TALPA ARC Matrix Validation – An Industry Perspective

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Alaska Airlines

Topics

- 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
- Airplane Performance – By the Numbers

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 FAA 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

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 1/8” and 1/4” of slush, wet snow or dry snow

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
  - Completed – Winter 2010-11
- Changes to the Final TALPA ARC Matrix complete

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

TALPA ARC Matrix after Validation

Airport Runway Condition Assessment				Pilot Reports (PIREPs) Provided To ATC And Flight Dispatch
Assessment Criteria		Downgrade Assessment Criteria		
Code	Runway Condition Description	Mu (μ) [1]	Deceleration And Directional Control Observation	PIREP
6	• Dry	40 or Higher	-	Dry
5	• Wet (includes water 1/8" or less and Damp) • Frost *1/8" or less depth of:* • Slush • Dry Snow • Wet Snow		Braking deceleration is normal for the wheel braking effort applied. Directional control is normal.	Good
4	*-15°C and Colder outside air temperature:* • Compacted Snow	39 to 30	Brake deceleration and controllability is between Good and Medium.	Good to Medium
3	• Wet ("Slippery when wet" runway) • Dry Snow or Wet Snow (Any Depth) over Compacted Snow *Greater than 1/8" depth of:* • Dry Snow • Wet Snow *Warmer than -15°C outside air temperature:* • Compacted Snow		Braking deceleration is noticeably reduced for the wheel braking effort applied. Directional control may be noticeably reduced.	Medium
2	*Greater than 1/8" depth of:* • Water • Slush	29 to 21	Brake deceleration and controllability is between Medium and Poor. Potential for hydroplaning exists.	Medium to Poor
1	• Ice [2]		Braking deceleration is significantly reduced for the wheel braking effort applied. Directional control may be significantly reduced.	Poor
0	• Wet Ice [2] • Water on top of Compacted Snow [2] • Dry Snow or Wet Snow over Ice [2]	20 or Lower	Braking deceleration is minimal to non-existent for the wheel braking effort applied. Directional control may be uncertain.	Nil

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Pilot Version of Matrix

RUNWAY SURFACE CONDITION REPORT ASSESSMENT TABLE (RSCRAT)

	Dry	Wet[1] (Includes water 1/8" or less and Damp)		Contaminant									
Type	N/A	Any	Slippery When Wet	Frost	Standing Water or Slush (WTR-SLR)		Wet Snow or Dry Snow (WSR-LSR)		Compacted Snow (May include Imbedded Ice) (SIR-PSR)		Dry or Wet Snow Over Compacted Snow (WSR OVR SIR)	Ice[2] (IR)	Wet Ice[2] Water Over Compacted Snow[2] Dry or Wet Snow Over Ice[2]
Depth3	N/A	1/8" or less		N/A	1/8"or less	Greater than 1/8"	1/3"or less	Greater than 1/8"	Any	Any	Any	Any	Any
Notes			Slippery When Wet used to indicate excess rubber deposits in touchdown zones.		For Standing Water 1/8" or less report as WET				OAT -15°C or Colder	OAT Warmer than -15°C			Taxi, takeoff, and landing operations in NIL conditions are prohibited.
Rwy Code	6	5 (GOOD)	3 (MEDIUM)	5 (GOOD)	5 (GOOD)	2 (MED to POOR)	5 (GOOD)	3 (MEDIUM)	4 (GOOD to MED)	3 (MEDIUM)	3 (MEDIUM)	1 (POOR)	0 (NIL)

1 For Takeoff – use WET data for any loose contaminant 1/8 inch or less. For Landing – Dispatch Planning, use Dry Landing Field Length Limit Weight if runway is WET and SLIPPERY.
2 The Runway Codes of 1 or 0 may be upgraded to Code 3 if accompanied by current Mu values 40 or better.
3 THIN (THN) may be treated as 1/8 inch or less depth if accompanied by Mu values 40 or better – otherwise THIN (THN) is treated as 1/4 inch.

