FAA ATO

June 2016

Terminal Facilities Standard Designs
A/E Project Manual

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Record of Changes

Change Number	Page/Paragraph Location	Description	Approved By	Date
1	Before Table of Contents (page iii)	Added Record of Changes to record HPSB updates		
2		Updated references	ZME	8/15/16
3		Added Dusty Shirley comments	ZME	7/19/19

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1.0 A/E Firm Project Manual

1.1 Introduction

The Federal Aviation Administration (FAA), Air Traffic Organization (ATO) Terminal Facilities Headquarters, has developed a standardized package to streamline the construction of terminal facilities. The goal of this program is twofold:

A. To reduce the life-cycle costs of terminal facilities.

B. To simplify the design and construction of Airport Traffic Control Towers (ATCTs), Terminal Radar Approach Control Facilities (TRACONs), and associated Base Buildings.

This package will provide for similar layouts, a consistent image for new ATCTs, TRACONs, and Base Buildings, and establish a system for analyzing facility costs. It will also provide for consistent adherence to national standards and establish a corporate identity for Terminal Facilities. The Terminal Facilities Standard Designs Package consists of the following:

A. A/E Project Manual

B. Standard Floor Plan Drawings

C. Master Specification

D. Design Guidelines

E. Drafting Guidelines

F. Sample Project Planning Document (PPD)

G. Associated Forms

H. Standard Details

1.2 What's New?

Revisions for the June 2016 Update include:

A. Sustainability Guidance – Guiding Principles for Sustainable Federal Buildings and Associated Instructions at Appendix F.

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2.0 The Terminal Facilities Standard Designs A/E Project Manual

2.1 Terminal Facilities Standard Designs

The Terminal Facilities Standard Designs is a standardized package with a certain amount of design flexibility. As with any standardization program, there are specific requirements and guidelines that must be adhered to, but there are also certain items that are most efficiently managed by the FAA Project Engineer and the A/E firm. Site adaptation is performed by the A/E firm in conjunction with the FAA Project Engineer. The intent of this Project Manual is to assist the FAA Project Engineer and provide direction to the A/E firm implementing the Terminal Facilities Standard Designs. The purpose of the manual is to explain the concepts behind the Standard Designs in general terms, and to address specific requirements for the development of Construction Documents. The steps involved in preparing Final Construction Documents are shown in Figure 1.

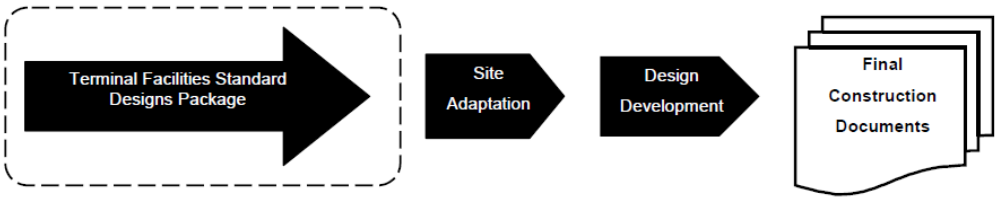

Figure 1

2.2 Standard Drawing CAD Files

The Terminal Facilities Standard Designs Package is developed in Bentley MicroStation® Version 8.i format. The Terminal Facilities Standard Designs is accessible on the FAA Terminal Facilities KSN website (see address, section 2.10).

The Standard Designs Package is also available on CD-ROM. Each FAA Project Engineer may determine the method of distribution which best suits their needs, whether it be CD-ROM, FTP, Bulletin Board System (BBS), or another method. Depending on the facility type and size, some standard design drawings are generated from AutoDesk Revit Building Information Model (BIM) files. These BIM files will be distributed when applicable to the respective project. It is the responsibility of each FAA Project Engineer to distribute the files to their A/E firms, as required.

2.3 Standard Drawing PDF Files

For those who do not have CAD capability, the Terminal Facilities Standard Design Drawings are also provided in ".PDF" format and are available on the FAA Terminal Facilities KSN website (see address, section 2.10).

2.4 FAA Design Criteria

The Design Criteria is an essential tool to be used in conjunction with the drawings and specifications. These documents detail the basic criteria under which the Terminal Facilities Standard Designs have been developed, and provides guidance for site-adapt issues such as Civil, Architectural, Structural, Mechanical, Electrical, and Fire Protection designs.

2.5 Terminal Facilities Standard Designs Master Specification

The Terminal Facilities Standard Designs Master Specification must be used for all Terminal Facilities projects. This Master Specification was generated using MasterFormat, as published by the Construction Specification Institute. The specification is considered to be a base, which must be completed by the A/E firm according to the design of a particular facility. The A/E firm must review, update, and edit all sections, as well as provide additional sections for any special site specific items.

2.6 Updates and Addenda

Starting in 2012, DEI will use a two year cycle to manage the update and release of the two key parts of the Standard Designs package: 1) A&E Project Manual and, 2) The Drawings, Specs and Details. The A&E Project Manual review occurred in 2012 and will be reviewed again in 2014. The review of Drawings, Specs and Details will occur in 2013 and will occur again in 2015. Future updates will continue on this two year cycle unless a different change plan is accepted by HQ DEI.

Because the Terminal Facilities Standard Designs are part of a continuing effort, interim updates and addenda may be distributed periodically. Any changes to the "YEAR" Standards will include an ATO Transmittal Letter. It is recommended that a hard copy of any Terminal Facilities Buildings Standard Designs related letter be kept with this manual. The Transmittal Letter will document the effective date and extent of changes. It will be accompanied by instructions for implementation and information on accessing revised Drawings, Details and/or Specifications on the FAA KSN Website.

2.7 Project Review

All project documents, CAD files, and BIM files that are part of the Project Planning Document (PPD), 45% Submittal, 70% Submittal, 100% Submittal, and Final Design, shall be forwarded to ATO Terminal Facilities headquarters for review. ATO Terminal Facilities shall coordinate with the CAEG Program Office headquarters regarding the deliverables developed in accordance with the FAA Minimum BIM Requirements document. The project review cover letter, included on the CD-ROM and posted to KSN, must accompany all submittals to Headquarters.

2.8 Deviations

Any deviations from the standard drawings and specification that are not part of the "site adaptation" of the project must be approved by ATO Terminal Facilities Headquarters prior to implementation. Changes to the overall building area, and/or changes to individual rooms must not be considered part of the site adaptation process, unless specifically directed within the Requirements Document. The deviation form is provided at Appendix E of this document and is also included on the Standard Designs KSN site. This form must be used to request acceptance for change. The form must be sent via e-mail to the Standard Designs Program Lead in Headquarters. Other major deviations to the Standard Designs, such as additional Base Building area, are not authorized and must be approved via a deviation request to Headquarters.

2.9 Feedback

ATO Terminal Facilities Headquarters appreciates any feedback from the A/E firm, the FAA Project Engineer, or any other FAA or contract personnel that may be helpful in improving future versions of the package. Please use the feedback form that is included at appendix C. The feedback form is also available online at the Standard Designs KSN site.

2.10 KSN Site

The Terminal Facilities Standard Designs Knowledge Sharing Network (KSN) website is a store house for the latest version of the Standard Designs Package documents as well as a resource for various design and policy guidelines. Access to the site is available at the following address:

https://ksn2.faa.gov/ajt/programops/Facilities/dei/standard_designs/default.aspx

2.11 Source of FAA Documents

Copies of FAA documents will be provided to the selected Designer. Documents are available for viewing at the following website: https://employees.faa.gov/tools_resources/orders_notices/

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3.0 Architect/Engineer (A/E) Guidelines

This portion of the manual is issued to inform Architect/Engineer (A/E) firms of the policies, general procedures, and requirements pertaining to professional services performed under architectural and engineering contracts. It is ***essential*** that all A/E firm personnel, associates, and consultants responsible for the preparation of Construction Documents (drawings, specification, and cost estimates), studies, or other services, follow the procedures and instructions contained herein. Special emphasis is placed on the responsibilities of the A/E firm under the terms of their contract with the Government. Other sections will define the design standards, detailed requirements, format, presentation and submittal of drawings, specification, cost estimates, and other related documents.

3.1 General Design

The underlying philosophy of these standards is one of responsive, responsible, and defensible design for FAA facilities with a commitment to design principles and practices which are requirements-based, logical, and conservative. These facilities must respond to user needs, but reflect a responsible use of public funds. While monumental structures with extraordinary features may give the appearance of "uniqueness" to the project, they are generally more expensive to install, repair, and maintain over the design-life of the building and are typically not recommended.

3.2 Implementation

Before beginning the design, the A/E firm must review the current criteria, instructions, standard drawings, and the specifications provided in the Standard Designs package. The A/E firm must make a thorough study of conditions at the site and the requirements of the project. If, after an analytical review, the A/E firm is of the opinion that a deviation from instructions, FAA criteria, or building codes would be of benefit to the Government, the A/E firm must bring the matter to the attention of the FAA Project Engineer for a decision. The Air Traffic Organization encourages the A/E firm to use ingenuity and professional expertise to develop the best possible design for all elements of the project within the constraints imposed.

3.3 Responsibilities of the A/E firm

Prior to proceeding with any work, the A/E firm must review the contract clauses and all attachments, in detail. The A/E firm must be responsible for the professional and technical accuracy and the coordination of all designs, drawings, specification, cost estimates and other work or materials furnished, including those prepared by their consultants. The Air Traffic Organization requires the A/E firm to use sustainable and integrated design practices to provide long term environmental, energy, and lifecycle benefits to the FAA as part of the High Performance Sustainable Building program. A guide to meeting FAA's sustainability goals are provided at Appendix F.

3.4 Cost Limitation

The Construction Documents submitted by the A/E firm must provide a complete and usable facility that will reasonably assure the award of a construction contract within 15% of the construction funds available and any cost limitations as set forth in the Scope of Work.

The A/E firm is responsible for designing the facility for the lowest total life-cycle cost including construction cost and accumulated maintenance and operating cost for the duration of the design life of 40 years, while still meeting the functional and security requirements herein. All cost analyses required within these guidelines must be for a period of 40 years and use a real interest (discount)

rate of 3%. The A/E firm must determine at the earliest possible stage of design, whether the estimated cost of the project will exceed the funds stated in the Scope of Work; if it will, the A/E firm must promptly notify the FAA Project Engineer in writing for a decision regarding how to proceed.

3.5 Quality of Work

The work of the A/E firm will be reviewed by the FAA Project Engineer to the extent necessary to establish conformance with the authorized Scope of Work and applicable FAA design criteria, and to establish a reasonable assurance that the work can be completed within budget. It will be the responsibility of the A/E firm, acting in a professional capacity, to ensure the accuracy, completeness, and correctness of the cost estimate and all engineering concepts and details of the work, including the coordination of the various Civil, Architectural, Structural, Mechanical, Electrical, Fire Protection, and other disciplines and with the specification. The A/E firm must perform a structured final quality control review of all drawings and specification prior to the 100% Submittal. The A/E firm must review for technical accuracy, coordination of work within each discipline, coordination of work among disciplines, and coordination of drawings and specification. On substantially large projects, and at the sole discretion of the FAA, the A/E's work may be sent for a separate, independently contracted constructability review. The A/E performing the design of the project must be required to modify their design as recommended by the FAA Project Engineer, based on this constructability review.

3.6 Errors and Omissions

Design errors or omissions which result in damages or increased cost to the Government will be evaluated for potential A/E firm financial liability. If the Government determines that the A/E firm is financially liable for a design deficiency, the A/E firm will be notified and advised by official correspondence. Reimbursement of costs incurred by the Government as a result of the A/E firm's errors and/or negligent performance will be actively pursued by the FAA.

3.7 Document Ownership

All electronic media, CAD files, BIM deliverables, drawings, designs, specification, notes and other work shall become the property of the Government.

3.8 Performance Evaluations

Immediately upon completion of final design or engineering services, the FAA Project Engineer will evaluate the A/E firm performance on the services rendered. Standard Form 1421, "Performance Evaluation (Architect/Engineer)", is used for this purpose and is provided at appendix B. A/E firm performance will be rated as either excellent, above average, average, below average, or poor regarding technical quality, coordination of design documents, cost effectiveness, maintaining project schedules, cooperativeness, etc. Incomplete submissions, late submissions, or resubmissions will have significant adverse impact on an A/E firm's performance evaluation. The A/E firm will be notified in writing if a "Poor" or "Below Average" rating is proposed, or if the A/E firm is not recommended for future contracts, and will be allowed an opportunity to meet with appropriate personnel to discuss the rating and possible corrective actions. The A/E firm's response will be taken into consideration when finalizing the evaluation. If the final evaluation is still "Poor", it will be attached to the finalized evaluation form. The A/E firm will also be notified in writing if an "Excellent" rating is earned. Performance evaluations are available to future selection boards and may be considered when subsequent A/E firm selections are made. Copies of these evaluations are available, by request, to other Federal Agencies that solicit A/E firm design contracts.

3.9 Release of Information

The Public Information Act, 5 USC 522, as amended, requires the release of records held by Government Agencies or Offices when requested by interested parties, unless such records are covered by one of the “exemptions” listed under the law. The Acquisition Management System (AMS) provides the FAA policy and guidance on handling requests for records and exemptions under this Act. A primary concern of the FAA is the release of cost and pricing data which A/E firms consider privileged information which is essential to their competitive position in their respective economic sectors. The A/E firm is advised that the Public Information Act applies to the data provided during negotiations. Therefore, in the event an A/E firm wishes their cost and pricing data to be privileged and exempt from public release, the FAA must be advised in writing and items containing such data must be appropriately marked. Before any information concerning a project under design or construction is released to the public, the A/E firm must contact the Contracting Officer, to obtain a clearance and release in writing. During the bidding period, all requests made to the A/E firm by prospective bidders for clarification or interpretation of drawings and specification must be referred to the FAA Project Engineer. All classified projects are to be accomplished in accordance with the appropriate clauses of the AMS, which will be added to the contract when applicable, and other supplemental security requirements as imposed by the FAA.

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4.0 A/E General Requirements

The Design Requirements listed herein are applicable to all projects completed within the context of the Terminal Facilities Standards Design Program. Additional design requirements, submittals, supplementary information, tasks, etc., will be clearly defined within the A/E Scope of Work with requirements for subsequent review by the FAA. All engineering drawings, calculations, and specifications must be signed and sealed by a registered professional engineer licensed to practice within the state or territory of the project site, or as modified by the A/E Scope of Work.

4.1 General Design

In general, the Construction Documents must be clear, concise, detailed, and thoroughly coordinated with all disciplines. The Construction Documents must be "non-proprietary" to the point that they allow full and open expenditure of public funds. Careful attention must be placed toward the FAA Orders and Standards as certain areas require a higher order of reliability than similar private industry construction. The A/E firm must review the requirements and criteria and request any additional criteria needed for the project. The Buy American Act requires that only domestic construction materials and equipment be specified and used in Government Contracts; however, this Act has recently been modified to allow the use of products from Canada, Mexico, and the European Community on projects with an estimated acquisition value of $6.5 million or more.

4.2 Contacts

All conferences with the FAA, other government agency personnel, the city, county and airport authorities, etc., including telephone conversations, consultations, or other forms of contact involving some aspect of the Scope of Work, primary design element, or other consideration of basic import, must be documented in writing by the A/E firm and forwarded to the FAA Project Engineer. The general intent being that the FAA Project Engineer will be fully apprised of all factors affecting the project. The A/E firm must contact the appropriate utility company representatives, as necessary, to determine the nearest location and characteristics of service facilities capable of supplying requirements. Such contacts must be made on an information basis only. Caution must be exercised to avoid any implied commitment on the part of the FAA for any planned requirements.

4.3 Site Information

All available information relative to existing conditions at the site of construction will be provided to the A/E firm by the FAA upon request. The A/E firm must evaluate and verify such information and make field measurements and investigations as necessary to prepare adequate construction documents including drawings and the specification. If, due to unforeseen conditions, additional site or soils data is required to adequately develop the design, the A/E firm must furnish specific written recommendations to the FAA with an itemized cost estimate for this work. Upon FAA approval, the A/E firm will be directed to obtain additional information and the contract will be adjusted in accordance with the contract clauses.

4.4 Site Investigation and Verification

The A/E firm or its subcontractors must obtain necessary local licenses and permits required for design of the project, must comply with all applicable laws, codes, and regulations in connection with site investigation, and must be responsible for all damages to persons or property that may occur during the investigation. The A/E firm must take proper safety precautions to protect the public, the property of the public, and Government personnel and property. Before starting the work, it is the

responsibility of the A/E firm to visit the site, inspect the location of the work, and become acquainted with all pertinent local conditions. Site visits during the design phase must be arranged with the FAA Project Engineer. In many cases, the Government does not require bidders to visit the project site prior to submitting a bid. Therefore, to avoid claims and extra costs, it is important that existing features are accurately shown on the drawings and described in the specification in sufficient detail to allow the contractor to bid the work without visiting the site. This is especially important for demolition and alteration work and will require adequate site investigation and verification of as-built drawings. Where existing conditions cannot be readily determined, such as the thickness of pavement or existence of hidden items, quantities must be estimated to establish a basis for bidding. If the cost to demolish or alter hidden features is significant, the A/E firm must request the FAA to authorize additional investigation or testing to quantify these costs.

4.5 Site Adaptation

The drawings, details, and specification contained in the Terminal Facilities Standard Designs are provided for site adaptation and production of final Construction Documents. Site adaptation, in general, consists of designing all exterior features (paving, drainage, utilities, foundations, etc.) to suit the site. The remainder of the design must consist of development of the standard drawings, details, and specification into final Construction Documents for the purpose of obtaining bids to construct the project. If necessary mechanical or electrical equipment cannot fit into the spaces provided in the Standard Drawings, then such space will be adjusted or increased as necessary to accommodate the equipment. It must be the responsibility of the A/E firm to certify the design of the Standard or any other construction drawings furnished for technical accuracy. However, if errors in the drawings are discovered or if the design or functional layout appears unworkable for the site adaptation, the matter must be brought immediately, in writing, to the attention of the FAA Project Engineer.

4.6 Physical Security

Physical Security includes both active and passive measures to safeguard personnel, protect property and assets, and prevent losses. Depending upon the type of facility involved, there are a number of documents controlling Physical Security, including the latest edition of FAA Order 1600.75 (Protecting Sensitive Unclassified Information) and FAA Order 1600.69 (FAA Facility Security Management Program). Appropriate consideration must be given to Physical Security in preparing the drawings and specification. Required Physical Security features must be incorporated initially to eliminate costly additions later. Specialists in various aspects of Physical Security are available within the FAA and must be consulted during early stages of design development to ensure that all required Physical Security standards and features are considered and incorporated. Early coordination with the FAA Project Engineer and the Regional Security Office must be accomplished to ensure all security requirements are addressed as early as possible.

4.7 Energy and Sustainability

There are a number of Federal mandates that impact energy and sustainable design choices. These include the Energy Policy Act of 2005, the Energy Independence and Security Act of 2007, and Executive Order (EO) 13693. In response to these executive, legislative, and regulatory mandates, the Department of Transportation (DOT) and its Operating Administrations (OAs) have committed to comprehensive national energy and environmental and sustainability initiatives that provide for sustainable buildings (including operations and maintenance), reduce greenhouse gases, encourage renewable energy, and mandate energy and water efficiency. In support of its commitment towards meeting these requirements, the Senior Sustainability Officer of the DOT has signed an agency

commitment letter that reaffirms DOTs commitment to being a leader in sustainability including meeting the Guiding Principles for Federal High Performance Sustainable Buildings (HPSB). As an OA of the DOT, the FAA has adopted the sustainability goals of DOT and requires all new ATO construction, major renovation, or repair and alteration of Agency buildings to be compliant with the HPSB Guiding Principles. The ATO also encourages the use of alternative renewable energy sources, and strategies that reduce energy and water consumption.

All new ATO design project requirements shall include a Sustainability Report prepared by the A&E to document their strategy to meet or exceed minimum sustainability requirements on the project as outlined in Appendix F. The Sustainability Report must be submitted along with the architectural submittal during every formal submission and updated as frequently as needed. The Sustainability Report shall describe the incremental costs with payback analysis anticipated to meet various HPSB guidelines. The report must also include documentation, including tables and checklists required to demonstrate compliance with the sustainability requirements. In the event the project anticipates failure to meet specific sustainability requirements, the sustainability report shall include justification for why each requirement cannot be met. If the requirement can be met partially, it must quantify the extent to which the project meets the requirement.

4.8 Environmental Protection

Many environmental requirements may apply to the siting, land use, facility design and construction of ATCTs, TRACONs and associated Base Buildings. All applicable standards promulgated by Federal, State, and Local agencies in implementing environmental legislation including but not limited to: National Environmental Policy Act (NEPA), Clean Air Act (CAA), Clean Water Act (CWA); Resource Conservation Recovery Act (RCRA); Safe Drinking Water Act (SDWA); Noise Control Act; Toxic Substances Control Act (TSCA); Marine Protection, Research and Sanctuaries Act (MPRSA); Federal Insecticide, Fungicide and Rodenticide Act (FIFRA); are applicable. "Applicable pollution control standards" are the same substantive, procedural requirements that would apply to the private and industrial sectors, including the Environmental Due Diligence Audit and Environmental Assessment (EA) (as applicable), and any Light Pollution laws applicable to that specific location. Additional requirements may include the following:

- Atomic Energy Act (AEA)
- Chemical Safety Information, Site Security and Fuels Regulatory Relief Act
- Comprehensive Environmental Response, Compensation and Liability Act (CERCLA, or Superfund)
- Emergency Planning and Community Right-to-Know Act (EPCRA)
- Endangered Species Act (ESA)
- Energy Independence and Security Act (EISA)
- Energy Policy Act
- National Technology Transfer and Advancement Act (NTTAA)
- Oil Pollution Act (OPA)
- Pollution Prevention Act (PPA)
- Shore Protection Act (SPA)
- Superfund - See Comprehensive Environmental Response, Compensation, and Liability Act
- Superfund Amendments and Reauthorization Act (SARA) - See Comprehensive Environmental Response, Compensation, and Liability Act

The facility design must also incorporate pertinent requirements of the Occupational Safety and Health Administration (OSHA) Part 1910, “General Industry Standards” and Part 1926, Construction

Standards during construction, use, and maintenance of the facility through its service life. See Section 4.9 below for additional safety requirements.

FAA specialists are available and should be consulted during the early stages of design regarding appropriate standards and the extent to which they are to be incorporated in the Construction Documents. Storm water management must be incorporated into all applicable designs so as to eliminate or reduce the discharge of pollutants from impervious surfaces, i.e. rooftops, and parking areas. Erosion and sedimentation requirements of the 2003 EPA General Construction permit or the applicable State and Local storm water management guidelines, whichever is more stringent, must be followed.

The A/E firm must prepare permit documents for any Federal, State, or Local environmental or storm water permits which may be required. The A/E firm or the FAA must submit these A/E firm prepared permits to the appropriate agency for approval. The FAA will be responsible for all permit fees associated with the requirements of this Section.

~~4.9 Safety~~

~~Employee safety requirements must be incorporated into the design of the facility being built and in the construction practices that will be used to build it. The A&E firm must ensure a design that complies with established building safety codes and regulations and applicable OSHA, ANSI and other national consensus standards, as well as FAA Orders. The project design must assure that known or identified hazards within the built environment are fully identified and properly managed. Typical hazards within FAA facilities that must be properly identified and mitigated can include but a not limited to:~~

- ~~Electrical hazards and Arc- flash;~~
- ~~Exit Routes and Emergency Planning;~~
- ~~Fall Protection and Working From Heights;~~
- ~~Powered Platforms, Manlifts, and Vehicle-Mounted Work Platforms;~~
- ~~Occupational Health and Environmental Control;~~
- ~~Hazardous Materials;~~
- ~~hazardous energy control (lockout/ tag-out);~~
- ~~Personal Protective Equipment; General Environmental Controls;~~
- ~~Medical and First Aid;~~
- ~~Fire Protection;~~
- ~~Compressed Gas and Compressed Air Equipment;~~
- ~~Materials Handling and Storage;~~
- ~~Machinery and Machine Guarding;~~
- ~~Hand and Portable Powered Tools and Other Hand Held Equipment;~~
- ~~Permit Required Confined Spaces;~~
- ~~Welding, Cutting, and Brazing;~~
- ~~Recordkooping Requirements; and~~
- ~~Toxic and Hazardous Substances, including Asbestos Containing Materials and lead based paints and coatings.~~

~~In addition, the design will consider the construction practices necessary to execute the design and the employee safety requirements in OSHA's regulations in 29 CFR Part 1910 and 1926. When designing facilities for the handling of hazardous materials or substances, allowable concentrations~~

~~of such materials may dictate the design of air conditioning or ventilation equipment. Therefore, all persons involved in design of places of employment must become thoroughly familiar with the OSHA standards and industrial hygiene practices and apply these standards wherever applicable in the design of FAA facilities. OSHA regulations are continually being updated and supplemented so that new conflicts may be generated before resolutions can be achieved.~~

~~The objective of safety program is to design into the facility all necessary safety features in a timely and cost effective manner. Before the design begins, hazards known to exist in similar facilities must be identified and management strategies developed. The A/E firm must assure that facilities being designed as places of employment are designed in compliance with the applicable safety requirements.~~

4.10 General Submittal Requirements

Submittal of the drawings, specification, cost estimate, and other data will be as stipulated in the A/E firm Scope of Work. Formal submissions must include the Project Planning Document (PPD), 45%, 100%, and Final Construction Documents. Major or highly technical projects may require an additional submittal between the 45% and the 100% stage; usually a 70% Submittal. Additional in-progress submittals may also be required. For some large projects, changes may be made during the bid process; therefore, the final drawings must be labeled "ISSUED FOR BIDDING" and the drawings and specification which are revised based on bid process must be labeled "ISSUED FOR CONSTRUCTION". All items in each submittal must be labeled with the date and stage of design submittal. Engineering calculations must be legible, neatly arranged, bound, and indexed with the A/E firm's name, the project title, and construction contract number clearly shown. The schedule for design submissions must be included with the A/E firm Scope of Work. It is essential to meet this submittal schedule. Any deviation from the schedule must be brought to the attention of the FAA Project Engineer as soon as possible. Late submissions may jeopardize project funding, construction contract award, or user need dates and may have an adverse impact on the A/E firm's performance evaluation. The scope must indicate which review agencies are to receive copies of each submittal. The A/E firm must submit the required number of copies directly to each agency and provide a copy of all transmittal letters to the FAA Project Engineer. The forwarding letter must request that comments be forwarded to the FAA Project Engineer within fifteen working days after receipt. With each submission, the A/E firm must include a copy of the previous submittal review comments annotated with the A/E firm's response to each comment. The A/E firm must provide an explanation why previous comments were not included in the present submission. All comments must be incorporated in the next submittal or otherwise resolved.

4.11 Project Planning Document (PPD) General Requirements

The PPD document is a graphic and written description showing the design intent of the project complying with requirements of the program, FAA Orders and Standards, site, building code, and user and space to accommodate the operation and function of the building. This document is similar to what is commonly referred to as a schematic design, or 10% submission, but is modified later within this document. Submission of the PPD must be required for all new facilities designed in accordance with these standards. A typical PPD will be provided to the A&E firm by the project engineer as part of the request for proposal. This document is provided as part of the Standard Designs Package. In addition to those requirements for the specific disciplines described in other sections of this document, the PPD Submittal Package must include the following items:

A. A cover sheet that includes a name, signature block with date signed, and contact information for the following personnel listed below: (Exact names and titles will be provided by the FAA Project Engineer.)

a. Local Air Traffic Manager
b. Local Facility Manager
c. ATO-W Regional Account Manager
d. ATO-W Service Area Engineering Manager
e. ATO-T Facilities Designee
f. ATO-W Service Area Project Engineer

B. Electronic equipment list based on existing facility configuration and validated equipment additions including mechanical heat load and electrical power load requirements.
C. The ATCT Siting Report
D. The Project Requirements Document
E. A Sustainability Report that summarizes the A&E's design strategy, cost implications with payback analysis, and impact to the environment related to meeting the High Performance Sustainable Building policy.
F. An overall schedule of the project including design, post design services, and the construction period
G. The FAA's expectation of the A&E will be to include the ability to modify floor plan drawings real time during the PPD review meeting.
H. BIM Project Execution Plan (PxP) shall be included as described in the latest edition of the FAA Minimum BIM Requirements document.

4.12 45% Design Submittal

The 45% Design Submittal must be provided in accordance with requirements of each engineering discipline as indicated in this manual and adhere to the latest edition of the FAA Minimum BIM Requirements document provided as part of the A/E Scope of Work.

4.13 70% Design Submittal

The purpose of this submittal is to provide a 'snapshot' update of design progress for the various design disciplines. To fulfill this submittal the A/E firm must provide a set of the design documents on the midpoint date between the 45% Design and 100% Design submittal dates. This submittal shall adhere to the latest edition of the FAA Minimum BIM Requirements document provided as part of the A/E Scope of Work.

Please note that two disciplines require specific information at the 70% review. These two disciplines include the Electrical discipline with requirements outlined at Chapter 9.6 and the Fire Life Safety discipline outlined at Chapter 10.6. Please refer to these sections for the additional prescriptive 70% requirements.

The A/E firm must incorporate FAA comments as the design progresses to the 100% Design submittal. Comments will normally be returned to the A/E firm within 20 working days after the time of submittal to the FAA for review.

4.14 100% Design Submittal

Provide 100% Design Submittal in accordance with the requirements of each engineering discipline

as indicated in this manual and adhere to the latest edition of the FAA Minimum BIM Requirements document provided as part of the A/E Scope of Work.

4.15 Final Submittal Requirements

The Final Submittal requirements are common to all disciplines on the project. The Final Submittal must be provided to the FAA Project Engineer only, and must incorporate the corrections and clarifications noted on the 100% Submittal. The exact number of copies required and their distribution will be specified in the A/E firm Scope of Work. Unless modified elsewhere, the Final Submittal must include the following:

A. Final Original Drawings
B. Copies of Original Drawings
C. Final Specification Originals
D. Copies of Original Specification
E. Final Cost Estimate
F. Design Data Handbook
G. CAD files, BIM files, IFC files, and COBie database files as specified in the FAA Minimum BIM Requirements document.

The A&E Firm must prepare a Design Data Handbook for each project. The purpose of the handbook is to convey complete information regarding the development of various designs. The handbook must include, but is not limited to, the following:

1. Design assumptions and parameters for each engineering discipline
2. Design calculations for each engineering discipline
3. Manufacturers' data for specified items, including catalog cuts, specification sheets, etc.
4. Geotechnical Report
5. Sustainability Report
6. Mechanical Life Cycle Cost Analysis
7. Electrical Short Circuit Analysis and Protective Device Coordination Study
8. Electrical Arc Flash Analysis

The 100% calculations must be corrected in accordance with 100% Review Comments and included with the Final Submittal. The calculations must be submitted in a folder with the licensed design engineer's signature and seal on the cover sheet of each discipline. The order of discipline presentation must be the following: Civil, Architectural, Structural, Mechanical, Plumbing, Electrical, and Fire Protection. In addition, the Final Submittal must include all computations, reports, studies, and other significant material not previously returned to the FAA Project Engineer. All computations, studies, and other significant material must be bound for this Final Submittal and scanned and converted to PDF format and provided on CD-ROM. Upon completion of the project and FAA acceptance of the Final Submittal, all project related documents must be provided to the FAA in PDF format on CD-ROM(s).

4.16 Post Design Services

The field administration and inspection of the construction contract normally will be managed by the FAA. During the construction period, the A/E firm may be required to furnish the following services as appropriate. The requirements for these services may be included in the original Scope of Work, or included by Amendment at a later date.

A. **Pre-Construction Conference:** When required, the A/E firm must schedule a representative to attend the pre-construction conference for the purpose of consultation on matters relating to the project, and to become acquainted with problems which the FAA and/or the Construction Contractor anticipate during construction. All actions affecting the A/E firm Contract (Scope of Work) must be coordinated with the FAA Project Engineer.

B. **Submittal Review:** When required by the A/E firm Contract, the A/E firm must review designated or all of the Construction Contractor's shop drawings, samples, catalog cuts, manufacturers' certificates, mill certificates, and other data which are submitted for review. The shop drawings, catalog cuts and other data must be endorsed as being in compliance, or not in compliance, with the Construction Contract requirements, by means of a stamped notation on the face of the submission containing the following information:

Contract Title/Location:
Construction Contract No.: Checked By (signature): Date:
A/E firm Name:
NO EXCEPTIONS TAKEN - RECOMMEND ACCEPTANCE.
RECOMMEND ACCEPTANCE WITH CORRECTIONS NOTED.
RESUBMITTAL REQUIRED - RETURNED FOR CORRECTIONS NOTED.
REJECTED - SEE REMARKS BELOW:
GENERAL DESIGN REQUIREMENTS PAGE

No particular format is prescribed, but the essential information noted above must be provided. The A/E firm's signature must be that of a registered architect or engineer as appropriate for the item being reviewed. The A/E firm must indicate the corrections to be made on all copies submitted and must keep one file copy. The A/E firm must stamp and sign four copies to be returned to the FAA Project Engineer, who will Government-stamp those copies to be returned to the Contractor. The A/E firm must submit letters of explanation or recommendation to the FAA Project Engineer concerning the shop drawings when appropriate. If the Contractor requests approval for material or equipment which is non-conforming to the contract requirements, but which the A/E firm considers to be satisfactory, the A/E firm must evaluate the submittal and furnish to the FAA Project Manager the answers to the following questions:

1. Is the substitution of equal, greater, or lesser quality than the design requirements?
2. If of less quality, what is the difference in value?
3. If of equal of better quality, what are the advantages to the Government in accepting the substitution at no change in contract price?

The need for expeditious handling of shop drawings and data submittals cannot be overemphasized since delays in processing these submittals can lead to delay claims by the Construction Contractor. Under normal circumstances, the A/E firm must return submittals to the FAA within 10 days of receipt. If additional review time is needed, the A&E firm must coordinate with the FAA Project Engineer.

C. **Site Visit during Construction:** At the option of the Government, the A/E firm may be required to send certain key personnel to the construction site to observe and report on

particular phases of construction or problems. The number of visits, type of personnel required, and the Scope of Work of the desired services must be prescribed in an amendment to the A/E firm's Contract. Upon written authorization, the A/E firm must schedule and coordinate the site visit with the FAA Project Engineer. Should the A/E firm visit the site or perform any service outside the Scope of Work for which services have been contracted, reimbursement will not be made.

D. **Construction Inspection:** When required by the Scope of Work, the A/E firm must provide construction inspection services to ensure compliance with the contract drawings and specification. The extent and nature of such services will be explicitly identified in the Scope of Work, or amendment to the Scope of Work.

4.17 Technical Assistance

The FAA maintains a staff of Architects, Engineers, Specialists, and Consultants who review A/E firm prepared documents. The FAA Project Engineer will arrange consultation conferences with the staff upon the request of the A/E firm. Consultants are available in the following fields:

A. Architecture
B. Civil Engineering
C. Electrical Engineering
D. Environmental Engineering
E. Fire Protection Engineering
F. Maintenance
G. Mechanical Engineering
H. Physical Security
I. Real Estate
J. Safety
K. Specifications
L. Structural Engineering

4.18 Preparation of Drawings

Drawings must be complete, accurate, and explicit. All elements of the work must be properly coordinated to insure that there are no conflicts between disciplines or between drawings and specification. Provide sufficient detail to show the extent, size, shape, and relationship between materials. Duplication of information on the drawings and in the specification must be avoided. The drawing format, style, and lettering must be in accordance with FAA-STD-002. All drawings must be easily legible when reduced to half the original scale. Every effort must be made to avoid poor spacing, careless lettering, weak lines, and crowded drawings, particularly regarding reduced half-scale sets of prints for bidders. All details and delineations must be shown on the drawings. Decals and "stick-on" drafting aids are not acceptable and must not be used on drawings submitted to the FAA.

4.19 Drawing Title Blocks

A sample of the drawing title block will be furnished to the A/E firm by the FAA Project Engineer upon commencement of design work. The project title must be on one line. On the drawing cover (title) sheet, the project title must be unabridged (not abbreviated). See Section 4.23 for additional information.

4.20 Drawing Scales

Scales must be located as per FAA-STD-002. It is not sufficient to place all scales on one master sheet; each sheet must be treated independently as each drawing is reduced in size and not always in exact-scaled proportions.

4.21 Arrangement of Drawings

Each set of drawings must be arranged per FAA-STD-002. Additional information on the organization and arrangement of drawings can be found on the CD-ROM or on the KSN Standard Designs website under the heading "Drafting Guidelines – 2009 Construction Drawings Matrix".

4.22 General Drawing Requirements

On small uncomplicated projects, one or more plans may be combined onto one sheet, but never so that the plans become congested with information. Most projects are photographically reduced to half-scale for bidding. As a result, crowded drawings become very difficult to read. Where feasible, plans may be oriented so that "North" is to the top or left of the sheet; however, other orientations are acceptable. Show North arrow on all plans. The scale of the Civil and Site drawings must be the largest practical; preferably 1" = 10’ or 1" = 20’. However, smaller scales will be acceptable to allow the entire plan to fit on a single sheet, provided the sheet is not too crowded. Architectural and Structural Plans must be 1/8" = 1’ 0" or 1/4" = 1’ 0" where practical. Unless indicated differently in other sections of this manual, the scale of detail drawings must be a minimum of 3/4" = 1’ -0" or 1" = 1’- 0". However, smaller scales will be acceptable provided they are clearly legible when reduced to half-scale. Show all new work in heavy, dark lines and existing items in light or dashed lines. Provide key drawings where necessary. The minimum size lettering used on all project drawings must be as described in FAA-STD-002. The minimum gap between lines must be equal to half of the letter height. All symbols must be large enough to be completely legible when reduced to half-scale. Symbols for project features must conform to current industry standards. Symbols used to identify sections, elevations, and details must be as described in FAA-STD-002. Unless otherwise noted, all drawings must be prepared on "D" size (22" x 34") sheets, and submitted for review on "B" size (11" x 17") half-scale sheets.

4.23 Nomenclature

There are many phrases and statements placed on drawings which are considered acceptable in the private sector but are not acceptable for Government projects. The following is a list of some items commonly shown incorrectly on drawings submitted by A/E firms:

TABLE 1 INCORRECT PHRASES	CORRECT
As instructed by the Architect	(Must not be used)
By others / By the FAA	By the Government

By Electrical Contractor	(Must not be used, See Note 1)
By the Plumber	(Must not be used, See Note 1)
By the Elevator Contractor	(Must not be used, See Note 1)
Furnish / Install	Provide (See Note 2)
12 GA Zinc-coated Steel	Metal Flashing (See Note 3)
Copper flashing	Metal Flashing (See Note 3)
Proposed	New
Sheetrock	Gypsum board (Proprietary names are not permitted.)

Notes:

1. The Government recognizes only the PRIME CONTRACTOR; the assignment of work to subcontractors is the Prime Contractor's responsibility and must not be performed by the Designer.

2. See Construction Contract Clauses for definitions. "**Install**" is defined to mean that others will furnish the item and the Contractor is only responsible for installation and/or connection. "**Furnish**" is defined to mean that the Contractor furnishes the item and others are responsible for installation and/or connection. "**Provide**" means the Contractor is responsible for furnishing, installing, and testing the item.

3. Metals are referred to only as metal and not as a particular material or gage. Material and gage are covered in the specification.

If information is provided on the drawings but is not included in the Scope of Work of the contract, specify one of the following descriptions: "Not in contract", "NIC", "By the Government", "Government Furnished Equipment" or "GFE".

4.24 Certification and Revision

Drawings must be sealed by the Architect or Engineer responsible for the work portrayed on the drawing. Drawings prepared by a consultant of the prime A/E firm may be sealed by the consultant. The firm name shown in the title block must be that of the prime A/E firm. The names of consultant firms to the prime A/E firm must not be placed on drawings, unless approved by the FAA Project Engineer. Registration seals (of a reproducible media) must be stamped to the left of the title block. All signatures, seals, and numbering of drawings must be accomplished prior to the final submission of Construction Documents. Changes to completed drawings must be coordinated with the FAA. When changes are made to the originals, appropriate change symbols must be used to indicate the changes and the "Revision" block must be completed with the required information, symbols, signatures, and dates.

4.25 Drawing Series

All FAA drawing series numbers must be as required by FAA-STD-002.

4.26 Drawing Review

During the submittal review process, the FAA will review and provide comments, as necessary, to ensure compliance with these drawing standards. The A/E firm must incorporate these changes as a regular course of action in the same manner as any other comments regarding the design of the project. Strict adherence to these drawing standards from the outset of the project will help ensure minimal changes through the completion of the Construction Documents.

4.27 Record ("As-Built") Drawings

The following is applicable when the A/E firm contract requires the preparation of record drawings showing "as-built" conditions upon completion of construction. A record log of all changes occurring during construction will be made by the Resident Engineer (R.E.) on the prints of the project drawings. At the conclusion of the project construction, the A/E firm will be furnished all original drawings and the prints marked by the R.E. The original drawings must be corrected to show "as-built" changes indicated on the marked prints. Deleted or superseded portions of the drawings must be erased. The final "as- built" drawings must show the actual construction only, except when the original drawing contains portions of the drawing marked "N.I.C." (not in contract), or when optional methods of construction are shown. The optional methods of construction not used must be crossed out and noted "Not Built". No change needs to be made to those portions of the drawings marked "N.I.C.". Changes to the drawings must be noted in the Description column of the Revision Block, "Corrected to As-Built". Where no changes are made to the original drawings, the description must be "As-Built, No Corrections". All as-built drawings must have the same date.

4.28 Preparation of Specification

The project specification must be prepared using the Terminal Facilities Standard Designs Master Specification located on the CD-ROM as noted in Section 2.5.

4.29 45% Design Specification Submittal

Provide a Table of Contents, "Outline" Specification, listing the numbers and titles of all Specification Sections that will be included in the project. All Division 1 Specification Sections from the Terminal Facilities Standard Designs Master Specification are mandatory on every project. The A/E firm must edit the list of Specification Sections for the remaining divisions, as required, to meet the needs of the specific project. In addition, the A/E firm must include any additional sections, including areas within Division 1, which are required for proper completion of the Construction Documents.

