Runway Condition Assessment Matrix

Minneapolis-St. Paul International Airport’s Perspective

John Ostrom
Manager, Airside Operations
2018

Operations
• 407,476 Operations
• 38,037,381 Passengers
• 17 Airlines

Infrastructure
• 3,000 Acres
• Runways - 4
• Taxiways – 19
• Feeders – 58
• Aprons – 10
• Aircraft Gates - 119
Background/History

Testing/Data Collection 2008-2009 – MSP and TVC

First Validation Winter 2009-2010

Second Validation Winter 2010-2011
2010-2011

- Apprehensive
- Overloaded
- Concerned
- Scared
FAA Guidance

- Operators & Pilots
- Airport Operators
- Air Traffic
- Manufacturers

https://www.faa.gov/about/initiatives/talpa
RCAM Timeline

- Reportable Contaminants in Field Condition (FICON) Notices to Airmen (NOTAMs)
  - 6/7/16
- CertAlert 16-02: Airport Snow and Ice Control Plan Revision and Snow and Ice Control Plan (SICP) template
  - 7/29/16
- Airport Condition Reporting and the Runway Condition Assessment Matrix (RCAM) Video (Version 1 & 2)
  - 8/2/16
  - 8/18/16
  - 9/8/16
  - 9/23/16
  - 9/30/16
- Revised Runway Condition Assessment Tool for Airport Operators
  - 10/1/16
- AC 150/5200-30D, Airport Field Condition Assessments and Winter Operations Safety
- CertAlert 16-04: Informational Webinars on Airport Condition Reporting and the Runway Condition Assessment Matrix (RCAM)
  - 9/8/16
- CertAlert 16-06: Announcement of the Take Off and Landing Performance Assessment (TALPA) Initiative Implementation Date and Time
  - 10/1/16
RCAM Timeline

AC 150/5200-28F, Notices to Airmen (NOTAMs) for Airport Operators

12/30/16

CertAlert 18-07: NOTAM Procedure Awareness Associated with Winter Operations

11/13/18

3/8/17

Change 1 to AC 150/5200-30D, Airport Field Condition Assessments and Winter Operations Safety
<table>
<thead>
<tr>
<th>Runway Condition Description</th>
<th>Code</th>
<th>Vehicle Deceleration or Directional Control Observation</th>
<th>Pilot Reported Braking Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td>6</td>
<td>Braking deceleration is normal for the wheel braking effort applied and directional control is normal.</td>
<td>Good</td>
</tr>
<tr>
<td>Frost</td>
<td>5</td>
<td>Braking deceleration OR directional control is between Good and Medium.</td>
<td>Good to Medium</td>
</tr>
<tr>
<td>Wet (Includes Damp and 1/8 inch depth or less of water)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slush</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry Snow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wet Snow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5°F (-15°C) and Colder outside air temperature:</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compacted Snow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slippery When Wet (wet runway)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry Snow or Wet Snow (Any depth) over Compacted Snow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greater than 1/8 inch (3mm) depth or less of:</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry Snow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wet Snow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greater than 1/8 inch (3mm) inch depth of:</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slush</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greater than 1/4 inch (6mm) inch depth of:</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ice ²</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wet Ice ²</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slush over Ice</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water over Compacted Snow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry Snow or Wet Snow over Ice ²</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/4 inch (6mm) or less of:</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/8 inch (3mm) or less of:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 The condition of the Mu (µ) values with runway conditions and condition codes in the Matrix are only approximate ranges for a generic friction measuring device and are intended to be used only to downgrade a runway condition code; with the exception of circumstances identified in Note 2. Airport operators should use subjective judgment when using friction measuring devices for downgrade assessments, including their experience with the specific measuring devices used.

2 In some circumstances, these runway surface conditions may not be as slippery as the runway condition code assigned by the Matrix. The airport operator may issue a higher runway condition code (but no higher than code 3) for each third of the runway if the Mu value for that third of the runway is 0.40 or greater obtained using a properly operated and calibrated friction measuring device, and all other observations, judgment, and vehicle braking action support the higher runway condition code. The decision to issue a higher runway condition code than would be called for by the Matrix cannot be based on Mu values alone, but all available means of assessing runway slipperiness must be used and must support the higher runway condition code. This ability to raise the reported runway condition code to a code 1, 2, or 3 can only be applied to those runway conditions listed under codes 0 and 1 in the Matrix.

