Takeoff and Landing Performance Assessment Validation Effort of the Runway Condition Assessment Matrix

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June 2013

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16. Abstract

In 2009, the Takeoff and Landing Performance Assessment (TALPA) Aviation Rulemaking Committee (ARC) recommended that the Federal Aviation Administration (FAA) conduct a trial program or validation effort to assess the use of a Runway Condition Assessment Matrix (RCAM), commonly referred to as the Matrix. The validation effort was intended to examine the RCAM's processes to determine if they could be implemented at airports nationwide in order to disseminate runway surface condition information to pilots prior to landing. The objectives included validating the correlation between the Matrix surface condition descriptions and pilot braking action reports (PIREP) and determining the usability of the Matrix for airport operators and pilots.

This technical note gives a general overview and background of the TALPA ARC and provides an overview of the two RCAM FAA validation efforts during consecutive winter airport operations seasons in 2009-10 and 2010-11. Recommendations for changes to the RCAM are also provided. This technical note discusses these two validation efforts along with the evaluation approach, analysis, results, and recommendations. Similarly, the revisions and changes that affected the RCAM and its processes during the course of this effort are also described.

An Industry Team comprised of industry representatives instrumental in the development of the RCAM, along with the FAA, airport operators, and air carrier representatives who participated in the validation efforts, reviewed the evaluation approach, analysis, and results. Based on the results of the validation efforts, the Industry Team recommended that the FAA work to implement the RCAM and its processes into aviation operations.

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LIST OF ACRONYMS

AAL	Alaskan Region
AAS	Office of Airport Safety and Standards
AC	Advisory Circular
ACARS	Aircraft Communications Addressing and Reporting System
ADQ	Kodiak Airport
AEA	Eastern Region
AFS	Flight Standards Service
AGL	Great Lakes Region
AIA	Aerospace Industries Association
AIM	Aeronautical Information Manual
ALPA	Air Lines Pilot Association
ANM	Northwest Mountain Region
ANC	Ted Stevens Anchorage International Airport
ARC	Aviation Rulemaking Committee
ASE	Aspen-Pitkin County Airport/Sardy Field
ATC	Air Traffic Control
BET	Bethel Airport
BIL	Billings Logan International Airport
BJI	Bemidji Regional Airport
BUF	Buffalo Niagara International Airport
CDV	Merle K. (Mudhole) Smith Airport
CFME	Continuous friction measuring equipment
CONUS	Contiguous United States
DEN	Denver International Airport
DOT	Department of Transportation
DRO	Durango-La Plata County Airport
EGE	Eagle County Regional Airport
FAA	Federal Aviation Administration
FAI	Fairbanks International Airport
FOQA	Flight Operational Quality Assurance
FSS	Flight Service Station
GFK	Grand Forks International Airport
GRR	Gerald R. Ford International Airport
HPN	Westchester County Airport
JNU	Juneau International Airport
KTN	Ketchikan International Airport
LAN	Capitol Regional International Airport
MKE	General Mitchell International Airport
MSN	Dane County Regional Airport/Truax Field
MSP	Minneapolis-St. Paul International Airport/Wold-Chamberlain
NAS	National Airspace System
NBAA	National Business Aviation Association, Inc.
NOTAM	Notice to Airmen

OAT	Outside air temperature
OME	Nome Airport
OTZ	Ralph Wien Memorial Airport
PIREP	Pilot braking action report
PSG	Petersburg James A. Johnson Airport
RCAM	Runway Condition Assessment Matrix
RCC	Runway Condition Code
R&D	Research and development
SAFO	Safety Alert for Operators
SBN	South Bend Regional Airport
SUN	Friedman Memorial Airport
TALPA	Takeoff and Landing Performance Assessment
TEB	Teterboro Airport
TVC	Cherry Capital Airport
WRG	Wrangell Airport
YAK	Yakutat Airport

EXECUTIVE SUMMARY

In 2009, the Takeoff and Landing Performance Assessment (TALPA) Aviation Rulemaking Committee (ARC) recommended that the Federal Aviation Administration (FAA) conduct a trial program or validation effort to assess the use of the first Runway Condition Assessment Matrix (RCAM) titled the Paved Runway Condition Assessment Table, commonly referred to as the Matrix. The validation effort was intended to examine the RCAM's processes to determine if they could be implemented at airports nationwide in order to disseminate runway surface condition information to pilots prior to landing. The objectives included validating the correlation between the Matrix surface condition descriptions and pilot braking action reports and determining the usability of the Matrix for airport operators and pilots.

This technical note presents a general overview and background of the TALPA ARC and provides an overview of two RCAM FAA validation efforts during consecutive winter airport operations seasons. Recommendations for future work are also provided. The first validation effort took place during the winter of 2009-10. Based on the results of the first validation effort, the FAA then conducted a second validation effort that took place during the 2010-11 winter. This technical note discusses the two validation efforts in detail along with the evaluation approach, analysis, results, and recommendations, as well as the revisions and changes to the RCAM.

An Industry Team comprised of industry representatives instrumental in the development of the Matrix along with members of the FAA, airport operators, and air carrier representatives who participated in the validation effort, held a meeting to discuss the evaluation approach, analysis, and results; the consensus was that Matrix correlations and usability was very encouraging. The Industry Team recommended changes to improve the Matrix and the runway condition assessment process based on the analysis and results, as well as a second validation effort. Subsequent to the meeting, the FAA Office of Airport Safety and Standards approved a second validation effort during the 2010-11 winter airport operations season.

The second validation effort objectives were the same as the previous year with an additional objective: determine if the changes made from the 2009-10 validation effort during the Industry Team meeting were accurate. Similar to the previous year, the Industry Team held a meeting to discuss the second validation effort's evaluation approach, analysis, and results. The consensus of the Industry Team was even more encouraging than the previous year based on the analysis and results; therefore, the Industry Team did not recommend a third validation effort. Additional changes were made to the runway condition assessment process and the Matrix, which included finalizing the name RCAM. The final version of the RCAM is included in this technical note. The Industry Team recommended that the FAA work to implement the RCAM into aviation operations.

RUNWAY CONDITION ASSESSMENT MATRIX OVERVIEW

In 2009, the Takeoff and Landing Performance Assessment (TALPA) Aviation Rulemaking Committee (ARC) recommended that the Federal Aviation Administration (FAA) conduct a trial program or validation effort to assess the use of the first Runway Condition Assessment Matrix (RCAM) titled the Paved Runway Condition Assessment Table, commonly referred to as the Matrix. The validation effort was intended to examine the RCAM's processes to determine if they could be implemented at airports nationwide in order to disseminate runway surface condition information to pilots prior to landing. The objectives included validating the correlation between the Matrix surface condition descriptions and pilot braking action reports (PIREP) and determining the usability of the Matrix for airport operators and pilots.

GENERAL OVERVIEW.

The FAA validation efforts of the RCAM occurred during two consecutive winter airport operations seasons, typically November through April. The first validation effort was recommended to the FAA by the TALPA ARC. The first validation effort took place between 2009 and 2010 (Year 1). Based on the results of the first validation effort, the FAA conducted a second validation effort, which took place between 2010 and 2011 (Year 2). This technical note describes the similar objectives of the two validation efforts and describes the changes and revisions that affected the efforts, the RCAM, and its processes during the course of this research.

This technical note is organized into four sections that discuss this validation effort in detail. The first section is a general overview and background of the RCAM. The second section describes the first year validation effort of the RCAM. The third section describes the second year validation effort of the RCAM. The fourth section is comprised of final recommendations to the FAA.

BACKGROUND.

Following the overrun of a Boeing 737 aircraft at Midway International Airport in December 2005, the FAA concluded that the regulation and guidance addressing aircraft operations on contaminated runways for the aviation industry was inadequate. As an interim measure, on August 31, 2006, the FAA published Safety Alert for Operators (SAFO) 06012, "Landing Assessments at Time of Arrival (Turbojets)" (see appendix A).

To determine a long-term solution, they formed an ARC to address the takeoff and landing performance assessment requirements for the appropriate Title 14 Code of Federal Regulations Parts 23, 25, 91K, 121, 125, 135, and 139. The formation of the committee was announced in the Federal Register on December 6, 2007, to allow interested parties the opportunity to request membership. The charter of the committee was to provide advice and recommendations to

- establish aircraft certification and operational requirements (including training) for takeoff and landing operations on contaminated runways.

- establish landing distance assessment requirements, including minimum landing distance safety margins, to be performed at the time of arrival.

- establish standards for runway surface condition reporting and minimum surface conditions for continued operations.

The ARC was comprised of approximately 75 representatives from air carriers of various sizes, commuter, on-demand air carriers (air taxis) and fractional ownership operators, aircraft manufacturers, airport operators, industry groups, and aviation regulators. The members were divided into four working groups: (1) Airports; (2) Air Carriers; (3) Commuter, On Demand Air Carriers and Fractional Ownerships; and (4) Aircraft Manufacturers. The ARC provided landing recommendations to the FAA in April 2009 and provided takeoff recommendations in July 2009. The TALPA ARC meetings occurred between March 2008 and May 2009. The complete TALPA ARC Membership List is provided in appendix B.

In formulating their recommendations, the ARC analyzed current practices and regulations and found deficiencies in several areas. Most notably, there was a lack of a standard means to assess and communicate actual runway conditions at the time of arrival, particularly when conditions have changed, in terms that directly relate to aircraft landing performance.

At the core of the TALPA ARC's recommendations is the concept of using a Paved Runway Condition Assessment Table, or Matrix, as the basis for the airport operator to report runway conditions and for the pilot to interpret the reported runway conditions in terms that relate to aircraft performance. This aircraft performance data would be supplied by aircraft manufacturers for each of the stated contaminant types, contaminant depths, and surface temperatures. This approach is a less subjective assessment of runway conditions by using defined objective criteria of contaminant types, contaminant depths, and surface temperatures, which have been determined by aircraft manufacturers to cause specific changes in aircraft braking performance.

Since this approach is very different from the traditional runway condition assessment and reporting practices, as well as pilot practices, it was recommended by the TALPA ARC that a trial program be conducted during the winter of 2009-10 to validate the ARC's recommendations and the Matrix. It was recommended that the trial program should involve 10 to 20 airports and require standardized documentation that could be analyzed in support of refinements to the Matrix or the accompanying instructions.

<u>INITIAL MATRIX HISTORY</u>. During the TALPA ARC meetings, considerable time was spent discussing the existing methods of assessing and reporting runway surface conditions used by airport operators and air carriers. Predominantly, three methods were used:

- PIREPs

- Runway friction-measuring devices that report the coefficient of friction or μ (Mu)

    - Continuous friction-measuring equipment (CFME)
    - Decelerometers

- Runway surface contamination descriptions of the contaminant type and depth disseminated through the Notice to Airman (NOTAM) system

All three methods had deficiencies and limitations.

- PIREPs
    - PIREPs are too subjective by nature.
    - Standard definitions of the PIREPs' terms do not exist.
    - Training and guidance are not given to pilots on how or when to report braking action.
    - There is no correlation between PIREPs from different aircraft types.
    - Most aircraft manufacturers do not provide performance data in terms of braking action.
- Friction Measurement Devices, such as CFMEs and decelerometers
    - Friction-measuring devices can only be operated when certain runway surface conditions are present, otherwise their readings are invalid. FAA Advisory Circular (AC) 150/5200-30C, "Airport Winter Safety and Operations," specifies FAA requirements for using CFMEs and decelerometers.
        - § If invalid readings are reported, an incident or accident could result.
    - Friction-measuring devices lack repeatable readings on consecutive measurements or from two of the same devices on contaminated runways.
    - There are no correlations between the friction measurements of different manufacturers' friction measurement devices.
    - There are no correlations between reported Mu and aircraft braking performance.
- Runway Surface Contamination Descriptions
    - Various terms and definitions are used to describe runway surface contaminants. Terms such as "patchy" and "thin" can be widely interpreted.
    - Inconsistent or lack of reporting accurate contaminant depth on a runway makes it difficult to determine aircraft performance degradation. Aircraft braking performance has an important 1/8-inch contaminant depth threshold.

- Changing runway conditions are currently reported using the NOTAM system but are frequently slow to be posted. (The Digital NOTAM System that is incrementally being deployed at U.S. airports should reduce some of the delays.)

The TALPA ARC recommendations for a new method of reporting runway conditions were to

- use a combination of the best attributes of current methods.
- introduce improvements to address known deficiencies.
- trial test the new method.
- continue researching improved methods.

This new method proposed a Paved Runway Condition Assessment Table, commonly referred to as the Matrix, as the basis for the airport operator to perform runway condition assessments and for the pilot to interpret the reported runway conditions in a standardized format. The Initial Matrix and its related notes (shown in figure 1) provided the format to be used by airport operators during the first trial test, or Year 1, validation effort. The same Matrix information could also appear in slightly different and easier to read formats for pilots, flight operations personnel, air traffic coordination, and aircraft manufacturers. The Initial Matrix proposed a new way of describing runway conditions based on defined terms and increments, and the use of runway condition codes (RCC) as a “shorthand” for runway conditions. These RCCs would replace Mu reports and be disseminated to pilots for determining their landing performance calculations.

The Initial Matrix was developed through the coordination of the four working groups of the TALPA ARC. Aircraft manufacturers supplied performance criteria related to runway contaminate conditions. Air carrier operators provided operational experience input. Airport operators provided airport experience input, and downgrade assessments were agreed upon by the working groups.

PAVED RUNWAY CONDITION ASSESSMENT TABLE

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:*** · Wet (Smooth, Grooved or PFC) · Frost ***Any Temperature with 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 Colder than -13ºC at any depth:*** · Compacted Snow	39-36μ	Brake deceleration and controllability is between Good and Medium.	Good to Medium
3	***Any Temperature:*** · Wet (Slippery) ***At or Colder than -3ºC and Greater than 1/8" of:*** · Dry or Wet Snow ***Warmer than -13ºC and at or Colder than -3ºC at any Depth:*** · Compacted Snow	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 ***Warmer than -3ºC at greater than 1/8" :*** · Dry or Wet Snow ***Warmer than -3ºC at any Depth:*** · Compacted Snow	29-26μ	Brake deceleration and controllability is between Medium and Poor. Potential for hydroplaning exists.	Medium to Poor
1	***At or colder than -3°C at any Depth of:*** · Ice	25-21μ	Braking deceleration is significantly reduced for the wheel braking effort applied. Directional control may be significantly reduced.	Poor
0	***Any Temperature and any Depth of:*** · Wet Ice · Water on top of Compacted Snow · Dry or Wet Snow over Ice ***Temperature Warmer than -3ºC at any Depth:*** · Ice	20μ or lower	Braking deceleration is minimal to non-existent for the wheel braking effort applied. Directional control may be uncertain.	Nil

Figure 1. Initial Matrix and Notes

Notes:

- ***Contaminated runway.*** *A runway is contaminated when more than 25 percent of the runway surface area (whether in isolated areas or not) within the reported length and the width being used is covered by water, slush, frost or snow greater than 0.125 inches (3 mm), or any compacted snow or ice.*
- ***Dry runway.*** *A runway is dry when it is not contaminated and at least 75% is clear of visible moisture within the reported length and width being used.*
- ***Wet runway.*** *A runway is wet when it is neither dry nor contaminated.*
- *Temperatures referenced are average runway surface temperatures when available, Outside Air Temperature (OAT) when not.*
- *While applying sand or liquid anti ice to a surface may improve its friction capability, no credit is taken until pilot braking action reports improve or the contaminant type changes (e.g., ice to water).*
- *Compacted Snow may include a mixture of snow and imbedded ice.*
- *Compacted Snow over Ice is reported as Compacted Snow.*
- *Taxi, takeoff, and landing operations in Nil conditions are prohibited.*

Figure 1. Initial Matrix and Notes (Continued)

HOW TO USE THE INTIAL MATRIX. To use the Initial Matrix, the airport operator is asked to perform the same runway condition assessment practices as they usually do. The main differences between the Initial Matrix and current practices are the use of standardized terminology and determination of the percentage of the contaminated runway. To determine RCCs, the airport operator must first determine if an entire usable runway is more or less than 25% contaminated or wet. If 25% or less, no RCCs are necessary and the condition is described with text. If more than 25%, the airport operator is asked to divide a runway into three equal parts and evaluate each runway third separately. Using the left-side, white columns on the Initial Matrix, labeled “Runway Condition Assessment-Reported,” the airport operator uses the “Runway Description” column by determining what is the predominant contaminant(s), depth of contaminant (if applicable to the type of contaminant), and runway surface temperature for each runway third. From the Runway Description, the associated RCC can be found in the first column, labeled “Code.” Therefore, every runway will have a three-digit RCC representing the first, second, and last thirds of the runway based on the takeoff or landing direction of aircraft traffic (e.g., 5/5/4).

Using the right-side, grey columns, labeled “Downgrade Assessment Criteria,” the airport operator has the option to downgrade the RCCs based on their airport operations experience, “Mu” reports, “Deceleration and Directional Control Observation,” and/or PIREPs from landing aircraft. For example, an airport operator with initial RCCs of 5/5/4 could downgrade their runway to a 3/3/3 because runway conditions are rapidly changing, the predicted forecast worsens, or medium PIREPs are reported. It is emphasized that airport operators should use caution and err on the side of safe operations.

In this case, the airport operator would report a 3/3/3 to air traffic control (ATC) and via the NOTAM system instead of Mu. Dispatchers using the NOTAM system would then dispatch aircraft planning for a 3/3/3 runway condition. Pilots receiving the RCCs prior to landing would perform a landing assessment using performance data and land accordingly.

ADVANTAGES TO USING THE MATRIX AND REPORTING PROCESSES. The following is a list of advantages expected if the Matrix and its reporting processes were used.

- RCCs would provide an abbreviated, standardized, and more effective method for airport operators to report runway surface conditions.

- Flight crews would receive runway surface conditions in a standardized format from all airport operators.

- Flight crews will have more detailed information available to make operational or landing decisions.

- Flight crews would be able to correlate runway surface conditions reported by airport operators to aircraft landing performance data supplied by the aircraft manufacturer.

- Airport operators and flight crews would have common terminology and understanding of PIREPs.

  - Airport operators may use the PIREPs section in the Matrix as one consideration in assessing if RCCs should be downgraded.

- Standard terminology would be used for describing runway surface conditions.

  - Specific terms and definitions would be universal.

  - Contaminated runways would be described in percentage covered.

  - Discontinue use of vague terminology, such as “patchy,” “trace,” and “thin.”

  - Descriptions would clearly identify the runway and direction.

  - Mu reports, which have no usable operational correlation to aircraft braking or stopping distance, would be eliminated.

VALIDATION EFFORT—YEAR 1

INTRODUCTION.

The TALPA ARC recommended that the FAA conduct a trial program or a validation effort to assess the use of the Paved Runway Condition Assessment Table (Matrix) and its associated processes to determine if it can be implemented nationwide for disseminating runway surface condition information to flight crews. The FAA Flight Standards Service (AFS) and Office of Airport Safety and Standards (AAS) sponsored the validation effort of the Matrix during the winter of 2009-10 with the support of the Airport Technology Research and Development (R&D) Branch (ANG-E26, formerly AJP-6310). One representative from the three FAA organizations made up the FAA Validation Team.

OBJECTIVES.

The three objectives for the Year 1 validation effort were as follows.

- Validate the correlation between Matrix contamination types/depths/temperatures, and PIREPs.

- Determine the Matrix usability for airport operators.

- Determine the Matrix usability for pilots.

EVALUATION APPROACH

PARTICIPATING AIR CARRIERS AND AIRPORT OPERATORS.

The Year 1 validation effort consisted of two air carriers, Alaska Airlines and Pinnacle Airlines; and ten airports from two FAA regions (Great Lakes Region (AGL) and Alaskan Region (AAL)) were selected to participate. Alaska Airlines and Pinnacle Airlines were active participants on the TALPA ARC and volunteered to participate in a validation effort of the Matrix. Alaska Airlines operates mostly Boeing 737-400 aircraft in the AAL, and Pinnacle Airlines operates Bombardier CRJ regional aircraft in AGL at the participating airports.

Three AGL airports were chosen because staff members from these locations participated in the TALPA ARC, were involved in the development of the Matrix, and were familiar with the Matrix and its procedures. In addition, they each had regular scheduled air service from Pinnacle Airlines. The seven AAL airports were chosen because they frequently experienced a variety of changing winter weather conditions, had a long winter season, and had the aircraft operations needed to validate the Matrix. Five of the seven airports are operated by the Alaska Department of Transportation (DOT) and share procedures and operational characteristics. Also, Alaska Airlines has scheduled air service into all seven airports. Appendix C shows the airport diagrams of the participating airports. Table 1 lists the participating airport, airport identifier, location, and FAA Region for the Year 1 validation effort. Figure 2 shows the participating airports geographically across the United States.

Table 1. Participating Airports and Location for Year 1 Validation Effort

Airport	Airport Identifier	Location	FAA Region
Gerald R. Ford International Airport	GRR	Grand Rapids, MI	AGL
Minneapolis International Airport/ Wold-Chamberlain	MSP	Minneapolis-St. Paul, MN	AGL
Cherry Capital Airport	TVC	Traverse City, MI	AGL
Kodiak Airport	ADQ	Kodiak, AK	AAL
Bethel Airport	BET	Bethel, AK	AAL
Merle K. (Mudhole) Smith Airport	CDV	Cordova, AK	AAL
Juneau International Airport	JNU	Juneau, AK	AAL
Ketchikan International Airport	KTN	Ketchikan, AK	AAL
Ralph Wien Memorial Airport	OTZ	Kotzebue, AK	AAL
Wrangell Airport	WRG	Wrangell, AK	AAL

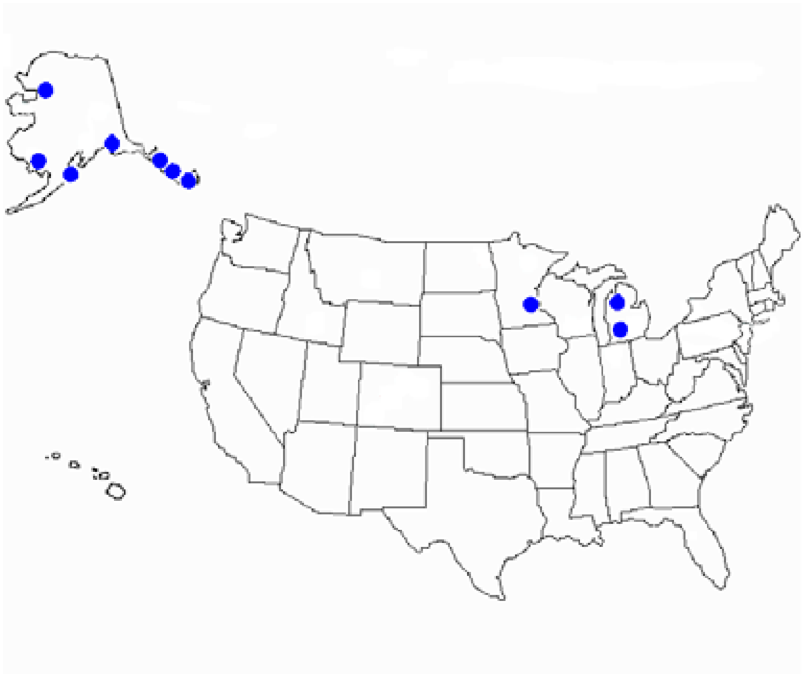


Figure 2. Year 1 Participating Airport Locations in the United States

TRAINING.

This section describes the training for the air carriers, airport operators, and the dissemination of RCCs.

AIR CARRIER TRAINING. The FAA Validation Team and representatives from Alaska and Pinnacle Airlines discussed expectations of participation, information required from flight crews, and flight crew training using the Matrix. Together, they developed a list of essential flight crew and landing information that was needed for the validation effort. Each air carrier created their own pilot data collection sheet, or Pilot Report, as well as reporting requirements and procedures for their flight crews. The air carriers also conducted training of their respective flight crews. The FAA informed the participating air carriers that all efforts were for validation effort information purposes only, and that current FAA guidance and decision-making procedures should be followed on aircraft landing performance.

AIRPORT OPERATOR TRAINING. Before the FAA trained the Alaskan airport operators, the FAA Validation Team worked with representatives from MSP and TVC to develop airport operator training material and an airport data collection sheet, or Airport Report, for collecting the data needed for the validation effort. Both airport representatives had some experience using the Matrix during their own trial, 2008-09 winter operation season. The Validation Team created a training presentation for the airport operators that included:

- The TALPA ARC background information
- Rationale for the TALPA ARC recommendation for reporting runway conditions

- The Matrix
- Expectations for airport use of the Matrix and its processes
- A review of new standardized terminology for contaminants, contaminant depths, percent coverage of runways, temperature, etc.
- Instructions on how to determine RCCs
- Instructions on how to downgrade RCCs
- Instructions on how to complete the Airport Report
- Instructions on how to use an FAA website for entering the Airport Report information
- Instructions on how to submit the hardcopy Airport Reports to the FAA
- Training exercises and scenarios that involved using the Matrix and determining RCCs

The Alaska DOT informed the participating AAL airports on the purpose of the validation effort and provided a brief summary of what would be expected. The FAA Validation Team then visited each AAL airport for a day and met with airport operations personnel for a training session. At each airport training session, an airport manager or operations manager/supervisor and some or all of the operators/mechanics/technicians who actually performed runway condition assessments were in attendance. At least one representative from Alaska Airlines and a representative from the local Alaska Airline Operations Center participated in all the training sessions. At least one representative from the Alaska DOT was present at ADQ, BET, CDV, JNU, OTZ, and WRG. In some cases, a tower controller or Flight Service Station (FSS) controller was also present.

The training session was provided in a classroom setting with a Microsoft® PowerPoint® presentation followed by seven training exercises in which the airport staff was given a scenario of runway conditions. Airport staff had to determine the appropriate RCC and to properly complete an Airport Report. The airport staff was encouraged to ask questions throughout the training session. At the conclusion of the training, the FAA Validation Team provided the following to all the airports:

- Electronic and hardcopy versions of the training presentation
- Electronic and hardcopies of the Airport Report
- Electronic and hardcopy instructions on how to complete the Airport Report on the FAA website
- Two types of snow rulers for easy determination of contaminant depth. Figure 3 shows one of the snow rulers given to the airports.

- A hand-held infrared temperature gun (figure 4)
- Contact information for the FAA Validation Team

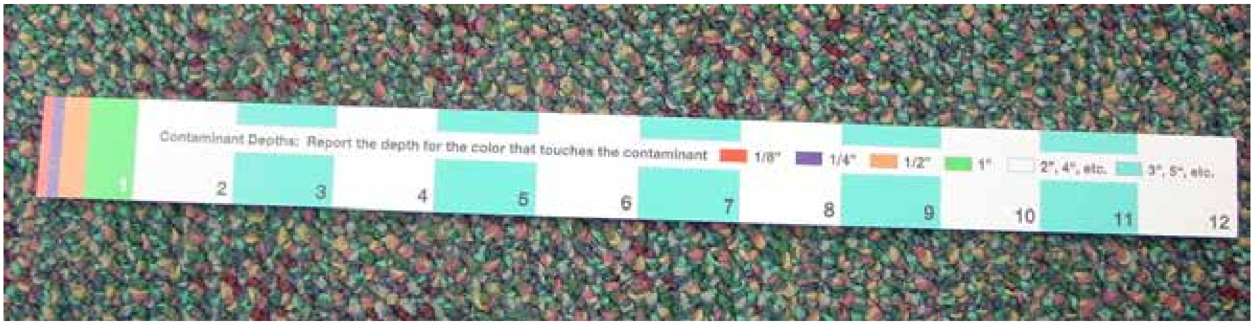


Figure 3. Snow Ruler

Figure 4. Infrared Temperature Gun

The FAA Validation Team traveled to ADQ to conduct training, but decided to cancel it because the airport had been experiencing local flooding and mudslides for the preceding 36 hours. The training was provided at a later date by representatives from Alaska Airlines and the Alaska DOT.

Two of the three AGL airports (GRR and TVC) received the same training as described above. The FAA Validation Team did not train MSP personnel because the MSP operations manager helped to develop the training, and it was agreed he would train his own airport staff.

DISSEMINATING RCCs. To determine the Initial Matrix usability for pilots, the FAA Validation Team had to find a way to disseminate the RCCs to the flight crew prior to landing. This would provide an accurate assessment as to whether the braking action the pilot experienced during landing was what they anticipated based on the RCCs received prior to landing.

During the training sessions in Alaska, ATC and/or FSS controllers participated in discussions of disseminating RCCs to flight crews prior to landing. FSS controllers were asked whether RCCs could be relayed through them and to the flight crew. Some controllers expressed concern that broadcasting those numbers would be confusing to other pilots on the radio frequency. Other controllers rejected the idea because it was outside their scope of work. Therefore, other options were considered. Because of the unique operating conditions and limited Part 121 flights landing at the AAL airports, Alaska Airlines often communicate directly with airport operators on the ground assessing and maintaining the runway over a Unicom radio frequency. Both the airport operators and Alaska Airlines agreed to disseminate RCCs using this method. The AGL airports did not have the same relationship with airlines, so this practice could not be accomplished. However, two weeks into the validation effort, the Alaska DOT requested that the airports discontinue relaying the RCCs to the pilots because it was believed that the airports were causing Alaska Airlines to needlessly cancel flights or overfly the airports. This is discussed more in the Monthly Teleconferencing section of this technical note.

DATA COLLECTION.

This section covers information on the data collection sheets, reporting and collection methods, time period, and monthly teleconferences.

PILOT REPORT. The Pilot Reports, provided in appendix D, were used to collect information from the flight crew on the PIREPs, date and time of landing, airport, aircraft type, and other miscellaneous data. The FAA and both air carriers determined what information was needed in the Pilot Reports. Each air carrier then designed the Pilot Report for their respective flight crews. Flight crews were instructed to complete the report after landing their aircraft. The Pilot Report data was used to correlate the PIREP with the RCCs and runway surface conditions in the corresponding Airport Report.

AIRPORT REPORT. The Airport Report, provided in appendix E, was created to help airport operator personnel perform runway surface condition assessments using the Matrix and to collect the information required by the FAA during the validation effort. Creating the report layout and format was a very difficult process. The report had to be usable to the airport operator performing an assessment while collecting the relevant information needed for data analysis. The design and layout of the Airport Report was created by the FAA Validation Team with input from the MSP representative. The Airport Report was used to determine if airport operators understood how to:

- Assess runway surface conditions using the Matrix processes
- Determine RCCs
- Create a Matrix Report

The information would be used to determine how well the reported runway surface conditions and RCCs correlated with the PIREPs in the Pilot Reports.

REPORTING AND COLLECTION METHODS. The FAA initiated a data collection website so that the information from the Pilot and Airport Reports could be easily submitted electronically to the FAA. Each airport operator (or the special designated user at the airport), the FAA Validation Team, and the air carrier representatives were given specific usernames and passwords to access the website for information entry and observation. The website consisted of mostly drop-down menu selections and text boxes that corresponded to data elements on the Pilot or Airport Reports. A visual sample of the website is provided in appendix F.

The Pilot Report hardcopies were completed by the pilots after each landing at the participating airports. They were then collected by air carrier personnel at the landing airport and mailed to the Alaska or Pinnacle Airlines representative. The Alaska Airlines representative entered the information on the Pilot Reports into the FAA data collection website, and mailed the hardcopy to the FAA for archiving. The Pinnacle Airlines representative did not enter the information into the website, but instead mailed the Pilot Report hardcopies directly to the FAA to be entered into the data collection website and archived.

The preferred practice was for participating airports to complete the Airport Report hardcopy immediately after assessing the runway surface conditions, if time permitted; however, it was acceptable to complete it as soon as possible after the assessment. The airports were instructed to complete an Airport Report whenever they assessed the runway or when conditions changed, if time allowed. At the Alaska airports, the information was entered into the data collection website by the local Alaska Airlines air carrier operations personnel. The Airport Report hardcopies were then mailed to and collected at the Alaska Airlines corporate office in Seattle, WA, for review. The Alaska Airlines representative then forwarded the Airport Reports to the FAA for archiving. For the AGL airports, MSP entered their Airport Report information into a spreadsheet and provided it directly to the FAA. GRR and TVC mailed their Airport Reports directly to the FAA for website data entry and archiving.

When the Pilot and Airport Reports were received by the FAA, each report was reviewed to determine that all the information was present and to identify inconsistencies with the website entries. Changes were made to the website data if information was incorrectly entered. Reports missing key information were removed from the website or not entered and archived for later analysis.

DATA COLLECTION PERIOD. The official data collection process began at Alaska airports on November 1, 2009, and continued until April 1, 2010. OTZ's data collection was extended until April 30, 2010, due to continued winter weather conditions in northwestern Alaska. The AGL airports' official data collection started on December 1, 2009, and continued until April 1, 2010.

MONTHLY TELECONFERENCING. During the data collection period, teleconferences were held with the Alaska airports, Alaska Airlines, and the FAA on a monthly basis to address any issues the airport operators were having and/or inconsistencies, missing information, or errors the FAA observed on the Pilot/Airport Reports and website. Only one teleconference was held with the AGL airports because they did not feel it was necessary to have monthly teleconferences. Therefore, it was agreed that the FAA would contact an individual airport operator if issues arose or if there were concerns about the data.

During one teleconference, Alaska Airlines expressed a concern about using the RCCs in their decision-making process for landing performance calculations. The Matrix processes did not allow for runway friction improvements or upgrades to the RCCs based on the application of sand and/or other remediation. This led to several flight cancellations, which the Alaska DOT and Alaska Airlines deemed unnecessary based on their previous landing history and known capabilities at the participating airports. Because of this issue, Alaska Airlines and the participating Alaska airports, from their point of view, believed the strict use of the Matrix processes to be very restrictive and overly conservative. Alaska Airlines made the decision on November 16, 2009, to no longer have the airports provide the RRCs to the flight crews prior to their landings and returned to the traditional methods for determining landing performance calculations. Unfortunately, without the pilots' perspective of the usability and the accuracy of the Matrix, it would be difficult to achieve the third objective of the validation effort. The pilots would not get the RCCs prior to arrival as they would have had the Matrix been fully implemented. Therefore, the pilots could not provide an accurate assessment as to whether the braking action they experienced was what they anticipated based on the RCCs received prior to landing.

ANALYSIS PROCESSES.

The data collection website was set up for quick input and storage of report information. However, as the FAA received the Pilot and Airport Report hardcopies, the FAA noticed some inconsistencies between the website data and the information on the report hardcopies. The FAA determined that some of the inconsistences may be caused by one of two factors, or a combination of both: (1) the person inputting the data mistakenly chose the wrong drop-down data entry, or (2) the drop-down menu design was inadequate. The FAA determined the problem was that if a drop-down menu was highlighted and the person used the computer mouse wheel, it would often change the entry instead of scrolling down the webpage. Once this was discovered, the FAA allowed airports to continue entering data on the website; however, each entry was critically reviewed and verified against the hardcopy. The website data was then imported into the database program, Microsoft® Access®, for analysis and considered FAA reviewed, or "clean data," with no entry errors. Once the database was complete, the FAA printed all the data strings, or datasets, with all the fields for each Airport Report and thoroughly reviewed each dataset, performing what the FAA called a "true code analysis" (True Code). The True Code performed two functions: (1) it noted similar general issues so they could be categorized and totaled later, and (2) it noted whether the RCCs reported by the airport were correct, based on the reported contaminants. If not, then the proper code was noted and if possible, a reason for the incorrect RCC was included. If they differed, the True Code (what the RCC should have been) was added to that record in the database.

To process and perform an analysis on all the datasets from the Airport and Pilot Reports, the FAA needed a way to sort, filter, and query the data, and correlate corresponding Airport Reports with Pilot Reports to accomplish the validation effort objectives. It was essential to compare the Airport Report contamination types/depths/temperatures near the time of landing to the PIREP from the Pilot Report, particularly for objective 1 (validate the correlation between Matrix contamination types/depths/temperatures, and PIREPs). The FAA then programmed functions within the database, creating a database analysis tool to perform these tasks that would make the process faster and easier to manage. The database analysis tool organized all the data into five major query tools.

1. All Airport Reports containing all the fields of data

2. All Airport Reports with just the Matrix Report fields of data (i.e., those that would have been disseminated via the NOTAM system in accordance with the matrix format)

3. All Pilot Reports containing all the fields of data

4. All Airport Reports with one or more corresponding Pilot Reports (A corresponding report was defined and programmed to be a Pilot Report with a date and time being made within 1 hour after an Airport Report at each airport.)

5. Airport Reports with one or more corresponding Pilot Reports only displaying the Matrix fields of data of the Airport Report.

Selecting query tool 1, 2, or 3 allowed the user to select criteria to filter data that could be viewed in a spreadsheet. For example, a user could select criteria to filter for a specific airport, runway condition, specific PIREP category, or date. A keyword search was also programmed into the query to allow reports to be queried for specific words, such as “sand.” This was critical in determining airport operators’ usability of the Matrix and its processes.

Selecting query tool 4 or 5 displayed corresponding reports in a spreadsheet. A correlated report consisted of the Pilot Report’s date/time within one hour of the Airport Report’s date/time. The user could then select a particular Airport Report and the associated Pilot Report should appear below it. This was critical in determining if contaminant types/depths/temperatures, RCCs, and PIREPs correlated in the Matrix.

RESULTS AND CONCLUSIONS—YEAR 1

TOTAL REPORTS.

The FAA received a total of 2041 Airport Reports and 2219 Pilot Reports. Ninety-nine Airport Reports and 24 Pilot Reports were discarded for reasons that are discussed in the Discarded Airport and Pilot Reports sections of this report. Therefore, 1942 Airport Reports and 2195 Pilot

Reports were entered into the database and used for analysis. There were a total of 628 Airport Reports with one or more corresponding Pilot Reports (631 pairings since three Airport Reports had multiple corresponding associated Pilot Reports). Table 2 shows the report summary.

Table 2. Total Reports Summary

Total Airport Reports Received	Airport Reports Discarded	Airport Reports Used for Analysis
2041	99	1942
Total Pilot Reports Received	Pilot Reports Discarded	Pilot Reports Used for Analysis
2219	24	2195
Corresponding Reports/Pairings	628/631	

AIRPORT REPORT ANALYSIS.

Errors found in the Airport Reports indicated the complexity of the runway surface condition information needed, the RCC determination process, and the complexity of the report design. In 49% of the Airport Reports used for analysis, the RCCs reported were incorrect, according to all the Matrix processes and instructions given to the airport operator for collecting information on contamination type, depth, percentage of coverage, and temperature reported. Some of the errors were considered minor by the Validation Team, such as reporting RCCs when they were not required. The most common errors in the Airport Reports are listed below.

- In 203 reports, dry conditions were reported as a 6/6/6. In these cases, the RCCs should have been left blank and reported as only as "dry."

- In 107 reports, contaminant depths were reported for contaminants such as frost, compacted snow, and ice. These contaminants are considered immeasurable.

- In 151 reports, RCCs were reported when the total runway percent coverage was less than 25%. In these cases, RCCs should not have been assigned.

- In several reports, the RCCs that were reported were inconsistent with the description of conditions in the remarks section of the same report.

Other general observations during the Airport Report True Code Analysis are listed below.

- There appeared to be difficulty in understanding or interpreting the runway in thirds of percent coverage and total runway percent coverage. In some reports, the runway percentages for thirds were inconsistent in relation to the total runway percentage.

    - In some cases, 10% and/or 25% coverage was reported for the runway thirds and the total runway percentage coverage reported 100%.

        - § Example—Airport XYZ: 25% (first third), 10% (second third), and 10% (last third) equaled 100% total coverage.

    - In other cases from the same airport(s), the percentages of runway thirds were the same and the total runway percent coverage was different.

        - § Example—Airport XYZ: 10% (first third), 10% (second third), and 10% (last third) equaled 50% total coverage.

- There appeared to be some confusion on how to report the total runway percentage coverage if there were multiple contaminants on the runway surface, such as ice, compacted snow, and dry snow.

- Some reports reported a percentage that did not match the defined increments of 10, 25, 50, 75, or 100 percentages, such as 33% total runway coverage. Those reports were changed in the database by revising the percentage to the next higher category.

    - Example—33% total runway coverage was changed to 50%.

- Several reports used a percentage when the runway condition was dry, e.g., reporting 100% dry. A percent coverage is only used when the runway surface has a contaminant on it.

- There were some contaminant depths described and written in the Airport Report as "less than 1/8 inch." Those were changed in the database to "1/8 inch" to match the defined increments.

- Surface temperatures were reported 1297 times; outside air temperature (OAT) was reported 443 times; and 202 reports did not record temperature.

    - 48% of the surface temperatures recorded the same temperature for each third of the runway. It is unlikely that each third of the runway was exactly the same temperature; therefore, it is suspected that one temperature was taken and recorded for all the thirds.

- In some reports, temperatures were reported in degrees Fahrenheit instead of degrees Celsius. If the temperatures where labeled in degrees Fahrenheit, they were converted to degrees Celsius in the database; however, some reports remained questionable.

- In most cases, the remarks section of the Airport Report was not used by the airport operator the way it was intended or in accordance with the FAA training. Many of the airports reverted to airport operator short format terminologies to explain runway surface conditions and included wordy details. Those details should have been written in the comments section of the Airport Report.

    - Examples—The terms "bare" and "full length" were used several times.
    - Examples—Terms such as "thin," "SIR," "patchy," etc., were used often.

DISCARDED AIRPORT REPORTS.

The 99 discarded Airport Reports were placed aside for analysis. The following lists some common issues.

- Several reports selected multiple percentages for the runway thirds.
- Several reports were missing percentages for one or more thirds of the runway.
- There was inconsistency amongst the reports in determining total runway percentage coverage after selecting the runway percentages for thirds.
- Several reports selected several contaminants types.
- Several reports were missing contaminant types.
- Some reports had two times (e.g., 24-hr and local formats) that conflicted.
- Several RCCs could not be analyzed due to several conflicting pieces of information, making the report unusable.

An additional table in appendix G shows a breakdown of the reasons for discarding the Airport Reports and the month in which they occurred. The airport identifiers were intentionally removed.

DISCARDED PILOT REPORTS.

The 24 discarded Pilot Reports were placed aside for analysis. The following lists some common issues.

- Unknown airport identifiers or others that are unreadable
- Missing dates
- Reports sent to the FAA that were dated prior to the start of the data collection period

An additional table in appendix H lists the Pilot Reports that were discarded and why. The airport and air carrier identifiers were intentionally removed.

CORRESPONDING REPORTS ANALYSIS.

The following analysis is a breakdown of the corresponding airport reports. A corresponding report was defined and programmed to be a Pilot Report with a date and time being made within one hour after an Airport Report at each airport. The 628 corresponding Airport Reports were carefully reviewed and categorized using the True Code Analysis to determine if the RCCs were completed correctly according to the training sessions with the FAA. Of the 628 reports, 428 were done correctly and 200 were done incorrectly. Of the 428 correct reports, 221 reports described wet or dry runway surface conditions, and 207 reports described conditions other than wet or dry. Of the 200 incorrect reports, 55 had minor mistakes, such as reporting RCCs when they were not required. In the other 145 incorrect reports, some of the RCCs could not be verified because multiple contaminants were listed, the depth of the contaminant was not listed, the total runway percent coverage was unknown, or incorrect RCCs were given based on the contamination type/depth/temperature on the Airport Report. Figure 5 shows a breakdown of corresponding Airport Reports.

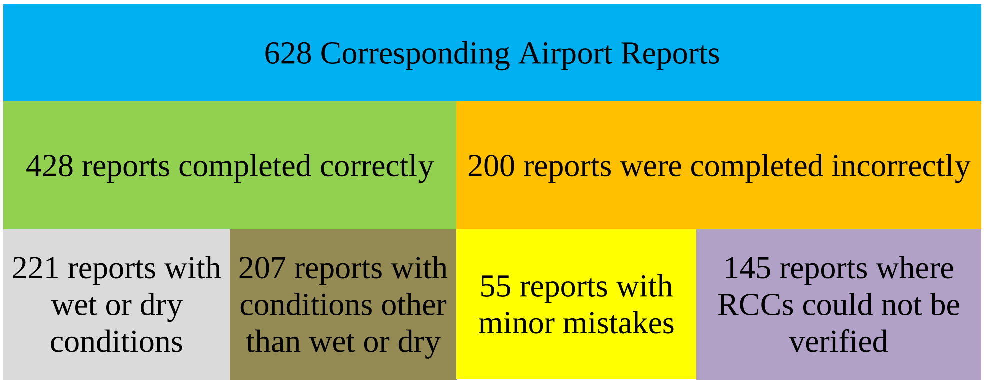


Figure 5. Breakdown of Corresponding Airport Reports—Year 1

Each corresponding report or pairing was categorized by the lowest RCC among the three thirds of the runway; for example, a 4/4/3 would be categorized as a 3. Each corresponding report was reviewed to determine if the lowest RCC matched the PIREP in the Matrix. If the corresponding report did not "match," the RCC was determined to be "favorable condition coding" (lower) or "unfavorable condition coding" (higher) when compared to the PIREP. The following defines these conditions in more detail.

- Match—the condition in which the RCC, generated by the runway condition description on the Matrix, matches the PIREP. This can be used to determine if the contaminant, depth, and temperature of the runway condition descriptions are aligned effectively to the PIREPs on the Matrix.

- Favorable Condition Coding—the condition in which the RCC recorded on the Airport Report is lower than what the PIREP reported. This is a more favorable runway condition than what the pilot may be expecting. (Reported downgraded RCCs were used if provided.) Example: RCC of 2/2/2 and PIREP of "Good."

- Unfavorable Condition Coding—the condition in which the RCC recorded on the Airport Report is higher than what the PIREP reported. This is a less favorable runway condition than what the pilot may be expecting. (Reported downgraded RCCs were used if provided) Example: RCC 5/5/5 and PIREP of "Medium."

There were 631 pairings of corresponding reports since three Airport Reports had multiple associated Pilot Reports. Of the 631 pairings, the RCC assigned by the airport matched the PIREP given by the pilots in the Matrix in 555 pairings (88%) (e.g., 3/3/3 = Medium). In 76 pairings (12%), the RCCs assigned did not match the PIREP. Of those 76 pairings, the RCC assigned was more favorable condition coding than the PIREP reported in 64 pairings (10%) (e.g., RCC of 2/2/2 and a PIREP report "Good"). Although the RCC and PIREP did not match in these pairings, they erred on the conservative side of safety because the pilot would have been conservative in their landing distance assessment. In 12 pairings (2%) of the 76 cases, the RCC assigned was unfavorable condition coding compared to the PIREP reported (e.g., RCC of 5/5/5 and the PIREP report of “Medium”). These reports are of interest because, if the pilots based their landing performance assessment on those numbers in a runway limited situation, it could lead to a runway overrun or excursion. Of the 64 pairings in which the RCCs had more favorable condition coding, 30 (47%) were when sand was used on the runway to improve aircraft braking. Figure 6 shows a breakdown of the Airport Reports with matching Pilot Reports.

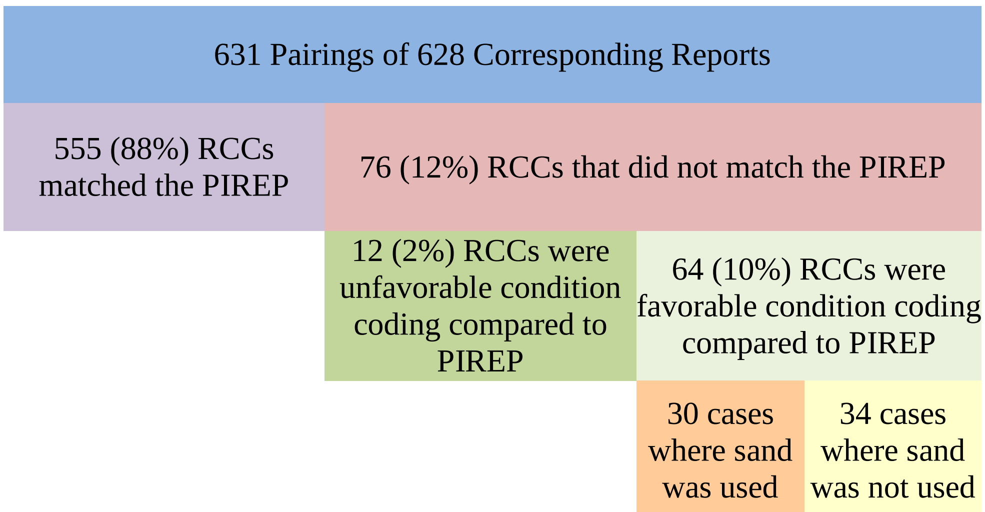


Figure 6. Breakdown of Airport Reports With Matching Pilot Reports—Year 1

AIRPORT OPERATOR FEEDBACK AND SURVEY.

