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Advisory Circular

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1. PURPOSE. This Change provides guidance to assist airport operators in applying sand to runways under winter operational conditions, the use of runway and taxiway edge light markers, and in reporting runway friction measurements taken under winter operational conditions.

2. PRINCIPLE CHANGES.

a. Edge Light Markers. The recommendation for the use of runway and taxiway edge light markers has been moved from Chapter 3, Snow and Ice Removal Procedures, to Chapter 2, Winter Operations on Airports, Paragraph 11, Preseason Preparations. A recommended minimum specification is now provided.

b. Friction measurement. Friction measurement reporting procedures have been modified to use whole numbers in harmony with international practice.

c. Sand Specification. The gradation requirements of the FAA standard for sand have been modified.

The change number and date of change is shown at the top of each page. The changed material is indicated by lines in the left-hand column margins.

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b. Evaluation Meetings. It may be helpful to conduct meetings during the season to evaluate, and if necessary, revise procedures.

c. Snow Committee. All airports subject to annual snowfall of several inches or more or icing conditions should have a snow committee. The committee size and function will vary depending on the frequency and amount of anticipated snowfall and the size of the airport. The formally constituted snow committee expedites decision making, reduces the response time for keeping runways, taxiways, and ramp areas operational, and improves the safety evaluation process which determines when or if a runway should be closed. A committee may be composed of representatives of airport management and operations staffs, airline flight operations departments and/or fixed-base operators, the air traffic control tower (ATC), the flight service station, airway facilities (AF), the National Weather Service, other meteorological services, and any other interested or concerned parties. Airlines normally provide information on aircraft operational limitations and assist in evaluating pavement surface conditions. Snow committees are generally chaired by the airport manager or his representative. Committees have proved useful, not only in day-to-day operations (because communications are enabled), but in identifying long-range equipment needs and selecting and applying ice control chemicals. Snow committees normally critique past season's activities. Many snow committees also critique responses after each storm event.

d. Snow Control Center. Airports in frequent or heavy snowfall areas should set up a special facility for all snow and ice control activities (i.e., a "Snow Desk" or "Snow Control Center"). The snow desk or snow control center will normally inform air carriers and the ATC of expected runway opening and closing times and serve as a prime source of field condition information. The size and complexity of this facility will depend on the size of the airport, local climate conditions, and the personnel available. Communication between the ATC tower, snow and ice control equipment and/or supervisors' vehicles, and other support elements need to be provided. Status boards are often used for displaying the type, identification number, status, and location of each piece of equipment. A status board is also useful for recording the condition and inspections of airport surfaces and visual aids. The snow control center can keep an equipment checklist to supplement the status board and a visual inspection to ensure that all equipment has cleared runways prior to resumption of aircraft operations.

e. Snow Removal Plan. Every airport where snowfall is likely should have a written plan which states the procedures, equipment, and materials to be used by the airport in removing snow and ice. It should set out maintenance objectives and the priorities assigned to the airport movement areas, establish and define areas of responsibility (including who can close a runway), establish operational requirements and procedures, and define relationships with contractors if used. The plan should also address any unique environmental, climatic, and physical conditions affecting the airport. Elements that should be in this plan are preseason preparation, snow committee composition, snow desk or snow control center location, equipment, personnel training, weather reports, field condition reports, clearance criteria, clearance priorities, supervision, and communications. The snow plan should be flexible enough to allow snow and ice removal operations to change with changing weather and operational procedures. The snow committee at the airport can be charged with helping the airport operator keep the snow plan up to date. The sophistication or detail included in a snow plan will necessarily increase with the increasing size and complexity of the airport. A typical snow plan is included in appendix 2.

10. SNOW REMOVAL PRINCIPLES. Certain principles or objectives form the basis for a snow removal plan. These are discussed below:

a. Snow Removal. Snow impedes the passage of wheels by absorbing energy in compaction and displacement. The resulting drag increases as the water content of the snow increases. Wet snow and, in particular, slush will accumulate on all exposed surfaces subject to splashing from the landing gear, degrading flight control effectiveness or possibly preventing retraction of landing gear. Engine flameout can also be caused by wet snow. Even dry snow will accumulate on the landing gear and underside of the fuselage because of engine heat and the use of reverse thrust. A slush-covered pavement will reduce friction coefficient and can also cause hydroplaning. It is, therefore, necessary to remove snow from Priority 1 (active) runways as soon as possible after snowfall begins. Dry snow falling on a cold dry pavement will generally not adhere and may be blown off by wind or aircraft operations. Under these circumstances, only brooming may be needed to prevent compacted snow tracks from forming. Wet snow cannot be blown off the pavement and will readily compact and bond to it upon the passage of wheels.

