway length
  – Drifting Snow
  – Loose Sand
  – Chemical Treatment
  – Snowbanks on Runway
  – Snowbanks on Taxiway
  – Snowbanks adjacent to Runway
  – Taxiway Conditions
  – Apron Conditions
  – Measured Friction
  – Free-text Remarks

GG EADBDQZX EADNZQZX EADSZQZX
070645 EADDYNYX
SWEA0151 EADD 02170055
SNOWTAM 0151
EADD 02170055 09L 5/5/5 100/100/100 NR/NR/NR WET/WET/WET
EADD 02170135 09R 5/2/2 100/50/75 NR/06/06 WET/SLUSH/SLUSH
EADD 02170225 09C 2/3/1 75/100/100 06/12/12 SLUSH/WET SNOW/WET SNOW 30
RWY 09L SNOWBANK R20 FM CL. RWY 09C ADJ SNOWBANKS. TWY B POOR. APRON NORTH POOR.
Circular 355

- Guidance material primarily written for airport operators
- Historical and Technical Background
  - Runway Characteristics
  - Impact on Aircraft Performance
- Runway Condition Reporting Concept and Methodology
  - Adapted formats of the Runway Condition Assessment Matrix (RCAM)
  - Rationale for criteria and thresholds
  - Downgrading and Upgrading of RWYCCs
  - Flowcharts
- Information Dissemination
- Friction Measurement
- Operational Hazards
### The Assessment Process

#### RUNWAY CONDITION REPORT (RCR)

<table>
<thead>
<tr>
<th>Information</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerodrome location indicator</td>
<td>ICAO Doc 7910, Location Indicators</td>
</tr>
<tr>
<td>Date and time of assessment</td>
<td>UTC time</td>
</tr>
<tr>
<td>Lower runway designation number</td>
<td>Actual runway (RWY)</td>
</tr>
<tr>
<td>RWYCC for each runway third</td>
<td>Assessment based upon RCAM and associated procedures</td>
</tr>
<tr>
<td>Per cent coverage contaminant for each runway third</td>
<td>Visual observation for each</td>
</tr>
<tr>
<td>Depth of loose contaminant for each runway third</td>
<td>Visual observation assessment confirmed by measurement</td>
</tr>
<tr>
<td>Condition description (contaminant type) for each runway third</td>
<td>Visual observation for each</td>
</tr>
<tr>
<td>Width of runway to which the RWYCCs apply if less than published width</td>
<td>Visual observations while from local procedures/snow removal</td>
</tr>
</tbody>
</table>

**Assessment… NOT Measurement**

**Visual Inspection is the primary tool**
Meteorology – Annex 3

- Removal of METAR/SPECI runway state group (MOTNE)
Phraseology – Annex 11 & PANS ATM

• Doc 4444
  – Integration of Pilot Reports of Braking Action into existing mechanism of AIREPs
  – Creation of Phraseology for Tower reports of runway condition using Information String and plain language
AIS/ATM – Annex 15

- Replace SNOWTAM with new special NOTAM
- Clear format and syntax
- Report validity period 8hrs

### SNOWTAM FORMAT

Source: Procedures for Air Navigation Services — Aeronautical Information Management (PANS-AIM, Doc 10066)

(see Chapter 5, 5.2.5.1.5)

(applicable 5 November 2020)

<table>
<thead>
<tr>
<th>(COM leading)</th>
<th>(PRIORITY INDICATOR)</th>
<th>(ADDRESSES)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(DATE AND TIME OF FILING)</td>
<td>(ORIGINATOR'S INDICATOR)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(Alphabetic heading)</th>
<th>(SWAA* SERIAL NUMBER)</th>
<th>(LOCATION INDICATOR)</th>
<th>DATE/TIME OF ASSESSMENT</th>
<th>(OPTIONAL GROUP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNOWTAM (Serial number)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Aeroplane performance calculation section**

