ARCHITECT OF THE CAPITOL

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EFFECTIVE DATE: Dec 26, 2018

SUBJECT: AOC Design Standards

SERIES: Program and Project Management

DESCRIPTION: This manual establishes minimum design standards and criteria for the design, repairs, alterations, modernizations, renewals and construction of facilities under the jurisdiction of the Architect of the Capitol. These standards apply to all projects which commence on or after the effective date of this Order.

The design standards outlined in this document are not intended to be used retroactively. AOC facilities that were designed and constructed and had projects completed using earlier versions of the AOC Design Standards shall not be deemed out of compliance with these facility standards merely because the standards have been updated.

SCOPE: The AOC Design Standards apply to all AOC staff, contractors and all AOC-managed facilities located in the District of Columbia, Maryland and Virginia, in support of the agency's mission and strategic vision.

OPR: Planning and Project Management

SUMMARY OF CHANGES: This document is an update to the August 2012 version of the AOC Design Guide and includes significant changes and improvements which are summarized in the Preface section.

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ARCHITECT OF THE CAPITOL

AOC Design Standards

December, 2018

ORDER OF THE ARCHITECT OF THE CAPITOL 28-8

AOC DESIGN STANDARDS

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Section A – Preface

1. **Background**
This document establishes the minimum standards for the design and construction of facilities under the jurisdiction of the Architect of the Capitol (AOC). These AOC Design Standards are a successor document to the AOC Design Guide in response to changing industry standards and agency needs.

2. **What's new**
Input from AOC subject matter experts updated each section based on the existing August 2012 AOC Design Guide text. The document was renamed "AOC Design Standards."

In general, the following changes appear throughout the document:

- All sections have been revised to reflect the requirements of the 2015 International Code Council (ICC) I-Codes.
- Referenced industry standards and other recognized codes have been updated to align with 2015 ICC I-Codes.
- Each section has been reorganized and includes a purpose statement.
- Agency contacts have been removed from each section and added to the appendix.

A synopsis of the major changes in each section is as follows:

- Section 1 GENERAL REQUIREMENTS:
  - Updated AOC policy references and industry best practices throughout the chapter.
  - Updated building descriptions and requirements to include the Thomas P. O'Neill Jr. House Office Building.
  - Updated to the 2015 International Building Codes.
  - Updated referenced construction industry standards and fire protection standards to align with recent industry updates.
- Section 2 HISTORIC PRESERVATION:
  - No significant changes.
- Section 3 SUSTAINABLE DESIGN:
  - Removed requirement for adherence to canceled Executive Orders.
  - Replaced LEED Silver requirements and replaced with the following portions of the International Green Construction Code, 2015 edition:
    - Integrated Design
    - Commissioning
    - Site Sustainability
    - Water Use Efficiency
    - Energy Performance and Analysis
- Section 4 SECURITY:
  - No significant changes.
- Section 5 SUPERSTRUCTURE:
  - Added O'Neill House Office Building to seismic design chart.
  - Aligned structural requirements with 2015 International Building Code.
- Section 6 SHELL:
  - Updated text to align with 2015 International Building Code requirements.
  - Added requirement for special inspections.
- Section 7 ARCHITECTURE AND INTERIOR DESIGN:
  - Added requirements for lactation rooms.
  - Added requirements for family restrooms.
  - Added requirements for baby changing stations.
- Section 8 FIRE PROTECTION AND LIFE SAFETY:
  - Updated requirements for voice communications of fire alarm systems to comply with NFPA 72.
  - Added requirement for special inspections.
- Section 9 MECHANICAL:
  - Changes to align with current code references.
  - Changes to align with new Building Automation Systems section.
- Section 10 PLUMBING:
  - Changes to align with current code references.
  - Changes to align with new Building Automation Systems section.
- Section 11 ELECTRICAL:
  - Changes to align with current code references.

- Changes to align with new Building Automation Systems section.
- Section 12 BUILDING AUTOMATION SYSTEMS
  - New section, consolidates all building automation systems into a single section.
- Section 13 COMMUNICATIONS SYSTEMS:
  - No significant changes.
- Section 14 EXTERIOR HORTICULTURAL AND IRRIGATION PRACTICES:
  - Section name changed from Landscaping.
  - Entire section revised and clarified requirements for all jurisdictions.
- Section 15 EQUIPMENT:
  - No significant changes.
- Section 16 BUILDING SITEWORK:
  - Clarifications on the applicability of stormwater, erosion and sediment control plans and permits.
- Section 17 OTHER CONSTRUCTION:
  - Removed.

3. **Feedback**

The AOC Design Standards is a living document that will continue to evolve and updated editions will be issued in the future. User feedback is essential and probably the most important method of maintaining the accuracy and technical correctness of the text. If an individual detects an error, conflict, or omission in this standard, or has a suggestion for material to be included in the text, please send your comments to the Planning and Project Management, Technical Support Branch.

This policy applies to all AOC organizations and employees unless otherwise stated.

4. **Website**

The AOC Design Standards may be found in the AOC eDocs Project Delivery Guidance site.

Section B – AOC Design Standards

1. **General Requirements**

1.1. **Purpose:**

a). This manual establishes minimum design standards and criteria for the design, repairs, alterations, modernizations, renewals and construction of facilities under the jurisdiction of the Architect of the Capitol. This document contains technical criteria to be used in the programming, design, construction, measurement, verification and documentation of AOC facilities.

b). This is a mandatory standard and is not a guidebook, textbook, handbook, training manual nor substitute for technical competence. It represents the AOC's commitment to comply with the requirements of applicable law and widely accepted building codes and standards.

c). This standard must be used in conjunction with the governing standards referenced in this document, as well as the building program for each project. If a conflict exists between these standards and a specific program and project requirements, contact Planning and Project Management for resolution.

d). The design team must review compliance with the building program at each stage of the project to ensure the requirements of the program, AOC Facility Standards and relevant codes and standards have been met.

1.2. **General Building Standards:**

a). **Quality of Architectural/Engineering Design:** The designs of new facilities should not detract from those that exist presently, and designs for rehabilitation or renovation should seek to preserve the character and history of the U.S. Capitol. New materials are expected to be of similar quality as existing, adjacent, historic, monumental examples:

i. **Dignity:** Designs shall reflect the dignity that the citizens of the United States accord their Congress.

ii. **Long Life:** Major facilities are designed for extremely long lives. Design shall provide for flexibility to allow for future change throughout the life of the building.

iii. **Maintenance:** The AOC requires that projects maximize program features and minimize maintenance requirements.

iv. **Security and Safety**: Provisions to maintain the security and safety of the facilities and the occupants thereof shall be included in all designs.

v. **Historic Preservation:** Designs affecting Heritage Assets shall fully adhere to the Preservation Policy and Standards (AOC Order 37-1). See below in Section B, 2, Historic Preservation.

vi. **Architectural Review Board (ARB):** The ARB reviews all new construction, additions or rehabilitation projects that may affect any publicly visible element of any building, structure, landscape, view or vistas within the jurisdiction of the Architect of the Capitol to preserve and enhance the Capitol complex and promote high-quality design. The ARB will review and recommend approval of projects in accordance with the AOC Architectural Review Board Charter.

1.2.1. **General Precepts:**

a). Design details and product specifications should reflect proven technology and recognized performance standards. All designs shall conform to referenced codes and standards. To the maximum extent possible, without compromising quality, projects should be designed using generic products and should minimize the use of brand names. The designer's work will be reviewed by all appropriate design disciplines within the AOC for conformance with project scope and program requirements, as well as referenced codes and standards. While the AOC may provide technical comments to the designer, the technical accuracy of the project and the coordination of design between disciplines is solely the responsibility of the Architect/Engineer (A/E).

1.2.2. **Commissioning:** Commissioning is a process that involves the entire Design Team throughout the planning, design, construction and occupancy of the project. Commissioning Guidelines for AOC Projects are contained in the policy statement of June 7, 2010.

a). During the initial planning process, the AOC Project Team shall determine the purpose and role of commissioning. The purpose may be to ensure proper integration of a small renovation/rehabilitation into the Capitol

complex, or it may be related to a certification. It may range from simple, direct Owner commissioning by the AOC to an independent Commissioning Agent with a substantial budget. As a rule, if a project is designed by an Associate A/E, then commissioning will be performed by a third party hired by the AOC.

b). Within the context of design for mechanical systems, commissioning plays a significant role. The designer of the mechanical system has these responsibilities:
   i. Develop and document the Program of Requirements (PoR.)
   ii. Develop a basis of design.

c). Commissioning shall help ensure that mechanical systems operate properly as a holistic system. The parts and pieces must interact as required by the sequences of operation and do so within an appropriate time frame. The pre-functional and functional performance tests will verify this performance, starting with the individual components and progressing to entire systems.

d). Adjustment of system operating parameters affects energy consumption. These will include duct pressure for VAV air handlers, leaving air set points, piping pressures and water temperature set points. For most projects, these must be adjusted to reflect actual built conditions that may not be easy to calculate in design.

e). Commissioning and testing of systems shall integrate those parts that relate to other building components.

f). Finally, commissioning of mechanical systems includes operations and maintenance (O&M). Both the Commissioning Agent and the mechanical designer must review the O&M manuals. These shall be organized according to the project specifications and provided to the AOC in both paper and electronic format (verify final formats with the AOC).

1.2.3. **Coordination:**

a). To the extent possible, these design standards have been coordinated with AOC Guide Specifications and AOC Multi-Award Contract (MAC) requirements. Please report any conflicts or ambiguities to the Technical Support Branch.

1.2.4. **Requirement for Computerized Design:**

a). The AOC requires design utilizing computer-aided design systems for graphics and associated engineering calculations. Unless specifically stated otherwise, all design documents shall be submitted using Bentley Systems MicroStation software. Comply with requirements of the AOC A/E Design Manual.

1.2.5. **Geodetic Datum:**

a). The AOC uses the District of Columbia Engineer's Department datum for all vertical elevations. Horizontal control observes the Maryland State Plane Coordinate System:
   i. **D.C. Engineers Datum:** Zero = +2.11 ft. above low water in Washington Harbor.
   ii. **Capitol Bench Mark:** DC =+89.84 ft. The Capitol Bench Mark is the apex of a bronze bolt set in the east windowsill of the south side of the Senate Wing of the U.S. Capitol. The bolt was placed in position in 1894 and is inscribed "Capitol B.M." (Formally approved February 10, 1999, Alan M. Hantman, FAIA, Architect of the Capitol).

1.2.6. **Buy American Act:**

a). Pursuant to AOC Order 34-1 Contracting Manual, The Buy American Act (BAA) establishes, as a government policy, that manufactured materials, supplies or articles acquired for public use shall be substantially constituted from domestically mined or manufactured articles or supplies:
   i. **Implementation:** The AOC has chosen to apply the BAA to AOC purchases. The AOC restricts the purchase of supplies (including construction materials and services in which supplies are furnished) that are not domestic end products. For manufactured products, the BAA uses a two-part test: (1) The article must be manufactured in the United States. (2) The cost of domestic components must exceed 50 percent of the cost of all components.
   ii. A foreign end product may be purchased if the CO determines that the price of the lowest domestic end product is unreasonable.
   iii. Contract files must include documentation of the efforts made to find a domestic end product, the results of the search, and, if both a foreign and domestic end product are available, a justification for acquiring the foreign end product. If price is used for the

justification, the following evaluation shall be performed: (1) If the domestic end product is made by an American small business, 12 percent must be added to the price of the foreign end product and the foreign end product must still be less than the domestic end product. (2) If the domestic end product is made by an American large business, 6 percent must be added to the price of the foreign end product and the foreign end product must still be less than the domestic end product.

1.2.7. **Historic Preservation:**

a). The Historic Preservation Officer (HPO), AOC Curator and U.S. Botanic Garden (USBG) Curator are responsible for ensuring that all Heritage Assets are properly protected during any modifications or upgrades. All AOC jurisdictions planning or carrying out design or construction projects that may affect a Heritage Asset shall consult the HPO and AOC Curator (and USBG Curator, depending on the project location), so appropriate ways to minimize or monitor the impact of the project on the Heritage Assets can be determined. Renovation and rehabilitation are terms used throughout the AOC Design Standards to indicate work being done to the whole or parts of a building. Renovation typically refers to the total removal and replacement of building systems, while rehabilitation refers to the process of extending the useful life of an asset through repair alterations and additions while preserving those portions or features which convey its historic, cultural or architectural values. These definitions do not affect those used by the building and fire protection codes. The term rehabilitation shall be used to refer to most projects, while renovation projects shall refer to systems renovations.

1.3. **Design Requirements:**

a). **Long Building Lives:** Due to the historical nature of the buildings in the AOC portfolio, one of the critical requirements is that designs should focus on unusually long building lives as compared to typical commercial construction.

b). **Building Quality Levels:** The AOC has adapted GSA quality levels to correspond to the design and construction activities required within the U.S. Capitol:

i. Temporary construction shall be designed to designated service lives.

ii. Design shall provide "tenant fit-out" construction consistent with the building in which it is located.

iii. Design affecting Heritage Assets shall comply with the AOC Preservation Policy and Standards. See Section B, 2, Historic Preservation.

