U.S. Department of Transportation

Federal Aviation Administration

Advisory Circular

Subject: OFFPEAK CONSTRUCTION OF AIRPORT PAVEMENTS USING HOT-MIX ASPHALT

Date: 8/27/90 **AC No:** 150/5370-13

Initiated by: AAS-200 **Change:**

1. PURPOSE. This advisory circular (AC) provides guidance for the planning, coordination, management, design, testing, inspection, and execution of offpeak construction of airport pavements using hot mix asphalt paving materials. Although this circular focuses on hot mix asphalt pavement construction, much of the material contained herein applies equally to other types of pavement construction.

2. SELECTED READING MATERIAL. Appendix 1 lists publications which contain additional information on the subject matter.

3. APPLICATION. The guidelines contained herein are recommended by the Federal Aviation Administration for applications at airports where closure of a pavement would create significant adverse impacts.

4. METRIC UNITS. To promote an orderly transition to metric units, the text and figures include both English and metric dimensions. The metric conversions are based on operational significance and may not be exact equivalents. Until there is an official changeover to the metric system, the English dimensions should be used.

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Director, Office **of Airport Safety and Standards**

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SECTION 1. BACKGROUND

1. JUSTIFICATION. As airport traffic increases and additional airport capacity becomes scarce, airport construction activities can cause severe disruptions to airport operations and contribute to flight delays, cancellations, and missed connections which are inconvenient to passengers, result in loss of schedule integrity, and are costly to aircraft operators. In addition to allowing aircraft operators to maintain scheduled air service to the community, paving airside pavements during offpeak periods may be an effective way to maintain airport construction schedules without loss of revenues, inconvenience to passengers or excessive air traffic system delays.

2. PURPOSE. Techniques for the use of hot-mix asphalt for paving during offpeak periods have been applied successfully at airports throughout the United States for many years. This advisory circular describes the techniques that are available and the procedures that should be followed in the execution of offpeak construction projects in order to ensure quality construction and avoid excessive air traffic delays.

3. OFFPEAK TIMES. In most cases offpeak refers to the nighttime hours between 9:00 pm and 7:00 am. However, offpeak may also include periods of low activity during the day. Offpeak may also include particular days or periods during the week, for example, from 10:00 pm Friday until 2:00 pm Sunday. At some airports such as those serving resort areas, offpeak may refer to particular seasons of the year, for example, spring or fall. Generally speaking, a work period of at least 8 hours is recommended, however, shorter work periods may be acceptable at locations where 8 or more hours is difficult to attain.

SECTION 2. PROJECT PLANNING

4. POTENTIAL. The potential for offpeak paving should be identified early in the project planning stage and discussed in the predesign conference, see AC 150/5300-9. After the need for a particular airport improvement has been identified, it should be determined whether that project will necessitate the closing of any airside pavements. Pavements should be identified which, if closed, may cause disruption to the flow of air traffic at the facility.

5. FEASIBILITY. If the project will involve the closing of critical airside pavements, it should be determined whether it is feasible to accomplish the project during offpeak periods. The first step should be to identify the offpeak hours associated with the facility in question. For example, the offpeak period for a primary runway may be during the nighttime hours between 10:00 pm and 7:00 am. However, the offpeak period associated with a taxiway leading to an air cargo ramp may be during the daytime or normal airport operating hours.

6. STAGING. It is often possible to stage the project so that some elements may be accomplished during normal working hours, while other elements may be completed during offpeak periods. For example, a taxiway that crosses an active runway may be resurfaced during normal working hours if alternative taxi routes are available. However, the portions of the taxiway which abut or intersect the runway and would involve closing the runway to aircraft operations may be good candidates for completion during offpeak hours. In addition, work can be accomplished when wind or other weather conditions prevent aeronautical use of sections of airside pavements.

7. CONSIDERATIONS. The major factors which influence the decision to perform construction during offpeak hours should be identified and, if possible, quantified. These factors should include those listed below:

a. Cost of Offpeak Construction. In many cases the standard unit price items, e.g., cost/ton of hot-mix asphalt, will be no more expensive for offpeak construction than that for normal working hours. However, as described in paragraphs 18a and 20a, additional inspectors and standby equipment may be required, thus increasing the project cost. Nighttime construction will require lighting units and night shift pay differentials which will also increase the project cost.

In addition, the availability of a nighttime testing lab facility and personnel may increase costs.

b. Cost of Aircraft Delays. The cost of delayed or canceled flights can be very expensive and, therefore, may be the most important factor in determining whether to accomplish the construction during offpeak periods. This is particularly true of paving projects requiring the closure of a runway, taxiway, or aircraft parking area. In such instances, the use of offpeak construction should be considered. Delayed flights, particularly arrivals, incur additional costs for operating the aircraft for the period of the delay. When the cost-per-minute of operating the aircraft is multiplied by the number of minutes the aircraft is delayed due to congestion caused by construction activities, and that value is multiplied by the number of aircraft so delayed, the magnitude of the delay cost is readily apparent.

Delay Cost = [(Cost/Minute)x(Minutes Delayed)] x Number of Aircraft Delayed

c. Quality of Construction. No additional testing is required for offpcak construction projects. However, acceptance testing should be performed at the completion of each work period and prior to opening to operations, and the results should be reviewed before work begins again. This will usually require additional personnel to ensure that the tests are performed correctly and on time and to ensure that the construction is of acceptable quality. More detailed construction monitoring is recommended, particularly for construction performed during the hours of darkness. In some instances more detailed monitoring, rapid acceptance testing, and the need to open the pavement for traffic at early ages has yielded higher quality construction than non-offpcak construction projects.

d. Disruption to Specialized Operators. Construction during offpeak hours can be accomplished without disrupting normal airport operations for most aircraft operators. However, some specialized carriers operate primarily outside the normal operating hours for the airport. For example, all-cargo aircraft usually operate at night or during the early morning when other airport operations are typically at a very low level. While an all-cargo carrier's operation may be a very small portion of the airport's total operation, that airport could be a major revenue-generating point for that particular carrier. The nature and extent of these operations will vary from airport to airport, as will the procedures to accomplish the construction without crippling the services of a specialized operator. In these cases it is particularly important to discuss the proposed construction with the aircraft operators well in advance so that mutually agreeable strategies, procedures, and financial arrangements can be developed.

8. COORDINATION. A coordination framework should be prepared which includes planning, design, and construction phases. This framework should specify who will be kept informed, what factors or events will be important to each, and when or at what points in the process they will be informed or contacted. Specific coordination procedures and organizations to be included are detailed in paragraph 10.

9. COST ESTIMATES. Cost estimates should be developed in sufficient detail to give an accurate indication of the finances necessary to accomplish the project. Estimates should specify all special pay items in order to maintain flexibility in project scheduling and to avoid unnecessarily inflated prices.

SECTION 3. COORDINATION

10. BACKGROUND. Offpeak construction projects involving pavements within aircraft operational areas are highly visible and have the potential to cause aircraft delays. Therefore, close coordination with all elements of the airport is essential throughout the planning, design, and construction phases. Figure 1 shows the organizations which should participate in the coordination of offpeak construction projects. As soon as an airfield paving project has been identified by the airport authority, the authority should meet with airport users and the FAA to discuss the manner in which the project will be implemented. Personnel representing the groups and organizations identified below should attend all planning meetings.

a. Airport Authority. The airport authority should be represented by the project manager as well as representatives of the planning, engineering, operations, and maintenance sections. If the authority has decided to retain the services of a construction management firm to oversee the project, the construction manager should also attend all meetings related to the project.