b. Height of Snow on Shoulders. Snow plowed off the runways must be reduced in height, sufficient to provide clearance for wings, engines, and propellers [see chapter 3, paragraph 21b(6)]. Eliminating windrows at the runway edge will also reduce the formation of drifts onto the runway. These drifts, often called finger drifts, frequently take the form of long, intermittent, and possibly narrow snow projections which taper in width and height and can cause loss of aircraft directional control. Furthermore, snow cleared from the runways should not be deposited within a navigational aid (NAVAID) critical area, especially a reflecting plane area (see figures 3-6a and 3-6b).

c. Ice and Bonded Snow Prevention. Proper application of approved chemicals on the pavement prior to or during the very early stages of a snowfall will reduce the likelihood of compacted snow bonding to the pavement. Prompt treatment will also reduce the effort needed by either mechanical or chemical means of removing the snow. Additionally, chemicals should not be used where their melting abilities may cause dry blowing snow to accumulate on pavement surfaces in the form of slush.

d. Response to Freezing Rain. Freezing rain will bond to a cold pavement surface and will require special treatment depending on the pavement surface temperature. If the pavement surface temperature is below freezing, chemical application may be the most effective control measure. On the other hand, if the pavement surface temperature is above freezing and a frozen rain (slush) develops, a more effective method of control would be brooming.

e. Effect of Chemicals on Friction.

(1) Deicing chemicals may initially degrade the frictional level of a pavement surface upon application because of the concentrated chemical film that will occur on the surface area. This is especially true with liquid chemicals. However, after a short period of time, the frictional quality of the pavement surface should recover if the microtexture of the pavement surface is sound.

(2) During anti-icing, pavements in otherwise good condition will not experience an unsafe drop in friction levels when chemicals are applied at the manufacturers' recommended rates. On the other hand, pavements with poor microtexture due to wear or contamination by rubber deposits may become slippery [Effects of Runway Anti-Icing Chemicals on Traction (DOT/FAA/CT-TN 90/53), Nov. 1990].

(3) After the threat of inclement weather has passed, prompt cleanup measures should be initiated to remove surface contaminants prior to aircraft operations.

f. Communications Equipment. Two-way radios provide the primary communication between snow and ice control elements, i.e., snow control center, supervisory vehicles, and often times with snowplows, brooms, and other equipment. All units operating on runways and taxiways should be able to communicate on the appropriate airport advisory frequency or be under the control of a radio-equipped vehicle. Methods of signaling to indicate to the operators the necessity for clearing the runway or changing the removal plan should be worked out in advance. Some airports use a flashing beacon on supervisory vehicles as a signal. This signal beacon is separate and distinct from the flashing beacon that should be operating whenever vehicles are in an aircraft movement area. High noise levels in snow and ice control equipment may justify the installation of radios equipped with headsets and noise-canceling microphones.

g. NAVAIDs and Weather Equipment. If there is any doubt about specific areas that need to be kept clear around weather and navigational equipment, the airport operator should contact the local or regional FAA Airways Facilities Office.

(1) NAVAIDS. Snow removal around FAA localizers, glide slope installations, transmissometers, etc., should commence in conjunction with runway/taxiway/ramp snow control based upon the snow and ice control plan and the Instrument Landing System (ILS) snow depth criteria agreed to with the FAA Airway Facilities System Management Office or designee. Prior to starting removal and after finishing removal, the air traffic control tower, flight service station, UNICOM, or appropriate facilities should be contacted. No equipment should be moved into the NAVAID areas until all aircraft approaches are completed. In addition, the local Airways Facilities office should be contacted before beginning removal actions unless the glide slope has been Notices to Airmen (NOTAMED) out of service. Clearance around non-Federal NAVAIDs should be accomplished according to the facility's operations/maintenance manual.

(2) Weather equipment. FAA and the National Weather Service have installed weather observation equipment at many airports. Because of the location of many of the Automated Surface Observing Systems (ASOS), snow drifts and snow accumulation may interfere with the ASOS sensors resulting in erroneous information. Crews should use caution during snow removal operations to avoid blowing snow from obscuring ASOS visibility sensors or to prevent snow accumulation from interfering with other ASOS sensors.

(3) Snow Fences. Snow fences can also minimize snow accumulation around NAVAIDs and other sensitive facilities. The nearest AF office should be contacted prior to erection of any snow fence for technical guidance and determination of the effect such structures will have on the proper functioning of the NAVAIDs. Failure to remove the snow in areas adjacent to the NAVAID may result in the restriction or shutdown of the facility. The airport sponsor should have an agreement with AF related to the conditions for which snow removal must be undertaken and the limits of the required snow removal to preclude restriction of the facility.

