Foreword

Leadership during an emergency event is most important. Winter events on airports are no less of an emergency and leadership; properly trained leaders are no less valuable. Preparing for, mitigating during and recover from these events requires airport operators to employ supervisors, managers and directors that have the knowledge and abilities to maintain a safe airport.

Is being safe the only measure of success? Efficient, operational, and meeting regulatory obligations are also important. The leaders can also be responsible for fiscal management of a winter event, progressive with the development of employees, aware of regulatory requirements, and constantly initiating improvements. This requires training just as maintaining the highest level of safety requires training.

The training and performance qualification for the individuals that are required to supervise, manage and direct the actual snow and ice control is absent in the industry. The members of International Aviation Snow Symposium Committee (IASS) recognized this vacancy. The IASS has been committed to providing relevant and focused training since the inception of the Symposium. The development of the Advanced Airport Winter Operations Specialist, an advance curriculum of the Snow Academy is the newest way to fulfill the winter operations training needs of airport leaders.

Preface

This Advanced Airport Winter Operations Specialist curriculum was developed by the IASS Academic Committee, with the support of the Northeast Chapter of the American Association Airport Executives, (NEC-AAAE) and the American Association Airport Executives (AAAE). This course is designed to provide airport supervisors, managers, and directors a stronger knowledge to operate a safe, efficient, and successful winter operations.

The information contained within this book is to provide each student sufficient knowledge that will prepare them for classroom lectures and discussions.

The information contained within this course was acquired through the review of FAA Advisory Circular (AC) 150/5210-20 Ground Vehicle Operations on Airports, AC 150/5200-30D Airport Field Condition Assessments and Winter Operations Safety, AC 150/5220-20 Airport Snow and Ice Control Equipment, FAA FAR part 139 Certification of Airports, the review of Airport Snow and Ice Control Plans, related Airport Cooperative Research Program (ACRP) reports and synthesis’, and from the actual experiences and knowledge of the members of the IASS Academic Committee.

This book is immediately useful as it includes regulated and currently acceptable practices. The members of the IASS Committee, the NEC-AAAE Executive Committee and the IASS Academic Committee are acknowledged on the previous page.
# Contents

Foreword........................................................................................................................................... i
Preface .................................................................................................................................................. i
Table of Contents............................................................................................................................... Error! Bookmark not defined.
Course Objectives ............................................................................................................................. 1

**Human Resource Module** .............................................................................................................. 3

Module Objectives ............................................................................................................................... 4
Safety ................................................................................................................................................... 4
Training ............................................................................................................................................... 5
Safety Management System (SMS) ..................................................................................................... 9
Summary ............................................................................................................................................ 20

**Airport Winter Safety and Operations** ........................................................................................... 21

Module Objective: ............................................................................................................................... 23
Snow and Ice Control Plan (SICP) .................................................................................................... 24
Initiating Snow Removal Operations ................................................................................................. 37
Letter of Agreement (LOA) ............................................................................................................... 70
Airport Certification Manual ........................................................................................................... 70

**Airport Funding: Bonds-Grants-AIP-PFC** ...................................................................................... 75

Module Objectives ............................................................................................................................... 76
Airport improvement program (AIP) ................................................................................................. 78
Funding Sources ................................................................................................................................. 79
National Plan of Integrated Airport Systems (NPIAS) ..................................................................... 80
Summary ............................................................................................................................................ 81

**Financial Impacts** ......................................................................................................................... 82

Financial Impacts ............................................................................................................................... 83
Event Report ...................................................................................................................................... 89
Reimbursements: ............................................................................................................................... 115
FEMA Documentations ................................................................................................................... 116
COURSE SUMMARY ......................................................................................................................... 125

**Works Cited** ................................................................................................................................ 126
Course Objectives
The Advanced Airport Winter Operations Specialist (AAWOS) will receive the advance knowledge of managing and leading safe and efficient winter operations of a FAR Part 139 certificated airport. The AAWOS will attain the advance knowledge of the regulatory and advisory guidance as provided within the Advisory Circular 150/5200-30d or current.

Upon completion the AAWOS will have the knowledge:
- To evaluate and implement human resource management skills.
- To recognize and implement proper training.
- Evaluate optional shift scheduling against performance and costs.
- To identify the important safety factors to be considered during the planning phase of a winter event.
- To build a Snow and Ice Control Team of employees with necessary skills and knowledge.
- Of all applicable regulations including but not limited to Advisory Circulars, FAR Part 139, and FAA Grant Assurances.
- To write and implement a Snow and Ice Control Plan that meets and exceeds the applicable regulations.
- To procure materials and equipment necessary for airport winter operations.
- Into the typical strategies and tactics used to leverage funds available for procurement of materials, equipment and facilities.
- Of how most local, state and federal systems work in the procurement of funds either through grants or reimbursements.
- Of the financial impacts of winter operations on the Airport Budget.
- Of required documentation and records used to evaluate planning, strategies and tactics as continuous process of improvement.
- To build a fleet of equipment utilizing; charts contained within the Advisory Circular 150/5220-20, Airport Snow and Ice Control Equipment, Snow Removal Equipment Calculator provided at the FAA website, or based solely on performance needs.
- Of the actual costs of the Human Resource.
- To compare actual costs for optional shift rotations, overtime procedures, temporary and seasonal employees, and the use of contracted snow removal.
- To compare the expenses related to hauling or melting snow.
- To compile all expenses related to mitigation of a winter event or season based upon records and projections.
Advanced Snow Academy

Human Resource Module
Objectives to Meet
The Human Resource Management Module presented in this AAWOS curriculum provides the students optional shift rotations and best management practices. We also learned to evaluate equipment operator rates and benefit factors. We also learned or will learn that we have overtime options, whether to pay 1.5 times regular rate or extend the rate to 2 times when hours exceed 16 consecutive.

It is important to recognize that differences in each scenario. Each scenario changes the number of personnel needed to fulfill the plan. These employees must be identified in the organizational chart outside of winter operations. As learned or will be learned in the Human Resource Management Module, these positions may be with Full-Time staff, Part-time, seasonal, temporary or contracted services. It is up to each Airport Operator to determine the benefits and detriments of each.

In each scenario the employees are subject to different terms of their work and break schedule. It is up to the Airport Operator, bargaining units and local jurisdictions to determine what break rotation and hours work is applicable and safe.

Module Objectives
Definition: The strategic planning and approach to the successful utilization of an organization's personnel.
Purpose: The purpose of this module to provide sufficient knowledge and skills for the successful utilization of personnel during winter operations with emphasis on training and shift scheduling.

This module shall also provide knowledge and awareness of personnel safety during winter weather events with strong emphasis on personal health, sleep deprivation, and stress.
Module Length: 1.5 to 2 hours.

Background
The value of Human Resources. Specific issues related to winter operations and airport human resources.

Safety
The safety of the airport, its customers and tenants are critical to the success of the airport. The FAA lists safety as a key objective for the airport’s operations and personnel at all times.

Personnel
According to the FAA 14 Code of Federal Regulation (CFR) Part 139.303, airport personnel should be equipped with proper resources and training in order to comply with the Airport Certification Manual. All airport personnel play a role in ensuring the airport operates safely for its employees, the passengers, the contractors and all those on the airport property.

**Training**

A key component of safety is proper training for airport personnel. The FAA lists training as a requirement in the CFR Part 139 Subpart D, Sections 303 Personnel and Section 313 Snow and Ice Control.

Overall safety is increased which is the first objective of training and education. The FAA requires that airports train all personnel who access the movement and safety areas. These personnel must be trained prior to the initial performance of any duties and at least once every 12 consecutive months. Training documentation must be kept updated.

The training must include the following:

1. Airport Familiarization, including airport marking, lighting and sign systems (139.311).
2. Procedures for access to, and operation in, movement areas and safety areas (139.329).
3. Airport communications, including radio communication between the air traffic control tower and personnel, and use of the common traffic advisory frequency at uncontrolled airfields.
4. Procedures for reporting unsafe airport conditions.
5. Duties required under the Airport Certification Manual (ACM) (to include Snow and Ice Control, and other applicable subject areas).
6. 139.319 Aircraft Rescue and Fire Fighting (ARFF): Operational Requirements (due to the depth of ARFF training and documentation, we recommend a separate records recording training in the 11-required subject areas for ARFF).
7. 139.321 Handling and storage of hazardous substances and materials.
8. 139.327 Self-inspection program (to include training in the following areas: Airport Emergency Plan; Notice to Airmen (NOTAM) notification procedures; and Discrepancy reporting procedures).
9. 139.329 Pedestrians and ground vehicles (due to the depth necessary for this training, we recommend additional records to document initial and recurrent training).
10. 139.337 Wildlife hazard management.
11. 139.339 Airport condition reporting.

FAA 14cfr Part 139, Section 303

During the winter season with snow and ice events, safe airport operations can be challenging. The Advisory Circular for Airport Winter Safety and Operations addresses the need for the airport to develop a Snow and Ice Control Plan (SICP) and train airport personnel on the SICP.
Although the training format can vary from airport to airport, the FAA recommends the programs contain at a minimum; the use of formal classroom lectures, training films if available and discussion periods to teach the contents of the SICP to individuals who need to understand procedures in detail.

The following are several types of training airport personnel could receive as part of their airport training program:

**Summer Training**
Snow removal skills training and operational briefings should not be limited to immediately prior to the winter season. Vehicle operators will benefit from off-season table-top exercises, operational briefings, and “dry-run” snow removal vehicle training sessions. The off-season timeframe will allow managers and operators the opportunity to experiment with new or revised strategies and tactics. The experiments can include changes to procedures or vehicle assignments. Summer training sessions may also provide an opportunity for key partners and stakeholders to ride along for the purposes of becoming more familiar with airport snow removal operations.

**Pre-Season Dry-Run Training**
Airports may conduct dry-run winter operations training in advance of the winter season. A simulated runway snow removal operation is coordinated with ATC, providing each agency with an opportunity for refresher training and re-familiarization of winter operations. A dry run provides the opportunity for air traffic controllers, airline personnel, and airport administrative staff to ride along with snow removal operators. The chance to ride in a snow removal vehicle on the airfield is appreciated and valued. Some airports take the dry run concept one step further by conducting a “snow rodeo,” where operators are put through a series of driving tests and obstacle courses. Certain airports score performance and present awards, often at a social event that immediately follows the rodeo.

**Formalized Annual Training**
Larger airports with available training resources have formalized annual, recurrent winter operations training for all appropriate internal employees. This level of training exceeds FAR Part 139 requirements, as not all participants have tasks identified in the ACM. Topics include SICP review, Surface Movement Guidance Control System (SMGCS) plan review, incident command, Snow Desk training, communications training, and other pertinent operational topics.

**Training for Contracted Personnel**
An in-depth training program is required for contracted personnel assigned to airside snow removal tasks. In addition to basic airport vehicle driver’s training, contracted personnel need to be educated on; the unique nature of the airport environment, hazards that are not encountered
at a normal job site and expectations, and desired snow removal methodology associated with working around aircraft.

Outside Stakeholder Involvement in Training
Airports may wish to provide familiarization training to Air Traffic Controllers (ATC), airline employees, FBO employees, and other tenant personnel to outline basic snow removal tactics, to identify equipment and its use, and to review areas of responsibility. The effort will likely enhance inter agency coordination and cooperation, as well as provide the opportunity to define snow removal goals and objectives. Airport personnel would also benefit from any reciprocal training and/or familiarization programs made available by key airport partners.

Stakeholder Ride-Along
Some airports provide stakeholders with the opportunity to ride along with snow removal teams. The experience should not be a quick orientation, but a full shift on the airfield. The experience will educate stakeholder personnel on the difficulty and hazards experienced by the snow removal equipment operators. This can facilitate an understanding of and an appreciation for the snow team’s efforts that will pay off with more cooperative interaction between the airport and its tenants. Additionally, stakeholders may enjoy and benefit from the opportunity to participate in “dry-run” snow removal training sessions.

Sleep Disorder Training
Airports should provide snow removal crews with sleep disorder training and circadian rhythm training. Online training and printed materials are readily available. This training will allow employees to recognize the symptoms of fatigue and the pre-event personal activities that could lead to fatigue on the job.

Training on Human Performance Factors and Situational Awareness
Airport operators should provide snow removal personnel with training and presentations on human performance factors and situational awareness. Training leads to safer outcomes. An overwhelming number of aircraft accidents and airport incidents have been attributed to the loss of situational awareness. Vehicle operators need to be reminded to slow down and add following distance when operating on contaminated surfaces and when operating in reduced visibility. Operators should be trained to avoid vehicle operation when fatigued and to immediately report the condition to a supervisor or manager. Snow removal related vehicle accidents can occur during clean-up operations when less stressful conditions lull a driver into a false sense of security.

Airport operators should maximize crew rest periods. Clean-up operations should be based on the next forecasted snow event and not be in any rush to complete that work as soon as possible.
Airports with a safety or risk management function may wish to consider inviting a representative of that department to act as a safety officer during weather events, observing operations from a supervisory or lead vehicle.

**Radio Communications Procedures**

It is imperative to train vehicle operators on proper radio communications procedures. Operators should be proficient in operating the type of radios installed in their vehicles. Proper radio communication protocols should be included in a vehicle driver’s training program. Assigned channels or frequencies need to be clearly delineated with a requirement that vehicle operators monitor assigned frequencies. A radio’s scan function leads to distractions and, therefore, its use should be prohibited. Radio transmissions should be strictly limited to safety- or business-related calls only; idle chatter should be prohibited. Airport operators may wish to consider the recording of critical radio channels for incident review and future training.

**Radio Frequencies**

Vehicle operators should be trained to have working knowledge of all ATC frequencies used on the airport. At minimum, a list of air traffic positions and assigned radio frequencies should be available in all vehicles. ATC assigns frequencies by type of surface (runway or taxiway), by geographical area, and by task (e.g., metering or clearance delivery). Persons assigned to communicate with ATC must know the correct radio frequency associated with the specific movement area surface. It is highly recommended that communications associated with runway operations be conducted on the appropriate local control or tower frequency. Communications related to taxiway operations should be broadcast on the appropriate ground control frequency. Procedures should be identified in the Letter of Agreement (LOA) with ATC, including the identification of an emergency telephone number in the event of radio communication failure.

**Vehicle-Specific Training**

Develop a comprehensive and practical training program for each vehicle in the fleet. Ensure that personnel have adequate training on each piece of equipment they are expected to operate. An appropriate amount of behind-the-book and behind the-wheel training is necessary in order for safe operation. Almost every piece of SRE is equipped with dual-operator cab seats, which facilitate training with an experienced operator on board. Simulator training may be of benefit for airport driver’s training and airport familiarization, but an operator will need to learn the handling characteristics of a particular vehicle. For instance, most airports operating multi-function vehicles noted the need for extended training periods due to the size, weight, and unique design of the equipment. The training program should identify standards that must be met before an employee is allowed to operate a vehicle on his or her own. Completion of training is documented in writing by management. An airport’s vehicle training program should include annual, recurrent training with an associated competency evaluation for each piece of equipment an employee is expected to operate. Airports that implemented a formal vehicle certification program reported reduced accident rates.
Web-Based Training Services
Airports with a high demand for winter operations training utilize web-based training services and, at a few airports, are utilizing a vehicle training simulator. Each option can generate an on-demand winter environment for training purposes. Airports that operate a simulator reported a number of employees experienced motion sickness while training in a full-environment simulator. Video game consoles were deployed to offset this problem and to train employees who were unable to participate in simulator training.

Field Maintenance Personnel Training
FAR Part 139.303 requires airport personnel with ACM compliance duties to complete annual, recurrent training. Due to assigned ACM compliance duties, operations personnel experience a higher volume of training than maintenance personnel. In an effort to increase proficiency and awareness of ACM compliance duties, airports have offered field maintenance personnel the opportunity to take training classes above the level required of their job duties.

Snow Desk Training
Airports that establish an Incident Command Position (ICP) or operate a Snow Desk during a winter event should conduct annual, recurrent training for airport staff and tenant representatives who are routinely assigned to those facilities. Off-season table-top exercises offer excellent training opportunities. Individuals assigned to an ICP or Snow Desk may benefit from National Incident Management System (NIMS) training, especially if NIMS procedures are used in snow removal operations. Various online courses are available from the Department of Homeland Security or Federal Emergency Management Agency: http://training.fema.gov/IS/NIMS.aspx.

Safety Management System (SMS)
The importance of aviation safety and safe operations continues to increase as air transportation continues to grow. Adopting new measures such as a Safety Management Systems (SMS) help in this effort.

“According to FAA AC 150/5200-37 (2007), (1) SMS is “the formal, top-down business-like approach to managing safety risk. It includes systematic procedures, practices, and policies for the management of safety (including safety risk management, safety policy, safety assurance, and safety promotion). SMS is a tool to translate an organization’s concerns about safety into effective actions to mitigate hazards. It is a documented system that encompasses the following:

• A safety policy incorporating responsibilities for everyone working at the airport and the airport’s safety objectives

• Effective decision tools for managers when dealing with safety issues
• A program for identifying training needs, training, assessing competency, and keeping records of training performed

• A framework for involving employees in the management of safety

• The collection, analysis, and reporting of safety performance data

• The identification of hazards in the airport

• The assessment of the risk that the hazards identified pose to airport activities

• The elimination or control of identified risks

• An evaluation of the effectiveness of control measures

• Arrangements for emergency preparedness and response

• Arrangements to improve safety awareness and to promote safety

• Documentation of meetings, decisions, actions, and other SMS-related activities or processes

• Systems for monitoring the safety performance of the airport

• Systems for the reporting and investigating accidents/incidents

• Processes that elevate safety reporting and safety decision making to top management levels of the organization

• Other aspects common to management systems, such as safety committees, document and records control, internal auditing, and management review meetings”

TRB ACRP Report 1 Safety Management Systems, Volume 2: Guidebook

SMS are designed to help airport avoid aircraft accidents and incidents by helping airports detect and correct problems before they occur. SMS is also designed to provide management with the ability to deal effectively with accidents and near misses so that valuable lessons are applied to improve safety and efficiency.

Once airport management chooses to use an SMS, it is important that airport personnel receive training so they are familiar with the airport’s SMS.

Training methods airports may choose to include are seminars, American Association of Airport Executives Certified Member (AAAE CM), Airport Certified Employee Program (ACE) Professional Development Courses, Critical Thinking and hands-on training at the airport.
Safety and training are the keys to the successful operation and the well-being of the airport, its personnel, the customers, passengers, and tenants of the airport.

The airport will remain open during a winter storm event because of proper personnel training, education and implementing their policies and procedures, such as SMS, thus benefitting the tenants and passengers financially by continuing normal operations, not cancelling flights, and to accepting diverted flight from other airports. Tenants including; airlines, cargo carriers, car rental agencies, concessions and the airport’s parking garages/lots will continue to generate income too when the airport remains open.

Efficient operations also contributes to the economy of the surrounding community by on time cargo services, passenger movements, mail, hotels, restaurants, shuttle services, etc. This also means that businesses benefitting by an open airport allows their employees to travel across the country in a timely manner. Businesses that are looking at relocation or developing manufacturing facilities always consider the airport reliability, viability in the community and effectiveness for remaining safely open during winter months.

**Lack of Safety Impacts**
The airport can recognize significant benefits from operational efficiencies when the personnel operate safely. The lack of safety also has many impacts on the airport and its personnel.

When airport personnel do not follow the implemented procedures such as the SICP and SMS or if personnel are not proper trained, safety is reduced. Any reduction in safety could lead to incursions, accidents and airport closures.

**Costs**
The costs to the airport can include equipment repair expenses, lost revenue from runway or airport closures. The costs can also include increased costs for personnel time and workman’s compensation claims due to an incursion or accident.

Employees having properly designed and strategically assigned equipment with sufficient training, will feel confidence in their ability to perform their job or make decisions.

The lack of safety can impact the ATCT and their confidence in the airport personnel performing the snow removal and other operations on the airfield. This could result in increased time necessary for clearing runways and taxiways, which may cause delayed or cancelled flights.

The lack of safety can also cause budgetary concerns for future years due to the disruption, expense and impact on the airport’s current business activity.

The lack of safety during winter operations negatively impacts airport personnel, operations, tenants and customers. Proper safety is the key for efficient and affective airport operations.
Health
The health and well-being of airport personnel have a significant impact on airport safety. Managing staffing levels during snow and ice events is key to the health and well-being of the employees and to the safety of the airport’s operations.

Human Factors
The health and well-being of the airport’s staff during a winter event will impact the safety of the operation. This must be taken into consideration. The fatigue and situational awareness of equipment operators during an event are causes of incursions and reduces safety. The amount of time between breaks, food, and proper rest are all things that have to be addressed for the well-being of the staff and for safe operations.

Sleep impacts your physical and mental health. We all know we need sleep and the right amount of sleep each person needs varies. Adults need between seven to nine hours of sleep a night. Sleep is a fundamental activity every human needs.

Many studies have been done about sleep deprivation. We know sleep deprivation causes accidents and in some cases serious accidents. Some of the most notable were the 1979 nuclear accident at Three Mile Island, The oil spill from Exxon Valdez, and the 1986 nuclear meltdown at Chernobyl. Every day we see accidents on the road because of drowsiness. In some studies they are seeing lack of sleep can impair driving more than drunk driving.

Lack of sleep over time can impact all aspects of your life, such as aging your skin, depression, forgetfulness, memory problems, loss of judgment, reduced creativity, problem solving skills, reduced immunity to colds and infections, obesity and increase your risk of death. These are only a few of the consequences of lack of sleep. It is not possible to make up for lost sleep, although it might help part of the sleep loss. A person needs to have a sleep-wake cycle that accommodates the seven to nine hours of sleep needed in a day.

As you go through the process of scheduling full and part time staff, it is important to keep in mind how much time they will have to sleep. How long does it take them to commute or whether they stay on site, and have a comfortable location to get in at least seven hours of sleep. It is just as important to schedule sleep time for yourself and the supervising staff.

Advanced Scheduling and Overnight Accommodations
Manage human performance factors by scheduling employees for snow removal duty as far in advance as possible, by providing food and beverages, and accommodations for rest or sleep. Locker rooms, shower facilities, and kitchen facilities are necessary to support on-airport sleeping quarters. Airports may consider agreements with local hotels to provide staff with sleeping facilities during extended snow events. Sleeping quarters and nearby sleeping arrangements may be of value when operating rotating shifts. Difficult travel conditions may prevent crew members from returning to the airport for their next shift. Keeping personnel
nearby during work breaks ensures maximum crew availability. The availability of onsite or nearby sleeping facilities enhances safety by immediately addressing crew fatigue.

**Distractions**

Vehicle operators need an environment free of distractions in order to more safely operate under stressful conditions. Most airport operators will follow applicable state laws regarding the use of personal electronic devices (e.g., cell phones, MP3 players) while operating a vehicle. However, due to the dangers inherent with operating a vehicle in the airport environment, most airport operators impose additional restrictions. The use of personal electronic devices while conducting snow removal operations is usually either prohibited or severely restricted. Some airport operators have an “anytime and anywhere” restriction while a vehicle is in motion, while other airports prohibit the devices only while conducting snow removal operations on Aircraft Movement Area (AOA) surfaces or in aircraft parking areas. Cell phone use is usually permitted in a stationary vehicle. Airport operators can counter an employee claim of the need to be available for family emergency calls by publishing a 24/7 emergency contact telephone number and requiring its use instead of personal cell phones. Multiple radio frequencies can also be a distraction. The majority of airport operators restrict radio use to two frequencies—an internal company frequency and an appropriate ATC ground control frequency. The use of AM/FM radios is usually prohibited.

**Provisions for Breaks and Food**

Airport operators need to pay special attention to human performance factors in preparing for winter operations. A large volume of subject matter material is available for review and reference. Training is available. Airport operators need to provide for basic human needs to support snow removal operations. The provision of food, beverages, and comfortable rest/break facilities has a positive effect on crew morale and crew performance. It is important to keep crews rested and alert during extended storms. Crews need to be given routine breaks or be empowered to take breaks as conditions allow. Some airports establish a maximum amount of time an operator can be at the controls of a vehicle. Studies have proven the advantages of short, 10 to 15 minute naps. Crews should be encouraged to take advantage of available breaks and take a quick nap in a vehicle while parked in a safe location. Personnel cannot be expected to maintain continuous operations. The onset of fatigue leads to complacency, errors, and accidents. Personnel should be trained to immediately report to a supervisor or manager when fatigue begins to affect their performance.
**Staffing Levels**

Proper staffing levels are always a primary consideration, especially during a snow and ice event. The airport’s Snow & Ice Control Plan should address staffing level protocols and airport personnel need to know and understand the SICP prior to the winter season. The staffing level should be based on the total Priority 1 paved area that is cleared of snow, slush or ice within the recommended clearance times.

“Just enough is not enough.” In the Fire Service there is a sector called staging. This is where additional human and equipment resources are “staged” during an emergency to be available if the emergency deteriorates. This concept should be employed for snow and ice control events. There should be additional resources “staged” and available if the airfield conditions deteriorate. Just enough on duty staff is not enough. Other emergencies can happen while mitigating the weather event.

*Designated Snow Boss or Incident Commander*

Under NIMS Incident Command protocols, a designated incident commander is the final authority regarding decisions at an incident scene. Snow removal operations benefit from the same principle. One individual should be designated as the Incident Commander or Snow Boss, with responsibility for implementation of the snow plan. Delegation of authority is a key element of incident command.

Effective Snow Bosses delegate decision-making authority as appropriate to managers and supervisors. Airports have reported success in designating an individual to a liaison position to assist the Incident Commander with communications during an event. Multiple persons should be trained for the role of Snow Boss or Incident Commander to facilitate rotating shifts. NIMS protocols recommend that at least three persons be trained for each position within the incident command system.

Due to the timing and critical nature of winter storms, the ability of many to make decisions is critical to the success of any operation. Attached is an example of a flow chart that represents the many levels of a winter operation:
With this many “buckets” it can be somewhat confusing if everyone had to wait for someone to give them authority to do their job. Each “bucket” has a leader that is in charge of that group. Everyone is communicating with each other so that the operation works out well. It is important to have a plan in place and it is communicated to everyone prior to the start of the winter season.

The airport’s SICP should address the staffing needs and protocols so all winter operations personnel know who will be making decisions such as spend money and apply Chemical or Sand, or closure of surfaces or entire airport.

The number of staff needed for a weather event depends on several factors. The amount of precipitation is one factor. Other factors that need to be considered are utility problems, sickness, special events, holidays, etc. They can all be factors other than snow that can make the amount of staff you have on hand critical to the success of the operation.

In addition to operators, other staff includes mechanics, welders, and HVAC personnel that may be needed for winter ops events. Many times we forget that these duties play a very important role in helping keep an airport operational in a snow event.
The weather event warrants the use of different staffing levels. Utilizing on-duty or having staff standing by for an event should be considered. Light events may require fewer people to make sure the airport is open and operating safely. Other events that have more snow/ice could dictate more staff and resources. The airport’s Snow and Ice Control Plan should address the staffing levels based on the event and the condition level, as well as shift duration.

**Shift Rotation**

The use of shift rotations during the winter season and specifically during a snow and ice event is a key tool for managing the health and well-being of airport staff and increasing the safety of airport operations.

**Scheduling and Shift Management**

There is no one-size-fits-all approach to crew scheduling. An in-depth analysis of all options should be conducted to evaluate 6-hour, 8-hour, 12-hour, or around-the-clock crew scheduling. Procedures for crew scheduling and call-back to the airport should be outlined in the SICP.

There are several types of shift rotation an airport can utilize. Types of shift rotation include: 4, 6, 8 or 12 hours On and 4, 6, 8 or 12 hours Off Approach; A/B/C Team Approach; and “All In” Approach until the event is complete.

