FAA TALPA ARC RUNWAY SURFACE CONDITION MATRIX

Federal Aviation Administration

Presented to: EASA Runway Friction and Aircraft Braking Workshop

By: Mr. Jerry Ostronic FAA, Capt. Mitch Matheny, Pinnacle Airlines, Mr. Chet Collett, Alaska Airlines

Date: March 11, 2010

Topics

- Introductions
- Takeoff And Landing Performance Assessment Aviation Rulemaking Committee (TALPA ARC) Background
- Scope of TALPA ARC Effort
- Runway Surface Condition Reporting
- Runway Surface Condition Matrix
- Matrix Validation - Industry Perspective

Introductions

Mr. Jerry Ostronic, FAA Aviation Safety Inspector (Operations) Air Transportation Division, FAA Flight Standards Service, Washington, DC

Capt. Mitch Matheny, Manager Flight Standards, Pinnacle Airlines, Memphis Tennessee.

Mr. Chet Collett, Manager Flight Standards, Alaska Airlines, Seattle Washington

Mr. Don Stimson, FAA Airplane Performance Engineer, Transport Airplane Directorate, Renton, Washington

Ms. Susan Gardner, Safety Analyst, FAA Office of Airports Safety and Standards, Washington, DC

TALPA ARC Background

- Following the 8 December 2005 landing overrun of a Southwest Airlines Boeing 737-700 at Chicago's Midway Airport, FAA established an internal team to review related FAA regulations and policies as well as industry practices
- The team found deficiencies in several areas, most notably in the lack of a standard and accurate means to assess runway surface conditions to determine landing performance at the time of arrival
- As a result, on 31 August 2006, the FAA published Safety Alert for Operators (SAFO) 06012, "Landing Assessments at Time of Arrival (Turbojets)" to provide guidance for the operational aspect of contaminated runway landings
- The FAA formed the Takeoff and Landing Performance Assessment (TALPA) Aviation Rulemaking Committee (ARC) to provide recommendations for rulemaking to address the identified safety risk

TALPA ARC Participants

Regulatory Authorities

- ✈FAA (Airports, Flight Standards, Certification, NOTAMS, Rulemaking, Legal)
- ✈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

- ✈Cherry Capital
- ✈Chicago Airport System
- ✈Chicago O'Hare
- ✈Grand Rapids Regional
- ✈Minneapolis/St. Paul Airport System

Airplane Manufacturers

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

Holistic Approach

- **Require manufacturers of large turbine powered airplanes and all turbojet airplanes to provide approved contaminated runway takeoff and landing performance data in the Airplane Flight Manual using a standardized method**
- **Require airplane operators to conduct an assessment of landing distance requirements at time of arrival using manufacturers' approved contaminated runway performance data, taking into account:**
  - **Conditions at time of landing (wind, pressure altitude, temperature, runway slope, approach speed, airplane configuration, landing weight)**
  - **Reported runway surface conditions or braking action reports**
  - **A 15% safety margin**
- **Require airplane operators to use manufacturers' approved contaminated runway takeoff data for takeoffs from contaminated runways**
- **Provide the best available (considering accuracy, timeliness, and operational usability) runway surface condition information to flightcrews for them to make their takeoff and landing performance assessments**

Many Links in the Chain

Determine and report runway surface condition	→	**Airport Operators**
Transmit runway surface condition/braking action reports	→	**Air Traffic Services, NOTAMs**
Determine and publish airplane performance for differing runway surface conditions/braking action	→	**Airplane Manufacturers**
Perform takeoff/landing performance assessments	→	**Airplane Operators/Pilots**

A Common Language

- **It quickly became apparent that the chain was broken and that a common runway surface condition description was needed between:**
  - Those who report the conditions (Airports)
  - Those who transmit the information (NOTAMS, Air Traffic)
  - Those who provide airplane performance data (Manufacturers)
  - Those who use the runway surface condition and airplane performance data to assess landing performance capability (Flightcrew and dispatchers)
- **Reviewed existing ICAO, EASA/JAA, FAA terms/methods**

Current Runway Surface Condition Information

- **Runway Friction Measuring Devices, μ (or Mu) Reports**
- **Pilot Braking Action Reports**
- **Runway Surface Contamination Description (Type and Depth of Contamination)**

Problem With Using μ For Takeoff and Landing Performance Assessments

- **Limited runway surface conditions for which they are applicable**
  - Conditions rarely exist during winter storm events for use of the devices
  - Often used and reported outside of device manufacturers' limitations for their use
- **Lack of repeatable results with same type of measuring device, or same device with consecutive measuring runs**
- **Device calibration concerns and procedures**
- **No operationally usable correlation between the different devices**
- **FAA concern of operationally usable correlation between reported μ and aircraft stopping performance**

Problem With Using Pilot Braking Action Reports

- **Subjective**
  - No standard definition of the pilot braking action reporting terms
  - No training or guidance given to pilots on how or when to report braking action
- **Until first aircraft lands and provides report no information is available**
- **Unknown correlation of reports between different airplane types**
- **Most airplane manufacturers do not provide performance data in terms of pilot braking action**
- **Nevertheless, in many cases overrun accident analysis has shown pilot reports to often be more accurate than other forms of runway surface condition information**

Problem With Using Runway Surface Contamination Descriptions (Type and Depth of Contamination)

- **Typically only available through NOTAM information**
- **Not updated in a timely manner**
- **Varying terms and definitions**
  - Patchy
  - Thin
  - Sanded
  - Dry snow vs. Wet snow
  - Wet snow vs. Slush
- **How to accurately measure depth?**
  - Significant airplane performance differences between ¼” (6 mm) and ½” (13 mm) of slush

Runway Surface Condition Reporting

Conclusion:

No Silver Bullet!

