Turbojet Braking Performance on Wet Runways

Safety Alert For Operators (SAFO)

Presented to: ICAO Asia/Pacific Aerodrome Assistance Working Group

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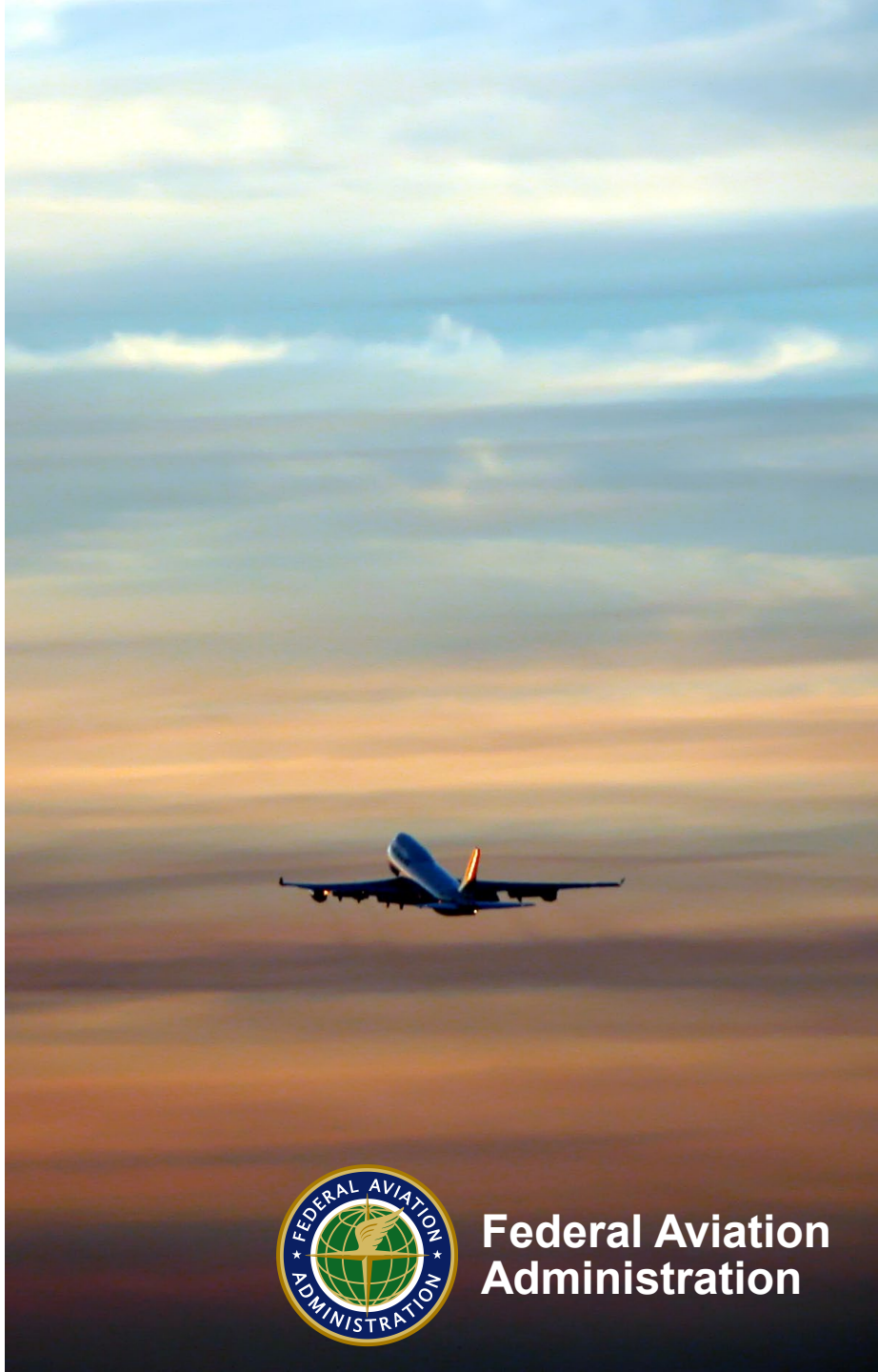

