UFC 3-260-11FA
25 May 2005

UNIFIED FACILITIES CRITERIA (UFC)

MODEL DESIGN-BUILD (D-B) REQUEST FOR PROPOSAL (RFP) FOR AIRFIELD CONTRACTS

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UNIFIED FACILITIES CRITERIA (UFC)

MODEL DESIGN-BUILD (DB) REQUEST FOR PROPOSAL (RFP) FOR AIRFIELD CONTRACTS

U.S. ARMY CORPS OF ENGINEERS

NAVAL FACILITIES ENGINEERING COMMAND

AIR FORCE CIVIL ENGINEER SUPPORT AGENCY (Preparing Activity)

Record of Changes (changes are indicated by **1**\ ... /**1**/)

Change No.	Date	Location

FOREWORD

The Unified Facilities Criteria (UFC) system is prescribed by MIL-STD 3007 and provides planning, design, construction, sustainment, restoration, and modernization criteria, and applies to the Military Departments, the Defense Agencies, and the DoD Field Activities in accordance with USD(AT&L) Memorandum dated 29 May 2002. UFC will be used for all DoD projects and work for other customers where appropriate. All construction outside of the United States is also governed by Status of forces Agreements (SOFA), Host Nation Funded Construction Agreements (HNFA), and in some instances, Bilateral Infrastructure Agreements (BIA.) Therefore, the acquisition team must ensure compliance with the more stringent of the UFC, the SOFA, the HNFA, and the BIA, as applicable.

UFC are living documents and will be periodically reviewed, updated, and made available to users as part of the Services' responsibility for providing technical criteria for military construction. Headquarters, U.S. Army Corps of Engineers (HQUSACE), Naval Facilities Engineering Command (NAVFAC), and Air Force Civil Engineer Support Agency (AFCESA) are responsible for administration of the UFC system. Defense agencies should contact the preparing service for document interpretation and improvements. Technical content of UFC is the responsibility of the cognizant DoD working group. Recommended changes with supporting rationale should be sent to the respective service proponent office by the following electronic form: Criteria Change Request (CCR). The form is also accessible from the Internet sites listed below.

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CHAPTER 1

INTRODUCTION

1-1 PURPOSE AND SCOPE

1-1.1 **General.** This document presents information pertinent to the preparation of a Request for Proposal (RFP) for airfield design-build (D-B) projects. The intent of a model RFP for D-B projects is to formulate a standardized approach to preparation of a RFP that will:

- Establish the roles and responsibilities of the Government and Contractor.
- Provide an adequate definition of project design and construction criteria.

If these objectives are met, the risks of D-B contracting are reduced for both the Government and Contractor.

1-1.2 **Projects Outside the United States.** The technical requirements recommended for inclusion in an airfield D-B project may not be applicable for projects outside the United States. RFP preparers for such projects should base the technical requirements in the RFP on the appropriate International Civil Aviation Organization (ICAO), North Atlantic Treaty Organization (NATO), Air Standardization Coordinating Committee (ASCC), and national criteria to assure a project that can be constructed using local materials and techniques. However, the overall objectives described herein should guide overseas RFP preparers to produce a D-B RFP that reduces risks for both the Government and Contractor. When the Air Force constructs an airfield in a foreign country, the United States obtains a base rights agreement. This is an agreement of the foreign state, but not by the Air Force. The provisions of the base rights agreement must be observed, and they may require that the construction be done according to the standards of the host country. Under such an agreement, and regardless of the conformity of the international standards with the standards of the host country, the host country must approve all plans. Use of equipment produced in the host country may be desirable.

1-1.3 **Applicability.** This UFC does not apply as a mandatory document for the Navy and Marine Corps; however, it provides applicable Navy publications where additional information can be found. The Navy's D-B acquisition template is located at http://www.wbdg.org/ndbm/, Section G2060.

1-2 **REFERENCES.** Each chapter of this UFC lists references applicable to the topic of the chapter. Appendix A contains a comprehensive list of references used in this UFC.

- United States Army Corps of Engineers (USACE) Technical Instruction (TI) 800-03, *Technical Requirements for Design-Build,* 1 July 1998

- USACE *Guidance for Firm Fixed-Price Design-Build Construction Contracts*, updated 10 July 2002, available at www.hnd.usace.army.mil/chemde/design-build.asp

1-3 **D-B PROCESS.** The intent of this document is not to discuss the D-B process but to provide guidance for the preparation of an RFP for an airfield D-B project. Discussion of the D-B contracting process is included in TI 800-03 and *Guidance for Firm Fixed-Price Design-Build Construction Contracts*

The first two chapters of TI 800-03 provide information regarding D-B contracting:

- Chapter 1, General
- Chapter 2, The Design-Build Process

The technical portions of *Guidance for Firm Fixed-Price Design-Build Construction Contracts* are based on building projects (vertical construction) more than site work (horizontal construction). However, there are parts that address contractual, proposal evaluation, and award criteria that are pertinent to D-B contracts for airfields. These parts are:

- Part 1, Introduction
- Part 2, Non-Traditional Roles and Responsibilities
- Part 3, Cost Limitation Clauses
- Part 4, Special Contract Clauses
- Part 5, Contract Clauses for D-B Contracts
- Part 6, Basis of Award
- Part 11, Proposal Evaluation Criteria

1-4 **D-B RFP.** Section 2-3 of TI 800-03 states that an RFP for a D-B contract should include proposal submission requirements, project requirements, criteria, and evaluation factors. The RFP should provide the framework and requirements necessary for offerors to submit proposals. The major parts of an RFP include:

- Instructions to Proposers
- Solicitation/Contract Form 1442
- Bidding Schedule
- Contract Clauses
- Special Contract Requirements
- Contract Completion Schedule and Phasing
- Contract Forms
- Proposal Submission Requirements

- Evaluation Factors for Award
- Design Criteria
- Specification Criteria
- Design After Award
- Review Process
- Construction

Figure 1-1 is a sample table of contents for a D-B RFP for an airfield project. This table of contents can be amended to meet the requirements of an individual project.

Figure 1-1. Sample D-B Airfield Project RFP Table Of Contents

Note: Many of the standard construction contract items included in Section 00700, Contract Clauses, and Section 00800, Special Contract Requirements, do not differ

greatly from a conventional invitation for bid package. Refer to part 5 of USACE's *Guidance for Firm Fixed-Price Design-Build Construction Contracts* for a discussion of some modifications for Special Contract Requirements.

1-5 **GOVERNMENT/CONTRACTOR D-B ROLES.** There are no inherent "design-build" roles and responsibilities simply because a contract is called design-build. To increase the probability of a successful D-B contract, it is necessary that both the Government and Contractor have a clear understanding of their respective roles, responsibilities, and risks. The general descriptions of the D-B roles in paragraphs 1-5.1 and 1-5.2 may change to meet the requirements of individual projects.

1-5.1 **Government Role**

- Clearly establish the roles of the Government and Contractor in the RFP.
- Express the intent of the design and provide an adequate and complete facility design/construction scope and criteria in the RFP.
- Establish execution requirements (e.g., customer schedule, customer operations, and any constraints on Contractor work, Contractor submittals, permits, special work acceptance requirements) and identify appropriate requirements in the RFP.
- Monitor design and construction during the project implementation for contract compliance.
- Respond quickly to the design and construction needs of the Contractor to avoid slowing down or otherwise impeding the Contractor's schedule.
- The Government must not assume responsibility for the design adequacy by "approving" design or construction submittals, except to approve requested deviations from the contract when acceptable and appropriate. The Government's role changes from reviewing designs and submittals for technical adequacy for design-bid-build projects to reviewing for conformance with the contract on D-B contracts.

1-5.2 **D-B Contractor Role**

1-5.2.1 Whether the prime is the designer or Contractor, or both, its role in a D-B contract is expanded from the conventional design-bid-build to include the following:

- Project management
- Integrated schedule for design and construction
- Extensions of designs
- Permit preparation (sometimes application)
- Cost control

- Material and equipment acquisition
- Construction
- Inspection and quality control
- As-built survey for acceptance and record purposes
- Training for operation and maintenance
- Turnover, warranty and record drawings.

1-5.2.2 The Contractor employs the designer(s) of record (DOR). The DOR must personally ensure the integrity of all extensions of the designs and ensure that all equipment and materials meet the design criteria requirements. This is a D-B Contractor function, not a Government function, which is a significant role reversal from design-bid-build contracting.

1-6 **PROJECT DEFINITION.** In addition to establishing the roles of the Government and D-B Contractor, the RFP preparer must present a definition of the project in sufficient detail to allow a proposal to be prepared by the prospective D-B Contractor. Chapter 2 includes a discussion of the development of various levels of project criteria that define the technical aspects of the project.

CHAPTER 2

AIRFIELD PROJECT DEFINITION (FACILITY CRITERIA)

2-1 **INTRODUCTION.** The goal of the RFP and the proposal development is to provide the Government and the D-B Contractor with a clear, mutual understanding of the contractually required end product. The less detailed the technical requirements included in the RFP, the more the opportunity the Contractor has to choose designs and equipment with the lowest initial cost but a higher life-cycle cost due to higher maintenance costs and a shorter service life. Therefore, all conditions or elements essential to the project must be stated in the RFP. If the Government requirements are not clearly defined and stated in the RFP, or specified in the accepted D-B proposal, the Contractor will not be obligated to provide any of those preferences, and the project may be compromised.

2-2 **REFERENCES.** Refer to Chapter 1 of TI 800-03 for more information on facility criteria.

Note: Appendix A contains a comprehensive list of references used in this UFC.

2-3 **RFP FACILITY CRITERIA.** The extent of criteria in an RFP can range from minimal to full project definition. Each D-B project has unique features that will result in the use of different levels of detail in the RFP. Three general levels of RFP criteria can be used in the preparation of an RFP and are discussed in more detail in TI 800-03.

2-3.1 **Nominal Criteria.** The Government states the purpose, function, and characteristics of the project and provides pavement designs. The D-B Contractor is then responsible to determine design parameters and detailed project definition which are submitted with the initial proposal. **Note:** The Nominal Criteria option is not for airfield projects unless specifically approved by the Air Force major command (MAJCOM), Navy Engineering Field Division (EFD), or USACE Transportation Systems Center (USACE-TSC).

2-3.2 **Partial Criteria.** The Government states the purpose, function, and characteristics of the project and also provides conceptual layouts and design parameters, pavement designs, and critical details. Partial Criteria includes sufficient detail for a general quantity take off. (The Partial Criteria option is the preferred option for airfield projects.)

2-3.3 **Full Criteria.** The Government provides full project definitions, including a more comprehensive set of RFP drawings and project implementation requirements than is prepared for a Partial Criteria project. Full Criteria includes sufficient detail for a quantity take off. (The Full Criteria option should be used only for special circumstances where Government preferences are extensive and mandatory and allow little or no flexibility for the D-B Contractor.)

2-4 **INFORMATION COMMON TO ALL LEVELS OF RFP CRITERIA**. Unified Facilities Guide Specification (UFGS) sections 01010, Statement of Work (Appendix I), and 01016, Detailed Technical Requirements (Appendixes J and K), provide required information/criteria for an airfield project RFP. The following items are common to most airfield projects and should be included in the RFP data, when applicable, in addition to technical requirements.

2-4.1 **Narrative Project Description**

2-4.2 **Completion Time for the Project and Project Phases**

2-4.3 **Airfield Traffic Constraints:**

- The impact the project will have on aircraft traffic
- Length of permitted closures or partial closures of airfield pavements

2-4.4 **Phasing Requirements:** Description of phasing necessary to accommodate airfield traffic constraints.

2-4.5 **Requirements for Control of Construction Traffic:**

- On active airfield pavements
- On inactive airfield pavements
- On the air base roadway system

2-4.6 **Cleaning Requirements for Pavements:**

- Active airfield pavements
- Before reopening closed airfield pavements
- Air base roadways

2-4.7 **Permits.** Erosion control and waste hauling and disposal are examples of permits to be included in the RFP.

2-5 **RFP DRAWINGS.** The most significant differences in the three levels of criteria are the design input and the detail of the RFP drawings. Table 2-1 lists possible drawings for different criteria levels to be included in the RFP. See Chapter 6 for additional information on drawings.

Table 2-1
RFP Drawings

Drawing Description	Information/Guidance		
	Nominal Criteria	Partial Criteria	Full Criteria
Cover Sheet		X	X
Location Plan/Project Site Plan	X	X	X
Contractor Access, Storage, and Haul Routes	X	X	X
Horizontal and Vertical Control		X	X
Existing Topography (if available)		(X)	X
Existing Utilities		X	X
Demolition Plans		X	X
Runway Geometry w/Key Elevations		X	X
Taxiway Geometry w/Key Elevations		X	X
Apron Geometry w/Key Elevations		X	X
Typical Pavement Sections	X	X	X
Phasing Plans		X	X
Conceptual Drainage Plans			X
Conceptual Grading Plans			X
Conceptual Jointing Plan			X
Joint/Sealant Detail			X
Grounding Point Locations			X
Mooring Point Locations			X
Pavement Marking Plans			X
Visual Navigation Aids Location			X
Electronic Navigation Aids Location			X
Apron Lighting Plan			X
Electric Vault Location			X
Fire Suppression System Plan			X

2-6 **RFP SPECIFICATIONS.** Inclusion of edited UFGS in an RFP for airfield projects is required for either Partial or Full Criteria. See Chapter 4 for additional information on RFP specifications.

2-7 **CONCEPTUAL DESIGN REPORT.** Project definition should include a Government-prepared conceptual design analysis for Partial or Full criteria that includes:

- Design analyses for all designs furnished by the Government, such as pavement design.
- Government-furnished data necessary for the D-B Contractor to further the design and prepare the final project design analysis.

The Government-furnished and Contractor-furnished design analyses are discussed further in Chapter 3.

2-8 **EXISTING CONDITIONS.** An RFP for a D-B project should include or provide for access to all available information regarding existing conditions as part of project definition. The following areas of information may be available.

2-8.1 **Topographic Surveys.** The results of recent topographic surveys should be provided as an RFP drawing, if available. If recent topographic surveys are not available, the RFP should include the Government topographic survey criteria as an appendix.

2-8.2 **Geotechnical Reports.** If a recent geotechnical survey is available, it should be included in the RFP as an appendix.

2-8.3 **Condition Surveys.** Any recent condition surveys of existing pavements, electrical systems, airfield lighting, electronic navigation aids (NAVAIDS), or other facilities should be included in the RFP if applicable to the project.

2-8.4 **As-Built Drawings.** The RFP should indicate the location and accessibility of any as-built drawings for existing facilities within the project area.

The RFP must state clearly that any information provided by the Government shall be verified by the D-B Contractor during the proposal phase by on-site inspection and additional surveys and/or testing by the Contractor if necessary for verification of existing information.

CHAPTER 3

TECHNICAL GUIDANCE

3-1 **INTRODUCTION.** The technical requirements included in a D-B airfield RFP must address the unique elements of an airfield construction project. Airfields experience traffic conditions and safety requirements not found at non-airport work sites. In addition, the performance of airfield facilities over the years has resulted in an awareness of the most safe, cost-effective, durable materials and design. The RFP must require the Contractor to design and construct the Government's preferences for facility development.

3-2 AIRFIELD PLANNING AND DESIGN REFERENCES

Note: Each chapter of this UFC provides references applicable to the topic of the chapter. Appendix A provides a comprehensive list of references.

3-2.1 Airfield Planning and Design, General

3-2.1.1 UFC

UFC 3-260-01, *Airfield and Heliport Planning and Design*

UFC 4-133-01N, *Design: Air Traffic Control Facilities*

UFC 4-141-10N, *Design: Aviation Operation and Support Facilities*

3-2.1.2 Air Force

Air Force Instruction (AFI) 32-1024, *Standard Facility Requirements*

Air Force Handbook (AFH) 32-1084, *Facility Requirements Handbook*

Engineering Technical Letter (ETL) 01-20, *Guidelines for Airfield Frangibility Zones*

3-2.1.3 Army

Army Regulation (AR) 210-20, *Master Planning for Army Installations*

3-2.1.4 Navy

Naval Facilities Engineering Command (NAVFAC) P-80.3, *Airfield Safety Clearances*, Appendix E

3-2.1.5 Federal Aviation Administration (FAA)

Advisory Circular (AC) 150/5300-13, *Airport Design* (See Note 2)

AC 150/5390-2B, *Heliport Design* (See Note 2)

3-2.2 Pavement Design and Evaluation

3-2.2.1 UFC

UFC 3-250-03, *Standard Practice Manual for Flexible Pavements*

UFC 3-250-04FA, *Standard Practice for Concrete Pavements*

UFC 3-260-02, *Pavement Design for Airfields*

UFC 3-260-03, *Airfield Pavement Evaluation*

3-2.2.2 Army/Air Force

Technical Manual (TM) 5-822-10/Air Force Manual (AFM) 88-6, Chapter 6, *Standard Practice for Pavement Recycling*

TM 5-809-12/AFM 88-3, Chapter 15, *Concrete Floor Slabs on Grade Subjected to Heavy Loads* (See Note 1)

3-2.2.3 Navy

Interim Technical Guidance (ITG), *Skid Resistance Criteria for Airfield Pavements*, 24 March 1999

3-2.2.4 Navy/Marines

UFC 4-211-01, *Design: Aircraft Maintenance Hangars: Type I and Type II*

3-2.2.5 FAA

AC 150/5320-6D, *Airport Pavement Design and Evaluation* (See Note 2.)

3-2.2.6 American Concrete Pavement Association (ACPA)

Innovative Pavement Research Foundation (IPRF) IPRF-01-G-002-1 (ACPA JP007P), *Best Practices for Airport Portland Cement Concrete Pavement Construction (Rigid Airport Pavement)* (Note 3)

3-2.3 Pavement Recycling

3-2.3.1 UFC

UFC 3-250-03, *Standard Practice Manual for Flexible Pavements*

UFC 3-250-08FA, *Design: Standard Practice for Sealing Cracks and Joints in Rigid and Flexible Pavements*

UFC 3-250-11, *Soil Stabilization for Pavements*

3-2.3.2 **Army/Air Force**

TM 5-822-10/AFM 88-6, Chapter 6, *Standard Practice for Pavement Recycling*

3-2.4 **Surface and Subsurface Drainage**

3-2.4.1 **UFC**

UFC 3-230-06A, *Design: Subsurface Drainage*

UFC 3-230-15FA, *Design: Surface Drainage Facilities for Airfields and Heliports*

UFC 3-250-04FA, *Standard Practice for Concrete Pavements*

3-2.4.2 **Air Force**

AFM 88-5, CH3, *Drainage and Erosion Control Structures for Airfields and Heliports*

3-2.4.3 **Army**

TM 5-820-3, *Drainage and Erosion Control Structures for Airfields and Heliports*

3-2.4.4 **Navy/Marines**

MIL-HDBK 1005/3, Drainage Systems (to be replaced by 3-200-10N)

3-2.4.5 **FAA**

AC 150/5320-5B, *Airport Drainage* (See Note 2)

3-2.4.6 **National Fire Protection Association (NFPA)**

NFPA Standard 415, *Standard on Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways*

3-2.5 **Visual Navigation Facilities and Area Lighting**

3-2.5.1 **UFC**

UFC 4-141-10N, *Design: Aviation Operation and Support Facilities*

UFC 3-260-01, *Airfield and Heliport Planning and Design*, Attachment 17

UFC 3-230-06A *Design: Subsurface Drainage*

UFC 3-535-01, *Design Standards for Visual Air Navigation Facilities*

UFC 3-535-02, *Visual Air Navigation Facilities and Design Drawings*

3-2.5.2 **Army**

TM 5-811-5, *Army Aviation Lighting*

3-2.5.3 **Navy/Marines**

Naval Air Systems Command (NAVAIR) 51-50AAA-2, *General Requirements for Shore Based Airfield Marking and Lighting*

3-2.5.4 **Illuminating Engineers Society of America (IES)**

IES-RP-14-1987, *IES Recommended Practice for Airport Service Area Lighting* (See Note 2)

3-2.6 **Aircraft Arresting Systems**

3-2.6.1 **UFC**

UFC 3-260-01, *Airfield and Heliport Planning and Design*, Chapter 3

3-2.6.2 **Air Force**

AFI 32-1043, *Managing, Operating, and Maintaining Aircraft Arresting Systems*

35E8-series Technical Orders

3-2.7 **Explosives**

3-2.7.1 **Air Force**

AFMAN 91-201, *Explosives Safety Standards*

3-2.7.2 **Army**

AR 385-64, *U.S. Army Explosives Safety Program*

3-2.7.3 **Navy/Marines**

Naval Sea Systems Command (NAVSEA) OP-5, *Ammunition and Explosives Ashore, Safety Regulations for Handling, Storing, Production, Renovation, and Shipping*

3-2.8 **Pavement Marking**

3-2.8.1 **UFC**

UFC 3-260-05FA, *Design: Marking of Army Airfield-Heliport Operational and Maintenance Facilities*

3-2.8.2 **Air Force**

AFI 32-1042, *Standards for Marking Airfields*

ETL 04-2, *Standard Airfield Pavement Marking Schemes*

3-2.8.3 **Navy/Marines**

NAVAIR 51-50AAA-2, *General Requirements for Shore Based Airfield Marking and Lighting*

3-2.8.4 **FAA**

AC 150/5340-1H, *Standards for Airport Markings* (See Note 2.)

3-2.9 **Theater of Operations**

3-2.9.1 **UFC**

UFC 3-250-09FA, *Design: Aggregate Surfaced Roads and Airfields*

3-2.9.2 **Air Force**

ETL 04-7, *C-130 and C-17 Landing Zone (LZ) Dimensional, Marking and Lighting Criteria*

ETL 97-9, *Criteria and Guidance for C-17 Contingency and Training Operations on Semi-Prepared Airfields*

3-2.9.3 **Army/Air Force**

FM 5-430-00-2/AFJPAM 32-8013 Volume II, *Planning and Design of Roads, Airfields, and Heliports in the Theater of Operations – Airfield and Heliport Design*

3-2.10 **Electronic NAVAIDS**

See UFC 3-260-01, *Airfield and Heliport Planning and Design*, Attachment 17, for references for electronic NAVAIDS.