Runway Surface Condition Reporting

TALPA ARC Recommendation:

- **Use a combination of the best attributes of each method**
- **Improvements to address known deficiencies**
- **Beta test proposed method**
  - Currently in progress
- **Continue researching improved methods**

Runway Surface Condition Matrix

- Aligns runway surface conditions reported by airport operators to contaminated landing performance data supplied by the airplane manufacturer
- Provides a shorthand method of relaying runway surface condition information to flightcrews through the use of runway condition codes to replace the reporting of μ readings to flightcrews
- Provides for a standardized method of reporting runway surface conditions for all airports
- Will provide more detailed information for the flightcrew to make operational decisions
- Standardized pilot braking action report terminology
- Is not perfect, based on the best information available today and a significant improvement over current practices

Pilot Version of Matrix

Braking Action Report PIREPs		Associated Runway Surface Condition	Runway Condition Code
Term	**Definition**		
Dry	-	**Any temperature:** ▪Dry	**6**
Good	Braking deceleration is normal for the wheel braking effort applied. Directional control is normal.	**Any temperature of:** ▪Wet surface (Smooth, Grooved, or PFC runway) ▪Frost **Any temperature of: 1/8" or less of:** ▪Water ▪Slush ▪Dry Snow ▪Wet Snow	**5**
Good to Medium	Brake deceleration and controllability is between Good and Medium.	**At or below -13ºC:** • Compacted Snow	**4**
Medium	Braking deceleration is noticeably reduced for the wheel braking effort applied. Directional control may be slightly reduced.	**Any temperature when:** ▪Wet (When runway is reported as "slippery when wet") **At or below -3°C, and Greater than 1/8" of :** ▪Dry or Wet Snow **Above -13°C and at or below -3°C:** ▪Compacted Snow (Any depth, depth not reported)	**3**
Medium to Poor	Brake deceleration and controllability is between Medium and Poor. Potential for hydroplaning exists.	**Any Temperature, and Greater than 1/8" of:** ▪Water ▪Slush **Temperature Above -3°C and:** ▪1/8" and Greater of Dry or Wet Snow ▪Compacted Snow (Any depth, depth not reported)	**2**
Poor	Braking deceleration is significantly reduced for the wheel braking effort applied. Directional control may be significantly reduced.	**At or below -3°C:** • Ice	**1**
Nil	Braking deceleration is minimal to non-existent for the wheel braking effort applied. Directional control may be uncertain.	**Any temperature of:** ▪Wet Ice ▪Water on top of Compacted Snow ▪Dry or Wet Snow over Ice **Temperature Above -3°C:** Ice	**0**

Runway Surface Condition

Braking Action Report PIREPs		Associated Runway Surface Condition	Runway Condition Code
Term	Definition		
Dry	-	**Any temperature:** ▪Dry	6
Good	Braking deceleration is normal for the wheel braking effort applied. Directional control is normal.	**Any temperature of:** ▪Wet surface (Smooth, Grooved, or PFC runway) ▪Frost **Any temperature of: 1/8" or less of:** ▪Water ▪Slush ▪Dry Snow ▪Wet Snow	5
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Runway Condition Codes

Braking Action Report PIREPs		Associated Runway Surface Condition	Runway Condition Code
Term	Definition		
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Braking Action Terms

Braking Action Report PIREPs		Associated Runway Surface Condition	Runway Condition Code
Term	Definition		
Dry	-	**Any temperature:** ▪Dry	**6**
Good	Braking deceleration is normal for the wheel braking effort applied. Directional control is normal.	**Any temperature of:** ▪Wet surface (Smooth, Grooved, or PFC runway) ▪Frost **Any temperature of: 1/8" or less of:** ▪Water ▪Slush ▪Dry Snow ▪Wet Snow	**5**
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Braking Action Definitions

Braking Action Report PIREPs		Associated Runway Surface Condition	Runway Condition Code
Term	**Definition**		
Dry	-	**Any temperature:** ▪Dry	**6**
Good	Braking deceleration is normal for the wheel braking effort applied. Directional control is normal.	**Any temperature of:** ▪Wet surface (Smooth, Grooved, or PFC runway) ▪Frost **Any temperature of: 1/8" or less of:** ▪Water ▪Slush ▪Dry Snow ▪Wet Snow	**5**
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Nil	Braking deceleration is minimal to non-existent for the wheel braking effort applied. Directional control may be uncertain.	**Any temperature of:** ▪Wet Ice ▪Water on top of Compacted Snow ▪Dry or Wet Snow over Ice **Temperature Above -3°C:** Ice	**0**

Use of Runway Friction Measuring Device Readings, μ

- **Only to be used by airport operator to further assess if the runway condition code should be downgraded from that associated with the contamination type, depth, and temperature.**
- **Cannot be used to upgrade runway condition code**
- **Not to be reported to flightcrews but remains one of the tools in the airport operators tool box for assessing runway surface conditions, and effectiveness of clearing actions taken**

Airport Estimated Runway Condition Assessment				Pilot Reports (PIREPs) Provided To ATC And Flight Dispatch
Runway Condition Assessment – Reported		**Downgrade Assessment Criteria**		
Code	**Runway Description**	**Mu (μ)**	**Deceleration And Directional Control Observation**	**PIREP**
6	**Any temperature:** ▪Dry	-	-	Dry
5	**Any temperature of:** ▪Wet surface (Smooth, Grooved, or PFC runway) ▪Frost **Any temperature of: 1/8" or less of:** ▪Water ▪Slush ▪Dry Snow ▪Wet Snow	40μ or higher	Braking deceleration is normal for the wheel braking effort applied. Directional control is normal.	Good
4	**At or below -13°C:** • Compacted Snow	39-36μ	Brake deceleration and controllability is between Good and Medium.	Good to Medium
3	**Any temperature when:** ▪Wet (When runway is reported as "slippery when wet") **At or below -3°C, and Greater than 1/8" of :** ▪Dry or Wet Snow **Above -13°C and at or below -3°C:** ▪Compacted Snow (Any depth, depth not reported)	35-30μ	Braking deceleration is noticeably reduced for the wheel braking effort applied. Directional control may be slightly reduced.	Medium
2	**Any Temperature, and Greater than 1/8" of:** ▪Water ▪Slush **Temperature Above -3°C and:** ▪1/8" and Greater of Dry or Wet Snow ▪Compacted Snow (Any depth, depth not reported)	29-26μ	Brake deceleration and controllability is between Medium and Poor. Potential for hydroplaning exists.	Medium to Poor
1	**At or below -3°C:** • Ice	25-21μ	Braking deceleration is significantly reduced for the wheel braking effort applied. Directional control may be significantly reduced.	Poor
0	**Any temperature of:** ▪Wet Ice ▪Water on top of Compacted Snow ▪Dry or Wet Snow over Ice	20μ or lower	Braking deceleration is minimal to non-existent for the wheel braking effort applied. Directional control may	Nil