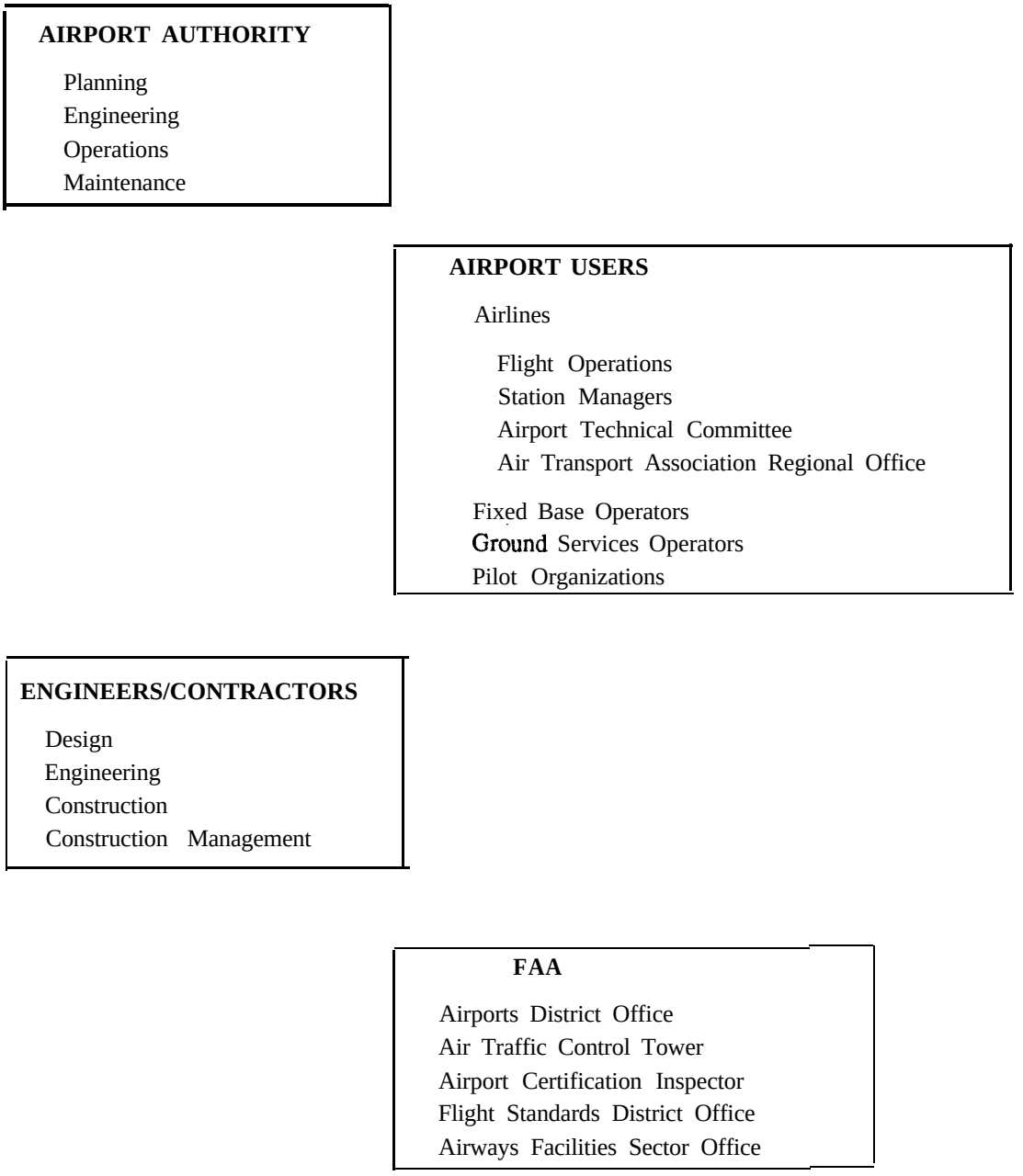

Figure 1. Coordination – Participating Organizations

b. Airport Users. Airport users who operate in the areas affected by the project, either regularly or on an occasional basis, should actively participate in the project coordination process. Airlines should be represented by the airport technical committee, the Air Transport Association Regional Office, and the station managers. Fixed-base operators and other users of airside facilities such as fuel suppliers, flight catering services, and pilot organizations should also be represented.

c. FAA. The FAA should be involved in the coordination process through representatives of the local air traffic control tower, the airports district office, the flight standards district office, and the airway facilities division. The airport authority should also maintain close coordination with the FAA regional airport certification inspector through the airports district office.

11. INITIAL COORDINATION. The initial coordination meeting in the project planning phase should identify the coordination process for the entire project and set forth the ground rules under which the project will be accomplished. The meeting agenda should include the following items:

a. Construction Work Periods. Working hours and daily or weekly work periods should be identified as soon as possible in the planning process. Because time is a critical factor in offpeak construction, the contractor should be given as much time as possible for paving during each work period. A minimum of 8–1/2 hours is recommended. The work should be scheduled during a time period that will displace the least number of scheduled flights. A specific work period should be selected in cooperation with airlines and other representatives as soon as possible in the planning phase. Work periods should be identified and agreed upon early enough to allow airlines to adjust their flight schedules as required for the project. Runways and other airside pavements crucial to maintaining aircraft operations should be opened and closed at the agreed upon times without exception because airline flight schedules and the contractor's work schedules are predicated upon the availability of the runway at the designated times.

b. Operational Criteria. Mutually agreeable operational criteria for each critical phase or sub-phase should be developed for those factors and procedures which will be in use during the construction process. These items include, but are not necessarily limited to, those listed below:

(1) Issuance of Notices to Airmen (NOTAMS) and advisories.

(2) Aircraft operations, performance, and taxi routes.

(3) Navigation aids and visual landing aids.

(4) Truck haul routes and security requirements.

(5) Testing and inspection.

(6) Requirements for reopening areas for operational use.

(7) Designation of equipment staging area(s).

(8) Placement and removal of construction barricades.

(9) Secure storage of construction materials.

(10) Temporary airfield pavement marking, signing, and lighting.

(11) Days of the week upon which construction will take place.

(12) Proper vehicle identification and maneuvering (e.g. lights, flags, when radio equipped escorts are needed, etc.)

(13) Contingency plans for construction interruptions due to equipment breakdowns or weather.

c. Communication. Lines of communication should be established to maintain coordination and control through all phases of the project. Proper communication procedures will ensure that the necessary organizations and individuals will be kept informed of developments and will provide necessary input at critical points throughout the project. It is particularly important to establish methods and lines of communication for determining whether the runway is available to start work at the beginning of each work period and whether the runway is in acceptable condition prior to its opening for aircraft operations.

d. Special Considerations. Particular aspects of construction which will require special coordination or communication procedures should be identified. These items are discussed in sections 5 and 7 and include pavement transitions and runway closings.

SECTION 4. PROJECT MANAGEMENT

12. PROJECT MANAGER. The airport authority should select a qualified project manager to oversee all phases of the project, from planning through final inspection of the completed work. The individual selected should be experienced in the design and management of airfield pavement construction projects. The individual should also be intimately familiar with the operation of the airport. The project manager should be the final authority on all technical aspects of the project and should be responsible for coordination with airport operations. All contact with the airport authority, the weather service, or the FAA should be made through the project manager to ensure continuity and proper coordination with all elements of the operation of the airport. Any changes resulting from discussions with the airport authority, the weather service, or the FAA should be processed through the project manager to maintain continuity and coordination. The project manager's specific responsibilities are detailed below:

a. Planning and Design.

(1) Establish clear and concise lines of communication.

(2) Participate as a member of the selection team for the design engineer, if allowed by local policy.

(3) Monitor and review the project design to ensure that it meets budget constraints.

(4) Coordinate the design review with other elements of the airport authority, the airlines, the Air Transport Association Regional Office, and the FAA, including designated working hours, aircraft and operational requirements, technical reviews, and establishment of coordination procedures.

(5) Chair all meetings pertaining to the project.

b. Construction.

(1) Brief construction personnel on basic ATC procedures for the facility, proper communications with ATC, hazards of jet blast, familiarization with the airport layout, and avoidance of runway incursions.

(2) Manage the overall construction effort with an adequate number of trained inspectors to observe and document the work done by the contractor.

(3) Contact the weather service, airport operations, the air traffic control tower, local Airway Facilities sector office, and field maintenance personnel prior to starting construction, and confer with the contractor's project superintendent to verify that weather and air traffic conditions will allow work to proceed as scheduled.

(4) Confer with the contractor's project superintendent daily and agree on how much work should be attempted during the next work period to ensure that the runway or other paved areas will be opened to aircraft operations at the specified time at the end of the work period. This is especially important in situations where pavement repair and replacement are to take place.

(5) Participate in post-construction inspections of the work areas prior to opening for aircraft operations. Figure 2 shows a sample checklist to aid the project manager in participating in the inspection.

