## **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

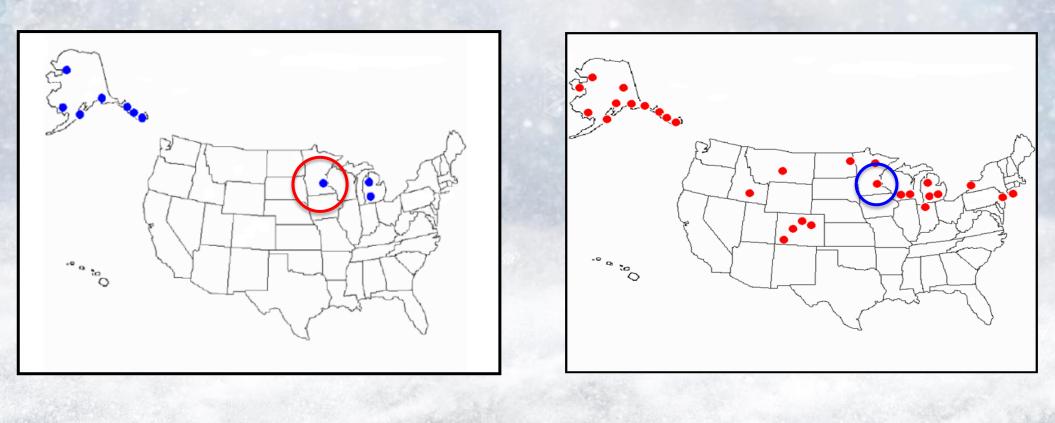
- 3,000 Acres
- Runways 4
- Taxiways 19
- Feeders 58
- Aprons 10
- Aircraft Gates 119

# **Background/History**

#### Testing/Data Collection 2008-2009 – MSP and TVC

#### **First Validation Winter 2009-2010**

#### Second Validation Winter 2010-2011



	Condition Report - Data Collection Sheet	2010-2011
	the portion of the Runway that is being maintained <u>MORE THAN</u> 25% overed with a contaminant?	Apprehensive
Local Time	Yes, assign Runway Condition Codes and complete the Matrix Report (blue box)	Apprenensive
Flight # "Matrix Report Rwy (Rwy #) (Rwy #)	No. DO NOT assign Runway Condition Codes but complete all other sections of the Matrix Report if any contamination is present (blue box)         I       (%)       (%)       (inch)         Condition Codes)       (%)       (%)       (inch)         (%)       (%)       (inch)       (Contaminant Type (Report in terms in worksheet below, or Dry Snow and Standing Water (Water 1/8 " or less report as WET with no depth)	• Overloaded
(Remarks to be transmitted)		Concerned
Misc. Data °C Outside Air Temp	(Date) (Time)           Adjusted Runway Condition Codes         Rwy Treatment Used?         Time Applied           Sand         Deicing Chem	• Scared
Active Precip? Yes or No	(ONLY If Downgrade or Upgrade Assessments Used) <u>Requires an explanation in the comments section below</u> $ \frac{Rwy}{Mu} \xrightarrow{Betore}{Ater} \boxed{1 \\ Ater} \xrightarrow{r} \boxed{1 \\ r} 1 \\$	
Ist Rwy Third           - For Coverage 25% or Less, Enter Code 6           - Circle (or Mark) any contaminant below that covers more than 25% of the Rwy Third, Record the most restrictive code in the box to the right.           - Circle (or Mark) Decth Only for:           - Water, Slush, Wet Snow, Dry Snow, or Any Snow OVER Compacted Snow	2nd Rwy Third       3rd Rwy Third         - For Coverage 25% or Less, Enter Code 5       - Cricle (or Mark) any contaminant below that covers more than 25% of the Rwy Third, Record the most restrictive code in the box to the right.       - Circle (or Mark) any contaminant below that covers more than 25% of the Rwy Third, Record the most restrictive code in the box to the right.         - Orcle (or Mark) Death Only for:       Water, Slush, Wet Snow, Dry Snow, or Any Snow         - Orcle (or Mark) Death Only for:       OVER Compacted Snow	
Dry         6         Wet(Damp)         5         Frost         4         Below M in Friction Level Classification - Wet allippery         3           Water or Slush         Slush         Wet Snow or Dry Snow           GREATER Than 1/8"         2         1/8" or LESS         5         GREATER Than 1/8"         1/8" or S	Dry     6     Wet (Damp)     5     Frost     4     Below M in Friction Level Classification - Wet Slippery     3     Dry     6     Wet (Damp)     5     Frost     4     Classification - Wet Slippery     3       Water or Slush     Slush     Wet Snow or Dry Snow     Water or Slush     Slush     Wet Snow or Dry Snow       GREATER Than     1/8" or LEBS     5     GREATER Than     1/8" or LEBS     5     GREATER Than	
1/8"         1/8"         LESS           Depth         Dry or Wet Snow OVER Compacted Snow           1/8" or Less         1/4"         1"           1/8" or Less         1/4"         1"	1/8*         1/8*         LESS         1/8* <th< td=""><td></td></th<>	
Compacted Snow	Compacted Snow         Compacted Snow           -15°C or Colder         4         Warmer than -15°C         3           Ice         1         Wet Ice, Water OVER Compacted Snow, Snow OVER Ice         0           Ice         1         Wet Ice, Water OVER Compacted Snow, Snow OVER Ice         0	
Pilot Braking Action Reports: Aircraft Type Comments for Evaluation Team on Accuracy and Usability of the Matri	Braking Action ReportedTime of Report	