Proposed Many Changes To Runway Surface Conditions Reports (NOTAM)

- **Changes in terminology reported**
  - Discontinued use of “patchy,” ‘trace,” and “thin”
  - Use of contamination terminology consistent with AFM landing performance data
- **Contamination descriptions provided in terms of type and depth of contaminant and percentage of runway coverage**
- **Clear identification of runway and direction for which the report is applicable**
- **Report provided in thirds of the runway**
- **Runway condition code provided in thirds of runway length when any one third greater than 25% covered**

Proposed Many Changes To Runway Surface Conditions Reports (NOTAM) (continued)

Runway Condition and Contamination Terms (for reporting)

- Dry
- Wet (also report runway type – smooth, grooved, PFC, or slippery when wet)
- Water
- Slush
- Wet Snow
- Dry Snow
- Compacted Snow
- Frost
- Ice
- Wet Ice

Proposed Many Changes To Runway Surface Conditions Reports (NOTAM) (continued)

Contaminant Depths to be Reported

- 1/8 inch (3 mm)
- 1/4 inch (6 mm)
- 1/2 inch (13 mm)
- 3/4 inch (19 mm)
- 1 inch (25 mm)
- 2 inches (51 mm)
- 3 inches (76 mm)
- 4 inches (102 mm)

Proposed Many Changes To Runway Surface Conditions Reports (NOTAM) (continued)

Contaminant Coverage to be Reported

- 10%
- 25%
- 50%
- 75%
- 100%

Sample

- **Airport GRR Runway 26L:**
- **The runway has been groomed 60 feet wide. Inside the groomed area the runway has 75% coverage of 1/4 inch slush. Outside the groomed area: compacted snow.**
- **Average surface temperature by runway thirds 0℃, -2℃, -1℃**
- **The operations vehicle experienced significantly reduced braking action and directional control on the first third of the runway.**

RUNWAY CONDITION REPORT – DATA COLLECTION SHEET

Airport: GRR

Runway: 26L (Direction of Landing/Takeoff)

Flight # That you prepared the runway for (if known):

Name/initials of Operator preparing this form:

Local Time: 1549

Date: 12/12/09

Rwy % Coverage

	1/3	2/3	3/3
10%			
25%			
50%			
75%	X	X	X
100 %			

Total Rwy % Reported: 75

Temp ℃: [X] Surface [ ] OAT

1/3	2/3	3/3
0	-2	-1

Rwy Contaminant Depth (inches)

	1/3	2/3	3/3
1/8"			
1/4"	X	X	X
1/2"			
3/4"			
1"			
2"			
3"			
4" or more			

Rwy Highest Depth Measured: 1/4

Rwy Contaminant Type

	1/3	2/3	3/3
Dry			
Wet			
Wet (slippery when wet)			
Water			
Slush	X	X	X
Dry Snow			
Wet Snow			
Compacted Snow (May include Imbedded Ice)			
Frost			
Ice			
Wet Ice, Water over Frozen Contaminant, Snow over Ice			

Report Contaminant with LOWER Condition Code: Slush

Please include other important Rwy information in the Remarks Section that will be reported to the Flight Crew.

* Remarks Section

Groomed 60 feet wide , remaining edges compacted
snow.

RUNWAY CONDITION CODE

1/3	2/3	3/3
2	2	2

Note: Runway Condition Code is determined using the unshaded portion of the Matrix provided on the back. Runway Code 6/6/6 is not to be used in the Condition Report.

DOWNGRADED RUNWAY CODE

1/3	2/3	3/3
1	2	2

Note: The Runway Condition Code may be downgraded using the Downgrade Assessment Criteria shaded portion of the Matrix provided on the back. REPORT THIS CODE in your CONDITION REPORT. Explain Why in Comments

Mu μ (1-100)

1/3	2/3	3/3

[ ] CFME [ ] Decel

Remarks for other important Rwy conditions would be added here to the Condition Report.

"Matrix Report . . .

GRR RWY 26L 1 / 2 / 2 75 % 1/4 (INCH) Slush (*) 1549 12/12/09"

(Airport) (Rwy#) (Runway Codes) (Total %) (Highest Depth) (Contaminant Type) (Remarks) (Time) (Date)

Once complete and entered into the database, please send forms to:

Nick Subbotin
Airport Technology R&D Branch
FAA William J. Hughes Technical Center
AJP-6311, Bldg. 296

Atlantic City Int'l Airport, NJ 08405

Additional Comments Regarding Matrix Validation:

Runway Surface Condition Report (NOTAM)

- **GRR RWY 26L 1 / 2 / 2 75 % 1/4 (Inch) Slush, Groomed 60 feet wide, remaining edges compacted snow, 1549 12/12/09**

Matrix Evaluation

- Beta tested at two airports last winter (2008 – 2009)
- Matrix was slightly modified based on the results of last years limited evaluation
- Current Matrix a result of those modifications
- Currently conducting Matrix validation testing at 7 Airports in Alaska, and 3 in Great Lakes Region in coordination with Alaska and Pinnacle Airlines.

Goals Of Continued Beta Testing of Matrix Determine If:

- Is it usable for airport operators?
- Is it usable for flightcrews and flight operations personnel?
- Are the relationships of runway surface conditions, (type, depth, and temperature) representative of pilot observed braking action?

Matrix Validation
Industry Perspective

- **Mr. Chet Collett – Manager Flight Standards Alaska Airlines**
- **Capt. Mitch Matheny – Manager Flight Standards Pinnacle Airlines**

Alaska Airlines

- Alaska Airlines operates into some of the most challenging airports in the world.
- Alaska Airlines has been using the Matrix for the Pilot in flight analysis since 2006.
- This season we trained 7 airports in the State of Alaska to use the matrix and other tools to provide good data comparisons between their Runway Condition Assessment Report and our Pilot Braking Action Reports.