CAUTION

Temperatures near and above freezing (e.g., at -3°C and warmer) may cause contaminants to behave more slippery than indicated by the runway condition code given in the Runway Surface Condition Report Assessment Table. At these temperatures, airport operators should exercise a heightened level of runway assessment, and should downgrade the runway condition code if appropriate.

Downgrade Assessment Criteria (Mu), Pilot Braking Action Descriptors and Landing Crosswind Component Limits							
Code	6	5	4	3	2	1	0
Mu (μ)[4]		40 μ or higher	39-36 μ	35-30 μ	29-26 μ	25-21 μ	20 μ 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, or directional control is slightly reduced.	Brake deceleration is between MEDIUM and POOR. Potential for hydroplaning exists.	Braking deceleration is significantly reduced for the wheel braking effort applied, or directional control is 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

Runway Surface Condition

RUNWAY SURFACE CONDITION REPORT ASSESSMENT TABLE (RSCRAT)

Rwy Code	6	5 (GOOD)	3 (MEDIUM)	5 (GOOD)	5 (GOOD)	2 (MED to POOR)	5 (GOOD)	3 (MEDIUM)	4 (GOOD to MED)	3 (MEDIUM)	3 (MEDIUM)	1 (POOR)	0 (NIL)

1 For Takeoff – use WET data for any loose contaminant 1/8 inch or less. For Landing – Dispatch Planning, use Dry Landing Field Length Limit Weight if runway is WET and SKID.
2 The Runway Codes of 1 or 0 may be upgraded to Code 3 if accompanied by current Mu values 40 or better.
3 THIN (THN) may be treated as 1/8 inch or less depth if accompanied by Mu values 40 or better – otherwise THIN (THN) is treated as 1/4 inch.

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PIREP	Dry	GOOD	GOOD to MEDIUM	MEDIUM	MEDIUM to POOR	POOR	NIL

Runway Condition Codes and Equivalent BA

RUNWAY SURFACE CONDITION REPORT ASSESSMENT TABLE (RSCRAT)

	Dry	Wet[1] (Includes water 1/8" or less and Damp)		Contaminant									
Type	N/A	Any	Slippery When Wet	Frost	Standing Water or Slush (WTR-SLR)		Wet Snow or Dry Snow (WSR-LSR)		Compacted Snow (May include Imbedded Ice) (SIR-PSR)		Dry or Wet Snow Over Compacted Snow (WSR OVR SIR)	Ice[2] (IR)	Wet Ice[2] Water Over Compacted Snow[2] Dry or Wet Snow Over Ice[2]
Depth3	N/A	1/8" or less		N/A	1/8"or less	Greater than 1/8"	1/3"or less	Greater than 1/8"	Any	Any	Any	Any	Any
Notes			Slippery When Wet used to indicate excess rubber deposits in touchdown zones.		For Standing Water 1/8" or less report as WET				OAT -15°C or Colder	OAT Warmer than -15°C			Taxi, takeoff, and landing operations in NIL conditions are prohibited.

1 For Takeoff – use WET data for any loose contaminant 1/8 inch or less. For Landing – Dispatch Planning, use Dry Landing Field Length Limit Weight if runway is WET and SLR.
2 The Runway Coces of 1 or 0 may be upgraded to Code 3 if accompanied by current Mu values 40 or better.
3 THIN (THN) may be treated as 1/8 inch or less depth if accompanied by Mu values 40 or better – otherwise THIN (THN) is treated as 1/4 inch.

CAUTION

Temperatures near and above freezing (e.g., at -3°C and warmer) may cause contaminants to behave more slippery than indicated by the runway condition code given in the Runwa Surface Condition Report Assessment Table. At these temperatures, airport operators should exercise a heightened level of runway assessment, and should downgrade the runway condition code if appropriate.

