U.S. Department
of Transportation
Federal Aviation
Administration

Advisory Circular

Subject: RAPID CONSTRUCTION OF RIGID (PORTLAND CEMENT CONCRETE) AIRFIELD PAVEMENTS

Date: 9/28/2007
Initiated by: AAS-100

AC No: 150/5370-16

1. PURPOSE. This Advisory Circular (AC) provides guidance for the planning, coordination, management, design, testing, inspection, and execution of rapid construction of rigid (Portland Cement Concrete) airfield pavements. This AC focuses on rigid airfield pavement construction. The material contained herein also applies to other types of airfield improvements where rapid construction is identified as the preferred construction method.

2. RELATED READING MATERIAL. Appendix A lists publications that contain additional information on the subject matter.

3. APPLICATION. The Federal Aviation Administration (FAA) recommends the guidelines and standards in this AC for rapid construction of rigid (Portland Cement Concrete) airfield pavements when airport operations do not allow extended closure of the affected pavement. This AC does not constitute a regulation and in general is not mandatory. However, use of these guidelines is mandatory for rapid construction of pavements funded under the Airport Improvement Program (AIP) or Passenger Facility Charge (PFC) Program. Mandatory terms such as “must” used herein apply only to those who undertake rapid construction of rigid airfield pavements using AIP or PFC funds.

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.

5. COMMENTS OR SUGGESTIONS. Send comments or suggestions for improving this AC to—

Manager, Airport Engineering Division
Federal Aviation Administration
ATTN: AAS-100
800 Independence Avenue SW
Washington DC 20591

6. COPIES OF THIS AC. The Office of Airport Safety and Standards is in the process of making ACs available to the public online. These ACs can be accessed through the FAA homepage (www.faa.gov). A printed copy of this AC and other ACs can be ordered from the U.S. Department of Transportation, Subsequent Distribution Office, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD 20785.

DAVID L. BENNETT
Director of Airport Safety and Standards

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101. JUSTIFICATION

As airport traffic increases and airport capacity diminishes, airport construction activities can cause untimely disruptions to airport operations.

Increases in airport traffic can consume pavement life much faster than originally anticipated. This often requires airport operators to reconstruct existing pavements much sooner than anticipated and at a time when airport operations do not allow extended closure of the affected pavement.

Rapid construction of rigid (Portland Cement Concrete) airfield pavement provides an effective means to accomplish repairs or reconstruction without significant loss of revenues, inconvenience to passengers, or excessive air traffic delays.

Runway closures for reconstruction at large airports can temporarily change aircraft flight patterns, which can create significant off-airport noise impacts. Rapid construction methods can help reduce the time period over which these impacts occur.

102. PURPOSE

This Advisory Circular (AC) provides guidance for the planning, coordination, management, design, testing, inspection, and execution of rapid construction of rigid airfield pavement.

This circular provides guidance regarding how projects are phased and implemented, what has worked well in the past and what has not, and particular lessons learned from previous projects.

Where applicable, the paragraphs have been divided into categories including large, small and panel replacement projects. Consideration may be given for panel replacement projects to be further subdivided into replacement projects for large or small areas.

Techniques for rapid construction of rigid airfield pavements have been applied successfully at airports throughout the United States. It is not the intent of this AC to require those airports that have developed successful rapid construction techniques/methods to change or modify those methods to comply with this document. Rather, this AC is a guide and is intended to help those who are unfamiliar with rapid construction techniques.

103. DEFINITIONS

a. Rapid Construction. Rapid construction refers to construction schedules and techniques that have been accelerated due to high demand and/or because there are no alternative routes to the airfield pavement area that is being constructed. Rapid construction projects generally require work to be completed during set hours of a day such as nighttime construction, extended off peak hours such as Friday night through Sunday morning, or with an accelerated schedule such as when the construction schedule has been compressed from 3 months to 1 month.

b. Large Projects. Large projects are considered to be in excess of 40,000 square feet (3716 square meters) of pavement. Examples of large projects include runways, taxiways, aprons, and other large areas of pavement such as de-icing pads and entrances to hangars.

c. Small Projects. Small projects are considered to be less than 40,000 square feet (3716 square meters) of pavement. Examples of small projects include intersections; stub and cross-over taxiways; high usage pavement areas (e.g., taxiway widening of fillets/curves); aircraft positioning hard stands; small aprons; and portions of runways, taxiways, aprons.

d. Panel Replacement Projects. Panel replacement projects involve replacing small sections of existing concrete pavement and may include continuation of existing pavements. Examples of panel replacement projects include replacement of deteriorated panels; replacement with a thicker pavement section due to an increase in design aircraft loading; and the expansion of pavement areas that tie-in to existing panels.

104. to 199. RESERVED.

SECTION 2. PROJECT PLANNING

201. IDENTIFICATION OF NEED FOR RAPID CONSTRUCTION

a. The need for rapid construction is determined by the project's impact to the normal use of the facility and its potential to disrupt scheduled user activities. 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 with rapid construction methods. This is particularly true of paving projects requiring the closure of a runway, taxiway, or aircraft parking area. In such instances, the use of rapid construction should be considered. Delayed flights, particularly arrivals, incur additional costs for operating the aircraft for the period of the delay. Extended periods of reduced flight schedules and canceled flights by aircraft operators, as well as the reduction in passenger volume, all account for lost revenues to the airport. In addition, reconstruction of major runways can change flight patterns. The use of rapid construction methods can help reduce the time period over which these impacts occur.

b. Pavement design alternatives should be evaluated utilizing AC 150/5320-6, *Airport Pavement Design and Evaluation*, based on the planned use of the pavement (e.g., critical, cargo, parking, etc.). If rigid pavement is selected as the preferred material alternative, then evaluate the impacts and determine if an accelerated construction schedule will be required.

c. Most projects benefit by identifying the need for an accelerated construction schedule early in the project planning process. Detailed initial planning will often allow for the successful completion of the accelerated rigid pavement construction.

d. The needs and options considered for rapid construction should be evaluated beforehand and discussed in the predesign conference (AC 150/5300-9, *Predesign, Prebid, and Preconstruction Conferences for Airport Grant Projects*).

e. The development of a construction phasing and pavement closure plan should be considered. These graphic tools are helpful in identifying the need for rapid construction. These plans should address the flow of air traffic at the facility based on seasonal, monthly, weekend, day and night usages. These plans will identify alternate routing for aircraft, aircraft support and facility vehicles, construction vehicles, and Aircraft Rescue and Firefighting Facility (ARFF) vehicles based on proposed construction activities.

202. FEASIBILITY. If the project involves closing critical airside pavements, it should be determined if it is feasible to construct the project on an accelerated schedule. The following steps should be undertaken during the feasibility planning process.

a. Operational Impacts. Identify the facility's standard hours of operations and all users affected by pavement closures.

b. Preliminary Cost Estimate. Prepare a preliminary cost estimate for the project. Estimates should address the differences in costs for standard construction compared to rapid construction. The cost estimate should also identify the different schedules and construction costs for extra work associated with rapid construction. In most cases, standard unit price items (e.g., the unit cost per cubic yard or per square yard of rigid pavement) will increase for rapid construction to account for additional work force and additional work periods outside normal working hours. As discussed in paragraph 203, additional inspectors and standby equipment may be required, thus increasing the project cost. If rapid construction is to take place during nighttime operations, this construction requires portable lighting units, supplemental equipment lighting and night shift pay differentials for construction personnel, all of which increase the project cost. In addition, the availability of a nighttime testing laboratory facility and personnel may increase costs. The preliminary estimate will identify whether the cost of rapid construction can be accomplished within the programmed funds or if supplemental funds are needed.

c. Pavement Area Closures. Examine the consequences of shutting down the proposed reconstructed/constructed pavement. With airports becoming busier every day and the need to provide 24-hour access to air carriers at some airports, there may be economic disincentives associated with disrupting the users. An evaluation should be made to determine at what time closure of the pavement will result in the least disruption to airport operations.

d. Construction Schedule Delays. Examine the consequences resulting from construction delays that extend the pavement closure beyond that originally planned. For example, will the airport and users face revenue reductions due to this longer shutdown and will the potential revenue losses be passed on to the contractor through liquidated damages? Refer to paragraph 209 for more information relating to the use of incentives.

e. Determination of the Project Area. Determine whether the area of rigid pavement requiring rapid construction is a large project, small project or panel replacement project. Consider the construction options based on the project's size, availability of local resources, limited time frames, and the disruption to the facility. An example of each type is discussed below.

(1) Large Project/Rapid Construction Example. A runway/taxiway reconstruction project has an accelerated schedule that requires the contractor to work extended hours with aggressive production rates for the shortest return to service time frame using a conventional concrete mixture. An option for rapid construction may allow the use of a concrete mix designed for high early strength gain at the intersections (runway-runway and runway-taxiway).

(2) Small Project/Rapid Construction Example. A stub taxiway construction project requires the contractor to work during weekends and nights so as not to disrupt operations on the runway during peak service times. An option for rapid construction may allow the use of a concrete mixture designed to reach the required loading strength before the time of the pavement reopening.