Table 1.3-1 Building Class

BUILDING CLASS	DESCRIPTION	INCLUDED BUILDING EXAMPLES
Principal	Major, monumental buildings of historic significance and characterized by very long service lives. These buildings house the Members of Congress and Supreme Court Justices, or house related agencies. Major public presence must be accommodated.	U.S. Capitol; Capitol Visitor Center; U.S. Supreme Court; Russell Senate Office Building; Dirksen Senate Office Building; Hart Senate Office Building; Cannon House Office Building; Rayburn House Office Building; Longworth House Office Building; Thomas Jefferson Building; John Adams Building; James Madison Memorial Building; U.S. Botanic Garden Conservatory.
Support	Buildings of long service life that support staff and related activities of the Congress, the Library of Congress or the Supreme Court. These buildings benefit from the use of durable materials with low maintenance but not of the finish levels provided for Principal Buildings.	Ford House Office Building; Eney, Chestnut, Gibson Memorial Building (USCP HQ); Alternate Computing Facility; Botanic Garden Admin Building; Senate Underground Garage; House Underground Garages; all Capitol Power Plant buildings; all Library of Congress (LOC) facilities at Ft. Meade, MD and Culpeper, VA; Thurgood Federal Judiciary Center, Thomas P. O'Neill Jr. House Office Building
Service	Utilitarian buildings that support service and maintenance functions, generally requiring low maintenance finishes and materials more consistent with standard commercial practice.	E Street Garage; Off-Site Inspection Center; Warehousing; House and Senate Page Dormitories; Day Care Centers; USBG Production Facility and other support facilities; LOC Special Facility Center; Dog Kennels; GPO Storage Facility

1.3.1. **General Design Criteria:**

a). The AOC will define the Building Class in the Program of Requirements. Projects shall be designed to conform to the following quality expectancies (exceptions will be noted in the Program of Requirements and/or Design Statement of Work):

Table 1.3.1-1 General Design Criteria

Service Quality Expected	Building Class		
	PRINCIPAL	SUPPORT	SERVICE
Service Life (minimum)	100 years +	50 to 100 years	25 to 50 years
Inaccessible or Structural Components	100 years	50 years	20 years
Components where replacement is expensive or difficult (includes below-ground drainage)	50 years	50 years	20 years
Major Replaceable Components	50 years	25 years	20 years
Services, Installations, and External Works	25 years	20 years	20 years
Space Efficiency Targets	60%	70%	80%
Lobby Space	Major (GSA 'A')	Proper (GSA 'B')	Efficiency (GSA 'C')
Special Spaces	Cafeteria	Cafeteria	Snack bar*
	Auditorium	Auditorium	Auditorium*
	Post Office	Post Office	
Shell			
Floor-to-Floor Height - First Floor	15 to 25 ft.	15 to 20 ft.	15 ft.

Service Quality Expected	Building Class		
	PRINCIPAL	SUPPORT	SERVICE
Floor-to-Floor Height - Other Floors	14 to 15 ft.	13 ft.	12 ft.
Spans	35 to 40 ft.	30 to 35 ft.	25 to 30 ft.
Material Quality	Granite/marble	Limestone/brick	Brick/precast

* Consistent with use

1.3.2. **Acoustic Requirements:**

a). Activity spaces shall be designed with minimum noise levels consistent with good design practice. Security or other sensitive spaces may require additional acoustical separation. Using the Space Classes defined by the General Services Administration, provide the following design levels:

Table 1.3.2-1 Acoustic Requirements

DESCRIPTION	MAX. AMBIENT NOISE LEVEL	PARTITION SOUND ISOLATION	CELING NRC	DOOR GASKET
Class A Spaces: Areas that are noise sensitive, such as hearing or committee rooms.	Special consideration by acoustical specialists.			
Class Bl Spaces: Areas where meetings take place on a frequent basis, such as conference and training rooms.	NC30	STC45	NRC 55 (Carpeted) or NRC 65	Yes
Class B2 Spaces: Areas where people may speak in higher than conversational levels, such as dining rooms, cafeterias and copier rooms.	NC40	STC45	NRC 55 (Carpeted) or NRC 65	Yes
Class Cl Spaces: General office areas.	NC35	STC40	NRC 55 (Carpeted) or NRC 65	No
Class C2 Spaces: Open plan office areas.	NC35	STC20	NRC 55 (Carpeted) or NRC 65	No
Class D Spaces: Areas where speech privacy is not a concern, such as corridors, stairs, etc.	NC35	N.A.	N.A.	No
Class E Spaces: Support spaces such as lobbies, toilets and locker rooms.	NC40	Separate from quiet areas	N.A.	No
Class F Spaces: Warehouses, parking garages, fire stairs, etc.	NC50	Separate from quiet areas	N.A.	No
Class X Spaces: Areas where inherently noisy activities are located, such as kitchens; mechanical, electrical, and communications equipment rooms; elevator machine rooms and trash rooms.	Treat if NC exceeds 60	STC45	N.A.	Yes

1.3.3. **Life Cycle Costing (LCC):**

a). Life Cycle Costing (LCC) is an important economic method of project evaluation used in the selection of alternatives that affect both current and future costs. It measures the economic value of decisions affecting a design project and allows all costs from owning, operating, maintaining and disposing of an asset

to be considered as part of the initial project funding decisions. LCC compares initial investment options and identifies the least cost alternatives for a 20-year period. At the beginning of each design, a decision will be made on the factors that are to be used in selecting alternatives to meet program requirements. For features for which cost is the driving factor, life-cycle costs must be determined and considered. However, in situations in which cost is not the driving factor, life-cycle costing may not be necessary. For example, if historic preservation is a major goal, initial and life-cycle costs may not be the driving decision factor and life-cycle costing may not be necessary. This determination will be made prior to design or during the initial stage of design. When life-cycle costing is appropriate:

i. Federal agencies use LCC as it is mandated by law and defined in the Code of Federal Regulations (CFR), Title 10, Part 436, Subpart A: *Program Rules of the Federal Energy Management Program*. AOC will use LCC to ensure that its projects preserve and maintain the Capitol buildings in the most efficient manner. That is, all costs influencing a project must be considered including environmental, economic, social and security.

ii. The National Institute of Standards and Technology (NIST) has developed the Life Cycle Costing Manual for the Federal Energy Management Program (NIST Handbook 135). Further information is given in the Building Life Cycle Cost (BLCC) software found on the Department of Energy website.

iii. AOC will also use Government Accountability Office (GAO) Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Capital Program Costs (GAO-09-3SP, March 2009). When a life-cycle cost analysis is performed, it must include sensitivity and uncertainty analyses consistent with GAO's guidelines. This includes performing a sensitivity analysis on forecasts of utility prices even though NIST 135 states this should not be done.

1.3.4. **Restrictions:**

a). This document is for projects delivered under the jurisdiction of the Architect of the Capitol.

1.4. **Maintenance Precepts:**

1.4.1. **Service:**

a). Equipment shall be located with manufacturer-recommended clearance to adjacent walls, piping and other equipment for maintenance and servicing. This includes removal of coils in domestic water heaters, converters, heat exchangers, etc. For servicing, design shall provide raised maintenance platforms for elevated equipment requiring regular servicing.

b). **Replacement**: Clearances shall be adequate to remove and replace equipment. Such replacement activities shall consider the entire access path within new or existing buildings when equipment is designed or specified.

c). **Replacement Parts:** Equipment components shall be sized and selected such that a minimum of different unit sizes is required to minimize stocking of replacement equipment and parts. Further, wherever practicable, equipment shall be selected from standard cataloged products of manufacturers regularly engaged in the production of such products and that are the manufacturer's latest standard design that complies with the project requirements. Equipment shall essentially duplicate items that have been in satisfactory commercial and industrial use for at least two years (or more, as appropriate). Design shall provide standard, domestically produced products for which the manufacturer has published assurances that the products and their parts will be available to the government later.

d). **Historic Preservation:** Design shall comply with policies and methodologies regarding Heritage Assets preservation. See Section B, 2, Historic Preservation.

1.4.2. **Restrictions:**

a). Do not include extra stock or replacement parts in specifications or construction contracts.

b). No shutdowns without coordination of building superintendent.

1.5. **Regulatory Requirements:**

a). Facilities built on the Capitol property ("Capitol Grounds") are exempt from the enforcement of local building codes. The facilities of the Congress are, by legislation, subject to most labor and environmental regulations that are enforced by the Environmental Protection Agency (EPA), the District Department of Energy and the Environment, DC Water, Maryland Department of the Environment and Virginia Department of Environmental Quality. **Note**: It is important to note that AOC is both the Client's representative and the Authority Having Jurisdiction (AHJ) over the project. Review comments provided by AOC shall be considered mandatory.

i. Regulations from other AHJ's include, but are not limited to Potomac Electric Power Co. (PEPCO), EPA, Department of Energy & Environment (DDOE), District Department of Transportation (DDOT), Department of Energy (DOE), the District of Columbia (DC), the state and local regulations of Virginia and the state and local regulations of Maryland. Individual projects shall identify the specific regulations and requirements that are required for compliance.

b). **Leased Facilities:** Design and construction in leased facilities shall comply with the code requirements of the jurisdiction in which they are located. Enhancements to those codes required to comply with agency safety requirements or agency continuity-of-mission requirements will be provided in writing by AOC on a project-specific basis as necessary.

c). **Permits:** Work in AOC facilities may require applying for local building permits. The designer shall ascertain code coverage prior to commencing design and verify requirements for water and sewer connections. For example, in order to comply with environmental regulations, such as underground storage tank registrations and erosion and sediment control permits, the AOC will be required to at least initiate the process of obtaining a building permit.

d). **Off-Capitol Projects:** For projects on either federal or non-federal property off-Capitol, submit the code analysis to the AOC Project Manager for approval.

e). **Historic Buildings:** For purposes of code interpretation, the U.S. Capitol, U.S. Supreme Court, Thurgood Marshall Judiciary Building, Dirksen Senate Office Building, Russell Senate Office Building, Hart Senate Office Building, Cannon House Office Building, Longworth House Office Building, Rayburn House Office Building, Ford House Office Building, John Adams Building, Thomas Jefferson Building, James Madison Memorial Building, U.S. Botanic Garden Conservatory, U.S. Botanic Garden Administration Building, Webster Senate Page Residence, Senate Underground Garage, House Underground Garage, Capitol Power Plant Main Boiler, East Refrigeration and Old Generator Buildings shall be considered historic buildings.

1.5.1. **Codes:**

a). Unless specifically instructed otherwise by the AOC in writing, it is AOC policy to comply with the following codes, as well as their referenced standards.

b). **Building Code:** The International Building Code, 2015 Edition (except Chapter 10, Means of Egress).

c). **Existing Buildings:** The International Existing Building Code, 2015 Edition.

d). **National Fire Protection Association (NFPA):**

i. NFPA 10, Standard for Portable Fire Extinguishers, 2013 Edition.

ii. NFPA 13, Installation of Sprinkler Systems, 2016 Edition.

iii. NFPA 14, Installation of Standpipe, and Hose Systems, 2016 Edition.

iv. NFPA 17, Standard for Dry Chemical Extinguishing Systems, 2017 Edition.

v. NFPA 17A, Standard for Wet Chemical Extinguishing Systems, 2017 Edition.

vi. NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection, 2016 Edition.

vii. NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances, 2016 Edition.

viii. NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, 2017 Edition.

ix. NFPA 30, Flammable and Combustible Liquids Code, 2015 Edition.
x. NFPA 30A, Code for Motor Fuel Dispensing Facilities and Repair Garages, 2015 Edition.
xi. NFPA 37, Standard for Installation and Use of Stationary Combustion Engines and Gas Turbines, 2015 Edition.
xii. NFPA 54, National Fuel Gas Code, 2015 Edition.
xiii. NFPA 70, National Electrical Code, 2017 Edition.
xiv. NFPA 70E, Standard for electrical safety in the workplace, 2015 Edition.
xv. NFPA 72, National Fire Alarm and Signaling Code, 2016 Edition.
xvi. NFPA 75, Standard for the Fire Protection of Information Technology Equipment, 2017 Edition.
xvii. NFPA 80, Standard for Fire Doors and Other Opening Protectives, 2016 Edition.
xviii. NFPA 85, Boiler and Combustion Systems Hazards Code, 2015 Edition.
xix. NFPA 92, Standard for Smoke-Control Systems, 2015 Edition.
xx. NFPA 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations, 2017 Edition.
xxi. NFPA 101, Life Safety Code*, 2015 Edition.