Factors that determine which staffing approach is taken include size of the airport, storm duration, peak precipitation, availability of meals, and whether or not employees are union.

Each shift rotation approach has common pros and cons that should be considered by the airport when determining which approach is right for their operations. The following are the most common pros and cons:

**4, 6, 8 or 12 hours On and 4, 6, 8 or 12 hours Off Approach:**

**4 On/4 Off Approach:**

Pros: Availability and sustainability of airfield qualified employees throughout event, more alert and attentive staff, easier to fuel and maintain vehicles

Cons: Requires appropriate number of employees. Rotating personnel in and out of equipment takes several minutes or more. This effort reduces the amount of equipment mitigating the storm.

**6 On/6 Off Approach:**

Pros: Availability and sustainability of airfield qualified employees throughout event, more alert and attentive staff, easier to fuel and maintain vehicles
Cons: Requires appropriate number of employees. Rotating personnel in and out of equipment takes several minutes or more. This effort reduces the amount of equipment mitigating the storm.

8 On/8 Off Approach:
Pros: Availability and sustainability of airfield qualified employees throughout event, more alert and attentive staff, easier to fuel and maintain vehicles

Cons: Requires appropriate number of employees, does not provide time out of the vehicle, 8 hours may be excessive. 8 hours off is not enough time to go home to rest.

12 on/12 off Approach:
Pros- Known staffing levels, proper rest

Cons: Logistics difficult for employee to get to/from airport, predicting event start time to bring in first crew.

Team Approach:
AM/PM teams:
Pros: Known schedule - Ability to plan, get rest, less stressful. Possible reduction in the number of pieces of equipment that are operating due to the fact that you have split the teams into 2 groups. This would increase the safety and also reduce some costs (fuel and wear on equipment).

Cons: Possibly understaffed if heavy event.

“C” Team Approach:
Pros: Majority (2/3) of team on the airfield at same time.

Cons: Down time may be limited resulting in lack of rest.

All In/ All Call Approach:
Pros: Maximum crew strength provides quickest effort, work effort buy-in from all employees

Cons: Requires appropriate number of employees, will cause exhaustion and fatigue.

Utilize Resources from Other Departments Approach:
Pros: Provides extra manpower

Cons: Lack of airfield specific knowledge and training. The longer the duration of the event, the more significant the drop in situational awareness.
Pre-event planning includes an analysis of the appropriate level of personnel necessary for effective snow removal operations. Many airports have multiple call-back levels that are based on the forecasted intensity and duration of a storm. When calling personnel back to the airport, consideration must be given to the status of personnel with regard to their regular assigned shifts.

The majority of airports implement a 12-on and 12-off shift schedule. Several airports noted success in creating 12-on and 12-off coverage by adding 4 hours of overtime to routine 8-hour shifts. An airport noted high crew performance and high morale associated with a 6-on and 6-off schedule.

A few large airports call in all personnel at the start of a snow event, but each of those airports have facilities to support 24/7 crew operations, including sleep areas and food.

General aviation airports tend to operate in the “all hands on deck” mode during snow removal. Those airports, however, have fairly well designed work and rest schedules.

Experience & Education
The FAA requires in 14 CFR Part 139.303 that airports hire qualified personnel to comply with the Airport Certification Manual (ACM) and that the airport train all personnel who access movement and safety areas.

Airport Support
In an effort to reduce the costs of employee turnover, help airport personnel improve and provide a career path within the airport and aviation community, organizations are assisting employees. Following are some of the ways airports are assisting their staff:

- Tuition Reimbursements – organizations are providing tuition reimbursement for classes the employee takes that relate to their current position or area within the airport/aviation community in exchange for a term of employment commitment by the employee.
- Succession Planning – managers identify staff and mentor them to increase their skill-set and knowledge in different areas of airport winter operations so they are ready when a position opens
- Reinvesting in employees – offering employees opportunities to take classes and attain certifications within the industry.
- Competencies based upon experience – utilizing personnel and giving them tasks and jobs that help maximize their skills.
**Human Resource Value Awareness**

Once the number of SRE has been determined, the next question is how many humans are needed to operate them. The Human Factor Module covered in the BAWOS curriculum discussed the effects of winter operations on the airport employees engaged in snow storm mitigation.

When preparing the winter operations and individual snow event budgets, airport managers must consider the personnel that will be needed for the winter season and each individual event.

Different size airports may choose to utilize hourly, full-time or part-time employees as well as over-hires and labor contractors for the winter weather event.

The large hub airports tend to use over-hires, other department employees or administrative staff to help during a large snow event.

When determining whether to use fulltime or part-time (winter) staff, the manager should consider that hiring practices can be challenging with part time staff. Challenges include asking them to do the same work as full-time employees for less pay and benefits, and part-time employees may not always have the same passion and willingness as full time staff to perform the work.

When considering Labor Contractors, the manager may have the option to choose to use snow removal contractors, contract labor or temporary staffing services. The airport’s local labor laws and requirements for using union labor should also be considered during the budgeting process.

The manager should understand the airport’s overtime policies and how they are used by your organization. This information should include:

- An overtime rate of 1.5 hourly + W.C. FICA 9% total 1.59. Includes monies for workmen’s compensation (W.C.) and applicable taxes.
- An overtime rate of 2x hourly + W.C. FICA total 2.09. Includes monies for workmen’s compensation (W.C.) and applicable taxes.
- The specific policy for breaking the clock and returning to normal shift.
- Comp time benefits where employees bank overtime hours to be used later.

Other considerations for the manager may want to utilize for the winter staff include:

- Stipend on-call pay for being on standby - provides the employee more freedom be home with their family
- Cell phone and pagers – employees can be mobile rather than wait at home for someone to call. Flexibility to allow for more freedom to the employee. The manager may choose to use a service such as Everbridge notification to simply
make one call and it goes to everyone in seconds. Typically this is very efficient and reliable.

- Rotating on-call – provides the employees with down-time from work and may help reduce the personnel costs if the airport has to pay employees during on-call service.
- The limiting of winter vacations instead of forbidding them. This allows staff the opportunity to have even more freedom in the winter. A calendar posted for all to see. Limit the number of days allowed. Need to take in account staffing issues like sickness or injuries that may require the time off to be impacted.
- Food Stipends – if food stipends are permitted, the amount and time frame should be established prior to the beginning of the winter season
- Caterers or Airport vendors – depending on the airport’s food vendors available and relationship, the manager should consider the cost and accessibility of utilizing a local caterer or an airport vendor during winter storm events.

**Overtime Impacts**
There are two types of overtime impacts, contractual and budget factors.

**Contractual**
The impact of the manager’s use of overtime during the winter season may be limited by the contractual obligations of the airport to the employee and possibly the local union. The manager should verify this with the human resource department.

**Budget Factors**
When considering the use of overtime for a storm event and the winter season, the budget factor has a great impact on the decision of utilizing overtime over other options.

The manager should run a financial comparison of the following:

- Comparison OT vs Permanent Hires
- Comparison OT vs Temporary Help.
- Comparison OT vs Closing Surfaces.
- Comparison OT vs Contracting.

**Summary**
The airport’s personnel are a key element to the success of its winter operations and the airport’s safety. An understanding of training and scheduling personnel for snow events and winter operations is a key for best utilizing the organization’s human resources to help maximize the safety of the airport and its personnel.
Advanced Snow Academy
Advisory Circular 150/5200-30C

Airport Winter Safety and Operations
Definitions:
The snow and ice control plan should list definitions and terminology used in conjunction with winter operations.

SICP

- **Contaminant** - Any substance on a runway or taxiway, for the purpose of this SICP contaminant is snow, slush, ice or standing water.

- **Eutectic Temperature/Composition.** A deicing chemical melts ice by lowering the freezing point. The extent of this freezing point depression depends on the chemical and water in the system. The limit of freezing point depression, equivalent to the lowest temperature that the chemical will melt ice, occurs with a specific amount of chemical. This temperature is called the eutectic temperature, and the amount of chemical is the eutectic composition. Collectively, they are referred to as the eutectic point.

- **Snow (on the ground).** A porous, permeable aggregate of ice grains, which can be predominately single crystals or close groupings of several crystals.

- **Dry Snow** - Snow that insufficient free water to cause cohesion between individual particles. If when making a snowball, it falls apart, the snow is considered dry.

- **Wet Snow** - Snow that has grains coated with liquid water, which bonds the mass together, but that has no excess water in the pore spaces. A well-compacted, solid snowball can be made, but water will not squeeze out.

- **Compacted Snow** - Snow that has been compressed into a solid mass that resists further compression and will hold together or break up into lumps if picked up.

- **Slush** - Snow that has water content exceeding its freely drained condition, such that it take a fluid properties (e.g. flowing and splashing). Water will drain from slush when a handful is picked up.

- **Patchy Conditions** - Contaminate conditions that cover 25% or less of the cleared/treated/usable surface shall be classified as "Patchy." Conditions covering more than 25% should be considered as covering the total surface area for surface condition reporting purposes.

- **Primary Runway.** A runway expected to be used under the existing atmospheric and storm event conditions where most of the takeoff and landing operations will take place.

- **Secondary Runway.** A runway that supports a primary runway. Takeoff and landing operations on such a runway are generally less frequent than on a primary runway.
• **Approved Chemicals** - A chemical, either solid or liquid, that meets a generic SAE or MIL specification.

• **Fluid Deicer/Anti-Icers.** The approved specification is SAE AMS 1435, Fluid, Generic Deicing/Anti-icing, Runways and Taxiways.

• **Generic Solids** - The approved specification is SAE AMS 1431, Compound, Solid Runway and Taxiway Deicing/Anti-Icing.

• **Airside Urea** - (Otherwise known as “Carbamide”) The approved specifications are SAE AMS 1431, Compound, Solid Runway and Taxiway Deicing/Anti-Icing, and MIL SPEC DOD-U-10866, Technical Urea. Agricultural grade urea that meets any of these specifications, called airside urea, is acceptable. (*Federal Aviation Administration, 2008*)

**Abbreviations and Terminology - FAA Order JO 7340.1Z – Contractions**

IR – Ice on runway
WSR – Wet snow on runway
SIR- Compacted snow/ice on runway
SLR – Slush
PTCHY – Patchy
WIP – Work in Progress
RFT – Runway friction tester
MU – Friction value
CLSD – Closed
BA Fair – Breaking action fair
BA Poor – Breaking action poor
BA Nil – Braking action Nil

**Module Objective:**

To provide thorough knowledge of the regulatory information contained within the Advisory Circular (AC) 150/5200-30C for properly compiling and implementing a Snow & Ice Control Plan (SICP). FAA AC 150/5200-30C provides guidance to assist airport operators in developing a SICP, conducting and reporting runway friction surveys, and establishing snow removal and control procedures. Certificated Airports are required to follow the requirements described within. The AC is only an advisory for non-certificated airports. Also included is a brief overview of FAA AC 150/5210-22 Airport Certification Manual (ACM) to provide general knowledge in preparation of the ACM referencing FAA Part 139.313 Snow and Ice Control Plan.
Introduction
Airports located in climates with cold temperatures and freezing contaminants must contend with harsh and unique situations brought on by winter conditions. These conditions can bring snow, ice and freezing rain for airports to manage in a safe and efficient manner. According to the FAA Advisory Circular, “The presence of contaminants such as snow, ice, or slush on airfield pavements and drifting snow causes hazardous conditions that may contribute to airplane incidents and accidents. Further, winter storm conditions usually reduce airport traffic volumes through flight delays and/or cancellations and, in severe storm conditions, airport closures. The extent to which these undesirable effects are minimized will depend on the approach taken by the airport operator to combat winter conditions”. (Federal Aviation Administration, 2008)

Snow and Ice Control Plan (SICP).
Winter weather impacts the national aerospace system by causing flight cancellations and delays. The airport operators that chose to combat the storms must measure the expense to remain open versus the cost of revenue lost should the airport close. The associated cost to airlines for delays and cancellations can have a significant impact on their operating budget; consequently the stakeholders involved with the purchasing of large winter operations fleet and materials can also have large impacts to their operating costs. It’s a fine line to keep costs minimal but also keep the airport operating safe and efficient. When attempting to remain open and combat the winter storms the FAA indicates “The most successful airport operators at combating winter storms are those that establish an airport snow and ice control committee that conducts pre- and post-seasonal planning meetings, operates a snow control center (SCC), and, most importantly, implements a written plan. For airports certificated under 14 CFR Part 139, Certification of Airports (Part 139), the written plan is referred to as the Snow and Ice Control Plan (see section 139.313, Snow and Ice Control.)” (Federal Aviation Administration, 2008)

The Snow and Ice Control Plan (SICP) is a basic document encompassing at least two separate phases. Phase #1 addresses pre- and post-winter season subjects that prepare the airport operator for the new winter season. This phase may include revising the existing SICP after the winter season ends. Phase #2 addresses the sequential actions, via instruction and procedures, taken by the airport operator for dealing with winter storms and notifying airport users in a timely manner when less than satisfactory conditions exist at the airport including the closure of runways. (Federal Aviation Administration, 2008)

SICP
A logical first step in writing the SICP is to identify and prioritize those aircraft movement areas to be cleared of snow and/or ice within certain times. Prioritizing the airfield and ramp areas will simplify the progress and give direction to personnel with a clear understanding what is expected to remain open at all times. The airport will evaluate most critical areas and prioritize them as priority 1, 2, 3 areas. As we progress further into developing a SICP the module will discuss airfield clearance times and clearing priorities. These parameters, in turn, guide the airport operator in selecting the conditions that initiate activities, such as, clearing operations, chemical applications, runway friction surveys, and other operations.
Next, the SICP must include instructions and procedures for handling the various types of winter storms encountered by the airport and how to notify airport users in a timely manner of other than nominal runway conditions, including, but not limited to:

- Runway closures, and when any portion of the movement area normally available to them is covered by snow, slush, ice, or standing water.

- When winter contaminants are present on pavements and/or a runway has to be closed

- Finally, the SICP should address special safety topics to minimize runway incursions during initial and follow-up clearing operations.

Phase #1:

Pre and Post Winter Topics

The Airport management should typically have meeting in the summer to initiate talks with necessary airport stakeholders and partners to review the past season events, equipment and material inventory, repairs and new equipment purchases, budgeting, training and any other topics associated with snow and ice control. At minimum, the following questions should be addressed when outlining new plans or revising existing plans.

- Are we materially prepared and adequately budgeted for the new winter season?
  Documentation of each event and a computation of each season are most valuable. This historic information of previous seasonal use of material should be compared to material in-stock. This evaluation may dictate supplier agreements or availability issues. Procurement codes governing the airport may dictate how and when material may be purchased. Contracts may need to be negotiated several months in advance.

- Did the SICP incorporate identified post-season improvements?
  The new addition of an ILS to the airfield must be included in the SICP. New snow removal equipment purchases must also be included in the SICP.

- Are we staffed adequately with qualified personnel?
  What constitutes qualified personnel? What types of training are being used, classroom, tabletops exercises, dry run, operational briefing. Are part-time or seasonal personnel used and how? The Airport Operator must identify what personnel are qualified to evaluate and report field conditions utilizing NOTAMs.

- Is our training program adequately tracking test records and development of qualified personnel?
  Examples of sufficient recording of training activities can be found with the Airport Rescue and Fire Fighting group, who are required by FAA Far Part 139 to record training and accurately evaluating trainings. Training should include lectures and hands on practical evaluations. Airfield familiarization and Air
Traffic Control communications should begin all equipment operator’s training for airfield vehicle operations. Certificated airports are required to have a formal Driver Training Program. (Administration U. D., 2010)

- **Do our environmental mitigation procedures for disposal of deicers and equipment maintenance materials and supplies keep us in compliance with storm water regulations?**
  The use of contracted regulatory consultants may be required for smaller airports that do not employ an Environmental Compliance Engineer. The SICP should indicate where aircraft deicing can be permitted. This should include the availability of secondary deicing when permitted.

- **Should our Snow and Ice Control Committee (SICC) conduct more pre- and post-season meetings?**
  Changes in personnel within each group may require additional meetings. To reach all ATCT employees working night and evening shifts will require alternate meeting schedules or additional trainings. Hosting meetings at various locations including the ATCT may produce greater attendance.

- **Did our weather forecasting method monitor last year’s storm events accurately and in a timely manner?**
  Recording forecasts provided pre-storm and measuring them against actual event conditions is required to accurately evaluate. Compare with other forecasting to determine if accuracy could have been improved. It is most important that the airport operator be able to prepare for each event based upon the reliability of the forecast. Early preparation is always preferred over late preparedness.

- **Do we need to change our prescribed storm conditions to start clearing operations or preventive measures?**
  Do the current procedures keep the efforts ahead of the event and efforts easily maintain good conditions or are crews often trying to improve conditions while trying to catch up to the storm? Activities to maintain a safe airfield should begin once conditions change from normal. Not including activities to prepare for the event which should begin as soon as the forecast dictates. Each airport operator should determine when snow removal activities should begin. For some airports snow removal begins with snow brooms as soon as pavement marking are obscured, for others snow plowing begins when a specific accumulation exist. It is the initiation that should be questioned.

- **Do we need to change our runway closure procedures as defined in paragraph 5-6 for closing a runway and other paved areas used by airplanes?**
  Ask if the current procedures meet regulatory requirements and test the timeliness of the notification process. The SICC should consider the impact of each closure. The reader should understand that some airports with multiple runways will close runways for snow removal while airplane activities continue on alternative open runways; where as other airports are closed to any activities when they close their only available runway during a winter event. The reader must also be aware that
closing taxiways may prevent arrivals from taxiing to their normal designated parking area and must be given an alternative location. When an airport closes a surface the SICC should be aware of the length of time snow removal crews will require to reopen each surface.

**In reference to our runway closure procedure, do we need to revise the steps we prescribed in the SICP for continuously monitoring the runway(s)?**
Provide specific language stating when the airfield will be monitored and by what staff designation. List the specific radio frequencies to be monitored. List the specific exit taxiway to be visually inspected while the runway is in use. The reader should understand that continuous monitoring is an activity that includes the visual inspection of a runway surface and/or the exit taxiway, the monitoring of each pilot’s report (PIREPS) of the specific runway condition, the monitoring of the current precipitation and the general understanding through physical evaluation of the condition of the active runway. This monitoring is required to prevent consecutive PIREPS of POOR braking action from automatically closing the runway from airplane activities.

**Do the same personnel continue to initiate the runway closure procedure (as developed by the airport) and are there any new procedures for the closure of a runway?**
Include language that describes the procedure for opening a previously closed surface.

**Are there any changes to our chain-of-command and phone numbers?**
Include other media for communications. Cell phones are replacing hard line phones. Text messaging is becoming common but requires return text for confirmation that the message was received. The implementation of on-line computer programs that allow for multiple notifications and dispatches should be updated within the SICP.

**Do we need to update or issue a Letter of Agreement (LOA) with the airport traffic control tower (ATCT) or other parties for implementing runway closure procedures?**
The review of all current LOA’s should be including within the agenda of the pre-seasonal meetings. The review should be conducted with all parties included within the agreement.

**Were there any changes to the airfield areas to be cleared and maintained, the timing of operations, and how clearing will be done?**
New equipment assignments should be identified. New tenant with new needs should be identified. The addition of an Instrument Landing System (ILS) may require that snow piles and windrow management be altered to avoid effecting the ILS signal(s).

**Are we informing our users frequently and in a timely manner when we must close the airport or report less than satisfactory surface conditions? Did we get complaints?**
Have we received complaints? Are current internet programs a viable option?
• **Are we meeting all applicable Part 139 requirements?**

139.313 Snow and ice control.

(a) As determined by the Administrator, each certificate holder whose airport is located where snow and icing conditions occur must prepare, maintain, and carry out a snow and ice control plan in a manner authorized by the Administrator.

(b) The snow and ice control plan required by this section must include, at a minimum, instructions and procedures for—

1. Prompt removal or control, as completely as practical, of snow, ice, and slush on each movement area;
2. Positioning snow off the movement area surfaces so all air carrier aircraft propellers, engine pods, rotors, and wing tips will clear any snowdrift and snow bank as the aircraft's landing gear traverses any portion of the movement area;
3. Selection and application of authorized materials for snow and ice control to ensure that they adhere to snow and ice sufficiently to minimize engine ingestion;
4. Timely commencement of snow and ice control operations; and
5. Prompt notification, in accordance with § 139.339, of all air carriers using the airport when any portion of the movement area normally available to them is less than satisfactorily cleared for safe operation by their aircraft.

(Administration U. D., 2010)

• **How do we ensure markings, signs, and lighting systems are legible/visible after clearing operations? Are touchdown markings addressed in our procedures?**

SICP should address procedures to maintain the visibility of surface painted marking including the Touch Down Zone Markings. The reader should be aware that obscured marking increase the opportunity for incursions. The combination of obscured markings along with snow covered signs nearly eliminates the visual aids relied upon by pilots.

• **What are our procedures in case of airfield accidents involving snow clearing crews, Airplanes, or other airport vehicles?**

Include notification procedures, documentation requirements, and any local regulatory languages. Some municipalities or agreements include drug and alcohol testing.

• **Did we address all unique airport site conditions?**

The plan should include snow removal procedures for service roads, emergency gate locations, ARFF ramps, and access to the airfield lighting vault(s). The SICP should address procedures when these surfaces must be closed. When the service road or a perimeter road is closed a Field Advisory could be issued to notify tenants. There may be specific language that requires vehicles to be escorted across a runway when the service road is closed due to snow.
• **Have all storm crews received training on the SICP and trained on new equipment?**
  Record all training dates; include signature sheets and copies of the training objectives along with training materials. All evaluations should be included within the records.

The Snow and Ice Control plan should list the chairperson of the meeting and the month it was conducted. The chairperson should document the meeting notes, which attended the meeting and distribute meeting information to all who were unable to attend.

**Staff Training and Recordkeeping**

“The SICP should describe qualification criteria and training for individuals directly involved in snow and ice control operations.” (Federal Aviation Administration, 2016)

Training may be specific to individual assignments. Equipment operators require different skills than the snow desk operator. The SICP will describe the record and reporting of trainings and evaluations.

“Although airport operators should develop their own training programs to address conditions at their particular airports, the FAA recommends the programs contain the following minimum components:

a. Use of formal classroom lectures, training films if available, and discussion periods to teach the contents of the SICP to individuals who need to understand procedures in detail.

b. Conduct of tabletop exercises that use miniature equipment on airfield layouts to simulate operations.

c. Hands-on training for equipment operators on how their equipment works as well as practice runs under typical operational scenarios.

d. Instruction on airfield familiarization that includes both day and night tours of the airfield and ensures an understanding of all surface markings, signs, and lighting.

e. Instruction for all personnel on proper communication procedures and terminology. This includes the special procedures to be followed during “whiteout” conditions and when radio signal is lost between drivers and/or the ATCT. See FAA AC 150/5210-20, Ground Vehicle Operations on Airports, for guidance on communication procedures for airport personnel.

f. Instruction for drivers on the proper procedures and communications to follow when the ATCT is not operating or the airport has no ATCT.

g. Training in following runway closure criteria for personnel responsible for closing and opening runways during snow events. This training is especially
important for non-towered airports or part-time towered airports.” (Federal Aviation Administration, 2016)

Review:

- The airport should list all personnel and titles that receive annual, recurrent snow removal training. All training for airport personnel should conducted by a training personnel (state who trained), when the training occurred (date) and title and name of who received the training.
  - Example: Title - Operations Manager, Training received, Review of SICP, Date.

- Equipment Preparation:
  - Prior to the snow season list who reviewed and inspected the snow removal equipment and when the work was completed. Make sure to inventory components, replaced parts, fluids for stocking purposes.

Snow and Ice Control Committee (SICC) Meetings:

The Airport Winter Operations Managers should understand that snow; slush, ice, and standing water on a runway are contaminants that impede airplane acceleration, effects decelerating and the directional control of an airplane. “These contaminants can also limit operations due to potential structural damage caused by the contaminants impinging on the airplane at high speed.” (Federal Aviation Administration, 2016). The airport develops a Snow and Ice Control Committee (SICC) to provide feedback and make recommendations to snow and ice removal operations and Snow and Ice Control Plan (SICP). The SICC chair person should be identified by title and include departments or titles from the airport, FAA Air Traffic/Operation Center, and tenants.

During the months of (list month) the airport will notify stakeholders, tenants and airport users to review and provide comments to be discussed during the season kick off meeting, list when the meeting occurred in SICP.

Also the airport winter operations specialist should be aware of the restrictions for the aircraft that are frequently operating at their airport. It is necessary to know the types of aircraft and the aircraft requirements in winter operations. The AC reports that numerous airplanes and airplane operators “are prohibited from operating on runways covered by more than ½ inch of wet snow, slush, or standing water. Consequently, these runway surface contaminants should be minimized to maintain safe landing, takeoff, and turnoff operations”. (Federal Aviation Administration, 2016)

All airports subject to icing conditions or annual snowfall of several inches (6 inches (15 cm) or more) should have a SICC. Snow and Ice Control Committees have been effective in (1) preseason planning, (2) focusing the operational plan to improve runway safety and
communications between various offices/departments involved or impacted by a storm event, (3) addressing the needs of airport users, and (4) critiquing clearing activities of the airfield and ramp areas after the winter season and after each storm event. Although it’s required the FAA recommends that ongoing evaluation meetings be held, preferably after each storm event, to allow evaluation of procedures, identify safety concerns, and, when necessary, implement revised clearing procedures. (Federal Aviation Administration, 2016)

Airport leaders must ensure that the SICC size and functions are based on the airport size, airport users, and the type of winter weather experienced within its geographical location. The airport manager or his/her representative should chair the SICC. The committee should include representatives from the following:

- Airport operations staff.
- Airline flight operations departments or fixed-base operators and airline station personnel (deicing representatives).
- FAA air traffic control, flight station, technical operations.
- Other concerned parties deemed necessary, such as the U.S. military (at joint-use airports), service providers, and contractors who may be actively conducting construction activities.

The Airport operators must cover the following during the SICC meetings:
- Areas designated as Priority 1 area, to include any new airfield infrastructure.
- Clearing operations and follow-up airfield assessments to further mitigate the potential pilot and vehicular surface incidents or runway incursions.
- Staffing requirements and qualifications (training) for snow crews and Snow Control center staff.
- Update to the training program to close any ambiguity.
- Streamline decision-making process, the “line-of-command” authority.
- Response times to keep runways, taxiways, and ramp areas operational, e.g., to rectify problems encountered during previous storm events that hampered airport operations.
- Communications, terminology, frequencies, and procedures with the airport traffic control tower (ATCT), snow crews, and the Snow Control Center.
- Monitoring and updating of runway surface conditions after a clearing operation and Deicing or sanding applications.
- Issuance of NOTAMs and dissemination to ensure timely notification.
- Equipment inventory, including assessing the condition of snow control equipment, scheduling repairs, and stocking spare parts.
- Status of procurement contracts and specifications for new vehicles or equipment.
- Preventive maintenance program for snow control equipment and maintenance and calibration for friction testing equipment.
- Status of procurement contracts and specifications for deicer-/anti-icer materials and sand supply, including their storage before the first snowfall.
- Validation of deicer certification letters from vendors.
• Procedures for storm water runoff mitigation.
• Snow hauling and/or disposal plan, including sites for dumping snow.
  New runoff requirements for the containment and/or collection of deicing chemicals
  and vehicle maintenance fluids and materials.
• Changes to contract service for clearing ramps. (Federal Aviation Administration,
  2016)

Other topics such as Air Carrier Ground Deicing/Anti Icing Programs:
The AC indicates that the airport operator should act as a facilitator and arrange a meeting for the
parties that may be affected by airplane ground deicing plans, including those plans required of
air carriers operating under 14 CFR Part 121, Operating Requirements: Domestic, Flag, and
Supplemental Operations. These parties include airport management and consultants, the air
carriers, other airport users, corporate tenants, pilot representatives, and FAA Air Traffic Control.
The meeting should assess the impact of any airplane ground deicing activities on airport
operations and identify actions that can be taken by the various parties to maximize the efficiency
of operations during icing conditions. For example, the committee may be able to identify the
most effective locations for secondary deicing and establish procedures for its implementation.
At most airports, one meeting should suffice to discuss these subjects before the start of the winter
season. However, at other airports, subsequent meetings may be necessary to assess the
effectiveness of plans and to modify them if necessary. These meetings typically address the
following topics:

• Assessment of all air carriers’ deicing programs from the previous year, including -
  ▪ Reviewing airplane surface flow strategies.
  ▪ Reviewing ground time and takeoff clearances after deicing.
  ▪ Analyzing and adjusting to airplane deicing plans.

