Airport Safety R&D Program @
William J. Hughes
FAA Technical Center

TALPA
Data Analysis Briefing

Presented to: **TALPA Update Meeting**

By: *Nick Subbotin (FAA)*

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Introductions & Acknowledgements

- **FAA Airport Safety & Standards (AAS)**
  - Susan Gardner, Phil Davenport, Alberto Rodriguez
- **CSRA**
  - Nick Schaeffer and William Smith
- **ARA**
  - Pam Phillips, Sam Guy, and Jim White
- **FAA NOTAM Office**
  - Trish Gay, Ryan Forster and Navpreet Kohli
- **MITRE**
  - Justin Cox and Ian Clark

Outline

- Background
- Objectives
- Observations and Results
- NIL PIREP (Pilot Braking Action) Analysis
- Questions/Comments

Definitions

FICON: Field Condition

PIREP: Pilot Braking Action Report

RwyCC: Runway Condition Code

NOTAM: Notice to Airmen

RCAM: Runway Condition Assessment Matrix

ENII (EN2): Federal NOTAM System, E-NOTAM II (Electronic Notice to Airmen)

NOTAM Manager: Federal NOTAM System (Direct Digital Entry Tool)

METAR: Aviation Routine Weather Report

Part 139 Airports: Airports serving scheduled passenger-carrying operations of an air carrier operating aircraft configured for more than 9 passenger seats; and unscheduled passenger-carrying operations of an air carrier operating aircraft configured for at least 31 passenger seats.

Background - (Airport Operator Version)

R unway
C ondition
A ssessment
M atrix

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

Background - (Pilot Version)

Assessment Criteria		Control/Braking Assessment Criteria	
Runway Condition Description	**RwyCC**	**Deceleration or Directional Control Observation**	**Pilot Reported Braking Action**
• Dry	6	---	---
• Frost • Wet (Includes damp and 1/8 inch depth or less of water) ***1/8 inch (3mm) depth or less of:*** • Slush • Dry Snow • Wet Snow	5	Braking deceleration is normal for the wheel braking effort applied AND directional control is normal.	Good
-15°C and Colder outside air temperature: • Compacted Snow	4	Braking deceleration OR directional control is between Good and Medium.	Good to Medium
• Slippery When Wet (wet runway) • Dry Snow or Wet Snow (any depth) over Compacted Snow ***Greater than 1/8 inch (3 mm) depth of:*** • Dry Snow • Wet Snow ***Warmer than -15°C outside air temperature:*** • Compacted Snow	3	Braking deceleration is noticeably reduced for the wheel braking effort applied OR directional control is noticeably reduced.	Medium
Greater than 1/8 inch(3 mm) depth of: • Water • Slush	2	Braking deceleration OR directional control is between Medium and Poor.	Medium to Poor
• Ice	1	Braking deceleration is significantly reduced for the wheel braking effort applied OR directional control is significantly reduced.	Poor
• Wet Ice • Slush over Ice • Water over Compacted Snow • Dry Snow or Wet Snow over Ice	0	Braking deceleration is minimal to non-existent for the wheel braking effort applied OR directional control is uncertain.	Nil

Background - RCAM Contaminants

- Wet
- Frost
- Slush
- Wet Snow
- Dry Snow
- Compacted Snow
- Water over Compacted Snow
- Dry Snow over Compacted Snow
- Wet Snow over Compacted Snow
- Dry Snow over Ice
- Wet Snow over Ice
- Slush over Ice
- Ice
- Wet Ice

Objectives

Primary Objective – Data analysis of 2016/17 implementation of the Runway Condition Assessment Matrix (RCAM) and revised winter operations field condition reporting process.

- Acquire all FICONs from the NOTAM System (Oct 1, 2016 – Apr 30, 2017)
- Develop an analytical toolset/database to accomplish the objective
- Import METAR weather data into the database
- Perform statistical analysis of all available information (contaminants, RwyCCs, PIREPs, comparisons, etc.)
- In-depth analysis in key areas
- Explore areas of interest, identify data irregularities, and considerations for improvement

2013 FAA Technical Note (DOT/FAA/TC-TN13/22) provided an overview of the Runway Condition Assessment Matrix (RCAM) validation efforts conducted during 2009-2011

METAR Weather Data

- **Incorporated METAR Data for analysis, particularly for in-depth analysis in key areas**
- **Not all Airports have their own METAR data.**
- **Not all METAR data is issued at the exact same time as a FICON.**
- **There was a very large volume of METAR information.**
- **METAR data narrowed down:**
  - Wind direction and gusts, precipitation, ceiling, and visibility.

