RUNWAY CONDITION ASSESSMENT MATRIX (RCAM)

Development & Background

Presented to: **ICAO SAM Regional Seminar on the GRF for Runway Conditions**

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Federal Aviation Administration

•Regulatory Authorities

- ✈FAA (Airports, Flight Standards, Certification, NOTAMS, Rulemaking, Legal)
- ✈ICAO
- ✈Transport Canada
- ✈Brazilian Certification Authority
- ✈EASA (Limited Participation)

•Other Organizations

- ✈Air Transport Association
- ✈Airline Pilots Association
- ✈Airports Council International
- ✈Allied Pilots Association
- ✈National Air Carrier Association
- ✈National Business Aviation Association
- ✈National Transportation Safety Board
- ✈Neubert Aero Corporation
- ✈Regional Airline Association
- ✈Southwest Airlines Pilot Association
- ✈Allied Pilots Association

•Airplane Operators

•*Part 121*

- ✈ ABX Air
- ✈ Alaska
- ✈ American Eagle
- ✈ American
- ✈ Continental
- ✈ Delta
- ✈ Express Jet
- ✈ Federal Express
- ✈ Northwest
- ✈ Pinnacle
- ✈ Southwest
- ✈ United
- ✈ UPS
- ✈ US Airways

•Airplane Operators

•*Part 91-K/125/135*

- ✈Alpha Flying, Inc
- ✈Bombardier Flexjet
- ✈Chantilly Air
- ✈Flight Works
- ✈Jet Solutions

- ✈Conoco Phillips Alaska
- ✈Net Jets
- ✈Pogo Jet, Inc

•Airports

- ✈Chicago Airport System
- ✈Cherry Capital
- ✈Denver International
- ✈Grand Rapids Regional

- ✈Minneapolis/St. Paul Airport System

•Airplane Manufacturers

- ✈Airbus
- ✈Boeing
- ✈Bombardier
- ✈Cessna
- ✈Eclipse
- ✈Embraer
- ✈Gulfstream
- ✈Hawker

TALPA ARC Recommendations

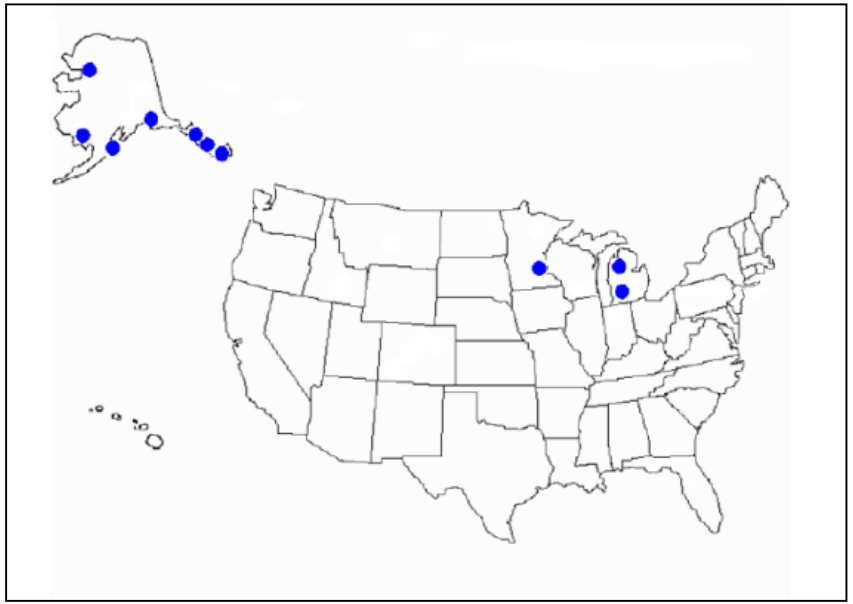
- Methods for assessing runway conditions
- Reporting of runway conditions through airport operators, the NOTAM system, and ATC agencies
- Reporting of braking action by pilots
- Airplane performance data
- Before landing/departing performance assessments
- Standardized condition reports and terminology