Downgrade Assessment Criteria (Mu), Pilot Braking Action Descriptors and Landing Crosswind Component Limits							
Code	6	5	4	3	2	1	0
Mu (μ)[4]		40 μ or higher	39-36 μ	35-30 μ	29-26 μ	25-21 μ	20 μ 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, or directional control is slightly reduced.	Brake deceleration is between MEDIUM and POOR. Potential for hydroplaning exists.	Braking deceleration is significantly reduced for the wheel braking effort applied, or directional control is 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

Braking Action Terms and Definitions

RUNWAY SURFACE CONDITION REPORT ASSESSMENT TABLE (RSCRAT)

	Dry	Wet[1] (Includes water 1/8" or less and Damp)		Contaminant									
Type	N/A	Any	Slippery When Wet	Frost	Standing Water or Slush (WTR-SLR)		Wet Snow or Dry Snow (WSR-LSR)		Compacted Snow (May include Imbedded Ice) (SIR-PSR)		Dry or Wet Snow Over Compacted Snow (WSR OVR SIR)	Ice[2] (IR)	Wet Ice[2] Water Over Compacted Snow[2] Dry or Wet Snow Over Ice[2]
Depth3	N/A	1/8" or less		N/A	1/8"or less	Greater than 1/8"	1/3"or less	Greater than 1/8"	Any	Any	Any	Any	Any
Notes			Slippery When Wet used to indicate excess rubber deposits in touchdown zones.		For Standing Water 1/8" or less report as WET				OAT -15°C or Colder	OAT Warmer than -15°C			Taxi, takeoff, and landing operations in NIL conditions are prohibited.
Rwy Code	6	5 (GOOD)	3 (MEDIUM)	5 (GOOD)	5 (GOOD)	2 (MED to POOR)	5 (GOOD)	3 (MEDIUM)	4 (GOOD to MED)	3 (MEDIUM)	3 (MEDIUM)	1 (POOR)	0 (NIL)

1 For Takeoff – use WET data for any loose contaminant 1/8 inch or less. For Landing – Dispatch Planning, use Dry Landing Field Length Limit Weight if runway is WET and SKR.
2 The Runway Codes of 1 or 0 may be upgraded to Code 3 if accompanied by current Mu values 40 or better.
3 THIN (THN) may be treated as 1/8 inch or less depth if accompanied by Mu values 40 or better – otherwise THIN (THN) is treated as 1/4 inch.

CAUTION

Temperatures near and above freezing (e.g., at -3°C and warmer) may cause contaminants to behave more slippery than indicated by the runway condition code given in the Runway Surface Condition Report Assessment Table. At these temperatures, airport operators should exercise a heightened level of runway assessment, and should downgrade the runway condition code if appropriate.

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 - **with one notable exception**
- 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

Mu Upgrade Exception

Ice[2] (IR)	Wet Ice[2] Water Over Compacted Snow[2] Dry or Wet Snow Over Ice[2]
Any	Any
	Taxi, takeoff, and landing operations in NIL conditions are prohibited.
1 (Poor)	**0 (NIL)**

2. Runway Condition Codes of 1 or 0 may be upgraded to Code 3 if accompanied by Mu values 40 or greater.

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
- Wet or Dry Snow over Compact 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

- 1% to 10% → 10%
- 11% to 25% → 25%
- 26% to 50% → 50%
- 51% to 75% → 75%
- 75% to 100% → 100%

Sample Matrix Report (NOTAM)

Runway Condition Report - Data Collection Sheet

OTZ	Airport
26	Runway
12/7/2011	Date
1440 (24 hr)	Local Time
CWC	Initials
	Flight #

Is the portion of the Runway that is being maintained MORE THAN 25% covered with a contaminant?