- (AERODROME LOCATION INDICATOR) M A)
- (DATE/TIME OF ASSESSMENT (Time of completion of assessment in UTC)) M B)
- (LOWER RUNWAY DESIGNATION NUMBER) M C)
- (RUNWAY CONDITION CODE ON EACH RUNWAY THIRD) (From Runway Condition Assessment Matrix (RCAM) 0, 1, 2, 3, 4, 5 or 6) M D) / /
- (PER CENT COVERAGE CONTAMINANT FOR EACH RUNWAY THIRD) C E) / /
- (DEPTH (mm) OF LOOSE CONTAMINANT FOR EACH THIRD OF RUNWAY) C F) / /
- (CONDITION DESCRIPTION OVER TOTAL RUNWAY LENGTH) (Observed on each runway third, starting from threshold having the lower runway designation number) M G) / /
Airworthiness – Annex 8

• Option for takeoff performance on contaminated runway
• Mandate split of landing performance information into
  – At Time of Takeoff data (dispatch)
  – At Time of Landing data (in-flight)
• New At Time of Landing Distances shall reflect real operating practices
• Both types of landing distances may be provided for contaminated runways
Operations - Annex 6

- For large and small airplanes
- Mandate AIREP when conditions worse than reported
- Mandate in-flight check with appropriate margin before starting approach
Aeroplane Performance Manual

- Introduction to Operations on Contaminated Runways
- 4 Flight-Phase oriented Chapters
  - Take-off
  - En-Route
  - Landing
  - Missed Approach

- Clear Focus on GRF

- Other information considered as non-controversial
- Based on existing national guidance and practices

- Still under Review by Ops Section
Chapter on Operations On Contaminated Runways

- Description of the RCR for Operators and Pilots
- Introduction to the Assessment Process applied by the Aerodrome
- Description and use of the RCAM and RWYCC
- Considerations for making AIREPs of Braking Action
- Training Syllabus
• Derivation of Landing Performance Data for Time of Arrival
• Publication of Data and Limitations
• Fallback Generic Factors in case no Data is provided by the Manufacturer
• Regulatory background
• Considerations for Performance Assessment in Approach Preparation
• Considerations for Flight Crew
• Pilot Procedures for Landing on Length-Limited Runways
Guidance for Manufacturers

- Publish Operational Landing Distances
  - “Minimum” Compliance with principles
  - Cover all 6 friction levels
  - Introduce Accountability for
    - Temperature effect
    - Runway slope effect
    - Approach speed increment effect
**No Margin**
- DRY
- WET
- WATER
- SLUSH
- SNOW
- ICE

**15% Margin**
- DRY
- GOOD
- GOOD TO MEDIUM
- MEDIUM
- MEDIUM TO POOR
- POOR

**V_{REF}**

**V_{TD}**

**V_{APP}**

**Stop**
ICAO Doc 10064 Aeroplane Performance Manual

- Provides the effective wheel to ground coefficient for each RWYCC
- Not specific to an individual aeroplane
- Adaptable to the anti-skid system type
- Ensures harmonized Landing Distances at Time for Arrival between all types

<table>
<thead>
<tr>
<th>RWYCC</th>
<th>Runway Surface Condition Description</th>
<th>Pilot-Reported Braking Action</th>
<th>Wheel Braking Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>DRY</td>
<td>Good</td>
<td>0.20^3</td>
</tr>
<tr>
<td>5</td>
<td>WET (the runway surface is covered by any visible dampness or water up to and including 3mm deep.) SLUSH (up to and including 3mm depth) DRY SNOW (up to and including 3mm depth) WET SNOW (up to and including 3mm depth)</td>
<td>Good</td>
<td>0.16^3</td>
</tr>
<tr>
<td>4</td>
<td>COMPACTED SNOW (outside air temperature minus 15 degrees Celsius or below)</td>
<td>Medium to Poor</td>
<td>0.20^3</td>
</tr>
<tr>
<td>3</td>
<td>DRY SNOW (more than 3mm depth) WET SNOW (more than 3mm 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)</td>
<td>Medium to Poor</td>
<td>0.20^3</td>
</tr>
<tr>
<td>2</td>
<td>STANDING WATER (more than 3mm depth) SLUSH (more than 3mm depth)</td>
<td>Medium to Poor</td>
<td>0.20^3</td>
</tr>
<tr>
<td>1</td>
<td>NOT</td>
<td></td>
<td>0.07^3</td>
</tr>
</tbody>
</table>