(3) Panel Replacement Project/Rapid Construction Example. A runway or taxiway reconstruction project involves the removal and replacement of existing deteriorated PCC slabs that have excessive defects requiring prompt repair. The contractor is required to remove the existing slabs, restore the subgrade, and repave the area during an overnight shutdown. An option for rapid construction may allow the use of an accelerated early strength gaining concrete mixture to reopen the pavement in the morning, once the modified concrete mixture has reached the required loading strength. Another option for this same work would be pre-cast panel replacements.

203. PROJECT COST CONSIDERATIONS

a. As mentioned in paragraph 202, rapid construction costs may be considerably higher than standard construction costs due to accelerated schedules. These costs may include standby equipment and operators, portable lighting during night work, and increased labor costs for regular overtime, night work differentials, weekend premiums, and long shifts for both the contractor personnel and resident inspection personnel.

b. Ensure that the project cost estimate identifies any special pay items related to rapid construction. This will allow flexibility in project scheduling and to avoid unnecessarily inflated bid prices.

c. It is sometimes difficult to quantify the total "savings" (in terms of cost in dollars) to the facility or its users to reflect adequately the potential benefits of completing the proposed construction in less time than standard.

204. STAKEHOLDER COORDINATION. A coordination framework for the project should be prepared by the airport operator that includes planning, design, and construction phases. This framework should specify the individual "stakeholder" organizations having interests in the project, factors or events that will be important to each group, and the time frame for involvement. Specific coordination procedures and organizations are discussed below.

a. Stakeholders. Stakeholders on airport construction projects typically include owners, designers, contractors, airlines, fixed base operators, air cargo, air traffic control, FAA, utility owners, and other airports within the region. A stakeholder is any party that has an involvement with the project or that has the potential to be impacted by the project.

b. Coordination. Close coordination is essential to the success of rapid construction projects. It is recommended that stakeholders attend all planning and coordination meetings. Table 2-1 identifies the stakeholders who should be represented during planning and coordination of the project. Special coordination consideration must be given to those airports that do not have an Air Traffic Control Tower (ATCT) or those that have limited ATCT hours.

(1) Airport Operator. The airport operator should be represented by the operator's project manager and in-house representatives of planning, engineering, environmental, operations, security, and maintenance sections. If the airport has retained the services of outside design consultants and construction management firms to oversee the project, respective managers (e.g., project/client manager) and field personnel (e.g., resident engineer, construction manager, etc.) should also attend all meetings related to the project. Environmental approvals / permitting that may be required related to demolition or construction should be coordinated early in the project design process to ensure they are in-hand prior to construction operations.

(2) Airport Users. Airport users that operate in the areas affected by the construction, 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. Air cargo facilities managers, fixed-base operators (FBOs) and other users of airside facilities such as fuel suppliers, flight catering services, and pilot organizations should be represented.

(3) FAA. The FAA should be involved through representatives of the local ATCT, National Airspace System Implementation Program Office (ANI), airports district office, flight standards district office, and airways facilities division. The airport operator should maintain close coordination with the FAA regional airport certification inspector through the airports district office.

(4) TSA. The TSA should be involved through representatives of the local Transportation Security Administration (TSA) office.

TABLE 2-1. COORDINATION – PARTICIPATING ORGANIZATIONS

STAKEHOLDERS	**REPRESENTATIVES**
Airport Operators	Planning Engineering Environmental/Noise Operations Security Maintenance
Airport Users	Airlines Flight Operations Station Managers Airport Technical Committee Air Transport Association Regional Office Air Cargo Station Managers Ground Managers Fixed Base Operators
Engineers/Contractors	Design Engineering Construction Inspection Construction Management
FAA/Transportation Security Administration (TSA)	Airports District Office Air Traffic Control Tower Airport Certification Inspector Flight Standards District Office Airways Facilities Sector Office Local Transportation Security Administration Office

205. PROJECT MANAGEMENT

a. Project Manager(s). The airport operator should select a qualified project manager(s) to oversee all phases of the project, from planning through final inspection of the completed work. The individual(s) selected should be experienced in rapid construction methods, the design and management of airfield pavement construction projects, as well as rigid pavement placement. The individual(s) should also be familiar with the airport operations, airport security requirements, aircraft operator schedules, and overall airport layout. The project manager(s) should be the final authority on all technical aspects of the project and must be responsible for coordination with airport operations. All contact with the airport operator, the weather service, or the FAA should be made through the project manager(s) or designated representative(s) (i.e., resident engineer) to ensure continuity and proper coordination with all elements of the operation of the airport. Any changes resulting from discussions with the airport operator, airport security, the weather service, or the FAA should be processed through the project manager(s) to maintain continuity and coordination with the rest of the stakeholders. All such communications and action taken should be documented in writing by the project manager(s). The specific responsibilities of the project manager(s) are discussed below.

(1) Planning and Design.

(a) Establish clear and concise lines of communication from the start. Establish clear limits of authority, such as what decisions on the project can be made at each level of the organization from the start. It is important to identify the person(s) who has authority to make decisions regarding scope of work and fiscal changes.

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

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

(d) Coordinate the design review with the stakeholders of the project including airport operator, the airlines, the Air Transport Association Regional Office, TSA, and the FAA. The review process should include designated working hours, aircraft and operational requirements, technical reviews, and establishment of coordination procedures. Coordinate collectively with each of the stakeholders for his/her input.

(e) Chair all meetings pertaining to the project.

(2) Construction.

(a) Have airport management, or their representatives, conduct training courses for construction personnel on vehicle driver's training and topics such as basic ATCT procedures for the facility, proper communications with ATCT, hazards of jet blast, familiarization with the airport layout, and avoidance of runway incursions. Establish the procedure for safe construction practices with all parties. Airports that are certificated under Title 14 Code of Federal Regulations Part 139, *Certification of Airports*, are required to have airport personnel perform this training per the Airport Certification Manual.

(b) Manage the overall construction effort with an adequate number of qualified resident engineers/construction managers and inspectors to observe and document the work done by the contractor.

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

(d) Coordinate with the contractor's project superintendent daily and agree on the limits of construction scheduled for the next work period to ensure that the selected work areas will be reopened to aircraft operations at the specified time for pavement reopening. This is especially important in situations where pavement repair and replacement are to take place.

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

TABLE 2-2. INSPECTION CHECKLIST

ITEM	COMPLETED	REMARKS
1. Have all paving operations planned for the work period been completed?	____________	
2. Are all transition ramps properly constructed and safe for aircraft operations?	____________	
3. Have all field quality assurance tests been conducted for the work period?	____________	
4. Have all temporary markings been applied?	____________	
5. Have all lighting units, construction equipment, and safety devices been removed to a remote storage location?	____________	
6. Have all construction materials that are to remain on site been properly secured from dislodgement by wind or jet blast?	____________	
7. Have all excavations been properly backfilled, plated, or appropriately marked for safe aircraft operations?	____________	
8. Has all construction debris been cleaned up and removed from the airport's construction site, access pavement, and haul routes? Has any necessary pavement sweeping been completed?	____________	
9. Have all obstruction lights and barricades been removed from areas that 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 NOTAMs been issued for the runway/taxiway/apron operating conditions?	____________	
13. Have all pavement "lips" greater than 3 inches (75 mm) in height been removed?	____________	
14. Has the rigid pavement cured enough to be opened to aircraft operations?	____________	
15. Has airport operations inspected the site and agreed to all of the above?		

b. Construction Manager. Some airport operators 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 205a(1) and 205a(2) and be familiar with the operating procedures of the airport. A division of responsibilities between the project managers for the construction management firm and the airport operator should be identified 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. The construction manager should be involved in the project as soon as possible before the construction phase begins.

c. Resident Engineer. A resident engineer, preferably a senior civil engineer or senior construction inspection professional, with experience working within an airport environment, should be designated to assist the project manager during the construction phases of the project. The resident engineer may be a member of airport operations, 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.

(1) Prepare documentation for all quantities constructed during each work period.

(2) Ensure that all tests are performed and results obtained from each work period.

(3) Schedule the inspections and surveys that must be performed during each work period.

(4) Observe compliance with contract plans and specifications and report any discrepancies to the project manager and the contractor.

(5) Maintain a construction diary and prepare daily inspection reports.

(6) Facilitate communication between the contractor, airport operations, affected airlines or FBOs, control tower, quality assurance testing personnel, and the project manager.

206. INITIAL COORDINATION. The initial coordination meeting in the project planning phase should identify the coordination framework and process for the entire project and set forth the ground rules under which the project will be accomplished.

a. Initial Coordination Meeting. The meeting agenda should include the following items.

(1) Construction Work Periods. Rapid construction projects generally require that work be either completed during set hours during a day (e.g., nighttime construction) or with an accelerated schedule (e.g., a construction schedule has been compressed from 3 months to 1 month). Therefore, work periods should be identified as soon as possible in the planning process. The work should be scheduled during time periods that will minimize operational impacts and displace the least number of scheduled flights. A specific work period timeframe and/or extended length work period timeframes should be identified, based on input from all participating organizations, as soon as possible in the planning phase. Work periods should be selected and agreed upon early enough to allow airlines to adjust their flight schedules as required for the project's scheduled construction period. Runways and other airside pavements crucial to maintaining aircraft operations should be opened and closed at the agreed upon time intervals without exception. Airline flight schedules and the contractor's work schedules are predicated upon the availability of the affected airport pavements at the designated times.