[X] **Yes, assign Runway Condition Codes and complete the Matrix Report** (blue box)

[ ] **No, DO NOT assign Runway Condition Codes but complete all other sections of the Matrix Report if any contamination is present** (blue box)

1st Rwy Third	2nd Rwy Third	3rd Rwy Third
- For Coverage **25% or Less** Enter Code 6	- For Coverage **25% or Less** Enter Code 6	- 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) 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.
3	3	3
- Circle (or Mark) Depth Only for: Water, Slush, Wet Snow, Dry Snow, or Any Snow OVER Compacted Snow	- Circle (or Mark) Depth Only for: Water, Slush, Wet Snow, Dry Snow, or Any Snow OVER Compacted Snow	- Circle (or Mark) Depth Only for: Water, Slush, Wet Snow, Dry Snow, or Any Snow OVER Compacted Snow
Dry 6 Wet (Damp) 5 Frost 5 Below Min Friction Level Classification - Wet Slippery 3	Dry 6 Wet (Damp) 5 Frost 5 Below Min Friction Level Classification - Wet Slippery 3	Dry 6 Wet (Damp) 5 Frost 5 Below Min Friction Level Classification - Wet Slippery 3
Water or Slush: GREATER Than 1/8" 2; 1/8" or LESS 5	Water or Slush: GREATER Than 1/8" 2; 1/8" or LESS 5	Water or Slush: GREATER Than 1/8" 2; 1/8" or LESS 5
Slush: GREATER Than 1/8" 3; 1/8" or LESS 5	Slush: GREATER Than 1/8" 3; 1/8" or LESS 5	Slush: GREATER Than 1/8" 3; 1/8" or LESS 5
Wet Snow or Dry Snow: GREATER Than 1/8" 3; 1/8" or LESS 5	Wet Snow or Dry Snow: GREATER Than 1/8" 3; 1/8" or LESS 5	Wet Snow or Dry Snow: GREATER Than 1/8" 3; 1/8" or LESS 5
Depth: 1/8" or Less; 1/4"; 1/2"; 3/4"; 1"; 2" or More	Depth: 1/8" or Less; 1/4"; 1/2"; 3/4"; 1"; 2" or More	Depth: 1/8" or Less; 1/4"; 1/2"; 3/4"; 1"; 2" or More
Dry or Wet Snow OVER Compacted Snow 3	Dry or Wet Snow OVER Compacted Snow 3	Dry or Wet Snow OVER Compacted Snow 3
Compacted Snow: -15°C or Colder 4; Warmer than -15°C 3	Compacted Snow: -15°C or Colder 4; Warmer than -15°C 3	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	Ice 1; Wet Ice, Water OVER Compacted Snow, Snow OVER Ice 0

Misc. Data

-14 °C — **Outside Air Temp**

Active Precip? Yes or [X] No

Adjusted Runway Condition Codes

[ ] [ ] [ ]

(ONLY If Downgrade or Upgrade Assessments Used)

Requires an explanation in the comments section below

Rwy Treatment Used? [X] Sand [ ] Deicing Chem

Time Applied 0600

Rwy Mu	Before (If Applicable)	After
	50	45 50

[X] Dece [ ] CFME

"Matrix Report . . OTZ (Airport) _ Rwy 26 (Rwy #) _ 3/ 3/ 3 (Rwy Condition Codes) 100 (%) (% Coverage - 10, 25, 50, 75, or 100%) _ - _ (inch) (Highest Depth only for Slush, Wet Snow or Dry Snow and Standing Water [Water 1/8 " or less report as WET with no depth]) _Compact Snow_ _ _ _ _ _ _ (Contaminant Type [Report in terms in Green Boxes, Water 1/8 " or less report as WET])

runway was sanded full width and length

(Remarks to be transmitted)

12/7/2011 (Date) 1440 (Time) "

Percentage Vs "Patchy"

Affect of various percentage of coverage on aircraft performance:

- 10% (1% thru 10%) Does not require any Performance Penalties
- 25% (11% thru 25%) Does not require any Performance Penalties
- 50% (26% thru 50%) Treat as 100% for performance Calculations
- 75% (51% thru 75%) Treat as 100% for performance Calculations
- 100% (76% thru 100%) Treat as 100% for performance Calculations

Patchy Thin Ice with Patchy Thin Water?!