• Actions needed to maximize efficiency of operations during icing conditions, including -
  ▪ Identifying locations for airplane deicing that use chemicals or infrared
deicing technology.
  ▪ Planning taxi routes to minimize ground time.
  ▪ Developing rates that control deiced departures.
  ▪ Allocating departure slot capacities.
  ▪ Determining airport deicing crew needs.
  ▪ Verifying communication procedures between air traffic control and
airplanes to be deiced.
  ▪ Any requirements for containment/collection of deicing/anti-icings.
  (Federal Aviation Administration, 2008)

Post Event/Post Season
After each snow event, airport management will request a meeting and invite Air Traffic Control
personnel to review and discuss any issues that have arisen from the winter storm event.
All members of the SICC should be encouraged to provide feedback to airport management
before, during or following each snow event. All information should be reviewed. After a
significant event or a challenging operation a separate SICC meeting will be held with airport management.

During the snow season winter operations should be an agenda item at construction meetings, tenant meetings, station manager meetings. The meetings should state when they occurred and the frequency of meetings.

- **Review:**
  After each snow season a SICC meeting will be scheduled, typically in *(state month)* to review the snow season issues and recommendations for changes. The same topics as pre-season should be reviewed. Provide actions items for each of your departments.
- **Example:**
  - Maintenance - Inspect and repair equipment, Operations - calibrate friction tester, Airport Management - update SICP changes and or procedures.

**Phase #2 Winter Storm Procedures**

The AC indicates, snow, ice, and slush should be removed as expeditiously as possible. The goal is to maintain runways, high-speed turnoffs, and taxiways in a “no worse than wet” (i.e., no contaminant accumulation) condition, realizing that this is not always possible. The airport operator can improve surface friction by applying materials such as sand and chemicals when unusual conditions prevent prompt and complete removal of slush, snow, or ice. Operating large snow removal equipment and support vehicles must be conducted in a way to prevent runway incursions and interference or with airplane operations. This safety responsibility is shared by airport personnel, airplane operators, and any contractors working at the airport. The reduced hours of daylight during the winter months and frequent low-visibility conditions resulting from fog, blowing snow, or precipitation require extra care during field operations and greater attention to enhancing visibility of equipment performing winter maintenance (i.e., snow removal, friction enhancement, etc.). Post-clearing operations must be conducted to ensure airfield signage; lighting and markings between the runways and apron are visible to pilots to reduce the potential for runway incursions.

Airport operators have a major duty to ensure the safety of operations at their facilities. This involves performance according to accepted principles, ensuring a high standard of care, providing state-of-the-art standards in equipment and techniques, and maintaining qualified crews. Care should be taken to ensure the snow and ice control plan is current, complete, and customized to the local conditions. All airport leases and agreements should be clear and specific and cover the duties and responsibilities of lessees to carry out their assigned snow and ice control duties. Airport operators, however, have the duty to warn the users of the airport of any change in published procedure or change in the physical facility. As an example, an airport operator should give *timely or proper notice* of pavement or visual aids that may have been damaged by a snow plowing operation. **Complete documentation of compliance with the snow and ice control plan (SICP) should be kept. The advisory circular uses the term “Snow and Ice Control Plan” to represent all types of snow and ice control plans.** *(Federal Aviation Administration, 2008)*
Review:
In the SICP indicate the airport staffing, chain of command and procedures you have in place. If your airport has several departments with responsibilities during snow removal operations provide an explanation of responsibilities for each section. In the SICP list triggers for initiating winter operations, how it was developed, what types and amounts of snow/ice initiate actions to remedy or remove contaminants from airport operating area.

Weather Forecasting
Appropriate responses to a winter storm event begin with accurate and timely weather information. A reliable weather forecast not only enhances the effectiveness and efficiency of any SICP, but it offers airport operators operational cost savings associated with snow clearing tasks, chemical usage, and staffing. Airport operators should base their snow clearing operations or preventive measures on weather forecasting that offers continuous, up-to-date, and airport weather-related information. The FAA recommends that airport operators select a weather forecasting approach that offers usable information to airport users as well as to the airport operator. One such approach, the Weather Support to Deicing Decision Making (WSDDM) System. (Federal Aviation Administration, 2008)

FAA Forecasting Research and Development for Airport Operators
Aviation Weather Research Program began research in the 1990s to fully understand the safety problems faced during winter storm events and to improve decision making by airport operators and air carrier ground operations during these events. The research resulted in the Weather Support to Deicing Decision Making (WSDDM) System, an integrated display system that depicts accurate, real-time determinations of snowfall rate, accumulations and their liquid equivalents, temperature, humidity, wind speed, and direction of storm events.

Weather Support to Deicing Decision Making (WSDDM) System
System is an automated system that analyzes and forecasts short-term winter weather conditions within the airport vicinity. The data inputs to the system are provided by snow gauges; weather radars, such as Doppler; surface weather stations; and National Weather Service Aviation Routine Weather Report (METAR) data from Automated Surface Observing Systems (ASOS). All data is processed by software algorithms to produce a graphical and text depiction of current weather conditions and a 1-hour forecast of expected snowfall rate and accumulation at the airport. The displayed analyses and forecasts can be easily understood by most users. The graphical data can be generated and displayed on a local computer or viewed online. The system has been effective at major U.S. airports.

The basic version of the WSDDM system, known as Basic WSDDM, is for unidirectional storm fronts. The system has a single snow gauge with a computer display of the current and historical liquid equivalent snowfall rates and accumulation. Airports that routinely encounter multiple storm fronts should use two or more snow gauges. Figure 3-1 shows one type of snow gauge used by WSDDM. Figure 3-2 illustrates the Basic WSDDM schematic for a unidirectional storm configuration.
WSDDM systems must comply with the equipment performance and installation requirements described in Society of Automotive Engineers (SAE) Aerospace Standard (AS) 5537, Weather Support to Deicing Decision Making (WSDDM), Winter Weather Nowcasting System. The SAE specification is available for purchase at http://www.sae.org.

Benefits to Airport Operators
Users of WSDDM have reported various operational and cost-saving benefits. WSDDM optimizes runway clearing operations by providing airport operators more accurate information about when a snow band will affect the airport. Accurate timing saves on anti-icers because it allows crews to apply them according to the manufacturer’s recommended lead times. In terms of managing crew workloads, WSDDM determines gaps in storm events, which can be used to change crew shifts, take rests, and refill chemical trucks, sand spreaders, and other equipment. Airport operators are also able to more accurately determine when the airport can resume normal operations by examining the radar loops and storm tracks and watching storm trends. By examining the storm tracks, users can make fairly accurate 3- to 4-hour forecasts of snow onset, which, in turn, allow airport operators to prepare more appropriately for winter storms. (Federal Aviation Administration, 2016)

Real-Time Liquid Content Forecast
A key safety element of the WSDDM system is the use of one or more precision snow gauges. These snow gauges provide real-time estimates of the liquid equivalent snowfall rate for every minute. This measurement is key to air carrier deicing operations because the deicing community has shown the liquid equivalent snowfall rate is the key factor leading to the failure of deicing/anti-icing fluids. The current National Weather Surface METAR stations do not provide this data. Instead, METAR provides hourly snow intensity estimates based on visibility. Snow intensity estimates based on visibility have been shown to be misleading when wet snow, heavily rimed snow (snow that has accreted significant amounts of cloud droplets), and snow containing single crystals of compact shape (nearly spherical) occur. Researchers define the hazard as high-visibility/high-snowfall rate conditions. Recent examination of five of the major
airplane ground deicing accidents showed that high visibility-high snowfall rate conditions were present during a number of these accidents. All of the accidents had nearly the same liquid equivalent rate of 0.1 inch/hour (2.5 mm/hour), but widely varying visibilities. The WSDDM System was designed to address this safety concern by including snow gauges to measure liquid equivalent snowfall rate every minute.

**Forecasting Runway Surface Conditions**

*One proven method of forecasting the surface conditions of runways is to use runway surface condition sensors (RSCS).* Two basic types of RSCS are in use today, namely in-pavement stationary sensors and vehicle-mounted infrared sensors. *(Federal Aviation Administration, 2008)* The safety benefit of RSCS is their predictive capability for proactive anti-icing decision making. Since the temperature of pavements lag behind air temperature, the use of air temperature to infer surface conditions is imprecise. Therefore, the use of air temperature is never recommended because it frequently leads to misinformation about the true behavior of pavement surfaces. This inaccuracy can result in inappropriate airfield clearing operations or poorly timed preventive measures. At its worst, this misinformation might result in delays that allow ice to bond to paved surfaces, the hardest condition to rectify.

With the exception of freezing rain, ice will not form on pavements unless the pavement temperature itself reaches the freezing point. Therefore, knowledge of the direction and rate of temperature change within a pavement structure provides the predictive capability as to when to expect the formation of ice. The predictive nature of RSCS is particularly valuable as it ensures the timely application of anti-icing (or deicers) chemicals which provide a cost savings in chemicals, and helps crews make appropriate chemical selections to prevent, weaken, or disbond ice or compacted snow from paved surfaces. Airport operators have at their disposal in-pavement RSCS at pre-determined sites and mobile RSCS that are hand-held or vehicle-mounted to evaluate any pavement.

**Stationary Runway Weather Information Systems** - These stationary sensors provide only site-specific pavement and air temperature trends, dew point temperature, chemical strength, and other atmospheric weather conditions at the installation sites. Sensor information is generally disseminated via a central computer to airport users. An added bonus of in-pavement RSCS is their ability to predict when previously applied chemicals have been diluted sufficiently to require reapplication of chemicals. *The FAA recommends that in-pavement RSCS comply with the performance and installation requirements of SAE Aerospace Recommended Practice (ARP) 5533, Stationary Runway Weather Information System (In-pavement). The SAE specification is available for purchase at [http://www.sae.org](http://www.sae.org).*

**Mobile Infrared Surface and Ambient Temperature Sensor Systems** - These vehicle-mounted sensors provide pavement and air temperatures at any desired airfield pavement location. Information is disseminated directly to the viewer or driver of the vehicle-mounted units. The FAA recommends that mobile RSCS comply with the performance requirements of SAE ARP 5623, *Mobile Digital Infrared Pavement Surface, Ambient Air and Dew Point Temperature Sensor System.* The SAE specification is available for purchase at [http://www.sae.org](http://www.sae.org).
Review:
- The SICP should describe who is responsible to monitor the current and/or forecast weather conditions and how often. The plan should explain what sources are used for weather forecasting and if the airport has surface sensors, surface sensors can be used for additional data collection.
- Example: Airport Operations receives weather reports and forecast from a contracted weather service. The reports include forecast, alerts and warnings of winter storms.

Initiating Snow Removal Operations

The AC indicates snow, slush, ice, and standing water on a runway impede airplane acceleration by absorbing energy in compaction and displacement, and by impinging on parts of the airplane after being kicked up by the tires. For airplanes decelerating, slush, snow, and standing water-covered pavements and, especially iced surfaces, hamper deceleration rates due to a reduction in the friction coefficient of the runway and the potential for hydroplaning. Large chunks of ice, from refreezing snow or slush, or deposited from aircraft gear during landings, can cause severe damage to tires, engines and airframes. Wet snow, slush, and standing water on a runway can also limit operations due to potential structural damage caused by the contaminants impinging on the airplane at high speed. Although the limits vary for different airplanes, most transport category airplanes are prohibited from operating on runways covered by more than ½ inch of wet snow, slush, or standing water (see AC 91-6A, Water, Slush, and Snow on the Runway.)

Contaminants on runway surface should be minimized to maintain safe landing, takeoff, and turnoff operations. For these reasons, snow clearing operations for Priority 1 runway(s), taxiway connectors, and taxiways to the terminal(s) should start as soon as possible after snowfall or icing begins. One prime goal is to take the appropriate measures so snow in its various forms, such as slush or frozen water, does not bond to the pavement. Dry snow falling on cold dry pavements will generally not adhere and may be blown off by wind or airplane operations or removed by brooming operations. In such conditions, only brooming may be needed to prevent the formation of compacted snow tracks. Snow fences may be of use to airports that primarily experience dry snowfalls. Wet snow, however, cannot be blown off the pavement and will readily compact and bond to it when run over by airplane wheels. The airport operator will need to implement different clearing and/or preventive measures for wet snow than those used for dry snow conditions. **When measures are taken, the airport operator’s Snow Control Center (SCC) must (1) maintain close coordination with the ATCT and the Flight Service Station (FSS) or UNICOM to ensure prompt and safe responses to winter storm events and (2) inform the users of the airport when less than satisfactory conditions exist. (Federal Aviation Administration, 2008)**

The Snow and Ice Control Plan should describe who operates the SCC, where the SCC is located and when the SCC is activated. The plan should also indicate who has the authority to initiate snow removal operations and who is responsible to monitor the airfield conditions, how and when the airfield inspections are being completed and by what department. If additional personnel are needed the plan should indicate who is responsible to initiate the winter operations callout and procedures for the callout and notification of personnel along with procedures to holdover additional personnel.
Example:

Snow and ice removal will be initiated when precipitation begins to accumulate on the surface. The runway will be closed for operations when the following occurs:

<table>
<thead>
<tr>
<th>Precipitation</th>
<th>Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slush</td>
<td>¼ Inch</td>
</tr>
<tr>
<td>Wet Snow</td>
<td>¼ Inch</td>
</tr>
<tr>
<td>Dry Snow</td>
<td>1 ¼ Inch</td>
</tr>
<tr>
<td>Ice or Freezing Rain</td>
<td>¼ Inch</td>
</tr>
<tr>
<td>Friction</td>
<td>Example: Below Number 20</td>
</tr>
</tbody>
</table>

**Snow Removal Action Criteria**

In organizing your SICP another step would be to list the personnel responsible for winter operations. The snow and ice control plan should indicate departments and requirements necessary to keep the facility operational during winter storms.

**Example:**

- **Operations** monitors and forecast weather conditions at the airport using weather outlets. Update airports stakeholders of changing conditions that may affect operations, notifications, field inspections, notams and closures.
- **Maintenance** – ensures that a sufficient number of qualified personnel are available to implement SICP, removal of contaminant, method of attack, control fatigue (windshield time), inspecting and maintaining equipment.

**Airfield Clearing Priorities for the Snow and Ice Control Plan (SICP)** - Airport operators cannot simultaneously clear all snow, slush, ice, or drifting snow from both the entire aircraft movement area and all supporting facilities necessary for flight. However, the airport operator can limit interruption of service as much as possible by classifying the most critical portions of the aircraft movement area and supporting facilities as Priority 1 and then taking care of other areas in their order of importance. For such a system to work, the SICP should identify at a minimum two priority categories based on the airport’s safety requirements, flight operations, visual navigation aids (VISAIDs) and electronic navigational aids (NAVAIDs), and other factors deemed important by the airport operator. Figure 1-1 illustrates an airport with typically prioritized areas. *(Federal Aviation Administration, 2008)*

**Priority 1:**

The plan should list areas to be cleared which are the most critical portions of the aircraft movement area. This should include primary runways and associated turnoffs, access taxiways leading to terminal, terminal/cargo ramps, ARFF stations, identified ARFF mutual aid access
points to include gate operability, emergency service roads, Navigational Aids, and other areas deemed essential, such as fueling areas and airport security/surveillance roads.

**Note:** The entire airport would not be a priority #1 area. Also some airports may list a priority 3 area, those areas are typically non-essential to flight operations or not used on daily basis could.

**Priority 2:**
The plan should identify areas as priority 2 that are of less important to than those listed in priority 1 areas. Areas normally included in this category are crosswind/secondary runways and their supportive taxiways, remaining aircraft movement areas, commercial ramp areas, access roads to secondary facilities, and airfield facilities not essential to flight operations or not used on a daily basis. A color coded map may be included but not substitute for text.

**Priority 3:**
Priority 3 areas would have less importance than those areas listed as priority 2. Priority 3 areas are not required in the SICP but some airports list priority 3 areas as areas not essential to flight operations.

---

(Federal Aviation Administration, 2008)

**Airfield Clearance Times**

Airports should have sufficient equipment to clear within a reasonable time 1 inch (2.54 cm) of snow weighing up to 25 lb/ft³ (400 kg/m³) for the priorities outlined in Paragraph 1-4 that

---

Figure 1-1. Example of Prioritized Paved Areas for the Snow and Ice Control Plan

(Federal Aviation Administration, 2008)
accommodate anticipated airplane operations. (Federal Aviation Administration, 2008) If supportive runways (such as a parallel runway) typically have simultaneous operations during the winter months, then the areas for both runways and associated principal taxiways should be included in the total area. The term “reasonable time,” as used in this AC, is based on the airport type and number of annual operations. The guidance in a. and b. below is provided to assist the airport operator in determining necessary equipment. It should not be interpreted as a requirement to clear surfaces within any particular time. The footnote in Table 1-1 to classify the airport as a Commercial Service Airport or a Non-Commercial Service Airport.

<table>
<thead>
<tr>
<th>Annual Airplane Operations (includes cargo operations)</th>
<th>Clearance Time(^{1}) (hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40,000 or more</td>
<td>½</td>
</tr>
<tr>
<td>10,000 – but less than 40,000</td>
<td>1</td>
</tr>
<tr>
<td>6,000 – but less than 10,000</td>
<td>1½</td>
</tr>
<tr>
<td>Less than 6,000</td>
<td>2</td>
</tr>
</tbody>
</table>

General: Commercial Service Airport means a public-use airport that the U.S. Secretary of Transportation determines has at least 2,500 passenger boardings each year and that receives scheduled passenger air transportation service [reference Title 49 United States Code, Section 47102(7)].

Footnote 1: These airports should have sufficient equipment to clear 1 inch (2.54 cm) of falling snow weighing up to 25 lb/ft\(^3\) (400 kg/m\(^3\)) from Priority 1 areas within the recommended clearance times.

<table>
<thead>
<tr>
<th>Annual Airplane Operations (includes cargo operations)</th>
<th>Clearance Time(^{1}) (hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40,000 or more</td>
<td>2</td>
</tr>
<tr>
<td>10,000 – but less than 40,000</td>
<td>3</td>
</tr>
<tr>
<td>6,000 – but less than 10,000</td>
<td>4</td>
</tr>
<tr>
<td>Less than 6,000</td>
<td>6</td>
</tr>
</tbody>
</table>

General: Although not specifically defined, Non-Commercial Service Airports are airports that are not classified as Commercial Service Airports [see Table 1-1 general note].

Footnote 1: These airports may wish to have sufficient equipment to clear 1 inch (2.54 cm) of falling snow weighing up to 25 lb/ft\(^3\) (400 kg/m\(^3\)) from Priority 1 areas within the recommended clearance times.

(Federal Aviation Administration, 2008)

Second, using the appropriate table, find the number of annual airplane operations handled by the airport and the recommended clearance time. As shown, this action-initiating condition, compared with an action-initiating event based on weather forecasts or runway surface condition sensors, calls for clearing operations for 1-inch (2.54-cm) snowfall with an assumed weight (snow density) of up to 25 lb/ft\(^3\) (400 kg/m\(^3\)). For airports located in regions where snow densities over 25 lb/ft\(^3\) (400 kg/m\(^3\)) are the norm, the airport operator should consider using a ½-inch (1.25 cm) snow depth as the action-initiating condition. Airport operators should keep in mind that heavier snow densities can increase the size and type of equipment comprising the fleet used to clear Priority 1 paved areas within the recommended clearance times (for details, see AC 150/5220-20, Airport Snow and Ice Control Equipment.) Reference FAA spreadsheet listed below.

Sizing and Staffing Snow and Ice Control Equipment Fleet
Sizing the snow and ice control equipment fleet should be based on the total Priority 1 paved area that is cleared of snow, slush, or ice within a recommended clearance time. AC 150/5220-20 offers guidance on how to select the number and types of equipment necessary to meet recommended clearance times. As for staffing, Part 139, sections 139.303(a) and (b) relate equipment fleet size with sufficient, qualified staff. Section 139.303(b) requires certificate holders “to equip personnel with sufficient resources needed to comply with the requirements of this part.” Part 139, section 139.303(a) requires certificate holders “to provide sufficient and qualified personnel to comply with the airport’s Airport Certification Manual and the requirements of this part.” While snow removal and surface treatment may be adequate for runways, the adequacy should extend to keeping all required associated taxiways cleared and to maintaining adequate surface friction to the extent practical.

### Snow Removal Equipment Calculations

<table>
<thead>
<tr>
<th>Airport Name</th>
<th>Location</th>
<th>*Average Annual Snow Fall</th>
<th>*Type of Airport</th>
<th>*Annual Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Commercial Service</td>
<td>≥50,000</td>
</tr>
</tbody>
</table>

#### Critical Snow Removal Areas:

- **Primary Runway (usually one)**
  - Length (ft) x Width (ft) = Area (sq. ft).
  - Actual Blade Length (ft) Required = *Plow Cutting Angle (degrees) x Effective Blade Length (ft).

- **Parallel taxiway and one or two principle connecting taxiways**
  - Length (ft) x Width (ft) = Area (sq. ft).
  - Actual Blade Length (ft) Required = *Plow Cutting Angle (degrees) x Effective Blade Length (ft).

- **Terminal, Cargo, and General Aviation Aprons**
  - Critical apron area assumed as 1/2 of the apron.
  - Length (ft) x Width (ft) = Area (sq. ft).
  - Actual Blade Length (ft) Required = *Plow Cutting Angle (degrees) x Effective Blade Length (ft).

- **Other critical areas (i.e., emergency or ARFF access roads)**
  - Length (ft) x Width (ft) = Area (sq. ft).
  - Actual Blade Length (ft) Required = *Plow Cutting Angle (degrees) x Effective Blade Length (ft).

#### Eligible Items

- **Eligible Items**
  - Rotary Plow
  - Displacement Plow
  - Sweeper
  - Hopper Spreader
  - Front End Loader

#### Snowfall Maps can be found here:

- **Iowa:**  [http://www.hprcc.unl.edu/wrcc/states/ia.html](http://www.hprcc.unl.edu/wrcc/states/ia.html)
- **Kansas:**  [http://www.hprcc.unl.edu/wrcc/states/ks.html](http://www.hprcc.unl.edu/wrcc/states/ks.html)
- **Missouri:**  [http://www.hprcc.unl.edu/wrcc/states/mo.html](http://www.hprcc.unl.edu/wrcc/states/mo.html)
- **Nebraska:**  [http://www.hprcc.unl.edu/wrcc/states/ne.html](http://www.hprcc.unl.edu/wrcc/states/ne.html)

#### Review:

- In developing your SICP discuss your airfield clearance times this should not be limited to runways it needs to include required associate taxiways.

---

**International Aviation Snow Symposium Snow Academy Advanced Airport Winter Operations Specialist 2015**
• State which table you comply with and delete the other table
• Snow equipment for winter operations should be listed in your SICP. The list can be referenced as an exhibit but provide year, make, model of each piece of snow equipment.

Storage of Snow and Ice Control Equipment
Whenever possible, snow and ice control equipment should be housed in a heated building to prolong the useful life of the equipment and to enable more rapid response to operational needs. Additionally, repair facilities should be available within the building for onsite equipment maintenance and repair during the winter season. Operationally, equipment should be inspected after each use to determine whether additional maintenance or repair is necessary. Guidance on storing snow and ice control equipment is provided in FAA AC 150/5220-18, Buildings for Storage and Maintenance of Airport Snow and Ice Control Equipment and Materials.

Buildings for Storage and Maintenance of Airport Snow and Ice Control Equipment and Materials.
Snow Clearing Operations and Ice Prevention

Snow Clearing Principles
Winter conditions and rates of accumulations of precipitation vary widely from airport to airport. However, there are some basic guidelines that apply to all airports that should be followed as closely as possible.

*The airport operator should notify airport users promptly and issue a NOTAM advising users of unusual airport conditions.* Wind speed and direction, available equipment, and local conditions that may require special equipment and techniques collectively determine the snow clearing procedures for the airport’s SICP. The following guidance offers a generic outline for writing the SICP that covers ramp/terminal-related items and runway/taxiway-related items.

Ramp and Terminal Clearing Objectives
Accumulations of snow and slush, snow tracks, and thin layers of ice on ramps and airplane parking areas, including holding areas, can make for safety hazards. *The SICP should contain measures to mitigate at least the following four common situations:*

**Slick Ramp Surfaces** - Ramp equipment and ramp personnel operating on slick or icy ramp surfaces lack sufficient traction to start, stop, or even remain in place when encountering jet exhaust from surrounding airplanes. Maintaining good traction is critical to the safety of personnel, equipment, and airplanes.

**Increased Airplane Engine Thrust** - Pilots of parked or holding airplanes must apply increased engine thrust to break away, maneuver, and taxi under adverse ramp surface irregularities, such as frozen ruts formed by tire tracks. The resultant excessive engine blast necessary to overcome such obstacles may damage other airplanes, ramp equipment, or ramp personnel.

**Obscured Taxi Signage** - The clearing of snow from ramp areas must not be performed in a way that partially or completely covers taxiway signs leading to the airfield with plowed snow. Observing this precaution will reduce the risk of runway incursions.

**Obscured Terminal Visual Aids** - The obscuration of normally visible surface markings or obliterated sign messages could make maneuvering on ramps difficult and slow. Pilots, unable to see these visual aids, are hard pressed to judge direction and taxiing clearances.

**Snow Stockpiles Adjacent to Airplane Operating Areas** - Airport operators should exercise care when moving snow from the ramps and terminals toward taxiways and runways. Depending on the amount of snow cleared and the size of the ramp, ramp signage directing pilots toward the runway could become obscured (covered with snow), and the resulting height of snow stockpiles could cause a clearance issue between taxiing airplanes and the snow stockpile. Airports that experience heavy snowfalls and have large ramps with limited space for stockpiling snow should consider operating snow melters or hauling snow away.
Review - Ramp and Terminal:

- Describe snow clearing objective for the ramp and terminal and who is responsible.
- Address procedures to ensure signs are clear of snow.
- Describe Snow disposal of large quantities of snow, snow stockpiles – height limitations, not obstructing pilot views and snow melters and snow hauling

Runway and Taxiway Suggested Clearing Objectives

The following guidance should not be interpreted to require specific equipment at any airport. It is presented to show efficient use of various equipment to optimize snow clearing operations. Some types of equipment may not be appropriate for some airports. Equipment and procedures used must be determined based on many factors, including but not limited to climate, number and types of operations, airport staffing, and the airport budget. (Federal Aviation Administration, 2008)

Focus runway snow clearing operations on keeping the entire primary runway(s), as near as practical to bare from snow accumulations or ice buildup. Depending on precipitation rate, the time required to clear the full width of the runway may result in additional accumulation, and thus less braking capability, on the critical center portion. In such a case, concentrating clearing operations on the center portion can result in greater safety. The minimum width required will vary by airplane type, but is generally 100’ for transport category airplanes. The airport operator should check with airport users regarding their minimum runway width requirements. (Federal Aviation Administration, 2008)

Depending on the equipment fleet, etc., some operations will start at the center of the runway and work outward to the shoulders.