RCAM

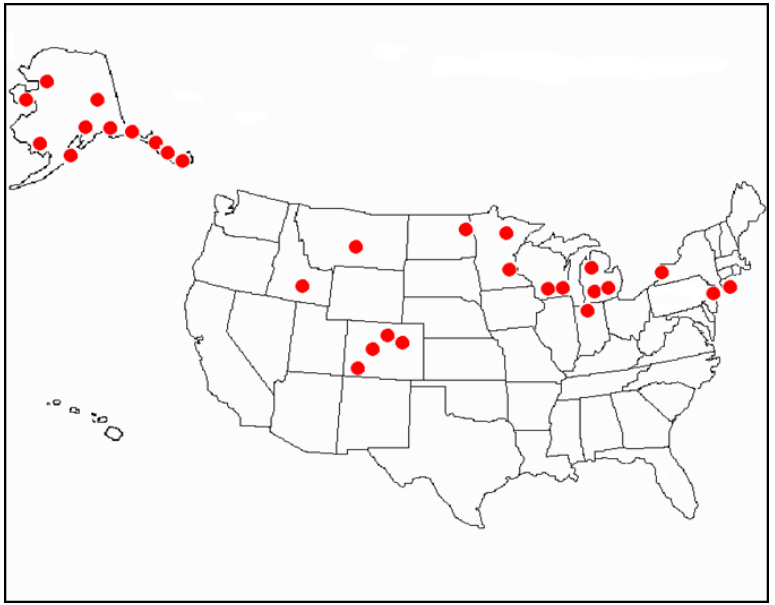
Runway Condition Assessment Matrix

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

First Validation Winter 2009-2010



Second Validation Winter 2010-2011



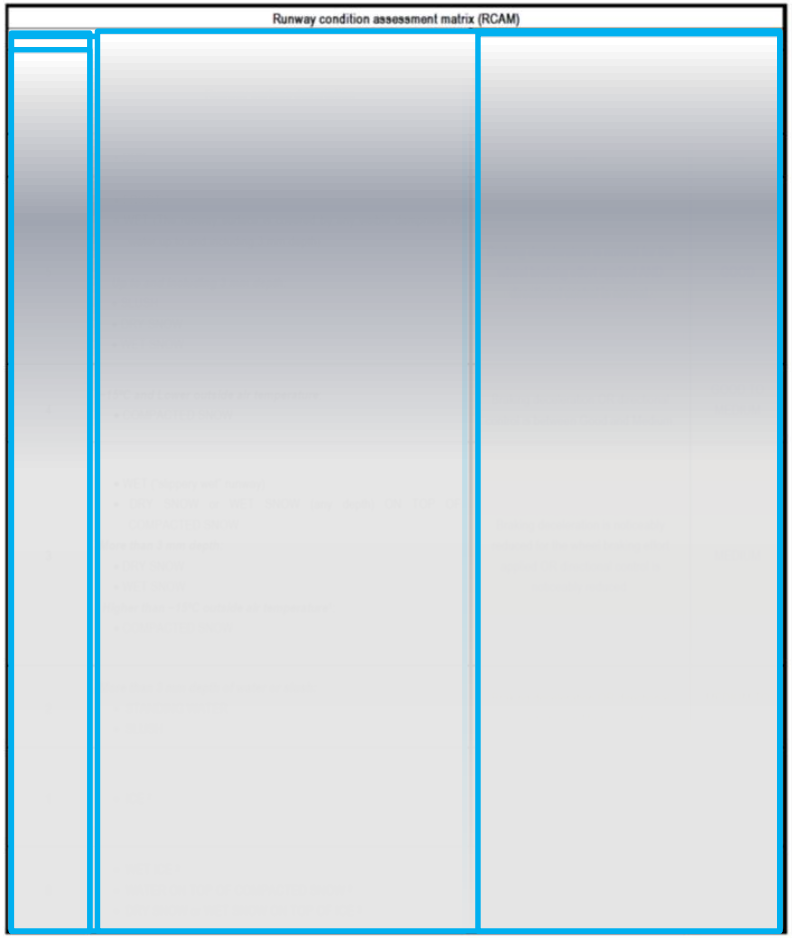
Standardized Contaminant List

DRY
FROST **WET** (the runway surface is covered by any visible dampness or water up to and including 3 mm deep) **SLUSH** (up to and including 3 mm depth) **DRY SNOW** (up to and including 3 mm depth) **WET SNOW** (up to and including 3 mm depth)
COMPACTED SNOW (Outside air temperature minus 15 degrees Celsius and below)
WET ("Slippery wet" runway) **DRY SNOW** (more than 3 mm depth)
WET SNOW (more than 3 mm depth) **DRY SNOW ON TOP OF COMPACTED SNOW** (any depth) **WET SNOW ON TOP OF COMPACTED SNOW** (any depth) **COMPACTED SNOW** (outside air temperature above minus 15 degrees Celsius)
STANDING WATER (more than 3 mm depth) **SLUSH** (more than 3 mm depth)
ICE
WET ICE **WATER ON TOP OF COMPACTED SNOW** **DRY SNOW OR WET SNOW ON TOP OF ICE**