Alaska Airlines Training

- **We Trained our pilots to do the in flight runway condition assessment analysis.**
- **Trained to land faithful to the data assumptions**

- **Used the 1000’ air run data with 15% safety margin.**
- **Trained our pilots to give good and reliable Pilot Braking Action Reports.**

RUNWAY SURFACE CONDITION REPORT ASSESSMENT TABLE

This chart is used in conjunction with Degraded Runway Condition Assessment and Landing Restriction Policies found in the FOM and listed on the reverse. It is applicable system wide. When runway contamination is determined to cover 25% or less of the usable landing surface, braking action may be considered **GOOD. Captain is charged with using ALL available information in making final decision to land.**

	Dry	Wet		Contaminated										
Type	N/A	Any	Slippery When Wet[1]	Frost	Standing Water or Slush (WTR-SLR)		Wet Snow or Dry Snow (WSR-LSR)			Compacted Snow (SIR-PSR)			Ice (IR)		Wet Ice: Water Over SIR, PSR or IR **OR** Snow Over IR
Depth	N/A	N/A	N/A	N/A	1/8" or less[2]	Greaterthan 1/8"[2]	1/8" or less[2]	Greater than 1/8"[2]		Any	Any	Any	Any[3]	Any	Any
Temp	Any	Any	Any	Any	Any	Any	Any	-3°C or Below	Above -3°C	-13°C or Below	Above -13°C at or Below -3°C	Above -3°C	-3°C or Below	Above -3°C	Any
Rwy Code	6	5	3	5	5	2	5	3	2	4	3	2	1	0	0

Notam Code Notes:

PATCHY **(PTCHY)** is considered **GOOD** Braking Action (Code 5) if accompanied by Mu values of 40 or better.

Treat Sand **(SA)** or Sanded Snow **(SN)** descriptors as information only – take no credit.

1. Slippery When Wet used to indicate excess rubber deposits in touchdown zones.
2. THIN **(THN)** may be treated as 1/8 inch or less depth if accompanied by Mu values of 40 or better – otherwise **(THN)** is treated as greater than 1/8 inch.
3. THIN Ice **(THN-IR)** at -3°C or below if accompanied by Mu values of 40 or better, is considered **MEDIUM** Braking Action (Code 3).

Downgrade Assessment Criteria (Mu), Pilot Braking Action Descriptors and Landing Crosswind Component Limits							
Code	6	5	4	3	2	1	0
Mu		40µ or higher	39-36µ	35-30µ	29-26µ	25-21µ	20µ or lower
Deceleration & Directional Control Observation		Braking deceleration is normal for the wheel braking effort applied. Directional control is normal.	Brake deceleration and controllability is between Good and Medium.	Braking deceleration is noticeably reduced for the wheel braking effort applied. Directional control may be slightly reduced.	Brake deceleration is between Medium and Poor. Potential for hydroplaning exists.	Braking deceleration is significantly reduced for the wheel braking effort applied. Directional control may be significantly reduced.	Braking deceleration is minimal to non-existent for the wheel braking effort applied. Directional control may be uncertain.
PIREP	Dry	Good	Good to Medium	Medium	Medium to Poor	Poor	Nil
Max Allowable Crosswind Component	40 kts	40 kts	30 kts	20 kts	17 kts	15 kts	N/A

Reduce guidelines by 5 kts on wet or contaminated runways whenever asymmetric reverse thrust is used. Crosswinds may be further restricted by emergency or abnormal procedures.

Pilot Braking Action Survey Form

Landing Airport: _____ Landing Runway: _____

Flight Number_____ **Local Date**: _____ **Local Time**: _____ (24h)

Aircraft Type (Circle one): 737-400, 737-700, 737-800, 737-900

Approximate Landing Weight: _ _ _ . _ (in 1000 lbs.)

Based on the runway conditions reported (NOTAM or Verbal), the Braking Action was: ☐ Better than expected

☐ As Expected

☐ Worse than expected

If the runway is DRY, then no other Estimated Braking Action needs to be marked. We ask that you do your best to report your estimate of the wheel braking action as per the following terms and add comments below if necessary:

Deceleration And Directional Control Observation	PIREP	Estimated Braking Action
-	Dry	☐
Braking deceleration is normal for the wheel braking effort applied. Directional control is normal.	Good	☐
Brake deceleration and controllability is between Good and Medium.	Good to Medium	☐
Braking deceleration is noticeably reduced for the wheel braking effort applied. Directional control may be slightly reduced.	Medium	☐
Brake deceleration and controllability is between Medium and Poor. Potential for hydroplaning exists.	Medium to Poor	☐
Braking deceleration is significantly reduced for the wheel braking effort applied. Directional control may be significantly reduced.	Poor	☐
Braking deceleration is minimal to non-existent for the wheel braking effort applied. Directional control may be uncertain.	Nil	☐

Data to FAA Technical Center

- **Over 1200 data points that match up between Airport Runway Assessment Reports and Pilot Braking Action Reports.**

Observations / Initial Findings

- **Overall the Matrix does a good job of predicting the slipperiness of the runway. In the absence of other information, conservatism is good.**
- **It is overly conservative in some areas**
  - Cold or Sanded Ice can be much better than a 1 or 0
  - Thin Ice can also be much better then a 1 or 0
  - Compacted Snow at warmer temperatures can be better than a 2
- **The struggle is – How do you validate this?**
  - Possibly allow Mu to be used by qualified Airport Personnel to validate that the Ice is really thin, or the sand had made it better?
  - There needs to be a way that the airport operator can use all available tools in their tool box to accurately describe the Runway Condition Code. We agree with not reporting Mu to the Pilot, but may be used along with the other tools

Compacted Snow (SIR-PSR)			Ice (IR)	
Any	Any	Any	Any[3]	Any
-13°C or Below	Above -13°C at or Below -3°C	Above -3°C	-3°C or Below	Above -3°C
4	3	2	1	0