11. PRESEASON PREPARATIONS. Preparation for the next winter season should begin as soon as the previous winter season ends. A review of the past winter's experiences and problems should be made as soon as possible while the experience is still fresh in mind.

a. Equipment and Supplies. The condition of the airport snow control equipment should be determined, repairs scheduled, and replacement parts not in stock ordered. Ice control chemicals and abrasives should be ordered to ensure their being on hand before the first snowfall of the following winter season. Chemical and abrasive spreading equipmentshould be calibrated to ensure application of a known, controlled amount of material. The correct spread rate should be based on the prevailing conditions and the guidance provided in chapter 3.

b. Training and Communications. Crews should be trained in the operation of the equipment, and practice runs should be made with the equipment in typical operational scenarios. Also, the crews should be taught general maintenance and repair techniques for the vehicles and be trained in communication procedures and terminology, as well as be completely familiarized with airport layout, marking, signs, and lighting. A complete check of communication equipment should be made. Operator training on the use and repair of specific pieces of equipment is extremely important as it allows more efficient use of the equipment and less likelihood of breakdowns during operation.

c. Installation of Snow Fences. Immediately prior to the onset of a winter season, snow fences should be installed at locations where prior observation has shown they will be effective in minimizing accumulation (see paragraphs 10g(2) and 21a(2)).

d. Identification of Disposal Areas. If there is insufficient storage space for snow near the areas to be cleared and no melting or flushing means are available, hauling to a disposal site may be necessary. In that case, a site should be selected before winter in an area where the snow pile will not interfere with aircraft operations, will be readily accessible, and will not interfere with the airport's NAVAIDs. The disposal site selection should be coordinated with the local AF Sector Office. Careful consideration must be given to drainage in selecting a land disposal site as the ground will remain snow-covered or wet long after all other snow has melted and seasonal vegetative growth will be delayed. If large quantities of snow must be handled, a tracked bulldozer may be necessary to push the snow from the truck dumping point into a pile. This will reduce the area occupied by the snow and prevent haul trucks from becoming stuck in the dumped snow. Debris remaining after the spring melt will need to be cleaned up. Disposal by use of melting devices is discussed in chapter 3.

e. Installation of Runway and Taxiway Edge Light Markers. The preferred method of ensuring that runway and taxiway edge lights are not obstructed by snow is by installing fixtures which are taller than 14 inches, in accordance with AC 150/5340-24, Runway and Taxiway Edge Lighting System. If this is not practicable, in heavy snow areas edge light markers may be installed prior to the first snowfall of the season to assist snow removal equipment operators in avoiding striking the lights while plowing near them. Markers should be securely fastened in place to avoid creating a foreign object damage (FOD) hazard. The flexible edge light markers, normally cylindrical sticks of 3/4 inch (2 cm) or less in diameter or flexible stakes with flags, may extend up to 24 inches (61 cm) above the top of the edge lights, but should be the minimum height necessary to extend above normal snow depth of a single snowfall event. In all cases, the height of these units should be 6 inches (14 cm) outside of the propeller arc of the most critical airplane using the airport. For cylindrical sticks, the wall's thickness should prevent kinking and keep the markers standing straight. If hollow, measures should be taken to prevent water accumulating inside the markers where it could freeze. The color of the flags or sticks, including any retroreflective material, should be high-contrast and high-visibility, such as international orange. The markers should be designed to exhibit similar properties of strength and flexibility throughout the temperature range that can be expected to be encountered. The markers should be designed to resist changes to properties of visibility, strength, and flexibility due to exposure to ultra-violet radiation. A cursory inspection of edge light markers should be performed regularly.

12. AIRFIELD CONDITION ASSESSMENT.

a. Weather Reports. Appropriate response to a snow or ice removal event depends on accurate information about an approaching storm and the likely effect of precipitation on airport surfaces. The snow or ice removal task can be reduced and costs lessened by a prompt, effective response to a storm warning; in addition, unnecessary callouts and other mobilization costs can be eliminated by responding appropriately to accurate storm forecasts. In many areas, good forecasts can be obtained from the National Weather Service. Where these are very general, both with regard to geographic area and time of the precipitation event, contract weather services are also available and can provide local specific forecasts and short-time warnings. Some airports have installed color weather radar monitors on which views of precipitation cells can be called up from local or distant radars. Another option may be procurement of a weather radar system including x-band radar (designed specifically for snow and low-level precipitation conditions like "lake effect storms"). At smaller airports, a telephone network with outlying areas (possibly county or State highway offices) can be used to track approaching storms.

b. Pavement Surface Condition Sensors. Sensors embedded in the pavement to measure surface conditions serve two functions: (1) they provide a precise measure of the pavement temperature and they indicate the presence of water, ice, or other contaminant; and (2) they transmit this information to the snow control center to provide an important part of the information necessary for selecting the most appropriate snow and ice control strategy. Many factors influence pavement temperature: surface color and composition, wind, humidity, solar radiation, traffic, and the presence of residual deicing chemicals or other contaminants. Since pavement temperature lags behind air temperature, use of air temperature to infer the condition of the pavement surface is imprecise and can be very misleading. Ice will not form unless the pavement temperature reaches the freezing point; therefore, knowledge of the direction and rate of change of pavement temperature will provide a predictive capability for the formation of ice. Sensors are particularly valuable in the timing of anti-icing applications of chemicals (see Chapter 3). If ice or compacted snow has accumulated on pavements, knowledge of the pavement temperature will guide selection of chemical and application rate to achieve clearance within a specified time with the minimum amount of material.