CERT ALERT 09-13

….. Current guidance considers a "Patchy" condition to exist anytime the surface is covered by less than 100% of the contaminate. New airport surface condition reporting terminology is being developed by a joint FAA/Industry group. However until the new guidance is completed and published, the FAA is directing that only contaminate conditions that cover 25% or less of the cleared/treated/usable surface be classified as "Patchy." Conditions covering more than 25% should be considered as covering the total surface area for surface condition reporting purposes. This breakdown will match the breakdown provided to airplane operators by the aircraft manufacturers for performance on contaminated surfaces.

This is 25% coverage, and would not require a performance adjustment by the pilot.

When the runway is not cleared to its full width, the percent of coverage only applies to the part of the runway that has been treated/cleared.

In this case, this would still represent 25% coverage.

If the coverage is concentrated in one of the thirds of the runway, even though it is still 25% - We need to know about this.

This would be an example of where you would DOWNGRADE that third of the runway – RWY 26 6/6/3 25% Compact Snow (last third of the runway)

Matrix Evaluation

- Winter (2009-2010) conducted Matrix validation testing at 7 Airports in Alaska, and 3 in Great Lakes Region in coordination with Alaska Airlines and Pinnacle Airlines.
- All Airports and Flight Crew Trained to provide Accurate Data
- Winter (2010-2011) conducted Matrix validation testing at 11 Airports in Alaska, and 17 in "Lower 48" in coordination with Alaska Airlines and Pinnacle Airlines.
- All Airports and Flight Crew Trained to provide Accurate Data

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?

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 11 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.

Data to FAA Technical Center

Number of Airport Reports in the Database

Alaska Region	1,330
Lower 48	760
TOTAL	**2,090**
Discarded Reports	27 (not included in the Total)

Data to FAA Technical Center

Number of Pilot Braking Action Reports in the Database

Alaska Region	8,685
Lower 48	12,182
TOTAL	**20,867**

Data to FAA Technical Center

Total Number of Reports with frequency of each Pilot Braking Action

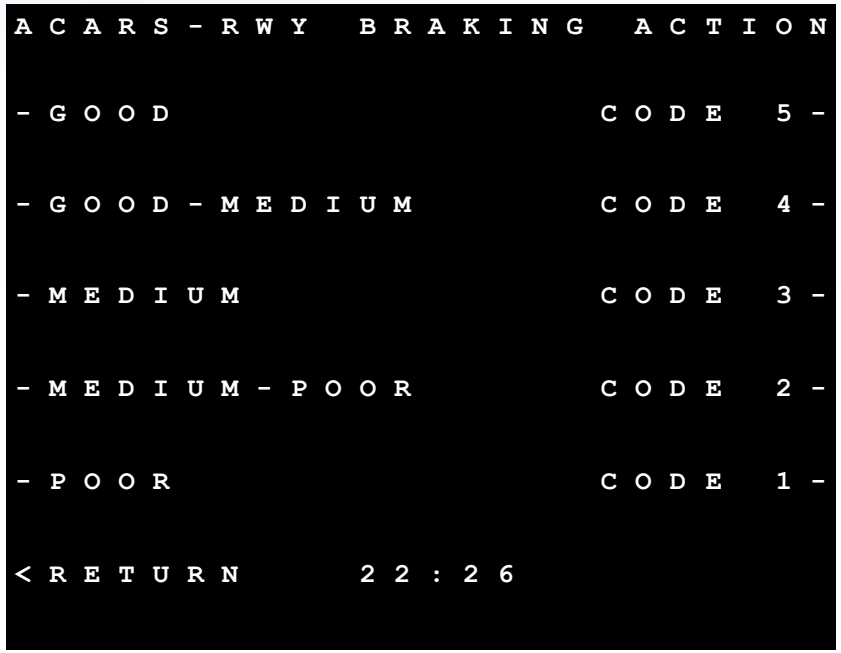
• Dry	* 10,829
• Good	* 9,314
• Good – Medium	250
• Medium	161
• Medium – Poor	32
• Poor	104