3-2.11 **Construction and Materials**

References for construction and materials are listed in the various UFGS, Divisions 2 through 16.

NOTE 1. References for hangar floors are for interior shop, storage, and maintenance floors not subject to aircraft wheel loads. For hangar floors subjected to aircraft wheel loads, UFC 3-260-02 applies.

NOTE 2. Usually Department of Defense (DOD) criteria will apply to projects. Exceptions include projects on joint use airfields and when DOD criteria is nonexistent for the subject matter.

NOTE 3. If this document has guidelines or requirements that differ from the UFGS or Unified Facilities Criteria, the UFGS and the UFC shall prevail.

3-3 **CONSTRUCTION PHASING.** Construction operations in, adjacent to, or requiring construction traffic through an airfield's air operations area (AOA) will require a phasing plan. The purpose of the plan is to establish guidelines and constraints the Contractor must follow during construction in these areas. This basic information for the phasing plan must be included in the RFP:

- AOA facilities that will be closed or partially closed for construction
- Phasing required to maintain minimum aircraft operation with those airfield facilities that will be opened and closed during each phase identified
- Maximum duration of each phase (or closure)
- Time allowance between phases for preparation to redirect air traffic
- Requirements for temporary marking and lighting
- Liquidated damages for each phase if closure and construction extend beyond the time limit for each phase

The Contractor shall submit the phasing plan with the first design submittal and include Contractor-furnished drawings showing phasing details and notes.

3-4 SAFETY AND SECURITY PLAN

3-4.1 **General.** Safety and site security during construction is a primary consideration. RFP Section 00120 requires Contractors to submit a safety program as part of their management plan. RFP Section 00700 provides guidelines for accident prevention. These two sections detail measures to prevent construction worker accidents. On airfield projects, a safety plan is also necessary to acquaint construction personnel with airfield operations and provide a safe environment for aircraft operations and personnel during construction. A security plan is required to assure security at the construction site and the air base.

3-4.2 **Aviation Safety.** RFP Section 0800 includes a standard titled "Airfield Safety Precautions (DFARS 252.236-7005) (Dec. 1991)." This standard includes some criteria and requirements that are not applicable to all airfields. An alternate to the use of a standard provision regarding aviation safety is the requirement of the D-B Contractor to develop an Aviation Safety Plan that addresses safety requirements of the specific project. Criteria for the D-B Contractor-developed safety plan should be included in UFGS Section 01016, Detailed Technical Requirements for Airfield Design-Build.

3-5 **GRADING.** Airfields have areas that must be graded to relatively smooth surfaces with positive drainage. These areas are defined in Table 3-1. An airfield project may require extensive grading or grading only in limited areas. The required extent of grading should be detailed in Section 01016.

Table 3-1
Airfield Grading Criteria

Airfield Feature	Graded Area	Reference
Runways	Length: Length of runway Width: Width of primary surface (1)	UFC 3-260-01, Table 3-2, Figure 3.1
Runway Clear Zone	Length: First 1000 feet of length plus transition Width: Width of primary surface (1)	UFC 3-260-01, Table 3-5, Figures 3.2, 3.10, 3.13, 3.16
Runway Overruns	Length: 200 feet for Class A runways, 1,000 feet for Class B runways Width: Same as runway plus shoulders (2)	UFC 3-260-01, Table 3-4
Taxiways	Length: Length of taxiway Width: 300 feet centered on taxiway for Class A runways, 400 feet for Air Force Class B runways	UFC 3-260-01, Table 5-1, Figure 5.3
Aprons	Class A runways, 100 feet from apron edge Class B runways, 125 feet from apron edge	UFC 3-260-01, Table 6-1

(1) Runway Primary Surfaces

Class A Runways – 500 feet each side of runway centerline

Class B Runways: Air Force and Navy – 1000 feet each side of runway centerline
Army – 500 feet each side of runway centerline

(2) The length and location of clear zone and overrun grading are the same, but the width of grading for the overrun is less than the clear zone. The longitudinal grade requirement for the overrun differs from the clear zone requirement. See references.

NOTES:

1. See UFC 3-260-01 for criteria for rotary-wing facilities.
2. Some visual and electronic NAVAIDS have criteria for grading. See UFC 3-260-01, Attachment 17, for references.

3-6 AIRFIELD PAVEMENTS

3-6.1 **General.** The information in this document is in brief format. A more detailed discussion of airfield pavements can be found in these references:

- UFC 3-250-04FA, *Standard Practice for Concrete Pavements*
- UFC 3-250-03, *Standard Practice Manual for Flexible Pavements*
- UFC 3-260-01, *Airfield and Heliport Planning and Design*
- UFC 3-260-02, *Pavement Design for Airfields*
- UFC 3-260-03, *Airfield Pavement Evaluation*
- ETL 01-9, *Procedures to Retard Reflective Cracking*

3-6.2 **Airfield Pavements Procedures and Requirements.** UFC 3-260-02 and the other references contain design procedures and requirements for numerous types of rigid and flexible pavements. The objective of pavement design and material selection is to provide airfield pavements that:

- Are structurally adequate to support heavy aircraft loads and traffic volumes.
- Provide good service over the design life or longer.
- Are resistant to foreign object damage (FOD) over their service life.
- Have good skid/hydroplaning resistance.
- Have cost effective materials that are commonly used in the construction industry—in both initial construction and maintenance programs.

Over the years, the performance of some pavement types did not meet these objectives. This led to the development of criteria for the use of the various types of pavements on airfields. UFC 3-260-02 includes limitations for the use of some pavements and identifies preferred pavements. The criteria for use of pavements and overlays on airfields are discussed herein.

3-6.3 **Pavement Types.** There are two general types of pavements, rigid and flexible. A rigid pavement is any pavement that contains Portland cement concrete as one element. Flexible pavements are so designated due to their flexibility under load and their ability to withstand small deformations. There are a number of variations of each type of pavement, which are described briefly in paragraphs 3-6.4 and 3-6.5.

3-6.3.1 The references in paragraph 3-6.1 include design procedures for various pavements and pavement overlays, including the preferred type of pavement recommended for various applications. The criteria for the use of different pavements are discussed in paragraphs 3-6.6, 3-6.7 and 3-6.9. The most often used pavement surfaces are:

- Plain jointed concrete pavement (rigid)
- Hot mix asphalt (HMA) on aggregate base course (flexible)

Table 3-2 summarizes the application criteria for plain jointed and flexible pavements.

3-6.3.2 The use of various types of pavement overlays is discussed in paragraph 3-6.9 and summarized in Table 3-3.

Table 3-2
Use of Rigid and Flexible Pavements

Runway Class	Airfield Feature	Rigid (Plain Jointed) (1) (2)	Flexible, HMA (3)
A	Runway	X	X
A	Taxiway	X	X
A	Apron-Aircraft	X	
B	Runway, End 1,000 feet	X	
B	Runway, Center	X	X
-	Runway Overruns (4)		X
-	Aircraft Arresting Gear (5)	X	
B	Taxiway, Primary	X	
B	Taxiway, Secondary	X	X
-	All Shoulders		X
B	Apron-Aircraft	X	
-	Apron-Helicopter	X	
-	Hangar Floors and Access Apron	X	
-	Parking Pads • Hazardous CargoPower Check • Compass Calibration • Warm-up • Alert • Arm/Disarm • Holding • Washrack	X	

Runway Class	Airfield Feature	Rigid (Plain Jointed) (1) (2)	Flexible, HMA (3)
-	Pavement Intersections (6)	X	
-	Heavily Loaded Pavement (7)	X	
-	Blast Protection Areas (8)	X	X
-	Helicopter Skid Areas	X	X
-	Heliports	X	X

NOTES:

1. Reinforced concrete pavement must be used for irregular pavement panels, at mismatched joints, panels with utility block-outs, pavement incorporating heating pipes, some pavements in frost areas, and Navy vertical take-off and landing (VTOL) and short take-off and landing (STOL) pavements. Other uses of reinforced pavement (including continuously reinforced, fibrous and prestressed concrete pavements) requires prior approval of USACE-TSC, Air Force MAJCOM, or Navy EFD.
2. The Navy requires a stabilized base for all rigid pavements less than 9 inches (in.) thick.
3. Other types of flexible pavement (e.g., tar based, all bituminous, with stabilized bases, resin modified) can be used only as an option to flexible, HMA pavement based upon economic analysis and prior approval of USACE-TSC, Air Force MAJCOM, or Navy EFD.
4. Overruns may be aggregate with a double application of surface treatment, with the exception of the 150 feet (ft) next to the runway pavement (Army and Air Force), which must have a minimum of 2 in. of HMA. Air Force and Army overruns where snow plows operate or where overruns are used to certify arresting barriers shall have a minimum of 2 in. of HMA. The Navy requires the entire length of the overrun to be HMA surfaced.
5. From threshold to 300 ft past arresting gear (Army, optional for Air Force) or 2 meters (m) either side of arresting gear (Navy).
6. Pavement intersections with a history of shoving or distortion must be rigid pavement.
7. Pavements subject to sustained operations with tire pressure of 300 pounds per square inch (PSI) (2.06 megapascals [Mpa]) must be rigid pavement.
8. The Navy requires blast protection areas to be rigid pavement.

Table 3-3
Use of Various Types of Overlays

Type of Pavement to be Overlayed (7)	Type of Overlay (1)						
	Rigid					Non-Rigid	
	Bonded (2)	Partially Bonded (3)		Unbonded (4)			
		Plain	Reinf	Plain	Reinf	Flexible (5)	All-Bituminous (6)
Rigid C=1.00	X						
Rigid Plain C≥0.35		X	X	X	X	X	X
Rigid Plain C<0.35				X	X	X	X
Rigid Reinf C≥0.35			X	X	X	X	X
Rigid Reinf C<0.35				X	X	X	X
Flexible				X	X	X	X
Composite				X	X	X	X

NOTES:

1. The type of overlay to be selected by USACE-TSC, Air Force MAJCOM, or Navy EFD and is not a Contractor option. The RFP shall state the type of overlay required.
2. Limited to correcting surface deficiencies of structurally adequate pavement with a C=1.00.
3. Used to structurally upgrade essentially sound pavement.
4. Best suited for restoring and upgrading deteriorated rigid pavement and overlay of flexible and composite pavements. Used when C<0.35, when plain concrete is used to overlay reinforced pavement, or when matching existing joints is impractical.
5. Granular base must be positively drained to prevent trapped water.
6. The all-bituminous overlay is the preferred non-rigid overlay to lessen the danger of entrapped water in the overlay.
7. “C” is a condition factor assigned to existing plain and reinforced concrete pavement. See Section 5, Chapter 17, of UFC 3-260-02.

3-6.4 Flexible Pavement Types

3-6.4.1 **General.** The term “bituminous” is a generic term for both asphalt and tar cements used in flexible pavements. The term asphalt is used in this document because asphalt is commonly used while tar cement is rarely used. The most common high-performance flexible surfacing for airfields is HMA. HMA is a mixture of mineral aggregates and asphalt cement heated and mixed in a central batch plant and placed and compacted while sufficiently hot so the required density and smoothness can be achieved.

3-6.4.2 **Flexible Pavement (HMA).** The principal components of flexible pavement include an HMA surface course, a graded crushed aggregate base course on a drainage layer, and prepared subgrade.

3-6.4.3 **Flexible Pavement with Stabilized Base.** A flexible pavement with a stabilized base (in lieu of an aggregate base) on a drainage layer.

3-6.4.4 **All Bituminous Concrete Pavement**. A pavement consisting of an HMA surface course on an HMA base course and a drainage layer.

3-6.4.5 **Asphalt Surface Treatment.** An application of liquid asphalt material followed by a layer of aggregate. Multiple applications of surface treatment may be used. Due to potential FOD, asphalt surface treatment can be used only on overruns.

3-6.4.6 **Aggregate Surface.** A surface of compacted crushed aggregates.

3-6.4.7 **Resin Modified Pavement.** An open graded asphalt concrete mixture containing 25 to 35 percent voids which are filled with a resin modified portland cement grout.

3-6.4.8 **Slurry Seal.** A slurry seal is a mixture of asphalt emulsion, fine aggregate, water, and mineral filler that produces a fluid-like slurry that is generally squeegeed over an existing worn, weathered, or cracked pavement to improve the quality of the pavement surface.

3-6.5 Rigid Pavement Types

3-6.5.1 **General.** A rigid pavement is considered to be any pavement that contains portland cement concrete as one element. The principal components are the concrete slab and drainage layer. A base course or stabilized layer may be included based on site conditions.

3-6.5.2 **Plain Concrete Pavement.** A pavement consisting of non-reinforced jointed rigid pavement.

3-6.5.3 **Reinforced Concrete Pavement.** A pavement consisting of jointed rigid pavement that is strengthened with deformed bars or welded wire fabric.

3-6.5.4 **Continuously Reinforced.** A pavement constructed without contraction joints that uses reinforcing steel to maintain structural integrity across contraction cracks that form in the pavement.

3-6.5.5 **Fibrous Concrete Pavement.** A rigid pavement strengthened with randomly mixed short, small cross section steel fibers. Use of fibrous concrete is prohibited by the Navy.

3-6.5.6 **Prestressed Concrete Pavement.** A rigid pavement that has been strengthened by steel tendons that apply a significant horizontal compressive stress during and after construction.

3-6.5.7 **Roller Compacted Concrete Pavement.** Concrete pavement constructed by lay down and compaction of a no-slump concrete mixture using equipment similar to that used in construction of asphalt concrete pavement.

3-6.6 **Pavement Use Criteria**

3-6.6.1 **Flexible Pavements**.

3-6.6.1.1 Limit asphalt pavement to areas not subject to fuel or oil spillage, severe jet blast, channelized heavy traffic, or parked aircraft.

3-6.6.1.2 HMA pavements are usually satisfactory for the following areas:

- Class A airfields except aprons
- Class B runway interiors
- Class B secondary taxiways
- Paved portions of overruns
- Paved shoulders
- Other areas not required to have rigid pavements

3-6.6.2 **Rigid Pavements**.

3-6.6.2.1 Rigid pavements are to be used in areas subject to fuel or oil spillage, severe jet blast, parked aircraft, and channelized heavy traffic.

3-6.6.2.2 Rigid pavements are required for the following uses:

- All aircraft/helicopter parking areas
- Hangar floors
- Hangar access aprons (optional for Air Force)
- Class B runways:

- Primary taxiways
- Runway ends (305 m or 1000 ft)
- Areas from the runway threshold to a line 90 m (300 ft) past aircraft arresting barrier to control hook skip (Army, and optional for Air Force)
- Two meters (6.53 ft) each side of arresting gear (Navy and Marine Corps)
- Aircraft parking pads including hazardous cargo, power check, compass calibration, warm-up, alert, arm/disarm, holding and washrack
- Pavement intersections with a history of flexible pavement shoving and/or distortion
- For areas where sustained operations of aircraft/vehicle tire pressure of 2.06 MPa (300 psi) occur
- Navy and Marine Corps airfield blast protection areas (UFC 3-260-02)

3-6.7 Use Of Various Types Of Pavements

3-6.7.1 Flexible Pavement Use

3-6.7.1.1 **HMA.** HMA flexible pavement is the preferred pavement.

3-6.7.1.2 **Flexible Pavement with Stabilized Layers.** Stabilized layers can be used in flexible pavement when economically justified. Approval of the Air Force major command (MAJCOM) is required for use of stabilized components on Air Force airfield pavements (UFC 3-260-02).

3-6.7.1.3 **All-Bituminous Pavement.** All-bituminous pavement can be used as an optional design based on economical analysis. USACE-TSC or Air Force MAJCOM approval is required for use on Army and Air Force airfields (UFC 3-260-02).

3-6.7.1.4 **Asphalt Surface Treatment.** Double asphalt surface treatment is used on Army and Air Force runway overrun areas beyond 150 ft from the end of the runway pavement (UFC 3-260-02).

3-6.7.1.5 **Slurry Seal.** Slurry seals are not permitted on military airfields (UFC 3-260-02).

3-6.7.1.6 **Aggregate Surface.** Aggregate surfaced pavement can be used for Air Force helicopter slide areas and heliports (UFC 3-260-02).

3-6.7.1.7 **Resin Modified Pavement.** Prior approval is required from USACE-TSC, Air Force MAJCOM, or Navy EFD Facility Engineer Command (FEC) before using any resin modified pavement.

3-6.7.2 Rigid Pavement Use

3-6.7.2.1 **Plain Concrete Pavement.** Unreinforced concrete is generally the most economical concrete airfield surface to build and maintain. Unreinforced concrete will be used for rigid military airfield pavements unless special circumstances exist (UFC 3-260-02) and except for the requirements for reinforced concrete in paragraph 3-6.7.2.2.

3-6.7.2.2 **Reinforced Concrete Pavement.** Reinforced concrete pavement will be used for the following applications (UFC 3-260-02):

- All irregularly shaped panels in plain jointed concrete pavement
- Navy VTOL and STOL pavements
- Panels with utility block-outs
- Location of mismatched joints
- Pavements that incorporate heating pipes
- Some pavements in frost areas

3-6.7.2.3 **Continuously Reinforced Concrete Pavement**

- Use requires approval of USACE-TSC, Air Force MAJCOM, or NAVFAC (UFC 3-260-02).
- Use for liquid oxygen (LOX) storage areas (UFC 3-260-02).

3-6.7.2.4 **Fibrous Reinforced Pavement**

- Use requires prior approval of the USACE-TSC or Air Force MAJCOM (UFC 3-260-02).
- Use on airfields is prohibited by the Navy.

3-6.7.2.5 **Prestressed Concrete Pavement.** The use of prestressed concrete pavement requires approval of USACE-TSC, Air Force MAJCOM, or NAVFAC.

3-6.7.2.6 **Roller-Compacted Concrete Pavement**

- With prior approval, roller-compacted concrete pavement is allowed by the Army and Navy and can be used for helipad and heliport pavements and all fixed-wing pavements except for runway and high-speed taxiways (UFC 3-260-02)
- Roller-compacted concrete pavement is not allowed on Air Force airfields.

3-6.7.2.7 **Pavements at Aircraft Arresting Systems.** Changes in pavement type or an interface between rigid and flexible pavements are not permitted within 60 m (200 ft) of arresting system cables (does not apply to sacrificial polyethylene pads or system

in overruns) (AFI 31-1043). Rigid pavement must be used as a foundation for sacrificial polyethylene pads (installed at arresting gear cables) in both rigid and flexible pavements (UFC 3-260-01).

3-6.8 **Instrument Landing System (ILS) Runway Pavement.** Reconstruction of a runway threshold, or runway pavement near the threshold, requires that no changes in grading within the ILS critical area occur, or the ILS system will require recalibration.

3-6.9 **Overlays**

3-6.9.1 **General.** Both rigid and flexible overlays are used. Overlays will be used when an existing non-stabilized aggregate base course can be positively drained. When the overlay includes a non-stabilized aggregate base course layer, the unbound base course must be positively drained (UFC 3-260-02).

3-6.9.2 **Hot Mix Asphalt (HMA) Overlays**

3-6.9.2.1 **Overlay Type.** HMA overlays include flexible (non-stabilized base and HMA wearing course) and all-bituminous concrete pavements. The all-bituminous overlay is the preferred non-rigid type overlay to lessen the danger of entrapped moisture in the overlay (UFC 3-260-02). Because of reflective cracking problems, all-bituminous overlays of jointed concrete pavement are best suited as an interim rehabilitation technique that postpones more comprehensive restoration of a deteriorated pavement (UFC 3-260-02).

3-6.9.2.2 **Reflective Crack Control.** ETL 01-9 includes three procedures to mitigate reflective cracking in all-bituminous overlays of jointed concrete pavements: rubblization, saw-cut joints and seal, or crack/break and seat. These three techniques can be used to control or mitigate reflective cracking. Use of any of the three techniques is generally based upon the condition of the existing pavement and must be approved by USACE-TSC, Air Force MAJCOM, or Navy EFD. If one of the reflective crack control techniques is to be used, it should be included in the specified pavement overlay details.

3-6.9.3 **Rigid Overlays**

3-6.9.3.1 **General.** Continuously reinforced, fibrous, and prestressed concrete overlays will not be permitted unless technically and economically justified and approved by USACE-TSC, Air Force MAJCOM, or Navy EFD (UFC 3-260-02).

3-6.9.3.2 **Bonded Overlay.** A fully bonded overlay is where the rigid overlay and rigid base pavement are bonded and behave monolithically. Bonded overlays will only be used on military airfields to correct surface deficiencies on pavement with C=1.00. They are not suitable for structural upgrades unless the pavement is redesigned assuming no load transfer (UFC 3-260-02).

3-6.9.3.3 **Partially Bonded Overlay.** A partially bonded pavement is a rigid overlay placed directly on the cleaned existing pavement (that has a condition factor of 0.35 or greater) without any special care to achieve a bond. A partially bonded plain jointed rigid pavement can be used to overlay an existing plain jointed rigid pavement. A partially bonded reinforced rigid pavement can be used to overlay an existing plain or reinforced rigid pavement (UFC 3-260-02).

3-6.9.3.4 **Nonbonded Overlay.** A rigid overlay placed on a bond-breaking medium is used when any of the following conditions exist:

- A plain jointed rigid pavement is used to overlay an existing reinforced rigid pavement (UFC 3-260-02).
- The condition factor of the existing pavement is less than 0.35 (UFC 3-260-02).
- Matching the existing joints is impractical (UFC 3-260-02).

3-6.10 Joints And Sealants, Rigid Pavement

3-6.10.1 Joints (UFC 3-260-02)

3-6.10.1.1 **Contraction Joints.** A contraction joint is a weakened plane joint that is provided to control cracking in rigid pavements and to limit curling and warping stresses resulting from drying shrinkage and contraction and from temperature and moisture gradients in rigid pavements.

Longitudinal construction joints are the edges of paving lanes. Transverse construction joints occur at the end of a paving lane concrete pour or at a partial panel replacement.

3-6.10.1.2 **Expansion Joints.** Expansion joints are constructed to allow pavements to expand and contract without damage to adjacent pavements or structures.