(2) Operational Criteria. Mutually agreeable operational criteria for each critical phase or sub-phase of the project should be developed for all parties having potential involvement and procedures established that will be in use during the construction process. These items include, but are not necessarily limited to, those listed below:

(a) Issuance of Notices to Airmen (NOTAMs) and advisories.

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

(c) Navigational aids and visual landing aids.

(d) Truck haul routes and airfield access security requirements.

(e) Testing, inspection, access, protocol, and procedures.

(f) Requirements and safety inspections for reopening areas for operational use.

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

(h) Placement and removal of construction safety barricades and runway closure markers.

(i) Designation of secure storage site for construction materials.

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

(k) Days of the week and detailed scheduled timeframe upon which construction will take place.

(l) Proper vehicle identification, security clearances, and airfield maneuvering (e.g., lights, flags, when radio equipped escorts are necessary, etc.).

(m) Contingency plans for construction interruptions due to equipment breakdowns or weather events. Large operations may require standby paving equipment for key areas like intersections.

(n) Emergency pavement reopening plan, which contains communications chains of command for such an occurrence.

(o) Temporary parking and service plan for aircraft during scheduled pavement closures.

(p) Detailed contractor safety plan.

(3) Communication. Lines of communication (see checklists in Tables 2-3 and 2-4) should be established by the airport operator to maintain coordination and control of pavement closures and reopenings through all phases of the project. Proper communication procedures will ensure that the necessary organizations and individuals will be kept informed of the project schedule and will provide necessary input at critical points throughout the project. It is particularly important to establish methods and lines of communication for determining if the project work area is available to start work at the beginning of each work period and if the work area is in an acceptable condition prior to its reopening for aircraft operations.

TABLE 2-3. PAVEMENT CLOSURE COMMUNICATION CHECKLIST

Contractor Superintendent	Resident Engineer	Airport Operator Project/ Operations Manager
Request pavement work area	Confirm Contractor's work time, area, & safety measures	Notify ATCT
Closure time and work annex to Resident Engineer	Request pavement closure from Project/Operations Manager	Issue NOTAMs
		Confirm closure with ATCT
		Notify Resident Engineer & Contractor to proceed with work

TABLE 2-4. PAVEMENT REOPENING COMMUNICATION CHECKLIST

Contractor Superintendent	Resident Engineer	Airport Operator Project/ Operations Manager
Request reopening time following cleanup	Inspect work area	Inspect work area
	Request reopening time to Project/Operations Manager	Notify ATCT, Resident Engineer and Contractor
		Update NOTAMs, as applicable
		Reopen pavement

(4) Special Considerations. Particular aspects of construction that will require special coordination or communication procedures should be identified. These items are discussed in sections 3 and 5 and include pavement transitions and runway closings.

(5) Other. The following should also be discussed during coordination meetings: utilities, lights, navigational aids, interference with navigational aids, temporary marking, etc.

b. Airline Input. Obtain airport operator and airport user input during initial coordination in order to minimize impact to operations and allow sufficient time to complete construction activities.

c. FAA Coordination. Obtain FAA involvement to assist with the accelerated schedule. Obtain approval or recommendation of methods to reduce the impact of the construction process at the facility based on established safety criteria.

The FAA regional office representative should be used as a resource from the start of the planning process to assist the airport operator, design team, and stakeholders with procedural guidelines for the planned project. The FAA should identify a representative who will be responsible for the coordination between the different divisions of the FAA that set minimum operational standards for the project airport and monitor or maintain NAVAIDs, which may be affected during construction.

The FAA should be involved in the coordination process through representatives of the local ATCT, National Airspace System Implementation Program Office (ANI), the airports district office, the flight standards district office, and the airway facilities division. The airport operator should also maintain close coordination with the FAA regional airport certification inspector through the airports district office.

207. PHASING AND SCHEDULING

a. During the phasing and scheduling process of the project design, determine the periods of time that the construction area(s) can be shut down from its normal operations with the least disruption. To avoid or reduce delays, all users' proposed schedules and preferred routing of aircraft movements (based on wind conditions) must be established and considered.

b. Depending on the use of the pavement area identified for construction, there may be time frames when no activity occurs. For example, this time frame when there is no or limited activity is typically nighttime for regular commuter flights and daytime for cargo operations. In addition to a specific time of day, the time of year is also an important factor when scheduling construction due to seasonal volume and atmospheric conditions of that particular region. The windows of opportunity for construction scheduling with minimal impacts will vary greatly based on the region and historic seasonal traffic volumes.

c. Although normal airfield operations establish preferred routing for taxiing aircraft and ground vehicles, temporary relocation measures should be considered as an option to decrease operational impacts at the facility while pavement areas are closed. Temporary construction of taxiways or conversion of taxiways to runways should not be ruled out.

d. Consider contingency plans if a rapid construction phased area goes badly and does not finish as scheduled, or if construction equipment or methods fail. Institute a "Plan B" option. Have a written plan in place, which has been agreed upon by all pertinent stakeholders, prior to the start of phased construction. This plan will include such provisions as: a designated off-site batch plant to be used as a backup facility; a requirement that additional equipment, materials, labor or specialized experts (e.g., electricians, FAA NAVAID maintenance personnel, engineer-of-record) be available on-site during construction; make provisions for a requirement that a process be in place to allow construction operations to continue as a temporary measure with alternative pre-approved temporary materials suitable for limited traffic use. The "Plan B" would allow construction operations to continue so that the pavement can be reopened on time or in an emergency situation, and that it would later be removed and replaced. An example of this would be placement of hot mix asphalt instead of concrete and reopening early.

e. Parts of the project may be able to be completed during peak hours with short recall to service times. Examples of preparatory work (non-disruptive work) include survey, saw cutting pavement, testing, and pavement marking efforts.

f. Consider whether particular parts of the project could be opened before final strength requirements are obtained. For example, a runway reconstruction project could open the safety area before it has obtained final strength to allow the runway to open. If a plane has to use the safety area and damages the new rigid pavement, then that pavement would be removed and replaced, at no fault to the contractor.

g. Consider combining construction activities during closures to reduce the number of times the area needs to be closed. However, also consider not combining activities if it is more critical to reopen pavement and the allowed length of closure time does not allow for all activities to be completed.

h. Consider using a stabilized subbase or base material to shed storm water. Although this may not be warranted for the structural design of the pavement, it will negate the risk of weather prolonging the project. One significant rain event can delay construction activities even on properly drained bases by several days.

i. Long lead times for certain critical path items (e.g., electrical items, structures, fill, etc.) have the potential to disrupt an accelerated schedule. Consider using owner furnished materials (procured under existing/prior/separate contract) or consider a provision for the contractor to “restock” these items. Another option is to allow multiple notices to proceed so the contractor can obtain the materials prior to commencing with construction activities. Have materials on site prior to starting critical pavement scheduled work; the lack of one frame and grate can delay reopening of pavements.

j. Extended mobilization period.

(1) Allow the contractor to set up portable plants and stockpile materials prior to the start of construction activities.

(2) Provide the contractor with a location for on-site batch plants, stockpile and laydown areas.

(3) Allow progress payments during mobilization and establishment of set percentages of unit pricing. Careful consideration should be given to how this payment would impact any quality assurance and quality control testing penalties, if applicable. If the penalties are associated with payment adjustments, based on nonconformance with one or more of the typical rigid pavement acceptance criteria (e.g., pavement thickness, surface smoothness, flexural strength, grade conformance, etc.), and the cement and aggregate were already paid for upon delivery under a previous progress payment, the calculation for the payment adjustment needs to account for this. Otherwise, the unit price for the material should be adjusted.

208. SECURITY CONSIDERATIONS

a. To reduce delays at security checkpoints during construction operations, the airport should consider the following options.

(1) Dedicate a single gate during construction to be used for the vehicle checkpoint.

(2) Install a separate (new) gate for project site access to eliminate congestion or delays caused by non-project related issues.

(3) Reduce the volume of vehicles that have to pass through security by requesting or requiring that employees travel together to the project site. Another option to reduce volume is to limit the number of personal vehicles allowed on-site or to restrict permitted vehicles to vehicles needed for construction purposes only.

(4) Badge all construction personnel to expedite the security process. Airport badges provide a consistent form of identification easily recognizable to security personnel as an authorized construction person.

(5) Dedicate drivers for regular deliveries to the project site such as mixer trucks and cement or aggregate deliveries and keep these personnel if possible.

b. Remove the project site from the Airport Operations Area (AOA).

(1) Install temporary fencing and gate(s).

(2) Consider a provision to have the gate(s) manned by Operations/Airfield Security, or private security firm approved by the airport owner.

c. Dedicate site access and pre-approved escorts.

(1) Complete escort training prior to project start.

(2) Complete badging and vehicle permitting prior to project start.

(3) Assign personnel as dedicated escorts for all construction vehicle movements over active pavements.