Pinnacle Airlines

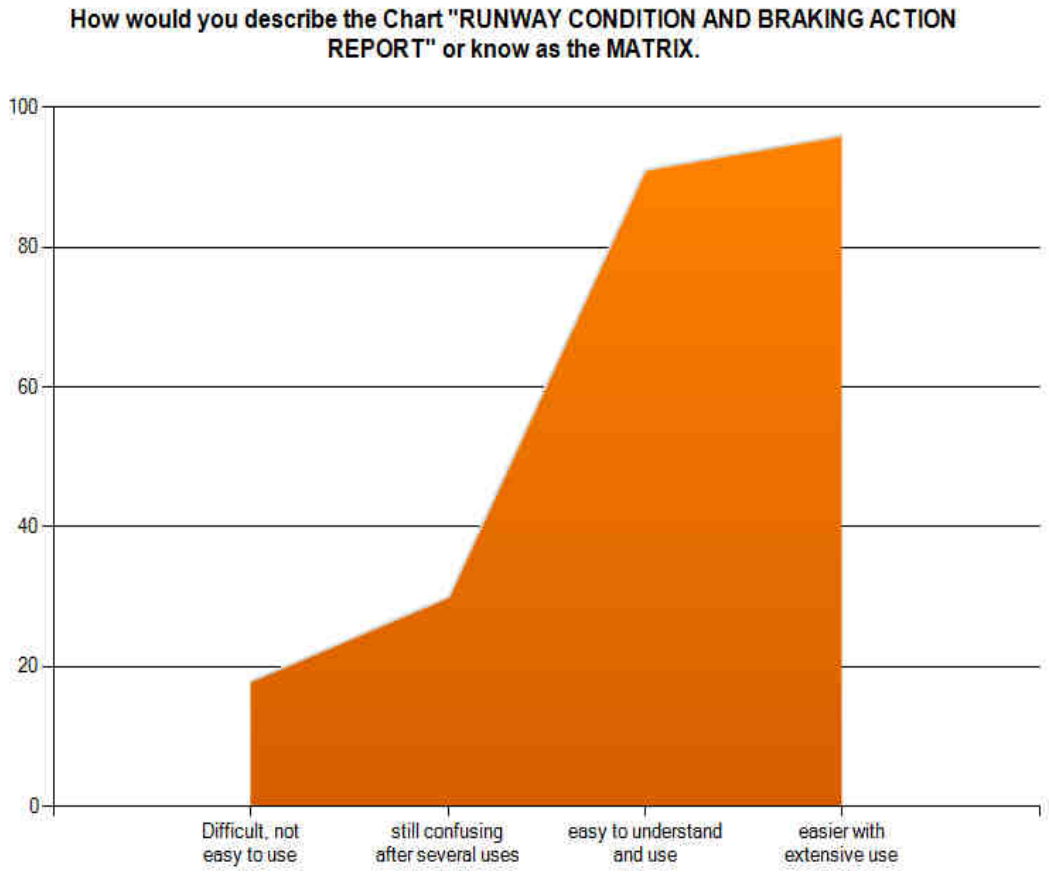
- **Operate 140 CRJ200/900 aircraft for DAL**
- **Operate 750+ flights day with extensive operations within Northern US and Canada**
- **Service many small regional airports (runways < 7000')**
- **Large winter operations on contaminated surfaces**

Matrix Training & Validation Testing

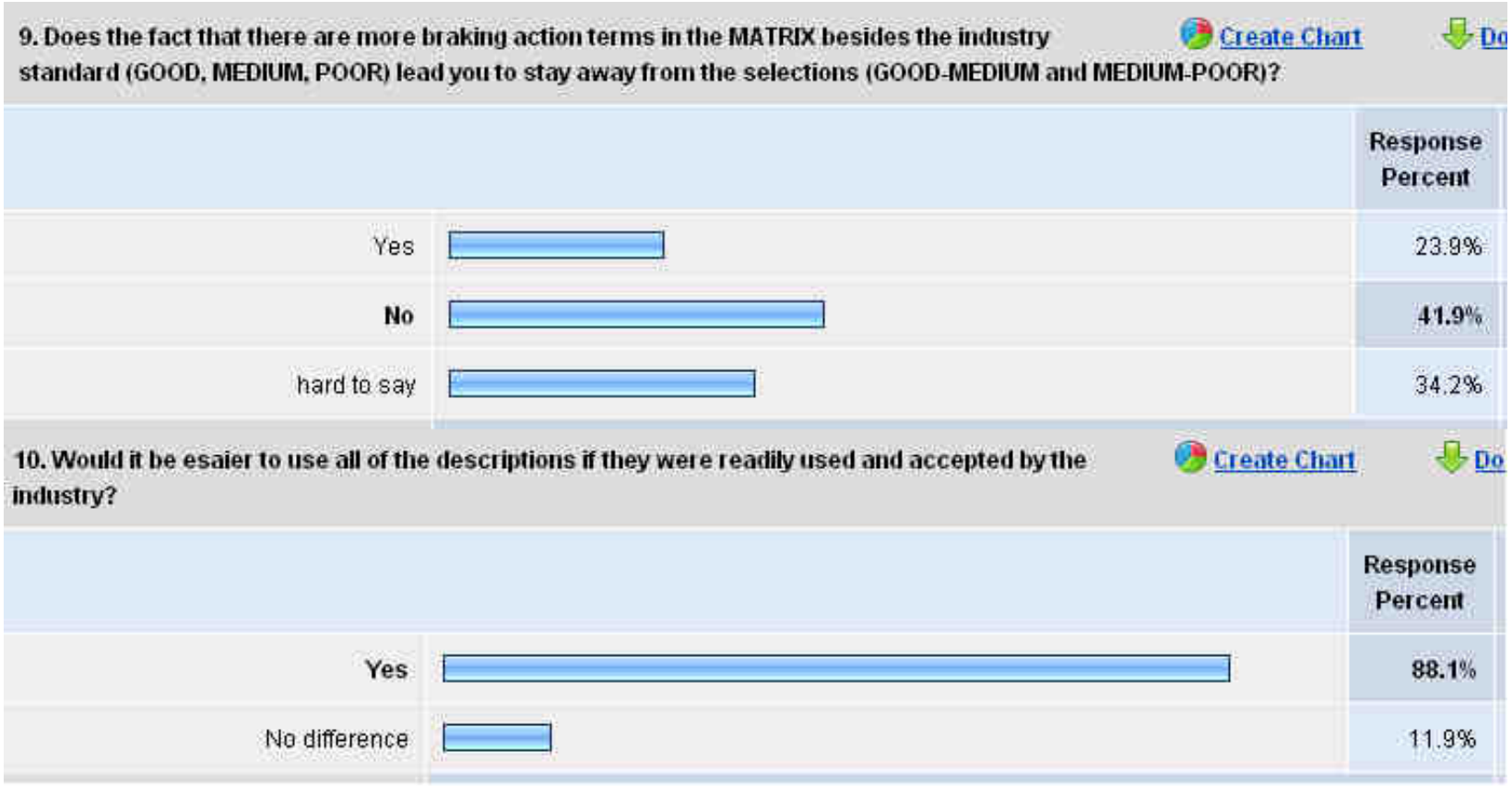
- **Working with GRR, MSP, and TVC airports**
- **Adjusting to new definitions, guidelines, and reporting**
  - Airport feedback
    - Surface temperatures verses OAT
    - Sanding and treating - surface improvement verification
- **Training**
  - The Matrix - (contaminate type/depth, BAR, surface temp.)
  - determine Runway Condition Codes,
  - determine Weight and Airport Alt,
  - Understanding Charts & calculating the Landing Distance Requirements (LDR)
- **Required Landing Distance vs Max Landing Weight**
  - Pilots will land on a runway if they're within 100 lbs of MLW.
  - Pilots are less likely to land if told they're within 100' of LDR.