*Note that any reference in NFPA 101 to NFPA 90A shall not apply. Instead, IMC shall be used.

xxii. NFPA 110, Standard for Emergency and Standby Power Systems, 2016 Edition.
xxiii. NFPA 111, Standard on Stored Electrical Energy Emergency and Standby Power Systems, 2016 Edition.
xxiv. NFPA 214, Standard on Water-Cooling Towers, 2016 Edition.
xxv. NFPA 232, Standard for the Protection of Records, 2017 Edition.
xxvi. NFPA 241, Standard for Safeguarding Construction, Alteration, and Demolition Operations, 2013 Edition.
xxvii. NFPA 255, Standard Method of Test of Surface Burning Characteristics of Building Materials.
xxviii. NFPA 484, Standard for Combustible Metals, 2015 Edition.
xxix. NFPA 780, Standard for the Installation of Lightning Protection Systems, 2017 Edition.
xxx. NFPA 850, Electric Generating Plants 2005 Edition.
xxxi. NFPA 914, Code for Fire Protection of Historic Structures, 2015 Edition.

e). **Fire Code:**
i. International Fire Code, 2015 Edition, as modified by AOC Fire Protection Policy 11-4
ii. AOC Fire Protection Policies in Section 1.1.2 Standards.

f). **Life Safety (Egress Requirements):** "Life Safety Code," American National Standards Institute (ANSI)/NFPA 101, 2015 Edition.

g). **Energy Conservation:** International Energy Conservation Code (IgCC), 2015 Edition, including ANSI/ASHRAE/USGBC/IES 189.1-2014 Standard for the Design of High-Performance Green Buildings Except Low Rise Residential Buildings.

h). **Fuel Gas:** International Fuel Gas Code, 2015 Edition.

i). **Elevator Code:** American Society of Mechanical Engineers (ASME) / ANSI Standard A17.1, Safety Code for Elevators, and Escalators, 2013 Edition, including addenda.

j). **HVAC Design:** American Society of Heating Refrigerating and Air Conditioning Engineers (ASHRAE), "Handbook of Fundamentals," 2017 Edition. "HVAC Applications" 2015 Edition.

k). **Mechanical Code:**
i. International Mechanical Code (IMC), 2015 Edition.
ii. National Power Piping Code, B31.1 2012 Edition.

l). **Plumbing:** International Plumbing Code, 2015 Edition:
i. Washington, DC, regulations for cross connections, 21 DCMR chapter 54.
ii. District of Columbia Water and Sewer Authority (WASA) - Design Standards, Standard Specifications and Standard Details.

m). **Sustainability:** The following section of the International Green Construction Code (IgCC), 2015 Edition, includes ANSI/ASHRAE/USGBC/IES 189.1-2014 Standard for the Design of High-Performance

Green Buildings Except Low Rise Residential Buildings. Specific exemptions are referenced in section 2 Sustainable Design.

n). **Lighting Design:** Illuminating Engineering Society of North America (IESNA) Handbook, 10th Edition.

o). **Structural:** The International Building Code, 2015 Edition.

p). **Connections to Utilities:** Comply with the latest published regulations of the affected utility.

q). **Streets and Highways:** Comply with the latest edition of District of Columbia (DC) Department of Highways, *Traffic Standard Specifications for Highways and Structures,* Virginia Department of Transportation (VDOT) and Maryland State Highway Administration and Manual of Uniform Traffic Control Devices for Street and Highways (MUTCD), Federal Highway Administration (FHWA), 23 CFR, Part 655, Subpart F.

r). **Instrumentation:** International Society of Automation, "Instrumentation Symbols and Identification (ANSI/ISA5.1)", 2009.

s). **Storm Water Requirements:**

i. District of Columbia (DC Water, DCDDOT, DOEE).
ii. State of Maryland requirements.
iii. State of Virginia requirements.

1.5.2. **Standards:**

a). Unless specifically instructed otherwise by the AOC in writing, it is AOC policy to comply with the following Standards, as well as their referenced Codes.

b). **AOC Orders and Standards:**

i. AOC Capitol Complex Master Plan Sustainability Framework Plan (latest edition).
ii. AOC Preservation Guides for each building in the Capitol Complex (in progress).
iii. AOC Resource Conservation Policy Statement, latest edition.
iv. AOC BAS Master Plan.
v. AOC BAS Top Level Requirements.
vi. AOC Building Automation and Control System Communication Integration Plan for the U.S. Capitol Complex.
vii. AOC Best Practices for Pools and Fountains (AOC Project # AC16002).
viii. AOC Commissioning Guidelines, latest edition.
ix. Order 7-4 Information Technology Security.
x. Order 12-4 Environmental Manual, Chapter 2: Recycling and Environmentally Preferable Purchasing and Chapter 8: Erosion and Sediment Control and Stormwater Permitting.
xi. Order 36-1 - Records Management and Archives Program.
xii. Order 37-1 - Preservation Policy and Standards, latest edition.
xiii. Order 28- - Architect / Engineer Design Guide.
xiv. Order 28-11 - Commissioning Guidelines, latest edition.
xv. PM 28-2 Energy Reduction and Sustainability Program.
xvi. PM 28-3 PM 28-3 Energy and Sustainability Policy and Standards.
xvii. Policy 11-1 - Authority Having Jurisdiction (AHJ) for Fire and Safety.
xviii. Policy 11-2 Interpretations Variances and Appeals for Fire and Life Safety.
xix. Policy 11-4 AOC Fire Protection Policy.
xx. Policy 11-5 – Fire Protection Requirements for Contracted Projects.
xxi. Policy 11-6 – Fire Protection Requirements for In House Projects.
xxii. Code of Ethics and Guidelines for Practice of the American Institute for Conservation of Historic and Artistic Works (AIC) for its use.
xxiii. Generic BACnet-based DDC specification at www.CtrlSpecBuilder.com for use as basis of project spec.
xxiv. Secretary of the Interior's Standards and Guidelines for Treatment of Historic Properties and Cultural Landscapes.

c). **Institute of Electrical Engineers (IEEE):**

i. IEEE, C.57.12.40 (transformer terminals for Network protectors).
ii. IEEE, C57 12.44 - 2005.

d). **National Electrical Manufacturer Association (NEMA):** TP1, Energy Efficiency Standard/ Transformers 2002.

e). **International Electrical Testing Association (NETA) 2015**.

f). **Underwriters Laboratories (UL):**

i. UL50, Enclosures for Electrical Equipment.
ii. UL 67, Standard for Electric Panelboards.
iii. UL 83, Thermoplastic- Insulated Wires and Cables.
iv. UL 96, Lightning Protection Components.
v. UL 96A, Installation Requirements for Lightning Protection Components.
vi. UL 489, Thermal Magnetic Breakers.
vii. UL 514A, Boxes and Covers.
viii. UL 723, Standard Method of Test of Surface Burning Characteristics of Building Materials.
ix. UL 886, Boxes in Hazardous locations.
x. UL 924, Standard for Emergency Lighting and Power.
xi. UL, 943 GFCI Circuit Breakers.
xii. UL 1449, Standard for Surge Protective Devices.
xiii. UL 723 (ASTM E84), Surface Burning Characteristics for Materials Used in Plenums.

g). **Air Conditioning, Heating and Refrigeration Institute (AHRI):**

i. AHRI 260 - Sound Rating of Ducted Air Moving and Conditioning Equipment.
ii. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.
iii. AHRI 430 - Central Station Air Handling Units.
iv. AHRI 550/590 - Performance Rating of Water Chilling Packages Using the Vapor Compression Cycle.
v. AHRI 880 - Performance Rating of Air Terminals.
vi. AHRI 885 - Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets.
vii. AHRI 300 - Sound Rating and Sound Transmission Loss of Packaged Terminal Equipment.

h). **Air Movement and Control Association (AMCA):**

i. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
ii. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
iii. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
iv. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating.
v. AMCA 500L - Laboratory Methods of Testing Louvers for Rating.
vi. AMCA 500-L-99 - Laboratory Methods of Testing Louvers for Rating.
vii. AMCA 99-0021-01 - The Fan Laws.

i). **American Society of Civil Engineers (ASCE):**

i. ASCE-7 – Minimum Design Loads for Buildings and Other Structures.

j). **American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):**

i. ASHRAE 15 - Safety Standard for Refrigeration Systems.
ii. ASHRAE 15 – Users' Manual.
iii. ASHRAE 34 - Designation and Safety Classifications of Refrigerants.
iv. ASHRAE 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
v. ASHRAE Standard 55-2004, Thermal Environmental Conditions for Human Occupancy.
vi. ASHRAE 55 - Errata 2007; Addendum a, b & d-g) Thermal.
vii. ASHRAE 55a - Thermal Environmental Conditions for Human Occupancy.
viii. ASHRAE 62.1 - Ventilation for Acceptable Indoor Air Quality.
ix. ASHRAE 90.1 – Energy Standard for Buildings Except Low-Rise Residential Buildings.
x. ASHRAE 100: Energy Conservation in Existing Buildings.
xi. ASHRAE 114: Energy Management Control Systems Instrumentation.
xii. ASHRAE 126 - Method of Testing HVAC Air Ducts.
xiii. ASHRAE 135 - BACNet – A Data Communication Protocol for Building Automation and Control Networks.
xiv. ASHRAE 140 - Standard Method of Test for the Evaluation of Building Energy Analysis Computer Programs.
xv. ASHRAE 147 - Reducing the Release of Halogenated Refrigerants from

Refrigerating and Air-conditioning Equipment and Systems.

xvi. ASHRAE 188 Legionellosis: Risk Management for Building Systems – 2015.

xvii. ASHRAE 189.1 Section 7.3.1 General Mandatory Provisions and Section 9.3.3 Refrigerants.

xviii. ASHRAE Handbook of Fundamentals.

k). **Sheet Metal and Air Conditioning Contractor's National Association (SMACNA):**

i. Architectural Sheet Metal Manual.

ii. Indoor Air Quality (IAQ) Guidelines for Occupied Buildings Under Construction, 1995).

l). **Aluminum Association:** Aluminum Design Manual (ADM): Part 1-A - Aluminum Structures, Allowable Stress Design; and Part 1-B - Aluminum Structures, Load, and Resistance Factor Design (AA ADM1-2015).

m). **American Architectural Manufacturers Association (AAMA/NWWDA):** Standard 101/I.S. 2-1997, Voluntary Standards for Aluminum, Vinyl (PVC), and Wood Windows and Glass Doors.

n). **American Concrete Institute (ACI):**

i. ACI 301 - Specifications for Structural Concrete.

ii. ACI 318-14 - Building Code Requirements for Structural Concrete.

iii. ACI 530-13/ASCE 5-13/TMS 402-13 - Building Code Requirements for Masonry Structures.

iv. ACI 530.1-13/ASCE 6-13/TMS 602-13 - Specification for Masonry Structures.

o). **American Forest & Paper Association (AF&PA):** Standard for Load and Resistance Factor Design (LRFD) for Engineered Wood Construction (AF&PA).

p). **American Industrial Hygiene Association:** Recognition, Evaluation and Control of Legionella in Building Water Systems (2015).

q). **American Institute of Steel Construction:** Specification for Structural Steel Buildings (360-10).

r). **American Institute of Steel Construction:** Seismic Provisions for Structural Steel Buildings (341-10).

s). **American Iron and Steel Institute:** North American Specification for Design of Cold-Formed Steel Structural Members (AISI S100-12).

t). **American National Standards Institute (ANSI):**

i. ANSI A137.1-12, Standard Specification for Ceramic Tile.

ii. ANSI A208.1, Particleboard.

iii. ANSI A208.2, Medium Density Fiberboard for Interior Applications.

iv. ANSI S12.60-2002 - Acoustical Performance Criteria, Design Requirements and Guidelines for Schools.

v. ANSI Compliance - Comply with applicable requirements of ANSI C2.

vi. ANSI/ASSR Z-359-2007, Safety Requirements Anchorage Connectors.

u). **American Society for Testing Materials (ASTM):**

i. ASTM E 84, Standard Test Method for Surface Burning Characteristics of Building Materials.

ii. ASTM D696 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between −30°C and 30°C with a Vitreous Silica Dilatometer.

iii. ASTM D 422 - Standard Test Method for Particle-Size Analysis of Soils Mechanical (Sieve) Analysis and Hydrometer Analysis.

iv. ASTM E 605, Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members.

v. ASTM E 736, Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.

vi. ASTM E 759, Standard Test Method for Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members.

vii. ASTM E 760, Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members.

viii. ASTM E 761, Standard Test Method for Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members.

ix. ASTM E 859, Standard Test Method for Air Erosion of Sprayed Fire-Resistive Materials (SFRMs) Applied to Structural Members.
x. ASTM D 2216 - Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
xi. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
xii. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3(2,700 kN-m/m3)).
xiii. ASTM D 1883 – Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.

v). **American Society of Civil Engineers / Structural Engineering Institute:**
i. ASCE/SEI 7-10 - Minimum Design Loads for Buildings and Other Structures.
ii. ASCE 41-17Seismic Evaluation of Existing Buildings.