Defined Pilot Reported Braking Action Terminology

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

Components Of The RCAM…

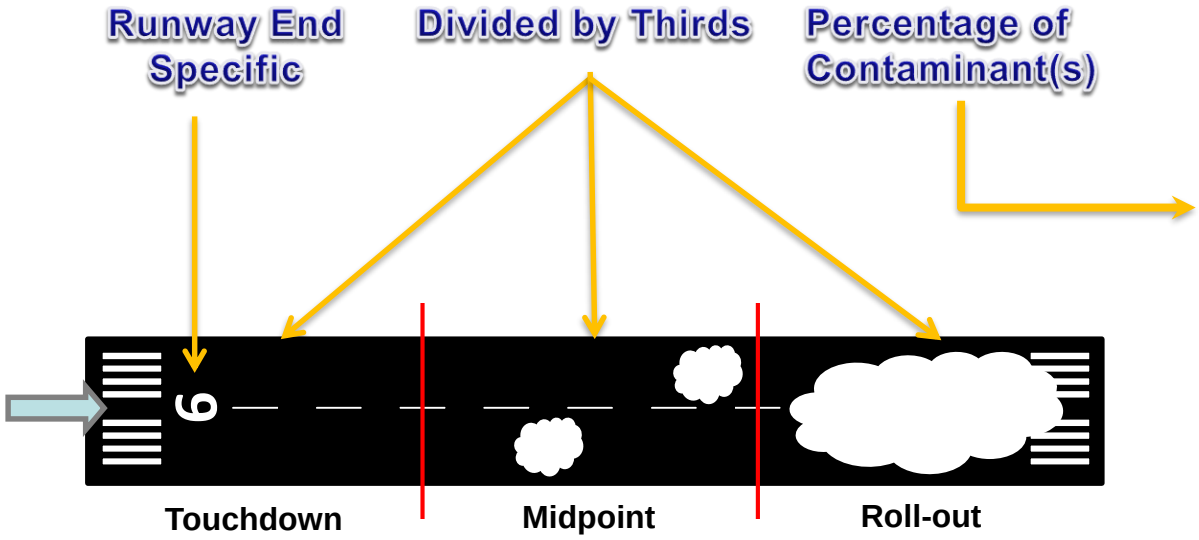


When is the RCAM Applicable?

- **Only on Paved Runways**
  - Not on Turf, Dirt, Gravel, or Water Runways,
- **Runway Condition Codes are NOT generated on Taxiways, Ramps, Heliports, etc…**
- **Codes are generated only when the total runway surface (or cleared width) is contaminated by more than 25%.**

Runway Condition Codes

- **Why is it better than Mu?**
  - Less subjective
  - More substantive
- **What does it mean to the Pilot?**
  - Location, type, and depth of contaminant(s).
  - Estimated aircraft braking action to be anticipated.
  - Calculative performance data.



Coverage	Range
Not Reported	Less than 10%
25%	10% thru 25%
50%	26% thru 50%
75%	51% thru 75%
100%	76% thru 100%

Standards and Guidance Changes

- **Runway closure triggers, friction testing subjectivity**
- **Published Reportable Contaminant List**
- **Standardized terminology and reporting methods**
- **Expanded NOTAM System for filing Field Condition NOTAMs (similar to SNOTAMs)**
  - Sortable FICON Information for end users
  - Domestic and International Compatibility
  - Real-time / Instantaneous reporting.

Standards and Guidance Changes

- **No longer reporting friction values (Mu).**
- **No longer reporting vehicle braking for <u>Runway conditions.</u>**
- **Percentage Based Reporting**
- **Reporting runway conditions in thirds.**

Reporting Airport Condition Information

- **Runway Condition Codes are disseminated via one or more of the following methods:**
  - Federal NOTAM System,
  - Airport Traffic Control Facility (corresponding Tower, Center, Tracon, etc.);
  - Flight Service Station (FSS) (as applicable); and
  - Directly from airport operator via Common Traffic Advisory Frequency (as applicable).