Use sweepers or brooms initially to keep the primary runway or its center portion, as near as practical, bare of accumulations. Also, when snow has melted or ice begins to separate from the pavement due to the action of chemicals, sweepers or brooms should be used to remove the residue. As soon as snow has accumulated to a depth that cannot efficiently be handled by the sweepers or brooms, displacement plows and rotary plows (snow blowers) should be used as follows.

Use displacement plows, in tandem if more than one, to windrow snow into a single windrow that can be cast over the edge of runway lights by a rotary plow.

For runways or other paved areas with in-pavement surface condition sensors, remove any snow or ice that affects the performance of the remote sensors.

Regarding the use of displacement plows, ice and snow will always melt around runway centerline and touchdown zone light assemblies. However, under cold temperatures, ice rings, termed “igloos,” tend to form around them. In order to prevent damage to lights, use appropriate polyurethane cutting edges or shoes and casters on plow moldboards and on the front of rotary plows.
Rotary plows should throw snow a sufficient distance from runways/taxiways edges so adequate clearance is available between airplane wings and engine nacelles and the cast snow banks.

**Figure 4-1** shows desired maximum snow height profiles, which are based on airplane design groups.

**Obscured visual aids** - in particular in-pavement and edge lights, taxiways, runway markings (such as touchdown marking), airport guidance signs, and runway end identification lights (REIL), precision approach path indicator (PAPI) or visual approach slope indicator (VASI) — need to be maintained free of snow and ice.
All drivers must maintain a safe distance between equipment operating in *echelon* (i.e., V-formation, close wing formation) in order to avoid accidental contact or accidents.

A covering of snow and ice or drifts may affect visual and electronic NAVAIDs. Any snow or ice that affects the signal of electronic NAVAIDs should be removed. When clearing with rotary plows and displacement plows, special procedures need to take into account the location of all NAVAIDs, especially to protect the guidance signal of instrument landing systems (ILS). The SICP needs to address the following situations:

**Glide slope critical ground areas** along the runway require that snow depths be limited in height to prevent signal loss or scattering. Figure 4-2 provides graphic representations of the glide slope ground snow clearance areas with prescribed snow depth limitations according to type of facility and aircraft approach category. When snow depths exceed the specified depth limitations, minima are raised to the “localizer only” function until the conditions revert or are corrected. Two consecutive pilot reports of glide slope signal malfunctions generally result in raised minima (a NOTAM must be issued by the owner of the NAVAID). A few additional points should be considered.

*Note:* Snow banking operations need to take into account the guidance in Figure 4-2.
Visibility of signs (legibility) and lights should be maintained by certain prescribed clearing techniques or by performing post-clearing maintenance. Maintaining visibility can be better achieved by taking into account wind directions. For example, in crosswind conditions, cast in the downwind direction. Figures 4-3 through 4-5 provide general guidance. 

(Federal Aviation Administration, 2008)
The snow depth height limitations noted in Figure 4-2 do not take into consideration airplane characteristics. That is, at some airports, airplane characteristics, such as engine clearances, may dictate lower snow banks than shown in Figure 4-2. The objective here is prevention by avoiding the introduction of hazardous snow banks, drifts, windrows, and ice ridges that could come into contact with any portion of the airplane wing or nacelle surface.

Upon completion of snow clearing operations, runway friction measurements should be taken to assess the effectiveness of the snow clearing operation. See Chapter 5 for recommended procedures.

If the airport’s operation involves the use of snow banks, their height profiles should be compatible with NAVAID ground requirements and offer sufficient clearance between airplane wings and engine nacelles to avoid structural damage to jet and propeller airplanes. Figure 4-1 shows desired maximum snow height profiles, which are based on airplane design groups (see AC 150/5300-13, Airport Design, for airplane design group categories.) Snow banking along terminal or cargo aprons likewise should comply with Figure 4-1 to prevent operational problems caused by ingestion of ice into turbine engines or by propellers striking the snow banks. Appendix 1, which used numerous airplane models, was used to develop criteria for figure 1.

(Federal Aviation Administration, 2008)
If the runway pavement temperature is warm enough for snow to compact and bond or if freezing rain is forecasted, approved anti-icing chemicals and/or heated sand should be applied prior to the start of precipitation or as soon as precipitation starts. Some airport operators prefer to apply deicing chemicals rather than anti-icing chemicals for different weather conditions. Paragraph 4-6 provides a listing of approved fluid and solid material specifications.

All snow removal units operating in aircraft movement areas must maintain radio communication with the ATCT, if one exists, or be under the direct control of a designated supervisor who in turn is in direct communication with the ATCT.

High-speed runway turnoffs require the same attention for ice and snow control and removal as runways. These turnoffs should offer sufficient directional control and braking action for airplanes under all conditions. Accident data clearly illustrate that poor attention to high-speed runway turnoffs contributes to veer offs.

Joint-use airports with military operations may have arresting barriers located near the end of the runway or at the beginning of the overrun areas. Great care should be taken in clearing snow from the barriers. Barriers located on the runway should be deactivated and pendants removed prior to snow removal operations. Snow should be removed to the distance required for effective run-out of the arresting system.

**Review - Runways & Taxiways:**

Describe equipment and procedures used at your airport. Also any local factors that contribute to the decision making process. Minimums acceptable clearing for runway at your airport (full width), 100’.

Typical techniques used at your airport.

- Types of formations
- High speed turn offs
- Snow Bank Height Profiles

Describe triggers to clear each glide slope critical areas and PAPI/VASI and who is responsible. Maps describing critical areas should be attached.

Controlling snow drifts – describe methods used at your airport to control snow drifts.

- Snow fence
- Snow Trench
- Describe Snow disposal of large quantities of snow, snow stockpiles – height limitations, not obstructing pilot views and snow melters and snow hauling
**Methods for Ice Control and Removal**

*Preventing a bond from occurring between ice and the pavement surface is always preferred over the mechanical removal or melting of the bonded ice. Appendix 2 provides the characteristics of ice and other forms of snow and other details about handling problems. Paragraph 4-6 provides the FAA-recommended chemical specifications for approved airside anti-icer and deicer products. (Federal Aviation Administration, 2008)*

Prevention is achieved by applying approved anti-icing chemicals to pavements with temperatures expected to go below $32^\circ$ F ($0^\circ$ C). Fluid anti-icing products instead of solid anti-icing products are recommended since the liquid form is more effective in achieving uniform distributions and improved chemical-adhesion to the pavement surface. The primary drawback of solid chemicals on cold pavements is their inability to adhere properly to the surface, which can lead to their being windblown or scattered about.

Once the ice has bonded to the pavement surface, the airport operators may use approved deicers to melt through the ice pack to break up or weaken the ice bond; increase the frictional characteristics of the surface, for example, by applying heated sand; or use mechanical means, such as plowing with under-body scrapers or scarifying the ice surface to break the ice packs. The type of brooms used to remove a layer of ice is important since in some cases the broom may actually “polish” the ice, thus reducing traction. Steel bristles are better than poly bristles since one “cuts” the ice surface while the other “flips” snow. Paragraph 4-7 provides guidance on methods to improve the frictional characteristics of surfaces, and Paragraph 4-8 provides the FAA recommended sand gradation for runway and taxiway usage.

**Approved Chemicals**

**Airside Chemicals:**

The FAA either establishes approval specifications or, upon acceptance, references the specifications of professional associations, such as SAE Aerospace Material Specifications (AMS), and the U.S. military (MIL-SPEC). The approved airside chemicals for runway and taxiway applications are fluid and solid products meeting a generic SAE or MIL specification. These specifications require vendors to provide airport operators with a lab certification stating the chemical conformed to the applicable specification and a material safety data sheet (MSDS) for handling the product. With the increased accountability placed on airport operators to manage deicing/anti-icing chemical runoff, they should request vendors to provide certain environmental data. These data consist of information on pollutants the Environmental Protection Agency and the State Department of Natural Resources request of the airport operators in their discharge reporting requirements. Typically, the information includes percent product biodegradability, biochemical oxygen demand (BOD$_5$), chemical oxygen demand (COD), pH, presence of toxic or hazardous components, if any, and remaining inert elements after application. MSDSs provide measures on how to secure large product spills and a 24-hour toll-free emergency phone number. While these fluid and solid specifications cover technical requirements for deicing/anti-icing products, they do not address the compatibility issue of combining products during operations. Airport operators, therefore, should query manufacturers about the safe and proper use of concurrently applying multiple deicers/anti-icers. The FAA-approved airside chemical specifications, which may be restricted by state or local environmental regulations, are as follows:
**Fluid Deicer/Anti-icers**
The approved specification is the latest edition of SAE AMS 1435, Fluid, *Generic Deicing/Anti-icing, Runways and Taxiways*. Approved products include glycol-based fluids, potassium acetate base, and potassium formate-based fluids. The SAE specification is available for purchase at [http://www.sae.org](http://www.sae.org). Application rates for a specific product are based on manufacturer recommendations. In terms of material cost-savings, less product is used by anti-icing operations than by deicing operations.

**Solid Deicer/Anti-icer**
**Generic Solids** - The approved specification is the latest edition of SAE AMS 1431, Compound, Solid Runway and Taxiway Deicing/Anti-icing. Approved solid compounds include airside urea, sodium formate, and sodium acetate. It is noted that, in comparison to airside urea, sodium formate and sodium acetate products continue to be effective for much colder pavement temperatures. The urea deicing function is practical only at temperatures above approximately 15°F (-10°C) because of the decreasing melting rates below this temperature value. The decreasing melting rate is a result of urea’s eutectic temperature, defined in Paragraph 1-9, which is approximately 11°F (-12°C). However, the presence of solar radiation assists urea in the melting action. Pavement surface temperature and ice thickness determine the urea application rate. Application rates for a specific product are based on manufacturer recommendations.

**Review:**
*Describe if anti-icer products are used and which ones and how they are applied.*

**FAA Approved Chemicals:**
- *The airport normally has ____ tons of solid deicer (sodium formate) and ______ gallons of liquid deicer (potassium acetate).*
- *The airport normally has ______ tons of sand.*
- *The airport deploys solid deicer with (type of vehicle).*
- *The airport deploys liquid deicer with (type of vehicle).*
- *The airport deploys sand with (type of vehicle).*
- *The airport recovers all sand after snow storms as necessary.*
- *Describe who records the chemical usage.*

**Sand**
Granular material provides a roughened surface on ice and thereby improves airplane directional control and braking performance. Use of sand should be controlled carefully on turbojet movement areas to reduce engine erosion. If the granules do not embed or adhere to the ice, they will likely be ingested into engines and/or blown away by wind or scattered by traffic action and thus serve no useful function. This is particularly the case when unheated sand is applied to ice or compacted snow is at temperatures below about 20°F (-6.7°C) since no water film exists on the surface to act as an adhesive.

There are three approaches to reducing loss of sand: (1) it can be heated to enhance embedding into the cold surface; (2) the granules can be coated with an approved deicing chemical in the stockpile or in the distributing truck hopper; or (3) diluted deicing chemical can be sprayed on the granules or the pavement at the time of spreading. If stockpiles are kept in a heated enclosure and spread promptly after truck loading, sufficient heat may remain for embedding.
without further treatment. Maintenance personnel should make a test on an unused pavement covered with ice or compacted snow to determine if bonding is adequate to prevent loss. When the slippery condition giving rise to the requirement for sand has passed, treated pavements should be swept as soon as air traffic volume allows to remove the residue to prevent engine damage. Other factors to consider when deciding to apply sand are pavement and air temperatures and frequency of operations.

*The use of other abrasives, such as slag, is not recommended since some metal-based slags may affect engine components.* (Federal Aviation Administration, 2008)

**Sand - Standard Gradation**

Table 4-2 provides the standard gradation for sand. Materials applied to aircraft movement surfaces must consist of washed granular mineral sand particles free of stone, clay, debris, slag, chloride salts, and other corrosive substances. The pH of the water solution containing the material must be approximately neutral (pH 7). Material must meet the following gradation using a U.S.A. Standard Sieve conforming to ASTM E 11-81. The upper and lower sand gradations are in response to engine manufacturers input that finer sized sand from time to time produced hard snowballs while coarser sized sand damaged engine components. The later case additionally causes damage to the fuselage.

**Review** – *Describe if sand is used, how and when it is applied and if it’s chemically treated or heated. State if the sand meets FAA gradient standards and which table below.*

(Federal Aviation Administration, 2008)

---

**Landside Chemicals**

The most effective landside chemicals used for deicing/anti-icing in terms of both cost and freezing point depression are from the chloride family, e.g., sodium chloride (rock salt), calcium chloride, and lithium chloride. However, these chemicals are known to be corrosive to aircraft and therefore are prohibited for use on aircraft operational areas. (Federal Aviation Administration, 2008) When any corrosive chemical is used, precautions should be taken to ensure that (1) vehicles do not track these products onto the aircraft operational areas and (2) chemical trucks used for transporting corrosive chemicals are cleaned prior to transporting airside chemicals or sand. It is noted that although the solids sodium acetate and sodium formate and the fluids potassium acetate and potassium formate products are classified as salts, those that contain corrosion inhibitor packages to comply with an SAE specification are approved for airside applications.

**Surface Incident/Runway Incursion Mitigation Procedures**
The FAA strongly recommends the SICP contain specific safety procedures or a separate written section to mitigate the possibility for surface incident/runway incursions. **These specific safety procedures should provide answers to, at minimum, the following two questions:**

1. How can pilots of small or large airplanes or vehicle drivers traversing the airfield cause a runway incursion because of our snow clearing operations? and
2. How do snow operation personnel at either non-towered airports or airports with less than 24-hour ATCTs monitor information released by the ATC enroute center? The procedure addressing the latter questions should apply even if a NOTAM has been issued closing the runway for snow clearing operations. This precaution is especially important during marginal visual meteorological condition (VMC). *(Federal Aviation Administration, 2008)*

**The SICP should address the following topics:**

**Radio Communications**

It is imperative to train winter operations personnel with proper radio usage, procedures and terminology (phonetic alphabet). Equipment operations must be timed carefully and coordinated properly with team members to ensure an orderly turnaround for safe return and start of a new pass. All airfield vehicles should have a list of radio frequencies with assigned areas of the airfield. **The SICP should designate a lead operator for each shift who maintains contact with his team members and the ATCT.** *(Federal Aviation Administration, 2008)* At airports without an operating control tower or when the tower is closed, proper radio communications must be maintained at all times and in accordance with SICP procedures. Consideration should be given to providing vehicle operators with headphones to minimize ambient noise disruption from vehicular noise.

**Failed Radio Signals**

The SICP must outline specific procedures when radio signal is lost between crews and when a single driver loses radio signal. The drafting of a LOA with ATC explaining proper procedures in this circumstance is appropriate. All drivers must be trained in the specific procedures to follow as outlined in SICP.

**Airfield Signage and Lights**

Airfield and ramp signs must be kept clean of plowed or cast snow to maintain the legibility of signage. Priority should be given to lights and signs associated with holdlines. Utilizing a truck mounted air-blast unit, spraying the faces of signs with an approved liquid deicer, or hand shoveling will improve safety in winter operations.
Low Visibility and Whiteouts

*It is of utmost importance to maintain visual contact with your surroundings during snow clearing operations, especially for operations in an echelon formation. Situational Awareness (SA) must be the highest priority.* (Federal Aviation Administration, 2008) There is many interpretations for SA but in regards to airport winter operations SA can be best explained as the continuous process of attentiveness and surveillance that results in an accurate perception of the factors and conditions affecting an individual and his or her environment during a defined period of time. (ACRP Synthesis S04-02) The SICP must specify procedures to follow if visibility suddenly drops to near zero or whiteout conditions exist while clearing operations are in progress. For example, the airport operator may require that all equipment report their positions and stop snow removal operations until visibility improves.

Driver Fatigue

Much Consideration should be given to monitoring fatigue of personnel working in winter operations. The AC refers to fatigue as regulating the amount of “windshield time” of drivers operating snow removal equipment because operator fatigue could become a contributing factor for runway incursions. In response, some airport operators have implemented limits on driver operating hours. Also referencing training, it may improve situational awareness if you review with all staff but especially the equipment operators, circadian rhythm and sleep disorders. The training will assist personnel in recognizing symptoms associated with fatigue and human performance.

*In the attached illustration from Fatigue Risk Management in Aviation Maintenance: Current Best Practices and Potential Future Countermeasures,* it depicts factors that surround human fatigue other than windshield time. (Federal Aviation Administration, 2011)
Review:

- Review past surface incidents at your airport that have occurred during snow removal operations.
- Review how additional vehicles and time on the airfield might lead to a surface incident. Explain preventative measures have you put in place at your airport to prevent such an occurrence during winter operations.
- State vehicles will be marked and lighted in accordance with FAA AC 150/5210-5 Painting, marking and lighting of vehicles used on an airport
- Radio Communications: Describe how radio communications work at your airport during snow removal operations, procedures, chain of command.
- Provide a description of your operation:
  - Ground Control frequency
  - CTAF
  - Direct Control of Vehicles
- Failed Radio Communications: Describe what procedures you have in place if radio communications fails between the snow team and or the Air Traffic Control Tower
- Whiteout Conditions & Low Visibility: Describe specific procedures you have in place to follow if whiteout condition exists and/or visibility suddenly drops
- Driver Fatigue: Describe if you have limits on time on equipment or shifts, explain what procedures you have for operator fatigue.
Runway Surface Assessment Reporting

The Snow Control Center (SCC) must be aware of the surface conditions of all aircraft movement areas in order to plan and carry out appropriate maintenance actions or to close a runway, taxiway, or ramp area to aircraft use. Assessing and reporting the surface condition of a runway poses a particular challenge for an airport operator and is of the utmost importance to airport users. Pilot braking action reports are the source of braking action information most accepted by pilots, but they can vary significantly, even when reporting on the same contaminated surface conditions, and obviously only apply to the portion of the runway where braking occurred. The use of a truck or automobile to estimate airplane braking action is also subjective. Research by the FAA at one time indicated that measurements using approved friction measuring devices would provide pilots with an objective assessment of the braking action that could be expected on the runway, but later research has not been able to identify a consistent and usable correlation between those measurements and airplane braking performance. Thus, this advisory circular contains significant changes to FAA recommendations regarding reporting of friction values.

Providing Information to Pilots

The goal in reporting runway surface conditions is to provide pilots with the best information available to ensure safe operations. Previously, there was no objective type of measurement of runway surface condition that has been shown to consistently correlate with airplane performance in a usable manner to the satisfaction of the FAA.

Providing Information to Pilots

Runway Condition Assessment Matrix (RCAM).

The RCAM is the method by which an airport operator reports a runway surface assessment when contaminants are present. Use of the RCAM is only applicable to paved runway surfaces. Once an assessment has been performed, the RCAM defines the format for which the airport operator reports and receives a runway condition “Code” via the NOTAM System. The reported information allows a pilot to interpret the runway conditions in terms that relate to airplane performance. This approach is a less subjective means of assessing runway conditions by using defined objective criteria. Aircraft manufacturers have determined that variances in contaminant type, depth, and air temperature can cause specific changes in aircraft braking performance. At the core of the RCAM is its ability to differentiate among the performance characteristics of given contaminants. (Federal Aviation Administration, 2016)

The following RCAM information is directly from the Advisory Circular 150/5200-30D
### Runway Condition Assessment Matrix (RCAM)

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
<th>Control/Braking Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Runway Condition Description</strong></td>
<td><strong>RwyCC</strong></td>
</tr>
<tr>
<td>• Dry</td>
<td>6</td>
</tr>
<tr>
<td>• Rain (Includes damp and 1/8 inch depth or less of water)</td>
<td>5</td>
</tr>
<tr>
<td>1/8 inch (3mm) depth or less of:</td>
<td></td>
</tr>
<tr>
<td>• Slush</td>
<td>4</td>
</tr>
<tr>
<td>• Dry Snow</td>
<td></td>
</tr>
<tr>
<td>• Wet Snow</td>
<td></td>
</tr>
<tr>
<td><strong>-15°C and Colder outside air temperature:</strong></td>
<td></td>
</tr>
<tr>
<td>• Compacted Snow</td>
<td>3</td>
</tr>
<tr>
<td>Greater than 1/8 inch (3 mm) depth of:</td>
<td></td>
</tr>
<tr>
<td>• Dry Snow</td>
<td></td>
</tr>
<tr>
<td>• Wet Snow</td>
<td></td>
</tr>
<tr>
<td>Warmer than -15°C outside air temperature:</td>
<td></td>
</tr>
<tr>
<td>• Compacted Snow</td>
<td></td>
</tr>
<tr>
<td>Greater than 1/8 inch (3 mm) depth of:</td>
<td></td>
</tr>
<tr>
<td>• Water</td>
<td>2</td>
</tr>
<tr>
<td>• Slush</td>
<td></td>
</tr>
<tr>
<td><strong>Ice</strong></td>
<td>1</td>
</tr>
<tr>
<td>• Wet Ice</td>
<td></td>
</tr>
<tr>
<td>• Slush over Ice</td>
<td></td>
</tr>
<tr>
<td>• Water over Compacted Snow</td>
<td></td>
</tr>
<tr>
<td>• Dry Snow or Wet Snow over Ice</td>
<td>0</td>
</tr>
</tbody>
</table>

### RCAM Components

**Assessment Criteria**

This section of the RCAM consists of a Runway Condition Description and a Runway Condition Code. This section includes contaminant type and depth categories which are objective assessments that have been determined by airplane manufacturers to cause specific changes in the airplane braking performance. These contaminants correspond to reportable “shorthand” Runway Condition Code when applicable.
Runway Condition Description
The Runway Condition Description column of the RCAM provides contaminants that are directly correlated to airplane takeoff and landing performance. The description sections, ranging in terms of slipperiness, are categorized based on type and depth of contaminant and temperature.

Code (Runway Condition Code – RwyCC).
Runway Condition Codes (Format: X/X/X) represent the runway condition description based on defined terms and increments. Use of these codes harmonizes with ICAO Annex 14, providing a standardized “shorthand” format for reporting RwyCC (which replaces Mu values), and are used by pilots to determine landing performance parameters when applicable. Runway Condition Codes are disseminated via the following methods:
1. Federal NOTAM System, preferably through NOTAM Manager or equivalent system(s);
2. Airport Traffic Control Tower (ATCT) (as applicable);
3. Flight Service Station (FSS) (as applicable); and
4. Directly from airport operator via Common Traffic Advisory Frequency (as applicable).

Downgrade Assessment Criteria
When data from the shaded area in the RCAM (i.e., CFME/deceleration devices, pilot reports, or observations) suggest conditions are worse than indicated by the present contaminant, the airport operator should exercise good judgment and, if warranted, report lower runway condition codes than the contamination type and depth would indicate in the RCAM. While pilot reports (PIREPs) of braking action provide valuable information, these reports rarely apply to the full length of the runway as such evaluations are limited to the specific sections of the runway surface in which wheel braking was utilized. It is not appropriate to use downgrade assessment criteria to upgrade contaminant based assessments of condition codes (e.g., from 2 to 3). There are specific rules and perimeters governing when the RwyCC may be upgraded from Code 0 or 1 to Code 3.

Mu (μ) (Friction Assessment).
The correlation of the Mu (μ) values with runway conditions and condition codes in the RCAM are only approximate ranges for a generic friction measuring device and are intended to be used for an upgrade or downgrade of 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.

Vehicle Deceleration or Directional Control Observation
This column is used to correlate estimated vehicle braking experienced on a given contaminant.
**Pilot Reported Braking Action**

This is a report of braking action on the runway, by a pilot, providing other pilots with a degree/quality of expected braking. The braking action experienced is dependent on the type of aircraft, aircraft weight, touchdown point, and other factors.

1. **Good**: Braking deceleration is normal for the wheel braking effort applied, and directional control is normal.

2. **Good-to-Medium**: Braking deceleration or directional control is between good and medium braking action.

3. **Medium**: Braking deceleration is noticeably reduced for the wheel braking effort applied, or directional control is noticeably reduced.

4. **Medium-to-Poor**: Braking deceleration or directional control is between medium and poor.

5. **Poor**: Braking deceleration is significantly reduced for the wheel braking effort applied, or directional control is significantly reduced.

6. **Nil**: Braking deceleration is minimal to non-existent for the wheel braking effort applied, or directional control is uncertain.

**Note**: A RwyCC of “0” denotes minimal or non-existent braking deceleration, which the FAA has determined to be an unsafe condition. The NOTAM system does not accept “0” for RwyCC and, if attempted, prompts the airport operator to close the surface and perform mitigating actions until the unsafe condition no longer exists.

**Step 1: RCAM Applicability**

Operating with an understanding of the RCAM, the airport operator must first determine whether the overall runway length and width coverage or cleared width (if not cleared from edge to edge) is contaminated greater than 25 percent. This step in the assessment process will dictate whether a runway condition code will be applicable and included in the reported runway conditions. When submitting runway condition information through the Federal NOTAM System, this calculation will be automatically conducted by the NOTAM system, based on the reported contaminants for each third of the runway.

If 25 percent or less of the overall runway length and width coverage or cleared width is covered with contaminants, RwyCCs must not be applied, or reported. The airport operator in this case will simply report the contaminant percentage, type, and depth for each third of the runway, including any associated treatments or improvements.

Or

If the overall runway length and width coverage or cleared width is greater than 25 percent, RwyCCs must be assigned, and reported, informing airplane operators of the contaminant present and associated codes for each third of the runway. (The reported codes, will serve as a trigger for all airplane operators to conduct a takeoff and/or landing performance assessment).
Step 2: Apply Assessment Criteria
Based on the contaminants observed, the associated RwyCC from the RCAM for each third of the runway will be assigned. To reduce the potential for human error, the NOTAM system (NOTAM Manager or ENII) will determine the relevant RwyCC for each third of the runway as applicable.

Step 3: Validating RwyCCs
With the contaminant assessment and code assignment completed, the airport operator may determine that the RwyCCs accurately reflect the runway condition. If so, no further assessment action is necessary, and the RwyCCs generated may be disseminated.

Downgrade Assessment Criteria
However, the airport operator may determine a need exists to downgrade the RwyCC (assessment is indicating a more slippery condition than is generated by the RCAM) because of other observations related to runway slipperiness. When necessary, use of the RCAM Downgrade Assessment Criteria (grey columns) may assist in making this determination.

Note: The criteria in the grey columns of the RCAM may only be used to downgrade the RwyCCs.

Step 3A: Mu (μ)
When conditions are acceptable for the airport operator to use available friction devices, the airport operator may utilize Mu readings as a means to assess runway slipperiness for downgrading or to validate the RwyCCs generated by the RCAM.

Step 3B: Vehicle Control
Vehicle deceleration or directional control may cause concerns for the airport operator. These concerns could be for either deceleration or directional control issues. However, they need not occur simultaneously for concern to exist.

Step 3C: Pilot Reported Braking Action
Pilot reports, which provide valuable information, rarely apply to the full length of the runway. As such, these reports are limited to the specific sections of the runway surface in which wheel braking was applied.

Note: Temperatures near and above freezing (e.g., at negative 26.6°F (-3° C) and warmer) may cause contaminants to behave more slippery than indicated by the runway condition code given in the RCAM. At these temperatures, airport operators should exercise a heightened awareness of airfield conditions, and should downgrade the RwyCC if appropriate.

Upgrade Criteria Based on Friction Assessments
Given the friction variability of certain contaminants, there are circumstances when a RwyCC of ‘0’ or ‘1’ (Ice, Wet Ice, Slush over Ice, Water over Compacted Snow, or Dry or Wet Snow over Ice)
may not be as slippery as the RwyCC generated by the RCAM. Only in these two specific circumstances, the airport operator may upgrade the RwyCC up to, but no higher than, a RwyCC of ‘3’, only when all of the following requirements are met:

1. All observations, judgment, and vehicle braking action support the higher RwyCC.
2. Mu values of 40 or greater are obtained for the affected third(s) of the runway by a calibrated friction measuring device that is operated within allowable parameters.
3. This ability to raise the reported RwyCC to no higher than a code 3 is applied only to those runway conditions listed under code 0 and 1 in the RCAM. (See footnote 2 on the RCAM.)
4. The airport operator continually monitors the runway surface as long as the higher code is in effect to ensure the runway surface condition does not deteriorate below the assigned code.
   a. The extent of monitoring considers 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 monitoring program must confirm continued effectiveness of the treatment.