Observations and Results

Bulk Data Analysis

All FICONs	**136,428**
FICONs with RwyCCs	107,889
FICONs without RwyCCs	28,539

FICONs with PIREPs	**2,809**
FICONs with RwyCCs & PIREPs	2,473
FICONs without RwyCCs & with PIREPs	336

Data Analysis Outline

All FICONs

FICONs and RwyCCs

FICONs with PIREPs

Contaminants

Airport Operator Adjusted RwyCCs

RwyCC and PIREP Examination

Selected Data Analysis

All FICONs

- FICONs and RwyCCs
- FICONs with PIREPs
- Contaminants
- Airport Operator Adjusted RwyCCs
- RwyCC and PIREP Examination

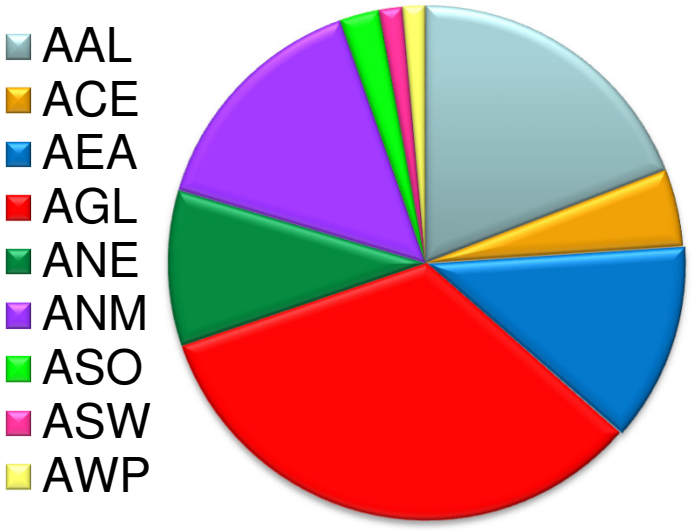
All FICONs

FICON Total: 136,428 Entries

Caveats

- Some FICONs didn’t qualify for RwyCCs
  - Examples: Dry runways or percent coverage did not qualify
- Most FICONs didn't have a PIREPs
- Some FICONs have PIREP but no RwyCC
- Some FICONs active for less than 2 minutes

Regional FICON Distribution



Airports that submitted FICONs	
REGION	COUNT
AAL	145
ACE	167
AEA	183
AGL	418
ANE	89
ANM	194
ASO	105
ASW	81
AWP	53

		Total FICONs by region
Alaska Region	AAL	26,059
Central Region	ACE	6,619
Eastern Region	AEA	17,021
Great Lakes Region	AGL	45,517
New England Region	ANE	13,358
Northwest Mountain Region	ANM	20,507
Southern Region	ASO	3,396
Southwest Region	ASW	2,000
Western Pacific Region	AWP	1,951

FICONs at Airports

Total Number of FICONs	**136,428**	
Part-139 Airports	**100,220**	**73%**
Non-Part-139 Airports	**36,208**	**27%**
Total Number of Airports reporting FICONs	**1,435**	
Part-139 Airports	**427**	**30%**
Non-Part-139 Airports	**1,008**	**70%**

Selected Data Analysis

- All FICONs
- **FICONs and RwyCCs**
- FICONs with PIREPs
- Contaminants and PIREPs
- Airport Operator Adjusted RwyCCs
- RwyCC and PIREP Examination

FICONs and RwyCCs

Total Number of FICONs	**136,428**	
FICONs with RwyCCs	**107,889**	**79%**
FICONs without RwyCCs	**28,539**	**21%**

Percentage of contaminant coverage may not qualify for a RwyCC (Example: < 25% coverage) or could be a dry runway assessment.

FICONS with RwyCC Distribution

RwyCC	RwyCC Count	
5/5/5	68,391	63.4%
4/4/4	3,843	3.6%
3/3/3	23,863	22.1%
2/2/2	2,262	2.1%
1/1/1	7,304	6.8%
Mixed RwyCC **Examples: (5/5/3) or (6/5/5)**	**2,226**	**2.1%**
Total:	**107,889**	

FICONs with RwyCCs at Airports

Total Number of FICONs	**136,428**	
FICONS from Part-139 Airports	100,220	73%
FICONS from non-Part-139 Airports	36,208	27%
Total Number of FICONs with RwyCCs	**107,889**	**79%**
Part-139 Airports	**83,331**	**77%**
Non-Part-139 Airports	**24,558**	**23%**

Percentage of contaminant coverage may not qualify for a RwyCC (Example: < 25% coverage) or could be a dry runway assessment.