4.30 70% Design Specification Submittal – See Section 4.13.

4.31 100% Design Specification Submittal

The specification must be complete, accurate, and explicit. All elements of the work must be properly coordinated to ensure that there are no conflicts between disciplines or between specification and drawings. They must be complete in every respect so that, if need be, the project could be advertised using this 100% Specification. Duplication of information in the specification and on the drawings must be avoided. The specification must be single-spaced in Letter-Quality type and must be submitted as a hard-copy, as detailed in the Scope of Work, as well as "PDF" and "doc" electronic formats. All comments must be incorporated or resolved prior to submission of the 100% Design Specification.

4.32 Final Design Specification Submittal

In addition to that which is detailed above, provide the professional seals and signatures of each of the design professionals responsible must be provided for the content of the specification and must be located at the front of the specification. Only this Final Design Submittal must require these seals and signatures. The Geotechnical Report must be furnished as an attachment to the Final Specification. All comments from all previous submittals must be incorporated or resolved prior to submission of the Final Specification.

4.33 Preparation of Cost Estimate

The objective of the Estimator is to develop an estimate to reflect the price at which the project can be awarded on an open bid basis. The price is defined as the lowest price at which a responsible Contractor is willing and able to perform the work defined by the Construction Documents. This requires precise pricing, experienced judgment, and accurate assessment of market conditions.

It is expected that the final estimate will approximate the low responsive bid within + or - 10%. Estimates that exceed + or - 15% of the low responsive bid will require an immediate post-bid analysis by the A/E firm to determine the reason for the variance. A written explanation listing specific areas of difference between the Government estimate and the bidding contractors must be provided to the FAA Project Engineer within 7 calendar days following notification that a post-bid analysis is necessary. The response must include an award/reject recommendation based on the findings with full rationale to support the recommendation. The bidders for the Contract must not be contacted by the A/E firm during the post-bid analysis. The cost estimate must be broken down by asset and work breakdown structure (WBS) components, and must be structured to allow tender of the contractors' offers by asset and WBS elements.

4.34 Project Planning Document (PPD) Cost Estimate Submittal

The PPD Cost Estimate must be prepared. This estimate will be used for project budgeting. Since little design has been developed, careful attention must be exercised to ensure all major elements are properly considered and evaluated. The PPD Cost Estimate is also called a Parametric Cost Estimate. The Parametric Cost Estimate must include a system quantity and unit cost for every major element in the project and must be broken down by asset and WBS elements. A description of the work included in each system must also be included.

4.35 45% Design Cost Estimate Submittal

The preliminary 45% Cost Estimate Submittal must provide as much detail as possible. Although the detailed system estimate may lack full definition at this stage, there must be a fully developed listing of the major systems of the Project Complete with unit costs. It is recognized that this estimate is based on preliminary drawings and quotes, and revision to the costs is likely as the project drawings and specification are further developed.

4.36 70% Design Cost Estimate Submittal – See Section 4.13.

4.37 100% Design Cost Estimate Submittal

The 100% Design Cost Estimate Submittal must be developed from the 100% drawings and specification. The estimate must be based on a fully developed and accurate quantity takeoff with current unit prices. The A/E firm must provide a brief narrative description of how the Cost Estimate was developed and what sources of pricing data were used in the estimate. The Narrative must

have a table that includes an overall summary of the cost per square foot (area) of the Base Building and/or TRACON, the cost per lineal foot (height) of the ATCT, and a roll-up of the costs by discipline (Civil, Architectural, Structural, Mechanical, Electrical, and Fire Protection). The A/E firm must provide specific rationale for factors that have a significant impact on the Cost Estimate (i.e. - local market conditions, project size, complexity, cost escalation, etc.). The A/E firm must also include the expected Life-Cycle Costs (LCC) for the Operations and Maintenance (O & M) of the facility over a 40 year period.

4.38 Final Design Cost Estimate Submittal

The Final Cost Estimate should normally require only minor revisions to the 100% Cost Estimate. The estimate must reflect any final adjustments in the project cost to ensure the estimate is in line with market conditions expected at the bid date and incorporates all changes that result from the 100% Submittal review. With this final submission only, the A/E firm must provide a copy of the estimate on CD-ROM. The final submission will become the Government estimate and will not be shared with anyone without written permission from the FAA Project Engineer.

5.0 Civil Engineering Design Requirements

5.1 Civil Engineering Design

The Civil portion of any design project must be prepared by a registered Civil Engineer in a thorough and logical manner. Include information in sufficient detail for all phases of the work to permit a complete technical review.

5.2 Civil Design Criteria

The latest version of the codes and standards provided at Appendix D must be used to complete the Civil Engineering design of the project:

5.3 General Civil Requirements

The A/E firm must be responsible for all necessary soil explorations and laboratory tests unless otherwise stated in the Scope of Work. Complete reports of these tests, including specific interpretations and cautions, are essential; and, copies of such reports must be made a part of the submittal requirements. The A/E firm must analyze and interpret all necessary information concerning foundation soil conditions and must include, in the preparation of specification and drawings, complete and specific coverage of procedures for foundation construction and for handling unusual subsurface conditions. Data shown on the drawings, including soil-boring logs, must include the date and the name of the firm which obtained the data. All soil boring logs must comply with the Unified Soil Classification System.

The A/E firm must make all field surveys required for the design of the project unless otherwise stated in the Scope of Work. In general, this must consist of locating and identifying species of existing trees, topographic site surveys, alignment, profiles, cross-sections, and locations of existing underground utilities. Provide a sufficient number of survey control points to serve as initial horizontal and vertical survey controls for construction of the project. On the drawings, show and identify the horizontal control points and benchmarks. Where practical, all survey reference points must be tied into existing grid and benchmark systems and must be based on North American Datum 1983 (NAD 83). Surveys must be submitted at the Final Design Submittal.

The A/E firm must indicate the locations of all utilities crossing and those that are immediately adjacent to the project limits. The utility locations must be obtained from station drawings and visible surface indications, i.e. valve covers, catch basins, manholes, etc. Inverts of storm sewers and sanitary sewers must be obtained and indicated at manholes or catch basins. Normally, excavation to uncover utilities will not be required. If excavation is required, it must be stated in the Scope of Work or by contract modification. Specific information concerning fire protection is located elsewhere in this document under Chapter 10, Fire Protection Engineering and Appendix A10, Fire Life Safety Design Guidance.. All existing utilities which interfere with new work (i.e. utilities located under the footprint of a new building) must be appropriately relocated.

Two environmental requirements may significantly affect siting of the new facility: National Environmental Policy Act (NEPA) and Environmental Due Diligence Audits. FAA Order 1050.1 establishes FAA policy for implementation of NEPA and FAA Order 1050.19 establishes policy for EDDA requirements. A NEPA analysis determines if a proposed project will impact protected resources (e.g., wetlands, endangered species). Results of the NEPA analysis may result in design changes in order to avoid impacts to sensitive environmental areas. An Environmental Due Diligence Audit (EDDA) is a systematic investigation of real property to determine if the property has

environmental contamination. When acquiring real property, an EDDA protects FAA from obtaining contaminated property and associated financial liabilities.

Should suspected wetlands be encountered during the field investigation, the limits and location of the wetlands must be surveyed and indicated on the drawings. The FAA Project Engineer must be informed immediately and provided an impact to sustainability statement so that appropriate and timely actions may occur.

The general permit requirements are contained in the A/E firm's Scope of Work. The A/E firm must become thoroughly familiar with the requirements of the appropriate permitting agencies and must design in accordance with those requirements. The A/E firm must prepare, sign, and seal, with an appropriate in-state seal, all required permit applications.

Electronic copies of FAA Standard Civil details are available upon request through the FAA Project Engineer. . Obtain additional details as appropriate from local jurisdictions. Include only applicable details in the plans and edit them as necessary.

5.4 Project Planning Document (PPD) Civil Submittal

The Civil portion of the PPD Submittal must include the Basis of Design which must supplement the preliminary drawings, specification, and estimates, and must be a presentation of facts sufficiently complete to demonstrate full understanding of the project scope, as well as ensuring that subsequent design details and their ultimate presentation in the final drawings and specification will be based on sound engineering judgment. The Civil Basis of Design must be included with the combined Basis of Design for the other design/engineering disciplines, which will be bound separately from other submission documents. The submission is to be substantiated by an economic analysis of alternatives examined and brief statements of the rationale for the various selections. Describe existing facilities which must be integrated into the project and state their adequacy for use with the new facility. Describe and provide a rationale for all special design required to complete the facility. The Basis of Design must also include statements giving details of project components which are required to meet regulatory requirements.

A. Describe the site of the project, its natural advantages and disadvantages relative to the proposed project, natural vegetation, trees, and topography which can be utilized in the enhancement of the completed facility. Outline the proposed landscaping and other site work necessary to complete the site development.

B. A statement of general soil conditions, with a brief outline of soil exploration and testing performed. Provide a preliminary discussion of foundation type.

C. Type and volume of traffic, controlling wheel loads, and types and/or classes of roads under consideration.

D. Explanations of existing water and storm water systems, covering the type, capacity, condition, present water use, and unsatisfactory elements of component parts for major extensions.

E. Statement of type of construction and materials for water mains, type of well, etc.

F. Statement of design for distribution systems, domestic and fire flow, residual pressure, and elevation differentials (this must also include designer's estimate of pipe sizes).

G. Statement of sizes, elevations, capacities, etc., for reservoirs, treatment units, pumping plants, well pumps, and such units.

H. Explanation of existing sanitary system covering particularly the type, capacity, condition, present flow, and unsatisfactory elements of component parts for major extensions.

I. Interpretation of degree of treatment necessary by effluent requirements and units necessary for treatment.

J. Statement of materials to be used for sewer systems and sewage treatment plants.

K. Describe type, height, clear zones, and justification for new security approved fencing. Describe height and type of existing fence on or adjacent to the project site. Include a description of any special phasing required to maintain security during removal and installation of fencing.

L. A statement of the requirements for storm water management for the particular state and local water management district for which the project is located. Discuss security measures to be used for ditches or pipe larger than 10 inches which will pass beneath security fencing.

M. Explanation of the design approach to be taken, including materials selection.

N. Plan and analysis for meeting National Environmental Policy Act.

O. Plan for Environmental Due Diligence Audit analysis.

P. Develop and implement a construction waste management plan that identifies strategies and methods to dispose, recycle, and reuse construction waste.

The initial calculations supporting the design must be submitted. All references, codes, and design data used in the calculations must be included and referenced in the calculations. All calculations must comply with the latest code adopted by the local code officials governing the facility location. The following drawings must be included and developed to the extent indicated.

A. General Location Plan: Show project location in relation to MAJOR landmarks or features of the installation. Also show the proximity to related facilities which influence project operations. Use insets with an overall view of the station to show widely separated but related facilities. The General Location Plan must include as much of the activity as necessary to convey meaningful information to someone who has not visited the facility.

B. Project Site Plan: This plan must show all new above ground site features including all buildings and pavements complete with dimensions, traffic flow patterns, parking layout and striping, including Accessible Parking Requirements, fences, and all other structures and facilities. Location of new facilities must be referenced to existing, identifiable surface features or survey control points and include site access points/roads. .

C. Topographical and Site Survey: Provide a complete and accurate map of the site, drawn to an appropriate scale, showing existing contours and spot elevations, as well as all topographic features. This plan must include all existing site information such as buildings, pavements, surface features of utilities and storm drainage, fencing, location and description of benchmarks, wooded areas, specimen trees, and other relevant and necessary information. All benchmark control points, markers, or monuments must be clearly referenced and described. The survey must be coordinated with Section 4.21 and must be provided with graphic scales, key maps, a North arrow, datum plane, station coordinates of benchmarks, and a legend to define all symbols used. Demolition drawings must be used when required. Demolished features must NOT be shown on subsequent drawings. The new facility must be outlined (by broken line) at the proper location on this sheet.

D. Electrical Site Plan: This plan must be coordinated and located with the Civil Drawings. For additional information refer to Section "Electrical Engineering Design".

E. Other Drawings: Prepare additional drawings as required to convey the Scope of Work and features of the project.

5.5 45% Civil Design Submittal

For the 45% Submittal, the Basis of Design must be modified as necessary to supplement the preliminary drawings, specification, and estimates. The design calculations presented in the PPD Submittal must be expanded and refined as necessary to support the plans and specification. Complete calculations must be submitted for all design features. All references, codes, and design data used in the calculations must be included and referenced in the calculations. The following Design Drawings must be included and developed to the extent indicated.

A. General Location Map: Show project location, haul routes, borrow areas, disposal areas, lay-down and storage areas, and plant sites.

B. Existing Site and Demolition Plan: A complete and accurate map of the site, drawn to an appropriate scale, showing existing contours and spot elevations, as well as all topographic features. This plan must include all existing site information such as buildings, pavements, utilities, storm drainage, fencing, location and description of benchmarks, wooded areas, specimen trees, and other relevant information. All benchmark control points, markers, or monuments must be clearly referenced and described. The maps must be provided with graphic scales, key maps, a North arrow, datum plane, station coordinates of benchmarks, and a legend to define all symbols used. All demolition must be shown on this drawing and indicated by legend. Demolished features must NOT be shown on subsequent drawings. The new facility must be outlined (by broken line) at the proper location on the Demolition Plan.

C. Site Plan: This plan must show all new above ground site features including all buildings and pavements, complete with dimensions, traffic flow patterns, parking layout and striping, including Handicapped Parking Requirements, fences, and all other structures and facilities. The plan must show setback dimensions and note if setbacks have been met. Location of new facilities must be referenced to existing, identifiable surface features or survey control points. Location of the air traffic control tower must be annotated with exact latitude, longitude and elevation of the tower center point with relationship to true north, grid north and/or runway center line.

D. Grading and Storm Drainage Plan: This plan includes all existing and finish contours at a maximum one foot interval, existing and finish spot elevations as necessary to insure proper drainage, ditches, existing and new storm drainage pipes with sizes and slopes shown, manholes, catch basins, curb inlets, headwalls, location and description of benchmarks, and other necessary structures. Clearly indicate locations of security barriers on man passable pipes and ditches which pass under security fences.

E. Utilities Layout Plan: This plan must show all existing and new utility lines with sizes indicated. Utility lines must include water, sewer, gas, electric, data, phone and other utilities as required. The water system must include the approximate elevation of the existing lines and the location of all valves and hydrants. The sewer system must include the location of manholes and pump stations, the inverts and top elevations of all manholes and cleanouts, and slopes of lines. Rough details of pump stations, and other special structures must be provided. Storm drainage lines must be shown including line sizes and material type, slopes, and appurtenances. Mechanical and electrical utilities must also be shown on this plan. Standard details need not be shown on this submission.

F. National Environmental Policy Act (NEPA) Analysis: The analysis must meet the requirements in FAA Order 1050.1E, Policies and Procedures for Considering Environmental Impacts.

G. Environmental Due Diligence Audit (EDDA) Analysis: The analysis must meet the requirements in FAA Order 1050.19B, Environmental Due Diligence Audits in the Conduct of FAA Real Property Transactions.

H. Electrical Site Plan: This plan must be coordinated and located with the Civil Drawings. For additional information refer to Section "Electrical Engineering Design".

I. Geotechnical Report with Soil Boring Logs: Logs must be referenced to the boring number in the Geotechnical report where shown. Soils must be identified in accordance with the Unified Soil Classification System. Standard penetration test blow counts and ground water table elevations must be shown. Soil borings and log elevations must be referenced to true benchmark elevations shown on the report with a note that must indicate when and by whom the borings were taken. The report must be complete at the 45% Submittal. The report must be included as an Appendix to the Specification. See Structural Design Appendix, Section 23.0 for additional Geotechnical/Subsurface Report Requirements.

The Specification must be developed as an index "Outline" as described in Section "45% Design Specification Submittal".

5.6 70% Civil Design Submittal – See Section 4.13.

5.7 100% Civil Design Submittal

For the 100% Submittal, the drawings and specification must be sufficiently complete to allow advertisement and construction of project. The 100% Submittal must include all drawings described for the 45% Submittal plus all necessary detail sheets to complete the Civil Engineering portion of the project. In addition, other sheets required showing such information as profiles and cross-sections for roads and ditches, profiles of sewer and drainage systems, and details of all appurtenances must be included. The Basis of Design must be modified as necessary to supplement the previous submittal drawings, specification, and estimates. The Design Calculations presented in the 45% Submittal must be revised and supplemented, as required, for the 100% Submittal. The format for Submittal must be identical to the 45% Design Submittal. The following Design Drawings must be included and developed to the extent indicated.

A. General Location Map: Identical to the 45% Design Submittal drawing requirement, modified as required for the 100% Design Submittal.

B. Existing Site and Demolition Plan:

1. All items to be demolished clearly shown.
2. Limits of removal.
3. Complete description of items to be removed.
4. Details, where necessary, of items to be removed.
5. Depth and dimension of affected pipelines and foundations.

C. Civil Site Plans and Detail Drawings:

1. All items to be demolished clearly shown.
2. Street profiles.

3. Pavement sections and joint layout and details.
4. Handicapped provisions details.
5. Parking and other pavement marking.
6. Curb and gutter details.
7. Walk details.
8. Pavement repair details (i.e. utility crossings).
9. Guard post details.
10. Fencing and gates location and details including security barriers for openings beneath fences and gates.
11. Wheel stop details.
12. Construction limits.
13. All existing above ground features which are not to be demolished.
14. Street sign details

D. Grading and Storm Drainage Plans and Detail Drawings:

1. Existing and finish contours
2. Existing and finish spot elevations
3. Ditch profiles and sections
4. New and existing storm drainage piping layout, including security barriers
5. Storm drainage structure details including security barriers
6. Slopes and inverts of all pipes and profiles where necessary
7. Inverts and top elevations of all structures
8. Frames, grates, and cover details
9. Class or gage of pipe
10. Clearing and grubbing limits
11. Landscaping limits
12. Benchmark information

E. Water and Sewer Systems Plans and Detail Drawings:

1. Overall layout of systems, showing line sizes
2. New and existing systems shown
3. Valve and fire hydrant locations
4. Fire hydrant installation details
5. Sizes of all components of systems indicated
6. Building services coordinated with building plumbing drawings
7. Separation of water and sewer lines
8. Backflow preventers

9. Manhole spacing and details (including top and invert elevations)
10. Cleanout location and details
11. Pipeline profiles (gravity sewers normally, plus force main when required by State Permitting Agency)
13. Manhole, frames, and cover details
14. Pump station location and details
15. Air release valves location and details
16. Thrust block details
17. Locations coordinated with existing and other utilities

F. Electrical Site Plan: This plan must be coordinated and located with the Civil Drawings. For additional information refer to Section "Electrical Engineering Design".

G. Additional Drawings to fully describe the project, including:

1. Civil Legend
2. Grading Plan with Storm Sewer Plan
3. Grading Details
4. Storm Sewer Details
5. Storm Sewer Profiles
6. Erosion Control Plan
7. Erosion Control Details
8. Utility Plan (Water, Storm Sewer, Natural Gas, Electric)
9. Utility Details (Water, Storm Sewer, Natural Gas, Electric)
10. Under Slab Drainage
11. Signage and Striping Plan
12. Signage and Striping Details
13. Fencing Details
14. Site Details
15. Electrical / Communication / Cabling Site Plan
16. Manhole Details
17. Duct Bank Details
18. Electrical Site Details
19. Security Site Plan
20. Security Site Details
21. Landscape Plan and Details
22. Irrigation Plan and Details

The specification and cost estimate must be developed to full completion for the Civil Engineering design as described in Section, "100% Design Specification Submittal".

5.8 Final Civil Design Submittal

Provide Final Design Submittal in accordance with Section "Final Submittal Requirements".

6.0 Architectural Design Requirements

6.1 Architectural Design

Adherence to the following requirements will enable the Architect to develop the architectural design in a manner which will permit a more expeditious review and approval by the Government.

6.2 Architectural Design Criteria

The latest version of the codes and standards provided at Appendix D must be used to complete the Architectural design of the project.

6.3 General Architectural Requirements

Uniform Federal Accessibility Standards (UFAS) have been superseded by the "Americans with Disabilities Act and Architectural Barriers Act Accessibility Guidelines." These guidelines were published in the Federal Register on July 23, 2004. The accessibility exception for ATCT cabs ("In air traffic control towers, an accessible route must not be required to serve the cab and the floor immediately below the cab.") is included in the revised Guidelines as ADA CHAPTER 2: SCOPING REQUIREMENTS - Section 206.2.3 EXCEPTION 6 and as ABA CHAPTER 2: SCOPING REQUIREMENTS - Section F206.2.3 EXCEPTION 5. This guidance for handicap accessibility must be followed in the design of new facilities and alteration of existing facilities where civilian employees or the public will visit or work. Local Accessibility Standards must also be considered. The detail to which interior design is included in the project will be delineated within the A/E firm Scope of Work. Specific information concerning fire protection is located elsewhere in this document under Chapter 10, Fire Protection Engineering and Appendix A10, Fire Life Safety Design Guidance.

6.4 Project Planning Document (PPD) Architectural Submittal

The Architectural portion of the PPD Submittal must include the Basis of Design which must supplement the preliminary drawings, specification, and cost estimate. It must be a presentation of facts sufficiently complete to demonstrate that the concept of the project is fully understood and that subsequent design details and their ultimate presentation in the final drawing and specification will be based on sound engineering. The Architectural Basis of Design must be included with the combined Basis of Design for the other design/engineering disciplines and must be bound separately from other submission documents. The Sustainability Report must accompany the PPD Architectural submittal and coordinated to the level of the design development. All assumptions made in the sustainability report must be labeled clearly and followed through as the design evolves. Include any LEED credit score cards if applicable, Guiding Principles checklists and any documentation/calculations which support them. Energy conservation aspects of design resulting from investigation of the complete energy system must be discussed. Brief statements must state that cost effective systems/features are incorporated, such as heat recovery, sun shade control devices, and others, as appropriate. The Architectural Basis of Design must include the following items:

A. Introduction: Briefly describe the purpose of this project and extent of construction. Include floor plans of the proposed Standard Base Building and proposed Standard ATCT, as per the approved Requirements Document. Refer to supporting Appendices at the end of the Basis of Design which must include design conference minutes.

B. Architectural Compatibility: Briefly describe architectural style of buildings in the immediate vicinity of the site and of other installation/Base Buildings having functions similar to the

facility being designed. Discuss the design approach to achieving architectural compatibility with nearby 'permanent category' existing facilities and facilities under construction. Identify design elements, details, materials, colors, signage, and landscaping which coordinate with existing facilities. Limit the narrative to a maximum of two typed pages.

All references, codes, and design data supporting the design must be submitted and must include all items needed to support compliance with requirements of this submittal. The following drawings must be included and developed to the extent indicated:

a) Architectural Plans (drawn to scale) showing:
    1. Room/space names with net square footage (SF) labeled and special equipment or furnishings indicated
    2. Door and window locations
    3. Dimensions and pertinent notes
    4. Toilet fixture locations with handicap accessible type noted
    5. Area Tabulation Diagram with gross SF shown
    6. Area Tabulation Diagram with net SF shown
    7. Roof Plan showing slope, crickets, and anticipated roof mounted equipment. Refer to Section 6.7 for required minimum roof slope
    8. North arrow and graphic scales on each sheet

b) Architectural Elevations (drawn to scale) showing:
    1. Exterior finish material and color notations
    2. Downspouts, flashing, crack control joints, expansion joints, and brick coursing
    3. Doors with frames and windows with frames, mullions, and operating sash
    4. Exterior grade and floor elevation(s)
    5. Extent of new additions/alterations related to existing construction
    6. Notes identifying special construction elements related to architectural compatibility or other requirements
    7. Graphic scale on each sheet

c) Architectural Building Section (drawn to scale) showing:
    1. Exterior wall type notations (cavity/veneer). Do not draw wall construction in detail.
    2. Outline of interior spaces and exterior limits of walls, floors, roofs, and shading devices
    3. Graphic scale on each sheet

d) Perspective sketch (only as required by the Scope of Work) showing:
    1. Vanishing point views of front and primary approach sides of facility.
    2. Two accurately proportioned vanishing point views of front and primary approach sides of facility.

3. Rendered exterior finish indications coordinated with ‘exterior finish material samples’.

C. Type of Construction: Describe type of construction as defined by the IBC.

D. Building Insulation: Describe types of insulation to be provided with specific R-values for roof(s) and walls. Typically:

1. Exterior walls associated with conditioned spaces must have the following thermal characteristics – Minimum heated and cooled structure wall thermal resistance, R-19.
2. Roofs must have the following thermal characteristics – Minimum thermal resistance, R-30.
3. Foundations must be constructed as follows – Minimum foundation insulation must be R-10.
4. The unoccupied areas of the tower shaft are typically not insulated (to avoid potential mold growth medium), and the typical design criteria is to maintain a temperature of 40°F to protect pipes from freezing.

E. Construction Materials and Finishes: Describe materials for all major items of construction including interior/exterior finishes.

F. Discussion of Physical (barriers) and Electronic Security requirements including listed criteria defining those requirements: Address design features proposed for use in construction.

G. Equipment List: Describe items not considered to be a permanent part of the structure, such as portable equipment, work benches, shelving, bins, and removable partitions.

H. Water and moisture proofing:

1. Identify roofing proposed generic type.
2. Describe typical roof and wall sections.

6.5 45% Architectural Design Submittal

For the 45% Submittal, the Basis of Design must be modified, as necessary, to supplement the preliminary drawings, specification, and cost estimate. The Design Calculations presented in the PPD submittal must be expanded and refined as necessary to support the plans and specification. The following Design Drawings must be included and developed to the extent indicated.

A. Architectural Floor Plans (drawn at 1/4-scale for small buildings and 1/8-scale for large buildings) showing:

1. Types of walls/partitions (including acoustical and fire-rating), door swings, door openings, windows, and stairs/steps/ramps with pertinent dimensions and notes
2. Rooms/spaces with names and numbers: Show furniture and furnishings on the “45% Furniture Footprint Plan.”
3. Key Plan on each floor plan sheet when the floor plan is not contained on a single sheet
4. Enlarged plans at 3/8-scale or 1/2-scale for toilets, kitchens, stairs, etc. Include toilet partitions, handicapped accessible/regular toilet fixtures/accessories/drinking fountains, and other provisions for handicapped.

5. Submittal of ComCheck energy report. See http://www.energycodes.gov/comcheck/

B. Roof Plan (normally at same scale as floor plan) showing:
    1. Slopes, internal drains or gutters, crickets, roof walkways, skylights, pipe penetrations, expansion joints, roof-mounted (mechanical/electrical/etc.) equipment, North arrow, and graphic scale
C. Building Elevations (normally at same scale as floor plan) showing:
    1. All sides with pertinent features noted and graphic scales
D. Exterior Wall Sections: Must be from foundation to top of roof membrane/parapet for each type of exterior wall system. Show and label each material. Include 'R-values' for wall and roof insulation, and the graphic scale on each sheet.
E. Typical Interior Partition Sections: Show fire and acoustical ratings. Coordinate with floor plans.
F. Details showing sufficient information to permit development of a reliable cost estimate: Include detail sections of typical roof at eaves or parapet conditions at a 0'-3" = 1'-0" scale.
G. Door and Window Schedules
H. Interior Finish, Color, and Signage Schedules
I. 45% Generic Furniture Footprint Plan drawn to scale: This is necessary to ensure that all required furniture and equipment is coordinated with the Collateral Equipment List and that each space has been sized and configured appropriately. Furniture layout must be based on industry standards or as directed by the FAA. Furniture layout will be basis for location of light fixtures, power, communication outlets, etc.
J. Color Boards in 8½" x 11" three-ring binder format showing actual samples of proposed exterior and interior finish materials: Provide three choices for the interior finishes, 'A', 'B', and 'C'. One of the two alternates will be determined 45 days after submission of the 45% Design Submittal.

The specification must be developed as an index "Outline" as described in "45% Design Specification Submittal".

6.6 70% Architectural Design Submittal – See Section 4.13.

6.7 100% Architectural Design Submittal

For the 100% Submittal, the drawings and specification must be sufficiently complete to allow advertisement and construction of the project. The 100% Submittal must include all drawings described for the 45% Submittal and all necessary detail sheets to complete the architectural portion of the project. The Basis of Design must be modified, as necessary, to supplement the previous submittal drawings, specification, and estimates. The Design Calculations presented in the 45% Submittal must be revised and supplemented, as required, for the 100% Submittal. The format for the 100% Submittal must be identical to the 45% Submittal. The following Design Drawings must be included and developed to the extent indicated below:

A. The Floor Plans must include:

1. Complete dimensions
2. Spaces labeled with doors and windows numbered and door swings indicated
3. Enlarged plans/elevations/sections and details
4. Wall and partition thickness, secure area partition type, partitions that extend to overhead structure, fire and acoustical rated partitions (show rating). Reference symbols for each related section/detail
5. Water coolers, janitor sinks, floor drains, fire extinguisher cabinets, access ladders and hatches, “walk-off” mats in exterior entrances, and built-in shelving and equipment
6. Wall and floor expansion/crack control joints
7. Boundaries of floor finish material changes and floor level transitions
8. Ramps, steps, and stairs
9. Necessary notes and schedules
10. Key Plans when an entire floor is not shown on a single sheet
11. Graphic scales and North arrow

B. The Reflected Ceiling Plans (at the same scale as the floor plans) must include:

1. All ceiling types (identified by note or legend) and acoustical ceiling tile grid(s)
2. Junctions of different ceiling finishes and ceiling level changes
3. All partitions with fire walls and security/acoustical partitions which extend to structure above.
4. HVAC diffusers and returns
5. Light fixtures
6. Access Panels
7. Ceiling-mounted signage
8. All required notes
9. Graphic scale and North arrow

C. The Roof Plans (at the same scale as the floor plans) must include:

1. Roof layout with all pertinent dimensions
2. Parapet walls, expansion joints, crickets, roof walkways, overflow scuppers, roof drains, gutters, and downspouts
3. Direction of roof slope and amount of slope is minimum ¼ inch per foot. Absolute minimum slope for re-roofing is ¼ inch per foot. All valleys must have positive slope
4. All roof-mounted equipment (coordinated with Structural, Mechanical, and Electrical Drawings) Mount air terminals (lighting rods) on parapet terminals.

5. All roof penetrations, vents, exhausts, skylights, monitors, and access hatches
6. Reference symbols for wall sections, building sections, and details.
7. All necessary notes
8. Graphic scale

D. The Architectural Elevations (at the same scale as the floor plans) must include:

1. All sides of building with vertical dimensions and floor level elevations
2. All finish materials and special requirements labeled
3. Expansion and crack control joints
4. Exterior doors
5. Windows
6. Exhaust fans, louvers, and grills
7. Gutters, downspouts, splash blocks, and overflow scuppers
8. Roof-mounted equipment, exhaust stacks, and antennas
9. Reference symbols for section and detail cuts
10. All necessary notes
11. Graphic scale and north arrow

E. The Building Sections (at the same scale as the floor plans) must include:

1. Floor, wall, partition, ceiling, and roof information for a minimum of one transverse and one cross section through entire building
2. Reference symbols for section and detail cuts
3. Doors, windows, finish materials, expansion joints, casework, toilet partitions, ladders, and signage
4. Lighting, HVAC registers and returns, built-in equipment
5. Graphic scale

F. The Enlarged Floor Plans must include:

1. Enlarged toilet plans at 3/8 inch or ½ inch = 1’-0” scale with labeled toilet fixtures (handicapped accessible and typical) and accessories. Special handicapped access clearances must be indicated.
2. Kitchen layout with dimensions and equipment
3. Dimensions of stairs treads, risers, landings, and railings
4. All necessary notes
5. Graphic scale

G. The Interior Elevations/Sections must include:

1. Toilets with fixtures, vanities, partitions, finishes, and accessories with labels and reference symbols
2. Typical room with lighting, wall HVAC registers and returns, built-in furnishings, doors, windows, and outline of equipment (such as refrigerators) and furniture which are 'not-in-contract.' This is necessary for coordination and conflict prevention.
3. Kitchen/food preparation area with outlined equipment
4. Janitor closets with shelving, wall hooks, and built-in equipment
5. Stairs with dimensioned railings, treads, risers, nosings, and framing
6. Graphic scale and north arrow

H. Additional Drawings to fully describe the project, including:

1. Architectural Legend
2. Door and Hardware Schedules
3. Door Details
4. Window Types and Details
5. Finish and Color Schedules (Based on decision made at 45% Submittal)
6. Signage Schedule and Details
7. General Architectural Details
8. Partition/Wall Types
9. ATCT and Base Building/TRACON Console Details
10. Equipment Details
11. Furniture/System Furniture Details

The specification and cost estimate must be developed to full completion for the Architectural design as described in Section "100% Design Specification Submittal". A fully developed Sustainability Report coordinated with 100% design drawings that includes material specifications, energy calculations, prescribed sustainable maintenance practices, etc must be included with the 100% Architectural Design Submittal.

6.8 Final Architectural Design Submittal

Provide Final Design Submittal in accordance with Section "Final Submittal Requirements".

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7.0 Structural Engineering Design Requirements

7.1 Structural Engineering Design

The structural analysis and design of the ATCT and Base Building/TRACON facilities must meet all design regulations contained on the Terminal Facilities Standard Designs CD-ROM package along with requirements and provisions provided in the current adopted building codes listed in Section 7.2 and Appendix A. The designer must use industry standard methods of analysis and design; all design assumptions, methods, and procedures must be clearly documented within submitted calculations.

7.2 Professional Registration.

All engineering drawings, calculations, and specifications related to structural design must be signed and sealed by a registered professional Structural Engineer licensed to practice within the state or territory of the project site, or as modified by the A/E Scope of Work.

7.3 Structural Design Criteria

The latest version of the codes and standards provided at Appendix D must be used to complete the Structural Engineering design of the project.

7.4 General Structural Requirements

The Structural Engineering design must result in a complete and coordinated set of submitted Structural Drawings, Specification, and Calculations based on industry standard engineering principles and practice regarding structural systems.

7.5 Project Planning Document (PPD) Structural Submittal

The Structural Portion of the PPD must include the Basis of Design which must justify the foundation and structural systems to be used. The Structural Basis of Design must be included in the combined Basis of Design for all design/engineering disciplines, which must be bound separately from other submission documents. A brief synopsis must be included to identify the various structural considerations and to discuss the rationale used to determine the best foundation and structural system. Careful attention must be given to all factors such as criteria, cost, local conditions, construction schedule, methods of analysis and design, availability of materials, etc. In addition the PPD must include a description of physical security requirements and how they will be incorporated into the design.

The description of the foundation and structural systems to be used must, as a minimum, include the following:

A. Description of the foundation: Must include subsurface conditions, method of analysis and design, and allowable capacity and time/settlement curves for potential differential settlement

B. Description of the structural system: Must include method of analysis and design, design assumptions, design criteria, design loads, type of structural system and all special features to be included on the drawings.

C. Include Blast Considerations: Must include set-back requirements and a description of required blast considerations.

D. Include Structural Floor Plans: Must include dimensions, stick framing, locations of openings, and a column grid. Structural members are not expected to be sized for PPD, but stick framing is reasonable.

7.6 45% Structural Design Submittal

For the 45% Submittal, the Basis of Design must be modified as necessary to supplement the preliminary drawings, specification, and estimates. All Structural design calculations must be performed in accordance with the project design criteria. The calculations must be presented in a legible, orderly, and easily understandable format. The 45% Submittal calculations must be complete for all major cost contributing components and must include the following:

A. Cover Sheet: Must include project title, location, construction contract number, and names of the persons originating and checking the calculations. The person checking calculations must be a registered/licensed Structural Engineer in the state of the project location and must be a separate engineer from the originator.

B. Index: Must include a Table of Contents displaying the subject and page number for each topic (Introduction, Design Criteria, Calculations) and subtopic (Loads, Materials, References, Analysis and Design of Lateral Load Resisting Elements, Analysis and Design of Gravity System, Footing Design, Wall Design, Column Design, etc.) addressed in the calculations. Each page, consecutively numbered, must identify the total number of pages contained in the calculations (Sheet__of__), the revision number, date, project name, project location, and must be initialed by the originator and the checker.

C. Introduction: Must include a brief statement describing the structural system, significant design parameters, and any restrictions that may affect the project design

D. Design Criteria: Must be provided and, as a minimum, include the following:

1. Design Loads: Include all loads, forces, temperature changes, induced settlements, etc. that may affect the design of the structure. Include the application/location, magnitude, and units of measure for each load.
2. Design Restrictions/Limitations: Include all limiting factors such as deflection limits, (horizontal and vertical), height restrictions, special tolerances for installing or operating equipment, or other special restrictions that may affect the design of the structure.
3. Materials: Include all material to be used and their allowable stress limits and ultimate yield strengths. The list must include material type and grade, allowable stress, ultimate yield strength, and appropriate units of measure.
4. References: Include all design criteria, accepted standards, manuals, codes, texts, papers, or other design information used during the structural analysis and design that is accepted in a public domain. All references must be appropriately identified. Abbreviations such as AISC, ASTM, ACI, etc. are acceptable. Also include computer software program (source and name), along with the version and date used for analysis and design. Should a facility user provide additional design criteria, the originator must be documented within the Structural calculations.

E. Calculations: Provide structural calculations supporting the analysis and design of the gravity and lateral structural systems of the building, including the major cost contributing structural elements such as: beams, columns, walls, foundations, slabs, bracing, diaphragms, equipment supports, etc. along with details of connections which must be designed to

provide a safe, stable, efficient and cost effective structural system. Sketches must contain sufficient detail to clearly convey the designer's intentions and must be presented in a concise and easily understandable format. All design assumptions and references to codes, standards, criteria, drawings, and computer output must be noted as necessary.

F. Computer Output: Must be presented similar to the calculations and may be referenced as an Appendix or attachment. The computer software program name, source, and version must be documented for each computer-generated design output. A summary must also be provided for each computer-generated printout consisting of a detailed explanation of the specific content presented. All schematic models used for computer input must be provided. As a minimum, the models must show nodes/joints, elements/members, materials/properties, all loadings, temperature changes, induced settlements/deflections, etc., and a list of load combinations considered during analysis. Computer results must include an output summary listing maximum and minimum member stresses, forces, and deflections, as well as joint reactions for each load combination. Controlling reactions and deflections must be highlighted and mapped to a figure displaying the controlling structural members.

The Drawings must include, as a minimum, the following:

A. Foundation Plan at the same scale as the Architectural Plans: Show general sizes, location, and arrangement of all significant features of the foundation system. The layout of all slabs, footings, piers, grade beams, piles, caissons, pile/caisson caps, trenches, pits, openings, depressed and thickened slabs, etc. showing all dimensions and elevations necessary for construction. All dimensions must be referenced to a column-line grid system oriented about the global axes of the structure and along the centerlines of the major support columns and walls. Elevations may be defined using any datum consistent throughout the structural drawings, as long as the chosen datum is referenced to its true elevation. Special construction features, sequencing, and site conditions such as de-watering, excavation bracing, underpinning, expansive soils, existing structures, etc. which may significantly impact the project cost must be shown.

B. Framing Plans consistent with the Foundation Plan: Show general sizes, location, and arrangement of all significant features of the horizontal framing system. The layout of all beams, joists, stringers, purlins, slabs, decks, plates, grating, etc. showing all dimensions and elevations necessary for construction must be included on the Framing Plans. The elevations must be referenced to some finished datum such as top of steel, slab, finished floor, concrete, joist, deck, etc. Special construction features, sequencing, and site conditions which have a significant impact on project cost must be shown.

C. Elevation Views (if necessary): Must be consistent with the Foundation Plans to show general sizes, location, and arrangement of all significant features of the vertical framing system. The layout of all columns, walls, beams, girts, stringers, bracing, etc. showing all dimensions and elevations necessary for construction must be included on the Elevations. Reference elevations must be consistent with the Framing Plans.

D. Sections and Details: Must provide sufficient information to identify general types of material and methods of construction required such that a reliable cost estimate can be developed for the structure. All members must be identified and shown in sufficient detail to provide an accurate representation of their size, connections, and spatial relationships to other structural/architectural features. All dimension and elevation references must be consistent with previous plans.

The specification must be developed as an index "Outline" as described in Section "45% Design Specification Submittal".

7.7 70% Structural Design Submittal – See Section 4.13.

7.8 100% Structural Design Submittal

For the 100% Submittal, the drawings and specification must be sufficiently complete to allow advertisement and construction of the project. The 100% Submittal must include all drawings and calculations described for the 45% Submittal plus all necessary detail sheets to complete the Structural engineering portion of the project. The Basis of Design must be modified, as necessary, to supplement the previous submittal drawings, specification, calculations, and estimates. The calculations must include the analysis and design of all major cost contributing elements including beams, columns, walls, foundations, slabs, bracing, diaphragms, equipment supports, etc. and the connections to each must be designed to provide a safe, stable, efficient, and cost effective structural system. Any connection to be designed by others (i.e. the steel fabricator) must be noted on drawings. Sketches must be provided with sufficient detail to clearly convey the designer's intentions, and must be presented in a concise and easily understandable manner. All assumptions and references to codes, standards, criteria, drawings, and computer output must be noted.

NOTE: The Cover Sheet of the Final Structural Calculations must be signed and sealed in ink by the individual in responsible charge of the structural design.