To evaluate the participating airport operators’ experiences collecting data and using the Matrix to determine RCCs, the FAA created a survey that was sent to the ten participating airports. The survey posed questions about the adequacy of the training received, the ease of implementing the new Matrix methodology into their operations, the ease of using the Matrix to assign RCCs, the accuracy of the Matrix, etc. Each airport was encouraged to allow all personnel who used the Matrix regularly over the winter operation season to complete a survey. A sample of the survey is provided in appendix I.

A total of 22 surveys were completed with at least one response from each airport operator. Table 3 shows the analysis of the number of completed surveys from each airport, and table 4 shows the position/title of the person who completed them.

Table 3. Surveys Completed by Airports—Year 1

Total	Alaska Region							Great Lakes Region		
	ADQ	BET	CDV	JNU	KTN	OTZ	WRG	GRR	MSP	TVC
22	1	1	1	7	1	1	1	2	2	5

Table 4. Position/Title of Person Who Completed the Surveys—Year 1

Airport Manager/Deputy	Operations Manager/Coordinator/Supervisor	Mechanic/Operator
7	10	5

Some of the survey feedback seemed to contradict what the analysis showed. For example, the survey responses indicated that most Matrix users found it easy to use, yet there were several errors in the Airport Reports. Generally, the survey feedback indicated that the Matrix was often very conservative and unnecessarily restrictive to airport operations. This was especially expressed in the comments with compacted snow appearing in three different RCC categories in the Matrix. In addition, many airport operators felt that there should be a process for upgrading the RCC when sand was applied to the runway or other remediation took place to increase the runway surface friction. Another noteworthy feedback comment was that the use of temperature in the Matrix was not necessary and should be deleted. Airport operators felt that the temperature would naturally affect the consistency of the contaminant and would, therefore, already be accounted for when selecting the contaminant type. Finally, there were indications that the different percentage thresholds for when to report an RCC or particular contaminant were difficult to employ. The complete survey feedback provided by the airport operators is provided in appendix J.

<u>AIR CARRIER FEEDBACK</u>.

A pilot survey was not conducted by the FAA; however, the air carriers conducted their own survey and received feedback from their flight crews. The following list summarizes the overall impressions of the air carrier representatives that were given to the FAA.

- The air carriers indicated that the Matrix was fairly straightforward for the pilots to use once they gained experience using it.
- Overall, the Matrix does a "good job" of predicting the slipperiness of the runway. In the absence of other information, conservatism is good.
- Some areas of the Matrix are overly conservative
  - Very cold ice or sanded ice can be better than RCC 0 or 1 based on air carrier experiences
  - A very thin layer of ice can be better than RCC 0 or 1
  - Compacted snow at warm temperatures can be better than a 2

- One air carrier wanted to allow airport operators to use all their experience, abilities, and equipment to accurately describe the RCCs and validate the effects of sand on the runway to upgrade RCCs.

- One air carrier surveyed their pilots to rank the level of importance and most reliable of the descriptors in the Matrix. In the survey, 82% indicated that the PIREPs were the most important to them.

RECOMMENDATIONS

THE FAA TEAM MEETING.

An FAA Team, comprised of the FAA Validation Team and other FAA colleagues who participated in the TALPA ARC, reviewed the data and analysis of the validation effort prior to briefing industry representatives and prepared recommendations that would be presented at the Industry Team Meeting.

INDUSTRY TEAM MEETING AND RECOMENDATIONS.

An Industry Team, comprised of industry representatives instrumental in the development of the Matrix, the FAA Team, and the airport operators and air carrier representatives who participated in the validation effort, held a three-day meeting in August 2010, in Washington, DC. The objectives were to review the analysis completed by the FAA, conduct further detailed analysis of the data where needed, and make recommendations to the FAA. Appendix K provides a list of the Industry Team Meeting attendees. Appendix L provides the Industry Team Meeting notes.

In general, the overall consensus of the Industry Team was that the correlation of RCCs to PIREPs in the Matrix was very encouraging. However, the process seemed too complex to expect airport operators to implement, especially during rapidly changing weather and runway conditions. Specific subsets of data were analyzed and led to the following recommended changes to the Matrix and runway condition assessment process:

- Remove temperature from the Matrix assessment criteria, with one exception:

  - Temperature will only be used to determine the RCC for compacted snow. Instead of three RCC classifications that used surface temperature as a determining factor, compacted snow will have two RCC classifications based on OAT. The new RCC assessment criteria for compacted snow would be:

    - When compacted snow is on the runway surface and the OAT is -15°C or colder, the RCC classification will be a 4.

    - When compacted snow is on the runway surface for all other OATs, the RCC classification will be a 3.

  - Remove the temperature assessment criteria of ice to a classification of either ice or wet ice.

- Change the assessment criteria for wet snow and dry snow from being based on surface temperature and contaminant depth to being based on depth criteria, i.e., 1/8 inch or less, or more than 1/8 inch.

· The contaminant classifications in RCC 1 and 0 may be upgraded to an RCC no higher than a 3 based on:

  - Mu readings at or higher than 40 for all three thirds of the runway, in addition to:

    § sand and other approved runway treatments, which may be used to accomplish the improvements in the runway surface friction to upgrade the RCC.

    § using all other methods that are available to the airport operator to determine the runway surface friction to support the Mu readings.

    § monitoring the runway surface by the airport operator to ensure that the runway surface condition does not deteriorate below the higher RCC assigned.

· Move frost from an RCC classification of 5 to a 4 based on validation results. Some results have suggested that reports of frost with no sand on the runway may have been ice, in addition to supported low Mu numbers and PIREPs.

· Add two new contaminants into the assessment criteria, dry snow over compacted snow and wet snow over compacted snow to a classification of RCC 3.

· Remove the 10% runway coverage criteria for mixed contamination conditions when determining which RCC to apply to the third of the runway, and standardize the determining value at the same 25% used for the total runway contamination coverage.

· Define when the warning "slippery when wet" would be issued an RCC and reported by the airport operator to the standardized 25% of the runway surface that does not meet the minimum runway friction level. At other times the standard NOTAM process would be used.

· Create new definitions for dry runway, wet runway, contaminated runway, and frost for the purposes of aircraft performance and the use of the Matrix.

· Establish recommended implementation procedures for ATC regarding when RCCs would be provided to an aircraft.

· Make significant specific changes to the Airport Report.

  - Incorporate the changes made in the Matrix to a new Airport Report
  - Redesign the layout to eliminate human factors errors

With the changes proposed for the Matrix, the Industry Team recommended that another winter validation be conducted during the winter of 2010-11, with the following parameters:

- Include all participants from the first validation that are willing to participate again.
- Include more airports to have greater variety in size, air traffic, and meteorological conditions. Some of these airports may not have a companion airline to assess Matrix accuracy, but could test the Matrix usability and processes for airports.
- Include at least two air carriers if possible.
- Revise the Airport Report and training process.
- Conduct over a timeframe similar to the first validation.

Subsequent to the meeting, the management of the FAA Office of Airport Safety and Standards agreed to conduct a second validation effort during the 2010-11 winter airport operations season.

VALIDATION EFFORT—YEAR 2

INTRODUCTION.

The FAA Flight Standards Service and Office of Airport Safety and Standards sponsored another validation effort of the Matrix during the winter of 2010-11 with the support of the Airport Technology R&D Branch. One representative from the three FAA organizations comprised the FAA Validation Team.

OBJECTIVES.

Objectives for the 2010-11 validation effort, referred to as Year 2, remained the same as the Year 1 validation effort with one additional objective.

- Validate the correlation between Matrix contamination types/depths/temperatures and PIREPs.
- Determine the Matrix usability for airport operators.
- Determine the Matrix usability for pilots.
- Determine if changes made from the Year 1 validation effort were accurate.

YEAR 2 VALIDATION EFFORT CHANGES.

Once the necessary approvals to proceed with a second validation effort were in place, the FAA Validation Team began to incorporate changes from the Industry Team Meeting recommendations and lessons learned from the previous validation effort. The following list includes general changes that were made during the Year 2 validation effort and are discussed in the next few sections of this technical note.

- Matrix changes
- Matrix processes
- Add additional airport operators
- Airport Report layout
- Pilot Report method
- Training sessions
- Data collection process
- Database analysis tool
- More thorough analysis

MATRIX CHANGES AND PROCESSES. The following is a list of changes was made to the Matrix and its processes.

- Removed temperature from the Matrix except for compacted snow that uses OAT for RCC classification.

- Compacted snow is in two RCC classifications instead of three and is based on OAT.

- Moved frost from an RCC classification of 5 to a 4.

- Added contaminant choices of dry snow over compacted snow and wet snow over compacted snow. Both have an RCC classification of 3.

- Changed percent criteria.

    - Removed the 10% criteria for mixed contamination conditions for determining which runway surface code to apply to the third of the runway.

    - Standardized using the same 25% as the threshold value for the total runway contamination coverage needed before determining an RCC.

- Defined when the condition “slippery when wet” would be issued an RCC and reported by the airport operator to the standardized 25% of the runway surface not meeting the minimum runway friction level. At other times, the standard NOTAM process would be used.

- The contaminant classification in RCC 1 and 0 can be upgraded to an RCC no higher than a 3 with the following criteria:

    - Mu readings for all three thirds of the runway must be higher than a 40.

    - All methods available to the airport operator must be used to determine the runway surface friction to support Mu readings.

    - The airport operator must continue to monitor the runway surface to ensure the runway surface condition does not deteriorate below the higher RCC assigned.

    - Sand and other approved runway treatments may be used to accomplish the improvements in the runway surface friction to upgrade the RCC.

- Created new definitions for dry runway, wet runway, contaminated runway, and contaminants used in the Matrix.

- Changed Mu column to include ranges.

- Made significant changes to the Airport Report.

    - Incorporated the changes made in the Matrix.
    - Reconfigured and simplified the layout to eliminate errors.

REVISED MATRIX. Figure 7 shows the Revised Matrix, notes, and definitions that were used for the Year 2 validation effort.

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		-	Dry
5	***1/8" or less depth of:*** · Wet (Damp or Water 1/8" or less) · Water (Includes Wet or Damp) · Slush · Dry Snow · Wet Snow	40 or Higher	Braking deceleration is normal for the wheel braking effort applied. Directional control is normal.	Good
4	· Frost ***-15ºC 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 -15ºC 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

Figure 7. Revised Matrix, Notes, and Definitions for the Year 2 Validation Effort

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

[2]*In some circumstances, these runway surface conditions may not be as slippery as the runway condition code assigned by the Matrix. The airport operator may issue a higher runway condition code (but no higher than code* ***3****) if Mu values greater than 40 are obtained on all three thirds of the runway 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 to a code 3 can only be applied to those runway conditions listed under code 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 -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****.*

Contaminant Definitions

Dry runway. For aircraft performance purposes and use of this Matrix, a runway can be considered dry when no more than 25 percent of the runway surface area within the reported length and the width being used is covered by:

1. Visible moisture or dampness, or
2. Frost, slush, snow (dry or wet), ice, or compacted snow.

Wet runway. For aircraft performance purposes and use of this Matrix, a runway is considered wet when more than 25 percent of the runway surface area within the reported length and the width being used is covered by any visible dampness or any water up to and including 1/8-inch (3 mm) deep.

Contaminated runway. For aircraft performance purposes and use of this Matrix, a runway is considered contaminated when more than 25 percent of the runway surface area within the reported length and the width being used is covered by any depth of slush, ice, snow (dry or wet), or frost, or by water more than 1/8-inch (3 mm) deep. Definitions for each of these runway contaminants are provided below:

Dry snow. Snow that can be blown if loose, or that will not stick together to form a snowball using gloved hands.

Wet snow. Snow that contains enough water content to be able to make a well-compacted, solid snowball, but water will not squeeze out.

Slush. Snow that is so water saturated that water will drain from it when a handful is picked up. Slush will splatter if stepped on forcefully.

Figure 7. Revised Matrix, Notes, and Definitions for the Year 2 Validation Effort (Continued)

Compacted snow. Snow that has been compressed into a solid mass such that the aircraft tires, at operating pressures and loadings, will run on the surface without significant further compaction or rutting of the surface. Compacted snow may include a mixture of snow and embedded ice; if it is more ice than compacted snow, then it should be reported as either ice or wet ice, as applicable. A layer of compacted snow over ice should be reported as compacted snow.

Frost. Frost consists of ice crystals formed from airborne moisture that condenses on a surface whose temperature is below freezing. Frost differs from ice in that the frost crystals grow independently and therefore have a more granular texture. Heavy frost that has noticeable depth may have friction qualities similar to ice and downgrading the runway condition code accordingly should be considered. If driving a vehicle over the frost does not result in tire tracks down to bare pavement, the frost should be considered to have sufficient depth to consider a downgrade of the runway condition code.

Water. Water in a liquid state.

Ice. Frozen water.

Wet ice. Ice with a layer of water on top of it or ice that is melting.

Slippery when wet runway. A runway where a friction survey, conducted for pavement evaluation/friction deterioration per Advisory Circular 150/5320-12C (or later revision), shows that more than 25 percent of the runway length does not meet the minimum friction level classification specified in Table 3-2 of that AC. The airport operator should assign and report a runway condition code of 3 for all applicable thirds of the runway when wet under this condition. If less than 25 percent of the runway fails the friction evaluation, the airport operator should report runway condition codes of 5 for the applicable runway thirds when the runway is wet, and report the deteriorated condition of the runway through the normal airport NOTAM system.

Figure 7. Revised Matrix, Notes, and Definitions for the Year 2 Validation Effort (Continued)

HOW TO USE THE REVISED MATRIX. Using the Revised Matrix is very similar to using the Initial Matrix described earlier in this technical note. The airport operator is asked to perform the same runway condition assessment practices as they usually do. The Matrix is used to determine RCCs when the entire usable runway is more than 25% contaminated or wet. If less than 25% of the total runway is contaminated or wet, then no RCCs are given. If more than 25%, the following steps should be used for each third of the runway to determine the RCCs.

1. Determine the predominant contaminant and the depth of contaminant (if applicable to the type of contaminant). Find its location in the Runway Condition Description column in the Matrix.

2. If the contaminant is compacted snow, determine if the OAT is warmer than 15°C or colder than or equal to -15°C.

3. From the Runway Condition Description column, the associated RCC can be found in the Code column.

4. Repeat steps 1-3 for each third of the runway.

Therefore, every runway will have a three-digit RCC representing the first, second, and last thirds of the runway based on the takeoff or landing direction of aircraft traffic (e.g., 5/5/4).

Pilots receiving the RCCs prior to landing would perform a landing assessment using performance data and make landing decisions accordingly.

Runway Condition Code Adjustments. The Revised Matrix allows for downgrades or upgrades of the RCCs, called adjustments. If runway conditions are worse than indicated by the RCC, the airport operator can exercise judgment and report a lower RCC based on the Downgrade Assessment Criteria of the Matrix, using the airport operator's experience, Mu reports, Deceleration and Directional Control Observation, and/or PIREPs from landing aircraft. The airport operator should consider that PIREPs rarely apply to the full length of the runway and are limited to the specific sections of the runway surface in which wheel braking was applied. The airport operator should also consider that temperatures near and above freezing may cause contaminants to be more slippery than what is indicated by the RCC derived from the Matrix. At these temperatures, airport operators should exercise a more conscientious runway assessment, and should downgrade the runway condition code when appropriate. It is emphasized that airport operator should use caution and err on the side of safe operations.

In some circumstances, those runway surface conditions listed as an RCC of 0 and 1 may not be as slippery as the RCC assigned by the Matrix. The airport operator may issue a higher RCC using the following upgrade rules.

1. All observations, judgment, and vehicle braking actions support a higher RCC.

2. Mu values greater than 40 are obtained on all three thirds of the runway by a properly operated and calibrated friction- measuring device.

3. The ability to upgrade is limited to runway conditions listed under RCC 0 and 1 in the Matrix.

4. An RCC cannot be raised higher than a code 3.

5. The airport operator must also continually monitor the runway surface as long as the higher RCC is in effect to ensure that the runway surface condition does not deteriorate below the assigned code. The extent of the 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 runway treatments are used to satisfy the requirements for issuing the higher RCC, the continued monitoring program must confirm continued effectiveness of the treatment.

EVALUATION APPROACH—YEAR 2

PARTICIPATING AIR CARRIERS AND AIRPORT OPERATORS.

The Year 2 validation effort consisted of the same two air carriers, Alaska Airlines and Pinnacle Airlines, and some changes and additions to participating airport operators from the 2009-10 validation effort (Year 1). Ketchikan International Airport elected not to participate in Year 2. Year 2 had a total of 29 participating airports from four FAA regions, Great Lakes Region

(AGL), Northwest Mountain Region (ANM), Eastern Region (AEA), and Alaskan Region (AAL). Table 5 lists the participating airport, airport identifier, location, and FAA Region. The 11 airport operators throughout Alaska and the 18 airport operators in the contiguous United States (CONUS) represented a wider range of winter operation conditions over a large geographical area, as shown in figure 8. Appendix M provides the airport diagrams of the new participating airports during Year 2.

Table 5. Participating Airports and Location for Year 2 Validation Effort

Airport	Airport Identifier	Location	FAA Region
Aspen-Pitkin County Airport/Sardy Field	ASE**	Aspen, CO	ANM
Billings Logan International Airport	BIL**	Billings, MT	ANM
Bemidji Regional Airport	BJI**	Bemidji, MN	AGL
Buffalo Niagara International Airport	BUF	Buffalo, NY	AEA
Denver International Airport	DEN	Denver, CO	ANM
Durango-La Plata County Airport	DRO	Durango, CO	ANM
Eagle County Regional Airport	EGE	Eagle County, CO	ANM
Grand Forks International Airport	GFK	Grand Forks, ND	AGL
Gerald R. Ford International Airport	GRR*	Grand Rapids, MI	AGL
Westchester County Airport	HPN	White Plains, NY	AEA
Capitol Region International Airport	LAN	Lansing, MI	AGL
General Mitchell International Airport	MKE	Milwaukee, WI	AGL
Dane County Regional Airport/Truax Field	MSN	Dane County, WI	AGL
Minneapolis International Airport/Wold-Chamberlain	MSP*	Minneapolis-St. Paul, MN	AGL
South Bend Regional Airport	SBN	South Bend, IN	AGL
Friedman Memorial Airport	SUN**	Hailey, ID	ANM
Teterboro Airport	TEB**	Teterboro, NJ	AEA
Cherry Capital Airport	TVC*	Traverse City, MI	AGL
Kodiak Airport	ADQ*	Kodiak, AK	AAL
Ted Stevens Anchorage International Airport	ANC	Anchorage, AK	AAL
Bethel Airport	BET*	Bethel, AK	AAL
Merle K. (Mudhole) Smith Airport	CDV*	Cordova, AK	AAL
Fairbanks International Airport	FAI	Fairbanks, AK	AAL
Juneau International Airport	JNU*	Juneau, AK	AAL
Nome Airport	OME	Nome, AK	AAL
Ralph Wien Memorial Airport	OTZ*	Kotzebue, AK	AAL
Petersburg James A. Johnson Airport	PSG	Petersburg, AK	AAL
Wrangell Airport	WRG*	Wrangell, AK	AAL
Yakutat Airport	YAK	Yakutat, AK	AAL

* 2009-10 validation effort participant
** No air carrier operations from Alaska or Pinnacle Airlines

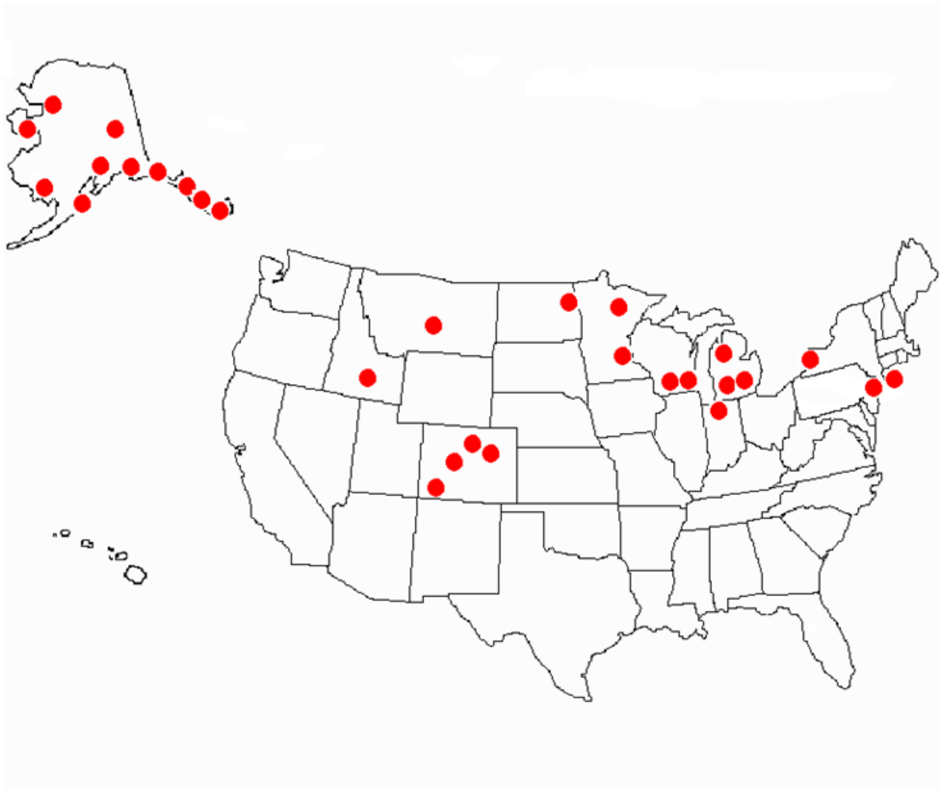


Figure 8. Year 2 Participating Airport Locations in the United States

TRAINING.

This section covers training for the air carriers, airport operators, and disseminating RCCs.

AIR CARRIER TRAINING. The FAA Validation Team and representatives from Alaska and Pinnacle airlines again discussed participation expectations, information required from flight crews, and flight crew training using the Matrix. Together, a list of essential flight crew and landing information needed for the Year 2 validation effort was developed. Some information from Year 1 was removed for Year 2 because it did not add value to the validation effort. Both air carriers took a progressive approach to collect PIREPs from their respective flight crews. Instead of using a hardcopy Pilot Report, both air carriers programmed their Aircraft Communications Addressing and Reporting System (ACARS) to include PIREP selections. This provided an electronic method to report and record PIREPs, which every pilot had to complete after each landing. Pinnacle Airlines used a combination of training methods to train their flight crews. They used computer training and simulation scenarios on proper braking technique and braking action reporting, changed flight manuals to include the Matrix and its processes, issued training bulletins, emphasized stabilized approaches when landing, and recurrent winter scenario pilot training. Alaska Airlines took a similar approach to training their flight crews with simulator training, changed their manuals to include the Matrix and its processes, instructed their pilots to perform an in-flight runway condition assessment prior to landing, and to give good reliable PIREPs.

AIRPORT OPERATOR TRAINING. The 11 participating airport operators in Alaska received on-site training from the FAA and Alaska Airlines personnel similar to the training provided in the Year 1 validation effort. The Microsoft PowerPoint training presentation used the previous year was revised and updated. It included:

- The TALPA ARC background information
- Rationale for the TALPA ARC recommendation for reporting runway conditions and Year 1's results and recommendations
- The revised Matrix
- Expectations for airport use of the Matrix and its processes
- A review of the standardized terminology for contaminants, depths, percent coverage of runways, temperature, etc.
- Instructions on how to determine RCCs
- Instructions on how to downgrade and upgrade RCCs
- Instructions on how to complete the new Airport Report
- Instructions on how to submit the hardcopy Airport Reports to the FAA
- Training exercises and scenarios using the Matrix

At the conclusion of the training, the FAA provided the following to all the airports:

- Electronic and hardcopy versions of the training presentation
- Electronic and hardcopy versions of the Airport Report
- Electronic and hardcopy instructions on how to complete the Airport Report
- Contact information for the FAA Validation Team in case they had questions
- File transfer program site information for downloading all the information received during training

Due to time constraints prior to data collection and the winter season, the FAA Validation Team did not have time to travel to all the airports in the CONUS for training. Therefore, the FAA Validation Team conducted the training through a series of webcasts. Two FAA Validation Team members traveled to the FAA Mike Monroney Aeronautical Center, in Oklahoma City, OK, which had the capability to perform the webcast. The webcasts reviewed the FAA training presentation followed by a question and answer session. Two training sessions were scheduled in December, over two days, at different times so airport operators could choose a training session that accommodated their schedule.

DISSEMINATING RCCs. The same Year 1 challenge of disseminating RCCs was present for Year 2. Therefore, pilots did not receive RCCs prior to landing. However, both air carriers performed their own in-flight runway condition assessment analyses based on the runway condition descriptions in the Matrix to determine RCCs prior to landing as an internal company standard procedure.

DATA COLLECTION.

This section discusses the data collection reports, reporting and collection methods, time period, and monthly teleconferences for the Year 2 validation effort.

PILOT REPORTS. At the end of the data collection period, Alaska Airlines gave the FAA their ACARS data in a Microsoft Access data table format. The data fields included the airport, flight number, arrival time/date, runway, PIREP, aircraft type, and weight. Pinnacle Airlines gave the FAA their ACARS data in a Microsoft® Excel® spreadsheet during several periods throughout the data collection period. The data fields included the airport, flight number, arrival time/date, runway, and PIREP.

AIRPORT REPORTS. Year 1's Airport Report was a major discussion point during the Industry Team Meeting after the conclusion of the Year 1 analysis. Changes were needed to simplify the layout and design, and to make it easier to use for the person performing the runway assessment while collecting the necessary information during Year 2. In addition, the FAA wanted to address when to assign RCCs, a point that was confusing for the airport operators during Year 1. The new Airport Report shown in appendix N addressed those changes and other areas of confusion. Before the final layout was chosen, the FAA Validation Team received input from two FAA Airport Certification Safety Inspectors familiar with the Matrix processes. The FAA also developed detailed instructions on how to complete the Airport Report and disseminated them to all the airports. The instructions are shown in appendix O. The Airport Report was again used to

- assess runway conditions using the new Matrix processes.
- determine RCCs.
- create a Matrix Report.

In addition, the information would be used to determine how well the reported runway conditions correlated with the PIREPs in the Pilot Reports.

During one teleconference, one airport expressed they would prefer the Matrix Report box (blue box) at the bottom of the Airport Report. Since moving the Matrix Report box to the bottom of the Airport Report would not change the data being collected, the FAA created another Airport Report with the recommended change and allowed the airport operators to use whichever Airport Report they preferred. This optional layout is shown in appendix P.

REPORTING AND COLLECTION METHODS. For Year 2, the FAA chose not to use the same website collection method used in Year 1. This was due to a combination of factors such as

- limited time to design and set up a website.

- website entry mistakes in Year 1 required the FAA to verify all the hardcopy Airport Reports.

- some remote airports had limited Internet capabilities.

- excessive time for the airport operator to enter the information for each Airport Report in addition to their other airport duties.

Instead, the airports were instructed to mail the Airport Reports directly to the FAA. Some airports digitally scanned the reports and emailed them to the FAA. Some Alaskan airports mailed their reports to Alaska Airlines, who forwarded them to the FAA. Upon the receipt of the reports, the FAA entered the reports into a database and archived the hardcopy reports. MSP entered their Airport Report data into a spreadsheet and provided it directly to the FAA.

Once received by the FAA, each Airport Report was reviewed for data completion, accuracy, errors, and unusual trends. Reports that were not completed 100% correctly were treated as errors and marked as such in the database. The type of error was also recorded in the database. Reports that were incomplete, illegible, and/or incorrect were discarded and not entered into the database. Discarded reports were archived for analysis.

Year 2's reporting and data collection methods were less complicated than Year 1's. This is because information was verified before it was entered into the database, which reduced data errors tremendously. The only drawback to this process was that it took approximately 10 to 30 days after the report was completed before it was entered into the database. Due to the delay, it was harder to monitor for reporting issues in a timely fashion and for the FAA to inform the airport operator.

The FAA entered the Pilot Report information into the database when the ACARS information was received.

<u>DATA COLLECTION PERIOD</u>. The official data collection process began at Alaska airports on November 1, 2010, and continued until April 1, 2011. The CONUS airports' official data collection started on December 1, 2010, and continued until April 1, 2011.

<u>MONTHLY TELECONFERENCING</u>. During the data collection period, teleconferences were again held on a monthly basis to address any issues the airports or air carriers were having, inconsistencies, missing data elements, or errors the FAA found on the Airport Reports. Issues that were discussed during the monthly teleconferences included the following.

- Some airports requested to move the Matrix Report box (blue box) to the bottom of the Airport Report.

- Some airports expressed that it was difficult to get Mu numbers prior to putting sand on the runway due to time, manpower, and experience.

- In a very few cases, the runway conditions were outside the acceptable conditions to use a CFME according to FAA AC 150/5200-30C, "Airport Winter Safety and Operations."

· An ACARS issue was discovered in which no dry PIREPs were reported. This occurred because Alaska Airlines did not program the term dry into their ACARS. In addition, the ACARS defaulted to "Good" if the pilot did not select a braking action. This was discovered by Alaska Airlines, which was routinely monitoring the data. They notified and instructed their pilots towards the end of December to select a different braking action if applicable. If a braking action appeared suspect, the flight crew was contacted by the Alaska Airlines validation coordinator to find out what the braking action was. The datasheet was corrected and sent to the FAA. Pinnacle Airlines experienced a similar issue with their ACARS. It defaulted to "Good," and if the PIREP was worse, the pilot had to select a different option. Pinnacle also reminded their pilots at the end of December to select a different braking action if applicable.

ANALYSIS PROCESSES.

The FAA created a Microsoft Access database to input all the data from the Airport and Pilot Reports. To process and perform an analysis on all the datasets from the Airport and Pilot Reports, the FAA again programmed functions within the database, creating a database analysis tool. Year 2's database analysis tool was faster and much more refined compared to the previous year. The database analysis tool added additional selection criteria, enhanced sorting, filtering, querying, and additional features for selecting correlated corresponding Airport and Pilot Reports. The database tool was organized into three major query tools.

1. View Airport Reports
2. View Pilot Reports
3. View Airport and Pilot Reports Matched Within 0 to 60 Minutes of Each Other

Selecting the "View Airport Reports" query allowed the user to select criteria to filter the data by any information reported on the Airport Report, in addition to keyword searches. The queried reports could then be viewed in a datasheet view, printed, or exported to Microsoft Excel. In the datasheet view, the data could then be sorted and filtered again for analysis. This was critical in determining the usability of the Matrix and its processes for airport operators'. Selecting the "View Pilot Reports" query allowed the user to select criteria to filter the data. The queried reports could then be viewed using the same methods as the Airport Reports.

Selecting the "View Airport and Pilot Reports Matched Within 0 to 60 Minutes of Each Other," query presented a search criteria used in both the Airport and Pilot Report queries. Before the database tool correlated reports, a time of 0 to 60 minutes had to be selected. A correlated report consisted of a Pilot Report with a date/time within the selected time range of the Airport Report's date/time. A datasheet view could then be displayed and the user could select a particular Airport Report and the associated Pilot Report would appear below it. This was again critical in determining if contaminant types/depths/temperatures, RCCs, and PIREPs correlated in the Matrix.

RESULTS AND CONCLUSIONS FOR THE YEAR 2 VALIDATION EFFORT

DATA STANDARDIZATION.

Because there were some inconsistencies in how the Airport Reports were filled out by the different airports and inconsistencies in the Pilot Reports received from the air carriers, the data was standardized to be consistent across all airports. This was vital to correlate Airport Reports with Pilot Reports using the database analysis tool. For example, on one Airport Report, a runway was listed as the opposite end of the runway on which the pilot actually landed, and a data modification was needed. All data modifications were recorded and are listed below. The airport operators and air carrier names are intentionally omitted.

- Airport A—2 Airport Reports were changed to correct runway end.
- Airport B—1079 Pilot Reports with 07R were changed to 7R.
- Airport C—72 Airport Reports stating runway 1L-19R were changed to the corresponding runway end from the applicable Pilot Report.
- Airport D—35 Airport Reports stating runway 9-27 were changed to the corresponding runway end from the applicable Pilot Report.
- Airport E—482 Pilot Reports had extra spaces before the runway numbers that were deleted.
- Airport F—Airport Reports were changed to the correct runway end.
- Airport G
  - 5 Pilot Reports with runway 08R were changed to 8R.
  - 144 Pilot Reports had an extra space before the runway numbers that was deleted.
- Airport H—182 Pilot Reports had extra spaces before the runway numbers that were deleted.
- Airport I
  - 225 Pilot Reports with runway 08 were changed to 8.
  - 6 Airport Reports were changed to the correct runway end.
- Airport J
  - 1 Airport Report was changed to the correct runway end.
  - 159 Pilot Reports had an extra space before the runway numbers that was deleted.
  - 4 Pilot Reports with runway 01L were changed to 1L.
  - 1 Pilot Report with runway 07R was changed to 7R.

· Airport K

  - 4 Airport Reports were changed to the correct runway end.
  - 408 Pilot Reports had an extra space before the runway number that was deleted.

· Airport L—505 Pilot Reports had an extra space before the runway numbers that was deleted.

· Airport M—12 Airport Reports were changed to the correct runway end.

· Airport N—19 Airport Reports were changed to the correct runway end.

· Airport O—24 Airport Reports were changed to the correct runway end.

· Airport P—4 Airport Reports were changed to the correct runway end.

· Airport Q—8 Airport Reports were changed to the correct runway end.

AIRPORT REPORTS ANALYSIS.

This section describes the complete analysis of the Airport Reports for the Year 2 validation effort.

TOTAL AIRPORT REPORTS. The following airports did not submit any reports.

· DRO—Durango-La Plata County, CO
· EGE—Eagle County, CO
· SBN—South Bend, IN
· TVC—Traverse City, MI

TVC informed the FAA that they were unable to participate as originally planned due to the hiring of new airport operations personnel and training.

The following airports participated in evaluating the usability of the Matrix and processes without any participating airlines landing at their airport.

· ASE—Aspen, CO
· BIL—Billings, MT
· BJI—Bemidji, MN
· SUN—Hailey, ID
· TEB—Teterboro, NJ

The FAA received a total of 2117 Airport Reports. Of the 2117 reports, 27 were discarded and 2090 were entered into the database. Table 6 shows the number of reports received from each airport.

Table 6. Total Airport Reports

Alaska Airports	Number of Total Reports	Number Discarded	Number in Database
ADQ—Kodiak, AK	58	1	57
ANC—Anchorage, AK	132	0	132
BET—Bethel, AK	152	1	151
CDV—Cordova, AK	76	4	72
FAI—Fairbanks, AK	32	2	30
JNU—Juneau, AK	160	4	156
OME—Nome, AK	128	7	121
OTZ—Kotzebue, AK	323	4	319
PSG—Petersburg, AK	146	1	145
WRG—Wrangell, AK	98	0	98
YAK—Yakutat, AK	49	0	49
Total Alaska Airport Reports	1354	24	1330
Airports in the CONUS	Number of Total Reports	Number Discarded	Number in Database
ASE—Aspen, CO	11	1	10
BIL—Billings, MT	14	0	14
BJI—Bemidji, MN	67	0	67
BUF—Buffalo, NY	45	0	45
DEN—Denver, CO	10	0	10
DRO—Durango-La Plata County, CO	0	0	0
EGE—Eagle County, CO	0	0	0
GFK—Grand Forks, ND	27	2	25
GRR—Grand Rapids, MI	50	0	50
HPN—White Plains, NY	14	0	14
LAN—Lansing, MI	13	0	13
MKE—Milwaukee, WI	37	0	37
MSN—Dane County, WI	109	0	109
MSP—Minneapolis, MN	348	0	348
SBN—South Bend Regional, IN	0	0	0
SUN—Hailey, ID	4	0	4
TEB—Teterboro, NJ	14	0	14
TVC—Traverse City, MI	0	0	0
Total CONUS Airport Reports	763	3	760
Total Airport Reports	2117	27	2090

DISCARDED AIRPORT REPORTS. There were a total of 27 discarded reports during Year 2. If the Airport Report did not provide enough information about the conditions, and/or the date and time, it was discarded. In some instances, the first question on the Airport Report, which asked if the maintained portion of the runway was more than 25% covered, was not answered. Without that question answered, the remainder of the report could not be verified for correctness. Conflicting information was present on a few reports and several were illegible. The reports collected after April 1 were not entered into the database. Figure 9 shows a breakdown and rationale of the discarded reports.

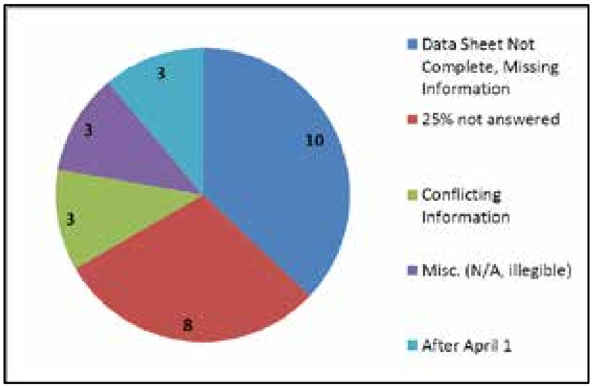


Figure 9. Breakdown and Rationale of Discarded Airport Reports—Year 2

OTHER AIRPORT REPORT TOTALS. The total number of reports recorded with each contaminant type is shown in table 7.

Table 7. Total Number of Airport Reports Recorded With Each Contaminant Type

Contaminant Type	Number of Reports
Compacted snow	281
Dry snow	520
Dry snow over compacted snow	85
Frost	205
Ice	153
Slush	35
Snow over ice	14
Water	2
Wet	372
Wet ice	5
Wet snow	137
Wet snow over compacted snow	21
Dry or wet snow over compacted snow*	38
N/A (no contaminant/dry)	222
Total	2090

*MSP's data did not distinguish whether their reported conditions of "snow over compacted snow" was "wet snow over compacted snow" or "dry snow over compacted snow;" however, both contaminants were correctly coded as a 3.

Of the 222 reports that did not specify a contaminant (N/A), 168 reports were marked less than or equal to 25% coverage and did not have any errors. Most of these were reported as dry. Fifty-four reports were marked less than or equal to 25% coverage, but contained the following errors.

- 20 reports assigned RCCs as if there was more than 25% coverage.
- 6 reports did not assign RCCs, but listed contaminants for thirds of the runway.
- 28 reports had various problems on the reports.

The total number of reports recorded for each reported depth is shown in table 8.

Table 8. Total Number of Reports Recorded for Each Reported Depth

Depth Reported	Number of Reports
N/A or left blank	1197
1/8 in. or less	709
1/4 in.	109
1/2 in.	55
3/4 in.	1
1 in.	14
2 in. or more	5
Total	2090

The total number of reports with runway treatment is shown in table 9.

Table 9. Total Number of Reports With Runway Treatment

Runway Treatment Type	Number of Reports
Sand only	437
Deice only	216
Sand and deice	138*

*Sand and Deicing chem were boxes that could be checked by the person filling out the Airport Report. The 138 reports represents when both boxes were checked off.

The total number of reports with frequency of NOTAM terminology used is shown in table 10.

Table 10. Total Number of Reports With Frequency of NOTAM Terminology Used

Terminology Used	Number of Reports
Patchy	594
Thin	663
Full (length/width)	70
Bare	327
Wide	353
Sand(ed)	266

Table 10. Total Number of Reports With Frequency of NOTAM Terminology Used (Continued)

Terminology Used	Number of Reports
Deice, deicer, deiced	225
Urea	25
Liquid	173

Note: The terminology and number of reports was gathered using the keyword search function in the database analysis tool.

AIRPORT REPORT QUESTION ANALYSIS. The Airport Report question, shown in figure 10, was the determining factor on whether RCCs were required. This question was entered into the database as "YES" or "NO."

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

- [ ] 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)

Figure 10. Airport Report Question

Of the 2090 reports, 577 reports recorded "No" as the response to the Airport Report question shown in figure 10. However, 17 of the 577 reports recorded a percentage greater than 25% on the Matrix Report/blue box. These reports were from multiple airports and were recorded as errors, because the report was not filled out correctly.

A total of 1513 reports recorded "Yes" as the response to the Airport Report question shown in figure 10. However, 113 reports recorded a percent coverage of 25% or less on the Matrix Report/blue box. Therefore, 6.2%, or a total of 130 reports (17 + 113), showed a conflict between the answer to the first question on the Airport Report and the information that was provided on the Matrix Report/blue box.

RUNWAY CONDITON CODE ANALYSIS. Reports were recorded with each set of RCCs and categorized by the lowest RCC assigned. The total number of reports with each set of RCCs is shown in table 11.

Table 11. Total Number of Reports With Each set of RCCs

Runway Condition Codes (all thirds alike)	Number of Reports	Runway Condition Codes (mixed)	Number of Reports	Totals
6/6/6	127			127
5/5/5	774	Example: 5/6/6	7	781
4/4/4	248	Example: 5/4/5	40	288
3/3/3	335	Example: 3/6/6	34	369

Table 11. Total Number of Reports With Each set of Runway Condition Codes (Continued)

Runway Condition Codes (all thirds alike)	Number of Reports	Runway Condition Codes (mixed)	Number of Reports	Totals
2/2/2	10			10
1/1/1	69	Example: 1/1/5	2	71
0/0/0	18			18
No codes (blank)	426			426
Total				2090

An adjusted RCC, or adjustment, is when the RCC (determined in the green boxes on the Airport Report) were upgraded or downgraded based on the Matrix processes for changing the RCC. There were a total of 201 adjusted RCC Airport Reports for the Year 2 validation effort. Incorrect adjustments were recorded and noted based on reviewing each Airport Report before entering the information into the database. In 51, or 25% of the total adjustments recorded, of those 201 adjusted reports, the RCCs were upgraded. Forty-one of those upgrades (80%) were done correctly, but 10 (20%) were done incorrectly. In 150 reports, or 75% of the adjusted reports, the RCCs were downgraded.

There were numerous reasons why the upgrades were considered incorrect based on the procedures and training airports received on how to upgrade the RCCs, including the wrong conditions were present to upgrade (only RCCs 1 or 0 can be upgrade, see superscript 2 on the revised Matrix); the Mu reports were not higher than 40 for all thirds of the runway; or the adjustment was upgraded to a RCC higher than a 3.

The analysis also determined the number of instances the RCCs were upgraded when they should not have been, based on the given corresponding PIREPs. Of the 41 corresponding, error-free, upgraded RCC Airport Reports, there were two cases in which the upgrade resulted in an unfavorable condition coding based on the PIREP received, as shown in table 12.

Table 12. Upgraded RCC Airport Reports That Resulted in Unfavorable Condition Coding

Case	Airport Report Number	Airport	Precipitation at Time of Report	RCC	Upgraded RCC	Percent Coverage	Runway Condition Contaminant	PIREP
1	547	BET	Active	1/1/1	3/3/3	50%	Ice	Medium to Poor
2	1750	YAK	Active	1/1/1	3/3/3	50%	Ice	Poor

An additional analysis of RCC adjustments was performed to determine if an upgrade or downgrade of the RCC by the airport operator resulted in the adjustment moving closer to or farther away from the reported PIREP. In this case, the PIREP is treated the same as its corresponding RCC on the Matrix. For example, a PIREP of “Good” corresponds to an RCC of 5, a PIREP of “Good to Medium” corresponds to an RCC of 4, a PIREP of “Medium” equals an RCC of 3, and so on. Therefore, an upgrade from an RCC of 1 to a 3, and a corresponding PIREP of “Good,” would result in the adjustment being closer to the PIREP. An upgrade from an RCC of 1 to a 3, and a corresponding PIREP of “Poor,” would result in the adjustment being farther away from the PIREP. The same is true for downgrades.

Evaluating only the corresponding reports, 57 Airport Reports had adjustments, and 41 of those were error free. Of the error-free reports, 9 were upgrades and 32 were downgrades. In the nine upgraded reports, seven RCCs were brought closer to the PIREP. This implies that in two of the nine reports, or 22.2%, the upgrade may have suggested to a pilot that the runway conditions would be better than what they experienced. In the 32 downgraded reports, only three brought the RCCs closer to the PIREP. This implies that in 29 of the 32 reports, or 90.6%, the downgrade may have suggested to a pilot that the runway conditions would be worse than what they experienced.

AIRPORT REPORT ERRORS. During database entry, Airport Reports with one or more errors were categorized by error type and noted in the database. This was helpful when conducting the error analysis for each airport and the comparison between Year 1 and Year 2 errors.

There were 337 reports with one or more categorized errors. Below are the categories of errors:

- Depth Error (i.e., reported depth for contaminants such as ice, wet, and compacted snow)
- Coverage Error (i.e., assigned RCCs when the total runway coverage was 25% or less)
- Inconsistent Codes (i.e., when comparing the RCCs to the runway surface conditions or remarks section)
- Adjustment Error (i.e., incorrect procedure for upgrading or downgrading RCCs)
- Miscellaneous Error (Most were due to incorrect percent coverage given such as 33%, 60%, or 80%.)

The total number of errors in the AAL airports and CONUS airports are shown in tables 13 and 14, respectively.

Table 13. Total Number of Errors in Airport Reports From AAL Airports

Alaska Airports	Depth Error	Coverage Error	Inconsistent Codes	Adjustment Error	Miscellaneous Error
Totals	36	35	35	9	122

Table 14. Total Number of Errors in Airport Reports From CONUS Airports

CONUS Airports	Depth Error	Coverage Error	Inconsistent Codes	Adjustment Error	Miscellaneous Error
Totals	46	25	14	1	40

It is assumed that many of the Year 2 report errors can be attributed to the layout/design of the Airport Report. For instance, contaminants that do not have a depth (e.g., ice, water, and compact snow) were reported with depths; and those that required a depth, sometimes did not have one reported. Because all the depth-related boxes are inside one large, dash-lined depth box, users may have overlooked that they should have marked two boxes, as shown in figure 11. Overall, the errors decreased during the season.

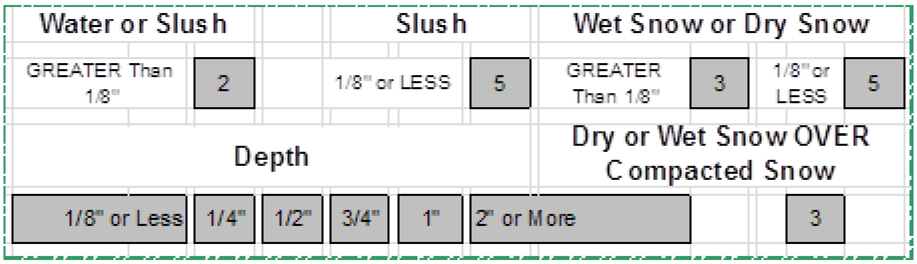


Figure 11. Depth Box on Airport Report

Analysis of Year 1 versus Year 2 was done to compare error rates.

- Year 2 Error Rate = 16% (337 Airport Reports with 1 or more errors/2090 total reports)
- Year 1 Error Rate = 32 % (624 Airport Reports with 1 or more errors/1942 total reports)

PILOT REPORT ANALYSIS.