SAFO 19003

U.S. Department
of Transportation
Federal Aviation
Administration

SAFO

Safety Alert for Operators

SAFO 19003
DATE: 7/2/19

Flight Standards Service
Washington, DC

http://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/safo

A SAFO contains important safety information and may include recommended action. SAFO content should be especially valuable to air carriers in meeting their statutory duty to provide service with the highest possible degree of safety in the public interest. Besides the specific action recommended in a SAFO, an alternative action may be as effective in addressing the safety issue named in the SAFO.

Subject: Turbojet Braking Performance on Wet Runways.

Purpose: This SAFO cancels and replaces SAFO 15009 and warns airplane operators and pilots that the advisory data for wet runway landings may not provide a safe stopping margin especially in conditions of Moderate or Heavy Rain.

SAFO 19003 Background

- **Concern:** Several recent landing overruns / incidents during “Wet” runway conditions (grooved and ungrooved).
- **Typical contributing factors:**
  - ✓ long touchdown
  - ✓ improper use of deceleration devices
  - ✓ tailwind
  - ✓ *less available friction than expected*

Background Continued…

- **Analysis:** Braking coefficient of friction was lower then expected. Raising concern over stopping performance assumptions.

- **Challenge:** Determining when the runway condition goes from “Wet” to “Water”.

Runway condition assessment matrix (RCAM)			
Assessment criteria		Downgrade assessment criteria	
Runway condition code	Runway surface description	Aeroplane deceleration or directional control observation	Pilot report of runway braking action
6	• DRY	---	---
5	• FROST • WET (The runway surface is covered by any visible dampness or water up to and including 3 mm depth) ***Up to and including 3 mm depth:*** • SLUSH • DRY SNOW • WET SNOW	Braking deceleration is normal for the wheel braking effort applied AND directional control is normal.	GOOD
4	***−15°C and Lower outside air temperature***: • COMPACTED SNOW	Braking deceleration OR directional control is between Good and Medium.	GOOD TO MEDIUM
3	• WET ("slippery wet" runway) • DRY SNOW or WET SNOW (any depth) ON TOP OF COMPACTED SNOW ***More than 3 mm depth:*** • DRY SNOW • WET SNOW ***Higher than −15°C outside air temperature***[1]: • COMPACTED SNOW	Braking deceleration is noticeably reduced for the wheel braking effort applied OR directional control is noticeably reduced.	MEDIUM
2	***More than 3 mm depth of water or slush:*** • STANDING WATER • SLUSH	Braking deceleration OR directional control is between Medium and Poor.	MEDIUM TO POOR
1	• ICE [2]	Braking deceleration is significantly reduced for the wheel braking effort applied OR directional control is significantly reduced.	POOR
0	• WET ICE [2] • WATER ON TOP OF COMPACTED SNOW [2] • DRY SNOW or WET SNOW ON TOP OF ICE [2]	Braking deceleration is minimal to non-existent for the wheel braking effort applied OR directional control is uncertain.	LESS THAN POOR

SAFO Recommended Action

- **Pilots and Airplane Operators should verify, prior to initiating an approach, that the aircraft can stop within the Landing Distance Available using a RwyCC of “2” whenever there is the likelihood of moderate or greater rain on a smooth runway or heavy rain on a grooved/PFC runway.**

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SAFO 19003 & Airport Operators

- **What does this SAFO mean to Airport Operators?**

- **What can an airport do to help minimize the risk associated with reduced pavement friction performance?**

Airport Operator Actions

- Runway Design
- Runway Maintenance
- Runway Assessments
- Runway Condition Reporting

Runway Design…

- **Properly Designed Pavement (according to standards and recommended practices).**
  - Runway Grooving
  - Proper Drainage (no ponding)
  - Sufficient Runway Length and Width (based on critical aircraft)
  - Adequate pavement load factors
  - Requisite Marking, Lights, and Signs

Runway Maintenance…

- Planned pavement replacement
- Repair of structural pavement failure such as rutting, raveling, cracking, joint failure, settling.
- Other indicators of distressed pavement can also contribute to runway friction losses.
- Routine rubber removal
- Removal of other contaminants- dust particles, jet fuel, oil spillage, water, snow, ice, and slush.