3-6.10.1.3 **Slippage Joint.** A slippage joint is an expansion joint at locations where slippage between two adjacent pavements will occur.

3-6.10.1.4 **Special Joints.** See UFC 3-260-02 for a discussion of special joints.

3-6.10.2 Recommended Joint Spacing

3-6.10.2.1 **Transverse Contraction Joint Spacing.** Table 3-4 lists recommended transverse joint spacing (UFC 3-260-02).

Table 3-4
Transverse Joint Spacing

Pavement Thickness Millimeters (Inches)	Joint Spacing Meters (Feet)	
	Army and Air Force	Navy
Less than 230 (9)	3.8 to 4.6 (12.5 to 15)	4.6 (15)
230-305 (9 to 12)	4.6 to 6 (15 to 20)	4.6 (15)
Over 305 (12)	6 (20) max	4.6 to 6 (15 to 20)

NOTE: For Navy pavements, transverse joint spacing cannot vary more than 25 percent of longitudinal joint spacing.

3-6.10.2.2 **Longitudinal Joint Spacing.** (See UFC 3-260-02.) For the Army and Air Force, if the paving lane width exceeds the joint spacing criteria in Table 3-4, a center-sawed contraction joint is required.

The standard panel size for Navy pavements is 3.8 by 4.6 meters (12.5 by 15 feet), with longitudinal joint spacing of 3.8 meters (12.5 feet). For pavements having a thickness greater than 300 millimeters (12 inches), joint spacing can be increased to a maximum of 6.1 meters (20 feet).

3-6.10.2.3 **Expansion Joints.** (See UFC 3-260-02.) Expansion joints should be used in these areas:

- At intersections of pavements with structures.
- At non-perpendicular pavement intersections.
- Between old and new pavements with non-aligned joints.

3-6.10.3 **Load Transfer.** (See UFC 3-260-02.) When properly designed and constructed, most joints provide load transfer from one slab to the adjacent slab. Load transfer efficiency is usually the ratio of deflection of the unloaded side to the deflection of the loaded side of a joint. Most pavement design assumes a load transfer of 25 percent. Different amounts of load transfer can be obtained through the use of aggregate interlock, dowel bars, keyways, a stabilized base, or a combination of approaches.

3-6.10.3.1 **Types of Load Transfer**

- Aggregate Interlock. Partial depth sawing of contraction joints results in the formation of a crack for the unsawed depth that provides aggregate interlock. Undowelled contraction joints rely on aggregate

interlock for load transfer. Aggregate interlock can be improved by the angularity of aggregates and shorter joint spacing.

- Keyway. Keyways have been used extensively to provide load transfer along longitudinal joints. Because of a substantial amount of keyway failure in pavements, keyways cannot be used on Army or Air Force pavements, and only on Navy pavements 225 millimeters (mm) (9 in.) or more in thickness.
- Dowel Bars. Dowel bars are commonly used to provide load transfer across expansion joints, butt construction joints, or contraction joints.
- Thickened Edge. The pavement is thickened along the joint to reduce pavement deflection (and stress) under load so that a load transfer device, such as a dowel bar, across the joint is not needed.
- Stabilized Base. Stabilized bases do not provide load transfer but reduce pavement deflections. The Navy requires a stabilized base on pavements thinner than 225 mm (9 in.) in lieu of load transfer.

3-6.10.3.2 **Load Transfer Criteria**

- Construction Joints. Keyways are not allowed in Army or Air Force pavements, but the Navy allows keyways on pavements thicker than 225 mm (9 in.). Butt joints can be used on Navy pavements less than 225 mm (9 in.) without load transfer on a stabilized base. Butt joints can be used on all thicknesses of pavement with the use of dowel bars. Thickened edge butt joints can be used on all thicknesses of pavement without dowel bars.
- Contraction Joints. Use aggregate interlock, except for the last three joints at runway ends, which must be dowelled. Similar dowel requirements should be included in the transverse contraction joints at the end of other long paved areas, such as taxiways and aprons where local experience indicates excessive joint opening may occur and/or where the paved ends are unconfined. For the Navy, use Number 5 deformed tie bars in longitudinal contraction joints within 4.6 m (5 ft) of a free edge of paved areas greater than 30 m (100 ft) wide.
- Expansion Joints. Use dowels or thickened edge for all expansion joints.
- Thickened Edge. The pavement is thickened along the joint to reduce pavement deflection under load so that a load transfer device across the joint is not needed.

3-6.10.4 **Sealant Types.** Four types of joint sealants are used on military airfields.

- Preformed
- Field formed hot applied

- Field formed cold applied
- Field formed silicone

3-6.10.5 **Sealant Use.** The selection of sealant type is based upon (a) life cycle cost analysis, or (b) user preference because of such considerations as experience with sealants used on other airfield pavements. The Air Force prefers preformed sealants. However, the USACE-TSC, Air Force MAJCOM, or Navy EFD shall select the appropriate sealant to be used for the project and the sealant requirement should be included in the RFP.

3-6.10.5.1 If poured sealant is used, apron sealants should be fuel resistant and sealants in the end 300 m (1000 ft) of runways should be heat and blast resistant.

3-6.10.5.2 Rubber removal operations will damage 200 E Silicone Sealant, which should not be used on runway areas subject to rubber build-up.

3-6.11 Pavement Recycling

3-6.11.1 **Recycling.** The type and extent of recycling shall be determined by the USACE-TSC, Air Force MAJCOM, or Navy EFD with the extent of use, limitations, and requirements stated in the RFP. If reclaimed concrete aggregates are to be used, the evaluation of sulfates and D-cracking is required.

3-6.11.2 Recycling Criteria

3-6.11.2.1 **Rigid Pavement Reclaimed Concrete Aggregate.** Rigid pavement reclaimed concrete aggregate (RCA) can be used for:

- Portland cement econocrete, cement-treated base, and aggregate bases (AFM 88-6, Chapter 6)
- Aggregate for hot-mix asphalt mixtures (UFC 3-250-03)

3-6.11.2.2 **Asphalt Pavement.** Reclaimed asphalt pavement (RAP) is used in three types of recycled pavement (UFC 3-250-03):

- Surface Recycling: Hot or cold in-place recycling of the top 6.35 to 38.1 mm (.25 to 1.5 in.) of pavement. Not used for airfield pavement rehabilitation.
- Cold-Mix Recycling: Mixing RAP with virgin materials in a cold-mix central plant.
- Hot-Mix Recycling: Mixing RAP with virgin materials in a hot-mix central plant.

Hot-mixed RAP can be used for airfield pavement bases and intermediate courses. RAP can be used in HMA for a surface course with prior approval from Air Force MAJCOM, USACE-TCS, or Navy EFD (UFC 3-250-03).

Cold-mixed RAP is not allowed for an airfield pavement base.

3-6.11.3 Pavement Recycling Constraints

3-6.11.3.1 RCA

- RCA that has experienced D-cracking must be crushed to a maximum aggregate size that will pass a ¾- in. sieve (AFM 88-6, Chapter 6).
- Special care must be taken with the use of RCA to eliminate sulfate problems (UFC 3-260-02).
- RCA must meet gradation and durability requirements for the use intended (UFC 3-250-04FA).
- RCA should come from a single source within the project to assure consistency. RCA from structures should not be mixed with RCA from pavement. The use of recycled building debris is not permitted (UFC 3-260-02).

3-6.11.3.2 **RAP.** The use of RAP for surface courses is not recommended by either the Army or the Air Force (UFC 3-250-03). The amount of RAP used in hot-mix asphalt can vary from 10 percent to a maximum of 40 percent (UFC 3-250-03).

3-6.12 Skid Resistance

3-6.12.1 **New Pavements.** Rigid runway pavements should be finished with a burlap (or fabric) drag and be grooved. Army and Air Force asphalt runway pavements should be grooved. Grooving for Navy asphalt pavement will be evaluated on a case-by-case basis. The grooving requirements shall be stated in the RFP. Helicopter runways should not be grooved. See UFC 3-260-02 for information on runway areas to be grooved and grooving details.

3-6.12.2 **Existing Pavements.** Re-texturing or rubber removal can be used to improve the skid resistance of existing pavements. Contact USACE-TSC, Air Force MAJCOM, or Navy EFD for guidance.

3-7 SUBSURFACE DRAINAGE

3-7.1 **Drainage Criteria.** All airfield pavements will be constructed with drainage layers except in the following two conditions:

- Pavements in non-frost areas with a subgrade permeability greater than 6 m (20 ft) per day do not require drainage layers.
- Flexible pavements in non-frost areas with a pavement thickness above the subgrade of 200 mm (8 in.) or less do not require drainage layers.

3-7.2 **Design.** Drainage layers and subsurface drains will be designed to meet the requirements of UFC 3-230-06A.

3-8 SURFACE DRAINAGE

3-8.1 **Design Responsibilities.** The Government shall provide guidance for the design of the storm water collection system by the D-B Contractor in Section 01016, Detailed Technical Requirements, and/or in the Government-furnished design analysis. Guidance by the Government should include:

- The area to be served by the drainage system construction or modification, including the area and probable use of future expansion
- Design storm recurrence
- Areas where ponding is permitted and any limitations
- The type of pipe and joints permitted
- Aircraft loading for inlet design
- Facilities for collection and handling of deicing compound and fuel spills
- Non-point source runoff collection and treatment criteria (if any)

3-8.2 Current Criteria

3-8.2.1 Open channels or natural water courses are permitted only at the airfield periphery, well removed from aircraft traffic areas (UFC 3-230-15FA).

3-8.2.2 Deicing runoff collection facilities should be provided (UFC 3-260-01).

3-8.2.3 Separate drainage and containment should be provided in areas with high potential for fuel spills (TM 5-82001/AFM 88-5).

3-8.2.4 The drainage system should allow for future expansion (UFC 3-230-15FA).

3-8.2.5 The storm frequency for drainage system design is different for each of the three services. This design parameter must be included in the RFP as a basis for Contractor design. Contact USACE-TSC, Air Force MAJCOM, or Navy EFD for the required design storm frequency for each project.

3-8.2.6 Locate storm water detention and retention ponds, if required, away from the airfield to the extent practical (ITG 02-04, *Airfield/Heliports Surface Drainage Design*, 30 September 2002).

3-8.2.7 Conduct a system capacity assessment to assure that the design discharge does not exceed the downstream drainage system capacity.

3-8.2.8 Study contiguous areas that may contribute flow and include any such flow in the design (UFC 3-230-15FA).

3-8.2.9 Temporary ponding on the airfield following the design storm event shall not result in ponding within 75 ft from the edges of airfield pavements (UFC 3-230-15FA).

3-8.2.10 Storm sewers shall be a minimum of 12 in. diameter on Army and Air Force airfields, and a minimum of 15 in. diameter on Navy and Marine projects.

3-9 **AIR NAVAIDS.** This section discusses the function of the various visual and electronic NAVAID components and the appropriate requirements of an RFP for a project that includes NAVAIDS.

3-9.1 **Meteorologic Conditions.** NAVAIDS are installed and operated to provide visual or electronic guidance to pilots during ground movements and aircraft flight operations over a range of meteorologic conditions. The meteorologic conditions and the rules that apply under those conditions are defined in paragraphs 3-9.1.1 through 3-9.1.4.

3-9.1.1 **Visual Meteorological Conditions (VMC):** When visibility and ceiling conditions exceed minimum criteria for visual aircraft operations.

3-9.1.2 **Visual Flight Rules (VFR):** Rules that govern the procedures for conducting flight under visual conditions.

3-9.1.3 **Instrument Meteorological Conditions (IMC):** When visibility and ceiling conditions are below VMC but exceed minimum criteria for instrument operations.

3-9.1.4 **Instrument Flight Rules (IFR):** Rules that govern the procedures for conducting instrument flight.

3-9.2 **NAVAID Types and Purpose.** Electronic NAVAIDS are needed to provide initial positioning and direction information to an aircraft approaching an airport and runway, particularly in IMC conditions. Visual landing aids provide direction to pilots during VMC conditions and also ensure a timely and safe transition from the instrument phase to the visual phase of a landing approach during IMC conditions. In addition, visual NAVAIDS provide information and directions to taxiing aircraft once on the ground.

Pavement marking can be considered a visual NAVAID and is discussed in paragraph 3-12.

3-9.3 **Airfield Operational Categories.** The visual and electronic NAVAIDS required for an airfield are based upon the operational category of the airfield facility.

3-9.3.1 **VMC:** A runway that is equipped only for daytime VFR operations.

3-9.3.2 **Night VMC:** A runway that is equipped for nighttime VFR operations.

3-9.3.3 **Non-Precision Approach:** A runway that has a non-precision IFR procedure for either a circling or straight-in approach. An airfield with non-precision landing capability has operational electronic NAVAIDS to guide the aircraft to the airfield for a VFR landing. A non-precision approach allows landings during lower minimums than for VFR operations but higher minimums than precision approaches.

3-9.3.4 **Precision Approach:** A runway that is equipped for instrument approaches during IMC. Electronic NAVAIDS can be placed in operations that, in conjunction with aircraft on-board equipment, allow runway approaches in the different categories of meteorologic conditions shown in Table 3-5. A precision approach generally requires an ILS or a Precision Approach Radar (PAR).

Table 3-5
Precision Approach Category

Precision Approach Category	Minimum Decision Height Meters (Feet)	Minimum Runway Visual Range Meters (Feet)
Category I	60 (200)	720 (2,400)
Category I – Air Force approach with PAR	30 (100)	360 (1,200)
Category II	30 (100)	360 (1,200)
Category III a	-	210 (700)
Category III b	-	45 (700)
Category III c	-	0

3-9.4 **Visual NAVAIDS.** Visual NAVAIDS consist of lighting, guidance signs, markers, and pavement marking. The principal component of visual NAVAIDS is the airfield lighting system, which is designed to aid pilots during takeoff, landing, and taxi operations. The locations and colors of airfield lighting, as well as pavement markings, are uniform at all civil and military airports to allow pilots to quickly interpret what they see. The design of airfield lighting must provide runway, runway approach, taxi and parking guidance, and obstruction warning lights.

3-9.4.1 **Visual NAVAID Components.** The type and quantity of visual NAVAIDS in a project can vary from zero to a comprehensive visual NAVAID facility. Visual NAVAID components are listed in paragraphs 3-9.4.1.1 through 3-9.4.1.8.

3-9.4.1.1 **Airport Location**

- Airport beacon

3-9.4.1.2 **Wind Indicator**

- Wind cone

3-9.4.1.3 **Runway Delineation**

- Pavement marking
- Runway End Identifier Lights (REIL)
- Approach light system
- Threshold lights
- Runway end lights
- Pavement edge lights
- Touchdown zone lights
- Centerline lights

3-9.4.1.4 **Taxiway Delineation**

- Pavement marking
- Edge lights
- Centerline lights
- Runway exit lights
- Taxiway clearance bars
- Runway guard lights

3-9.4.1.5 **Apron Delineation**

- Apron edge lighting at perimeter taxi lanes
- Apron floodlighting
- Pavement marking

3-9.4.1.6 **Approach Slope Guidance**

- Precision Approach Path Indicator (PAPI)

3-9.4.1.7 **Signage and Markers**

- Mandatory signs
- Taxiway guidance and information signs
- Location signs

- Runway distance remaining markers
- Tactical air navigation (TACAN) checkpoint signs

3-9.4.1.8 **Safety Lighting**

- Obstruction lighting

3-9.4.2 **Visual NAVAID Requirements**

3-9.4.2.1 **Army and Air Force Visual NAVAID Requirements.** Visual NAVAID requirements (excluding pavement marking) for Army and Air Force installations are found in UFC 3-535-01. UFC 3-535-01 summarizes the requirements in the following tables:

- Table 2.1A for the Air Force
- Table 2.1B for the Army
- Table 2.2 for helipads and helicopters

A companion publication, UFC 3-535-2, includes design drawings for visual NAVAIDS.

3-9.4.2.2 **Navy Visual NAVAID Requirements.** The visual NAVAID requirements of the Navy are documented in NAVAIR 51-50AAA-2.

3-9.4.2.3 **Scope of Visual NAVAID Requirement.** The RFP preparer must provide sufficient detail in the RFP (Section 01016, Design-Build Detailed Technical Requirement for Airfield) to establish the scope of the visual NAVAID requirement in the project:

- Describe the location and scope of all NAVAIDS to be installed or rehabilitated.
- Require that all NAVAIDS be installed in conformance with UFC 3-535-01 or NAVAIR 51-50AAA-2.
- Require preliminary plans to be submitted with the first Contractor design submittal showing location, type, lens color, height, and details of visual NAVAIDS.
- Require Contractor design analysis, including a description of, and all calculations for, electrical components, sizes, and quantities.
- Require testing and inspection by the Contractor before Government acceptance in conformance with Chapter 14 of UFC 3-535-01. Require the appropriate DOR or Contractor quality control representative (QCR) to submit certified completed check lists for NAVAID components in the project.

- Require the Contractor to assist in Government flight checks of NAVAIDS before acceptance and operation.

3-9.5 Electronic NAVAID Components

3-9.5.1 **En Route Navigation Equipment.** Paragraphs 3-9.5.1.1 through 3-9.5.1.6 are brief descriptions of the most common en route electronic navigation equipment.

3-9.5.1.1 **VOR.** The VOR, or Very High Frequency Omnidirectional Range, is the primary navigation facility for en route aircraft navigation. The VOR system in the United States consists of a series of ground stations that broadcast directional signals that are used by aircraft to determine bearings to or from the broadcasting stations.

3-9.5.1.2 **Terminal VOR (TVOR).** A TVOR is a VOR located on an airfield that provides terminal guidance for aircraft.

3-9.5.1.3 **Distance Measuring Equipment (DME).** DME transmits a signal that tells the distance an aircraft is from the DME location.

3-9.5.1.4 **Tactical Air Navigation (TACAN).** A TACAN is an en route navigation aid developed by the military that provides both directional and distance information.

3-9.5.1.5 **VORTAC.** A VORTAC is a collocated VOR and TACAN.

3-9.5.1.6 **Non-directional Beacon (NDB).** A non-directional beacon provides guidance to and from the NDB antenna location.

3-9.5.2 **Runway Approach NAVAIDS.** There are two electronic NAVAIDS that can be used for guidance to aircraft during IMC runway approaches.

3-9.5.2.1 **Instrument Landing System (ILS).** An ILS is a system that transmits guidance information to equipment in the approaching aircraft. The ILS consists of three components:

- Localizer. Equipment that indicates if the aircraft is right or left or on the correct lateral alignment for a runway landing.
- Glide Slope. Equipment that indicates the correct angle of descent to the runway.
- Markers. The outer and middle marker signals an aircraft when it crosses over the marker location indicating a certain distance from the runway. An inner marker is also required for Category II landings. A DME can be used in lieu of markers if it is located with the localizer.

3-9.5.2.2 **Precision Approach Radar (PAR).** PAR is an electronic NAVAID that is not dependent on airborne navigation equipment. The PAR provides the air traffic

controller with the lateral alignment and angle of descent of an aircraft on approach to a runway. Landing instructions are given to the pilot by voice communications.

3-9.6 Electronic NAVAID Requirements

3-9.6.1 **Project Scope.** The operational category of the existing runway system will establish the electronic NAVAID requirement. The operational categories of new runways, changes in operational categories, the required NAVAIDS, and the type of NAVAID (i.e., ILS or PAR) will be established by USAC-TSC, Air Force MAJCOM, or Navy EFD.

3-9.6.2 **NAVAID Design and Installation.** Table A17.1 in UFC 3-260-01, Attachment 17, includes a list of design documents governing NAVAIDS and the agency from which siting and design information can be obtained for each type of electronic NAVAID.

3-10 AIRFIELD ELECTRICAL SYSTEMS

3-10.1 **General.** Airfield electrical facilities for visual NAVAIDS are almost universally series circuit with power supplied by constant-current regulators with engine-generator standby power, all housed in airfield lighting vaults.

The power supply for electronic NAVAIDS is alternating current transformed to the appropriate voltage, with standby power supplied by engine-generators and/or batteries. Transformers and controls are housed in equipment shelters.

3-10.2 **Power Source.** Power for NAVAIDS can be supplied by the air base or by commercial utility sources. In addition to the primary power source, all airfield visual NAVAIDS listed as required in UFC 3-535-01 need an emergency back-up power source that is automatically activated in case of a primary power source outage. Older visual NAVAID systems were, and are, based on a 2,400-volt (V) power source. Newer installations generally feed the vault equipment with 480V power, although 240V is sometimes used for small installations.

3-10.3 **Standby Power.** Emergency back-up power is typically provided by an engine-generator (E/G). E/G installations require a separate room or shelter with independent ventilation. Fuel storage capacity for 72 hours of operation is required.

Automatic starting and transfer switching is required with the E/G to be on-line within 15 seconds of a primary power failure except where Category II operations are conducted. During Category II operations, a one-second power transfer is required.

3-10.4 **Constant Current Regulators (CCR)**. Power to airfield series lighting circuits is controlled by CCRs that convert constant voltage regulator input to a constant current output. The CCR output provides either 6.6 or 20.0-ampere current output to power the lighting circuits, with the voltage varying with the number of connected lights.

3-10.5 **Series Circuits.** Most visual NAVAID light systems are installed in constant current series circuits, circuits in which light elements are connected in series with the same current flowing to each light element. The circuit is one continuous loop starting and ending at the power source. Runway and taxiway lighting systems and steady burning approach light systems are on constant current series circuits, which provide more uniform intensity and better brightness control of the lights. Runway and approach lights are installed with five steps of brightness, while taxiway lights, medium intensity runway lights, flashing lights, and Medium Intensity Approach Lighting Systems with Runway Alignment Indicator Lights (MALSR) are installed with three brightness steps. Because of the number of fixtures in runway and taxiway light systems, it is common for multiple circuits to serve a runway and its taxiways. Switching is required to simultaneously operate all circuits on an individual runway or an individual taxiway system.