13. CONSTRUCTION MANAGER. Some airport authorities may choose to retain the services of a construction management firm to oversee the accomplishment of the construction project. If the construction management firm is to assume the full responsibility for the management of the project, the firm's project manager should be responsible for those items detailed in paragraphs 12a and 12b and be intimately familiar with the operating procedures of the airport. A division of responsibilities between the project managers for the construction management firm and the airport authority should be clearcut and understood by all parties throughout all phases of the project. A division of responsibility between project managers is not recommended in the construction phase. In any case, the construction manager should be involved in the project as soon as possible before the construction phase begins.

14. RESIDENT ENGINEER. A resident engineer, preferably a civil engineer, should be designated to assist the project manager during the construction phases of the project. The resident engineer may be a member of the airport authority, the design engineering firm, or the construction management firm, but in any case should report directly to the project manager. In order to be of maximum benefit to the project, the resident engineer should be responsible for the items listed below:

a. Prepare documentation for all quantities constructed during each work period.

b. Ensure that all tests are performed and results obtained from each work period.

ITEM	COMPLETED	REMARKS
1. Have all paving and rolling operations planned for the work period been completed?		
2. Are all transition ramps properly constructed and safe for aircraft operations?		
3. Have all quality assurance tests been properly conducted?		
4. Have all temporary markings been applied to all appropriate newly paved surfaces?		
5. Has all construction equipment, including lighting units, been removed to a remote storage location?		
6. Have all construction materials which are to remain on site been properly secured from dislodgement by wind or jet blast?		
7. Have all excavations been properly backfilled or appropriately marked for safe aircraft operations?		
8. Has all construction debris been cleaned up and removed from the construction site to a safe disposal location?		
9. Have all obstruction lights and barricades been removed from areas which are to be opened to aircraft operations?		
10. Has all lighting and/or temporary lighting been returned to service and tested?		
11. Have all visual aids been returned to service and tested?		
12. Have proper NOTAM's been issued for the runway/taxiway/apron operating conditions?		
13. Have all pavement "lips" greater than 3 inches in height been removed?		

Figure 2. Inspection Checklist

c. Schedule the inspections which must be performed during each work period.

d. Observe compliance with contract specifications and report any discrepancies to the project manager and the contractor.

e. Maintain a construction diary.

SECTION 5. DESIGN CONSIDERATIONS

15. PLANS AND SPECIFICATIONS. Plans and specifications for pavement repair and overlay during offpeak periods should be presented in sufficient detail to allow ready and accurate determination of the limits of pavement repair, finish grades (in accordance with standards in AC 150/5300–13), and depths of overlay. They should be used by the contractor and the inspectors for each work period and should, therefore, be clear and precise in every detail.

16. PAVEMENT SURVEY. Accurate surveys and proper grade control are critical to the successful accomplishment of a quality offpeak paving job, particularly if the paving is done during the hours of darkness. The following factors should be used as a guide to surveying for offpeak paving projects:

a. Cross-Sectioning. A complete system of benchmarks should be set on the side of the runway or taxiway to permit a ready reference during cross-sectioning operations. The benchmarks should be set at approximately 400-foot (120 m) intervals. Pavement cross-sectioning should be performed on 25–foot (7.5 m) intervals longitudinally and, because many pavers can only pave a 12–1/2–foot wide strip, 12–1/2–foot (3.75 m) intervals transversely.

b. Elevations. Extreme care should be exercised in level operations because the elevations will be used in determining the depth of the asphalt overlay. The design engineer should not use grade information from previous as-built drawings or surveys that were run during the winter months, because elevations can vary from season to season. This is particularly critical for single-lift asphalt overlays.

c. Grades. After the finish grades and transverse slopes of the pavement are determined, a tabulation of grades should be included in the plans for the contractors to use in preparing bids for the project, and eventually for the establishment of the erected stringline during the paving operation. The tabulation of grades should include a column showing the existing runway elevation, a column showing finish overlay grade, and a column showing depth of overlay. Grades should be shown longitudinally every 25 feet (7.5 m) and transversely every 12–1/2 feet (3.75 m). This item is considered essential in the preparation of plans which are sufficiently accurate for contracting for offpeak construction services.

17. SPECIAL DETAILS. Details pertaining to the following items should be included in the plans for the project.

a. Transition Ramps. At the end of each work period, it will be necessary to provide a transition from the completed course of an overlay to the existing pavement. The construction of this ramp is one of the most important tasks in each work period. Details on transition ramp construction techniques are presented in paragraph 36.

b. In-Pavement Lighting. If the paving project involves in-pavement lighting fixtures, the plans should depict the removal and reinstallation of the fixtures in detail. Construction techniques for in–pavement lighting are discussed in paragraph 37.

c. Temporary Pavement Markings. During the course of offpeak construction projects, temporary pavement markings are often required to allow for aircraft operations between work periods. During the design phase of the project, the designer should coordinate with the users and the FAA Airports project manager to determine minimum temporary markings. The FAA Airports project manager should, in turn, coordinate with the appropriate FAA Flight Standards Office. Further details on temporary markings are presented in paragraph 38.

d. Skid Resistance. If a special skid resistant surface or grooving is required, the guidance published in AC 150/5320–12, Measurement, Construction, and Maintenance of Skid Resistant Airport Pavement Surfaces, should be used to ensure adequate braking action.

18. SPECIFICATIONS. In addition to the typical specifications required for any pavement project, the following items should be included in the specifications for offpeak paving projects:

a. Standby Equipment.

(1) Construction Equipment. The contract should require the contractor to maintain standby

equipment at the construction site for all construction work performed during offpeak periods. The specific type and amount of equipment should be that which is necessary to complete the work planned for that work period should any piece of equipment break down. This includes equipment such as paving machines, milling machines, rollers, trenching machines, core drills, backhoes, graders, and tack trucks. In addition, standby cleanup equipment such as sweepers, brooms, etc., should be available to ensure timely reopening of the pavement at the end of the work period. Standby equipment may be used for construction to improve productivity, but the contractor should be required to properly repair or replace broken equipment before being allowed to proceed with the next work period. Standby equipment should be listed on the daily equipment log which is usually required by the contract's specifications. On small projects in remote locations, providing standby equipment may be cost prohibitive. In such instances the contractor should be required to furnish proof that the equipment has been well maintained and is in good working condition. In addition, if at all possible, the contractor should be required to prearrange for alternate equivalent equipment to permit completion of the project in a timely fashion in the event of a major breakdown.

(2) Asphalt Plant. Provision should also be made for a stand-by asphalt production plant or for sufficient hot storage bins to provide enough material to reopen the construction area to aircraft operations should the primary plant break down.

b. Obstruction Lighting and Barricades. Drawings and specifications applicable to the work should show the details of the obstruction lighting and barricades to be used. The types of obstruction lights and barricades to be used and the procedures for marking construction areas should be consistent with AC 150/5370–2, Operational Safety on Airports During Construction. Some airports have used lighted X's to indicate closure of runways at night.

c. Construction Lighting.

(1) Construction Area. Lighting equipment should be sufficient to adequately illuminate the work area in order to ensure a quality asphalt overlay if the construction is to be performed during nighttime hours. A minimum of 10 foot-candles of illumination should be provided in the work area, using maneuverable light plants with 1,000–watt metal halide flood lights, mounted as high as aircraft, airspace, and practicality will allow. The lights should be positioned to provide the most natural color illumination and contrast with a minimum of shadows. At least one consultant has found spacing the lighting units at approximately 100 feet (30 m) on both sides of the runway or taxiway will provide adequate lighting. However, the spacing for each individual project will have to be determined by trial. Lighting the pavement from both sides is considered preferable as lighting from only one side can result in objectionable shadows. Any elevated lighting equipment to be left at the construction site when the pavement is open to aircraft operations must be lowered or positioned so as not to violate Federal Aviation Regulation, Part 77, criteria or the criteria contained in AC 150/5300–13, unless location and height of the lighting have been approved by an FAA airspace study. A separate bid item for the number of lighting unit days should be included in the specifications.

