



AN ANALYSIS OF THE OBSERVATIONS AND EXPERIENCES IN REGARD TO THE NEW FORMAT OF SNOWTAM REPORT

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Abstract

This paper presents a new ICAO methodology for assessing and reporting runway surface conditions, commonly known as the Global Reporting Format (GRF) and its impact on flight crews and airline operation. It explains the background of the system and its effect on safe operation. Furthermore, it compares the current format of the SNOWTAM message with the old one applicable until November 2021. It also presents research which aims to enhance winter operations safety by gathering observations and experiences with the new format of a SNOWTAM report applicable as of 2021. The paper points out the experiences of flight crews gathered with a survey created by the author of this thesis. It also summarises the impact of the new methodology on airplane performance calculations backed by the research. The new system is expected to provide better understanding of the runway situation and give clearer information about contamination of the movement area.

Keywords

SNOWTAM, GRF, winter operation, RWY conditions

1. INTRODUCTION

International Civil Aviation Organisation (ICAO) considers runway safety as one of the top three priorities in their safety program. The goal is to reduce a number of runway (RWY) excursions. Roughly 90% of such incidents occur on contaminated runways, where the RWY is slippery because of wetness, snow, slush, or ice [1].

ICAO introduced a new methodology of Global reporting format (GRF) which replaced existing system of reporting runway conditions from November 2021. The new system covers new methods for assessing and reporting runway surface conditions. The introduction of GRF represents a source of change to each State's aviation system [2].

2. WINTER OPERATIONS

Winter and snow can be a source of frustration to airports, crew, and passengers. Beside snow coverage on ground, ice on the wing can reduce lift by as much as 30% and increase drag by up to 40%. This can result in a significantly negative impact during the takeoff roll [3].

2.1. Runway excursion

Furthermore, contamination on airport RWY and taxiways (TWY) causes increased drag on aircraft wheels when taxiing and reduces braking effects. During landing, the necessary distance to stop the plane is extended, while the braking can be different compared to dry RWY [4]. It is therefore the duty of airport operators to keep these areas clean, without any visible dampness.

A runway excursion is defined as a "veer off or overrun of the runway surface", which can happen during landing or take off [5].

The International Air Transport Association (IATA) has performed a study of incident and accident. They reported that between 2005 and the first half of 2019, 23 percent (283) of accidents in IATA's global accident database involved a runway excursion [6].

European manufacturer Airbus has developed the Runway Overrun Prevention System (ROPS) as a response to runway overrun events during the landing phase. ROPS takes into consideration external elements, such as change of wind velocity and direction, and evaluates whether the aircraft can safely brake on the remaining length of the runway [7].

Technological development can easily help pilots to understand the runway situation and adjust their decisions during final approach segment.

2.2. Runway contamination and Snowplan

ICAO defines runway surface conditions in document PANS-Aerodromes (Doc. 9981) as well as ICAO Annex 14 – Aerodromes.

- 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. A runway is considered wet when it is covered by any visible dampness or water that is 3 mm or less in depth.
- 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 runway surface condition descriptors.” [8]

Airport operators have to be ready for winter operation as well as flight crew. The winter organization and airports Snowplan have to prioritize the cleaning procedures in coordination with air traffic control services [4].

The new runway condition reporting and assessment format, based on a series of recommendations from ICAO, has brought fundamental changes to the reporting of the surface condition of the airport’s moving areas throughout the entire year. It is because the new methodology describes the assessment of not only runways contaminated by snow and ice, but also wet runways contaminated by standing water. This addition can create better view on situation at the airport for flight crews when receiving the condition report [8] [9].

3. GLOBAL REPORTING FORMAT

The GRF is intended to cover conditions found in all climates. It provides a means for aerodrome operators to assess runway surface conditions rapidly and correctly, whether they are exposed to wet runway conditions, snow, slush, ice, or frost, including rapidly changing conditions, such as those experienced during winter or in tropical climates [2].

The new methodology was introduced by the adoption of Amendment 39 to ICAO Annex 15 issued on 1 April 2016 with the effective date of 11 July 2016. The second part of the amendment (39B - about new SNOWTAM format) is applicable as of 4 November 2021 [10]. The original date was supposed to be set a year earlier, but due to the COVID-19 pandemic ICAO adopted amendments on the postponement of the applicability date, from 5 November 2020 to 4 November 2021 [11].

European Union Aviation Safety Agency (EASA) issued a regulation aimed at ensuring the adoption of the new GRF methodology at an earlier date. The GRF related requirements applied in European Union as of 12 August 2021. EASA wanted to prepare flight crews for the new system gradually by adopting GRF during the summer season so operators will be fully prepared when winter in Europe will fully start [12].

In the Slovak Republic, the GRF methodology together with the new SNOWTAM report format has been implemented on 12 October 2021 [13].