Selected Data Analysis

- All FICONs
- FICONs and RwyCCs
- **FICONs with PIREPs**
- Contaminants
- Airport Operator Adjusted RwyCCs
- RwyCC and PIREP Examination

FICONs with PIREPS

Total Number of FICONs	136,428	
FICONs without PIREPs	133,619	97.9%
FICONs with PIREPs	2,809	2.1%

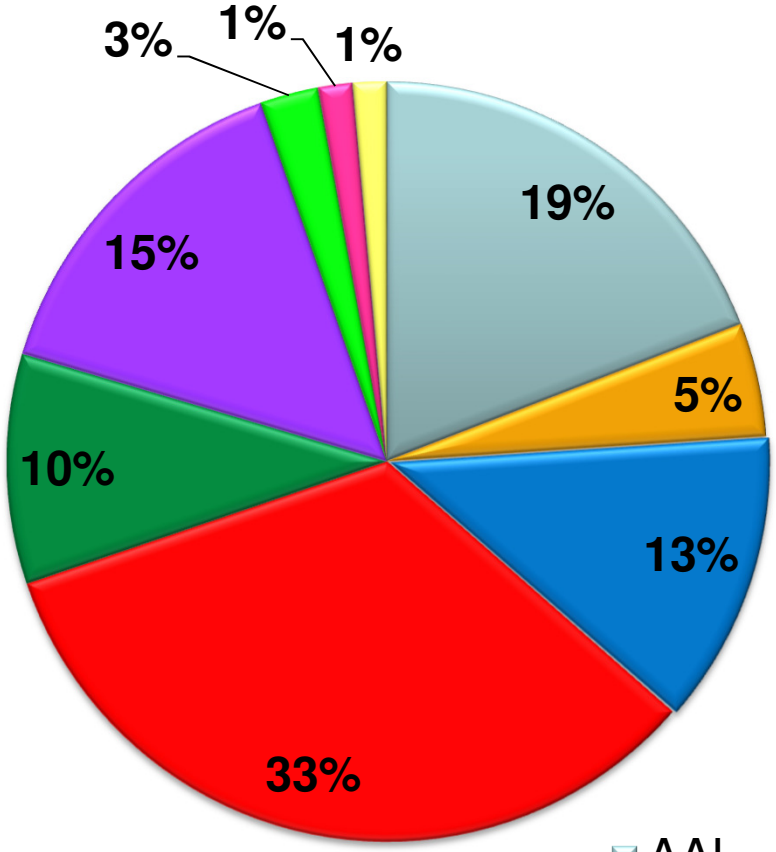
Regional PIREP Distribution

2,809 FICONs with PIREPS

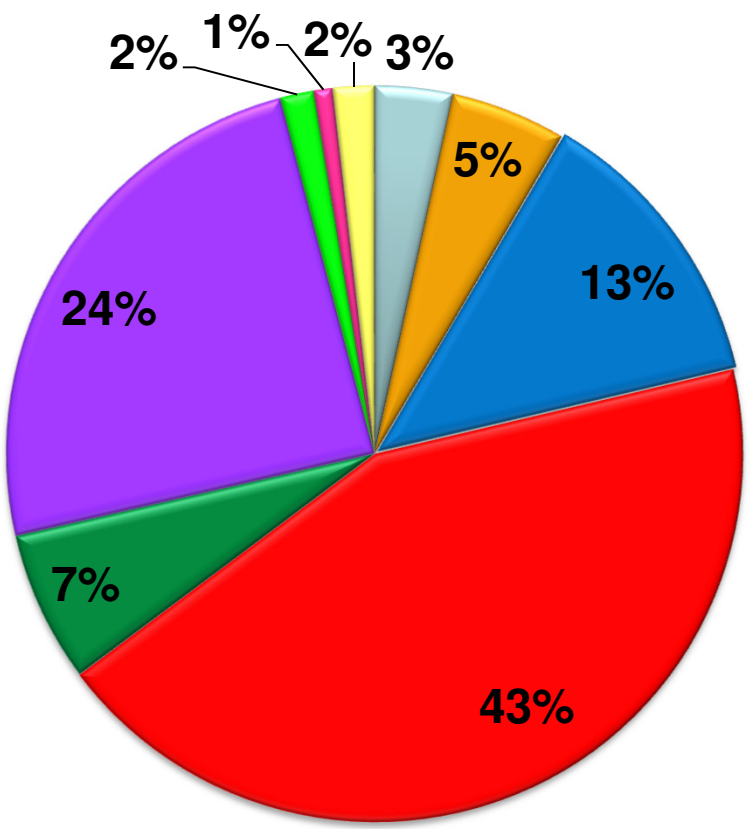
		Total PIREPs by region
Alaska Region	AAL	96
Central Region	ACE	142
Eastern Region	AEA	361
Great Lakes Region	AGL	1,221
New England Region	ANE	186
Northwest Mountain Region	ANM	687
Southern Region	ASO	42
Southwest Region	ASW	23
Western Pacific Region	AWP	51