**Applying the RCAM to a Runway Assessment**

To use the RCAM, the airport operator will use the same runway condition assessment practices as they have used in the past. The airport operator will assess surfaces, report contaminants present, and the NOTAM system (NOTAM Manager or ENII) will generate the RwyCCs based on the RCAM when applicable. The RwyCCs may vary for each third of the runway if different contaminants are present. However, the same RwyCC may be applied when a uniform coverage of contaminants exists.

“The goal in reporting surface conditions is to provide pilots with accurate and timely information to ensure safe operations. The RCAM is now the most objective method for performing condition assessments by airport operators.” (Federal Aviation Administration, 2016)

**Runway Closures**

The previously accepted philosophy of the aviation industry was that the airport operator was obligated to provide an accurate description of the runway conditions, and it was solely up to the pilot to decide if the runway was safe for use. Accident data do not support such a philosophy, and FAA Flight Standards Service has determined that operations on runways reported as having NIL braking are inherently unsafe. Admittedly, this is a conservative
approach considering the variation in pilot braking action reporting, but considering the possible consequences of ignoring a NIL braking action report, requirements for closure of runways are presented in paragraph below.

Requirements for Runway Closures
The following circumstances require the prescribed action by the airport operator:

- **A NIL pilot braking action report (PIREP), or NIL braking action assessment by the airport operator, requires that the runway be closed before the next flight operation. The runway must remain closed until the airport operator is satisfied that the NIL condition no longer exists.**

- **When previous PIREPs have indicated GOOD or MEDIUM (FAIR) braking action, two consecutive POOR PIREPS should be taken as evidence that surface conditions may be deteriorating and require the airport operator to conduct a runway assessment. If the airport operator has not already instituted its continuous monitoring procedures (see paragraph 5-7), this assessment must occur before the next operation. If the airport operator is already continuously monitoring runway conditions, this assessment must occur as soon as air traffic volume allows, in accordance with their SICP. Deteriorating conditions include but are not limited to:**
  - Frozen or freezing precipitation
  - Falling air or pavement temperatures that may cause a wet runway to freeze
  - Rising air or pavement temperatures that may cause frozen contaminants to melt
  - Removal of abrasives previously applied to the runway due to wind or airplane affects
  - Frozen contaminants blown onto the runway by wind

Under the conditions noted above, the airport operator must take all reasonable steps using all available equipment and materials that are appropriate for the condition to improve the braking action. If the runway cannot be improved, the airport operator must continuously monitor the runway to ensure braking action does not become NIL. The airport operator’s procedure for monitoring the runway should be detailed in the SICP. (Federal Aviation Administration, 2008)

To ensure that the airport operator receives necessary information, a Letter of Agreement (LOA) should be formalized between the airport operator and the air traffic control tower. At a minimum, the LOA should specify how all pilot braking reports (PIREPS) of “POOR” and “NIL” are to be immediately transmitted to the airport operator, e.g., the SCC for action, as required by FAA Order 7110.65, Air Traffic Control. It should also include agreement on actions by Air Traffic personnel for immediate cessation of operations upon receipt of a “NIL” PIREP. A reference to the signed LOA, whose procedures for ATCT and the airport will likely vary from airport to airport, should be contained in the airport’s SICP. Finally, the airport operator must inform airport users in a timely manner of any runway closure. See paragraph 5-2, Runway Condition Reporting, for disseminating such information in a timely manner to airport users.
Review:

Describe what procedures and Letters of Agreement (include LOA’s) that you have in place to immediately cease all aircraft operations on any runway when a NIL braking action is received.

- It’s recommended some airports develop additional triggers for runway closures, Examples: Maximum slush, wet snow depths, dry snow depths, ice or freezing rain and minimum MU level.
- If you have several triggers requiring runway closures, the format of a table might be beneficial
- Two consecutive poor PIREPS

Runway Condition Reporting

The SCC needs to carefully monitor changing airfield conditions and disseminate information about those conditions in a timely manner to airport users. Part 139 requires affected airport operators to issue prompt notification, in accordance with section 139.313(b), to all air carriers using the airport when any portion of the movement area normally available to them is less than satisfactorily cleared for safe operation by their aircraft. In addition, SICPs must contain provisions for informing all airplane operators of any pavement condition that is worse than bare and dry. (Federal Aviation Administration, 2008) It is imperative that the field condition report contain accurate and timely information. For example, the type and depth of contaminant is critical information to airplane operators. Also, the determination of dry versus wet snow or slush condition is another key element in the report because of its potential for significant impact on an airplane’s takeoff and landing performance capabilities.

Because runway surface conditions can change quickly, either due to weather conditions or corrective actions taken to mitigate such conditions, NOTAMs describing the runway surface conditions must be timely. The FAA recommends that airport operators review their reporting method and procedures so their SICP procedures are conducive to timely reporting. (Federal Aviation Administration, 2008) For airports, particularly smaller airports, that do not monitor weather conditions between certain hours due to staffing limitations, the issued NOTAM should contain text indicating that “airfield surface conditions are not monitored between the hours of ‘x – y’.” This additional text helps to avoid erroneous condition assessments by users of the information.

Review:

- Runway condition reporting is provided whenever the pavement condition is worse than bare and wet.
- Airport Condition Reporting shall be disseminated in accordance with ACM section 139.339 – Airport Condition Reporting and if necessary LOA.
- The FAA ATCT will immediately relay all PIREP’s (as required in LOA) to airport personnel (Ops or Maintenance personnel).
When to Issue New Runway Condition Reports

Runway condition reports must be updated any time a change to the runway surface condition occurs. Changes that initiate updated reports include weather events, the application of chemicals or sand, or plowing or sweeping operations. *Airport operators should not allow airplane operations on runways after such activities until a new runway condition report is issued reflecting the current surface condition(s) of affected runways. At certificated airports, such changes to the runway surface condition must be updated and appropriately disseminated so airplane operators are aware of the current conditions before continuing with their operations.* (Federal Aviation Administration, 2008) During active snow events or rapidly changing conditions (e.g., increasing snowfall, rapidly raising or falling temperatures) airport operators are required to maintain a vigilant runway inspection process to ensure accurate runway condition reports. While pilot reports (PIREPs) of braking action provide valuable information, these reports may not apply to the full length of the runway as such evaluations are limited to the specific sections of the runway surface in which the airplane wheel braking was used. In addition, runway condition reports should be updated at least at the beginning of each shift of operations personnel.

Winter NOTAM Abbreviations

Snow-related NOTAMs should adhere to the format and abbreviations found in AC 150/5200-28, Notices to Airmen (NOTAMs) for Airport Operators, and FAA Orders 7930.2, Notices to Airmen (NOTAMS), and 7340.1, Contractions. (Federal Aviation Administration, 2008)

**Review:** Describe procedures for reporting:

- Runway surface conditions by Runway Condition Codes.
- When the cleared runway width is less than full width, and if you have un-cleared runway edges with a different condition from cleared width on runway.

Describe procedures for determining when to update runway conditions. What triggers a runway condition report to be updated or changed (time/changing weather conditions)? Any time a change to the runway surface conditions occurs which could be any of the following:

- Active snow event
- Plowing/brooming/deicing/sanding
- Rapidly rising or falling temperatures
- Rapidly changing conditions
- State what the minimum timeline acceptable at your airport when contaminants exist on the runway and runway condition report is updated.
- Describe how the airport assesses runway conditions to ensure that they are accurate and timely?
- How often and who is responsible?
- How this information is communicated to the user of your airport and who is responsible to communicate this information?
- What forms are used to convey this information (should be included in you SICP).
If applicable, for small airports:

Issuance of a NOTAM “airfield surface conditions not monitored between the hours of _____ and ____ local time.” Describe the dates this would be in effect for and who would be responsible to issue this NOTAM annually for your airport.

**Runway Friction Surveys**

FAA-approved friction measuring equipment may be employed to help in determining the effects of friction-enhancing treatments, in that it can show the trend of a runway as to increasing or decreasing friction. Airport operators must not attempt to correlate friction readings (Mu numbers) to Good/Medium (Fair)/Poor or Nil runway surface conditions, as no consistent, usable correlation between Mu values and these terms has been shown to exist to the FAA’s satisfaction. Runway Friction Values are no longer reported. It is important to note that while manufacturers of the approved friction measuring equipment may provide a table that correlates braking action to Mu values, these correlations are not supported by the FAA. To ensure that data collected are accurate, qualified personnel should use FAA-approved equipment and follow the manufacturer’s instructions for use. *Further guidance on runway friction measurement may be found in AC 150/5320-12C, Measurement, Construction, and Maintenance of Skid-Resistant Airport Pavement Surfaces.* (Federal Aviation Administration, 2008)

**Conditions Acceptable to Use Decelerometers or Continuous Friction Measuring Equipment to Conduct Runway Friction Surveys on Frozen Contaminated Surfaces**

The data obtained from such runway friction surveys are only considered to be reliable when the surface is contaminated under any of the following conditions.

1. Ice or wet ice. Wet ice is a term used to define ice surfaces that are covered with a thin film of moisture caused by melting. The liquid water film deposit is of minimal depth of 0.04 inch (1 mm) or less, insufficient to cause hydroplaning.
2. Compacted snow at any depth.
3. Dry snow 1 inch or less.
4. Wet snow or slush 1/8 inch or less.

It is not acceptable to use decelerometers or continuous friction measuring equipment to assess any contaminants outside of these parameters. (Federal Aviation Administration, 2008)

**When to Conduct Runway Friction Assessments on Contaminated Surfaces**

The airport operator should conduct runway friction assessments whenever it is thought that the information will be helpful in the overall snow/ice removal effort, and the conditions are within the limits above. Within those conditions, runway friction assessments should be conducted:

1. When the central portion of the runway, centered longitudinally along the runway centerline, is contaminated over a distance of 500 feet (152 m) or more.
2. Following all snow clearing, anti-icing, deicing, or sanding operations.
Immediately following any aircraft incident or accident on the runway, recognizing that responding ARFF or other circumstances may restrict an immediate response.

**FAA-Approved Runway Friction Measuring Equipment**

There are two basic types of friction measuring equipment that can be used for conducting friction surveys on runways during winter operations: Continuous Friction Measuring Equipment (CFME) and Decelerometers (DEC).

**Continuous Friction Measuring Equipment (CFME)**

CFME devices are recommended for measuring friction characteristics of pavement surfaces covered with contaminants, as they provide a continuous graphic record of the pavement surface friction characteristics with friction averages for each one-third zone of the runway length. They may be either self-contained or towed. AC 150/5320-12, *Measurement, Construction, and Maintenance of Skid-Resistant Airport Pavement Surfaces*, contains performance specifications for CFME in Appendix 3 and a list of FAA-approved equipment in Appendix 4.

**Decelerometers**

Decelerometers are recommended for airports where the longer runway downtime required to complete a friction survey is acceptable, and may actually be preferred at some busy airports where it is difficult to gain access to the full length of a runway crossed by another runway. Decelerometers should be of the electronic type due to the advantages noted below. Mechanical decelerometers may be used, but should be reserved as a backup. Airports having only mechanical devices should plan to upgrade as soon as possible. Neither type of decelerometers will provide a continuous graphic record of friction for the pavement surface condition. They provide only a spot check of the pavement surface. On pavements with patches of frozen contaminants, decelerometers may be used only on the contaminated areas. For this reason, a survey taken under such conditions will result in a conservative representation of runway braking conditions. This should be considered when using friction values as an input into decisions about runway treatments.

*In addition, any time a pilot may experience widely varying braking on various portions of the runway, it is essential that the patchy conditions be noted in any report intended to relay friction values to pilots. FAA-approved decelerometers are listed in Appendix 3 of the FAA Advisory Circular, and performance specifications are provided in Appendix 4. (Federal Aviation Administration, 2008)*

(1) **Electronic Decelerometers**

Electronic decelerometers eliminate potential human error by automatically computing and recording friction averages for each one-third zone of the runway. They also provide a printed record of the friction survey data.

(2) **Mechanical Decelerometers**

Mechanical decelerometers may be used as a backup to an electronic decelerometers. The runway downtime required to complete a friction survey will be longer than with an electronic
Mechanical decelerometers do not provide automatic friction averages or a printed copy of data.

**Review:**

- **State what type of equipment (decelerometer or continuous friction measuring equipment) you airport operates.**
  - Continuous Friction Measuring Equipment (CFME)
  - Decelerometers (DEC)
  - Dynatest RFT – CFME
  - Griptester Friction Tester - CFME
  - Douglas Mu Meter – CFME
  - Bowmonk Decelometer – DEC
  - Tapley Decelometer – DEC
- **Describe what pavement contaminants conditions are acceptable to use decelomter or continuous friction measuring equipment.**

**When to Conduct:** Friction assessments should be conducted if any of the following occurs:

- **When the central portion of the runway, centered longitudinally along the runway centerline, is contaminated 500 feet or more.**
- **After any type of snow removal operations or chemical application (including sanding).**
- **Immediately following any aircraft incident or accident on the runway.**
- **Describe any additional triggers you have locally.**

**Calibration**

The friction measuring equipment operator is responsible for ensuring that equipment is correctly calibrated in accordance with its operations manual. Some devices perform an automatic electronic calibration each time the power is turned on; others require the operator to initiate the calibration procedure. In the latter case, the electronic calibration should be performed before placing the equipment in operation for the day. The equipment operator should also check all ancillary systems (such as recording devices, tow vehicles, and two-way radios). Factory calibrations of CFME should be performed as recommended by the manufacturer, or sooner if indicated by erroneous data. The operator responsible for the device should perform only adjustments recommended by the manufacturer. **Factory calibration should be scheduled during the spring-summer season to ensure the equipment will be ready for the next winter’s runway friction surveys.** *(Federal Aviation Administration, 2008)*

**Review:**

- **Describe how often your friction equipment is calibrated and who is responsible to ensure that it is.**
Location and Direction to Conduct Runway Friction Surveys

**Lateral Location**

On runways that serve primarily narrow-body airplanes, runway friction surveys should be conducted approximately 10 feet (3 m) from the runway centerline. On runways that serve primarily wide-body airplanes, runway friction surveys should be conducted approximately 20 feet (6 m) from the runway centerline. (Federal Aviation Administration, 2008) Unless surface conditions are noticeably different on the two sides of the runway centerline, only one survey is needed, and it may be conducted on either side.

**Direction** - Friction measuring equipment is operated in the same direction that airplanes are landing.

**Runway Survey Zones** - The runway length is divided into three equal zones: the touchdown, midpoint, and rollout zones. These zones are defined according to airplane landing direction. If possible, the entire survey should be completed in one pass. However, if ATC cannot schedule enough time to do a complete runway friction survey, the airport operator should request ATC to schedule each zone separately until all three zones have been completed.

**Conducting Runway Friction Surveys Using Decelerometers** - A minimum of three braking tests are required in each zone to determine the average friction value for that zone. This will result in a minimum of nine tests for a complete runway friction survey. The vehicle speed for conducting the friction survey should be 20 mph (32 km/h).

Example #1 provides an illustration.

<table>
<thead>
<tr>
<th>Runway Zone 1</th>
<th>Runway Zone 2</th>
<th>Runway Zone 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Touchdown</td>
<td>Midpoint</td>
<td>Rollout</td>
</tr>
<tr>
<td>A qualified airport operator obtains four $\mu$ readings in the touchdown zone: 25, 27, 26, and 31. The average of these readings is 27.25, which would be rounded to 27.</td>
<td>Four readings are obtained for the midpoint zone: 26, 28, 28, and 32. The average of 28.5, which would be rounded to 29.</td>
<td>After the minimum three readings (29, 30, and 31) are obtained for the rollout zone, ATC instructs the operator to clear the runway. It is not required that an equal number of readings be obtained for each zone, so the three readings are averaged to a reading of 30.</td>
</tr>
</tbody>
</table>

(Federal Aviation Administration, 2008)

**Review:**

Describe procedures in how you conduct a friction test and address:
• Lateral location from centerline (provides distance based on narrow or wide body aircraft 10’ or 20’ from centerline).
• Direction (same direction as arrival aircraft)
• Friction tests is completed in one pass
• Runway zones, touchdown, midpoint and rollout zones.

Continuous Monitoring
Continuous monitoring procedures can vary from airport to airport. Acceptable procedures may include:

• Observing which exit taxiways are being used.
• Maintaining a regular program of friction testing to identify trends in runway traction.
• Monitoring runway physical conditions including air and surface temperatures, contaminant types and depths.
• Monitoring pilot communications.
• Monitoring weather patterns. (Federal Aviation Administration, 2008)

Review:
Describe when continuous monitoring procedures are put in place and what deteriorating braking action, weather and surface conditions triggers continuous monitoring. What constitutes continuously monitoring a runway at your airport, list details in SICP.

Example:
The process of “Continuous Monitoring” shall consist of any, or all, of the following actions:

• Observing which exit taxiways are being used by landing aircraft. This activity is performed by Operations personnel on the airfield, in the Air Traffic Control Tower, or in the Snow Control Center.
• Conducting friction surveys at least hourly, but preferably sooner, when visual runway inspections and/or pilot braking action reports indicate that runway friction changing to identify trends in runway traction.
• Monitoring runway physical conditions including air and surface temperatures. The monitoring of runway physical conditions is performed in the Snow Control Center via in-pavement runway sensors and by ( ) personnel on the field.
• Monitoring contaminant types and depths. This activity is conducted by Airport ( ) personnel on the airfield.
• Monitoring of pilot communications by personnel on the airfield, in the Air Traffic Control Tower, or in the Snow Control Center
• Monitoring weather patterns. The Snow Control Center monitors weather information from the National Weather Service as well as other sources.
Letter of Agreement (LOA)

Letter of Agreement is to ensure the airport operator receives needed information, it should be formalized between the airport and air traffic control. Specify that PIREPs of Poor and Nil are immediately transmitted to the airport operator. It should include actions to immediately cease operations upon receipt of NIL PIREP.

Appendices

Appendices can range from an airport layout diagrams, snow removal equipment sheets to FAA safety alerts, referencing the SICP.

Airport Certification Manual

Lastly, the Snow & Ice Control Plan will need to be incorporated into the airport certification manual (ACM). The requirements for the ACM can be found in FAA Advisory Circular 150/5210-22.

The function of the ACM is to provide the bridge between the requirements of Part 139 and applications at each airport, taking into account the airports unique size, design, configuration and level of activity. The ACM should provide enough direction to be compliant with regulations but not be so detailed as to lack operational flexibility. The requirements for airports to have an ACM are listed below:
Under 14 CFR Part 139, the following airports in the United States and its possessions must hold Airport Operating Certificates:

Airports (except those in the State of Alaska) serving *scheduled* passenger-carrying operations of air carrier aircraft designed for 10 to 30 passenger seats.

Airports serving *scheduled* and *unscheduled* passenger-carrying operations of air carrier aircraft designed for more than 30 passenger seats. *(Federal Aviation Administration, 2004)*

Before the revision of Part 139, a certificated airport had either an ACM or Airport Certification Specifications, depending on the type of certificate held by the airport operator. The revised Part 139, however, requires airport operators at all certificated airports to develop and implement an ACM. This AC provides guidance on revising an existing or developing a new ACM.

**FUNCTION OF THE AIRPORT CERTIFICATION MANUAL (ACM)**

Part 139 includes terminology and minimum requirements broad enough to encompass all federally certificated airports to ensure the ACM fulfills its intended purpose, it should be the following:

**A. Comprehensive**

The ACM must address all Part 139 requirements that apply to the airport. A comprehensive ACM will provide airport personnel with all the information they need to comply with these requirements.

**B. Direct**

The content of the ACM should be accurate, clear, and speak directly to Part 139 requirements. An ACM that provides clear instructions but avoids excessive detail will help ensure that personnel understand how the airport operator will attain regulatory compliance at the airport and leave the airport with the flexibility necessary to address unforeseen circumstances.

**Preparation of the ACM**

In addition to specifying technical content, Part 139 stipulates standards for the approval, format, and distribution of the ACM.

**Approval** - Part 139 mandates two levels of approval for the ACM:

**Airport Approval** - Part 139 requires the airport operator to sign and approve the ACM before submitting it to the FAA. In this context, “airport operator” means an official of the operator who has the authority to implement and enforce all provisions of the ACM. Changes in airport management personnel do not require new airport approval as long as the airport operator continues to keep its ACM current. The statement of approval must include the airport name, the official’s title and name, the official’s signature, the document title, and the date. The
approval can be added to a signature page at the front of the ACM or, if the ACM has a cover, incorporated into the title page.

**FAA Approval - Prior to issuing an Airport Operating Certificate, the FAA must approve an airport operator’s ACM. Part 139 requires that each page of the ACM show FAA approval and the date of initial FAA approval or, if the page has been revised, the date of approval for the most recent change.** This requirement applies to all aspects of the ACM, including appendices, grid maps, the table of contents, and the airport sign and marking plan. To facilitate this requirement, each ACM page should include a location for indicating FAA approval and the approval date. For ease of use, the FAA approval block should have a consistent format and location throughout the document.

**Format**

Page layout, assembly and printing, and organization of content should be considered during preparation of the ACM.

(1) **Page Layout**

The ACM is a working document that reflects current airport conditions. It should be easy to maintain and revise. In addition to the date and FAA approval, each page of the ACM should specify the page number and document section. The ACM must also include a Page Revision Log that can function as an inventory of current pages. This log can simply include columns of page numbers with space for approval dates alongside. This is a very useful device to verify the currency of a page without having to leaf through the entire document. It also serves as a checklist for maintenance of the ACM as it tracks pages that have been revised, added, or deleted.

(2) **Assembly and Printing**

Part 139 requires the airport operator to maintain the ACM in printed form. (It can be transmitted to the FAA electronically, but the airport operator should confirm in advance that the FAA can access the file format used.) A simple format will make both the initial assembly and later revisions easier. Odd-sized or multicolor media and certain types of bindings (e.g., spiral or comb) can complicate the processes of reproduction, insertion, filing, and mailing. The FAA suggests the following format for the ACM:

1. 8½ x 11 inch, loose-leaf paper;
2. Single-sided, black-and-white printing, except where color is specifically required; and
3. Assembly in a three-ring binder.

(3) **Organization of Content**

The organization of the ACM should follow the sequence of Sections in Part 139 and in Chapter 5 of this AC. The Checklists in Appendices 2 and 3 provide additional guidance on what should be included in each Section.
Dissemination

Part 139 requires the airport operator to distribute applicable portions of the ACM to the airport personnel who are responsible for their implementation. The ACM is not intended to provide complete instructions for all jobs or operational procedures, but it should provide instructions for any critical tasks that are necessary for compliance with Part 139.

Required Contents

As a general rule, the ACM must contain operating procedures, equipment descriptions, responsibility assignments, and any other information needed by airport personnel to comply with Part 139. In particular, it must address compliance with the provisions of Subpart D of Part 139 and any limitations imposed by the FAA. This information will vary from airport to airport.

Provisions of Subpart D - Subpart D is the main body of operational requirements that an airport must meet to obtain and hold an Airport Operating Certificate. The ACM must address all required provisions of Subpart D, which comprises Sections 139.301 through 139.343 of the Regulation. The required Subpart D provisions depend on the class of the airport. The required elements for each class are listed in Section 139.203(b) and in Appendix 1 of this AC.

Limitations

The FAA occasionally imposes limitations on certificated airports. These limitations can cover a range of regulatory provisions. Generally, they deal with unusual operational characteristics at an airport, such as a need to restrict air carrier operations from using certain areas of the airport or to specify aircraft rescue and fire fighting staging locations. The ACM must contain copies of any limitation placed on the airport by the FAA. Sections of the ACM that discuss related provisions of Part 139 must refer to applicable limitations.

Guidelines for Specificity

The central theme and purpose of the ACM is embodied in the language of Section 139.203(a). In each Section, the ACM should answer the following questions: WHO is going to perform the tasks, WHAT do the tasks consist of, HOW are they to be performed, and WHEN should they occur. WHO, WHAT, HOW, and WHEN are often closely associated, and most instructions will need to address all of them.

WHO - The instructions in the ACM should be clear to staff who routinely perform the tasks described as well as to staff required to act when the usual chain of responsibility and authority is temporarily interrupted. The ACM must explain what is required from a regulatory standpoint and clearly state who (functional position) is primarily responsible for carrying out each function. Since a substitute might not normally perform (or directly oversee) a required task, the ACM should provide specific instructions about critical aspects of the job, including whom to contact if problems arise.
**WHAT and HOW** - The WHAT and HOW of ACM instructions refer to the tasks assigned to various individuals or departments charged with achieving compliance with Part 139. Unless all personnel assigned to the task are fully familiar with the regulatory requirement, the ACM must provide guidance appropriate to the training and experience of the personnel. For example, an instruction in the ACM to the ground maintenance crew to “maintain all safety areas in accordance with the Regulation” is not useful unless the crew has sufficient knowledge of Part 139 requirements. A better approach is to identify the physical boundaries of the safety areas and to state clearly how surface conditions are to be maintained.

**WHEN** - The timing of tasks will often be triggered by circumstances, such as a certain depth of snow accumulation or a specific temperature drop. The ACM must clearly define the circumstances that trigger action. It must also address the frequency of tasks that occur on a regular basis.

**SECTION 139.313–Snow and Ice Control** - AC 150/5200-30, Airport Winter Safety and Operations, contains technical information that will help airport operators develop a snow and ice control plan, which is required by Part 139 for Class I, II, and III airports where snow and ice conditions exist. If snow and ice conditions rarely occur at the airport, the ACM should include a statement to this effect. If a chance of snow or ice exists, however, the airport operator should

- Provide specific procedures in the ACM for notifying air carrier users of airport movement area conditions.
- Provide instructions and explain snow removal arrangements for preventing interference to navigation aids (NAVAIDs) caused by the accumulation of snow.
- Specify in the ACM who has the authority to initiate snow removal operations, especially when procedures require calling in municipal or contract assistance.

**ACM/SICP Review:**

*No person may operate an airport subject to this part unless that person adopts and complies with an ACM, as required under this part*

- Approved by the administrator
- Contains only items authorized by the administrator
- Printed form and signed by the administrator

*Form that is easy to revise and organized in a manner helpful to the preparation, review, and approval processes, including a revision log. In addition, each page or attachment must include the date of the administrator’s initial approval or approval of the latest revision.*

- Must keep the ACM current at all times
- Must maintain at least one complete and current copy of its approved ACM on the airport, must be available for inspection.
- Must furnish the applicable portions of the approved ACM to airport personnel responsible for its implementation.
- Must ensure that the Regional Airports Division Manager is provided a complete copy of its most current approved ACM
Advanced Snow Academy

Airport Funding: Bonds-Grants-AIP-PFC
Module Objectives
The purpose of this module is to enhance the knowledge of those individuals who supervise, manage and direct the mitigation of winter weather and share in the responsibility for the procurement of materials and equipment necessary for operations. Specifically, the information in this module is intended to inform those individuals of the financial resources used for the correct procurement procedures for snow removal/mitigation equipment. The intent is to provide insight into the typical strategies and tactics used to leverage funds available for procurement.

This module shall also provide a general understanding of how the local, state, and federal systems work airport wide.