(2) Vehicular Lighting. All paving machines, rollers, distributor trucks, and other equipment, except haul trucks, should be equipped with artificial illumination to safely illuminate the area immediately surrounding their work areas.

(3) Enforcement. The project manager should strictly enforce lighting requirements because sufficient light is necessary to observe properly the placement and compaction of material, and thus ensure the satisfactory construction of overlays. Pay items should be established in the contract to ensure that the contractor is willing and able to provide adequate temporary construction lighting on a per-unit basis.

d. Special Pay Items. Special pay items pertaining to lost time should be established in the contract specifications in order to maintain the maximum flexibility in the scheduling of work and to avoid unnecessarily inflated prices. By having these times defined as pay items, the contractor will not have to include compensation in other bid items to cover these delays. These items should include suspension time, standby time and down time, as described below.

(1) Suspension Time. Suspension time is the suspension of the entire work period, with advance notice of at least two hours prior to the scheduled start time.

(2) Standby Time. Standby time is the time when a contractor's forces are mobilized for work and waiting to start. This condition may last for a maximum of two hours after the scheduled start time.

(3) Down Time. Down time is the period between the end of the standby time and normal quitting time.

e. Liquidated Damages. It is imperative that the runway, taxiway, and other airside pavements crucial to maintaining aircraft operations and schedule integrity be opened on time following the completion of each work period. Scheduled airlines and the air traffic control system usually have aircraft enroute to coincide

with the opening. If the opening is delayed, diversions and cancellations costing thousands of dollars may be incurred. One way of calling the contractor's attention to the importance of opening on time is to include a liquidated damage clause in the contract. The liquidated damage assessed should reflect the revenue lost and additional expenses incurred by the airport sponsor and aircraft operators when the pavement is not usable. Liquidated damages for both daily and total project completion are often used. The method used to calculate the amount of liquidated damages should be shown in the design report or other appropriate documents. Limits to liquidated damage clauses may vary by political jurisdiction, but some sort of motivating pressure should be put on the contractor to open on time.

SECTION 6. TESTING AND INSPECTION

19. TESTING. Offpeak construction does not require any additional types of tests other than those required under normal construction procedures. The major difference between offpeak construction and normal construction is that, usually, not all acceptance testing can be performed prior to opening the area to aircraft. operations. For example, cores for the determination of hot-mix asphalt density should not be taken until the pavement has cooled to ambient temperature. Thus density cores for a given work period may have to be taken during the following work period. Nuclear density tests, while not allowed as acceptance tests for FAA funded projects, can be valuable as construction control tests to ensure specified density is being achieved. These procedures may require additional personnel to ensure that the tests are performed correctly and on time.

20. INSPECTION. High quality inspection performed in a timely manner contributes significantly to the success of any paving project. The number of inspectors required for any given paving project will depend on a number of factors (project size, complexity, production rates, etc.). The resident engineer should be responsible for overall inspection and reporting. Generally speaking, adequate inspection can be achieved with (in addition to the project manager and the resident engineer) an asphalt plant inspector, with one or two helpers, for each plant, and one paving inspector, with an adequate number of helpers, at the paving site. The number of helpers required depends on several factors, such as, number of paving machines, production rates, complexity of the project, etc. Areas requiring particular attention typically include: pavement repair inspection, hot-mix asphalt production and laydown, electrical inspection, and surveying.

a. Asphalt Plant Inspector(s). The asphalt plant inspector(s) should be primarily responsible for sampling and testing of the hot-mix asphalt, as produced, to assure the product is within specifications. The asphalt plant inspector(s) must maintain records and prepare reports as required by the specifications.

b. Paving Inspector(s). The paving inspector(s) should be primarily responsible for sampling, testing, and proper laydown of the hot-mix asphalt, as placed, to assure conformance with the specifications. The paving inspector(s) must maintain records and prepare reports as required by the specifications.

SECTION 7. OPERATIONAL SAFETY PROCEDURES

21. GENERAL. Offpeak construction should never derogate the safety or security of aircraft operations or construction operations. In order to provide for safety and security during offpeak construction, the topics in this section are emphasized.

22. SAFETY PLAN. A safety plan should be prepared to guide activities in the construction phase, and a contingency plan should be prepared to address cases of abnormal failures or unexpected disasters.

23. CONSTRUCTION ACTIVITIES.

a. NOTAM's. Notices to Airmen (NOTAMS) should be issued as early as possible advising users of any construction activity which will require the shutdown of airside pavements and/or navigational aids for more than 24 hours or in excess of 4 hours daily on consecutive days.

b. Safety Meetings. Regularly scheduled safety meetings should be held to discuss safety issues. Personnel should be reminded that nighttime offpeak construction offers some unique safety concerns, such as, the need to lock out electrical switches to prevent accidentally or prematurely energizing electrical sys-

terns, the need to wear reflective vests and hats to increase visibility, etc.

c. Truck Haul Routes. Truck haul routes should be located so as to avoid the use of airside airport pavements (unless there is no cost effective alternative), minimize hauling operations within aircraft operating areas, and to avoid truck traffic in close proximity to navigational aids. Truck haul routes should be clearly marked.

d. Obstruction Lighting and Barricades. The contractor should be required to have sufficient obstruction lighting and barricades (as indicated in the plans and specifications) to block off any intersecting runways and taxiways and to delineate haul routes to the work site.

e. Staging Areas. Equipment staging area(s) should be located in a remote area of the airport so as not to interfere with aircraft operations or navigational aids. The staging area(s) should be fenced and secured.

f. Storage of Construction Materials. Storage of construction materials should be located within or near the equipment staging area(s), if practical. However, if this is not practical, stored material should be covered and located to preclude wind, jet blast, prop wash and/or rain from blowing or washing materials into aircraft operating areas. Stored materials should not encroach on aircraft operating areas or otherwise violate Part 77 criteria or the airport hazard criteria contained in AC 150/5300–13 unless the location and heights of the stored material have been approved by an FAA airspace study.

24. POST-CONSTRUCTION INSPECTION. The project manager (or his/her designated representative) should conduct an inspection of the work area with airport operations personnel and the project superintendent before opening to aircraft operations. The project manager should ensure that all construction materials have been secured, all pavement surfaces have been swept clean, all transition ramps have been properly constructed and that surfaces have been appropriately marked for aircraft to operate safely [see 12b(5) and figure 21. Only if all items on the list meet with the airport manager's (or his/her designated representative) approval should the air traffic control tower be notified to open the area to aircraft operations.

SECTION 8. CONSTRUCTION PRACTICES

25. PRECONSTRUCTION CONFERENCE. The requirements and procedures to be followed during the offpeak construction process should be set forth in detail and discussed with all parties involved in or affected by the construction at a preconstruction conference. The format, agenda and timing of preconstruction conferences are described in AC 150/5300–9, Predesign, Prebid, and Preconstruction Conferences for Airport Grant Projects. The overall purpose of these conferences is to ensure that all parties understand the construction procedures, as well as potential problems and possible solutions. The conference should be convened and conducted by the project manager as soon as practicable after the construction contract has been awarded and before the notice to proceed has been issued. The agenda should include such items as operational safety, testing, quality control, security, labor requirements and environmental factors. The items discussed below are particularly important and should be emphasized at preconstruction conferences for offpeak paving projects.

26. PROJECT SUBMITTALS. Prior to beginning work on the project, the contractor should be required to file the following items with the project manager for approval:

a. Progress Schedule. A detailed progress schedule showing the proposed schedule of work in the areas to be constructed each period.

b. Equipment and Personnel. A complete list of equipment and personnel to be used, including standby equipment, as required by the specifications.

c. Asphalt Plant. Evidence that the hot-mix asphalt plant or plants meet the requirements of the specifications.

d. Quantity. Evidence that the amount of hot–mix asphalt that the contractor proposes to place each work period can be supplied to the construction site in the time required.

e. Project Superintendent. The experience record of the project superintendent that the contractor proposes to place in charge of the project. The experience record should list the superintendent's experience on hot-mix asphalt overlays, including nighttime or offpeak construction.

f. Other Requirements. Other requirements identified in the contract documents.