All Structural Drawings must be completed in accordance with the following minimum requirements:

A. General Conditions:
   1. Design criteria for loads, materials, and references
   2. General Notes for the project
   3. Material Notes such as structural steel, concrete, masonry, etc
   4. Bid information such as pile/caisson lengths
   5. Special load test requirements
   6. Other information/instructions to contractor
   7. Abbreviations and symbols used for structural drawings

B. Foundation Plan:
   1. Layout of foundation support systems showing all dimensions and elevations necessary for construction
   2. Size or schedule references for all foundation features such as footings, grade beams, piles, caissons, pile/caisson caps, etc.
   3. Control/expansion joints in floor slab and foundation walls
   4. Trenches, pits, openings, depressed/thickened slabs
   5. Test pile/caisson location

6. Special construction features including: de-watering, excavation, bracing, underpinning, etc.
7. Special construction sequencing
8. Existing site conditions/features
9. Graphic scales

C. Framing Plans:

1. Layout of horizontal framing elements showing all dimensions, orientation and elevations necessary for construction
2. Size or schedule references for all horizontal framing elements such as beams, joists, slabs, decks, grating, etc.
3. Slab control/expansion joints
4. Opening sizes, locations, special framing, and reinforcing
5. Location of splices, brackets, penetrations, sleeves, embedment, bracing, welds, etc.
6. Special temporary bracing, shoring or forming
7. Other special requirements such as equipment clearances travel distances for hoists and cranes, etc.
8. Graphic scales

D. Elevations:

1. Layout of vertical framing elements showing all dimensions, orientations, and elevations necessary for construction. For concrete or masonry bearing or shear walls, provide elevation views showing joints, openings, wall piers and associated reinforcement details.
2. Size or schedule references for all vertical framing elements such as column, walls, piers, beams, bracing, etc.
3. Wall control/expansion joints
4. Opening sizes, locations, special framing, and reinforcing
5. Location of splices, brackets, penetrations, sleeves, embedment, bracing, welds, etc.
6. Special temporary bracing, shoring, or forming
7. Other special requirements such as equipment, clearances, travel distances for hoists and cranes, etc.
8. Graphic scales.

E. Sections and Details:

1. Layout of all sections and details showing all members, shapes, sizes, materials, dimensions, elevations, arrangements, and orientations necessary for construction

2. Standard connections or scheduled references for forces, fasteners, welds, plates, clips, ties stirrups, pins, etc., including weld and bolt sizes
3. All special connections completely detailed to a point where no further engineering is necessary
4. Concrete/masonry wall reinforcement details showing size, clearances, placement, shape, etc.
5. Lintel details or scheduled references for loads, sizes, materials, arrangements, etc.
6. Anchor bolts, base plates, bearing plates, or scheduled references for materials, size, thickness, welds, embedments, threaded parts, projections, etc.
7. Diaphragm deck type, gauge, yield strength, minimum number of spans or length, fastener type, and pattern
8. Applicable special notes and instructions
9. Graphic scales

F. Schedules:

1. Provide all information/instructions for fabrications, forming, placement, erection, installation, etc. necessary for construction.
2. Schedules for beams, lintels, joist, trusses, frames, piles, caissons, footings, pile/caisson caps, grade beams, slabs, etc.
3. Calculated column and foundation loads, beam reactions, shears, and moments, footing pressures, pile/caisson capacities/loads (vertical and horizontal) etc.
4. Special instructions, materials, process, etc.

G. Additional drawings to fully describe the project, including:

1. Layout of structural systems requiring special fabrication and construction sequence such as space trusses/frames, long span trusses, Vierendeel trusses, shells, towers, fabric structures, etc.
2. Temporary structures to be dismantled/relocated

The specification and cost estimate must be developed to full completion for the Structural Engineering design as described in Section “100% Design Specification Submittal”.

7.9 Final Structural Design Submittal

Provide Final Design Submittal in accordance with Section, “Final Submittal Requirements”.

8.0 Mechanical and Plumbing Engineering Design Requirements

8.1 Mechanical Engineering Design

Mechanical Systems must be designed in accordance with the Mechanical Life-Cycle Cost and Design Guideline and latest industry standards. The plans, specification, and calculations must be prepared in a thorough and logical manner. Sufficient detail must be included to permit a thorough technical review of the project documents. Fire Protection Design requirements related to Mechanical Engineering Design are located elsewhere in this document under Chapter 10, Fire Protection Engineering and Appendix A10, Fire Life Safety Design Guidance.8.2 Mechanical Design Criteria

The latest version of the codes and standards provided at Appendix D, must be used to complete the Mechanical Engineering design of the project.

8.3 Life Cycle Cost Analysis (LCCA)

A Life Cycle Cost Analysis (LCCA) is required for all new construction. The analysis must be performed in accordance with 10 CFR 435 and 436 procedures and FAA Order 6480.7E requirements. The design must comply with Executive Order 13514: *Federal Leadership in Environmental, Energy, and Economic Performance as well as* the Energy Policy Act of 2005 and Executive Order 13423 *Strengthening Federal Environmental, Energy, and Transportation Management*. Multiple types of HVAC systems may be considered including, : air cooled chilled water systems, water cooled chilled water systems, air to air heat recovery units, water source heat pumps, condensing boilers, ground source heat pumps, and variable refrigerant volume. A minimum of three HVAC systems must be analyzed. The ultimate selection of an HVAC system must be based upon sustainability implications and the lowest Life-Cycle Cost of the three evaluated systems.

8.4 Project Planning Document (PPD) Mechanical Submittal

The Mechanical Engineering portion of the PPD Submittal must include both the LCCA and the Mechanical Basis of Design. The LCCA must meet the requirements of Section 8.3 and must include a narrative clearly indicating the proposed mechanical system selection and major equipment selection. All system and major equipment selections must be substantiated by an analysis of examined alternatives and a brief statement of the rationale for the various selections. The preliminary LCCA must be submitted with all supporting data including a narrative incorporating the following minimal information:

A. Description of the three HVAC systems to be considered in the LCCA: All assumptions and unusual requirements or building features must be indicated in the narrative. The type of HVAC control system to be used with each alternative must also be included.

B. Heating, Ventilation, and Air Conditioning:

    1. Documentation of unusual temperature & humidity requirements
    2. Ventilation rates
    3. Areas to be conditioned and equipment locations must be identified.
    4. Mechanical room space requirements must be indicated.

C. Miscellaneous Mechanical Systems: Must describe special mechanical systems (such as compressed air systems) and must identify and explain the source of the medium.

D. Computer software program proposed for use during analysis
E. Facility data
F. Operational schedules
G. Design temperatures
H. “U” values
I. Personnel loading
J. Lighting levels
K. Fuel prices
L. Fuel differential escalation rates
M. Study life
N. Approximate total building heating and cooling loads
O. Sensible and latent loads imposed by equipment processes (including domestic hot water) which must be included in the facility.
P. Statement describing the energy budget for the facility
Q. Additional information relative to the system selection such as availability and condition of existing equipment proposed for use
R. Plumbing Systems:
    1. Plumbing Fixture Schedule: Must be prepared based on code occupancy for quantity of water closets, lavatories, drinking fountains, and service sinks. Number of water closets in the men’s restroom being substituted with urinals must be in compliance with the adopted International Plumbing Code and must be clearly indicated within the schedule.
    2. Selection of piping materials
    3. Calculate required water pressure
    4. Water heating method & fuel
    5. Statement regarding facility rainfall rates for storm drainage calculations

The Mechanical Basis of Design must include “cut-sheets” for all proposed mechanical and plumbing equipment and must be included with the combined Basis of Design for other design/engineering disciplines, which must be bound separately from other submission documents.

Calculations supporting the preliminary LCCA assumptions and the Mechanical Basis of Design must be submitted along with drawings showing sufficient detail to indicate major equipment locations and major runs of ductwork and/or piping distribution to the extent known. Single line drawings may be used for this submittal.

8.5 45% Mechanical Design Submittal

For the 45% Submittal, the drawings, specification, calculations, energy analysis, and cost estimate must be expanded and refined as necessary to supplement the preliminary drawings, specification, and estimates. The Basis of Design must include the manufacturer’s “cut-sheets” for all proposed

mechanical and plumbing equipment. These “cut-sheets” may be submitted in a separate bound document, if referenced by the Basis of Design. The LCCA must be complete and submitted with all supporting data, including a narrative supporting the system selection. The following information must be provided within the 45% Mechanical Design Submittal:

A. All data as required in the PPD Submittal above: This data must be updated to reflect the completed calculations and any comments received from the FAA on the PPD Submittal.

B. A statement that clearly reflects the recommended choice for the HVAC system: This statement must include any back-up information, as well as any data and assumptions used to select the recommended system.

Calculations must follow procedures and must be presented in the format of ASHRAE GRP 158, “Cooling and Heating Load Calculation Manual”. At a minimum, the following information must be submitted for approval:

A. Source documentation for all design values used

B. Tabulation of inside and outside design temperatures and relative humidity: Tolerance values for inside conditions must be included.

C. Building sections (i.e. roof/ceiling & walls) showing U-value calculations

D. HVAC calculations: Tabulation of process/electronic loads must be included.

E. Energy calculations which are not a part of the LCCA

F. Preliminary plumbing calculations: Water heating and storage requirements must be included.

G. Manufacturer’s “cut sheets” documenting equipment selection points

Drawings must be prepared to include, as a minimum, the following:

A. Heating, Ventilation, and Air Conditioning:

   1. Floor Plans: Must show the location of major equipment and ductwork. Mechanical floor plans must be not less than 1/8” = 1’0”.

   2. Floor plan scales of 1/4” = 1’-0” must be considered when the complexity of the plans results in overcrowded drawings, such as for the Mechanical Room Layout. Single line drawings may be used for this submittal.

   3. Basic system and riser diagrams

   4. Equipment Schedules: Must be as complete as the design will allow. Show all necessary information for coordination with other engineering and architectural disciplines, such as equipment weights and electrical requirements.

B. Plumbing Systems:

   1. Site Layout: Must show points of utility connections, including sanitary sewer invert elevations at the boundary line extending five feet outside the exterior of the building. If all utility connections are shown on the Civil Drawings, a Mechanical Site Layout will not be required.

   2. Exterior piping: Must include chilled/hot water, condenser water, plumbing/sanitary, steam, fuel, compressed air and gas piping, etc. Invert elevations must be shown on this plan if a Mechanical Site Layout is not provided.

3. Equipment locations,
4. Fuel storage general arrangement

The specification must be developed as an index “Outline” as described in Section, “45% Design Specification Submittal”.

8.6 70% Mechanical Design Submittal – See Section 4.13.

8.7 100% Mechanical Design Submittal

For the 100% Submittal, the drawings, specification, and cost estimate must be sufficiently complete to allow advertisement and construction of the project. The 100% Submittal must include all drawings and calculations necessary to complete the Mechanical Engineering portion of the project. The LCCA must be submitted with changes based on any comments received regarding the previous submittal.

NOTE: LCCA changes must not be required if the previous submittal did not include comments.

The calculations presented in the 45% Submittal must be revised and supplemented, as required, for the 100% Submittal. In addition, the following information must be provided:

A. Ductwork static pressure calculations for all systems including primary air, supply air, return air, and exhaust air systems
B. Psychrometric plots showing all state points for each air handling unit
C. Cv-pressure drop calculations for all control valves
D. Pump head calculations: “Rule of thumb” estimates for fitting losses are not acceptable. Include all water and fuel systems.
E. Compressed air and natural gas including demand tabulation

Additional drawings to fully describe the project, including:

A. Heating, Ventilating, and Air Conditioning:
    1. HVAC Legend
    2. HVAC Floor Plans
    3. HVAC Roof Plan
    4. HVAC Enlarged Mechanical Room Plan
    5. HVAC Elevations and Sections
    6. HVAC Schedules, including Louver Schedule
    7. HVAC Details
    8. HVAC Control Diagrams with Sequence of Operation
B. Plumbing Systems:
    1. Plumbing Legend
    2. Plumbing Floor Plans

3. Plumbing Roof Plan
4. Plumbing Enlarged Plans
5. Plumbing Risers
6. Plumbing Schedules
7. Plumbing Details

The specification and cost estimate must be complete for the Mechanical Engineering design as described in Section, “100% Design Specification Submittal”.

8.8 100% Final Mechanical Design Submittal

The Final Design Submittal must be provided in accordance with the “Final Submittal Requirements” Section.

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9.0 Electrical Engineering Design Requirements

9.1 Electrical Engineering Design

The Electrical portion of any design project must be prepared by a licensed Electrical Engineer, in a thorough and logical manner. Include information in sufficient detail for all phases of work to permit a complete technical review.

9.2 Electrical Design Criteria

The latest version of the codes and standards provided at Appendix D must be used to complete the Electrical Engineering design of the project:

9.3 General Electrical Requirements

Provide thorough and coordinated plans, specification, calculations, and cost estimate data. It is incumbent upon the Electrical Engineer to ensure that the Electrical design complies with all design criteria. If there is any question or apparent conflict between criteria, the FAA Project Engineer must be informed as soon as it becomes apparent. Specific information concerning fire protection is located elsewhere in this document under Chapter 10, Fire Protection Engineering and Appendix A10 Fire Life Safety Design Guidance.

9.4 Project Planning Document (PPD) Electrical Submittal

The Electrical Engineering portion of the PPD submittal, when required, must include the Basis of Design which must supplement the preliminary drawings and must include the items listed. The Electrical Basis of Design must be included with the combined Basis of Design for the other design/engineering disciplines, which will be bound separately from other submission documents.

A. Primary Distribution System:

1. Describe the primary source of power
2. Location of the source of power
3. Statement relative to the adequacy of the primary supply at the point of take-off
4. Available utility short circuit current
5. A letter with the available short circuit current from the utility company at the point of connection
6. Estimate of total connected load and resulting KVA demand load by applying proper demand (state operating assumptions) and diversity factors.
7. Basis for selection of secondary voltage
8. Distribution, overhead or underground
9. Type of conduit or duct, if applicable

A statement describing pertinent standards of design, such as voltage drop, physical characteristics of overhead or underground circuits, NEC Working clearances, etc.

B. Description of the Primary Service Transformation to Secondary Service:

1. Primary and secondary voltage rating

2. Description of the proposed utility transformer
3. Description of the proposed primary and secondary switchgear
4. Description of the proposed primary and secondary protection devices
5. Estimated fuse size and type on the utility primary

C. Description of the Electrical Systems including the following:
   1. Description of the proposed primary and secondary protection devices
   2. Lighting and emergency lighting systems using LED type lighting to the maximum extent possible
   3. Normal, essential, and critical power systems
   4. Telephone/LAN systems, associated conduit and cable tray
   5. Grounding/cable tray/wireway/conduit systems
   6. Intercommunication systems such as television, paging, call, etc.
   7. Physical and electronic security such as gate operators, cameras, etc.
   8. Load shedding scheme during fire pump start while building is on EG.

Electrical Drawings must include, at a minimum, the following items:

A. Existing Site and Demolition Plan: Must include all existing site information such as buildings, pavements, and utilities. All electrical demolition must be shown on this drawing and indicated by legend. Demolished features must not be shown on subsequent drawings.

B. Site Plan: Must show new and remaining above ground and underground electrical equipment. When located in proximity to other utilities, all equipment must be shown to avoid conflicts. Information on existing conditions must be complete and field checked. Plan must also show FAA Field Cable, Telco, airfield lighting, etc. from site boundary to termination inside the building

C. Single Line Diagram: Must show the following:
   1. Existing distribution to a point of connection.
   2. Primary feeder to project.
   3. Pad-mounted transformer or substation with primary and secondary switchgear.
   4. Secondary feeders down to lowest downstream panel.
   5. E/G and UPS capacity

9.5 45% Electrical Design Submittal

For the 45% Submittal, the Basis of Design must be modified as necessary to supplement the preliminary drawings, specification, and cost estimates. This submittal must include cut sheets for electrical equipment such as light fixtures, panel boards, switchboards, transformers, etc. It must also include design calculations regarding load analysis, demand factors and load calculations for each panel board and switchboard, voltage drop analysis, E/G size calculations, UPS size

calculations, and interior and exterior lighting calculations. The Drawings must contain, at a minimum, the following information:

A. Existing Site and Demolition Plan: Must develop the PPD Submittal drawing to approximately 45% complete, be coordinated with the Civil Site Plan, and be included with the Civil Site Drawings. Interior demolition must be shown on a separate plan.

B. Site Plan: Must develop the PPD Submittal drawing to approximately 45% Complete. Information on existing conditions must be complete and field checked. This Plan must be coordinated with the Civil Site Plan and must be included with the Civil Site Drawings.

C. Lighting Plan(s): Must show the building's full floor plan (first floor, second floor, etc.) with the layout and type of fixtures to be used and the design foot-candle levels for all types of lighting systems. Provide low glare lighting fixtures in office areas.

D. Power Plan(s): Must show the building's full floor plan (first floor, second floor, etc.) with the location of receptacles, panel boards, switchboards, motor control centers, transformers and any other major equipment throughout the inside and outside of the building or project. Plan must show all details to scale.

E. Single Line Diagram: Must develop the PPD Submittal drawing to approximately 45% complete showing all panels, switchboards, motor control centers, transformers, and other major electrical loads such as pumps, A/C chillers, etc.

F. Additional Plans/Risers (show location of devices):

1. Lighting and Emergency Lighting plans using battery backup
2. Normal, essential, and critical power single line
3. Telephone/LAN system
4. Grounding/cable tray/conduit systems
5. Intercommunication systems such as television, paging, call, etc.
6. Physical and electronic security
7. Cable tray and wireway layouts
8. FAA Field cable/airport lighting/Telco ductbanks entering the facility
9. Motor tables including all HVAC, VAV, EWH, HU, etc. showing equipment designation, voltage, panel/circuit feed, breaker/disconnect size, conduit/conductor size.
10. Enlarged drawing of the main switchgear layout in the EG, Switchgear, UPS rooms and TRACON electronic equipment rooms.
11. Receptacle layouts
12. Mechanical equipment layouts.
13. Panel schedules including breaker types/AIC ratings
14. Lighting fixture schedule
15. Any other drawings required for clarity of design and/or coordination with other engineering disciplines.

16. Detailed Console Access Level coordination drawing

The specification must be developed as an index “Outline” as described in Section, “45% Design Specification Submittal”.

9.6 70% Electrical Design Submittal

For the 70% Submittal, the drawings and specification must be sufficiently complete to allow advertisement and construction of the project. The 70% Submittal must include all drawings and calculations necessary to complete the Electrical Engineering portion of the project. The Basis of Design must be modified as necessary to supplement the preliminary drawings, specification, and cost estimates including changes required to the calculations submitted as part of the 45% Submittal. The Short Circuit Analysis/Protective Device Coordination Study and the Arc Flash Analysis for the electrical distribution system must be provided. The intent of these studies is to verify that the specified and supplied equipment are properly rated, correctly applied, and within industry and manufacturer’s tolerances. The study must be based on using Square D electrical equipment and accomplished by a Square D engineer familiar with coordination study requirements. The coordination study will determine the correct settings for the protective devices which will minimize the damage caused by an electrical fault and allow for selective coordination between the devices. The coordination study must include the closest upstream utility protective device down to the lowest downstream branch breaker. The coordination study must consider operation during normal conditions, alternate operation, and during Emergency Generator operation. The study must be prepared by qualified engineers from Square D. The engineer must be a Registered Professional Electrical Engineer who has at least ten years of experience and specializes in performing power system studies for Square D. The study must be in accordance with the specific procedures outlined in IEEE 141 (Red Book) and ANSI/IEEE 242 (Buff Book). Electrical design must be considered incomplete until the FAA Project Electrical Engineer(s) approve the Short Circuit Analysis/protective device coordination study and Arc Flash Analysis. Arc Flash labels must be provided Arc Flash labels should be 4" x 6" self-adhesive vinyl labels and include information such as Hazard Risk Category, Incident Energy (cal/cm2), Arc Flash Protection Boundary, Limited/Restricted/Prohibited Approach Boundaries, necessary PPE, and Equipment Name. The labels should be consistent with OSHA and industry standards (including NEC, NFPA 70E and IEEE1584). Soils resistivity measurements are required for a properly designed electrical system and should be accomplished using the fall of potential method. These measurements must be recorded on the drawings (Civil and Site Electrical Drawings.) The drawings must include all sheets indicated for the 45% Submittal plus all detail sheets necessary to fully present the Scope of Work of the electrical work required for the project.

A. Existing Site and Demolition Plan: Must include all existing site information such as buildings, pavements, and utilities that affect or interface with the demolition of the electrical portions of the project. The specification must indicate the disposition of demolished materials and equipment. The limits of demolition must be clearly defined, i.e., if a portion of overhead line is to be removed, provide a detail showing how the remaining portion is to be terminated. This Plan must be coordinated with the Civil Site Plan and must be included with the Civil Site Drawings.

B. Site Plan and Details: Must show all new and existing above ground and underground features such as buildings, pavements, and utilities that affect or interface with the electrical portions of the project. This Plan must be coordinated with the Civil Site Plan and must be included with the Civil Site Drawings. As a minimum, the following information must be shown:

1. Primary and secondary electrical lines
2. Fire alarm and communication lines
3. All FAA field cable/Telco/airfield lighting/etc conduit and ductbank sizes and the route to the lease line
4. Transformer or substation estimated size (located by dimensions from the building or other prominent features)
5. Streets, parking area and other flood lighting
6. All other exterior electrical equipment, A/C units, sump pumps, gate operators, etc.
7. In congested areas a profile of duct lines must be provided.

C. Lighting Plans and Details: These drawings must show the building's full floor plan (first, second, etc.) with the location and number of lighting fixtures, type and size of wiring serving these fixtures. Provide details of all lighting fixtures used (include mounting height and support details). Emergency, exit, and security lighting must be included where required. Use LED type lighting to the maximum extent possible.

D. Power Plans and Details: These drawings must show a building's full floor plan (first, second, etc.) as well as any large scale plans necessary to prevent overcrowding. The power plans must show the location of receptacles and electrical equipment and the type, size and location of wiring required throughout the facility. Show an enlarged plan view of the EG/Switchgear/UPS rooms and the layout of associated electrical equipment.

E. HVAC Power Plan: Show VAV Layout, tabulation of all HVAC equipment with power run defined. Show conductor and conduit size along with required disconnect switches and associated circuit callouts for each piece of equipment.

F. Telephone/LAN Plan: Show location of all Telco and LAN outlets, including systems furniture installation. Show layout of Telco/LAN cable tray.

G. Grounding/Cable Tray/ Lightning Protection /Conduit Plan: Drawings as required to fully describe the interconnectivity of the grounding/ lightning protection and cable tray systems.

H. Surge Protective Devices: Including location on power panels as well as systems entering the building from the exterior, and exterior systems.

I. Additional drawings to fully describe the project, including:

1. Electrical Legend
2. Lighting and Emergency Lighting Plans
3. Power and Emergency Power Plans
4. HVAC Power Plans, including HVAC, VAV, pumps, dampers, etc.
5. Telephone/LAN Plans, with associated conduit and cable tray
6. Grounding/Cable Tray/ Wireway/Conduit Plans
7. Electrical Elevations, showing transformer/panel layouts in congested areas
8. Enlarged Plans (Electrical, E/G Rooms and TRACON equipment rooms)

9. Panel Schedules, including main breaker size, neutral size, voltage, ampacity, Equipment designation
10. Circuit Breaker Settings, including breaker name/type, frame size, trip unit size, sensor size, LT/ST Pickup/Delay, Instantaneous
11. Switch Board and Motor Control Center Schedule
12. Lighting Fixture Schedules
13. Electrical Details
14. Electrical Roof Details
15. Single Line Riser Diagram
16. Telephone/LAN Riser Diagram
17. Grounding/ Lightning Protection Riser Diagram
18. Intercommunication Riser Diagram
19. Conduit Schedule
20. FAA Communications Riser
21. Cable Tray/Ductwork/Fire Sprinkler/Lighting Coordination Drawing
22. Detailed Console Access Level Coordination Drawing

The specification and cost estimate must be developed to full completion for the Electrical Engineering design as described in Section, “100% Design Specification Submittal”.

9.8 Final Electrical Design Submittal

Provide Final Design Submittal in accordance with Section, “Final Submittal Requirements”.

10.0 Fire Protection Engineering Design Requirements

10.1 Fire Protection Engineering Design

Fire Protection can be defined as the protection of life, mission and property against the threat of fire or other related hazards. The designer must be aware of the everyday activity of the occupants and how to safely evacuate and isolate them from a fire. Maintaining and protecting the exit enclosure is critical, as immediate egress from the facility is not always possible. The primary goal of the fire protection and life safety systems for these buildings is to provide a tenable exit for at least the time required for all occupants to exit the building. This goal requires additional features not always found in typical buildings.

Decisions must be made early in the project to provide the maximum degree of life safety to the occupants and to the protection of the mission and property, while obtaining an economical design. Strict integration with all engineering disciplines must be established. Fire protection and life safety system designs often require coordination with architectural, civil, mechanical and electrical designs. It is the responsibility of the Architectural/Engineering Design Team to facilitate this coordination in all phases of the project. It is essential that these objectives are identified and design decisions are made as early as possible to provide an economical and effective design.

The Architectural/Engineering Design Team must include in all phases of the project a registered professional Fire Protection Engineer (FPE), as the Engineer of Record for the overall facility fire protection and life safety design concept, as presented in the Basis of Design Report. The FPE must have a minimum of 5 years' experience in fire protection and life safety system design and hold a current license in Fire Protection Engineering.

10.2 Fire Protection Design Criteria

The latest version of the codes and standards provided at Appendix D must be used to complete the Fire Protection Engineering design of the project.

10.3 General Fire Protection Requirements

It is essential that all decisions regarding fire protection or life safety be made early in the design process to provide an effective and economical design. The key element to a proper fire protection design is coordination between all disciplines including the local fire authorities. The International Building Code must govern all issues related to design, construction, and occupancy of all Terminal Facilities, with the exception of the means of egress. Due to a special agreement between OSHA and the FAA that requires compliance with 29 CFR 1960.20, "Alternate Emergency Egress Standard for Airport Traffic Control Towers", NFPA 101 must govern issues related to ATCT egress. To the greatest extent possible, the ATCT Terminal Facilities Standards Floor Plans have been produced in compliance with NFPA 101, as noted above. The A/E firm must immediately notify the FAA Project Engineer should there be any question regarding the issues and limits associated with the use of NFPA 101 for ATCT Construction. All coordination with the local fire authorities must be completed prior to the 45% Submittal. All notes regarding this coordination must be transcribed into the Basis of Design report at the 45% Submittal. The FAA Project Engineer must be contacted for clarification regarding all Fire Protection Design issues.

10.4 Project Planning Document (PPD) Fire Protection Submittal

The Fire/Life Safety portion of the PPD submittal, authored by the Fire Protection Engineer of Record, must be included in the Basis of Design. The contents of the Basis of Design must describe, in detail, the fire protection and life safety approach and include:

A. Applicable codes and standards: Identify all applicable codes and standards for the project including relevant editions. Describe and document all alternative approaches to compliance with these requirements, as well as, alternative materials and methods of protection.

B. Occupancy Use Group: Identify the occupancy use group of the facility. Also, include a discussion of the special hazards for the Airport Traffic Control Tower or TRACON (i.e. delayed egress).

C. Occupant Load and Egress Calculations: Include occupant load calculations in accordance with applicable codes and the Appendix of this manual. Demonstrate that sufficient egress capacity is provided for the facility.

D. Type of Construction: Clearly identify and describe the type of construction to be used as defined by the International Building Code detailing the maximum fire area and separation of structures.

E. Accessibility Requirements: Indicate applicable accessibility standards, and where compliance with these standards is required.

F. Fire Protection, Detection and Alarm: Include a brief description of the fire protection, detection and alarm systems to be provided for the facility.

G. Smoke Enclosures / Control System(s): Include a brief description of the approach to smoke proof enclosure design for the facility.

H. Fire Hydrant Flow Test Data: Provide fire hydrant flow test data current within one year of the PPD issue date. The following data must be provided:

    1) Hydrant locations (indicate on an existing site plan)
    2) Hydrant elevations
    3) Static pressure
    4) Residual pressure
    5) Pitot pressure
    6) Hydrant type and outlet coefficient
    7) Flow
    8) Flow at 20 psi residual
    9) Date of test
    10) Time of test
    11) Name of person(s) conducting the test

The PPD submission must also include drawings which at a minimum indicate:

A. Egress: Drawings must be provided showing major routes of egress and exit locations. The drawings must be coordinated with the egress calculations provided in the Basis of Design report.

B. Site: Site drawings must be provided clearly indicating sources of fire protection and fire hydrant locations (site water supply). Drawings must also indicate stand-off distances, fire department access, etc.

10.5 45% Fire Protection Design Submittal

Prior to the design of any structure, specific questions regarding fire protection must be raised in order to address the occupants' particular needs and to determine the acceptable level of fire risk considering egress and fire rated separations. It is essential that any decisions regarding fire protection be determined as early as possible. All agreements between the local fire authority and the A/E firm must be documented. All documents must be submitted with the 45% submittal. The Fire Life Safety portion of the 45% submittal, authored by the Fire Protection Engineer of Record, must be included in the Basis of Design. The contents of the Basis of Design must describe, in detail, the fire protection and life safety approach and include the following items, in addition to items provided within the PPD Submittal:

A. Fire Protection System(s): Identify the fire protection systems to be provided (including portable fire extinguishers), detailing design parameters and areas to be protected, listing design criteria references. The specific hazard to be protected (i.e. light, ordinary, extra, etc.) must be clearly outlined in addition to the density provided over the desired operating area. Calculations showing that water flow is adequate to meet sprinkler demands are required, which will necessitate a field survey and consideration of the fire hydrant flow test data by the A/E firm to determine actual water supply data. Design must be in accordance with IBC and NFPA criteria as appropriate. Additionally, all hydraulic calculations must include at least a 10% safety factor.

B. Fire Pumps: Describe the size, number and associated zones for each fire pump. Negotiations with the local fire authority are required to determine if a manual wet standpipe system is acceptable in order to reduce the size of the fire pump. If possible the local fire department will provide water flow and pressure for the facility standpipe systems through the use of the fire department connection.

C. Fire Alarm and Detection Systems: Clearly describe fire alarm and fire detection system to be provided. List all actuating devices and functions the system will perform including a sequence of operations. Any existing fire alarm equipment must be identified, with special emphasis on any requirement to provide connection(s) to an area wide fire reporting system (such as common on a military base or large airport). All fire alarm aspects must be designed for long term system ITM sustainability including accessibility of all components requiring testing and maintenance.

D. Fire Resistance Rated Walls: Fire resistance rated walls and barriers (including exterior exposure protection if required), smoke barriers and smoke partitions must be indicated on the drawings.

E. NFPA 75 Analysis: Clearly describe the fire protection, compartmentation and design approaches used to comply with the requirements of NFPA 75.

F. Miscellaneous Code Analysis: Clearly describe the means of egress, interior finishes, height/area calculations, and compliance with 29 CFR 1960.20 including plans for storage. Add storage construction and use guidance to appendix.

G. Calculations: Provide calculations to verify that the water supply available for the fire sprinkler system and fire hose requirement adequately meets the demand. Update occupant load and exit calculations in accordance with NFPA 101.

H. Fire Authority Coordination: Consult with the local fire authorities and include a brief description of the following:

   1) Applicability of sizing the fire pump to meet the sprinkler demand only and utilizing a manual wet standpipe system
   2) Fire alarm control panel location
   3) Stair pressurization fan diagram requirements
   4) Access road width, turn radius, and site/gate access
   5) Fire department connection location
   6) Fire hydrant locations
   7) Fire pump room access and location

The following design drawings are required to be submitted with the 45% Design Documents:

A. Fire Protection Drawings: The sprinkler riser must be located on the plans but the layout of the overhead sprinkler piping is not required to be shown. All areas to be protected by the automatic fire sprinklers suppression system(s) must be clearly identified including hazard classification, sprinkler density, and remote area of sprinkler operation. The Fire Suppression System Riser Diagram must be shown to include all devices.

B. Fire Alarm Drawings: The drawings must show all fire alarm and detection devices. Include all manual pull stations, automatic detectors, control panels, and audible and visible alarms. A fire alarm riser diagram must be shown including all fire alarm equipment and interconnections. Indicate the source of power supply and connection to any area wide fire alarm system (if required). The drawings must also show the location of any new exterior fire alarm reporting stations and the point of connection of new equipment to any exterior area wide reporting system (if required).

C. Life Safety Drawings: Location and fire resistance ratings of all exits, firewalls, corridors, stairwells, and any other required fire-rated enclosure(s) must also include occupant load calculations and specifically identify those portions of the facility, which are considered information technology equipment areas (ITEA) or rooms (ITER).

10.5.1 Associated Disciplines

The drawings associated with Fire Protection criteria must be shown on fire protection drawings except as indicated as follows:

A. Civil Drawings: Must show all existing and new water lines with any required valves and other items such as backflow prevention, post indicator valves and water meters. Particular attention must be made to the location of existing and proposed fire hydrants to ensure compliance with local fire department requirements. Point(s) of connection to sprinkler

system supply lines must be shown with required valves. Gates and access roads must be coordinated with the local fire authority and the IFC.

B. Architectural Drawings: Must show a general building layout with regard to life safety and fire separation(s) as required by the IBC. The designer must anticipate the occupant's range of activities during a 24 hour day, 7 day week period to determine the required life safety needs of the occupants. It is critical that all life safety questions be answered early in the project as the floor plan is directly involved. The following additional items must be included:

   1) Location and fire resistance ratings of all exits, firewalls, corridors, stairwells, and any other required fire-rated enclosure(s)
   2) Details of each fire resistance rated wall type
   3) Location and strategy for storage

C. Mechanical Drawings: Must include design and specification of the ATCT system required for a compliant smoke proof enclosure as well as the locations of any required fire and/or smoke dampers. Interaction between duct detectors and AHU must be indicated. Mechanical drawings must indicate all fire and smoke dampers required for compliance with NFPA 75, Standard for the Protection of Information Technology Equipment.

D. Electrical Drawings: The following items must be included in the Electrical design:

   1) The location of exit lights and emergency lights must be shown.
   2) Location of power for all motorized smoke dampers.
   3) Location of power for fire alarm control units, fire pump, and stair pressurization system.

The specification must be developed as an index "Outline" as described in Section, "45% Design Specification Submittal".

10.6 70% Fire Protection Design Submittal

The 70% Submittal must include all drawings and calculations necessary to complete the fire protection engineering portion of the project including cost estimates. The Basis of Design must be modified as necessary to supplement the previous submittal drawings, specification, calculations, and estimates. The calculations provided in the 45% Submittal must be revised and supplemented, as required, for the 70% Submittal. The format for the 70% Submittal must be identical to the 45% Design Submittal. The Fire/Life Safety portion of the 70% submittal, authored by the Fire Protection Engineer of Record, must be included in the Basis of Design. The contents of the Basis of Design must describe, in detail, the fire protection and life safety approach and include the following items, in addition to items provided within the 45% Submittal. The Design Drawings must be included and developed to the extent indicated:

A. Fire Protection Drawings: Fire Protection Drawings must include the following:

   1) Legend, including all symbols and line-types utilized on the drawing.
   2) The locations of sprinklers risers, sprinkler piping and sprinklers.
   3) The physical layout of the fire pump and associated piping.
   4) Sprinkler riser diagram.
   5) Typical sprinkler sections and details for all components of the sprinkler system.

B. Fire Alarm Drawings: Fire Alarm Drawings must include the following:

1) Legend, including all symbols and line-types utilized on the drawing.
2) The locations of fire alarm equipment including control panel, manual pull stations, automatic detectors, extinguishing system pressure switches, and audible and visible appliances.
3) Fire alarm riser diagram, including interfaces with sprinkler system and other building systems.
4) Typical fire alarm sections and details for all components of the fire alarm system.
5) Sequence of operations matrix.

C. Life Safety Drawings: Location and fire resistance ratings of all exits, firewalls, corridors, stairwells, and any other required fire-rated enclosure(s). The following additional items must be included:
1) Location and length of dead end corridors
2) Travel distance
3) Common path of travel
4) Location of photo luminescent egress marking
5) Occupant load calculations

D. Civil Drawings: Normally shown on Civil Utility Sheets which show water distribution to within five feet of the building. Other disciplines must pick up beyond this point:
1) Show all new and existing water piping including sizes.
2) Show new and existing valve and fire hydrant locations ensuring conformance with the IFC and the local fire authority.
3) New valve and fire hydrants must require an installation detail complete with guard posts.
4) The water line supplying the sprinkler riser must be shown with the connection into the building. The location of any required fire pump or water storage tank must be shown.
5) Show gates and access roads ensuring conformance with the IFC and the local fire authority.

E. Architectural Drawings:
1) The location and rating of smoke and fire barriers must be clearly shown and detailed with special emphasis on the hourly fire-rating.
2) A detail of the fire and smoke barrier construction must be provided along with the particular Underwriters' Laboratories listing obtained from the latest edition of the U.L. Fire Resistance Directory.
3) Details of any fire and smoke barrier penetrations must be provided for each type of wall construction as outlined in the U.L. Building Materials Directory or Fire Resistance Directory.
4) Detail type and size of fire extinguisher to be provided.
5) The class and hour rating of fire doors must be provided on the door schedule.

6) Details and section of egress stairs and corridors to ensure the required 80 inch headroom is achieved throughout the facility.

F. Mechanical Drawings:

1. The design and specification, including detailed sequence of operation, for the ATCT smoke proof enclosure.
2. The location of smoke and fire dampers with a detail must be shown.
3. Any required duct-mounted smoke detectors must be shown on the HVAC Drawings.
4. Firestopping detail for penetrations of fire walls with reference.

G. Electrical Drawings:

1) Emergency lighting locations and exit lights must be provided on the Electrical.
2) Lighting Plan with a detail of each.
3) Fire pump power must be shown on the electrical one-line diagram.
4) Power to any smoke or combination fire/smoke dampers must be shown on the Electrical Power Plan.

The specification and cost estimate must be developed to full completion for the Fire Protection Engineering design as described in this Section.

10.7 100% Fire Protection Design Submittal

For the 100% Submittal, the drawings and specification must be complete to allow advertisement and construction of the project. The 100% Submittal must include all drawings and calculations necessary to complete the fire protection engineering portion of the project. The Fire Life Safety portion of the Basis of Design must be modified by the Fire Protection Engineer of Record, as necessary, to supplement the previous submittal drawings, specification, calculations, and estimates. The calculations provided in the 70% Submittal must be revised and supplemented, as required, for the 100% Submittal. The format for Submittal must be identical to the 70% Design Submittal. The Design Drawings must be included and developed to address comments received after the 70% submittal.

The specification and cost estimate must be revised to full completion for the Fire Protection Engineering design based on revisions made.

10.8 Final Fire Protection Design Submittal

The Final Submittal requirements are common to all disciplines on the project. The Final Submittal must be provided to the FAA Project Engineer only, and must incorporate the corrections and clarifications noted on the 100% Submittal. The exact number of copies required and their distributions will be specified in the A/E firm Scope of Work. Unless modified elsewhere, the Final Submittal must include the following:

A. Final Drawings

B. Copies of Drawings

C. Final Specification

D. Copies of Specification

E. Final Cost Estimate

F. Design Data Handbook. The Designer must prepare a Design Data Handbook for each project. The purpose of the handbook is to convey complete information regarding the development of various designs. The handbook must include, but is not limited to, the following:

   a. Design assumptions and parameters for each engineering discipline

   b. Design calculations for each engineering discipline

   c. Manufacturer's data for specified items, including catalog cuts, specification sheets, etc.

G. The 100% calculations must be corrected in accordance with 100% Review Comments and included with the Final Submittal. The calculations must be submitted in a folder with the licensed design engineer's signature and seal on the cover sheet of each discipline. The order of discipline presentation must be the following: Civil, Architectural, Structural, Mechanical, Plumbing, Electrical and Fire Protection. In addition, the Final Submittal must include all computations, reports, studies and other significant material not previously returned to the FAA Project Engineer. All computations, studies, and other significant material must be bound for this Final Submittal and scanned and converted to PDF format and provided on CD-ROM. Upon completion of the project and FAA acceptance of the Final Submittal, all project related documents must be provided to the FAA in PDF format on CD-R.

11.0 Environmental and Occupational Safety and Health (EOSH) Design Requirements

11.1 EOSH Design

Employee safety requirements must be incorporated into the design of the facility being built and ~~in~~ the construction practices that will be used to build it. The A&E firm and Engineering Services must ensure ~~a~~ all designs ~~that~~ complies with established building safety codes and regulations ~~and applicable~~including OSHA, FAA Orders, and applicable ~~ANSI and other n~~national consensus ~~s~~standards~~, as well as FAA Orders~~. The project design must assure ~~that known or identified~~environmental, occupational safety, and health hazards within the built environment are fully identified, ~~and~~ properly managed, and prevented through design where possible. ~~FAA projects will comply with OSHA code and FAA Orders as they stand at the moment of project completion.~~

11.2 EOSH Design Criteria

FAA projects will comply with OSHA standards and FAA Orders upon project completion. The latest version of the codes and standards provided at Appendix D must be used to complete the EOSH design of the project.

11.3 Project Planning (PPD) and Design (DD) and Construction Document (CD) EOSH Submittals

Typical hazards within FAA facilities that must be properly identified and mitigated through design and construction ~~can~~ includes, but ~~a~~ not limited to:

- Electrical hazards and Arc- flash;
- Exit Routes and Emergency Planning;
- Fall Protection and Working ~~From~~from Heights (Walking and Working Surfaces);
- Powered Platforms, Manlifts, and Vehicle-Mounted Work Platforms;
- Occupational Health and Environmental Control;
- Hazardous Materials;
- ~~h~~Hazardous energy control (lockout/ tag out);
- Personal Protective Equipment; General Environmental Controls;
- Medical and First Aid;
- Fire Protection (during construction);
- Compressed Gas and Compressed Air Equipment;
- Materials Handling and Storage;
- Machinery and Machine Guarding;
- Hand and Portable Powered Tools and Other Hand-Held Equipment;
- Permit-Required Confined Spaces;
- Welding, Cutting, and Brazing;
- Recordkeeping Requirements; and

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Comment [PM[2]: Denotes that FLS requirements pertain primarily to the operational structure(s).

- Toxic and Hazardous Substances, including Asbestos-Containing Materials and lead based paints and coatings.
- Minimum required egress lighting.
- Fire Life Safety (FLS) bus power distribution/configuration

~~In addition, t~~The design will consider the construction practices necessary to execute the design and the employee safety requirements in OSHA's regulations in 29 CFR Part 1910 and 1926. When designing facilities for the handling of hazardous materials or substances, allowable concentrations of such materials may dictate the design of air conditioning or ventilation equipment. Therefore, all persons involved in design of places of employment must become thoroughly familiar with the OSHA standards and industrial hygiene practices and apply these standards wherever applicable in the design of FAA facilities. OSHA regulations and FAA Orders are ~~continually~~subject to change, and may be ~~being~~ updated ~~and~~or supplemented ~~so that new conflicts may be generated~~ before open issues or findings can be resol~~utions~~ved ~~can be achieved~~.