c. Field Condition Assessment. The snow control center must be aware of the surface conditions of all movement areas in order to plan and carry out appropriate maintenance actions. Runway condition reports received from pilot reports, "snow team" personnel, friction measurements (paragraph 13), or pavement condition sensors can be used to assess the surface state. This same information forms the basis for field condition reports. In addition to the usefulness for efficient snow and ice removal, field condition reports can enhance aircraft safety when provided to pilots during winter operations. Therefore, when the airport has appropriate equipment and trained personnel, these reports should be prepared and promulgated in accordance with procedures and formats set forth in paragraphs 13 and 14.

13. RUNWAY FRICTION SURVEYS. Under certain winter operating conditions, difficulties in stopping and/or controlling aircraft on snow or ice-covered runways raises the potential for an accident or incident. Pilot braking action reports oftentimes have been found to vary significantly, even when reporting on the same frozen contaminant surface conditions. Using a truck or automobile to estimate aircraft braking action is subjective and of questionable benefit. For this reason, airports should conduct friction surveys to obtain an indication of the existing level of friction on runways contaminated with snow and/or ice. To ensure that data collected is accurate, it is important that these surveys be conducted by qualified personnel using approved equipment. While it is not yet possible to calculate aircraft stopping distance from friction measurements, data have been shown to relate to aircraft stopping performance under certain conditions of pavement contamination, and are considered helpful by pilots' organizations. Further guidance on runway friction measurement may be found in Advisory Circular 150/5320-12, Measurement, Construction, and Maintenance of Skid-Resistant Airport Pavement Surfaces.

a. Conditions Acceptable for Conduct of Friction Surveys on Frozen Contaminated Surfaces. The data obtained from friction surveys are generally considered to be reliable when the surface is contaminated by:

(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. This film deposit is of minimal depth, insufficient to cause hydroplaning), or

(2) compacted snow (any depth).

Note: The above conditions can be expected after mechanical methods have removed all winter contaminants possible. Realistically, a small amount of dry snow, or wet snow/slush will often remain on the surface. It is generally accepted that friction surveys will be reliable as long as the depth of dry snow does not exceed 1 inch (2.5 cm), and/or the depth of wet snow/slush does not exceed 1/8 inch (3 mm).

b. Conditions Not Acceptable for Conduct of Friction Surveys on Frozen Contaminated Surfaces. The data obtained from friction surveys are not considered reliable if conducted under the following conditions:

(1) when there is more than .04 inch (1 mm) of water on the surface, or

(2) when the depths of dry snow and/or wet snow/slush exceed the limits in the note above.

c. When to Conduct Friction Surveys on Frozen Contaminated Surfaces. The airport operator should conduct friction surveys whenever it is felt that the information will be helpful in the overall snow/ice removal effort. The following guidelines, however, pertain to friction surveys conducted for the benefit of aircraft operators. Friction surveys should be conducted:

(1) when the central 60 feet (18 m) of the runway, centered longitudinally along the runway centerline, is contaminated over a distance of 500 feet (150 m) or more, subject to the limitations in paragraphs a. and b. above;

(2) whenever visual runway inspections and/or pilot braking action reports indicate that runway friction is changing;

(3) following anti-icing, de-icing, or sanding operations;

(4) at least once during each eight hour shift while contaminants are present; and

(5) immediately following any aircraft incident or accident on the runway.

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

(1) Continuous Friction Measuring Equipment (CFME). CFME devices are the preferred equipment and are recommended for measuring friction characteristics of pavement surfaces covered with frozen contaminants. CFME's are likewise recommended for use at airports that have significant turbojet aircraft operations. They provide a continuous graphic record of the pavement surface friction characteristics with friction averages for each one-third zone portion of the runway length. They may be either self-contained or towed. Advisory Circular 150/5320-12, Measurement, Construction, and Maintenance of Skid-Resistant Airport Pavement Surfaces, contains performance standards for CFME in Appendix 4, and a list of approved equipment in Appendix 5.

(2) Decelerometers. Decelerometers are recommended for airports where the longer runway downtime required to complete a friction survey is acceptable. Decelerometers may be either electronic or mechanical. Neither type of decelerometer 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 regarding 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. Electronic or mechanical decelerometers may serve as backup equipment at airports that have a more sophisticated primary device. Approved decelerometers are listed in Appendix 4. Performance standards for decelerometers may be found in Appendix 5.