3.1. Background

In 2016 ICAO reported 59 accidents, of which more than half were due to runway excursions. The catalyst for the change of the reporting system started with the overrun of a Southwest Airlines 737 in December 2005. Boeing 737-700 was preparing to land at Chicago Midway International Airport during a snowstorm. From reading the investigation report, the initial touchdown went as expected, but it quickly became apparent that the aircraft was not decelerating as expected even though snow cleaning was reported as completed [5] [14].

During an investigation in 2006, the Federal Aviation Administration (FAA) formed the Take-off and Landing Performance Assessment Aviation Rule-making Committee (TALPA ARC) to address and properly investigate runway

overruns. The core outcome was the Runway Condition Assessment Matrix (RCAM). In 2008 ICAO established the Friction Task Force which aimed to cooperate with TALPA ARC and create new system for assessing and reporting runway conditions [15].

New changes became applicable by the beginning of 2016 when airline manufactures started to implement Take-off and Landing Performance Assessment charts (TALPA) to help pilots understand the runway situation and different methods of braking action assessments [15].

3.2. Assessment of RWY condition

An aerodrome operator has to assess the runway surface conditions, including contaminants, for each third of the runway length, and report it by mean of a uniform runway condition report (RCR). The information received via RCR is than published to end users by Aeronautical information services (AIS) in SNOWTAM report format or distributed by Air Traffic Services (ATS) by Automatic Terminal Information Service (ATIS) or radio [9] [16].

The RCR should give a complex picture of the situation on moving areas on a given aerodrome. Because of that the report is divided into two sections:

- Aeroplane take-off and landing performance calculations.
- Situational awareness of the surface conditions on the runway, taxiways, and aprons [16]

New RCR shall be established when a significant change in runway surface condition occurs due to water, snow, slush, ice, or frost. A runway is also considered contaminated when more than 25% of the surface (whether in isolated areas or not) is covered by one of the following contaminants:

- Standing water, slush, loose snow with depth of 3mm or more
- Compacted snow
- Ice, including wet ice [9]

The methodology for reporting and assessing runway surface conditions include eight descriptors, which can be presented on the runway surface:

- Compacted snow
- Dry snow
- Frost
- Ice
- Slush
- Standing water
- Wet ice
- Wet snow

These contaminants can be presented either alone or combined with each other. The RCR is a validated method that replaces subjective judgements with objective assessments. All of the

assessments done by trained professional aerodrome personnel are done visually and no special equipment is needed [9].

During the assessment of runway surface conditions, the airport operators should use a tool called Runway Condition Matrix (RCAM) to help them either assess the required criteria or downgrade the existing assessment [17].

The RCAM compares a runway surface descriptor presented on the RWY with its depth and outside temperature and gives an adequate Runway Condition Code (RWYCC). Each RWYCC is directly connected to a pilot report of runway braking action previously measured by special equipment (Fig. 1). The RWYCC code designation ranges from 0 to 6, where 6 represents the best runway conditions and 0 the worst [9] [17].

Table 1 - RWYCC compared to pilot braking action [17]

<i>Pilot report of runway braking action</i>	<i>Runway condition code (RWYCC)</i>
N/A	6
GOOD	5
GOOD TO MEDIUM	4
MEDIUM	3
MEDIUM TO POOR	2
POOR	1
LESS THAN POOR	0

By introducing the new methodology, the ICAO wants to increase safety at airports and provide flight crews with better information about the current state of airport movement areas. The ICAO member states had to implement the new GRF system into their national regulations to reflect the possible pitfalls of winter operations in the given country.

4. SNOWTAM REPORT

For better understanding of available information about contaminated areas at the aerodrome, ICAO had to establish a unified reporting system. In 1967 ICAO published a tenth Amendment to Annex 15 for the first time specifying Snowplan and definition for the SNOWTAM report. The SNOWTAM was applicable since 8 February 1968 and no major changes had been implemented until 2016 with introduction of the new GRF methodology [18].

4.1. Old format

Old SNOWTAM format was applicable until 3 November 2021. "A special series NOTAM notifying the presence or removal of hazardous conditions due to snow, ice, slush, or standing water associated with snow, slush and ice on the movement area, by means of a specific format." [18]

Old format report was valid for 24 hours and divided into 17 items labeled with letters A to T. Items A and B formed heading and introduction for the given SNOWTAM message. Items C to M described the runway condition and the following items (N - T) referred to the remaining movement areas of the airport. Runway conditions were reported for each third of the RWY and

type of deposit was published in coded language using numbers [19].

The information published in the SNOWTAM report, especially the type of deposit and the braking action, were used by the pilots to calculate the performance of the airplane. The Onboard Performance Tool system (OPT) from the manufacturer Boeing is used to calculate the performance, which can provide flight crews with the necessary calculations for landing and takeoff in real time according to the actual conditions at the airport [20].

4.2. New format

In April 2016 the ICAO published an amendment of regulation Annex 15, Appendix 39. Second part (39B) presents new format of SNOWTAM report applicable as of 4 November 2021 [10].