The objective of these safety ~~program~~mandates is to assure the design of FAA facilities properly and adequately considers and incorporates ~~into the facility~~ all necessary safety features in a timely and cost effective manner. ~~-~~ Consequently, ~~B~~before the design begins, hazards known to exist in similar facilities must be identified and management strategies developed. ~~-~~ The A/E firm and or Engineering Services must assure that facilities being designed as places of employment are designed in compliance with the applicable safety requirements.

For reference, a detailed set of EOSH requirements is located in Appendix G. This list contains applicable requirements to be used in designing a building for occupancy. Additional requirements may exist for ongoing construction projects as found in OSHA's 29 CFR Part 1926, may be enforced by localities, or may have been created since the addition of this chapter.

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Appendix A5

Civil Engineering Design Guidance

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Appendix A5: Civil Engineering Design Guide

1.0 EARTHWORK AND SITE PREPARATION.

The geotechnical recommendations report must provide characteristics, composition, and properties of the soil.

A. Consideration of clearing and grubbing, normally the initial phase, requires investigation of several items, including: borrow and waste areas, the protection of existing utilities, erosion and dust control, and provisions for hazardous and objectionable material disposal.

B. Grading. Limits, acceptable tolerances, and adequate explanation provided through plans and specifications are necessary to successfully prepare the required design.

2.0 STORM DRAINAGE.

The FAA Advisory Circular 150/5320-5C, “Surface Drainage Design”, along with Federal, State, and Local regulations, must be used during the design of site drainage systems.

A. Unusual drainage conditions on or adjacent to the site must be considered, including rainwater effluent drainage effects.

B. The maximum rainfall intensity-frequency criteria must be based on the maximum one-hour rainfall, in inches, to be expected once in 50 years.

C. The designer must review the airport storm sewer drainage system to ensure localized flooding, runoff, or airport ponding will not affect the site.

3.0 ACCESS ROADS.

Roads or streets providing access to the ATCT and Base Building/TRACON site must be designed to conform to the American Association of State Highway Transportation Officials (AASHTO) guidelines and other State and Local requirements. Consideration must be given to future maintainability, such as the use of interlocking pavers in areas where appropriate.

A. Layout. Access to the site must provide for the shortest and most direct routes that will not be affected by traffic interruption such as rail crossings, major traffic routes, or aircraft movement. Streets on the site must be designed to provide access with the least traffic congestion. Layout plans must include existing and final contours, a centerline profile, and must be supplemented by adequate typical sections representative of the various conditions.

B. Grade. In areas subject to snow and ice conditions, longitudinal grade must not exceed 5 percent. In all other areas, grade may be increased to a maximum of 6 percent. Transverse grades must not exceed 2 percent.

C. Width. Lane width must be 10ft excluding curb and gutter. Intermediate and major activity facilities must have a two-lane access road.

D. Shoulders. Minimum shoulder width must not be less than 3ft. Where shoulders slope to the street, the maximum slope must be 2 percent. Where shoulders slope away from the street, the minimum slope must be 3 percent.

E. Curb or Curb and Gutter System. A curb or curb and gutter system is recommended for all flexible pavement. Where rigid pavement is specified, a curb or curb and gutter system is required by design.

F. Pavement Design. Several potential designs are generally available for a specific site. The most practical and economical design is normally selected. Since the decision on the practicability of a particular design may largely be based on a matter of judgment and site location, a detailed description regarding the selection for final design, including the recommendations provided in the soils report, must be included in the design analysis of the 45% submittal. All materials and construction procedures must conform to the State Highway Specifications for the state in which the project is to be constructed.

G. Fire Department Access. The building access roads must accommodate access of fire department apparatuses to the building, consistent with the applicable model building code. Minimum access road requirements include: an all-weather paved surface with not less than 20ft unobstructed width, adequate roadway turning radius, ability to properly support heavy fire apparatus, and a minimum vertical clearance of 13ft and 6in. Access roadways must also be constructed with parking outside the unobstructed width requirements. The roadway limits must facilitate the fire department suppression and rescue operations including tower aerial ladder operations. Any local jurisdiction requirements that may exceed model code requirements must be verified.

H. Tractor Trailer Access. Subject to available property, the building access roads must allow Tractor Trailer access to the Base Building Mechanical and Equipment Rooms. Minimum Requirements include a 50ft turning radius.

4.0 PARKING ACCOMMODATIONS.

The parking lot size must accommodate the peak demand which occurs during shift changes. Typical stall dimensions must be 9’-0” x 18’-0”. Handicap parking accommodations must be provided per the IBC. The parking lot must include motorcycle parking provisions on a concrete pad. Additional requirements include:

A. Layout. Raised curbs, bumper islands, and wheel stops must not be incorporated within interior parking areas and certain perimeter areas at locations where snow removal operations will be conducted.

B. Grade. Minimum slope must be 1 percent. Maximum slope in areas subject to ice and snow conditions must be 3 percent in the longitudinal direction and 3 percent in the transverse direction.

C. Pavement Design. Parking lot pavement design, curb or curb and gutter, materials, and construction procedures must conform to the requirements outlined in Section Access Roads.

D. Parking Traffic Control Signs. Parking traffic control signs must be provided within the parking area limits indicating “PARKING”, “NO PARKING”, “EXIT”, “DO NOT ENTER”, “DISABLED PERSONS PARKING”, “STOP”, “SPEED LIMIT”, etc., as appropriate. Signs must be furnished and installed in accordance with DOT Manual, Uniform Traffic Control Devices (MUTCD).

E. Engine Block Heater Outlets. Vehicle engine block heater weatherproof outlets must have ground fault interruption protection and must be installed in parking areas reserved for government/maintenance vehicles where severe winter conditions exist. Additionally, engine block heater outlets may be required at employee parking spaces at locations where there is an agreement with employees to do so. Engine block heater outlets are to be installed for sites having an exterior design temperature of 0°F or less, in accordance with ASHRAE guidelines.

F. Parking Lot Visibility. There must be an unobstructed view of access roadways when exiting facility parking lots.

G. Security Requirements. Refer to FAA Order 1600.69B for parking security reference documents.

5.0 SIDEWALKS.

Concrete sidewalks must be provided in accordance with operational and pedestrian traffic requirements and must conform to disabled access requirements mandated by Federal Regulations. Minimum clear width of the sidewalk must be 4ft. The sidewalk must conform to finished grade, with a maximum 1/4 inch per foot cross-slope in the direction of natural drainage. Interlocking pavers may be used for sidewalks where appropriate. Sidewalks must meet requirements of the ADA/ABA Accessibility Guidelines.

6.0 LANDSCAPING.

Landscape design is subject to approval by the FAA Security Division. Landscaping must be of a minimum maintenance design. A "xeriscape" design concept must be used whenever possible, unless limited by local landscape building exterior requirements, such as the use of local plants. Plant specimens proven to be hardy and tolerant to specific site conditions must be utilized. The location and tree species to be planted must preclude roots from damaging underground facilities. Trees and shrubs must be strategically planted to minimize obstacles of efficient grass mowing and snow removal. Plants which are especially attractive to birds and animals must be avoided. Sprinkler systems and hose bibbs must be installed in areas requiring irrigation. Adoption of rainwater harvesting is encouraged and its feasibility must be explored. The landscape planting objectives are to accomplish the following:

A. Enhance exteriors and integrate buildings with adjacent open areas

B. Give scale and character to buildings and their surroundings

C. Provide shade and shelter from wind or snow

D. Screen out views of less desirable features

E. Reduce noise, dust, and erosion

F. Minimize maintenance requirements, such as by using grass or ground cover which does not require mowing

G. Low maintenance, including minimization of fertilizers, herbicides, and watering required

7.0 SECURITY.

Coordinate security requirements directly with SSE and refer to FAA Order 1600.69B – FAA Facility Security Management Program.

8.0 TRAFFIC SIGNS.

Roadway signs, markings, and traffic control must follow DOT Manual, Uniform Traffic Control Devices (MUTCD).

9.0 FACILITY SIGN.

A facility identification sign must identify each ATCT and Base Building/TRACON facility. This sign must be installed and conform to applicable codes and FAA standards. An example of the facility sign is provided within the Standard Designs Package.

10.0 UTILITY SITE WORK.

All utilities must be protected by underground installation, marked for recognition using locally accepted utility marking procedures (locating tape, utility marking paint, cable markers), and readily accessible for maintenance. Layout or location of services must take into consideration future expansion of the facility and/or additional demands that may be required of the service.

11.0 ACCESSIBILITY.

Site design and development must include requirements for accessibility to all spaces and must conform to disabled access requirements mandated by ADA/ABA Accessibility Guidelines.

12.0 TRASH STORAGE AND DISPOSAL AREA.

A trash and recycling dumpster concrete pad with concrete ramp must be provided and must be located approximately 100ft from the ATCT and Base Building/TRACON building. Dumpsters must not be located near building air intake vents.

Appendix A6

Architectural Design Guidance

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Appendix A7

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Structural Design Guidance

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Appendix A7: Structural Design

1.0 GENERAL.

This chapter contains general guidance including codes, requirements, and loads for the structural design of Airport Traffic Control Towers and Base Building.

The FAA orders, standards, and specifications, and the national codes and publications identified within this document must be the basic references for structural design. Local building codes must be referenced for frost penetration depth, snow loads, wind loads, seismic zones, foundation restrictions, and other local conditions which may govern over the requirements provided within this document; however, structural design must meet the requirements of the codes and provisions outlined at Appendix D.

2.0 SECURITY.

The Structural design must comply with the requirements of FAA Order 1600.69B, for blast hardening of the facility.

3.0 BASIC REQUIREMENTS.

It is desirable to provide maximum flexibility for future modifications and for adapting building requirements to individual site restrictions. The cab, shaft, link, and Base Building must be designed as independent structures when possible to achieve this desired flexibility. It is imperative that the Structural and Architectural designers work closely together to assure that the required spaces and desired appearance are achieved. Floor, roof, and wall penetrations, as well as space requirements for ductwork, piping, cable trays, floor drains, etc., must be coordinated with the structural elements to avoid incompatible layouts. Allowance must be made for orderly future expansion of the Base Building. Exterior columns and foundations must be designed with consideration for future loads. Exterior walls must be removable without damage to the structural frame, unless Blast Resistance Design requires permanent attachments.

4.0 STANDARD LOADINGS.

A. Live Gravity Loads. Must include non-permanent loading produced by the use and occupancy of the building. Unfactored ATCT and Base Building/TRACON live loads are listed below:

- Cab Floor - 100 psf.

NOTE: Cab floor must also meet electronic equipment load bearing requirements in FAA-G-2100.

- TRACON Operations Room - 100 psf.
- Equipment Rooms (Telco, Communications, Radar, etc.)-150 psf.
- Mechanical Rooms and Electrical Rooms - 150 psf (or actual planned) (UPS - 250 psf).
- Storage space, light - 125 psf.
- Loading Dock - 200 psf.
- Restrooms - 50 psf.
- Locker Room - 50 psf.
- Office Areas - 50 psf.

- Stairs and Landings - 100 psf.
- Public Areas (lobbies, corridors) - 100 psf.

B. Dead Loads. Must be actual weights of materials used, including permanent partitions. Also include permanent equipment weight and forces caused by pre-stressing. The unfactored antenna dead load must be a minimum of 5 psf.

C. Lateral Loads. Wind and seismic loadings must be determined in accordance with IBC and ASCE 7, Minimum Design Loads for Buildings and Other Structures. Wind pressures must be calculated based on the design wind speed and other factors as prescribed by code.. Wind Tunnel Analysis must be conducted for any ATCT taller than 100 feet to the cab floor. Seismic loading must be calculated based on soil conditions presented in the Geotechnical Soils Report along with factors prescribed by the code.

D. Special Considerations. All structures must be designed to have a limiting drift (story lateral deflection/story height) of 0.002 or less due to wind loads. When an Airport Surface Detection Equipment (ASDE) is expected to be installed, the ATCT control cab must be designed to support a penthouse (ASDE equipment) above the cab roof (ceiling). The Equipment Room must be coordinated to provide adequate ASDE equipment space. Additionally, the Penthouse Roof must support the ASDE antenna system.

E. Seismic Loads. In accordance with IBC, dynamic analysis and site response calculations are required at all seismically active locations. Light fixtures, cable trays, motors, UPS modules, switchgear, and motor control centers must be mounted in accordance with IBC Seismic Design requirements, using the specific values for short and long periods. E/G assemblies, transformers, batteries, and bus ducts must be mounted in accordance with IBC Seismic Design Category requirements for the specific site. Electronic equipment must be seismically braced in accordance with FAA-G-2100.

5.0 SPECIAL LOADINGS.

A. Antennas. The structural designer must provide support for communication, ASDE, microwave antennas, and other special equipment. If there are no other provisions for microwave antennas, standard details must be shown for mounting a 4 feet diameter antenna on the catwalk railing (using a 4-1/2 inch outside diameter (OD) pipe) including waveguide entrances to the tower shaft which may be cut after tower construction.

B. Cab Glass. The structural designer must investigate whether window washing will be manual or automated and must consider these loads in the design of the catwalk and glass support system. The catwalk and roof must be designed to support glass panels weighing a minimum of 1,200 pounds each with a minimum area of 70 ft^2 along with hoisting, scaffolding, personnel, and other loads associated with cab glass replacement. The capability to change cab glass panels utilizing a standard design such as davits to be stored and shipped to the site to be used in conjunction with post and pad eye buttons installed on the cab roof must be provided. Cab glass panes must be designed for temperature changes and calculated wind pressures considering the height at which they are placed and exposed to these elements. Particular attention must be given to the trapezoidal shape of the panes.

C. Elevators. Design must be consistent with the load data required for specific elevator type as specified by the architect. Use 100 percent impact for elevator support.

D. Fireproofing. Use dead load of actual materials selected.

E. Temperature. Calculations must be provided for the structural frame to include temperature change and temperature loads required for the framing design.

F. ASDE. ASDE includes a radar antenna installed on the control cab roof at certain airports. The ASDE transmits a signal at a depression angle of -32.5° with respect to the horizontal. When ASDE is required, the designer must be supplied with the loads of the specific product to be installed by the FAA Project Engineer.

6.0 LOADING COMBINATIONS.

Calculations must be provided to support the design of every building component has strength adequate to resist the most critical effect resulting from the combination of dead loads, live loads and lateral loads (wind, seismic, and earth pressure loadings). Applicable Sections of the IBC and ASCE-7 must dictate the combining methods and their respective load factors.

7.0 STRENGTH OF MATERIALS.

The following is a representative structural materials list. Materials for ATCT and Base Building/TRACON construction are not limited to this list. Minimum acceptable strength of material requirements are:

A. Structural steel - ASTM A36 - Fy = 36,000 pounds per square inch (psi)

B. Bolts for structural connections - ASTM A325

C. Anchor bolts - ASTM A307 or ASTM A36 threaded rods

D. Welding electrodes - E70 series, conforming to American Welding Society (AWS) D1.1. "Structural Welding Code Steel"

E. Concrete:

1. Slabs, walls, footings - f'c = 3000 psi
2. Precast, pre-stressed, fill for steel shell piles -f'c = 5000 psi
3. Cast in place concrete around post-tensioned anchorage - f'c = 5000 psi

F. Reinforcing steel - ASTM A615 - Grade 60 - Fy = 60,000 psi

G. Welded wire fabric - ASTM A185 using ASTM A82 wire

H. Hollow load-bearing masonry units - ASTM C90

8.0 MATERIAL SELECTION.

The best structural system for a particular application is one that will satisfy the functional and architectural finished structure requirements at minimum cost. Consideration must be given to future expansion or rearrangement of spaces and costs of maintenance. Generally, the preferred systems utilize material efficiently, provide maximum usable space, minimize special equipment use, and can be constructed by using conventional procedures.

9.0 ENVIRONMENTAL PROTECTION.

Protect structures from moisture penetration and exposure to seawater, corrosive soils, and corrosive atmosphere. Provide water-stops at all construction and expansion joints in concrete walls and slabs below grade where water problems may be anticipated. Use membrane waterproofing for occupied spaces below grade.

10.0 DURABILITY.

Choose materials to assure low maintenance and economic life of the project.

11.0 TROPICAL ENVIRONMENTS.

Steel structures must not be considered for facilities in coastal regions and the tropical environments of Puerto Rico and the U.S. Virgin Islands. The high temperature, humidity, and salt content of breezes within these coastal areas combine to cause rapid steel structure deterioration due to corrosion. Steel maintenance in tropical regions is labor intensive, expensive, and is an endless effort. Materials suited for coastal regions include cast-in-place and pre-cast reinforced concrete and concrete blocks.

12.0 STEEL.

Generally, rigid frames are easier to maintain than steel braced frames because fewer surfaces are subject to corrosive effects; however, rigid frames have a higher unit material and connection cost. Horizontal deflections will generally be smaller for a braced frame than for rigid frames. Diagonal wall bracing may be undesirable when considering architectural or functional requirements. Braced frames generally can be erected faster than rigid frames, in particular, welded rigid frames. Braced frames are usually the preferred type of steel construction when coordinated with architectural requirements. Bracing for main force-resisting systems must be designed so that stability of the structural system does not depend on any single member or connection; i.e. redundancy must be provided. Exposed structural steel must meet fireproofing requirements. Minimize field welding for connections of members that are part of the main force-resisting systems. Shop-welded, field – bolted connections are preferred.

13.0 CONCRETE.

Pre-cast concrete must be used only where acceptable, such as where large numbers of units of similar size and shape are required, pre-casting may be cost-effective. Pre-stressing is generally used to control deflection of unusually long spans, to minimize depth, to aid in developing continuity, or to join pre-cast elements. Pre-stressing requires higher strength concrete, steel tendons, and skilled labor. Pre-stressing is particularly useful for tower shaft construction to resist tensile stresses on the structure due to overturning moments. Post tensioning must not be used due to possible bomb blast stresses. Refer to FAA Order 1600.69B. Pre-stressed construction members must be designed individually to accommodate hangers and penetrations to aid in adding accessories for future expansion.

14.0 CONTROL CAB FRAMING SYSTEM.

Roof and frame construction is generally limited to steel construction since columns must be as small as practical to allow maximum visibility. Since cross bracing would also interfere with visibility, cabs depend on frame action to resist lateral load.

15.0 STEEL FRAMING SYSTEMS.

Open-web steel joists are adaptable to a wide range of spans, from 8 feet to over 100 feet. Floor joist spacing is generally 2 feet and the roof may be as much as 7 feet or 8 feet. Joist construction features rapid erection, open webs for piping, ductwork, or conduit runs, and adaptability to irregular column spacing. Calculations for wind uplift on the roof must be prepared. Calculations for floor framing of relatively large open areas must also be prepared to ensure the framing design minimizes vibrations. Steel beam and girder systems are usually most economical in the 20 feet to 30 feet span range. Beams may be spaced to suit slab or deck limitations. Concentrated loads and heavy live loads are more easily accommodated with steel beam and girder systems than with steel bar joists. Openings, such as for stairs or elevators, are more easily framed and the structural system is more

readily adaptable to future framing changes. Beams and girders are generally more economically fireproofed using sprayed-on or cementious materials. Metal roof decks for steel framing systems are commonly 1 /2-inches deep. The deck is welded to the steel framework and may be designed as a diaphragm to distribute horizontal loads to vertical resisting elements. The roof system must be checked for sufficient pitch or adequate stiffness to prevent ponding. Lightweight insulating concrete may be used to provide roof insulation, to develop drainage control slopes, and to provide added dead load to resist uplift forces due to wind. Maximum practical pitches must be considered for roof deck construction. The minimum pitch must not be less than 1/4-inch per foot. Floor slabs for steel systems may be one of the following preferred options:

1. Conventionally reinforced formed concrete slabs which may be designed as one-way or two-way slab systems, depending on beam spacing.
2. Non-composite metal deck used as a permanent form to support a concrete slab, which is generally limited to fairly short spans.
3. Composite steel deck which is generally the most efficient floor slab due to the metal deck acting as a form, positive moment reinforcement, and in some cases, can achieve a two-hour fine rating without additional treatment.

16.0 CONCRETE SYSTEMS.

Concrete flooring systems include slab and beam systems, one-way or two-way conventionally reinforced concrete slabs, flat slabs, flat plates, and waffle slabs. While these systems offer certain advantages, such as built-in fire resistance and reduced story heights for flat plate design, several factors limit their use in tower construction. Concrete systems are most economical when forms are re-used and floor construction is repeated for multistory buildings. Re-usable forms are used for levels with typical column spacing and where few openings have to be specially formed. Generally, the Base Building interior columns need to be irregularly spaced to fit the interior wall layout. The housed activities space requirements vary and the room layout does not lend itself to repetition. Although the shaft floors are repetitious, they have numerous openings in various locations such as for utility chases, stairways, and elevators, which restrict the efficiency of a concrete system. As a result, the concrete slab systems listed above may have limited suitability for tower construction.

17.0 WALLS AND PARTITIONS.

The architect selects wall and partition materials. All materials including concrete, concrete masonry units, metal panel, masonry, or metal studs, must be designed in accordance with nationally adopted model codes. Specifications for prefabricated wall systems must include performance and testing requirements and submittal of ICC Evaluation Service Reports, to document that the system meets code requirements.

18.0 EXTERIOR WALLS.

The exterior walls are designed for their respective gravity and lateral loads.

19.0 INTERIOR WALLS.

The interior walls must be designed to support their weight along with a lateral load not less than 5 psf applied perpendicular to the walls. The loaded wall deflection must not exceed 1/240 of the span for walls with brittle finishes and 1/120 of the span for walls with flexible finishes.

20.0 WALLS BELOW GRADE.

Basement and retaining walls will generally be constructed of concrete and must be designed to resist the material retained lateral pressure, including surcharge and hydrostatic head. They must be

designed to resist a minimum lateral force exerted by an equivalent 30 pounds per cubic foot of fluid weight. Walls below grade must have no water leakage due to critical equipment below grade.

21.0 SLAB-ON-GRADE.

When walls and columns are founded on separate spread footings, the concrete floor slab must be designed as a separate "floating" slab. Concrete must have a minimum thickness of 5 inches for foot and light pneumatic wheeled traffic and must be reinforced with at least 6 x 6 - W1.4 x W1.4 welded wire fabric, located two inches from the top surface. Slabs must be placed over a vapor barrier on a minimum of 6 inches of compacted stabilized aggregate base. Slabs must be thickened under concrete block walls.

A. Isolation joints must be used at all columns, wall footings, machine foundations, or other points of restraint. The joints permit horizontal slab movement caused by shrinkage and vertical movement due to differences in unit soil pressure under floors, walls, columns, and machinery footings. Isolation joints extend the full slab depth and may be formed with a pre-molded joint filler or two, 30-pound, roofing felt layers.

B. Control joints must also be used to control random cracking. Construction joints must be located and sawed to act as control joints. The maximum spacing between control joints and between construction joints must be in accordance with American Concrete Institute (ACI) standards. Preferably, slab panels must be placed in a lane pattern with a minimum three day delay between adjacent placements. Joints must be sealed with a two-component polysulfide base sealant to prevent infiltration of foreign material into the joint.

22.0 FOUNDATIONS AND WALLS.

Reinforced concrete foundations must be provided for perimeter walls and grade beams. All basement walls must be reinforced concrete, waterproofed, waterstopped, and provided with foundation drains. Where a storm sewer drainage system is available, foundation drains must connect to the storm sewer drainage system.

23.0 SUBSURFACE INVESTIGATION.

Foundation design must be based on recommendations and information contained in a soils report. The designer will provide the soil consultant with appropriate information including building locations, description of structural system, wall construction, column loads and spacing, etc., for the consultant to conduct a subsurface investigation. The soil report must include a site description, a field investigation summary, laboratory tests and borings, groundwater conditions, and a subsurface condition description including seismic geological conditions. The report must also make specific recommendations regarding foundation types, allowable soil bearing pressures, anticipated total and differential settlements, types of piles, pile capacity, pile length, special problems such as de-watering or existing structures protection, lateral soil pressure for basement or retaining wall design, soil corrosion potential and required protection for steel pilings, and any other information that must be considered during the design and construction of foundations. The report must also specifically state potential soil liquefaction, fracture, rupture, location, and distance to the nearest fault or other seismic geological information. Costs must be included to mitigate discovered seismic geological concerns. Sites prone to rupture or liquefaction must be used only as a last resort. The Earth Electrode System (EES) establishes the electrical connection between the facility and the body of the earth. This connection is necessary for lightning protection, power fault protection, and the minimization of noise between interconnected facilities. The subsurface investigation and site survey must determine the soil resistivity, geological features, and review local climatic conditions which include incidence of lightning, frost-line depth, moisture content, and annual rainfall.

24.0 CONSTRUCTION.

Certain construction details may cause problems in tower facilities. Design considerations include the following: Exposed steel columns of tower shaft may be subjected to thermal expansion. The physical results of this differential expansion must be considered during design. Condensation, rust, and staining may result when steel columns are erected with a flange exposed to the exterior. Hollow tubular columns in tower shafts may compound acoustical problems. Headroom clearance above tower stairs is critical. Construction must assure adequate height and space is provided for the cable access level.

25.0 STRUCTURAL DRAWINGS.

In addition to the Structural Plans and Details, the first sheet of the structural drawings must contain a list of the design loads and strengths of materials used, including foundation capacity.

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Appendix A8

Mechanical Design Guidance

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Appendix A8: Mechanical & Plumbing Design Guidance

1.0 GENERAL.

This chapter contains the basic design data, criteria, and guidelines necessary to develop a heating, ventilation, and air conditioning system for ATCT and Base Building/TRACON facilities. Variations have been specified and limitations imposed in this chapter to assure compatibility of mechanical systems with other design requirements of this handbook. The HVAC system and components must maintain the ATCT and TRACON critical space environment within the occupying system reliability requirements.

2.0 LIFE CYCLE COST ANALYSIS.

A Life Cycle Cost Analysis (LCCA) must be performed for selection of the Mechanical System. See Chapter 8 for additional information.

3.0 ENERGY CONSERVATION CONSIDERATIONS.

The following section provides guidance on energy conservation methods/techniques for incorporation into FAA terminal facilities. Some of these ideas represent best practices that should be considered and others represent practices that must be followed.

A. Energy Efficient Design. The designer must use ASHRAE 90.1 for guidance in developing an energy efficient design for ATCT and Base Building/TRACON buildings.

B. Humidity Control

1. Humidification. All electronic equipment requires controlled and stable humidity. The designer must provide humidification, as required, for electronic equipment spaces where load calculations indicate humidity control is warranted. Special care must be taken by the design engineer to specify humidifiers based on site water quality, energy efficiency, installation costs, and operating/maintenance costs. Care must be taken to specify reliable humidistats and their locations. .

2. Dehumidification. Cooling equipment provides effective dehumidification without the addition of special equipment. In locations where high humidity exists most of the cooling season, effective humidity control can be achieved by limiting fresh air intake (not below the outside air requirement for space occupancy) and exhaust, sizing compressors for continuous operation, driving coil temperatures lower to remove excess moisture in the air, and by providing an air sealed room environment for critical electronic equipment. Dehumidification that utilizes reheat coils is acceptable in electronic equipment rooms where other methods of control cannot maintain stable humidity.

C. Solar Photovoltaic, Solar Lighting and Heating. Solar heating can be cost effective under certain circumstances. For ATCT and Base Building/TRACON facilities, prior to specifying solar collectors, the designer must establish there is adequate solar energy to satisfy solar collectors (including photovoltaic (PV)). The designer must verify that the system will have correct orientation without shading, the system will be cost effective, and the system reliability and maintenance will not be appreciably degraded. The designer must consider photovoltaic electrical panels and solar lighting, via windows, mirrors, and light ducts. Active water media collectors must be avoided. Passive air and active air media systems are generally more acceptable. These systems are currently being used extensively by industry and must be considered in regions where they have been determined beneficial.

D. Economizer Cycles. HVAC economizer cycle utilization must be dependent on the regional geographic location of the site. Economizers, even with enthalpy controls, are not to be used for HVAC systems serving electronic equipment. This includes the ATCT control cab, TRACON operations room, all electronic equipment rooms, and the Telco room. Where economizer cycles are being used, HVAC systems must be equipped with appropriate economizer cycles and enthalpy controllers to provide "free cooling" with outside air. The economizer cycle operation must not require use of the humidifier during extremely dry air intake periods. These humidifiers will consume more energy than saved by shutting down compressors. During uneconomical periods of operation, the control system must lockout the economizer cycle or humidifiers with enthalpy controls. Additionally, manual lockouts must be available within the EMCS/DDCS to lockout economizer use when outside air contains unwanted pollutants such as pollen, petroleum fumes, and dust.

E. Modular Heat Recovery Chiller. Sites should consider utilizing a modular heat recovery chiller to make chilled water and 105 degree F hot water for heating and reheat.

F. Hot Water and Chilled Water Systems. If these systems are installed at a given site, they should be variable speed and designed for a 10 degree F delta T.

G. Variable Speed Drives. Consider using variable speed drives on all CRAC units. These systems may be operated in a VAV mode or manually set to the actual load.

H. Control Cab. The control cab is a poorly insulated glass box subject to the maximum effects of changes in atmospheric conditions. Solar gain, greenhouse effect, humidity, conductive heat loss, and convection are forces that influence the design of a specialized cab HVAC system.

1. Proper air distribution must be controlled to maximize the comfort in the control cab. When necessary, ceiling fans must be considered to improve air distribution throughout the facility.
2. Supply air must be equally distributed around the perimeter of the cab and operated continuously at constant volume. Air distribution must be present along the perimeter of the Control Cab to prevent glass fogging.
3. Return air must be collected from registers located near the floor or down the stairway and designed to minimize noise transmission from the air handlers.
4. Cab perimeter diffusers should be adjustable to keep airflow from impinging on Cab glass. A perforated baffle upstream of the diffuser is an option to insure uniform air distribution across the entire width of the diffuser to avoid heavy center area flow.
5. The cab HVAC system must be designed as multiple air-handling units in parallel to provide 100 percent cooling redundancy.
6. Variable speed drives should be used on all Cab air handlers and should be manually set to actual load.
7. Cabs may be equipped with more than one temperature sensor to allow averaging temperatures throughout the cab.
8. Cab insulation must be chosen carefully and provided for all cold metal surfaces to eliminate condensation problems.
9. The cab HVAC system must serve only the cab and adjoining spaces within the same fire area.

10. The HVAC system must be connected to the essential power distribution system. Failure of one unit must allow continuing operation of the second unit.

I. Radar, Communication, and Telco Rooms. These spaces house solid state electronic equipment and require complete heating and air conditioning. Cooling and humidity control is required for reliable equipment operation and cooling loads are generally constant, 24 hours per day, except during additions or equipment modifications. Humidification is required to prevent electrostatic charges from derogating equipment performance.

1. One option available for conditioning areas with raised flooring include using multiple small floor mounted air handler units designed for computer room environments. A typical system would utilize two air handling units that house humidifiers. Each unit should be sized for the maximum load for redundancy. Ventilation requirements are based on occupancy and the designer must collect information about room personnel occupancy.

2. High efficiency air filtration must be integrated into the systems to minimize dust and contaminants.

J. TRACON Operations Room. Raised floor grilles must be sized and located to provide proper air distribution. Where raised floors are not utilized or where two separate equipment and people conditioning systems are used, dampers in an overhead system must control proper air distribution. Either system designed for use in the TRACON must provide a comfortable working environment. Under-floor pressure and air volumetric delivery, measured in cubic feet per minute (cfm), must initially be balanced for the design load. The system must be re-balanced to take advantage of additional design capacity when future equipment is added. Where required by local environmental conditions, the outside air must be carbon filtered at the make-up air intakes for the TRACON operations room. The Total Power requirement for a typical RADS (ARTS radar display) is 5500 BTU/hr. Total Power requirement for a typical TCW (STARS radar display) is 3600 BTU/hr.

4.0 EXISTING HVAC SOURCES USE.

Preliminary consideration must take into account the location of the ATCT and Base Building/TRACON facility as it relates to the overall airport complex. In some locations, a central heating and cooling source may be available that is capable of handling the ATCT and Base Building/TRACON facility requirements. The existing HVAC system identification must consider whether the system is sized to meet the present HVAC load, is operating appropriately, is reliable and available, and if alternative back-up heating and cooling sources are provided, or whether the system can be modified to provide a more efficient operation. These questions must be answered in the architect/engineering (A/E) firm's site report. In the event that existing HVAC equipment and energy sources are available (packaged or central), a cost analysis must be performed to determine the feasibility for revising or modifying it. Factors to be considered include energy source, redundancy, chlorofluorocarbons (CFC) replacement, energy conservation, long-term availability, cost projection, present operations, and serviceability.

5.0 EXTERIOR DESIGN TEMPERATURES.

Heating and cooling load calculations must be made using the following exterior design temperature criteria. For specific ATCT and Base Building/TRACON facilities with known locations, the designer must use the criteria set forth in the ASHRAE Handbook – Fundamentals. When the ASHRAE handbook is used, the designer must reference:

1. Table 4A, 0.4%, ASHRAE Fundamentals for outside air conditions for makeup air

2. Table 4B, 0.4%, ASHRAE Fundamentals for the minimum outside air conditions for air cooled condensers.
3. Table 1B, Cooling DB/MWB should not be used for critical facilities.

6.0 INTERIOR DESIGN TEMPERATURES.

The mechanical systems design serving an ATCT and Base Building/TRACON facility must be based on maintaining the following temperature and humidity requirements:

A. Office spaces and break rooms, storage rooms, rest rooms, kitchens, hallways, administrative rooms, and other personnel areas of electronic rooms:

Winter / Summer - 75 (± 3)° F, dry bulb

Winter Humidity Requirements: 55% Maximum

Summer Humidity Requirements: 50%-55%

B. Mechanical & Electrical Equipment Rooms:

Normal Operation – 55 to 85 (± 3)° F, dry bulb

Winter Humidity Requirements: 95% Maximum

Summer Humidity Requirements: 5-95%

C. Critical Spaces:

73º F stable ± 2º F for periods of 6 hours minimum.

35% to 60% R.H. stable ± 5% for periods of 6 hours minimum.

7.0 DESIGN ANALYSIS.

HVAC system peak load calculations must be performed. Computer analysis must be used to aid the designer in calculating energy loads, energy consumption, highlighting energy losses, selecting the best HVAC equipment, sizing equipment capacity for economy, and testing effectiveness of differing building characteristics.

8.0 GENERAL REQUIREMENTS.

The primary HVAC system design objective is to provide environmental control for electronic equipment and personnel. In electronic equipment areas, provisions for temperature and humidity control within the room and under the raised floor must be installed. Special attention must be given to factors involving installation, maintenance, operation, and reliability with consideration given to diversity and economics. ATCT HVAC system design simplicity for all ATCT facilities must be a design goal. HVAC equipment must be limited to serving one or two floors.

9.0 CRITICAL SPACES.

Certain spaces in any ATCT and Base Building/TRACON facility are considered critical and must have the capability to maintain certain temperature/humidity design conditions. Normally critical spaces are the Control Cab, Communications Equipment Room, Telco Room, TRACON Operations Room, and the Radar and ARTS Equipment Rooms. All cooling systems (central air handling units, DX package units, DX split systems, etc.) serving these spaces must be connected to the essential power system, if existing, and must have 100 percent redundancy and preclude any single-point failure. Electronic equipment rooms with raised floor must have the option to be cooled by multiple

floor mounted computer room units. Rooms without raised floor must be served by overhead distribution from adjacent air handling units. Air conditioning equipment serving critical spaces must be provided with low ambient control to allow cooling in the winter season.

10.0 LOADS.

Total heating and cooling loads must be based on the design analysis. Special electrical loads associated with the technical equipment in critical spaces must be obtained from the latest information available, supplied by the electrical load study.

11.0 RELIABILITY.

The HVAC system design must allow the critical spaces to function under routine and emergency conditions. The HVAC system must have a changeover capability for cases of prime equipment failure allowing critical spaces to be provided with conditioned air until primary equipment is repaired. The changeover control to back-up equipment must be automatically accomplished.

12.0 GENERAL SPACE REQUIREMENTS.

Each ATCT and Base Building/TRACON facility space or room has a unique function resulting in specific HVAC requirements. Since all ATCT and Base Building/TRACON spaces and various equipment are not located at all facilities, the designer and designated approval authority must determine the spaces and equipment necessary for each ATCT and Base Building/TRACON configuration. Space and equipment usage requirements must be supported by appropriate FAA specifications/standards/orders.

13.0 BASIC REQUIREMENTS.

Energy costs need to be considered in the design of the HVAC system. Reheat use must be minimized in non-VAV applications. All critical spaces have specialized, redundant cooling requirements. Locating HVAC and related equipment above the ceilings in occupied critical areas must be avoided to eliminate problems associated with noise, vibration, and access. Locating equipment on the roof of any facility must also be avoided to the maximum extent practical. If equipment must be located on the roof, it must be provided with the proper stand-off distances from building edges in accordance with OSHA 29 CFR 1910 requirements and be in compliance with fall protection requirements as outlined in JO Order 3900.63 ATO Fall Protection Order.

A. Junction and Sub-junction Levels. Cab stairwells and elevator lobbies must be heated and cooled with minimum ventilation. Stair vestibules have special ventilation requirements per Fire Protection requirements. Electronic equipment rooms generally have constant loads; therefore, they can be cooled with multiple small air handlers mounted on the raised floor or with overhead distribution for equipment rooms without a raised floor system. Systems serving communication, microwave, or other specialized equipment spaces must run on essential power and be separate from the control cab system.

B. Administrative Spaces. These spaces require normal office environment cooling, humidification, and heating systems. Heating and cooling loads are variable. Administrative spaces are not normally occupied more than 8 hours a day and must be zoned by occupancy hours and similarities in comfort control requirements. Use night setback thermostats must be used in areas occupied for eight hours per day. HVAC systems with VAV are optional and zones must be determined from building size and layout.

C. Break Room. Provide HVAC capacity for 24-hour per day operation to handle the heat generated by existing and planned vending machine, cooking equipment, and refrigeration compressor associated with under-the-counter refrigerators and drinking water remote chillers when provided. The kitchen area must have its own exhaust fan activated by a switch

which is located near the cook-top or microwave oven. TRACONs and ATCT Base Buildings without a TRACON have similar break rooms. A range hood with exhaust fan and a residential type hood fire suppression system must be provided for residential type ranges.

D. Toilet, Shower, and Locker Rooms. Provide tempered conditioned supply air ducted directly to toilet room ceilings in the amounts only as required to compensate for heating or cooling thermal envelope loads. Louvered door makeup air must not be used if toilet room entrance walls are fire-rated; nor must door louvers or undercuts be considered if requirements exceed 100 cfm. In Base Buildings the exhaust fans serving toilets (and adjoining janitor closets) must be interlocked with the building HVAC fan(s). In low activity buildings without central HVAC systems, toilet rooms must be equipped with an exhaust vent fan operated with the room lighting switch.

E. E/G Room. For summer conditions, provide an exhaust fan that is mounted to the side or on the building roof and is weatherproof for space ventilation, activated by a thermostat with set point at 80° F (adjustable). If local climate conditions will not allow this temperature, provisions must be considered to maintain room temperatures between 80° F and 95° F. Design must preclude drawing outside air that could be contaminated by the battery room exhaust. An additional high volume fan is required for simultaneous operation with the engine-generator set via the essential power buss. This fan must be sized to draw air through the E/G space at a rate sufficient to provide the necessary heat removal for the specified E/G. Alternatively, a two-speed thermostatically activated fan with activation set-points at 85° F and 90° F, sized as noted above, to operate with E/G operation may also be considered. Air intake for both normal ventilation and high-volume exhaust fans must be via low efficiency filtered storm-proof outdoor air louvers or intake hoods with multi-blade (sectioned) low-leakage motorized control dampers (insulated airfoil dampers or similar type preferred for all heating climate zone I through III inclusive). Dampers on fan intake throats must be of similar type, motorized, and interlocked with either fan operation or barometric backdraft. For installation in colder northern regions, a low ambient thermostatic damper control to interlock intake damper blade sections for high volume exhaust fan to preclude the full damper area from opening on E/G start-up when outdoor ambient is below freezing. Other design options can be considered. For E/G sets equipped with bed-rail mounted integral radiators, the high volume exhaust fan is not typically required as air is drawn over the engine and discharged to the atmosphere via the integral radiator fan (requirements must be verified individually for such installations). E/G space must be provided with a thermostatically-activated unit heater to maintain this space at no less than 50° F. A cold water tap, floor drain, and emergency eyewash station must be provided within the E/G Room.

F. Mechanical Rooms. These rooms must incorporate air conditioning to maintain the required equipment room temperature listed at 6.0-B.

G. Utility and Elevator Shafts. These spaces usually require natural ventilation only. Storm-proof louvers must be provided to the outside at the top portion of each shaft. Air intake at lower levels may be via passage door, space under doors, or louvers at the base level. Utility chase spaces containing water pipes and drain lines must be heated to maintain a minimum temperature of 55° F.

H. ATCT Stair Shaft. Space conditioning for tower stair shafts is generally not required; however, stair shafts must be controlled to mechanical room standards. Stair sections must be heated above the top elevator landing which leads to the cab. Heating or cooling may be required in some locations due to extreme summer or winter temperatures.