(a) 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.

(b) Mechanical Decelerometers. Mechanical decelerometers should be used only at airports where the cost of an electronic decelerometer is not justified. The runway downtime required to complete a friction survey will be longer than that for an electronic decelerometer. (A rule of thumb is that mechanical decelerometers are appropriate for use on runway ends with 30 or fewer commercial turbojet aircraft arrivals per day.) Mechanical decelerometers do not provide automatic friction averages or a printed copy of data. Busier airports that currently own mechanical decelerometers should plan to replace them with electronic versions as soon as practicable.

e. Friction Measuring Procedures.

(1) Calibration. The friction measuring equipment operator has the responsibility to ensure that the equipment is correctly calibrated in accordance with its operation 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, two-way radios, etc.). Factory calibrations of the CFME should be performed as recommended by the manufacturer, or sooner if indicated by apparently 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 that the equipment will be ready for the next winter's friction surveys.

(2) Advance Coordination. Runway friction surveys take time, and while the tests are being conducted, the runway may be closed to air traffic. Airport operators should work closely with air traffic control, the airlines, and/or the fixed base operators, to minimize interruption to aircraft operations. Close coordination, communication, and cooperation among all parties concerned is vital if personnel safety, traffic management, and timely friction survey objectives are to be met. The airport operator should request from air traffic control an appropriate period of time to conduct a friction survey of the runway. At a high activity airport, friction surveys may have to be conducted in segments. The airport operator should request air traffic control to plan a break in arrival and departure traffic to provide time to conduct a friction survey. With such planning, the friction survey team can be in position adjacent to the runway when air traffic control gives the clearance to proceed. This cooperative effort with air traffic control will result in minimal disruptions to aircraft operations. A letter of agreement between the airport operator and air traffic control is suggested as a means to identify the procedures and responsibilities for coordination and for reporting runway surface conditions.

(3) Air Traffic Control Clearance When Conducting Friction Surveys on Open Runways. Before proceeding with the friction survey at controlled airports, the airport operator responsible for conducting the friction survey must contact air traffic control for runway clearance according to standard procedures and remain in radio communications during the entire time it takes to complete the friction survey on an open runway. Air traffic control will provide appropriate clearances on and off the runway to permit the airport operator access to conduct the friction survey. At uncontrolled airports, airport operations personnel must be alert for aircraft and advise any air traffic on advisory frequencies before, during, and after completion of the friction survey. In this situation, coordination between the area air traffic control, the airport operator, and the airlines is particularly important to ensure that safe and efficient aircraft operations are maintained at all times.

(4) Location of Friction Surveys.

(a) Lateral Location. On runways that serve primarily narrow-body aircraft, friction surveys should be conducted approximately 10 feet (3 m) from the runway centerline. On runways that serve primarily wide-body aircraft, friction surveys should be conducted approximately 20 feet (6 m) from the runway centerline. 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.

(b) Direction. The friction measuring equipment should be operated in the same direction that aircraft are landing.

(c) Runway Zones. The runway length should be divided into three equal zones; the touchdown, midpoint, and rollout zones. These zones are defined according to aircraft landing direction. If possible, the entire survey should be completed in one pass. However, if air traffic control cannot schedule enough time to do a complete friction survey, then the airport operator should request air traffic control to schedule each zone separately until all three zones have been completed.

(5) Conducting Friction Surveys Using Decelerometers. A minimum of three braking tests are recommended in each zone to determine the average friction value for that zone, resulting in a minimum of nine tests for a complete runway survey. The vehicle speed for conducting the friction survey should be 20 mph (32 km/h).

Example:

The operator obtains four readings in the touchdown zone: 25, 27, 26, and 31. The average of these readings is 27.25. For reporting purposes, the number is rounded to the nearest whole number, or in this case, 27.

Four readings are obtained for the midpoint zone: 26, 28, 28, and 32. The average of 28.5 is reported as 29.

After the minimum three readings (29, 30, and 31) are obtained for the rollout zone, air traffic control 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 and reported as 30.

(6) Conducting Friction Surveys Using CFME. A friction survey is recommended for the full length of runway to determine the average friction value for each zone. The survey may be conducted at any speed up to 40 mph (65 km/h) as safety considerations allow. Some towed devices (trailers), however, can become unstable, and thus provide unreliable data, when operated at speeds above 20 mph (32 km/h) on contaminated pavements.

(7) Recording Friction Survey Data. The equipment operator should record all data and observations obtained from friction surveys. Data and observations recorded can be used to assess the effectiveness of runway surface treatments and snow removal operations; and may be helpful in accident or incident investigations. Table 2 is a suggested form which can be used for this purpose. The remarks column can be used to record pilot braking action reports and associated aircraft type, and other observations of any unusual conditions existing when the friction surveys were conducted. The CFME and electronic decelerometers provide the airport operator with their own records. These records may be used to augment the suggested form as appropriate.