Background
Funding for snow and ice removal can be a major budget line item for airports. Systems and processes have evolved over time in order to facilitate the procurement of equipment. Federal standards have emerged to ensure due diligence with regard to the care and process of equipment purchases. Local, State, and Federal programs and their funding levels are under constant scrutiny. The use of available funds in a manner consistent with their intent is a necessity for the continued support, maintenance, and expansion of airports and their properties.

Tax Exempt Bonds
The use of tax exempt bonds are common and issued by a municipality or airport authority that uses the revenues of the airport facility to back the bond. An airport revenue bond is tax-exempt and is typically issued when a municipality or airport is looking to expand its facilities or pay for upgrades. Because this debt is issued by a municipality or airport authority it is more likely to have a lower interest rate, making the long-term financing costs for the airport lower. The tax-exempt status of an airport revenue bond may depend on the airport's mix of public and private use. The more an airport is used for private purposes rather than public, the less likely the bond will offer the full extent of tax-exempt options. The rating of this type of bond by credit analysts is dependent on the amount of traffic the airport receives, how well the airport performs financially and how likely it is that airlines will continue use the facility.

A general obligation bond is a common type of municipal bond in the United States that is secured by a state or local government's pledge to use legally available resources, including tax revenues, to repay bond holders.

Most general obligation pledges at the local government level include a pledge to levy a property tax to meet debt service requirements, in which case holders of general obligation bonds have a right to compel the borrowing government to levy that tax to satisfy the local government's
obligation. Because property owners are usually reluctant to risk losing their holding due to unpaid property tax bills, credit rating agencies often consider a general obligation pledge to have very strong credit quality and frequently assign them investment grade ratings. If local property owners do not pay their property taxes on time in any given year, a government entity is required to increase its property tax rate by as much as is legally allowable in a following year to make up for any delinquencies. In the interim between the taxpayer delinquency and the higher property tax rate in the following year, the general obligation pledge requires the local government to pay debt service coming due with its available resources.

A revenue bond is a special type of municipal bond distinguished by its guarantee of repayment solely from revenues generated by a specified revenue-generating entity associated with the purpose of the bonds, rather than from a tax. Unlike general obligation bonds, only the revenues specified in the legal contract between the bond holder and bond issuer are required to be used for repayment of the principal and interest of the bonds; other revenues (notably tax revenues) and the general credit of the issuing agency are not so encumbered. Because the pledge of security is not as great as that of general obligation bonds, revenue bonds may carry a slightly higher interest rate than general obligation bonds; however, they are usually considered the second-most secure type of municipal bonds.

An industrial revenue bond is a unique type of revenue bond organized by a state or local government. The bond issue is sponsored by a government entity but the proceeds are directed to a private, for-profit business. An industrial revenue bond differs from traditional government revenue bonds as the bonds are issued on behalf of a private sector business. Industrial revenue bonds are typically used to support a specific project, such as a new storage or maintenance hangar.

The bond issue is created and organized by a sponsoring government, with the proceeds used by the private business. The business is responsible for bond repayment. The sponsoring government holds title to the underlying collateral until the bonds are paid in full. This arrangement provides tax exempt status to the bonds, and many times a property tax exemption on the collateral. The sponsoring government is not responsible for bond repayment and the bonds do not affect the government’s credit rating. Industrial revenue bonds are desired as the private business receives a lower interest rate (due to the bonds tax-exempt status), a property tax exemption, and a long-term, fixed rate financing package.

A Hybrid source bond is created by the combination of general obligation bond or revenue bond with (PFC) Passenger Facility Charges. These hybrid obligations are debt instruments that carry pledges from two separate and distinct revenue streams, either of which could receive a credit rating by itself. The issuers full faith and credit is pledged to meet debt service, but facility-generated revenues are fully expected to cover all requirements.
**Airport improvement program (AIP)**

During the 1930’s, the Federal Government viewed airports as a local responsibility. Soon after because of an overall concern for defense and the effects of WWII, in 1946 a federal aid program was adopted that allowed the US Treasury to set aside special funding for airports. Throughout the 1960’s and 1970’s there were many changes in aviation (conversion of military to civilian fields, introduction of commercial jet aircraft, the need to update runways) that enabled the Airport and Airway Trust Fund. The current system in place, commonly known as the Airport and Airway Improvement Act was first established in 1982. This created the funding source for the current AIP program. Most recently with the passage of the FAA Modernization and Reform Act of 2012.

**THE Basics of AIP**

Grants are currently issued to 3,380 public use airports under the AIP program. Funding levels can reach up to 90-95% of a project cost. Current federal levels of the program have reached $3.5 Billion. While helping to increase safety, security, and efficiencies of airports across the system, the program helps to alleviate the burden of bonding and debt financing from local airports. The acceptance of funding under the AIP program enables the FAA to enforce federal policy amongst its users. The use of grant money also enables some assurances like maintaining a current layout plan, open-public use airports, and financial reporting. The FAA utilizes a prioritization plan for the selection of projects in which airport sponsors apply for grant funds. This program is known as the Airport Capital Improvement Plan (ACIP). ACIP is a need based system 5 year prioritization plan. The priorities within the plan are

- Airport safety and security projects
- Preservation of existing infrastructure
- Noise mitigation and environmental concerns
- Compliance with standards
- Stimulating airport system capacity and reducing congestion

Within the grant procedures are the types of grants issued; each considered through a congressional legislation formula. An **entitlement grant** (apportionment) is considered using the number of enplaning passengers and or cargo tonnage for cargo airports. **Set Aside** grants are open to all public use airports and are directed to support specifically defined congressional mandates. While **discretionary grants** are intended to provide flexibility to meet the national airport system need with priorities set by the FAA. Under the current AIP program funds are also categorized and limited by airport type. Commercial primary airports funding levels are based on enplanements and are $650K minimum with up to $22M available. Non-primary airports can utilize $150K on a project while general aviation airports are capped at $150K funding levels per year.
**Funding Sources**

Passenger Ticket Tax (on domestic ticket purchases and frequent flyer awards) 7.5%
Flight Segment Tax (domestic, indexed annually to Consumer Price Index) $3.80
Cargo Waybill Tax 6.25%
Frequent Flyer Tax 7.5%
General Aviation Gasoline* 19.3 cents/gallon
General Aviation Jet Fuel* (Kerosene) 21.8 cents/gallon
Commercial Jet Fuel* (Kerosene) 4.3 cents/gallon
International Departure/Arrivals Tax $17.20 (Alaska/Hawaii = $8.60)
Fractional Ownership Surtax on general aviation jet fuel 14.1 cents/gallon

**Application and Distribution**
National Plan of Integrated Airport Systems (NPIAS)
The National Plan of Integrated Airport Systems (NPIAS) is submitted to Congress in accordance with title 49 U.S. Code (U.S.C.), section 47103.

The plan identifies 3,345 public-use airports (3,331 existing and 14 proposed) that are important to national air transportation and therefore eligible to receive grants under the Federal Aviation Administration (FAA) Airport Improvement Program (AIP).

Airport capital development needs are driven by current and forecast traffic; use and age of facilities; and changing aircraft technology, which requires airports to update or replace equipment and infrastructure.

Procurement
The FAA has recently issued standards in the newest edition of the AIP Handbook Order #5100.38D (September 30, 2014). The AIP Handbook is a vital source of information with regard to putting together requests for funding from the FAA for sponsors (airports) in the acquisition of new equipment. The handbook constantly references the code of federal regulations (49 CFR – 18.36) that encompasses the federal guide for procurement standards.

Another essential element that is covered in the handbook is the “Buy American Requirement” (U-4). This standard applies to any “goods” procured with federal funding. All “goods” acquired with federal monies are required to be essentially US made. Within the requirement are a few waivers that allow a sponsor to use non-100% US materials. The most common waiver that can be issued is a Type III waiver. The Type III waiver states that a finished product must contain at least 60% US manufactured component with final assembly completed within the United States.

The only exception within Type III waivers is that all steel in the finished product must be a product of the United States. There is currently a list of common use airport products that are documented on a “National Buy American Waiver” (NBAW) and can be found on the FAA website. Items that are listed on this NBAW require no further documentation from the sponsor in the application or procurement process. The standards that exist within the AIP Handbook are consistent with meeting all local, state, and federal guidelines for procurement. Meeting these standards is key to ensuring a consistent approach in the procurement process. The standards that are outlined cover a variety of topics such as: deadlines, responsiveness, insurance, fair and equal competition, protests, and evaluation. The handbook essentially details a “Written Code of Standards for Procurement.”
Passenger facility charge (PFC)
The passenger facility charge (PFC) was originally authorized by the Aviation Safety and Capacity Expansion enacted by Congress in 1990. Currently it is limited to $4.50 per segment and a total of $18.00 on a round trip fare. AAAE and ACI –NA are currently lobbying Congress to raise the cap to $7.50 per segment.
PFC funds are collected by the airlines and then forwarded to the airport. Federal law restricts the use of PFC funding use to the following:
- Enhance/Improve safety, security, capacity
- Noise reduction
- Increase air carrier competition
Large and medium hub airports that accept PFC charges are required to return up to 50% of their AIP allotments. This reduction in funds has allowed for increased discretionary fund expenditures at smaller airports within the system set up as the “Small Airport Fund” under the AIP system.

State and Local Grants
The use of state and local grant programs often allow airports to even further reduce the costs of projects/purchases that are procured with federal funds. State and local funding varies by location and can be affected by several conditions: population base (available taxes), number of airports located within the state, special interest groups. Eligibility requirements through state and local grant programs often differ from federal programs. Developing good relationships with state aviation offices and local interest groups will ensure programs and funding are utilized to their maximum potential.

Misc. Airport Revenue
Typically most airports receive funding from local, state, and federal sources. However, funding can also be generated by the airport itself. Typical sources of funding under this miscellaneous category are found through parking fees, landing fees, terminal area and concessions rent, airline leases, and other property lease agreements.

Summary
Funding is an essential element to the viability of modern airports. Funds can be sourced from multiple locations and can be combined for overall efficiencies in the acquisition of new equipment for snow and ice mitigation. All airports have the responsibility to understand and utilize the necessary resources to secure adequate funding to support their operations. An understanding of the proper procedures/programs will not only result in compliance with the laws that govern the use of funds, but will also ensure the airport and its process for procurement will run smoothly.
Advanced Snow Academy

Financial Impacts
Financial Impacts
Definition: Expense or loss of revenue due to winter weather events.

Purpose: To provide general knowledge of the impacts to the airport budget during winter operations for overtime, addition staffing, material use, fuel use, and equipment repairs. To also provide a general understanding of loss of revenue due to loss of services or changes to services due to forecasted and actual winter events.

Module Length: 2 to 3 hours.

**The Airport Operator must understand and manage the fiscal implications of Winter Operations.**

To manage the fiscal implications of winter operations every strategy and tactic must be measured.

These can be measured analytically; *one gallon of Potassium Acetate is $4.00 per gallon and the recommended application is .5 per 1,000 square feet and the runway is 150 feet wide by 10,000 feet long so one can expect to expend $3,000.00 per application.*

These can also be measured by comparing historical data; *a rate of .5 gallons per 1,000 square feet was affective when pavement temperatures were 30 degrees, air temperature was 27 degrees, the precipitation was rain, and the application followed a pretreatment of .5 gallons per 1,000 square feet, but was not affective without a pretreatment during a previous weather event.*

They can be measured theoretically; if this airport receives 24 hours of freezing rain, the airport can expect to dispense 3,000 gallons of KA per hour at $4.00 per gallon. The budgetary impact can be expected to be $12,000.00. Each specific task and application must be measured. Any method provides measurable information to be used while managing the strategies and tactics of the winter weather event.

Recording and reviewing historical data is a simple task. Recording the start and stop time of each event. Recording the pavement and air temperatures throughout the event and the type(s) and total water content or snow fall are also important. However, few utilize historical weather data as part of their annual winter operations. Recording the total personnel hours, sand and chemical use, fuel burned, tons of snow melted or hauled all become storm summaries for future re-evaluation or equally important reimbursements. Those airports that do record this information have experienced a significant and highly visible operational disruption due to a winter storm event or are airports that have learned how to apply for and receive federal reimbursement from a previous disaster declaration. The importance of recording and reviewing historical data is to learn from experience and to measure improvements.

Comparing past storm and seasonal performance and efficiency measurements to recent winter storm events to understand relative changes. Airports that appear to be experiencing a sustained change in expected weather may elect to utilize data from more recent periods (e.g., the past two
decades) rather than the full available period of record. While climate change and its effect on airport winter operations are beyond the scope of this course, _ACRP Synthesis 33: Airport Climate Adaptation and Resilience_ reviewed the range of risks to airports from projected climate change and the emerging approaches for handling them.

We measure performance to identify goals and expectations. To recognize any improvement or change one must know where the baseline is. To meet these goals the airport operator needs to know what has been achieved. It is important to set reasonable goals for a snow and ice control plan. Clear and concise, attainable goals, incorporating improvements are necessary.

Airport Cooperative Research Program (ACRP0 Syntheses 12, agrees that “Investment in winter operations to improve performance requires the identification of, the collection of, the review of, and action-oriented response to relevant data.” (Program, Report 123 A Guidebook for Airport Winter Operations, 2015)

**What should be measured?**

1. The resources utilized to perform the winter weather mitigation. Equipment, Equipment Operators, wearable items like cutting edges and broom bristles. Tons of aggregate and gallons of pavement deicer applied, gallons of fuel consumed.

2. The results of the mitigation activities. The square feet of each priority pavement maintained. The areas and duration of closures. The number of aircraft operations or cancelations. Include the NOTAMS and the frequency that field conditions were updated.

3. The results. Reductions or increases of operating expenses, decreased departure delays and cancellations, no runway incursions by snow team, no go-rounds due to closed runways, etc., which are compared to its objectives (i.e., intermediate outcomes) and goals (i.e., end outcomes).

**Records begin with the Pre-Plan**

The recording and the reports begin with the pre-planning process. As the forecast begin to develop the trend of the forecast is evaluated. As we learned in the Winter Weather Forecasting Module, the forecast trend is as important as the forecast. Each forecast should be reviewed against the previous. All forecast should be recorded to measure against the actual weather experience. Not to find fault but to recognize how predictability should be valued.

The practice of utilizing a written pre-plan that evolves into a situational worksheet (see ITEM 1) to be utilized during an event should be the normal protocol. These situational worksheets become the hour by hour record of activities that can be most important when completing the required documentation for Federal Reimbursements.
ITEM 1

SITUATION

CURRENT PRECIPITATION:

DATE:   TIME:

AIR:    PAVEMENT:

RUNWAY CREW

<table>
<thead>
<tr>
<th>121.3</th>
<th>Communications Officer:</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-5</td>
<td>Ap77</td>
</tr>
<tr>
<td>B-6</td>
<td>Ap40</td>
</tr>
<tr>
<td>B-7</td>
<td></td>
</tr>
<tr>
<td>B-8</td>
<td>Ap88</td>
</tr>
<tr>
<td>B-9</td>
<td>Ap30</td>
</tr>
<tr>
<td>Ap24</td>
<td></td>
</tr>
<tr>
<td>Ap80</td>
<td>Ap99</td>
</tr>
<tr>
<td>Ap44</td>
<td>Ap60</td>
</tr>
</tbody>
</table>

TAXIWAY CREW

<table>
<thead>
<tr>
<th>121.9</th>
<th>Communications Officer:</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-1</td>
<td>Ap83</td>
</tr>
<tr>
<td>B-2</td>
<td>Ap93</td>
</tr>
<tr>
<td>B-4</td>
<td>Ap11</td>
</tr>
<tr>
<td>Ap23</td>
<td></td>
</tr>
<tr>
<td>Ap25</td>
<td>Ap15</td>
</tr>
<tr>
<td>Ap26</td>
<td>Ap16</td>
</tr>
<tr>
<td>Ap70</td>
<td>Ap21</td>
</tr>
</tbody>
</table>

SHOP CREW

| Desk   | Mech                   |
| OPS    | Mech                   |
| DP     | Mech                   |

The sheets can be developed utilizing a basic spreadsheet. They can be specifically tailored to each airport's specific information needs. For larger and more complicated airports, a situational
sheet per major demographic area can be used and then combined with the other areas to create an airport event work book.

The spreadsheet template is created that allows for easy recognition of required information. In ITEM 1, the top of the spreadsheet is completed with event information: Date, time, current pavement and air temperatures, current precipitation and basic forecast.

The body of the example is where the strategy of the storm mitigation is developed and recorded. In the example the current or projected runway crew is identified including equipment call sign, operators name, team leader and the radio frequency all will be operating on. Next in the body would be other teams including the taxiway(s) group and ramp(s) groups. In each case the equipment call sign, the operators, team leader and radio frequency(s) are recorded.

In the case of the example the position at the snow desk, the dispatch position and the mechanics are also recorded.

These Situational Sheets can be completed prior to each event and set for specific duration of time. As the equipment operators and others go on break the replacement operators or if the equipment is also inactive, are removed from the appropriate time sheet.

This Situational Sheet can be updated throughout the event as crews grow and fluctuate.

**Operator Sheets**

If your airport does not require Operator Reports (see ITEM 2) it should. An Operator report should be completed by each and every vehicle and equipment operator. See example. The sheet has two (2) parts; the first is an inspection checklist for completed prior to use; the second part is the post trip report on the condition of the vehicle or equipment as it is returned to service. The start and stop times on these reports should confirm the data listing in the situational worksheet. The pre trip section would include a walk around inspection for visible damage or issues, an inspection of all safety devices, starting mileage or hours, amount of fuel available, and any other pertinent information the individual airport operator may require. The post trip section should include; ending miles or hours, vehicle condition, where the vehicle is parked, if the vehicle is plugged into a shoreline, and in the case for brooms and plows, the condition of the wearable’s; cutting edges and bristles.

A specially designed Operator Sheet should be used for equipment that dispenses materials. (See ITEM 3). It should include the typical pre-trip and post trip information but it should also include space to record material use. The material use section should include where, how much, at what rate and on what surface the material was dispensed. This section should include the current weather information including surface and sub surface temperatures. This information not only becomes a record but it can be reviewed to determine whether the treatments successfully performed the desired outcome.
ITEM 2

OPERATOR

<table>
<thead>
<tr>
<th>VEHICLE:</th>
<th>DATE:</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOURS:</td>
<td>HOURS:</td>
</tr>
</tbody>
</table>

**PRE-TRIP**

<table>
<thead>
<tr>
<th>DAMAGE:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TIRE WEAR:</td>
<td>LEAKS:</td>
</tr>
<tr>
<td>OIL LEVEL(S):</td>
<td>COOLANT LEVEL(S):</td>
</tr>
<tr>
<td>COMPANY RADIO:</td>
<td>ATCT RADIO:</td>
</tr>
<tr>
<td>STARTING MILES:</td>
<td>FUEL LEVEL:</td>
</tr>
</tbody>
</table>

**NOTES**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CONDITION WHEN PARKED**

<table>
<thead>
<tr>
<th>ENDING MILES:</th>
<th>FUEL LEVEL:</th>
</tr>
</thead>
<tbody>
<tr>
<td>IGNITION KEY:</td>
<td>FUEL KEY:</td>
</tr>
<tr>
<td>EMPTY BED:</td>
<td>CLEAN INTERIOR:</td>
</tr>
<tr>
<td>LOCATION:</td>
<td>HEATER PLUG:</td>
</tr>
<tr>
<td>DATE:</td>
<td>TIME:</td>
</tr>
</tbody>
</table>

**SUBMIT REPORT IMMEDIATELY AFTER OPERATING VEHICLE**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SIGNATURE:**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>

**Call Sign:**
<table>
<thead>
<tr>
<th>ITEM 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LIQUID DE-ICER</strong></td>
</tr>
<tr>
<td><strong>OPERATORS REPORT</strong></td>
</tr>
<tr>
<td><strong>DATE:</strong></td>
</tr>
<tr>
<td><strong>CURRENT PRECIPITATION:</strong></td>
</tr>
<tr>
<td><strong>AIR:</strong></td>
</tr>
<tr>
<td><strong>GALLONS AT START:</strong></td>
</tr>
<tr>
<td><strong>RWY 17-35</strong></td>
</tr>
<tr>
<td><strong>RWY 06-24</strong></td>
</tr>
<tr>
<td><strong>TWY WEST</strong></td>
</tr>
<tr>
<td><strong>TWY EAST</strong></td>
</tr>
<tr>
<td><strong>FEDEX RAMP</strong></td>
</tr>
<tr>
<td><strong>UPS RAMP</strong></td>
</tr>
<tr>
<td><strong>WIGGINS RAMP</strong></td>
</tr>
</tbody>
</table>

**SUBMIT REPORT IMMEDIATELY AFTER EXITING VEHICLE**

| **GALLONS PARKED:** |
| **SIGNATURE:** | **CALL SIGN** |
**Event Report**

Soon after each event or at the end of the weather event the Event Report should be completed. The event report will begin with a cover sheet that easily identifies the specific weather event. **See ITEM 4**. It would include the date and day of the week, start time and precipitation type, total precipitation experienced and then day, date and time the precipitation ended.

Following the cover sheet should be each individual Situational Sheet in chronological order. Following each time stamped Situational Sheets should be copies of the Operator Reports. The Operator Reports should match the times indicated on the situational sheets.

Following the Situational Sheets and Operator Sheets should be copies of each airfield condition report and copies of the NOTAMS issued. Following the NOTAMS should be copies of each runway friction evaluation also in chronological order.

The last page of the report should be a summary sheet, **(See ITEM 5)**. This includes a total computation of labor hours, fuel used, sand and chemicals dispensed, hours of snow melting, if applicable and a brief summary of the storm. This should be a single sheet to simplify the quantity of costs related items expended during the event. This sheet may include contractor expenses without listing specific expenditures. This sheet doesn’t identify how the storm was mitigated; it only calculates the total expense.

The information listed on the summary sheet should be transferred to an annual report summary spreadsheet **(See ITEM 6)**. This will compile all of the costs associated with winter operations.

The storm report is attached to the daily log to summarize important data related to the storm, including the amount and type of snow received, snow removal methodology, amount of chemicals used, frequency of runway closures, airport capacity, deicing performance, and other notable events. An event critique would include a storm-to-storm comparison. A daily log becomes a quick reference guide when responding to tenant questions during winter event performance review meetings. Storm reports include the information and event summaries that are excellent end-of-season resources for SICC review when considering possible revisions to the SICP.

A review of the event report with a comparison to previously recorded winter event will identify performance and costs changes. These changes can be attributed to storm specifics such as start and stop times or slightly different pavement temperatures, and the changes can be attributed to changes in strategies and techniques. These are the contributors that can and should be managed by the Airport Operator and discussed within the SICC.

The Airport Operator and/or the SICC should use this information to establish minimum standards and acceptable winter-event responses along with predictable airfield conditions. The information will allow the Airport Operator and/or SICC to define the desired winter operations performance capabilities. This expectation should identify the surfaces to be maintained at a minimum condition with a given snow fall or precipitation rate, utilizing a specific list of equipment. Greater and lesser precipitation rates shall have specific effects on the performance
and should be described. The expectations should include the meteorological condition that is beyond an airport operator’s capabilities to maintain to the pre-established airfield condition.

ITEM 4

Friday
January 30, 2015

Snow began falling at 00:30

Friday
January 30, 2015

Snow stopped falling at 16:00

Total accumulation 2 inches
ITEM 5
Storm Report

Date: 

<table>
<thead>
<tr>
<th>Actual Start and Stop Times</th>
<th>Start</th>
<th>Stop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type and Total Accumulation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start Time Temperatures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Man Hours Regular</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Man Hours Seasonal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amount of Airfield Sand</td>
<td>Runways</td>
<td>Taxiways</td>
</tr>
<tr>
<td>Amount of Potassium Acetate</td>
<td>Runways</td>
<td>Taxiways</td>
</tr>
<tr>
<td>Amount of Solid Deicer</td>
<td>Runways</td>
<td>Taxiways</td>
</tr>
<tr>
<td>Amount of Diesel Fuel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hours Snow Melters Operated</td>
<td>East</td>
<td>South</td>
</tr>
<tr>
<td>Number of Lighting</td>
<td>During</td>
<td>After Clean up</td>
</tr>
<tr>
<td>List of Notams used:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notes:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Equipment

What your airport fleet looks like depends on two major factors: what equipment you need and what your airport can afford. We are going to start with determining what is eligible for funding utilizing Airport Improvement monies (discussed in module). According to the Airport Snow and Ice Control Equipment Advisory Circular (AC) 150/5220-20, Airport must first identify the type of equipment that performs a desired task. You’ve learned this in the BAWOS Snow Equipment Module. Now we must identify the number of such equipment needed.

To do so the airport operator must determine the total square footage of the “critical” airfield pavement and facilities, including Aircraft Rescue and Fire Fighting (ARFF) access roads, mutual aide gates, and other surfaces requiring first priority attention to provide safe aircraft operations. It is also required to identify the classification of the airport as either commercial or non-commercial. The critical paved areas establish the “Priority 1” response effort for the airport operator.

AC 150/5200-30, Airport Winter Safety and Operations provides guidance in identifying the “Priority 1” surfaces and then establishes a clearance time for a range of annual airplane operations. The AC recognizes that airport operators cannot simultaneously clear all snow, slush, ice, or drifting snow from both the entire aircraft movement area and all supporting facilities necessary for flight. However, the airport operator can limit interruption of service as much as possible by classifying the most critical portions of the aircraft movement area and supporting facilities as Priority 1 and then taking care of other areas in their order of importance. For such a system to work, the SICP should identify at a minimum two priority categories based on the airport’s safety requirements, flight operations, visual navigation aids (VISAIDs) and electronic navigational aids (NAVAIDs), and other factors deemed important by the airport operator.

Items normally included as the Priority are the primary runway(s) with taxiway turnoffs, access taxiways leading to the terminal, terminal(s) and cargo ramp(s), Airport Rescue and Fire Fighting (ARFF) station(s), identified ARFF mutual aid access point(s) to include gate(s) operability, emergency service roads, NAVAIDs, and other areas deemed essential, such as fueling areas and airport security/surveillance roads.

Items normally included as Priority 2 are crosswind/secondary runways and their supportive taxiways, remaining aircraft movement areas, commercial ramp areas, access roads to secondary facilities, and airfield facilities not essential to flight operations or not used on a daily basis. Depending on the wind direction and available NAVAIDS, Priority 2 Surfaces could become Priority 1 surfaces during specific events. For the purpose of this exercise the Airport Operator will select the most commonly used runway.

The AC 150/5200-30 also indicates that “airports should have sufficient equipment to clear within a reasonable time 1 inch (2.54 cm) of snow weighing up to 25 lb/ft³ (400 kg/m³) for the Priorities 1 areas that accommodate anticipated airplane operations. If supportive runways (such as a parallel runway) typically have simultaneous operations during the winter months, then the areas for both runways and associated principal taxiways should be included in the total area.
The term “reasonable time,” as used in the AC, is based on the airport type and number of annual operations.

The reasonable time for Commercial Airports with annual airplane operations, including cargo operations, of 40,000 or more is one half hour, for greater than 10,000 operations but less than 40,000 the reasonable time is one hour, for greater than 6,000 but less than 10,000 the reasonable time is 1.5 hours, and for less than 6,000 annual airplane operation the reasonable time is two hours. These airports should have sufficient equipment to clear 1 inch (2.54 cm) of falling snow weighing up to 25 lb/ft³ (400 kg/m³) from Priority 1 areas within the recommended clearance times.

The reasonable time for Non-Commercial Airports with annual airplane operations, including cargo, of greater than 40,000 is two hours, for greater than 10,000 but less than 40,000 the reasonable time is three hours, for greater than 6,000 but less than 10,000 the reasonable time is four hours, and for less than 6,000 annual operations the reasonable time is six hours. Although not specifically defined, Non-Commercial Service Airports are airports that are not classified as Commercial Service Airports. These airports may wish to have sufficient equipment to clear 1 inch (2.54 cm) of falling snow weighing up to 25 lb/ft³ (400 kg/m³) from Priority 1 areas within the recommended clearance times.