w). **American Society of Mechanical Engineers (ASME):**
i. ASME A17.1 Safety Code for Elevators and Escalators.
ii. ASME 18.1 Safety Standard for Platform Lifts and Stairway Chairlifts.
iii. AMSE Manual.

x). **American Society of Plumbing Engineers (ASPE):** ASPE data Books.

y). **American Welding Society: Structural Welding Codes** (D1.1-2011, D1.3-2011, D1.4-2011).

z). **Architectural Woodwork Institute (AWI):** Architectural Woodwork Quality Standards, 7th edition.

aa). **Carpet & Rug Institute - (CRI) "Green Label + Program".**

bb). **Code of Ethics and Guidelines for Practice, American Institute for Conservation of Historic and Artistic Works.**

cc). **Copper Development Association (CDA):** Copper in Architecture Design Handbook.

dd). **Department of Energy -** "Federal Energy Management Program" (FEMP) and Energy-Star®.

ee). **Door and Hardware Institute (DHI): DHIA115-W-95,** Wood Door Hardware Standards.

ff). **Geotechnical Engineering:**
i. American Association of State Highway and Transportation Officials (AASHTO).
ii. Association of Environmental and Engineering Geologists (AEG).

gg). **Hollow Metal Manufacturers Association (HMMA):** HMMA 861, Guide Specifications for Commercial Hollow Metal Doors and Frames.

hh). **Housing and Urban Development Fire Ratings of Archaic Materials and Assemblies.**

ii). **National Association of Architectural Metal Manufacturers (NAAMM):** Standard SW-1.

jj). **National Design Specification (NDS) for Wood Construction with 2012 Supplement (NDS-2012).**

kk). **National Fuel Gas Code:** Standard 54.

ll). **National Roofing Contractors Association (NRCA):** NRCA Roofing and Waterproofing Manual.

mm). **Security:**
i. The Design – Basis Threat - Interagency Security Committee Report April 12, 2010, For Official Use Only (FOUO).
ii. Physical Security Criteria for Federal Facilities - Interagency Security Committee Standard April 12, 2010 (FOUO).

nn). **Steel Door Institute (SDI):** SDI108-90, Recommended Selection and Usage Guide for Standard Steel Doors.

oo). **Steel Joist Institute**: Standard Specification for Longspan Steel Joists, LH Series and Deep Longspan Steel Joists, DLH Series (SJI LH/DLH-1.1-10).

pp). **Steel Joist Institute:** Standard Specification for Open Web Steel Joists, K Series (SJI K-1.1-10).

qq). **Steel Joist Institute:** Standard Specifications for Joist Girders (SJI JG-1.1-10).

rr). **Steel Window Institute:** The Specifier's Guide to Steel Windows.

ss). **The Energy Independence and Securities Act of 2007 (EISA).**

tt). **Tri-Service Manual:** Structures to Resist the Effects of Accidental Explosions (TM 5-1300).

uu). **Window & Door Manufacturers Association**

(WDMA): Standard I. S.4-99, Industry Standard for Wood Stile and Rail Doors, and Standard I.S.l-A-97, Architectural Wood Flush Doors.

vv). **Wire Reinforcement Institute (WRI):** Design of Slab-on-ground Foundations (WRI/CRSI-81, with 1996 Update).

1.5.3. **Provisions for Persons with Disabilities**:

a). As required by the Congressional Accountability Act of 1995, the AOC is required to provide accessibility in compliance with the Americans with Disabilities Act and the Americans with Disabilities Act Accessibility Guidelines (ADAAG) *2010 ADA Standards for Accessible Design*. The 2010 Standards consist of the 2004 ADAAG and the requirements contained in subpart D of 28 CFR part 36 (2010).

b). In addition, the AOC requires accessibility utilizing the following standards:

i. The US Access Boards proposed 'Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way" dated July 26, 2011 (including Supplemental Notice "Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way: Shared Use Paths") shall be used for exterior and site related facilities.

ii. International Building Code 2015, Chapter 11 Accessibility.

iii. ICC A117.1-2009 Accessible and Usable Buildings and Facilities.

c). Designer shall consult with the AOC's Universal Accessibility Coordinator for interpretations with regard to rehabilitation or renovation of AOC facilities.

d). The above-referenced standards, for the purpose of this document, shall be referred to hereinafter as "ADA."

1.5.4. **Metric Dimensioning**:

a). The use of metric dimensioning is not required on AOC projects, but may be used on a case-by-case basis as determined by the project statement/scope of work (SOW) or program of requirements (POR). If metric dimensioning is required, the following standards apply:

i. American Society for Testing and Materials (ASTM) E 380: Standard for Metric Practice.

ii. ASTM E 612: Standard Practice for the Use of Metric (SI) Units in Building Design and Construction.

b). Connections to Utilities: Comply with the latest published regulations of the affected utility.

c). Streets and Highways: Comply with the latest edition of District of Columbia (DC) Department of Highways and Traffic *Standard Specifications for Highways and Structures.*

1.5.5. **Environmental and Health Regulations**:

a). Reasonable effort has been made by AOC to identify and quantify any installed regulated or otherwise hazardous materials that may be present in the portions of existing buildings subject to rehabilitation or renovation. Building or component demolition activities may impact regulated materials that were not accessible for testing by AOC (see section 1.12.4 below to address this circumstance).

b). **Hazardous Material Identification:** Review existing asbestos and lead test results provided by AOC. Perform additional testing for lead-based paint, asbestos-containing materials, mercury and polychlorinated biphenyls (PCBs) as necessary to determine the extent of hazardous materials to be encountered during the construction of the project. A certified inspector must be used to obtain the required number of bulk asbestos and/or lead-based paint samples in the areas affected by the project and to submit the samples to a certified laboratory for analysis. The asbestos samples must be analyzed using either polarized light microscopy (PLM) with dispersion staining (EPA Method 600/R93-116) or transmission electron microscopy (TEM) for non-friable organically bound bulk samples (NY ELAP Method 198.4). Designer shall provide a report that reflects both the reliance on past testing and the results of any additional analysis, and state quantities of the hazardous materials found.

c). **Waste Stream Samples:** To address EPA regulatory concerns, take a representative sample of the waste stream to be generated and perform Toxicity Characteristic Leaching Procedure (TCLP) testing (EPA Method 1311)

to determine if the lead/heavy metals in the wastes should be managed and disposed of as hazardous waste; or determine through appropriate calculations that the lead/heavy metal content cannot exceed the TCLP limit for hazardous waste.

d). **Abatement:** Incorporate appropriate abatement, monitoring and disposal procedures into the design documents.

e). **Hidden Hazards:** Incorporate standard language related to hidden hazards and unforeseen conditions.

f). **OSHA:** AOC is subject to requirements under 29 CFR 1910 and 1926. All projects shall comply with all OSHA requirements unless specifically exempted in writing by AOC. In addition, compliance with state or DC occupational safety and health regulations is required.

g). **Environmental:** AOC is subject to a variety of environmental regulations issued by the Environmental Protection Agency (EPA), the [D.C.] Department of Energy and Environment (DOEE), the Maryland Department of the Environment (MDE), and the Virginia Department of Environmental Quality (VDEQ), including the following:

i. Title 40 of the Code of Federal Regulations (CFR), Parts 1-1899.
ii. Titles 20 and 21 of the District of Columbia Municipal Regulations (DCMR).
iii. Title 26 of the Code of Maryland Regulations (COMAR).
iv. Titles 4 and 9 of the Virginia More specific Administrative Code (VAC).

h). More specific references to regulations commonly applicable to AOC projects include:

i. 10 CFR 434 standards - Energy Code for New Federal Commercial and Multi-Family High-Rise Residential Buildings.
ii. Air permitting regulations at 20 DCMR Chapters 2 and 3.
iii. Clean Water Act 33 U.S.C. §1251 et seq. (1972).
iv. Cross connection (backflow prevention) regulations at 21 DCMR Chapter 54.
v. Drinking water protection regulations at 40 CFR Parts 141 through 143.
vi. Environmental Protection Agency Water Sense Standards.
vii. Energy Policy Act of 2005 (P.L. 109-58).
viii. Erosion and sediment control and stormwater regulations at 21 DCMR Chapter 5.
ix. General Services Administration (GSA) - "Construction Waste Management Database," accessible via the National Institute of Building Sciences (NIBS) "Whole Building Design Guide" web-site.
x. Hazardous waste management regulations at 20 DCMR Chapter 42.
xi. Noise control regulations at 20 DCMR Chapters 27 through 29.
xii. Pesticide application regulations at 20 DCMR Chapters 22 through 25.
xiii. Procurement guidelines for products containing recovered materials at 40 CFR Part 247.
xiv. Regulations for the disposal of polychlorinated biphyenls at 40 CFR part 761.
xv. Spill prevention, control, and countermeasures (oil storage) regulations at 40 CFR Part 112.
xvi. Underground storage tank regulations at 20 DCMR Chapters 55 through 70.
xvii. Volatile organic compound emissions regulations at 20 DCMR Chapter 7.
xviii. Wastewater discharge regulations at 21 DCMR Chapter 15.
xix. Well construction, maintenance, and abandonment regulations at 21 DCMR Chapter 18.

*Note that the focus of the regulations listed above are those that apply in Washington D.C. Regulations for AOC facilities in Maryland and Virginia often differ from those listed above. Please contact the AOC Environmental Division with questions about environmental regulations.

xx. All projects shall comply with all environmental requirements. All publicly owned treatment works (POTW) discharge restrictions shall be adequately addressed in design, construction and operation activities. Required environmental permit and registration requirements associated with the project must be identified as part of the

design work. Develop supporting data and calculations, complete required forms, paperwork and permit applications, for any equipment or operations that will require AOC to obtain a registration, operating permit, or similar approval under federal, state or local regulations. Examples include, but are not limited to, tank registrations, National Pollutant Discharge Elimination System (NPDES) permits and air permits. This documentation shall be submitted to the AOC Project Manager for review by the AOC Environmental Division before being submitted to the appropriate regulatory agency.

i). Sites Other than the Capitol complex: Projects designed for sites other than those located in the District of Columbia shall have all local and state environmental codes investigated and a summary prepared for AOC analysis.

1.5.6. **Food Service:**

a). Designs shall comply with the American National Standards Institutes (ANSI) – accreditation certification program and 2013 Food Code Recommendations of the United States Public Health Service Food and Drug Administration. Projects involving food service will be reviewed by the Office of the Attending Physician.

1.5.7. **Statement of Special Inspections:**

a). Construction documents shall include a Statement of Special Inspections on the design documents. IBC Chapter 17 shall be considered a minimum, with additional inspection requirements, deemed critical to the project by the Architect-Engineer, added on a case-by-case basis. Note that the Statement of Special Inspections should correlate to the project, i.e., only those inspections applicable to the scope the project's work should be listed.

b). AOC contracting rules typically preclude the AOC from employing the Special Inspection Agency(s). Therefore, IBC 2015 section 1704.1, paragraph 1, is not applicable. Construction documents shall include the following statements: "The Contractor shall employ an AOC-approved Special Inspection Agency to perform the Special Inspection Tasks identified in these documents" and "A copy of all Special Inspection Reports shall be made available for AOC review."

1.5.8. **Architectural Review Board:**

a). The Architectural Review Board (ARB) reviews all new construction, additions, or rehabilitation projects that may affect any publicly visible element of any building, structure, landscape, view or vista within the jurisdiction of the Architect of the Capitol. The ARB will typically not review work in private offices, underground utilities unless the work affects the landscape or landscape features, or work that is mechanical, electrical, or plumbing in nature not exposed to public view and not affecting a publicly visible portion of a building, structure or landscape. The ARB is the official body providing design review for the Office of the Architect of the Capitol, but the Architect of the Capitol retains sole authority for final design approval.

b). ARB review covers planning, design, appearance, and visibility of projects designed by consulting architects, in-house designers, and other parties. ARB review applies to third-party entities, not under contract to, or directly supervised by the Architect of the Capitol including, but not limited to, legislative branch agencies and public utilities. The ARB design review is separate from the technical reviews of consultant-generated contract documents and specifications provided by PPM.

1.5.8.1. **Review Criteria:**

a). Consistency with the AOC Design Standards, the Capitol Complex Master Plan, and the Preservation Policy and Standards.

b). Compatibility of the design approach and setting with the existing buildings, landscape, and landscape elements.

c). Compatibility of the massing, volume, scale, proportions, color, and quality of materials with the building and neighborhood.

d). Impacts on views and vistas.

e). Compatibility of the landscape quality and design with the historic landscape.

f). Any other design factor that, in the opinion of the ARB, could adversely affect the Capitol complex.

1.5.8.2. **Timing:** Submit projects for ARB review at the earliest possible design stages to allow incorporation of the ARB recommendations into the project design with minimal impact to the project schedule and cost. Small, single-issue projects may require no or only one review. For projects defined as small projects review will occur at concept and final (100 percent) design. For projects defined as medium or large projects, review will occur at concept, mid-point and final design. The ARB Chair will determine the level of review required for a project.