This section describes the analysis of the Pilot Reports. Some issues occurred due to receiving the pilot data from the ACARS. Alaska Airlines did not program the term dry into their ACARS, so there could be no dry PIREPs received. In addition, the ACARS defaulted to “Good” if the pilot did not choose a braking action. Alaska Airlines discovered this issue while routinely monitoring the data. They notified and instructed their pilots in December to select a different braking action if applicable. If a braking action appeared suspect, the Alaska Airlines validation coordinator contacted the flight crew to find out what the braking action was and corrected it on the FAA data. For correlation purposes, any RCC of 5 or 6 was considered a “Good” braking action. Therefore, there is a slight probability that some of the PIREPs were something other than “Good.”

Pinnacle Airlines experienced a similar issue with their ACARS. The ACARS defaulted to “Good,” and if the PIREP was worse, the pilot had to select a difference option. Pinnacle also reminded their pilots at the end of December to select a different braking action if applicable. There were also a large number of “Poor” and “Nil” PIREPs from HPN. It is unlikely there were so many “Poor” and “Nil” landings at HPN. It is theorized there may have been an issue with the HPN data received from Pinnacle Airlines.

TOTAL PILOT REPORTS. A total of 20,867 Pilot Reports were received by the FAA. Table 15 shows the number of reports received by each region and month.

Table 15. Total Pilot Reports Received by Region and Month

Regions	Number of Pilot Reports	November	December	January	February	March	April
Alaska	8,685	0	2239	2262	2032	2152	0
CONUS	12,182	2462	2363	2748	1817	2698	94
Total	20,867	2462	4602	5010	3849	4850	94

The total number of reports with frequency of each PIREP is shown in table 16.

Table 16. Total Number of Reports With Frequency of Each PIREP

PIREP	Number of Reports
Dry*	10,829
Good*	9,314
Good-Medium	250
Medium	161
Medium-Poor	32
Poor	104
Nil	177
Total	20,867

*Alaska Airlines did not report any PIREPs as dry. Alaska Airlines did not program dry into their ACARS for their pilots to choose as an option. In addition, the ACARS system defaulted to "Good" if the pilot did not choose a braking action. Therefore, there is a slight probability that some of the PIREPs were something other than "Good."

Note: Of the 281 combined "Poor" and "Nil" PIREPs, 239 of them were from HPN. It is theorized that there may have been an issue with the data received from Pinnacle Airlines for HPN. It is unlikely that there were that many "Poor" and "Nil" landings at HPN.

The total number of reports with frequency of each PIREP with HPN data removed is shown in table 17.

Table 17. Total Number of Reports With Frequency of Each PIREP With HPN Data Removed (270 PIREPs)

PIREP	Number of Reports
Dry *	10,800
Good*	9,312
Good-Medium	250
Medium	161
Medium-Poor	32
Poor	21
Nil	21
Total	20,597

*Alaska Airlines did not report any PIREPs as dry. Alaska Airlines did not program dry into their ACARS for their pilots to choose as an option. In addition, the ACARS system defaulted to "Good" if the pilot did not choose a braking action. Therefore, there is a slight probability that some of the PIREPs were something other than "Good."

CORRESPONDING REPORTS ANALYSIS—YEAR 2.

The following analysis is a breakdown of the corresponding reports from the Year 2 validation effort. Table 18 shows the number of corresponding reports in the database beginning at 60 minutes and decreasing in 15-minute increments. Tables 19 and 20 show the number of corresponding reports at each airport for 60 and 30 minutes for AAL and CONUS airports, respectively. Table 21 shows the frequency of PIREPs of the corresponding reports for 60 minutes and 30 minutes for the AAL and CONUS airports, respectively.

Table 18. Total Number of Corresponding Reports for Time Increments

Time Search Criteria (minutes)	Number of Reports
60	1012
45	799
30	524
15	200

Table 19. Total Number of Corresponding Reports per Airport for 60 Minutes and 30 Minutes for AAL

Alaska Airports	Number of Corresponding Reports	
	60 Minutes	30 Minutes
ADQ—Kodiak, AK	36	19
ANC—Anchorage, AK	63	37
BET—Bethel, AK	106	71
CDV—Cordova, AK	43	25
FAI—Fairbanks, AK	24	13
JNU—Juneau, AK	87	26
OME—Nome, AK	78	58
OTZ—Kotzebue, AK	162	60
PSG—Petersburg, AK	101	71
WRG—Wrangell, AK	47	16
YAK—Yakutat, AK	29	21
Total	776	417

Table 20. Total Number of Corresponding Reports per Airport for 60 Minutes and 30 Minutes for CONUS Airports

CONUS Airports	Number of Corresponding Reports	
	60 Minutes	30 Minutes
BUF—Buffalo, NY	3	1
DEN—Denver, CO	1	1
GFK—Grand Forks, ND	1	0
GRR—Grand Rapids, MI	6	1
HPN—White Plains, NY	1	1
MKE—Milwaukee, WI	9	3
MSN—Dane County, WI	12	4
MSP—Minneapolis, MN	203	97
Total	236	107

Table 21. Frequency of PIREPs of the Corresponding Reports for 60 Minutes and 30 Minutes

PIREP	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

Table 22 shows the frequency of PIREPs of corresponding reports which used sand on the runway. Table 23 shows the frequency of PIREPs of corresponding reports that reported frost as the contaminant. Table 24 shows frost and the PIREPs comparison between the Year 1 and Year 2 corresponding reports with no errors. Table 25 shows corresponding reports reporting 1/8 inch or less, dry snow or wet snow, 50% to 100% coverage, active precipitation, and no errors.

Table 22. Frequency of PIREP of Corresponding Reports
That Used Sand on the Runway

PIREP	Number of Reports
Good/Dry	259
Good-Medium	32
Medium	22
Medium-Poor	7
Poor	4
Nil	1
Total	325

Table 23. Frequency of PIREP of Corresponding Reports
Reporting Frost as the Contaminant

PIREP	Number of Reports
Good	93
Good-Medium	6
Medium	4
Total	103

Table 24. Frost and PIREP Comparison for Year 1 (2009-10) and Year 2 (2010-11) Corresponding Reports With no Errors

Year 1 (628 total reports)*		Year 2 (1012 total reports)**	
PIREP	Number of Reports	PIREP	Number of Reports
Dry	13	Dry	0
Good	25	Good	81
Good to Medium	0	Good to Medium	4
Medium	2	Medium	3
Total	40	Total	88

*Year 1—Runway Condition Code for Frost = 5
**Year 2—Runway Condition Code for Frost = 4

Table 25. Corresponding Reports Reporting 1/8 Inch or Less, Dry Snow or Wet Snow, 50% to 100% Coverage, Active Precipitation, no Errors

PIREP	Number of Reports
Dry/Good	66
Good-Medium*	7
Medium	5
Total	83

*One report with an RCC of 5/5/5 was downgraded to 4/4/4.

DETAILED CORRESPONDING REPORTS ANALYSIS. The following is a detailed analysis of corresponding reports, categorized by the lowest RCC for several different scenarios. Each corresponding report was reviewed to determine if the RCCs aligned or matched the PIREPs in the Matrix. The findings determined whether there was a match or an adjusted match. If the corresponding reports did not match, the RCC was determined to be favorable (lower) or unfavorable (higher) when compared to the PIREP. The analysis was conducted for each numeric RCC and color coded (see definitions below) for ease of comparison. A summary table follows each scenario (tables 26-28).

- Match—When the RCC, generated by the runway condition description on the Matrix, matches the PIREP. This can be used to determine if the contaminant, depth, and temperature of the runway condition descriptions are aligned effectively to the PIREPs on the Matrix.

- Adjusted Match—When the RCC, as correctly adjusted using the upgrade or downgrade assessment criteria, matches the PIREP.

- Favorable Condition Coding—When the RCC recorded by the airport on the Airport Report was lower than what the PIREP reported. This is a more favorable runway condition report than what the pilot may be expecting. (Adjusted RCCs were used if provided.) Example: RCC of 2/2/2 and PIREP of “Good.”

- Unfavorable Condition Coding—When the RCC recorded by the airport on the Airport Report was higher than what the PIREP reported. This is a less favorable runway condition report than what the pilot may be expecting. (Adjusted RCCs were used if provided.) Example: RCC 5/5/5 and PIREP of "Medium."

Scenario 1: All Corresponding Reports Within 60-Minute Time Frame (1012 Reports).

- RCCs of 6:
  - 48 Matches for RCC 6
- RCCs of 5:
  - 329 Matches for RCCs of 5
  - 24 Airport Reports recorded Unfavorable Condition Coding
- RCCs of 4:
  - 16 Matches for RCCs of 4
  - 1 Adjusted Match for RCC of 4
  - 121 Airport Reports recorded Favorable Condition Coding
  - 4 Airport Reports recorded Unfavorable Condition Coding
- RCCs of 3:
  - 14 Matches for RCCs of 3
  - 7 Adjusted Matches for RCC of 3
  - 157 Airport Reports recorded Favorable Condition Coding
  - 8 Airport Reports recorded Unfavorable Condition Coding
- RCCs of 2:
  - 1 Match for RCC of 2
  - 1 Adjusted Match for RCC of 2
  - 5 Airport Report recorded Favorable Condition Coding
  - 1 Airport Report recorded Unfavorable Condition Coding
- RCCs of 1:
  - 8 Airport Reports recorded Favorable Condition Coding
- RCCs of 0:
  - All RCCs of 0/0/0 were upgraded to 3/3/3
- RCCs that were blank (not filled out):
  - 192 Matches for blank RCCs
  - 6 Airport Reports recorded Unfavorable Condition Coding
  - 69 Airport Reports had no RCCs identified due to missing information

Table 26. Summary of Corresponding Reports Analysis Within a 60-Minute Time Frame (1012 Reports)

	Number of Reports	Percentage of 1012 Reports (%)
Match	600	59
Adjusted Match	9	1
Favorable Condition Coding	291	29
Unfavorable Condition Coding	43	4
Code Cannot be Identified—Missing Information	69	7

Scenario 2: Corresponding Reports Within 60-Minute Time Frame, With 50% to 100% Runway Coverage, no Precipertation, and no Errors (299 Reports).

- RCCs of 6:
  - No applicable corresponding reports for RCC 6.
- RCCs of 5
  - 131 Matches for RCCs of 5
  - 3 Airport Reports recorded Unfavorable Condition Coding
- RCCs of 4:
  - 10 Matches for RCCs of 4
  - 86 Airport Reports recorded Favorable Condition Coding
  - 2 Airport Reports recorded Unfavorable Condition Coding
- RCCs of 3:
  - 5 Matches for RCCs of 3
  - 2 Adjusted Matches for RCCs of 3
  - 54 Airport Reports recorded Favorable Condition Coding
  - 2 Airport Reports recorded Unfavorable Condition Coding
- RCCs of 2:
  - 2 Airport Reports recorded Favorable Condition Coding
- RCCs of 1
  - 2 Airport Reports recorded Favorable Condition Coding
- RCCs of 0:
  - There were no applicable corresponding reports for RCC 0.

Table 27. Summary of Corresponding Reports Analysis Within a 60-Minute Time Frame, With 50% to 100% Runway Coverage, no Precipitation, and no Errors (299 Reports)

	Number of Reports	Percentage of 299 Reports (%)
Match	146	49
Adjusted Match	2	1
Favorable Condition Coding	144	48
Unfavorable Condition Coding	7	2

Scenario 3: Corresponding Reports Within 30-Minute Time Frame, With 50% to 100% Runway Coverage, Active Precipitation, and no Errors (160 Reports).

- RCCs of 6:
  - No applicable corresponding reports for RCC 6.
- RCCs of 5:
  - 87 Matches for RCCs of 5
  - 9 Airport Reports recorded Unfavorable Condition Coding
- RCCs of 4:
  - 1 Match for RCC of 4
  - 1 Adjusted Match for RCC of 4
  - 7 Airport Reports recorded Favorable Condition Coding
  - 1 Airport Report recorded Unfavorable Condition Coding
- RCCs of 3:
  - 8 Matches for RCCs of 3
  - 37 Airport Reports recorded Favorable Condition Coding
  - 3 Airport Reports recorded Unfavorable Condition Coding
- RCCs of 2:
  - 1 Match for RCC of 2
  - 1 Airport Report recorded Favorable Condition Coding
  - 1 Airport Report recorded Unfavorable Condition Coding
- RCCs of 1:
  - 3 Airport Reports recorded Lower Condition Coding
- RCCs of 0:
  - No applicable corresponding reports for RCC 0.

Table 28. Summary of Corresponding Reports Analysis Within a 30-Minute Time Frame, With 50% to 100% Runway Coverage, Active Precipitation, and no Errors (160 Reports)

	Number of Reports	Percentage of 160 Reports (%)
Match	97	60
Adjusted Match	1	1
Favorable Condition Coding	48	30
Unfavorable Condition Coding	14	9

SECONDARY PIREPs.

During Year 2, airport operators were asked to record additional PIREPs from any aircraft around the time when the Airport Report was completed. These PIREPs may have been from participating air carriers, other air carriers, corporate, or general aviation aircraft. These PIREPs were categorized as secondary PIREPs. The analysis compared all secondary PIREPs to the Airport Reports to gather additional data and potential matches, as shown in table 29. Some Airport Reports provided up to three secondary PIREPs. Only Airport Reports with 50% to 100% coverage and without errors were reviewed. Adjusted codes were used when applicable. The data shows a high number of RCCs of 3. This is presumed because the PIREPs were from nonparticipating air carriers that do not use Good-Medium and Medium-Poor PIREPs.

Table 29. Total Number of Secondary PIREPs Categorized by RCCs

RCC	Number of Airport Reports	Number of Secondary PIREPs	Number of Matches	Number of Airport Reports Recorded Favorable Condition Coding	Number of Airport Reports Recorded Unfavorable Condition Coding
5	155	159	140	0	19
4	52	55	5	48	2
3	144	185	55	112	18
2	3	5	0	3	2
1	4	4	0	4	0
0	4	5	0	5	0
Total	362	413	200	172	41

CORRESPONDING REPORTS ANALYSIS SUMMARY.

There were 103 corresponding reports with frost listed as the runway contaminant. Of the 103 reports, 93 (90%) had a "Good" PIREP associated with it, as opposed to its RCC equivalent of "Good-to-Medium." This suggests that frost in the Matrix may need to be revised to correlate with the "Good" PIREP in the Matrix.

If 69 reports are eliminated from the 1012 total corresponding reports due to missing information, 64% of the RCCs in the Airport Reports matched the PIREP accurately. One percent of the RCCs in the Airport Report were adjusted using the Matrix adjustment guidelines and matched the PIREP as intended, indicating the adjustment process was successful. Approximately one-third, or 31%, of the Airport Reports assigned a more favorable RCC, indicating the Matrix tends to be on the conservative side for runway condition reporting. The same trend was observed when analyzing the 299 corresponding reports with 50% to 100% runway coverage, no precipitation, and no reporting errors. In the 160 corresponding reports within 30 minutes with 50% to 100% runway coverage, during active precipitation, and no reporting errors, the unfavorable condition reporting goes up slightly, probably due to the time lapse between when the Airport Report was made and when the aircraft landed. It should be emphasized that during active precipitation, runway conditions may change more rapidly and should be monitored frequently.

It was also observed that airport personnel continued to use NOTAM terminology (i.e., patchy, thin, bare, full length/width) when completing the Matrix Report section on the Airport Report.

AIRPORT OPERATOR FEEDBACK—YEAR 2.

To gain additional feedback on how usable the Matrix and its processes were to the airport operators for collecting data and determining RCCs, the FAA created a new survey that was sent to the participating airports. Questions were asked about the adequacy of the training session received, the ease of implementing the new Matrix methodology, the ease of using the Matrix to assign RCCs, the accuracy of the Matrix, etc. Each airport was encouraged to allow any personnel who used the Matrix over the winter operation season to complete a survey. A sample of Year 2's survey is provided in appendix Q. Questions varied slightly for airports that had also participated in Year 1.

A total of 35 surveys were completed by 18 of the 25 airport operators who participated in Year 2's validation effort. Table 30 shows the breakdown of the number of complete surveys at each airport and table 31 shows the breakdown of the position/title of the person who completed it.

Table 30. Surveys Completed by Airports—Year 2

Total	AAL									
	ADQ	BET	FAI	JNU	OME	OTZ	PSG	WRG		
	2	3	1	4	2	1	1	1		
35	CONTUS Regions									
	ASE	BIL	BUF	DEN	GFK	GRR	HPN	LAN	MSP	SUN
	1	2	2	2	8	1	1	1	2	1

Table 31. Position/Title of Person Who Completed a Survey—Year 2

Airport Manager/Deputy	Operations Manager/Coordinator/ Supervisor	Mechanic/ Operator	Training Coordinator	Unknown
4	10	17	3	1

The survey feedback varied between airport operators. This was particularly true from the responses in questions 24 and 31; when asked if the RCCs represent actual runway slipperiness and if the Matrix is on the right track to improve airport winter operations. The survey responses indicated that most thought the training provided by the FAA was adequate. In addition, most understood how the Matrix reporting worked, felt that the Airport Report was understandable and easy to use, and said determining RCCs were easy. Most airport operators stated that using the Matrix and completing Airport Reports became easier with experience. The complete survey feedback provided by the airport operators is shown in appendix R.

AIR CARRIER FEEDBACK.

A pilot survey was not conducted by the FAA for the Year 2 validation effort; however, the air carriers received feedback from their flight crews on their experiences. The following list summarizes their overall impressions. The input was provided to the FAA by the air carrier representatives.

- Training
    - Both air carriers incorporated the TALPA Matrix processes and SAFO 06012 into their daily operations for their landing assessment training.
    - Initial and annual training for all pilots in contaminated landing assessment process greatly improved airline winter landings to help eliminate the hazards of winter runway excursions.
    - Manual changes and training bulletins incorporated the Matrix and its processes on contaminant types, depths, and temperature, PIREPs, and understanding of friction and Mu.
    - Training helped pilots to give good and reliable PIREPs.
    - Pilot's received simulator training on proper braking technique.
    - Training helped pilots to do the inflight runway condition assessment analysis.
    - Pilots were able to use charts and the Matrix to calculate the landing distance required.
    - Pilots were able to program and implement procedures into ACARS for landing distance calculations.
    - Pilots were trained to land faithfully to the data assumptions.
    - Pilots were able to use the 1000-foot air run data with a 15% safety margin in the landing distance assessment.

- Procedures
  - Procedures emphasized and trained pilots on stabilized approaches.
  - Pilots were trained to fly stabilized approaches consistently, not just during winter operations to ensure consistent outcomes.
  - Both air carriers operated with a touchdown policy in their landing standards and emphasized touchdown zone consistency.
  - Pilots must be trained to adhere to the touchdown policy and monitored to ensure consistent outcomes.
- Evaluation
  - Flight Operational Quality Assurance (FOQA) monitoring of stabilized approaches and touchdown standards reinforced consistent performance.
  - Stabilized approach validation was accomplished through FOQA.
- Overall
  - Standardized aviation industry process and terms will continue to improve operational safety.
  - Pinnacle pilots preferred the TALPA ARC methodology and terminology and look forward to industry wide implementation.
  - Over 85% of the Pinnacle pilots stated the Matrix was easy to use after initial training and use.
  - The additional PIREP options ("good-medium" and "medium-poor") were not an issue. Eighty-eight percent of the Pinnacle pilots stated if the industry accepted the five terms that they would have no issues with their use.
  - Pilots overwhelmingly stated that they felt PIREPs were 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 can be achieved with:
    - Uniform acceptance and reporting from airports
    - Standardized performance data from manufacturers
    - Standardized aviation industry use of the Matrix
    - Timely and accurate runway surface condition information
    - Standardized easy to use automated processes
    - Technology enhancements to ACARS and electronic flight bags

RECOMMENDATIONS—YEAR 2

THE YEAR 2 FAA TEAM MEETING.

As in the Year 1 validation effort, an FAA Validation Team meeting was scheduled to review the data, analyses, and surveys of the Year 2 validation effort prior to providing a briefing at the Industry Meeting. The FAA Validation Team meeting took place in June 2011. At the conclusion of the meeting, the FAA Validation Team prepared recommendations to present to the Industry Team.

THE YEAR 2 INDUSTRY TEAM MEETING AND RECOMMENDATIONS.

The Year 2 Industry Team, comprised of aviation representatives, FAA Team members, and additional FAA personnel, met in August 2011 at the FAA Northwestern Region Office in Renton, Washington, to review the analysis completed by the FAA Validation Team. See appendix S for a list of attendees and appendix T for meeting notes.

In general, the Industry Team believed that the correlation of RCCs to PIREPs was again very encouraging. Based on the data and analysis presented to the Industry Team, a third validation effort was not recommended. It was recommended that the FAA work to implement the Matrix into aviation operations. Some of the major points discussed during the meeting are listed below.

- The use of the PIREP terminology “Good to Medium” and “Medium to Poor,” and the difficulty for pilots to distinguish them were not significant issues judging from air carrier feedback. No changes to the PIREP terminology were made.

- The Matrix procedure requirement to have a Mu values greater than 40 for the entire runway to upgrade the RCCs was an issue. In some cases, runway surface conditions could be outside the FAA AC parameters for measuring Mu with continuous friction measuring equipment, even though other indications and experience expressed by some airport operators that the runway is better than a RCC of 0 or 1. This prohibits the airport from upgrading. It could limit their operations and force the runway to close; yet there were only three cases in which these conditions were present in the 1012 corresponding events where in the runway would have been closed. There was not enough data to warrant a change to the above 40 Mu threshold or allow the airport operator another method of assessing the runway surface condition to upgrade RCCs. Action taken to change the runway surface condition or increase its friction characteristics would have to be performed to reassess the RCCs. The RCC upgrade process was not changed; however, all participants agreed that airport operators should be allowed to upgrade RCCs for the individual thirds of the runway for Mu above 40 along with other indicators.

- The Airport Report usability and layout from the previous year’s validation effort was improved. However, portions of the Airport Report may have contributed to some errors again. It was difficult to balance the need for an Airport Report to collect information about the runway surface conditions for the validation effort and remain simple enough for airport operators to use while doing the assessment. If the Matrix is implemented, airports should be able to collect runway conditions however they choose.

- Multiple contaminants were discussed because some airports were having difficulty assigning RCCs when multiple contaminants were present. Additional and more thorough training on multiple contaminants would be needed if the Matrix process is implemented. It was assumed that airports should use the worst or most slippery contaminant that the aircraft tires will interact with as the primary contaminant.

- Training on the implementation of the Matrix is the key to its success across the National Airspace System (NAS). Discussion focused on what, how, when, and who would be effective in training airports. The FAA may have to standardize what airport operators are expected to know about the Matrix. Additional discussion addressed the concepts of aviation organizations developing training courses, independent trainers, an FAA training DVD, and regional training at conferences to train the trainers. The timing of training was also discussed in detail, such as phased implementation, the implementation of a practice year and a turn-on date, and how the FAA's Air Traffic Organization procedures would change.

- The Notice of Proposed Rulemaking process and other options for implementing the Matrix were discussed. Due to a backlog in the rulemaking process, the consensus of the group was to go forward with all FAA nonregulatory efforts to implement the Matrix initially. Steps included AC changes, adding information into the Aeronautial Information Manual (AIM), voluntary OpSpecs for air carriers, etc.

- The FAA's Office of Airport Safety and Standards is working with the FAA NOTAM office to incorporate TALPA changes and terminology into the digital NOTAM system.

- Final changes to the Matrix were discussed.

- FAA actions and next steps were discussed.

The following were changes made to the Matrix and runway condition assessment process:

- Moved Frost back to a RCC of 5.

- Added supporting guidance for how to handle multiple contaminants.

- Allowed the RCC upgrades of individual runway thirds.

- Added "Vehicle" to the beginning of the title of Column 4 on the Matrix.

- Used "may be" in the Vehicle column, and added "OR" to indicate it could be either deceleration or directional control that causes the concern—it does not have to be both.

- Added definitions for layered contaminants.

- Added the rules for multiple contaminants.
- Deleted box in upper right corner that read “Pilot Reports (PIREPs) Provided To ATC And Flight Dispatch.”
- Deleted “Dry” from PIREP column and replaced with dashed line.
- Shaded the PIREP column (same gray as columns 3 and 4).
- Changed the title of the Matrix to Runway Condition Assessment Matrix (RCAM).

NEXT STEPS.

At the conclusion of the Industry Team Meeting, the FAA Validation Team determined that the next steps for implementing the Matrix were to:

- discuss the TALPA validation efforts, results, and Industry Team recommendations with FAA senior leadership, and present an implementation outline on what was necessary for the FAA to implement the Matrix in the NAS.
- prepare an implementation outline that would include the effect of the Matrix on all FAA lines of business and make recommendations for an Implementation Team.
- complete an FAA Technical Note that documents the history, effort, data, analysis, and recommendations of the TALPA validation efforts of the RCAM.

FINAL MATRIX AFTER THE YEAR 2 INDUSTRY TEAM MEETING.

The following figures were considered final at the conclusion of the Industry Team Meeting. Figure 12 shows the final version of the Matrix and its notes. Figures 13 and 14 show the contaminant definitions, percent coverages, and reporting contaminants that were agreed to at the Industry Team Meeting.

Runway Condition Assessment Matrix (RCAM)				
Assessment Criteria		**Downgrade Assessment Criteria**		
Code	Runway Condition Description	**Mu (μ)** [1]	**Vehicle Deceleration Or Directional Control Observation**	**PIREP**
6	· Dry		---	---
5	· Frost · Wet (Includes Damp and1/8" or less depth of Water) ***1/8" or less depth of:*** · Slush · Dry Snow · Wet Snow	**40 or Higher**	Braking deceleration is normal for the wheel braking effort applied AND directional control is normal.	Good
4	***-15ºC and Colder outside air temperature:*** · Compacted Snow	**39 to 30**	Braking deceleration OR directional control 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 -15ºC outside air temperature:*** · Compacted Snow		Braking deceleration is noticeably reduced for the wheel braking effort applied OR directional control is noticeably reduced.	Medium
2	***Greater than 1/8" depth of:*** · Water · Slush	**29 to 21**	Braking deceleration OR directional control is between Medium and Poor.	Medium to Poor
1	· Ice [2]		Braking deceleration is significantly reduced for the wheel braking effort applied OR directional control is 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 OR directional control is uncertain.	Nil

Figure 12. Final Version of Matrix and Notes

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

[2]*In some circumstances, these runway surface conditions may not be as slippery as the runway condition code assigned by the Matrix. The airport operator may issue a higher runway condition code (but no higher than code* ***3****) for each third of the runway if the Mu value for that third of the runway is 41 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 to a code 1, 2, or 3 can only be applied to those runway conditions listed under codes 0 and 1 in the Matrix.*

The airport operator must also continually monitor the runway surface as long as the 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 -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****.*

Figure 12. Final Version of Matrix and Notes (Continued)

Contaminant Definitions

DRY RUNWAY. For aircraft performance purposes and use of this Matrix, a runway can be considered dry when no more than 25 percent of the runway surface area within the reported length and the width being used is covered by:

1. Visible moisture (including a damp runway), or
2. Frost, slush, snow (dry or wet), ice, or compacted snow.

WET RUNWAY. For aircraft performance purposes and use of this Matrix, a runway is considered wet when more than 25 percent of the runway surface area within the reported length and the width being used is covered by any visible dampness or any water up to and including 1/8-inch (3 mm) deep.

CONTAMINATED RUNWAY. For aircraft performance purposes and use of this Matrix, a runway is considered contaminated when more than 25 percent of the runway surface area within the reported length and the width being used is covered by any depth of slush, ice, dry or wet snow, or frost, or by water more than 1/8-inch (3 mm) deep. Definitions for each of these runway contaminants are provided below:

Dry snow. Snow that can be blown if loose, or that will not stick together to form a snowball using gloved hands.

Wet snow. Snow that contains enough water content to be able to make a well-compacted, solid snowball, but water will not squeeze out.

Slush. Snow that is so water saturated that water will drain from it when a handful is picked up. Slush will splatter if stepped on forcefully.

Compacted snow. Snow that has been compressed into a solid mass such that the aircraft tires, at operating pressures and loadings, will run on the surface without significant further compaction or rutting of the surface. Compacted snow may include a mixture of snow and embedded ice; if it is more ice than compacted snow, then it should be reported as either ice or wet ice, as applicable. A layer of compacted snow over ice should be reported as compacted snow.

Frost. Frost consists of ice crystals formed from airborne moisture that condenses on a surface whose temperature is below freezing. Frost differs from ice in that the frost crystals grow independently and therefore have a more granular texture. Heavy frost that has noticeable depth may have friction qualities similar to ice and downgrading the runway condition code accordingly should be considered. If driving a vehicle over the frost does not result in tire tracks down to bare pavement, the frost should be considered to have sufficient depth to consider a downgrade of the runway condition code.

Water. Water in a liquid state.

Ice. Frozen water.

Wet ice. Ice with a layer of water on top of it or ice that is melting.

Slippery When Wet Runway. A runway where a friction survey, conducted for pavement evaluation/friction deterioration per Advisory Circular 150/5320-12C (or later revision), shows that more than 25 percent of the runway length does not meet the minimum friction level classification specified in Table 3-2 of that AC. The airport operator should assign and report a runway condition code of 3 for all applicable thirds of the runway when wet under this condition. If less than 25 percent of the runway fails the friction evaluation, the airport operator should report runway condition codes of 5 for the applicable runway thirds when the runway is wet, and report the deteriorated condition of the runway through the normal airport NOTAM system.

Layered Contaminants. Definitions for the layered contaminants listed in the Matrix are simply a combination of the above definitions for each of the layered contaminants. For example, the definition of "Wet Snow over Ice" is "Snow that contains enough water content to be able to make a well-compacted, solid snowball, but water will not squeeze out" over "frozen water."

Figure 13. Contaminant Definitions

Percent Coverage and Reporting Contaminants

1. Report the percentage of the contaminated runway within the reported length and width being used. If greater than 25%, proceed to step 2. If less than or equal to 25%, proceed to step 4.
2. Report a runway condition code for each third of the runway.
3. Determine the runway condition code from the Runway Condition Assessment Matrix. Assign the code associated with the most slippery (i.e., lowest code) contaminant (including wet) that covers more than 25% of the runway surface. If less than 25% of the runway surface is covered with contamination (or is wet) assign it a code 6.
    a. Small areas (i.e., less than 25% coverage) should be described in the remarks section of the runway surface condition report.
    b. If multiple contaminants are present where the total runway percent coverage is greater than 25%, but no single contaminant covers more than 25%, choose the runway condition code based on your judgment, considering what contaminant will most likely be encountered by the aircraft and its likely effect on the aircraft's stopping ability. Use all the assessment tools available in determining the runway condition code to assign.
4. Provide a description of the most predominant contamination type using the contamination terms defined above. Any additional contamination types and percentage of their coverage of the runway surface should be provided in the remarks section of the runway surface condition report.
5. Runway surface condition reports of bare and dry (runway condition code 6/6/6) should not be disseminated via the NOTAM system unless requested. All other reports should be disseminated through the NOTAM system and other local procedures.

Example: The first third of runway 28R at ZZZ airport is approximately 30% covered with ice, the middle third has approximately 50% dry snow over compacted snow, and the last third is approximately 10% ice, 20% wet snow of less than 1/8 inch depth, and 40% wet.

Runway surface condition report: ZZZ Rwy 28R 1/3/5 75% Dry Snow over Compacted Snow, (Remarks) first 3000 ft 30% ice, last 3000 ft 30% ice and wet snow, Time & Date.

Figure 14. Percent Coverage and Reporting Contaminants

SAFO

Safety Alert for Operators

U.S. Department
of Transportation

Federal Aviation Administration

SAFO 06012
DATE: 8/31/06

Flight Standards Service
Washington, DC

http://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/safo

A SAFO contains important safety information and may include recommended action. SAFO content should be especially valuable to air carriers in meeting their statutory duty to provide service with the highest possible degree of safety in the public interest.

Subject: Landing Performance Assessments at Time of Arrival (Turbojets)

1. Purpose. This SAFO urgently recommends that operators of turbojet airplanes develop procedures for flightcrews to assess landing performance based on conditions actually existing at time of arrival, as distinct from conditions presumed at time of dispatch. Those conditions include weather, runway conditions, the airplane's weight, and braking systems to be used. Once the actual landing distance is determined an additional safety margin of at least 15% should be added to that distance. Except under emergency conditions flightcrews should not attempt to land on runways that do not meet the assessment criteria and safety margins as specified in this SAFO.

2. Discussion: This SAFO is based on the FAA's policy statement published in the Federal Register on June 7, 2006, and incorporates revisions based on public comments received by the FAA. Accordingly, the FAA has undertaken rulemaking that would explicitly require the practice described above. Operators may use Operation/Management Specification paragraph C382 to record their voluntary commitment to this practice, pending rulemaking.

Operators engaged in air transportation have a statutory obligation to operate with the highest possible degree of safety in the public interest.

3. Applicability:

a. This SAFO applies to all turbojet operators under Title 14 of the Code of Federal Regulations (14 CFR) parts 121, 135, 125, and 91 subpart K. The intent of providing this information is to assist operators in developing methods of ensuring that sufficient landing distance exists to safely make a full stop landing with an acceptable safety margin on the runway to be used, in the conditions existing at the time of arrival, and with the deceleration means and airplane configuration that will be used. The FAA considers a 15% margin between the expected actual airplane landing distance and the landing distance available at the time of arrival as the minimum acceptable safety margin for normal operations.

b. The FAA acknowledges that there are situations where the flightcrew needs to know the absolute performance capability of the airplane. These situations include emergencies or abnormal and irregular configurations of the airplane such as engine failure or flight control malfunctions. In these circumstances, the pilot must consider whether it is safer to remain in the air or to land immediately and must know the actual landing performance capability (without an added safety margin) when making these evaluations. This guidance is not intended to curtail such evaluations from being made for these situations.

c. This guidance is independent of the preflight landing distance planning requirements of part 121, section 121.195, part 135, section 135.385, and part 91, section 91.1037.

d. This 15% safety margin should not be applied to the landing distance determined for compliance with any other OpSpec/MSpec requirement. The landing distance assessment of this guidance is independent of any other OpSpec/MSpec landing distance requirement. The minimum landing distance should comply with all applicable landing distance requirements. Hence, the minimum landing distance at the time of arrival should be the longer of the landing distance in this guidance and that determined to be in compliance with any other applicable OpSpec/MSpec.

e. This guidance does not apply to Land and Hold Short Operations (LAHSO).

4. Definitions: The following definitions are specific to this guidance and may differ with those definitions contained in other published references.

a. Actual Landing Distance. The landing distance for the reported meteorological and runway surface conditions, runway slope, airplane weight, airplane configuration, approach speed, use of autoland or a Head-up Guidance System, and ground deceleration devices planned to be used for the landing. It does not include any safety margin and represents the best performance the airplane is capable of for the conditions.

b. Airplane Ground Deceleration Devices. Any device used to aid in the onset or rate of airplane deceleration on the ground during the landing roll out. These would include, but not be limited to: brakes (either manual braking or the use of autobrakes), spoilers, and thrust reversers.

c. At Time of Arrival. For the purpose of this guidance means a point in time as close to the airport as possible consistent with the ability to obtain the most current meteorological and runway surface conditions considering pilot workload and traffic surveillance, but no later than the commencement of the approach procedures or visual approach pattern.

d. Braking Action Reports. The following braking action reports are widely used in the aviation industry and are furnished by air traffic controllers when available. The definitions provided below are consistent with how these terms are used in this guidance.

Good – More braking capability is available than is used in typical deceleration on a non-limiting runway (i.e., a runway with additional stopping distance available). However, the landing distance will be longer than the certified (unfactored) dry runway landing distance, even with a well executed landing and maximum effort braking.

Fair/Medium – Noticeably degraded braking conditions. Expect and plan for a longer stopping distance such as might be expected on a packed or compacted snow-covered runway.

Poor – Very degraded braking conditions with a potential for hydroplaning. Expect and plan for a significantly longer stopping distance such as might be expected on an ice-covered runway.

Nil – No braking action and poor directional control can be expected.

NOTE: Conditions specified as "nil" braking action are not considered safe, therefore operations under conditions specified as such should not be conducted. Do not attempt to operate on surfaces reported or expected to have nil braking action.

e. Factored Landing Distance. The landing distance required by 14 CFR part 25, section 25.125 increased by the preflight planning safety margin additives required by the applicable operating rules. (Some manufacturers supply factored landing distance information in the Airplane Flight Manual (AFM) as a service to the user.)

f. Landing Distance Available. The length of the runway declared available for landing. This distance may be shorter than the full length of the runway.

g. Meteorological Conditions. Any meteorological condition that may affect either the air or ground portions of the landing distance. Examples may include wind direction and velocity, pressure altitude, and temperature. An example of a possible effect that must be considered includes crosswinds affecting the amount of reverse thrust that can be used on airplanes with tail mounted engines due to rudder blanking effects.

h. Reliable Braking Action Report. For the purpose of this guidance, means a braking action report submitted from a turbojet airplane with landing performance capabilities similar to those of the airplane being operated.

i. Runway Surface Conditions. The state of the surface of the runway: either dry, wet, or contaminated. A dry runway is one that is clear of contaminants and visible moisture within the required length and the width being used. A wet runway is one that is neither dry nor contaminated. For a contaminated runway, the runway surface conditions include the type and depth (if applicable) of the substance on the runway surface, e.g., standing water, dry snow, wet snow, slush, ice, sanded, or chemically treated.

j. Runway Friction or Runway Friction Coefficient. The resistance to movement of an object moving on the runway surface as measured by a runway friction measuring device. The resistive force resulting from the runway friction coefficient is the product of the runway friction coefficient and the weight of the object.

k. Runway Friction Enhancing Substance. Any substance that increases the runway friction value.

l. Safety Margin. The length of runway available beyond the actual landing distance. Safety margin can be expressed in a fixed distance increment or a percentage increase beyond the actual landing distance required.

m. Unfactored Certified Landing Distance. The landing distance required by section 25.125 without any safety margin additives. The unfactored certified landing distance may be different from the actual landing distance because not all factors affecting landing distance are required to be accounted for by section 25.125. For example, the unfactored certified landing distances are based on a dry, level (zero slope) runway at standard day temperatures, and do not take into account the use of autobrakes, autoland systems, head-up guidance systems, or thrust reversers.

5. Background: After any serious aircraft accident or incident, the FAA typically performs an internal audit to evaluate the adequacy of current regulations and guidance information in areas that come under scrutiny during the course of the accident investigation. The Southwest Airlines landing overrun accident involving a Boeing 737-700 at Chicago Midway Airport in December 2005 initiated such an audit. The types of information that were evaluated in addition to the regulations were FAA orders, notices, advisory circulars, ICAO and foreign country requirements, airplane manufacturer-developed material, independent source material, and the current practices of air carrier operators. This internal FAA review revealed the following issues:

a. A survey of operators' manuals indicated that approximately fifty percent of the operators surveyed do not have policies in place for assessing whether sufficient landing distance exists at the time of arrival, even when conditions (including runway, meteorological, surface, airplane weight, airplane configuration, and planned usage of decelerating devices) are different and worse than those planned at the time the flight was released.

b. Not all operators who perform landing distance assessments at the time of arrival have procedures that account for runway surface conditions or reduced braking action reports.

c. Many operators who perform landing distance assessments at the time of arrival do not apply a safety margin to the expected actual landing distance. Those that do are inconsistent in applying an increasing safety margin as the expected actual landing distance increased (i.e., as a percentage of the expected actual landing distance).

d. Some operators have developed their own contaminated runway landing performance data or are using data developed by third party vendors. In some cases, these data indicate shorter landing distances than the airplane manufacturer's data for the same conditions. In other cases, an autobrake landing distance chart has been misused to generate landing performance data for contaminated runway conditions. Also, some operators' data have not been kept up to date with the manufacturer's current data.

e. Credit for the use of thrust reversers in the landing performance data is not uniformly applied and pilots may be unaware of these differences. In one case, there were differences found within the same operator from one series of airplane to another within the same make and model. The operator's understanding of the data with respect to reverse thrust credit, and the information conveyed to pilots, were both incorrect.

f. Airplane flight manual (AFM) landing performance data are determined during flight-testing using flight test and analysis criteria that are not representative of everyday operational practices. Landing distances determined in compliance with 14 CFR part 25, section 25.125 and published in the FAA-approved AFM do not reflect operational landing distances (Note: some manufacturers provide factored landing distance data that addresses operational requirements.) Landing distances determined during certification tests are aimed at demonstrating the shortest landing distances for a given airplane weight with a test pilot at the controls and are established with full awareness that operational rules for normal operations require additional factors to be added for determining minimum operational field lengths. Flight test and data analysis techniques for determining landing distances can result in the use of high touchdown sink rates (as high as 8 feet per second) and approach angles of -3.5 degrees to minimize the airborne portion of the landing distance. Maximum manual braking, initiated as soon as possible after landing, is used in order to minimize the braking portion of the landing distance. Therefore, the landing distances determined under section 25.125 are shorter than the landing distances achieved in normal operations.

g. Wet and contaminated runway landing distance data are usually an analytical computation using the dry, smooth, hard surface runway data collected during certification. Therefore, the wet and contaminated runway data may not represent performance that would be achieved in normal operations. This lack of operational landing performance repeatability from the flight test data, along with many other variables affecting landing distance, are taken into consideration in the preflight landing performance calculations by requiring a significant safety margin in excess of the certified (unfactored) landing distance that would be required under those conditions. However, the regulations do not specify a particular safety margin for a landing distance assessment at the time of arrival. This safety margin has been left largely to the operator and/or the flightcrew to determine.

h. Manufacturers do not provide advisory landing distance information in a standardized manner. However, most turbojet manufacturers make landing distance performance information available for a range of runway or braking action conditions using various airplane deceleration devices and settings under a variety of meteorological conditions. This information is made available in a wide variety of informational documents, dependent upon the manufacturer.

i. Manufacturer-supplied landing performance data for conditions worse than a dry, smooth runway is normally an analytical computation based on the dry runway landing performance data, adjusted for a reduced airplane braking coefficient of friction available for the specific runway surface condition. Most of the data for runways contaminated by snow, slush, standing water, or ice were developed to show compliance with European Aviation Safety Agency and Joint Aviation Authority airworthiness certification and operating requirements. The FAA considers the data developed for showing compliance with the European contaminated runway certification or operating requirements, as applicable, to be acceptable for making landing distance assessments for contaminated runways at the time of arrival.

6. Recommended Action:

a. A review of the current applicable regulations indicates that the regulations do not specify the type of landing distance assessment that must be performed at the time of arrival, but operators are required to restrict or suspend operations when conditions are hazardous.

b. 14 CFR part 121, section 121.195(b), part 135, section 135.385(b), and part 91, section 91.1037(b) and (c) require operators to comply with certain landing distance requirements at the time of takeoff. (14 CFR part 125, section 125.49 requires operators to use airports that are adequate for the proposed operation). These requirements limit the allowable takeoff weight to that which would allow the airplane to land within a specified percentage of the landing distance available on: (1) the most favorable runway at the destination airport under still air conditions;

and (2) the most suitable runway in the expected wind conditions. Sections 121.195(d), 135.385(d), and 91.1037(e) further require an additional 15 percent to be added to the landing distance required when the runway is wet or slippery, unless a shorter distance can be shown using operational landing techniques on wet runways. Although an airplane can be legally dispatched under these conditions, compliance with these requirements alone does not ensure that the airplane can safely land within the distance available on the runway actually used for landing in the conditions that exist at the time of arrival, particularly if the runway, runway surface condition, meteorological conditions, airplane configuration, airplane weight, or use of airplane ground deceleration devices is different than that used in the preflight calculation. Part 121, sections 121.533, 121.535, 121.537, part 135, section 135.77, part 125, section 125.351, and part 91, sections 91.3, and 91.1009 place the responsibility for the safe operation of the flight jointly with the operator, pilot in command, and dispatcher as appropriate to the type of operation being conducted.

c. Sections 121.195(e) and 135.385(e), allow an airplane to depart even when it is unable to comply with the conditions referred to in item (2) of paragraph 5b above if an alternate airport is specified where the airplane can comply with conditions referred to in items (1) and (2) of paragraph 5b. This implies that a landing distance assessment is accomplished before landing to determine if it is safe to land at the destination, or if a diversion to an alternate airport is required.

d. Part 121, sections 121.601 and 121.603, require dispatchers to keep pilots informed, or for pilots to stay informed as applicable, of conditions, such as airport and meteorological conditions, that may affect the safety of the flight. Thus, the operator and flightcrew use this information in their safety of flight decision making. Part 121, sections 121.551, 121.553, and part 135, section 135.69, require an operator, and/or the pilot in command as applicable, to restrict or suspend operations to an airport if the conditions, including airport or runway surface conditions, are hazardous to safe operations. Part 125 section 125.371 prohibits a pilot in command (PIC) from continuing toward any airport to which it was released unless the flight can be completed safely. A landing distance assessment should be made under the conditions existing at the time of arrival in order to support a determination of whether conditions exist that may affect the safety of the flight and whether operations should be restricted or suspended.

e. Runway surface conditions may be reported using several types of descriptive terms including: type and depth of contamination, a reading from a runway friction measuring device, an airplane braking action report, or an airport vehicle braking condition report. Unfortunately, joint industry and multi-national government tests have not established a reliable correlation between runway friction under varying conditions, type of runway contaminants, braking action reports, and airplane braking capability. Extensive testing has been conducted in an effort to find a direct correlation between runway friction measurement device readings and airplane braking friction capability. However, these tests have not produced conclusive results that indicate a repeatable correlation exists through the full spectrum of runway contaminant conditions. Therefore, operators and flightcrews cannot base the calculation of landing distance solely on runway friction meter readings. Likewise, because pilot braking action reports are subjective, flightcrews must use sound judgment in using them to predict the stopping capability of their airplane. For example, the pilots of two identical aircraft landing in the same conditions, on the same runway could give different braking action reports. These differing reports could be the result of differences between the specific aircraft, aircraft weight, pilot technique, pilot experience in similar conditions, pilot total experience, and pilot expectations. Also, runway surface conditions can degrade or improve significantly in very short periods of time dependent on precipitation, temperature, usage, and runway treatment and could be significantly different than indicated by the last report. Flightcrews must consider all available information, including runway surface condition reports, braking action reports, and friction measurements.

(1) Operators and pilots should use the most adverse reliable braking action report, if available, or the most adverse expected conditions for the runway, or portion of the runway, that will be used for landing when assessing the required landing distance prior to landing. Operators and pilots should consider the following factors in determining the actual landing distance: the age of the report, meteorological conditions present since the report was issued, type of airplane or device used to obtain the report, whether the runway surface was treated since the report, and the methods used for that treatment. Operators and pilots are expected to use sound judgment in determining the applicability of this information to their airplane's landing performance.

(2) Table 1 provides an example of a correlation between braking action reports and runway surface conditions:

Braking Action	Dry (not reported)	Good	Fair/Medium	Poor	Nil
Contaminant	Dry	Wet Dry Snow (< 20mm)	Packed or Compacted Snow	Wet Snow Slush Standing Water Ice	Wet ice

Table 1. Relationship between braking action reports and runway surface condition (contaminant type)

NOTE: Under extremely cold temperatures, these relationships may be less reliable and braking capabilities may be better than represented. This table does not include any information pertaining to a runway that has been chemically treated or where a runway friction enhancing substance has been applied.

f. Some advisory landing distance information uses a standard air distance of 1000 feet from 50 feet above the runway threshold to the touchdown point. Unfactored dry runway landing distances in AFMs reflect the distances demonstrated during certification flight testing. These unfactored AFM landing distance data include air distances that vary with airplane weight, but are also nominally around 1000 feet. A 1000 foot air distance is not consistently achievable in normal flight operations. Additionally, the use of automatic landing systems (autoland) and other landing guidance systems (e.g., head-up guidance systems) typically result in longer air distances. Operators are expected to apply adjustments to this air distances to reflect their specific operations, operational practices, procedures, training, and experience.

g. To ensure that an acceptable landing distance safety margin exists at the time of arrival, the FAA recommends that at least a 15% safety margin be provided. This safety margin represents the minimum distance margin that must exist between the expected actual landing distance at the time of arrival and the landing distance available, considering the meteorological and runway surface conditions, airplane configuration and weight, and the intended use of airplane ground deceleration devices. In other words, the landing distance available on the runway to be used for landing must allow a full stop landing, in the actual conditions and airplane configuration at the time of landing, and at least an additional 15% safety margin.

h. Operator compliance can be accomplished by a variety of methods and procedurally should be accomplished by the method that best suits the operator's current procedures. The operator's procedures should be clearly articulated in the operations manual system for affected personnel. The following list of methods is not all inclusive, or an endorsement of any particular methods, but provided as only some examples of methods of compliance.