14. PAVEMENT CONDITION REPORTING.

a. When To Report Friction Values. Friction values should be reported to interested parties:

(1) whenever compacted snow and/or ice are present on the center 60 feet (18 m) of the runway, and friction values are below 40 on any zone of the runway; and

(2) when friction values rise above 40 on all zones of any active runway previously showing a friction below 40.

Note: Friction values are technically decimal numbers (e.g. .10, .24, .30), but are generally referred to using whole numbers (e.g. 10, 24, 30) for convenience. Confusion between the decimal and whole numbers is rarely a problem.

b. Report Contents. The friction report should identify the runway followed by the friction number for each of the three runway zones (rounded to the nearest whole number), a short description of the cause of the runway friction problem, and the time of the report. It is especially important that pilots be advised of patchy conditions that may result in different braking action on various sections of the runway. It is not necessary to report the type of friction measuring device since the friction numbers below 40 read essentially the same for all approved devices. Example:

The friction measuring equipment operator conducts a survey on runway 14R with CFME and obtains averages for the touchdown, midpoint, and rollout sections of 23, 27, and 32 respectively. He/she notes that the surface is contaminated by compacted snow, with patches of ice. The survey is completed at 10:15 am. The report transmitted to air traffic control would be "Friction for runway 14R, 23, 27, 32, compacted snow with patchy ice at one zero one five.

c. Reporting Procedures. The procedure for transmitting friction values to air traffic control for dissemination to pilots may vary from airport to airport. The letter of agreement between the airport operator and air traffic control should spell out the procedures and formats for each type of event - runway closure, friction survey results, runway treatment, etc. For example, certain friction equipment manufacturers offer the airport operator an optional data link system that provides direct transmission of the friction measuring equipment data to airport operators, or air traffic control, or both. Reports may also be furnished to local operators, airlines, or other users. In the absence of a control tower on the airport, the report should be supplied to the air traffic control facility that provides approach control service or to an appropriate flight service station (FSS), fixed-base operator (FBO), or other authority to broadcast on the Unicom, Common Traffic Advisory Frequency (CTAF), or Airport Advisory Service Frequency.

d. Out-Of-Service Friction Measuring Equipment. During winter operations, if friction values taken on compacted snow and/or ice have been issued on a regular basis and the equipment used to obtain these values is not available, a Notice to Airmen (NOTAM) should be issued and maintained until the equipment is restored to service. Meanwhile, runway advisories may be issued using other means of observation (e.g., pilot reports).

15. NOTAMS. Airport operators are responsible for issuing NOTAMS. AC 150/5200-28, Notices to Airmen (NOTAMS) for Airport Operators, provides details of format and abbreviations for use in reporting winter conditions on aircraft movement areas. See Appendix 1 for examples of NOTAM snow reports.

(7) Movement areas where aircraft will operate at high speeds such as turnoffs should receive the same snow and ice control attention as runways. Areas of low speed operation such as taxiways and ramps can also be critical under some conditions. Directional control and braking action should be maintained under all conditions.

(8) Airports with joint military operations may have arresting barriers located near the end of the active runway or the beginning of the overrun area. 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 runout of the arresting system. Snow removal involving arresting barriers should be coordinated with the military tenant prior to the snow removal season.

(9) The faces of all signs and all lights should be kept clear of snow and in good repair at all times. Priority should be given to lights and signs associated with hold lines and ILS critical areas. Time and effort in clearing snow from around the lights may be minimized by plowing as close as possible to them. It is also recommended that the remaining snow be blown away using a truck-mounted airblast unit, the airblast from a broom, or by spraying with a liquid deicing chemical. As a last resort, hand shoveling may be necessary.

(10) Centerline and touchdown zone (TDZ) lights inset in the pavement tend to form "igloos" of ice or compacted snow surrounding them. Heat from the lamps will melt even cold dry snow which will refreeze and adhere to the pavement and then accumulate around the lights. One method of control or removal is described in paragraph 24. To prevent damage to these lights, use rubber or plastic cutting edges or shoes and casters on plow moldboards and the front of rotary plows.

(11) Striated pavement markings are useful in reducing ice buildup.

22. SNOW DISPOSAL. Some means of disposing of snow must be provided when there is insufficient space for storage adjacent to cleared areas. This will entail loading trucks and hauling to a disposal site, pushing the snow into melting pits sited near the areas being cleared, or portable melting pits set up over catch basins. Although melting pits eliminate long hauls and may reduce truck traffic in the ramp area, an economic analysis should be made to determine the benefit of constructing and operating them. Calculation of the thermal energy required is based on the heat of fusion of ice, 144 Btu/lb. (335 kJ/kg) and the specific heat of ice, 0.5 Btu/lb. (2.1 kJ/kg). Submerged combustion burners have been developed and are commercially available. A typical 10 x 8 x 8 ft (3 x 2.4 x 2.4 m) deep melting pit containing two burners can melt 120 tons of snow per hour (30 kg/s) consuming 60 gal. (227 liters) of No. 2 fuel oil per burner.