1.5.8.3. **Review Requests:** Submit requests for review to the Chair of the ARB through Project Managers, Jurisdictional Executives, Superintendents, and their designated staff. The ARB will review any project that the ARB Chair determines will affect a visible element of any building, structure, landscape, view or vista.

1.6. **Temporary Facilities and Controls:**

1.6.1. **Design Requirements:**

a). Security Inspections: All deliveries must be inspected off-site and placed under U.S. Capitol Police (USCP) seal. The location of the inspection facility is: D.C. Village, 4700 Shepherd Parkway, Washington, D.C.; contact phone number is 202.226.0905.

b). **Hours of Operation:** 5:00 a.m. to 2:00 p.m., Monday through Friday.

c). **Required Data:** Designer shall provide letter to the United States Capitol Police, on company letterhead stationary accompanied by the signature of the owner, president, or manager.

i. **Renewal:** Letters shall be renewed three times per year, by April 30, August 31, and December 31, and should contain the following information: name of the company, name of the employees requiring access, Social Security number and date of birth for each employee, buildings to be accessed, company contact person and telephone number.
Provide information to: United States Capitol Police, Operations Division, 119 D Street N.E., Washington D.C., 20510-7218, Fax: 202.224.4505.

d). **Notification:** All Contractors shall notify AOC a minimum of two working days in advance of each delivery. Designers shall provide the following information for each vehicle making a delivery: make, model, year, color, state and license plate number.

e). **Access to Loading Docks:** Contractor access to congressional loading docks is limited to the times listed in the table on the following page unless special arrangements are made with the appropriate Superintendent. The costs of said special arrangements for operating the facility shall be reviewed and may require reimbursement from the contractor for the special arrangements.

f). **Temporary Facilities:** Comply with the DC Building Code requirements and regulations governing construction and local industry standards, in the installation and maintenance of temporary services and facilities. Comply with the requirements of NFPA Code 241, "Standard for Safeguarding Construction, Alteration, and Demolition Operations" the ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition," and the National Electrical Contractors Association (NECA) National Joint Guideline (NJG)-6 "Temporary Job Utilities and Services."

g). **Police to Have Keys:** Designer shall provide two sets of keys to the USCP for all temporary facilities and locked cabinets within the construction compound or site. For projects in the United States Supreme Court, provide keys to the Marshal of the Supreme Court.

h). **AOC Construction Fence:** Aesthetic design requirements for two versions of AOC construction fences are available in MicroStation DGN formats from the Technical Support Branch. The A/E shall be responsible for the final design/engineering requirements and calculations for the construction fence. The AOC Project Manager should determine the appropriate version to be used on the project. Projects not located within the Capitol complex should use standard chain link fencing whenever possible.

i). **Construction Signage:** All construction signage shall be subject to AOC approval. Directional signage shall be planned and coordinated with the AOC Project Manager. All planned routes and locations for signs shall be

approved by the AOC Project Manager prior to preparation of any construction signage. Projects in Washington, D.C., requiring erosion and sediment control plans must display signage in accordance with 21 DCMR 543.22. Signage shall comply with the following:

j). **Signing Materials:** DC, Department of Public Works, *Standard Specifications for Highways and Structures*, Section 823, Signing Materials, and Federal Highway Administration Standard Alphabets referenced therein, with the exception that materials for temporary guide sign panel faces may be 3/4" painted plywood in lieu of reflective sheeting. Colors shall comply with the Manual of Uniform Traffic Control Devices for Street and Highways. Text, text height and wording shall be as approved by the AOC Project Manager.

k). **Closed Sidewalks and Streets:** To the extent possible, construction activities should be planned to minimize disruption of existing sidewalks and streets. Any planned construction that will disrupt sidewalks and streets shall be identified early in the design process to facilitate proper coordination with and approval of planned pedestrian and vehicular routes with congressional authorities and local authorities having jurisdiction.

1.6.2. **Restrictions:**

a). Do not assume contractor has access to any site or facility.

b). Do not place any signs on the site without written AOC approval.

c). Any correspondence with environmental regulators must be reviewed and approved by the AOC Environmental Division and AOC Office of General Counsel.

d). No shutdowns without coordination of building superintendent.

Table 1.6.1-1 Loading Dock Usage, Monday through Friday only

Jurisdiction	Hours Open	Contact #	Address
U. S. Capitol	5:00 AM to 2:00 PM	202.228.8800	North Barricade on Constitution Avenue, NE at Delaware Avenue, NE
Senate Office Buildings	7:00 AM to 3:30 PM	202.224.3668	Access via tunnel at D Street, NE adjacent to Police Headquarters
House Office Buildings	6:00 AM to 4:00 PM	202. 225.4141	Delaware Avenue, SW at C Street, SW Ford House Office Building by appt. Virginia Avenue, SW between Second and Third Streets, SW
Library of Congress	6:30 AM to 3:00 PM	202.707.9085	C Street, SE between First and Second Streets, SE
Supreme Court	By Appointment	202.479.3143	East Capitol and First Streets, SE
Botanic Garden	By Appointment	202.359.9214	Independence Avenue, SW at West Courtyard Gate
Power Plant	By Appointment	202. 226.4526	E Street, SE
U.S. Capitol / Capitol Visitor Center	5:00am to 8:00pm	202.228.8800	New Jersey Avenue, NW, and C Street, NW

1.7. **Bidding Requirements, Contract Forms and Conditions:**

1.7.1. **About:**

a). **The AOC Acquisition and Materials Management Division is structured into three branches:** AE & Construction Branch, Supply and Service Branch and the Small Purchases Branch. The AE & Construction Branch is responsible for soliciting and awarding AOC procurements for architect, engineering, construction management and construction services exceeding $100,000. Service & Supply Branch is responsible for soliciting and awarding AOC procurements for commodities and services (excluding AE and Construction Management) exceeding $100,000 and all GSA actions exceeding $1,000,000. The Small Purchase Branch awards AOC procurements of $100,000 or less and GSA actions less than $1,000,000.

1.7.2. **Applicability of Laws and Statutes:**

a). The procurement authority for AOC is established by statute codified at 2 U.S.C. § 1801 et seq. As a legislative branch agency, AOC is not required to follow the Federal Acquisition Regulation (FAR). However, AOC does incorporate certain FAR clauses and provisions in its solicitations and follows the regulatory guidance found in the FAR to the maximum extent possible. The AOC's formal guidelines are established in AOC Order 34-1, Contracting Manual.

b). For procurements of $100,000 or less ("small purchases"), the AOC uses small purchase procedures implemented through policy signed by the Architect. Procurements exceeding $5,000 up to $100,000 are normally provided by small businesses utilizing the AOC small business set-aside program in a competitive process.

1.7.3. **Schedules:**

a). All AOC projects require a written schedule. All projects being completed by a contractor require a resource-loaded design and cost-loaded, Critical Path Method (CPM) construction schedule.

1.8. **Documentary Photography:**

1.8.1. **About:**

a). The AOC Photography Branch is responsible for creating and preserving photographic documentation of projects before, during and after implementation.

1.8.2. **Applicability:**

In accordance with the March 28, 1997, AOC directive, documentary photography, photographic documentation must be included in all project planning, design and implementation and scheduling documents. Coordinate with the AOC Photography Branch to prepare existing condition, construction and completion photography. Coordinate with the AOC Photography Branch to determine the appropriate level of documentation for each project and for archiving of all project photography and videos, whether made by the branch or others.

2. **Historic Preservation**

2.1. **The AOC's Mission:**

a). The AOC is committed to the preservation of the Heritage Assets in its care and recognizes the need to maintain consistently high standards of preservation treatment. Preservation is central to the AOC's mission to Serve, Preserve and Inspire. Preserving and maintaining the Heritage Assets of the Capitol requires innovative design solutions that are affordable and extend the useful life of the Heritage Assets. Design solutions must minimize the potential short and long-term negative effects of the alterations needed to keep buildings safe, functional and efficient.

b). The AOC Preservation Policy and Standards establish the preservation philosophy and standards for treatment of all AOC Heritage Assets and are intended to ensure that the preservation, conservation, restoration, rehabilitation and maintenance activities of the AOC meet the highest professional standards.

2.2. **Background:**

a). The AOC Heritage Assets include the buildings, structures, cultural landscapes, fine art, decorative art, architectural fine art, architectural decorative art, monuments, memorials, archival records, photographic records, living botanical assets, views and vistas, archeological resources and stored art and architectural materials that have historical, architectural, artistic, cultural, or educational significance. The Heritage Assets are among the most significant in the United States and therefore, a consistently high level of preservation treatment is required.

2.3. **Policy:**

2.3.1. **Design Principles:**

a). Design for improvements to existing facilities and design for new construction shall preserve and enhance the character and history of the Heritage Assets. This includes design of modern systems for security, life safety and energy efficiency. Design of improvements and new facilities must respect the existing historic context and be compatible with and integrated into the Capitol Heritage Assets. To ensure this result, three principles shall be followed:

i. **Quality:** Design shall be of the highest quality, timeless and durable.

ii. **Reversibility:** Design shall be undertaken in a manner that, if removed in the future, the essential form and integrity of the Heritage Asset and its environment would be unimpaired.

iii. **Security, Sustainability:** Seamlessly incorporate security and sustainability into all designs. Coordinate with the AOC Historic Preservation Officer (HPO), the AOC Curator and other related disciplines during the design and planning phases.

2.3.2. **General Precepts:** Design and material selection shall reflect proven technology and recognized performance standards.

a). Conform to current codes and standards to the fullest extent possible without adversely affecting the Heritage Assets.

b). Preserve the distinctive materials, features, finishes and construction techniques that characterize an asset.

c). When incorporation of modern materials and systems is required they shall:

i. Be analyzed thoroughly for compatibility with the historic materials.

ii. Be identifiable as new by the trained eye.

iii. Be installed with minimally adverse effect on the Heritage Assets.

2.3.3. **Design Requirements:**

a). **Significance:** The AOC Heritage Assets are a collection of nationally significant historic structures, artwork and landscapes, bounded by significant streets and encompass significant views and viewsheds. The Heritage Assets provide a setting for special administrative and commemorative events and are symbols of the United States democracy, national pride, freedom, strength, permanence, etc.

b). **Preservation Philosophy:** The primary tenet of AOC's preservation philosophy is to retain and protect the maximum amount of significant and character-defining historic features and materials as is possible for as long as possible and to maintain the integrity of an asset while ensuring the continued utility of the U.S. Capitol as a public workplace.

c). **Review:** Review proposed work that may affect a Heritage Asset with the HPO and/or Curator to discuss the preservation standards and treatment

methodologies. The HPO and/or Curator will review the design philosophy, the preservation approach, the detailing and the materials and procedures proposed. Contact the HPO and Curator early in the planning and design phases to expedite the design process and avoid potential conflicts and delays.

2.3.4. **Design Considerations:**

a). Each heritage asset within AOC's jurisdiction shall be recognized as a physical record of its time, place and use.

b). The historic character of an asset shall be retained and preserved. The removal of historic materials or alteration of historic features and spaces shall be avoided or minimized to the greatest extent possible.

c). **New use:** If a new use is proposed, the new use shall be compatible and respectful of the original and shall avoid distinctive spatial, structural or mechanical conflicts between the old and the new uses.

d). Additions, alterations or related new construction shall not destroy historic materials, features and spatial relationships. Upon close inspection, it should be possible to differentiate new work from the historic construction. Make new work compatible with the historic materials, features, size, scale, proportion, and massing, and shall be reversible to the greatest extent possible.

e). **New systems in historic buildings:** The insertion of new systems in historic buildings must be done with care to avoid or minimize impacts to the historic fabric. The Project Manager shall inform the HPO and Curator of the proposed systems, materials, functions, finishes, etc. Evaluate new systems design to ensure that the new systems are compatible with and will not harm or cause deterioration of any Heritage Asset.

f). The existing condition of Heritage Assets shall be evaluated to determine the appropriate level of intervention needed. Deteriorated features shall be repaired rather than replaced.

g). Prominent structural, mechanical, and electrical features that may be considered significant shall be preserved in place when possible, protected and, if disturbed, shall be fully documented. If removal is essential, coordinate with HPO and Curator for packing, identification, transportation, and storage.

2.3.5. **Construction Documents for preservation shall:**

a). Clearly identify the location and extent of all Heritage Assets, significant features and materials and detail the full scope of required protection, preservation, conservation and/or restoration treatment.

b). Direct the construction, become the record of the scope of the construction work, and become a detailed record of details, materials and procedures employed.

c). Become the current record of the Heritage Asset once the record construction documents are completed.

d). **Construction Documents preparation shall:**

i. Include fully detailed 'existing conditions' documentation of the portions of the asset where the work will be conducted, either as drawings or photographs.

ii. Include clear, concise and precise information where the new work will impact historic features.

iii. Thoroughly coordinate the location, routing and installation methods of all disciplines, clearly indicate specific locations and limits of the removal of historic materials, and clearly indicate the materials and methodology for protection, preservation, conservation or restoration.