The AC 150/5200-30 footnotes that these reasonable times are not to be interpreted as a requirement to clear surfaces within any particular time.

The AC 150/5200-30 indicates that for airports located in regions where snow densities over 25 lb/ft³ (400 kg/m³) are the norm, the airport operator should consider using a ½-inch (1.25 cm) snow depth as the action-initiating condition. Airport operators should keep in mind that heavier snow densities can increase the size and type of equipment comprising the fleet used to clear Priority 1 paved areas within the recommended clearance times (for details, see AC 150/5220-20, Airport Snow and Ice Control Equipment.)

Within the AC 150/5220-20A, Airport Snow and Ice Control, there is a specific selection process once the determination of the Priority 1 Areas has been established. This AC applies and equipment efficiency factor equal to 70 percent. As it is explained this assumption takes into account that throughout the snow removal process the equipment seldom if ever operates at the optimum efficiencies. Equipment must slow down, turn around, hold short and all perform all sorts of impedimental operations while operating on an airfield.

There are two processes to be used in determining the number of equipment suggested or eligible; one uses the grafts within the AC 150/5220-20A and the other uses the Snow Removal Equipment Calculator available at [http://www.faa.gov/airports/central/aip/cip/](http://www.faa.gov/airports/central/aip/cip/) (See ITEM 7). There are two procedures for calculating the minimum types and number of snow removal and ice control equipment. Both can be used whether utilizing the charts or excel sheet. Knowing the total square footage of the Priority 1 Area and the airport classification use the charts or excel sheet to determine the number of runway brooms, solid material spreaders and liquid material spreaders. There is no other formula for those styles of equipment.
The selection of rotary plows and displacement plows require the parameter of tonnage of snow to be removed in a given time in addition to other parameters required by the equipment. Examples; casting distances for rotary plows, plow working angle for displacement plows, when displacement plows support rotary plows the operational speed must be factored.

**Snow Removal Calculator**

Snow Removal Equipment Calculations

Airport Name
Location

*Average Annual Snow Fall: 66
*Type of Airport: Commercial Service
*Annual Operations: 46,000

Time allowed for removal per AC 150/5200-30: 0.5 hours

Rotary Plow

- Rotory Plow Efficiency %: 70
- Minimum Rotary Plow snow removal rate: 8,031 tons/hr

Displacement Plow

- Operating Speed (mph): 25
- Plow Efficiency %: 70
- Plow Cutting Angle (degrees): 35
- Effective Blade Length (ft) Required: 58.4 ft
- Actual Blade Length (ft) Required: 72.0 ft

Critical Snow Removal Areas:

- Primary Runway (usually one)
  - Length (ft) x Width (ft) = 1,500,000 sq. ft
  - Minimum Rotary Plow snow removal rate: 8,031 tons/hr

- Parallel taxiway and one or two principle connecting taxiways
  - Length (ft) x Width (ft) = 750,000 sq. ft
  - Operating Speed (mph): 25
  - Plow Efficiency %: 70
  - Plow Cutting Angle (degrees): 35

- Terminal, Cargo, and General Aviation Aprons
  - Critical apron area assumed as 1/2 of the apron.
  - Length (ft) x Width (ft) = 325,000 sq. ft

- Other critical areas (emergency or ARFF access roads)
  - Length (ft) x Width (ft) = 124,000 sq. ft

- Snow Depth (in): 1
- Snow Density (lbs/cu ft): 25

Tons of Snow: 2,811 tons

<table>
<thead>
<tr>
<th>Eligible Items</th>
<th>Max Quantity</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotary Plow</td>
<td>6</td>
<td>8,031 tons/hr</td>
</tr>
<tr>
<td>Displacement Plow</td>
<td>6</td>
<td>72</td>
</tr>
<tr>
<td>Sweeper</td>
<td>6</td>
<td>75</td>
</tr>
<tr>
<td>Hopper Spreader</td>
<td>6</td>
<td>75</td>
</tr>
<tr>
<td>Front End Loader</td>
<td>6</td>
<td>72</td>
</tr>
</tbody>
</table>

AC 150/5220-20A indicates that rotary plows dictate general clearing operations where supporting displacement plows are selected to match the speed and snow removal capacity of the rotary plow.

--

Snowfall Maps can be found here:
- Iowa: [http://www.hprcc.unl.edu/wrcc/states/ia.html](http://www.hprcc.unl.edu/wrcc/states/ia.html)
- Kansas: [http://www.hprcc.unl.edu/wrcc/states/ks.html](http://www.hprcc.unl.edu/wrcc/states/ks.html)
- Missouri: [http://www.hprcc.unl.edu/wrcc/states/mo.html](http://www.hprcc.unl.edu/wrcc/states/mo.html)
- Nebraska: [http://www.hprcc.unl.edu/wrcc/states/ne.html](http://www.hprcc.unl.edu/wrcc/states/ne.html)

Users requiring assistance or reasonable accommodation may contact the FAA Central Region at 816-329-2600

Refer to AC 150/5220-20, Airport Snow and Ice Control Equipment, and AC 150/5200-30, Airport Winter Safety and Operations for specific guidance.

This program assumes at least 15” annual snow fall.

**Snow Removal Equipment Calculations**

Airport Name
Location

*Average Annual Snow Fall: 66
*Type of Airport: Commercial Service
*Annual Operations: 46,000

Time allowed for removal per AC 150/5200-30: 0.5 hours

Rotary Plow

- Rotory Plow Efficiency %: 70
- Minimum Rotary Plow snow removal rate: 8,031 tons/hr

Displacement Plow

- Operating Speed (mph): 25
- Plow Efficiency %: 70
- Plow Cutting Angle (degrees): 35
- Effective Blade Length (ft) Required: 58.4 ft
- Actual Blade Length (ft) Required: 72.0 ft

Critical Snow Removal Areas:

- Primary Runway (usually one)
  - Length (ft) x Width (ft) = 1,500,000 sq. ft
  - Minimum Rotary Plow snow removal rate: 8,031 tons/hr

- Parallel taxiway and one or two principle connecting taxiways
  - Length (ft) x Width (ft) = 750,000 sq. ft
  - Operating Speed (mph): 25
  - Plow Efficiency %: 70
  - Plow Cutting Angle (degrees): 35

- Terminal, Cargo, and General Aviation Aprons
  - Critical apron area assumed as 1/2 of the apron.
  - Length (ft) x Width (ft) = 325,000 sq. ft

- Other critical areas (emergency or ARFF access roads)
  - Length (ft) x Width (ft) = 124,000 sq. ft

- Snow Depth (in): 1
- Snow Density (lbs/cu ft): 25

Tons of Snow: 2,811 tons

<table>
<thead>
<tr>
<th>Eligible Items</th>
<th>Max Quantity</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotary Plow</td>
<td>6</td>
<td>8,031 tons/hr</td>
</tr>
<tr>
<td>Displacement Plow</td>
<td>6</td>
<td>72</td>
</tr>
<tr>
<td>Sweeper</td>
<td>6</td>
<td>75</td>
</tr>
<tr>
<td>Hopper Spreader</td>
<td>6</td>
<td>75</td>
</tr>
<tr>
<td>Front End Loader</td>
<td>6</td>
<td>72</td>
</tr>
</tbody>
</table>

AC 150/5220-20A indicates that rotary plows dictate general clearing operations where supporting displacement plows are selected to match the speed and snow removal capacity of the rotary plow.

---

International Aviation Snow Symposium Snow Academy Advanced Airport Winter Operations Specialist 2015
Runway friction testing equipment and in-pavement temperature, moisture, and precipitation sensors do not follow the same parameters that previously described equipment selections follow.

At least one high speed rotary plow is recommended and eligible for commercial service airports that provide scheduled air carrier service. Each high speed rotary plow is supported by a minimum of two displacement plows having equal snow removal capacity. The selected high speed rotary plow(s) should be capable of removing the volume of snow from the Priority 1 paved area with a predetermined casting distance to comply with runway and taxiway snow bank clearance criteria described within AC 150/5200-30.

To work through the graphs and excel sheet to determine the size and quantity of rotary plows the airport operator must provide the following information:

- Priority 1 square footage of paved area - for this exercise we will use 2,700,000 square feet.
- Commercial or Non-Commercial classification of airport - we will use Commercial.
- Number of annual airplane operations - we will use 50,000.
- Reasonable clearance time for the total Priority 1 Area - one half hour.
- The minimum casting distance required for the High Speed Rotary Plow to achieve - 100 feet.

Determine the total critical paved area for Priority 1. For this example use 2,700,000 square feet. Use figure 2-3 on page 13 or 2-4 on page of the AC 150/5220-20A. For this example we will use the graph for the commercial airport. Enter the graph form the horizontal axis labeled “Square Feet of Priority 1 area” with PA= 27 (2,700,000 square feet) and proceed vertically until you intersect the last line selecting 40,000 or more annual operations (1/2 hr).

Upon locating this reference line, proceed to the left to intersect the vertical axis which reads “snow tons per hour x 1,000.” This intersection determines the tonnage (volume) of snow to be removed from the total priority 1 area within the reasonable time of one half hour. In this example, the removal rate equals 7,500 tons per hour. This removal rate set the second criteria for selecting the high speed rotary plow.

Using the same figure, continue proceeding to the left of the figure with 7,500 tons per hour to pre-select among the various classes of rotary plows and their number. In this example classes I and II are too small. The options are three, Class IV or two Class Vs. Class IV cast a minimum of 3000 tons per hour a minimum distance of 100 feet and Class V cast a minimum of 4000 tons per hour a minimum distance of 100 feet.

It was previously suggested that two displacement plows are required to support each High Speed Rotary Plow. To determine the actual length of total cutting edge and number of carrier vehicles necessary refer back to the actual airport conditions where the annual activity level equals 50,000 operations with a reasonable clearance time of one half hour for the priority 1 areas. The average operating speed of the snow plow unit is at least 25 miles per hour.
Figure 2-3. High-speed rotary plow calculations for airports with commercial service
Figure 2-4. High-speed rotary plow calculations for airports with non-commercial service
Figure 2-5. Snow removal (tons/hr) for Priority 1 paved areas for commercial service airports
Figure 2-8

Figure 2-7. Effective snow plow blade length related to snow displacement

Note: Use the provided equation when snow displacement (tons/hr) needs exceed the amount provided by the chart. When using the chart do not interpolate between speeds.

$b_2 = \frac{(C_2 ER_{p})}{(\delta)(\nu)(\rho)\eta}$

$b_2$ = *Effective* blade length (in feet)

Q = displacement (in tons/hr)

δ = snow depth (in inches)

V = operating speed (in mph)

$\rho$ = snow density (in lbsft$^3$)

$E_{P}$ = rotary plow efficiency (in percent)

$E_{R_{p}}$ = snow plow efficiency (in percent)
Figure 2–8. Effective versus actual snow plow blade length

Selection: The selection criterion for snow plows supporting a rotary plow is 2 snow plows for each rotary plow. Hence, four snow plows should be obtained with separate carrier vehicles. Note: If the airport is not in a snow region and does not receive sufficient annual snowfall for a high-speed rotary plow, then the airport operator should select 2 snow plows with 20-foot and 22-foot cutting edges.

<table>
<thead>
<tr>
<th>CAUTION:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snow plows that support high-speed rotary plows must match the travelling speed of the rotary and match or exceed the snow removal capacity of the rotary.</td>
</tr>
</tbody>
</table>
The snow density assumed is 25 pounds per cubic foot, the cutting edge working angle is 35 degrees, and the efficiency of the snow plow matches the 70 percent efficiency of the high speed rotary plow.
Three grafts within AC 150/5220-20A must be utilized. We’ve previously determined the priority 1 surface area is equal to 2,700,000 square feet. Start with figure 2-5 on page 16 to determine the tonnage of snow removal per hour. Enter the graph from the horizontal axis labeled “Priority 1 Paved Area” with PA equals 2.7 (2,700,000 square feet) and proceed vertically until this intersects the appropriate reference line labeled “Time: ½ hour” which is the reasonable clearance time for airports with greater than 40,000 operations annually.

Upon locating the “Time: 1/2 hour” reference line, proceed to the left to intersect the vertical axis which reads “Q Snow displacement (tons/hr)”. This intersection determines the tonnage (volume) of snow to be cleared from the entire Priority 1 paved area within the recommended clearance time of one half hour. In this example, Q = 8,000 tons per hour.

The Graph 2-7 found on page 19 of AC 150/5220-20A, must be used to determine the effective snow plow blade length related to snow displacement at the recommended speed of 25 miles per hour. Enter the graph from the horizontal axis labeled “snow displacement (tons/hr). In our scenario where 8,000 tons are recommended but not listed on the horizontal axis we must use the provided equation. Effective Blade length equals 8000 tons per hour multiplied 70 percent efficiency (5600) divided by 1 inch of snow multiplied by 25 pounds per cubic foot multiplied by 25 MPH (437.5). 5600/437.5= 12.8. Multiply 12.8 by 4.545 for an effective blade length of 58.17 feet.

Assuming a lesser tonnage of 4,000 enter the horizontal axis labeled “snow displacement (ton/hour) at 4,000 and proceed vertically until you intersect reference line labeled “V =25”.

Upon locating the “V=25 mph” reference line, proceed to the left to intersect the vertical axis which reads “effective cutting edge.” This intersection yields 28 feet. Had we used this and then multiplied by 2, the recommended and eligible effective blade length would have been assumed to be 56 feet.

To determine the “actual cutting edge length to be purchased figure 2-8 on page 20 of AC 150/5220-20A must be utilized. There is no horizontal axis point of 56 feet. We will begin at axis point 28 then proceed vertically to the appropriate reference line reading “cutting angle 35 degrees. At this intersection move left to intersect the vertical axis to read 35 feet and then double the result to 70 feet of actual blade length.

The options are Three Class IV or Two Class V rotary plows. To support Three Class IV high speed rotary plows 6 (six) displacement plows are recommend with separate carrier vehicles. To support 2 Class V rotary plows 4 (four) displacement plows with separate carrier vehicles are recommended. A few unknown factors may dictate the option selected. Available financial resources for maintenance, available snow removal storage facilities and the number of available operators are a few factors that may dictate the decision to select either option. We have determined that fewer pieces of equipment operating on the field are more efficient and safer human resource management.

For each 750,000 square feet of pavement declared as Priority 1, a runway broom with air-blast is recommended and eligible. This broom may be self-propelled or a tow behind design. 2,700,000 square feet divided by 750,000 square feet equals 3.6 brooms. We will assume that we can justify 4 brooms.
Also for every 750,000 square feet one solid material spreader for sand and/or one for applying solid deicing/anti-icing chemical is recommended and eligible. In lieu of or additional to the aggregate spreader a liquid deicing/anti-icing chemical spray vehicle is recommended and eligible. In our scenario our airport it is recommended and eligible to utilize 3.6 spreader and or spray vehicles. We will assume to have justified 3 solid spreaders and 1 liquid sprayer. To determine the size and weight capacity of each spreader the graph 2-9 on page 23 of AC 150/5220-20A will be utilized.

To determine the total gallon of the liquid material spreader the airport operator determines the Priority 1 paved area, we will continue to assume our selection is 2,700,000 square feet. Multiply 2,700,000 by 1 gallon per 1000 square feet for a minimum tank capacity of 2,700 gallons. For our purpose we would negotiate that a 4,000 gallon spreader would be more practical.

Using the available graphs we have determined that our recommended and eligible fleet would include; 2 Class V, High-Speed Rotary Plows designed to cast a minimum of 4000 tons per hour a minimum distance of 100 feet. To support the rotary plows we have 4 displacement plows on separate carrier vehicles with a combine actual blade length of 70 feet, capable of moving snow at a minimum speed of 25 miles per hour.

There would be 3 to 4 runway brooms, 3 solid spreaders, and a liquid spreader with a minimum tank capacity of 2,700 gallons. For efficiencies the spreaders and sprayer could be mounted upon the displacement plow trucks. The 4 displacement plows could be coupled with 4 tow behind brooms. The displacement plows and brooms could be configured into 4 multi-tasking pieces. A single Multi-Tasking piece of equipment replaces two pieces of snow and ice control equipment.

The AC 150/5220-20A continues to aid in the development of equipment specifications and designs. The AC references all applicable Society Automotive Engineers (SAE) Aerospace Recommended Practice (ARP) specifications for the Airport Snow and Ice Control Equipment.

Ramp dozer and material loaders are not called out as recommended or eligible within AC 150/5220 unless it is the carrier vehicle for a displacement plow. The charts identified that the following equipment list is recommended and eligible:

- 2 High-Speed Rotary Plows
- 4 Displacement Plows
- 4 Runway Brooms
- 3 Solid Material Spreaders
- 1 Liquid Sprayer
- or
- 4 Multi-tasking
Performance Based Fleet

Building the fleet based upon AIP eligibility does not address the airport’s performance needs or expectations. In any fleet development performance, needs should build the desired fleet and funding dictates real equipment acquisitions, performance is then identified by expectations out of the available fleet.

Performance needs are identified by examining the average and peak 24 hour aircraft operating schedule. In our airport example, there were 50,000 annual operations. We will assume that there are an average of 75 air carrier and cargo operations every 24 hours, a peak 24 hour period of 140 air carrier and cargo flights, and the busiest 8 hours would see 60 air carrier and cargo flight operations. In most cases this is spread over 2 runways, except when higher winds dictate otherwise. Looking at each schedule it is determined that there is an arrival or departure every 15 minutes. In most cases there is a 12 minutes window between flights.

To maintain a safe and open 150 foot wide and 10,000 foot long runway, we will design a runway team that can plow, broom, blow snow and treat with liquid chemical and/or solid aggregate, then measure braking action within the 12 minutes between flights. We will also build the support equipment to maintain the priority 1 taxiways and ramps.

The runway is 2 miles long and the equipment will need a minute or two to enter and exit the runway. We will reduce our time available to 10 minutes. Basic math tells us the average speed of operations will need to be 2 miles every 10 minutes or 12 miles per hour for a single pass. For a single pass fleet we would need enough equipment to clear near the 150 feet in width. We will also consider performing 2 passes in 10 minutes, operating less equipment at an average of 24 miles per hour. To average 24 miles per hour the equipment must be able to attain and achieve efficient operating speeds up to 30 miles per hour.

Unlike the Advisory Circular, we need to build this fleet with brooms first. For a single pass the fleet will need to include 150 feet of effective broom width. To achieve this effectively it will require at least 8 carrier vehicles with either tow behind or front mounted broom.

To ensure that there is sufficient displacement plows to plow in front of the brooms, this fleet will include 8 carrier vehicles, each with 20 feet of efficient cutting edge length. If we were to consider a70 percent efficiency with the brooms 9 or 10 would be requested.

To anticipate rotary plow needs we again go back to the schedule and the available frequency to perform snow removal activities. At our example airport we anticipate 12 minutes on the runway every 20 minutes or 3 times an hour. Based upon a performance standard that we choose to target we want to build this fleet to sustain an inch per hour snow fall with access to the runway limited to twice per hour to remain open during peak periods. One half of an inch of snow on the 150 foot wide and 10,000 foot long runway would equate to 62,500 cubic feet of snow or, at 25 pounds per cubic foot, at least 781.25 tons of snow. Anyone with any airport snow removal experience will agree that act of moving snow makes the snow denser and heavier per cubic foot and 50 pounds per cubic foot should be anticipated. Three, Class III or Two, Class IV would appear acceptable with an 80 plus ton per minute capability or at least
4800 tons per hour. We know that efficiency is 70 percent so the Rotary Plows must be able to achieve near 7000 tons per hour at an average speed of 12 miles per hour. We will select two Class IV Rotary plows for our fleet.

We will need liquid and spreading capabilities. To cover 150 feet we would need two liquid deicing trucks with a minimum of 75 feet of spray booms. Each displacement plow truck could have spreader bodies mounted or if we chose to have tow behind brooms and this option is not available, our fleet would need to include at least 3 solid spreader vehicles capable of spreading near 40 feet wide each.

The final vehicles in the runway fleet would be a runway friction measuring vehicle of choice and at least one command vehicle. Currently our runway fleet includes: 8 brooms, 8 displacement plow trucks, 2 rotary plows, two deicing trucks, 3 spreader trucks, a runway friction measuring vehicle and a command vehicle for a total of 23 pieces of equipment.

There are two other options to reduce the number of equipment just operating on the runway. One option would be to use tow behind brooms mounted to the displacement plows. This would eliminate 8 pieces of equipment. This would reduce the runway fleet to 15 individual pieces of equipment.

The other option would be to utilize high speed equipment that is capable of performing two passes in the 10 minute expected time allowed upon the runway. By building a two pass fleet the efficient displacement plow and broom widths can be reduced by nearly half. Reminder: We determined that 8 brooms and plows were sufficient but 9 would address efficiencies.

To build a fleet capable of operating up to 30 miles per hour the fleet would include 5 High Speed Multitasking (Plow, Broom and Air blasting) Equipment, 2 High Speed Rotary Plows with the capability to efficiently cast snow at a minimum of 24 miles per hour and operate at up to 30 miles per hour. A single 4000 gallon liquid deicing truck with 75 feet of spray booms is needed. Two solid spreaders could efficiently broadcast aggregate. This fleet still requires a command vehicle and a runway friction measuring vehicle. This fleet includes a total of 12 pieces of equipment.

When building a SRE team based upon performance, many airports have created taxiway snow removal teams to operate in support of, or independent of, runway snow removal teams. Independent taxiway teams are assigned to maintain the top priority taxiway routes. Taxiway teams can operate on taxiway/runway intersections, behind the group of runway equipment. The taxiway team reduces the amount of time required to conduct a runway snow removal operation. The availability of multiple runway exit points provided by the taxiway team reduces runway occupancy times and increases airport capacity.

There are a couple of options for taxiway/runway intersection snow removal. One option would include pairs of 30-foot ramp plow with a dedicated blower. One pair on each side of the runway could clear 2 intersections with-in each 10-12 minute runway offering. Another option would include 3 displacement plows with 3 tow behind brooms, 3 additional front mounted brooms or 3 multitasking pieces. Each group would include an additional rotary plow with
sanding and de-icing capabilities. This team of 6 to 9 pieces of equipment can maintain a single
parallel taxiway, two to 3 runway/taxiway intersections, and approximately an additional 10,000
feet of 75-foot taxiways leading into ramps.

The equipment to maintain terminal and other ramps must be based upon activities also. To
maintain a plowed surface when the accumulation rate equals 1 inch per hour a single 30-foot
ramp plow with a minimum of 300 hp is needed for every 25 acres in a single location. When
removing snow in and around aircraft smaller and more nimble equipment are required. Gate
positions may need to have dedicated smaller brooms and plows that are capable of removing
contaminants during the short time frames between flights. Removal of the plowed snow
requires additional consideration. If there is snow storage adjacent to the ramps then a rotary
plow will be needed to blow the snow into the storage area. A single 3000 ton per hour unit can
team with each 25 30-foot ramp plow. If there is no snow storage then the airport operator must
chose to haul and/or melt snow.

When hauling snow the snow dump location must be considered. If the snow dump is located
off the AOA or outside of the security fence, then the time for each security check must be
included in the formula. Snow dumps located within the AOA or inside of the security fence
will reduce the hauling time. The equipment needed to load and pile snow must be included to
fulfill the task. To evaluate hauling snow the measure of snow is evaluated in cubic yards. For
25 acres of ramp with 1 inch of snow accumulation there would be approximately 3360 cubic
yards of snow to be hauled. The haul route is assumed to be 30 minutes each trip to and from
the dump site. Assuming 6 trucks capable of hauling 30 cubic yards of snow each, it would
require 9 hours of hauling operations. A loader capable of moving 360 cubic yards of material
each hour would also be required.

To melt the 1 inch of snow on the 25 acre ramp we must calculate snow tonnage. The FAA
recommends 25 pounds per cubic foot when calculating equipment capacities. For 25 acres of 1
inch snow there would be up to 1,134 tons of snow to melt. Utilizing a snow melter with the
capacity to melt 500 tons per hour it would require approximately 3 hours. Calculating snow of
a medium density would require 2 hours of melting, light snow could be melted in
approximately 1 hour.

The design of the melter dictates what equipment is needed to fill the melter, whether it is
portable and must be loaded with a bucket loader, or a fixed unit that snow could be pushed
into. In the portable configuration a loader capable of loading 500 tons per hour would be
required additional to the machine plowing the ramp. A fixed melter may be configured to
allow the 30-foot ramp plow clearing the ramp to push into the pit of the melter. In this
configuration one less piece of equipment is required.

For the airport used in our example there is 350,000 square feet of ramp, approximately 8 acres.
Using the calculations in the previous paragraphs a single ramp plow would clear this surface of
1 inch of snow in an hour. A loader and two haul trucks could haul 1 inch on snow in 9 hours,
or 6 trucks could haul in 3 hours. A single melter capable of melting 300 tons per hour could
melt 1 inch of snow in approximately 1 hour.
Depending on the Airport Operator’s decision of what configuration the fleet resembles there will be between 33 and 44 pieces of equipment performing snow removal activities on this example airfield. This doesn’t include specialized optional equipment configured for snow removal around lights, small plows and brooms to clear around aircraft and buildings, and glycol recovery equipment if needed.

It is important to understand the cost of a SRE fleet in terms that is relevant to the decision-making process. For each piece of SRE, calculate the annualized capital cost. Although no simple formula for establishing a lifetime cost will suffice for all cases, a combination of past experience with similar equipment, peer input, and manufacturer data can be used.

FAA established that the normal useful life for SRE is about 10 years, although equipment can be maintained for longer periods (15). Let’s assume our 33 pieces of equipment cost $14,500,000.00 to purchase. Divide total purchase cost by 10 years of life to determine the $1,450,000.00 per year capital cost. Include the $200,000.00 for maintenance repairs and wearable items, and an interest rate value of approximately $75,000, and the cost to fuel this fleet of approximately $180,000.00 per year for a total annual expenditure value of $1,905,000.00 for this SRE fleet.

**The Costs of the Human Resources**

Once the number of SRE has been determined, the next question is how many humans are needed to operate them. The Human Factor Module covered in the BAWOS curriculum discussed the affects of winter operations on the airport employees engaged in snow storm mitigation.

The Human Resource Management Module presented in this AAWOS curriculum provides the students optional shift rotations and best management practices. We also learned to evaluate equipment operator rates and benefit factors. We also learned or will learn that we have overtime options, whether to pay 1.5 times regular rate or extend the rate to 2 times when hours exceed 16 consecutive. For the following exercise we will pay our operators $25.00 per hour and include a benefit factor of 1.5. We will also pay an overtime rate of 1.5 regular for hours worked beyond 8 and two times regular for hours worked beyond 16 consecutive. The overtime benefit fact will be 1.10 because we have learned or will learn that most benefits are calculated for regular hours only. Our hourly cost for each operator on regular time is $37.50 ($25 x 1.5), for the first 8 hours of overtime the cost is $41.25 (($25 x 1.5)x 1.10), and for every hour worked beyond 16 consecutive the cost is $55.00 (($25 x 2) x 1.10). We will use this information to build a team of winter operations specialist to operate this fleet and to man our SICC.

The import forecast information to most Airport Operators is the type of event and the duration of an event. We want to know when is the storm going to start and when will it end. For this exercise the forecast if for 20 hours of precipitation.
We have already determined that we have a fleet of 33 pieces of equipment. We could assign one person per piece of equipment and determine that 33 operators would be the size of our team. The precipitation is forecasted to last 20 hours. We can expect to work an additional 4 hours for storm cleanup. We can expect some of the crew to already be on-duty when the storm begins. We can expect some of the crew will need to remain on duty after the precipitation to end to fulfill normally scheduled shifts. In our situation we will say that the minimum staffing is 6 people. If the storm begins mid shift, the 6 on-duty staff can expect to work at least 24 hours and the staff assigned to the following shift will work a minimum of 24 hours. If this is mid week the on duty staff might be the same group working the following day. In this case those 6 individuals can expect to work 32 consecutive hours. The remaining 27 individuals will work 24 consecutive hours. Easy, until someone is absent or so fatigued that they can no longer operate a vehicle safely.