Comparison

Total FICONs: 136,428



FICONs with PIREP: 2,809

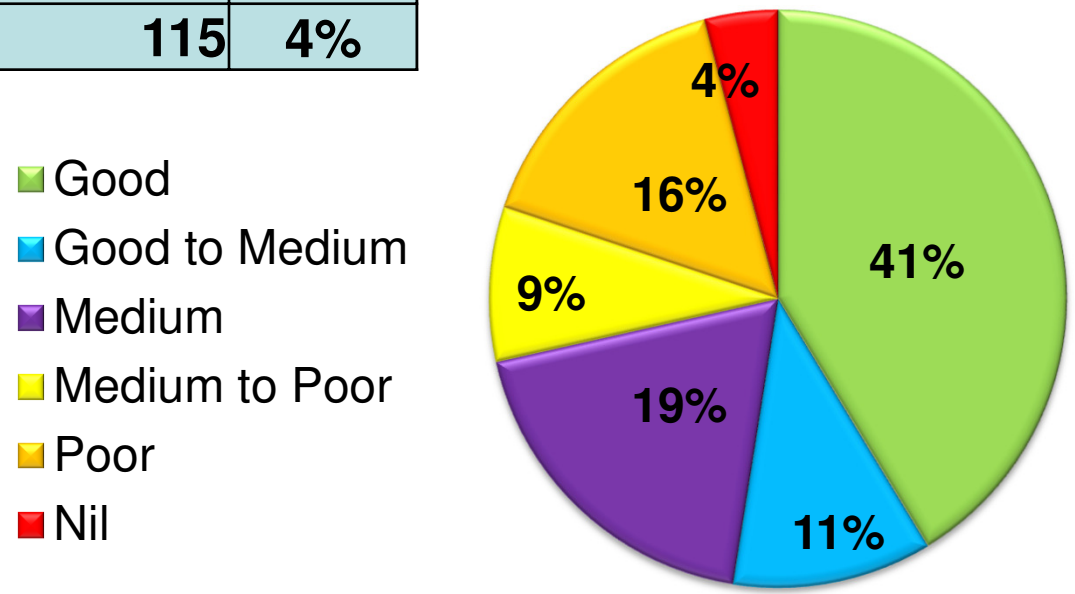


AAL ACE AEA AGL ANE
ANM ASO ASW AWP

PIREP Distribution

PIREP	PIREP Count	
Good	1,161	41%
Good to Medium	314	11%
Medium	533	19%
Medium to Poor	243	9%
Poor	443	16%
Nil	115	4%

FICONs with PIREP:	2,809



Selected Data Analysis

- All FICONs
- FICONs and RwyCCs
- FICONs with PIREPs
- **Contaminants**
- Airport Operator Adjusted RwyCCs
- RwyCC and PIREP Examination

Contaminants

Contaminants	Contaminant count	FICON %
FROST	3,838	3%
WET	60,899	45%
WET SNOW	12,261	9%
DRY SNOW	39,451	29%
SLUSH	4,699	3%
COMPACTED SNOW	24,230	18%
DRY SN OVER COMPACTED SN	7,333	5%
WET SN OVER COMPACTED SN	1,036	1%
ICE	22,274	16%
WET ICE	304	0%
SLUSH OVER ICE	123	0%
WATER OVER COMPACTED SN	13	0%
DRY SN OVER ICE	1,103	1%
WET SN OVER ICE	229	0%

Total Contaminant Count = 177,793.

A FICON may contain multiple contaminant types.

Example: 5/5/5 - Wet, Wet, Wet Snow

Runway Improvements	Contaminant count	FICON %
SAND	7,403	5%
DEICED	8,248	6%
DEICED SOLID	3,112	2%
DEICED LIQUID	6,348	5%
SCARIFIED ICE	45	0%

Breakdown of Wet FICONs

FICON Total: 136,428 Entries

FICONs with a WET contaminant	60,899	45%
FICONs with WET on all runway thirds*	47,726	35%
FICONS with WET 100% coverage	41,860	31%
FICONs with WET less than 100% coverage	5,866	4%

*554 Airports reported WET on all runway thirds

Contaminants with PIREPs

Contaminant*	PIREP count
FROST	37
WET	724
WET SNOW	407
DRY SNOW	1,099
SLUSH	172
COMPACTED SNOW	485
DRY SNOW OVER COMPACTED SNOW	161
WET SNOW OVER COMPACTED SNOW	25
ICE	833
WET ICE	23
SLUSH OVER ICE	3
WATER OVER COMPACTED SNOW	1
DRY SNOW OVER ICE	18
WET SNOW OVER ICE	4