- Establishment of a minimum runway length required under the worst case meteorological and runway surface conditions for operator's total fleet or fleet type that will provide runway lengths that comply with this guidance.

- The requirements of this paragraph could be considered along with the other applicable preflight landing distance calculation requirements and the takeoff weight adjusted to provide for compliance at the time of arrival under the conditions and configurations factored in the calculation. This information, including the conditions/configurations/etc. used in the calculation, would be provided to the flightcrew as part of the release/dispatch documents. (However, this method may not be sufficient if conditions/configurations/etc. at the time of arrival are different than those taken into account in the preflight calculations; therefore, the flightcrew would need to have access to the landing performance data applicable to the conditions present upon arrival.

- Tab or graphical data accounting for the applicable variables provided to the flightcrew and/or dispatcher as appropriate to the operator's procedures.

- Electronic Flight Bag equipment that has methods for accounting for the appropriate variables.

NOTE: These are only some examples of methods of compliance. There are many others that would be acceptable.

7. Summary of Recommendation.

a. Turbojet operators have procedures to ensure that a full stop landing, with at least a 15% safety margin beyond the actual landing distance, can be made on the runway to be used, in the conditions existing at the time of arrival, and with the deceleration means and airplane configuration that will be used. This assessment should take into account the meteorological conditions affecting landing performance (airport pressure altitude, wind velocity, wind direction, etc.), surface condition of the runway to be used for landing, the approach speed, airplane weight and configuration, and planned use of airplane ground deceleration devices. The airborne portion of the actual landing distance (distance from runway threshold to touchdown point) should reflect the operator's specific operations, operational practices, procedures, training, and experience. Operators should have procedures for compliance with this guidance, absent an emergency, after the flightcrew makes this assessment using the air carrier's procedures, if at least the 15% safety margin is not available, the pilot should not land the aircraft.

(1) This assessment does not mean that a specific calculation must be made before every landing. In many cases, the before takeoff criteria, with their large safety margins, will be adequate to ensure that there is sufficient landing distance with at least a 15% safety margin at the time of arrival. Only when the conditions at the destination airport deteriorate while en route (e.g., runway surface condition, runway to be used, winds, airplane landing weight/configuration/speed/deceleration devices) or the takeoff was conducted under the provisions described in paragraph 5 (c) of this guidance, would a calculation or other method of determining the actual landing distance capability normally be needed. The operator should develop procedures to determine when such a calculation or other method of determining the expected actual landing distance is necessary to ensure that at least a 15% safety margin will exist at the time of arrival.

(2) Operators may require flight crews to perform this assessment, or may establish other procedures to conduct this assessment. Whatever method(s) the operator develops, its procedures should account for all factors upon which the preflight planning was based and the actual conditions existing at time of arrival.

b. Confirm that the procedures and data used to comply with paragraph 6 (a) above for actual landing performance assessments yield results that are at least as conservative as the manufacturer's approved or advisory information for the associated conditions provided therein. Although the European contaminated runway operations requirements are applied differently than the requirements of this guidance, the operator may choose to use data developed for showing compliance with the European contaminated runway operating requirements for making these landing distance assessments for contaminated runways at the time of arrival.

c. A safety margin of 15% should be added to the actual landing distance and require that the resulting distance be within the landing distance available of the runway used for landing. Note that the FAA considers a 15% margin to be the minimum acceptable safety margin.

d. If wet or contaminated runway landing distance data are unavailable, the factors in Table 2 should be applied to the pre-flight planning (factored) dry runway landing distances determined in accordance with the applicable operating rule (e.g., sections 91.1037, 121.195(b) or 135.385(b). Table 2 should only apply when no such data are available. The factors in Table 2 include the 15% safety margin recommended by this guidance, and are considered to include an air distance representative of normal operational practices. Therefore, operators do not need to apply further adjustments to the resulting distances to comply with the recommendations of this guidance.

Runway Condition	Reported Braking Action	Factor to apply to (factored) dry runway landing distance*
Wet Runway, Dry Snow	Good	0.9
Packed or Compacted Snow	Fair/Medium	1.2
Wet snow, slush, standing water, ice	Poor	1.6
Wet ice	Nil	Landing is prohibited

Table 2. Multiplication factors to apply to the factored dry runway landing distances when the data for the specified runway condition are unavailable.

* The factored dry runway landing distances for use with Table 2 must be based on landing within a distance of 60% of the effective length of the runway, even for operations where the preflight planning (factored) dry runway landing distances are based on landing within a distance other than 60% of the effective length of the runway (e.g., certain operations under part 135 and subpart K of par t91). To use unfactored dry runway landing distances, first multiply the unfactored dry runway landing distance by 1.667 to get the factored dry runway landing distance before entering Table 2 above.

> **NOTE: These factors assume maximum manual braking, autospoilers (if so equipped), and reverse thrust will be used. For operations without reverse thrust (or without credit for the use of reverse thrust) multiply the results of the factors in Table 2 by 1.2. These factors cannot be used to assess landing distance requirements with autobrakes.**

e. The landing distance assessment should be accomplished as close to the time of arrival as practicable, taking into account workload considerations during critical phases of flight, using the most up-to-date information available at that time. The most adverse braking condition, based on reliable braking reports or runway contaminant reports (or expected runway surface conditions if no reports are available) for the portion of the runway that will be used for the landing should be used in the actual landing performance assessment. For example, if the runway surface condition is reported as fair to poor, or fair in the middle, but poor at the ends, the runway surface condition should be assumed to be poor for the assessment of the actual landing distance. (This example assumes the entire runway will be used for the landing). If conditions change between the time that the assessment is made and the time of landing, the flightcrew should consider whether it would be safer to continue the landing or reassess the landing distance.

f. The operator's flightcrew and dispatcher training programs should include elements that provide knowledge in all aspects and assumptions used in landing distance performance determinations. This training should emphasize the airplane ground deceleration devices, settings, and piloting methods (e.g., air distance) used in determining landing distances for each make, model, and series of airplane. Elements such as braking action reports, airplane configuration, optimal stopping performance techniques, stopping margin, the effects of excess speed, delays in activating deceleration devices, and other pilot performance techniques should be covered. All dispatchers and flightcrew members should be trained on these elements prior to operations on contaminated runway surfaces. This training should be accomplished in a manner consistent with the operator's methods for conveying similar knowledge to flight operations personnel. It may be conducted via operations/training bulletins or extended learning systems, if applicable to the operator's current methods of training.

g. Procedures for obtaining optimal stopping performance on contaminated runways should be included in flight training programs. All flight crewmembers should be made aware of these procedures for the make/model/series of airplane they operate. This training should be accomplished in a manner consistent with the operator's methods for conveying similar knowledge to flight operations personnel. It may be conducted via operations/training bulletins or extended learning systems, if applicable to the operator's current methods of training. In addition, if not already included, these procedures should be incorporated into each airplane or simulator training curriculum for initial qualification on the make/model/series airplane, or differences training as appropriate. All flight crewmembers should have hands on training and validate proficiency in these procedures during their next flight training event, unless previously demonstrated with their current employer in that make/model/series of airplane.

APPENDIX B—AVIATION RULEMAKING COMMITTEE MEMBERSHIP LIST

Name	Organization
Douglas Carr	National Business Aviation Association, Inc. (NBAA)
Bill deGroh	Air Line Pilots Association (ALPA)
David Lotterer	Regional Airline Association
Paul Railsback	Air Transport Association
Ty Prettyman	National Air Carrier Association
Jacqueline E. Rosser	National Air Transportation Association
Lori Edwards	National Air Transportation Association
Dennis Parrish	ConocoPhillips Alaska
Jens Hennig	General Aviation Manufacturers Administration
Melissa Sabatine	American Association of Airport Executives
Richard Marchi	Airports Council International
Michael Romanowski	Aerospace Industries Association (AIA)
Ranee Carr	AIA
Bob Young	AIA
William Dolejsi	Cessna
Saverio Bellomo	Eclipse
Nelson Barbosa	Embraer
Roesney Carvalho Santos	Embraer
Paul Giesman	Boeing
Robert Lignee	Airbus
Douglas W. Andrews	Dassault Falcon Jet Corp.
John Hawley	Hawker Beechcraft Corp.
Frank Stastny	Bombardier Aerospace
Carl Allen	Alaska Airlines
David Anvid	Northwest Airlines
Joe Bracken	ALPA
David R Harrington	Airbus
Paul A. Schmid	Boeing
Paul Hannah	ExpressJet
Chet Collett	Alaska Airlines
Brain Chapman	United Airlines
Mitch Matheny	Pinnacle Airlines
Edward Ray Uribe	Southwest Airlines
Lisa Brokenbrough	Northwest Airlines
Ravin Agarwal	Continental Airlines
Dave Sorrell	Federal Express
Kent Wingate	ABX Air
Martin McKinney	United Parcel Service
Michael Byham	USAirways

Name	Organization
Jeff Holt	American Eagle
Roy Maxwell	Delta Airlines
John Gadzinski	Southwest Airlines
Mike Michaelis	American Airlines
Glen Finch	ALPA
Augusto Rocha	Embraer
Brian Gleason	Southwest Airlines
Dennis Keith	Jet Solutions
Pat Connor	Gulfstream Aerospace
Yves Grenier	Bombardier Aerospace
Richard Clairoux	n/a
Michael K. Stuart	Pogo Jet, Inc.
George J. Hamilton	Alpha Flying, Inc.
Joseph D. Cimperman	Flight Options
Ari Sarmento	FlightWorks, Inc.
Duane Giorgetti	Bombardier Flexjet
Paul Moore	Atlantic Aviation Flight Services
Dave Hewitt	NetJets
Timothy P.Sullivan	Chantilly Air
Michael Nichols	NBAA
Casey Kinosz	General Aviation Manufacturers Association
Richard Marchi	Airports Council International
Murray J. Auger	Northwest Airlines
Robert Perkins	ALPA
Tim Neubert	Neubert Aero Corp.
Bruce Applebach	Grand Rapids Airport
Raymond J. Hoffelt	Chicago Airport Authority
John Cowan	United Airlines
Kevin Klein	Cherry Capital Airport
Al Perez	Chicago Airport System
Paul Sichko	MSP Airports Commission
Skip Miller	Louisville Airport
Robert H. Junge	Port Authority of New York and New Jersey
Maria Ruiz	European Aviation Safety Agency
Ron Doggett	New Zealand Civil Aviation Authority
Paul Carson	Transport Canada Civil Aviation
Jim Martin	Transport Canada National Aircraft Certification
Cesar Rodrigues Hess	Brazilian Certification Authority
Francisco Padilha	Brazilian Certification Authority

Name	Organization
José Ramón Oyuela	Central American Agency for Air Navigation
Jorge Vargas	Central American Agency for Air Navigation
Kevin Renze	National Transportation Safety Board
Jerry Ostronic	Federal Aviation Administration (FAA)
Don Stimson	FAA
Gordy Rother	FAA
Pete Neff	FAA
Gary Prock	FAA
Alberto Rodriguez	FAA
Mark Gabel	FAA
Joe Foresto	FAA
Carl N. Johnson	FAA
Adrian Wright	FAA
Roy Spencer	FAA
Rick Marinelli	FAA
Susan Gardner	FAA

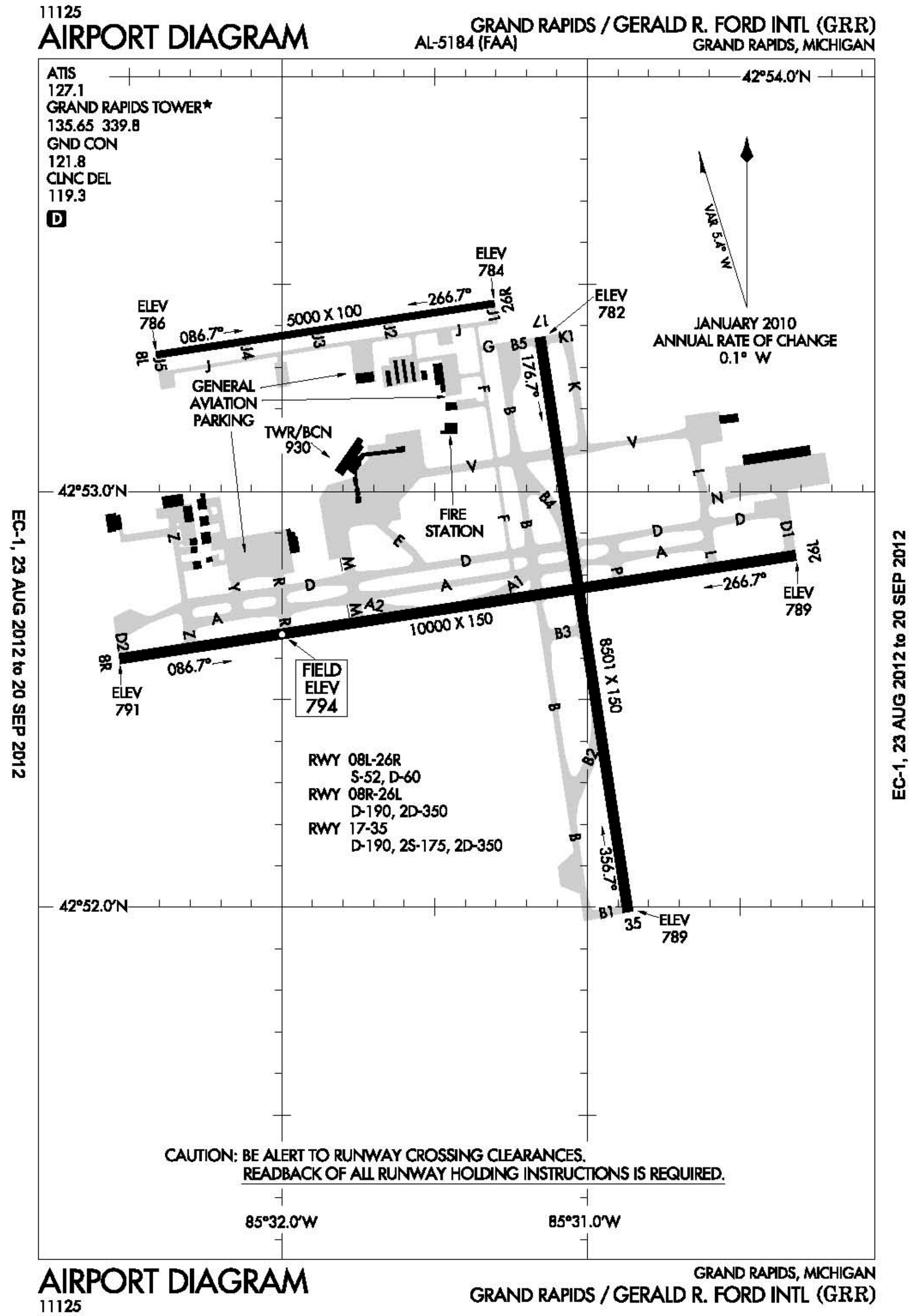


Figure C-1. Gerald R. Ford International Airport

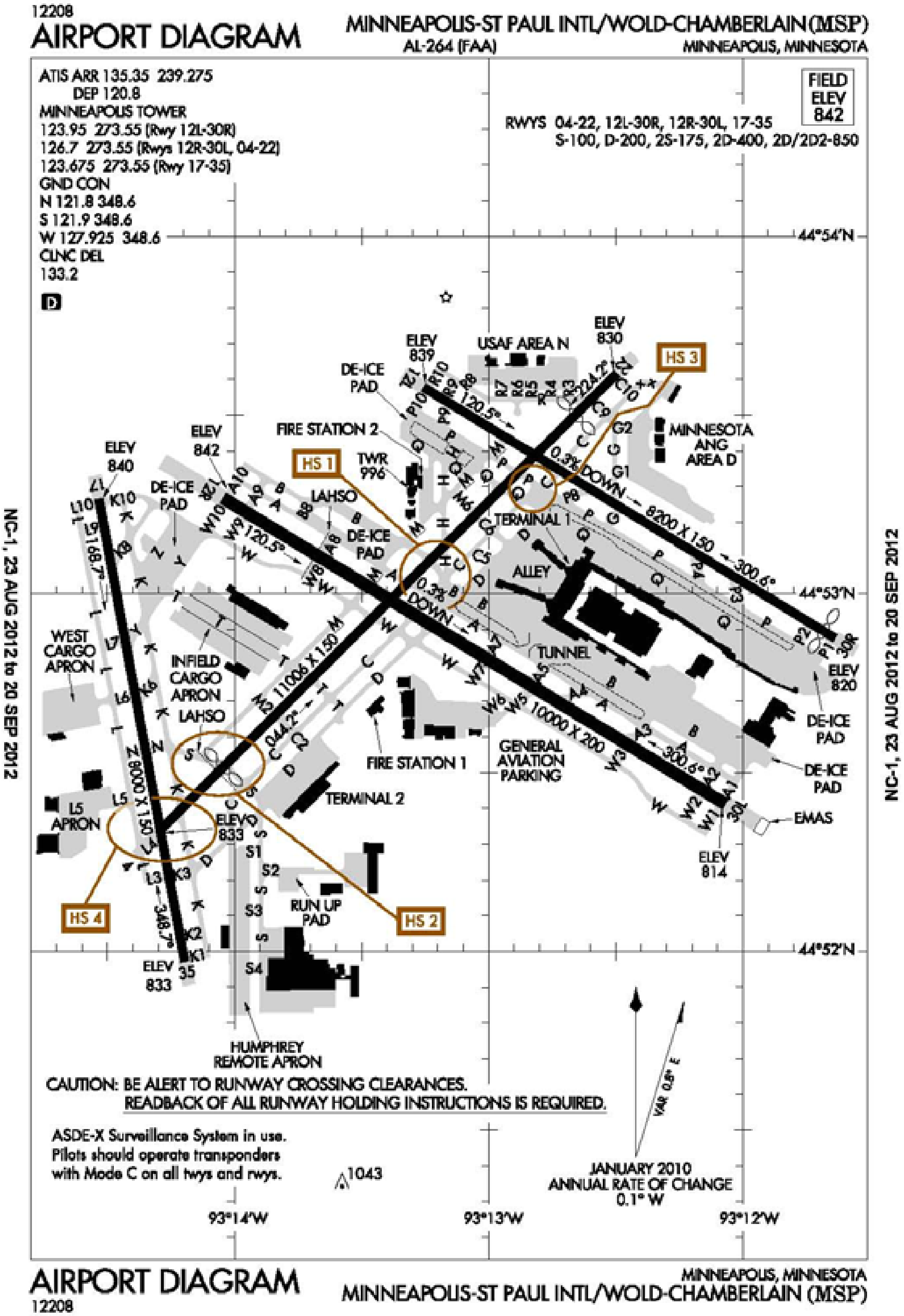


Figure C-2. Minneapolis-St. Paul International Airport/Wold-Chamberlain

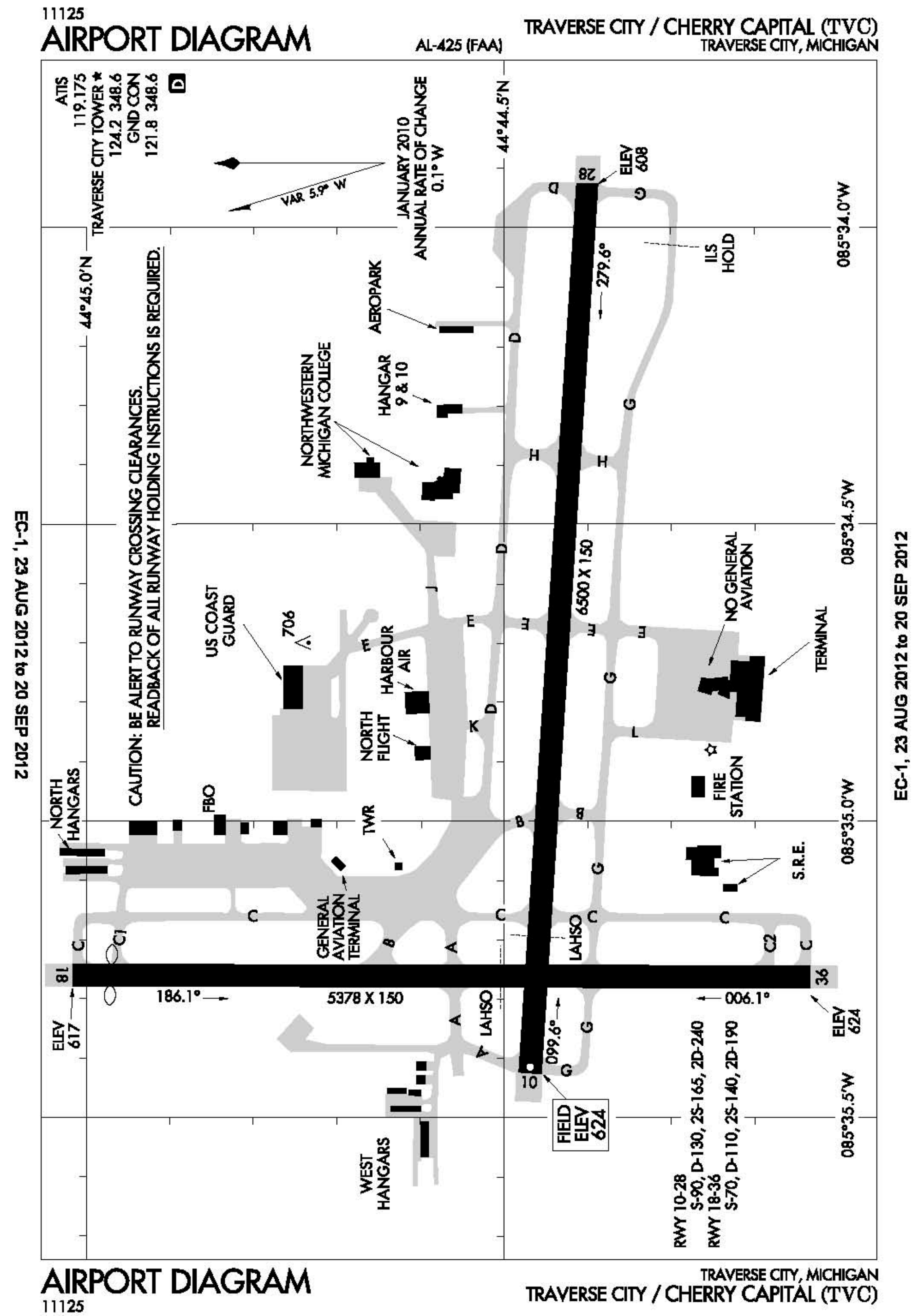


Figure C-3. Cherry Capital Airport

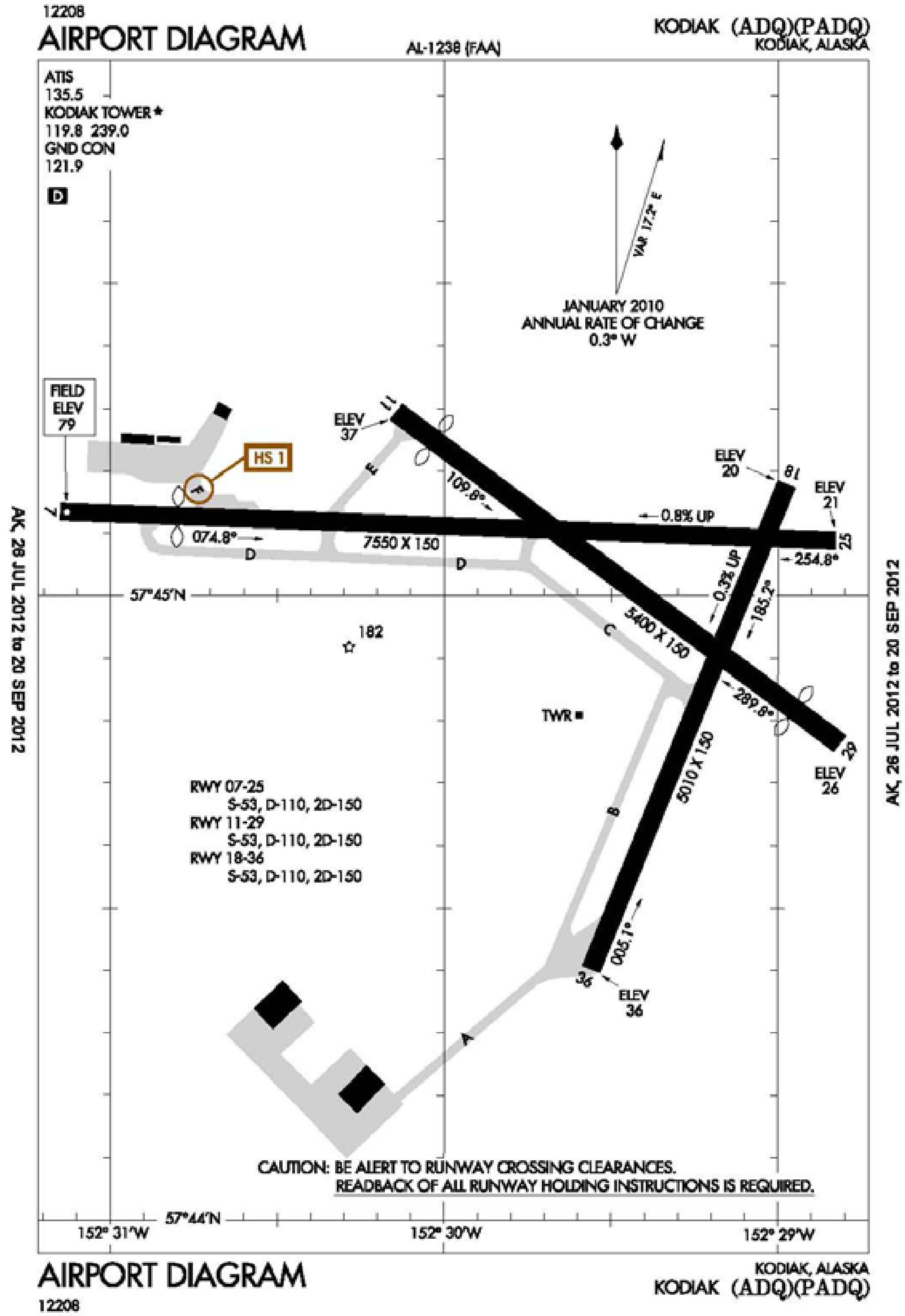


Figure C-4. Kodiak Airport

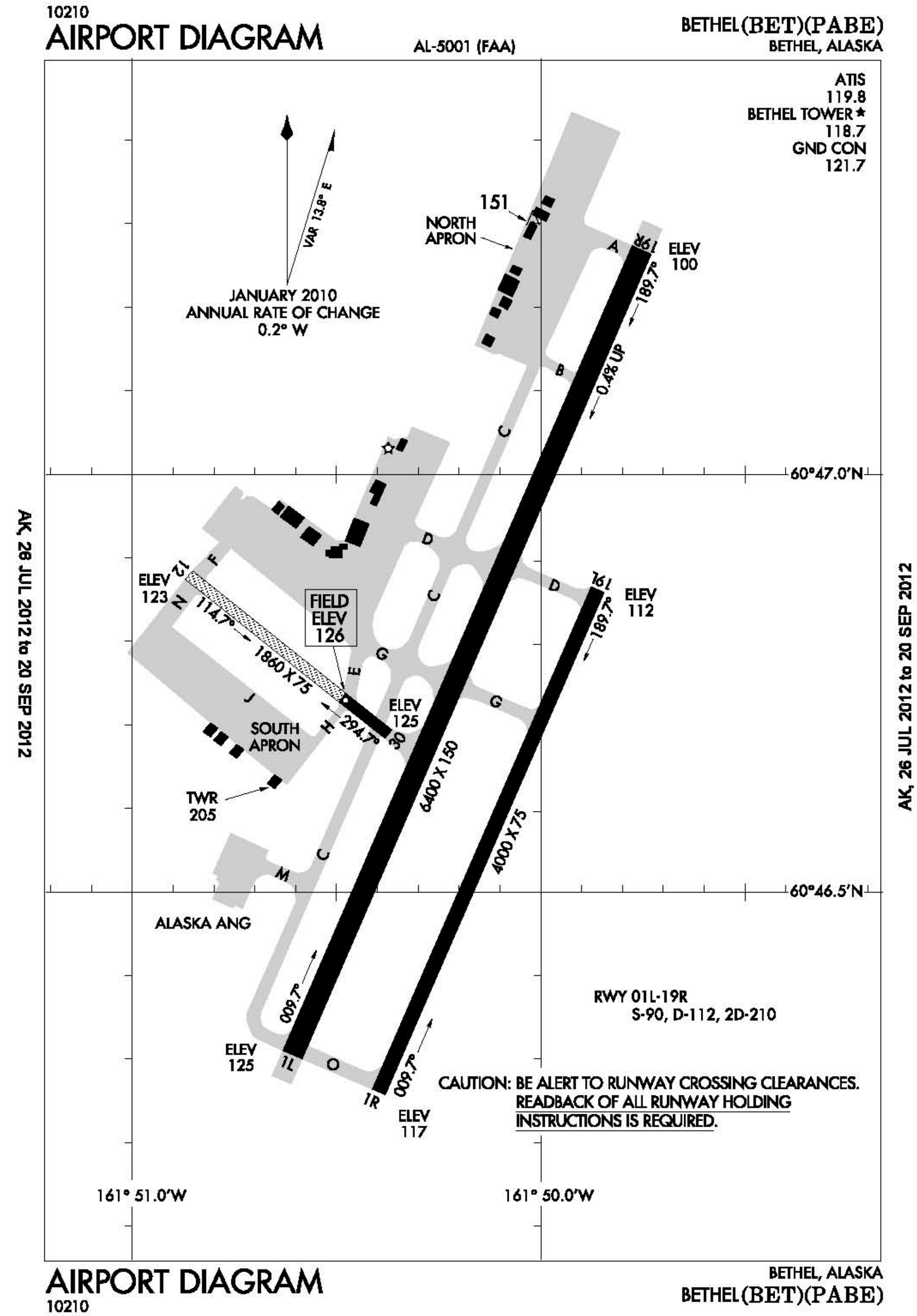


Figure C-5. Bethel Airport

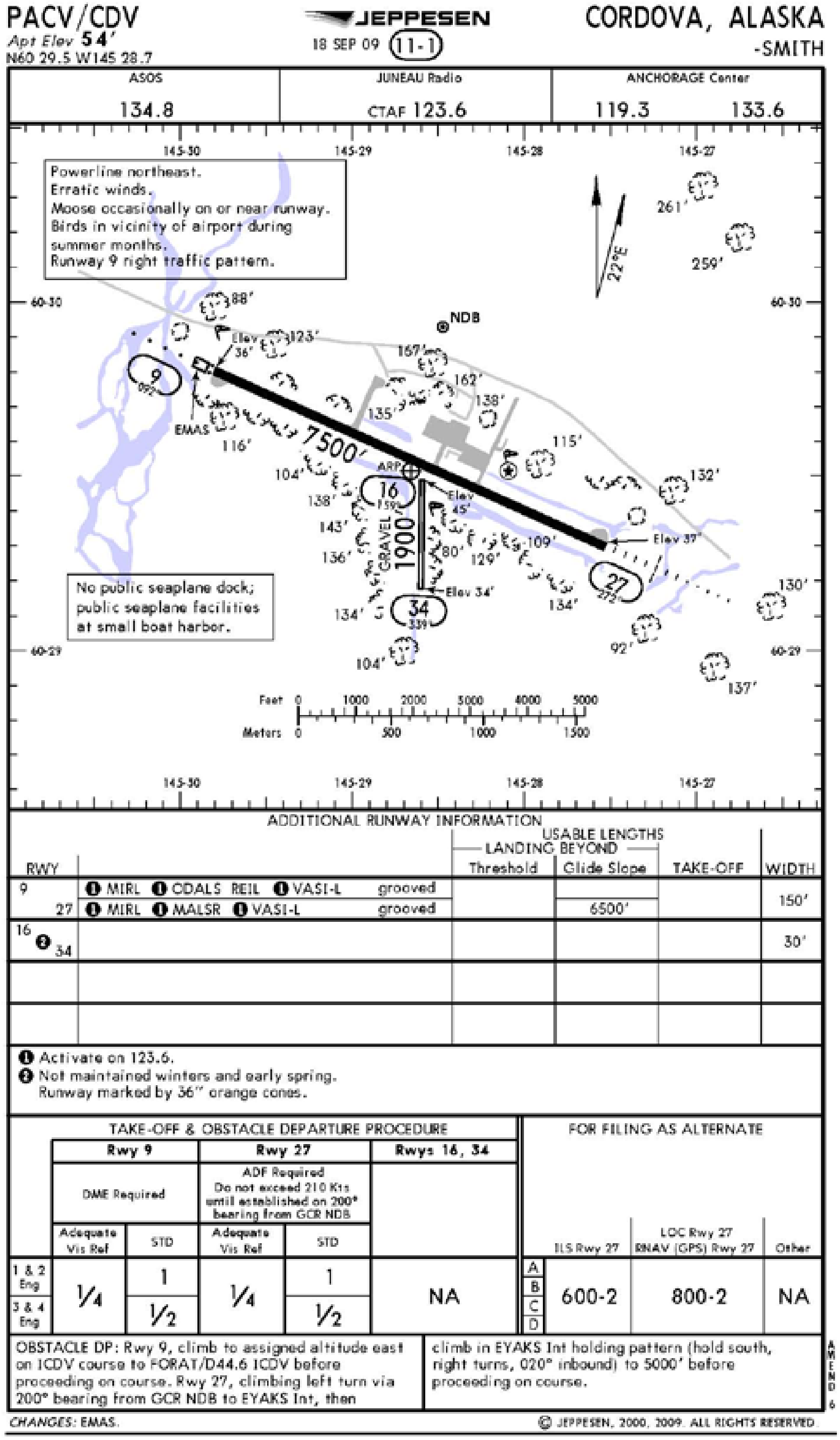


Figure C-6. Merle K. (Mudhole) Smith Airport

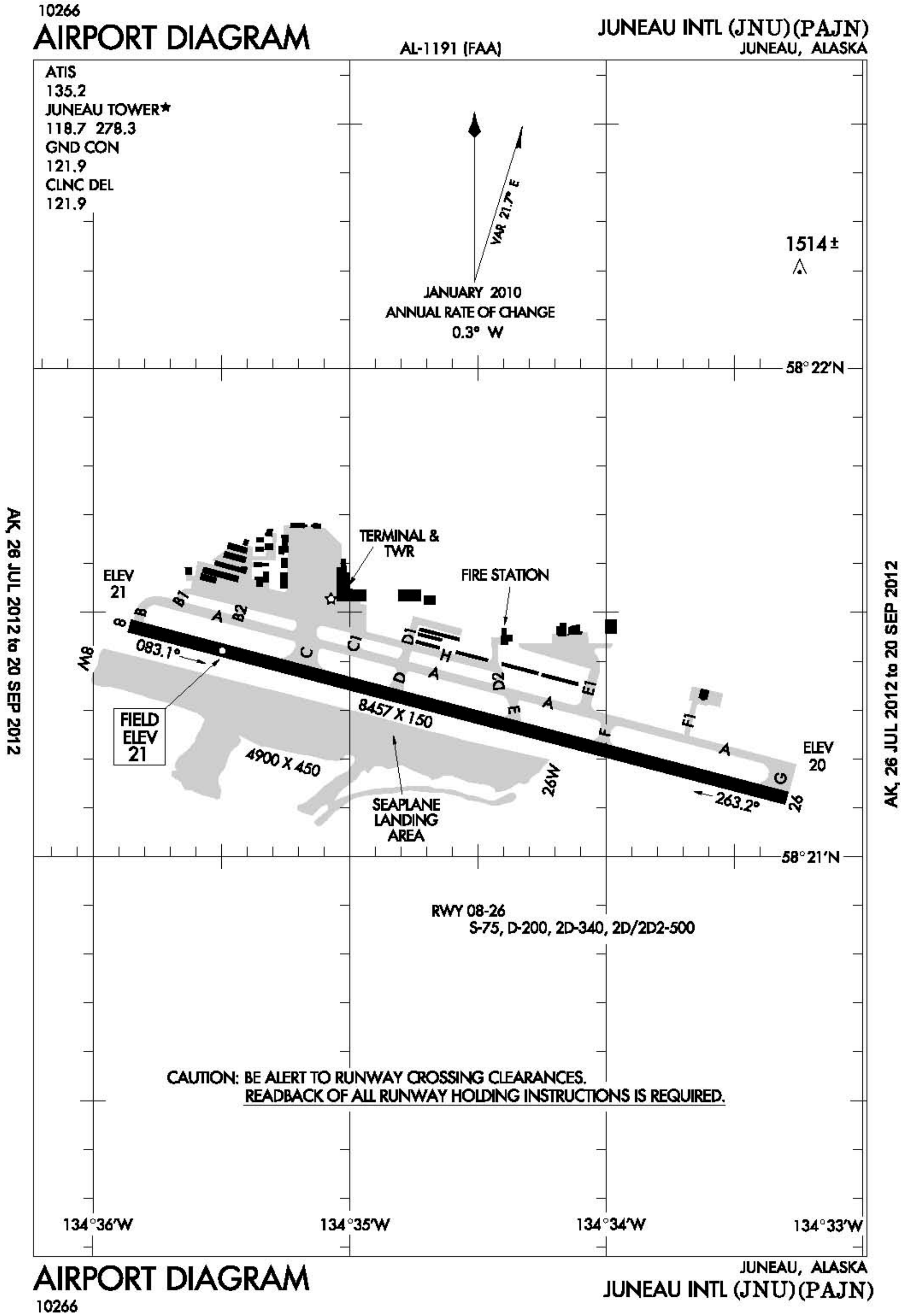


Figure C-7. Juneau International Airport

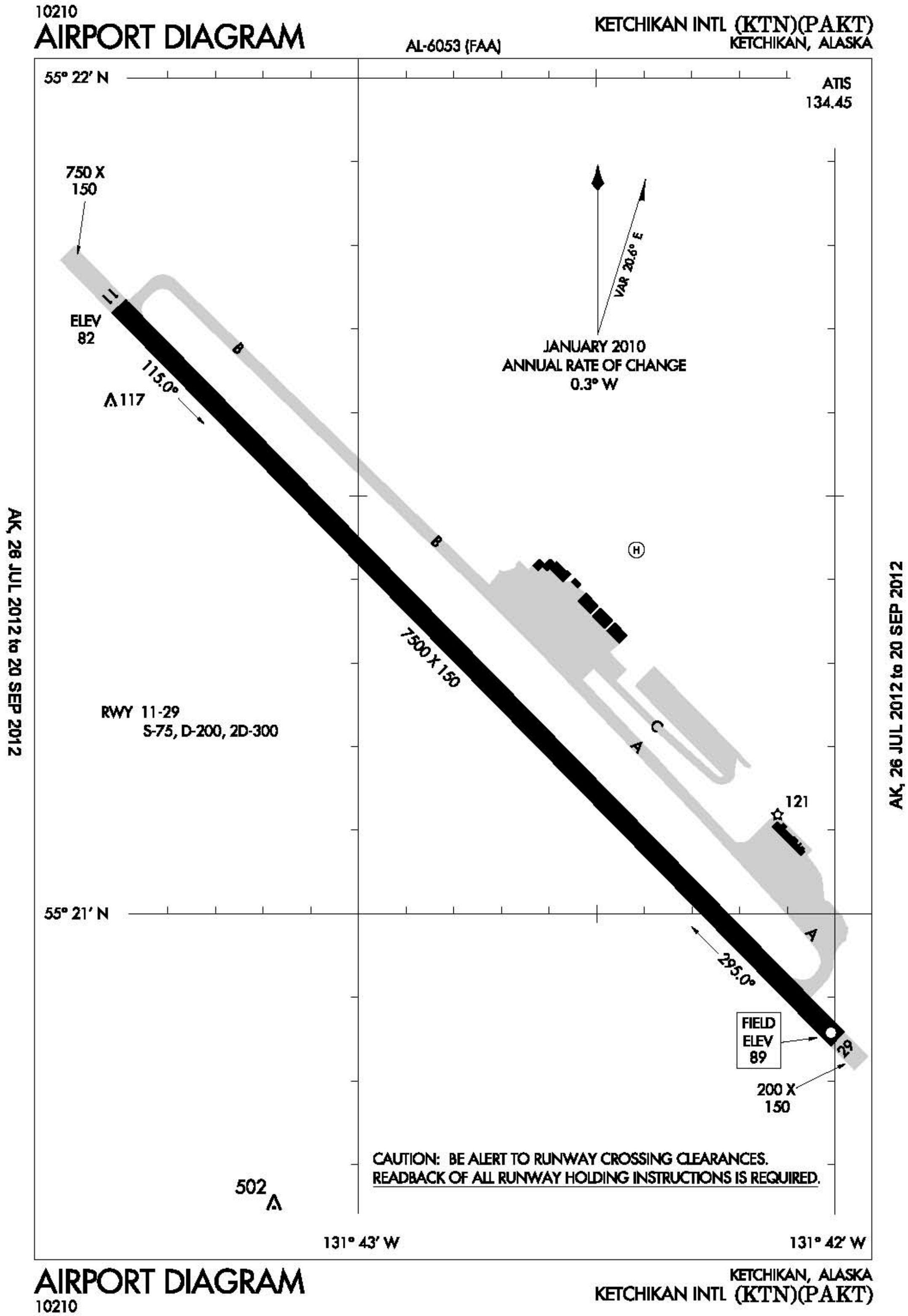


Figure C-8. Ketchikan International Airport

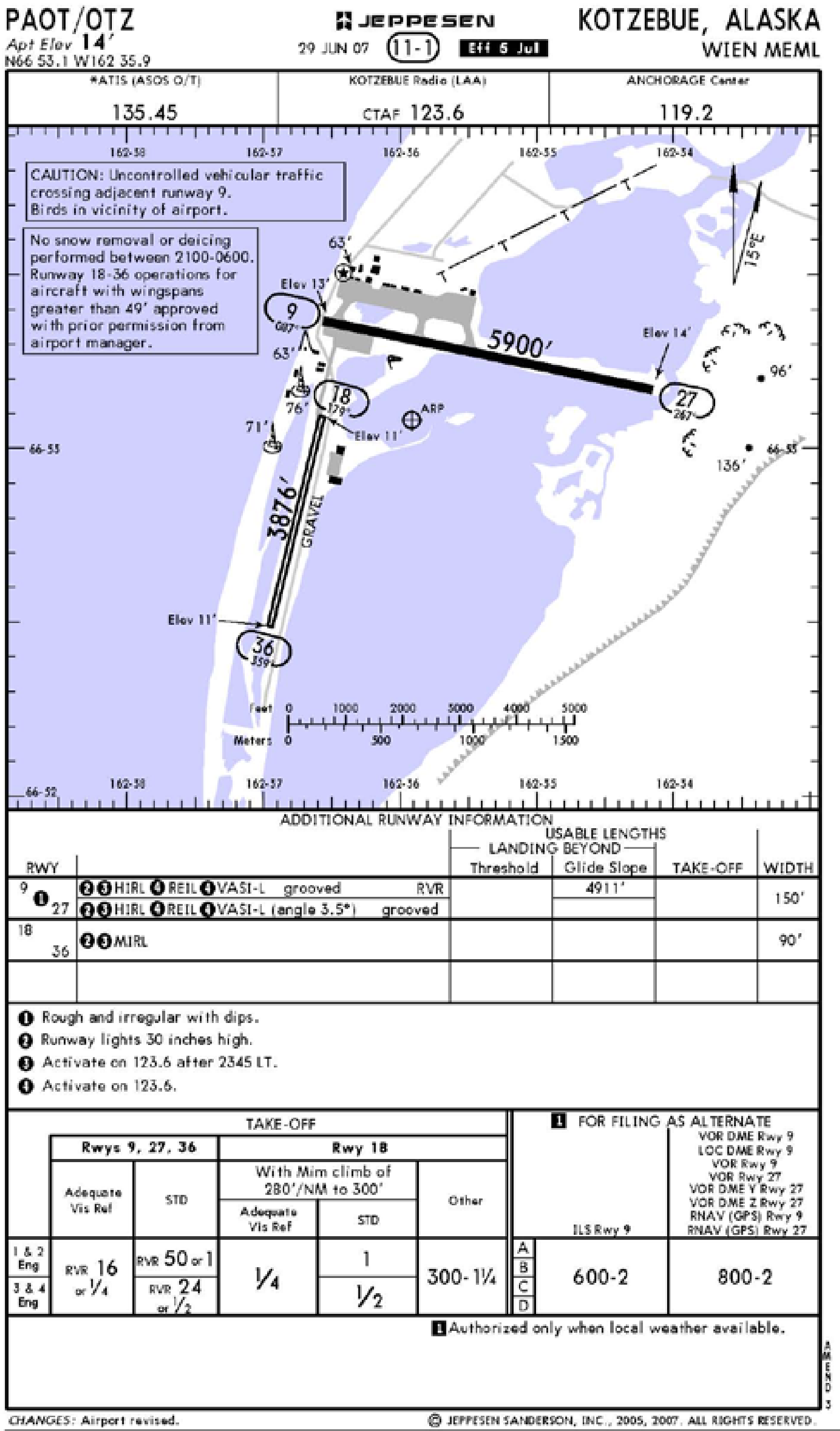


Figure C-9. Ralph Wien Memorial Airport

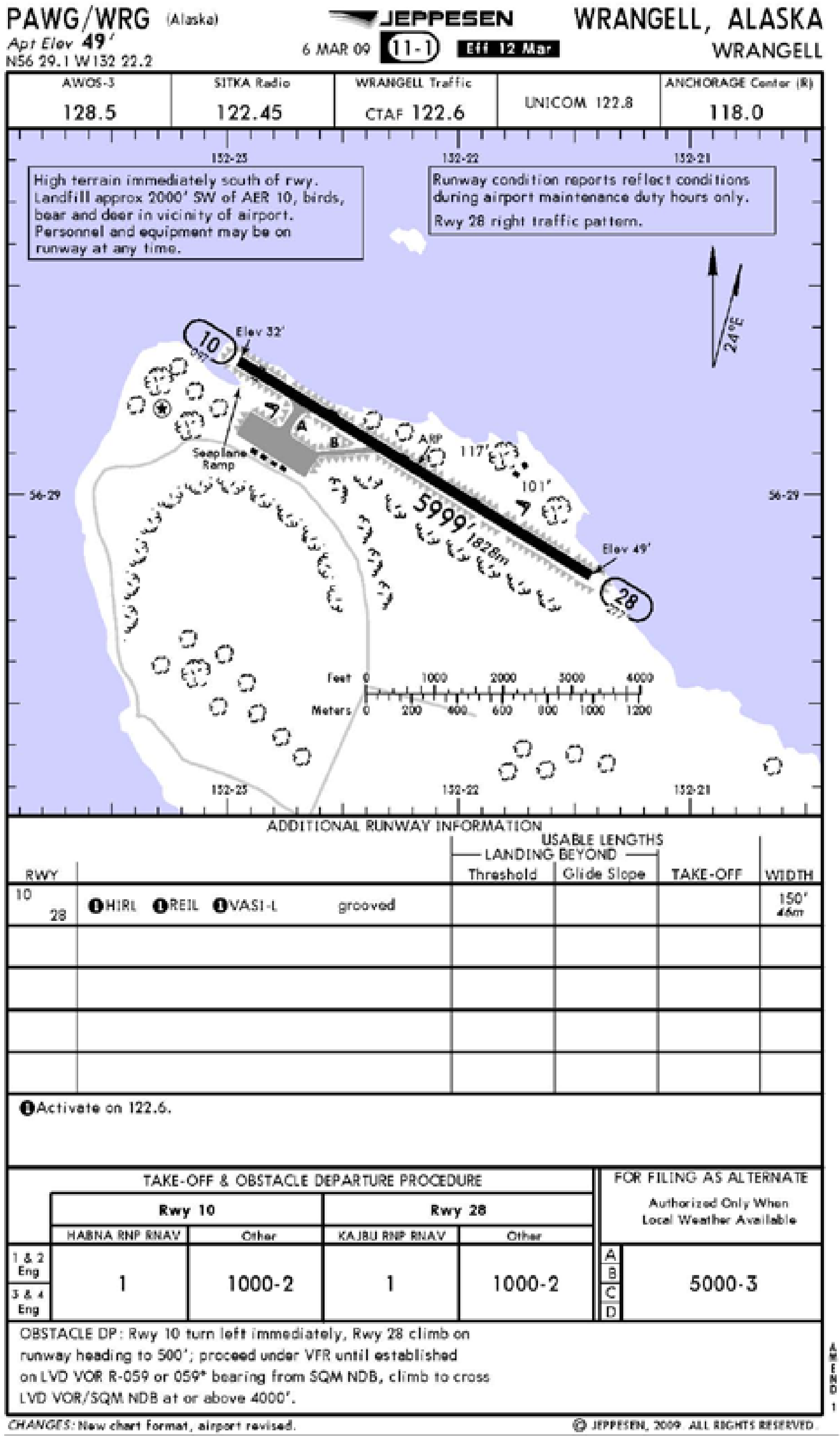


Figure C-10. Wrangell Airport

Estimated Pilot Braking Action Report Form

The FAA in cooperation with an industry workgroup has developed a Runway Surface Condition Reporting Matrix. One of the goals of this matrix is to have a direct correlation between the surface conditions that are reported to an anticipated braking action and to contaminated runway performance data supplied in the Aircraft Flight Manual. Alaska Airlines, in cooperation with the Alaska DOT and the Boroughs of Juneau and Ketchikan; are participating in the validation process of the Runway Surface Condition Matrix at the following airports – KTN, WRG, JNU, CDV, ADQ, BET, and OTZ. A necessary part of this validation is to obtain the pilots opinion of the braking action that you experienced on the landing. For this reason we are asking that you complete this form and return it to the Departure Coordinator, CSA, or CSM immediately after landing so that it can be accurately recorded in the data base for analysis and comparison to the runway surface conditions that have been recorded for your arrival. ***This information will not be used for any additional purpose.***