I. UPS Equipment Room. This room must be served with two completely redundant (essential power feed) cooling-only constant volume air conditioning systems. Air supplied to this space must be 100 percent filtered. Commonality of system ductwork, air-intake louvers, and plenums is acceptable. The essential power system must be part of the essential system serving other critical HVAC Base Building areas. Rooftop air-cooled direct refrigerant expansion condensing units are permitted when chilled water is not available as a primary cooling source or when the rooftop unit serves as the redundant back-up cooling system. Automatic switchover must be provided in the event of failure of the primary unit. UPS heat rejection must be verified for each site regarding specific equipment to be provided. Room design temperatures must be in accordance with the mechanical equipment room standards, year-round, stabilized at a particular value once initially established and must not vary over seasonal periods. Air distribution must be via an overhead or low sidewall supply directed toward the UPS gear base (integral) ventilation intakes. The UPS gear cooling load is continuous, 24-hours per day, year round, and is approximately constant regardless of associated air traffic activity/TRACON equipment load imposed on the gear. With the UPS gear, consider the option of incorporating an airside or hydronic run-around-loop heat recovery system or air-to-air heat exchanger for preheating winter ventilation air for other Base Building HVAC fan systems. Outside air economizers must not be used due to dust and/or humidity exposure to the sensitive equipment within this room.

J. Electrical Rooms, Elevator Machine Rooms and Storage Rooms. These rooms require continuous ventilation and may require cooling in summer and heating in winter.

K. Smoking Room. Smoking rooms must be kept at a negative pressure in relation to the rest of the facility to contain smoke. Air from the smoking room must be exhausted directly to the outside with no recirculation to the rest of the facility. Smoking must be prohibited in remainder of the areas in the facility and also prohibited within 25 feet of entries, outdoor air intakes, and operable windows. Provide signage to reflect this.

14.0 SPECIAL REQUIREMENTS.

The selection of the HVAC system and the associated equipment must be accomplished so that standard manufactured and certified products with a background of reliable energy efficient performance are assured. The American Refrigeration Institute (ARI) must rate all HVAC equipment. In addition, the designer must avoid complicated and overlapping designs and layouts in meeting HVAC requirements in all ATCT and Base Building/TRACON facilities. The HVAC system must also meet all applicable ASHRAE standards to include, but not limited to, ASHRAE 62, ASHRAE 55, and ASHRAE 90.1. Refrigerant monitoring must be provided in accordance with ASHRAE 15. Refrigerant systems must comply with FAA Order 1050.18, Chlorofluorocarbons and Halon Use at FAA Facilities.

15.0 AIR DISTRIBUTION.

The air distribution system must follow configurations and patterns that are standard to the industry (SMACNA standards). Low and medium pressure ductwork systems must be used where possible. Duct sections with inherently high airflow resistance must be voided. The number of sharp turns and branching patterns that create airflow turbulence must be minimized. Ductwork must be thermal/noise insulated and must be obstruction free from auxiliary hardware must be designed. Design ductwork to utilize minimum fan horsepower. Exterior insulation must be considered in lieu of duct lining material when required to reduce possible long-term moisture build-up that may lead to growth of mold.

Noise Control. HVAC system noise control is required for ATCT and Base Building/TRACON facilities. The Cab and TRACON Operations Room HVAC systems must be designed for airflow

noise levels limited to 35 NC. The design for the HVAC systems serving the electronic equipment area, offices, conference rooms, and training rooms must limit the airflow noise level to 45 NC. Sound traps must be used, as required, to achieve these levels and where return air passes through sound treated walls. To minimize HVAC noise, equipment must be mounted on vibration isolators. Rooftop equipment may require installation of noise traps on the supply and/or return air duct openings, depending on the unit configuration, fan location, and working characteristics. All rooftop mounted air-handling systems and packaged air conditioning systems must be strategically mounted to alleviate noise attenuation. Ceiling fans must be considered for installation in tower control cabs for circulation of conditioned air and ventilation.

16.0 AIR FILTRATION.

The inclusion of highly sensitive electronic equipment in ATCT and Base Building/TRACON facilities requires the use of high quality air filtration systems. High-efficiency filters must be installed in equipment serving critical areas.

1. A minimum of 2inchthick disposable 30 percent pre-filters rated MERV 8 must be used in all units.
2. CRAC units must utilize high-efficiency filters rated at a minimum of 65 percent efficiency by ASHRAE Standard 52.1
3. Filters must provide fuel odor protection. If severe problems are anticipated due to site location, charcoal filters or HEPA filters may be used for outside air intakes serving critical equipment rooms. If carbon filters are used, they must have 2 inch thick filters upstream and at least a 2 inch MERV 8 and a 12 inch MERV 14 ES downstream to catch carbon dust.

NOTE**:** Careful consideration must be made for specification of these systems due to the size and high maintenance cost of these filters. High-efficiency filters must be rated at a minimum of 65 percent efficiency by ASHRAE Standard 52.1. Electrostatic air filters must be considered in critical spaces of locations with high ambient dust levels such as airports in desert areas. During design, care must be taken to ensure these filters will not produce electronic feedback or allow harmonics back into the system.

17.0 VENTILATION.

The applicable ventilation standard is ASHRAE Standard 62. Base ventilation rates on required CFM per person and CFM per square foot. The ASHRAE Ventilation Rate Procedure and Indoor Air Quality Procedure may be used as alternate procedures. Outside air intakes must be located away from exhaust fans, stacks, toilets, food preparation hood vents, combustion exhaust, aircraft fueling operations, trash dumpsters, or any sources that might contaminate intake air. Outdoor air intakes must be at least 10 feet above grade to comply with security requirements. Design may consider air-to-air heat exchangers for energy conservation.

18.0 SEISMIC RESTRAINT.

All HVAC systems and equipment must be installed in accordance with IBC and SMACNA. The specified restrain system must be consistent with the local seismic conditions of the particular facility.

19.0 THERMOSTATS.

A thermostat must be provided for each zone or zone combination serving a conditioned space. Multiple location temperature sensors must be considered in tower control cabs. Zones must be comprised of spaces with similar environmental control requirements. Thermostats must be

tamperproof with keyed setting devices. Thermostats and humidistats must be located where they will measure the best average condition in a zone. Thermostats are to be located away from direct sunlight, heating or cooling sources, and exterior walls.

20.0 CAB WINDOWS.

The capability to keep the tower cab windows free of condensation in all weather conditions (e.g., rain, frost, sleet, snow, dust, condensation, etc.) must be provided. The window washing method may be automatic or manual.

21.0 EXPANSION.

ATCT and Base Building/TRACON facilities are designed for a specific activity level expected within 15 years. A close examination of the feasibility of the future HVAC system expansion must be made after existing requirements are met. The Requirements Document for a specific facility design must provide details for the magnitude of any required future expansion elements within the facility. Elements, which will expand within the facility, must be designed into the initial system. Major building additions will most likely require separate systems suited to the addition. If specifically required for a particular facility, the design must include items such as piping taps, shut-off valves, and increased chiller sizing for future expansion capability. In no case must the mechanical equipment, including chiller, oversizing exceed 15 percent of the current design capacity.

22.0 VACUUM CLEANING SYSTEM.

A central vacuum system must be installed to serve the control cab and TRACON. Consideration must be given to include other electronic work areas, as required. Due to noise considerations in normally occupied air traffic control areas, the blower unit must be installed in a remote location. The central vacuum system must be designed to preclude potential smoke infiltration into the control cab. Installation of central vacuum system must include end caps. Recommend including remote starting switch co-located with hose attachment / plugin locations.

23.0 HVAC CONTROL SYSTEMS AND EQUIPMENT.

Selection of appropriate HVAC equipment will require an in-depth analysis of facility loads and will depend upon the type and size of the facility. The designer must consider the installation, operation, and maintenance (O&M) costs of the various systems. Selection of HVAC systems must be based on the Life Cycle Cost Analysis (LCCA) for the facility. System pressures must be designed to be as low as practical. Space static pressures must be as close to atmospheric pressure as possible with slight favor to overpressure, particularly in electronic equipment areas. The ECMS/DDCS is used to start/stop HVAC equipment, limit electrical demand and shed electrical load, optimize HVAC functions, monitor alarms and log operation data, issue reports, and provide equipment historical alarm/maintenance records. Microprocessors with energy conservation software, remote communications capability, equipment sensors and controls, maintenance history, and training capability for new employees are generally available with state-of-the-art ECMS/DDCS. The ECMS/DDCS must consist of a central control and monitor computer to regulate each major building component and HVAC system and subsystem for energy conservation. The ECMS/DDCS must be located in a secure space near the mechanical equipment room or electrical room. The ECMS/DDCS must provide all building alarms and on-off indicators for system status, supply air temperature, outside air temperature, mixed air temperature, economizer cycle, energy source, pumps, exhaust and supply fans, critical louvers, and dampers, etc., as appropriate. Controls necessary for the operation of all major components of the HVAC system must be available through the computer. ECMS/DDCS systems must be an “open system” design that does not rely on an individual manufacturer’s proprietary software or hardware. All set points and alarm functions must be fully adjustable from the computer keypad. Generally, as a minimum, alarm functions must be

provided for smoke detector activation, sump pump failure, failure of primary or standby fan and refrigeration systems where dual sources are required, and out of tolerance filter loading differential pressure. Scheduling functions and general alarm notification of the electronic equipment room (computer room air-conditioners) HVAC equipment must be available through the ECMS/DDCS. The ECMS/DDCS must provide the alarm functions mentioned above along with HI/LO relative space humidity, HI/LO space temperature and optional access floor water detection.

24.0 TRACON AND EQUIPMENT ROOM ESTIMATED HEAT GAIN.

For situations in which the final electronic equipment list is not available, the following approximations may be used to determine the minimum heat gain associated with electronic equipment areas.

ROOM	MIN BTU/SF EQUIPMENT
COMM	65
RADAR	65
TELCO	35
TRACON	35

25.0 GENERAL PLUMBING REQUIREMENTS. Plumbing in an ATCT and Base Building/TRACON facility normally involves a few specific minimum requirements that are more rigid than those utilized in most office buildings. This chapter presents the minimum requirements and special equipment needed at most ATCT and Base Building/TRACON facilities. Piping must be kept clear of cable tray access.

26.0 CAST IRON PIPE. All below-grade sanitary and storm sewer piping located within 5 ft outside of the exterior wall and/or foundation must be standard weight bell and spigot with push- on neoprene gasket, cast-iron or ductile iron pipe. No-hub standard-weight cast iron pipe may be considered for below grade sanitary and storm sewer piping. All above ground interior sanitary sewer and storm sewer piping must be no-hub standard-weight cast iron or ductile iron, or D-W-V copper pipe. Vertical pipe in the tower shaft must have expansion fittings sized per the height involved.

27.0 COPPER PIPE. All above-grade hot and cold domestic water pipe must be Type-L, hard-drawn, copper pipe. Type-K copper tubing must be used for underground water supply.

28.0 PLASTIC PIPE. Plastic pipe schedule 40 and schedule 80 may be used in accordance with ANSI standards for underground applications where ground conditions cause high corrosion rates in cast iron pipe.

29.0 NOISE ISOLATION. Shock absorbent, flexible connections, special mounting, or hangers must be used where noise problems are critical.

30.0 CONTROL CAB DOWNSPOUTS. Piping for downspouts from the control cab roof must be installed inside the control cab roof support column and must be Type-L or Type-K soft-temper copper. Flexible stainless steel drain lines may be necessary and used only if there is no ability to use Type-L or Type-K soft-temper copper.

31.0 INSULATION. In cold weather climates, roof drain hubs and downspout piping must be insulated. The insulation for the downspout pipe within the control cab roof support column must be 1/ -inch-thick foam rubber with the remaining tube void filled with foam insulation. It must be noted that the control cab structure tube configuration produces a significant interior space limitation. Electrical heat tapes and insulation for water pipes must be provided where required.

Heat tapes must include thermostat control with visual indicator for "ON" condition. Where possible, a minimum of 18 inches of heat tape clearance access must be provided all around. Heat tape must not be used on fire protection piping.

32.0 SEISMIC RESTRAINT. All plumbing and fire protection systems must be installed in accordance with IBC and SMACNA.

33.0 CONTROL CAB FIXTURES. The control cab for all ATCT and Base Building/TRACON facilities must have a compact refrigerator, sink with bubbler, and water cooler. The sink must be stainless steel with satin finish. Emphasis must be placed on assuring that no plumbing fixtures or piping will interfere with the functional cab use. Additionally, the domestic water supply must be designed to prevent stagnant water at the control cab.

34.0 BREAK ROOM. ATCT and Base Building/TRACON facilities containing break rooms must have one or more appropriately sized refrigerators, sink, garbage disposal, microwave oven, and stove/range unit with filtered hood, vented to the exterior. Break room access must be in accordance with ADA/ABA Accessibility Guidelines requirements.

35.0 TOILET ROOMS. Vitreous china fixtures must be used in all rest rooms. Flush valves must be used on ground or second-floor only. Tank-type fixtures must be used above the second-floor elevation. Chair mounts must be used whenever possible. Provide disabled fixtures required by ADA/ABA Accessibility Guidelines for disabled access. Lavatories in tower restrooms must consider in-line hot water heaters. Water conserving closets (1.6 gallons per flush) and urinals (1.0 gallon per flush) must be used in design.

36.0 SERVICE SINKS. Mop sinks in Janitor Closets must be floor type. Other service or utility sinks may be floor mounted or wall mounted and constructed of fiberglass, or cast iron enameled material. Each sink must be provided with wall-mounted faucets including a vacuum breaker and hose connections. Service sinks must not be designed for the disposal of hazardous cleaning materials.

37.0 HOSE BIBBS. Hose bibbs with vacuum breakers (backflow preventers) must be provided at ground level around the perimeter of the building and at the cab walkway level. All exterior hose bibbs subject to freezing conditions must be freeze proof type.

38.0 AUTOMATIC LAWN SPRINKLER SYSTEM. Automatic sprinkler systems for maintenance of landscaping and lawns must be installed wherever there is grass or landscaping to be watered.

39.0 WATER PRESSURE. At ATCT locations where the main water service pressure is not sufficient to provide at least 30 psi at the top of the tower, a storage tank water pressure system with a booster pump must be installed. Two booster pumps must be installed when additional pressure is required. A primary pump must be used for normal operation with a standby pump connected. The changeover operation must be accomplished automatically. The complete

pressure system must have automatic operation capabilities. The pump system must be designed for minimum pump horsepower. Seismic and/or thermal expansion joints must be installed where appropriate.

40.0 FUEL STORAGE TANKS. Where applicable, liquid propane pressure piping must be installed in accordance with NFPA 58, LP-Gas Code, Order 1050.15A (Fuel Storage Tanks at FAA Facilities); and Order 1050.16 (Implementation Guidelines for Compliance with Underground Storage Tanks.) The storage tank must be 250 psi single wall, and approved for liquid petroleum gas (LPG). LPG tanks must only be used in geographic areas where feasible. All diesel underground storage tank (UST) installations must be in accordance with Orders 1050.15A and 1050.16, NFPA 50, and State and Local codes. The fuel storage tank must be located so that easy access is permitted. All above ground storage tank installations must be in accordance with Order 1050.15A and NFPA 30, and comply with State and Local codes. Fuel tank capacity must be of sufficient size for 72 hours of continuous E/G operation at a particular facility. Larger fuel tanks require additional spill prevention control requirements that can burden the facility with higher operation and maintenance costs and must be avoided. Extra capacity for alternate or duel fueled boilers is not required. Diesel storage tanks must be provided with a fuel filtering/polishing system.

41.0 SANITARY TREATMENT. Connection to local sanitary sewer systems is recommended at all ATCT and Base Building/TRACON facilities. In cases where connection is not possible, the design must include a storage or treatment system. The system to be utilized must be approved by the designated approval authority after consultation with appropriate Local, State and Federal agencies. When these techniques are used, precaution must be taken to ensure against possible contamination of domestic water supply system.

42.0 SUPPLEMENTARY WATER HEATING. In keeping with energy conservation policies, the ATCT facility Base Building designer must investigate solar energy feasibility for domestic hot water heating and building heating. Prior to implementing these techniques, operation impact, equipment redundancy, equipment reliability, initial, and operational costs must be assessed. The designated approval authority must approve the cost assessment methodology.

43.0 STORM DRAINAGE. Connection to local storm sewer drainage system is recommended at ATCT and Base Building/TRACON facilities.

44.0 FOUNDATION DRAINAGE. The geotechnical report data must be used to design the drainage system.

Appendix A9

Electrical Design Guidance

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Appendix A9: Electrical Design Guidance

1.0 GENERAL.

The criteria set forth in this chapter includes the minimum functional and design requirements of the ATCT and Base Building/TRACON facilities' interior and exterior electrical systems. The power distribution system and components must meet overall power system and critical occupying system reliability requirements

2.0 CODES AND STANDARDS.

Electrical designs must be in accordance with the latest edition of applicable electrical codes and standards. Standby power systems must be installed in accordance with Order 6950.2 – Electrical Power Policy Implementation at National Airspace System Facilities. The specific type of stand-by power system must be as provided in the Requirements Document.

3.0 DISTRIBUTION SYSTEMS.

The electrical systems addressed in this chapter include, but are not limited to, the following:

A. Exterior Systems
B. Building Services
C. Wiring
D. Panelboards and Switchboards
E. Lighting and Wiring Devices
F. Grounding, Lightning, and Surge Protection
G. Emergency Lighting
H. Security Systems
I. Fire Alarm Systems
J. Telephones
K. Cable Trays
L. Engine Generators
M. DC Power Systems
N. Motor Control
O. UPS
P. Local Area Network (LAN)
Q. Fiber Optic Cables

4.0 SITE LIGHTING.

Site lighting must be designed and installed in accordance with FAA Order 1600.6. The site lighting design must include photocell control for parking and walkways used 24 hours per day. Parking lots used only partially during evening hours must be controlled by a photocell and time switch connected in series allowing lighting can be turned off during selected hours. All sign lighting must

be controlled with the same time controls used for adjacent lighting. These lighted areas must permit safe, vehicular, and pedestrian maneuvering. The design for these areas must limit the ambient light on the control tower cab windows to no more than 0.1 foot-candles and must be in accordance with the guidelines set forth in the Illuminating Engineering Society (IES) of North America's Reference and Application Handbook. LED type lighting should be used to the maximum extent possible. Further minimum requirements regarding lighting intensities are listed below:

A. Roadway. 0.6 to 2.0 foot-candles average maintained (with 3-1 uniformity).

B. Parking/Sidewalk. 0.8 foot-candles.

NOTE: Values indicated may be superseded by security requirements.

Lighting sources must be compatible with adjacent lighted areas. (i.e. If roadways to ATCT are lighted with high pressure sodium (HPS) or metal halide, that source must be used for site lighting and roadway lighting. Color temperatures should be similar for LED parking lot lights, LED bollards, LED wallpacks, etc.

5.0 BUILDING SERVICE FACILITIES.

Arrangements must include the determination of whether the utility company or the user will provide the service transformer. Preferably, the utility company will provide the transformer; however, the final decision must be based on the most economical method and local power company policy. The preferred service transformer must be delta primary, 480 volt wye, three-phase secondary with neutral. The neutral and equipment ground should be bonded at the service entrance disconnect (usually a circuit breaker with GFP if required) which be located as close as possible to the transformer, preferably on the interior of the outside wall that faces the utility transformer. The exact distance must be determined by the building design. Delta primary is preferred to reduce certain utility harmonics which improves the overall power quality supplied to the ATCT. A service transformer delta primary is required for new construction and modernization of projects, and is subject to a cost/benefit analysis. Feeder voltage drops must be no more than 2 percent under the actual connected load conditions that serve sensitive electronic loads or associated power conditioning equipment. Branch circuits voltage drops serving sensitive loads must be less than 1 percent of the feeder line voltage.

6.0 COMMERCIAL SUPPLY.

Incoming feeders must be single or dual, conform to Orders 6030.20 and 6950.2, and meet utility power quality requirements as defined by the ANSI/CBEMA voltage criteria (see IEEE-STD-1100). The utility harmonic limits must meet IEEE STD 519 harmonic limit requirements. The incoming feeders located exterior to the building must be coordinated with the utility company's source. The feeders must enter the building underground. When dual feeders are required, these feeders must be taken from two separate sources and must run in separate ducts. When utility power quality is unable to meet FAA power quality requirements, the facility power design must correct deficiencies to meet these FAA power requirements.

7.0 ELECTRICAL CONDUITS.

Electrical designs must consider below grade conduit installations where possible. FAA-C-1391 and FAA-STD-019 provide guidance on conduit.

8.0 SERVICE DISCONNECT MEANS.

The secondary side of the service transformer must terminate, in accordance with NEC Section 230-70, in a separately mounted circuit breaker. The service disconnect means is also permitted to be a separately mounted fusible safety switch or a fusible panel board with a main fusible switch. Ground

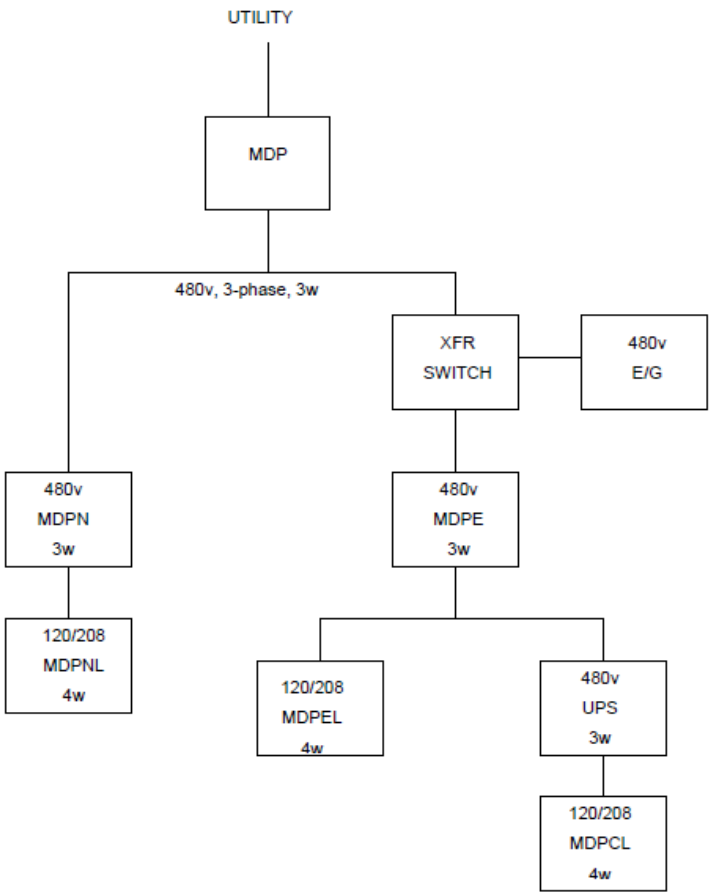
fault interruption protection must be provided in accordance with NEC, and additionally, provide single-phase voltage loss protection where required. Ground fault interruption protection on the main distribution panel (MDP) must include a main circuit breaker with ground fault interruption protection. When using fuse disconnects, downstream electrical distribution must provide single-phase voltage loss protection to any sensitive electronic equipment. Panel nameplates and identification must be installed in accordance with FAA-C-1217.

9.0 MAIN DISTRIBUTION PANEL (MDP).

The MDP must be located in a room or space dedicated for such equipment in accordance with NEC. This panel will normally be rated 480 volt, three-phase three-wire and must be designed with a minimum spare capacity of 25 percent. A short circuit calculation and protective device coordination analysis for the entire facility must be accomplished to determine the appropriate available interrupting current capacity requirement (AIC) and circuit breaker settings for all facility panels and breakers. This analysis must be performed in accordance with Order 6950.27, Short Circuit Analysis and Protective Device Coordination Study.

The design must allow only the over current device closest to the fault to operate. Ground fault interruption protection option on all solid-state 480-volt breakers rated 1000 ampere three-phase or higher with appropriate interrupt capacity must be provided. The main distribution panel essential (MDPE) will normally be rated 480 volt, three-phase, three-wire. This panel must be designed with a minimum spare capacity of 25 percent. All breakers 1000 ampere three-phase and higher must be installed in accordance with the NEC, have ground fault interruption protection option, and be rated to provide interrupting capacity in accordance with the short circuit study.

When an ATCT and Base Building/TRACON facility requires a critical power distribution system (CPDS), the electrical design must be coordinated with the Headquarters Power Systems Office. Only 480 volt, three-phase, wye, three-wire distribution systems must be used, based on their superior harmonic resolution capability. This capability is applicable to all ATCT and Base Building/TRACON facilities unless 480 volt, three-phase utility power is not available. The electronic equipment requires 120/208-volt service, and will generally be supplied from transformers 30 kVA to maximum 75 kVA at the load (480 volt delta, 120/208 volt wye). The designer must follow guidelines in IEEE STD 1100, the Federal Information Processing Standard (FIPS) power distribution publication for electronic equipment, and actual equipment loads to size transformer.



BASIC ELECTRICAL DISTRIBUTION SYSTEM

10.0 PANELBOARDS/SWITCHBOARDS.

Panelboards for building loads will normally be rated 480 volt, three-phase, three or four wire, and have interrupting capacity rated breakers sized in accordance with the short circuit study. The building loads may consist of the following:

A. Motors 1/2 hp and larger - 480 volts, three phase.
B. Motors less than 1/2 hp - 120 volts, single phase.

C. Fluorescent lighting - 277 volts, high efficiency type except in dimming applications and where cost saving can be achieved in low quantity fixture applications. If it is determined that 277 volts would not provide better service, a lower voltage system may be considered.

D. LED lighting - 120, 208, 277 volts, color temperatures similar to fluorescent/daylight lighting is required.

E. High intensity discharge (HID) lighting (i.e. Mercury vapor, high pressure sodium or metal halide – 120, 208, 277 or 480 volts.) Consider LED type lighting as an alternate.

F. Console task lighting – LED gooseneck type – 120 volts.

G. Convenience outlets – 120 volts, located per NEC.

Panelboards for FAA electronic equipment must be rated 120/208 volts, , three-phase, four-wire, and correct interrupting capacity rated breakers. Final breaker interrupting capacity must be based upon the short circuit study and analysis conducted in accordance with Order 6950.27. When the building has normal and emergency power sources, these panels must be connected to the essential or critical main distribution panel. Sub-feeding an FAA electronics panel from another FAA electronics panel should be avoided.

Panelboard doors must be installed in accordance with FAA-C-1217. Provide panel board doors with hinged door installed in hinged cover. All phase, neutral, and grounding bus within the electrical panels must be copper and all connectors must be Underwriters Laboratories (UL) listed for copper. All critical panel neutral buses should be rated at 100%. Panel schedules must be typed and completed and installed in accordance with FAA-C-1217. The following rooms or equipment types in new designs with 277/480 volts available must have individual panel boards with appropriate size, 480 volt delta to 120/208 volt wye K-13 rated transformer located within 10 feet, where feasible, that serve only the electronic load in that room or of that type:

A. Cab

B. Communications Equipment Room

C. Automation Equipment Room

D. TRACON Operations Room

E. Telco Room

F. Communications and Radar Workshop

G. ASDE Equipment

H. RML/TML Equipment

Isolation transformers rated up to 150 kVA with 208V/120 secondary normally will have less than 10 kA available fault current. Panel boards can generally use less costly breakers with 10 kAIC interrupting capacity rating. The actual circuit loading must dictate the minimum size of the isolation transformer. Switchboards may require solid-state circuit breaker type with ground fault interruption protection option when rated over 1000 amps, three-phase. Required studies and design dictate actual devices used. Breakers with interrupting ratings in accordance with the short circuit study must be provided. All panel boards must be designed with 25 percent spare main capacity and additional installed breakers. The panelboards and switchboards must be provided in a configuration allowing spare circuit breaker space to exist for each power type on a system basis. (i.e. building service, essential, and critical systems.) The spare circuit breakers must be distributed and present in every panelboard/switchboard. Fuses, in lieu of circuit breakers, are allowed where complete

protection device coordination in the critical systems cannot be obtained using other protection devices.

11.0 STANDBY POWER SYSTEMS.

Facility standby power systems requirements must be determined within the Requirements Document for a specific site. The E/G set may only be provided as government furnished equipment (GFE). The main fuel tank is purchased separately from the E/G and can be contractor furnished. In the event of utility power failure, the E/G must provide power to critical, essential, and life safety loads. E/G's must come with a separate, permanent load bank. Separate conduit not containing power wires, must be provided for installing control and monitor cabling to the E/G as well as remote annunciation (typically in the ATCT cab). Conduit must be installed in accordance with FAA-C-1217. The E/G must be monitored from the AT operational (TRACON and/or cab) area(s). The designer is responsible for confirming the required size of the E/G with the designated design approval authority. The E/G size is based on calculated connected facility load with demand factors, and arrangement of Fire Pump load shedding scheme. Consult the Power Systems Office to obtain the latest requirements regarding sizing the engine-generator. The E/G fuel choice must meet Local and Federal EPA environmental requirements. E/G sizing and system accessory information is provided on the Engine Generator Program web site.

Uninterruptible Power Source (UPS). When required, a UPS must be provided and physically located by the designer to regulate and provide quality power to critical electronic equipment. UPS equipment must only be purchased through the UPS Program Office. The UPS normally consists of a primary AC power source, rectifier/battery charger, batteries, static inverter, maintenance by-pass switch, and static transfer switch. The UPS must be designed to provide uninterrupted continuous power for critical equipment between failure of commercial power and E/G start up and to protect equipment against damage or failure from transient voltages from the utility service. Critical electronic equipment power back-up requirements are defined in Order 6950.2.

Battery installation requires special attention to ensure that the load distribution does not exceed floor design limit. Batteries require sufficient environmental control to maintain ambient temperatures between 65° F and 77° F. The UPS equipment and battery areas require adequate ventilation or space conditioning to control heat dissipated from the equipment cabinet and, if required, to exhaust gases or odors that might be released in the event a battery enclosure is fractured. The UPS, with required battery monitoring, is installed in series with commercial power and standby E/G and continuously feeds branch panels serving critical automation equipment. The UPS design must provide maintenance load bank capability. The load bank can be an integral part of the power distribution system or provide a maintenance connection that allows the use of a portable load bank. Typically, a free standing load bank is provided.

The UPS equipment installation must generate minimum harmonic distortion and must conform to the "Power Distribution to Electronic Equipment" IEEE-STD-1100, Recommended Electronic Equipment Grounding Practice guidelines, and the Federal Information Processing Standard (FIPS) publications. The UPS batteries must be installed in accordance with NEC and OSHA safety requirements.

12.0 MOTORS AND MOTOR CONTROLS.

Overcurrent protection must be provided in the combination starters and disconnects or circuit breakers feeding the motors. Only high efficiency motors must be used. Motor sizes commonly used in ATCT and Base Building/TRACON facilities must have efficiency ratings between 85 and 90 percent. Motor controls and disconnecting means must be installed in accordance with FAA-C-1217. All motors must be controlled by one of the following methods:

A. Magnetic type starters for three-phase systems

B. Manually with thermal element for single-phase systems

C. Reduced voltage type for large motors and compressor motors when they exceed 20 percent of the supplying transformer capacity

D. Variable frequency drives (VFDs)

13.0 TRANSFORMERS.

Dry-type, K-rated transformers must be provided to power electronic equipment from the 480 volt, three-phase, three-wire source. The transformers must be sized no larger than 75 kVA and located as close as possible to the electronic load in accordance with IEEE STD 1100, rated 480 delta to 208/120Y volts, 60 hertz, three phase, four wire, and designed for non-linear loads. Dry-type transformers used indoors must be copper windings, energy efficient, quiet type with standard National Electrical Manufacturer's Association (NEMA) taps and meet IEEE STD 1100, FAA-C-1217 and FIPS 94 recommendations. Minimum transformer K-rating must be K-13, with 80°C temperature rise.

14.0 WIRING METHODS.

All wiring and conduit must be installed in accordance with FAA-C-1217 and the NEC. Conductors for discrete control wiring must be No. 14 AWG minimum, No. 16 AWG minimum for analog control, and must always be in a separate conduit. Cables in tray systems located in return air plenums must not be over 600 volts and must have a flame-retardant jacket and cable rated and listed for return air plenum installations. Other types of wiring in accordance with the NEC and specific lighting situations are authorized. Conductors to life safety loads such as the Stair Pressurization Fan, Elevator and Emergency Egress Lights must be fed with ceramifiable RHW conductors. As a result of consultation with the Electronics FAA Project Engineer, and as a requirement for the facility, the A/E Firm must provide a fiber optic network for tall ATCTs. The ATCT fiber optic network must be designed as required by the Electronic FAA Project Engineer.

15.0 CAB DC POWER SYSTEM.

Certain FAA solid state equipment or traffic control light-guns in ATCTs not equipped with an E/G will require a nominal 12 or 24 volt DC electrical power supply in accordance with Order 6950.2. The DC power system must contain the following items:

A. Modular Panel board, +/-24 volts DC/200 ampere, with capability to be reconfigured to +12 volts DC or –48 volts DC by using DC to DC converters

B. Distribution panels utilizing circuit breaker panel

C. Distribution AC to DC rectifiers, sized to supply DC power to the load and recharge the batteries within 12 hours following a four-hour operation of the batteries. The rectifiers must be solid-state and acceptable to the telephone and microwave industries

D. Battery system capable of sustaining equipment operation for four hours after commercial power loss

E. Battery disconnect panel utilizing 2-pole, 200 ampere circuit breakers

F. Local meter and alarm panel or local/remote monitoring system

G. System steady state voltage at the equipment must remain between 22 and 28 VDC (float) when utilizing +/-24 VDC rectifiers, 11 and 14 VDC (float) when utilizing +12 VDC rectifiers, or 47 and 56 VDC (float) when utilizing -48 VDC rectifiers whether being energized by

commercial power, from batteries alone, or during the transition period from commercial power to batteries

H. System steady-state voltage at the equipment must remain at 12 VDC +/- 2V, whether being energized by commercial power, battery power, or during a transition between commercial and battery power. Maximum DC system output ripple at the equipment feed must not exceed 100 mV peak, when energized by commercial power without batteries.

I. System Status and Control Panel that offers remote and local monitoring of the DC Power System as well as control functions

J. Consider providing a portable or mobile E/G connection where no installed engine is provided.

16.0 LIGHTING AND CONVENIENCE OUTLETS.

Energy efficiency must be considered in the lighting design using LED's to the maximum extent possible. The design of interior lighting must be coordinated with architectural room layouts and equipment room layouts. All fluorescent fixtures must be high efficiency solid-state design. EMI/RFI emitted by fluorescent light fixtures must not interfere with electronic and computer equipment. The lighting system must be designed to suppress radio frequency interference (RFI) and electromagnetic interference (EMI) related noise. Full spectrum fluorescent light fixtures may be used for lighting. Electronic ballasts must have a total harmonic distortion less than 10 percent. Light switches must be specification grade quiet type rated 20 ampere, 120 or 277 volts, single pole, three-way or four-way, as required by the circuit controlled. Lighting patterns and switching must be designed for maximum energy efficient operation, including the consideration of infrared and motion sensing switching and two light level switching for each room. LED obstruction lights must be provided for all towers in accordance with Advisory Circular AC70/7460-1, Obstruction Marking and Lighting, and Federal Aviation Regulation (FAR) Part 77. Convenience outlets must be specification grade rated 20 ampere minimum. Planning must be accomplished to ensure that power outlets are convenient to work areas. Isolated ground receptacles must be provided as required by specific equipment. Fluorescent lights on a separate circuit with keyed switch for cleaning illumination must be included in operational areas where low ambient lighting is required (TRACON and ATCT cab). All facility designs must include energy efficient glare reducing lighting with VDT compliant lens. For energy conservation purposes, incandescent lighting must be kept to a minimum.

17.0 TRACON OPERATIONS ROOM.

Lighting intensities in the TRACON Operations Room are usually kept at a very low ambient level, less than 5 foot-candles (fc), in order to prevent glare and reflection detracting from the target viewing on the radar displays. An acceptable lighting design for this space will maximize ambient lighting levels below console shelf height to provide good visibility for movement within the room. Can Light reflectors must be black specular type. The light intensity must be uniform and approximately 10-15 fc. Above shelf height, the designer must minimize stray light sources and reflection which may appear as reflections on the displays. The electrical design engineer and the architect must coordinate proper finish materials selection with surface texture and color that will complement the lighting design. In addition, a separate 2x2 or 2x4 fluorescent lighting circuit for maintenance and house cleaning must be provided. House cleaning lights must be connected to a keyed switch to prevent accidental turn-on. Indirect fluorescent dimmer switch controlled lighting must be considered for low lighting requirements. All lighting must be on dimmer switches with circuits that permit zoned control. Provide dimming controls for lighting arranged in zones based on console configuration and usage. The high ambient light level must be less than 2 fc at the shelf for glare free radar displays. Shields and filters must be installed around light sources and/or displays to

mitigate sources of glare. Information for one type of light filter source can be viewed at http://www.ergonomicaccessories.com/lighting.

Another option to consider is incandescent lighting with pinhole covers or framing capabilities. This light can be aimed exactly where needed and can successfully be dimmed to low light levels without flicker. The technical and operational need may outweigh the additional cost of the incandescent light higher energy consumption.

A. Ambient Lighting for TRACONs with Low Ceilings. TRACONS with ceilings 8ft-10ft high must use indirect fluorescent cove lighting mounted to the wall perimeter. TRACONs with ceilings 10ft–13ft high must consider indirect cove lighting and/or indirect pendant lighting. Indirect pendant lighting requires adequate ceiling height to allow even distribution of light reflected from the ceiling. If it is determined that a lighting design using indirect lighting would not result in adequate glare reduction, deep can lights may be considered.

B. Ambient Lighting for TRACONs with High Ceilings. Lighting for large TRACONs with ceiling heights above 13', must be modeled in general after the Display System Replacement (DSR) fluorescent lighting fixtures installed in the Air Route Traffic Control Centers (ARTCC). The indirect pendant light fixtures must be positioned low enough below the ceiling to allow even distribution of light reflected from the ceiling, but must be placed high enough to provide adequate clearance for personnel safety. Indirect cove lighting mounted to the wall perimeter may also be used.

C. Light Fixture Baffles. Light baffles must be provided to block the glare from a direct light source, as needed. The baffles must be louvered to keep from obstructing the operation of smoke detectors. Light baffles must be black specular type.

D. Supervisor's Console Lighting. The lighting at the supervisor's consoles must not need modification. Most supervisors' consoles have, and must continue to have, self-contained lighting on a dimmer. The lighting fixtures are flexible such that the source can be aimed away from the Scope of Work. Baffles are utilized here, as well.

E. Position Lighting. Typically, can-lights (specular black finish, spots) or LED bezel lights with adjustable apertures exist over the positions. A dimmer usually controls the position lighting and shines directly onto the writing shelf.

F. Floor Lighting. Under counter lighting and theater type floor lighting is used to light the floor between aisles.

G. Console task lighting. Typically, LED gooseneck type lighting is provided.

18.0 CONTROL CAB.

An acceptable cab lighting design will accomplish the following:

A. Provide adequate lighting for movement within the cab under nighttime conditions.

B. Provide sufficient task lighting (LED gooseneck type) at the consoles to permit writing and fine print reading.

C. Prevent excess cab luminaries glare from appearing on the cab windows or instrument dials, by utilizing specular black reflectors.

D. Provide 2x2 or 2x4 troffer fluorescent light fixtures on a keyed switch for house cleaning.

Projector type framing lights for console desk illumination have been used with success as well as track lighting, museum type 2-inch diameter spot lights, theater lighting for floors, sharp cutoff spots for center room illumination, and back lighted displays for instrumentation (electro-illumination). All cab lighting must be controlled by dimmer switches, and zoned by lighting type and location.

19.0 EQUIPMENT ROOM.

The room lighting must be designed to provide glare-free illumination on the equipment surfaces. Each row of fixtures must have individual switches to control glare.

Equipment rooms containing communications equipment must be installed as close as possible to the antennas to reduce transmission loss. Antenna cables should have SPDs installed on an antenna bulkhead plate prior to cables entering the facility. The bulkhead plate must be located in a box on the roof and attached directly to counterpoise.

20.0 AIRFIELD LIGHTING CONTROL PANEL.

Provisions must be made in the cab console for the airfield lighting control panel. The airport authority must be notified as soon as possible so they can budget the control panel relocation. The field cable conduit must run from the field location in conduit directly up the electrical chase to the ATCT cab.

21.0 EXTERIOR HEATER OUTLETS.

Outlets must be provided for auto heaters in parking lots at cold weather sites when required by other sections of the Design Guidelines.

22.0 GROUNDING, LIGHTNING, AND SURGE PROTECTION.

Lightning protection, transient surge protection, grounding, bonding, and shielding design must be designed and installed in accordance with FAA-STD-019, FAA-STD-020, NFPA 780, Underwriters Laboratory 96A, Installation of Lightning Protection Systems, FAA-C-1217, and FAA Order 6950.19.

23.0 EMERGENCY LIGHTING.

Emergency lighting must consist of the following:

A. For towers without E/Gs the emergency lighting must be battery backup type provided as follows:

   1. Exits, path of egress corridors, and egress stairs illumination

   2. Interior spaces housing critical electrical and mechanical equipment

   3. Critical areas housing electronic equipment

B. Space luminaries connected to the emergency power circuits in the cab, radar, and communication equipment rooms, E/G room, TRACON (spots and floor lights only), electrical/mechanical room, break room, stairways, lavatory, and other areas must be spaced as required by model building codes for egress. Exit corridors and vestibules must have sufficient general building luminaries connected to the emergency system to provide emergency exit illumination.

24.0 SECURITY SYSTEMS.

Security system design must be completed in accordance with Order 1600.69. The Security System must be powered from the essential bus or a small UPS installed for the security system. ATCT and Base Building/TRACON facilities security systems will vary according to the security category code

assigned by the initial security survey conducted by the servicing security element in the development process data collection phase. All facilities generally will separately control internal access to critical functions and access through an employee entrance using an access control system. There must be adequate security devices (e.g. remote closed circuit television (CCTV) cameras with remote door release) to allow admittance, verification, and entrance in accordance with current FAA policy. Security systems for ATCT and Base Building/TRACON facilities may include automatic gate control with card reader and/or cipher lock door control, electric strike controlled entry, or CCTV at entries. Electric strike door control must be provided at the visitor entry. Security entry control must be provided at the Control Cab, TRACON, and employee entrance. An intercom via the building telephone system or security lock system must be provided at building entries.