***A single FICON may contain multiple contaminants.**

Selected Data Analysis

- All FICONs
- FICONs and RwyCCs
- FICONs with PIREPs
- Contaminants
- **Airport Operator Adjusted RwyCCs**
- RwyCC and PIREP Examination

RwyCCs Adjustments – Focused with PIREPs

		RwyCC					
Contaminants	**Count**	**6**	**5**	**4**	**3**	**2**	**1**
FROST (5)	35	0	21	↓ 2	↓ 10	↓ 2	0
WET (5)	280	0	255	↓ 16	↓ 9	0	0
WET SNOW (5,3)	357	0	125	↓ 22	179	↓ 15	↓ 16
DRY SNOW (5,3)	687	0	289	↓ 29	330	↓ 22	↓ 17
SLUSH (5,2)	136	0	80	↓ 11	↓ 10	32	↓ 3
COMPACTED SNOW (4,3)	198	0	0	61	128	↓ 8	↓ 1
DRY SNOW OVER COMPACTED SNOW (3)	129	0	0	0	118	↓ 11	0
WET SNOW OVER COMPACTED SNOW (3)	24	0	0	0	23	0	↓ 1
ICE (1)	380	0	0	0	26 ↑	6 ↑	348
WET ICE (0)	8	0	0	0	3 ↑	0	5 ↑
SLUSH OVER ICE (0)	2	0	0	0	0	0	2 ↑
WATER OVER COMPACTED SNOW (0)	0	0	0	0	0	0	0
DRY SNOW OVER ICE (0)	12	0	0	0	1 ↑	1 ↑	10 ↑
WET SNOW OVER ICE (0)	4	0	0	0	2 ↑	0	2 ↑
Bold contaminants yield a zero RwyCC					Operator Adjusted		**263**

Selected Data Analysis

- All FICONs
- FICONs and RwyCCs
- FICONs with PIREPs
- Contaminants
- Airport Operator Adjusted RwyCCs

RwyCC and PIREP Examination

RwyCC and PIREP Examination

Total Number of FICONs	136,428	
FICONs without PIREPs	133,619	97.9%
FICONs with PIREPs	2,809	2.1%

FICONs with RwyCC and PIREP	2,473	88.1% of 2,809	1.81% of 136,428
FICONs without RwyCC and with PIREP	336	11.9% of 2,809	0.2% of 136,428

RwyCC and PIREP Examination

FICONS with RwyCC

RwyCC	RwyCC Count	
5/5/5	68,391	63.4%
4/4/4	3,843	3.6%
3/3/3	23,863	22.1%
2/2/2	2,262	2.1%
1/1/1	7,304	6.8%
Mixed RwyCC	**2,226**	**2.1%**

Total: 107,889

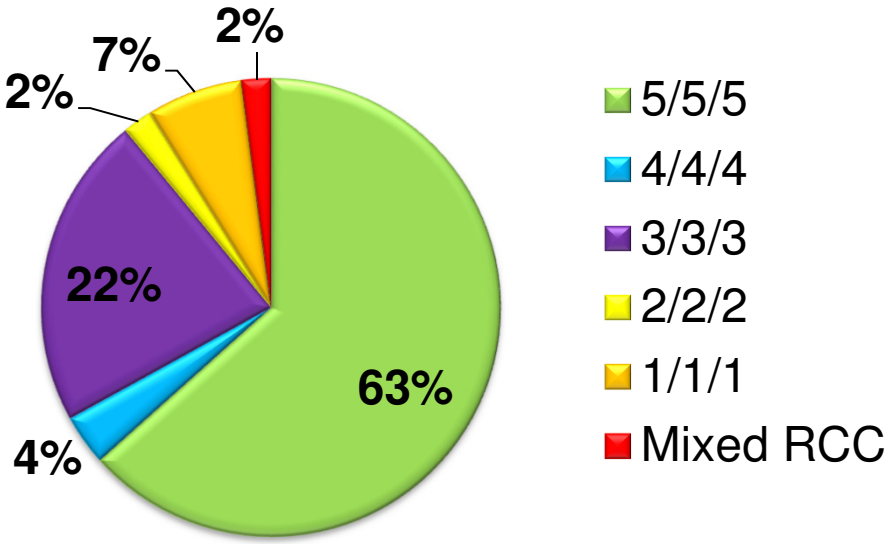
FICONs with RwyCC & PIREPs

RwyCC	PIREP Count	
5/5/5	949	38.4%
4/4/4	153	6.2%
3/3/3	777	31.4%
2/2/2	88	3.6%
1/1/1	427	17.3%
Mixed RwyCC	**79**	**3.2%**