### **FAA Guidance**

Ounited States Department of Ti	ransportation About DOT Our Activities Areas of Focus
Federal Av Administra	
WISTRA	Search Search
Aircraft Airports A	ir Traffic Data & Research Licenses & Certificates Regulations & Policies Training & Testing
	FAA Home • About FAA • Programs & Initiatives
Budget	Takeoff and Landing Performance < 🚔
Business Opportunities	Assessment (TALPA)
Committees	
FAA Mobile	The Takeoff and Landing Performance Assessment (TALPA) initiative
History	reduces the risk of runway overruns by providing airport operators with a
Key Officials	method to accurately and consistently determine runway conditions when
Mission	a paved runway is not dry. Federally obligated airports and many other airports use TALPA procedures to conduct runway assessments and to
Offices	report those conditions in Field Condition (FICON) Notices to Airmen
Plans & Reports	(NOTAMs).
Programs & Initiatives 👘	FICON NOTAMs provide pilots and flight planners information that helps
FAA Reauthorization	determine the runway length needed to safely stop an aircraft after a
Safety & Efficiency	rejected takeoff or a landing. Water, snow, ice, and slush on runways and taxiways can create hazardous conditions for
	↓ TALPA Update Meeting     aircraft
	↓ TALPA Resources
	For Operators & Pilots
	<ul> <li>♦ For Airport Operators</li> <li>♦ For Air Traffic</li> </ul>
	♦ For Manufacturers
	♦ TALPA-Related Regulations
	↓ Feedback

### https://www.faa.gov/about/initiatives/talpa

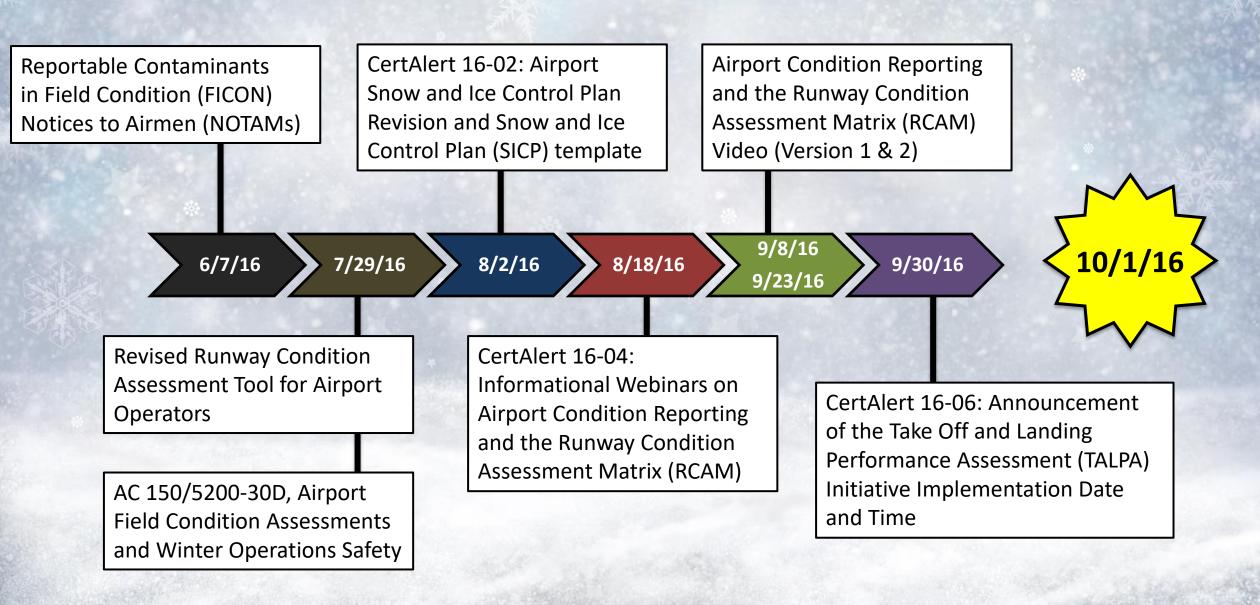
\* Operators & Pilots

\* Airport Operators

\* Air Traffic

\* Manufacturers

# **RCAM Timeline**



# **RCAM Timeline**

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

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

12/30/16 3/8/17 11/13/18

Change 1 to AC 150/5200-30D, Airport Field Condition Assessments and Winter Operations Safety