27. TESTING AND INSPECTION. It should be emphasized to the contractor that acceptance testing

will take place each work period, and that work will not be allowed to proceed in the next work period unless all tests have been recorded and approved. The daily inspection reports should be made by the inspection team and testing laboratory. These reports should include the location and description of the work performed, the results of the inspections, and any comments on the specifications. Items considered to be critical are Marshall test results, in-place density, pavement smoothness, and finished grade elevation.

28. CONSTRUCTION PROGRESS MEETINGS.

a. Daily. A daily progress meeting should be held between the project manager and the contractor's superintendent to discuss the work requirements for the next work period and to review the test results from the previous work period.

b. Weekly. A weekly progress meeting should be held with representatives of all elements of the airport and the airport user community. The agenda for this meeting should include the work schedule for the coming week, any operational problems which have been encountered or may be expected, and any other operational aspects of the project as necessary. Also, the project manager and the contractor's superintendent should agree on the quantities of material placed to date.

29. WEATHER.

a. Permissible Weather Conditions. The project manager, the contractor, the local airway facilities sector office and field maintenance personnel, airport operations, and the air traffic control tower should establish procedures for determining the weather conditions under which work will not begin as scheduled. It is particularly important to establish an adequate lead time for notifying the contractor if work is to be suspended for the period due to inclement weather.

b. Wind Conditions. Weather conditions which may affect construction include wind conditions, as well as precipitation and temperature. For example, a forecast of winds from a particular direction may preclude the use of a crosswind runway or other alternative. Offpeak construction during Instrument Flight Rule (IFR) conditions is not recommended because construction vehicles and markings may be difficult to see from the control tower as well as from an aircraft cockpit.

30. COMMUNICATION. It should be emphasized to the contractor that all communication with the air traffic control tower or any other element of the airport should be made through the project manager or his designated representative. This is very important because the number of people having contact with the various elements of the airport should be limited in order to prevent possible misunderstandings or conflicting information. The project manager should have direct contact with airport operations at all times. All requests for closing and/or opening the construction area to aircraft operations should be made only by the project manager.

a. Radio Frequencies. On large paving projects, project managers, contractors, airport management, and security personnel must coordinate to ensure that the radio frequencies used for contact and control of day-today construction operations by radio do not conflict with existing frequencies used for air traffic, security, and emergency purposes.

31. SECURITY DURING CONSTRUCTION. In addition to the normal security requirements and operational procedures of the airport, all personnel and suppliers should be given a drawing showing haul routes, restricted areas, and any other details pertinent to the construction operation. The drawing should contain a notice which states that any unauthorized construction personnel found in restricted areas of the airport are subject to arrest for a punishable Federal offense and will be promptly and permanently removed from the job. At some airports, all vehicles are escorted to and from airside locations for safety and security reasons.

32. ASSEMBLY OF EQUIPMENT. Prior to beginning work, the contractor should make certain that all equipment, including standby equipment, is in good operating condition and ready to begin work. After the project manager has checked with the weather service and airport operations, has conferred with the contractor's superintendent, and has agreed that work may proceed as scheduled, the contractor should assemble all personnel and equipment in the designated staging area(s). Equipment and personnel should be organized so that they can proceed to the work area as soon as authorization is given. Also, all hot-mix plants should be operating and ready to produce the paving material when notified.

SECTION 9. CONSTRUCTION TECHNIQUES

33. TEST SECTIONS. Prior to beginning any pavement work on the project, a test strip should be placed to provide a trial run for all aspects of the paving operation as well as communications and acceptance testing. The test strip should be at least 150 feet (45 m) long with a nominal thickness of two inches (50 mm) and should include transition ramps.

34. LIMITS OF OVERLAY OPERATIONS. When placing overlay pavement during offpeak periods, it is essential that the full width of the overlay be placed during each work period. Each work period should be as long as possible in order to limit the number of transverse joints for the entire project. When overlaying runways, the overlay operation should begin at one end of the runway and proceed in the primary direction of aircraft operations.

35. PLACEMENT OF HOT-MIX ASPHALT.

a. Spreaders. The preferred method of placing hot-mix asphalt is to use 25–foot (7.5 m) spreaders working in echelon (Figure 3). Paving spreaders of lesser widths may be used, however, wider spreaders will maximize the use of available time for paving. Spreaders working in echelon help to maintain a hot joint between adjacent paving lanes. The spreaders should start on the centerline and work their way outward in the sequence shown in Figure 4. It is important to overlay as much of the center portion of the runway as possible in the event that equipment failure or weather problems force the suspension of work. During the paving operation, the contractor should hold raking to a minimum and should be prohibited from casting raked material on the mat.

b. Grade Control. If the runway is considered sufficiently smooth, the contractor may be permitted to place hot-mix asphalt using a traveling stringline. A slope control device should not be used under any circumstances because the cumulative error in multiple–lane paving may violate the grade control criteria. If the runway is not considered sufficiently smooth for the use of a traveling stringline, an erected stringline (Figure 5) or laser control should be required. In this case erected stringlines or laser controls should be used on both sides of the paver for the initial pass. Subsequent passes may be controlled by a joint matcher on the newly overlaid side of the paver and an erected stringline or laser control on the opposite side.

c. Opening to Traffic. The time required between the end of hot-mix asphalt placing and opening the pavement to aircraft traffic will vary depending on several factors. Asphalt placing can continue up to the time which will allow the newly placed surface to cool sufficiently to avoid rutting and the construction team, inspectors, and survey crew can complete their assigned tasks. These tasks include acceptance testing, pavement striping, cleaning up the construction area, and securing all materials which are to be left on the construction site. The potential for aircraft traffic to cause rutting of the newly placed mat is a function of the stability of the mix, which varies with temperature. As a general rule, aircraft traffic should not be allowed on the newly placed mat until it cools to 150” F (65.5” C) or lower.

36. TRANSITION RAMPS.

a. Transverse Ramps. At the end of each work period a ramp should be constructed to provide a transition from the completed course of the overlay to the existing pavement. The construction of this transition is one of the most important tasks in the work period because a ramp that is too steep could cause structural damage to an operating aircraft or a malfunction of the aircraft’s instruments. A ramp that is too long may result in raveling of the pavement and damage to aircraft engines if any of the loosened material is ingested.

b. Multiple-lift Overlays. In multiple-lift overlays the transition ramps should not be constructed any closer than 500 feet (150 m) to one another. The length of all longitudinal ramp slopes should be 15 feet (3 m) for each inch (25 mm) of depth of compacted overlay. Every effort should be made to pave the full width of the runway or taxiway during each work period. However, in cases where it is necessary to construct a transverse transition ramp, the ramp slope should be 5 feet (1.5 m) in the transverse direction for each inch (25 mm) of compacted overlay. Aircraft operations are sometimes allowed on very thin partial width overlays, such as porous friction course surfaces without transverse ramps.

c. Construction Methods. Transition ramps may be constructed in one of two ways, depending upon the type of equipment that is available:

(1) With Cold-planing Equipment. The most effective method of ramp construction is to use a cold-planing machine (Figure 6) to heel cut the pavement at the beginning and at the end of each work–period overlay. This method is shown in Figure 7. When placing the final surface course of an overlay, the heel cut at the start of the second overlay period should be equal to the thickness of the overlay to ensure a smooth joint.