The airport operator must also continually monitor the runway surface as long as the other code is in effect to ensure that the runway surface condition does not deteriorate below the assigned condition. The extent of monitoring must consider all variables that may affect the runway surface condition, including any precipitation conditions, changing temperatures, effects of wind, frequency of runway use, and type of aircraft using the runway. If said or other approved runway treatments are used to satisfy the requirements for issuing this higher runway condition code, the remained monitoring program must confirm continued effectiveness of the treatment.

Caution: Temperatures near and above freezing (e.g., at 26°F (-3°C) and warmer) may cause contaminants to behave more slippery than indicated by the runway condition code given in the Matrix. At these temperatures, airport operators should exercise a heightened level of runway assessment, and should downgrade the runway condition code if appropriate.
2016-2017 Preseason Preparation

- MSP Airport Certification Manual (ACM) Snow and Ice Control Plan (SICP) change by October 1, 2016
- Airlines and ATCT briefings on RCAM
- Airlines expectations and operational impacts
- Staffing matrix changes
  - Runway, Taxiway, NOTAM/FICON Positions
20 Minute Runway Closures
- 15 minutes Plowing
- 5 minutes SFT and SUV

SUV
- Contaminant Type
- Contaminant Depth
- % Coverage

SFT
- Pre-Run Mu values
- Post Run Mu values

All data called in to Ops Center to determine RCCs and then communicated to ATCT when runway is opened.
FAA Digital NOTAM System
FAA Digital NOTAM System

Contaminant Width (Fields Marked * are required)

Width: [ ] FT

Pilot reported braking action information (within the last 15 minutes) (Fields Marked * are required)

Pilot
Reported Braking Action:

Observation Details (Fields Marked * are required)

Observation Time (UTC)*

MM/dd/yyyy [ ] hh:mm [ ] Current Date and Time

Treatment (Fields Marked * are required)

Method 1
Type: [ ] --Select Value--
Width:

Method 2
Type: [ ] --Select Value--
Width:

Remainder (Fields Marked * are required)

Contaminant 1:
Type: [ ] --Select Value--
Depth 1:

Contaminant 2:
Type: [ ] --Select Value--
Depth 2:
FAA Digital NOTAM System
FAA Digital NOTAM System

1. MSP XX/XXX MSP RWY 12L FICON 3/3/100 PCT 6IN DRY SN 1803201932-1803211832

2. XX/XXX NOTAMN
   Q) ZMP/OMR/XX/TV/NBO/A/000/999/4452N09313W005
   A) KMSP
   B) 1903220115
   C) 1903220115
   E) 12L FICON 3/3/100 PCT 6IN DRY SN

3. Issuing Airport: (MSP) Minneapolis-St Paul Intl/Wold-Chamberlain
   NOTAM Number: XX/XXX
   Effective Time Frame
   Beginning: Wednesday, March 20, 2019 1932 (UTC)
   Ending: Thursday, March 21, 2019 1932 (UTC)
   Affected Areas
   Runway: 12L
   Condition: 3/3/100 PCT 6IN DRY SN
March 12, 2017

17:22
- Runway 12R opened
- .5 mile visibility, snowing
- Dry Snow
- <1/8”
- 100% Coverage
- RCC = 3/3/3 (downgraded)
- Mu = 28/24/24

17:39
- PIREP BRA M
- PIREP BRA M-P

17:45
- FedEx 728 requested BRA
- ATC Advised BRA M-P
- ATC advised RCC 1

17:55
- FedEx 728 Diverted to MKE
February 19, 2018

ASRS Report

19:15
- Runway 12L inspected
- Dry Snow
- <1/8"
- 100% Coverage
- 2” windrows
- RCC = 5/5/5
- Mu = 29/29/32

19:49
- ATC advised Ops that Skywest 4796 reported Runway 12L BRAP-N
- Runway 12L closed
- Mu 27/27/27
- Dry Snow
- <1/8"
- 100% Coverage
- 2” windrows
- Would have been 5/5/5
“So far my experience with RCC values has proven them to not be sufficient in evaluating actual runway conditions. More than a year after the implementation I have yet to see an RCC value below 5 on a runway I've used in varying conditions. The reported values during the time of our landing were not an accurate representation of the actual runway conditions.”
Skywest 4796