2.3.6. **Maintenance of Heritage Assets:**

a). To facilitate proper and adequate long-term care and maintenance of the Heritage Assets, at the completion of a project, provide the AOC with a maintenance manual that provides recommendations for cyclical inspection, maintenance schedules and maintenance materials and procedures.

2.4. **Preservation Policy Administration:**

2.4.1. **Roles and Responsibilities**

a). **The Architect of the Capitol:** The Architect of the Capitol has responsibility for preservation-related decisions and for making recommendations to the Congress and the appropriate governing authorities. The Architect has delegated policy administration, interpretation, and implementation authority to the Historic Preservation Officer and the AOC Curator.

b). **AOC Historic Preservation Officer:** The HPO is responsible for implementing the Preservation Policy and Standards for the historic buildings, structures, monuments, memorials, cultural landscapes, architectural decorative art, views and vistas, archeological resources and stored architectural materials under the jurisdiction of the AOC. The HPO is vested with the authority to advise upon, review and approve projects (initiated from within the agency or from consultants outside the agency) that may impact the Heritage Assets.

c). **AOC Curator:** The AOC Curator is responsible for implementing the AOC Preservation Policy and Standards for works of art such as paintings, sculpture and decorative art under the jurisdiction of the Joint Committee of the Library, architectural fine art and decorative art (such as murals), stored art-related materials and outdoor sculpture. The Curator is also responsible for maintaining the archival and photographic records of the AOC. The AOC Curator will advise upon, review and approve projects that may impact the Heritage Assets for which the Curator has responsibility.

d). **AOC Architectural Review Board:** The AOC Architectural Review Board (ARB) provides review of aesthetic considerations of projects. It is not solely a historic preservation review but does consider effects on Heritage Assets as part of its review. Refer to section 1.5.9 for ARB project review requirements.

2.4.2. **Historic Building Preservation Guides / Cultural Landscape Reports / Preservation Zone Plans:**

a). Historic Building Preservation Guides provide basic documentation for each historic building and Cultural Landscape Reports (CLRs) provide concise information for each historic landscape within AOC's jurisdictions. The Guides and CLRs are intended to be a reference documents for AOC personnel and contractors.

b). The Guides and CLRs include a statement of significance, documentation of the asset's major alterations over time, inventories of significant materials and elements, and color-coded floor plans of the building showing the hierarchy of spaces within a building (Restoration, Rehabilitation and Renovation).

c). Historic Building Preservation Guides and Cultural Landscape Reports provide architectural and social history, original construction details and material sources, treatment guidelines, and preservation, conservation, restoration or rehabilitation recommendations intended to ensure informed preservation and maintenance design.

2.5. **Standards for the Treatment of Heritage Assets:**

2.5.1. **General:**

a). To ensure that the work affecting the Heritage Assets incorporates sound preservation philosophy and treatment, the AOC has adapted the Secretary of the Interior's Standards and Guidelines for Treatment of Historic Properties and Cultural Landscapes, and the Code of Ethics and Guidelines for Practice of the American Institute for Conservation of Historic and Artistic Works (AIC) for its use.

b). The AOC Standards for Treatment of Heritage Assets focus on retaining and preserving the maximum amount of the historic fabric for as long as possible, assuring that treatment will not result in irreversible harm to the Heritage Assets and to assure that alterations or additions are sympathetic with character of the Heritage Asset.

2.5.2. **Standards for the Treatment of Heritage Assets:**

a). An asset will be used as it was used historically, or it will be given a new use that requires minimal change and maximizes the retention of distinctive materials, features, spaces and spatial relationships.

b). The historic character of an asset will be retained and preserved. The removal of historic materials or alteration of historic features, spaces and spatial relationships will be avoided or minimized to the greatest extent possible.

c). Each asset within the AOC jurisdiction will be recognized as a physical record of its time, place and use. Changes or additions to existing historic materials and features will be physically and visually compatible, identifiable upon close inspection and properly documented.

d). Changes or additions that have acquired historic significance in their own right will be retained and preserved.

e). Distinctive materials, features, finishes and

construction techniques or examples of craftsmanship that characterize an asset will be preserved.

f). The existing condition of an asset will be evaluated to determine the appropriate level of intervention. Deteriorated historic features will be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature will match the old in design, color, texture and materials. Replacement of missing features will be based upon documentary and physical evidence. A false sense of history will not be created by adding conjectural features, features from other properties, or by combining features that never existed together historically.

g). Chemical or physical treatments, if appropriate, will be undertaken using the gentlest means possible. Treatments that cause damage to historic materials will be avoided.

h). Additions, alterations or related new construction will not destroy historic materials, features or spatial relationships. The new work will be differentiated from the old and will be compatible with the historic materials, features, size, scale and proportion and massing. Additions, alterations and new construction will be reversible to the greatest extent possible.

i). Additions and adjacent or related new construction will be undertaken in a manner that, if removed in the future, the essential form and integrity of the asset and its environment would be unimpaired.

j). Archaeological resources will be protected and preserved in place. If such resources must be disturbed, mitigation measures will be undertaken, and, in any case, they will be fully documented.

k). Before any intervention is conducted, careful examination and thorough documentation of the condition of a heritage asset will be made. The HPO or Curator will ensure that appropriate historic research is conducted and will arrange for any needed scientific investigation, such as paint analysis, in order to make an accurate determination of significance and condition.

l). Proposed treatment will be suited to the preservation of the aesthetic, conceptual, and physical characteristics of the heritage asset. No treatment may be the best option.

m). A treatment plan describing the course of treatment, the justification for and objectives of treatment, any alternative approaches, and potential risks will be prepared. The goal of treatment will be to retain as much as possible of the original fabric of the heritage asset for as long as possible.

n). Only materials and methods appropriate to the objectives of each treatment and consistent with currently accepted practices will be chosen. The advantages of the materials and methods chosen must be balanced against their potential adverse effects on future examination, scientific investigation, treatment and function. Specific to fine and decorative art, any intervention to compensate for loss should be documented in treatment records and reports and should be detectable by common examination methods. Such compensation should be reversible and should not falsely modify the known aesthetic, conceptual, and physical characteristic of the asset, especially by removing or obscuring original material.

o). Accurate, complete and permanent records of examination, sampling, scientific investigation, and treatment before, after, and during, will be produced and maintained. Documentation is a valuable part of the history of a Heritage Asset and will be produced and archived in a permanent manner. Copies of examination and treatment reports will be kept permanently by the AOC.

p). After treatment, a follow-up maintenance plan will be designed and implemented through the AOC Curator or HPO offices.

2.5.3. **Heritage Assets Protection:**

a). All AOC jurisdictions planning construction or maintenance projects that may affect Heritage Assets shall consult with the HPO and Curator, so ways to minimize or monitor the impact of the project on the Heritage Assets can be determined. In the case of unplanned events, such as leaks, occurring near Heritage Assets, immediately inform the HPO and Curator so that assets can be protected and/or treated quickly to prevent permanent damage.

b). The AOC requires conservators to be members of the American Institute for the Conservation of Historic and Artistic Works (AIC) and all conservation contracts require that conservators follow the AIC Code of Ethics and Guidelines

for Practice.

2.6. **Applicability:**

a). Compliance with the Preservation Policy and Standards is required of all AOC personnel, consultants and contractors. The Policy and Standards are available to all offices and individuals who are involved with projects in the Capitol complex that may affect Heritage Assets.

2.7. **References:**

a). The Architect of the Capitol is responsible for the care and maintenance of the U.S. Capitol and the Capitol Grounds (see 2 U.S.C. 1811). The U.S. Capitol was designated a National Historic Landmark on December 19, 1960, but is specifically exempted from the provisions of the National Historic Preservation Act of 1966. Therefore, it is not listed on the National Register of Historic Places.

b). Architect of the Capitol projects are not subject to the regulations of the 1966 Historic Preservation Act, review of the Advisory Council on Historic Preservation pursuant to Section 106 of the Act. AOC projects are not subject to review by the District of Columbia, SHPO / Historic Preservation Review Board, the Commission of Fine Arts, or the National Capital Planning Commission.

c). The AOC Photography Branch is responsible for creating and preserving photographic documentation of projects before, during and after implementation in accordance with AOC directive of March 28, 1997.

d). Records Management and Archives Program, Order 36-1-6, and relevant Records Retention Schedules.

2.8. **Restrictions:**

a). Do not contact local District of Columbia agencies for approvals/permits without prior written approval of AOC. (Note: Some leased facilities and properties not located within the Capitol are subject to District of Columbia regulations).

b). Facilities at Ft. Meade, Maryland and Culpepper, Virginia, are subject to varying state and local codes and military regulations. Verify coverage of codes and regulations, with the AOC, before commencing work.

3. **Sustainable Design**

3.1. **Introduction and General Provisions**

a). **Purpose:** This section provides minimum requirements, and guidance for planning, designing, constructing, renovating, and maintaining, high performance and sustainable buildings that will enhance the AOC's mission capability by reducing total ownership costs.

b). **General:** The main objectives of this section are to optimize building performance and minimize adverse effects on the environment. It is the intent of this section to achieve these goals through the following measures:

i. Address planning, designing and construction of new buildings and renovations or alterations to existing buildings.
ii. Increase cost savings through better energy, water and material management.
iii. Reduce water supply constraints and preserve a critical natural resource.
iv. Access tools to encourage energy efficiency improvements.
v. Empower project teams to make more informed decisions.
vi. Gather information about building energy and water use to increase awareness and data-driven decision making.
vii. Create built environments that are livable, comfortable, safe, productive and resilient.
viii. Drive transformation in the performance of the AOC's facilities.
ix. Require energy performance analysis.
x. Balance building performance with occupant comfort, health and wellness.
xi. Coordinate requirements among disciplines.
xii. Is organized around the International Green Construction Code (IgCC), 2015 Edition, includes ANSI/ASHRAE/USGBC/IES 189.1-2014 Standard for the Design of High-Performance Green Buildings Except Low Rise Residential Buildings.

3.2. **Related Sections:**

a). Other Sections that contain important information that may affect elements of this section or their implementation, include, but are not limited:

i. Refer to Section 1, General Requirements, for required codes and standards.
ii. Refer to Section 6, Shell, for cool roofing and other roofing-related information.
iii. Refer to Section 7, Architect and Interior, for finishes and installed material requirements.
iv. Refer to Section 9, Mechanical and HVAC, for related information.
v. Refer to Section 10, Plumbing, for related information.
vi. Refer to Section 11, Electrical, for related information.
vii. Refer to Section 12, Building Automation System, for related monitoring requirements.
viii. Refer to Section 14, Horticulture and Irrigation, Practices, for irrigation related requirements.

3.3. **Integrated Design Principles:**

a). Project teams shall employ comprehensive, integrated strategies for all projects. Incorporate into planning and evaluations as described in ASHRAE 189.1 Appendix F.

b). AOC staff and contractors shall use a collaborative, integrated project team in all stages of project planning and delivery. The Project Team shall work in concert with jurisdictional partners and the community. The Project Team shall be aware of the AOC's sustainable design goals and requirements and shall establish performance goals for project siting, energy and water conservation, materials, and building health and wellness. The team shall consider the entire life cycle of the building, including deconstruction.

3.4. **Energy Analysis:**

a). The Energy Analysis describes how a project complies with the AOC's energy conservation performance requirements. It identifies the strategy or compliance path taken by the team and the code or ASHRAE standard used for design. Complete an Energy Analysis that represents the entire project as applicable to the scope of the project work. The Energy Analysis may be in one of the formats below. Other formats may be used if approved in advance by the AOC-Energy and Sustainability Branch (ESB).

b). COMcheck.
c). DOE2-based energy modeling software, using Form EN1 for reporting results to the AOC-ESB.
d). Applicability of an energy analysis may be determined on a project by project basis. Develop supporting justification for any project that does not require an energy analysis.

3.5. **Life Cycle Cost Analysis:**
a). Life-cycle cost-effectiveness (LCCE) applies to this entire section unless otherwise stated. In addition to energy, water and renewables, LCCE may be applied to other materials, and building construction types. The purpose of the LCCE is to deliver buildings that meet mission needs at the lowest total ownership cost.

3.6. **Metering:**
a). Coordinate with AOC for all service side utility meter(s) installation(s) serving the building or sub-system (e.g., steam, chilled water, electricity, natural gas, fuel oil, etc.) in the standard units of the measure. Meters must be connected to utility monitoring and building automation system using the installation's advanced metering protocols. The consultant/contractor shall work closely with the AOC for specific requirements.
b). **Building Sub-metering:** At a minimum, high energy intensive building uses such as data centers, fountains and food service operations shall be sub-metered to measure all relevant energy usages. All other sub-system requirements shall be reviewed with the AOC for specific requirements.