(4) Consider busing employees to the project site to reduce the number of personnel who need to be trained and the number of vehicles on-site.

d. Coordinate security staffing needs at the required gate access outside the standard gate hours of operations with the owner to ensure construction personnel access and deliveries (sometimes these are separate gates/haul routes). It should be determined during the planning phase of the project, once the anticipated construction work periods are established, whether there is or will be sufficient security personnel to staff the gate access. If the construction work period includes hours outside standard security operations, it should be determined as soon as possible who (the owner or the contractor) will be responsible for payment of the additional security personnel required.

(1) Work Hours. Security work hours should be identified for the project. Discuss time frames for regular, extended and overnight hours. Overtime and/or additional staffing may be required for extended and overnight work periods.

(2) Work Days. Security work days should be identified for the project. Discuss time frames for regular and extended work days. Regular work days may be Monday through Friday, where extended work days may be Saturday and Sunday, or just Sundays.

209. CONTRACT CONSIDERATIONS

a. General. It is not the intent of this AC to give guidance on different types of construction contracts. The guidance given in this paragraph is general guidance that may be considered for contracts that include rapid construction.

b. Existing Contracts or Purchase Orders. Consider the use of existing contracts or purchase orders to accelerate time sensitive purchases or work. For example, to accelerate a project schedule it may be useful to purchase and stockpile time sensitive material. This can accelerate the project schedule by allowing the contractor to start work immediately after the construction contract has been issued and not delayed by the material delivery lead time for certain materials. The risk associated with this process is that the contract unit price for that particular work item may not be as low as an all-inclusive competitive bid. Alternatively, there is also the risk that the unit bid price may increase.

c. Supplemental Funds. An owner may allow for additional funds to be available to the project manager during construction. This may be desirable because change orders are often inevitable on large projects where unexpected conditions or events can occur regardless of proper planning. Allowing supplemental funds to pay for design changes, and field changes, can ensure that a rapid construction project will not be delayed due to lack of funding.

d. Incentive Clauses. Incentive clauses in the contract documents may allow for the project pavement to be opened ahead of schedule. The contractor may have innovative construction techniques that will allow them to accelerate the construction more than the design engineers and planners anticipated. Incentive clauses may also eliminate situations where the majority of the project has been completed ahead of schedule and then the last tasks are finished slowly at less cost to the contractor. Incentive clauses are generally not funded by the FAA, but if the construction area can be opened ahead of schedule and start earning income, then it may be beneficial for the airport owner to fund them.

e. Disincentive Clauses. Disincentive clauses are more widely used in rapid construction contracts than incentive clauses. Disincentive clauses often take the form of liquidated damages and roughly approximate the daily costs likely to fall upon the airport if the construction area fails to open at the scheduled time. Including disincentive clauses may cause the contractor to increase their bid price depending on the amount of risk involved with the project schedule.

f. Partnering. Partnering has been used on rapid airport construction projects to facilitate better project coordination. Partnering is a relationship (not necessarily a legally binding relationship) between stakeholders that is intended to promote best value and performance for the project by allowing for inter-disciplinary exchanges of ideas and the identification of project risks. This identification process provides an opportunity to manage those risks, rather than to wait until a project crisis occurs and making decisions under pressure. Individual disciplines come away with a better understanding of all the risks involved, and with a deeper appreciation of how all the seemingly disjointed elements of a project come together to form the whole. Partnering, by itself, does not change the terms of the contract unless all of the signatories to an agreement concur to change them. Partnering must be started early in a project and neutral facilitators generally play a central role.

g. Design Build. Design build is not recommended for rapid construction projects. Design and subsurface investigation work should be performed prior to the start of construction to eliminate or reduce unforeseen circumstances. The design build process does not have a proven track record for airport paving projects.

h. Pre-approved or Pre-qualified Contractors. Some facilities may have a list of "pre-approved" contractors that have the qualifications to work on particular types of projects based on prior work experience at that facility or one of similar magnitude. Some facilities will request qualification proposals to compile a list of "pre-qualified" contractors for projects. Both options are in lieu of awarding contracts based solely on the "low bid" contractor.

i. Extended Mobilization. Extended mobilization periods allow for the procurement of materials prior to commencement of construction. This method is similar to utilizing existing contracts to stockpile materials or perform preparatory work.

210. to 299. RESERVED.

SECTION 3. DESIGN CONSIDERATIONS

301. DEVELOPMENT AND ASSESSMENT OF DESIGNS

a. Selection of Rigid Airfield Pavement Alternatives. At the start of the design process, an assessment of all of the design alternatives available should be undertaken. Often a combination of design alternatives may be chosen as the preferred design.

(1) Conventional Rigid Pavement. Defined as conventional PCC mixtures using the P-501 specification for flexural strength and modified as necessary based on traffic loads and climates.

(2) Accelerated Early Strength Gaining Rigid Pavement. This type of PCC mixture can be tailored to the project scheduling for reopening pavements at early stages of curing. These mixtures gain strength at set rates based on additive properties and cement properties. These mixtures can be specified to set and have compressive strengths to accommodate aircraft traffic loading within a few hours.

(3) Pre-cast Rigid Pavement. Pre-cast panels pre-determined for size, strength, and load transferring devices. These rigid panels may be used as replacement or for new construction. One limiting factor is the size and weight of panels (e.g., panels over 15 feet wide by 20 feet long) require special over-the-road permitting to deliver. The use of pre-stressed, pre-cast panels is becoming more prevalent in highway reconstruction projects and has seen some limited use in airport applications.

b. Advantages and Disadvantages of Design Alternatives. The advantages and disadvantages associated with each design alternative need to be assessed. Table 3-1 provides typical advantages and disadvantages for the different rigid pavement designs.

TABLE 3-1. ADVANTAGES AND DISADVANTAGES OF DESIGN ALTERNATIVES

RIGID PAVEMENT ALTERNATIVE	ADVANTAGES	DISADVANTAGES
Conventional Mix Rigid Pavement	• High final strength. • Contractor/Work Crews have experience with material. • Workability of material. • Specifications, testing procedures and design are proven. • Placement alternatives (form work or slip form paving). • Accurate cost estimates. • Low cost in comparison with other rigid pavement alternatives. • Readily available in most markets. • Backup equipment is easy to secure. • Low maintenance pavement.	• Length of construction time. • Length curing time. • If concrete does not meet specifications in the field then it may have to be removed.

RIGID PAVEMENT ALTERNATIVE	ADVANTAGES	DISADVANTAGES
	• Long life span of pavement.	
Rapid Set Rigid Pavement	• High Early Strength allows early use of pavement.	• High cost. • Lower final strength (potential). • Greater tendency for pavement to develop early cracks. • Pavement life may be shorter than conventional mix. • If concrete does not meet specifications in the field then it may have to be removed. • Workability Issues. • Inexperience of contractor/work force with rapid set mix. • Delivery of material (Plastic longevity). • Larger work force required because of rapidness of setting. • Material is highly susceptible to variation from weather and handling. • Increased safety risk to workers as some rapid set accelerants are caustic. • Requires precise scheduling. • Set times can be unpredictable.
Pre-cast Panels	• Rapid placement of panels. • Panels are cast in controlled conditions in pre-cast yard. • Panels are already at loading strength when placed. • Pre-stressing panels may make them stronger and allow reduction of pavement thickness. • Can be used as a temporary measure.	• High cost. • Placing and moving panels may be difficult. • Sizes of panels are generally smaller than if cast in place. • Trucking panels to site. • Requires precise fine grading. • Edges of panels are easily damaged. • May require power grouting or lifting screw jacks. • Inexperience of contractor working with pre-cast panels as pavement.

c. Underlying Layer. The design alternative should consider whether the existing pavement or subbase can be used as an underlying layer.

d. Cost Comparison. The selection of the preferred design alternative should include a cost comparison of the rigid pavement alternatives in Table 3-1.

e. Life Span/Structural Strength Comparison. The selection of the preferred design alternative should include a life span and structural strength comparison of the rigid pavement alternatives in Table 3-1.

302. PLACEMENT METHOD COMPARISON

a. Slipform Paving. Some common advantages and disadvantages for slipform paving are listed below.

(1) Advantages. The following are common positive points associated with slipform paving.

(a) Potentially fastest rate of production on large projects.

(b) Less labor force required.

(c) Proven technology and conventional mixtures.

(d) Allows for complete automation.

(2) Disadvantages. The following are common negative points associated with slipform paving.

(a) On-site batch plant usually required or similar level of control of rigid pavement production necessary to ensure supply to paver is constant. Permitting for batch plant typically required.

(b) Time consuming to gang drill longitudinal construction joints for dowel bar insertion. Requires the need for the PCC to reach sufficient strength before it can be drilled without damage to the concrete pavement.

(c) Stringline guidance can be compromised, and continuous verification is needed.

(d) May have portions of the project that require form work, such as around utilities/structures, pavements with reinforcing, airfield in-pavement lighting, etc.

(e) Potential inexperience of contractor/labor force with method.

b. Fixed-form Paving. Some common advantages and disadvantages for fixed-form paving are listed below.

(1) Advantages. The following are common positive points associated with fixed-form paving.

(a) Provides a greater level of grade control than slipform paving.