3-10.5.1 **Runway Circuit Lights.** Lights that are connected to a runway circuit or circuits for simultaneous switching include:

- Edge lights
- Threshold lights
- Runway end lights
- Runway distance markers and arresting gear markers
- Mandatory signs
- Runway exit signs

3-10.5.2 **Taxiway Circuit Lights.** Lights that are connected to a taxiway circuit include:

- Edge, centerline and runway exit lights
- Taxiway hold lights/stop bar, and runway guard lights
- Information signs
- Location signs

3-10.5.3 **Isolation Transformers.** A series constant current circuit requires isolation transformers at each light or group of lights to reduce the high voltage of the series circuit to the low voltage for light operation and to provide a constant current to the light at 6.6 amperes (at high step brightness). The isolation transformer also acts as a bypass to prevent an open condition (caused by a lamp failure) on the primary circuit that would cause the entire series circuit to shut down.

3-10.6 **Circuits Other Than Series Circuits.** Beacon, wind cones, obstruction lights, MALSR, floodlights, sequence flashers, REIL, and electronic NAVAIDS are powered by constant voltage circuits. Devices with lower power requirements are served by 120V circuits. Devices with larger power requirements (or where long distances result in excessive voltage drop) use 480V or higher.

3-10.7 **Controls.** Airfield operational safety requires that air traffic controllers be able to energize, de-energize, change brightness, and switch the various aviation lighting circuits quickly as required by the operational conditions. Older lighting control systems included a primary control panel consisting of switches and relays located in the air traffic control tower (ATCT). A secondary control panel is located in the airfield lighting vault (ALV).

More recent airfield lighting control systems have used programmable logic controllers (PLC) or personal computers (PC) instead of the traditional switch/relay control panel.

These systems may also use coaxial cable, fiber optic cable, or radio telemetry for communicating control signals from the ATCT to the ALV, and status or alarm signals from the vault back to the ATCT.

3-10.8 **Status Monitoring.** Most NAVAIDS require remote status monitoring of NAVAID electrical circuits at the ATCT. The status monitoring system should show on/off status as well as brightness control when applicable. Some NAVAID systems require alarm signals at the ATCT in the event of power failure.

3-10.9 **Summary.** Table 3-6 summarizes the power and control requirements for most NAVAIDS.

Table 3-6

NAVAID Power and Control Systems

NAVAID Component	Typical Power	Standby Power	Brightness Control	Power Status Monitor	ATCT Control	Vault or Shelter Control	Local Control
Runway Edge Lights, H.I.	CCS	R	5 ST	R	R	R	N
Runway Edge Lights, M.I.	CCS	R (16)	3 ST	NR	R	R	N
Runway Threshold Lights, H.I. (2)	CCS	R	5 ST	R	R	R	N
Runway Threshold Lights, M.I.	CCS	R (16)	3 ST	NR	R	R	N
Runway Centerline Lights (3)	CCS	R	5 ST	R	R	R	N
Runway Touchdown Lights	CCS	R	5 ST	R	R	R	N
Taxiway Edge Lights	CCS	R (4)	3 ST	NR	R	R	N
Taxiway Centerline Lights	CCS	R (4)	3 ST	NR	R	R	N
Runway Exit Lights	CCS	R (4)	3 ST	NR	R (5)	R (5)	N
Taxiway Clearance Bars	CCS	R (4)	3 ST	NR	R	R	N
Runway Guard Lights	CCS	R (4)	3 ST	NR	R	R	N
ALSF 1 and SSALR	CCS	R – 15 sec	5 ST	R (1)	R (6)	R	N
ALSF 2 and SSALR	CCS	R – 1 sec	5 ST	R	R (6)	R	N
ALSF 1 and 2 Flashing Lights	480V	R	3 ST	NR	R (7)	R	N

NAVAID Component	Typical Power	Standby Power	Brightness Control	Power Status Monitor	ATCT Control	Vault or Shelter Control	Local Control
SALS	CCS	R-15	5 ST	NR	R	R	N
MALSR	120V/ 240V	NR (8)	3 ST	NR	R	R	N
MALSR Flashing Lights	120V	NR (8)	3 ST	NR	R (7)	R	N
REIL	120V/ 240V	NR	3 ST	NR	R	NR	N
PAPI	(15)	NR (8)	5 ST	NR	(9)	NR	R
Airport Beacon	120V	NR (8)	N	NR	(10)	(10)	R
Lighted Wind Cone	120V/ CCS	NR	N (12)	NR	(11)	NR	N
Apron Floodlights	240V	NR	N	NR	R	NR	N
Obstruction Lights	120V/ CCS	NR (8)	N (13)	NR (14)	(10)	NR	R
ILS Localizer	120/240V	R	N	R	R	R	R
ILS Glide Slope	120/240V	R	N	R	R	R	R
ILS Category I Markers	120V	R	N	NR	R	R	R
ILS Category II and III Markers	120V	R	N	R	R	R	R

NAVAID Component	Typical Power	Standby Power	Brightness Control	Power Status Monitor	ATCT Control	Vault or Shelter Control	Local Control
DME	120/240V	R	N	R	R	R	R
NDB	120/240V	R	N	R	R	R	R

NOTES:

1. When used with runway visual range (RVR) below 730m.
2. When approach lights are installed, half of threshold lights may be circuited with approach lights.
3. Required for Category II and Category III IMC.
4. Standby power required only for taxiways serving precision instrument approaches.
5. Taxiway exit lights controlled separately from taxiway lights except with taxiway centerline lights.
6. Provide a remote selector switch for switching to simplified short approach lighting system with runway alignment indicator lights (SSALR) configuration.
7. Provide an on/off remote control for sequenced flashing lights separate from steady-burn lights.
8. Emergency power is not required, but use it if it is available.
9. Remote control is required, or indirect control is required if powered by runway edge light circuit.
10. Preferably ATCT on/off control. A photoelectric or clock control is acceptable.
11. An on/off control is required. If the runway light circuit is used for power, no separate control is required.
12. If powered by a runway circuit, brightness cannot vary more than 20 percent at lowest runway light brightness.
13. Obstruction lights for day marking to automatically select reduced intensity for night operation.
14. Observe visually. If lighting cannot be readily observed, provide remote monitoring.
15. 120V/240V or constant current series circuit.
16. Standby power for medium intensity lights is required for primary runways

LEGEND:

R	Required	NR	Not Required
CCS	Constant Current Series Circuit	3 ST	Three Step Brightness
N	None	5 ST	Five Step Brightness

3-11 **AIRFIELD LIGHTING VAULTS (ALV).** The main ALV should contain power supply and distribution and control equipment for runway and taxiway light systems and other lighting circuits that can feasibly use the vault. The approach light ALV houses power supply and controls primarily for the approach lights and sequence flashers, but other nearby lighting systems may use the vault as an equipment shelter. Vaults should be of concrete or masonry construction.

3-12 **PAVEMENT MARKING.** There are three types of runway pavement marking: basic (or visual), non-precision instrument, and precision instrument. Runways, taxiways, aprons, and pads all require pavement markings in conformance with the references in paragraph 3-2.8. When a portion of a runway is constructed, or reconstructed, the entire runway should be remarked. This may require rubber removal. The limits of marking and rubber removal should be stated in the RFP.

3-13 **OBSTRUCTION SURVEYS.** The D-B Contractor should be required to submit the results of an obstruction survey for any project involving a new runway, runway extension, or any changes in existing runway imaginary surfaces. Also, surveys and profiles should be submitted for any visual or electronic NAVAID for runway approaches. Surveys and profiles should provide information in conformance with these references:

- Obstruction surveys: UFC 3-260-01, Section 3.15.
- Clear zone profiles: UFC 3-260-01, Section 3.15.
- Light plane profile and light elevations for approach lights: UFC 3-535-01, Chapter 3.
- PAPI – Profile showing the approach path, clearance plane, and controlling obstruction: UFC 3-535-01, Chapter 3.
- ILS glide slope – Profiles showing the glide path, inner slope, outer slope, and obstruction clearance: FAA Order 6750.16C, *Siting Criteria for Instrument Landing Systems*.

The D-B Contractor should submit the results of any obstruction surveys, with obstructions identified, with the first design submittal. The contracting officer will determine the resolution of any obstruction.

3-14 **AIRCRAFT ARRESTING SYSTEMS.** Runway construction, reconstruction, or overlay may require the installation, modification, relocation, or upgrading of aircraft arresting systems. UFC 3-260-01 lists nine different types of arresting systems in use today. The 35E8-series technical orders (operational and maintenance instructions) provide information on each type of system, with installation instructions in Chapter 3. The Government will furnish the main equipment elements for aircraft arresting gear installation or modification.

The RFP preparer should include a narrative description of the required aircraft arresting system work in UFGS Section 01016, Detailed Technical Requirements for Airfield Design-Build, including:

- Type of system
- Work required, including field testing and certification
- List of Government-furnished equipment
- References for the specific system

3-15 DESIGN ANALYSIS

3-15.1 **Government-Furnished Conceptual Design Analysis.** Either Partial or Full Criteria project definition includes facility and pavement designs and details in the RFP drawings and specifications. A Government-prepared conceptual design analysis should also be included in the RFP documents. This preliminary design analysis should include all design parameters for the Contractor to advance the design. Appendix B is an outline for the Government-furnished design analysis that can be used and amended to define the project. Appendix B is a suggested outline and all information included may not be available to the RFP preparer.

3-15.2 **Contractor-Furnished Design Analysis.** The Contractor is required to build upon the Government-furnished design analysis and submit a design analysis with each design submittal. An outline for the suggested Contractor-furnished design analysis is included as an appendix to Section 01018, Design After Award (Appendix K).

3-15.3 **Design Analysis Coordination.** The RFP preparer should coordinate and edit, as appropriate, the Government and Contractor design analyses requirements for each project to assure that a record of all design aspects of the project are included in at least one of the analyses.

3-16 **SUBMITTAL LIST.** Appendix C is a list of D-B Contractor submittals required by Section 00800 and the Division 01 UFGS listed in Figure 1-1, Chapter 1. RFP preparers should review the list of submittals and eliminate any submittals not required for the project by editing Section 0800 and the appropriate UFGS.

CHAPTER 4

RFP SPECIFICATIONS

4-1 **INTRODUCTION.** The UFGS should be edited to show all Government preferences and should be included in the RFP document. It is important that the edited UFGS are detailed enough so that the required construction quality is met and not reduced with cost reduction efforts. Each project will have some variation that results in the use of different UFGS sections.

4-2 **DIVISION 01 SPECIFICATIONS.** Division 01 UFGS that are unique to airfield D-B projects are included in this document as Appendixes I, J, and K, respectively:

- Section 01010, Statement of Work for Airfield Design-Build
- Section 01016, Detailed Technical Requirements for Airfield Design-Build
- Section 01018, Design After Award for Airfield Design-Build

Additional Division 01 specifications can be included in the RFP after editing standard UFGS.

4-3 **DIVISION 02 THROUGH 16 UFGS.** The Division 02 through 16 specifications to be included in an RFP will vary to meet the requirements of each project. These guide specifications provide various design preferences to be selected by the specifier. Some preferences listed as optional in the UFGS are mandatory for some airfield developments. A tabulation of construction preferences to be specified in each UFGS used for airfield construction is included as Appendix D. The RFP preparer should edit the appropriate UFGS in accordance with Appendix D to assure that Government preferences will be included in the project. Include edited UFGS in the RFP.

4-4 **STATE SPECIFICATIONS.** State specifications are not allowed as a basis for material quality or construction practices for most airfield facilities. Only state specifications listed as allowable in the RFP can be used by the D-B Contractor. The RFP preparer may consider the use of a state specification for such items as airfield shoulders, overrun pavements, roadways, and seeding. State specifications whose use is allowed should be listed in the RFP. RFP preparers should list a state specification for use only if there is a history of successful use of the specification at the project location. Consult with USACE-TSC, Air Force MAJCOM, or Navy EFD before using any state specifications.

CHAPTER 5

DRAWINGS

5.1 **GENERAL.** All drawings, both Government- and Contractor-furnished, shall be prepared in an electronic format selected by the project owner. Appendix 01018-B of Section 01018, Design After Award for Airfield Contracts (Appendix K),. is a suggested outline for both Government- and Contractor-prepared drawings. The RFP preparer should edit Appendix 01018-B to meet the requirements of the project.

5.2 **GOVERNMENT-FURNISHED DRAWINGS.** Paragraph 2-5 provides a suggested list of drawings to be included in the RFP. Drawings should be provided in both hard copy and electronic format. The D-B Contractor can then use these drawings to further the design and include in the final documents. Government-prepared drawings should conform to the guidelines in Appendix 01018-B where applicable.

5.3 **CONTRACTOR-FURNISHED DRAWINGS.** The Contractor should be required to develop a complete set of project construction drawings in conformance with the suggested drawing list in Appendix 01018-B. The Contractor will be required to furnish some drawings with the design analysis that will not be included in the construction plans, such as obstruction profiles and drawings needed to support the design development. These design analysis drawings should be in the same size and format as the construction drawings.

CHAPTER 6

DESIGN-CONSTRUCTION TEAM EXPERIENCE

6-1 **INTRODUCTION.** Section 00110 of the RFP, Submission Requirements and Instructions, typically includes a section on construction team experience. D-B contracts should require information to be submitted in the proposal that addresses the experience of the D-B team.

6-2 **REFERENCE.** *Guidance for Firm Fixed-Price Design-Build Construction Contracts*, updated 7/10/02, Chapter 10.

6-3 **EXPERIENCE DOCUMENTATION.** References and information relative to experience should be provided by the RFP offeror for those specific types of design and construction pertinent to the project, such as:

- Airfield pavement
- Airfield lighting and visual NAVAIDS
- Electronic NAVAIDS
- Aircraft fueling system

The specific different types of airfield design/construction for which information is needed should be stated in Section 00110. The forms (Appendixes E, F, G, and H) for the D-B Contractor's experience as well as the experience records of key personnel should also be included in Section 00110.

GLOSSARY

Acronyms and Abbreviations

ACPA—American Concrete Pavers Association
AC—Advisory Circular
AFI—Air Force Instruction
AFH—Air Force Handbook
AFM—Air Force Manual
ALSF—approach lighting system with sequenced flashers
ALV—airfield lighting vault
AOA—air operations area
AR—Army Regulation
ASCC—Air Standardization Coordinating Committee
ATCT—air traffic control tower
CBR—California Bearing Ratio
CCR—constant current regulators
ETL—Engineering Technical Letter
FAA—Federal Aviation Administration
D-B—design-build
DFARS—Defense Federal Acquisition Regulations Supplement
DME—distance measuring equipment
DOR—designer of record
DOD—Department of Defense
EC—Engineering Circular
EFD—Engineering Field Division (Navy)
E/G—engine-generator
FAIR—frost area index of reaction
FASSI—frost area soil support index
FEC—Facility Engineer Command
FOD—foreign object damage
ft—feet
HMA—hot mix asphalt
HQ AFCESA—Headquarters, Air Force Civil Engineer Support Agency
HQ USACE—Headquarters, U.S. Army Corps of Engineers
IES— Illuminating Engineers Society of America
ILS—Instrument Landing System
in.—inches
ITG—Interim Technical Guidance
ICAO—International Civil Aviation Organization
IFR—Instrument Flight Rules
IMC—instrument meteorological conditions
IPRF—Innovative Pavement Research Foundation
LOX—liquid oxygen
LSFP—limited subgrade frost penetration
LZ—landing zone

m—meter(s)
MALSR— Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights
MAJCOM—major command
MIL-HDBK—Military Handbook
mm—millimeters
MPa—megapascals
NATO—North Atlantic Treaty Organization
NAVAID—navigational aid
NAVAIR—Naval Air Systems Command
NAVFAC—Naval Facilities Engineering Command
NAVSEA—Naval Sea Systems Command
NDB—non-directional beacon
NFPA—National Fire Protection Association
NOTAM—Notice to Airmen
O&M—operation and maintenance
PAPI—Precision Approach Path Indicator
PAR—Precision Approach Radar
PC—personal computers
PLC—programmable logic controllers
PSI—pounds per square inch
QCR—quality control representative
RAP—reclaimed asphalt pavement
RCA—reclaimed concrete aggregate
REIL—runway end identifier lights
RFP—Request for Proposal
RSS—reduced subgrade strength
RVR—runway visual range
SALS—short approach lighting system
SFL—sequenced flashing lights
SSALR—simplified short approach lighting system with runway alignment indicator lights
STOL—short take-off and landing
TACAN—Tactical Air Navigation
TI—Technical Instruction
TM—Technical Manual
TVOR—Terminal Very High Frequency Omnidirectional Range
UFC—Unified Facilities Criteria
UFGS—Unified Facilities Guide Specifications
USACE-TSC—USACE Transportation Systems Center
VFR—Visual Flight Rules
VMC—visual meteorological conditions
V—volt
VOR—Very High Frequency Omnidirectional Range
VORTAC—VOR collocated with TACAN
VTOL—vertical take-off and landing

APPENDIX A

REFERENCES

GOVERNMENT PUBLICATIONS:

1. Department of the Air Force

Headquarters, Air Force Center for Environmental Excellence
Technical Directorate
HQ AFCEE/TD
3300 Sidney Brooks
Brooks City-Base TX 78235
Phone: (210) 536-4191
DSN: 240-4191

AFI 32-1024, Standard Facility Requirements
http://www.e-publishing.af.mil/

AFH 32-1084, Facility Requirements Handbook
http://www.e-publishing.af.mil/

35E8-series Technical Orders

Headquarters, Air Force Civil Engineer Support Agency
Engineering Support Directorate
HQ AFCESA/CES
139 Barnes Drive, Suite 1
Tyndall AFB FL 32403-5319
Phone: (850) 283-6263
DSN 523-6263

AFI 32-1042, Standards for Marking Airfields
http://www.e-publishing.af.mil/

AFI 32-1043, Managing, Operating, and Maintaining Aircraft Arresting Systems
http://www.e-publishing.af.mil/

ETL 97-9, Criteria and Guidance for C-17 Contingency and Training Operations on Semi-Prepared Airfields
http://www.afcesa.af.mil/library/index.asp

ETL 01-20, Guidelines for Airfield Frangibility Zones
http://www.afcesa.af.mil/library/index.asp

ETL 04-2, Standard Airfield Pavement Marking Schemes
http://www.afcesa.af.mil/library/index.asp

ETL 04-7, C-130 and C-17 Landing Zone (LZ) Dimensional, Marking, and Lighting Criteria
http://www.afcesa.af.mil/library/index.asp

Headquarters, Air Force Safety Center Plans and Programs Division HQ AFSC/SEP 9700 Avenue G, SE Kirtland AFB, NM 87117-5670 DSN 246-1388	AFMAN 91-201, Explosives Safety Standards http://www.e-publishing.af.mil/

2. Department of the Army

Headquarters Department of the Army Washington, DC	AR 210-20, Master Planning for Army Installations http://www.usapa.army.mil
Headquarters Department of the Army Army Safety Office (DACS-SF) 200 Army Pentagon Washington, DC 20310-0200	AR 385-64, U.S. Army Explosives Safety Program http://www.army.mil/usapa/index.html
Headquarters United States Army Corps of Engineers (USACE) Engineering and Construction Division Directorate of Military Programs Washington, DC 20314-1000	TI 800-03, Technical Requirements for Design-Build, 1 July 1998 http://www.hnd.usace.army.mil/index.asp Guidance for Firm Fixed-Price Design-Build Construction Contracts, updated 5 January 2004 www.hnd.usace.army.mil/chemde/design-buildguidance.aspx TM 5-811-5, Army Aviation Lighting http://www.army.mil/usapa/eng/

3. Department of the Navy

Standardization Documents Order Desk 700 Robbins Avenue, Bldg. 4D Philadelphia, PA 19111-5094	ITG, Skid Resistance Criteria for Airfield Pavements, 24 March 1999 ITG 02-04, Airfield/Heliports Surface Drainage Design, 30 September 2002 http://www.ccb.org/docs/INTCRIT/fy02_04.pdf MIL-HDBK 1005/3, Drainage Systems NAVAIR 51-50AAA-2, General Requirements for Shore Based Airfield Marking and Lighting

NAVFAC P-80.3, Airfield Safety Clearances

NAVSEA OP-5, Ammunition and Explosives Ashore, Safety Regulations for Handling, Storing, Production, Renovation, and Shipping

4. Tri-service Publications

HQ AFCESA/CES
39 Barnes Drive, Suite 1
Tyndall AFB FL 32403-5319
Phone: (850) 283-6263
DSN 523-6263

and

USACE
Engineering and Construction Division
Directorate of Military Programs
Washington, DC 20314-1000

TM 5-809-12/AFM 88-3, Chapter 15, Concrete Floor Slabs on Grade Subjected to Heavy Loads
http://www.e-publishing.af.mil/

TM 5-820-3/AFM 88-5, Chapter 3, Drainage and Erosion Control Structures for Airfields and Heliports
http://www.usace.army.mil/inet/usace-docs/armytm/

FM 5-430-00-2/AFJPAM 32-8013 Volume II, Planning and Design of Roads, Airfields, and Heliports in the Theater of Operations – Airfield and Heliport Design
http://www.army.mil/usapa/doctrine/

TM 5-822-10/AFM 88-6, Chapter 6, Standard Practice for Pavement Recycling
http://www.usace.army.mil/inet/usace-docs/armytm/tm5-822-10/

USACE
Engineering and Construction Division
Directorate of Military Programs
Washington, DC 20314-1000

UFC 3-230-06A, Design: Subsurface Drainage

UFC 3-230-15FA, Design: Surface Drainage Facilities for Airfields and Heliports

UFC 3-250-03, Standard Practice Manual for Flexible Pavements

UFC 3-250-04FA, Standard Practice for Concrete Pavements

UFC 3-250-08FA, Design: Standard Practice for Sealing Cracks and Joints in Rigid and Flexible Pavements

UFC 3-250-09FA, Design: Aggregate Surfaced Roads and Airfields

UFC 3-250-11, Soil Stabilization for Pavements

UFC 3-260-02, Pavement Design for Airfields

UFC 3-260-03, Airfield Pavement Evaluation

UFC 3-260-05FA, Design: Marking of Army Airfield-Heliport Operational and Maintenance Facilities

HQ AFCESA/CES
139 Barnes Drive, Suite 1
Tyndall AFB FL 32403-5319
Phone: (850) 283-6263
DSN 523-6263

UFC 3-260-01, Airfield and Heliport Planning and Design

UFC 3-535-01, Design Standards for Visual Air Navigation Facilities

UFC 3-535-02, Visual Air Navigation Facilities and Design Drawings

Department of the Navy
Standardization Documents Order Desk
700 Robbins Avenue, Bldg. 4D
Philadelphia, PA 19111-5094

UFC 4-133-01N, Design: Air Traffic Control Facilities

UFC 4-141-10N, Design: Aviation Operation and Support Facilities

UFC 4-211-01, Design: Aircraft Maintenance Hangars: Type I and Type II

All UFC available at
http://65.204.17.188//report/doc_ufc.html

UFGS, Divisions 1 through 16 available at
http://www.ccb.org/

5. Federal Aviation Administration (FAA)	AC 150/5300-13, Airport Design AC 150/5320-5B, Airport Drainage AC 150/5320-6D, Airport Pavement Design and Evaluation AC 150/5340-1H, Standards for Airport Markings AC 150/5390-2B, Heliport Design Order 6750.16C, Siting Criteria for Instrument Landing Systems All FAA publications available at http://www.faa.gov/regulations/

NON-GOVERNMENT PUBLICATIONS:

1. American Concrete Pavement Association (ACPA) Washington Office 1010 Massachusetts Avenue, N.W. Suite 200 Washington, DC 20001 Phone: 202-842-1010 Fax: 202-842-2022	IPRF-01-G-002-1 (ACPA JP007P), Best Practices for Airport Portland Cement Concrete Pavement Construction http://www.pavement.com/ or http://www.iprf.org/products/main.html
2. Illuminating Engineering Society of North America (IES) 120 Wall Street, Floor 17 New York, NY 10005 212-248-5000, ext. 112 fax: 212-248-5017/18 email: iesna@iesna.org	IES-RP-14-1987, Recommended Practice for Airport Service Area Lighting
3. National Fire Protection Association (NFPA) 1 Batterymarch Park Quincy, Massachusetts USA 02169-7471 Tel: +1 617 770-3000 Fax: +1 617 770-0700	Standard 415, Standard on Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways http://www.nfpa.org/

APPENDIX B

DESIGN-BUILD AIRFIELD PROJECT
OUTLINE FOR GOVERNMENT-FURNISHED CONCEPTUAL DESIGN ANALYSIS

1. INTRODUCTION

a. Purpose of the Report. To describe the Government-furnished project designs in sufficient detail for review, evaluation, and documentation of the design, and to provide technical information for use by the Contractor to complete Contractor-furnished design.

b. Scope of the Report

1) State the design phase that the report covers.
2) List the topics discussed in report.

c. Project Description

1) Extent of the proposed construction (e.g., new construction; runway extension; apron expansion; overlay; rehabilitation and repair; lighting; drainage, security, and NAVAID improvements)
2) Purpose of the proposed construction or improvements
3) Types and extent of the construction activities (e.g., demolition, excavation and embankment, grading, paving, patching, marking, lighting, electrical, fencing, seeding)

d. Project Authorization (Include copies of authorization letter, directive, or other pertinent items, with dates.)

e. Design Criteria. Reference the key criteria and directives used in the design, with dates. Since criteria are constantly being revised and updated, the key criteria should be documented so that the basis of the design can become a historical record.