Pilot Survey – Matrix Validation

Over 85 % of Pilots say the Matrix is easy to use after training and use.

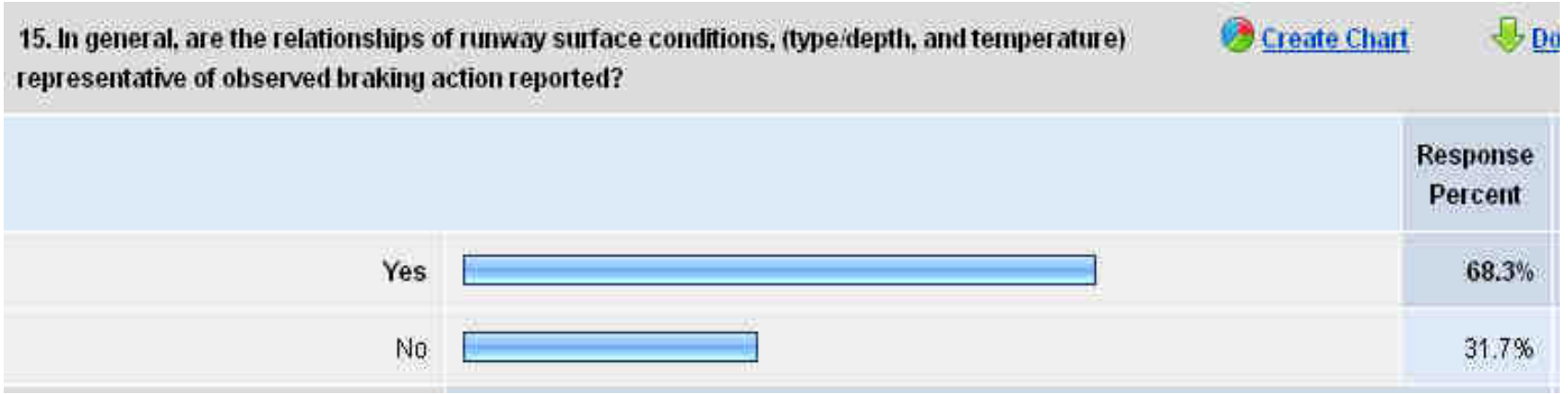


Pilot Survey – Matrix Validation



Five categories/buckets are not an issue. 88% say if industry accepted 5 terms they would have no issues with their use.