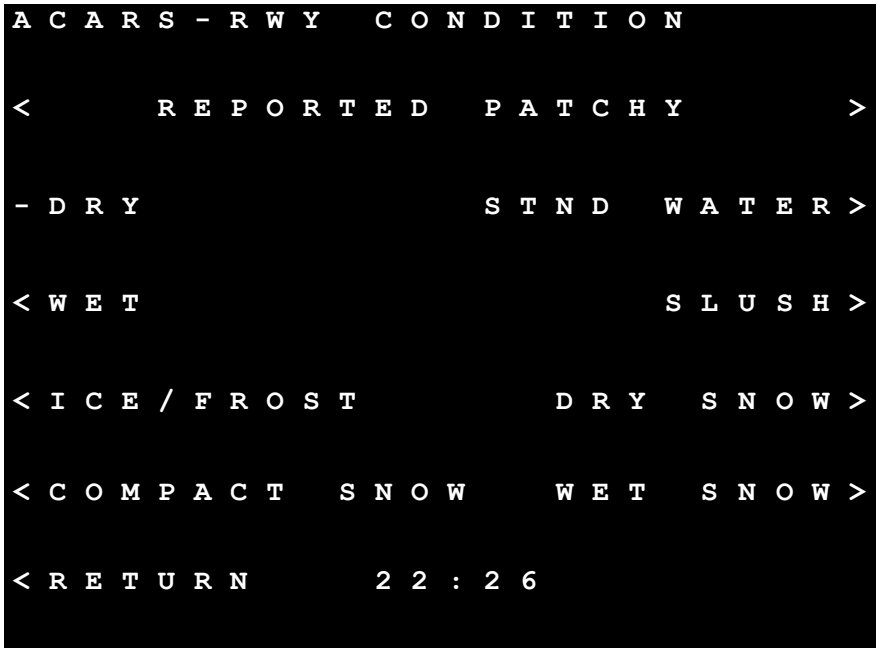
Data to FAA Technical Center

Total Number of Reports with frequency of each Pilot Braking Action

Pilot Braking Action	60 Minutes	30 Minutes
Dry	207	94
Good	688	365
Good-Medium	68	32
Medium	36	24
Medium-Poor	7	4
Poor	5	4
Nil	1	1

Aircraft Performance by the Numbers





Aircraft Performance by the Numbers

```
COMPACT  SNOW  OPTIONS

<COMPACT  SNOW  (SIR)

<WATER  OVR  COMPACT  SNW

-DRY  SNW  OVR  COMPACT  SNW

-WET  SNW  OVR  COMPACT  SNW



<RETURN      22:26
```

```
ACARS-OTZ  LAND  400        1/3
RW09           DS/SIR
TM13  29.43  SIR3  MED
WND  026M/06       X05  HW03


AB-MAX          FLP30       FLP40
VREF+ADD     140+05      136+05
LDA     5900   124.6       129.3
LDW  120.1     5700         5518
<PRINT

<RETURN      22:26
```

Aircraft Performance by the Numbers

```
ACARS-OTZ  LAND  400        2/3
RW09                  LDW  120.1
WTS  BASED  ON  LDA   5900
AB-MAX
                   FLP30      FLP40
5  GOOD            155.0      155.0
4  GD/MD           140.9      146.7
3#MED              124.6      129.3
2  MD/PR      *111.3W    *116.3W
1  POOR       *  99.6W    *104.6W
<PRINT

<RETURN        22:26
```

```
ACARS-OTZ  LAND  400        3/3
RW09                  LDA   5900
DIST  BASED  ON  LDW  120.1
AB-MAX
                   FLP30      FLP40
5  GOOD             4539       4395
4  GD/MD            5119       4957
3#MED               5700       5518
2  MD/PR      *   6354W   *   6088W
1  POOR       *   7094W   *   6742W
<PRINT

<RETURN        22:26
```

Thank You!

Questions?

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