Examples:
Aircraft Operator Side

Airline Operating Manuals

Inflight

5.4.1

RCC		6	5	4	3	2	1
Pressure Altitude Feet	Gross Weight 1000 lb	DRY	GOOD	GOOD to MEDIUM	MEDIUM	MEDIUM to POOR	POOR
Sea Level	100	3770	4330	4990	5590	6140	10260
	110	3880	4460	5220	5820	6480	10720
	120	4070	4670	5450	6050	6830	11180
	130	4230	4860	5680	6280	7170	11640
	137.7	**4360**	**5020**	**5860**	**6460**	**7440**	**12000**
	140	4410	5070	8130	8600	9030	13620
	150	4660	5360	8710	9290	10180	14650
	160	5170	5940	9280	9980	11330	15690
	166.4	5440	6260	9650	10420	12070	16350
2000	100	3890	4480	5430	6070	6920	11180
	110	4020	4620	5660	6300	7260	11640
	120	4220	4860	5890	6530	7610	12100
	130	4390	5050	6120	6760	7950	12560
	137.7	**4530**	**5210**	**6300**	**6940**	**8220**	**12920**
	140	4580	5270	8570	9090	9820	14540
	150	4930	5670	9140	9780	10970	15570
	160	5480	6310	9720	10470	12120	16610
	166.4	5750	6610	10090	10910	12850	17270
4000	100	4030	4630	5870	6560	7700	12100
	110	4170	4790	6100	6790	8040	12560
	120	4380	5040	6330	7020	8390	13020
	130	4560	5250	6560	7250	8730	13480
	137.7	**4720**	**5420**	**6730**	**7420**	**9000**	**13840**
	140	4770	5490	9000	9570	10600	15460
	150	5230	6020	9580	10260	11750	16490
	160	5800	6670	10150	10950	12900	17530
	166.4	6090	7000	10520	11390	13630	18190
6000	100	4170	4800	6300	7040	8480	13020
	110	4330	4980	6530	7270	8830	13480
	120	4550	5230	6760	7500	9170	13940
	130	4750	5460	6990	7730	9520	14400
	137.7	**4920**	**5660**	**7170**	**7910**	**9790**	**14760**
	140	4990	5740	9440	10050	11380	16380
	150	5550	6380	10020	10740	12530	17410
	160	6130	7050	10590	11430	13680	18450
	166.4	6420	7380	10960	11870	14420	19110
8500	100	4360	5010	6850	7640	9460	14170
	110	4540	5220	7080	7870	9800	14630
	120	4780	5500	7310	8100	10150	15090
	130	5010	5760	7540	8330	10490	15550
	137.7	**5250**	**6030**	**7720**	**8510**	**10760**	**15910**
	140	5360	6170	9990	10650	12360	17530
	150	5960	6860	10560	11340	13510	18560
	160	6570	7550	11140	12030	14660	19600
	166.4	6880	7910	11510	12480	15390	20260
VAPP	VLS+10	+ 0	+ 0	+ 357	+391	+587	+541
	VLS+15	+ 0	+ 0	+713	+782	+1173	+1081
per knot of TW		+110	+120	+140	+166	+269	+423
per 10° ABV ISA		+ 0	+ 0	+196	+242	+380	+564
No Reversers		+ 0	+ 0	+575	+759	+828	+2438
Autoland		+ 0	+ 0	+1035	+1058	+ 1208	+ 1173

Airbus ROPS and TALPA

- **In flight, predicted stopping point based on TALPA ARC recommendations**
  - Includes 15% operational safety margin
  - On A350, can select runway condition by either runway surface description or braking action
- **On ground, predicted stopping point transitions to being based on actual deceleration being achieved**
- **In-flight landing distance check required to ensure alerts will not trigger during a normal approach**

RWY CONDITION
Information & selection means

A350 XWB

Destination runway reminder
(cyan if LDG runway ≠ FMS runway

PERF APPR data
If the RWY is unknow, all green values are empty.

Active condition in green

Active condition in amber
if rwy is TOO SHORT.

Multi-condition assessment for the selected runway
Continuous amber/black rubber.

AIRBUS

Comments and Questions?

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Office of Airport Safety & Standards