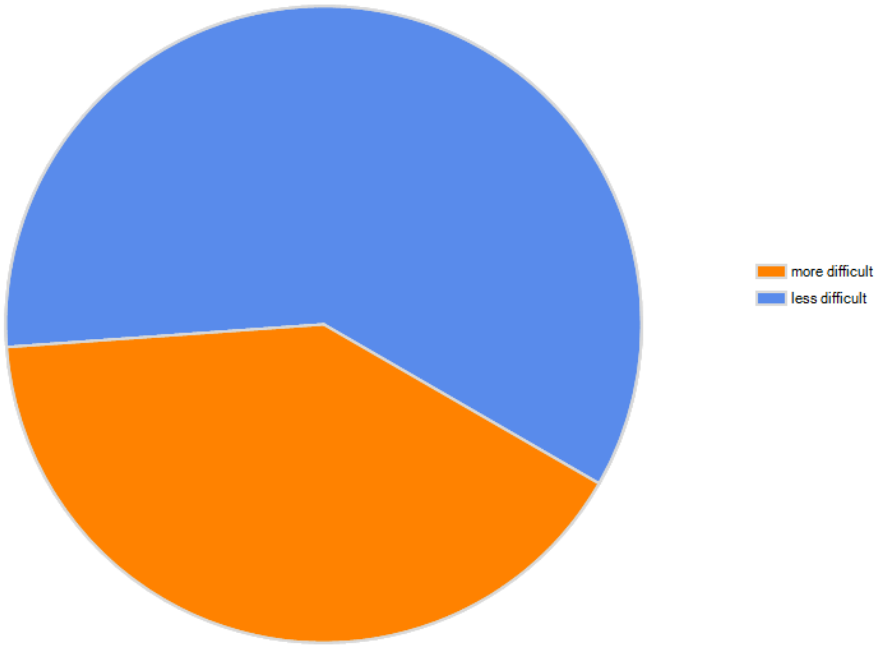
Pilot Survey – Matrix Validation



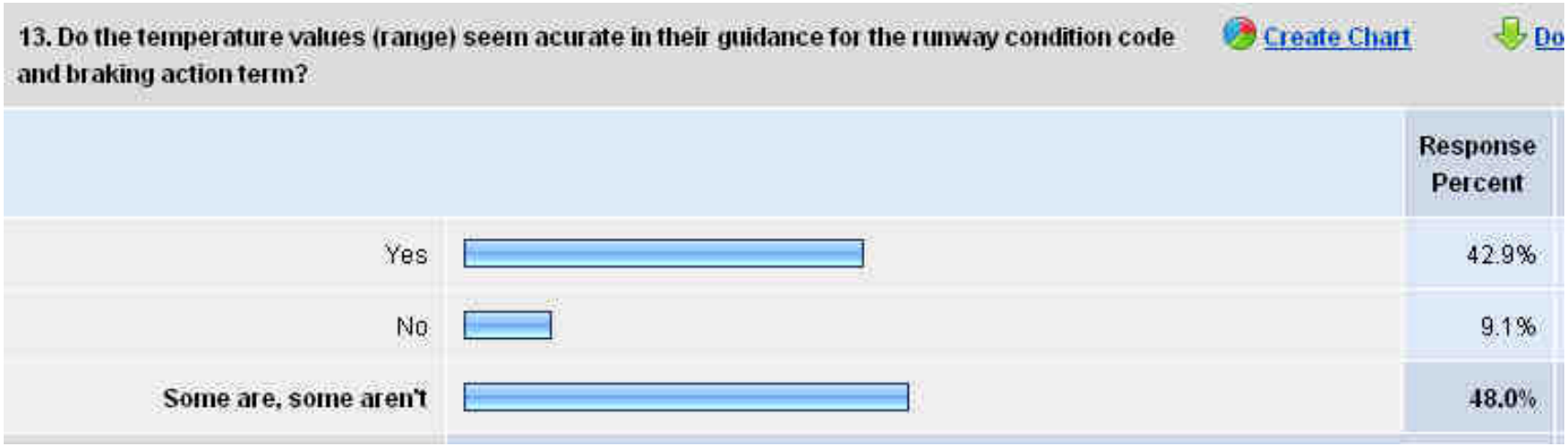
68% say the Matrix category conditions represent the Pilot braking actions reported

Pilot Survey – Matrix Validation

The ARC debated heavily on all of the temperature variations. Pilots represented in the ARC felt that this may be too specific/difficult. However, 60% surveyed indicated that the details make it less difficult to determine the appropriate correlation.