(b) Provides a greater level of control for dowel bar alignment/installation. Does not require longitudinal drilling and epoxying.

(c) Capability for placement around utilities/structures, pavement with reinforcing, and especially airfield in-pavement lighting and conduits.

(d) Easier to stop production if a problem is encountered.

(e) Backup equipment and mixing plant readily available.

(2) Disadvantages. The following are common negative points associated with fixed-form paving.

(a) May be time-consuming setting forms and stripping form work.

(b) More labor intensive than slipform paving for placement and finishing.

(c) Higher slump means longer setting/curing time and, potentially, loading times.

c. Pre-cast Panels. Some common advantages and disadvantages for the use of pre-cast panels are listed below.

(1) Advantages. The following are common positive points associated with pre-cast panels.

(a) Integrity of pre-cast panels is already known as they were cast-in-place in a controlled environment prior to their arrival at the project site.

(b) Extremely fast to reopen pavement area once set and leveled.

(c) Smaller crew required, less equipment.

(2) Disadvantages. The following are common negative points associated with pre-cast panels.

(a) Grade control of base course extremely critical to proper bearing capacity and final grades.

(b) Final grade of panel replacements typically requires adjustment through power grouting underneath panel or grinding of panel surface to match existing.

(c) Special/heavy equipment and skilled operators are required for placement of panels. Small mis-movements while placing panels may cause edge damage.

303. SURVEY AND SUBSURFACE INVESTIGATION

a. Topographic Survey. Precise topographic survey information is essential for the successful planning and development of detailed construction specifications and drawings for any size airfield project using rigid pavements and rapid construction techniques. The accuracy of the entire project design, surface movement of aircraft, and the project's construction layout is directly linked to the initial survey data. The survey data should be reproducible and tied to the State Plan Coordinate System with horizontal and vertical datum obtained from the latest National Geodetic Survey. The survey data may also be tied to the airport's coordinate system, if applicable. Survey control should be established and maintained in locations that are accessible and that will not be disturbed during construction activities. The following factors should be used as a guide for surveying and adjusted based on the size of the project.

(1) General Considerations for Existing Conditions Survey. The survey of the project area should take place once the planning process has reached a stage where the stakeholders have determined the project is feasible and a schedule for the construction has been established. The survey will require coordination with federal, state, local and airfield personnel, as applicable, to determine the locations of all surface and buried utilities, navigational aids, electrical feeds, lighting, and drainage systems within the project area.

(2) Cross-sectioning. A complete field survey containing baseline and benchmarks should be set on the side of the project area to permit a ready reference during construction activities and periodic cross-sectioning operations. Benchmarks should be set at approximately 400-foot (120M) intervals for large projects such as runways, taxiways, and aprons. A minimum of two benchmarks should be set within 200 feet (60M) of the project area for small projects such as apron expansions, stub-taxiways, and hardstands. Pavement cross-sectioning for large projects should be performed, at a minimum, on a 25-foot (7.5M) grid system both longitudinally and transversely. All breakpoints (high, low, and crown) should be added to the grid system to supplement the survey. For small-scale projects, the sectional grid system should be adjusted accordingly to match the project area. Where matching existing pavements is proposed for the project, the match line area minimum grid system should be reduced to a 10-foot (3M) grid system.

(3) Elevations. Extreme care should be exercised in level operations with an accuracy of 0.01 feet (3 mm) on existing pavements and 0.10 feet (30 mm) for other areas. The design engineer should not use grade information from previous as-built drawings or surveys that were performed during potential frost conditions because these elevations will vary seasonally.

(4) Grades. After the design finish grades, transverse slopes, break points and joint patterns of the rigid pavement are determined, a tabulation of grades and a finish grade grid with spot elevations at corner joints should be included in the plans the contractors will use in preparing bids for the project. The finish grade grid system and spot elevations will be used for the establishment of the project's reference elevations. The tabulation of grades should include the existing elevations, design finish grades, depth of excavation (if required) and depth of rigid pavement. Grades should be shown longitudinally every 25 feet (7.5M) and transversely every 25 feet (7.5M) on a grid system with all break points included. This level of topographic survey information is considered essential in the preparation of plans that are sufficiently accurate for all size projects utilizing rapid construction.

b. Subsurface Investigation. Subsurface investigation is important for all size rapid construction projects before proceeding with the design of the pavements. As-built data of pavement, base, subbase, and subgrade layer depths and the individual properties of these materials should not be assumed to be accurate. The investigation should include soil borings/corings/test pits at regular intervals as noted in AC 150/5320-6 to the maximum extent practical without severely disrupting airport operations. When conventional methods of sampling and testing are not practical, the use of non-destructive testing such as Falling Weight Deflectometer (FWD), Ground Penetrating Radar (GPR), and Dynamic Cone Penetrometers (DCP) should be considered. Projects that are determined to be rehabilitation of existing rigid pavements by removal and replacement methods should investigate existing depths of rigid pavements and base courses by coring and manual sampling of underlying subbase soils. The results of the subsurface investigation directly influence the project's pavement design and the overall construction efforts and schedule. The encountering of unexpected subsurface conditions during rapid construction could severely impact the project schedule and jeopardize the delivery timing for which the stakeholders have planned.

304. SPECIAL CONSIDERATIONS FOR RAPID CONSTRUCTION

a. Design. When designing for a rapid construction project:

(1) Consider the use of standard designs and straightforward details.

(2) Consider the use of conventional construction methods and do not limit the project to only one method.

(3) Consider the use of well-known and/or local materials and products. The contractor will be more familiar with these items and the installation requirements.

(a) Larger projects require significant quantities of materials. Consider the availability of items before specifying them.

(b) Smaller rapid setting concrete mixtures and panel replacement projects are more sensitive to learning curves. Avoid specifying materials that may have the potential for long learning curves and short set times.

b. Pavement Layers. Consider reducing the number of pavement layers to reduce the overall construction time. Fewer layers will take less time to construct. For example, eliminate the stabilized subbase course and increase the thickness of the rigid pavement and aggregate base course to meet the same aircraft loading criteria. Compare the time savings and value of the eliminated stabilized subbase course to the cost of the increased quantity of aggregate and rigid pavement.

c. Subgrade. Consider designing a weather-resistant subgrade to allow rapid construction to occur in inclement weather. The use of a stabilized subgrade is more critical to larger projects as they are open to the elements for a longer construction period.

d. Plans and specifications. The level of detail on construction plans and specifications is critical to rapid construction. Consider increasing the quality assurance review period.

(1) Standby Equipment and Increased Maintenance of Equipment. When operationally critical pavements are involved, the contract should require the contractor to maintain standby equipment at the construction site for all construction work performed. 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 breakdown. This includes equipment such as paving machines, texturing or curing equipment, trenching machines, core drills, backhoes, graders, and any equipment necessary to remove disabled equipment. 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 any 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. To minimize the chances of equipment failure, 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) Mixing Plant. Provision should also be made for a standby mixing/batch plant or for sufficient silos/storage bins to provide enough material to reopen the construction work area to aircraft operations should the primary plant break down. If using an on-site batch plant, provisions may be made for use of an off-site production plant in case of emergency or breakdown. Once the primary plant problem is resolved, the substituted rigid pavement placed must be removed and the area repaved with material as specified in the contract documents. The project manager and the contractor must agree prior to construction commencement on the exact concrete mix design that will be allowed in the case of an emergency.

(3) Construction Lighting and Barricades. The construction plans and specifications should include details for the construction-related obstruction lighting and safety barricades to be used. The types of construction 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.*

(4) Key Project Milestones.

(a) 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 en route 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 hourly, 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. At very busy airports, liquidated damages have been assessed in time increments as short as 15 minutes. It is important to keep in mind that the liquidated damages established for a project must be based on reasonable and realistic estimates of the costs incurred to the owner and the airport users as a result of contractor's failure to complete on time. In order to be fully enforceable, liquidated damages cannot be established in an arbitrary and capricious manner. The assessed liquidated damages should reflect and not exceed the lost revenue and additional expenses incurred due to unusable pavement. 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. Liquidated damages should be identified by the airport operator's construction representative project manager, construction manager, and resident engineer, and tracked accordingly whether hourly, daily, or total contract time. The airport's representative should notify the contractor's superintendent as soon as the scheduled opening time has not been met and that liquidated damages for delays to airport operations are in effect. The assessment of liquidated damages should be held for possible review until the project is complete.

(b) Multiple Notices to Proceed. Consider implementing multiple notices to proceed based on each key milestone. Liquidated damages, as discussed above, may be incorporated per each notice to proceed.

(5) Special Pay Items. Special pay items or allowances pertaining to lost time experienced by the contractor due to wind/weather conditions, airline schedule requirements and other airport operational requirements or needs beyond the contractor's control should be established in the contract specifications. This will maintain maximum flexibility in the scheduling of work and will avoid unnecessarily inflated prices. By having these times defined as pay items, the contractor will not have to anticipate in his bid the full risk of such lost time by increasing other bid items to cover these delay-associated costs. One typical method for addressing these special pay items is to provide for owner-estimated dollar amount allowances in the bid schedule that all contractors will carry in their bids. The actual costs of lost time events would then be calculated on a time and materials basis as specified and paid out of the allowance amounts. These lost time pay items should include suspension time, standby time and down time, as described below.