Please keep in mind that we are attempting to correlate runway contaminate conditions to the braking capability of the aircraft. Although all the deceleration devices available to the pilot should be used on landing as necessary to assure a safe landing we are primarily interested only in the wheel braking capability and not the overall deceleration of the aircraft. We ask that you do your best to report your estimate of the wheel braking action as per the following terms:

Pilot Braking Action Survey Form

Landing Airport: _____ Landing Runway: _____

Date: ________ Flight Number__________ Zulu Time: _____

Aircraft Type: ____ Approximate Landing Weight _ _ _ . _

Base on the runway conditions reported, the Braking Action was:
☐ Better than expected
☐ As Expected
☐ Worse than expected

Mark Estimated Braking Action and add comments below if necessary:

Deceleration And Directional Control Observation	PIREP	Estimated Braking Actionl
-	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	☐

Comments: ______________________________

Return this form to the Station Departure Coordinator, CSA, or CSM

□ Information entered into FAA Website Database
□ COMAIL Completed Form (after data entry) to SEAOT – Chet Collett

Figure D-1. Alaska Airlines Pilot Report

PINNACLE & FAA RUNWAY ASSESSMENT TESTING
Estimated Pilot Braking Action Report Form

The FAA in cooperation with an industry workgroup has developed a Runway Surface Condition Reporting Matrix. One of the goals of this matrix is to have a direct correlation between the surface conditions that are reported to an anticipated braking action and to contaminated runway performance data supplied in the CFM. Pinnacle Airlines, in cooperation with the FAA; are participating in the validation process of the Runway Surface Condition Matrix at the following airports – MSP, TVC, and GRR for the 2009-10 Winter season. A necessary part of this validation is to obtain the pilots opinion of the braking action that you experienced on the landing. For this reason we are asking that you complete this form and return it to the gate agent after landing at one of these airports so that it can be accurately recorded in the FAA database for analysis and comparison to the runway surface conditions that have been recorded for your arrival. **This information will not be used for any other purpose.**

Please keep in mind that we are attempting to correlate runway contaminate conditions to the braking capability of the aircraft. Although all the deceleration devices available to the pilot should be used on landing as necessary to assure a safe landing **we are primarily interested only in the wheel braking capability and not the overall deceleration of the aircraft. We ask that you do your best to report your estimate of the wheel braking action as per the following terms:**

Landing Airport (circle): MSP TVC GRR Landed on Runway: ________

Date: ___________ FLT#_________ Landed at Zulu Time: ___________

Aircraft Type: CRJ200 Approximate Landing Weight ___ ___ . ___

Based on the runway conditions reported, the Braking Action was: ☐ **Better than expected** ☐ **As Expected** ☐ **Worse than expected**

Place a check mark adjacent the closest actual Braking Action that You experienced

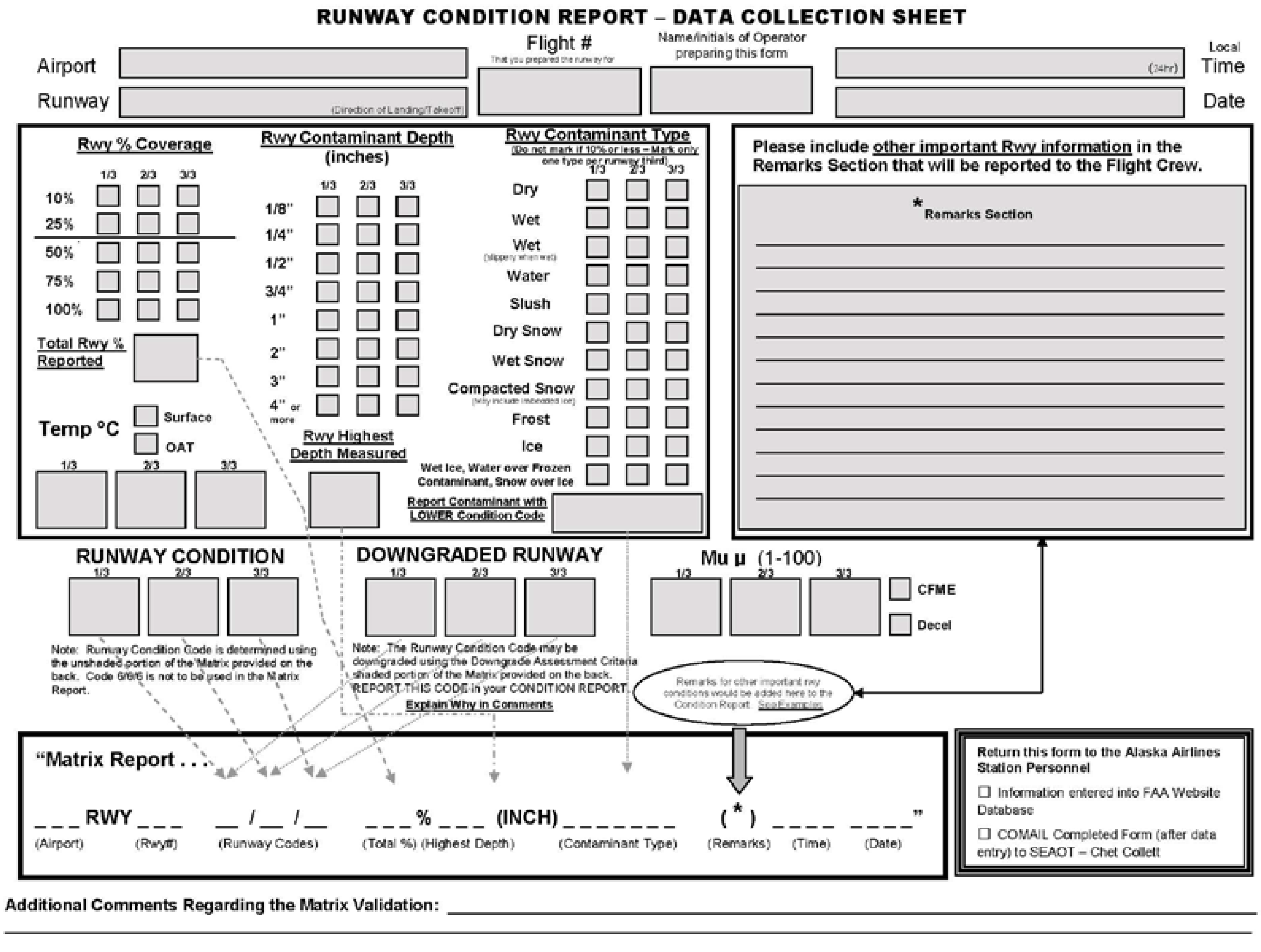
Deceleration And Directional Control Observation	ATC / PIREP	Actual
Braking deceleration is normal for the wheel braking effort applied. Directional control is normal.	**Good**	☐
Brake deceleration and controllability is between Good and Medium.	**Good to Medium**	☐
Braking deceleration is noticeably 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**	☐

Crews: Return this form to the Gate Agent for forwarding to Pinnacle Flt Ops

TVC & GRR - FEDEX Completed Forms to: Pinnacle Airlines – Capt. Mitch Matheny – Mngr. Flt Standards – Suite 118 - 1689 Nonconnah Blvd - Memphis, TN 38132

MSP – Forward to MSP Flt Ops to COMAT to Capt. Mitch Matheny – Mngr. Flt Standards – MEM - CEC

Figure D-2. Pinnacle Airlines Pilot Report



RUNWAY CONDITION REPORT – DATA COLLECTION SHEET

Airport | Flight # (That you prepared the runway for) | Name/initials of Operator preparing this form | Local Time (24hr)

Runway (Direction of Landing/Takeoff) | Date

Rwy % Coverage (1/3, 2/3, 3/3): 10%, 25%, 50%, 75%, 100%

Total Rwy % Reported

Temp °C: Surface, OAT (1/3, 2/3, 3/3)

Rwy Contaminant Depth (inches) (1/3, 2/3, 3/3): 1/8", 1/4", 1/2", 3/4", 1", 2", 3", 4" or more

Rwy Highest Depth Measured

Rwy Contaminant Type (Do not mark if 10% or less – Mark only one type per runway third) (1/3, 2/3, 3/3): Dry, Wet, Wet (slippery when wet), Water, Slush, 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

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

*Remarks Section

RUNWAY CONDITION (1/3, 2/3, 3/3)

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

DOWNGRADED RUNWAY (1/3, 2/3, 3/3)

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. See Examples

"Matrix Report . . .

_ _ _ RWY _ _ _ __ / __ / __ _ _ _ % _ _ _ (INCH) _ _ _ _ _ _ _ (*) _ _ _ _ _ _ _ _"

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

Return this form to the Alaska Airlines Station Personnel

☐ Information entered into FAA Website Database

☐ COMAIL Completed Form (after data entry) to SEAOT – Chet Collett

Additional Comments Regarding the Matrix Validation: ____________________

Figure E-1. Front Page of Airport Report

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:*** • Wet (Smooth, Grooved or PFC) • Frost ***Any Temperature with 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 Colder than -13°C at any depth:*** • Compacted Snow	39-36μ	Brake deceleration and controllability is between Good and Medium.	Good to Medium
3	***Any Temperature:*** • Wet (Slippery) ***At or Colder than -3°C and Greater than 1/8" of:*** • Dry or Wet Snow ***Warmer than -13°C and at or Colder than -3°C at any Depth:*** • Compacted Snow	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 ***Warmer than -3°C at greater than 1/8":*** • Dry or Wet Snow ***Warmer than -3°C at any Depth:*** • Compacted Snow	29-26μ	Brake deceleration and controllability is between Medium and Poor. Potential for hydroplaning exists.	Medium to Poor
1	***At or colder than -3°C at any Depth of:*** • Ice	25-21μ	Braking deceleration is significantly reduced for the wheel braking effort applied. Directional control may be significantly reduced.	Poor
0	***Any Temperature and any Depth of:*** • Wet Ice • Water on top of Compacted Snow • Dry or Wet Snow over Ice ***Temperature Warmer than -3°C at any Depth:*** • Ice	20μ or lower	Braking deceleration is minimal to non-existent for the wheel braking effort applied. Directional control may be uncertain.	Nil

Notes:

- ***Contaminated runway.*** *A runway is contaminated when more than 25 percent of the runway surface area (whether in isolated areas or not) within the reported length and the width being used is covered by water, slush, frost or snow greater than 0.125 inches (3 mm), or any compacted snow or ice.*
- ***Dry runway.*** *A runway is dry when it is not contaminated and at least 75% is clear of visible moisture within the reported length and width being used.*
- ***Wet runway.*** *A runway is wet when it is neither dry nor contaminated.*
- *Temperatures referenced are average runway surface temperatures when available, OAT when not.*
- *While applying sand or liquid anti ice to a surface may improve its friction capability, no credit is taken until pilot braking action reports improve or the contaminant type changes (e.g., ice to water).*
- *Compacted Snow may include a mixture of snow and imbedded ice.*
- *Compacted Snow over Ice is reported as Compacted Snow.*
- *Taxi, takeoff, and landing operations in Nil conditions are prohibited.*

	Dry	Wet		Contaminated												
Type	N/A	Any	Slippery When Wet	Frost	Standing Water or Slush		Wet Snow or Dry Snow				Compacted Snow			Ice		Wet Ice, Water Over Compacted Snow, Dry or Wet Snow Over Ice
Depth	N/A	N/A	N/A	N/A	1/8" or less	Greater than 1/8"	1/8" or less	Greater than 1/8"		Any	Any	Any	Any	Any	Any	Any
Temp	Any	Any	Any	Any	Any	Any	Any	-3°C or Colder	Warmer than -3°C	-13°C or Colder	Warmer than -13°C and at or Colder than -3°C	Warmer than -3°C	-3°C or Colder	Warmer than -3°C	Any
Code	6	5	3	5	5	2	5	3	2	4	3	2	1	0	0

Figure E-2. Back Page of Airport Report

APPENDIX F—DATA COLLECTION WEBSITE

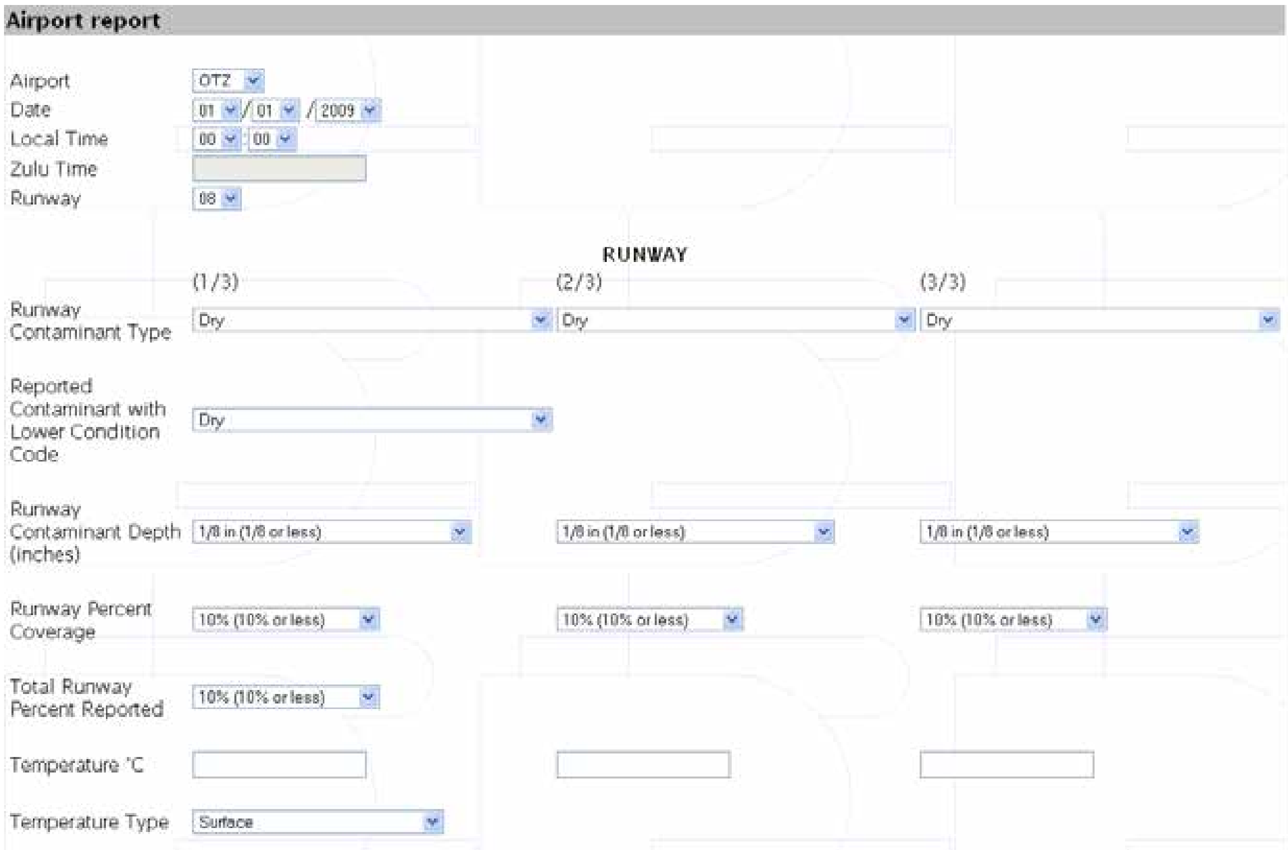
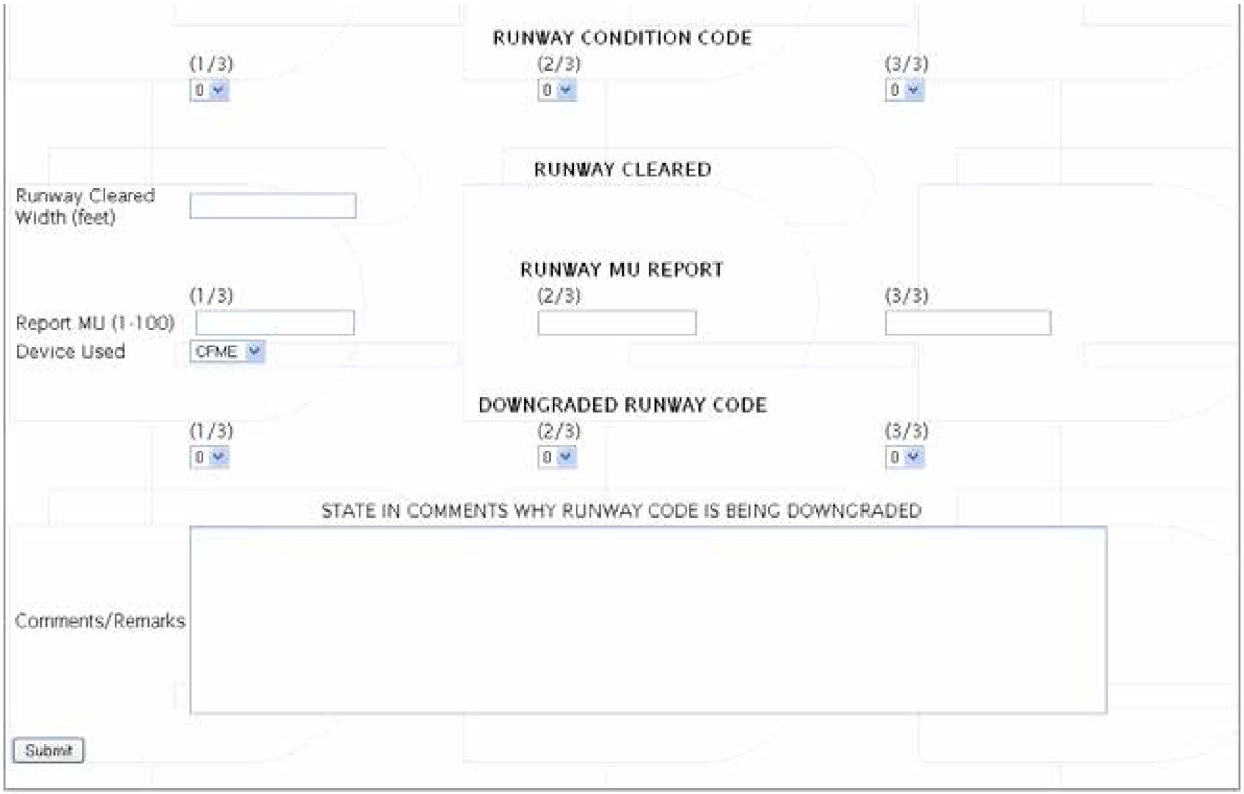


Figure F-1. Website Page 1


RUNWAY CONDITION CODE

(1/3) 0 (2/3) 0 (3/3) 0

RUNWAY CLEARED

Runway Cleared Width (feet)

RUNWAY MU REPORT

(1/3) (2/3) (3/3)

Report MU (1-100)

Device Used CFME

DOWNGRADED RUNWAY CODE

(1/3) 0 (2/3) 0 (3/3) 0

STATE IN COMMENTS WHY RUNWAY CODE IS BEING DOWNGRADED

Comments/Remarks

Submit

Figure F-2. Website Page 2

Airport	Total	No Date	No Time or Confusing	No Percent Coverage or Unknown	Incomplete Percent Coverage	No Contaminant Depth when needed	No Contaminant Type or Confusing	Incomplete Contaminant Type	No Temperature	Overall Conflicting Information	Very Little Information	No Runway Condition Code	Nov	Dec	Jan	Feb	Mar	Apr	UKN	Additional Reasons
XXX	8		4	4	3	2	3	4	1		1	4	8							Mixture of issues
XXX	2									2				2						Checked off dry, but reported compact snow
XXX	1	1															1			Unknown Date
XXX	70	2	10	8	31	7	31	18	5	29			51	10	1	3	3		2	Too many issues and problems to explain
XXX	17						17			17			1	12	1	4				Multiple Contaminant Types & Percentages
Unknown	1	1	1																1	No time or date

Airport	Total	XXX	XXX	Dry	Good	Good - Med	Med	Med - Poor	Poor	Nil	Unk	Reasons
Missing Airport Info	3	2	1		2		1					No Airport Information
Unknown Airport Info	6	6	0	2	3	1						Unknown Airport Information
XXX	3	3	0	1	2							Data was not clear - No date
XXX	1	1			1							Date and Time was not clear
XXX	3	3		1	2							No Dates
XXX	2	2			1						1	No Dates - Missing other information
XXX	1	1			1							Date was not clear
XXX	5		5		4	1						No Date - Prior to start of 12/1

2009-2010 Winter Validation

Airport Feedback

Thank you for participating in the validation of the Runway Condition Matrix over the past winter. The FAA greatly appreciates the effort you made during this winter's validation! We are currently analyzing all the data that was collected at the 10 participating airports. We received over 2,000 airport report data sheets, which was far beyond our original expectations. The FAA will convene an industry group in the next few months to determine what changes might need to be made to the Runway Condition Matrix or the method for collecting contaminant data.

If you recall our original meeting, one of our goals is to determine the Runway Condition Matrix usability for airport operators. We're asking that you complete a brief feedback sheet about using the Runway Condition Matrix this past winter. This is your chance to tell us exactly what you think, your feelings, and opinions. Please be honest, your experience and feedback is important for the analysis group in determining what changes are necessary to make runway condition reporting more timely and accurate which will provide a safer-operating system.

What is your Position/Title: ______________________________

What is your Airport: ______________________________

Please indicate the level to which you agree with the following:

	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree
The training, presentation, and information left by the FAA at our airport were adequate.	☐	☐	☐	☐	☐
I was confused by the Runway Condition Matrix and reporting presented by the FAA.	☐	☐	☐	☐	☐
I understood why the FAA is trying this new Runway Condition Matrix and reporting.	☐	☐	☐	☐	☐
More time was needed with the FAA to discuss the Runway Condition Matrix and reporting.	☐	☐	☐	☐	☐
Overall, the Airport Report Form was understandable and, with some use, easy to use.	☐	☐	☐	☐	☐
Determining the Runway Contaminant Type was easy.	☐	☐	☐	☐	☐
Determining the Runway Contaminant Depth was easy.	☐	☐	☐	☐	☐
Determining the Runway Percent (%) Coverage was easy.	☐	☐	☐	☐	☐
Determining the Temperature was easy.	☐	☐	☐	☐	☐
The Temperature Gun helped.	☐	☐	☐	☐	☐
Determining the Runway Condition Codes was easy. Example: 5/4/4	☐	☐	☐	☐	☐
I understood how to downgrade the Runway Condition Codes.	☐	☐	☐	☐	☐
A checklist or flow chart would have helped in using the Runway Condition Matrix and determining the Runway Condition Codes.	☐	☐	☐	☐	☐
I understood how the Remarks Section worked.	☐	☐	☐	☐	☐
I understood how to use the Runway Condition Matrix with multiple contaminants.	☐	☐	☐	☐	☐
As I gained experience using the Airport Report, collecting the information became easier.	☐	☐	☐	☐	☐

As I gained experience, using the Runway Condition Matrix to determine the Runway Condition Codes became easier.	❑	❑	❑	❑	❑
The Runway Condition Codes represented the actual runway slipperiness.	❑	❑	❑	❑	❑
The matrix method of reporting runway conditions is more accurate than our current method.	❑	❑	❑	❑	❑
I like using Mu, CFMEs, and Decels better.	❑	❑	❑	❑	❑
Determining the Runway Condition Codes is too complicated to make it useable.	❑	❑	❑	❑	❑
I had a hard time determining the Runway Condition Code in the time between working on the runway and aircraft landing.	❑	❑	❑	❑	❑
I am concerned that pilots may not accept the Runway Condition Codes.	❑	❑	❑	❑	❑
The Runway Condition Matrix and reporting required more staff time than our current method.	❑	❑	❑	❑	❑
If you entered the Airport Report onto the website: The website was hard to use.	❑	❑	❑	❑	❑
If you entered the Airport Report onto the website: The website took too long to use.	❑	❑	❑	❑	❑

The most difficult thing about using the Runway Condition Matrix method was ____________________

____

The best thing about using the Runway Condition Matrix new method was ____________________

____

Were there any times of day or particular circumstances that made the Runway Condition Matrix method more difficult to use than other times? If so, please describe. ____________________

____

Please add any additional comments you have about the Runway Condition Matrix. ____________________

____

Please add any additional comments you have about the Airport Report. ____________________

____

Please add any additional comments, feelings, or opinions you have about the winter validation and/or Runway Condition Matrix and reporting. ____________________

____

Thank you again for your participation and feedback!

There are 3 options for returning your feedback form:

Please **email** your feedback to: susan.gardner@faa.gov OR Please **fax** your feedback to: 202-267-5383 OR	Please **mail** your feedback 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

APPENDIX J—AIRPORT SURVEY FEEDBACK—YEAR 1

2009-2010 Winter Validation
Airport Feedback

Number of Responses

	Alaska							Great Lakes		
Total	ADQ	BET	CDV	JNU	KTN	OTZ	WRG	GRR	MSP	TVC
22	1	1	1	7	1	1	1	2	2	5

Position of Respondents

Airport Manager/Deputy	Ops Mgr/Coord/Super.	Mechanic/Operator
7	10	5

Please indicate the level to which you agree with the following:

	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree	Blank
1. The training, presentation, and information left by the FAA at our airport were adequate.	3	**16**	0	2	1	0
2. I was confused by the Runway Condition Matrix and reporting presented by the FAA.	0	**7**	2	**10**	3	0
3. I understood why the FAA is trying this new Runway Condition Matrix and reporting.	6	**13**	2	1	0	0
4. More time was needed with the FAA to discuss the 5. Runway Condition Matrix and reporting.	1	**8**	3	**8**	1	1
5. Overall, the Airport Report Form was understandable and, with some use, easy to use.	1	**14**	3	4	0	0
6. Determining the Runway Contaminant Type was easy.	2	**14**	1	5	0	0
7. Determining the Runway Contaminant Depth was easy.	2	**16**	4	0	0	0
8. Determining the Runway Percent (%) Coverage was easy.	0	7	1	**12**	1	1
9. Determining the Temperature was easy.	1	**12**	2	6	0	1
10. The Temperature Gun helped.	3	**8**	**7**	2	2	0
11. Determining the Runway Condition Codes was easy. Example: 5/4/4	2	**13**	3	4	0	0
12. I understood how to downgrade the Runway Condition Codes.	2	**19**	0	1	0	0
13. A checklist or flow chart would have helped in using the Runway Condition Matrix and determining the Runway Condition Codes.	3	5	**9**	5	0	0
14. I understood how the Remarks Section worked.	2	**14**	5	1	0	0
15. I understood how to use the Runway Condition Matrix with multiple contaminants.	1	**16**	2	2	1	0
16. As I gained experience using the Airport Report, collecting the information became easier.	2	**15**	4	1	0	0
17. As I gained experience, using the Runway Condition Matrix to determine the Runway Condition Codes became easier.	2	**16**	3	1	0	0

18. The Runway Condition Codes represented the actual runway slipperiness.	0	3	4	**12**	3	0
19. The matrix method of reporting runway conditions is more accurate than our current method.	3	1	**8**	7	3	0
20. I like using Mu, CFMEs, and Decels better.	**5**	3	**5**	**6**	3	0
21. Determining the Runway Condition Codes is too complicated to make it useable.	0	5	3	**13**	1	0
22. I had a hard time determining the Runway Condition Code in the time between working on the runway and aircraft landing.	2	7	4	**9**	0	0
23. I am concerned that pilots may not accept the Runway Condition Codes.	2	4	**12**	4	0	0
24. The Runway Condition Matrix and reporting required more staff time than our current method.	4	**7**	3	**8**	0	0
25. If you entered the Airport Report onto the website: The website was hard to use.	0	1	**13**	4	4	0
26. If you entered the Airport Report onto the website: The website took too long to use.	0	2	**13**	4	3	0

27. The most difficult thing about using the Runway Condition Matrix method was:

Determining the pertinent runway contaminate information from actual conditions when multiple contaminates existed.
It was difficult to maintain the matrix along with our procedures due to the workload it put on staff members.
Incorporating pavement temperature data. While temperature affects the contaminant, the resulting state of the contaminant is exactly as is reported. There was no observed relevance to reporting the temperature. I relied heavily on the in-pavement temperature probes as the gun significantly increased my runway occupancy time. However, this action did not allow me to complete the matrix reports in the vehicle. My workload often necessitated the completion of the reports following my actual "tour" of the airfield.
Determining the appropriate condition code with multiple contaminants and temperatures.
Traditional methods vs matrix = flights couldn't accept conditions with matrix, but could accept conditions using traditional method.
When multiple contaminants present of nearly equal percentage.
Using the temperature. The temperature would always drop the codes.
Deciding on the worst contaminant between a few & their depths.
All-around confusing
It's new. Takes time and having to do "dual" reports.
Time frames/ manpower
Having the time to do it in snow days.
Getting used to a new system
This was new. Small learning curve.
Getting familiar with it.
Determining runway percent coverage. Question if Mu value numbers are equivalent to Tapley meter readings?
Credibility in the codes assigned from the matrix by types of contamination, temperatures, and depth matching the actual braking action of the surface.
The amount of time it took to fill out the form after the runway check was complete.
Trying to gather information prior to aircraft landing while preparing the runway.
Determining the percentage of coverage was difficult at times. During a snow/wx event with changing conditions it was difficult to get the new updated matrix numbers in a timely manner prior to an air carrier arrival.
Just getting used to change - as we used it, it became easier
Fitting some of the various conditions into what choices we had.

28. The best thing about using the Runway Condition Matrix new method was:

Contaminate coverage of 25% or less required no code.
Blank
Reporting the percent of contaminant coverage.
The concept of publishing objective friction data that would be consistent system wide.
Very black and white. Took something that used to be different depending on location and standardized reporting methods.
Downgrading.
Using all tools to come up with 1 set of codes, everyone reported the same information.
You had space to explain the conditions in better detail in the remarks section.
N/A
Being on the "ground" floor to help develop new report and know that it will simplify reports in the future.
Simpler form
It is easier and faster.
It simplified the reporting process
It was accurate and faster.
Felt confident that it was correct.
Other than the time needed to provide Mu values with decel, the matrix was quick to perform.
The simplicity of the matrix.
It shared a common language with the pilot's way of reporting conditions.
Blank
It is an attempt to standardize the reporting system and guidelines are set for what information is to be reported.
I believe it will unite all users eventually
The only mechanical device we had to use was the temp gun.

29. Were there any times of day or particular circumstances that made the Runway Condition Matrix method more difficult to use than other times? If so, please describe.

Blank
Yes, glycol run off of the aircraft at the ends of the runways at times gave a false interpretation of the actual condition of the runway.
Blank
The presence of multiple contaminants made it significantly more challenging at times.
Rapidly changing conditions; ex. Wet snow with falling temps or any snow over any ice = 0/0/0
Temperature does not reflect positively with Matrix - Temperature should be removed.
Temperature would drop the codes when I felt they should be higher. Example: a 2/2/2 should be a 4/4/4.
The more flights, the more difficult, or with rapidly changing conditions.
No.
No Sand Credit. And we rarely use the Mu readings. Decel is not consistent or accurate under certain conditions - so validation is harder.
Heavy snows/ storms lack of manpower
On snow days when we were working. Need one extra guy.
No
No
Not that I know of.
Being minimally staffed, at times during adverse weather, it is difficult to stop snow removal

operations to provide matrix and braking action test
During rapidly changing conditions or squalls of precipitation in the last minutes before the arriving flight always proves challenging. Prompt, direct communication with the pilot is essential in those cases. Also, accurately determining percentage of ice coverage in darkness and poor visibility is difficult at best.
During times of continuous snow removal, when we did not have extra staff at work to fill out the reports, the extra 5-10 minutes of paperwork seemed to be too much when you have to use it [the time] to get the runway in its best condition for the aircraft that is landing. Using the FSS to relay this information would have been better. This would allow the DOT operator(s) to continue to clean the runway.
During major snow events or changing conditions.
Early morning arrivals when there is a limited time to prep the runway and also during snow/wx events when the conditions are constantly changing getting the information relayed was at times difficult.
early morning - due to staff levels
Blank

30. Please add any additional comments you have about the Runway Condition Matrix.

Blank
Blank
The matrix often indicated that the runway conditions were worse than pilots and I felt they were. This was seen quite often when icing conditions were present on the airfield. Wet ice or ice regularly required the publication of a 0/0/0 report, while accurate Mu's indicated braking was 40+/40+/40+ and pilot's reported good braking. The good braking was usually the result of either solid or liquid deicing chemicals or an icing condition when the sun was slowing melting the ice.
The matrix often generated overly conservative codes, which would have imposed unnecessary operational restrictions on safe surfaces. In light of this, it might be more reasonable to adjust the codes to less conservative levels and utilize the "downgrade" option more frequently. The temperature element proved rather burdensome and provided limited if any benefits. We somehow have to simplify the code determination process.
I like the idea of standardization, from the pilot's perspective it makes great sense.
Temperature caused more problems and was not reflective of true conditions.
Blank
Not good enough to implement. Contaminant section holds you back from telling the real story on the surface. Depths and % are good.
I believe that mu's should still be incorporated. Was not as good as it was made out to be. Information was not dispersed properly ??? With pilots.
In the future, this report system should work with the NOTAM system going "live". Immediate reports would be available.
better temp gauges
I think the Matrix will be good once the kinks have been worked out.
Blank
Blank
You must have very accurate temp gun.
I cannot say that the Matrix is any more accurate than how we normally report by "painting a picture" of the conditions.
I think the Matrix needs a great deal of work yet. For example, Frost is coded at a 5 any depth, any temp, is not correct; frost can actually be poor to nil depending on temp and depth and requires a downgrade assessment frequently. Also, the limitations of not being able to upgrade sanded ice with GRT [Griptester] numbers all above 40 and normal braking deceleration for the wheel braking effort applied and normal directional control observations needs some work. We have always used a temperature gun in WRG, mainly for decision making on deicer application. We have used the GRT within its limitations for years and have observed consistent accurate measurements and have confidence in its performance when used correctly. The unknown for me is how the measurements of the GRT relate to landing performance of the aircraft. Have you

operations to provide matrix and braking action test
During rapidly changing conditions or squalls of precipitation in the last minutes before the arriving flight always proves challenging. Prompt, direct communication with the pilot is essential in those cases. Also, accurately determining percentage of ice coverage in darkness and poor visibility is difficult at best.
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During major snow events or changing conditions.
Early morning arrivals when there is a limited time to prep the runway and also during snow/wx events when the conditions are constantly changing getting the information relayed was at times difficult.
early morning - due to staff levels
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30. Please add any additional comments you have about the Runway Condition Matrix.

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received useful landing performance data from Boeing yet?
During certain conditions and temperatures the reporting table does not have an accurate reading section available. Staff Comments: The Tapley would not agree with the Matrix chart quite often. I found on several occasions that even with good numbers the chart would force me to rate the runway much lower than what the Tapley readings were saying. [Includes specific dates.] Another issue was when the runway is bare and dry it shows 6 for the condition code, yet it says not to put 6/6/6 on the report. What do we do when the runway surface is bare and dry, full length?
Blank
Situations when there is ice present the percentage of ice had a huge impact on the runway condition; 25% or less you could have a runway condition of 5 or 6 while just over 25% your condition reported could go down as a 1. Thus the accurate percentage is important. There is no consideration for sand applied and no consideration for a Mu upgrade. At times you can have ice with sand which is a 1 while the Mu could be 40-50. Thus your information you can relay is limited.
blank
I believe that with a little adjusting, this will become a good useful method of reporting.

31. Please add any additional comments you have about the Airport Report.

Blank
Blank
Completion of an accurate NOTAM (separating the center of the runway from the edges), the matrix, and Mu's will result in a significant increase in workload when trying to rapidly transmit the data to an aircraft on approach.
While this was only a "trial run" for the matrix, a thorough and specific guidance document on determining codes will be necessary if this tool is implemented system wide.
Using the temperature is redundant and should be removed. It is implied by the type of contaminants, ex. Wet snow vs. dry snow. OAT is available to the pilots any way.
Remove temperature criteria and the matrix can be usable.
Website worked great. If only we could have edited previous reports instead of adding a whole new report.
Good. No issues.
No comment.
It will work well in the end, very simple. We will just have to get over a few hurdles like an accurate Temperature Gun.
N/A
The sheets could be easier to read. Both ways were different for me.
Blank
Blank
Blank
The Matrix brings standardization of conditions to code assignment with remarks section for additional information.
Easy to use.
1 - There is not enough room in the Matrix Report section of the form. My suggestion would be to remove the "Return this form to the Alaska Airlines Station Personnel" box and extend it to the end of the page. 2 - At the top of the page it should read in this order, Airport, Runway, Time, Date, Flight #, Name/Initials. This would make it faster for the operator to fill out. 3 - Built-in truck mounted surface temperature readers instead of the temperature gun. This way we don not have to stop to get readings on the runway,
Blank
As much information as possible should be reported to give the complete picture of the actual conditions.
blank
Blank

32. Please add any additional comments, feelings, or opinions you have about the winter validation and/or Runway Condition Matrix and reporting.

Blank
Blank
1. I strongly feel that the burden of reporting pavement temperatures far exceeds the benefit obtained by aircraft operators. 2. The matrix in its current form; will also unnecessarily close airports for extended periods of time. 3) The concept behind the matrix is much better than our current system of reporting braking action (Good, Fair, Poor, Nil) when the contaminants exceed the manufacturers limits on decelerometers.
This was a very worthwhile test. I believe we all learned as much about the process as we did about the concept, which should help us significantly with our next steps.
Blank
Blank
Please get rid of the temperature part of the Matrix.
I feel it is somewhat moving into a better direction for reporting, but there are too many holes in this set up. I feel the way we report now is all more efficient and effective , informative/safe. The matrix is a way but not the right way or parallel with what we have now.
Matrix not helpful. Need Mu's involved. Education was not provided properly.
JNU had a very mild winter, so I don't think we really got to apply the Matrix report infull. We were not able to see if filling out reports with continuous event changes would mean a delay in reporting.
N/A
It is easier and faster. The temp gun must be a good one. You should be able to check this gun some way.
Temp gun was not accurate.
Temp gun was not reliable.
Blank.
Obtaining Mu values from a Decelerometer under "nominal conditions" is difficult to obtain readings much of the time, causing excessive wear on vehicle tires and brakes. Tapley meters are quicker and easier on test vehicles.
I still firmly believe when you go back to the drawing board on the matrix verbal descriptions should be incorporated into the matrix rather than the numeric so that the pilots, PIREPS, Flight Service and maintenance personnel are all talking the same language.
1 - Built-in truck mounted surface temperature readers instead of the temperature gun. This way we do not have to stop to get readings on the runway. 2 - Also a computer with satellite link up so we can send the reports direct to the FSS/ATCT without having to use paperwork.
After this past winter I feel that it would be less complicated if we were able to use either the old system or the matrix, but not both.
At times pilots are requesting runway conditions 20 minutes out with constantly changing conditions and are unable to pass on information until just prior to air carrier landing to provide the most accurate information. This is where Mu readings just prior to landing I believe is more beneficial. Also one individual's idea on contaminant type may vary from another's opinion, especially when considering compacted snow or ice which can then change the runway condition number. There may be some differences in the reporting from individuals due to the interpretation of percentages and contaminant type.
We did not have FAA give presentation due to emergency flooding. When we had presentation it was given by Alaska Airlines representatives, so DOT staff was under impression this was driven by Alaska Airlines - was kind of from airlines view on presentation. Did cause some confusion with reporting to pilot before landing.
Blank

APPENDIX K—LIST OF INDUSTRY TEAM ATTENDEES

Name	Organization
Bruce Applebach	Gerald R. Ford International Airport
Joe Cimperman	Flight Options, LLC
Chet Collett	Alaska Airlines
John Cowan	United Airlines
Bill DeGroh	Air Line Pilots Association
Patty de la Bruere*	Juneau International Airport
Jim Freeman	Alaska Airlines
John Gradzinski	Four Winds Consulting
Susan Gardner	Federal Aviation Administration (FAA) Office of Airport Safety and Standards—Safety and Operations
Paul Giesman	Boeing
Kevin Klein*	Cherry Capital Airport
Troy Larue	Alaska DOT
Dick Marchi	Airports Council International
Rick Marinelli	FAA Office of Airport Safety and Standards—Airport Engineering
Mitch Matheny	Pinnacle Airlines
Bill O'Hallaran	Alaska Department of Transportation
Jerry Ostronic	FAA Flight Standards Service
Paul Sichko	Minneapolis-St.Paul International Airport
Don Stimpson	FAA Aviation Safety, Aircraft Certification Service
Nick Subbotin	FAA Airport Technology Research and Development Branch—Airport Safety Section
Tom Yaeger (retired)	National Aeronautics and Space Administration
Ray Zee	FAA Office of Airport Safety and Standards—Airport Engineering

*Participated via teleconference

APPENDIX L—INDUSTRY TEAM MEETING NOTES

Notes from Winter Validation Industry Meeting
31 August 2010—2 September 2010
Washington, DC

The first day was primarily taken up with briefings on the Winter Validation results. First, Jerry Ostronic (FAA Flight Standards) reminded the group of the three validation goals and presented a high level summary of the collected data and analysis results. Next, Chet Collett presented Alaska Airlines feedback on the validation, followed by Mitch Matheny presenting the Pinnacle perspective. Troy LaRue and Bill O'Hallaran (Alaska DOT) as well as Paul Sichko (MSP), Bruce Applebach (GRR), and Kevin Kline (TVC) gave brief remarks about their airport's experience using the matrix. In the afternoon, Nick Subbotin (FAA Airport Safety R&D) presented the data collection process, how data verification and Matrix code validation was conducted and represented in the database, a summary of database tables and formats, and a summary of analysis conducted. Finally, Susan Gardner (FAA Airport Safety & Operations) presented the results of the survey given to the participating airports. All of the presentations can be found on the Winter Validation website. (Website no longer exists)

The second day's discussions centered on data analysis and discussion of issues related to Compacted Snow; Temperature; Dry and Wet Snow; Ice; Sand; Upgrading for Ice; Frost; Snow over Compacted Snow; and Percent Coverage. The third day again focused on data analysis and additional discussion of Percent Coverage; Upgrades for codes 1 and 0; Definitions of Dry, Wet, Contaminated, and Frost; Slippery When Wet; Precipitation; and possible Further Validation, including participants, training, and data collection forms.

Major Discussion Points/Observations:

- Matrix overly conservative in some areas
  - Cold/sanded ice, thin ice can be better than 1 or 0.
  - Compacted Snow at warmer temperatures can be better than 2.
- Need to provide a way to upgrade/validate
- The current matrix is slicing too fine.
- In trying to implement, we have to be lighter on the academic and heavier on people's experience.
- Percentages – 25% is the only percentage that means anything relative to aircraft performance.
- We need to look at the shelf-life of airport reports.
- Usability is critical for airport operators in rapidly changing conditions.
- Temperature- the value of incorporating temperature into the matrix is questionable:
  - With in-pavement temperature sensors, the readings can vary from the north to the south side of the runway, especially with crowning.
  - High-end temperature guns can vary by plus/minus 2°.
  - There can be a 10 – 14 degree difference between OAT and Surface Temperature.
  - The Matrix was keyed to surface temperature, yet approximately 20% of the airport reports were reporting OAT.

- In many airport reports, what was reported as surface temperature was exactly the same for all three thirds, leading us to question whether they really were taken on all three thirds.
- At least one airport was converting from Fahrenheit to Celsius.

Decisions/Recommendations:

- We need to continue to report in thirds. Rationale: conditions can vary over the thirds of the runway, and it wouldn't be accurate enough to give just one number.
- Compacted snow in the matrix should be changed to bucket 3, with compacted snow at -15 ° OAT or colder, at a code 4. Rationale: having compacted snow in 3 buckets is too complicated; it is slicing things too thin. EASA data based on the equivalent of 4 for 20 years. Temperature did not provide the value we envisioned.
- Put dry snow and wet snow over 1/8 inches in bucket 3. Temperature not providing the value we expected. We should put in the **guidance** for airport operators to use the temperature as heightened awareness for transition from snow to slush.
- Keep dry snow and wet snow as separate contaminants. They behave differently enough that they should be thought of as 2 separate contaminants. Aircraft landing performance is different for these 2 contaminants. Impingement drag is different from dry to wet.
- Take temperature from ice at 1; leave wet ice at 0. Take ice >-3° C out of level 0. We need to give pilots **guidance** in the AIM on when temperature ranges can turn into wet ice.
- For ice only, you can upgrade if all three Mu's are above 40 as well as an operational assessment using other items in the toolbox supports the Mu's (i.e., indicate better braking action), the code can be upgraded to a maximum of code 3. This is not based necessarily on the use of sand. Rationale: under certain conditions, to include the use of sand, braking action can be better than expected.
- For ice only, if an operator gets 30 Mu's, throws sand, then gets Mu over 40, along with an operational assessment using other items in the toolbox, then the codes can be upgraded up to a 3. Rationale: In some cases, mitigation can improve the friction of the surface. Mu needs to reflect the part of the runway being used.
- Frost moved to bucket 3. Rationale: In many cases, frost behaves like ice. The braking action reports in the data are not worse than a medium. This is also in line with Mu readings.
- Leave Dry Snow <1/8 inch in Bucket 5. Leave Wet Snow <1/8 inch in Bucket 5. Rationale: we do not have enough data to justify making a change.
- Remove the 10% threshold per third. It will still appear in the comments section. Rationale: This was too complicated for airport operators and didn't justify the added confusion. Coverage over 25% of the length for the usable runway triggers coding for the runway. Within the thirds, the contaminant must be greater than 25% to affect the code.
- We will follow the new process proposed by Jerry, as modified by the group, as the process for determining codes when multiple, non-layered contaminants are present on thirds of the runway. *(See Attachment 1 at the end of this document for the proposed process.)* Step #1 should include that it's the treated part. Clarify that the threshold is less than or equal to 25%. In guidance material give 4 examples. Pictorial examples with NOTAM. Include contaminant on edges.