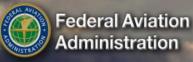


C Condition

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Assessment

Matrix



Assessment Criteria			D	owngrade Assessment Crite	eria
Runway Condition Description	Code	Mu (	µ) 1	Vehicle Deceleration or Directional Control Observation	Pilot Reported Braking Action
• Dry	6				
<ul> <li>Frost</li> <li>Wet (Includes Damp and 1/8 inch depth or less of water)</li> <li>1/8 inch (3mm) depth or less of:</li> <li>Slush</li> <li>Dry Snow</li> <li>Wet Snow</li> </ul>	5		40 or Higher	Braking deceleration is normal for the wheel braking effort applied AND directional control is normal.	Good
<ul> <li>5° F (-15°C) and Colder outside air temperature:</li> <li>Compacted Snow</li> </ul>	4	39		Braking deceleration OR directional control is between Good and Medium.	Good to Medium
<ul> <li>Slippery When Wet (wet runway)</li> <li>Dry Snow or Wet Snow (Any depth) over Compacted Snow</li> <li>Greater than 1/8 inch (3mm) depth of:</li> <li>Dry Snow</li> <li>Wet Snow</li> <li>Wet Snow</li> <li>Warmer than 5° F (-15°C) outside air temperature:</li> <li>Compacted Snow</li> </ul>	3	to 30	П	Braking deceleration is noticeably reduced for the wheel braking effort applied OR directional control is noticeably reduced.	Medium
Greater than 1/8 (3mm) inch depth of: • Water • Slush	2		29 1	Braking deceleration OR directional control is between Medium and Poor.	Medium to Poor
• Ice <sup>2</sup>	1		to 21	Braking deceleration is significantly reduced for the wheel braking effort applied OR directional control is significantly reduced.	Poor
<ul> <li>Wet Ice<sup>2</sup></li> <li>Slush over Ice</li> <li>Water over Compacted Snow<sup>2</sup></li> <li>Dry Snow or Wet Snow over Ice<sup>2</sup></li> </ul>	0	20 or Lower		Braking deceleration is minimal to non-existent for the wheel braking effort applied OR directional	Nil

The correlation of the Mu ( $\mu$ ) 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 their best judgment when using friction measuring devices for downgrade assessments, including their experience with the specific measuring devices used.

control is uncertain.

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 40 or greater obtained by 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; 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 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 higher code is in effect to ensure that the runway surface condition does not deteriorate below the assigned code. 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 sand or other approved runway treatments are used to satisfy the requirements for issuing this higher runway condition code, the continued monitoring program must confirm continued effectiveness of the treatment.

Caution: Temperatures near and above freezing (e.g., at 26.6° 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.

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Domestic **ICAO** Plain Text IMSP XX/XXX MSP RWY 12L FICON 3/3/3 100 PCT 6IN DRY SN 1903201932-1903211932 Plain Text **ICAO** Domestic XX/XXX NOTAMN Q) ZMP/QMRXX/IV/NBO/A/000/999/4452N09313W005 A) KMSP B) 1903210115 C) 1903220115 E) 12L FICON 3/3/3 100 PCT 6IN DRY SN . Plain Text **ICAO** Domestic Issuing Airport: (MSP) Minneapolis-St Paul Intl/Wold-Chamberlain NOTAM Number: XX/XXX Effective Time Frame Wednesday, March 20, 2019 1932 (UTC) Beginning: Ending: Thursday, March 21, 2019 1932 (UTC) Affected Areas Runway: 12L

Condition: 3/3/3 100 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"</li>
- 100% Coverage
- 2" windrows
- Would have been 5/5/5



# Skywest 4796

"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



# Delta 588

\* "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	, Configura	tion		Snow Rate: 1 inch per hour	Snow Rate: .5 inch per hour
2	Runway	Rwy Closed	Rwy Open	Elapsed Time	Snow Accumulation	Snow Accumulation
1	12R/30L	0900	0920	0	.125" snow	.125" snow
	12L/30R	0925	0945	25 minutes	.54" snow	.27" snow
VIST -	17/35	0950	1010	50 minutes	.95" snow	.45" snow
	12R/30L	1015	1035	55 minutes	1" snow	.5" snow
	12L/30R	1040	1100			
	17/35	1105	1125			