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

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

(c) Down Time. The period between the end of the standby time and normal quitting time.

(6) Long Lead-time Items. Identify all long lead-time items in the plans and specifications.

(7) Owner Furnished Materials. Identify all owner furnished materials in the plans and specifications.

305. to 399. RESERVED.

SECTION 4. CONSTRUCTION CONSIDERATIONS

401. COORDINATION

a. General. Coordination is a crucial component of all construction projects. It is critical on rapid projects as any delays caused by lack of coordination can harm the rapid schedule of the project.

b. Identify Key Roles and Personnel. A key to success to rapid construction projects is identifying and maintaining key personnel (airport operations, airport users, engineer, contractor, etc.) throughout the project. Key personnel should have relevant experience and authorization to make quick decisions and authorize change orders. It is also important to have these individuals available at all times during the project.

c. Coordination Considerations for Large Projects.

(1) As large projects may have a longer schedule it is important to sustain the coordination effort throughout the entirety of the project.

(2) More parties may be involved in a large project. As necessary, establish procedures for coordination with multiple general contractors or coordination with subcontractors, if appropriate, prior to construction to avoid miscommunications or delays.

(3) Resolution of issues or requests for information will typically be resolved within 24 hours. A commitment from the airport and engineer to respond to requests for information, submittals, change orders, etc., promptly is recommended.

d. Coordination Considerations for Small Projects.

(1) As most small projects will be conducted during a quick shutdown time (overnight or weekend), there is no room for coordination error for these projects.

(2) Resolution of issues or requests for information need to be resolved within hours, not within a day or days.

e. Coordination Considerations for Panel Replacement Projects.

(1) As most panel replacement projects will be conducted also during a quick shutdown time (overnight or weekend), there is no room for coordination error for these projects.

(2) Resolution of issues or requests for information need to be resolved within hours, not within a day or days.

f. Coordination Considerations with Multiple Contractors. Coordination between and with multiple general contractors is more complex than when there is one prime contractor. Clear procedures and chains-of-command should be established at the preconstruction conference. Testing and inspection may be able to be separated per each contractor's work efforts.

g. Coordination Considerations with Multiple Crews. When there are multiple crews working on a project, the general contractor must maintain coordination. Testing and inspection may be able to be separated per each crew's work efforts.

h. Notice(s) to Proceed. Consider issuing multiple notices to proceed for different phases of the project.

i. Submittal Schedule. The contractor should provide a submittal schedule after receiving the notice to proceed and prior to the start of construction. Submittals should be provided to the airport and engineer with adequate time to review them. With rapid construction, all submittals should be completed prior to the start of construction to reduce delays due to materials not meeting specifications.

j. Owner Furnished Materials. Consider the option for the contractor to restock the items in lieu of owner furnished materials (OFMs).

k. Logistics. Coordination efforts should address the following logistical aspects.

(1) Truck routes on and off airport property, when applicable. Consider whether deliveries will be delayed due to normal traffic congestion for a particular route.

(2) Permitting for on-site batch plants, etc should be addressed, for large projects.

(3) Time constraints on work schedule. Some cities/towns have ordinances in place that restrict work on Sundays.

(4) Delivery schedule should be coordinated with the hours of operations for security checkpoints to ensure security staffing availability. This coordination may involve requesting extended hours of operations to support delivery or construction schedule.

402. PRECONSTRUCTION CONFERENCE. The requirements and procedures to be followed during the rapid 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. 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 items such as operational safety, testing, quality control, security, labor requirements and environmental factors. The items discussed within this section are particularly important and should be emphasized at preconstruction conferences for rapid construction paving projects.

a. Identify Potential Changes in Design and Phasing. Contractors may have design innovations or alternative construction methods that may save time and money. Consideration needs to be given before allowing changes that would be considered significant to the bidding process and that could potentially lead to a bid protest during construction.

b. Identify the Coordination Framework. Identify the coordination framework and process for the entire project and set forth the ground rules under which the project will be accomplished. For example, establish a distribution list of the people with whom all correspondence (e.g., general correspondence, submittals, change orders, etc.) should be copied.

(1) Construction Work Periods.

(2) Operational Criteria.

(3) Communication.

(4) Special Considerations.

c. Identify Contractor Communication and Response Time.

(1) Requests for Information. As discussed in paragraph 401, responses to requests for information should be prompt for rapid construction projects. Similarly, the submission of these requests should be detailed and timely.

(2) Project Submittals. As soon as possible and prior to beginning work involving the specific project submittal, the contractor should file all project submittals with the project manager for approval. Prior to beginning work on the project, the contractor must 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 contractors, equipment, and personnel to be used, including standby equipment, as required by the specifications.

(c) PCC Plant. Evidence that the PCC plant(s) meets the requirements of the specifications.

(d) Quantity. Evidence that the amount of rigid pavement that the contractor proposes to place each work period can be supplied to the construction site in the time required.

(e) Project Superintendent(s). 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 rigid pavement projects, including nighttime or rapid construction.

(f) Safety/Phasing Plan. A detailed safety plan that addresses airfield security requirements, construction safety barricade locations, haul routes, etc. All safety plans must be coordinated with the FAA's Airports District Office and updated weekly as required in paragraph 502.

(g) Other Requirements. Other requirements identified in the contract documents.

(3) Change Orders. Prior to completing the work in question, a change order should be provided to the airport and engineer for that work the contractor considers additional to the terms of the contract. The change order should be filed with all associated costs and time extensions the contractor is requesting.

d. Meetings. Provide a weekly progress meeting schedule and identification of the need for additional, separate meetings for quality assurance and quality control representatives; to discuss navigational aids (NAVAIDs) or electrical issues; and, for preconstruction meetings per project phase or subcontractor.

e. Contractor Schedules. The contractor's detailed schedule (hour-by-hour if necessary) and frequency for updates/revisions should be established.

f. Contingency Planning. The contractor should submit a detailed, written contingency plan(s) prior to the start of any construction activities. The contingency plan(s) should address such items as emergency reopening of pavements, material/product shortages, delivery of material/product not meeting specifications, equipment failure, plant breakdown, significant weather events, etc. The contingency plan(s) should also address what action will be taken by the contractor, whose responsibility the additional material/time/delay is, and whether these methods/materials will be considered temporary or permanent as an "or equal."

g. Supply and Delivery of Materials. Identify material supply/delivery issues. The contractor should furnish a weekly delivery schedule and coordinate with security to ensure appropriate access is provided.

403. 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 that have been encountered or may be expected, and any other operational aspects of the project as necessary. The progress meeting should also address the updated safety/phasing plan with the associated changes for the following week.

404. COMMUNICATIONS. 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 project manager's designated representative) or as agreed upon between the ATCT and the airport. This is 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 only exception should be radio-equipped escort vehicles controlling construction traffic through active airfield pavements or zones. 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 (or the project manager's designated representative).

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-to-day construction operations by radio do not conflict with existing frequencies used for air traffic, security, and emergency purposes. Airport communication requirements should be included in the contract documents and followed in their entirety over the life of the project.

b. Construction and Emergency Contact Lists. Contact lists for everyday and emergency situations should be provided and readily available to all stakeholders. These lists should be maintained for the duration of the project.

405. 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 weather conditions under which work will not begin as scheduled or when work should be suspended due to inclement weather. 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. Other Weather Conditions. Weather conditions that 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. Overnight rapid construction during 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.

406. CONSTRUCTION TECHNIQUES. The type and size of the project, in addition to the construction schedule, will influence the contractor's general methods, paving equipment and staffing. Keeping the project simple by using conventional concrete mixtures and providing precise details of the required work in each phase will promote a successful high quality project. There are three basic methods of rigid pavement paving used in airfield construction projects; these are fixed-form paving, slipform paving, and pre-cast panels. These methods are suitable for rapid construction and each method has individual advantages and disadvantages based on the project application.

a. Slipform Paving Method. This method of rigid paving requires the use of a slipform paver, precise grade control, and a steady supply of concrete designed for use with the paver. This method is best suited for large projects where the long paving lanes result in high production rates for concrete placed on the project.

(1) Requires longer closures of existing pavements to be productive.

(2) Base preparation ahead of paving is required.

(3) Precise grade control and stationing reference (stringline) set to grade. Recent technology allows for stringless paving utilizing laser grading or GPS stationing for horizontal and vertical reference, coupled with automatic cross-slopes.

(4) Concrete production and delivery system consistent with high volume placements may require temporary plants be set up.

(5) Pavers are equipped to finish automatically the surface of the placement, if a drag finish is required.

(6) Longitudinal dowel placement usually requires drilling and epoxying of the bars into hardened concrete.

(7) Depth of placement is adjustable to a high degree for different thickness if required.

b. Fixed-form/Side-form Paving Method. This method of rigid paving requires the setting of steel forms to grade on a prepared base, placement of concrete within, and finishing of the surface. Fixed-form finishing methods and equipment are varied based on the size of the project and contractor's preferred choice of equipment. There are three basic types of fixed-form finishing apparatus commonly used for rigid pavement placements; these are the vibrating screed, roller screed and bridge deck pavers. The overall production rate for fixed-form paving is usually less than slipform paving due to form setting/stripping time and the labor force involved to produce the finished product.