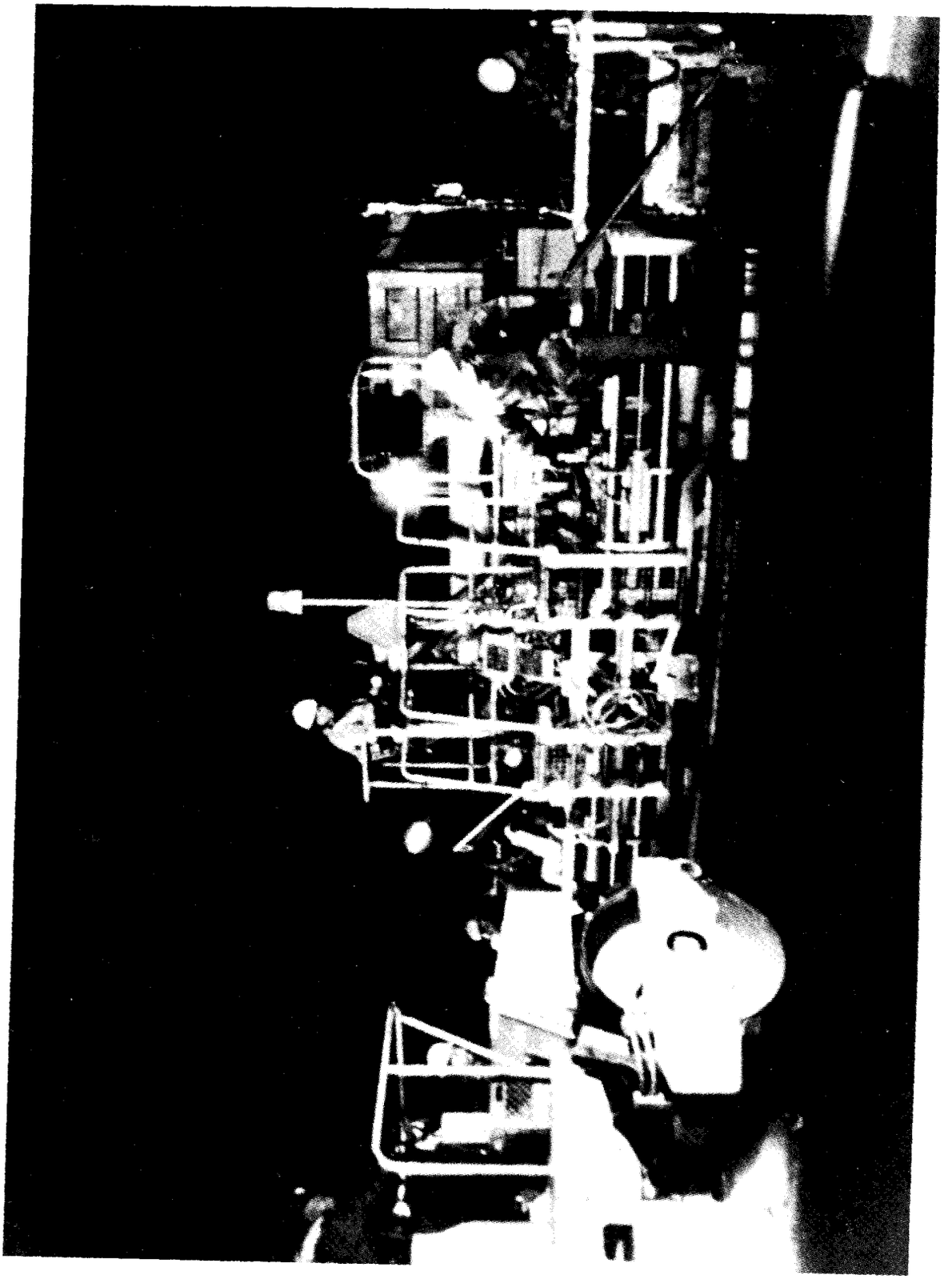

Figure 3. **Pavement Spreader in Nighttime Construction**

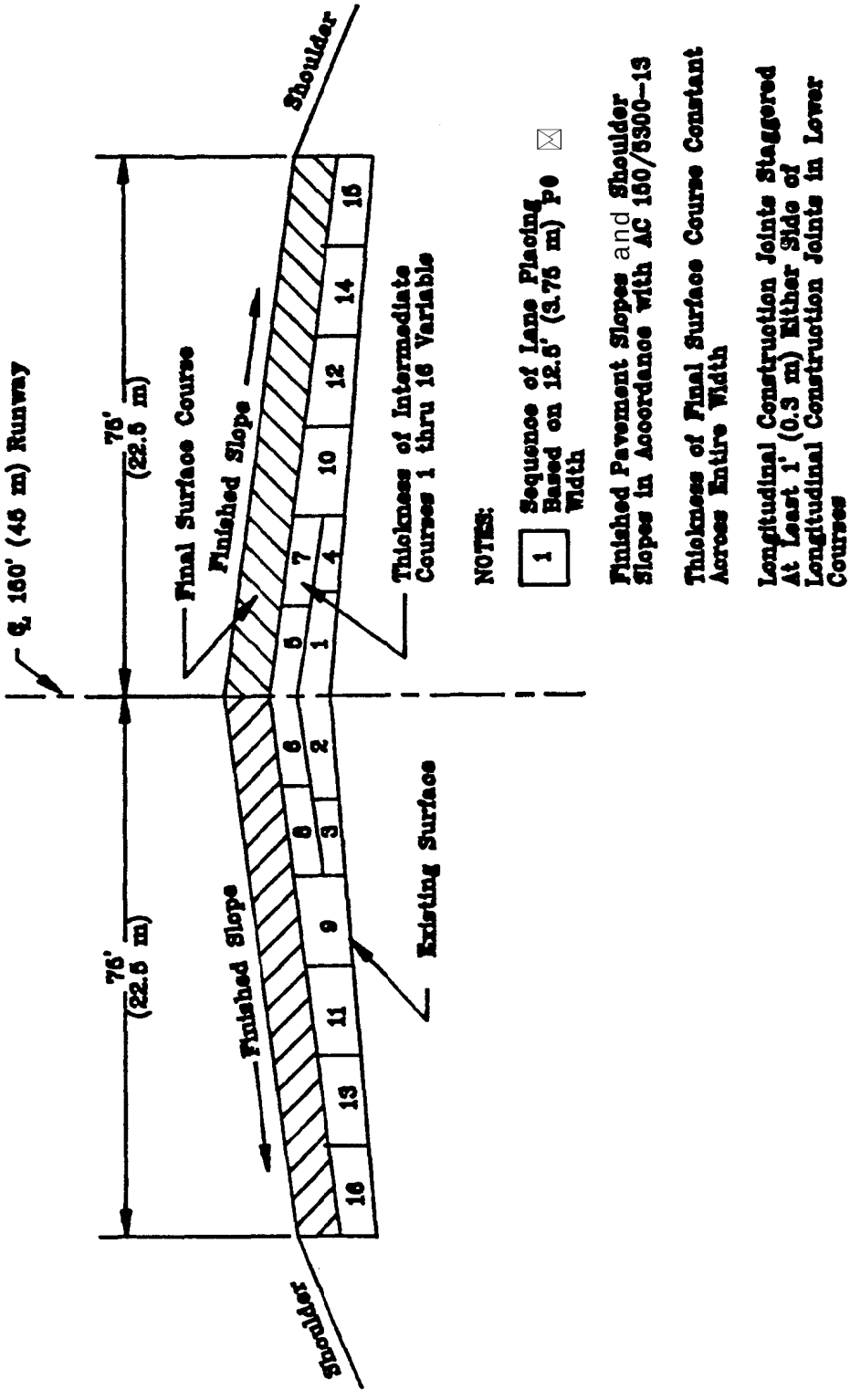

Figure 4. Typical Overlay Section – 150-Ft. Runway

Figure 5. Setting an Erected Stringline

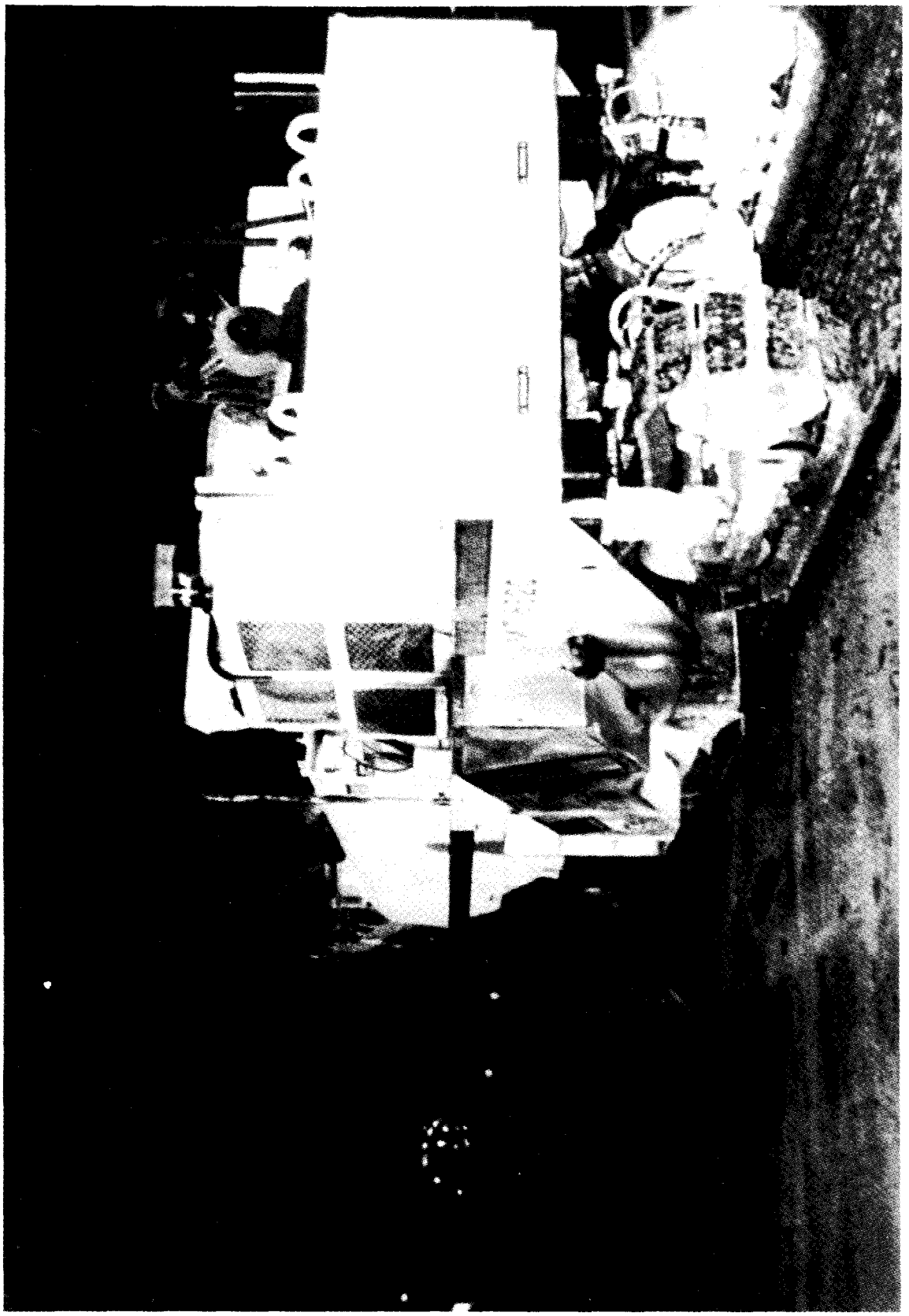

Figure 6. A Cold Planer Removing Transition Ramp

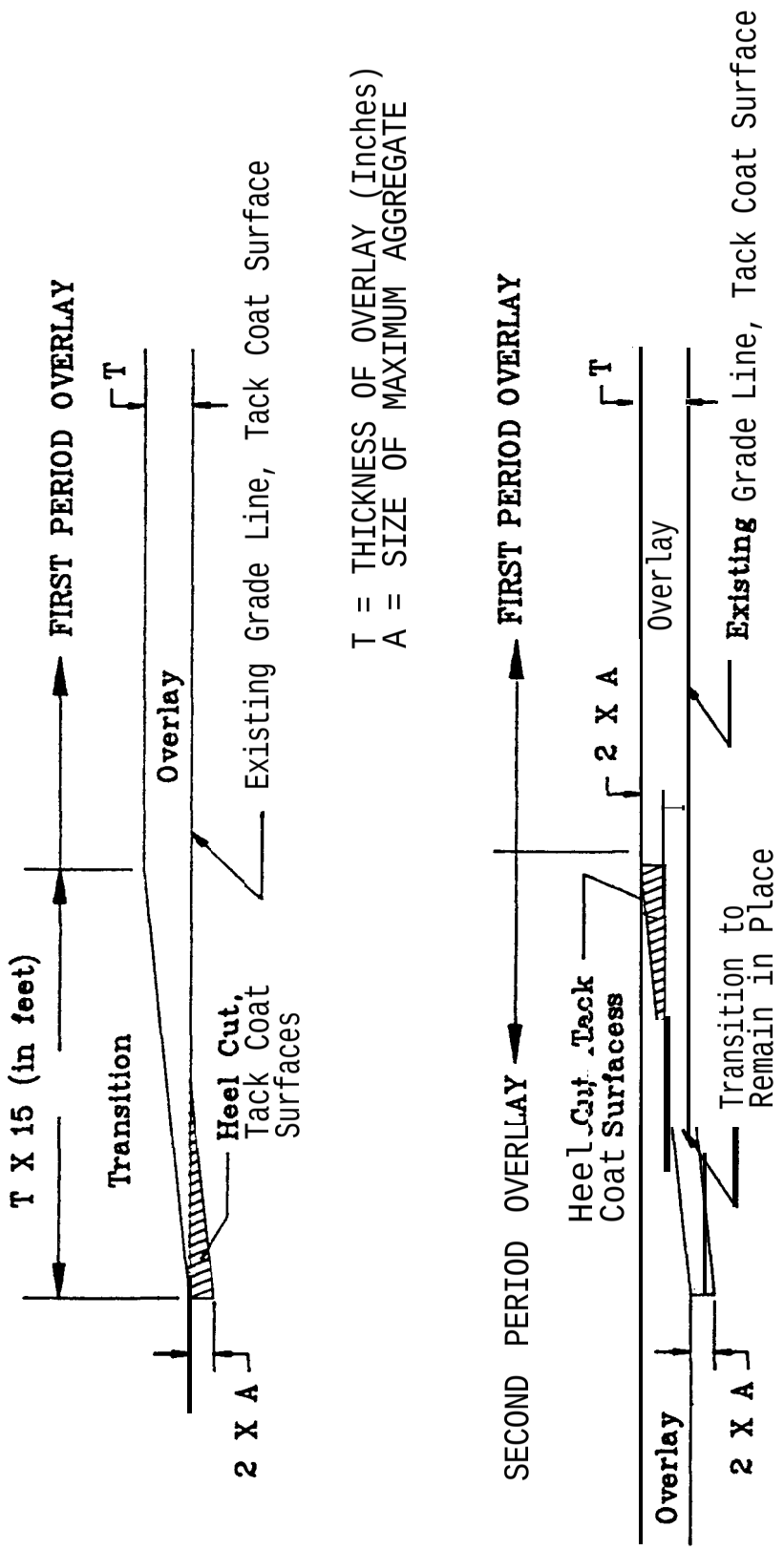

Figure 7. Transition Ramp Construction With Cold-Planing Equipment

(2) Without Cold-planing Equipment. If cold-planing equipment is not available, a transition ramp should be constructed as shown in Figure 8. A bond-breaking layer should not be placed under the ramp for easy removal in the next work period as the ramp is likely to come loose causing subsequent break-up of the pavement under aircraft operations. Under no circumstances should the transition be left in place and a slip joint constructed. This method can result in a rough joint and/or extensive raveling under operational use.

d. Other Requirements. Other requirements identified in the contract documents.

37. IN-PAVEMENT LIGHTING. Details depicting the removal and reinstallation of in-pavement lighting should be included on the plans where applicable. The details should depict: removal of the light fixture and extension ring, placement of a target plate over the light base, filling the hole with hot-mix asphalt until overlay operations are complete, accurate survey location information, core drilling with a small (3– to 4-inch core) to locate the center of the target plate, and final coring with an appropriate sized core machine (Figure 9). The light and new extension ring can then be installed to the proper elevation. When measuring and installing new extension rings after the overlay is in place, care should be taken to match each extension ring with the specific light fixture for which it was measured. Also, the compound used to seal around the light bases and to fill slots for conduits should be a type manufactured for that particular purpose and should be compatible with the hot-mix asphalt. With thin overlays, extension rings are sometimes added before overlaying.