25.0 LOCAL AREA NETWORK AND FIBER OPTIC CIRCUITRY.

Future cable installations for local area network and fiber optic circuitry must be provided. The designer must consider the installation of cable trays to accommodate the future installation of LAN and fiber optic lines to satisfy signal and control requirements between the ATCT, TRACON, and other portions of the facility, as appropriate. Specific guidance must be obtained from the designated approval authority and/or Electronics FAA Project Engineer.

26.0 CABLE TRAYS.

A cable tray raceway system with a depth of four inches must be provided for electronic and telephone equipment. The cable trays must be designed to provide shielding consistent with equipment cabling requirements, FAA-STD-019, and must be UL listed. The system design must be coordinated with specific equipment layouts as directed by the designated Electronics FAA Project Engineer. Cable trays must not be located in fire rated corridors. Cable trays must be easily accessible for maintenance. Cable trays penetrating a fire wall must use EZ Path or an equivalent system. Cable trays must be bonded in accordance with Standard 19. Cable tray installations must provide one foot clearance above the tray and three feet clearance on either side of the tray.

27.0 LABELING.

Provisions must be made for labeling of all distribution panels, control equipment and conduits. Communications conduits must be labeled with a self-adhesive label which indicates destination information. Equipment must be labeled with permanent marking as identified on plans, and feeders must be labeled with service voltage. Distribution panels must be labeled with their name, voltage, phase, wire and next breaker supply source.

28.0 METERING.

Metering must be provided in accordance with local utility standards.

29.0 TELECOMMUNICATIONS AND NETWORKS.

Wiring for telecommunications and computer networks (voice/data/video), when specified by the designated approval authority, must conform to the EIA/TIA 568 requirements. Telecommunications and network cables must be specified to provide adequate bandwidth for the installed or planned networks. Cable performance categories listed in EIA/TIA TSB36 must be used. Pathways and spaces for these systems must conform to the requirements of EIA/TIA 569. The designer must implement a cable management system using the EIA/TIA 606 guidelines as part of the design. Category 6 LAN wiring must be installed as a minimum; however, when this is not possible, best commercial practices must be used.

30.0 POWER AND COMMUNICATIONS OUTLETS.

Power outlets and telephone, local area network (LAN), and National Radio Communications System (NRCS) jacks must be convenient to work areas.

Appendix A10

Fire Life Safety Design Guidance

Appendix A10: Fire Life Safety Design Guidance

1.0 GENERAL.

This section provides the designer with life safety information necessary to plan and design ATCT and Base Building/TRACON facilities and is not a substitute for codes and standards enforced by local jurisdictions. Design and construction of NAS facilities dictate the use of highly competent professionals experienced with the delivery of facilities aligned with the FAA's needs and requirements. The use of fire protection engineers in the design and construction of complex or unique structures or those equipped with highly integrated fire/life safety systems is a common industry practice. Specifically, the ATCT and Base Building/TRACON projects involve the integration of fire/life safety features in complex facilities containing unique and critical operations.

2.0 FIRE PROTECTION ANALYSIS.

Each phase of a site adaptation design document submittal by the A/E firm must be accompanied with a fire protection analysis (Basis of Design) by a registered professional engineer licensed in the discipline of fire protection engineering. The final assessment document must be signed and sealed by the fire protection engineer. The assessment of the overall facility fire protection features must include:

A. Fire extinguishing

1. Overall system description
2. Hydraulic analysis
3. Sprinkler system zoning
4. Fire pump sizing
5. Use of pressure reducing devices
6. Fire extinguishers

B. Smoke management

1. Overall system description
2. Pass fail criteria
3. Fan sizing
4. Number of injection points (stair pressurization)
5. Over pressure relief
6. Interfaces to other fire protection systems

C. Detection and alarm, communication

1. Overall system description
2. Alarm notification zones
3. Description of system interfaces (Elevator recall, HVAC shutdown, etc.)
4. General sequence of operations

D. Fire resistance

1. Overview of walls required to be rated
2. Spray on fireproofing
3. Intumescent paint

E. Means of egress

1. Overall description
2. Detailed occupant load calculation

3. Actual stair/door/corridor widths
4. Exit discharge

F. Fire Department Access

1. Road width
2. Road turn radius
3. Fire Department Connection location
4. Fire hydrant locations

G. Other pertinent fire protection and life safety issues

H. Unique code requirements

1. Local Fire Life Safety requirement applied to this project
2. Alternative approaches

All life safety requirements must comply with OSHA, Order 3900.19~~B~~, 29 CFR 1960.20 and NFPA 101. Established security requirements must be reviewed to determine that no conflicts exist with life safety requirements.

3.0 OCCUPANT LOADS.

Occupant loads must be determined in accordance with NFPA 101 and the requirements of this document. Occupancy of the facility must be addressed both on a floor by floor basis and an aggregate occupant load. For ATCTs with a single exit, the tower must have fewer than 25 total occupants and each level of the ATCT must have an occupant load of 15 or fewer occupants. The following describes the method of calculating the occupant load in ATCTs and base buildings.

Occupant load factors provided by the NFPA 101 must be used to calculate occupant loads for the following areas of the ATCT: the Cab level, conference rooms, break rooms, storage areas, and office spaces (see Table 1 below).

Occupant loading in mechanical and equipment spaces is not addressed by the NFPA 101. However, it should be expected that these spaces may be occupied by service and maintenance workers. Thus, the occupant load factor for mechanical and equipment spaces specified by the IBC must be used (see Table 1 below).

TABLE 1: APPLICABLE OCCUPANT LOAD FACTORS FOR ATCTS

Use	(ft^2 per person)
Assembly, less concentrated use (conference rooms, break rooms, etc.)	15 Net
Business Use (other than Cab Area)	100 Gross
Air traffic control tower observation levels (Cab Area)	40 Gross
Storage Use	500 Gross
Mechanical and Equipment Spaces	300 Gross

The following modifications to the calculated occupant load methods outlined above should be considered:

A. Calculate the floor occupant load and the building occupant load separately.

B. For Equipment Spaces (including mechanical equipment, electrical equipment, and NAS equipment):

   1. Include only the largest equipment space in the building occupant load calculations.
   2. Utilize an occupant load factor of 300 sq. ft. per person (gross) in the equipment spaces.
   3. Assume the other equipment spaces or floors containing only equipment in the ATCT are not occupied; as these spaces are periodically occupied by maintenance personnel, typically ATCTs have a limited number of maintenance personnel present during a shift, and it is unlikely that ATCTs containing multiple equipment spaces will have maintenance personnel in these spaces at the same time.

C. Utilize an occupant load factor of 15 sq. ft. per person (net) in break rooms when calculating the floor occupant load and 100 sq. ft. per person (gross) when calculating the total building occupant load; as it is unlikely that the break room and the Cab will both be fully occupied at the same time.

4.0 MEANS OF EGRESS REQUIREMENTS.

A. General. Every building, structure, or portion thereof must be provided with means of egress as required by NFPA 101.

B. Accessibility. Accessible means of egress are required in all new ATCTs however an accessible route is not required in the Cab and the floor immediately below the Cab. Where provided, accessible means of egress must comply with the IBC.

C. Unoccupied Spaces. In accordance with NFPA 101, unoccupied spaces are not permitted to open directly into an exit enclosure.

D. Equipment Seismic Security. Equipment along the egress path must be properly secured to meet the desired facility seismic safety level requirements.

E. Headroom. Special attention is required in meeting the minimum headroom provisions of NFPA 101. At no point along the means of egress must the headroom be reduced below 6'-8*"*.

F. Circular or Spiral Stairways. Circular or spiral stairways must not be used in ATCTs. Properly designed and constructed stairs with winders per NFPA 101 are permitted to the level of the cab only.

G. Photo Luminescent Marking. Photo luminescent markings must be provided in all exit stairs in accordance with the IBC requirements for luminous egress path markings.

H. Slip Resistant Stair Treads. Materials used for floors that are acceptable as slip resistant provide adequate slip resistance where used for stair treads. Slip resistance must be uniform across the tread. Strips of materials must not be applied unless covering the entire tread.

I. Open Risers. Open risers are prohibited in new stairs.

J. Interior Finish. All interior finishes must comply with the NFPA 101 for Class A or Class B flame spread rating. Carpeting is not allowed to be used on walls or ceilings.

5.0 SMOKE PROOF ENCLOSURES.

A. General: All ATCT facilities must be provided a smoke proof enclosure (exit) in accordance with NFPA 101. Smoke proof enclosures must consist of continuous 2-hour fire resistance rated stairways enclosed from the discharge point of the Cab exit access to the exit discharge. The stairway enclosure must be designed to prevent products of combustion produced by a fire occurring in any part of the building from entering the stair as required by applicable codes and standards.

B. Method: Typically, smoke proof enclosures in an ATCT are provided via a mechanical stair pressurization system.

C. Power Supply: Provide NEC Article 700 emergency power for stair pressurization system fans including the branch circuit by means of the Emergency Generator (E/G).

D. Access/Location: Mechanical equipment for smoke proof enclosures must be located so that it is accessible and maintainable. Protection of the equipment if not located within the smoke proof enclosure must comply with NFPA 101 and referenced codes and standards.

E. Control: The smoke control systems must be controlled directly by the fire alarm system. Smoke controls systems must not be activated or controlled by the building automation system or HVAC system.

F. Stair Pressurization Fan Installation: The following items must be provided where stair pressurization fans are installed:

1. Install bird and insect screens at the intake and exhaust louver(s).
2. Provide a sign indicating the fan is part of the life safety system.
3. Provide locks or fire alarm monitor modules on the disconnect.
4. Protect the fan intake from potential fire exposures. Consider separating the stair pressurization intakes to the extent practical.
5. The mechanical equipment room containing the stair pressurization equipment must not be used for storage or any other purpose unrelated to the mechanical equipment.

Additional requirements for units located outdoors include:

1. Install a weather hood on outside units.
2. Locate fans within the secure perimeter where not accessible to the public.
3. Install the fan such that the intake is high enough above the ground to prevent ingestion of dirt, rocks, and debris.
4. Ensure that the concrete pad the fan sits on is large enough to prevent the growth of vegetation that may enter the fan intake.
5. In areas where snow is a concern, provide sufficient clearance so the intake will not be easily blocked by accumulating snow and that it will not obstruct snow removal efforts.
6. Verify that the fan is installed so that water drains away from the unit. Provide drains if needed.

6.0 PASSIVE FIRE PROTECTION.

6.1 CONSTRUCTION TYPE.

The Construction Type must be in accordance with section 412.3 of the IBC, unless are limitations are exceeded.

A. Combustibility and Separation of Structures. Buildings and structures for ATCT and Base Building/TRACON construction are classified by their relative degree of combustibility. Construction types are identified on the Standard Drawings, on sheets designated as "Basis of Design." The Base Building/TRACON must be separated from the ATCT with a firewall in accordance with the IBC; however, the separation is not required to be structurally independent from the ATCT.

B. Cab Mullions. Cab mullions when utilized as structural support must be provided with the fire rating required by the applicable codes/standards. Typically, cab mullion fire ratings are achieved through the use of intumescent fire paint.

6.2 BARRIERS AND PARTITIONS

A. General. These construction components must be installed in buildings to separate areas of hazardous occupancies, such as mechanical, generator, elevator, battery rooms, and technical equipment rooms including communication, radar, telephone, and TRACON rooms from each other and from areas of ordinary or light hazard occupancy such as stairways, corridors, offices, training rooms, ready rooms, and the control cab. Fire resistance rated partitions comprising electronics equipment room enclosures must be constructed in accordance with: NFPA 75, Standard for the Protection of Information Technology Equipment, NFPA 101, Life Safety Code, NFPA 110, Standard for Emergency and Standby Power Systems, and the applicable model building code for all other building areas.

B. Storage Areas. An analysis of storage areas must be completed and fire-rated partitions must be provided to separate the storage areas where needed.

C. Control Environment. Fire/smoke rated partitions must be provided around control areas and any room containing National Air Space (NAS) equipment and areas defined as ITEA and ITER in accordance with NFPA 75. Separation must include but not be limited to the following:

1. Separate Cabs with one-hour fire resistance rated construction.
2. The Cab must be separated by construction to limit smoke entry.
3. Separate TRACONs from other building areas with one-hour fire resistance rated construction.
4. The TRACON should also be constructed to limit smoke entry. TRACON walls/floors/ceilings must be smoke barriers.

D. Labeling/Identification. Fire rated barriers and partitions must be labeled with their rating and language similar to "Fire Barrier – Firestop All Openings."

E. Shafts. Shafts that do not extend to the top of the building must be capped with an assembly to maintain the fire resistance rating of the shaft.

6.3 THROUGH-PENETRATIONS AND OPENING PROTECTIVES.

A. General. Penetrations through fire resistance rated assemblies and smoke proof barriers must be provided with an approved through-penetration fire-stop system. All penetrations through fire-rated partitions must be sealed to maintain the fire rating. Where the penetrant(s) and barrier do not match any listed firestop systems or devices, an engineering judgment is required to be obtained from a manufacturer for the firestopping. If a scissor stair configuration is provided, penetrations between the two stair enclosures are prohibited.

B. Firestopping Specification and Engineering Judgments. A firestopping specification is located as part of the Standard Designs and must be used as a template for fire stopping work.

C. Cab and TRACON Penetrations. Penetrations through the Cab and TRACON floors and walls must be firestopped with a system that has a low "L" rating in accordance with the FAA Standard Design firestopping specification.

D. Penetrations in Non-Fire Rated Barriers Required to Resist the Passage of Smoke. In order to properly seal a penetration in a non-fire rated assembly such that it resists the passage of smoke, the following guidelines must be used:

1. Penetration must be sealed such that there are no gaps, holes or other openings in the wall/ceiling envelope. Fill materials must be noncombustible.
2. Standard construction practices must be used as long as it is "tight" construction. Firestopping compounds can be used to seal the penetrations, although not necessary.

E. Fire/Smoke Dampers. Duct and air transfer openings that penetrate fire rated assemblies must be protected with the appropriate fire and/or smoke dampers in accordance with the applicable codes and standards. The omission of dampers permitted by the IBC, IMC and NFPA 90A are acceptable in FAA facilities. However, special consideration must be made for NFPA 75, Standard for the Protection of Information Technology Equipment. NFPA 75 requirements supersede those of the IBC, IMC and NFPA 90A. NFPA 75 requires fire smoke dampers in all fire resistance rated assemblies.

F. Labeling/Identification. Penetrations through fire resistance rated assemblies must be labeled with the appropriate UL through-penetration classification number.

G. Fire Doors. Fire doors within the ATCT shall be provided with magnetic hold-open devices. The release of the doors must be upon activation of the fire alarm system resulting from any initiating device.

H. Door Seals, Gaskets, and Thresholds. New smoke barrier door installations must be leakage rated. Doors in fire resistance rated smoke barriers must be installed in accordance with the conditions they were listed under. Fire doors marked with an "S" on the UL label indicate they are suitable for use in a fire rated smoke barrier (as required by the IBC). The IBC requires these types of doors in fire rated smoke barriers, but not in non-rated smoke barriers. These types of doors may require gasketing to meet the UL listing requirements. NFPA 101 does not require a special listing for doors in fire rated or non-fire rated smoke barriers. Door seals, gaskets and thresholds may be needed for other purposes as well. Seals and gaskets may be needed to assist in attaining the required pressure differential for stair pressurizations systems.

7.0 FIRE DETECTION AND ALARM.

A. General. Automatic smoke detection and alarm systems must be installed in all ATCT and Base Building/TRACON facilities in accordance with NFPA 101 and NFPA 72.

B. Smoke Detection. Smoke detection must be provided in the ATCT in locations indicated by NFPA 101. Smoke detection must be provided throughout Base Buildings if provided with a TRACON. For Base Buildings not provided with a TRACON, smoke detection must be provided in electrical equipment areas and mechanical equipment areas and other areas as required by code. Smoke detection must be located at the top of all stair enclosures.

C. Notification. Notification must be provided through the ATCT and Base Building in accordance with applicable codes/standards, with exception of control spaces (Cabs and TRACONs) via horn and strobe appliances. In control spaces, applicable audibility requirements are not required or desired, as they may interfere with air traffic operations. Sound levels in control spaces resulting from audible devices located outside the control

spaces must not exceed that consistent with human voices during normal conversation (approximately 50 to 55 dB). Audible notification must be permitted to be omitted from the Console Access Level or adjacent equipment and TELCO rooms, if the control area is included in the Cab or TRACON environment, respectively (i.e., no sound barriers are provided.) Audible notification appliances serving corridors outside TRACONs must be spaced to limit sound transmission into the control areas. Clear lens strobes are not permitted in the control space; a red lens incandescent strobe must be located in the control space in a visible location which does not interfere with air traffic operations. Coordination between the placement of fire alarm equipment in control spaces and air traffic operations is required.

D. Annunciation. The fire alarm system must report to a constantly attended location in accordance with NFPA 72. Remote annunciators must be required at the main entrance of the facility and in each control space (Cab and/or TRACON). Annunciators located in control spaces must have a silence button to silence the annunciator sounder only, but not silence or reset the rest of the fire alarm system.

E. Circuits. The fire alarm and detection system circuits must be arranged "Class A" and must comply with the Class A separation provisions of the Appendix material located in NFPA 72. Fire alarm circuits must run continuously from device to device. A minimum separation of 1 foot where the circuit is installed vertically and 4 feet where the circuit is installed horizontally must be provided. All circuits must be installed in conduit. All circuits must terminate at a device/appliance or in a junction box on an approved terminal strip. Wire splices are not acceptable. Wire nuts or crimp connectors must not be used. Pigtail connections must not be used. Individual stranded wires must be tinned.

F. Surge Suppression. Transient voltage surge suppression must be provided on all A/C power lines and telephone lines or fire alarm circuits that enter or exit the building in accordance with FAA STD-019 and contract specifications.

G. Grounding. The fire alarm system ground must be connected to the ATCT Multipoint Ground System. Ground conductors must be sized and installed in accordance with FAA-STD-019.

H. Interface with Smoke Control. The fire alarm system must monitor and directly control the smoke control system. The fire alarm must be arranged to perform a weekly self-test of the smoke control system, and must indicate a "supervisory" condition if any component fails to operate properly during the test.

I. Fire Alarm System Monitoring Methods. Central station service must be utilized wherever feasible. The connection to the central station must be via a Digital Alarm Communicator Transmitter (DACT). Two loop start telephone lines must be utilized. The telephone lines must be upstream of the PBX or phone system. At a minimum, signals for alarm, sprinkler water flow, supervisory, and trouble conditions must be sent to the central station.

8.0 FIRE SUPPRESSION SYSTEMS.

A. General. Fire suppression systems are required for ATCT, Base Building, and TRACON facilities. National Fire Protection Association (NFPA) requirements must guide the fire suppression systems design. All areas of Terminal Facilities must be wet pipe fire-suppression sprinkler systems, unless a dry pipe system is required based upon environmental conditions (areas subject to temperatures below 40^{o} F).

B. Fire Pumps. Fire pumps must be designed in accordance with NFPA 20 to provide adequate water pressure and flow for required fire suppression systems. The fire pump room should be located in the Base Building, and must be provided with direct exterior access. Doorways to

the fire pump room must be large enough to allow removal of large pump components including the motor, pump, and controller. If the pump room is located above or below grade level, clear access to an elevator must be provided. Adequate clearance must be provided to all fire pump controllers.

1. Pump Size. Minimizing the size of the fire pump is recommended. The A/E must consult the local fire department regarding the use of a manual wet standpipe in order to reduce the flow and/or pressure rating of the fire pump. Additionally, designs with multiple zones and multiple smaller fire pumps must be considered to reduce the power and emergency generator requirements associated with fire pumps.
2. Pump Power Supply. The fire pump power must be protected against interruption from a fire with a fire resistance rating of 2-hours.

C. Seismic Protection. Seismic protection of the fire suppressions systems must be provided if required by applicable codes/standards. Seismic protection may be required in regions where seismic protection is not typically provided due to the high important factor of the facility.

D. Standpipes. Standpipe systems must be installed in accordance with NFPA 14 in all new ATCTs where the floor of an occupiable story is greater than 30ft above the lowest level of fire department vehicle access. In scissor stairways, standpipe piping must not penetrate the enclosure walls between the two stair enclosures and the standpipe riser must be located in the plumbing shaft. Risers must not be located in a manner as to block the egress path.

E. Hose Valves. Hose valves must be provided at the highest intermediate landing between floor levels in every required exit stairway (connections may be located on the main floor level landings when approved by AHJ) and in each exit passageway at the entrance from the building areas into the passageway. The top most hose valve location must be provided with an additional 21/2-inch outlet for testing purposes. Where scissor stair configurations are provided, hose valves must also be provided in the utility stair in addition to those in the exit stair at the intermediate level between all floor levels. Additionally, a standpipe hose outlet is required on the cable access level outside the stair. Means for testing the standpipe system must be provided. Hoses must not be installed. Hose valves must not be located in a manner as to block the egress path.

F. High Pressure Valves and Fittings. In areas where the building sprinkler systems could experience pressures greater than 175 psi, high pressure fittings, valves, sprinkler heads, and other components must be considered. The need for high pressure fittings and components must be determined during the design of the facility based on hydraulic calculations for the system. If water pressure exceeds the working pressure of the system components (i.e., 175 psi) an evaluation will be needed to determine the cause of the high system pressure. Means must be implemented to maintain the water pressure below 175 psi or high pressure fittings/components must be installed.

G. Pressure Regulating Devices. The use of pressure regulating devices in sprinkler, fire pump, and standpipe systems must be avoided to the maximum extent possible. In many cases pressure regulating devices can be avoided if the system is properly engineered and the fire pump churn pressure is properly selected. Where the use of pressure regulating devices is required, they must be maintained and tested in accordance with NFPA 25 to ensure they function as designed. In order to perform necessary testing, adequate drainage to the exterior of the building is required.

H. Local Application Equipment Protection Systems. Local application fire suppression systems are not required protection for FAA equipment. However, consideration must be given to the

installation of such systems to protect critical NAS equipment. An example may be an in-cabinet local application system to protect NAS equipment in a computer cabinet. An evaluation must be performed on a case-by-case basis to determine if the installation of such systems is warranted and appropriately designed.

9.0 FIRE EXTINGUISHERS.

A. General. NFPA 10 must be referenced to specify ATCT and Base Building/TRACON facilities portable fire extinguisher requirements. A minimum of one fire extinguisher with a 2-A rating must be provided for each occupied floor for all ATCTs. Maximum travel distance from any point to a fire extinguisher must be 75ft.

B. General Facility Extinguishers. 2-A:10-B:C dry chemical extinguishers must be installed and located for a maximum of 75 ft travel distance from any point. Location must be near the exit in the general path of egress from the area being protected. The maximum area of protection for an extinguisher must not exceed 11,250 sq. ft. The extinguisher must be located in common areas (corridors, lobbies, etc.) unless rooms are too large for such placement. In all facilities, at least one extinguisher must be provided near the exit on each floor level.

C. Electronic Equipment Area (EEA) Extinguishers. EEA includes critical NAS equipment, not desktop computers, office servers, battery, generator, electrical, or mechanical rooms. General facility extinguishers identified above must be distributed for these areas. Provide 10-B:C carbon dioxide extinguishers in the room or area containing the electronic equipment.

D. Generator Rooms and Areas. Distribute 2-A:10-B:C extinguishers for a maximum of a 30ft travel distance between the fire area and the extinguisher. The unit must be placed in the path of egress travel from the room or area.

E. Kitchen and Break Room Areas with Stoves and Frying Equipment (not microwaves). 2-A:K wet chemical extinguishers must be place for a maximum of 30ft travel distance between the fire area and the extinguisher. Fixed suppression is provided to protect the cooking equipment, the extinguisher agent in the area should be provided to match the agent provided in the fixed system.

10.0 FIRE HYDRANTS/SITE.

A. General. Site location of fire hydrant protection and other features must be in accordance with the International Fire Code (IFC). Local fire departments must be consulted for site specific requirements. Where possible, a combination domestic water supply/fire hydrant supply line must be considered to reduce installation costs.

B. Site Access. Site access must be coordinated with the local fire department and the IFC. The designer must consider at a minimum access road width, minimum turn radius, gate access, fire department connection locations and fire hydrant locations.

11.0 Security Interfaces.

See attachment 1.

12.0 OSHA 29 CFR 1960.20

1960.20. On May 06, 1998 an agreement was reached in cooperation with employee and management representatives of the Federal Aviation Administration, the office of the Secretary of Transportation, and the Occupational Safety and Health Administration to adopt 29 CFR Part 1960.20 which sets forth the minimum requirements essential to providing a safe means of exit from an airport traffic control tower in case of fire and other emergencies. This document provides alternatives to strict code compliance as written and published, by providing the minimum

acceptable level of safety for existing, single exit ATCTs. Subjects like Occupant Protection and Structural Integrity are the focus of 1960.20.

A copy of CFR 1960.20 is available on the Terminal Facilities Standard Designs KSN site at the following address:

https://ksn2.faa.gov/ajt/programops/Facilities/dei/standard_designs/Key%20FAA%20Standards%20and%20Orders/1960_20.pdf

Attachment 1

A report entitled *Coordination of Fire/Life Safety and Security Interfaces in FAA Facilities*, November 5, 2004 contains guidance. Findings and recommendations from the report are summarized below:

Fire Department Site Access:

1. If the facility is staffed 24-hours per day for seven days per week, guards or other appropriate personnel should be trained for the appropriate course of action when an emergency responder arrives. Planning will allow access of the emergency personnel without delay while addressing security related site access concerns.
2. If the facility is not staffed 24-hours per day and the facility has a mechanically or electromechanically locked perimeter fence, then a key vault (e.g., Knox Box) should be provided at the fence on the exterior side. The key vault will contain keys or pass-cards for the gate and for the building. The key vault can be monitored with the site Intrusion Detection System (IDS). A single contact switch can be used so an alarm signal will be transmitted if it is opened inadvertently or maliciously.
3. The fire department should be consulted and a pre-fire plan should be written and agreed upon. Elements of the pre-fire plans should include: the location that the fire department should respond to; entry routes into the building; security features; key vault locations; hours of operation for the facility; what type of hazards exist in the building; emergency contact numbers; etc. Ensure that the pre-fire plan that takes into consideration perimeter fencing, if provided.
4. Perimeter fencing or barricades that are installed should not impede fire department operations. The fire department should be able to get through the main gate, and get all the way around the building. A fire department access road should extend to within 50 ft of one exterior door providing access to the interior of the building. Provide additional gates in the perimeter fencing if the fire department cannot get within 150 ft of all portions of the facility (or to within 450 ft for sprinklered facility). Fire department access roads are required to have an unobstructed width of at least 20 ft and an unobstructed vertical clearance of at least 13 ft 6 in. (unless a lower height is acceptable to the fire department). Dead-end fire department access roads in excess of 150 ft in length are required to have provisions for the turning around of fire apparatus (i.e. circles or tees for three-point turns).

Fire Department Building Access:

5. Responding personnel should be granted access to the building to assess a fire situation, access the fire alarm panel, perform manual suppression (if necessary), and perform rescue operations (if necessary). A key vault should be provided at the main entrance to the facility on the outside of the building.

Exit Discharge from Buildings within Confined Perimeters:

6. For buildings with a secure perimeter fence, consider the occupants discharging from the building exits. The best option is to provide a dedicated pedestrian gate in the perimeter fence large enough in width to accommodate all occupants discharging from the exits. The gate should be accessible only from inside the secure perimeter and monitored by the IDS system. Another option is to allow the occupants to egress through the vehicular gate. For this option, a means should be provided for the occupants to open the gate such as a button or switch located inside the secure perimeter to open the gate. Occupants should be trained on how to operate the gate during an emergency. A third option is to keep the occupants inside the perimeter fence, but allow them to move away from the building. The enclosed area must be large enough to accommodate all occupants at least 50 ft from the building while providing a net area of 15 ft^2 per person.

Security Doors in the Means of Egress, Electric Locks:

7. The use of mechanical security devices (e.g. cipher locks, hasps, bolts, key locks) are not permitted on doors in the means of egress.
8. The use of electro-mechanical security devices is permitted on doors in the means of egress if they do not impede egress. If egress is impeded by security devices, meet the requirements of NFPA 101, *The Life Safety Code* for special locking arrangements.
9. Prior to the installation of security features on facility doors, the fire/life safety program should be coordinated with to confirm which doors are in the *required* means of egress. Special provisions may be necessary for these doors. The security system installer or other security personnel should not be responsible for determining the egress routes in FAA facilities.
10. No more than one delayed-egress lock should be provided along the path of egress.
11. Delayed egress locks are should not be used in ATCTs and ARTCCs. A significant delay may already exist in Air Traffic environments if occupants need to hand-off air traffic operations before exiting. In addition, the means of egress from some ATCTs consist of a single exit. Delayed egress hardware should not be installed on a single means of egress, including the base of the stair.
12. Where delayed egress locks and access control hardware are used, they should be fail-safe and unlock the door under failure of the device or power failure, and be connected to the fire alarm system for release upon fire alarm.
13. Electric mortise type locks should not be used on fire doors unless they can be arranged to fail safe. The locks should be configured so that electrical current is needed to keep the door locked. Upon power failure or failure of the device, the door should unlock, but remain latched.
14. Electric locks used on exit doors should be UL Listed for use on an exit door. In the UL product directory, special locking arrangements are listed under the following sections:

    FWAX – “Special Locking Arrangements”

    FULA – “Controlled Exit Panic Devices” (Delayed Egress)

    FUQV – “Exit Locks”

    FVSR – “Panic Hardware”

15. If an electric strike is used in the means of egress, it should be rated for continuous duty. The solenoids and other components in this type of hardware can withstand being powered continuously and will therefore last longer.
16. If electric security hardware is needed, an electric strike type hardware should be used where the direction of egress travel is away from the secure area. These devices can be used to meet the requirements of the security and fire/life safety programs if installed properly. An occupant on the secure side of the door is able to pass through the door unimpeded. As long as the path of egress travel is from the secure area out into the unsecured area, and the door swings in the correct direction, the doors would not need to meet to special locking requirements described in the NFPA 101.
17. Where electro-magnetic locks are used they must meet the requirements of the NFPA 101 for special locking arrangements (i.e., request to exit button, unlock upon fire alarm or sprinkler activation, etc.).

Power Supplies for Security Hardware:

18. The NFPA 101 requires fail-safe operation of electric locks that impede the means of egress. Upon power failure, these doors are required to unlock. Therefore, the access control system should be connected to a reliable AC power source and to an uninterruptible power supply (UPS) such as batteries. This will prevent the security doors from unlocking during power outages.
19. Since the NFPA 101 requires fail-safe operation of electric locks the lock power wiring should be protected to minimize inadvertent or malicious unlocking of the doors. The access control wiring should be installed inside electrical metallic tubing (EMT) that is installed inside wall cavities, where possible. Although it may not be feasible during a retrofit installation, EMT should be used for all new construction. This type of installation protects to the access control wiring from physical tampering. The door lock power wiring should also be monitored for integrity by the security system, where possible.

Modifications to Fire and Smoke Doors for Security Hardware:

20. Security hardware installed on a fire or smoke door should be UL Listed for such applications. If modifications to the fire/smoke door or frame are necessary for the installation of security devices, the door manufacturer should be contacted to determine which modification are acceptable to maintain compliance with the listing and installation requirements.
21. Holes or cavities should not be put through a fire door or frame unless the Listing for the hardware allows such modifications.
22. The types of security hardware that compromises the latching feature of the door (e.g., electric mortises) should not be installed on fire or smoke doors. Fire and smoke doors are required to be latched at all times.

Fire Alarm and Access Control Hardware Interfaces:

23. Verify that technical specifications clearly state the performance objectives of the access control system during a fire alarm condition. The contractor installing an access control system on doors in the means of egress should specifically demonstrate on the shop drawings how the performance requirements of the system will be met. A factory trained and qualified electrician should make the final connections between the fire alarm system and the access control equipment. A complete system test should be

thoroughly performed to verify all interfaces between the fire alarm system and the security systems work.

24. The integrity of the conductors between the fire alarm control panel and the access control panel should be protected. The fire alarm interface module (if used) should be located no more than three feet away from the access control panel. In addition, the conductors should be installed in electrical metal tubing (EMT) or metal clad (MC) cable should be used.
25. If the fire alarm system is interfaced with the access control system, a by-pass switch should be provided on the fire alarm control panel to by-pass the security door release. Otherwise, a security breach will result every time the fire alarm system is tested. If a by-pass switch cannot be provided on the fire alarm control panel, then a method of manually shunting out the door release circuits(s) should be provided at the fire alarm control panel.

Security System Installation:

26. Penetrations in fire rated barriers, including those created by cables, piping or conduit are required to be protected with firestopping materials or systems. All firestopping assemblies should be installed in accordance with their UL Listing. Coordination between safety and security personnel is needed to establish which walls and floors are designated fire barrier. The security system installer or other security personnel should not be responsible for determining which components of the building construction are fire-resistance rated.

27. Do not install security conduits or wiring in the stairs.

Entrapment:

28. During the security upgrades, verify that there are no doors that an occupants can access from one direction and then become inadvertently trapped due to security hardware on door. Locations this could potentially happen include secure elevator lobbies if the elevator is recalled. Other potential locations include rooftops or exterior balconies if stair doors are designed to lock from the outside.

Locking of Stair Doors:

29. Allow occupants to re-enter the building from the stair at the following locations at minimum:
    1. Every fourth story.
    2. At the top or next to the top story leads to another exit.

Appendix B: Standard Form 1421, Performance Evaluation

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PERFORMANCE EVALUATION (ARCHITECT-ENGINEER)

1. PROJECT NUMBER

2. CONTRACT NUMBER

IMPORTANT: Be sure to complete Performance section on reverse. If additional space is necessary for any item, use Remarks section on reverse.

3. TYPE OF REPORT *(Check one)*	4. REPORT NUMBER	5. DATE OF REPORT
☐ INTERIM ☐ COMPLE-TION OF DESIGN OR STUDY ☐ COMPLE-TION OF CONSTRUC-TION ☐ TERMI-NATION		

6. NAME AND ADDRESS OF CONTRACTOR	7. PROJECT DESCRIPTION AND LOCATION

8. OFFICE RESPONSIBLE FOR:

A. SELECTION OF CONTRACTOR	B. NEGOTIATION/AWARD OF CONTRACT	C. ADMINISTRATION OF CONTRACT

9. CONTRACT DATA

A. TYPE OF WORK	B. TYPE OF CONTRACT
	☐ FIXED-PRICE ☐ OTHER *(Specify)* ☐ COST-REIMBURSEMENT

C. PROJECT COMPLEXITY	D. PROFESSIONAL SERVICES CONTRACT					
☐ DIFFICULT ☐ ROUTINE ☐ SIMPLE	INITIAL FEE	AMENDMENTS NO.	AMENDMENTS AMOUNT	CLAIMS BY CONTRACTOR NO.	CLAIMS BY CONTRACTOR AMOUNT	TOTAL FEE
	$		$		$	$

E. DATE CONTRACT AWARDED	F. CONTRACT COMPLETION DATE *(Including extensions)*	G. ACTUAL COMPLETION DATE OF CONTRACT

10. KEY CONSULTANT DATA

A. NAMES	B. ADDRESS	C. SPECIALTY

11. CONSTRUCTION COSTS	A. INITIAL ESTIMATE	B. AWARD	C. ACTUAL
	$	$	$

12. CONSTRUCTION CHANGES AND DEFICIENCIES	NUMBER	TOTAL
A. CONSTRUCTION CHANGES		$
B. CONSTRUCTION CHANGES RESULTING FROM DEFICIENCIES IN A-E PERFORMANCE		$
C. DEFICIENCIES PAID FOR BY A-E		$
D. DEFICIENCIES PAID FOR BY GOVERNMENT		$

13. OVERALL RATING	14. RECOMMENDED FOR FUTURE CONTRACTS?
☐ EXCELLENT ☐ AVERAGE ☐ POOR	☐ YES ☐ NO *(If "NO," explain in REMARKS on reverse)*

15A. NAME AND TITLE OF RATING OFFICIAL	16A. NAME AND TITLE OF REVIEWING OFFICIAL

15B. SIGNATURE	15C. DATE	16B. SIGNATURE	16C. DATE

NSN 7540-01-155-3244

STANDARD FORM 1421 (10-83)
Prescribed by GSA
FAR (48 CFR) 5.236-2(d)

PERFORMANCE

STAGES OF SERVICES *(As applicable)*					NOT APPLICABLE	RATING FACTORS/RATING: ACCURACY	COMPLETENESS	COOPERATION	COORDINATION	MANAGEMENT	MEETING SCHEDULE	PERSONNEL ABILITY	WORK QUALITY	RATED BY
														CODE LEGEND: + EXCELLENT; A AVERAGE; P POOR; N/A NOT APPLICABLE; NI NO INFORMATION
														SIGNATURE AND DATE
CONCEPTS	SCHEDULE *(Mo., day, yr.)*	FROM	TO	ARCH.										
				STRU.										
	ACTUAL *(Mo., day, yr.)*	FROM	TO	MECH.										
				ELEC.										
TENTATIVES	SCHEDULE *(Mos. day, yr.)*	FROM	TO	ARCH.										
				STRUC.										
	ACTUAL *(Mo., day, yr.)*	FROM	TO	MECH.										
				ELEC.										
WORKING DRAWINGS	SCHEDULE *(Mo., day, yr.)*	FROM	TO	ARCH.										
				STRUC.										
	ACTUAL *(Mo., day, yr.)*	FROM	TO	MECH.										
				ELEC.										
ESTIMATES				A/S										
				M/E										
CRITICAL PATH METHOD				PRE-AWARD										
				POST-AWARD										
POST CONSTRUCTION CONTRACT SERVICES				SHOP DWGS.										
				MAN-UALS										
INSPECTION				FIELD										
				OFFICE										
SOLICITATION DOCUMENTS														

REMARKS

STANDARD FORM 1421 BACK (REV. 10-83)

Appendix C: Standard Designs Feedback Form

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ato

AIR TRAFFIC ORGANIZATION

Building Design Standards Feedback Form

Date: _____

Region Name: _____

Name of Reviewer: _____

Telephone Number: _____

Location within Document:

(As specific as possible: Program Name, Chapter#, Page#, Section#; Plan #, Drawing #, Detail #, etc.)

Problem or Concern:

_____

_____

_____

_____

_____

_____

_____

Proposed Solution:

_____

_____

_____

_____

_____

_____

_____

Attach additional sheets as necessary. Number of sheets attached:____

Forms should be e-mailed, mailed or faxed to the Manager, Terminal Engineering Services at the RO.

They will then be forwarded to the "Waiver Authority", HQ Terminal Facilities Standard Designs Program Manager.

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Appendix D: List of Codes and Standards

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Codes and Standards List

Codes

1. International Building Code (IBC) - International Code Council
2. Minimum Design Loads for Buildings and Other Structures - American Society of Civil Engineers
3. International Existing Building Code (IEBC) – International Code Council
4. American Concrete Institute - ACI 318
5. American Institute of Steel Construction - AISC Steel Construction Manual
6. American Concrete Institute - ACI 530/ASCE 5/TMS 402, Building Code Requirements for Masonry Structures
7. American Society of Civil Engineers – ASCE 7, Minimum Design Loads for Buildings and Other Structures (Use Risk Category IV for determination of loads i.a.w. ASCE-7)
8. International Mechanical Code - International Code Council
9. International Plumbing Code – International Code Council
10. National Electrical Code - National Fire Protection Association
11. 10 CFR 435 and 436 - Code of Federal Regulation
12. Mechanical Life-Cycle Cost and Design Guideline
13. NFPA 10, Standard for Portable Fire Extinguishers
14. NFPA 13, Standard for the Installation of Sprinkler Systems
15. NFPA 14, Standard for the Installation of Standpipes and Hose Systems
16. NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection
17. NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances
18. NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
19. NFPA 30, Flammable and Combustible Liquids Code
20. NFPA 37, Standard for Installation and Use of Stationary Combustible Engine and Gas Turbines
21. NFPA 54, National Fuel Gas Code
22. NFPA 58, Liquefied Petroleum Gas Code
~~20.~~23. NFPA 70, National Electric Code (NEC)
~~21.~~24. NFPA 70E, Electrical Safety in the Workplace
~~22.~~25. NFPA 72, National Fire Alarm and Signaling Code
~~23.~~26. NFPA 75, Standard for the Protection of Information Technology Equipment
~~24.~~27. NFPA 80, Standard for Fire Doors and Other Opening Protectives
~~25.~~28. NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems
~~26.~~29. NFPA 92A, Standard for Smoke-Control Systems Utilizing Barriers and Pressure Differences
~~27.~~30. NFPA 101, Life Safety Code
31. NFPA 110, Standard for Emergency and Standby Power Systems
~~28.~~32. NFPA 704, Standard System for the Identification of the Hazards of Materials for Emergency Response
~~29.~~33. NFPA 780, Standard for the Installation of Lightning Protection Systems
~~30. 29 CFR 1960.20, Alternate Standard for Fire Safety in Airport Traffic Control Towers~~
~~31.~~34. International Fire Code (IFC) – International Code Council
~~32.~~35. Factory Mutual Approval Guide – Factory Mutual Research Corporation
~~33.~~36. Building Materials Directory – Underwriters Laboratories, Inc.
~~34.~~37. Fire Resistance Directory – Underwriters Laboratories, Inc.
~~35.~~38. FAA-STD-019, Lightning and Surge Protection, Grounding, Bounding, and Shielding Requirements for Facilities and Electronic Equipment

39. FAA-C-1217
~~36.~~40. ASTM E2432—Standard Guide for the General Principles of Sustainability Relative to Building
~~37.~~41. ANSI Z358.1, American National Standard for Emergency Eye Wash and Shower Equipment
~~38.~~42. 40 CFR, Protection of Environment
~~39.~~43. ANSI A17.1, Safety Code for Elevators and Escalators

Codes and Standards List

STANDARDS

1. Clean Air Act (CAA)
2. Clean Water Act (CWA)
3. Resource Conservation Recovery Act (RCRA)
4. Safe Drinking Water Act
5. Noise Control Act
6. Toxic Substances Control Act (TSCA)
7. Marine Protection and Sanctuaries Act
8. Federal Insecticide, Fungicide and Rodenticide Act
8. ~~Executive Order 13514: Federal Leadership in Environmental, Energy, and Economic Performance~~
9. Energy Policy Act, 2005
10. Executive Order 13693: Planning for Federal Sustainability in the Next Decade
10. ~~13423 Strengthening Federal Environmental, Energy, and Transportation Management.~~
11. Energy Independence Security Act, 2007, (PL110-140)
12. FAA Advisory Circular 150/5320-5C, "Surface Drainage Design"
13. 10 CFR Part 20, Standards for Protecton Against Radiation
14. 29 CFR 1910, Occupational Safety and Health Standards (General Industry)
15. 29 CFR 1926, Safety and Health Regulations for Construction
16. 29 CFR 1960.20, Alternate Standard for Fire Safety in Airport Traffic Control Towers
17. 40 CFR, Chapter 1, Environmental Protection Agency
18. 40 CFR, Part 61, National Emission Standards for Hazardous Air Pollutants (NESHAP)
19. 40 CFR, Part 63, Subpart ZZZZ, National Emission Standards for Hazardous Air Pollutants for Reciprocating Internal Combustion Engines
20. 40 CFR, Part 82, Protection of Stratospheric Ozone
21. 40 CFR, Part 112, Spill, Prevention, Control, and Countermeasure (SPCC)
22. 40 CFR, Part 122, EPA Administered Permit Programs: The National Pollutant Discharge Elimination System (NPDES)
23. 40 CFR, Part 280, Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (USTs)
24. 40 CFR, Part 761, Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions
25. DOT Specification FAA-G-2100H, Electronic Equipment, General Requirements
26. Emergency Planning and Community Right-to-Know Act
27. Energy Policy Act of 2005
28. FAA Order 1050.10, Environmental Pollution Control and Abatement at FAA Facilities
29. FAA Order 1050.14, Polychlorinated Biphenyls (PCBs) in the NAS
30. FAA Order 1050.15~~A~~, Fuel Storage Tanks at FAA Facilities,
31. FAA Order 1050.16, Implementation Guidelines for Compliance with Underground Storage Tanks (UST) Regulations
32. FAA Order JO 1050.17, Environmental Compliance for ATO
33. FAA Order 1050.20, Airway Facilities Asbestos Control Program
34. FAA Order 3900.19~~B~~, FAA Occupational and Health Program

Comment [PM[3]: Revoked by EO 13693

Comment [PM[4]: Revoked by EO 13693

Comment [PM[5]: Removing the letter, note C is active now.