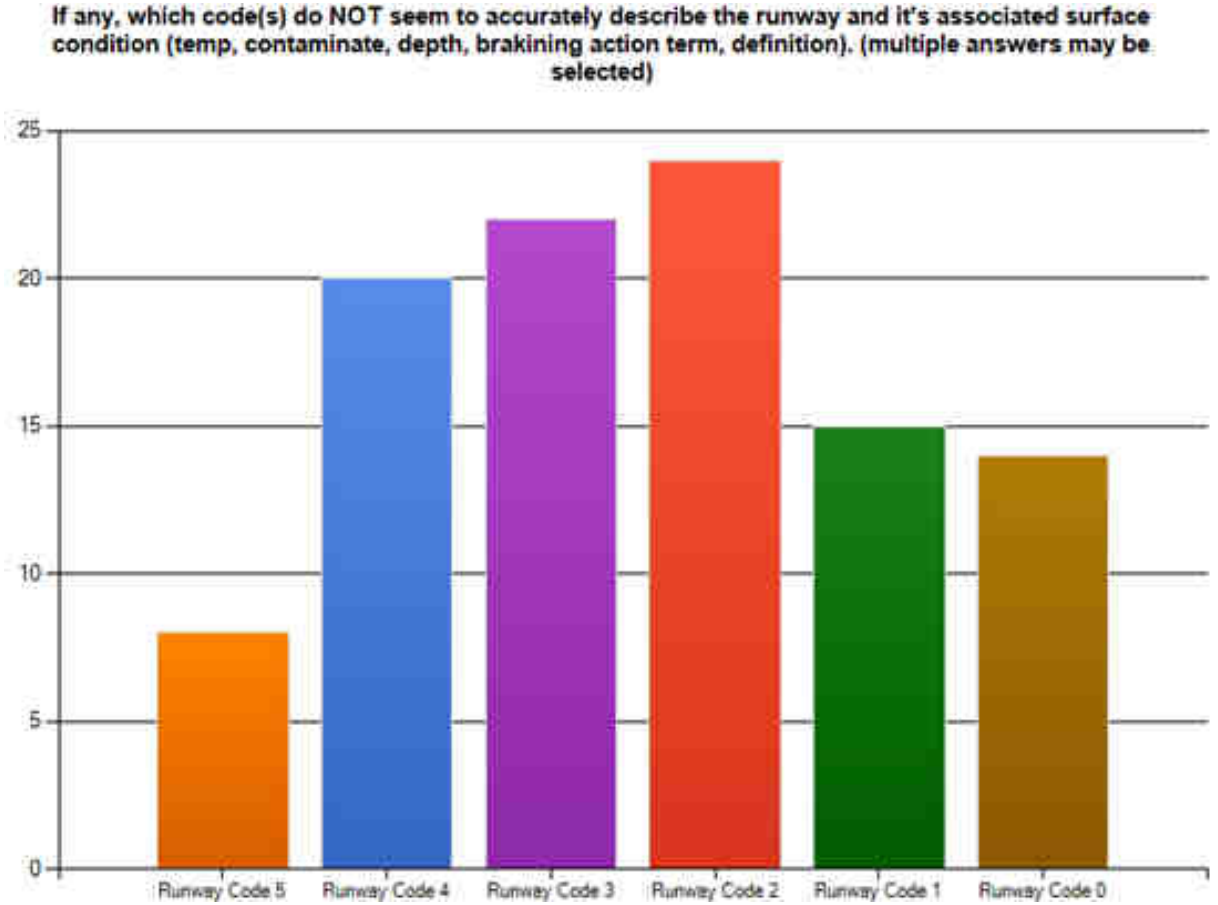


Pilot Survey – Matrix Validation



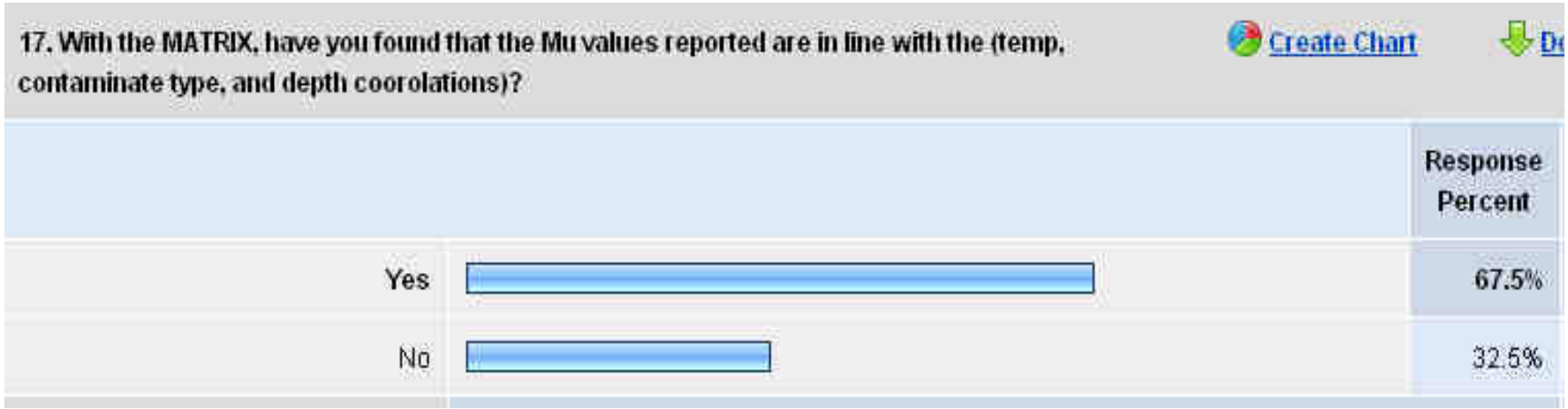
91% stated the temperature values (ranges) were accurate with some categories more accurate than others. Only 9% stated they were not accurate at all.

Pilot Survey – Matrix Validation



48% reported some ranges more accurate than others and Runway Condition Code 2 (MEDIUM-POOR) was chosen as the least accurate description.

Pilot Survey – Matrix Validation



68% of Pilots report that the Mu values are in line with the reported surface conditions on the Matrix.

Pilot Survey – Matrix Validation

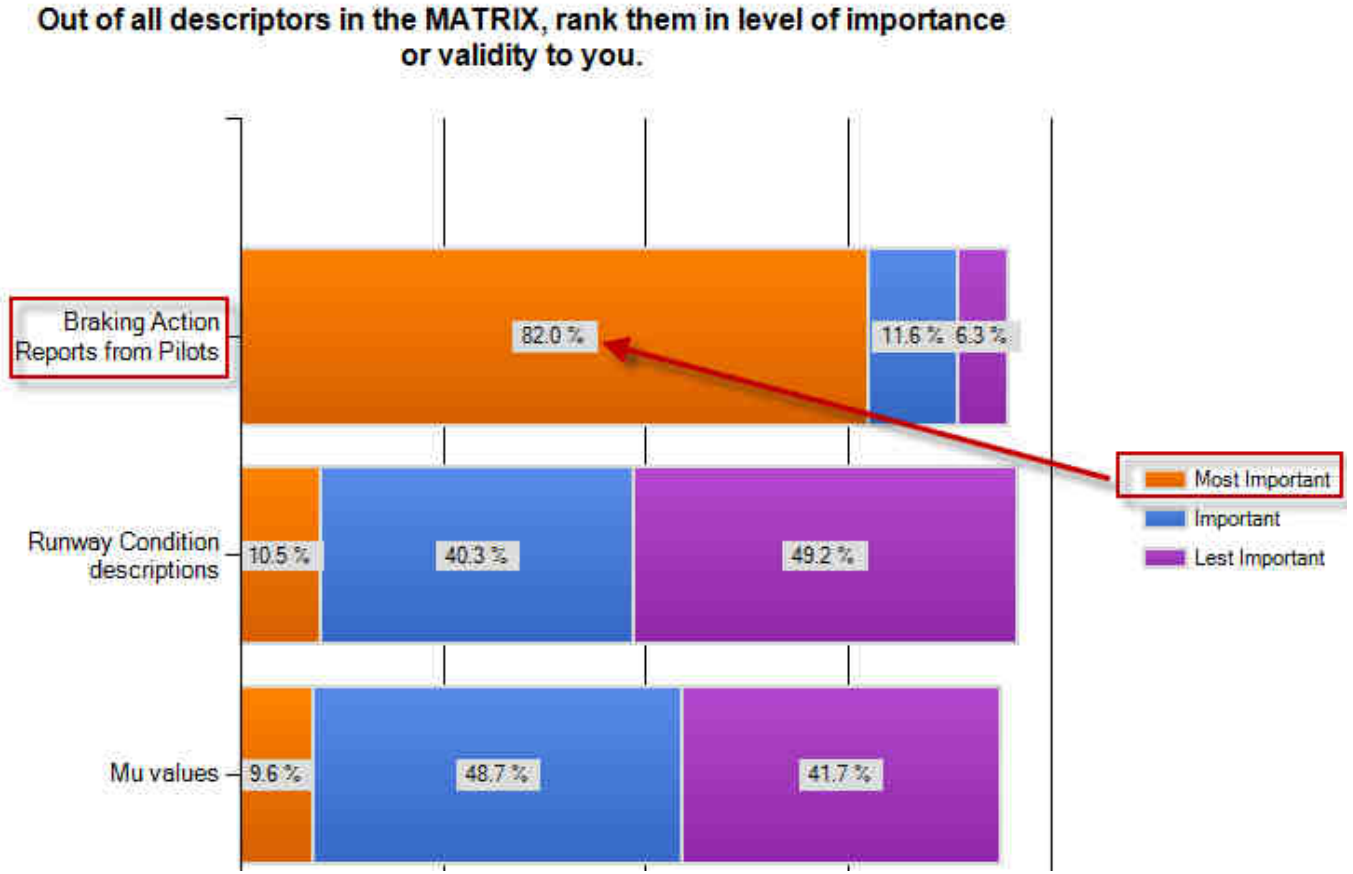
16. When airports report that they have sanded/treated a runway, has your experience been that the actual braking action is _____ than compaired to the MATRIX (temp, contaminate type/depth, Mu values) reported:

Create Chart

	Response Percent
Better	48.6%
Worse	7.6%
No significant difference	43.8%

Pilot reports are divided fairly equally in their opinions of sanding/treating the runway improves or doesn't make a significant difference in the braking action that they experience for the contaminant conditions reported.

Pilot Survey – Matrix Validation



Pilot Braking Action Reports are by far the most reliable means of reporting runway surface conditions. Runway conditions and Mu values are shown to be about equal in reporting and importance.

Quicker and more accurate Landing Data

- Uniform acceptance and reporting from Airports
- Standardized data from Manufacturers
- Standardized Industry use of Matrix
- Timely and accurate surface data
- Standardized easy to use Processes
- Technology enhancements

Questions?

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