- Snow over compacted snow is a code 3 regardless of depth. Joint Aviation Authority (JAA) statistics match up with it being medium to good braking action.
- For all contaminants in bucket 0, you can upgrade if all three Mu's are above 40 as well as an operational assessment using other items in the toolbox supports the Mu's (i.e., indicate better braking action), the code can be upgraded to a maximum of code 3. If you upgrade, you must continue to monitor the situation. Rationale: airports need some way to improve from a 0. NOTE: We need to make sure that it is clear that only buckets 0 and 1 can be upgraded. Also, contaminates other than compact snow and ice >1/8 inch cannot be upgraded. Refer to AC for proper use of Mu devices.
- The FAA team will come up with a way to revise the Mu column of the matrix so it is not in such small blocks. Rationale: With the margin for error and differences among devices, it doesn't make sense to have such narrow ranges attached to specific matrix levels.
- Add a note to the matrix that frost, may take on the quality of ice and should be assigned the proper code. On occasion, frost will build to a depth and behave like ice, and it should be coded as ice.
- The new definitions of Dry, Wet, and Contaminated, as proposed by Don Stimson, and slightly modified by the group, were adopted. Rationale: The definitions as revised now cover all cases and will be clearer for international pilots.
- If there is a code 5/5/5 or better, the code will not be relayed by the tower. Time permitting, it would be on the ATIS. It would be in a NOTAM. Pilots would have to know that if they are not getting a code, the runway could still be wet. They would have to make that determination based on weather data.
- When runway friction is below the minimum friction level, a NOTAM will be issued saying "slippery when wet". If the condition is greater than 25% of the runway surface, the airport should use the matrix and give a code.
- In guidance material it needs to say that pilots need to be trained that in rain there could be local flooding that you don't expect. Just because you have a 5/5/5 and heavy rain, it could be worse because of hydroplaning.

Another Validation:

This year's testing showed that the correlation of the matrix with pilot braking was good, but needed a few tweaks. It also showed that the matrix is too complex and difficult for airports to use. We are not satisfied with the usability aspect. In addition, since Matrix codes were not relayed to flight crews after the first two weeks, we lost some of the pilot perspective. Gathering PIREPs from non-participating aircraft could also have been valuable in that regard. Therefore, the group recommended another year of validation be conducted over the 2010-2011 winter. All Alaska DOT airports, Great Lakes airports, Alaska Airlines, and Pinnacle agreed to participate again. [Note: Juneau and Ketchikan airports were not represented at the meeting, so we do know if they are willing to participate again.]

Major Points:

- We need to validate matrix changes
- The data collection process and form needs to be simplified for users.
- We should broaden the number of participating airports and geographic areas
- We can try to get specific types of data we were light on this year

- Try to link with FOQA data if possible.
- As more airports and pilots are exposed to the matrix through the validation, we could get more buy-in.
- We should try to add one or 2 small carriers.
- We should test the matrix at some airports without carrier data to test usability for airports and training. At those airports, they could record PIREPs from any pilot.
- If Alaska Airlines and Pinnacle participate again, we should try to have the matrix code relayed to the crews prior to landing.
- At airport that participated last year, staff could just get training on the differences from last year.
- We should develop some kind of workbook or quick reference guide for airports.
- We need a better quality control process during the data collection phase. The group decided that in the interest of seeing how easy (or not) it is for the airports to use the form, we should not have any automated form of error flagging.
- GRR is not comfortable interjecting TALPA stuff into live ops. He would document any pilot Braking Action Reports. Talking with Bruce about this after the meeting, I think we could work out using the runway condition codes for PCL.
- We should continue to collect data that is extra for the validation but would not be required once we implemented it. (e.g., we would still collect data if the contaminant was less than 25%)
- If a pilot reports a braking action that does not agree with the code, the airport should document as much information as possible explaining why they chose the codes they did and what was going on condition-wise at the time.
- We should collect depth for snow over compacted snow for the database. It will be a factor for takeoff.
- We may want to compare 2009-2010 data with 2010-2011 data.
- Try to get airports to take pictures, especially of unusual conditions.
- We may want to factor in precipitation. Weather would have to be accounted for in pilot procedures.
- We may want to get a chronology from the airport operator – a history of their treatments, Mu's, weather, and how long the condition remained.
- Any time a runway is updated/validated, the airport should note why, when, how long these conditions remained.
- We should try to capture NOTAMs that would match timeframes of collected data.

<u>Airport Training:</u>
If an additional validation is done, changes should be made to the training:

- During training, emphasize to airports to put weather in the remarks to give us a hint to pull METARs.
- During training, emphasize to airport staff that 25% contaminant coverage is the point where there is an impact on aircraft performance. Might get better buy-in.
- It helps to have FAA and airline reps at the training.
- We would need two different versions of training – one for new airports and one for repeat airports. Maybe Alaska Airlines and Alaska DOT could do recurrent/refresher training in Alaska.

- We could pull actual condition reports from the airports we train and use those as examples for coding the matrix during training. We could try to get at least one report with each person's initials.

<u>Data Collection Form:</u>
If an additional validation is done, changes should be made to the airport data collection form:

- Maybe we should put together a form that will lead airports through the analysis and get them to NOTAM format.
- Make sure not to forget data describing the remaining edges.
- Form should be designed to get the reporter to look at total runway percentage first.
- "Total Rwy % Reported" should be changed to "Total Rwy Covered by Contaminant - When over 25%, report codes".
- The dividing line between percentages would only apply to the total runway, not to runway thirds.
- We will need to add the additional contaminant types such as snow over compacted snow.
- Should we have a designated block to record conditions/weather (current ATIS)
- The Remarks section should be moved down by the "Matrix Report" so you don't break the flow of the report for the reporter.
- Add a box for checking off Good/Fair/Poor braking action and kind of aircraft the report came from
- "Runway Condition" should be changed to "Runway Condition Code" and "Downgrade Rwy" should be changed to "Downgrade Rwy Code" or possibly "Downgraded/Upgraded/Validated Rwy Code".
- Should the form include Slippery when Wet?
- "Rwy Highest Depth Measure" should be "Highest Rwy Contaminant Depth". It should have N/A for a choice.
- We may want to structure the form so that once the reporter selects the contaminant type, they only have a choice of the appropriate depth(s), etc.
- Suggestion to have the Matrix Report box near the top of the form.
- Have just one temperature box for OAT.
- Is there any way for the Data Collection Sheet to be more like the airport's self-inspection report?
- Eliminate some of the directions on the form and put them in the workbook/quick reference guide.
- If there is any way to eliminate having to flip the page over from the form to consult the matrix, that would help. Want both in front of you at the same time.

At the conclusion of the meeting, Jerry committed to meet with Mike O'Donnell, the FAA Director of Airport Safety and Standards within the next week to see if he would support another winter of validation and be willing to provide funding. Pinnacle and Alaska Airlines stressed that for winter training purposes, they need to know about another validation ASAP. Output from the meeting will be meeting notes including group decisions and recommendations, a revised matrix incorporating changes discussed, and a revised data collection form incorporating points discussed. If approval is given for an additional validation, FAA will move quickly to identify potential additional airports and carriers for participation.

Contaminant Definitions

Dry runway. For aircraft performance purposes and use of this Matrix, a runway can be considered dry when no more than 25 percent of the runway surface area within the reported length and the width being used is covered by:

1. Visible moisture or dampness, or
2. Frost, slush, snow (dry or wet), ice, or compacted snow.

Wet runway. For aircraft performance purposes and use of this Matrix, a runway is considered wet when more than 25 percent of the runway surface area within the reported length and the width being used is covered by any visible dampness or any water up to and including 1/8-inch (3 mm) deep.

Contaminated runway. For aircraft performance purposes and use of this Matrix, a runway is considered contaminated when more than 25 percent of the runway surface area within the reported length and the width being used is covered by any depth of slush, ice, snow (dry or wet), or frost, or by water more than 1/8-inch (3 mm) deep. Definitions for each of these runway contaminants are provided below:

Dry snow. Snow that can be blown if loose, or that will not stick together to form a snowball using gloved hands.

Wet snow. Snow that contains enough water content to be able to make a well-compacted, solid snowball, but water will not squeeze out.

Slush. Snow that is so water saturated that water will drain from it when a handful is picked up. Slush will splatter if stepped on forcefully.

Compacted snow. Snow that has been compressed into a solid mass such that the aircraft tires, at operating pressures and loadings, will run on the surface without significant further compaction or rutting of the surface. Compacted snow may include a mixture of snow and embedded ice; if it is more ice than compacted snow, then it should be reported as either ice or wet ice, as applicable. A layer of compacted snow over ice should be reported as compacted snow.

Frost. Frost consists of ice crystals formed from airborne moisture that condenses on a surface whose temperature is below freezing. Frost differs from ice in that the frost crystals grow independently and therefore have a more granular texture. Heavy frost that has noticeable depth may have friction qualities similar to ice and downgrading the runway condition code accordingly should be considered. If driving a vehicle over the frost does not result in tire tracks down to bare pavement, the frost should be considered to have sufficient depth to consider a downgrade of the runway condition code.

Water. Water in a liquid state.

Ice. Frozen water.

Wet ice. Ice with a layer of water on top of it or ice that is melting.

Slippery when wet runway. A runway where a friction survey, conducted for pavement evaluation/friction deterioration per Advisory Circular 150/5320-12C (or later revision), shows that more than 25 percent of the runway length does not meet the minimum friction level classification specified in Table 3-2 of that AC. The airport operator should assign and report a runway condition code of 3 for all applicable thirds of the runway when wet under this condition. If less than 25 percent of the runway fails the friction evaluation, the airport operator should report runway condition codes of 5 for the applicable runway thirds when the runway is wet, and report the deteriorated condition of the runway through the normal airport NOTAM system.

Attachment 1

Percent Coverage and Reporting Contaminants

3. Report on the runway surface condition report the total percentage of the runway surface covered by contaminant, if > 25% go to step 2. If ≤ 25% go to step 4.
4. Report a runway condition code for each third of the runway
5. Determine the appropriate code from the table assigning the code associated with the most slippery (top to bottom) contaminant or wet that covers more than 25% of the runway surface, if less than 25% of the surface is covered with contamination or wet assign it a code 6.
    a. Small areas, less than 25% coverage should be described in the remarks section of the runway surface condition report.
    b. If multiple contaminates are present and none alone is greater than 25% coverage but the total combined coverage exceeds 25% the report should be based on the reporter's judgment as to which contaminant will most likely be encountered by the aircraft and its likely effect on the stopping ability of the aircraft. The reporter should use all the assessment tools available to him in determining the condition code to assign.
6. Provide the description of the most predominant contamination type using the contamination terms provided on the reporting form. Any additional contamination types and percentage of their coverage of the runway surface should be provided in the remarks section of the runway surface condition report.
7. Runway surface condition reports of bare and dry 6/6/6 should not be disseminated via the NOTAM system unless requested. All other reports should be disseminated through the NOTAM system and other local procedures.

Example: The first third of the runway has approximately 30% of ice, the middle third has approximately 50% dry snow over compacted snow, and the last third has approximately 10% ice spots, 20% wet snow of less than 1/8 inch, and 40% wet.

Runway surface condition report: PIT Rwy 28R 1/3/5 75% Dry Snow over Compacted Snow, (Remarks) first 3000 ft. 30% ice, last 3000 ft. 30% ice and wet snow

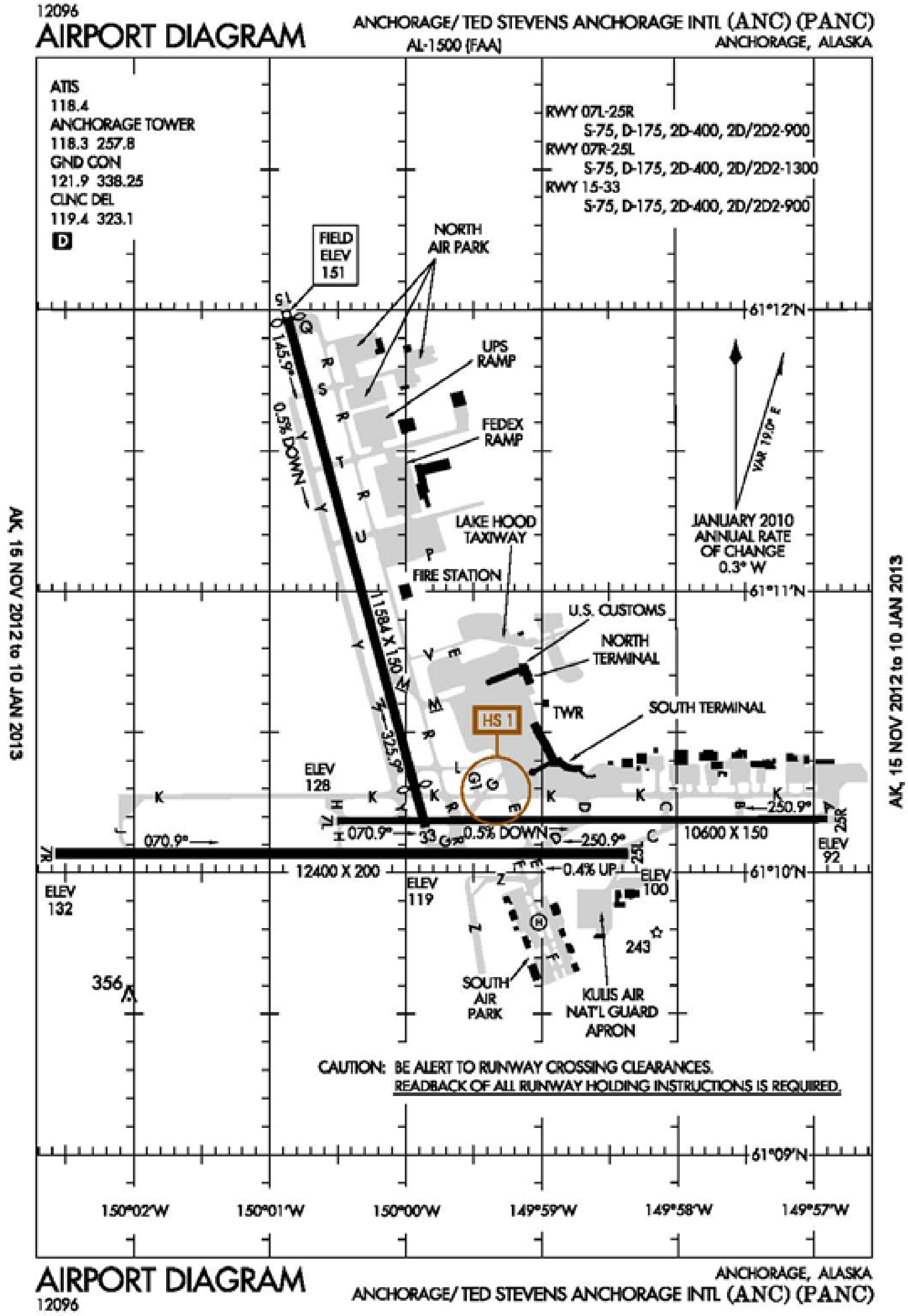


Figure M-1. Ted Stevens Anchorage International Airport

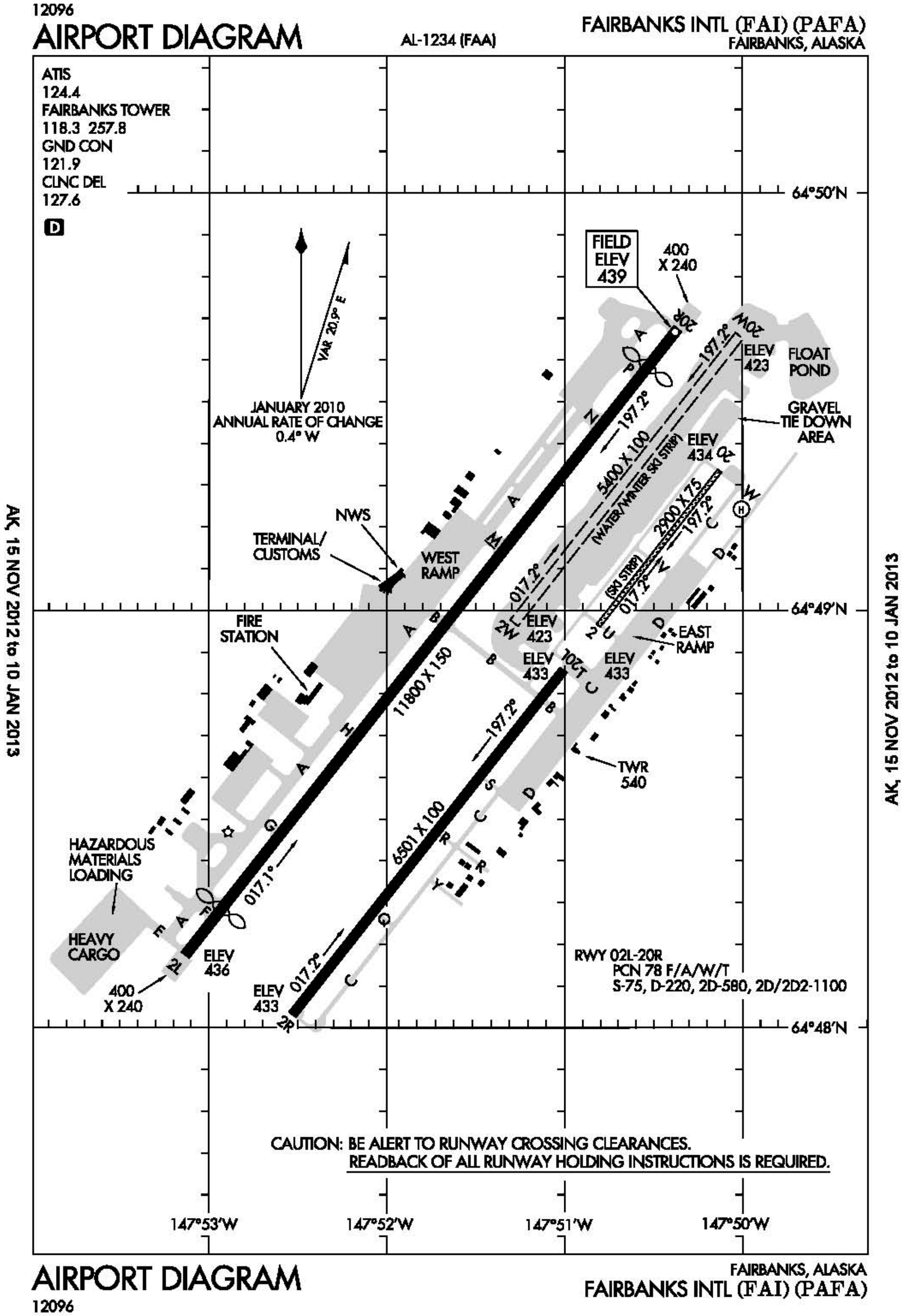


Figure M-2. Fairbanks International Airport

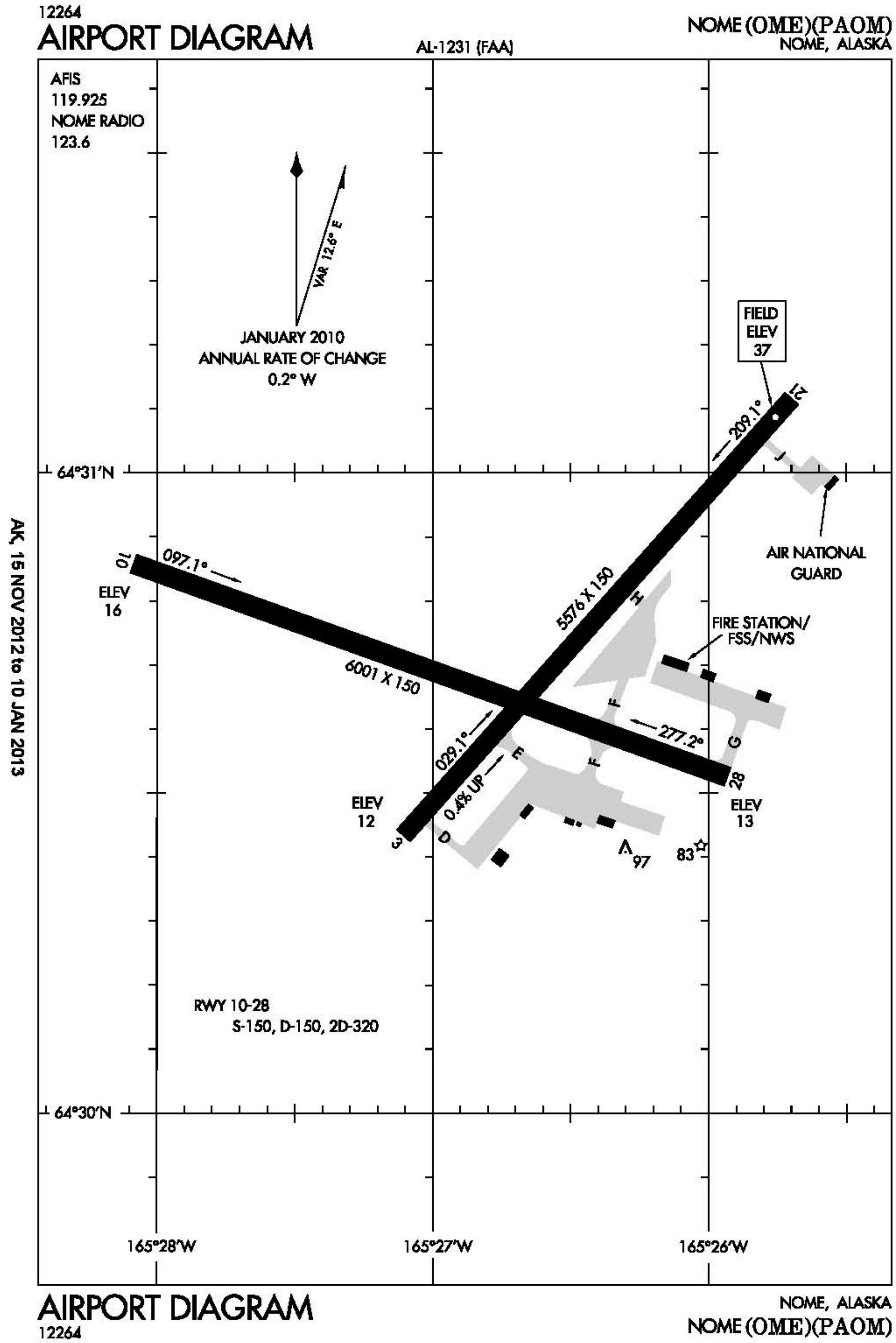


Figure M-3. Nome Airport

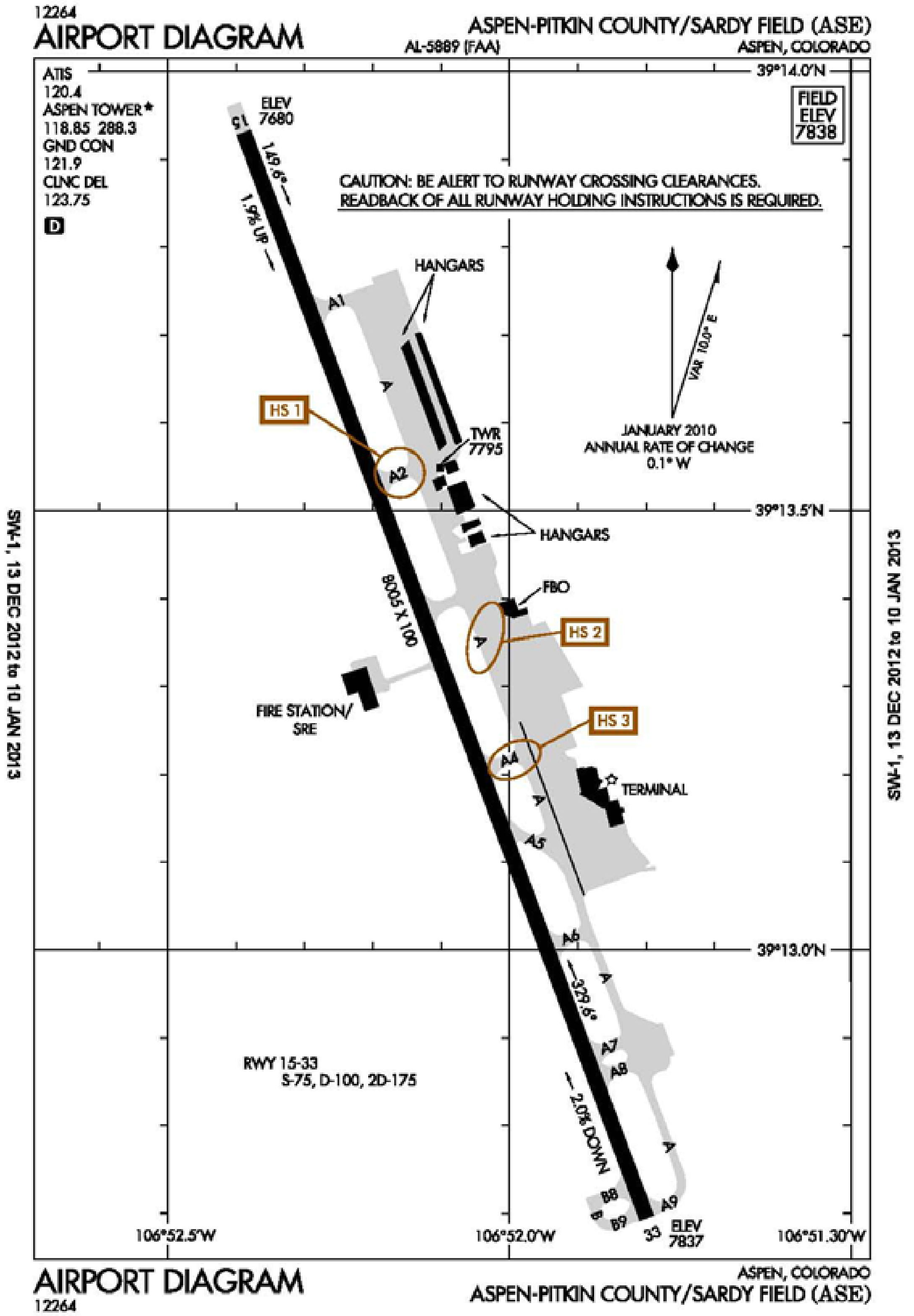


Figure M-4. Aspen-Pitkin County Airport/Sardy Field

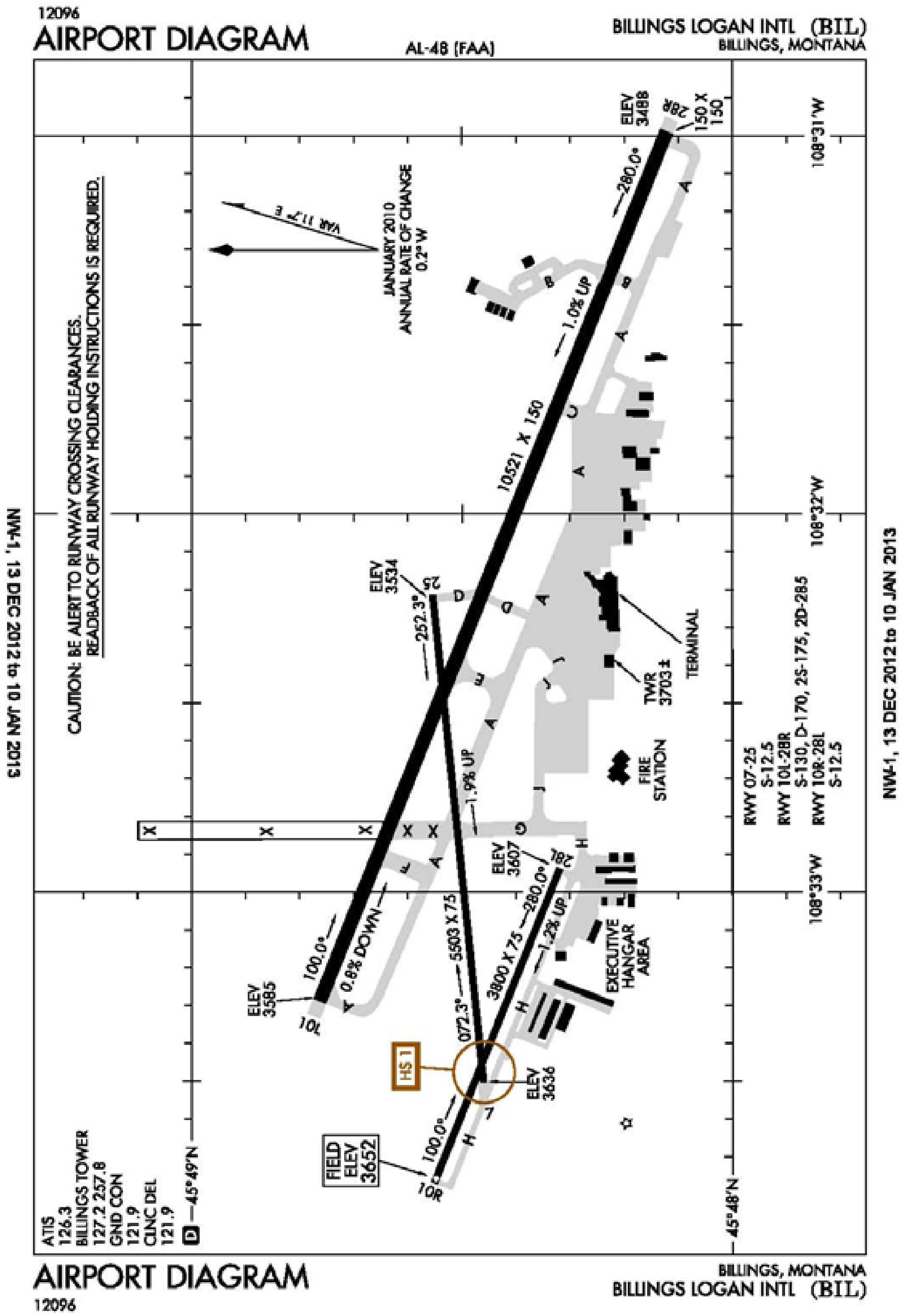
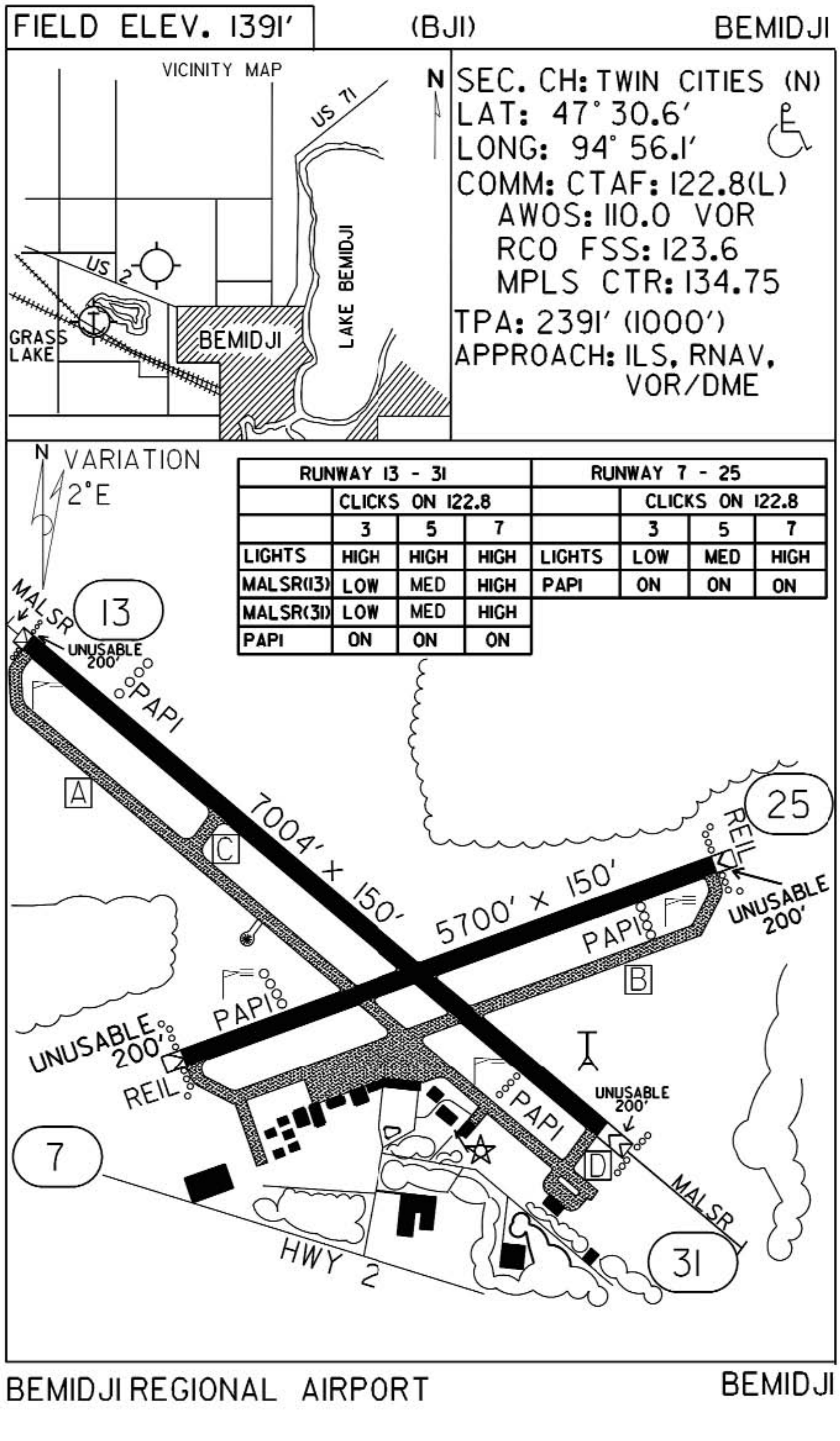


Figure M-5. Billings Logan International Airport



RUNWAY 13 - 31			
	CLICKS ON 122.8		
	3	5	7
LIGHTS	HIGH	HIGH	HIGH
MALSR(13)	LOW	MED	HIGH
MALSR(31)	LOW	MED	HIGH
PAPI	ON	ON	ON