1) Correspondence and directives
2) Unified Facility Criteria (UFC)
3) Engineering Technical Letters (ETLs)
4) Technical manuals (TMs and AFMs)
5) Engineering Circulars (ECs)
6) Pavement evaluations/condition surveys
7) Computer programs
8) Other special design criteria

f. Design Traffic. Include the air traffic for which the project is to be designed.

1) Pavement design: Type of design aircraft mix and number of passes
2) Design wheel load for inlet and manhole design
3) Wingspan of critical aircraft for design clearances

2. **SITE DESCRIPTION** (Refer to the RFP drawings.)

a. Location (location map with graphical scale)

1) Existing airfield/heliport facilities (e.g., layout, type)
2) Location of the proposed project with respect to existing facilities, utilities, or improvements
3) Extent of the proposed construction (e.g., size, dimensions)

b. Topography/Drainage of Site

1) Topography (e.g., hilly, rolling, flat, terrace, floodplain)
2) Surface drainage (characteristics and direction)
3) Subsurface drainage (characteristics, groundwater conditions and elevations, including seasonal variations) if available
4) Existing surface and subsurface drainage facilities (e.g., type, location, capacity, condition)

c. Climate (Use National Oceanographic and Atmospheric Administration or the military installation's weather service center for climatological data where available.)

1) Temperatures (especially with reference to frost condition and design air freezing index)
2) Rainfall (particularly with respect to its effect on construction operations)
3) Season variations

d. Vegetation (e.g., wooded, open, brush, cultivated fields)

3. **FIELD INVESTIGATIONS** (if any)

a. Subgrade explorations (type of investigations)

b. Borrow explorations for fill (type of investigations)

c. Evaluations of existing pavements (Describe all evaluations conducted.)

1) Destructive
2) Nondestructive

d. Evaluation of existing aviation lighting and electrical systems

e. Evaluation of electronic NAVAIDS

4. **TESTING** (if any)

a. Laboratory (Describe lab testing conducted.)

b. Field (Describe field testing conducted.)

5. **RESULTS OF ANY INVESTIGATIONS AND TESTING**

a. Material Characterization. Subgrade characteristics (e.g., soil classifications, unit weights, moisture-density relationships, gradations, Atterberg limits, California Bearing Ratio (CBR) and/or modulus of subgrade reaction, permeability)

b. Groundwater and Subsurface Drainage Conditions

c. Frost Conditions (where applicable)

1) Frost susceptibility of materials (based on gradation and frost classification, laboratory freeze tests, heave measurements, observations or ice lens formations in test pits, or other factors)
2) Frost penetration (based on field observations or design air-freezing index and modified Berggren equation)
3) Moisture availability
4) Mean annual temperature
5) Duration of freezing season
6) Number of freezer-thaw cycles

d. Existing Pavement Evaluation/Characterization

e. Adopted Design Parameters (Summarize)

6. **PAVEMENT THICKNESS DESIGN CRITERIA**

Load (Include a copy of the Airfield/Heliport Mission List.)

1) Airfield/heliport/helipad class or type
2) Design aircraft or aircraft mix

3) Pass levels
4) Mission operational weights
5) Traffic areas

7. PAVEMENT THICKNESS DESIGN

a. Flexible Pavement Design (for each pavement feature)

1) Design curves or computer programs used
2) Layers (thicknesses, type, design CBR values)
3) Compaction requirements
4) Proof rolling requirements
5) Bituminous mixture requirements (gradation, stability)
6) Selection of AC grade
7) Tack and prime coat requirements (type, grade)
8) Grooving requirements

b. Rigid Pavement Design (for each pavement feature)

1) Design curves or computer programs used
2) Flexural strength
3) Layers (thicknesses, type, subgrade modulus values)
4) Compaction requirements
5) Joint design (spacing, type)
6) Joint sealant (type)
7) Grooving requirements

c. Overlay Design (for each pavement feature)

1) Type of design (flexible, rigid, bonded, unbonded)
2) Existing paving system characteristics
3) Design curves or computer programs used
4) Overlay layers (e.g., thicknesses, type)
5) Surface preparation requirements

d. Frost Design (for each pavement feature)

1) Design methodology limited subgrade frost penetration (LSFP) or reduced subgrade strength (RSS)
2) Design air-freezing index (for LSFP method)
3) Frost area soil support index (FASSI) or frost area index of reaction (FAIR) value
(for RSS method)
4) Design curves or computer program used
5) Layers (number, thickness, type)

6) Special subgrade, subbase, and base course preparation for frost design

8. **DRAINAGE DESIGN**

a. Location of Fueling Aprons and Required Facilities

b. Location of Deicing Aprons and Required Facilities

c. Drainage Area to be Served

d. Location and Description of Future Airfield Use Within Project Drainage Area

e. Where Temporary Ponding is Permitted (or Prohibited)

f. Aircraft Wheel Load for Inlet/Manhole Design

g. Drainage Areas Contiguous to Project Area that Contribute Storm Flow to Project

9. **VISUAL AIR NAVIGATION FACILITIES**

a. Airfield Lighting Requirements

1) Edge lights (location, type, height)
2) In-pavement lights (location, type)
3) Control and monitoring systems, including type of controllers

b. Approach Light Systems (location, type)

c. Runway End Identifier Lights (REIL)

d. Precision Approach Path Indicator (PAPI). Identify height group of aircraft for design.

e. Constant Current Regulators Identify all lighting and NAVAIDS to be served by new regulators. List the location of new regulators.

f. Cabling and Ductwork. Identify the location, size, and number of spare ducts required in all pavement crossings.

g. Airfield Signs and Marker Requirements. All signs shall be frangible and shall be lighted for nighttime operations.

1) Mandatory signs

2) Taxi guidance signs
3) Informational signs
4) Location signs
5) Runway distance markers
6) Arresting gear markers

10. **ELECTRONIC AIR NAVAIDS**

11. **LIST OF GOVERNMENT-FURNISHED EQUIPMENT**

a. Aircraft Arresting Gear

b. Electronic NAVAIDS

c. Other

12. **LIST OF REQUIRED WAIVERS**

a. Reference the regulation document (title, page, paragraph).

b. State the regulation in violation.

c. State the reason the waiver is required.

APPENDIX C

DESIGN-BUILD AIRFIELD PROJECT SUBMITTALS LIST

Specification Reference	Item Description	Submittal Date
00800 – 1.2	Small Tool Usage Plan	
00800 – 1.9.5	Final Contour Map – On Site Borrow and/or Spoil Areas	Closeout
00800 – 1.9.8 01780-1.2.1	As-Built Drawings	At completion of each definable feature
00800 – 1.9.9 01780 – 1.2.3	Final As-Built Drawings	30 days after transfer of facility
00800 – 1.9.11 01780 – 1.2.4	As-Built Specifications	30 days after transfer of facility
00800 – 1.10	Equipment-in-Place List	At least 30 days prior to completion of any segment
01780 – 1.2.5	Equipment-in-Place List	Draft at time of transfer of facility Final within 30 days after transfer of facility
00800 – 1.10	Maintenance and Parts Data	At least 30 days prior to completion of facility
00800 – 1.12	Request for Utility Interruption	14 days prior to planned interruption
00800 – 1.18 01500 – 1.1.2	ID Information (finger prints) of Employees	As needed
00800 – 1.20.3	Name of Company Authorized to do Warranty Work	At Quality Control Completion Inspection
00800 – 1.20.3 01780 – 1.3.1	Equipment Warranty Tag	Before Final Acceptance
00800 – 1.33	7 day Notice of Soil Treatment	7 days before treatment
00800 – 1.35	Daily Equipment Report	Daily

Specification Reference	Item Description	Submittal Date
01321 – 1.6.3.2 00800 – 1.35	Labor, Equipment, and Material Reports for Extra Work/Cost	Daily as work incurred
00800 – 1.39	Progress Photographs	By 15th of each month taken
00800 – 1.41	Insurance Certificates	Before commencing work
00800 – 1.50	Written Hazard Communication Plan	Include in Accident Plan
00800 – 1.50	Accident Prevention Plan	Not specified
00800 – 1.59 01355 – 1.7	Construction and Demolition Waste Management Plan	30 days after contract award
00800 – 1.73	Pollution Prevention Plan	Prior to construction
00800 – 1.73	Storm Water Pollution Prevention Plan	Prior to construction
01011 – 1.4.4	Phasing Plan	First Design Submittal
01011 – 1.5	Notice of Construction	At least 30 days before construction
01011 – 1.6	NOTAM Information	72 hours before NOTAM is needed
01011 – 1.7	Site Security Plan	First Design Submittal
01011 – 1.7	Design Phase Safety Plan	Pre-Design Conference
01011 – 1.7	Operational Safety Plan	First Design Submittal
01012 – 1.1	60 Percent Design Submittal	Set by Approved Schedule
01012 – 1.1	95 Percent Design Submittal	Set by Approved Schedule
01012 – 1.1	Design Complete Submittal	Set by Approved Schedule

Specification Reference	Item Description	Submittal Date
01012 – 1.2	Designer(s) of Record Designation	10 days prior to Pre-Design Meeting
01012 – 1.3	Design Needs List	Bi-weekly
01012 – 1.4	Design Analysis Update	Each design submittal
01012 – 1.8	Drawings	Each design submittal
01012 – 1.9	Specifications	95 percent submittal
01012 – 1.9.2 01331 – 1.3	Submittal Register	With first design submittal. Submit with QCP and schedule and with each invoice submittal.
01321 – 1.5	Scheduler Qualifications	10 days prior to Pre-Design Meeting
01321 – 1.6.2.3	Activity ID Dictionary	With first schedule submittal
01321 – 1.6.2.4	Activity Code Dictionary	With first schedule submittal
01321 – 1.6.3	Required Tabular Reports • Earned Value Report • Log Report	Include with each schedule submittal
	Optional Tabular Reports • Activity ID Report • Total Float Report • Early Start Report • 30-day Projected Status • Predecessor/Successor Report • Labor Staffing Report and Histogram • Equipment Usage Report and Histogram	Include with each schedule submittal
01321 – 1.7.2	Design Network Analysis Schedule	10 days after Pre-Design

Specification Reference	Item Description	Submittal Date
01321 – 1.7.3	Construction Network Analysis Schedule	First Design Submittal
01321 – 1.7.3	Baseline Network Analysis Schedule • Network Diagrams • Tabular Reports • Cash Flow S-Curve	5 days after Design and Construction Schedule acceptance
01321 – 1.7.6	Monthly Network Analysis Updates • Narrative Report • Tabular Reports • Network Diagrams • Update Meeting Minutes	Monthly Intervals
01321 – 1.7.7	Summary Network Report • Summary Network Diagram • Activity ID Report • Total Float Report • Earned Value Report	6-month interval and after each major schedule change
01321 – 1.7.8	As-Built Schedule	With last schedule update
01321 – 1.8	Contract Modification	If needed
01321 – 1.8.1	Time Impact Analysis	With a proposed contract change
01321 – 1.11	3 week look ahead schedule	Weekly
01321 – 1.12	Weekly coordination meeting minutes	1 day after meeting
01331 – 3.1	Draft DD Form 1354	With final design
01331 – 3.2	Shop Drawings	As needed
01331 – 3.2	Product Data	As needed
01331 – 3.2	Samples	As needed

Specification Reference	Item Description	Submittal Date
01331 – 3.2	Test Reports and Manufacturers Field Reports	As needed
01331 – 3.2	Operation and Maintenance Data	As needed
01355 – 1.7	Environmental Protection Plan • Erosion and Sediment Control Plan (or Storm Water Pollution Prevention Plan) • Traffic Control Plan • Work Area Plan • Spill Control Plan • Non-Hazardous Solid Waste Disposal Plan • Recycling and Solid Waste Minimization Plan • Air Pollution Control Plan • Contaminant Prevention Plan • Waste Water Management Plan • Historical, Archeological, Cultural Resources, Biological Resources and Wetlands Plan • Pesticide Treatment Plan	Prior to Construction
01355 – 1.8	A Report Describing Features Requiring Protection Under Contract Clauses	Prior to Construction
01355 – 3.1	Environmental Permits and Commitments	Prior to Construction
01780 – 1.3.1	Warranty Management Plan	30 days before Pre-Warranty Conference
01780 – 1.6	List of Completed Clean-up Items	Day of Final Inspection
01453 – 3.2	Design Quality Control Plan	10 days after Notice to Proceed

Specification Reference	Item Description	Submittal Date
01453 – 3.2	Quality Control Plan	Within 30 days after Notice to Proceed
01453 – 3.10	Daily Quality Control Report	Within 24 hours of day reported

NOTE: Shop prints, test results, samples, and operation and maintenance (O & M) manuals to be submitted as required by Division 02 through 16 UFGS.

APPENDIX D

UNIFIED FACILITY GUIDE SPECIFICATIONS (UFGS)
DESIGN-BUILD RFP REVISIONS

Each specification section should be edited in accordance with its respective Designer's Notes. Fill in the blanks or choose among alternatives, as indicated. The additional requirements listed below amplify or expand on those Notes for selected sections used in airfield pavement design-build projects. Only the language identified in the Guide Specifications or listed below should be edited.

Para. Ref.	Requirement	Edit
02714 – Drainage Layer		
1.3	Unit Prices	For lump sum payment, delete subparagraphs.
1.4	System Description	Coordinate with user for selection of drainage layer material and use "Tailoring Option" of SpecsIntact editor to select the material.
2.2.2	Gradation Requirements	Select gradation in Table 1, use "Tailoring Option."
2.3	Bituminous Materials	Specify penetration grade asphalt cements for OCONUS projects.
2.4	Cementitious Materials	Specify ASTM C 150, Types I and/or II Portland cement.
02721 – Subbase Courses		
1.2	Unit Prices	For lump sum payment, delete subparagraphs.
2.1.1	Subbase Materials	Do not permit the use of State DOT materials for airfield pavements.
2.1.1	Subbase Materials	Select gradation to match CBR used in pavement design.
3.1	Aggregate Sources	There are no aggregate resources on Government property.
3.7	Compaction	Specify 100 percent for flexible pavements.
3.8	Proof Rolling	Select proof rolling only for the specified conditions; otherwise, delete.
02722 – Aggregate And/Or Graded-Crushed Aggregate Base Course		
1.2	Definitions	Select ABC or GCA through specification to match CBR used in pavement design. See UFC 3-260-02, Chapter 8, for design CBR for each material.
1.3	Unit Prices	For lump sum payment, delete subparagraphs.
2.1	Subbase Materials	Do not permit the use of State DOT materials for airfield pavements.
2.1.1.c	Coarse Aggregate	Delete recycled concrete as a coarse aggregate unless the subgrade is free of sulfates and the concrete is not-Alkali-Silica Reactive.
3.2	Aggregate Sources	There are no aggregate resources on Government property.
3.5.5	Compaction	Specify 100 percent for flexible pavements.
3.5.6	Thickness	Show compacted thickness on drawings.
3.5.7	Proof Rolling	Select proof rolling only for the specified conditions; otherwise, delete.
02748 – Bituminous Tack and Prime Coats		
1.2	Payment	For lump sum payment, delete subparagraphs.
3.6	Field Quality Control	Sample and test all OCONUS-supplied materials per lot delivered.
02749 – Hot-Mix Asphalt (HMA) for Airfields		
1	General	Select "Other Than FAA" from the SpecsIntact Tailoring Option menu.
1.5	Payment	Include unit price from government estimate for lump sum projects.

Para. Ref.	Requirement	Edit
2.1.4	Aggregate Gradation	Select gradation based on lift or layer thickness.
2.2	Asphalt Cement Binder	Specify PG grades for CONUS projects and Penetration Grades for OCONUS projects.
3.11	Acceptance and Payment	Paragraph requires separate test performance and payment for QA testing.
3.11.8.1	Smoothness Requirements	Edit Tables 9 and 10 to retain desired features, delete others.
02753 – Concrete Pavement for Airfields and Other Heavy-Duty Pavements		
1	General	Select among “Tailoring Options” on SpecsIntact menu before editing.
1.4.2.2	Lump Sum Payments	Include unit price from Government estimate for lump sum projects.
1.10	Test Section	Delete reference to keys here and throughout rest of section.
1.12.1.2	Plant Capacity	Minimum capacity shall be 200 cubic meters/hour (250 cubic yards/hour).
1.12.7	Texturing Equipment	Coordinate with user for texturing choice. U.S. Air Force generally prefers fabric drag. Also revise paragraph 3.6.5 to match.
2.2.1.3	Combined Aggregate Gradation	Retain for U.S. Air Force projects world-wide and all OCONUS projects.
2.2.2.4	Deleterious Materials	Select column based on weather conditions. “Negligible” column is for Navy projects only.
2.8.3	Tie Bars	Delete. Tie bars are not used on Tri-Service airfield pavements.
2.10.1	Specified Flexural Strength	Specify flexural strength to match that used in pavement design. Do not exceed 4.5 Mpa (650 psi) at 90-days of age.
3.5.5.1.a	Formed Keyways	Delete. Keyways are not used on Tri-Service airfield pavements.
3.5.6.1	Slipform Paving – General	Delete. Keyways are not used on Tri-Service airfield pavements.
3.5.8	Placing Dowels and Tie Bars	Delete tie bars. Tie bars are not used on Tri-Service airfield pavements.
3.6.5	Texturing	Coordinate with paragraph 1.12.7.
3.8.2	Longitudinal Construction Joints	Delete keys and tie bar language. Use dowels only.
02760 – Field Molded Sealants for Sealing Joints in Rigid Pavements		
1.2	Unit Prices	For lump sum payment, delete subparagraphs.
1.5	Test Requirements	Specify government sampling and testing for all OCONUS-supplied materials per lot delivered.
1.7	Trial Joint Sealant Installation	Add requirement for manufacturer’s representative to be on site for the trail joint sealant installation on OCONUS projects.
2.1	Sealants	Coordinate with user regarding sealant selection.
2.1	Sealants	Do not use silicone sealants (ASTM D5893) on runways or other areas subject to water blasting for rubber removal.
02762A – Compression Joint Seals for Concrete Pavements		
1.4	Test Requirements	Specify government sampling and testing for all OCONUS-supplied materials per lot delivered.
1.6	Trial Joint Seal Installation	Add requirement for manufacturer’s representative to be on site for the trial joint sealant installation on OCONUS projects.