“The airport had reported 5/5/5 as the RCC for the runway of intended landing. Having taken off earlier, in similar meteorological conditions, and noticing no abnormal conditions on the runway, we could have probably been a little complacent, and should have questioned the actual runway condition based on the new BA reports of medium to poor. However, the significant difference between reported RCC and actual conditions, led us to believe that a safe landing was a reasonable assumption.”
December 31, 2018

ASAP Report

11:40
- Runway 12L inspected
- Wet
- 80% Coverage
- RCC = 5/5/5

14:37
- -SN

15:55
- Delta 588
- Runway 12L BRAM by CRJ
- Upset that RCC didn’t match PIREP

16:17
- Runway 12L inspected
- Dry Snow
- < 1/8”
- 50 % / 50% /100%
- RCC = 5/5/5
“Using the MSP ATIS C we were expecting and briefed runway 30R/12L to have braking conditions of 5 5 5 which is Good. When we contacted MSP Tower they gave us the actual runway conditions which was Medium braking being reported by a CRJ. Medium braking is a big difference from Good braking which was still being reported on the MSP ATIS RCCs. When we landed we had Medium braking which is what ATC Tower gave us and not the Good being reported on the MSP ATIS Runway Condition Codes.”
## Runway Plowing

### 3 Runway Configuration

<table>
<thead>
<tr>
<th>Runway</th>
<th>Rwy Closed</th>
<th>Rwy Open</th>
<th>Elapsed Time</th>
<th>Snow Rate: 1 inch per hour</th>
<th>Snow Rate: .5 inch per hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>12R/30L</td>
<td>0900</td>
<td>0920</td>
<td>0</td>
<td>.125” snow</td>
<td>.125” snow</td>
</tr>
<tr>
<td>12L/30R</td>
<td>0925</td>
<td>0945</td>
<td>25 minutes</td>
<td>.54” snow</td>
<td>.27” snow</td>
</tr>
<tr>
<td>17/35</td>
<td>0950</td>
<td>1010</td>
<td>50 minutes</td>
<td>.95” snow</td>
<td>.45” snow</td>
</tr>
<tr>
<td><strong>12R/30L</strong></td>
<td><strong>1015</strong></td>
<td><strong>1035</strong></td>
<td>55 minutes</td>
<td><strong>1” snow</strong></td>
<td><strong>.5” snow</strong></td>
</tr>
<tr>
<td>12L/30R</td>
<td>1040</td>
<td>1100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17/35</td>
<td>1105</td>
<td>1125</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Challenges: RCAM and MSP ATCT

- Controllers feel they’re getting less information with FICONs
- Controllers converting aircraft braking action PIREPs to RCCs
  - Pilot reports Medium
  - Controller calls it 3/3/3
- Controllers reporting RCCs as aircraft braking action
  - FICON shows 5/5/5
  - Controller calls it Good
Challenges: RCAM and MSP Pilots

- Pilots not understanding that a FICON is a snap shot in time and only valid at the date and time of issuance
- Pilots calling ATCT for clarification of FICON information and for updated FICONs
- Pilots reporting aircraft braking using RCC
  - Braking action 4
- Pilots wanting FICON to show clear and dry (6)
Challenges: RCAM and MSP

- Increased staff by 1 for FICON/NOTAM issuance
- No option for reporting residual glycol or chemical on runway for RCC. Airport reporting it wet, contrary to guidance.
- Fudged contaminant depth reporting after runway closure during active event
- Pilots using only lowest RCC number
- Wet FICONs are killing us
Wet FICONS

Issue
• Runway 4/22 – Wet
• Runway 12L/30R – Wet
• Runway 12R/30L – Wet
• Runway 17/35 – Wet
• Taxiways – Wet
• Aprons – Wet

Cancel
• Runway 4/22 – Wet
• Runway 12L/30R – Wet
• Runway 12R/30L – Wet
• Runway 17/35 – Wet
• Taxiways – Wet
• Aprons – Wet