38. PAVEMENT MARKING. Several different types of paint have been successfully used for temporary markings. Solutions of dilute water emulsion based paint (Federal Specification TT–P–1952) have been used, however, drying times for these paints are sometimes unacceptably long during cold or humid conditions. During cold or humid weather conditions, light applications of thinned oil based paint (Federal Specification TT-P-85) may be effective. Consultants have also reported that temporary markings using rubber based paints (Federal Specification TT-P-115) have performed adequately. Temporary markings, lightly applied and made with dilute paint, normally do not have to be removed prior to placing the next overlay course.

a. Pavement Curing. If possible, it is recommended that temporary markings on the final surface be left in place until final curing of the surface is achieved, usually 30 days. Allowing the final surface to cure will usually result in better appearance and adherence of the permanent markings.

b. Marking Tape. Pavement marking tape is not recommended for the temporary marking of paved surfaces. If the temperature of the mat is too high when the tape is put down, the tape may melt into the pavement and will be very difficult and time-consuming to remove prior to the application of the next course of the overlay. Also, if the tape does not adhere properly, it can be blown loose by jet blast and possibly be ingested by an aircraft engine.

39. WORK AREA CLEANUP. Sufficient time should be provided at the end of each work period to allow for cleanup and inspection of the work area before it is opened to aircraft operations. All construction debris should be totally removed from the work area. Suction/brush type sweepers should be in operation during most of the work period to minimize final work area cleanup time. Rotary broom and blower type sweepers have been found effective in cleaning milled pavement surfaces. Where additional courses of pavement raise the surface of the pavement to the point where the runway shoulders deviate from the standards set forth in Federal Aviation Regulation, Part 139, and AC 150/5300–13, the contractor should restore the shoulders to the proper grade before the pavement is reopened to air traffic. All construction materials that must be left onsite should be secured so that they cannot be dislodged by wind or jet blast. The contractor's superintendent should accompany the project manager and a representative from airport operations on an inspection of the work area before it is opened to traffic, The contractor should have the necessary manpower and equipment standing by to perform any additional cleanup that may be identified during this inspection. The work area should be periodically monitored by airport operations personnel while the area is operational between construction periods to ensure safety and security. Airports possessing adequate cleaning equipment may find it less costly to perform cleanup operations themselves rather than paying for contractor cleanup. However, precise definitions of responsibilities and close coordination between the contractor and the airport will be required for this to work smoothly.

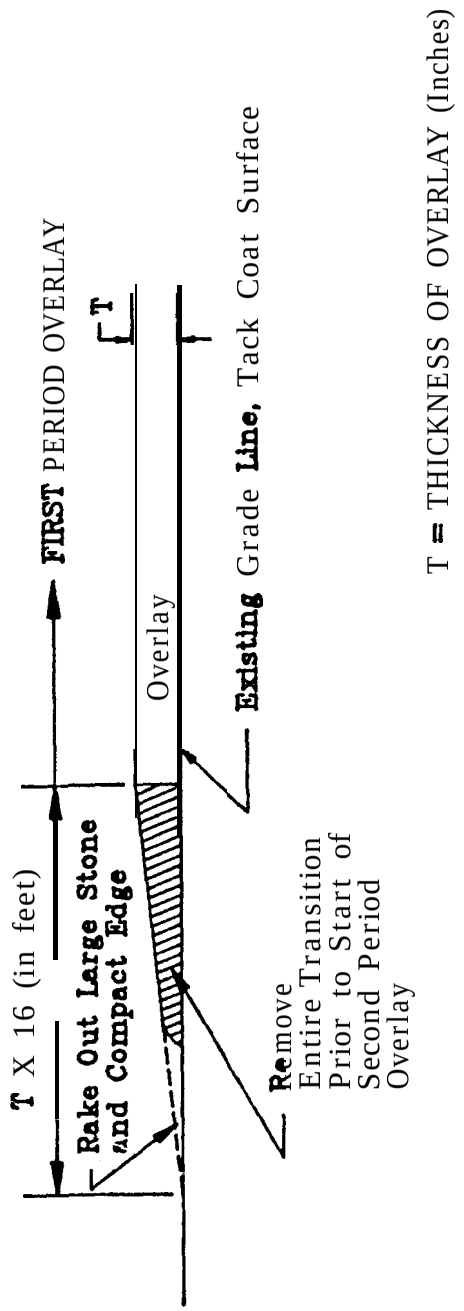

Figure 8. Transition Ramp Construction Without Cold-Planing Equipment

Figure 9. Core Drilling Above In-pavement Light Base (Note Drilling Rig is Plumb)

40. MILLED SURFACES. The construction process can sometimes be made more efficient by milling off a greater area of the pavement surface than will be overlaid during the work period. On occasion, airlines and the airport owner (airport operations officer) have agreed to permit operations on runways which have partially milled surfaces. Operations on partially milled surfaces are generally allowed when milling requirements have not been extensive. On certificated airports, the partially milled surface must not violate any of the pavement requirements set forth in Federal Aviation Regulation, Part 139. Generally, a maximum length of 700 feet of milled surface has been accepted. In addition, the milled surface must not be so deep or of such a geometry as to impair directional control of the aircraft. Milled surfaces must be thoroughly cleaned of dust and loose particles prior to opening for aircraft traffic.

SECTION 10. SUMMARY

41. GENERAL. Offpeak construction can be an effective way to maintain and improve airports while avoiding excessive aircraft delays. However, as described in the preceding paragraphs, certain factors must be considered and procedures followed to ensure quality construction while maintaining a safe operating environment. The airport sponsor should conduct a cost-benefit analysis to determine the applicability of offpeak construction to any particular project. In summary, adequate lead times should be given for airport users to adjust their schedules and operating procedures where feasible and possible. Coordination should be maintained with all affected parties through all phases of the project. Construction specifications should be detailed to show the unique aspects of the project. Finally, specific construction practices and techniques should be followed to ensure that the construction is of acceptable quality, particularly if the work is to be done at night.

APPENDIX I-RELATED READING MATERIAL

1. FREE ADVISORY CIRCULARS. The latest issuance of the following free advisory circulars may be obtained from the Department of Transportation, Utilization and Storage Section, MA43.2, Washington, D.C. 20590.

a. AC 00-2, Advisory Circular Checklist. Contains a listing of all current advisory circulars.

b. AC 150/5300–9, Predesign, Prebid and Preconstruction Conferences for Airport Grant Projects. Provides guidance for conducting predesign, prebid and preconstruction conferences for projects funded under the Federal Aviation Administration's airport grant program.

c. AC 150/5320–6, Airport Pavement Design and Evaluation. Provides guidance to the public for design and evaluation of pavements at civil airports.

d. AC 150/5320–12, Measurement, Construction and Maintenance of Skid Resistant Airport Pavement Surfaces. Contains guidance on determining runway surface friction characteristics, specifications for friction measuring equipment, and procedures for the construction and maintenance of skid resistant airport pavement surfaces.

e. AC 150/5340–1, Marking of Paved Areas on Airports. Describes the standards for marking paved runways, taxiways, and closed or hazardous areas on airports.

f. AC 150/5370–2, Operational Safety on Airports During Construction. Sets forth guidelines concerning the operational safety on airports during construction, to assist airport operators in complying with Part 139, Certification and Operation: Land Airports Serving Certain Air Carriers, of the Federal Aviation Regulations, and with the requirements of federally funded construction projects.

2. OTHER ADVISORY CIRCULARS. The following advisory circulars may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Refer to AC CO-2 for pricing and additional ordering information.

a. AC 150/5300–13, Airport Design. Presents the Federal Aviation design standards for airports.

b. AC 150/5370–10, Standards for Specifying Construction of Airports. Provides construction standards usually used to specify grading, drainage, paving, lighting, fencing, and turfing items of work on civil airports.

3. GOVERNMENT REPORTS. The following Government reports are for sale and may be obtained from the National Technical Information Service (NTIS), Springfield, Virginia 2215 1.

a. DOT/FAA/RD–80/121, Current Practices on Nighttime Pavement Construction-Asphaltic Concrete, July, 1982.

b. FAA/RD–76/221, Study of Nighttime Pavement Construction Practices-Asphaltic Concrete, December, 1987.

4. OTHER REPORTS. The following report may be obtained from Mr. Richard P. Raymond, Metropolitan Dade County, Aviation Department, P.O. Box 592616, Miami, FL 33159.

a. Off-Peak Construction Practices for Airfield Pavements Utilizing Asphaltic Concrete, Richard P. Raymond, International Industry Working Group, April, 1988.