23. MECHANICAL METHODS FOR CONTROLLING ICE. Ice near the freezing point is soft and may be scraped off the pavement. Cold, hard ice bonds much more tenaciously and is difficult to remove by mechanical means. Scraping is not very effective, and attempts to lift the ice from the pavement by penetration with a wedge parallel to the pavement, have only been partially successful. Cutting edges attached to plow moldboards can be operated in contact with the pavement in the attempt to remove ice. At plowing speeds above about 10 mph (16 km/hr), front-mounted plows tend to bounce and leave ice on the pavement. Slower speeds, heavier plows, or plows which can be downloaded can reduce this "porpoising" or bouncing. Application of downward force also helps to penetrate and scrape the ice. Although down pressure can be applied by hydraulic cylinders on front-mounted plows, underbody blades can apply greater pressure without reducing steering control. All blades or cutting edges or the moldboards to which they are attached should have trip mechanisms to release the blade upon striking an obstacle in order to prevent damage to the blade, truck, pavement insert, or pavement. Carbon steel cutting edges run in contact with the pavement wear rapidly and require frequent replacement. Tungsten carbide cutting edges are extremely tough and can last for thousands of miles. They are brittle, however, and can chip upon striking metal or other very hard projections. Serrated cutting edges which cut grooves in hard ice are sometimes used and will facilitate retention of chemicals and abrasives which might otherwise be blown off. Centerline or flush lights should not be plowed with metal cutting edges contacting the pavement; rubber or polymer cutting edges will help prevent damage to the lights. Slush or very soft ice can also be removed effectively by rubber cutting edges which squeegee the pavement.

24. ANTI-ICING VS. DEICING. The most difficult task in winter maintenance occurs when snow or ice bond to the pavement. Thus the primary effort should be directed at bond prevention. Though dry snow will not readily form a strong bond even under heavy and frequent wheel passes, wet snow and ice will develop such a strong bond that mechanical removal is either difficult, slow, or damaging to the pavement. Ice removal after formation is called deicing; preventing the bond from forming is called anti-icing or bond prevention. Anti-icing, which is recommended over deicing whenever possible, is accomplished by concentrating either thermal or chemical energy at the pavement surface. Because of the high cost of installing pavement heating systems and the large amounts of energy required to maintain the surface above freezing prior to the onset of precipitation, anti-icing/deicing with approved airside chemicals is generally more economical. Chemical application is in either solid (includes pre-wetted) or liquid form. Chemicals in liquid form are most effective for uniform anti-icing treatment of pavements. All deicing/anti- icing chemicals should be applied based on pavement temperature rather than air temperature (see AC 150/5220-13A, Runway Surface Condition Sensor-Specification Guide).

a. Deicing Chemicals. Deicing chemicals should be applied on ice 1/16 inch (1.5 mm) or less in thickness. Thicker layers of ice require an extended period of time to obtain ice-free pavement. However, solar radiation from even a cloudy sky enhances melting action to such an extent that elimination of ice thickness greater than 1/16 inch (1.5 mm) are possible.

b. Anti-icing Chemicals. The recommended chemical form for anti-icing is liquid, although solid chemicals can also be effective in this application. A dry solid chemical has the disadvantages that if applied to a cold dry surface it may not adhere and therefore, may be windblown or scattered by aircraft movements. However, certain physical properties of a solid, such as its bulk density, particle shape, etc., may reduce these tendencies. Regardless, wetting a dry anti-icing chemical, either during distribution or before or after loading into the application vehicle, improves the ability to achieve uniform distribution and improved adhesion.

25. CHEMICALS. Any water-soluble substance will lower the freezing point of water and thus promote the melting of ice. Theoretically, the lower the molecular weight and the more individual particles (ions) the substance disassociates into, the more effective the product is as an ice control chemical, assuming its solubility still remains high at the freezing temperature. For the purpose of shared information, airport operators should advise the airlines before introducing a new chemical on the airside.