Total: 2,473

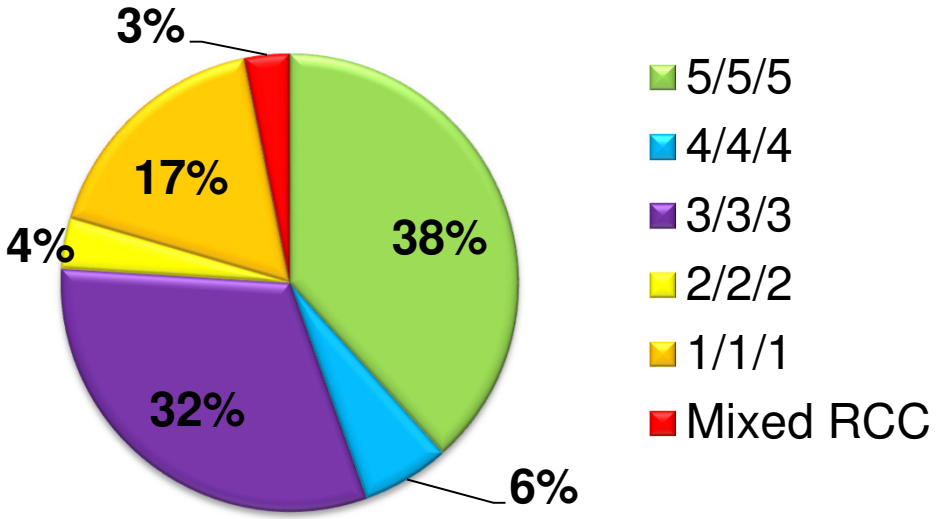
Comparison

FICONs with RwyCC



Total: 107,889

FICONs with RwyCC & PIREPs



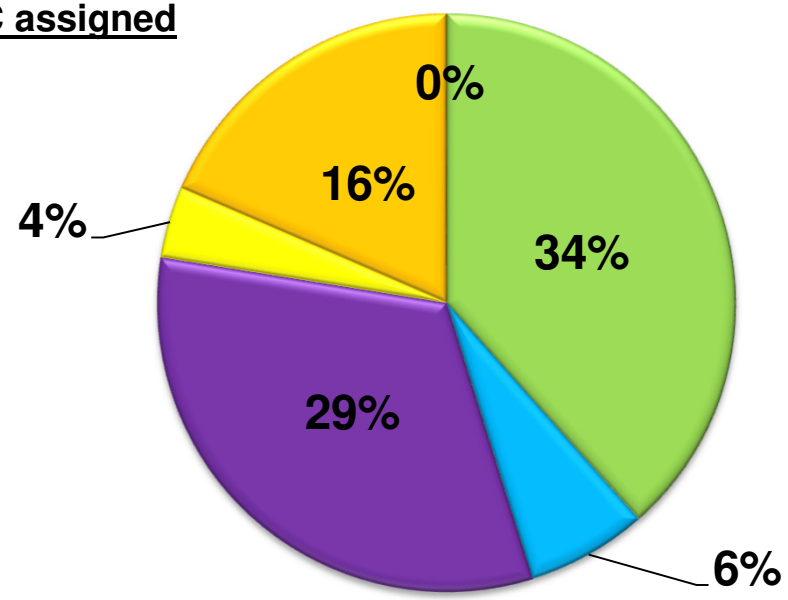
Total: 2,473

RwyCCs with PIREPs Categorization

Each set of RwyCCs were categorized by the lowest RwyCC assigned

RwyCC	PIREP Count	
5	948	34%
4	167	6%
3	801	29%
2	99	4%
1	458	16%
0	-	0%

Total: 2,473



RwyCC and PIREP Examination

The two RCAM FAA validation efforts conducted during 2009-2011 resulted in an FAA Technical Report that framed the basis for the RCAM that we have today.

The FICON RwyCCs were categorized by the lowest RwyCC amongst the 3 thirds of the runway.

Important Data Examination Consideration

2009-11 RCAM Validation

- FICON with RwyCCs (Airport Report) came before PIREP.
  - RwyCCs were matched to a PIREP within 60-minute and 30-minute time frames
  - Time frames of RwyCCs, PIREP, & aircraft type were known
- "Easy" Explanation: RwyCC then PIREP (60 & 30 minute time frames)

2016-17 RCAM Analysis

- PIREPs were optionally recorded by Airport Operator
  - PIREP time unknown & aircraft most times unknown
- Most cases PIREP came before FICON

RwyCC and PIREP Examination

RwyCC's were treated as follows:

RwyCC same row as PIREP:
MATCH

Example: RwyCC 5 with a Good PIREP

RwyCC is "lower" than a PIREP:
FAVORABLE Condition Coding

Example: RwyCC 3 with a Good PIREP

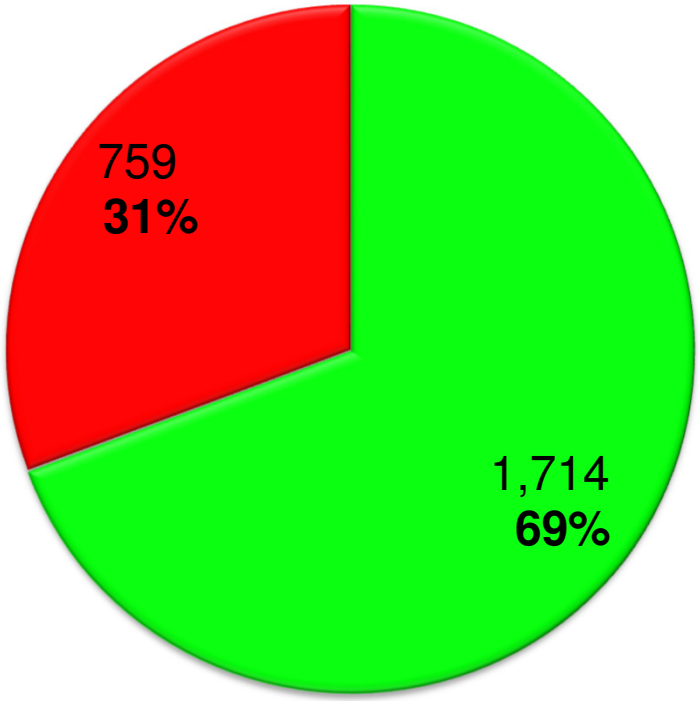
RwyCC is "higher" than a PIREP:
UNFAVORABLE Condition Coding

Example: RwyCC 3 with a Poor PIREP

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

RwyCC and PIREP Examination

Total FICONs with RwyCCs and PIREPs: 2,473



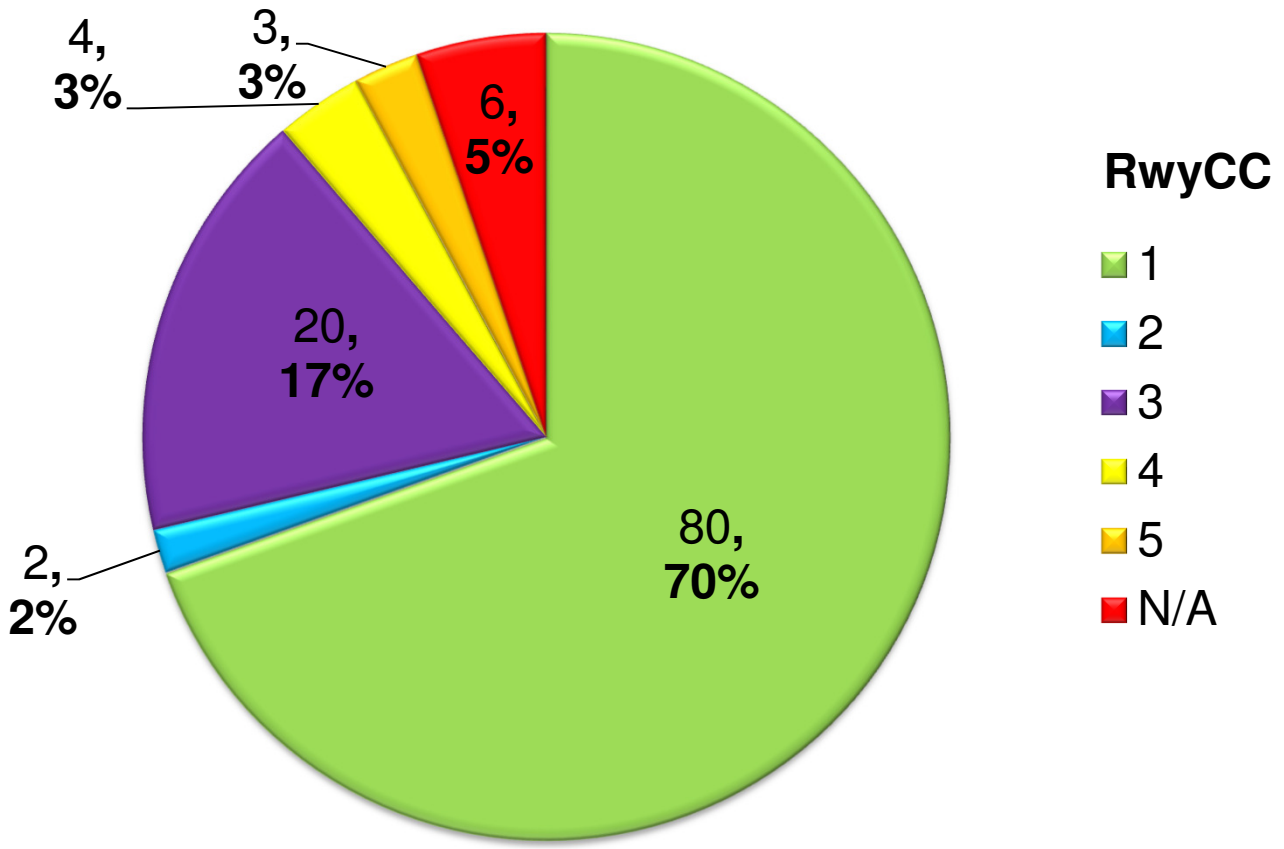
- Match or Favorable
- Unfavorable condition coding