APPENDIX E

AIRFIELD EXPERIENCE
DESIGN FIRM

Provide information about military and civil airfield design projects performed by your company within the last 5 years preceding the proposal due date. Projects should be of similar type and scope as the proposed project. Use a separate sheet for each project.

a. Your Firm's Name _____

b. Name of Project _____

c. Location of Project _____

d. Owner _____

e. Project was on a Civilian or a Military Airfield _____

f. General Scope of Construction Project _____

g. Summary of Your Firm's Role in Design of this Project _____

h. Estimated Construction Cost _____

i. Percent of Effort and Type of Design Work You Subcontracted _____

_____

j. Dates Design: Began _____ Completed _____

k. Your Performance Evaluation by Owner (if Formal Evaluation) _____

l. Owner's Point of Contact (POC) for Reference (Name and Company) _____

_____

m. Telephone Number of POC for Reference _____

APPENDIX F

AIRFIELD EXPERIENCE
CONSTRUCTION FIRM AND SUBCONTRACTORS

Provide information about projects your company constructed within the last 5 years preceding the proposal due date that indicate experience with projects of similar type and scope as the proposed project. List civil and military airfield projects and design-build projects. Use a separate form for the prime contractor and each subcontractor.

a. Your Firm's Name _____

b. Name of Project _____

c. Location of Project _____

d. Owner _____

e. Project was on a Civilian or a Military Airfield _____

f. General Scope of Project _____

g. Your Role (e.g., Prime, Joint Venture, or Subcontractor, and Work Your Company Self-Performed)_____

_____

h. Construction Cost _____

i. Extent and Type of Construction Work You Subcontracted Out _____

_____

j. Dates Construction: Began _____ Ended_____

k. Your Performance Evaluation by Owner (if Formal Evaluation) _____

l. Were You Terminated or Assessed Liquidated Damages? (If either answer is "Yes," Attach Explanation) _____

_____

m. Owner's Point of Contact (POC) for Reference (Name and Company) _____

_____

n. Telephone Number of POC for Reference _____

APPENDIX G

KEY PERSONNEL
DESIGN

For each discipline required for the project, provide information showing the qualifications of the Designer of Record (DOR). Use a separate sheet for each DOR, and use continuation sheets if necessary.

a. Name and Title _____

b. Assignment on this Project _____

c. Name of Your Firm: _____

d. No. of Years: With this Firm _____ With other Firms _____

e. Education: Degree(s)/Year/Specialization _____

f. Active Registration: No. _____ State(s) _____ Year _____

g. Specific Experience and Qualifications Relevant to this Project _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

APPENDIX H

KEY PERSONNEL
CONSTRUCTION

Provide information about the qualifications of the Project Manager, Site Supervisor, Quality Control Manager, Superintendent, and Project Scheduler. Use a separate sheet for each position, and use continuation sheets if necessary.

a. Name and Title_____

b. Assignment on this Project_____

c. Name of Your Firm:_____

d. No. of Years: With this Firm _____ With other Firms _____

e. Education: Degree(s)/Year/Specialization _____

f. Specific Experience and Qualifications Relevant to this Project _____

APPENDIX I

UFGS SECTION 01010
STATEMENT OF WORK

SECTION 01010

STATEMENT OF WORK

1.1 PROJECT DESCRIPTION

The project consists of the design and construction of (Project Description). The project is further defined in the RFP drawings, specifications, and conceptual design analysis.

1.2 LOCATION

The project site location is at (Project Location).

1.3 PROJECT SCHEDULE

The project start date, completion time, and liquidated damages are specified in Section 00800. The project phasings and requirement to maintain aeronautical traffic for the different phases are detailed in Section 01016 Detailed Technical Requirements.

- End of Section -

APPENDIX J

SECTION 01016
DETAILED TECHNICAL REQUIREMENTS FOR AIRFIELD DESIGN-BUILD

SECTION TABLE OF CONTENTS

SECTION 01016

DETAILED TECHNICAL REQUIREMENTS
FOR AIRFIELD DESIGN-BUILD

PART 1 GENERAL

1.1 INTRODUCTION

These RFP documents define the functional requirements of the project. It is the Contractor's responsibility to further develop the design, to prepare a proposal, and to provide a complete and useable facility. The Contractor shall involve the Subcontractors and Designers in the preparation of the proposal.

1.2 RFP TECHNICAL DOCUMENTS

The RFP drawings and specifications should be used as complimentary documents. The requirements are intended to complement one another and should not be viewed as independent requirements that exclude or contradict the design as a whole.

The technical requirements in this RFP are the minimum standards for quality of construction and materials. The drawings and specifications are intended to allow the Contractor to choose from a range of acceptable alternatives. However, deviations will not be allowed from details included in the RFP documents such as pavement dimensions, elevations, paving materials, or pavement layer thicknesses. The Design-Build (D-B) Contractor shall prepare drawings and specifications as required in Section 01012, D-B Design After Award.

1.3 AIRFIELD DATA

1.3.1 Runway Type (Class)

1.4.1 Reference

UFC 3-260-01, Airfield Heliport Planning And Design, Attachment 15.

1.4.2 General Requirements

The following paragraphs describe the work included in each construction phase, with the maximum time limit for completion of the phase.

1.4.3 Drawings

The Contractor-developed drawings shall show all aspects of the construction phasing on the sheets PHASING PLANS AND DETAILS, which shall be included with the first design submittal.

1.4.4 Phasing Plan

The Contractor shall prepare a construction phasing plan meeting all the RFP requirements and additional requirements of Section A15.3 of Attachment 15 in UFC 3-260-01. The Contractor Phasing Plan shall be included in the first design submittal.

The construction schedule developed by the Contractor shall include a minimum of 48 hours between phases to allow the Air Base to adjust traffic operations.

1.5 NOTICE OF CONSTRUCTION

FAA Form 7460-1, NOTICE OF PROPOSED CONSTRUCTION OR ALTERATION (http://www.faa.gov/arp/ace/faaforms.htm) must be submitted to FAA at least 30 days prior to the start of construction. Form 7460-1 will be submitted by the Air Base Manager, but the Contractor must provide all information and prepare the form for submission.

1.6 NOTICE TO AIRMEN (NOTAM)

1.6.1 References

Air Force Joint Manual 11-208, Army Regulation 95-10, OPNAVINST 3721.20b Department of Defense Notice to Airmen (NOTAM) System.

FAA ADVISORY CIRCULAR 150/5200-28, Notices To Airmen (NOTAMS) For Airport Operators.

1.6.2 Issuance of NOTAMS

Only Air Base Management can close, open, or restrict the use of any part of an airfield facility. Any conditions that would prevent, restrict, or present a hazard to arriving or departing aircraft requires public notification. Public notification is accomplished by the Notice to Airmen (NOTAM) system. NOTAMS are submitted to the FAA by the Air Base Management. It is the responsibility of the Contractor to coordinate with the Contracting Officer for the issuance of NOTAMS during construction. The Contractor shall provide the necessary information at least 72 hours before occurrence of the event that requires the NOTAM.

1.7 SECURITY AND OPERATIONAL SAFETY

1.7.1 General

The Contractor shall prepare a security/safety program that includes the preparation and monitoring of site security and operational safety.

1.7.2 Security

The Contractor shall prepare a plan for site security during construction. The plan shall be submitted with the first design submittal. The plan shall include detailed procedures for controlling access to the project site through the use of gate guards, ID badge, entry access lists and/or other measures as required by the Air Base. The Contractor shall become acquainted with all the required security measures of the Air Base during the proposal phase.

1.7.3 Operational Safety

1.7.3.1 References

UFC 3-260-01, Airfield And Heliport Planning And Design, Attachment 15

FAA ADVISORY CIRCULAR 150/5370-2E, Operational Safety On Airports During Construction

1.7.3.2 Pre-Proposal Site Visit

Access to the airfield site and required security clearance during the pre-proposal phase can be detailed in Contract Clauses under PRE-PROPOSAL CONFERENCE AND SITE VISIT. If this information is not included in Contract Clauses, provide details in this section. Information to be included consists of the following:

- **When and where will the Pre-Proposal Conference be held, if any?**
- **Will individual site visits be allowed?**
- **Will a site tour be conducted? If so, at what time?**
- **Will pre-submittal of names and information of conference/tour attendees be required? If so, how many days in advance?**

1.7.3.3 Design Phase Safety

The Contractor shall submit airfield access requirements of design personnel at the Pre-Design Conference. The safety requirements and procedures for design personnel access to the project site will be established at the Pre-Design Conference. It is the Contractor's responsibility to ensure that design personnel are familiar with and follow airfield safety procedures.

1.7.3.4 Operational Safety Plan

The Contractor shall prepare an operational safety plan that addresses the requirements and safety considerations of Sections A15.5 and A15.6 in Attachment 15 of UFC 3-260-01.

The plan shall address operational safety during each project phase and subphase identified in the Phasing Plan. The operational safety plan shall be submitted with the first design submittal.

1.8 EXISTING SITE CONDITIONS

1.8.1 Site Inspection

The Contractor is responsible for making the necessary site visits during the Proposal and Design phases to assess existing conditions and to obtain all detailed information that is required to develop a Proposal and Design.

1.8.2 Surveys

- **State those surveys that are the responsibility of the D-B Contractor and include the Government Criteria for the surveys and reporting of survey results. Also, list or describe any surveys that are Government furnished. The criteria for all surveys should be included as an appendix or edit accordingly.**

1.8.2.1 Contractor-Furnished

The Contractor shall prepare [topographic surveys], [obstruction surveys], [geotechnical surveys], [pavement evaluation surveys]. The results of all surveys shall be included in the Contractor-furnished Design Analysis and be included in the first design submittal. The criteria for all Contractor-furnished surveys are included herein as an appendix.

All site investigations by the Contractor shall be coordinated with the Base Civil Engineer or Department of Public Works. The exact location of any geotechnical excavation, whether by drilling or digging, shall be approved by the appropriate

authorities, be it the local utility or the local utility location service or by a company hired by the geotechnical engineering firm to locate utilities. During the execution of the field investigation work, the Contractor shall be responsible for obtaining necessary permits and complying with applicable laws, codes and regulations, including OSHA regulations. The Contractor shall be responsible for all damages to persons and property, which occur as a result of the Contractor's fault or negligence. The Contractor shall take proper safety precautions to protect the public and the Government from physical hazards and unsafe conditions. Upon completion of field investigations, the Contractor shall return the property to its original condition except as released in writing by the Government.

1.8.2.2 Contractor-Provided Reports

The results of all Contractor surveys, investigations, and evaluations shall be presented to the Government as part of the Contractor-Furnished Airfield/Heliport Design Analysis in conformance with Section 1.7 and Appendix A of Section 01018, Design After Award For Airfield Design-Build.

1.8.2.3 Government-Furnished

The Government will furnish (topographic survey), (geotechnical survey),(pavement evaluation survey). The Government-furnished surveys and reports shall be reviewed by the offeror during the proposal phase for completeness and clarity. If additional information is required, the Contractor shall, at his cost, supplement the Government-furnished data during the design phase and include with the first submittal of the Contractor-furnished Design Analysis.

1.8.3 Existing As-Built Drawing and Specification

The Government will furnish available "as-built" documents pertinent to the facilities involved in the project. Such documents, however, may not show existing conditions correctly. It is the responsibility of the Contractor to verify the accuracy of existing "as-built" documents and obtain all other data as required to assure the complete and proper design and construction of the project.

1.9 UTILITIES

1.9.1 Utility Capacity

If utilities are to be constructed or extended for the project by others and not be part of the D-B construction, the details of such plans shall be included in this paragraph with suitable editing.

Contractors shall verify that adequate capacities for water and power are available outside the project site to support the proposed improvements during the proposal phase. If adequate utilities are not available, the Contractor shall furnish all utilities required for the proposed improvements.

1.9.2 Location of Utilities

The Government will furnish all available information pertaining to all utility lines known to exist at and in the immediate vicinity of the site. The Contractor shall verify by field reconnaissance the actual location of all such utility lines.

1.9.3 Airfield Electrical System

The Government will furnish all available information regarding the underground wiring, conduits and appurtenances of the airfield lighting system as well as visual and electronic navigation aids within the project site. Prior to beginning work on any construction phase, the Contractor shall field locate and mark all subsurface electrical systems within the construction area.

1.9.4 Protection of Utilities

Prior to construction, the Contractor shall notify the Contracting Officer of the Contractor's plans for utility protection. In the event of an unexpected utility interference during construction, the Contractor shall immediately notify the Contracting Officer.

1.9.5 Interruption of Utilities

The Contractor shall notify the Contracting Office and the appropriate Air Base personnel immediately upon the disturbance of any existing utility during construction. Any utility disturbed by the Contractor's operations shall be restored immediately at no cost to the Government. Any interruption of a utility service, including airfield electrical systems, that is necessary for construction must be coordinated and receive prior approval in accordance with Section 00800.

1.9.6 Use of Utilities

See Section 00800-1.12 and Section 1500-1.2 regarding Use of Utilities.

1.10 DEMOLITION

1.10.1 General

Structures and/or pavements shall be demolished at locations and within the limits shown on the RFP drawings or described in the Government-furnished design analysis.

1.10.2 Removal of Bituminous Pavement

Edges of pavement to be matched with new pavement shall be cut full depth of the bituminous layers. The existing surface course shall be cut and removed six (6) inches back from the full depth cut to provide a step joint. Pavements to be removed to a line that will become a permanent pavement edge shall be cut full depth through all bituminous layers. If, due to the Contractor's operations, any surfaces or pavements to remain are damaged, they shall be repaired as directed at no additional cost to the Government.

1.10.3 Removal of Concrete Pavement

Construction methods will be used that will prevent damage to adjacent pavements that are to remain. Pavement removed shall be in accordance with Section 2753, Concrete Pavement for Airfields and Other Heavy Duty Pavements, including double saw-cut around the pavement to be removed.

1.10.4 Disposal of Demolition Debris

Demolition debris should be recycled to the maximum extent practical. All debris that is not recycled shall be disposed of at a site provided by the Contractor off the Air Base. A construction and demolition waste management plan is required in conformance with Section 00800-1.59.

1.11 EARTHWORK AND GRADING

1.11.1 General

Earthwork shall conform to the lines and grades shown on the drawings and as required by UFC 3-260-01, Airfield and Heliport Planning and Design. Scheduling of earthwork and grading shall be in accordance with the Section 1.4, Construction Phasing Plan.

1.11.2 Work in Critical Areas

Earthwork and grading operations on the airfield shall be conducted in conformance with Section 15.6.7, Attachment 15, UFC 3-260-01. The Contractor shall notify the Air Base Management seventy-two (72) hours prior to working in navigation aid critical areas or in areas where cables and facilities serving navigation aids are located.

During preparation of the RFP, the disposal of excess topsoil and excavation should be discussed with the Air Base regarding whether disposal should be on or off the Air Base. Section 1.11.3 should then be edited accordingly.

1.11.3 Disposal of Excess Excavation

[Excess topsoil and excess excavation free from demolition debris shall be stockpiled at a location on the Air Base shown on the drawings or as directed by the Contracting Officer. Excess excavation and topsoil shall be stockpiled separately. Topsoil or excavation containing demolition debris shall be disposed of at a site provided by the Contractor off the Air Base.] [Excess excavation and topsoil shall be disposed of off the Air Base at a location provided by the Contractor.]

1.12 CONTRACTOR HAUL ROUTES

1.12.1 Air Operations Area (AOA) Pavements

Waste and loose material on pavements open to aircraft operations can cause damage to aircraft landing gear, propellers, or engines (foreign object damage [FOD]). If material hauling to and from the construction site occurs across an active airfield pavement, the haul route shall be continuously cleaned by vacuum brooming during hauling operations to keep the pavement clean.

1.12.2 Closed Airfield Pavements (Existing or New)

If hauling occurs over airfield pavements that are temporarily closed, the pavements shall be cleaned as necessary during the hauling operation to prevent pavement damage by hauling traffic over loose rock or debris. The pavements shall be cleaned by the Contractor and inspected by Air Base Management before reopening the pavement to aircraft traffic.

1.12.3 Haul Roads

a. Paved

If the existing Air Base roadway system is used for hauling or access, the Contractor shall maintain the roads under use in a clean condition by power-brooming or other methods to the satisfaction of the Air Base Management.

b. Unpaved

If hauling occurs along a route across earth surfaces, with or without turf, any dust that is generated by the hauling operation shall be mitigated by watering or other approved methods to the satisfaction of the Contracting Officer.

1.12.4 Unsatisfactory Cleaning

If the airfield and roadway cleaning is considered inadequate by the Contracting Officer or Air Base Management, the Contracting Officer may stop construction operations until any cleaning deficiencies are corrected.

1.13 RECYCLING

If there are any limitations on the use of recycled materials, such limitations should be stated in Section 1.13.1.

1.13.1 General

Recycling of demolished pavements and structures should be used to the maximum extent practical.

1.13.2 References

TM 5-822-10/AFM 88-6 Chapter 6, Standard Practice for Pavement Recycling

UFC 3-250-03, Standard Practice Manual for Flexible Pavements

UFC 3-250-04FA, Standard Practice for Concrete Pavements

1.13.3 Reclaimed Concrete Aggregate (RCA)

If a geotechnical report addresses sulfate testing of the soils and groundwater, and if the pavement is known to have experienced D-cracking or alkali silica reaction, this section should be edited accordingly. If this information is not known, require the Contractor to obtain the information and address the issue in the Design Analysis if concrete pavement demolition is in the project.

Existing Portland cement concrete (PCC) pavement may be crushed and reused as material for subbase, aggregate base course, stabilized layers, and bituminous mixtures provided the RCA and the native soils and groundwater meet all of the following requirements.

a. Crushed material must meet specified gradation requirements for the intended use.
b. Crushed material must meet the quality requirements for the intended use. Quality includes meeting specification requirements for sulfate soundness, abrasion loss, flat and/or elongated particles and fractured bases.
c. Subgrade soils must be tested in accordance with CRD-C 403, Method for Determination of Sulfate Ion in Soils and Water, to determine the presence of sulfates. Subgrade soils must

have sulfate concentrations below 0.05 percent (by weight) to allow use of recycled concrete as a project material.

d. Groundwater collected from borings within the project site must be tested in accordance with ASTM D 516, Standard Test Method for Sulfate Ion in Water, to determine the presence of sulfates. Groundwater must have a sulfate concentration below 75 ppm to allow use of recycled concrete as a project material.

e. If pavement to be recycled has experienced D-cracking, the maximum recycled aggregate size must pass a 3/4" sieve.

f. Recycled concrete aggregates proposed for use shall be evaluated and tested by the Contractor for alkali-aggregate reactivity in accordance with ASTM C 1260. Test results shall have a measured expansion equal to or less than 0.08 percent at 16 days after casting. Should the test data indicate an expansion greater than 0.08 percent, the recycled concrete aggregate shall be rejected.

1.13.4 Reclaimed Asphalt Pavement (RAP)

Prior approval is required from USACE-TSC, Air Force MAJCOM, or Navy EFD for the use of Reclaimed Asphalt Pavement in surface course. Delete the term "surface course" unless approval is obtained.

RAP can be used in hot plant-mixed asphalt mixtures for airfield pavement bases and intermediate courses [and surface course]. The maximum allowable content, by weight, of RAP in the asphalt mix is 40 percent. Use of RAP shall conform to UFC 3-250-03.

1.13.5 Uniformity

General: Recycled aggregates used in pavement mixes should be from a single source for consistency. If materials from different pavements and structures are to be recycled, separate quality testing and design mixes are required for each material source. Stockpiles of recycled aggregates from different sources shall be separated.

1.14 AIRFIELD LAYOUT AND DESIGN

The configuration, grades, slopes, imaginary surfaces, and aircraft clearances for airfield facilities shall meet the requirements of the RFP drawings, these specifications, conceptual design analysis, and UFC 3-260-01, Airfield and Heliport Planning and Design.

1.15 AIRFIELD PAVEMENTS

1.15.1 References

Normally DOD criteria will apply to airfield paving projects. Exceptions include projects on joint use airfields and when DOD criteria is nonexistent for

the subject matter. Edit out references to FAA criteria if they are not applicable.

Pavement Design, General

UFC	UFC 3-260-02, Pavement Design for Airfields
UFC	UFC 3-260-03, Airfield Pavement Evaluation
Navy/Marines	MIL-HDBK 1021/2, General Concepts for Airfield Pavement Design
FAA	AC 150/5320-6, Airport Pavement Design and Evaluation

Hangar Pavement Design

Navy/Marines	UFC 4-211-01, Design: Aircraft Maintenance Hangars: Type I and Type II
Army	TM 5-809-12, Concrete Floor Slabs on Grade Subjected to Heavy Loads
Air Force	AFM 88-3, Ch. 15, Concrete Floor Slabs on Grade Subjected to Heavy Loads

NOTE: Hangar floors subject to aircraft wheel loads are to be designed in accordance with UFC 3-260-02 instead of TM 5-809-12 or AFM 88-3, Chapter 15.

Rigid Pavement Design

UFC	UFC 3-250-04FA, Standard Practice for Concrete Pavements
UFC	UFC 3-260-02, Pavement Design for Airfields
FAA	AC 150/5320-6, Airport Pavement Design and Evaluation

Flexible Pavement Design

UFC	UFC 3-250-03, Standard Practice Manual for Flexible Pavements
UFC	UFC 3-260-02, Pavement Design for Airfields
FAA	AC 150/5320-6, Airport Pavement Design and Evaluation

1.15.2 Pavements

Pavement details should be included in the Conceptual Design Analysis and RFP drawings for projects with Full or Partial Criteria. If a project proposal is based upon Nominal Criteria, the thickness and material description of each layer of each pavement type in the project should be specified in this section.

Pavements shall be designed in conformance with the pertinent references listed above. The design parameters, materials, and thicknesses of each layer, joints, and joint sealants shall be as

detailed in the Conceptual Design Analysis and RFP drawings furnished by the Government. The pavement systems detailed in the Conceptual Design Analysis are minimum requirements.

Decreases in pavement thicknesses or materials quality are not allowed.

1.16 SURFACE DRAINAGE

Editing of surface drainage is required.

1.16.2.1) Enter required design storm frequency, 5 or 10 year.
1.16.2.3) Enter the minimum pipe size. A minimum of 12 inch diameter for Army and Air Force. A minimum of 15 inch diameter for the Navy and Marines.
1.16.2,3)g) Enter the storm sewer pipe and joint sealant materials.

1.16.1 References

Air Force	AFM 88-5, Surface Drainage Facilities for Airfields and Heliports
Army	TM 5-820-01, Surface Drainage Facilities for Airfields and Heliports
Navy/Marines	MIL-HDBK 1005/3, Drainage Systems
FAA	AC 150/5320-5, Airport Drainage
NFPA (1)	NFPA Standard 415, Standard on Airport Terminal Buildings, Fueling, Ramp Drainage, and Loading Walkways

1.16.2 Design

The Contractor shall further the design data provided by the Government for construction of a surface storm water collection and conveyance system in accordance with the references listed above and as specified herein. The design and the system shall conform to the following criteria.