~~21.~~35. FAA Order JO 3900.57, Environmental and Occupational Safety and Health (EOSH) Requirements in the Planning and Execution of Construction and Maintenance Activites at NAS Facilities
36. FAA Order JO 3900.63 ATO Fall Protection Program
37. FAA Order JO 3900.64, ATO Electrical Safety Program
~~22.~~38. FAA Order JO 3900.67, ATO Hazardous Energy Control (Lockout/Tagout) Program
39. FAA Order 4600.27, Personal Property Management
~~23.~~40. FAA Order 6980.25~~C~~, Maintenance of Batteries for Standby Power
~~24.~~41. FAA Order 7110.65~~S~~, Air Traffic Control
~~25.~~42. FAA Order JO 7210.3~~X~~, Facility Operation and Administration,
43. FAA Order JO 6470.5~~A~~, Maintenance of Air Route Traffic Control Center Environmental Systems,
~~26.~~44. FAA Order 6470.59, JO 6470.59 - Interim Clarification of Parameters for Order JO 6470.5A
~~27.~~45. FAA Order JO 6980.11~~E~~, Maintenance of Engine Generators~~,~~
~~28.~~46. FAA Standard HF-STD-001, Human Factors Design Standard
~~29.~~47. AMS Real Estate Appendix B – Administrative Space Standard Guidance
48. FAA Order 6930.1~~B~~, Fire Prevention and Maintenance of Fire Protection Equipment
~~30.~~49. FAA Order 6950.27, Power System Analyses: Load Flow Calculations, Short Circuit Analyses, Protective Device Coordination Studies, and ARC Flash Hazard Analysis
~~31.~~50. DOT Order 4353, Sustainable Buildings Policy

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Appendix E: Deviation Form

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Date:

"WAIVER AUTHORITY"
MANAGER, HQ TERMINAL FACILITIES STANDARD DESIGNS PROGRAM

PROJECT NAME:

PROJECT ENGINEER:

REQUEST FOR
DESIGN DEVIATION FROM: (Check all that apply)

- ❑ Master Specifications
- ❑ TRACON Standard Designs
- ❑ Standard Design Criteria
- ❑ Other: _____
- ❑ ATCT Standard Designs
- ❑ Base Building Standard Designs
- ❑ Standard Details Criteria

BACKGROUND: [Insert project(s) description and applicable history]

JUSTIFICATION: [Insert justification for deviation request]

COST IMPACT: [Insert justification for deviation request]

SCHEDULE IMPACT: [Insert justification for deviation request]

RISK IMPACT: [Insert justification for deviation request]

SUMMARY: [Insert summary of proposed deviation]

Signature

[Name of Regional Office Terminal Engineering Services Manager]

Manager

[Name of Regional Office]

Attachments: [**Supplementary narrative information,** floor plan, site plan, supporting information as required by justification. Note that all requests having to do with air traffic space *must* include concurrence with the appropriate air traffic management; all requests having to do with security requirements must include concurrence and supporting documentation from the appropriate local security certifying official.]

cc: [FAA Regional Office Terminal Engineering Services Manager]
[FAA Project Engineer]

Design Deviation Request Approval Signatures: ❑Approved ❑Approved as Noted ❑Denied

"Waiver Authority", HQ Terminal Facilities Programs Date

Approving Organization(s) Date

Comments:

Appendix F: Sustainability Guidance

Appendix G: EOSH Requirements

1.0 General EOSH Requirements

The designer shall ensure all work be in accordance with personnel safety requirements as defined in:

- 29 CFR 1910, Occupational Safety and Health Standards (General Industry)
- FAA Order 3900.19, FAA Occupational Safety and Health Program
- FAA Standard HF-STD-001, Human Factors Design Standards, Chapter 12, Personnel Safety

The designer will ensure that all required permits and plans are obtained or acquired prior to the commencement of work. These permits include, but not limited to asbestos work permits, confined space permits, energized electrical work permits, hot work permits, and environmental permits, in accordance with FAA Order JO 3900.57, Environmental and Occupational Safety and Health (EOSH) Requirements in the Planning and Execution of Construction and Maintenance Activities at National Airspace System (NAS) Facilities.

The designer shall ensure that equipment which presents a potential safety hazard to personnel shall be marked with appropriate warning labels or placards, in accordance with 29 CFR 1910.145, Specifications for Accident Prevention Signs and Tags, and FAA Standard HF-STD-001, Human Factors Design Standard, Chapter 12.16, Safety Labels and Placards.

The designer shall ensure that required permits and plans are obtained or developed, including:

- Construction and Demolition Permits, in accordance with FAA Order JO 3900.57, Environmental and Occupational Safety and Health (EOSH) Requirements in the Planning and Execution of Construction and Maintenance Activities at National Airspace System (NAS) Facilities
- Asbestos National Emission Standards for Hazardous Air Pollutants (NESHAP) Permits, in accordance with 40 CFR 61, if demolition or renovation activities may disturb asbestos containing material (ACM)
- National Pollutant Discharge Elimination System (NPDES) permits, in accordance 40 CFR Part 122 and the Clean Water Act
- Stormwater permits and Stormwater Pollution Prevention Plans (SWPP), in accordance with 40 CFR Part 122-123
- Spill Prevention, Control, and Countermeasure (SPCC) Plans, in accordance with 40 CFR Section 112.

All listed orders are subject to change or update by the associated organization, please check the references as necessary. Please note that FAA Orders, not standards, do not include their "Alpha" notation.

2.0 Specific Safety Features and Protection~~Physical Components:~~

2.01 Electrical Safety

The designer shall ensure the facility is in accordance with electrical safety requirements as defined in:

- 29 CFR 1910, Subpart S, Electrical
- 29 CFR 1910.147, The control of hazardous energy (lockout/tagout)
- FAA Order JO 3900.64, Air Traffic Organization Electrical Safety Program
- FAA Order JO 3900.67, Air Traffic Organization Hazardous Energy Control (Lockout/Tagout) Program

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- FAA Standard HF-STD-001, Human Factors Design Standard, Chapter 12.4, Electrical Hazards
- DOT Specification FAA-G-2100H, Electronic Equipment, General Requirements
- National Fire Protection Association (NFPA) 70, National Electrical Code
- NFPA 70E, Standard for Electrical Safety in the Workplace.

If equipment racks are to be installed, removed, or repositioned (either temporarily or permanently) during construction or electronic install, minimum clear working space requirements shall be met in accordance with 29 CFR 1910.303 and NFPA 70 Article 110.26.

The designer will ensure installed equipment does not have any "daisy chaining" of flexible cord sets (power cords) as stated in FAA Order 3900.64, Chap. 2.8.(7).

All hazards associated with electrical equipment shall be marked with labels indicating the hazard, in accordance with DOT Specification FAA-G-2100H, General Requirements, Chapter 3.3.5.5, Markings, Signs, Tags and Symbols.

FOR MODIFICATION AND IMPROVEMENT PROJECTS: If equipment will be installed in an FAA facility in a manner that would modify existing power distribution, the program shall meet the requirements of FAA Order 6950.27, Power System Analyses: Load Flow Calculations, Short Circuit Analyses, Protective Device Coordination Studies, and ARC Flash Hazard Analysis.

2.02 Arc Flash

The designer shall ensure that personnel are protected from arc flash hazards, in accordance with FAA Order JO 3900.64, Air Traffic Organization Electrical Safety Program, and NFPA 70E, Standard for Electrical Safety in the Workplace.

The designer shall ensure that an Arc Flash Risk Assessment (AFRA) is performed when new facilities are constructed or when a major modification occurs at an existing facility. The AFHA must determine the arc flash boundary, the incident energy at a specified working distance, and the personal protective equipment (PPE) required for the Qualified Person working within the arc flash boundary, in accordance with FAA Order JO 3900.64.

The designer shall ensure Arc Flash Hazard Analyses are performed in accordance with FAA Order JO 3900.64 and NFPA 70E, Standard for Electrical Safety in the Workplace, Article 130. Even if an AFHA is not required, the potential for an arc flash hazard exists. The appropriate PPE must be identified using NFPA 70E Table 130.7(C)(15)(a).

As stated in NFPA 70E 130.5(C), electrical equipment, such as switchboards, panelboards, industrial control panels, transformers, disconnect switches, and motor control centers that are in other than dwelling units and are likely to require examination, adjustment, servicing, or maintenance while energized must be field marked to warn qualified persons of potential electric arc flash hazards. The marking must be located so as to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

2.03 Engine Generators

The designer shall ensure that all installed engine generators associated with construction projects are installed, operated and maintained in compliance with federal, state and local regulations, and FAA Orders and Technical Information Bulletins on maintenance of engine generators, including but not limited to:

- FAA Order JO 1050.17, Environmental Compliance at Air Traffic Organization Facilities
- FAA Order JO 6980.11, Maintenance of Engine Generators
- FAA Order JO 6470.5, Maintenance of Air Route Traffic Control Center Environmental Systems
- FAA Order JO 6470.59 - Interim Clarification of Parameters for Order JO 6470.5
- FAA Order JO 7110.65, Air Traffic Control

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- FAA Order JO 7210.3, Facility Operation and Administration
- 40 CFR Part 63, Subpart ZZZZ, National Emissions Standards for Hazardous Air Pollutants for stationary Reciprocating Internal Combustion Engines
- NFPA 37, Standard for Installation and Use of Stationary Combustible Engine and Gas Turbines
- NFPA 54, National Fuel Gas Code
- NFPA 58, Liquefied Petroleum Gas Code
- NFPA 110, Standards for Emergency and Standby Power Systems

The designer shall ensure assessments are conducted to determine whether air pollution permits are required prior to acquisition of any new or replacement stationary air pollution sources (e.g., engine generators, boilers), and shall obtain the required permits prior to construction, commissioning or operation of the equipment, in accordance with FAA Order JO 1050.17.

FOR MODIFICATION AND IMPROVEMENT PROJECTS: The designer shall ensure that when replacing engine generators as part of implementation activities, all associated hazardous materials such as fuel, oil, and coolants are removed and disposed of in accordance with 40 CFR, Chapter 1, Subchapter I (Solid Wastes) and any applicable Reutilization and Disposition Plan.

FOR MODIFICATION AND IMPROVEMENT PROJECTS: The designer shall ensure that all removed engine generators are disposed of in accordance with FAA Order 4600.27, Personal Property Management.

2.04 Fuel Storage Tanks

The designer shall ensure the design, installation, and operation of fuel storage tank systems are in accordance with:

- FAA Order 1050.15, Fuel Storage Tanks at FAA Facilities
- FAA Order 1050.16, Implementation Guidelines for Compliance with Underground Storage Tanks (UST) Regulations
- FAA Order JO 1050.17, Environmental Compliance at Air Traffic Organization Facilities
- NFPA 30, Flammable and Combustible Liquids Code
- NFPA 37, Standard for Installation and Use of Stationary Combustible Engine and Gas Turbines
- NFPA 58, Liquefied Petroleum Gas Code
- NFPA 704, Standard System for the Identification of the Hazards of Materials for Emergency Response
- 40 CFR Part 112, Oil Pollution Prevention Regulations
- 40 CFR Part 280, Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST)
- Energy Policy Act of 2005 (EPACT)
- Applicable state regulations and local codes that address construction, installation, operation, permitting, and maintenance requirements

FOR MODIFICATION AND IMPROVEMENT PROJECTS: The designer shall ensure that removal, disposition and/or transfer of storage tanks comply with 40 CFR Part 112 (ASTs), 40 CFR Part 280 (USTs), FAA AMS Real Estate Guidance Section 5.4.8, and applicable state and local regulations.

The designer shall ensure that facilities which will be operating under the jurisdiction of the Oil Pollution Act of 1990 shall develop Spill Prevention, Control and Countermeasure (SPCC) plans in accordance with 40 CFR Part 112.

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Comment [PM[6]]: I have included this FST section as it pertains to EOSH. It may be beneficial to merge these items or consult with the FST group to see if structural requirements should be kept apart from safety requirements.

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2.05 Grounding, Bonding, Shielding, and Lightning Protection

The designer shall ensure that grounding, bonding, shielding, control of electrostatic discharge (ESD), and lightning protection for all electronic equipment are in accordance with:

- DOT Specification FAA-G-2100H, Electronic Equipment, General Requirements
- DOT Standard FAA-STD-019~~E~~, Lightning and Surge Protection, Grounding, Bonding and Shielding Requirements for Facilities and Equipment.
- National Fire Protection Association (NFPA) 70, National Electrical Code
- NFPA 70E, Standard for Electrical Safety in the Workplace
- NFPA 780, Standard for the Installation of Lightning Protection Systems
- Fir Life Safety/ Electrical Work group Report dated May 14, 2012.

2.06 Seismic Safety

The designer shall ensure the safety of personnel during a seismic event, the facility and equipment shall meet anchoring requirements for the seismic zone in which the equipment is located, and the requirements in DOT Specification FAA-G-2100H, Electronic Equipment, General Requirements, Section 3.2.1.1.1, Seismic Zone Design, and 3.3.5, Personnel Safety and Health.

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2.07 Energized Electrical Work, Lockout/Tagout

An Energized Electrical Work Permit (EEWP) must be obtained when working on energized electrical conductors or equipment, in accordance with FAA Order JO 3900.64, Air Traffic Organization Electrical Safety Program.

The designer shall implement lockout/tagout (LOTO) procedures, including zero energy verification, that meet or exceed minimum requirements for controlling hazardous energy during installation, service, modification, and maintenance of equipment, and personnel must be trained in accordance with 29 CFR 1910.147, FAA Order 3900.19, and FAA Order JO 3900.67, Air Traffic Organization Hazardous Energy Control (Lockout/Tagout) Program.

All new equipment installed, or any replacement or major repair, modification, alteration, or renovation to existing machines or equipment must be equipped with the capacity for lockout, in accordance with FAA Order 3900.19.

2.08 Fall Protection

All work performed at four feet or above ground level and all procedures for installing, maintaining, repairing, and operating equipment at four feet or above ground level (e.g., lightning protection systems, antennas, weather sensors, etc.) must meet fall protection requirements in accordance with:

- FAA Order JO 3900.63, Air Traffic Organization (ATO) Fall Protection Program,
- 29 CFR 1926, Safety and Health Regulations for Construction
- 29 CFR 1910, Occupational Safety and Health Standards (General Industry)

The designer shall seek to eliminate fall hazards where possible, and install fall protection equipment (ladders, ladder safety systems, guardrails, rated anchorages, etc.) and implement procedures to protect personnel from fall hazards where hazard elimination is not possible, in accordance with FAA Order JO 3900.63. This shall include eliminating hazards during planning and design where possible.

2.09 Batteries

The designer shall ensure that storage, use, disposal, and maintenance of backup batteries located in new facilities or in modernized areas are in accordance with:

- National Fire Protection Association (NFPA) 70, National Electrical Code, Article 480
- FAA Order 6980.25, Maintenance of Batteries for Standby Power.

2.10 Emergency Eyewashes/Showers

The designer shall ensure emergency eyewash and shower equipment for immediate emergency use is available in any work area where the eyes or body of any person may be exposed to injurious corrosive materials, in accordance with:

- 29 CFR 1910.151, Medical Services and First Aid
- FAA Order 6980.25, Maintenance of Batteries for Standby Power.

The designer shall ensure that eyewash/shower equipment is placed in locations where the eyewash/shower water spray will not impact electrical equipment or expose personnel to additional hazards, in accordance with FAA Order 6980.25, Maintenance of Batteries for Standby Power.

2.11 Material Handling

Where necessary, the designer shall ensure that new or replaced heavy equipment is labeled in accordance with:

- FAA Order 3900.19, FAA Occupational Safety and Health Program
- FAA Standard HF-STD-001, Human Factors Design Standard, Chapter 12, Personnel Safety
- 29 CFR 1910, Occupational Safety and Health Standards (General Industry), Subpart N, Materials Handling and Storage.

The designer shall ensure that equipment does not exceed roof or floor loading limits in FAA buildings or structures where the equipment will be installed, transported or stored, in accordance with 29 CFR 1910.22.

The designer shall ensure that a label is affixed to any replaceable equipment weighing 37 pounds or greater that indicates its weight, center of gravity, and the number of people recommended to lift or carry the unit, in accordance with FAA Standard HF-STD-001, Human Factors Design Standard, Chapter 12, Personnel Safety.

2.12 Occupational Noise

The designer shall ensure that any FAA facility area complies with occupational noise requirements in accordance with:

- 29 CFR 1910.95, Occupational Noise Exposure
- FAA Order 3900.19, FAA Occupational Safety and Health Program
- FAA Standard HF-STD-001, Human Factors Design Standard, Chapter 12, Personnel Safety.

2.13 Confined Spaces

The designer shall ensure that entry of personnel into confined spaces to perform work in support of program activities is conducted in accordance with 29 CFR 1910.146, Permit-Required Confined Spaces, 29 CFR 1926 Subpart AA, Confined Spaces in Construction, and FAA Order 3900.19.

In order to protect personnel from confined space hazards, all confined spaces designated as permit-required confined spaces under 29 CFR 1910.146 or 29 CFR 1926.1204 shall be labeled with warning signs, and entry shall be controlled under the facility's confined space entry program.

2.14 Indoor Air Quality (IAQ)

The designer shall ensure that indoor air quality (IAQ) at FAA facilities is in accordance with:

- FAA Order 3900.19, FAA Occupational Safety and Health Program
- U.S. Environmental Protection Agency (EPA) primary and secondary standards
- Applicable state and local regulations.

~~Disposal Requirements~~ ~~(Applicable to Improve and Demolition Projects)~~

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~~The designer shall identify any hazardous materials in the equipment and their respective disposal requirements, in accordance with the Resource Conservation and Recovery Act (RCRA).~~

~~The designer must mandate construction and demolition (C&D) debris recycling for construction, demolition, and modernization of facilities when the value of the work is expected to exceed $100,000, in accordance with Executive Order 13693, Planning for Federal Sustainability in the Next Decade.~~

~~3.0 Grounding, Bonding, Shielding, and Lightning Protection~~

~~The designer shall ensure that grounding, bonding, shielding, control of electrostatic discharge (ESD), and lightning protection for all electronic equipment are in accordance with:~~

- ~~DOT Specification FAA-G-2100H, Electronic Equipment, General Requirements~~
- ~~DOT Standard FAA-STD-019E, Lightning and Surge Protection, Grounding, Bonding and Shielding Requirements for Facilities and Equipment.~~
- ~~National Fire Protection Association (NFPA) 70, National Electrical Code~~
- ~~NFPA 70E, Standard for Electrical Safety in the Workplace~~
- ~~NFPA 780, Standard for the Installation of Lightning Protection Systems~~

Hazardous Materials

3.01 General Hazmat Requirements

Handling of hazardous materials in FAA facilities shall be in accordance with:

- 29 CFR 1910, Occupational Safety and Health Standards (General Industry)
- FAA Order 3900.19, FAA Occupational Safety and Health Program
- FAA Order JO 1050.17, Environmental Compliance at Air Traffic Organization Facilities

Safety Data Sheets (SDS) for hazardous components shall be furnished upon delivery and made available to personnel in the work area, and all hazardous materials shall be labeled in accordance with 29 CFR 1910.1200, Hazard Communication and FAA Order 3900.19.

The designer shall ensure that all hazardous chemicals expected during occupancy or during facility construction, as applicable, are included in the facility chemical inventory, in accordance with 29 CFR 1910.1200, Hazard Communication and FAA Order 3900.19.

A. Mercury

The designer shall ensure construction activities minimize the use of mercury, in accordance with FAA Order 1050.10, Prevention, Control, and Abatement of FAA Environmental Pollution.

Ozone Depleting Substances (ODS)

The designer shall ensure that Class I ozone-depleting substances (ODS) and selected Class II ODS (HCFC-22, HCFC-141b, and HCFC-142b) are not present in construction materials or products, in accordance with 40 CFR Part 82, Protection of Stratospheric Ozone and FAA Order JO 1050.17, Environmental Compliance at Air Traffic Organization Facilities.

During service, maintenance, repair, or disposal of equipment containing ozone-depleting substances (ODS), Class I and Class II ODS must be recovered in accordance with 40 CFR Part 82 and FAA Order JO 1050.17.

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B. Polychlorinated Biphenyls (PCBs)

The designer shall ensure that polychlorinated biphenyls (PCBs) are not present in construction materials or products, in accordance with 40 CFR Part 761.

FOR MODIFICATION AND IMPROVEMENT PROJECTS: The designer shall ensure that legacy equipment containing PCBs that may be modified or removed will be handled, marked, stored, transported and disposed of in accordance with 40 CFR Part 761, FAA Order 1050.14, Polychlorinated Biphenyls (PCBs) in the National Airspace System (NAS), 29 CFR 1910.1000 Table Z1, and 29 CFR 1910 Subpart I.

C. Asbestos

The designer shall ensure that asbestos is not present in construction materials or products, in accordance with the Clean Air Act (CAA) and Toxic Substances Control Act (TSCA). Upon completion of all construction activities, the new facility or improved space may be confirmed asbestos free either via documentation or laboratory testing.

FOR MODIFICATION AND IMPROVEMENT PROJECTS: Personnel shall be protected from asbestos hazards during renovation and demolition activities, in accordance with 29 CFR 1910.1001, Asbestos, and FAA Order 1050.20, Airway Facilities Asbestos Control Program.

FOR MODIFICATION AND IMPROVEMENT PROJECTS: The designer will coordinate with the relevant Facility Asbestos Coordinators (FACs) or Safety and Environmental Compliance Managers (SECMs) to determine whether any asbestos containing material (ACM) will be impacted by proposed program activities. Facilities requiring modification (e.g., drilling holes in walls, flooring, or fire barriers, removing floor or ceiling tiles) shall be inspected for asbestos in the area to be disturbed prior to modification. If asbestos is identified in an inspection, an action plan for removal shall be developed and implemented before the commencement of work, in accordance with FAA Order 1050.20, FAA Order 3900.19, and 29 CFR 1910.1001, Asbestos.

D. Lead and Lead-Based Paint

The designer must ensure that new equipment, systems, and construction do not contain lead-coated materials, in accordance with FAA Order JO 1050.17.

FOR MODIFICATION AND IMPROVEMENT PROJECTS: The designer will coordinate with the relevant SECMs to determine whether any activities have the potential to disturb lead-based paint (LBP), and will conduct all activities (paint removal, cutting, burning or drilling structures containing LBP, etc.) in accordance with FAA Order JO 1050.17, FAA Order 3900.19, 29 CFR 1910.1025 and 29 CFR 1926.62.

E. Silica

The designer shall ensure personnel be protected from silica hazards during renovation, construction, and demolition activities and upon occupancy, in accordance with 29 CFR 1926.1153, Respirable Crystalline Silica.

FOR MODIFICATION AND IMPROVEMENT PROJECTS: The designer will coordinate with SECMs to determine whether any material containing or potentially containing silica will be impacted by proposed program activities. Facilities requiring modification including drilling, grinding, or crushing of materials such as mortar, bricks, stones, or concrete blocks will require ventilation of the work area or worker PPE as per 29 CFR 1926.1153. No employee will be exposed to more than 50 µg/m3 of respirable silica over an eight-hour (8hr) time-weighted average (TWA); this is the Permissible Exposure Limit as per 29 CFR 1926.1153(d)(1).

3.02 Radiation Safety

The designer shall ensure FAA facilities comply with radiation health hazard and personnel protection requirements as defined in the following:

- FAA Order 3900.19, FAA Occupational Safety and Health Program
- 10 CFR Part 20, Standards for Protection Against Radiation
- 29 CFR 1910.97, Nonionizing Radiation
- 29 CFR 1910.1096, Ionizing Radiation.

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The designer shall ensure that manufacturers and suppliers of FAA-purchased equipment containing radiation sources provide appropriate radiation source identification, emissions data, and hazard warning labels that demonstrate compliance with RSP standards and guidelines, in accordance with 10 CFR Part 20, Standards for Protection Against Radiation.

The designer shall ensure that personnel who may be exposed to radiation hazards in the workplace are provided with appropriate training and personal protective equipment (e.g., laser safety eye glasses), in accordance with FAA Order 3900.19 and other FAA requirements.

3.03 Disposal Requirements (Applicable to Improve and Demolition Projects)

The designer shall identify any hazardous materials in the equipment and their respective disposal requirements, in accordance with the Resource Conservation and Recovery Act (RCRA).

The designer must mandate construction and demolition (C&D) debris recycling for construction, demolition, and modernization of facilities when the value of the work is expected to exceed $100,000, in accordance with Executive Order 13693, Planning for Federal Sustainability in the Next Decade.

~~Seismic Safety~~

~~The designer shall ensure the safety of personnel during a seismic event, the facility and equipment shall meet anchoring requirements for the seismic zone in which the equipment is located, and the requirements in DOT Specification FAA-C-2100H, Electronic Equipment, General Requirements, Section 3.2.1.1.1, Seismic Zone Design, and 3.3.5, Personnel Safety and Health.~~

~~Employee Safety and Health~~

~~General EOSH Requirements~~

~~The designer shall ensure all work be in accordance with personnel safety requirements as defined in:~~

- ~~29 CFR 1910, Occupational Safety and Health Standards (General Industry)~~
- ~~FAA Order 3900.19, FAA Occupational Safety and Health Program~~
- ~~FAA Standard HF-STD-001, Human Factors Design Standards, Chapter 12, Personnel Safety~~

~~The designer will ensure that all required permits and plans are obtained or acquired prior to the commencement of work. These permits include, but not limited to asbestos work permits, confined space permits, energized electrical work permits, hot work permits, and environmental permits, in accordance with FAA Order JO 3900.57, Environmental and Occupational Safety and Health (EOSH) Requirements in the Planning and Execution of Construction and Maintenance Activities at National Airspace System (NAS) Facilities.~~

~~The designer shall ensure that equipment which presents a potential safety hazard to personnel shall be marked with appropriate warning labels or placards, in accordance with 29 CFR 1910.145, Specifications for Accident Prevention Signs and Tags, and FAA Standard HF-STD-001, Human Factors Design Standard, Chapter 12.16, Safety Labels and Placards.~~

~~The designer shall ensure that required permits and plans are obtained or developed, including:~~

- ~~Construction and Demolition Permits, in accordance with FAA Order JO 3900.57, Environmental and Occupational Safety and Health (EOSH) Requirements in the Planning and Execution of Construction and Maintenance Activities at National Airspace System (NAS) Facilities~~
- ~~Asbestos National Emission Standards for Hazardous Air Pollutants (NESHAP) Permits, in accordance with 40 CFR 61, if demolition or renovation activities may disturb asbestos containing material (ACM)~~
- ~~National Pollutant Discharge Elimination System (NPDES) permits, in accordance 40 CFR Part 122 and the Clean Water Act~~
- ~~Stormwater permits and Stormwater Pollution Prevention Plans (SWPP), in accordance with 40 CFR Part 122-123~~

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- Spill Prevention, Control, and Countermeasure (SPCC) Plans, in accordance with 40 CFR Section 112.

Electrical Safety

The designer shall ensure the facility is in accordance with electrical safety requirements as defined in:

- 29 CFR 1910, Subpart S, Electrical
- 29 CFR 1910.147, The control of hazardous energy (lockout/tagout)
- FAA Order JO 3900.64, Air Traffic Organization Electrical Safety Program
- FAA Order JO 3900.67, Air Traffic Organization Hazardous Energy Control (Lockout/Tagout) Program
- FAA Standard HF-STD-001, Human Factors Design Standard, Chapter 12.4, Electrical Hazards
- DOT Specification FAA-G-2100H, Electronic Equipment, General Requirements
- National Fire Protection Association (NFPA) 70, National Electrical Code
- NFPA 70E, Standard for Electrical Safety in the Workplace.

If equipment racks are to be installed, removed, or repositioned (either temporarily or permanently) during construction or electronic install, minimum clear working space requirements shall be met in accordance with 29 CFR 1910.303 and NFPA 70 Article 110.26.

The designer will ensure installed equipment does not have any "daisy chaining" of flexible cord sets (power cords) as stated in FAA Order 3900.64, Chap. 2.8.(7).

All hazards associated with electrical equipment shall be marked with labels indicating the hazard, in accordance with DOT Specification FAA-G-2100H, General Requirements, Chapter 3.3.5.5, Markings, Signs, Tags and Symbols.

FOR MODIFICATION AND IMPROVEMENT PROJECTS: If equipment will be installed in an FAA facility in a manner that would modify existing power distribution, the program shall meet the requirements of FAA Order 6950.27, Power System Analyses: Load Flow Calculations, Short Circuit Analyses, Protective Device Coordination Studies, and ARC Flash Hazard Analysis.

Arc Flash

The designer shall ensure that personnel are protected from arc flash hazards, in accordance with FAA Order JO 3900.64, Air Traffic Organization Electrical Safety Program, and NFPA 70E, Standard for Electrical Safety in the Workplace.

The designer shall ensure that an Arc Flash Risk Assessment (AFRA) is performed when new facilities are constructed or when a major modification occurs at an existing facility. The AFHA must determine the arc flash boundary, the incident energy at a specified working distance, and the personal protective equipment (PPE) required for the Qualified Person working within the arc flash boundary, in accordance with FAA Order JO 3900.64.

The designer shall ensure Arc Flash Hazard Analyses are performed in accordance with FAA Order JO 3900.64 and NFPA 70E, Standard for Electrical Safety in the Workplace, Article 130. Even if an AFHA is not required, the potential for an arc flash hazard exists. The appropriate PPE must be identified using NFPA 70E Table 130.7(C)(15)(a).

As stated in NFPA 70E 130.5(C), electrical equipment, such as switchboards, panelboards, industrial control panels, transformers, disconnect switches, and motor control centers that are in other than dwelling units and are likely to require examination, adjustment, servicing, or maintenance while energized must be field marked to warn qualified persons of potential electric arc flash hazards. The marking must be located so as to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

Energized Electrical Work, Lockout/Tagout

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An Energized Electrical Work Permit (EEWP) must be obtained when working on energized electrical conductors or equipment, in accordance with FAA Order JO 3900.64, Air Traffic Organization Electrical Safety Program.

The designer shall implement lockout/tagout (LOTO) procedures, including zero energy verification, that meet or exceed minimum requirements for controlling hazardous energy during installation, service, modification, and maintenance of equipment, and personnel must be trained in accordance with 29 CFR 1910.147, FAA Order 3900.19, and FAA Order JO 3900.67, Air Traffic Organization Hazardous Energy Control (Lockout/Tagout) Program.

All new equipment installed, or any replacement or major repair, modification, alteration, or renovation to existing machines or equipment must be equipped with the capacity for lockout, in accordance with FAA Order 3900.19.

Fall Protection

All work performed at four feet or above ground level and all procedures for installing, maintaining, repairing, and operating equipment at four feet or above ground level (e.g., lightning protection systems, antennas, weather sensors, etc.) must meet fall protection requirements in accordance with:

- FAA Order JO 3900.63, Air Traffic Organization (ATO) Fall Protection Program.
- 29 CFR 1926, Safety and Health Regulations for Construction
- 29 CFR 1910, Occupational Safety and Health Standards (General Industry)

The designer shall seek to eliminate fall hazards where possible, and install fall protection equipment (ladders, ladder safety systems, guardrails, rated anchorages, etc.) and implement procedures to protect personnel from fall hazards where hazard elimination is not possible, in accordance with FAA Order JO 3900.63. This shall include eliminating hazards during planning and design where possible.

Batteries

The designer shall ensure that storage, use, disposal, and maintenance of backup batteries located in new facilities or in modernized areas are in accordance with:

- National Fire Protection Association (NFPA) 70, National Electrical Code, Article 480
- FAA Order 6980.25, Maintenance of Batteries for Standby Power.

Emergency Eyewashes/Showers

The designer shall ensure emergency eyewash and shower equipment for immediate emergency use is available in any work area where the eyes or body of any person may be exposed to injurious corrosive materials, in accordance with:

- 29 CFR 1910.151, Medical Services and First Aid
- FAA Order 6980.25, Maintenance of Batteries for Standby Power.

The designer shall ensure that eyewash/shower equipment is placed in locations where the eyewash/shower water spray will not impact electrical equipment or expose personnel to additional hazards, in accordance with FAA Order 6980.25, Maintenance of Batteries for Standby Power.

Material Handling

Where necessary, the designer shall ensure that new or replaced heavy equipment is labeled in accordance with:

- FAA Order 3900.19, FAA Occupational Safety and Health Program
- FAA Standard HF-STD-001, Human Factors Design Standard, Chapter 12, Personnel Safety
- 29 CFR 1910, Occupational Safety and Health Standards (General Industry), Subpart N, Materials Handling and Storage.

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Occupational Noise

The designer shall ensure that any FAA facility area complies with occupational noise requirements in accordance with:

- 29 CFR 1910.95, Occupational Noise Exposure
- FAA Order 3900.19, FAA Occupational Safety and Health Program
- FAA Standard HF-STD-001, Human Factors Design Standard, Chapter 12, Personnel Safety.

Confined Spaces

The designer shall ensure that entry of personnel into confined spaces to perform work in support of program activities is conducted in accordance with 29 CFR 1910.146, Permit-Required Confined Spaces, 29 CFR 1926 Subpart AA, Confined Spaces in Construction, and FAA Order 3900.19.

In order to protect personnel from confined space hazards, all confined spaces designated as permit-required confined spaces under 29 CFR 1910.146 or 29 CFR 1926.1204 shall be labeled with warning signs, and entry shall be controlled under the facility's confined space entry program.

Indoor Air Quality (IAQ)

The designer shall ensure that indoor air quality (IAQ) at FAA facilities is in accordance with:

- FAA Order 3900.19, FAA Occupational Safety and Health Program
- U.S. Environmental Protection Agency (EPA) primary and secondary standards
- Applicable state and local regulations.

Radiation Safety

The designer shall ensure FAA facilities comply with radiation health hazard and personnel protection requirements as defined in the following:

- FAA Order 3900.19, FAA Occupational Safety and Health Program
- 10 CFR Part 20, Standards for Protection Against Radiation
- 29 CFR 1910.97, Nonionizing Radiation
- 29 CFR 1910.1096, Ionizing Radiation.

The designer shall ensure that manufacturers and suppliers of FAA-purchased equipment containing radiation sources provide appropriate radiation source identification, emissions data, and hazard warning labels that demonstrate compliance with RSP standards and guidelines, in accordance with 10 CFR Part 20, Standards for Protection Against Radiation.

The designer shall ensure that personnel who may be exposed to radiation hazards in the workplace are provided with appropriate training and personal protective equipment (e.g., laser safety eye glasses), in accordance with FAA Order 3900.19 and other FAA requirements.

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Guiding Principles for Sustainable Federal Buildings and Associated Instructions

The Council on Environmental Quality
February 2016

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I. Purpose

In 2006, Federal agencies owning and operating more than 90% of all Federal facilities signed the *Memorandum of Understanding for Federal Leadership in High Performance and Sustainable Buildings* (2006 Guiding Principles).[1] The Memorandum contained the first set of Guiding Principles - overarching environmental performance goals - for new Federal buildings. The 2006 Guiding Principles addressed reducing energy and water use, conserving resources, minimizing waste, protecting indoor air quality, and requiring the use of integrated teams during the design, construction, and operation of new Federal facilities. An updated set of Guiding Principles, called "High Performance and Sustainable Buildings Guidance," December 2008, contained "Guiding Principles for Sustainable New Construction and Major Renovation" and "Guiding Principles for Sustainable Existing Buildings."[2] Previous Executive Orders (E.O.) 13423 (2006) and 13514 (2009) recognized green buildings as a key component in efforts to reduce environmental impacts, cut greenhouse gas (GHG) emissions, and lower the operating costs at Federal facilities. E.O. 13693, *Planning for Federal Sustainability in the Next Decade, March 19, 2015*, reaffirmed Federal green building efforts and called for revised Guiding Principles to reflect progress in green building design, construction, and operation practices; broaden considerations around protecting occupant health, wellness, and productivity; and address climate change risks.[3]

E.O. 13693 section 4(f) requires "…CEQ… [to] prepare and issue revised Guiding Principles for both new and existing Federal buildings…" For existing buildings, E.O. 13693 section 3(h)(ii) states that agencies will identify "…a percentage of at least 15 percent, by number or total square footage," of their "existing buildings above 5,000 gross square feet (GSF) that will, by fiscal year 2025, comply with the revised Guiding Principles for Federal Leadership in…Sustainable Buildings (Guiding Principles)…and making annual progress toward 100 percent conformance with the Guiding Principles for its building inventory." For new construction and modernization, E.O. 13693 recommits the Federal Government to these revised Guiding Principles, and beginning in fiscal year (FY) 2020, to design new buildings to be net-zero energy by FY 2030. The June 10, 2015 Implementing Instructions to E.O. 13693 confirmed that agencies "…shall ensure that all new major construction [and] renovation…of buildings over 5,000 gross square feet compl[y]with the Guiding Principles where cost-effective."[4] E.O. 13693 reconfirmed that green building work is an important part of Federal efforts to protect the environment, support communities, and address climate change.

This document updates and replaces the December 2008 Guiding Principles to:

1) Reflect the evolution of sustainable building design, construction, and operating practices since 2008,
2) Incorporate other building-related E.O. 13693 requirements,
3) Increase the economic and environmental benefits of Federal investments in facilities,
4) Enhance occupant health, wellness, and productivity,

[1] www.fedcenter.gov/_kd/Items/actions.cfm?action=Show&item_id=4713&destination=ShowItem
[2] www.wbdg.org/pdfs/hpsb_guidance.pdf
[3] www.gpo.gov/fdsys/pkg/FR-2015-03-25/pdf/2015-07016.pdf
[4] www.whitehouse.gov/sites/default/files/docs/eo_13693_implementing_instructions_june_10_2015.pdf

5) Include climate resilience in building design, construction, and operations, and protect Federal facilities investments from the potential impacts of climate change, and
6) Provide information on tracking agency green building performance.

II. Applicability

The Guiding Principles for new construction and modernization apply to all new Federally owned buildings over 5,000 square feet. The Guiding Principles for existing buildings should be adopted for agencies' existing portfolio of Federally owned buildings over 5,000 square feet. Agencies must ensure that they meet the Guiding Principles on at least 15% of these existing buildings (either by building or by square footage) no later than FY 2025. Once an agency achieves 15% compliance, it should set annual targets and continue to strive to apply the guiding principles to 100% of its building inventory. The Guiding Principles do not apply to those buildings where a Report of Excess (ROE) has been submitted to GSA, a Determination of Disposal has been made, or the building has been classified as Surplus. Agencies should check the Annual Federal Real Property Profile Guidance for additional details. For facilities located outside of the United States, consider the provisions of Section 17 of E.O. 13693 to determine applicability of the Guiding Principles.

Leases will no longer be included in calculating compliance with the Guiding Principles. However, agencies should strive to incorporate as many of the Guiding Principles as possible in new lease actions.

When evaluating compliance with the Guiding Principles, the new construction and modernization criteria should be applied for all new construction and when the project that an agency is undertaking in an existing building is essentially a comprehensive replacement or restoration of virtually all major systems, interior work (such as ceilings, partitions, doors, floor finishes, etc.), and building elements and features.

The Guiding Principles apply to buildings, as well as some functions inherent in optimizing building utilization, including integrated design and operation and maintenance. Some of these concepts, such as occupant health and wellness, overlap with multiple principles. Occupant health and wellness represents a new focus area not included in the 2008 Guiding Principles and so it is highlighted as its own new principle below, despite overlap with other principles such as integrated design and indoor environmental quality. Examples of occupant health and wellness areas that overlap with multiple principles include indoor air quality, accessibility of staircases, fitness facilities, bicycle commuter facilities, and healthy dining options. Similarly, climate resilience and adaptation, which is new and therefore has a principle dedicated to it, also applies to other principles.