\( \text{Note:} 90 \text{ per cent of certified value used to comply with Annex 8 Part IIB 2.2.7 e})^1\)

Per method defined in Note 2 below.
ICAO Doc 10064 Aeroplane Performance Manual

- Provides the effective wheel to ground coefficient for each RWYCC
- Not specific to an individual aeroplane
- Adaptable to the anti-skid system type
- Ensures harmonized Landing Distances at Time for Arrival between all types
- Based on existing EASA guidance on contaminated runway friction from historic flight tests
Runway Condition Code – Direct Input to Landing Distance Computation

<table>
<thead>
<tr>
<th>Runway condition code</th>
<th>6 - DRY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>reverse thrust, manual landing tailwind, VAPP=VLS without APPR COR.</td>
</tr>
<tr>
<td></td>
<td>Corrections on Landing Distance (ft)</td>
</tr>
<tr>
<td>6-DRY</td>
<td>FULL</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5 - GOOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correction on Landing Distance (ft)</td>
</tr>
<tr>
<td>5-GOOD</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4 - GOOD TO MEDIUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correction on Landing Distance (ft)</td>
</tr>
<tr>
<td>4-GOOD TO MEDIUM</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3 - MEDIUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correction on Landing Distance (ft)</td>
</tr>
<tr>
<td>3-MEDIUM</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2 - MEDIUM TO POOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correction on Landing Distance (ft)</td>
</tr>
<tr>
<td>2-MEDIUM TO POOR</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1 - POOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correction on Landing Distance (ft)</td>
</tr>
<tr>
<td>1-POOR</td>
</tr>
</tbody>
</table>

Select runway condition from list:
- 6-Dry
- 5-Good
- 4-Good to medium
- 3-Medium
- 2-Medium to poor
- 1-Poor
Chapter on the Situation for Takeoff

- RWYCC provides information on friction only
- At takeoff fluid contaminants generate drag
  - Displacement
  - Compression
  - Impingement
- Takeoff can be limited by
  - Distance needed to accelerate to lift-off speed
  - Distance needed to accelerate to decision speed V1 and come to full stop on available runway
- Contaminant drag must be accounted for in takeoff computations

Takeoff computation must be done for prevailing contaminant!
Takeoff
Computation with Contaminant Type and Depth
Takeoff
Computation with Contaminant Type and Depth

- Typical manufacturer data certified to CS25 pre-Amdt 2 does not cover many contaminants in the RCAM
  - Missing:
    - Frost
    - Dry Snow
    - Wet Snow
    - Compacted Snow at OAT above -15°C
    - Slippery When Wet
    - Ice Cold & Dry

- APM offers advice on how to compute for missing contaminants conservatively
Takeoff
Computation with Downgraded RWYCC

APM recommends “to delay take-off. However, [...] it may be sufficient to determine performance in nominal conditions and to adopt appropriate operational procedures such as considering reduced crosswind limits, using the full length of available runway and avoiding rolling take-off.”
A) ENNK
B) 11 JAN 2013 04:43
C) 01 F) 379/379/379 G) XX/XX/XX H) 3/4/4
N) C/CLSD ALL REMAINING TWYS/379
R) APRON B/CLSD ALL REMAINING APRONS/379
T) CONTAMINATION/100/100/100/PERCENT. SAND APPLIED.

Landing Performance Level
Direct input into Assessment
At Time of Arrival

ENCN 09111400 09L 3/3/2 25/50/50 05/05/02 DRY SNOW/WET SNOW/WET SNOW 30.
DRIFTING SNOW. RWY 09L CHEMICALLY TREATED. TWY B POOR
Thank you