1) The storm sewer system shall be designed to convey the [_____] year frequency storm without ponding.

2) Conduct a system capacity assessment to ensure that the design discharge rate does not exceed the downstream drainage system capacity.

3) Temporary ponding is permissible in the airfield turfed areas in accordance with the following:

a) Turfed areas shall be graded as required in Section 1.11, EARTHWORK AND GRADING.

b) Ponding resulting from a 10-year recurrence storm shall not encroach within 75 feet of a paved area.

c) Ponding from a 100-year recurrence storm shall not encroach within 25 feet of a primary runway.

d) If additional storm water dry-bottom detention ponds are required, they shall be located as remote from air operational pavements as practical. Wet-bottom storm water retention ponds are not permitted.

e) The Contractor shall analyze the 10-year and 100-year storm event and determine the ponding volumes, areas and elevations and delineate the 10-year and 100-year ponding areas on a contour plan of the airfield. If the 100-year storm event results in ponding in excess of criteria, storm water detention shall be provided as necessary to meet pending criteria. Detention shall be located away from the airfield to the extent possible.

f) Storm sewers shall be a minimum of [_____] inches diameter.

g) Storm sewer pipe shall be [___] with [____] type of joint sealants.

4) Apron Drainage. Aircraft parking apron shall have an interior system of inlets and storm water drains.

a) Fuel Spill Potential Area

The storm water facilities for an apron that will experience fueling operations shall be designed and constructed in conformance with NFPA Standard 415. Storm sewers shall not have bituminous coatings and sewer joints shall be sealed with fuel resistant, water-tight neoprene or rubber sealants. The storm drain for a fueling apron shall be separate from airfield drainage and convey the flow through a fuel spill containment facility.

b) Deicing Apron

Aprons used for deicing shall have a drain system separate from airfield drainage that will divert the first flush apron drainage to a deicing chemical recycling and/or treatment facility.

c) Aprons shall have a system of interior inlets.

d) Aprons shall be sloped such that the maximum depth of ponding at an inlet shall be 9 inches before sheet flow of storm water off the apron occurs.

5) The drainage design shall include any storm water flow that enters the project site from contiguous areas.

****
Delete this Section if floodlighting is not in the Project Scope. In paragraph 1.17.2 describe the apron or parts of the apron to be lighted.
****

1.17 APRON LIGHTING

1.17.1 References

UFC	UFC 3-535-01, Design Standards for Visual Air Navigation Facilities
Army	TM 5-811-5, Army Aviation Lighting
Navy/Marine	NAVAIR 51-50AAA-2, General Requirements for Shore Based Airfield Marking and Lighting
Navy/Marine	MIL-HDBK 1023/1, Airfield Lighting
IES	IES-RP-14-1987, IES Recommended Practice for Airport Service Area Lighting

1.17.2 General

The Contractor shall provide a lighting system to floodlight the [_____] including design and all fixtures, hardware, poles, power supply, controls, and appurtenances needed to provide a fully functional lighting system.

1.17.3 Illumination

Upon completion, the Contractor shall test the lighting system which shall meet or exceed the following criteria: All areas designated loading zones shall be illuminated to a minimum of 21.52 lux (2 foot-candle) in the horizontal plane, and all other apron areas designated for lighting shall be illuminated to a minimum of 10.6 lux (1 foot-candle) in the horizontal plane. The horizontal plane shall be at the pavement surface. The ratio of maximum to minimum illumination should not exceed 5 in any 20-meter wide strip on the apron, parallel to the apron edge where the lights are located. The Contractor shall provide a point-to-point lighting plan showing that the design meets the minimum illumination requirement in the horizontal plane throughout the apron area to be illuminated.

1.17.4 Poles

The Contractor-furnished drawings shall show:

a. Pole locations with dimensions between poles and the distance from the apron pavement edge.
b. The clearance line required to provide the minimum required wing tip clearance for the critical aircraft taxiing along the near edge of the apron.
c. The elevation of the top of pole and the elevation of the obstruction imaginary surface at the pole location.

d. Design for local wind load requirements. Provide design calculations for review in the first design submittal.

1.17.5 Floodlights

The Contractor shall provide the following:

a. An aiming table with horizontal and vertical aiming angles for each light fixture.

b. A floodlight fixture detail showing horizontal and vertical aiming angles relating to the aiming table.

c. Glare louvers on all lighting fixtures. Submit a ray diagram analysis to assure no glare (direct sight of the fixture lamp) to the Air Traffic Control Tower and to the pilots on approach. The floodlights may require custom louvers to meet this criteria.

1.17.6 Foundations, Poles, and Supports

Floodlight poles, foundations, and luminaires supports shall be designed using dead load, ice load, and wind loading. The loads and design shall meet the requirements of AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, latest edition. Wind loading shall be the Annual Extreme-Mile 30 Feet Above Ground, 50-Year Mean Recurrence Interval determined for the project location. Foundations shall be reinforced concrete.

AASHTO publications can be obtained at:

ASHTO – American Society of State Highway
and Transportation Officials
444 North Capitol Street, N.W., Suite 249
Washington, DC 20001

1.17.7 Floodlight Controls

Floodlight circuiting shall include manual on-off controls at the apron lighting location with remote controls in the Air Traffic Control Tower and at the point of floodlight electric service connection.

1.18 VISUAL NAVIGATION AIDS (NAVAIDS)

1.18.1 General

Visual NAVAIDS consist of airfield lighting, guidance signs, location signs, and markers.

1.18.2 References

UFC	UFC 3-260-01, Airfield and Heliport Planning and Design, Attachment 17
UFC	UFC 3-535-01, Design Standards for Visual Air Navigation Facilities
UFC	UFC 3-535-02, Visual Air Navigation Facilities and Design Drawings
Navy/Marines	NAVAIR 51-50AAA-2, General Requirements for Shore Based Airfield Marking and Lighting
Navy/Marines	MIL-HDBK 1024/1, Aviation Operational and Support Facilities
Army	TM 5-811-5, Army Aviation Lighting

1.18.3 Visual NAVAIDS Requirements

Visual NAVAIDS requirements for Army and Air Force installations are found in UFC 3-535-01 and are summarized in the following tables.

- Table 2.1A for the Air Force
- Table 2.1B for the Army
- Table 2.2 for Helipads and Helicopters

The visual NAVAIDS requirements of the Navy are found in NAVAIR 51-50AAA-2.

The above tables list NAVAIDS that are required for the various airfield facilities. Optional NAVAIDS listed are required only if specified herein.

****

In 1.18.4 include a narrative description of what visual NAVAIDS are required and where they are located, including any optional NAVAID requirements. Include a narrative description of what existing visual NAVAIDS are to be evaluated in 1.18.5.

****

1.18.4 Visual NAVAIDS in Project

The D-B Contractor shall provide visual NAVAIDS for the [____________].

The D-B Contractor shall submit preliminary plans for all visual NAVAIDS with the first design submittal showing location, type, lens color, height, and details.

1.18.5 Evaluation of Existing Systems

The D-B Contractor shall evaluate the existing visual NAVAIDS on [________________]. The condition of existing NAVAIDS, conformance with current criteria, and need for any waivers of requirements shall be included in the Contractor-furnished Design Analysis. The Contracting Officer shall determine the disposition of

deficiencies. The D-B Contractor is not responsible for correcting existing deficiencies unless directed to in these specifications.

1.18.6 Visual NAVAID Controls

The control system shall be [expanded as required] [replaced with a modernized system] [a new system]. Expansion of existing system shall be with components compatible with the existing control systems. Replacement control systems can be either the traditional switch/relay system or Programming Logic Controllers (PLCs). All new control systems shall be based upon PLCs. Control systems shall be in conformance with Figures 12.3 or 12.4 and other requirements of UFC 3-535-01.

1.18.7 NAVAID Lights

All visual NAVAID lights shall be in conformance with the details in UFC 3-535-2. Light fixtures shall be incandescent or quartz. LED lights will not be permitted. Plastic light can bases and plastic bolts are not permitted.

1.18.8 Threshold Lights

Unidirectional green threshold light fixtures shall meet the candela requirements of 10,000 CD minimum average for green light. L-850-E military style 2, unidirectional threshold fixtures manufactured by Siemens Airfield Solutions, Inc., Part No. 44A6248-1x10, will meet the candela requirements.

1.18.9 Obstruction Surveys and Profiles

Obstruction surveys and profiles shall conform to the applicable provisions of UFC 3-535-01 and are required for [ALSF-1], [ALSF-2], [MALSR], and [PAPI]. Results of the obstruction survey and profile plots shall be included with the first submittal of the Contractor-furnished Design Analysis.

1.18.10 Signs and Markers

All mandatory signs and markers will be included for airfield pavements included in the project. Signs and markers consist of:

- Guidance Signs – Informative
- Guidance Signs – Mandatory
- Runway Distance Marker
- Arresting Gear Marker

The required signage varies with runway Operational Category. Required signage is listed in Tables 2.1A and 2.1B of UFC 3-535-01 and in NAVAIR 51-50AAA-2. Arresting Gear Markers (AGM) are required for each end of the arresting gear. There is no standard configuration for signing that applies to all airfields. New

signage must be consistent with an Air Base signage master plan. If a master plan does not exist, the D-B Contractor shall prepare a signage layout in conformance with Section 9.5 of UFC 3-535-01 and submit the layout with the first design submittal. All signage and markers shall be illuminated. Lighted signage and markers may be connected to the appropriate edge light series circuit for both power and control.

1.18.11 Inspection and Testing

a. Checklists and Manuals

At the completion of visual NAVAID installation, the Contractor's Designer of Record (DOR) or Quality Control Representative (QCR) shall submit the completed applicable checklists included in UFC 3-535-01, Chapter 14. The DOR and QCR shall certify that the checklists were completed during an on-site inspection and are correct. The Contractor shall also submit six (6) copies of operation and maintenance (O&M) manuals furnished by the equipment manufacturers for all visual NAVAIDS.

b. Operational Testing

Upon submission of the checklists and O&M manuals, the Contractor shall aim and adjust the equipment as necessary and conduct checkout tests in accordance with the procedures contained in the O&M manuals. The Contractor shall demonstrate, by operational test, that the entire system will operate satisfactorily on remote and local control. The Contractor shall include Air Base personnel during the shakedown testing to exercise and test the system in an operational environment to determine if the system is ready for full operation.

c. Flight Inspection

After the shakedown testing is completed, the Government will schedule and conduct a commissioning flight inspection before accepting, or placing in operation, the ALSF-1, ALSF-2, MALSR, or PAPI. The Contractor shall cooperate and assist the Government during the flight inspection. Any deficiencies found in the visual NAVAIDS system shall be corrected by the Contractor immediately so a re-check can be conducted.

1.19 ELECTRONIC NAVAIDS

1.19.1 General

The Contractor shall provide electronic NAVAIDS consisting of [_____]. The electronic NAVAIDS shall be in conformance with the requirements detailed in the Government-furnished Design Analysis.

1.19.2 NAVAID Equipment

a. Government-Furnished Equipment

The Government will furnish certain components of the electronic NAVAID system. The Government-furnished Design Analysis includes a list of all Government-furnished components for installation by the D-B Contractor.

b. Contractor-Furnished Equipment

The D-B Contractor shall furnish and install all materials and equipment necessary for a complete operable system that are not furnished by the Government.

1.19.3 Inspection and Testing

All electronic NAVAIDS shall be inspected and testing in conformance with Sections 1.18.10.a and 1.18.10.b.

1.19.4 Flight Check

After the shakedown testing is completed, the Government will schedule and conduct a commissioning flight inspection before accepting or placing any electronic NAVAIDS in operation. The Contractor shall cooperate and assist the Government during the flight inspection. The Contactor shall immediately correct any deficiencies found in the electronic NAVAIDS during the flight inspection so a re-check can be conducted. The Contractor shall assist the Government during all flight inspection checks until the project is completed and fully approved by the Federal Aviation Administration (FAA).

1.20 AIRFIELD ELECTRICAL SYSTEMS

1.20.1 Series Circuits

Visual NAVAID power circuits shall be constant current electrical circuits with intensity control of the lighting components unless parallel circuits are specified in UFC 3-535-01. If the connected load requires more than one regulator and circuit, the circuits shall be interleave.

1.20.2 Constant Current Regulators (CCR)

Power supply for a series circuit shall be provided by a CCR that is capable of both local and remote control. The maximum sized CCR shall be 30 KW. If the total connected load for an individual airfield facility (such as a runway) exceeds 30 KW, multiple circuits and CCRs shall be provided. Multiple series circuits supplying power to the lights of an individual airfield facility shall be energized simultaneously and operated at the same brightness step. Load calculations for each CCR in the project

shall be included in the Contractor-Furnished Design Analysis in the format of Table 15.4 in UFC 3-535-01. All CCRs shall be FAA type L-828 or L-829 and be the Ferro-Resonate type.

1.20.3 Cable and Duct System

****
In this section, the RFP preparer should include any Government preferences regarding the electrical duct system, such as duct size, maximum circuits in each duct, and requirements for spare ducts.
****

All underground electrical circuits shall be installed in duct. The Contractor may use existing spare duct if compatible with the proposed improvements. All new underground duct shall be concrete-encased PVC electrical duct in conformance with Table 12.1 in UFC 3-535-01. Power and control circuits shall be in separate duct, 2-inch minimum size. Manholes, handholes, or light bases shall be at a maximum spacing of 400 feet.

1.20.4 Lighting Vault (LV)

1.20.4.1 General

The main airfield LV shall house power distribution and control systems for runway, taxiway, and apron lighting systems and any other visual NAVAID lights that can feasibly use the LV.

The LV improvements shall include [use of the existing LV] [expansion of the existing LV] [an auxiliary LV] [a new LV].

1.20.4.2 LV Expansion, Auxiliary LV, or New LV

All LV construction shall be in conformance with UFC 3-535-01, with a layout similar to Figure 12.2. Vaults shall include the following:

a. Doors for pedestrian traffic and equipment installation.
b. Foundation and structure meeting applicable codes.
c. Walls and ceiling insulated to R-11.
d. Interior building surfaces to be painted a light color.
e. Floor surface to be light-colored vinyl.
f. Florescent lighting.
g. Duplex receptacles at a maximum of 15-foot spacing.
h. All conduit, wireways, and equipment to be surface mounted.
i. Lightning protection.
j. Interior grounding plates.
k. Fan-forced air heater with separate thermostatic control.
l. Exhaust fan system, including intake and exhaust louvers with separate thermostatic control.

1.20.4.3 LV Expansion

Expansion of an existing LV shall be with the same or similar materials to the existing LV construction. All equipment and controls shall be protected from dust during construction. The existing LV being expanded shall, at all times, be provided with a secure structure. The building heating and ventilation and lighting systems shall be expanded as required.

1.20.4.4 Auxiliary LV

An auxiliary LV shall be located in near proximity to the main LV and shall be self-contained, including equipment and controls and control panel.

1.20.4.5 New LV

New LVs shall be located in conformance with the guidelines in UFC 3-535-01.

1.20.5 Interruption of Service

The ATCT and Air Base Management shall be notified at least seventy-two (72) hours before any service interruption to any existing visual navigation systems for the purpose of vault construction or modification to existing circuits. Such work shall be carefully organized to minimize any interruption to existing NAVAIDS. A completion schedule for any NAVAID interruption must be approved before any service interruption.

1.20.6 Hangar Electrical Systems

a. Hazardous Areas

Hangar area, including the bays and all adjoining areas, NOT CUT OFF AND VENTILATED shall be rated Class 1, Division 1, Group D per NEC article 513 from floor level and below. Hangar area, including the bays and all adjoining areas from 18 inches away from the walls and up to the hangar door level, shall be rated Class 1, Division 2, Group D per NEC article 513. Two (2) design solutions for the adjoining area are:

1. Elevate all the adjoining areas 18 inches above the hangar bay floor and provide a ventilation system separate from the hangar bay areas.
2. Provide a vestibule with automatic door closures and a ventilation system separate from the hangar bay areas for each door entering into the bay areas.

b. 400 Hz

Raceways for the 400Hz wiring shall be Rigid Aluminum Conduit where installed above grade and in schedule 80PVC where installed below grade or floor level.

c. Grounding

EXTERIOR STATIC GROUNDING RECEPTABLE. Use Figure A12.12 from UFC 3-260-01. Add the following note to the detail: "A special driver to protect the shepherds hook during installation is available from Thompson Lightning Protection, 800-777-1230, POC Bob Stickler."

1.21 ENVIRONMENTAL

1.21.1 References

EM 200-1-3	Requirements for the Preparation of Sampling and Analysis Plans
ER 1110-1-263	Chemical Data Quality Management for Hazardous, Toxic, Radioactive Waste Remedial Activities

1.21.2 Contaminated Soil

If there are known contaminated soils, the location and extent should be defined in this section and state that removal of the specified soils is included as part of the project.

If contaminated soil is found during construction, it will be handled and disposed of in accordance with all applicable Federal, state and local government laws and regulations. A list of sites to be used for disposal must be submitted to the Contracting Officer. In case of fuel/chemical spills that do damage and/or enter the sewers, the spills must be reported to the Base Fire Department at the following numbers [_____].

Excavation encountering contaminated soil, based on field screening, will not be enlarged to remove contamination beyond the proposed excavation dimensions. The suspect soil left in place at these locations must be sampled for chemical laboratory analysis (BTEX, MTBE and PNAs). A representative soil sample will be taken from the bottom of the excavation where suspected contamination is left in place. For areas encountering apparent contamination for more than 20 linear feet of excavation, a representative sample will be taken from the excavation bottom for every 20 feet. Appropriate decontamination procedures will be performed between each individual sampling episode to prevent cross contamination of the individual samples. Appropriate sample containers and preservation techniques will be used to assure quality chemical data. Appropriate chain-of-custody documentation will accompany laboratory samples. A sampling and analysis plan will be prepared in accordance with EM 200-1-3 that details the proposed sampling procedure. Chemical laboratory analysis will be performed in accordance with ER 1110-1-263. Contaminated locations will be located in the field by a professional surveyor and clearly documented on the as-built drawings so they can be revisited in the future.

Contaminated soils found during excavation of soils must be segregated from clean soil, consolidated, and tested for disposal. All soil suspected of being contaminated will be placed on a minimum of 6-mil plastic (or equivalent), and covered by a minimum of 6-mil plastic. Measures should be taken to prevent any surface runoff from entering the stockpile, or washing away the excavated materials. These measures should include constructing an earthen berm or placing straw bales around the perimeter of the stockpile to prevent contamination of the surrounding surfaces. The Contractor will utilize separate stockpiles for contaminated and clean soil storage. Stockpiles of suspected contaminated materials shall be completely covered with the appropriate plastic at all times and secured accordingly. Parameters and specifications for testing will be dictated by the disposal facility. If contamination is encountered, the [ ] Environmental Division should be contacted immediately.

For estimation purposes, the Contractor is not required to assume any contamination in their base bid proposal. When any suspect contamination is identified, the Contractor shall notify the Contracting Officer immediately.

1.21.3 Asbestos Removal

No asbestos-containing materials are anticipated to be found within the project site. However, in the event other suspect materials are encountered during field activities, the Design/Build Contractor must have the materials sampled and tested for the presence of asbestos before being disturbed.

1.21.4 Spills

Any spill that threatens or enters the sewer system should be reported immediately to the Fire Department. These spills can be categorized in two (2) groups: hazardous chemicals and other materials (e.g., paint, tar). The other materials, as well as the hazardous materials, may have potential negative impact to the environment, as well, specifically to the storm water system. Any type of spill shall be reported to the Fire Department.

1.21.5 Storm Water Pollution Prevention Plan

The Contractor is required to prepare and submit a Storm Water Pollution Prevention Plan sixty (60) days prior to construction. The storm water pollution plan must be prepared and approved by the Contracting Officer. The plan must be submitted to the Contracting Officer representative as required by Contract paragraph 00800-1.73.

Temporary storm water pollution prevention measures provided for the site will meet the requirements of the USACE Handbook for the Preparation of Storm Water Pollution Prevention Plans for Construction Activities. The measures used are as follows:

1. Silt fence
2. Silt fence drop inlet protection
3. Stone construction entrances

The location of the measures shall be in two (2) phases. Phase 1 shall consist of construction of the silt fence, construction entrance, and inlet protection. These items will be in place prior to any clearing and grading operations. Phase 2 will consist of placing additional erosion-control measures to protect new construction in addition to the surrounding environment. These will remain in place until permanent stabilization is achieved.

Permanent storm water pollution prevention measures include seeding and mulching. The Contractor shall also install protective measures to direct surface water away from open excavations exhibiting indications of contamination. These requirements will be specified in Specification Section 02921 of the Technical Specifications.

1.22 AIRCRAFT ARRESTING SYSTEM(S)

1.22.1 General

Provide a narrative description of all Aircraft Arresting System work in the project, including type of system and whether the equipment housing is to be installed above or below ground.

1.22.2 References

The 35E8-series Technical Orders include a separate order for each type of aircraft arresting system. Include the 35E8-series reference number for the type of system required and instructions for obtaining a copy.

UFC 3-260-01, Airfield and Heliport Planning and Design, Chapter 3

AFI 32-1043, Managing, Operating, and Maintaining Aircraft Correcting Systems

1.22.3 Government-Furnished Equipment

The Government will furnish Aircraft Arresting Gear equipment, delivered to the job site, in conformance with the equipment list in the Government-Furnished Design Analysis.

1.22.4 Contractor-Furnished Materials and Equipment

The D-B Contractor shall furnish all materials and equipment necessary for a complete operable system that is not furnished by the Government.

1.22.5 Testing

Before acceptance of the Aircraft Arresting System by the Government, the D-B Contractor shall simulate aircraft engagements and make any adjustments necessary to assure the system is in operable condition.