Rubber Removal Frequency

TABLE 4-1. RUBBER DEPOSIT REMOVAL FREQUENCY

NUMBER OR DAILY TURBOJET AIRCRAFT LANDING PER RUNWAY END	SUGGESTED RUBBER DEPOSIT REMOVAL FREQUENCY
LESS THAN 15	2 YEARS
16 TO 30	1 YEAR
31 TO 90	6 MONTHS
91 TO 150	4 MONTHS
151 TO 210	3 MONTHS
GREATER THAN 210	2 MONTHS

Note: Each runway end should be evaluated separately, e.g. Runway 18 and Runway 36.

Runway Assessments…

- Daily visual inspections
- Pilot Reported Braking Assessments
- Macrotexture and Microtexture measurement
- Core sampling
- Non-destructive testing
- Friction Surveys

TABLE 3-1. FRICTION SURVEY FREQUENCY

NUMBER OF DAILY MINIMUM TURBOJET AIRCRAFT LANDINGS PER RUNWAY END	MINIMUM FRICTION SURVEY FREQUENCY
LESS THAN 15	1 YEAR
16 TO 30	6 MONTHS
31 TO 90	3 MONTHS
91 TO 150	1 MONTH
151 TO 210	2 WEEKS
GREATER THAN 210	1 WEEK

Friction Classification Levels

TABLE 3-2. FRICTION LEVEL CLASSIFICATION FOR RUNWAY PAVEMENT SURFACES

	40 mph			60 mph		
	Minimum	Maintenance Planning	New Design/ Construction	Minimum	Maintenance Planning	New Design/ Construction
Mu Meter	.42	.52	.72	.26	.38	.66
Dynatest Consulting, Inc. Runway Friction Tester	.50	.60	.82	.41	.54	.72
Airport Equipment Co. Skiddometer	.50	.60	.82	.34	.47	.74
Airport Surface Friction Tester	.50	.60	.82	.34	.47	.74
Airport Technology USA Safegate Friction Tester	.50	.60	.82	.34	.47	.74
Findlay, Irvine, Ltd. Griptester Friction Meter	.43	.53	.74	.24	.36	.64
Tatra Friction Tester	.48	.57	.76	.42	.52	.67
Norsemeter RUNAR (operated at fixed 16% slip)	.45	.52	.69	.32	.42	.63

Runway Condition Reporting…

- **Wet reporting (RCAM)**
- **Contaminants (RCAM)**
- **Failed friction testing levels (Slippery When Wet).**
- **Change in published runway characteristics (length, width, etc.)**
- **Inoperative lighting, signage, markings**
- **Any potential unsafe condition**

Informational Resources

- **SAFO 19003 - Turbojet Braking Performance on Wet Runways**
  https://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/safo/all_safos/

- **AC 150/5320-12C Measurement, Construction, and Maintenance of Skid- Resistant Airport Pavement Surfaces**
  https://www.faa.gov/airports/resources/advisory_circulars/index.cfm/go/document.current/documentNumber/150_5320-12

- **AC 150/5320-6, Airport Pavement Design and Evaluation**
  https://www.faa.gov/airports/resources/advisory_circulars/index.cfm/go/document.current/documentNumber/150_5320-6

- **AC 150/5380-6, Guidelines and Procedures for Maintenance of Airport Pavements**
  https://www.faa.gov/airports/resources/advisory_circulars/index.cfm/go/document.current/documentnumber/150_5380-6

Comments and Questions?

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Office of Airport Safety & Standards

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