Issue – Wet (6)
Cancel – Wet (6)

Proposed
Issue – Aerodrome Wet
Cancel – Aerodrome Wet
When an airport condition (FICON) NOTAM includes RwyCCs, it is an indicator that more than 25% of the overall runway coverage or cleared width is contaminated and performance impacts are likely. When a runway is less than 25% contaminated, RwyCCs will not be generated, and performance impacts are less likely.
RCAM Anomalies

* Tried to break the FICON/RCC process
  
  100% Wet / 100% Wet / **25% 10” Slush** = 5/5/2 (3,333 ft x 50 ft)
  
  MSP MSP RWY 30L FICON 5/5/2 100 PCT WET, 100 PCT WET, 25 PCT 10IN SLUSH
  1903270150-1903280150
  
  No Treatment

  100% Wet / 100% Wet / **25% 10” Slush and 75% Wet** = 5/5/5 (3,333 ft x 50 ft)
  
  MSP RWY 30L FICON 5/5/2 100 PCT WET, 100 PCT WET, 25 PCT 10IN SLUSH PLOWED
  AND SWEPT AND SANDED AND DEICED LIQUID 2IN WINDROWS 1903220225-1903230225
Example 1

Runway = 200’ wide, 10,000’ long

- **RO**
  - Contaminant = ICE
  - % Coverage = 25

- **MP**
  - Contaminant = ICE
  - % Coverage = 25

- **TD**
  - Contaminant = ICE
  - % Coverage = 25

Ice = 50 feet wide, 10,000 feet Long
**FICON**

<table>
<thead>
<tr>
<th>Contaminants</th>
<th>TOUCHDOWN</th>
<th>MIDPOINT</th>
<th>ROLLOUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Coverage</td>
<td>25%</td>
<td>25%</td>
<td>25%</td>
</tr>
<tr>
<td>Contaminant</td>
<td>Ice</td>
<td>Ice</td>
<td>Ice</td>
</tr>
</tbody>
</table>

**Coverage**

<table>
<thead>
<tr>
<th>Coverage (TD)</th>
<th>Coverage (MD)</th>
<th>Coverage (RO)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25%</td>
<td>25%</td>
<td>25%</td>
</tr>
</tbody>
</table>

**Depth**

<table>
<thead>
<tr>
<th>Depth (TD)</th>
<th>Depth (MD)</th>
<th>Depth (RO)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Select Value**

<table>
<thead>
<tr>
<th>Select Value (TD)</th>
<th>Select Value (MD)</th>
<th>Select Value (RO)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Add Contaminant**

<table>
<thead>
<tr>
<th>Add Contaminant (TD)</th>
<th>Add Contaminant (MD)</th>
<th>Add Contaminant (RO)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Copy to**

<table>
<thead>
<tr>
<th>Copy to MP (TD)</th>
<th>Copy to RO (MD)</th>
<th>Copy to MP (RO)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Calculate RCC**

<table>
<thead>
<tr>
<th>TD</th>
<th>MP</th>
<th>RO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Example 1
Runway = 200’ wide, 10,000’ long

RO
- Contaminant = ICE
- % Coverage = 25

MP
- Contaminant = ICE
- % Coverage = 25

TD
- Contaminant = ICE
- % Coverage = 25

MSP RWY 27 FICON 25 PCT ICE 1903220225-1903230225

NO RWYCC

Ice = 50 feet wide, 10,000 feet Long
Example 2
Runway = 200’ wide, 10,000’ long

RO
- Contaminant = ICE
- % Coverage = 50

MP
- Contaminant = Wet
- % Coverage = <10

TD
- Contaminant = Wet
- % Coverage = <10

!MSP XX/XXX MSP RWY 27 FICON 10 PCT WET, 10 PCT WET, 50 PCT ICE 1903220225-1903230225

NO RWYCC
Ice = 200’ wide, 1,666’ Long
Technology

- Testing and demo with AST’s SafeLand and SafeScan systems
- Testing and demo with Vaisala Sensor System
- Runway Friction Prediction Tool - NCAR

- Sensors = Automation
  - Depth
  - % Coverage
  - Contaminant Type
  - OAT
  - Friction*
Good Progress,
With More Work Ahead
Questions