Although E.O. 13693 revoked several previous E.O.s and Presidential memoranda that applied to Federal buildings, the following documents still apply and should continue to be used in implementing the Guiding Principles: Sustainable Locations for Federal Facilities of September 15, 2011; Sustainable Practices for Designed Landscapes of October 31, 2011, as supplemented on October 22, 2014; Federal Greenhouse Gas Accounting and Reporting Guidance [Revision 1] of June 4, 2012; and Federal Agency Implementation of Water Efficiency and Management Provisions of Executive Order 13514 of July 10, 2013.

III. Agency Determination of a Building's Compliance with the Guiding Principles

Determining a Building's Compliance with the Guiding Principles

Each agency is responsible for evaluating its buildings for compliance with the Guiding Principles. This determination should be made on a building by building basis. Each agency should ensure that sufficient evidence and documentation is readily available to demonstrate compliance with the Guiding Principles. ENERGY STAR® Portfolio Manager is one of the tools available for agencies to use to organize and keep Guiding Principles documentation; this tool was specifically developed to assist agencies with implementation, documentation, and tracking the Guiding Principles.[5]

Documentation developed to meet the requirements of consensus-based third-party green building rating systems can be used to document compliance with the Guiding Principles. Note, however, that green building rating systems may meet many, but not all Guiding Principles. Therefore, required elements or sub-elements of the Guiding Principles not tracked by the third party rating system must also be met.

Guiding Principles that are "Not Applicable"

Previously, there was some ambiguity in determining compliance in buildings where one or more of the guiding principles, elements, or sub-elements were not applicable to the building under evaluation. For building evaluation purposes, "not applicable" may be used where the building's inherent function, mission, safety, or designation prevents compliance with a specific guiding principle, element, or sub-element. The use of "not applicable" should be minimized. For new construction and modernization, "not applicable" is equivalent to compliance with that guiding principle, element, or sub-element. However, for existing buildings, criteria that an agency determines to be "not applicable" do not count toward the total number of required metrics for an individual building. Agencies should document all determinations of non-applicability.

Protocols, Processes, Contracts, and Projects that May Apply to More than One Building

Individual buildings can be compliant with a guiding principle, element, or sub-element through "campus-wide" or "installation-wide" protocols, policies, contracts, or projects only where a given building is directly subject to that protocol, process, contract, or project. Examples of this approach include:

- Green cleaning requirements in a contract servicing all buildings on a campus would mean that each building serviced under that contract meets that particular requirement.
- A centralized or aggregated renewable energy project on an installation that is designated to serve a particular building or buildings on the installation can be used to qualify each

  of those buildings as meeting cost effective renewable and clean energy requirements.
- A stormwater management project that serves more than a single building site can benefit multiple buildings within the project boundary.

[5] www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager

- Measures that protect a campus' utilities and make them more resilient can be applied to each building that benefits from those measures.

E.O. 13693 green building requirements are applied on an individual building basis to improve Federal building design, construction, and operating practices and to foster continuous improvement in building environmental performance. Thus, performance metrics such as energy use or water use cannot be applied to more than one building. Determination of compliance with the Guiding Principles cannot be determined at a campus-wide or installation-wide level.

Life Cycle Cost-Effective

Section 3 of E.O. 13693 states that the Guiding Principles should be applied where life cycle cost-effective. The term "cost-effectiveness" should include the use of benefit-cost analysis in accordance with OMB Circulars A-94 as well as A-11 Part 7 *Capital Programming Guide*.

Updating the Sustainable Building Information in the Federal Real Property Profile

Each agency is responsible for accurately updating Guiding Principles compliance data as part of the agency's annual Federal Real Property Profile (FRPP) submission. Currently, *Sustainability* is the data element that identifies whether or not a building has met the Guiding Principles. Agencies should check the most recent FRPP guidance documents, which are issued annually for specific reporting requirements.

Under E.O. 13693 Section 3 (h)(ii), the percentage of each agency's building inventory meeting the Guiding Principles will be calculated by: (1) gross square footage of subject buildings and (2) number of subject buildings. Agencies can report achievement toward the goal on the higher of the two calculations.

IV. Effective Date

The 2008 Guiding Principles for existing buildings can continue to be used to qualify buildings as meeting the Guiding Principles where agencies have already taken significant action and made substantial progress in transforming the building to meet the Guiding Principles. For existing buildings, completion of project design and/or the issuance of contracts that will result in meeting at least half of the required guiding principles, elements, and sub-elements is evidence of significant action and substantial progress. This group of existing buildings can apply the 2008 Guiding Principles to certify a building as meeting the Guiding Principles through September 30, 2017. The 2016 Guiding Principles will apply to all applicable existing buildings that have not yet crossed the significant action and substantial progress threshold, upon issuance.

The 2008 Guiding Principles for new construction and modernization requirements can be used only to qualify any new building or modernization where project design has been completed before the issuance of the 2016 Guiding Principles. The 2016 Guiding Principles for new construction and modernization requirements shall be used to qualify any new building or modernization as meeting the Guiding Principles for all new construction and modernization where a project design has not been completed.

Buildings that were determined to have met the 2008 Guiding Principles are considered to meet the Guiding Principles through FY 2025 as long as they continue to meet ongoing requirements such as Energy Independence and Security Act of 2007 (EISA) section 432 requirements including quadrennial evaluations, ongoing commissioning, benchmarking, and operating and maintenance requirements. Also, for these [grandfathered] buildings, agencies should add the sixth Guiding Principle on Resilience as they implement the ongoing requirements for a four- year evaluation.

Likewise, buildings that have been determined to meet the 2016 Guiding Principles for new construction and modernization can be considered as meeting the Guiding Principles if they continue to meet ongoing sustainable operating requirements such as recommissioning every four years, benchmarking, waste diversion, etc.

V. General Provisions

The revised Guiding Principles shall be implemented consistent with applicable law and regulations, and subject to the availability of appropriations or other authorized funding. The revised Guiding Principles do not supersede or invalidate any existing laws, regulations, or other legal requirements. If there is any conflict between the revised Guiding Principles, and a statute, regulation, or executive order, the statute, regulation, or executive order governs. This document is intended solely to improve the internal management of the Executive Branch. It is not intended to, and does not, create any right or benefit, substantive or procedural, enforceable by any party against the United States, its departments, agencies, or entities, its officers, employees, or agents, or any other person.

VI. Guiding Principles for Sustainable Buildings

A. Guiding Principles for New Construction and Modernization

1. Employ Integrated Design Principles

a. Sustainable Locations

Consider the environmental impact of siting decisions when making new facility investments and balance those concerns with cost and security. The guidance included in Implementing Instructions-Sustainable Locations for Federal Facilities highlights the need to strike the appropriate balance.[6] Consider site-specific long-term climate change impacts such as drought, flood, wind, and wildfire risks. Prioritize sites that offer robust transportation options, including walking, biking, and transit, and minimize the combined greenhouse gas emissions of the building and associated commuter and visitor transportation emissions over the project's life. Leverage existing infrastructure, and align, where possible, with local and regional planning goals; protect natural, historic, and cultural resources.

[6] Implementing Instructions-Sustainable Locations for Federal Facilities: www.whitehouse.gov/sites/default/files/microsites/ceq/implementing_instructions_-_sustainable_locations_for_federal_facilities_9152011.pdf

b. Integrated Design

Use a collaborative, integrated process and team to plan, program, design, construct, commission, and transition to operation each new building project or modernization. Ensure that the process and team:

i. Integrate the use of OMB's Circular A-11, Part 7, *Capital Programming Guide*.
ii. Establish performance goals for energy, water, materials, indoor environmental quality, and daylighting along with other comprehensive design goals and ensure incorporation of these goals throughout the design and life cycle of the building.
iii. Follow sustainable landscape design principles[7] including protection and promotion of pollinator habitat.[8, 9]
iv. Evaluate and provide appropriate electric vehicle charging infrastructure, in accordance with applicable laws and regulations.
v. Consider design choices that improve environmental performance, protect historic properties, enhance indoor environmental quality, support health and wellness of building occupants, and address climate risks, including wildfire.
vi. Consider all stages of the building's life cycle.

c. Commissioning

Employ commissioning tailored to the size and complexity of the building and its system components in order to optimize and verify performance of building systems. Commissioning should be led by an experienced commissioning provider who is independent of the project design and construction team and the operations team. At a minimum, commissioning should include a commissioning plan, verification of the installation and performance of systems being commissioned, and a commissioning report that confirms identified issues were appropriately addressed. Follow EISA 2007 section 432 and associated Federal Energy Management Program (FEMP) commissioning guidance.[10, 11]

[7] Guidance for Federal Agencies on Sustainable Practices for Designed Landscapes, October 31, 2011: www.whitehouse.gov/administration/eop/ceq/sustainability/landscaping-guidance
[8] Presidential Memorandum -- Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators, June 20, 2014: www.whitehouse.gov/the-press-office/2014/06/20/presidential-memorandum-creating-federal-strategy-promote-health-honey-b
[9] Supporting the Health of Honey Bees and Other Pollinators, October 2014: www.whitehouse.gov/sites/default/files/docs/supporting_the_health_of_honey_bees_and_other_pollinators.pdf
[10] 42 U.S.C. § 8253(f): energy.gov/sites/prod/files/2014/07/f17/commissioning_fed_facilities.pdf
[11] Guidance for the Implementation and Follow-up of Identified Energy and Water Efficiency Measures in Covered Facilities (per 42 U.S.C. 8253(f), Use of Energy and Water Efficiency Measures in Federal Buildings), September 2012: energy.gov/sites/prod/files/2013/10/f4/eisa_project_guidance.pdf

2. Optimize Energy Performance

a. Energy Efficiency

Employ strategies that minimize energy usage. Focus on reducing energy loads before considering renewable or clean and alternative energy sources. Use energy efficient products as required by statute.[12]

b. Renewable and Clean Energy

Implement life cycle cost-effective renewable electric energy and thermal energy projects on-site. Consider long-term off-site sources of renewable power or Renewable Energy Certificates (RECs) where on-site opportunities are limited. Utilize clean and alternative energy sources where possible.[13]

c. Metering

To track and continuously optimize energy performance, install building level meters for electricity, natural gas, and steam. Install advanced meters as required by statute. Standard meters should be used when advanced meters are not appropriate.[14]

d. Benchmarking

Benchmark building performance at least annually, preferably using ENERGY STAR Portfolio Manager. Agencies should strive to benchmark unusual buildings and space types against similar facilities within their portfolios. Regularly monitor building energy performance against historic performance data and peer buildings to identify operating inefficiencies and conservation opportunities.[15]

3. Protect and Conserve Water

a. Indoor Water Use

Employ strategies that minimize water use and waste, including:

i. Water-Efficient Products

Purchase water conserving products, including WaterSense[16] and FEMP-designated products, as required by statute.

[12] 42 U.S.C. § 8259b and 10 C.F.R. § 436.40 *et seq*.
[13] E.O. 13693, section 3(b), (c), (d), and (e) and associated definitions in section 19
[14] 42 U.S.C. § 8253(e): energy.gov/sites/prod/files/2014/11/f19/metering_guidance.pdf
[15] 42 U.S.C. § 8253(f) (8): energy.gov/sites/prod/files/2014/09/f18/benchmarking_guidance08-2014.pdf
[16] www3.epa.gov/watersense/

ii. Water Meters

Install building level water meters to allow for the management of water use during occupancy, including detection of leaks.

iii. Cooling Towers

Optimize cooling tower operations.

iv. Single Pass Cooling

Eliminate single pass cooling.

b. Outdoor Water Use

Use water efficient landscapes that incorporate native, non-invasive, drought tolerant, and low maintenance plant species and employ water efficient irrigation strategies to reduce outdoor potable water consumption. Install water meters for irrigation systems serving more than 25,000 square feet of landscaping.[17]

c. Alternative Water

Implement cost effective methods to utilize alternative sources of water such as harvested rainwater, treated wastewater, air handler condensate capture, grey water, and reclaimed water, to the extent permitted under local laws and regulations.[18]

d. Stormwater Management

Employ design and construction strategies that reduce stormwater runoff and discharges of polluted water offsite to protect the natural hydrology and watershed health. For any new construction per EISA section 438,[19] use site planning, design, construction, and maintenance strategies to maintain hydrologic conditions after development, or to restore hydrologic conditions following development, to the maximum extent that is technically feasible.

4. Enhance Indoor Environmental Quality

a. Ventilation and Thermal Comfort

Provide safe and healthy ventilation and thermal comfort.

[17] DOE FEMP metering guidance: www.energy.gov/eere/femp/downloads/federal-building-metering-guidance-usc-8253e-metering-energy-use
[18] Industrial, Landscape, and Agricultural Implementing Instructions, July 10, 2013: www.whitehouse.gov/sites/default/files/water_implementing_instructions.pdf
[19] http://www.epa.gov/greeningepa/technical-guidance-implementing-stormwater-runoff-requirements-federal-projects

b. Daylighting and Lighting Controls

Maximize opportunities for daylighting in regularly occupied space, except where not appropriate because of building function, mission, or structural constraints. Maximize the use of automatic dimming controls or accessible manual lighting controls, task lighting, and appropriate shade and glare control.

c. Indoor Air Quality

Take actions to ensure optimal indoor air quality, including:

i. Radon

Test for radon in buildings and mitigate high levels.

ii. Moisture Control

Establish policy and implement a moisture control strategy to prevent building materials damage, minimize mold growth, and reduce associated health risks.

iii. Low-Emitting Materials

Use low emitting materials for building construction, modifications, maintenance, and operations. In particular, specify the following materials and products to have low pollutant emissions: composite wood products, adhesives, sealants, interior paints and finishes, solvents, carpet systems, janitorial supplies, and furnishings.

iv. Indoor Air Quality during Construction

Establish a policy and implement necessary protocols to protect indoor air quality during construction and in the finished building.

v. Environmental Smoking Control

Prohibit smoking in any form within the building and within 25 feet of all building entrances, operable windows, and building ventilation intakes.

vi. Integrated Pest Management

Use integrated pest management techniques as appropriate to minimize pesticide usage.

d. Occupant Health and Wellness

Promote opportunities for occupants to voluntarily increase physical movement such as making stairwells a desirable option for circulation, active workstations, fitness centers, and bicycle commuter facilities. Support occupant health by considering options such as providing convenient access to healthy dining options, potable water, daylight, plants, and exterior views.

5. Reduce the Environmental Impact of Materials

a. Material Content and Performance

Procure construction materials and building supplies that have a lesser or reduced effect on human health and the environment over their life cycle when compared with competing products or services that serve the same purpose, including:

i. Recycled Content and Comprehensive Procurement Guidelines

Use Resource Conservation and Recovery Act (RCRA) section 6002 compliant products that meet or exceed EPA's recycled content recommendations for building construction, modifications, operations, and maintenance.[20]

ii. Biobased Content

Per section 9002 of the Farm Security and Rural Investment Act (FSRIA), for USDA-designated products, use products with the highest content level per USDA's biobased content recommendations.[21]

iii. Other Green Products

Purchase products that meet Federally Recommended Specifications, Standards and Ecolabels[22] or are on the Federal Green Procurement Compilation.[23]

iv. Ozone Depleting Compounds and High Global Warming Potential (GWP) Chemicals

Do not use ozone depleting compounds and high GWP chemicals where EPA's Significant New Alternative Policy (SNAP) has identified acceptable substitutes or where other environmentally preferable products are available during construction, repair, or replacement at the end of life.[24]

b. Waste Diversion and Materials Management

Incorporate appropriate space, equipment, and transport accommodations for collection, storage, and staging of recyclable and, as appropriate, compostable materials in building design, construction, renovation, and operation. During construction, where markets or on-site recycling exist, divert at least 50% (by weight) of construction and demolition materials, excluding land clearing debris and material used as alternative daily cover, from landfills. Maximize reuse or recycling of building materials, products, and supplies wherever possible. Provide reuse and recycling services, including composting, for building occupants, where markets or on-site

[20] 42 U.S.C. 6962, EPA's Comprehensive Procurement Guidelines for Construction: www3.epa.gov/epawaste/conserve/tools/cpg/products/construction.htm
[21] 7 U.S.C. 8102, USDA's BioPreferred website: www.biopreferred.gov/BioPreferred/
[22] www2.epa.gov/greenerproducts/epas-recommendations-specifications-standards-and-ecolabels
[23] Green Procurement Compilation: sftool.gov/greenprocurement
[24] EPA SNAP website: www.epa.gov/snap

recycling exist, and divert at least 50% of non-hazardous and non-construction related materials (by weight), from landfills.

6. Assess and Consider Climate Change Risks

Assess potential impacts and vulnerabilities, from both acute weather events and chronic climate changes, to inform the design of new construction and modernization and facility operations to increase climate resilience, including:

a. Mission Criticality

Determine the long-term mission criticality of the physical asset and operations to be housed in the facility.

b. Floodplain Considerations

For new construction, avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and avoid floodplain development whenever there is a practicable alternative.[25]

c. Facility Design

For new construction, based on the most recent National Climate Assessment,[26] determine key potential climate change impacts for the project location, identify projected climate changes, where feasible, during the useful life of the building, and incorporate those projections as performance targets for project design. Consider fire-resistant design and construction to enhance resilience to the impacts of wildfires and reduce risks to the lives of occupants in the event of a wildfire. Balance options to address predicted climate change impacts against mission criticality, cost, and security to determine design parameters. At a minimum, include low and no cost resilience measures to address predicted climate conditions.

d. Facility Adaptation

For modernization, focusing on the resilience of the physical facility, take action to mitigate identified physical risks considering mission criticality, potential climate change impacts, security, and cost. Consider phased adaptation over time.

[25] www.gpo.gov/fdsys/pkg/FR-2015-02-04/pdf/2015-02379.pdf

[26] Use Climate Science Supplement Appendix 3 of the 2014 National Climate Assessment and the NOAA Technical Report NESDIS 142-9, January 2013 Regional Climate Trends and Scenarios for the U.S. National Climate Assessment Part 9, Climate of the Contiguous United States, or most recent.

B. Guiding Principles for Existing Buildings

1. Employ Integrated Assessment, Operation, and Management Principles

a. Integrated Assessment, Operation, and Management

Through an integrated process and team, identify and implement sustainable operations and maintenance policies that improve building environmental performance, protect natural, historic, and cultural resources, support occupant health and wellness, and improve the climate resilience of facilities and operations.

i. Integrate the use of OMB's Circular A-11, Part 7, *Capital Programming Guide*.

ii. Assess existing condition and operational procedures of the building and major building systems, adequacy of electric vehicle charging infrastructure, in accordance with applicable laws and regulations, and identify areas for improvement.

iii. Establish operational performance goals for energy, water, material use and recycling, and indoor environmental quality, and ensure incorporation of these goals throughout the remaining life cycle of the building and verify that they are being met.

iv. Incorporate goals into building management to ensure that operating decisions and tenant education are carried out with regard to integrated, sustainable building operations and maintenance.

v. Engage building occupants with building environmental performance information. Augment building operations and maintenance as needed using occupant feedback on work space satisfaction.

b. Commissioning

Meet the commissioning requirements of EISA 2007 section 432 and FEMP guidance.[27, 28] Employ recommissioning, tailored to the size and complexity of the building and its system components, in order to optimize and verify performance of building systems. Recommissioning should be led by an experienced commissioning agent who is independent of the facility operations team. Building recommissioning should include a commissioning plan, verification of the performance of systems being commissioned, and a commissioning report that confirms identified issues were appropriately addressed.

[27] 42 U.S.C. § 8253(f): energy.gov/sites/prod/files/2014/07/f17/commissioning_fed_facilities.pdf

[28] Guidance for the Implementation and Follow-up of Identified Energy and Water Efficiency Measures in Covered Facilities (per 42 U.S.C. 8253(f), Use of Energy and Water Efficiency Measures in Federal Buildings), September 2012: energy.gov/sites/prod/files/2013/10/f4/eisa_project_guidance.pdf

2. Optimize Energy Performance

a. Energy Efficiency

Seek to achieve optimal energy efficiency and measure performance on a regular basis. Focus on reducing energy loads before considering renewable or clean and alternative energy sources. Use energy efficient products as required by statute.[29]

b. Renewable and Clean Energy

Implement cost-effective renewable electric energy and thermal energy projects on-site. Consider long-term off-site sources of renewable power or RECs where on-site opportunities are limited. Utilize clean and alternative sources where possible.[30]

c. Metering

To track and continuously optimize energy performance, install building level meters for electricity, natural gas, and steam. Install advanced meters as required by statute. Standard meters should be used when advanced meters are not appropriate.[31]

d. Benchmarking

Compare building performance with energy performance benchmarks at least annually, preferably using ENERGY STAR Portfolio Manager. Agencies should strive to benchmark unusual buildings and space types against similar facilities within their portfolios. Regularly monitor building energy performance against historic performance data and peer buildings to identify operating inefficiencies and conservation opportunities.[32]

3. Protect and Conserve Water

a. Indoor Water Use

Employ strategies that measure and minimize water usage, including:

i. Water Use Evaluations

Conduct an analysis and take action to monitor facility water use and identify and implement conservation opportunities.[33]

[29] 42 U.S.C. § 8259b and 10 C.F.R. § 436.40 *et seq*.
[30] E.O. 13693, section 3(b), (c), (d), and (e) and associated definitions in section 19
[31] 42 U.S.C. § 8253(e): energy.gov/sites/prod/files/2014/11/f19/metering_guidance.pdf
[32] 42 U.S.C. § 8253(f) (8): energy.gov/sites/prod/files/2014/09/f18/benchmarking_guidance08-2014.pdf
[33] www.energy.gov/eere/femp/developing-water-management-plan can provide an understanding of how to develop a water use analysis

ii. Water-Efficient Products

Purchase water conserving products, including WaterSense[34] and FEMP-designated products, as required by statute.

iii. Water Meters

Install building level water meters to allow for the management of water use during occupancy, including detection of leaks.

iv. Cooling Towers

Optimize cooling tower operations.

v. Single Pass Cooling

Eliminate single pass cooling.

b. Outdoor Water Use

Use water efficient landscape and irrigation strategies to reduce outdoor potable water consumption.[35] The installation of water meters is required for irrigation systems serving more than 25,000 square feet of landscaping.[36]

c. Alternative Water

Implement cost effective methods to utilize alternative sources of water such as harvested rainwater, treated wastewater, air handler condensate capture, grey water, and reclaimed water, to the extent permitted under local laws and regulations.[37]

d. Stormwater Management

Employ strategies that reduce stormwater runoff and discharges of polluted water offsite to protect the natural hydrology and watershed health.[38]

[34] www3.epa.gov/watersense/
[35] Guidance for Federal Agencies on Sustainable Practices for Designed Landscapes, October 31, 2011: www.whitehouse.gov/administration/eop/ceq/sustainability/landscaping-guidance
[36] DOE FEMP metering Guidance: www.energy.gov/eere/femp/downloads/federal-building-metering-guidance-usc-8253e-metering-energy-use
[37] Implementing Instructions: Federal Agency Implementation of Water Efficiency and Management Provisions of E.O. 13514, July 10, 2013: www.whitehouse.gov/sites/default/files/water_implementing_instructions.pdf
[38] http://www.epa.gov/greeningepa/technical-guidance-implementing-stormwater-runoff-requirements-federal-projects

4. Enhance Indoor Environmental Quality

a. Ventilation and Thermal Comfort

Provide safe and healthy ventilation and thermal comfort.

b. Daylighting and Lighting Controls

Maximize opportunities for daylighting within the existing structure except where not appropriate because of building function, mission, or structural constraints. Maximize the use of automatic dimming controls or accessible manual lighting controls, task lighting where life cycle cost-effective, and appropriate shade and glare control.

c. Indoor Air Quality

Take actions to ensure optimal indoor air quality, including:

i. Radon

Test for radon in buildings and mitigate high levels.

ii. Moisture Control

Establish policy and implement a moisture control strategy to prevent building materials damage, minimize mold growth, and reduce associated health risks.

iii. Low-Emitting Materials

Use low-emitting materials for building modifications, maintenance, and operations. In particular, specify the following materials and products to have low pollutant emissions: composite wood products, adhesives, sealants, interior paints and finishes, solvents, carpet systems, janitorial supplies, and furnishings.

iv. Indoor Air Quality during Building Alterations

Establish a policy and implement necessary protocols to protect indoor air quality during renovations, repairs, and alterations, and during occupancy.

v. Environmental Smoking Control

Prohibit smoking in any form within the building and within 25 feet of all building entrances, operable windows, and building ventilation intakes.

vi. Integrated Pest Management Use integrated pest management techniques as appropriate to minimize pesticide usage.

d. Occupant Health and Wellness

Promote opportunities for voluntary increased physical movement of building occupants such as making stairwells a desirable option for circulation, active workstations, fitness centers, and bicycle commuter facilities. Support occupant health by considering options such as providing convenient access to healthy dining options, potable water, daylight, plants, and exterior views where possible.

5. Reduce the Environmental Impact of Materials

a. Material Content and Performance

Procure products and supplies that have a lesser or reduced effect on human health and the environment over their life cycle when compared with competing products or services that serve the same purpose, including:

i. Recycled Content and Comprehensive Procurement Guidelines

Use RCRA section 6002 compliant products that meet or exceed EPA's recycled content recommendations for building C construction, modifications, operations, and maintenance.[39]

ii. Biobased Content

Per section 9002 of the FSRIA, for USDA-designated products, use products with the highest content level per USDA's biobased content recommendations.[40]

iii. Other Green Products

Purchase products that meet Federally Recommended Specifications, Standards and Ecolabels[41] or are on the Federal Green Procurement Compilation.[42]

iv. Ozone Depleting Compounds and High Global Warming Potential Chemicals

Eliminate, to the maximum extent practicable, ozone depleting compounds and high GWP chemicals where EPA's SNAP has identified acceptable substitutes or where other environmentally preferable products are available.[43]

b. Waste Diversion and Materials Management

During alteration and repair projects, where markets or on-site recycling exist, divert at least 50% (by weight) of construction and demolition materials, excluding land clearing debris and

[39] 42 U.S.C. 6962, EPA's Comprehensive Procurement Guidelines for Construction: www3.epa.gov/epawaste/conserve/tools/cpg/products/construction.htm
[40] 7 U.S.C. 8102, USDA's BioPreferred website: http://www.biopreferred.gov/BioPreferred/
[41] www2.epa.gov/greenerproducts/epas-recommendations-specifications-standards-and-ecolabels
[42] Green Procurement Compilation: sftool.gov/greenprocurement
[43] EPA SNAP website: www.epa.gov/snap

material used as alternative daily cover, from landfills. Provide reuse and recycling services, including composting, for building occupants where markets or on-site recycling exist, and divert at least 50% of non-hazardous and non-construction related materials (by weight) from landfills. Provide salvage, reuse, and recycling services for waste generated from building operations, maintenance, repair and minor renovations, and discarded furnishings, equipment, and property.

6. Assess and Consider Climate Change Risks

Assess risks to facility and operations from both acute weather events and chronic climate changes, and implement action to increase climate resilience. Where possible, align with local and regional efforts to increase community resilience.

a. Mission Criticality

Determine the long-term mission criticality of the physical asset and the operations housed in the facility.

b. Risks from Climate Change

Assess facilities, and based on mission criticality, identify possible existing, short-term, and long-term physical and operational vulnerabilities related to potential climate impacts.[44]

Consider fire-resistant operation and management to enhance resilience to the impacts of wildfires and reduce risks to the lives of occupants in the event of a wildfire.

c. Facility Adaptation

Focusing on the resilience of the physical facility, take action to mitigate identified physical risks considering mission criticality, potential climate change impacts, security, and cost.

[44] Use Climate Science Supplement Appendix 3 of the 2014 National Climate Assessment and the NOAA Technical Report NESDIS 142-9, January 2013 Regional Climate Trends and Scenarios for the U.S. National Climate Assessment Part 9, Climate of the Contiguous United States, or most recent.

Determining Compliance with the Guiding Principles for Sustainable Federal Buildings

February 2016

Determining Compliance with the Guiding Principles for Sustainable Federal Buildings
February 2016

This document is a companion to the revised *Guiding Principles for Sustainable Federal Buildings* (Guiding Principles) issued by the Council on Environmental Quality in February 2016, per Executive Order 13693, *Planning for Federal Sustainability for the Next Decade*.

Full implementation of all principles, elements and sub-elements described in the Guiding Principles is strongly encouraged. The tables below include metrics for agencies to use to evaluate compliance with the Guiding Principles. For new construction, 20 out of 21 metrics are required, and for modernization, 19 out of 21 metrics are required. For existing buildings, although agencies are strongly encouraged to meet as many metrics as possible, 12 out of 18 metrics are required—eight specified plus four additional—in order to determine that a building is in compliance with the Guiding Principles.

When evaluating a building for compliance with the Guiding Principles, the new construction and modernization criteria should be applied when the project that an agency is undertaking in an existing building is essentially a comprehensive replacement or restoration of virtually all major systems, interior work (such as ceilings, partitions, doors, floor finishes, etc.), and building elements and features.

New Construction or Modernization

For new construction, metrics number one through 20 are required, and for modernization, metrics number one through 18 and number 21 are required, as specified below.

	I. Employ Integrated Design Principles	**Yes/No**
1	**Integrated Design:** Consider the environmental impact of siting decisions and use an integrated project team to: establish energy and other environmental performance goals in the design process; follow sustainable landscape design principles; evaluate electric vehicle charging needs; consider design choices that improve environmental performance, support health and wellness of building occupants and consider climate risks including wildfire; and consider all stages of the building's life cycle. **[Required]**	
2	**Commissioning:** Commission and recommission at least every 4 years to optimize building performance using commissioning agents who are independent of the design and construction or operating team.	

	Commissioning should be consistent with the Energy Independence and Security Act (EISA) section 4321 and Federal Energy Management Program (FEMP) commissioning guidance.2 [Required]	
	II. Optimize Energy Performance	
3	**Energy Efficiency:** A. For new construction, ensure energy efficiency is 30% better than the current American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 90.1 standard, OR B. For modernization, ensure: 1) Energy use is 20% below the fiscal year (FY) 2015 energy use baseline, OR 2) Energy use is 30% below the FY 2003 energy use baseline, OR 3) The building has an ENERGY STAR® rating of 75 or higher, OR 4) For building types not in ENERGY STAR Portfolio Manager, where adequate benchmarking data exists, the building is in the top quartile of energy performance for its building type, AND C. For new construction and modernization, use energy efficient products, as required by statute.[3] **[Required]**	
4	**Renewable and Clean Energy:** Evaluate and implement, where appropriate, life cycle cost-effective renewable energy projects on-site; consider long-term off-site renewable sources and Renewable Energy Certificates (RECs); and utilize clean and alternative energy where possible. **[Required]**	
5	**Metering:** Install building level meters for electricity, natural gas, and steam; install advanced or standard meters as appropriate. **[Required]**	
6	**Benchmarking:** Benchmark building performance at least annually, preferably using ENERGY STAR Portfolio Manager; regularly monitor building energy performance against historic performance data and peer buildings.[4] **[Required]**	
	III. Protect and Conserve Water	
7	**Indoor Water Use:** A. Build to ASHRAE standard 189.1-2014 sections 6.3.2, 6.4.2, and 6.4.3, or current comparable ASHRAE standards, AND B. Use water-efficient products; install building level water meters; optimize cooling tower operations; and eliminate single pass cooling. **[Required]**	
8	**Outdoor Water Use:** A. Separately meter water for irrigation systems greater than 25,000 square feet, AND B. Use water efficient landscapes, AND C. Limit potable water use for irrigation to 50% or more below conventional practices using methodologies from (but not the numeric requirements	

[1] Guidance for the Implementation and Follow-up on Identified Energy and Water Efficiency Measures in Covered Facilities (per 42 U.S.C. 8253(f), Use of Energy and Water Measures in Federal Buildings September 2012: energy.gov/sites/prod/files/2013/10/f4/eisa_project_guidance.pdf)
[2] energy.gov/sites/prod/files/2014/07/f17/commissioning_fed_facilities.pdf
[3] 42 U.S.C. § 8259(b) and 10 C.F.R. § 436.40 et seq.
[4] 42 U.S.C. § 8253(f) (8); energy.gov/sites/prod/files/2014/09/f18/benchmarking_guidance08-2014.pdf

	contained in) ASHRAE standard 189.1-2014 section 6.5.1, or current comparable ASHRAE standards, to calculate water use of conventional practices. **[Required]**	
9	**Alternative Water:** Consider alternative sources of water where cost-effective and permitted by local laws and regulations. **[Required]**	
10	**Stormwater Management:** For new construction meet or exceed EISA section 438 stormwater management requirements. **[Required]**	
	IV. Enhance Indoor Environmental Quality	
11	**Ventilation and Thermal Comfort**: Meet current ASHRAE standards 55 and either 62.1 or 62.2 for ventilation and thermal comfort. **[Required]**	
12	**Daylighting and Lighting Controls:** Maximize opportunities for daylighting in regularly occupied space, automatic dimming controls or accessible manual controls, task lighting, and shade and glare control. **[Required]**	
13	**Indoor Air Quality:** Develop and implement an indoor air quality policy that considers the following: moisture control, use of low emitting materials and products with low pollutant emissions, necessary protocols to protect indoor air quality during construction and in the finished building, prohibition of smoking in any form inside and within 25 feet of all building entrances, operable windows, and building ventilation intakes, and use of integrated pest management techniques. **[Required]**	
14	**Occupant Health and Wellness:** Promote opportunities for voluntary increased physical movement of building occupants such as making stairwells an option for circulation, active workstations, fitness centers, and bicycle commuter facilities; and support convenient access to healthy dining options, potable water, daylight, plants, and exterior views. **[Required]**	
	V. Reduce the Environmental Impact of Materials	
15	**Material Content and Performance:** Procure products that meet the following requirements where applicable: A. Resource Conservation and Recovery Act (RCRA) section 6002, AND B. Farm Security and Rural Investment Act (FSRIA) section 9002, AND C. Federally Recommended Specifications, Standards and Ecolabels[5] or are on the Federal Green Procurement Compilation for other green products, as appropriate,[6] AND D. Avoid ozone depleting compounds and high global warming potential (GWP) chemicals. **[Required]**	
16	**Waste Diversion:** Where markets exist, provide reuse and recycling services for building occupants and divert at least 50% of non-hazardous, non-construction related materials from landfills. **[Required]**	
17	**Materials Management:** Where markets exist, divert at least 50% of construction and demolition materials from landfills. **[Required]**	
	VI. Assess and Consider Climate Change Risks	
18	**Mission Criticality:** Determine long-term mission criticality of the physical asset and operations to be housed in the facility to inform the design of new	

[5] www2.epa.gov/greenerproducts/epas-recommendations-specifications-standards-and-ecolabels
[6] Green Procurement Compilation: sftool.gov/greenprocurement

	construction and modernization to increase climate resilience. **[Required]**	
19	**Floodplain Considerations:** For new construction, avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and avoid floodplain development whenever there is a practicable alternative. **[Required]**	
20	**Facility Design:** For new construction, balance options to address predicted climate change impacts against mission criticality, cost, and security to determine design parameters; at a minimum, include low and no cost resilience measures to address predicted climate conditions. **[Required]**	
21	**Facility Adaptation:** For modernization, take action to mitigate identified risks, considering mission criticality, climate impacts, cost, and phased adaptation over time. **[Required]**	

Existing Buildings

Twelve out of 18 metrics are required—eight that are specified as required plus four additional. Any metric determined to be "not applicable" cannot be counted toward the 12 required.

	I. Employ Integrated Assessment, Operation, and Management Principles	**Yes/No**
1	**Integrated Assessment, Operation, and Management:** Through an integrated process and team, assess building and operating conditions and identify areas for improvement; establish operational goals for environmental performance; and incorporate goals into building management. **[Required]**	
2	**Commissioning:** Commissioning reports for certification purposes must be completed within two years prior to certification date. Recommissioning should be completed at least every four years thereafter to optimize building performance. Use commissioning agents who are independent of the design and construction or operating team. Commissioning should be consistent with EISA section 432[7] and FEMP commissioning guidance.[8] **[Required]**	
	II. Optimize Energy Performance	
3	**Energy Efficiency:** A) Ensure: 1. The building has an ENERGY STAR rating of 75 or higher, OR 2. Energy use is 20% below the FY 2015 energy use baseline, OR 3. Energy use is 30% below the FY 2003 energy use baseline, OR 4. Energy efficiency is 30% better than the current ASHRAE 90.1 tandard, AND B) Use energy efficient products, as required by statute.[9] **[Required]**	
4	**Renewable and Clean Energy:** Evaluate and implement, where appropriate, life cycle cost-effective renewable energy projects on-site; consider long-term	

[7] Guidance for the Implementation and Follow-up on Identified Energy and Water Efficiency Measures in Covered Facilities (per 42 U.S.C. 8253(f), Use of Energy and Water Measures in Federal Buildings, September 2012: energy.gov/sites/prod/files/2013/10/f4/eisa_project_guidance.pdf)

[8] energy.gov/sites/prod/files/2014/07/f17/commissioning_fed_facilities.pdf

[9] 42 U.S.C. § 8259(b) and 10 C.F.R. § 436.40 et seq.

	offsite renewable sources and RECs; and utilize clean and alternative energy were possible.	
5	**Metering:** Install building level meters for electricity, natural gas, and steam; install advanced or standard meters as appropriate.	
6	**Benchmarking**: Compare building performance with energy performance benchmarks at least annually, preferably using ENERGY STAR Portfolio Manager; regularly monitor building energy performance against historic performance data and peer buildings.[10]	
	III. Protect and Conserve Water	
7	**Indoor water use:** A. Install building level water meters, reduce water use 20% below FY 2007 baseline, and use water efficient products, OR B. Install building level meters, conduct an analysis of water use,[11] identify and repair leaks, eliminate single pass cooling, optimize cooling tower operations, and use water efficient products. **[Required]**	
8	**Outdoor Water Use**: A. Install water meters for irrigation systems serving more than 25,000 square feet of landscape, AND B. Either: 1. Use water efficient landscaping, OR 2. Limit potable water use for irrigation to 50% or more below conventional practices using methodologies from (but not the numeric requirements contained in) ASHRAE standard 189.1-2014 section 6.5.1, or current comparable standard, to calculate water use of conventional practices.	
9	**Alternative Water:** Consider alternative sources of water where cost-effective and permitted by local laws and regulations.	
10	**Stormwater Management:** Employ strategies that reduce storm water runoff and discharges of polluted water offsite to protect the natural hydrology and watershed health.	
	IV. Enhance Indoor Environmental Quality	
11	**Ventilation and Thermal Comfort:** Meet the current ASHRAE 55 and either 62.1or 62.2 standards for ventilation and thermal comfort. **[Required]**	
12	**Daylighting and Lighting Controls:** Maximize opportunities for daylighting in regularly occupied space, automatic dimming controls or accessible manual controls, task lighting, and shade and glare control.	
13	**Indoor Air Quality:** Develop and implement an indoor air quality policy that considers the following: moisture control, use of low emitting materials and products with low pollutant emissions, necessary protocols to protect indoor air quality during construction and in the finished building, prohibition of smoking in any form inside and within 25 feet of all building entrances, operable windows, and building ventilation intakes, and use of integrated pest	

[10] 42 U.S.C. § 8253(f) (8); energy.gov/sites/prod/files/2014/09/f18/benchmarking_guidance08-2014.pdf

[11] www.energy.gov/eere/femp/developing-water-management-plan can provide an understanding of how to develop a water use analysis

	management techniques.	
14	**Occupant Health and Wellness:** Where feasible, promote opportunities for voluntary increased physical movement of building occupants such as making stairwells an option for circulation, active workstations, fitness centers and bicycle commuter facilities; and support convenient access to healthy dining options, potable water, daylight, plants, and exterior views.	
	V. Reduce the Environmental Impact of Materials	
15	**Material Content and Performance:** Procure products that meet the following requirements where applicable: A. RCRA section 6002, AND B. FSRIA section 9002, AND C. Federally Recommended Specifications, Standards and Ecolabels[12] or are on the Federal Green Procurement Compilation for other green products, as appropriate,[13] AND D. Avoid ozone depleting compounds and high GWP chemicals. **[Required]**	
16	**Waste Diversion:** Where markets exist, provide reuse and recycling services for building occupants and divert at least 50% of non-hazardous non-construction related materials from landfills. **[Required]**	
17	**Materials Management:** Where markets exist, divert at least 50% of construction and demolition materials from landfills.	
	VI. Assess and Consider Climate Change Risks	
18	**Climate Resilience and Adaptation:** A. Determine long-term mission criticality of the physical asset and operations to be housed in the facility, AND B. Evaluate climate change impacts, including wildfire, based on mission criticality and cost, AND C. Implement no and low cost actions to increase climate resilience. **[Required]**	

[12] www2.epa.gov/greenerproducts/epas-recommendations-specifications-standards-and-ecolabels

[13] Green Procurement Compilation: sftool.gov/greenprocurement

3.0 Resources

Weblinks

E.O. 13693, "Planning for Federal Sustainability in the Next Decade"

https://www.whitehouse.gov/the-press-office/2015/03/19/executive-order-planning-federal-sustainability-next-decade

Guiding Principles for Sustainable Federal Buildings and Associated Instructions
The Council on Environmental Quality - February 2016

https://www.whitehouse.gov/sites/default/files/docs/guiding_principles_for_sustainable_federal_buildings_and_associated_instructions_february_2016.pdf

Determining Compliance with the Guiding Principles for Sustainable Federal Buildings

February 2016

https://www.whitehouse.gov/sites/default/files/docs/determining_compliance_with_the_guiding_principles_for_sustainable_federal_buildings_february_2016.pdf

Whole Building Design Guide for New Construction:

http://www.wbdg.org/references/fhpsb_new.php

Building Life Cycle Cost (BLCC) program:

http://energy.gov/eere/femp/building-life-cycle-cost-programs

U.S. Department of Energy - Energy Efficiency and Renewable Energy - Guidance for Sustainable Design

https://www4.eere.energy.gov/femp/requirements/guidelines_filtering?print=1

Energy Star website, New Building design guidance

http://www.energystar.gov/index.cfm?c=new_bldg_design.new_bldg_design