a. Approved Airside Chemicals. The FAA either establishes approval specifications or, upon recognition, references the specifications of professional associations such as the Society of Automotive Engineers (SAE) through Aerospace Material Specifications (AMS) and the United States military (MIL-SPEC). The approved airside chemicals for non-aircraft applications are fluid and solid products meeting a generic SAE specification or MIL specification. These specifications require vendors to provide the airport operator with a material safety data sheet (MSDS) and certification that the chemical conforms to the applicable specification. 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 pollutants that the Environmental Protection Agency and the State Department of Natural Resources require of the airport operator in their discharge reporting. Typical information includes: percent product biodegradability, biochemical oxygen demand (BOD5), chemical oxygen demand (COD), pH, presence of toxic or hazardous components, if any, and remaining inert elements after application. Related to the environment, 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 compounds, they do not address the compatibility issue of combining products during operations. Airport operators should query manufacturers about the safe and proper use of concurrently applying multiple deicers/anti-icers.. The FAA-approved airside chemical specifications are as follows:

turbojet movement areas to reduce engine erosion. If the granules do not embed or adhere to the ice, not only are they likely to be ingested in engines but they can be blown away by wind or scattered by traffic action and serve no useful function. This is particularly the case when ice or compacted snow is at temperatures below about 20° F (-7° C) since no water film exists on the surface to act as an adhesive. There are three approaches to reducing loss of sand: (a) they can be heated to enhance embedding into the cold surface; (b) the granules can be coated with an approved deicing chemical in the stockpile or in the distributing truck hopper; or (c) dilute 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 the necessity for any further treatment. One method of setting the sand, though difficult to implement, is to apply heat after the sand has been spread by using weed burners or other open flame sources. 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 to remove the residue to prevent engine damage. Sand should be used when the friction measurement, as discussed in paragraph 13, is below 27 (MU equivalent). Other factors to consider when deciding to apply sand are pavement and air temperatures and frequency of operations.

(2) Ice Scarifying. Directional control of vehicles on an ice or compacted snow surface can be improved dramatically by cutting longitudinal grooves in the ice. However, no improvement in braking effectiveness results from grooving, so this approach is only an expedient to be employed when very low temperatures prevent rapid chemical action or mechanical removal. The grooves trap sand or chemicals and hence contribute to improving the surface friction characteristics and melting action.

28. SAND.

a. Materials. All sands do not perform the same. Studies have shown, however, that virtually any sand will be adequate to improve traction on a runway if used in sufficient quantities. In general, the greater the quantity of sand applied, the greater the increase in traction. Fine sands show superior performance on warmer ice (> 20°F (-7°C)), while coarser sands show superior performance on colder ice (<15°F (-9°C)). (For the purposes of this AC, sand retained on a #30 sieve is considered "coarse," and sand passing a #30 sieve is considered "fine.") The type and quantity of sand used, therefore, should be based on local needs, availability and price, and required application rate based on experience. While some sands may be more expensive, a lower required application rate may make such a sand the most economical choice for a particular airport. Tenant airlines should be consulted about the material used on the runways.

(1) Standard. *The following is the minimum acceptable standard for sand.* Friction improving materials applied to airport movement surfaces shall consist of washed granular mineral sand particles free of stones, clay, debris, slag, and chloride salts and other corrosive substances. The pH of the water solution containing the material shall be approximately neutral (pH 7). Material shall meet the following gradation using U.S.A. Standard Sieves conforming to ASTM E 11-81.

Sieve Designation	Percent by Weight Passing
8	100
80	0-2

(2) Recommendation. For optimum performance on both warmer and colder ice, a gradation that balances fine and coarse particles is desireable. For this reason, the inclusion of an additional sieve beyond that required by the FAA minimum standard is recommended, resulting in the following gradation:

Sieve Designation	Percent by Weight Passing
8	100
30	20-50
80	0-2

b. Application. Hard silica sand provides the greatest increase in traction and remains effective the longest when compared to softer materials because of its resistance to fracturing. However, it is also very abrasive and, therefore, more potentially damaging to aircraft engines. Limestone is softer and may be used where available if abrasion needs to be reduced. Tests have shown that application rates of 0.02-0.1 lb/ft^2 (0.1-0.5 kg/m^2) of sand will substantially increase the runway friction coefficient. The greater amount is required at temperatures approaching 32°F (0°C), the amount decreasing as the temperature drops. Fractured particles provide some advantage in traction enhancement but not enough to justify much of a difference in cost.

c. Chemically or Heat-treated Sand. Granular particles may be treated with approved chemicals or heated to make them adhere to ice, thereby preventing loss of material. At temperatures above 15°F (-9°C), a solution of airside urea may be used; below this temperature, glycol or potassium acetate will be more effective. Approximately 8-10 gallons (30-40 liters) of fluid chemical are required to coat one ton of sand. The most effective method of applying the chemical is to spray it on granules as they drop onto the spinner mechanism of a material spreader since wetting is more thorough than pouring the chemicals onto the stockpile or the hopper load. Below 0°F (-18°C), heated sand can be more effective because of more rapid adhesion of the granules to ice. If the decision is made to use heated sand, a coarser mixture should be used, as fine particles cool too rapidly on dispersal before hitting the ice. Sands heated to 80°F (27°C) or higher adhere well to ice.