"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." [18]

The SNOWTAM report is part of the new global methodology GRF applicable in European Union as of August 2021 [21].

The introduction of the new SNOWTAM report aims to simplify the report itself and thus speed up its deciphering by the flight crews during the flight. The validity of the new SNOWTAM report is 8 hours compared to 24 hours in the old format applicable until November 2021. New SNOWTAM should be published every time an aerodrome operator publishes a new RCR report.

New SNOWTAM should also be published when there is a significant change in in the runway surface condition in RCR.

"A change is considered significant whenever there is:

- a) any change in the RWYCC
- b) any change in contaminant type
- c) any change in reportable contaminant coverage
- d) any change in contaminant depth according to attached table (Fig. 2)
- e) any other information, for example a pilot report of runway braking action, which according to assessment techniques used, are known to be significant." [17]

Table 2 - Assessment of depth for different types of deposits [17]

<i>Contaminant</i>	<i>Valid values to be reported</i>	
	<i>reported</i>	<i>Significant change</i>
STANDING WATER	04, then assessed value	3 mm up to and including 15 mm
SLUSH	03, then assessed value	3 mm up to and including 15 mm
WET SNOW	03, then assessed value	5 mm
DRY SNOW	03, then assessed value	20 mm

The new SNOWTAM is divided into two sections same as RCR. First section should help pilots to get their aeroplane performance calculations and second section should give them situational awareness around the aerodrome itself [10] [17].

The letters used to indicate items are only used for reference purpose in new format and should not be included in the messages. Each item also includes additional letter that mark the usage and information – M (mandatory), C (conditional) and O (optional) [19].

The new SNOWTAM does not include estimated braking action, but the item is replaced by RWYCC derived from RCAM. For this reason, TALPA conversion charts have been upgraded by airlines to help flight crews correctly assign the RWYCC code to individual braking effects. The new format also includes a number identifying the percentage coverage of a contaminant for each runway third [17].

5. RESEARCH

A part of the paper is also research which aims to enhance winter operations safety; gather observations and experiences with the new format of a SNOWTAM message applicable as of November 2021.

The author created a survey for pilots only. The survey compares old and new SNOWTAM format from different angles. It mainly focused on new changes such as RWYCC and percentage coverage of a contaminant on RWY and its impact on airplane performance calculations.

As of now, there has already been two winter seasons worldwide using the new methodology GRF for assessing and reporting runway conditions. The goal is to show whether ICAO made a good decision in creating this new methodology and whether pilots find the new system better to understand and easier to work with.

The survey had been distributed to different airline companies in Europe such as Smartwings, Air Explore, Norwegian and Finnair. A goal was to gather observations and feedback on the topic of the new SNOWTAM report and find out how flight crews understand these changes, whether their companies have prepared them correctly and whether they think that the new methodology will help to enhance safety.

We gained responses from 112 flight crew members from the entire world. Most of the pilots - 79,5% are full time employment pilot, 16,1% of the respondents are still in training and 4,5% of the pilots fly as a hobby pilot (private pilots). Overall, they found out new system to be clearer compared to old SNOWTAM format (88,4% - 99 pilots) and about half of the respondents (57,1%) would choose new RWYCC as a single item to help them easily understand the runway situation. About 34,8% (39 pilots) would choose old braking action and the rest would either choose both, neither of these two or some other information in SNOWTAM report.

A part of the research project also to gained observations and feedbacks from airport operators. We addressed 5 operators in Slovak Republic and 4 operators in Czech Republic and gained answers from all of them. They found out new GRF system to be less precise compared to old one, mainly because of the absence

of a braking action which is measured only for conformity of visual assessment and not even published in SNOWTAM report.

6. CONCLUSION

Contaminated movement areas cause irregular operations at airports, which represent losses for airlines. Inappropriate reporting of runway condition can lead to wrong airplane performance calculation and can turn into an incident.

Runway accidents and incidents are aviation's number one safety-related risk category. A primary factor contributing to this risk includes runway excursions during take-off or landing in adverse weather conditions; the runway surface may be contaminated by snow, ice, slush, or water, with a potentially negative impact on an aircraft's braking, acceleration, or controllability. ICAO therefore introduced a methodology to harmonize the assessment and reporting of runway surface conditions.

In 2016 has ICAO introduced new methodology for assessing and reporting runway conditions called Global Reporting Format (GRF). The new system includes new reports such as RCR and changes to format of a SNOWTAM report as well. The GRF methodology should be easier to understand and easier to use compared to old system.

Aerodrome operators will assess runway conditions by visual observations and publish RCR report which is later distributed in form of SNOWTAM to final users. Pilots found out new system to be clearer at the first glance, but it is harder to work with information in new SNOWTAM report in terms of performance calculations. Airport operators found new assessment process to be longer and not coherent and they stated that they found out a lot of differences in EASA, ICAO, and national authority legislative structures.

This creates question whether this worldwide unification actually created united system which is used in a same way all over the world.

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