3.7. **Commissioning:**
a). Meet the requirements of section 1.2.2 Commissioning, which includes ANSI/ASHRAE/USGBC/IES Standard 189.1 Section 10.3.1.2 Building Project Commissioning.
b). Commissioning activities shall be coordinated with AOC-ESB, in accordance with AOC Commissioning Guidelines, AOC Order 28-11.
c). The Project Team shall employ commissioning practices tailored to the size and complexity of the building and system components to verify performance and to ensure that sustainable design requirements are met.

3.8. **Extreme Weather Risk:**
a). Evaluate the vulnerability of the project or building's (as applicable) infrastructure to the anticipated impacts of extreme weather and identify and implement strategies to make it more resilient. All projects shall provide design solutions responsive to the AOC's or other Government-provided projections of extreme weather risks.

3.9. **Federal Laws and Statutes:**
a). The AOC requires compliance with federal laws and regulations, including those that affect certain areas of sustainable building design and operation. These laws include:
  i. Energy Policy Act (EPAct) of 2005.
  ii. The Energy Independence and Securities Act of 2007 (EISA).
  iii. Resource Conservation and Recovery Act of 1976 (42 U.S.C. 6962) as amended.
  iv. Clean Water Act 33 U.S.C. §1251 et seq. (1972).

3.10. **Sustainability Scorecards and Guidance:**
a). All projects shall develop a Sustainability Scorecard to document sustainability and energy conservation project goals.
  i. Sustainability scorecard shall be approved in advance by AOC-ESB.

3.11. **Policy:**
a). The AOC is fully committed to good stewardship through sustainable business practices while accomplishing its mission of preserving, maintaining, and enhancing the national treasures entrusted in its care. For further information, see the Resource Conservation Policy Statement, a memorandum signed September 8, 2009, by the Architect of the Capitol.
b). Order 37-1 Preservation Policy and Standards, latest edition.
c). Order 28-11 Commissioning Guidelines, latest edition.
d). Environmental Manual 12-4, Chapter 2: Recycling and Environmentally Preferable Purchasing and Chapter 8: Erosion and Sediment Control and Stormwater Permitting.
e). Environmental Program Plan Fiscal Year 2017- 2021.
f). Order 7-4 Information Technology Security.

g). PM 28-2 Energy Reduction and Sustainability Program.
h). PM 28-3 PM 28-3 Energy and Sustainability Policy and Standards Fiscal Years 2017-2021.
i). Resource Conservation Policy Statement (September 2009).

3.12. **Design Requirements:**

3.12.1. **Site Planning:**

j). **Site Selection:** The Project Team shall avoid locating projects at inappropriate sites in order to reduce the environmental impact of building on a site. New construction and major renovation/rehabilitation projects shall consider minimizing development footprint and/or maintain existing open space to the greatest extent possible. A "public amenity" space evaluation shall be included as a part of the project implementation process.
k). **Stormwater:** Comply with all applicable federal/state/local regulations and AOC Policy requirements (AOC Environmental Manual 12-4, chapter 8) for stormwater runoff.
l). During the planning phase of a building design, an erosion and sediment control plan and a stormwater management plan shall be developed to control the quality and quantity of site stormwater runoff when required by regulation.
m). The plan shall provide strategies to reduce or eliminate pollution and decrease the amount of site stormwater runoff. The plan shall comply with all applicable federal, state, local and AOC Policy requirements (AOC Environmental Manual 12-4, chapter 13) for stormwater runoff.
n). Meet the requirements of ANSI/ASHRAE/USGBC/IES Standard 189.1 Section 5.3.7.2 Bicycle Parking.
o). Meet the requirements of ANSI/ASHRAE/USGBC/IES Standard 189.1 Section 5.3.7.3 Site Vehicle Provisions, to incorporate requirements and preferred parking for efficient vehicles, when project scope allows.
p). Consider non-roof heat island measures such as:
  i. Limited impervious landscaped areas on site.
  ii. Encouraging design teams to specify hardscape materials with an SRI of at least 29.
  iii. Using an open-grid pavement systems and underground parking wherever possible.
q). **Rainwater and Condensate Harvesting:** Design shall consider incorporating rainwater and/or condensate harvesting systems. The designer shall analyze building location, climate, and average rainfall to determine feasibility.

3.12.2. **Water Use Efficiency:**

a). **Indoor Water:** During the design phase, considerations shall be made to reduce the demand for domestic water, and where possible, reuse and recycle process water. Implement Federal Energy Management Program (FEMP) Best Management Practices. See Section 10, Plumbing, for further information.
  i. Any systems or appliances not covered under Section 10, Plumbing, refer to the requirements of ASHRAE 189.1 Section 6.3.21 (Mandatory Provisions: Building Water Use Reduction Plumbing Fixtures and Fittings and 6.3.2.2 Appliances).
b). Consider the reuse of greywater for non-potable applications such as toilet and urinal flushing and custodial uses:
  i. Cooling towers and food service, meet the requirements of ASHRAE 189.1 Section 6.3.2.3, 6.4.2 (Building Water Use Reduction).
  ii. Avoid water-cooled refrigeration.
c). **Water Metering:** Meet the requirements of ASHRAE 189.1: Section 6.3.3 (Mandatory Provisions: Water Consumption Measurement):
  i. **Building Level Meters:** Building level water meters shall be installed on new buildings and included on major renovations. Buildings shall meter both indoor and outdoor water and, where possible, shall sub-meter any processes that use a large amount of water. All irrigation, fountain, and cooling tower water uses shall be sub-metered to allow for sewer charge deductions.
  ii. Refer to section 12 - Building Automation System, for additional requirements.

d). **Outdoor Water:**

i. For new construction, at minimum, limit potable irrigation water use by 50 percent compared to the conventional methods. For new or major improvements to irrigation systems, meet the requirements of ASHRAE 189.1: Section 6.3.1 (Mandatory Provisions: Site Water Use Reduction) and either Section 6.4.1 (Prescriptive Option: Site Water Use Reduction) or Section 6.5.1 (Performance Option: Site Water Use Reduction). These requirements shall not conflict with the jurisdictions required best practices or prohibit a jurisdiction from achieving their mission.

ii. For existing systems, if a building has a single water meter, reduce indoor and outdoor potable water use combined by at least 20 percent compared to building water use in 2007.

iii. Show preference for irrigation contractors who are certified through a WaterSense labeled program or other industry-recognized credentialing programs.

iv. Consider alternative water sources, such as harvested rainwater, treated wastewater, air handler condensate capture, grey water, and reclaimed water.

v. Meet the requirements of ASHRAE 189.1 Section 6.4.3 (Special Water Features), when system improvements are made.

vi. Avoid once-through fountain features.

3.12.3. **Energy Performance:**

a). **Energy Conservation:** Design shall prioritize energy optimization and building performance to the greatest extent possible in order to support achievement of AOC's overall energy reduction targets. Complete an Energy Analysis or energy model that describes how a project complies.

b). For new construction and building renewals, meet the requirements of ANSI/ASHRAE/USGBC/IES Standard ASHRAE 189.1 Section 7.3.1 General Mandatory Provisions. Establish a whole building energy performance target taking into account the intended use, occupancy, operations, plug loads, other energy demands.

c). For existing buildings and interior renovations, meet one of the following requirements:

i. Design shall achieve ASHRAE 90.1 – 2010 if life-cycle effective.

ii. During the design phase, the Project Team shall establish a whole building energy performance target taking into account the intended use, occupancy, operations, plug loads, other energy demands.

d). Design shall use high-quality energy-efficient lighting system and the appropriate level of controls. In addition, design shall use occupancy sensors in publicly used areas, such as conference rooms, training rooms and restrooms.

e). **Additional energy savings opportunities:**

i. Window systems

ii. Additional wall insulation

iii. Additional roof insulation and reflectance

iv. Waste energy recovery

f). **Renewable Energy:** Design shall evaluate all available on-site renewable energy options and implement where feasible and cost-effective. Options evaluated may include:

i. Passive Solar Heating

ii. Wind

iii. Photovoltaic

iv. Geothermal and Groundwater Cooling

v. Biomass

vi. Solar Hot Water

g). **Ozone Depleting Substances:**

i. Meet the requirements of ASHRAE 189.1 Section 9.3.3 (Refrigerants), if equipment or systems using ozone-depleting substances are included in the project. Do not use ozone-depleting substances (ODS) or high Global Warming Potential (GWP) chemicals where EPAs Significant New Alternative Policy (SNAP) has identified acceptable substitutes or where other environmentally preferable products are available for use in construction, repair or end-of-life replacements: www.epa.gov/snap. Chillers at the Capitol Power Plant shall be reviewed on a case by case basis for compliance with these provisions.

h). **Exceptions:** fire protection system requirements.

3.12.4. **Health and Wellness:**

a). **Acoustics:** Design shall ensure that appropriate indoor ambient noise levels are achieved in 80 percent of office areas. See the AOC's Existing Building Sustainable Guidelines and Resource Guide (2013), for further information.

b). **Air Quality:** Design shall use for guidance the minimum outdoor air ventilation rates as described in IMC 2009.

c). **Air Quality During Construction:** The Project Team shall develop and follow a Construction Indoor Air Quality (IAQ) Management Plan during the construction/rehabilitation process to protect indoor air quality. The plan shall meet or exceed the Sheet Metal and Air Conditioning Contractor's Association (SMACNA) Indoor Air Quality (IAQ) Guidelines for Occupied Buildings Under Construction, 1995, Chapter 3.

d). After construction and prior to occupancy, the Project Team shall conduct a minimum 72-hour flush-out with maximum outdoor air consistent with achieving relative humidity no greater than 60 percent. After occupancy, the maintenance staff shall continue to flush out as necessary to prevent exposure of new building materials to contaminants. Applicability or duration of a project flush may be determined on a project by project basis. Develop supporting justification for a modified length or for any project that does not require a minimum 72-hour flush-out.

e). **Daylighting:** Design shall optimize daylighting potential in regularly occupied spaces. Design elements include but are not limited:

i. Exterior Shading and Control Devices
ii. Window Glazing
iii. Reflectance of Room Surfaces
iv. Integrated Lighting Controls
v. Open office perimeter uses
vi. Use of low partitions
vii. Interior glazed partitions

f). **Thermal Comfort:** Design shall meet or exceed ASHRAE Standard 55-2004, Thermal Environmental Conditions for Human Occupancy, including continuous humidity control within established ranges per climate zone. Where possible design shall provide for individual thermal control. See Section 9, Mechanical and HVAC, for further information.

g). **Views:** Design shall optimize views in all buildings in coordination with acoustics, security and historic preservation requirements. Design shall locate offices on the interior with open plan work areas on the exterior. Design shall provide lower partition heights at interior open-plan work areas. Where possible, vision preserving blinds and increase vision glazing shall be implemented.

h). **Toxin Elimination:** Environmentally Preferable Products shall be evaluated for use. As applicable to the project budget, the designer shall select these products when they meet cost, performance, and availability expectations:

i. **Building Materials:** Design shall specify all building materials as Environmentally Preferable Products where possible. When developing project specifications, the designer shall consider a broad range of factors including waste prevention, recyclability, the use of recycled content, environmentally preferable and biobased products, low VOC, low formaldehyde, life-cycle cost and ultimate disposal. Only compliant refrigerants shall be specified for HVAC systems. Refrigerants containing Ozone Depleting Substances (ODSs) shall be phased out in renovation/rehabilitation projects.

ii. **Construction Materials:** Design shall specify all construction materials as Environmentally Preferable Products where possible. Projects shall follow AOC Construction IAQ Management Plan.

iii. **Furniture and Carpet**: Office systems, lounge, public area, furniture, etc. shall be BIFMA level 1 (or higher) certified (this requirement does not supersede existing furniture and interior finish standards required by a particular jurisdiction or building). Unique, antique or period pieces are excepted. Carpet, carpet adhesive, and carpet cushion shall comply with CRI Green Label or Green Label Plus standards and be certified to NSF/ANSI 140 at the silver or above level. Exceptions may include woven Axminster or Wilton carpets.

i). Environmentally Preferable is defined by the EPA as “products or services that have a lesser or reduced effect on human health and the environment when compared with competing products or services that serve the same purpose." For more information on Environmentally Preferable Products, see EPA’s Comprehensive Procurement Guidelines and Environmentally Preferable Purchasing (EPP) Program.

j). Promote opportunities for occupants to voluntarily increase physical movement such as making stairwells a desirable option for circulation and active workstations wherever possible.