- End of Section -

APPENDIX K

SECTION 01018
DESIGN AFTER AWARD FOR AIRFIELD DESIGN-BUILD

SECTION TABLE OF CONTENTS

SECTION 01018

DESIGN AFTER AWARD
FOR AIRFIELD DESIGN-BUILD

PART 1 GENERAL

1.1 INTRODUCTION

The Contractor shall schedule the design submittal phases and include that information in the project schedule. Design submittals are required at the preliminary (60 percent), final (95 percent), and design complete (100 percent) stage. The requirements of each design stage are listed herein.

1.2 DESIGNERS OF RECORDS

All design disciplines shall be accounted for by registered Designers of Record (DOR). All DOR shall have current registration to practice in the particular professional field involved in a State or Possession of the United States, in Puerto Rico, or in the District of Columbia. DOR shall be responsible for ensuring integrity of their design and design integration in all construction submittals and extensions to design developed by others, such as the constructor, subcontractors or suppliers. DORs shall review and approve all construction submittals and extensions of design in accordance with the procedures in Section 01330, Submittal Procedures. The DOR shall stamp, sign, and date all final design drawings under their responsible discipline.

1.3 SEQUENCE OF DESIGN-CONSTRUCTION

Fast track construction start is [not] permitted by this contract. (See Section 0800 for restrictions on fast tracking.)

No construction shall begin until the design of such construction has been reviewed and the Government concurs that the design meets the contractual requirements.

1.4 DESIGN SUBMITTALS

1.4.1 Quantity of Design Submittals

The documents that the Contractor shall submit to the Government for each submittal are listed and generally described herein. Unless otherwise indicated, the Contractor shall submit twenty-five (25) copies of each item required at each Review Submittal stage. All drawings for interim review submittals shall be half-size. At the Design Complete Submittal, the Contractor shall submit five (5) complete full-size sets of drawings, five (5) complete half-size sets, and two (2) copies of Computer-Aided Design and Drafting (CADD) files in AutoCADD Release 2000 format, five (5) sets of the specifications and two (2) copies on electronic medium in Microsoft Word.

The Contractor shall submit two (2) complete copies of the design submittals directly to the U.S. Army Corps of Engineers TSMCX. The exterior site work and exterior lighting for airfield pavements and aviation support facilities will all be included in the same submittal to the Government.

1.4.2 Delivery of Design Submittals

****

[After award of the contract, the Government will furnish the Contractor [ ] separate addresses where design submittals shall be delivered.] [The Contractor shall deliver the quantities of items of each submittal to the addresses on the attached Review Distribution list.]

Each delivery shall have a transmittal letter accompanying it indicating the date, design percentage, type of submittal, list of items submitted, transmittal number, and point of contact with telephone number.

1.5 COORDINATION

1.5.1 Pre-Design Meeting

The pre-design meeting shall be on a date mutually agreeable to the Government and Contractor within 21 days after award of the contract, and at the time the completed design schedule is submitted. The Contractor shall also submit the first "design needs" list at the pre-design meeting. The pre-design meeting will be held at the [_____ _____].

1.5.2 Written Records

The Contractor shall prepare a written record of each design site visit, meeting, or conference, either telephonic or personal, and furnish the record within five (5) working days to the Contracting Officer and all parties involved. The written record shall include subject, names of participants, outline of discussion, and recommendation or conclusions. The written records shall be numbered in consecutive order.

1.5.3 Design Needs List

Throughout the life of this contract, the Contractor shall furnish the Contracting Officer a bi-weekly "needs" list for design-related items. This list shall itemize design data required by the Contractor to advance the design in a timely manner. Each list shall include a sequence number, description of action item, name of the individual or agency responsible for satisfying the action item, and remarks. Once a request for information is initiated, that item shall remain on the

list until the requested information has been furnished or otherwise resolved.

1.6 GOVERNMENT REVIEW COMMENTS

After satisfactory submittal receipt, the Government will be allowed twenty-one (21) days to review and comment on the preliminary (60 percent) design submittal, and twenty-one (21) days to review and comment on the final (95 percent) design submittal, except as noted below. For each design review submittal, Government comments from the various design sections and from other concerned agencies involved in the review process will be made in DrChecks.

The review will be for conformance with the contract. The Contractor shall respond to all comments in DrChecks in advance of the next scheduled submittal. The response shall identify action taken with citation of location (drawing number or specification paragraph) within the relevant document. Generalized statements of intention such as "will comply" or "will revise the specification" are not acceptable.

If the Contractor disagrees technically with any comment and does not intend to comply with the comment, the Contractor must clearly outline, with ample justification, the reasons for non-compliance within five (5) days after close of the review period in order that the comment can be resolved. If the Contractor believes the action required by any comment exceeds the requirements of this contract, he should "flag" the comment within DrChecks as being outside the design scope. Further, the Contractor shall notify the Government in writing immediately.

Review conferences will be held for each design submittal at [__]. The Contractor shall bring the personnel that developed the design submittal to the review conference. These conferences will take place the week after review completion of each submittal, with a minimum of two (2) design review conferences occurring at the Air Base. A review conference will occur after the 60 percent and the 95 percent design submittals.

During the design review process, comments will be made on the design submittals that will change the drawings and specifications. The Government will pay no additional compensation to the Contractor for the incorporation of comments. Review comments are considered part of the design-build process.

1.7 DESIGN ANALYSIS

1.7.1 Media and Format

Present the design analysis on 8.5-inch by 11-inch paper except that larger sheets may be used when required for graphs or other special calculation forms. All sheets shall be in reproducible form. The material may be typewritten, hand lettered, handwritten, or a combination thereof, provided it is legible. Side margins shall be 1-

inch minimum to permit side binding and head-to-head printing. Bottom margins shall be 1.25 inches, with page numbers centered 1 inch from the bottom.

1.7.2 Design Analysis Preparation

The Government will furnish the conceptual design analysis which, together with the RFP drawings and specifications, define the project. The Contractor shall supplement the furnished conceptual design analysis with additional design data for each review submittal. Appendix 01018-A of this Section is a general outline to be used as a guide by the Contractor for design analysis updates. The outline should be expanded as required to provide a complete record of the design process. The complete design analysis presented for final review with the final drawings and specifications shall carry the designation "FINAL DESIGN ANALYSIS" on the title page.

1.7.3 Design Calculations

Design calculations are a part of the design analysis. When they are voluminous, bind them separately from the narrative part of the design analysis. Present the design calculations in a clean and legible form, incorporating a title page and index for each volume. Provide each page with a number centered one (1) inch from the bottom. Furnish a table of contents, which shall be an index of the indices, when there is more than one volume. Identify the source of loading conditions, supplementary sketches, graphs, formulas, and references. Explain all assumptions and conclusions. Calculation sheets shall carry the names or initials of the designer and the checker and the dates of calculations and checking. No portion of the calculations shall be computed and checked by the same person.

1.7.4 Computerized Design Analysis

The design analysis shall include descriptions of the computer programs used and copies of the input data and output summaries. When the computer output is large, it may be divided into volumes at logical division points. Precede each set of computer printouts by an index and by a description of the computation performed. If several sets of computations are submitted, a general table of contents in addition to the individual indices shall accompany them. The description that must accompany each set of printouts shall include the following:

Explain the design method, including assumptions, theories, and formulas.

Include applicable diagrams, adequately identified.

State exactly (specific equations and formulas) the computation performed by the computer.

Provide all necessary explanations of the computer printout format, symbols, and abbreviations.

Use adequate and consistent notation.

Provide sufficient information to permit manual checks of the results. Also, include one example manual check of the results for this project.

1.7.5 Pavement Design

Pavements shall be designed using the PCASE pavement design program that can be obtained electronically on the World Wide Web (WWW) at http://pcase.com.

1.8 DRAWINGS

1.8.1 General

Appendix 01018-B is a general outline of drawings to be furnished by the Contractor. The drawings shall expand and supplement the RFP drawings provided by the Government. The RFP drawings will be provided both in hard copy and CADD files in AutoCADD Release 2000 format.

1.8.2 Drawing Preparation

Prepare all drawings using CADD so that they are well-arranged and present complete information. The Contractor shall prepare the drawings with such clarity that the Corps of Engineers could construct the facility without any additional assistance from the Contractor. Drawings shall be complete. Unnecessary work such as duplicate views, notes and lettering, and repetition of details shall not be permitted. Do not show standard details not applicable to the project, and minimize unnecessary space. Detail the drawings such that conformance with the contract can be checked and to the extent that shop drawings can be checked. The Contractor shall use standard Corps of Engineers title blocks and borders on all drawings. An index of drawings shall be included with each submittal. The Government will furnish the Contractor drawing numbers for inclusion in the title blocks of the drawings.

All CADD drawings shall be prepared in accordance with the applicable provisions of the "CENABEN Contract Clauses for CADD Deliverables," which are available at http://www.en.nab.usace.army.mil or by request on CD ROM.

1.9 SPECIFICATIONS AND SUBMITTAL REGISTER

1.9.1 Specifications

The design shall be developed using Unified Facilities Guide Specifications (UFGS) and SPECSINTACT software. Both the UFGS and SPECSINTACT are available free of charge for downloading from http://www.ccb.org/ufgs/ufgs.htm. Where UFGS do not include a specification for a particular feature of work, a Federal Aviation

Administration specification may be substituted. If neither a USGS nor FAA specification is available for a particular feature of work, the Contractor may use specifications from other agencies or sources, or provide custom-written specifications. Such specifications only may use another software program than SPECSINTACT. The specifications for this project shall be edited and submitted in hand marked-up or graphic highlighted (via word processor or specification software) draft version at the Final (60 percent) Review submittal stage.

UFGS shall be edited only as directed in the specification notes and instructions, where choice options allow, and where features of work are added or deleted. A minimum quality standard for the project shall be maintained by only selecting among the choices for quantity and quality that are presented in the applicable UFGS, unless specifically indicated otherwise in Section 1016, Detailed Technical Requirements.

Manufacturer's catalog cut sheets will not be accepted as a substitute for the "products" portion of the specifications, nor any other part. Catalog cut sheets may be added to the specifications, but not as a substitute.

Include with Contractor-prepared specifications all Sections from the RFP (furnished by the Government in SPECSINTACT "sec" files) and specification attachments (furnished by the Government in portable document format and readable with Adobe Acrobat).

Project specifications shall be furnished in CSI, 40 Division, 3 Part Section Format. Each specification volume shall include a cover page and table of contents and be printed on 20-lb. white paper. Specifications will also be provided in electronic format.

The cover page shall include:

a. Project title, activity and location
b. Construction contract number
c. Construction Contractor's name and address
d. Design firm's name and address
e. Names of design team members responsible for each Contractor-prepared technical discipline of the project specification
f. Name and signature of a Principal of the design firm
g. Line for the designated Government representative to sign and date for the Government

1.9.2 Submittal Register

The Contractor shall develop the submittal requirements during the design phase of the contract, by producing a Constructor Submittal Register in accordance with Section 01330, Submittal Procedures. Proper tagging of SPECSINTACT-prepared specifications allows this form to be generated at printing. If custom-written specifications are developed that are not in SPECSINTACT, the register for those sections must match the SPECSINTACT-generated form in format and columns (quantities and designations). The Contractor shall be responsible for listing all required construction submittals necessary to ensure that the project requirements are complied with. The Register shall identify submittal items such as shop drawings, manufacturer's literature, certificates of compliance, material samples, guarantees, and test results that the Contractor shall submit for review. (NOTE: Approval of design-build submittals is the role of the design-builder's Designer of Record. The Government will normally only review for conformance to the contract, consisting of the RFP design criteria and the accepted proposal.) The DOR shall edit the submittal register and specifications to designate which submittals are for DOR Approval or for DOR Information and indicate that submittals are for Government Information or Approval (where GA is designated for Government).

During construction, the Contractor will be required to run the submittal register program in the Resident Management System (RMS). SPECSINTACT allows downloading of a submittal register program that is compatible with the RMS. However, for construction purposes the Contractor will be required to add all submittals from non-SPECSINTACT-prepared specifications into RMS manually. The Contracting Officer can provide advice regarding this process if it is requested.

APPENDIX 01018-A

DESIGN-BUILD AIRFIELD PROJECT
OUTLINE FOR CONTRACTOR-FURNISHED AIRFIELD/HELIPORT DESIGN ANALYSIS

1. INTRODUCTION

Scope of Report

1) State the design phase that the report covers.
2) List topics discussed in report.

2. LIST OF REQUIRED WAIVERS

a. Reference the regulation document (title, page, paragraph).

b. State the regulation in violation.

c. State the reason the waiver is required.

3. FIELD INVESTIGATIONS (Supplement Government-furnished data as required.)

a. Subgrade explorations (type of investigations, number, locations, depth, samples obtained)

b. Borrow explorations for fill (type of investigations, number, locations, depth, samples obtained)

c. Evaluations of Existing Pavements (Describe all evaluations conducted to supplement Government-furnished information.)

1) Destructive
2) Nondestructive

d. Testing

1) Laboratory (Describe lab testing conducted.)
2) Field (Describe field testing conducted.)

4. PAVEMENT THICKNESS DESIGN

The Contractor designer shall validate the pavement thickness design for each pavement feature.

5. PAVEMENT CONSTRUCTION MATERIALS

a. General. The Contractor shall provide details regarding the source and manufacturer of aggregate and paving materials in addition to the following information.

b. Rigid Pavement

1) Coarse aggregate (type, gradation, deleterious limits, wear, particle shape)
2) Fine aggregate (type, gradation, deleterious limits)
3) Cement (type)
4) Fly ash (class)
5) Admixtures (type)
6) Curing compound (type)
7) Dowels (size, type).
8) Reinforcing (size, type)
9) Joint filler
10) Joint seals (type)

c. Flexible Pavement

1) Aggregates (type, gradation, percent fractured faces, wear)
2) Mineral filler
3) Asphalt cement (grade)
4) Prime coat material (type, grade)
5) Tack coat material (type, grade)

d. Base Courses

1) Graded crushed-aggregate base course (gradation, percent fractured faces, wear)
2) Rapid draining base course (RDM or OGM gradation, percent fractured faces, wear)
3) Separation layer (gradation, design CBR-value)
4) Subbase course (gradation, design CBR-value)

e. Borrow Material

6. DRAINAGE DESIGN

a. Hydrology

b. Surface Drainage (including drainage plans and profiles)

c. Subsurface Drainage

7. DRAINAGE CONSTRUCTION MATERIALS

a. Surface and Subsurface Drainage System

1) Pipe (size, type)
2) Structure construction
3) Bedding material
4) Filter material
5) Manhole construction

8. PAVEMENT MARKING MATERIALS

9. PROPOSED GRADES

   a. Longitudinal (for each pavement feature)

   b. Transverse (for each pavement feature)

10. RECYCLING

   a. List any proposed use of recycled materials.

   b. List percentage of recycled materials in any pavement mix.

11. ELECTRICAL SYSTEMS

   a. Constant Current Series Circuits

      Calculations for each circuit showing total connected load and regulator sizes (see Table 15.4, UFC 3-535-01)

   b. Calculations for all transformer sizing (excluding light isolation transformers)

   c. Calculations for conductor sizing

12. APPLICABLE SIGNAGE

   a. Air Base signage master plan, if available

   b. Signage layout for project-location, message and color

13. APPLICABLE OBSTRUCTION SURVEYS, PROFILES

   a. Light Plane Profiles for ALSF-1, ALSF-2, MALSR

   b. PAPI Clearance Plane and Approach Plane

   c. Clear Zone Obstruction Profiles

   d. Part 77 Obstruction Surveys

APPENDIX 01018-B

RECOMMENDED OUTLINE
CONTRACTOR-FURNISHED DRAWINGS
(Adapted from UFC 3-260-02, Appendix C)

The list of drawings that follows should be used as a guide. All drawings may not be needed. Include drawings only for the components included in the project. Some subjects may require multiple sheets.

1. TITLE SHEET

   a. Project Title
   b. Location
   c. Year
   d. Volume Number

2. INDEX SHEET

   a. Listing of Sheet Names
   b. Assigned Sheet Numbers (in sequential order)

3. COMBINED TITLE/INDEX SHEETS. SHEETS 1 AND 2 MAY BE COMBINED.

4. LEGEND

   a. Civil
   b. Electrical
   c. Mechanical
   d. Architectural

5. LOCATION/SITE PLAN

   a. Base Map with State (Vicinity) Map
   b. Project Location
   c. Contractor Access Routes
   d. Location of Base Gates and Any Restrictions
   e. Borrow/Waste Areas
   f. Batch Plant Area
   g. Contractor’s Staging and/or Storage Area
   h. Utility Hookup Locations
   i. General or Special Notes
   j. Concurrent Construction (Not in Contract)

6. Imaginary Surfaces on Existing Airfield Layout

   a. Airspace Imaginary Surfaces Conforming to UFC 3-260-01
   b. Location and Dimensions of Navigation Aid Critical Areas impacted by Construction

7. PHASING PLAN AND DETAILS (INCLUDE REQUIREMENTS OF UFC 3-260-01 SECTIONS 15.3 AND 15.4.)

a. Location and Sequencing of Work Areas
b. Scheduling for Each Phase of Project
c. General Listing of Tasks to be Performed Under Each Phase
d. Concurrent Construction That May Affect Each Phase
e. Location and Type of Area Control (Security) Measures
    1) Temporary Barricades and Fencing
    2) Temporary Lighting
    3) Temporary Pavement Markings (Closure Markings)
f. Traffic Circulation (Aircraft and Vehicular)
g. Special Notes
    1) Security Measures
    2) Contractor's Housekeeping Measures
    3) Controls on Contractor's Traffic

8. HORIZONTAL AND VERTICAL CONTROLS

a. Layout
b. Bench Marks (USGS Datum) With Only One Master Bench Mark
c. Control Stationing
d. Horizontal Control (Coordinates)

9. GEOMETRIC LAYOUT PLAN (OPTIONAL)

a. Curve Data
b. Control Stationing
c. Geometric Layout

10. BORING LOCATION PLAN AND BORING LOG DATA

11. PAVEMENT REMOVAL PLAN

a. Pavement Removal Limits (e.g., Dimensions, Stationing)
b. Type and Thickness of Pavement Removed
c. Utilities and Structures Affected by the Removal
    1) Manholes
    2) Aircraft Arresting System
    3) Blast Deflectors
    4) Runway/Taxiway Lighting
    5) Communication Cables
    6) Water/Sewer Lines
    7) In-Ground Aircraft Support Systems
d. Special Notes Regarding Removals
e. Location of Removal Sections

12. REMOVAL SECTIONS AND DETAILS

Sections should be specific, not general or typical. Show several sections. Show new sections for changes in pavement type, thickness, or any other condition that has an impact on pavement construction. Sections should be complete both laterally and vertically for the entire pavement structure, including subgrade preparation.

a. Removal Limits (Lateral Dimensions, Depth)
b. Show Make-Up of the Existing Pavement
    1) Pavement Type and Thickness
    2) Joint Type (e.g., Doweled, Tied, Contraction)
    3) Existing Reinforcing (if any)
c. Special Notes
    1) Equipment Type/Size
    2) Procedures
    3) Housekeeping
    4) Other

13. EXISTING UTILITIES PLAN

a. Show Existing Utility Locations and Type
b. Show Pavement Penetrations

14. PAVING PLAN

a. Thickness
b. Type
c. Location
d. Location of Section Cuts
e. Stationing
f. Dimensions

15. PAVING SECTIONS

Make the sections specific. Do not overuse "Typical Sections." Cut a section wherever there is a change from one pavement section to another in any direction and on all pavement edges. The same section may be referenced numerous places on the plan sheets, but each location must be marked and properly annotated. Remember, only by including everything in the plans can the design be built as envisioned. One hour spent by the designer will save several hours work by the field engineer.

a. Include the entire paving section from surface through subgrade.
    1) Thickness of Surface
    2) Prime Coat Requirements
    3) Thickness of Bases and Subbases
    4) Thickness of Drainage Layer
    5) Depth and Type of Subgrade Preparation
b. Jointing Locations and Type
c. Surface Grades/Slope
d. Subsurface Drainage/Subdrain Provisions

16. PLAN AND PROFILE SHEETS

a. Plan
    1) Outline of Pavement
    2) Utilities
    3) Stationing
    4) Geometrics

b. Profile
   1) Stationing
   2) Elevations (New and Existing)
   3) Vertical Curve Data
   4) Utility Depth and Location

17. GRADING AND DRAINAGE PLANS

a. Contours (New and Existing)
b. Surface and Subsurface Drainage System Layouts, Structure Locations, Types, and Sizes
c. Ditch Alignment

18. GRADING SECTIONS

a. Cut/Fill Requirements
b. Topsoil Requirements

19. PAVEMENT SURFACE ELEVATIONS

a. Spot Elevation Plan (Joint Intersections or Grid Pattern)
b. Spot Elevation Schedule

20. PAVEMENT JOINTING PLANS

a. Legend with Joint Types
b. Joint Location

21. PAVEMENT JOINT AND JOINT SEALANT DETAILS

22. REINFORCING DETAILS

a. Dowels
b. Reinforcement
c. Tie Bars
d. Complete Pavement Joint Details

23. SURFACE AND SUBSURFACE DRAINAGE SYSTEMS

a. Profiles
b. Schedules
c. Details

24. AIRFIELD REPAIR PLAN AND DETAILS

25. PAVEMENT MARKING

a. Plan
b. Details

26. AIRCRAFT MOORING AND GROUNDING POINTS

a. Plan

b. Details

27. GROOVING PLAN AND DETAILS

28. VISUAL NAVAIDS

a. Plan
b. Schedule
c. Details

29. AIRFIELD LIGHTING VAULT

a. Plan showing locations of constant current regulators, airfield lighting, control systems, diesel-engine generator set
b. Elevations showing regulators, generator set, switch gear panels and wireways
c. Details and wiring diagrams

30. APPROACH LIGHT SYSTEMS

a. Plan
b. Elevation showing light plane clearances over roads, railroads, fences and any other potential line of sight obstructions
c. Details and wiring diagrams

31. APRON FLOOD LIGHTS

a. Location plan of lights with aiming data
b. Plan with point-by-point light intensities showing compliances with minimum light intensity requirements
c. Details and wiring diagrams

32. MECHANICAL (FUEL)

a. Plans
b. Profiles
c. Schedules
d. Details

- End of Section -