(1) Production can be adjusted to the time requirements of pavement closures.

(2) Base preparation and form setting closely spaced.

(3) Grade control established at top of form; forms can be shimmed to precise design grade.

(4) Concrete production and delivery can utilize conventional ready-mix plants and trucks.

(5) Placement and finishing usually requires separate labor force for each. Bridge deck pavers may have self-contained finishing apparatus.

(6) On aircraft parking aprons, longitudinal dowel placement can often be cast-in-place, thus reducing the need for drilling and epoxying. Wider paving lanes for concrete placement on taxiways do not typically allow for cast-in-place dowels at longitudinal joints due to paving equipment width limitations.

(7) Depth of placement is not readily adjustable, requires special form extensions.

c. Pre-cast Panels. This method uses pre-engineered pre-cast concrete panels delivered to the site for installation by lifting equipment. The panels may be cast on site or trucked to the project. Size and weight are the determining factors in delivery and installation. The preparation of the base material is critical for proper grade control and load bearing of the panels. Typical installation may require cement grouting of key way to level the panels and the insertion of dowel bars in pre-formed pockets that are then epoxied.

(1) Production can be adjusted to meet the tightest of schedules of any methods for the reopening of critical pavements.

(2) Requires the most stringent grade control of base material.

(3) Panels are pre-finished; there is no curing time and no loading restrictions.

(4) Requires special diamond grinding equipment to true surfaces at joints, should grading be off slightly.

(5) Can be the most expensive method due to labor and production.

407. SECURITY CONSIDERATIONS. 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 that 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. Security requirements vary at individual airports and these requirements should be detailed in the project specifications.

408. GRADE PREPARATION. Grade preparation is often the most time consuming component of the project construction schedule.

a. Horizontal and vertical control set and checked by survey parties from the contractor’s and owner’s work forces should be done before the start of the project. Agreement by all parties performing and checking grading on what control references are to be used in each portion of the project.

b. Grading requirements and equipment for rapid construction will vary based on the type of project undertaken and the base material to be used or re-used.

c. The preparation and grading of the base course for placement of the rigid pavement can be the most demanding time factor in the overall schedule for the project. The demolition of existing pavement, removal, and subsequent base restoration may require adjustments to methods used, dependent on the actual field conditions of the existing pavement and base course once exposed.

d. The first step in successful demolition is to define the area and double saw cut the existing pavement full-depth along the limits of the defined work area. Saw cutting is a very time consuming operation especially when cutting thicker pavements or pavements with reinforcement and/or dowels. Whenever possible, the saw cutting should be scheduled a minimum of one day in advance of the demolition. Double saw cuts are recommended to help prevent damage to existing adjacent pavements that are to remain in place. Saw cutting out sections of PCC pavement results in the loss of load transfer capability that is typically provided by dowels, or aggregate interlock in the case of non-doweled joints. As a result, drilling and grouting of dowels into the edges of existing concrete prior to placing the new concrete is required to restore suitable load transfer.

e. The demolition and removal process is dependant on the methods employed by the contractor and whether the existing base is to be salvaged. The least disruptive method of removal is to saw cut the pavement into manageable-sized slabs, then lift up and place on trucks for removal. This method allows the existing base to remain intact and ready for paving with minimal preparation. When the existing base requires modification or re-grading, the demolition and removal method usually involves the use of specialized pavement breakers capable of reducing the existing pavement into concrete rubble. The concrete rubble is then removed with excavators and dump trucks ahead of the base restoration process.

409. TESTING

a. Testing Locations. On any project, a site must be designated for the fabrication and storage of material test specimens. This area must be accessible to testing agencies' personnel on a continuous basis to allow for timely transportation of material samples to the testing laboratories. The scale and schedule of the project may be of sufficient magnitude to consider a portable laboratory being set up for the use of the quality control/quality assurance personnel.

b. Field Testing. Sufficient support for sampling, testing, and fabrication of PCC specimens should be supplied for both contractor quality control and owner quality assurance. Due to time constraints associated with rapid construction of PCC pavements and the need to reopen areas to aircraft traffic in a timely manner, consideration to the number of specimens should be given. Beyond the typical (7-day, 14-day and 28-day breaks) testing frequency, additional specimens should be taken for hourly breaks (1-hour, 3-hour, etc) as needed to determine design strength and material acceptability at the earliest possible juncture.

c. Test Results. Rapid construction may require additional testing requirements beyond the standard requirements based on early opening of rigid pavements to aircraft. It is a benefit to all parties involved in the construction process to have test results and data available in real time without delay. The evaluation of test results and data based on actual material production may allow for modifications to the methods being used, resulting in options for schedule advancement.

Testing requirements of a rapid construction project also need to be accelerated. Commitments from all testing agencies involved (quality control and quality assurance) need to be implemented to ensure timely return of test results. Without prompt results, designers/engineers cannot assist owners in determining acceptability of materials or quality of work. A delay in test results directly affects the construction schedule.

(1) Quality Control (QC). The following are typical criteria subject to contractor QC testing. More information on contractor quality control can be found in AC 150/5370-10, *Standards for Specifying Construction of Airports*.

(a) Flexural or Compressive Strength of rigid pavement.

(b) Grade Conformance. Rigid pavement conforms to the lines and grades as shown on the plans and within the specified tolerances. It is important that grade conformance be verified early and frequently to ensure the contractor's methods of placement are and continue to be accurate/precise.

(c) Surface Smoothness.

(d) Pavement Thickness.

(e) Slump, Air Entrainment, and Temperature.

(f) Gradation and Moisture Content for Aggregate.

(g) Specification Compliance for items such as: dowel bar alignment, edge slump, joint sawing and sealing, and other product/installation requirements.

(2) Quality Control Program. A quality control program should be in place prior to commencing construction operations. The program should address all elements that affect the quality of the rigid pavement. AC 150/5370-10 provides guidance on what elements should be addressed within the plan, such as the following:

(a) Mix Design

(b) Aggregate Gradation

(c) Quality of Materials

(d) Stockpile Management

(e) Proportioning

(f) Mixing and Transportation

(g) Placing and Consolidation

(h) Joints

(i) Dowel Placement and Alignment

(j) Flexural or Compressive Strength

(k) Finishing and Curing

(l) Surface Smoothness

(3) Quality Assurance (QA). Quality assurance testing is the independent verification of quality control testing, as listed above, for the owner's assurance.

(4) Nondestructive Testing Methods. Nondestructive testing methods should be considered during a rapid construction project to eliminate the patching of the areas tested. Use of Innovative Pavement Research Foundation (IPRF) research report IPRF-01-G-002-02-2, *Acceptance Criteria of Airfield Concrete Pavement using Seismic and Maturity Concepts*, should be followed as a reference guide for nondestructive testing of rigid pavements. Some examples of nondestructive testing methods are Portable Seismic Pavement Analyzer (PSPA) and Maturity Testing.

410. 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 the number of factors (project size, complexity, production rates, etc.). The resident engineer should be responsible for overall inspection and report. Adequate inspection can be achieved with (in addition to the project manager and the resident engineer) a concrete 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 rigid pavement plant production and field placement, pavement joint/dowel inspection, electrical inspection, and surveying. Other areas of inspection include the following:

a. Underground utilities/structures inspection.

b. Earth work/compaction inspection.

c. Subgrade/subbase/base course (grade control and density testing) inspection.

d. Rigid pavement placement inspection.

e. Review all QC and QA test results.

411. TEMPORARY PAVEMENT MARKING. Several different types of paint have been successfully used for temporary markings. However, water emulsion-based paint (Federal Specification TT-P-1952) is generally preferred over solvent-based paint (Federal Specification A-A-2886) due to the lower cost of the paint and lower effort and maintenance cost associated with cleanup. When applying temporary markings during rapid construction, it is recommended that the fast drying paint be used to allow for faster reopening of the pavement. When applying temporary markings at night, it is also recommended that the fast drying paint be used to help offset the higher humidity and cooler temperatures often experienced at night. Temporary markings are generally applied at 50 percent of the application rate recommended for permanent markings. Diluting the paint is not recommended. Dry time will be increased substantially if paint is diluted. Drop-on glass beads are not required for temporary markings. The decreased paint thickness of temporary markings results in proper embedment of only a portion of drop-on glass beads. If a marginal increase in conspicuity is necessary, the smallest gradation for glass bead conforming to Federal Specification TT-B-1325, Type I, is recommended. Loose beads on the pavement are considered construction debris and must be removed. Striated markings may also be used for certain temporary markings. AC 150/5340-1, *Standards for Airport Markings*, has additional guidance on temporary markings.

a. Pavement Curing. The application of permanent pavement markings on the new rigid pavement should not occur until final curing of the surface is achieved (usually 30 days after the placement of concrete). At that time, cleaning operations to remove curing compound and temporary markings applied to the rigid pavement can commence. It is recommended that the curing compound and temporary markings be removed by water blasting. The water blasting equipment specified should be capable of a water pressure of 2600 psi (6.9 kPa) at 140°F (60°C) to clean adequately the surface to be marked. Pavement surfaces should be allowed to dry, when water is used for cleaning, prior to marking.

b. Pretreatment for Early Painting. Where early painting is required for rapid construction, a pretreatment with an aqueous solution (e.g., 3 percent phosphoric acid and 2 percent zinc chloride) must be applied to the prepared pavement areas prior to painting.