The human cost for this event is as follows: The six on-duty staff will each cost 8 @ $37.50, 8 more at $41.25, and 16 @ $55.00 for a group total $9,069.00. The remaining 27 operators will each work 8 at $37.50, 8 at $41.25, and 8 at $55.00 for a group total of $28,890.00. The total Human resource expenditure for all of the operators is $37,959.00. If we chose not to pay double time the savings would be 264 hours at $13.75 for a savings of $3,630.00.

Next easy method is to utilize a 12 on and 12 off rotation. With two operators assigned to each shift, the size of our team would be at least 66. If we are smart we will add 2 to 4 more individuals that would enable us to survive any absentee. Now we have a crew of 70 operators. Each operator will work 8 hours at the regular rate of $37.50 and 4 hours at the 1.5 overtime rate of $41.25. Each operator will cost $465.00 for this 24 hour event. The total human resource expenditure for this event is $32,550.00

Another option for operator rotation is to assign 4 operators for each 3 pieces of equipment and allow the storm to dictate the rotation. In this scenario it would require 44 equipment operators. Each person can expect to rotate 8 on and 4 off for the duration. To facilitate this rotation 33 operators would start the storm. Eleven operators would start approximately 7 hours later to facilitate the first break rotation. Eleven of the first 33 would be relieved of duty after 20 hours on duty. The cost would break down as follows. A selected 22 of the first 33 would cost 8 at $37.50, 8 at $41.25, and 16 at $55.00 for a group total of $33,220. The remaining 11 of the first 33 would cost 8 at $37.50, 8 at $41.25 and 12 at $55.00 for a group total of $14,190.00. The 11 that arrives 4 hours later would cost 8 at $37.50, 8 at $41.25 and 12 at $55.00 for a group total of $14,190.00. The combined human resource expenditure for this event utilizing this rotation would be $61,600.00. If double time was not utilized the cost would be reduced by $8470.00 for a new total of $53,130.00.

There are other scenarios in which crews are assigned 16 hours on-duty and 8 hours off duty (paid). The airport that agrees to use this rotation method while keeping all employees on paid duty can rotate staff at different intervals. They may choose to rotate in any configuration that has 2/3 of the staff actively mitigating the event and 1/3 on break. A minimum of 50 employees would be needed for this rotation. This scenario would have 6 on-duty, 27 individuals would join the original 6 at the onset of the storm (4 hours), 6 more individuals would join this crew at
the interval determined to relieve the original 6 (hour 4 of storm), the remaining 11 would arrive at the determined interval to begin the break rotation for the remaining crew (hour 8 of storm).

The financial impact of the human resources for this scenario would be as follows: The six on-duty members would receive 8 at $37.50, 8 at $41.25 and 8 at $55.00 for a total of $6,420.00. The next 27 would work 16 at $41.25 and 8 at $55.00 for a total of $20,790.00. The next 6 would work 16 hours at $41.25 and 8 at $55.00 for a total of $5,940.00. The last 11 would work 16 hours at $41.25 for a total of $7,260.00. The total for this scenario would be $40,410.00. Without the expense of double time the cost for this event in this scenario would be $35,790.00.

In a scenario where the crew rotates 16 on-duty and 8 hours off duty (unpaid) the financial expenditures would be $23,250.00, a savings of $17,160.00. In lieu of no pay, a reduction in pay rate during off-time or the elimination of double time would result in a lesser savings.

The following summarizes the work schedule scenarios discussed:

- Our scenario assumed, a 24-hour event, 33 pieces of equipment operating or positions needing to be filled, 6 person minimum staffing.
  1. One person per position, all in start to finish.
     a. Staffing equals 33.
     b. Human resource expenditure equals $37,959.00
        i. Elimination of overtime at 2 times rate equals new total of $34,329.00
  2. 12-hours on 12-hours off.
     a. Staffing equals 66.
     b. Human resource expenditure equals $32,550.00
  3. 4 people assigned to fulfill 3 positions. (¾ to ¼ rotation)
     a. Staffing equals 44.
     b. Human resource expenditure equals $61,600.00
        i. Elimination of overtime at 2 times rate equals new total of $53,130.00
  4. 16-hours on 8-hours off paid.
     a. Staffing equals 50.
     b. Human resource expenditures equals $40,441.00
        i. Elimination of overtime at 2 times rate equals new total of $35,790.00
  5. 16-hours on 8-hours off unpaid.
     a. Staffing equals 50.
     b. Human resource expenditures equal $23,250.00

It is important to recognize the differences in each scenario. Each scenario changes the number of personnel needed to fulfill the plan. These employees must be identified in the organizational chart outside of winter operations. As learned or will be learned in the Human Resource
Management Module, these positions may be with full-time staff, part-time, seasonal, temporary or contracted services. It is up to each Airport Operator to determine the benefits and detriments of each.

**Overtime Comparison**

**Overtime vs. Permanent Hires:**
When evaluating the financial factor between overtime verses additional permanent employees the airport operator must consider that overtime rate is typically 1.5 times the regular base salary with a minimal benefit factor to cover workman’s compensation insurance. This could reach .9 percent for a total overtime costs of 1.59 of base hourly pay. Regular pay equals base pay plus benefit factors that include health insurance, dental plan, sick and vacation accruals and retirement plans. This could quickly add up to .40 percent or more. This equates to 1.40 or more for the actual cost of regular time. With a difference of less than 20 percent or even less, it is easy to calculate that 1830 hours of overtime equals one full time regular person that you must employ for 2080 hour each.

Keep in mind that a single individual would not work 1800 hours of overtime for winter operations. The hours would be shared among several employees. A single full time hire couldn’t replace and eliminate this overtime. These numbers are important when numerous employees work thousands of hours of overtime combined. Let’s use 35 employees each averaging 400 hours of overtime for the winter season for a total of 14,000 overtime hours and a total of hours worked of 86,800 hours.

The airport operator must consider if additional full time employees working fewer overtime hours is a smarter plan. If this airport hires 5 more full time employees for a total of 40 to break even with the total hours work, it must reduce overtime to 90 hours each. In most plans this may be difficult to accomplish considering that only 5 additional employees are added to the winter crew.

**Overtime vs. Temporary Hires:**
Financially, temporary or part-time hires seem the least expensive alternative. Normally, fewer benefits are attributed to the payroll to reduce the regular hourly rate and the work schedule can be limited only to the winter season. Airport operators must consider the value of these hires. Typically this personnel group would be less familiar with operating on an airfield. More training would be required or less responsibility would be given to this group. It makes most sense to blend a small amount of this option with a strong compliment of well trained full time staff.

For those airports with union employees, it may be more difficult to blend these groups. It can be determined that these seasonal employees provide the union group with a better break schedule and because their employment ends when winter ends, the easier and less stress full summertime overtime offerings are protected just for the full time staff. Seasonal and Part-time employees make the perfect candidates for full time employees. There are partially trained and aware of the position requirements. They have worked with and for the
group they seek to join. They have been provided an opportunity to expose their ability to fulfill the position or the inability to become a full-time employee.

**Overtime vs. Contracting**

Contracting for snow removal services is common in this industry. It is most often utilized off of the AOA. The financial savings is based upon the style of contract utilized. A contract can be written where the contractor is compensated for the season, for each event, for total accumulation, or by the hour per piece of equipment.

One price for the season provides the airport with a solid number to base a budget upon. In a season of greater snow fall the contractor takes on the financial burden. In seasons with less or no snow fall, the contractor enjoys the windfall. Both parties can limit the gamble by setting a minimum and a maximum snow accumulation amount. For example; the contract could be for a single season where snow fall is greater than 30 inches and less than 60 inches. A cost per inch for each inch out of this range would be compensated back to either party.

Price per storm or per inch gives the contractor the opportunity to earn more profit through efficiency. The airport pays for only the service rendered to mitigate the event based upon the amount of snow fallen or accumulated. During the lighter seasons the airport reduces their expenditures. During the heavier seasons the airport bears the burden.

**Overtime vs. Closing**

Early on we discussed the cost of delays and cancellations. These costs can be measured to identify the value. Measure this value against the overtime scenario required to stay open. If we look at the different overtime scenarios for a 24 hour event, the most costly was $61,600.00 dollars. FAA IP&A estimated the FY 2014 average value of a delayed business traveler’s time to be $63.00 per hour, and a delayed personal traveler’s time to be $35.10. If each personal traveler was delayed for the 24 hours the cost for each day per traveler is $824.40. It would only take 80 travelers delayed for a single day to justify the $66,600 in overtime.

An airport with an average of 2500 on the day of the storm would only need to delay them for a single hour to justify the effort. If the FAA study is wrong by $20.00 per hour then it would take 2 hours of delay to warrant the costs.

**Safety First**

Safety has no price. If the airport can’t remain safe, at any cost, then the airport or specific surfaces must be closed.

Too few personnel available for snow and ice control operations result in a rush to job completion and the higher probability of an accident or incident. Err on the side of safety when determining the number of employees needed for a snow event. The opposite shift or relief crews should be available on a timely basis. Airport operators should also consider roadway conditions airport employees will face while driving to the airport. Congestion, snow and ice-contaminated surfaces will require additional travel time.
Human Factors
In each scenario the employees are subject to different terms of their work and break schedule. It is up to the Airport Operator, bargaining units and local jurisdictions to determine what break rotation and hours work is applicable and safe.

Airports should provide snow removal crews with sleep disorder training and circadian rhythm training. Online training and printed materials are readily available. This training will allow employees to recognize the symptoms of fatigue and the pre-event personal activities that could lead to fatigue on the job.

Airport operators need to pay special attention to human performance factors in preparing for winter operations. A large volume of subject matter material is available for review and reference. Training is available. Airport operators need to provide for basic human needs to support snow removal operations. The provision of food, beverages, and comfortable rest/break facilities has a positive effect on crew morale and crew performance. It is important to keep crews rested and alert during extended storms. Crews need to be given routine breaks or be empowered to take breaks as conditions allow.

Some airports establish a maximum amount of time an operator can be at the controls of a vehicle. Studies have proven the advantages of short, 10 to 15 minute naps. Crews should be encouraged to take advantage of available breaks and take a quick nap in a vehicle while parked in a safe location. Personnel cannot be expected to maintain continuous operations. The onset of fatigue leads to complacency, errors, and accidents. Personnel should be trained to immediately report to a supervisor or manager when fatigue begins to affect their performance.

Manage human performance factors by scheduling employees for snow removal duty as far in advance as possible; provide food and beverages, accommodations for rest or sleep, locker rooms, shower facilities, and kitchen facilities are necessary to support on-airport sleeping quarters. Airports may wish to consider agreements with local hotels to provide staff with sleeping facilities during extended snow events. Sleeping quarters and nearby sleeping arrangements may be of value even when operating rotating shifts. Difficult travel conditions may prevent crew members from returning to the airport for their next shift. Keeping personnel nearby during work breaks ensures maximum crew availability. The availability of onsite or nearby sleeping facilities enhances safety by being able to immediately address crew fatigue.

Loss Revenue
Airport revenue is generated from aeronautical charges, those that relate to the operation and use of the airfield by aircraft or aviation-related businesses and from non-aeronautical charges, those that relate to activities that are incidental to the operation of aircraft. When winter weather delays or cancels flights, both sources are affected. The loss of landing fees, parking revenue, passenger facility charges, or percentage of retail revenue all hit the airport’s financial abilities.
Airports collect a percentage of revenue from tenants, a percentage of parking revenue, a percentage of taxi services, and from a host of other activities that shut down or are greatly reduced when winter weather prevents passengers from utilizing these activities.

How great the impact is based upon the structure of the contracts, but it is easily recognized that a single flight cancellation with 150 passengers aboard will impact revenue by several thousand dollars. Landing fee could range from a couple to several hundred dollars, CFC’s could equal $1,500, concessions may lose several hundred dollars, and fuel isn’t sold to an aircraft that didn’t arrive. Depending on your airport, hundreds of flights, at thousands of dollars are not generated due to a single weather event.

At airports that are competing with other airports for flights may use reliability as a marketing tool. One airport can safely stay open and the other struggles to receive flights. Passengers become aware of what flights cancel readily and which airport remains open. Eventually, reliability becomes a factor when determining which airport to fly into, out of or through. This revenue loss may be too abstract to measure but the loss is real.

For an airport with approximately 2 million passenger activities per year, and an annual budget of less than 50 million dollars, that experiences winter weather, and that has 150 air carrier flights cancelled, the loss in revenue is equal to full percentages. A 1 or 2 percent loss in revenue is huge for this airport. Winter seasons that last 4 to 6 months can easily affect 150 flights at a small hub airport. Increase this affect by the activities at medium or large hub airports and the losses are in the multiple millions.

**The Cost of Storms**

In March of 2015, CNBC reporter John Schoen reported that airline flight cancellations had cost American passengers some $2.2 billion. (Schoen, 2015)

Also reported was that most of the expense was for out-of-pocket costs for hotels, meals, alternative travel arrangements shelled out by the roughly 4.5 million stranded air travelers from December through February, along with the wider economic impact of lost productivity from canceled flights. There were a total of 63,000 flights canceled in the first three months of 2015.

Winter conditions on pavement surfaces other than runways do contribute to ground delays for taxiing aircraft. These delays are more difficult to measure and can be attributed to SRE performance. This is especially true if ramp and apron pavement snow removal responsibilities are shared among multiple entities.

Understanding the nature and impact of runway closures on flight delays will enable airports to be more informed as they engage their stakeholders about reducing SRE runway occupancy time during winter weather events. This can be accomplished by estimating aircraft delays attributable to winter weather event runway closures, and then calculating associated aircraft and passenger delay costs.
The fiscal pressures facing every airport and stakeholder, drives the need for financial accountability and cost efficiency. This in turn drives the need to establish and document a cost baseline for current operations. Like the performance baseline, a cost baseline will help in the assessment of future changes to a winter operations program. The cost baseline should not only include the airport operator’s equipment and operating costs but also, where possible, airline and passenger delay costs driven by the airport operator’s winter operations performance. General considerations related to documenting these costs are described further in this section. FAA IP&A also estimated the FY 2014 average value of a delayed business traveler’s time to be $63.00 per hour, and a delayed personal traveler’s time to be $35.10 (I).

While unavoidable to a certain extent, aircraft flight delays present real costs to airlines commercial and private operators, traveling passengers, and the U.S. economy. The U.S. Travel Association, a national, non-profit organization representing all components of the travel industry, determined that every hour a flight is delayed costs the U.S. economy an average of $3,300 in passenger-related economic activity (16). The FAA Office of IP&A estimated fiscal year (FY) 2014 average hourly aircraft direct operating costs for passenger and cargo air carriers, as well as general aviation aircraft.

For example, the FAA Office of Investment Planning and Analysis estimated the 2014 operating cost of a delayed passenger aircraft to be $82.66 per minute, and the 2014 value of time for a delayed business passenger to be $1.05 per minute with flight cancellations posing even greater costs - a factor that can support a decision to increase investment in snow removal so as to reduce the time required to clear a runway.

Unilateral decisions on the level of airport investment in winter operations can be a source of conflict between airport operators and their stakeholders, particularly tenant air carriers. For example, an airport operator choosing the minimum levels of snow removal equipment (SRE) described in FAA Advisory Circular (AC) 150/5200-30C, Airport Winter Safety and Operations, and AC 150/5220-20, Airport Snow and Ice Control Equipment, may contribute to flight delays and cancellations that financially impact air carriers and their passengers.

Conversely, airport operators choosing to invest hundreds of thousands and even millions of dollars in SRE and equipment operators to minimize flight delays and cancellations may increase costs to air carriers if the equipment is funded through rates and charges.

**Contracting**

Airport Operators often rely on full-time airport personnel to the airside snow removal activities, due to the safety and skills required. Although there are several reasons that snow removal from landside roadways and surface parking lots to be equally important. It doesn’t make sense that the airfield is clear and safe yet the passengers can’t safely arrive at the terminals.

To address this, most airports enter into third-party contracts for landside and parking lot snow removal services. It is expected that the parking management company will be responsible for snow removal from within their leasehold areas. Third-party agreements identify equipment...
type and specifications, minimum number of snow removal vehicles, response time requirements and performance standards.

It is nearly as common to use contractors to remove snow from aircraft parking gate and cargo ramps. It is possible for air carriers and cargo operators to be responsible for snow removal from within their leasehold areas.

Contract may be written based upon equipment hourly rate, costs per storm, price per inch, price per season, or a blend of each.

**Reimbursements:**
Definition: Federal Emergency Management Agency disaster assistance specifically reimbursement procedures.
Purpose: To provide the general knowledge and skills to successfully apply for and receive reimbursement for disaster assistance from the Federal Emergency Management Agency.

**Disaster Declaration and Reimbursement**
State and local government entities are eligible applicants. This group includes: the States of the United States of America, the District of Columbia, the territories of Guam, the Virgin Islands, and American Samoa, the Commonwealths of Puerto Rico and the Northern Mariana Islands, counties, municipalities, cities, towns, townships, local public authorities, school districts, special districts, intrastate districts, councils of government, regional or interstate government entities, and agencies or instrumentalities of a local government.

There are several categories for reimbursements. Category “A” provides for debris cleanup. FEMA can assist you with funding for the clearance, removal, and/or disposal of items such as trees, woody debris, sand, mud, silt, gravel, damaged building components and contents, wreckage produced during the conduct of emergency work, and other disaster-related wreckage.

Category “B” provides for protective measures including; snow removal cost reimbursed by equipment rate, hourly rate for personnel for overtime, contractor expenses, and material use. The category we will focus on.

FEMA can also help pay for actions taken by the community (almost always government agencies) before, during, and after a disaster to save lives, protect public health and safety, and prevent damage to improved public and private property.

Categories C-G provides reimbursement for permanent repairs to; road systems, water control facilities, building contents, public utility systems and other.
FEMA Documentations

Early in this module we described the important documentations. These records become the foundation of the documentation required by FEMA. The data recorded is transferred into FEMA Forms and becomes the justifications for the reimbursements. These forms are then submitted for approval. In most cases the reimbursement is for 75% of an evaluations based upon equipment rates provided by FEMA, for overtime supported by payroll records, inventory supported by purchase orders and application records and contractor expenses supported by invoices.

FEMA forms are a excel work book with sheets assigned as; Summary Account Sheet, Fringe Benefit Analysis, Force Account Labor, Force Account Labor, Material Record, Contract Services Record and Contract Equipment Record. Completion of the workbook will provide a Summary Narrative of Disaster Costs.

The Summary Account Sheet identifies the Airport, the disaster code (provided by FEMA), the amount of time covered for the event (all declarations provide a number of consecutive hours during a specific range of dates and the applicant determines the selected start and stop time based upon the greatest impact to the facility), the category of work, a brief description of the work performed, (snow removal), and the names and number of sheets of the report.
Welcome to the Public Assistance Spreadsheet(s) designed to assist the applicant in summarizing costs associated with a declared disaster. Please do the following:

1. Please highlight the cell directly below (with the red border) and fill in the Name of the Applicant. This will be Carried Over to all the Work Sheets:

2. Please highlight the cell directly below (with the red border) and fill in the four (4) Digit FEMA Disaster Number. This Number will be Carried Over to all Work Sheets:

3. Insert time frame covering event:
   from: 
   to 

4. Insert the Category of Work:

5. Insert the Location/Site:

6. Brief Description of the Work Performed:

On the bottom of the screen there is a menu bar which names all the sheets associated with this Excel Workbook. The following are the names with the number of sheets for each:

a. Welcome to Public Assistance (1)
b. Public Assistance Help (1)
c. Summary Sheet (1);
d. Fringe Benefit Analysis (1);
e. Force Account Labor (5);
f. Force Account Equipment (5);
g. Materials Record (4);
h. Contract Services Record (4); and
i. Contract Equipment (4).

These sheets, once filled out, must be certified by the department heads and backup documentation may be required. Written narratives concerning the tasks performed by specific individuals is helpful when justifying labor for someone working outside of their normal job title (e.g. a clerk was detailed to issue food in an emergency shelter). The intent of this file is to be used for one Project Worksheet (PW) or project. If multiply PWs or projects are being written, then this file should be copied as many times as needed. The Summary Account Sheet should reflect only one (1) PW.

Please Refer to the 'Public Assistance HELP' Sheet for Additional Information & Assistance.
The Fringe Benefit Analysis can be the most frustrating analysis required. FEMA provides examples to help alleviate the frustration. The Fringe benefit Analysis calculates the actual costs for regular time and overtime. This includes the rate of base pay, the rate of FICA and Social Security deductions, the costs for unemployment and workman’s Compensation, Vacation and Sick Time Accruals, Holiday Pay, Retirement paid by the municipality and Insurance paid by the municipality. All this computes to a Total Benefit Percentage for Regular Time. An overtime rate is calculated by removing costs associated with Vacation, Holiday and Insurance Benefits. Both the rates are then applied within the Force Labor Sheets.

<table>
<thead>
<tr>
<th>Community:</th>
<th>Disaster #:</th>
</tr>
</thead>
<tbody>
<tr>
<td>To Whom It May Concern:</td>
<td></td>
</tr>
<tr>
<td>To the best of my knowledge, the payroll benefit expenses incurred by</td>
<td>are as follows:</td>
</tr>
<tr>
<td>FICA - SS</td>
<td>Regular Time</td>
</tr>
<tr>
<td>FICA - Medical</td>
<td>%</td>
</tr>
<tr>
<td>Unemployment</td>
<td></td>
</tr>
<tr>
<td>Workman’s Compensation</td>
<td></td>
</tr>
<tr>
<td>Vacation</td>
<td></td>
</tr>
<tr>
<td>Holiday Pay</td>
<td></td>
</tr>
<tr>
<td>Retirement</td>
<td></td>
</tr>
<tr>
<td>Insurance</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
<tr>
<td>Total Benefit Percentage</td>
<td>%</td>
</tr>
</tbody>
</table>

I certify that the information above was transcribed from payroll records or other documents which are available for audit.

___________________________
signature (as certified by)  
date:  

name (print)  
(title)  

nhoem (disastAc.xls)
Force Account Labor Summary Record is created from the Force Account Labor Sheets. Within these sheets each employee's Name, Title, dates and hours worked, hourly rate, benefits rates and total costs are recorded and calculated.

<table>
<thead>
<tr>
<th>2. PA ID</th>
<th>3. PROJECT NO.</th>
<th>4. DISASTER NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CATEGORY**

**PERIOD COVERING**

<table>
<thead>
<tr>
<th>8. DESCRIPTION OF WORK PERFORMED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DATE / HOURS WORKED EACH DAY</th>
<th>TOTAL HOURS</th>
<th>HOURLY RATE</th>
<th>BENEFIT RATE/HR</th>
<th>TOTAL HOURLY</th>
<th>TOTAL COSTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL COST FOR FORCE ACCOUNT LABOR REGULAR TIME:**

---

Force Account Equipment Summary Record is created from the Force Account Equipment Sheets. Within these sheets all equipment types, equipment costs code numbers (FEMA),...
operator’s name, dates and hours of operation, total hours, equipment rates, total costs are recorded and calculated. Please note that operators name and hours of operations must match the dates and times of each operator listed within the Force Account Labor Sheets.

<table>
<thead>
<tr>
<th>TYPE OF EQUIPMENT</th>
<th>EQUIPMENT CODE NUMBER</th>
<th>OPERATOR’S NAME</th>
<th>DATE AND HOURS USED EACH DAY</th>
<th>TOTAL HOURS</th>
<th>EQUIP RATE</th>
<th>TOTAL COST</th>
</tr>
</thead>
</table>
Material Summary Record is created from the Material Records. Within these sheets the Vendor or Inventory is defined, a description of the material, the quantity applied, the unit price, total price, date purchased, and date applied are recorded and calculated.

<table>
<thead>
<tr>
<th>VENDOR</th>
<th>DESCRIPTION</th>
<th>QUANTITY</th>
<th>UNIT PRICE</th>
<th>TOTAL PRICE</th>
<th>DATE PURCHASE</th>
<th>DATE USED</th>
<th>INFO FROM (CHECK ONE)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>INVOICE</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>STOCK</td>
</tr>
</tbody>
</table>

GRAND TOTAL
Contract Work Summary Record is created from the Contract Services Record. Within these sheets the date worked, the contractor’s name, the billing invoice number, the amount and a comment or scope of work is recorded and calculated.

<table>
<thead>
<tr>
<th>1. APPLICANT</th>
<th>2. PA ID</th>
<th>2. PA ID</th>
<th>4. DISASTER NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5. LOCATION/SITE</th>
<th>6. CATEGORY</th>
<th>7. PERIOD COVERING to</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8. DESCRIPTION OF WORK PERFORMED

<table>
<thead>
<tr>
<th>DATES WORKED (mm/dd/yy To mm/dd/yy)</th>
<th>CONTRACTOR</th>
<th>BILLING/INVOICE NUMBER</th>
<th>AMOUNT</th>
<th>COMMENTS - SCOPE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

GRAND TOTAL

I CERTIFY THAT THE ABOVE INFORMATION WAS TRANSCRIBED FROM DAILY LOGS OR OTHER DOCUMENTS WHICH ARE AVAILABLE FOR AUDIT.

CERTIFIED TITLE DATE

FEMA Form 90-126, NOV 98
Contract Equipment Summary Record is created from the Contract Equipment Record. Within these sheets the type of equipment, the dates and hours used, the rate per hour (with or without an operator), total costs, the vendor’s name, the invoice number, the check number and the amount paid are recorded and calculated.

The Summary Narrative of Disaster Costs complies all of the reports into a single page summary. The summary identifies the name of the applicant (airport), the FEMA Disaster number, the total costs and codes for Labor, Labor Overtime, Equipment, Materials, Contact Services, and Contract Equipment. The total gross value is record along with any comment.
This report is then submitted for review and acceptance. Upon acceptance FEMA will reimburse the airport for the expenses created by the event.
COURSE SUMMARY

The Airport Supervisors, Managers and Directors have a role like no other position in any other industry. They must manage their airport like a business and comply like a municipality. When winter weather events affect airport activities, it is up to these leaders to implement mitigation activities that comply with the applicable regulatory requirements without reckless abandonment of their fiscal responsibilities.

To meet these challenges, these Airport leaders and executives need to completely understand their human resources and to which limits these resources can be demanded upon. They need to recognize the impacts of overtime structures, shift rotations, the use of seasonal and contracted personnel on the persons and the budgets.

Airport managers and leaders must be competent in the development of a Snow and Ice Control Plan and Committee that meets or exceeds the requirements of the applicable Advisory Circulars and Far Part 139. They must be able to develop the procedures that can be included within the Airport Certification Manual for all Operational employees to follow.

These leaders need to know and be capable of justifying equipment acquisitions based upon identifying their Priority 1 responsibilities. They must be able to understand the funding available to procure equipment. They must be able to identify the equipment eligible for AIP funding and the equipment required based upon performance and the demands of their airfield.

These individuals benefit their airport with the ability to apply for and receive Federal Emergency Management Agency (FEMA) reimbursements for emergency declarations.

Airport Executives and Leaders must be capable of building and managing a budget for Airport Winter Operations.

This list of required knowledge and skills have been provided to the Advanced Airport Winter Operations Specialist (AAWOS) throughout the modules contained within this book and through the lectures provided during the classroom presentation. Experience during winter operations utilizing this knowledge will further develop the AAWOS in the successful management for winter weather mitigation and management at airports.
Works Cited