### **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

### SAFO: Runway Assessment and Condition Reporting Effective October 1, 2016

\* 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**

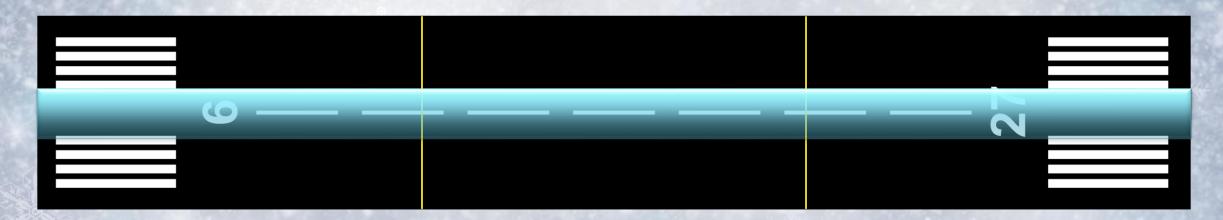
\* Tried to break the FICON/RCC process
\* 100% Wet / 100% Wet / 25% 10" Slush = 5/5/2 (3,333 ft x 50 ft)
MSP MSP RWY 30L FICON 5/5/2 100 PCT WET, 100 PCT WET, 25 PCT 10IN SLUSH 1903270150-1903280150

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

• Contaminant = ICE

MP

• % Coverage = 25

- TD
- Contaminant = ICE
- % Coverage = 25

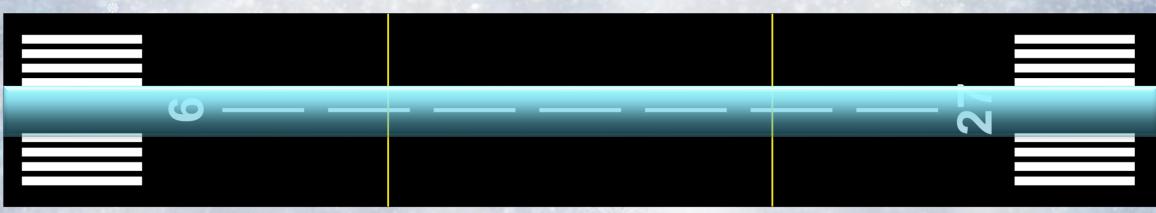
#### Ice = 50 feet wide, 10,000 feet Long

FICON

		TOUCHDOWN		
% Coverage 25%	Depth	Select Value	Contaminant Ice	5
			Copy to MP + Add	Contaminan
Coverage (TD)	Depth (	(TD)	Contaminant (TD)	
25%			Ice	đ
		MIDPOINT		
% Coverage 25%	Depth	Select Value	Contaminant Ice	
			Copy to RO + Add	Contaminan
Coverage (MD)	Depth (	(MD)	Contaminant (MD)	
25%			Ice	Ī
		ROLLOUT		
% Coverage 25%	Depth	Select Value	Contaminant Ice	5
			+ Add	Contamina
Coverage (RO)	Depth (	(RO)	Contaminant (RO)	
25%		· · · · · · · · · · · · · · · · · · ·	Ice	ī
		Calculate RC		RO - N

# **Example 1**

#### Runway = 200' wide, 10,000' long



### RO

- Contaminant = ICE
- % Coverage = 25

- MP
- Contaminant = ICE
- % Coverage = 25

### TD

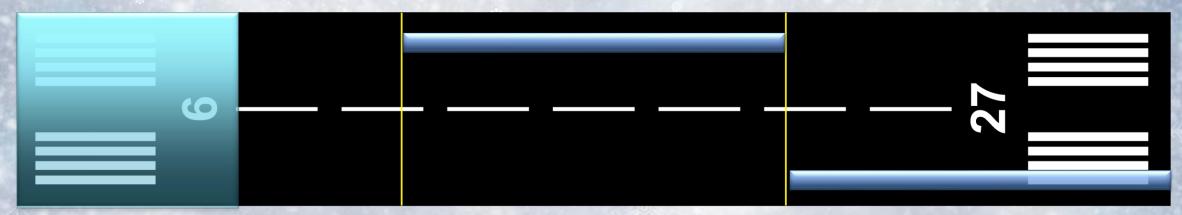
- Contaminant = ICE
- % Coverage = 25

### 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

### MP

### TD

- Contaminant = ICE
- % Coverage = 50

- Contaminant = Wet
- % Coverage = <10

- Contaminant = Wet
- % Coverage = <10

IMSP 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\*



# Questions