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

412. IN-PAVEMENT LIGHTING SYSTEMS. Due to the complexity of most in-pavement lighting systems, it is important to develop plans closely with the contractor to ensure the systems are constructed along with the same rapid schedule as the rest of the project. Details of in-pavement lighting installation should be specifically detailed and noted in the contract drawings and specifications. Two common methods for installation of in-pavement lighting systems are described below.

a. Blockouts. Blockouts are typically used when fixed-form paving is chosen as the method of placement. Blockouts are installed such that the blockout elevation ensures grout box clearance. Filler material should be used to stabilize the blockout during placement. The filler material should be brought up within 3 inches (75 mm) or less of the finish grade. Concrete mix is placed around the blockouts. When blockouts are utilized, additional reinforcement of the surrounding panel should be considered to minimize the potential for random cracking. After concrete placement, the filler material is removed and the light can is installed and backfilled with fresh concrete mix. See the note below for further references on the use of blockouts for installing in-pavement lighting systems. It should be noted that the use of blockouts is usually the least desirable option and that whenever possible full panel replacement, which is likely to be more time/cost efficient, should be considered.

b. Split Cans and Coring. Split cans and coring are typically used when slipform paving is chosen as the method of placement. Adjustments to light can elevations can be made after concrete placement. Place a small quantity of concrete mix around the base of the partial can to anchor it prior to paving the lane. After paving, a 4-inch (100 mm) diameter core should be drilled to determine the exact center of the can. Then a 14- to 18-inch (360 to 460 mm) hole can be drilled for the can top section and the light installation completed.

NOTE: For more information on installing in-pavement lighting/electrical systems refer to AC 150/5340-30, *Design and Installation Details for Airport Visual Aids*. Additional guidance on the installation of in-pavement lighting can be found in *The Design, Installation and Maintenance of In-Pavement Airport Lighting* by Arthur S. Schai, F.I.E.S, ©1986, Library of Congress Catalog Card Number 86-81865. This document does not form a part of this guidance, but is listed as a resource material for the design and installation of light bases. In addition, the FAA is funding research by IPRF (Innovative Pavement Research Foundation) on in-pavement lighting. The research report: Report IPRF 01-G-002-03-1, *Best Practices Guide for In-Pavement Lighting, Portland Cement Concrete Pavement*, is expected to be released in 2008.

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SECTION 5. OPERATIONAL SAFETY PROCEDURES

501. GENERAL. Safety is the first concern on all construction projects whether they are on an accelerated schedule or not. Rapid construction projects typically have more safety concerns than a project on a normal schedule. This is due to such things as larger work crews working in close proximity, night work, tight schedules, and aircraft operating in or close to the work area.

502. SAFETY PLAN. A construction safety/phasing plan that addresses work area security, access, lighting, and barricades, and emergency contacts should be prepared to guide activities in the construction phase. Refer to paragraph 206a(2) for additional requirements to cover in the safety plan. Once the safety plan is developed for construction, coordinate with the FAA's Airport District Office. A contingency plan should be prepared to address cases of abnormal failures or unexpected disasters. These plans should be updated weekly as the project schedule progresses. Refer to AC 150/5370-2 for further guidance on safety related issues. Safety plans may need to be adjusted as the project progresses. Weekly construction meetings need to be held to discuss how effective the plan is and what adjustments are needed to keep it realistic.

503. CONSTRUCTION ACTIVITIES

a. NOTAMs. 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. NOTAMs should be prepared daily by the airport operator and issued by the airport operator to reflect current construction activities.

b. Safety Meetings. Regularly scheduled safety meetings should be held to discuss safety issues. Personnel should be reminded that nighttime and off-peak construction offers some unique safety concerns such as the need to lock out electrical switches to prevent accidentally or prematurely energizing electrical systems, the need to wear reflective vests and hats to increase visibility, etc. Safety meetings should address airfield environment awareness and stress the serious consequences of runway/taxiway incursions. Keeping contractor and subcontractor personnel up to date on the changing work areas and changing active airfield areas is critical.

c. Working in Proximity to Operating Aircraft. If sharing the construction site with operating aircraft is unavoidable, for example working on a terminal apron or active taxiway, then careful planning and thought needs to be given to the interaction between aircraft and crews.

(1) Aircraft taxilanes should be selected to avoid the work areas and the taxilane safety areas marked by weighted (waterfilled) barricades.

(2) If jet aircraft are present then precautions need to be taken to avoid jet blast striking workers and equipment. Precautions may include designating clear space behind jet aircraft when they are turning under power or requiring all jet aircraft to be towed through the construction area.

d. Truck Haul Routes and Vehicle Escorts. Truck haul routes should be located 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. The use of radio equipped escort vehicles to guide truck traffic to and from the work area is highly recommended.

e. Construction Lighting and Barricades. The contractor should be required to have sufficient construction lighting and barricades (as indicated in the construction safety/phasing plans and specifications) to block off any intersecting runways and taxiways and to delineate haul routes to the work site. In some cases, airports may supply safety items for the contractor's use, such as portable elevated lighted runway closure devices. The contract should clearly state that it is the contractor's responsibility to correctly place, recover, transport/store, and maintain in good condition (to be replaced if damaged) all safety devices regardless of source for the duration of the project. Incidentals (e.g., sandbags) required for use with any owner furnished safety items should be identified in the contract plans and specifications as well.

f. Staging Areas. To facilitate construction equipment, staging area(s) should be as close to the work site as possible in a location that will not interfere with aircraft operations or navigational aids. The staging area(s) should be fenced and secured where practical.

g. 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 criteria in Title 14 Code of Federal Regulation (CFR) Part 77, *Objects Affecting Navigable Airspace,* or the airport hazard criteria contained in AC 150/5300-13, *Airport Design*, unless the location and heights of the stored material have been approved by an FAA airspace study.

504. OPENING OF CONSTRUCTION AREA TO TRAFFIC AND POST-CONSTRUCTION INSPECTION. Prior to reopening pavements to aircraft operations, inspection and testing of the work area must be performed. The quality control program should be used to determine that the in place concrete strength has reached the specified strength to take traffic. For guidance on the procedure for opening a construction area see paragraph 206. The project manager (or project manager's designated representative) should conduct an inspection of the work area with airport operations personnel and the project superintendent. 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. Only if all items on the list meet with the airport operator and project manager's (or project manager's designated representative) approval should the air traffic control tower be notified to open the area to aircraft operations. The contractor's superintendent should be required to retain a suitable workforce and the necessary equipment at the work area for any last minute cleanup that may be requested by the airport's project manager prior to opening the pavement.

505. to 599. RESERVED.

APPENDIX A. RELATED DOCUMENTS

A1-1. ADVISORY CIRCULARS. The most current versions of the following ACs can be obtained from the FAA's website at www.faa.gov.

a. 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.

b. AC 150/5300-13, *Airport Design*. Contains FAA standards and recommendations for airport design.

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 150/5340-1, *Standards for Airport Markings*. Describes the standards for marking paved runways, taxiways, and closed or hazardous areas on airports.

e. AC 150/5340-30, *Design and Installation Details for Airport Visual Aids*. Provides guidance and recommendations on the installation of airport visual aids.

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 Title 14 Code of Federal Regulations Part 139, *Certification of Airport*s, and with the requirements of federally funded construction projects.

g. AC 150/5370-10, *Standards for Specifying Construction of Airports*. Provides construction standards and guide specifications to be used in specifying grading, drainage, paving, lighting, fencing, turfing, and other construction activities at civil airports.

A1-2. INNOVATIVE PAVEMENT RESEARCH FOUNDATION (IPRF) REPORTS. The following reports can be obtained from the Innovative Pavement Research Foundation's (IPRF's) website at www.iprf.org.

a. Report IPRF-01-G-002-02-3, *Accelerated Practices for Airfield Concrete Pavement Construction – Volume I: Planning Guide*.

b. Report IPRF-01-G-002-02-3, *Accelerated Practices for Airfield Concrete Pavement Construction – Volume II: Case Studies*.

c. Report IPRF-01-G-002-1, *Best Practices for Airport Portland Cement Concrete Pavement Construction (Rigid Airport Pavement).*

d. Report IPRF-01-G-002-03-1, *Best Practices Guide for In-Pavement Lighting, Portland Cement Concrete Pavement*

e. IPRF-01-G-002-02-2, *Acceptance Criteria of Airfield Concrete Pavement using Seismic and Maturity Concepts*

A1-3. MISCELLANEOUS. This document does not form a part of this advisory circular but is listed as a resource material on the installation of light bases. It is available on the FAA's website at www.faa.gov.

The Design, Installation, and Maintenance of In-Pavement Airport Lighting, by Arthur S. Schai, F.I.E.S., ©1986. (Library of Congress Catalog Card Number 86-81865.)