RUNWAY 7 - 25			
	CLICKS ON 122.8		
	3	5	7
LIGHTS	LOW	MED	HIGH
PAPI	ON	ON	ON

Figure M-6. Bemidji Regional Airport

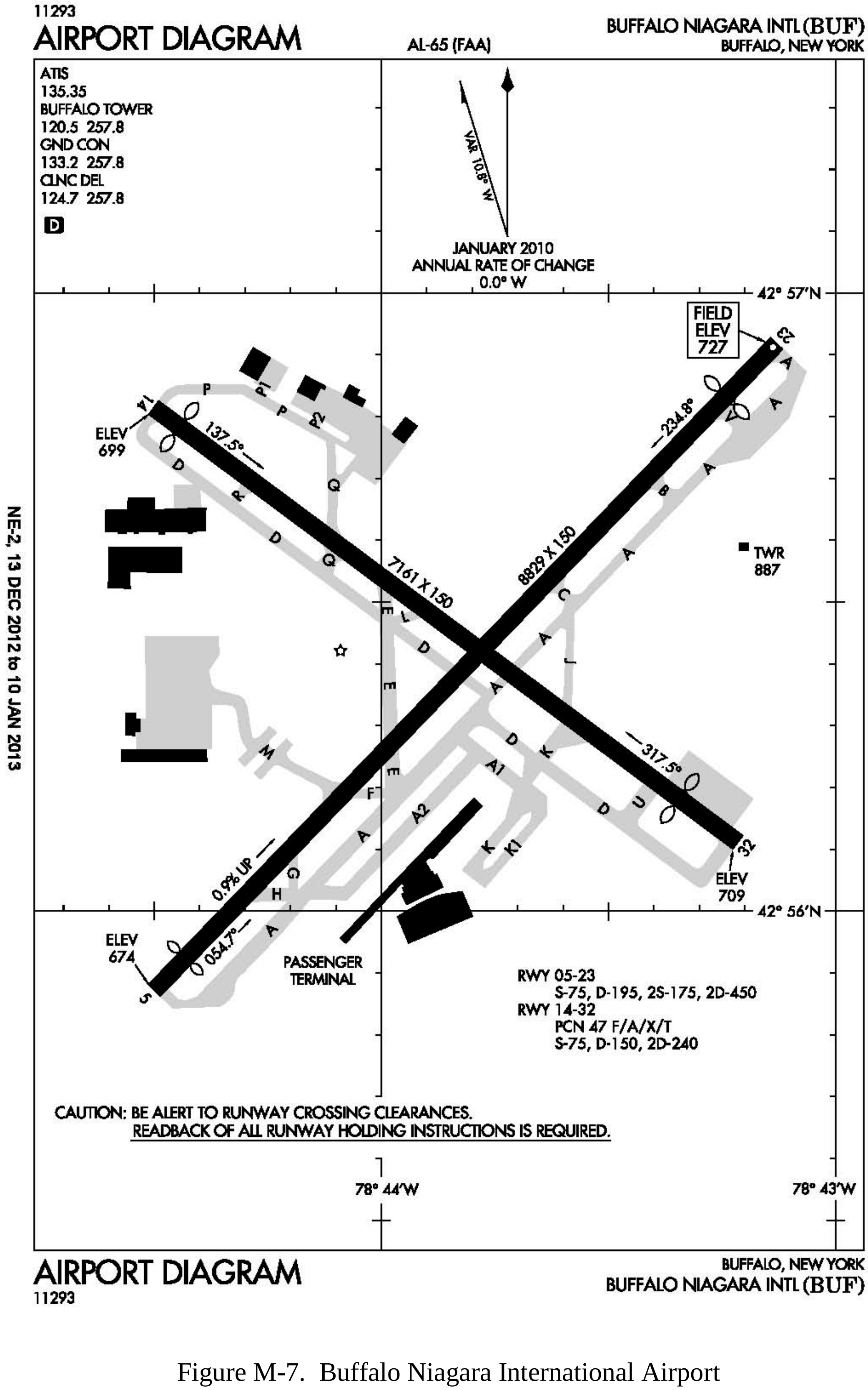


Figure M-7. Buffalo Niagara International Airport

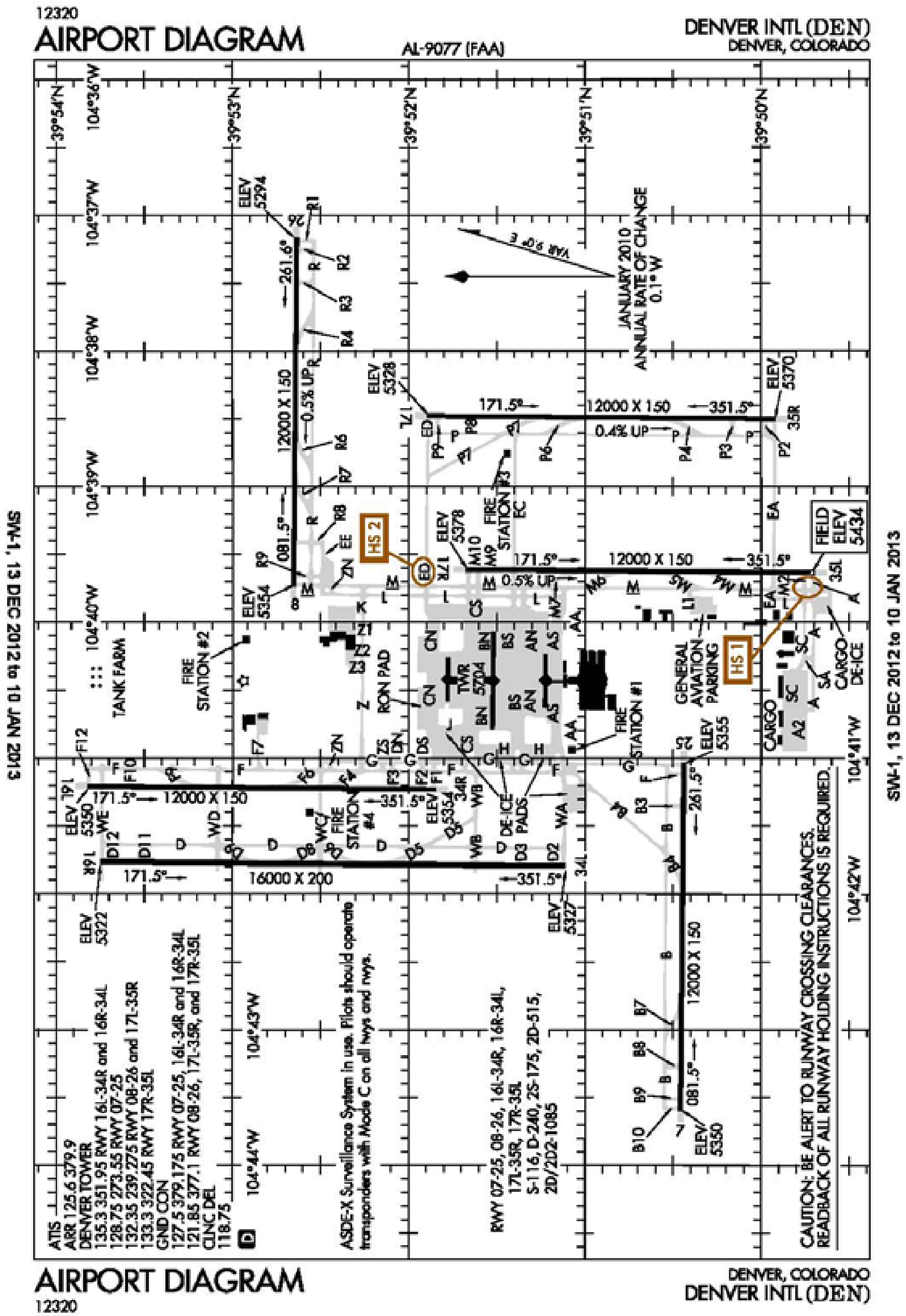


Figure M-8. Denver International Airport

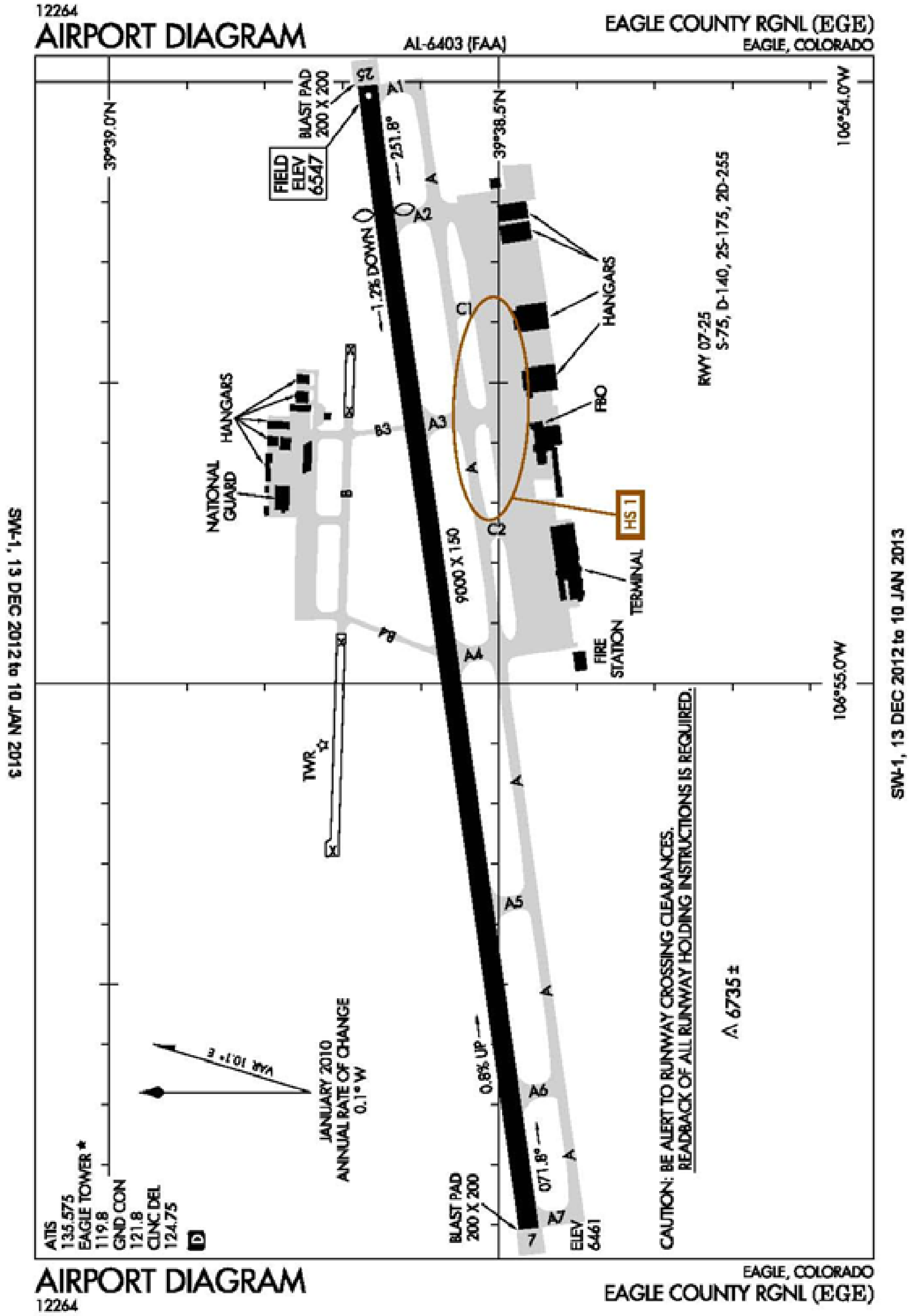


Figure M-9. Eagle County Regional Airport

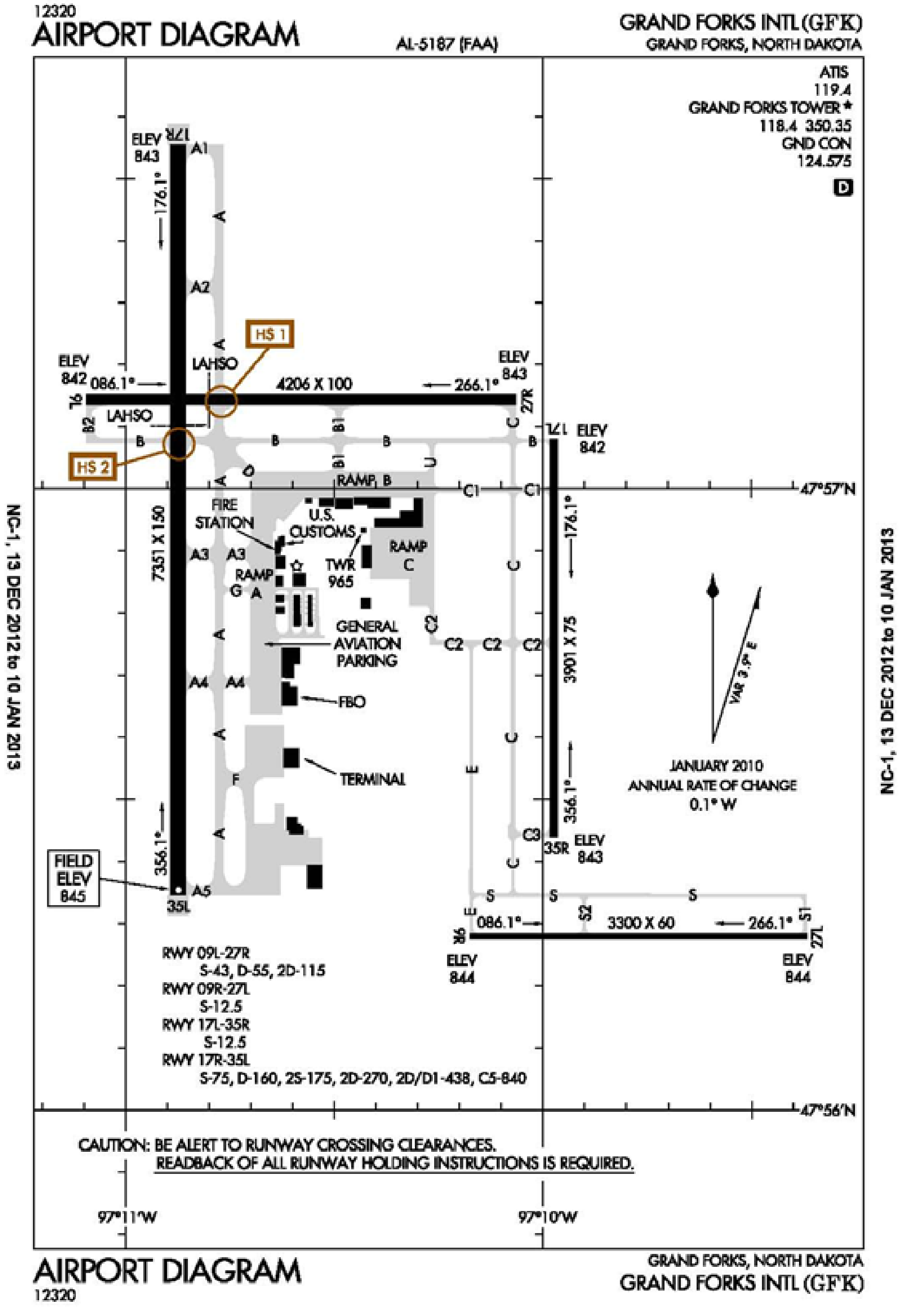


Figure M-10. Grand Forks International Airport

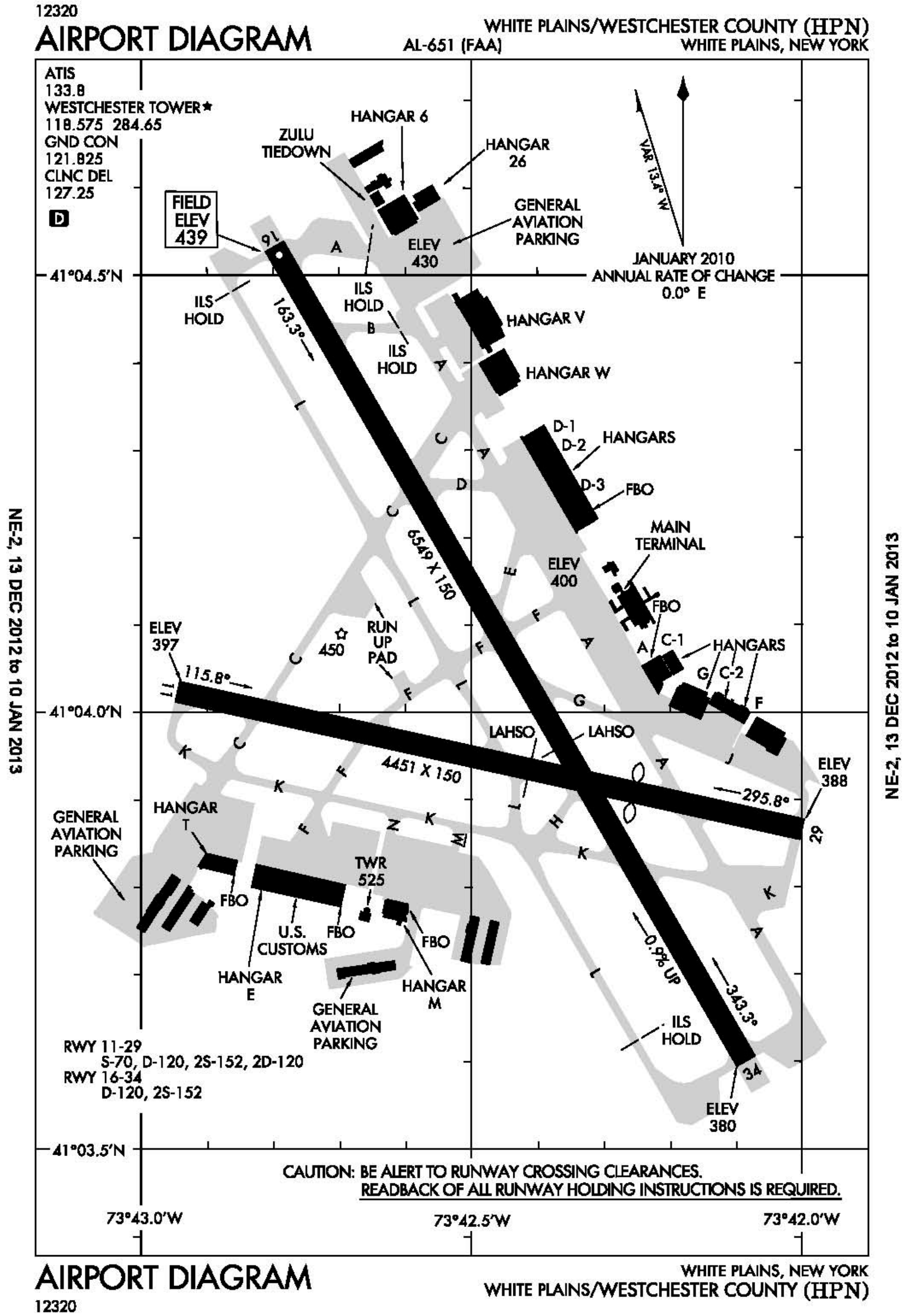


Figure M-11. Westchester County Airport

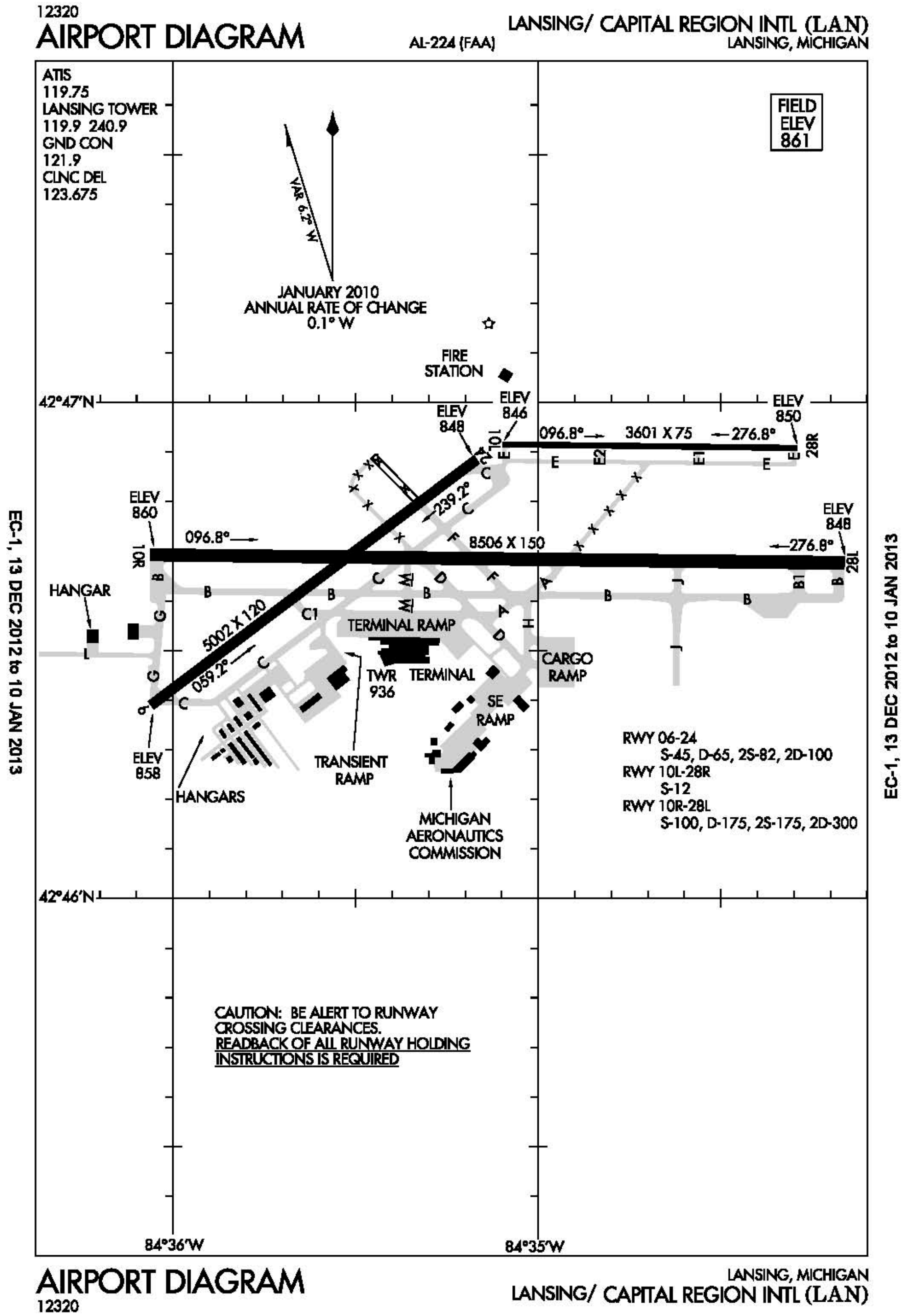


Figure M-12. Capital Regional International Airport

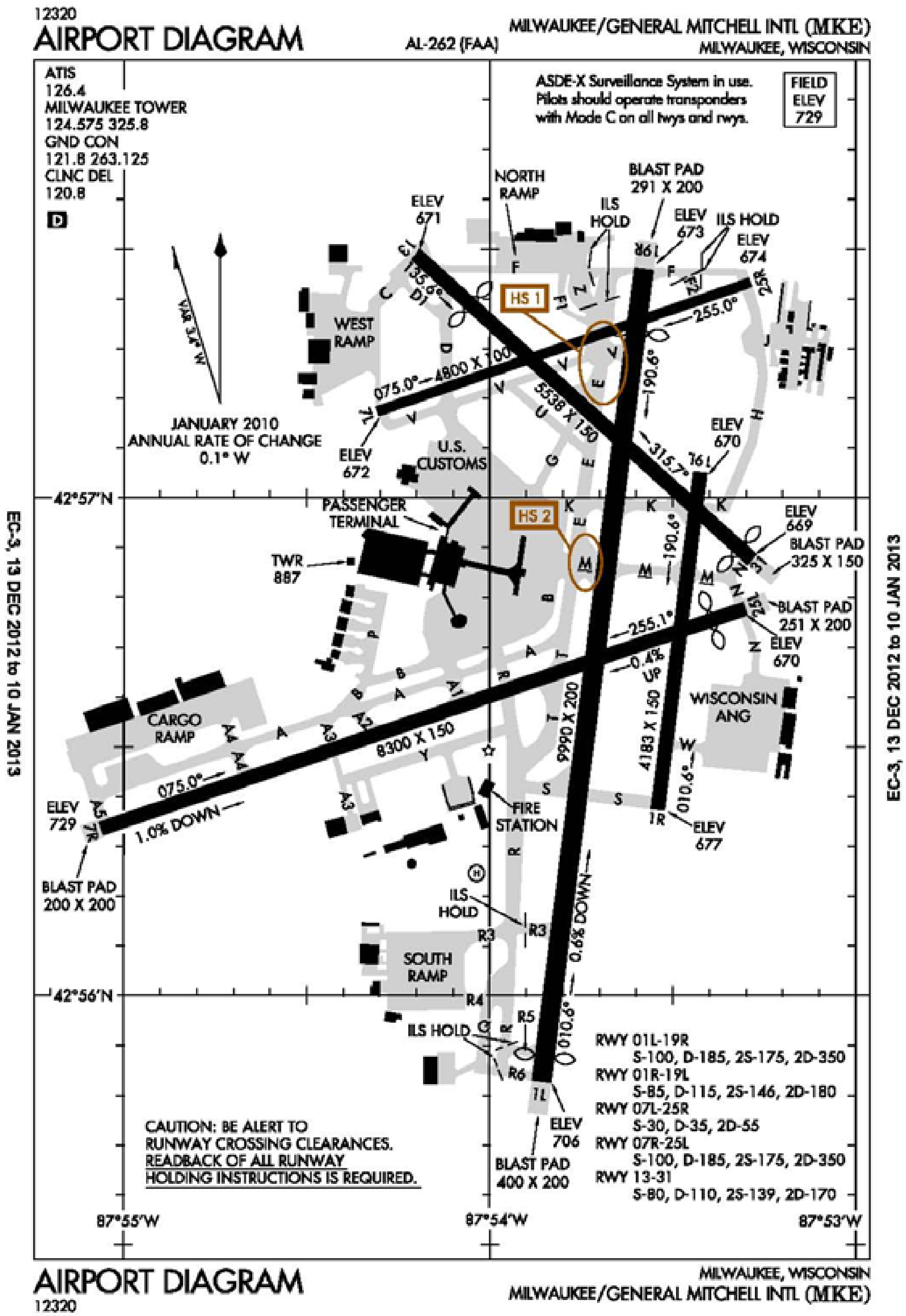


Figure M-13. General Mitchell International Airport

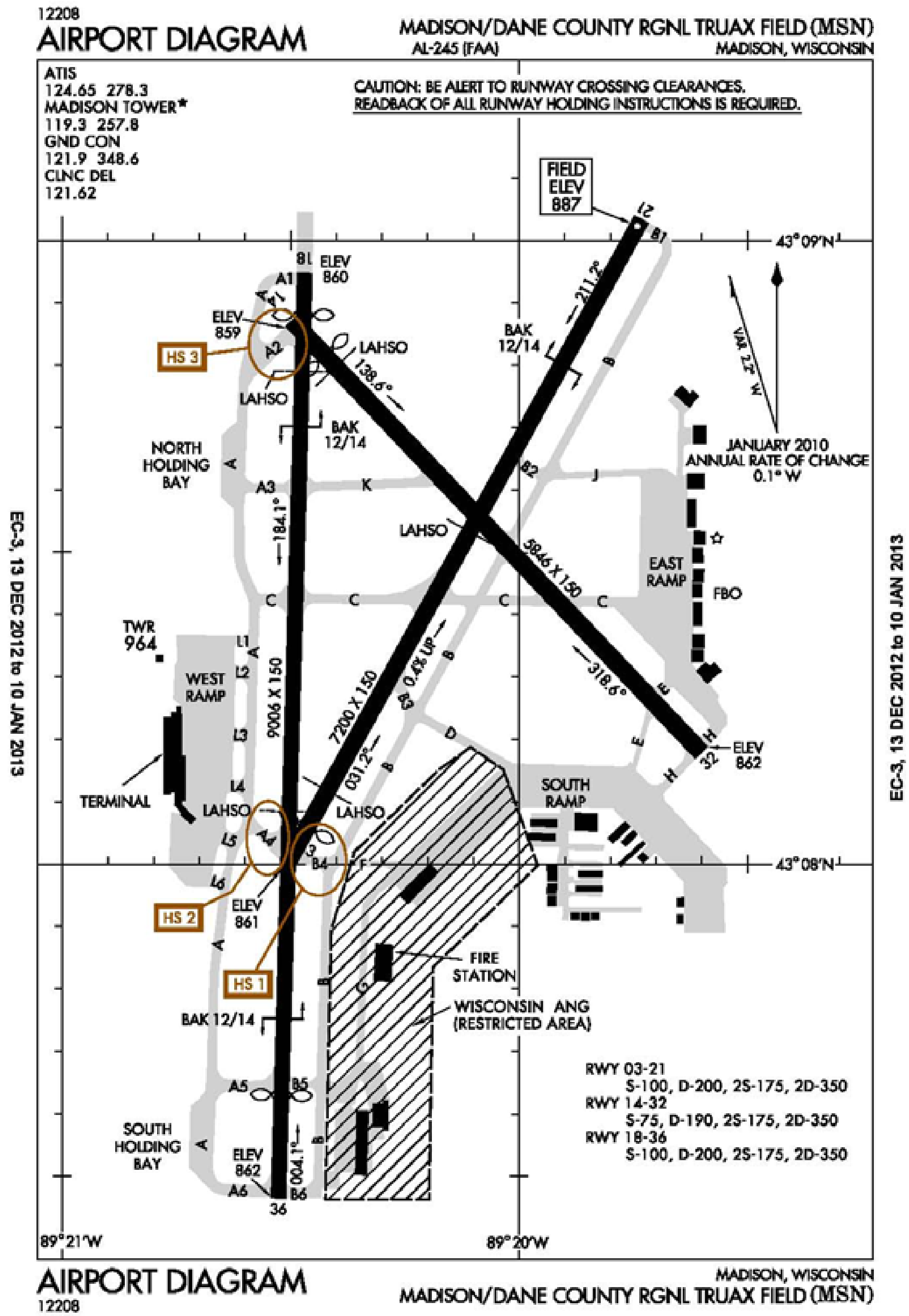


Figure M-14. Madison-Dane County Regional Airport/Truax Field

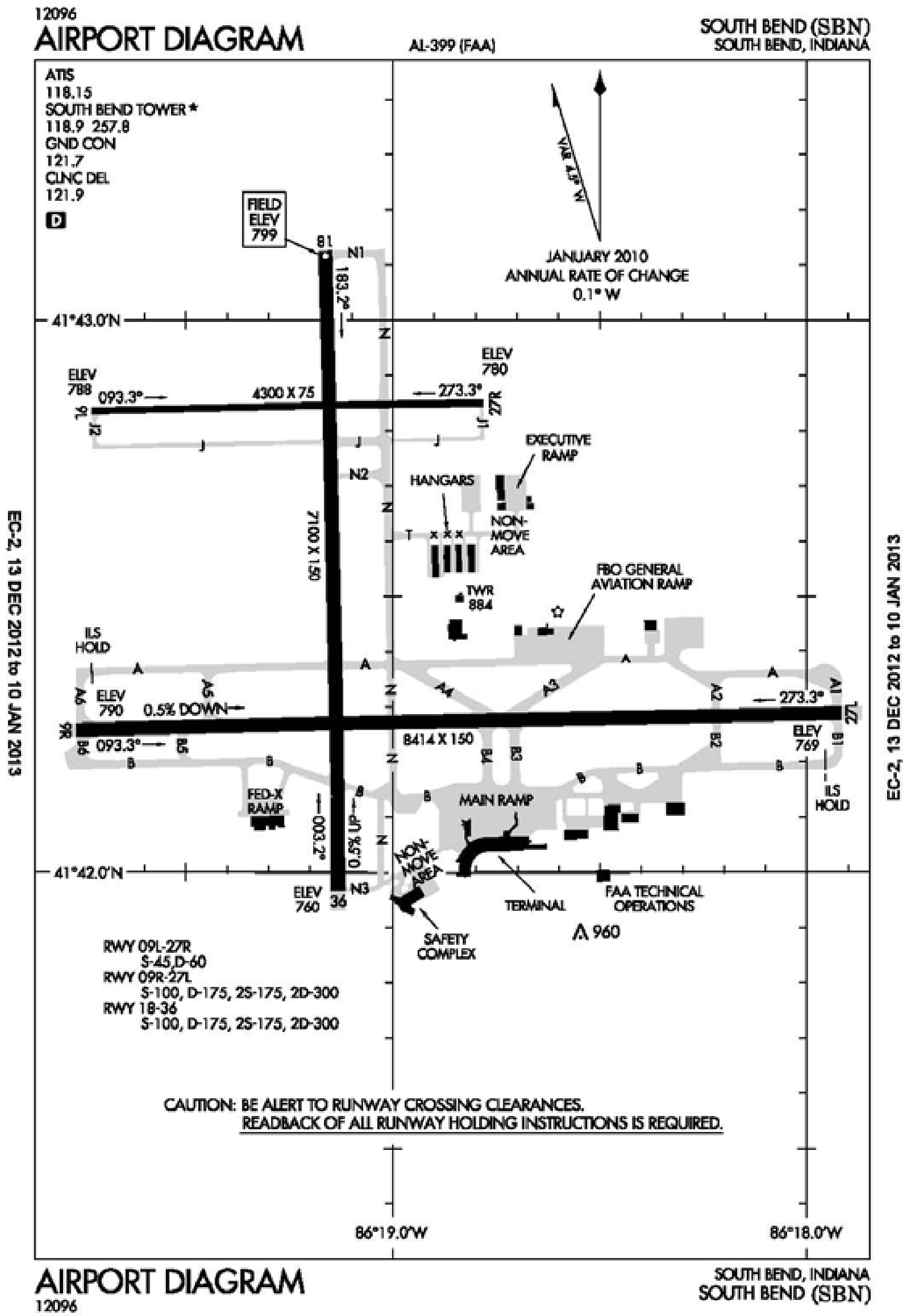


Figure M-15. South Bend Regional Airport

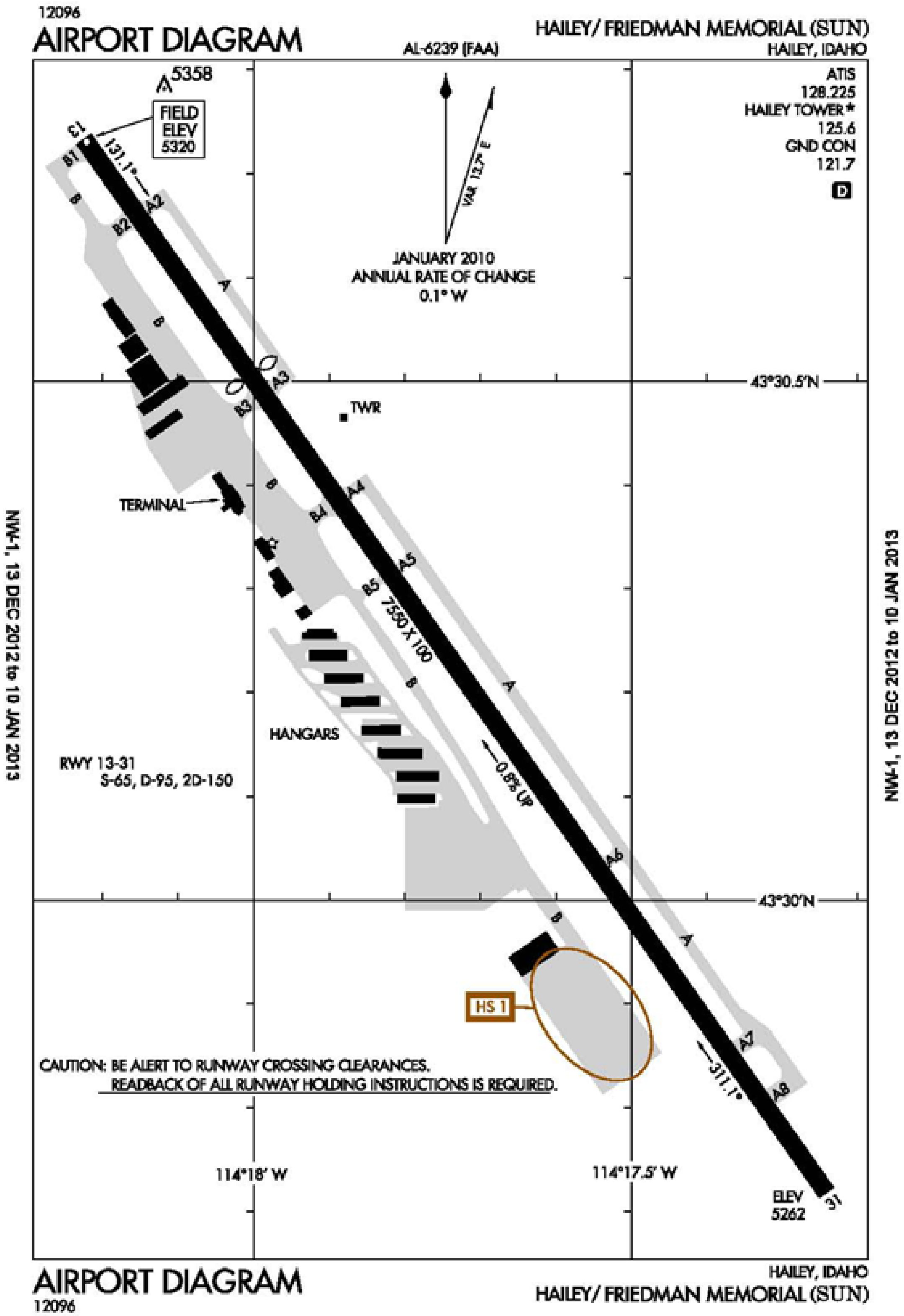


Figure M-16. Friedman Memorial Airport

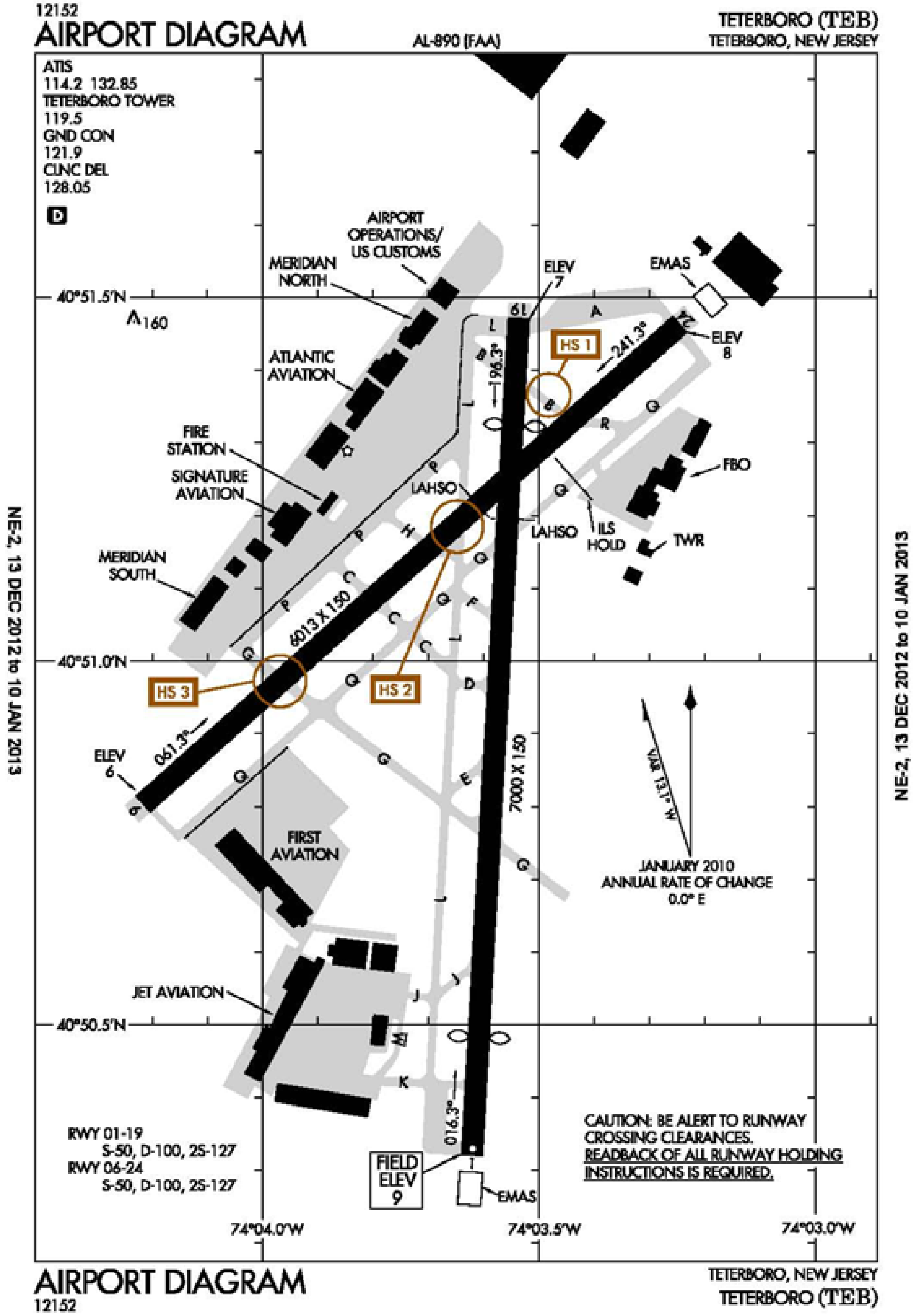


Figure M-17. Teterboro Airport

Runway Condition Report - Data Collection Sheet

Airport

Runway

Date

(24 hr) Local Time

Initials

Flight #

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

☐ 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)

"Matrix Report . . . _ _ _ Rwy _ _ _ __/__/__ _ _ _ (%) _ _ _ (inch) _ _ _ _ _ _ _ _ _ _ _

(Airport) (Rwy #) (Rwy Condition Codes) (% Coverage - 10, 25, 50, 75, or 100%) (Highest Depth only for Slush, Wet Snow or Dry Snow and Standing Water [Water 1/8 " or less report as WET with no depth]) (Contaminant Type [Report in terms in worksheet below, Water 1/8 " or less report as WET])

(Remarks to be transmitted)

"

(Date) (Time)

Misc. Data

°C Outside Air Temp

Active Precip? Yes or No

Adjusted Runway Condition Codes

(ONLY If Downgrade or Upgrade Assessments Used)

Requires an explanation in the comments section below

Rwy Treatment Used? Time Applied

☐ Sand ☐ Deicing Chem

Rwy Mu Before (if Applicable) After

☐ Decel

☐ CFME

1st 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) Depth Only for: Water, Slush, Wet Snow, Dry Snow, or Any Snow OVER Compacted Snow

Dry [6] Wet (Damp) [5] Frost [4] Below Min Friction Level Classification - Wet Slippery [3]

Water or Slush: GREATER Than 1/8" [2]

Slush: 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]

Dry or Wet Snow OVER Compacted Snow [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]

2nd 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) Depth Only for: Water, Slush, Wet Snow, Dry Snow, or Any Snow OVER Compacted Snow

Dry [6] Wet (Damp) [5] Frost [4] Below Min Friction Level Classification - Wet Slippery [3]

Water or Slush: GREATER Than 1/8" [2]

Slush: 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]

Dry or Wet Snow OVER Compacted Snow [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]

3rd 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) Depth Only for: Water, Slush, Wet Snow, Dry Snow, or Any Snow OVER Compacted Snow

Dry [6] Wet (Damp) [5] Frost [4] Below Min Friction Level Classification - Wet Slippery [3]

Water or Slush: GREATER Than 1/8" [2]

Slush: 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]

Dry or Wet Snow OVER Compacted Snow [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]

Pilot Braking Action Reports: Aircraft Type__________ **Braking Action Reported** __________________ **Time of Report**______________

Comments for Evaluation Team on Accuracy and Usability of the Matrix Reporting System ______________________________

Use reverse side if more space is needed.

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		-	Dry
5	• Wet (Includes water 1/8" or less and Damp) *1/8" or less depth of:* • Slush • Dry Snow • Wet Snow	40 or Higher	Braking deceleration is normal for the wheel braking effort applied. Directional control is normal.	Good
4	• Frost *-15°C and Colder outside air temperature:* • Compacted Snow	39	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	to	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	30 29 to	Brake deceleration and controllability is between Medium and Poor. Potential for hydroplaning exists.	Medium to Poor
1	• Ice [2]	21	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

[2]*In some circumstances, these runway surface conditions may not be as slippery as the runway condition code assigned by the Matrix. The airport operator may issue a higher runway condition code (but no higher than code 3) if Mu values greater than 40 are obtained on all three thirds of the runway 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 to a code 3 can only be applied to those runway conditions listed under code 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 -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.

(Comments or additional PIREPS)

				Contaminated										
Type	Dry	Wet (Damp)	Slippery When Wet - Rwy Below Friction Level Classification	Water (standing)	Slush		Dry Snow or Wet Snow		Frost	Compacted Snow		Dry Snow or Wet Snow OVER Compacted Snow	Ice	Wet Ice; Water OVER Compacted Snow; Dry Snow or Wet Snow OVER Ice
Depth	N/A	N/A	N/A	GREATER than 1/8"	1/8" or LESS	GREATER than 1/8"	1/8" or LESS	GREATER than 1/8"	N/A	N/A	N/A	N/A	N/A	N/A
Temp	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-15°C or COLDER	WARMER than -15°C	N/A	N/A	N/A
Rwy Code	6	5	3	2	5	2	5	3	4	4	3	3	1	0

APPENDIX O—NEW AIRPORT REPORT INSTRUCTIONS

Runway Condition Report - Data Collection Sheet

Instructions

These sections are very important to the data collection process. This information will be used to match the runway condition report to the pilot braking action reports. PLEASE write as clearly as possible, and Thank You!

Airport

Runway

Date

(24 hr) Local Time

Initials

Flight #

Airport – Record the three letter identifier for the reporting airport.
(Examples: ANC, CDV, KTN)

Runway – Record the runway number in the direction of takeoff and landing if it is known. (Examples: 27, 36, 24L, 6R)

Date – Record the month, date, and year using the format [mm/dd/yy or mm/dd/yyyy]. (Examples: 12/25/2010 or 12/25/2010)

Local Time – Record the local time using the 24 hour format (Examples: 0700, 1000, 1410, 1930). If you don't like using the 24 hour format, please record the time using AM or PM.

Initials – Record the initials of the person or persons making the runway assessment. This will ONLY be used to contact the person if something on the report is unclear or misunderstood.

Flight # - If known, record the specific flight number of an airline participating in this validation exercise, place the flight number in this block.
(Examples: ASA 64, DAL 675)

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

- ☐ **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)

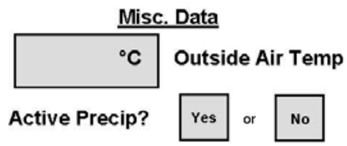
Portion of the Runway that is being maintained – In most cases this is the entire runway, full length and width.

However, if only a portion of the runway is being kept clear, maintained, or treated for takeoff and landings, it would be that portion that you would consider when answering this question.

For example, if only 60 ft either side of the runway centerline is being kept clear, maintained, or treated, then it would be only the 120 ft for the length that is being maintained that should be considered for this important question, the percentage of the contamination that is present. In these circumstances, you would not include the contamination percent of coverage, type of contaminate, or depth of contaminant of the remaining edges in the Matrix Report line. You would however report these conditions in the Remarks Section of the Matrix report (blue box). (Example: Runway cleared and chemically treated 60 ft. either side of the centerline, outer edges 1 inch wet snow).

Is the maintained portion more than 25% covered with standing water, contaminant or wet (damp) – This is not intended to be an exact measurement but your best judgment as to the percent coverage. If in doubt as to percentage of coverage, always err on the side of safety and report the higher percentage of contaminate coverage.

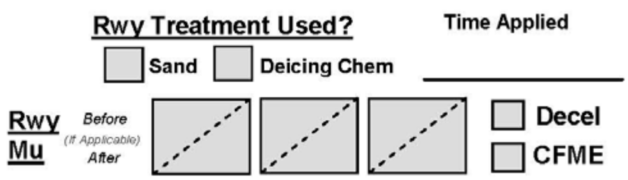
> **If YES** – Determine the appropriate runway condition codes for each third of the runway using the green boxes at the bottom of the airport condition report and then place those codes in the Matrix Report.
>
> **If NO** – Do not assign runway condition codes for any portion of the runway but fill out all other portions of the Matrix Report (blue box) using the Matrix contamination terms.



Outside Air Temperature (OAT) - Record the outside air temperature in °C degrees in this block. If you can not record in °C degrees, please indicate that you are using °F degrees This temperature will be used to:

- Determine if you should assign a runway condition code of 4 or 3 per the Matrix for Compacted Snow;
- Determine if Ice is wet or not
- Determine if you should downgrade a runway condition code for temperatures near freezing.

Active Precipitation – Check the appropriate box to indicate if any precipitation (light, moderate, or heavy) is falling or not while the runway condition assessment is being taken.



Rwy Treatment if Used – If no sanding or other runway chemical treatments were applied leave these two blocks blank. If sand and/or chemicals were used, check the appropriate box or boxes. Write in the approximate time that the sand/chemical treatment was applied to the runway; if it was on a previous day indicate the date as well.

Rwy Mu (Before/After) – If one Mu reading is taken (assuming it was taken on runway surface conditions for which the device may be used according to the device's manufacturer and FAA Advisory Circulars, the device is properly calibrated/maintained, and the operator is properly trained in the use of the device), record the Mu reading in each box for the applicable third of the runway, disregarding the diagonal line through the boxes. If sand or other runway deicing chemicals are applied and Mu readings were taken before this treatment and after this treatment, record the "*before*" Mu values in the upper left hand corner of the applicable boxes and the "*after*" Mu values in the lower right hand corner of the applicable boxes. If Mu readings are taken only after sanding or chemical treatment, place the values in the lower right hand corner of the applicable boxes and draw a line through the upper left hand portion of the boxes. Put a check mark or X in the applicable box to indicate if the Mu reading was taken with a decelerometer (Decel) or a Continuous Friction Measuring Device (CFME).

Runway Condition Code Worksheet

1st 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) Depth Only for: Water, Slush, Wet Snow, Dry Snow, or Any Snow OVER Compacted Snow

Dry	6	Wet (Damp)	5	Frost	4	Below Min Friction Level Classification - Wet Slippery	3

Water or Slush		Slush		Wet Snow or Dry Snow			
GREATER Than 1/8"	2	1/8" or LESS	5	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

Dry or Wet Snow OVER Compacted Snow: 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

Runway surface conditions are reported by thirds for each third of the runway starting in the direction of takeoff or landing. Therefore the first third is the one the aircraft is expected to touch down on, the second third is the middle section of the runway and the last third is the end of the runway that the aircraft rolls out on prior to turning off or around on the runway.

If runway condition codes are required to be reported, as per the decision made on the top of the airport reporting form, than treat each third of the runway independently for completing the green worksheet portion of the report. If all the contamination on that third of the runway is covering 25% or less of that third of the runway, report that third as a runway condition code of **6**. However the runway surface condition information should be reported in the remarks section of the Matrix Report.

> For example, if 10% of the first third of the runway was covered with ice it would be reported as a runway condition code of 6, but in the Remarks Section (blue box) of the Matrix Report it would be reported as "First third of runway 10% ice," or something similar.

Circle, check, or X, **all** of the applicable contaminant(s) present on the individual third of the runway surface (being maintained for takeoff and landing) that is greater than 25% coverage of that third of the runway. Place in the big gray box in the upper right hand corner of each runway third work sheet the **most restrictive** of the runway surface condition codes marked for that runway third that is covering greater than 25% of that runway third. The most restrictive will be the lowest numerical value in the boxes that were marked for that runway third.

If multiple contaminants are present and none alone is greater than 25% coverage but the total combined coverage exceeds 25% mark all forms of contamination present, The runway condition code should be based on your judgment as to which contaminant type will most likely be encountered by the aircraft during its takeoff and/or landing and its likely effect on the stopping ability of the aircraft. The operator should use all the assessment tools available to him in determining the condition code to assign for these mixed contaminate condition.

> **Note:** The "Below Min Friction Level Classification – Wet Slippery" – should only be assigned to a wet runway when more than 25% of the runway has failed to meet the required runway maintenance friction level as per current FAA guidance material. If 25% or less has failed to

meet the applicable friction level this should be published in the normal NOTAM system and the runway not assigned the "Wet Slippery" runway condition code.

If the initial code in the upper right hand corner for every runway third (dark gray box) on the worksheet is not downgraded or upgraded, copy it in the Matrix Report (following the arrows).

Circle, check, or X the highest depth of contamination for standing Water greater than 1/8 inch, Slush, Wet Snow, Dry Snow, and Wet Snow or Dry Snow OVER Compacted Snow for the contaminant(s) present in that runway third. This depth will be used along with the highest depth on the other two thirds of the runway to determine the contaminant depth to be reported in the Matrix Report.

Note: ***Compacted Snow*** *may include a mixture of snow and imbedded ice, if it is more ice than compacted snow it should be reported as ice.* ***Compacted Snow over Ice*** *is reported as Compacted Snow.* ***Frost****-Frost consists of ice crystals formed from airborne moisture that condenses on a surface whose temperature is below freezing. Frost differs from ice in that the frost crystals grow independently and therefore have a more granular texture. Heavy frost that has noticeable depth may have friction qualities similar to ice and downgrading the runway condition code accordingly should be considered. If driving a vehicle over the frost does not result in tire tracks down to bare pavement, the frost should be considered to have sufficient depth to consider a downgrade of the runway condition code.*

Adjusted Runway Condition Codes

Adjusted Runway Condition Codes

(ONLY If Downgrade or Upgrade Assessments Used)
Requires an explanation in the comments section below

Downgrading Runway Condition Codes

If conditions are worse than indicated by the initial runway condition code(s) from the green boxes, you should exercise prudent judgment and, if warranted, report a lower runway condition code. Use the shaded area in the Matrix called Downgrade Assessment Criteria (CFME/ deceleration devices, pilot reports, observations, and/or your experience with your airfield and runways). While pilot reports (PIREPs) of braking action provide valuable information, these reports rarely apply to the full length of the runway - they are limited to the specific sections of the runway surface in which wheel braking was applied. Likewise, Mu readings are only one of your tools and should not be the sole source for downgrading the runway condition code. If the runway condition code is downgraded please explain in the comment section of the airport report form what you used to make the downgrade decision.

> ***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 Matrix. At these temperatures, airport operators should exercise a heightened level of runway assessment, and should downgrade the runway condition code if appropriate.***

Upgrading Runway Condition Codes

In some circumstances, those runway surface conditions listed under condition codes of 0 and 1 (Ice, Wet Ice, Water OVER Compacted Snow, or Snow OVER Ice) *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) if:

1. **All observations, judgment, and vehicle braking action support the higher runway condition code, and**
2. Mu values **greater than 40 are obtained on all three thirds** of the runway by a properly operated and calibrated friction measuring device,
3. 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.
4. This ability to raise the reported runway condition code to **no higher than a code 3** can only be applied to those runway conditions listed under code 0 and 1 in the Matrix. (See the footnote number 2 on the Matrix)
5. 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.
    a. 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.
    b. If sand or other approved runway treatments are used to satisfy the requirements for issuing the higher runway condition code, the continued monitoring program must confirm continued effectiveness of the treatment.

If you assign a downgraded or upgraded runway condition code for the applicable third of the runway using the criteria specified above write the applicable adjusted condition code in each of the Adjusted Runway Condition Code boxes. These values should then be copied into the Matrix Report (following the arrows as indicated) and reported as the runway condition code assigned in that runway surface condition report.

Matrix Report

The idea behind the Matrix Report portion of the form is that it would serve as the collecting point for the runway assessment and place all the information in a format for dissemination as a Runway Surface Condition NOTAM when the NOTAM system is developed to support the Matrix reporting process. All of the information in this section is taken from other places on the form.

"Matrix Report . . . _ _ _ Rwy _ _ _ __/__/__ _ _ _ (%)

(Airport) Rwy #) Rwy Condition Codes) (% Coverage - 10, 25, 50, 75, or 100%)

Airport – Three letter identifier for the airport filing the report (i.e., JFK, BOS, ANC)

Rwy – Runway that the report is being provided for (i.e., 27, 36, 9R 10C)

Rwy Condition Codes – The code assigned per thirds of the runway in the large gray boxes in the Green boxes at the bottom of the page **unless** the downgrade/upgrade criteria was applied and the runway code was adjusted. <u>If codes were adjusted the Adjusted Runway Condition Codes</u> from the applicable boxes in the center of the form are placed in this space.

% Coverage – Report the percentage of the maintained portion of the total runway (all three thirds together) that is covered with standing water, other contaminants, or wet (damp). Report this coverage as either 10%, 25%, 50%, 75% or 100% of runway coverage. Use the following chart as an aid in determining what percentage to report. If in doubt as to which to report, always err on the side of safety and report the higher percentage.

0 to 10%	→	10%
11% to 25%	→	25%
26% to 50%	→	50%
51% to 75%	→	75%
75% to 100%	→	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])

(Contaminant Type [Report in terms in worksheet below, Water 1/8 " or less report as WET])

Inch – Report the highest depth of the contaminant on the total (all three thirds) maintained portion of the runway for the following contaminate types only;

Slush
Wet Snow or Dry Snow
Wet snow or Dry Snow OVER Compacted Snow
Standing Water (Water 1/8 inch or less is reported as WET without a depth)

For depths of 1 inch or less, report in the following increments;

1/8 inch
1/4 inch
1/2 inch
3/4 inch
1 inch

Note: *After 1 inch of accumulation, report additional accumulation in whole inches and discontinue the use of fractions. After a depth of 35 inches report the additional amounts in whole feet only. (AC 150/5200-28D)*

Contaminant Type - Report the **most predominant** contamination type on the maintained portion of the runway using the contamination terms provided on the worksheet portion of the runway condition report and listed below. Any additional contamination types and percentage of their coverage of the runway surface should be provided in the remarks section of the Matrix Report.

Wet (Water 1/8 inch or less of depth or damp)
Water (Greater than 1/8 inch in depth)
Slush
Wet Snow
Dry Snow
Compacted Snow
Dry Snow or Wet Snow OVER Compacted Snow
Frost
Ice
Wet Ice (Includes Water on top of Compacted Snow, Dry Snow or Wet Snow OVER Ice)

(Remarks to be transmitted) "

(Date) (Time)

Remarks – This section is a free text area to give you the ability to describe the runway surface conditions that are not clearly conveyed by the runway condition code, percentage of coverage, depth, and contaminant type. Other types of contaminant present, depth, and amount of coverage should be reported in this section along with width and length of the runway that is being maintained for takeoff and landing and any treatments that have been applied. Runway conditions outside of the portion that is being maintained for takeoff and landing should also be indicated in this section. Information on the surface condition of runway turnoffs and associate exit and entry taxiways should also be provided in this section if applicable to the safe operation on the runway for takeoff and landing. In the future NOTAM system these remarks would be transmitted via the NOTAM distribution system.

Date and Time – Record the date and time the runway was assessed, month, day, year and 24 hour local time format. (i.e. 10/20/2010 1430)

Pilot Braking Action Reports: Aircraft Type__________Braking Action Reported ____________________Time of Report__

Braking Action Reports - If a braking action report on the runway being reported in the assessment is received through any source within one hour of taking the runway assessment, to the extent possible report the aircraft type, braking action report received, and the time of the braking action report. If additional braking action reports are received within the hour please enter them on the back of the airport report form and indicate at the bottom of the page that additional information is on the reverse side of the form.

Comments for Evaluation Team on Accuracy and Usability of the Matrix Reporting System ____Use reverse sid

Comments - Please enter any and all comments that you would like to provide to the analysis team that would be helpful in the validation of the Matrix. Both negative and positive comments are encouraged along with personal opinions. Please include any information that may have affected the accuracy of the report or problems with completing the report form completely or accurately.

Please feel free to contact any member of the training team if you have any question.

Please mail completed forms to:

Nick Subbotin
FAA Technical Center
AJP-6311 Bldg 296
Atlantic City Int'l Airport, NJ 08405

9

Runway Condition Report - Data Collection Sheet

Airport

Runway

Date

(24 hr) Local Time

Initials

Flight #

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

☐ **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

- 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) Depth Only for: Water, Slush, Wet Snow, Dry Snow, or Any Snow OVER Compacted Snow

Dry 6 | Wet (Damp) 5 | Frost 4 | Below Min Friction Level Classification - Wet Slippery 3

Water or Slush: GREATER Than 1/8" 2 | Slush: 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 | Dry or Wet Snow OVER Compacted Snow 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

2nd 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) Depth Only for: Water, Slush, Wet Snow, Dry Snow, or Any Snow OVER Compacted Snow

Dry 6 | Wet (Damp) 5 | Frost 4 | Below Min Friction Level Classification - Wet Slippery 3

Water or Slush: GREATER Than 1/8" 2 | Slush: 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 | Dry or Wet Snow OVER Compacted Snow 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

3rd 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) Depth Only for: Water, Slush, Wet Snow, Dry Snow, or Any Snow OVER Compacted Snow

Dry 6 | Wet (Damp) 5 | Frost 4 | Below Min Friction Level Classification - Wet Slippery 3

Water or Slush: GREATER Than 1/8" 2 | Slush: 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 | Dry or Wet Snow OVER Compacted Snow 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

Misc. Data

°C Outside Air Temp

Active Precip? Yes or No

Adjusted Runway Condition Codes

(ONLY if Downgrade or Upgrade Assessments Used)

Requires an explanation in the comments section below

Rwy Treatment Used?