Important Data Examination Considerations:

- **Differences between 2009-11 RCAM Validation & 2016-17 RCAM Analysis**
- **2,473 is ONLY 2.3% of 107,889 FICONs with RwyCC**

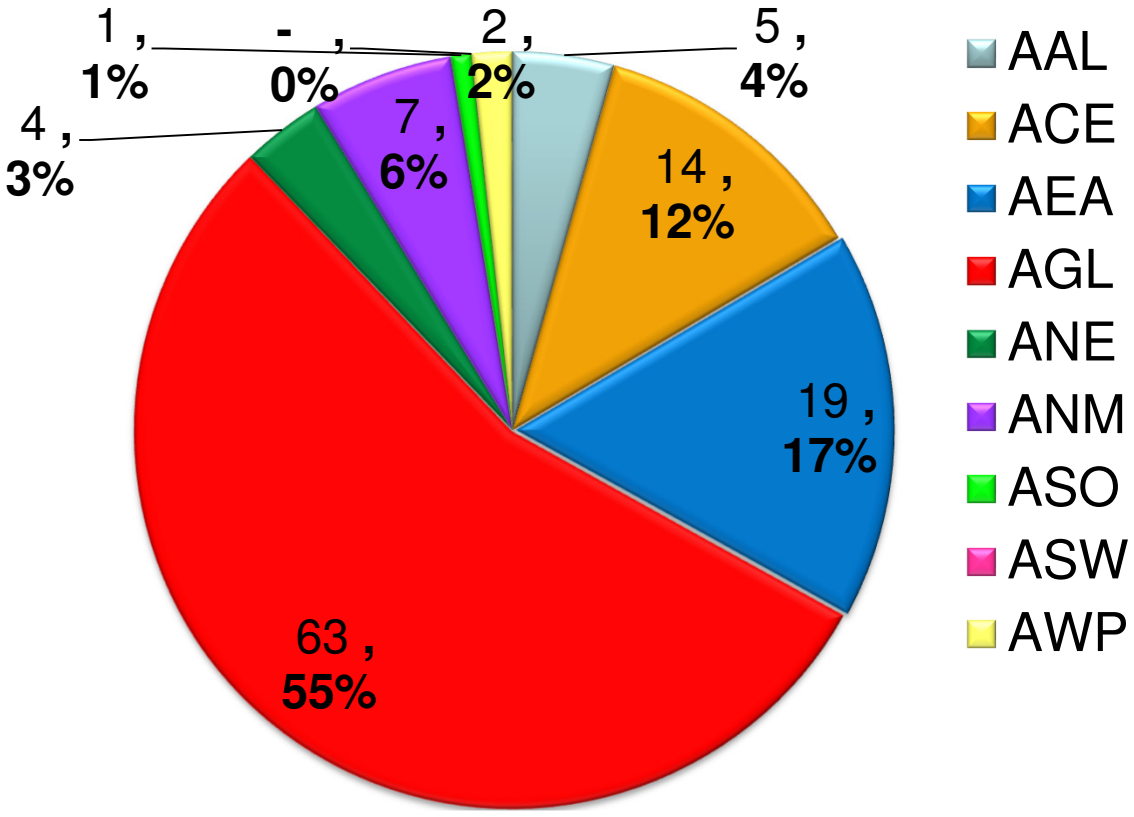
NIL PIREP Analysis
115 total

NIL PIREP with Associated RwyCC



115 total

NIL PIREP by Region



115 total

Closing Remarks

- **136,428 FICONS!!**
  - 1,435 Airports Reporting FICONs
- **411 Airports recorded PIREPS**
  - Thank you to those airport who took the time to enter the PIREP data
- **Our data analysis tools allow in-depth examination of all FICON and PIREP data**
  - Very capable analytical toolset/database for in-depth analysis
  - For the researchers, more data = more analysis = more value to the airport community

Questions or Comments?

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