Time Applied

☐ Sand ☐ Deicing Chem ________

Rwy Mu — Before (if Applicable) / After

☐ Decel

☐ CFME

"Matrix Report . . . ___ Rwy___ __/__/__ ___ (%) ___ (inch) _______________

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

____

(Remarks to be transmitted)

____

____ "

(Date) (Time)

Pilot Braking Action Reports: Aircraft Type__________ Braking Action Reported __________________ Time of Report________________

Comments for Evaluation Team on Accuracy and Usability of the Matrix Reporting System ____

Use reverse side if more space is needed.

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		-	Dry
5	• Wet (Includes water 1/8" or less and Damp) *1/8" or less depth of:* • Slush • Dry Snow • Wet Snow	40 or Higher	Braking deceleration is normal for the wheel braking effort applied. Directional control is normal.	Good
4	• Frost *-15ºC 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 -15ºC 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

[2]*In some circumstances, these runway surface conditions may not be as slippery as the runway condition code assigned by the Matrix. The airport operator may issue a higher runway condition code (but no higher than code 3) if Mu values greater than 40 are obtained on all three thirds of the runway 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 to a code 3 can only be applied to those runway conditions listed under code 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 -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.

				Contaminated										
Type	Dry	Wet (Damp)	Slippery When Wet - Rwy Below Friction Level Classification	Water (standing)	Slush		Dry Snow or Wet Snow		Frost	Compacted Snow		Dry Snow or Wet Snow OVER Compacted Snow	Ice	Wet Ice; Water OVER Compacted Snow; Dry Snow or Wet Snow OVER Ice
Depth	N/A	N/A	N/A	GREATER than 1/8"	1/8" or LESS	GREATER than 1/8"	1/8" or LESS	GREATER than 1/8"	N/A	N/A	N/A	N/A	N/A	N/A
Temp	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-15°C or COLDER	WARMER than -15°C	N/A	N/A	N/A
Rwy Code	6	5	3	2	5	2	5	3	4	4	3	3	1	0

(Comments or additional PIREPS)

APPENDIX Q—AIRPORT SURVEY—YEAR 2

2010-2011 Winter Validation

Airport Feedback

Thank you for participating in the validation of the Runway Condition Matrix for a second year. The FAA greatly appreciates the effort you made again this winter! We are currently analyzing all the data that was collected at the 29 participating airports. We received over 2,000 airport report data sheets and several thousand pilot reports. The FAA will convene an industry group in the next few months to determine what changes might need to be made to the Runway Condition Matrix or the method for collecting contaminant data.

If you recall from your training and participation last year, one of our goals is to determine the Runway Condition Matrix usability for airport operators. We're asking that you complete a brief feedback sheet about using the Runway Condition Matrix this past winter. **Please be honest**, your experience and feedback is important for the analysis group in determining what changes are necessary to make runway condition reporting more timely and accurate which will provide a safer-operating system. Please have everyone who regularly used the Runway Condition Matrix complete a feedback form. The more input we receive the better analysis we can perform.

What is your Position/Title: ______________________________

What is your Airport Code: __________

Please indicate the level to which you agree with the following:

	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree
The training and information provided by the FAA were adequate.	❑	❑	❑	❑	❑
I was confused by the Runway Condition Matrix and reporting presented by the FAA.	❑	❑	❑	❑	❑
More time was needed during training to discuss the Runway Condition Matrix and reporting.	❑	❑	❑	❑	❑
Overall, the Airport Report Form was understandable and, with some use, easy to use.	❑	❑	❑	❑	❑
This year's Airport Report Form was easier to use than last year's report form.	❑	❑	❑	❑	❑
Determining the Runway Contaminant Type was easy.	❑	❑	❑	❑	❑
Determining the Runway Contaminant Type was easier than last year.	❑	❑	❑	❑	❑
Determining the Runway Contaminant Depth was easy.	❑	❑	❑	❑	❑
Determining the Runway Contaminant Depth was easier than last year.	❑	❑	❑	❑	❑
Determining the Runway Percent (%) Coverage was easy.	❑	❑	❑	❑	❑
Applying the Runway Percent (%) Coverage to determine when to give a code was easier this year than last year.	❑	❑	❑	❑	❑
Determining the Runway Condition Codes was easy. Example: 5/4/4	❑	❑	❑	❑	❑
Determining the Runway Condition Code was easier this year than last year.	❑	❑	❑	❑	❑
I understood how to downgrade the Runway Condition Codes.	❑	❑	❑	❑	❑
I understood how to upgrade the Runway Condition Codes.	❑	❑	❑	❑	❑

The upgrade process was too difficult.	❑	❑	❑	❑	❑
A checklist or flow chart would have helped in using the Runway Condition Matrix and determining the Runway Condition Codes.	❑	❑	❑	❑	❑
I understood what to record in the Remarks Section.	❑	❑	❑	❑	❑
I understood how to use the Runway Condition Matrix with multiple contaminants.	❑	❑	❑	❑	❑
It was easier to use the Matrix with multiple contaminants this year than last year.	❑	❑	❑	❑	❑
As I gained experience using the Airport Report Form, collecting the information became easier.	❑	❑	❑	❑	❑
As I gained experience, using the Runway Condition Matrix to determine the Runway Condition Codes became easier.	❑	❑	❑	❑	❑
Determining the Runway Condition Codes this year was easier than last year.	❑	❑	❑	❑	❑
The Runway Condition Codes represented the actual runway slipperiness.	❑	❑	❑	❑	❑
The Runway Condition Codes from this year's Matrix represented the actual runway slipperiness better than last year's version of the Matrix.	❑	❑	❑	❑	❑
The matrix method of reporting runway conditions is more accurate than our current method.	❑	❑	❑	❑	❑
Determining the Runway Condition Codes is too complicated to make it useable.	❑	❑	❑	❑	❑
I had a hard time determining the Runway Condition Code in the time between working on the runway and aircraft landing.	❑	❑	❑	❑	❑
I could determine the Runway Condition Code more quickly than I could last year.	❑	❑	❑	❑	❑
The Runway Condition Matrix method of reporting required more staff time compared to our current method.	❑	❑	❑	❑	❑
The Runway Condition Matrix and Code system is on the right track to improve airport winter operations.	❑	❑	❑	❑	❑

The most difficult thing about using this year's Runway Condition Matrix method was ______________________

____

____

____

____

The best thing about using this year's Runway Condition Matrix new method was ________________________

____

____

____

____

Were there any times of day or particular circumstances that made this year's Runway Condition Matrix method more difficult to use than other times? If so, please describe. ____

Did you use the upgrade process? What did you like about it or what did you dislike about it? ________________

Did anyone from your airport watch the training video on how to use the Runway Condition Matrix and Airport Condition Report? If so, was it an effective way to provide the training? ________________________________

Please add any additional comments you have about this year's Runway Condition Matrix. ____________________

Please add any additional comments you have about this year's Airport Report. ____________________________

How did using this year's revised Matrix and process compare to last year?________________________________

Please add any additional comments, feelings, or opinions you have about the winter validation and/or Runway Condition Matrix and reporting. ____

What suggested changes would you recommend to improve airport Winter Operations using either the current system or Condition Codes using Matrix system.____

Thank you again for your participation and feedback!

There are 3 options for returning your feedback form:

email your form to: susan.gardner@faa.gov

OR

fax your form to: Susan Gardner at 202-267-5383

OR

mail your form 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

APPENDIX R—AIRPORT SURVEY FEEDBACK—YEAR 2

2010-2011 Winter Validation

Airport Feedback

Please indicate the level to which you agree with the following:

		Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree	Blank	N/A
1.	The training and information provided by the FAA were adequate.	3	27	3	1	0		
2.	I was confused by the Runway Condition Matrix and reporting presented by the FAA.	0	5	6	18	5		
3.	More time was needed during training to discuss the Runway Condition Matrix and reporting.	0	9	8	16	1		
4.	Overall, the Airport Report Form was understandable and, with some use, easy to use.	3	23	1	7	0		
5.	This year's Airport Report Form was easier to use than last year's report form.	1	7	2	3	0		20
6.	Determining the Runway Contaminant Type was easy.	2	26	1	4	0	1	
7.	Determining the Runway Contaminant Type was easier than last year.	0	6	5	0	0	3	20
8.	Determining the Runway Contaminant Depth was easy.	1	28	2	3	0		
9.	Determining the Runway Contaminant Depth was easier than last year.	0	5	5	1	0	3	20
10.	Determining the Runway Percent (%) Coverage was easy.	0	17	4	12	1		
11.	Applying the Runway Percent (%) Coverage to determine when to give a code was easier this year than last year.	3	3	4	4	0	0	20
12.	Determining the Runway Condition Codes was easy. Example: 5/4/4	1	26	3	3	0	1	
13.	Determining the Runway Condition Code was easier this year than last year.	0	8	5	1	0	0	20
14.	I understood how to downgrade the Runway Condition Codes.	4	26	1	3	0		
15.	I understood how to upgrade the Runway Condition Codes.	4	27	0	3	0		
16.	The upgrade process was too difficult.	1	8	9	15	1		
17.	A checklist or flow chart would have helped in using the Runway Condition Matrix and determining the Runway Condition Codes.	2	13	10	7	2		
18.	I understood what to record in the Remarks Section.	2	30	0	2	0		
19.	I understood how to use the Runway Condition Matrix with multiple contaminants.	2	25	3	4	0		
20.	It was easier to use the Matrix with multiple contaminants this year than last year.	0	4	6	3	0	1	20
21.	As I gained experience using the Airport Report Form, collecting the information became easier.	4	23	5	2	0		
22.	As I gained experience, using the Runway Condition Matrix to determine the Runway Condition Codes became easier.	4	24	4	2	0		

23.	Determining the Runway Condition Codes this year was easier than last year.	0	8	6	0	0		20
24.	The Runway Condition Codes represented the actual runway slipperiness.	2	9	16	6	1		
25.	The Runway Condition Codes from this year's Matrix represented the actual runway slipperiness better than last year's version of the Matrix.	2	3	7	2	0		20
26.	The matrix method of reporting runway conditions is more accurate than our current method.	1	6	11	13	3		
27.	Determining the Runway Condition Codes is too complicated to make it useable.	1	6	9	16	1		
28.	I had a hard time determining the Runway Condition Code in the time between working on the runway and aircraft landing.	3	6	10	13	2		
29.	I could determine the Runway Condition Code more quickly than I could last year.	0	7	5	2	0		20
30.	The Runway Condition Matrix method of reporting required more staff time compared to our current method.	9	10	3	12	0		
31.	The Runway Condition Matrix and Code system is on the right track to improve airport winter operations.	5	11	9	7	1		

- Blue Ink indicates an airport operator that participated for the first time in Year 2.
- Dark Red Ink indicates an airport operator that participated both in Year 1 and Year 2.
- 10 airports did not provide any input.

33. The most difficult thing about using the Runway Condition Matrix method was	
	Getting used to something new and having an additional task to do in conjunction with NOTAMS etc. In know the blue box was the end result, but when you had basically wrote everything twice it made it less desirable and take longer. (Airport, Runway, Date, Time, etc was repeated on the form.) I know this would probably not be the case when it gets implemented.
	Buying in on the inability to upgrade further when the conditions warrant.
	Agreeing or understanding that the runway condition codes actually matched the condition on the runway.
	During a steady snow event it took too long in keeping up with airfield conditions.
	Retrieving information from multiple sources
	Additional staff time required. Forms had to be completed after the inspections were completed.
	It is time consuming and cumbersome.
	Determining percentages
	The amount of time required to complete the report.
	The time involved in paper work. The overall time was too long. I felt that time is a factor, and this method for me took too long to complete.
	The form was a little confusing at first.
	Determining percent coverage. An example includes how to report a runway that has 1/2" snow on the edges but is dry in the center 60' each side.
	Again, the matrix seemed overly conservative. This is going to result in airports losing operations due to the nature of this system. This was particularly noted when the surface was covered with ice or snow over ice and braking remained "good". The only way to recover from this situation would be to throw an excessive amount of chemical down to pull up the ice. This wouldn't do anything for safety, but only be done to satisfy the matrix and not have to report a 0/0/0.
	Nothing was difficult.
	Adapting to a new and different system while also continuing to issue NOTAMs in our traditional format.
	Remembering what contaminate correlated with what code number. As time went on it became more second nature but a quick reference card was essential.

	Downgrading at times. It was almost too much information to choose from. I also found the overlapping mu values (in Matrix) too confusing. Where as before it was more cut and dry.
	That the data collection sheet should start at the top of the page and go in order to the bottom.
	The amount of time required to fill out.
	The time to be able to fill the form out.
	Remembering to do one.
	Getting the updated information relayed in time during a snow event.
	Determining percentage of runway coverage.
	1. Double work. Love this system but feel it really needs to be integrated into existing processes & systems to be useful & wholeheartedly adopted. During a snow event, adding even one more distraction/system is a challenge to accurate reporting.
	Small boxes/numbers
	Still having to use the Griptester and supply the man hours to run and maintain it.
	Getting used to it the first few times, then it was a breeze.
	Nothing. Just getting used to the formula.
	Trying to use it during weather conditions right before the jet landed. Having to fill out the paperwork required too much time for Rural Airport types of operation. There is not a lot of time for an operator to clear the runway during snow removal operations and then have to fill out the matrix report and either fax it or deliver it to the airlines. Everything needs to become computerized and wireless to each airport can report and send runway conditions "on the go."
	Getting it done before a flight arrives; there are lots of times we are working right up till the aircraft lands.
	Blank (6 Responses)

34. The best thing about using the Runway Condition Matrix new method was	
	It is heading toward a standard that can be accepted amongst the airports and airlines through testing and collaboration. Relatively straight forward when you used it a few times.
	Once you used the form a few times it was fast & easy to fill in all the boxes.
	The amount of thought and effort put into the Matrix
	Field conditions were recorded on one report.
	I failed to find anything really useful compared to our current system.
	Easy to get runway condition code
	It has potential to be useful.
	Basic numbers to correlate with conditions.
	The ability to upgrade when you can use the decelerometer. However, considering we often have snow depths exceeding out decelerometer's limitations, this benefit was not realized as often as it was needed.
	Please let us know.
	Breaking the runway into thirds for more accurate reporting. The condition assessment tables on the back provide a good method to balance Mu values, PIREPS, and deceleration info.
	Most reporting was consistently the same which as time went on made reports easier to mentally process on the fly since it was almost the same as the last report.
	The segment codes. It broke down each segment of the runway. There were times when the compacted snow -15C or warmer and the new paved runway condition assessment table had me guessing weather or not to downgrade. Again the overlapping mu values vs. the temp made me unsure as to down grade or leave as is.
	I'm getting used to them more.
	You were able to determine if the matrix was needed to be filled out or not; example if the contaminants were less than 10% you didn't need to.
	Pilots weren't asking for them this year.
	It appeared all parties included had a bit more information on the form such as pilots, Alaska Airlines Dispatch, and tower.
	Less reliance upon friction measurements, however coordination & procedures (orders) updates w/ATO will be necessary to be successful in this endeavor. ATC gives a one word descriptor & Mu values to pilots - says it's policy.
	That the need of the temperature gun was omitted from the process.
	It was a simpler form and more clear. Upgrades were allowed.

	Left no room for misinterpretation. Rather than label everything as thin SIR the new method allowed a more concise description of the actual surface.
	The best thing about using this year's Runway Condition Matrix new method was using a different system to help the guys understand runway condition report from a different perspective.
	It shows your conditions throughout the year.
	None/No Opinion (3 Responses)
	Blank (10 Responses)

35. Were there any times of day or particular circumstances that made the Runway Condition Matrix method more difficult to use than other times? If so, please describe.	
	The fact that our airport closes overnight and we do the majority of our snow removal prior to the airport opening contributed to us not conducting many of these reports. We normally had the runway cleared by this time.
	Ice. When ice exists the Matrix does not accurately specify the runway condition.
	From Morning rush to late evening during a snow event.
	Yes, some instances made it difficult to report the matrix; when conditions were constantly changing, also additional paper work being filed.
	We tried to capture the data live when we had 2 people in the vehicle. There was some concern regarding the data collection form in a live event causing an opportunity to be head down to capture.
	Rapidly changing weather events.
	Night time
	No different than current method
	Changing conditions while aircraft is on approach.
	Yes, when aircraft requested updated conditions in a short tine frame
	It does take more time than simply taking Mu readings. High volume times are therefore more difficult.
	For my purposes all of my calculations were done at a desk after the storm. So it's not comparable to a field person doing the evaluation in the midst of a storm with everything going on. My expectation is this will be a very difficult learning curve to handle in a winter storm environment. After more experience, reporting becomes much easier.
	Yes, downgrading with mu, see above.
	Just that it took time away from my job and dewing regular NOTAMS.
	Not really; only if the conditions were changing fast.
	Especially during snow events and early morning when we were attempting to prepare the runway for first arrivals after a night of snow fall and or ice accumulation.
	It takes longer to use this form, keeping it updated when conditions are changing rapidly is difficult, the pilots seemed interested in current friction ratings.
	Sure - During snow events (see above) mot of this info is (or becomes) objective after entry & thus should be easily used in culling data for NOTAMS. Most often we have one person on duty assessing AND issuing NOTAMS - In later review/comparison between Matrix forms and issued NOTAMS, we would find that depths & widths, contaminants did not match (yikes!).
	During multiple jets combined with weather event; had to handwrite comments
	We found no real difficulty with the method or process other than the use of our Griptester as part of the validation.
	No, just events of rain or freezing
	Not really, we did ours at the end of the day.
	No or N/A (7 Responses)
	Blank (7 Responses)

36. Did you use the upgrade process? What did you like about it or what did you dislike about it?	
	Due to our lack of conditions requiring it we didn't use it. I think it is a good process from discussing it and examples.
	Yes. There need to be more flexibility to the upgrade process. A runway with a condition code of a 1 or 2 could & would be treated with sand and or de-ice fluid & drastically improve the braking action on that surface. Mu readings & pilot reports were .35-.40 & Fair to Good but the matrix doesn't allow to accurately show this.
	Yes, the good of it was preventing runway closures.
	Yes. Needs to be easier.

	Yes, you could not upgrade to 6/6/6
	Yes. Did not dislike anything. Although ice can be thicker than a thin layer.
	I liked the process. The only problem we ran into was wanting to upgrade 1 or 2 1/3's but not being able to.
	As I recall, the upgrade process never a circumstance we encountered or had to use.
	No, MSP did not experience any instances where a second friction run and/or upgrade was necessary.
	Yes. I didn't do a lot of upgrading, however, every time I can remember, it had to do with the fact that de-icer was used and conditions were improved as a result. It is my understanding that the pilots do not use de-icer as criteria for decisions on what they think breaking is however it is a very valuable tool and should have more weight in deciding the codes associated with the surface conditions.
	I like it; you were able [to] add the deicer and sand in the process; which in most cases would increase braking. That was nice to be able to do that.
	Yes, for sand etc.
	Yes, a few times. Sand actually helped the BA and gave a better picture of what the runway actually was.
	I used upgrade once or twice but only when certain the form wasn't accurately representing dry subarctic snow/frost conditions accurately.
	Yes, but the Nu's supported the sand application. We should have a box for sanded surface that allows a 3/3/3 instead of having to report ice/compact then upgrade. If Mu's don't support, you can always downgrade after that.
	Yes, we did, but again the task of having to support the upgrade with a Mu report complicated the process.
	Yes. The ability to provide an accurate rating. Use of sand is effective.
	It just simplified things and allowed some discretion.
	Yes, it was an improvement over last year's matrix, because some unique conditions cannot be report on the old form. The new upgrade system allowed us to report conditions more accurately.
	No, NA, Did not use, No Opinion (10 Responses)
	Blank (7 Responses)

37. Did anyone from your airport watch the training video on how to use the Runway Condition Matrix and Airport Condition Report? If so, was it an effective way to provide the training?	
	I think this is an effective form of training for certain things. [NOTE: They had on-site training.]
	Yes, the entire staff watched and it was very effective. I was surprised with how many other airports had difficulty with the form.
	Yes, training was possible after seeing the web broadcast.
	Yes. We completed the training in February. Overall the team learned the concepts fairly quickly.
	Yes, yes
	Yes, yes
	Yes
	Yes we did. I would have preferred training as a group and then had a webcast w/other groups for questions.
	Yes, in person would have been better.
	Yes. If it was more localized training, i.e., just one airport. With all the other airports involved at times it seemed to get off track. Limit the airport involved per session.
	Yes, it was all right.
	Excellent training. We were properly prepared to help provide you with accurate condition reporting.
	I believe we all watched it. The training was effective but a little too slow and drawn out. The examples at the end were the most helpful to me.
	Yes, it was helpful for me in that it was another source reinforcing the different criteria and reporting methods in the matrix.
	Yes, (three names were removed)
	Yes. I don't think we would have a clue how complete the form.
	Yes, I did and it helped.
	Yes. Having the guys out here for questions was more helpful though.
	Downloaded it but did not watch.
	It was ok.
	No, Don't remember watching, NA (11 Responses)

	Blank (5 Responses)

38. Please add any additional comments you have about the Runway Condition Matrix.	
	Relatively easy to use after we worked with it a few times.
	Consolidated condition reports to only numbers.
	Understood the matrix, but question what the gains would be.
	Just because you have ice on the runway does not mean that you have a one.
	Use of Mu's with a continuing plowing and sweeping process seems to me a much more effective and efficient way of runway condition reporting.
	Thin ice does not always mean poor friction. I understand there is the option for upgrade, but would be nice to go higher.
	Somewhat confusing and takes time.
	The matrix takes reporting to a much more general level. It appears that most winter operations receive a value of "3". If pilots are ok with this more general form of reporting as opposed to specific Mu values would be an important consideration.
	I am still a firm believer that the use of pavement temperature is not pertinent to the matrix. I do like the improvements to the way the temperature information was presented on the matrix report.
	The new runway condition matrix reporting will require additional competent persons to accurately execute.
	We wanted to know if the airlines would land if we had a 0 or 1?
	One thing I dislike is that Alaska Airlines does not give any, or little, credit to de-icing agents applied to the runway surface per the codes. For example code # will dictate the breaking i.e. Poor, fair etc, however sand or liquid deicer can dramatically improve actual numbers. (I upgraded codes in these cases although I had to spend extra time explaining in the comments.) Also runway mu #s at the time of landing since I think they are a more accurate representation of breaking at a specific time than code #s which seem to be more generic and not quite as accurate unless you specifically upgrade them.
	It was better than last year reporting.
	Matrix appeared easier to follow than last years.
	It's too complicated to keep up when conditions are changing.
	Great idea, good direction. Scalability to larger airports important.
	I think the numbers support the friction Mu's but the form still needs work. Need simple, but easy to read in a truck…at night. Computerized would be nice at some point. Touch screen.
	Just continue to tweak it and improve the tool. Simplify it.
	I think the past two years of testing has allowed all of us to take a look at better ways of condition reporting. Combining the Tapleys with the conditions and reporting runway conditions based off of that gives the most accurate reports available. I don't think it is good enough to make changes to the system we use now. At least not until funding becomes available to incorporate it into a remote wireless computer type system. Simple is still better until we can put all this into the computers.
	None (2 Responses)
	Blank (15 Responses)

39. Please add any additional comments you have about the Airport Report.	
	Compacted snow also has ice blended in, from the friction of the brooming/rotating bristles
	The form is fine.
	Blue Box should stay at the bottom of form.
	I would love to see something come out with the matrix allowing airports to opt not to report a contaminant if it covers less than 1% of the runway. A matrix report isn't generated as it stands now, but the airport is still required to report it.
	Through my experience in maintaining a very busy Class I Part 139 commercial service, GA small hub airport I have heard the following: Pilots on short final want clear and accurate information regarding braking action and runway condition reporting. Most pilots want to hear the last aircraft braking, i.e., Good, Fair, Poor, or Nil with current runway conditions and treatments. Keep it simple for pilots operating in adverse conditions.
	If we have less than 1/8 inch of wet or dry snow the condition code is easy to get, but would we list the maximum depth as 1/8 inch even though it is less? I know the goal is to eliminate the subjective thin depths.

	To make the data collection sheet more user friendly start at the top and work down to the bottom in order.
	If we had more options for condition changes.
	When things got busy, this form was the first to get dropped.
	We had another mild winter, so I don't know how much data really helped justify the project. Not that we want a bad winter…just don't know if we provided much input.
	The way the form was laid out made it a little difficult to fill out. I felt like I was searching back and forth on the form. It doesn't have an easy flow from the part of choosing the contaminant and depth.
	Wireless type Apple Notebooks designed for runway reporting should be given to all certificated airports. Runway layouts, lighting grids, a list of condition reporting, and room to improve and tweak each airports unique conditions should also be an option. In the long run this would save everyone time and money, especially if the NOTAM's went into a central NOTAM database where everyone had them available.
	None (2 Responses)
	Blank (22 Responses)

40. How did using this year's revised Matrix and process compare to last year?	
	It was easier, due to the improvements, but still required a lot more time than taking Mu readings. I question if there will be enough time to disseminate the report before an aircraft conducts an operation on the surface.
	About the same, but maybe a little more complicated due to the downgrade criteria overlapping in Mu values.
	It was a step by step process and better guidance than last year. At times the detail can overload the employees that worked on the matrix during the winter times with the workload.
	About the same, but I feel like I knew what information managers were after and it didn't seem as hard as the first year.
	Better
	Didn't use it last year personally.
	It appeared easier to use due to continuous use of the Matrix process and being more familiar with the process.
	It's slower, it duplicates info (the pilot has access to temp, weather, etc from other sources), friction readings are available from the Tapley report.
	It seemed easier mainly because this was our second year and we were more familiar with what was expected from our crew as part of the validation process.
	It was much better & easier to use.
	It was more user-friendly for all types of condition reporting, but I didn't think it was the right change needed for reporting conditions.
	N/A (21 Responses)
	Blank (4 Responses)

41. Please add any additional comments, feelings, or opinions you have about the winter validation and/or Runway Condition Matrix and reporting.	
	We had a late start this year being trained on how to do these reports and a lack of weather to conduct these. For our airport it would be nice to get buy in from the airlines so we can compare the results and see how it works for our system as a whole.
	I feel this system will help pilots determine there braking action on slippery surfaces no matter what's the size of the aircraft.
	There was some concern regarding accuracy as it pertains to when sand is applied. Both the operator and first lander's PIREP reported Braking Performance better than the matrix when sand is applied. Interestingly, in the same storm there were times when sand was NOT applied and the matrix information matched the first lander's PIREP of medium.
	Not sure or convinced this is the right direction to be going.
	We have not experienced any difficulty with the current reporting system and in interest of safety are committed to doing whatever is necessary to best all users.
	Overall the changes made from last year was quite helpful and good guidance.
	The more the process was used the easier it was to accomplish, however regardless of the Matrix reporting system, the pilots appeared to rely heavily on the Bowmonk Tapley numbers more than anything.
	Splitting the contaminant depth and type into 3 zones is irrelevant. If the runway has a slippery condition in one zone the tendency would be to evaluate the whole runway to that condition.
	Strongly feel it needs integrated into DDN & made more user-friendly. Great idea, just continue develop the program

	so it's not extra work. Make us work smarter, not harder - fewer mistakes this way.
	I hope we (aviation, FAA) continue this project and see it become an ICAO standard. It would really simplify things. Headed in right direction.
	We should have had this questionnaire closer to the end of our snow season. We would have been sharper on our memory of what was good and what was not so good with this process.
	Like I stated in an earlier comment, I do not think this is a good enough reporting system to change what is already in place. The system we use now is the most efficient for the tools we have to work with, as long as people are trained properly. I would like to see a system developed where everything is - touch screen and send. That simple.
	The current Reporting System that we have always used seems to work for us better than the coded system that Matrix uses.
	In my position, I never actually went out on the runway to report a condition. I did attend training and listened to the opinions of my airport managers. Most of my answers show "no opinion" because I didn't actually go out to check runway conditions. I did feel that the new forms were an improvement over last year's forms and that they were both equally user friendly. My airport managers can provide better feedback on some of your other questions.
	None (2 Responses)
	Blank (20 Responses)

42. What suggested changes would you recommend to improve airport Winter Operations using either the current system or Condition Codes using Matrix system.	
	Ability to upgrade higher than a 3 based on observations, experience, etc.
	Incorporate the matrix system through the RFT (Runway Friction Tester.
	Simplify for airports with limited staff - need something that's more timely.
	More education/training for pilots.
	Making a system wide method so that every airport uses. By using the Matrix or whatever as long as everyone is reporting the same way. Make reporting system computer based. Eliminated the paper to computer input. An app for smart phones would be nice.
	Allow upgrades and downgrades both directions from 6 to 1
	Regardless of the matrix, PIREPS are still going to be the controlling force for flight crews. The ability to upgrade or downgrade the reports, while helpful, brings the subjectivity back to the reports. My thought is if we are going back to a subjective approach, perhaps we should just stick to a language that our pilots understand and will rely upon anyway. Or continue to push for a decelerometer that will provide consistent results.
	Have Airport Operators provide Vehicle BRAX reports as Notams for Good, Fair (medium), Poor, or Nil. It seems to be the best understood by pilots in making their decision for operating safely.
	I think it is a new system and it will be hard to change to this system because no matter what the pilots will always have there own opinion on what we report no matter what we come up with.
	Providing as much information as possible referencing actual runway conditions. I believe is more beneficial than assigning a matrix number when it comes to information passed on to the flight crew.
	Please do not make the form such that we must pull & re-write the info in a manner that makes it easier to type or read to pilot. Go electronic & make redundancy obsolete.
	Box for "Sanded" surface rather than the "upgrade" process.
	Like I stated above, switching to an automated-computer type of system would be the best. It only makes sense with the way the world is evolving.
	If the Matrix System is used Good-Fair-Poor-Nil rather than 5-4-3-2-1 for reporting. It would be more user-friendly.
	None (3 Responses)
	Blank (19 Responses)

APPENDIX S—LIST OF INDUSTRY TEAM MEETING—YEAR 2

Name	Organization
Bruce Applebach	Gerald R. Ford International Airport
Chet Collett	Alaska Airlines
John Cowan	United Airlines
Bill de Groh	Air Line Pilots Association
Chuck Enders	Federal Aviation Administration (FAA) Flight Standards Service
Mark Gabel	FAA Northwest Mountain Region (ANM) Airport Safety Certification Inspector
John Gadzinski	Four Winds Consulting
Susan Gardner	FAA Office of Airport Safety and Standards—Safety and Operations
Paul Giesman	Boeing
Lars Kornstaedt	Airbus
Troy Larue	Alaska Department of Transportation (DOT)
Mitch Matheny	Pinnacle Airlines
Alberto Rodriguez	FAA Great Lakes Region Airport Safety Certification Inspector
Don Stimson	FAA Aviation Safety, Aircraft Certification Service
Nick Subbotin	FAA Airport Technology Research and Development Branch—Airport Safety Section
Lauren Vitagliano	SRA International
Bill Watson	FAA ANM Airports Division
Jeremy Worrall	Alaska DOT
Ray Zee	FAA Office of Airport Safety & Standards—Airport Engineering
David Anvid*	Delta Airlines
Joe Cimperman*	Flight Options, LLC
Thomas Dames*	Buffalo Niagara International Airport
Patty de la Bruere*	Juneau International Airport
Dick Marchi*	Airports Council International—North America
Roy Maxwell*	Delta Airlines
Paul Sichko*	Minneapolis-St. Paul International Airport
Tom Yager*	National Aeronautics and Space Administration (retired)

*Participated via teleconference

APPENDIX T—INDUSTRY TEAM MEETING NOTES—YEAR 2

Notes from Winter Validation Industry Meeting
24-25 August 2011
Seattle, Washington

The first day, Don Stimson (FAA Aircraft Certification) and Chuck Enders (FAA Flight Standards) welcomed the group, orchestrated introductions, and provided details on the facility. Susan Gardner (FAA Office of Airports) reviewed the three validation goals and presented a high level summary of the validation participants and their training. Nick Subbotin (FAA Airport Safety R&D), assisted by Lauren Vitagliano (SRA Int'l), presented the data collection process, how data verification and Matrix code validation was conducted and represented in the database, a summary of database tables and formats, and a summary of analysis conducted. Several ad hoc queries were done in response to attendee questions and requests. Susan Gardner (FAA Office of Airports) presented the results of the survey given to the participating airports. Next, Mitch Matheny from Pinnacle presented informal feedback on the validation, followed by Chet Collett presenting the Alaska Airlines perspective.

On the second day, discussion of the data continued. In addition, Don Stimson presented an update on where the TALPA project stands with respect to Rulemaking. Susan Gardner presented an update on work the Office of Airports has been doing with the NOTAM Office to move toward the TALPA way of reporting contaminants.

The entire presentation can be found on the Winter Validation website at
(no longer available). You must be using Internet Explorer to view the files. Firefox and other internet browsers will not work.

A list of meeting attendees is attached to these notes.

Data Discussion Items:

ACARS: The Alaska Airlines Aircraft Communications Addressing and Reporting System (ACARS) defaulted to "good" if a value was not selected by the pilot. "Dry" was not an option in their system. Alaska Airlines reminded their pilots around Christmas-time that they needed to select a braking action. If Chet saw a braking action that looked suspicious, he contacted the crew to find out what the braking action was and he corrected the forms before he sent them to Nick.

Pinnacle ACARS defaulted to "Good," and if it was worse, the crew had to select a different option. Pinnacle also started reminding their pilots to select a braking action in late December. Both Chet and Mitch said they would be fine with only considering "post-reminder" data in our analysis. For now, the FAA has not acted on this.

"Tweeners" and PIREP Terminology: Very few (282 of 20,867) of the braking action reports were reported as "Good to Medium" or "Medium to Poor," also referred to as "tweeners."

- Bill de Groh (ALPA) believes the paucity of the "tweener" data appears to support ALPA's position during the ARC that Good-to-Medium and Medium-to-Poor are performance levels too fine for pilots to discern.
- John Gadzinski (Four Winds Consulting) stated that he is not opposed to use of the "tweener" categories, but questioned whether the reliability of "tweener" reports is as good as the data appears to show.

- John Cowan (UAL) noted that he believed everyone understood that “tweener” PIREPs would be rare, and that the real value of the tweeners is to provide more granularity to the performance data (5 buckets vs. 3 buckets). With only 3 buckets, performance differences between the PIREP categories can be very large.
- Chet Collett (Alaska Airlines) felt that the correlated data in the table below (from the draft analysis report) illustrated the distribution of the use of “tweeners” was consistent with what might be expected based on how well the airports maintained the runways last season. He felt that the fact that there were more “Good to Medium” than “Medium” reports was a good test of whether or not the tweeners are able to be used by the pilots.
- Chet Collett (Alaska Airlines) –when you look at the correlated data in the table below, the distribution of the use of “tweeners” was consistent with what you might expect based on how well the airports maintained the runways last season. I found it very enlightening that there were more “Good to Medium’s” reported than “Mediums!” This is a much more accurate test of whether or not the tweeners are able to be used by the pilots. If you compare the number of tweeners to the whole data set, then yes, their use looks small. But when you look at the “tweeners” when the runways were really degraded (as indicated by the correlated data), then their use is commensurate with that you might expect based on runway conditions.

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

- John Gadzinski – The pilot today has no visibility to the system performance of his brakes and so is fundamentally unable to discriminate between aerodynamic deceleration and mechanical deceleration, especially above 60 knots. … The fact is that these pilot reports are themselves a condition that breeds a certain amount of error. For those of us in the lower 48 who only see snow 3-4 months out of the year, I am very hesitant to believe that braking reports in the “tweener” regions are going to be a valid source of hazard identification data. I’m not opposed to their use, but I’m a little hesitant to believe their reliability is going to be as good as some of this data makes them appear to be.
- Bill de Groh (ALPA) – The data appears to support ALPA’s position during the ARC that Good-to-Medium and Medium-to-Poor are performance levels too fine for pilots to discern.
- John Cowan (UAL)- I believe we all understood that it would be a rare event for pilots to provide tweener PIREPs and that was okay. The real value of the tweeners is to provide a greater spread of performance data based on the contaminant type/depth (5 buckets vs. 3 buckets). The tweener categories should continue to be used.
- No changes were made to the PIREP terminology.

<u>Mu and Upgrades</u>: There were multiple discussions about having the requirement for a Mu above 40 to upgrade the runway condition codes (RCC). In some cases the runway surface conditions and weather are outside the FAA Advisory Circular parameters for measuring Mu with continuous friction measuring equipment, even though other indications and experience of the airport operator indicate that the runway is better than a RCC of 0 or 1, leaving the airport unable to upgrade.

- Bill de Groh The fact that the airport cannot use CFME when conditions are outside the FAA AC requirements should not prevent the airports from upgrading the runway as long as “something” was done to the surface. An action taken to clean the surface makes a “new” surface that can be evaluated on its own merits.
- Chet Collett (Alaska Airlines)The problem that the airports deal with is they have snow over ice (Code 0), but they have sanded and plowed, but the snow on the ramp is outside of the CFME specs. They drive out on the runway, and if they had a Decel Mu device, the would be able to verify with Mu values above 40 that

they can upgrade to a Code 3, but if they do not have the Decel Mu, all they have is how the truck behaves. They were asking for the ability to upgrade based on all the tools available in their tool box, even though the CFME "tool" is not available.

Suggestions:

- The mandatory Mu requirement for upgrade should be removed and the airport should be able to rely on "all the tools in the toolbox" when deciding to upgrade the RCC.
- Lower the Mu requirement to lower than 40. The FAA could collect data for a few years and see what the data indicates.

Other Factors:

- Using a Mu value as a necessary parameter in the upgrade process appears to contradict the FAA's position that Mu is not valid enough to report to pilots.
- Bill de Groh (ALPA)This observation seems to support ALPA's concerns with allowing the use of Mu to upgrade runway conditions. At the time that compromise was made it was understood that no assessment would be made on Mu alone. This, and the fact that airport personnel are trained on using their particular device, may alleviate the apparent contradiction mentioned, since pilots aren't trained on the use and limitations of CFME/DEC
- Chet Collett (Alaska Airlines) This observation was made not to show there was a problem with the upgrade process. Upgrade data showed that when the rules were followed, most upgraded runways (Code 1 or 0 to a Code 3) were reported as Good. There were 34 cases where the aircraft would not have been able to land on a Code 1 (ice) runway, but because it was upgradeable to a Code 3 the aircraft successfully landed. Of the 17 correlated reports (within 60 minutes), 11 reported Good, 1 Good-to-Medium, and 4 reported Medium. Only two reports show a Pilot Braking Action less than Medium. I would say that validates the upgrade process.
- Chet Collett (Alaska Airlines) In all the data from corresponding reports, there were only 3 cases out of 1,012 when a runway would have been shut down because of an RCC of "0." There were 34 cases where the aircraft would not have been able to land on a Code 1 (ice) runway, but because with the upgrade to a Code 3, the aircraft could continue the landing. Of the 17 correlated reports (PIREP and runway condition report provided within 60 minutes of each other), 11 reported Good, 1 Good-to-Medium, and 4 reported Medium. Only two reports show a pilot braking action less than Medium.
- There is concern that if the FAA were to implement the Matrix with current upgrade procedure, it could lead to reduced capacity issues during certain conditions at some airports. However, having any upgrade procedure at all (which had not been included in the original TALPA ARC recommendations), helps to address concerns with capacity issues caused by conditions associated with poor or nil braking conditions.
- Bill de Groh - This has me concerned a little. I realize there are concerns that implementation may reduce capacity during slippery runway operations. However, we must also keep in mind that our task is the prevention of runway excursions due to contaminated runways. If this can be done without affecting capacity, great. But capacity should not be the driving factor. de Groh
- A Mu reading from a CFME is taken on just a narrow (3 inch) strip of the runway. A decelerometer only spot checks portions of the runway.
- Some airports wanted to allow upgrading RCCs other than 0 or 1.

Conclusion:

The RCC upgrade methodology was not changed. At this point there was not enough data to warrant a change to the "above 40" threshold. Don reminded the group that the methodology as it is now was a compromise.

Alaska Airlines and Pinnacle Pilot Training:
Alaska Airlines used a simulator for TALPA Validation training. Pinnacle used computer-based training for all annual recurrent pilot training as well as new hire and upgrade SIM scenarios that require use of the Matrix and contaminated landing assessments. All Alaska Airlines pilots were trained on the Matrix.

Where do we go from here?

Another Validation: At this point, there is no plan to have another winter of validation. Alaska DOT indicated they want to keep this fresh in their airports' minds. Alaska Airlines and Pinnacle will continue to use the Matrix. There was concern expressed that the validations hadn't included east coast high volume airports. They also did not include wide-body aircraft.

SAFO 06012
Since SAFO 06012 has expired, it would help to have it updated or reissued. That way the SAFO could be used as a way of getting the updated matrix into the flight community plus getting the basic TALPA ARC recommendations out "officially." This would also be a "hook" to get the manufacturers to move forward with a more comprehensive redo of their current operational data.

Data Collection Form: There was discussion of whether anything more needed to be done with the data collection sheet. It was decided that nothing further needed to be done since upon implementation of the Matrix an airport can collect the data however they choose to.

Airport Training Issues:
- Good quality, effective training will be the key to the success of the program.
- There was discussion of having some sort of certification for airport staff members that are "qualified" to determine the RCCs. Rules could be set up so that to report on certain weather conditions you would have to have a higher level of "qualification." Feedback from airport inspectors in the group was that it would never happen for several reasons based on current Part 139 and AC interpretation. Currently there isn't that type of "qualification" for ARFF, fueling etc.
- Training should be done during the winter in actual winter conditions.
- Leaving it up to airports to design their own training is not a good idea. It needs to be standard, at least to a certain level.
- There is likely to be pushback from airports if they are required to use an outside trainer or training package.

Possibilities for Airport Training:
- ACI and AAAE could develop training courses.
- FAA can specify the minimum necessary objectives and tasks just like those contained within the pilot certification Practical Test Standards.
- The FAA could set up a program to have "approved" vendors to offer the course.
- FAA produce a training DVD that could be sent to airport.
- FAA could have regional conferences to at least give airports, airlines, and private pilots a "heads-up" that this change is coming. Perhaps include some training.
- John Gadzinski (Four Winds Consulting) said he would draw up a proposal for Matrix training based on IFPA workshop.

Timing of Training:
- Once we target a winter for implementation, training should be conducted during the preceding winter.
- We should give airports a winter to practice using the matrix before implementing it.

Legal Questions:

- Under the voluntary scenario, does the fact that an air carrier voluntarily incorporates use of the Matrix into their Ops Spec mean they could be found in violation for not following the Matrix procedure? [Later conversations with our AGC member indicate that under those circumstances the carrier could be found in violation.]

Implementation:

- Phased Implementation: Could implement in phases in different ways:
  - by carrier
  - by airport
  - by first changing to Matrix terminology and then adding the RCC
- Concern that depending how we phase it, we could have reporting in two different formats.
- Some favored a "turn-on date."
- There was a suggestion to form an implementation committee to devise an Implementation Plan with members from ATA, pilot unions, other alphabet groups.
- Could airlines use the matrix without FAA approval?
- Concern about the small amount of Air Traffic participation so far.
- There is uncertainty how the SMS process will play into the implementation and whether there is a need for a "safety case(s)." How will it impact the implementation schedule?
- The FAA should continue to collect data even after the Matrix is rolled out. It could lead to tweaks in the Matrix, similar to Hold Over Tables are today.
- Concern that depending on how the implementation is phased, Mu could be taken away without replacing it with the codes. Some airlines have removed Mu from their training/performance documents, but others still have it.
- There was agreement that the Matrix and related TALPA changes should not be put on hold out of concern that it will never happen.
- Alaska Airlines and Pinnacle requested something in writing (perhaps an INFO) from the FAA stating that this is the direction the FAA is going to show that TALPA is going forward. Industry could use it to go to manufacturers to ask for the performance data. There is a concern that it will take years for manufacturers to decide to produce the performance data, and additional time to actually come up with the data.
- There was general support for revising and re-issuing SAFO 06012 in the short term.

Rulemaking:

Because of Congressionally mandated rulemaking that the FAA must do, TALPA rulemaking is 2-4 years away. The discussion centered on whether it would make sense to go ahead and do as much as the FAA could without rulemaking. One issue with rulemaking is the Cost-Benefit Analysis (CBA). Benefits really is equal to accidents avoided (fatal accidents), and in the U.S. we have few fatal injuries or hull losses, and are not allowed to used non-U.S. accidents. Therefore, there is the possibility that even with the rulemaking approach it may not make it past the CBA.

- A possible path is to put the Matrix in the AIM and have airports implement Matrix reporting. Allow carriers to voluntarily put use of the Matrix into their Ops Spec. Under this scenario, manufacturers would not have to provide the performance data.
- Concern was expressed over what would motivate carriers to adopt use of the Matrix. One advantage seen was the fact that it would do away with the requirement for 2 landing calculations required by Ops Specs C054 and C060.

- Concern expressed that the FAA would be seen as regulating via AC.
- Concern expressed that if the manufacturers don't provide the data, the airlines may have to perform their own calculations/translations and that may be more confusing.
- Consensus of the group was to go forward with the non-rulemaking approach.

NOTAM System:
AAS-300 has been working with the NOTAM office to incorporate TALPA changes. Currently, adoption of Matrix terminology is scheduled for implementation for the fall/winter of 2012.

- There was a discussion of what to report on taxiways and aprons since TALPA only dealt with runways. There was a proposal that airports only have to report taxiways as open or closed – if open, a pilot could assume it was usable. Bill de Groh is going to discuss this with other ALPA pilots. Another suggestion was to have ATC relay taxiway status, but that could be a workload issue.
- Discussion of having the NOTAM system determine the RCC based on what the airport enters for contaminant type, depth, and percentage.

Changes for the Matrix:
- Move Frost back to a code 5.
- Add supporting guidance for how to handle multiple contaminants (Jerry's Rule).
- Allow for upgrade of individual runway thirds.
- Add "Vehicle" to the beginning of the title of Column 4.
- Use "may be" in the Vehicle column, and add OR to indicate it could be either deceleration or directional control that causes the concern – it doesn't have to be both.
- Add definitions for layered contaminants.
- Add the rules for multiple contaminants.
- Delete box in upper right corner that says "Pilot Reports (PIREPs) Provided To ATC And Flight Dispatch"
- Delete "Dry" from PIREP column and replace with dashed line.
- Shade in the PIREP column (same gray as columns 3 and 4).

Actions:
- Update the 2006 SAFO 06012 - Chuck
- Let the TALPA ARC members know how we are going to proceed once a decision is made. (Attendees are at liberty to let people know the status of TALPA and let their opinions be known.) This will be relayed via email. - Don
- Develop an Implementation Plan – Working group

- Pursue NOTAM updates with the capacity to handle codes. - Susan
- Update and synchronize all documents. – all LOBs
- Develop a Condition Reporting AC that vendors could use to develop training. - AAS
- Write and publish Technical Notes of both validations. - Nick
- Bill de Groh to write an article for publication. - Bill
- Changes to Pavement Maintenance AC and NOTAM AC for Slippery when Wet. – Ray and Susan
- Determine if there is a need to fix the lowest range of Mu in the Matrix. Airbus expressed concern that the way the ranges are displayed now it looks like and airport could get a Mu value of 0 and still be able to give the code of 1. Possible solutions: move the “20 or lower” box so it doesn’t go into the Code 1 level so that if Mu is 20 or less it would definitely be a Code 0; put a lower numerical limit in the 20 or lower box; or move the “29 to 21” box so it is lower into level 0. – Don
- Come up with a name for the Matrix. – Working Group