3.12.5. **Environmental Impact of Materials**

a). **Construction:** All new construction projects shall specify maximum use of materials that are Environmentally Preferable Products (EPP). If an EPP is available for an application and the Designer chooses not to use it, an explanation shall be provided. Historic preservation, safety and security requirements should be considered in relation to meeting this goal:

i. **Recycled Content:** The Resource Conservation and Recovery Act requires agencies to buy recycled content products designated by the EPA (EPA Comprehensive Procurement Guidelines 40 CFR part 247). For EPA designated materials, use products meeting or exceeding EPA’s recycled content requirements. For other products, design shall use materials with recycled content, such that the sum of post-consumer content constitutes at least 10 percent of the total value of the materials of the project. The designer shall select these products where available and when they meet cost and performance availability expectations.

ii. **Regional Materials:** To the extent possible, design shall specify that project materials shall be extracted, processed, and manufactured within 500 miles of the project site. Furniture may be included in this requirement.

iii. **Biobased Materials:** For US Department of Agriculture (USDA) designated products, design shall specify materials meeting or exceeding USDA’s Biobased Content requirements (refer to 7 CFR part 3201). For all other products, design shall use Biobased Materials made from rapidly renewable resources and certified sustainable wood. All wood must be specified as Forest Stewardship Council (FSC)-certified. As applicable to the project budget, the designer shall select these products when they meet cost, performance and availability expectations.

b). **Construction Waste:** A construction waste management system shall be followed for all projects:

i. During the planning stage, the designer shall identify recycling and salvage operations able to process site-related construction and demolition materials.

ii. Incorporate appropriate specifications as required.

iii. Construction waste system shall be approved in advance by AOC-ESB.

3.13. **Restrictions:**

a). No building material, component, equipment or furnishing shall be removed or disposed of without the written approval of AOC.

4. **Security**

4.1. **Introduction and General Provisions**

a). **Purpose:** The primary security focus is preservation of life, followed by survivability of buildings, critical systems and equipment. The AOC reserves the authority to prescribe security elements and components.

b). **General:** The AOC, the Office of Security Programs and the Office of Safety, Fire and Environmental Programs (SFEP) shall be consulted for all decisions that relate to security and safety planning, design and mitigation measures. All critical information and items concerning site, structure, entrances, interiors, security, equipment and systems will be coordinated through the AOC and the Office of Security Programs, who will coordinate with the U.S. Capitol Police.

c). The security design and implementation requirements identified within this section impact all architectural and engineering elements for project design, especially as it pertains to:

i. Boundary Perimeters
ii. Approach Control
iii. Interior Site
iv. Facility Access Control
v. Building Exterior
vi. Building Interior
vii. Vital Structural and Non-Structural Systems
viii. Temporary Construction Facilities

d). During the review of each project, specific security requirements will be assessed and addressed. At that time additional security requirements, beyond those identified in this document, may be required.

4.2. **Design Standards:**

a). Excellence shall be the goal in the security design of AOC projects. Each building system, integrative functional element or other component shall support risk mitigation and reduce the probability of casualties, property damage and loss of critical building functions.

b). Structural design must be developed to meet the design basis threats (DBT), and address the appropriate combination of relevant threats with corresponding loading conditions and structural behavior and performance.

c). The design shall consider post-incident conditions to ensure effective rescue operations. All such operations include two important features:

i. Evacuation of occupants
ii. Protection of unaffected areas

d). Safe havens or refuge areas, which are fully enclosed structures designed to resist the effects of blast loads and the impact of fragments and debris due to an explosive event, must be a consideration in the design of all AOC buildings. These areas should be designed to fulfill dual roles:

i. Support normal activities
ii. Act as a safe area in an emergency

4.3. **Historic Preservation:**

a). Security design development for AOC projects shall incorporate a planned protection strategy approach with effective physical security, defensive architecture, protective design, and electronic security and control mitigation measures that complement the historic significance of each building throughout the design process. Consult Section 2, HISTORIC PRESERVATION, for further information regarding preservation of Heritage Assets.

4.4. **Access:**

a). All Contractors that enter or leave United States Government property will comply with the current version of *AOC* 52.223-5 *Special Security Requirements – Services,* which describes operational security procedures. The AOC Procurement is the document owner.

4.5. **Restrictions:**

a). Do not use powder-actuated fasteners to anchor ceilings without AOC and USCP authorization.

5. **Superstructure**

5.1. **Introduction and General Provisions**

a). **Purpose:** This Section establishes the minimum structural design standards and criteria for AOC's facilities, and shall be applicable for new buildings, additions, renovations, repairs and alterations, modernizations, lease construction, and facility condition assessments. It is standards referenced herein as well as the program requirements for each individual project. If conflicts exist between any of the standards and/or the specific program and project requirements, contact the AOC Project Manager for resolution.

b). **General:** The AOC's facilities are designed for longer service lives than similar private-sector buildings. Additionally, facilities under the jurisdiction of the AOC will typically be subject to multiple renovations/rehabilitations during their lives and as such shall have suitable allowances made for differing partition configurations wherever practicable.

c). **Limitations on Structural Systems:** Acquire prior review and approval by AOC's Project Manager for structural systems such as post-tensioned concrete, precast concrete vertical framing systems, shored construction systems, and wood structural systems, as well as cambered systems, due to the need and/or desire for both longevity as well as flexibility.

d). **Conformance to Program:** At each stage of the project the design team must review compliance with requirements of the program, provisions contained in this Section, and the relevant Codes and Standards to guard against unplanned expansion of the program because of design and engineering choices.

e). **Vertical References to be included on the Documents:** Designer shall show elevations for top of beams and slabs, top and bottom of columns, and top or bottom of footings or other foundation elements.

f). **Lateral Drift:** Generally, design shall limit building lateral deflection to H/500 unless materials and/or AOC's Project Manager indicate otherwise.

g). **Vertical Deflection Limits:** Generally, design shall limit vertical deflections to the criteria contained in the Code and other standards referenced in the Section. More restrictive deflection limits, if required, will be included in the program requirements and/or will be indicated by the AOC's Project Manager.

h). **As-Built Drawings and Campus Surveys:** Confer with AOC's Project Manager to determine if as-built drawings and specifications, campus surveys, property descriptions, and geotechnical reports are available for the intended project site.

i. The design team shall determine, confirm and/or investigate for the presence of existing buried structures and/or tunnels and other buried utilities as part of the due diligence for the given project.

i). **Durability and Corrosion Protection:** Corrosion has been and continues to be a concern for AOC facilities. The designer shall identify, as well as indicate, measures that will adequately address this concern:

i. **All structures:** subject to salt runoff from streets and parking surfaces shall be protected against salt-induced corrosion including splash zones of all vertical surfaces.

ii. **Steel deck:** shall have a galvanized coating of not less than G90

iii. **Concrete Durability:** Designs should incorporate the most recent ACI recommendations for concrete durability for the concrete exposure, such as minimum concrete strengths, maximum water-cement ratios, target air content requirements, and limits on cementitious materials.

iv. **Limitations**: No active corrosion mitigation systems will be allowed without prior review and approval by AOC's Project Manager.

5.2. **Related Sections:**

a). Other Sections that contain important information that may affect the structural design, or may require structural design as part of their implementation, include, but are limited to:

i. Refer to Section 1, General Requirements.

ii. Consult Section 2, Historic Preservation, and the HPO for further information regarding preservation of Heritage Assets.

iii. Refer to Section 6, Shell.

iv. Refer to Section 8, Fire Protection and Life Safety, for fireproofing and firestopping requirements and fire suppression systems. Design shall use fire ratings of structural members and floor slabs in compliance with the International Building Code (IBC). Although the fire suppression system(s) are covered under Section 8, Fire Protection and Life Safety, it is the Structural Engineer of Record's responsibility to ensure that any and all loads imparted by the fire suppression systems to the superstructure have been properly identified and addressed (i.e., gravity, thrust, etc.).

5.3. **Structural Design Standards:**

a). The standards to be used as the basis for design reviews and approvals are listed in Section 1, General Requirements, 1.5 Regulatory Requirements. Any standard specifically referenced by the AOC Design Standards shall be considered mandatory.

5.4. **Security / Anti-Terrorism Force Protection (ATFP) / Progressive Collapse:**

a). **Progressive Collapse:** Generally, the structure of the building must not be subject to progressive collapse. The failure of a beam or slab shall not result in the failure of the structural system below or in adjacent bays. In case of column failure, the damage shall be limited to the bays supported by that column. Additional, more specific requirements would be included in the program requirements and/or will be indicated by the AOC's Project Manager.

b). **Security and ATFP:** Design requirements, if any, will be included in the program requirements and/or will be indicated by the AOC's Project Manager.

5.5. **Design Live Loads:**

a). Because of the long service life of AOC buildings, functions will often change numerous times over the life of the building. To allow for these changes of use, irrespective of code requirements, floor systems shall be designed to accommodate the following live loads and be evaluated for concentrated loads, like security safes, battery systems, and space saver filing systems:

Occupancy	Minimum Live Load
Office Areas & Light Storage	125 lbs./sq.ft.
Corridors	150 lbs./sq.ft.
Corridors within Suites	Same as office areas. (Note: this does not apply to existing stairs)
Assembly Areas	150 lbs./sq.ft.
Loading Docks, Heavy Storage and Service Areas	250 lbs./sq.ft.
Mechanical Systems Areas (exclusive of equipment)	150 lbs./sq.ft.
Raised Flooring (Access Flooring)	250 lbs./sq.ft. & 2,000 lb. point load.
Stairways	100 lbs./sq.ft.
Roofs	30 lbs./sq.ft.

b). For occupancy uses not defined in the above Occupancy Table, designs shall consider building code live loads to be minimums and adjust upward in conformance with program requirements. If there is any doubt regarding the required design Live Loads, confer with the AOC Project Manager.

c). For buildings having plaza or terrace areas where there is a possibility of large trucks, emergency vehicles, or similar vehicles larger than a standard passenger vehicle, the design loads for these types of vehicles shall be provided for in the design. Consult the project program requirements and/or confer with the AOC Project Manager for specifics of these vehicular loads.

d). Live Load reduction, in accordance with the Code, is permitted. However, in addition to the limitations contained in the Code do not use Live Load reduction on the following:

e). Horizontal framing members.

f). Transfer girders supporting columns.

g). Columns or walls supporting the roof/top-most floor level

h). Subterranean structures, or those portions of structures that occur below finished grade, shall be designed for the anticipated soil surcharge and the live loads defined in the program requirements. Both the soil surcharge load and live load shall be listed on the design

documents. Subject to more specific loadings contained in the program requirements, minimum live loads at lightly landscaped areas shall be 350 psf and at roadway areas shall be 750 psf.

5.5.1. **Floor Vibrations:**

a). American Institute of Steel Construction (AISC) Design Guide 11 shall be the primary reference for design for vibrations.

b). The baseline for floor design will be "Office" acceleration limits, walking induced vibrations.

c). Higher performance levels, such as laboratories and other sensitive instrument areas, will be included in the program requirements and/or will be indicated by the AOC's Project Manager.

d). Consultation with a Vibration analysis consultant, if determined to be necessary, shall be included in the design team.

e). The design should consider the proposed use of the space and possible future uses.

f). Particular attention shall be paid by the designer to vibrations for monumental linear stairs and pedestrian bridges.

5.6. **Design Snow and Wind Loads:**

a). **Design Snow Load:** Design for snow loads shall be per the referenced standards. Consistent with the Code, existing structures not directly part of the program requirements, but affected by drifting or sliding snow loads caused by work pertaining to the program requirements, shall be evaluated by the design team for the new snow loads. Unless otherwise modified by project program requirements and/or the AOC Project Manager, ground snow loads shall be:

i. Metro DC Area: 25 psf

ii. Culpepper, VA: 30 psf

b). **Design Wind Load:** Design for wind loads shall be per the referenced standards. Note: consistent with the IBC Code, conversion to "ASD" wind speeds shall not be used in design unless it is illustrated that the exceptions contained in the IBC Code are met.

c). **Building Occupancy Risk Categories:** The ASCE- 7 Building Occupancy Risk Categories can be found in the table on the following pages.

5.7. **Seismic Design Parameters**

a). Seismic design shall be per the referenced standards.

b). **Seismic Design Parameters:** Basic seismic design parameters, as derived from ASCE-7, can be found in the table on the following pages.

c). The seismic performance level for all AOC facilities is Life Safety. Higher seismic performance levels are determined by the AOC Project Manager as required by the project.

d). **Seismic Upgrades:** Numerous AOC facilities may need seismic upgrades. Unless specifically called for in the program requirements or by the AOC Project Manager, the IEBC shall be used to determine the threshold for triggering the need for seismic upgrades.

e). **Seismic Evaluations:** ASCE 41, cited in the referenced standards, shall be used for Evaluation Reports.

Table 5.7-1 ASCE 7 / IBC Design Parameters for AOC Facilities

Building	Mapped Acceleration Parameter		Risk Category	Site Class	Seismic Importance Factor	Site Coefficient		Seismic Design Category	Spectral Response Acceleration Parameters	
	Ss	S1			I	Fa	Fv		SDS	SD1
Capitol	0.150	0.051	III	D	1.25	1.6	2.4	B	0.160	0.082
Cannon House Office Building	0.150	0.051	III	C	1.25	0.8	0.8	A	0.08	0.027
Longworth HOB	0.150	0.051	III	D	1.25	1.6	2.4	B	0.160	0.082
Rayburn HOB	0.150	0.051	III	D	1.25	1.6	2.4	B	0.160	0.082
Ford HOB	0.150	0.051	II	D	1.00	1.6	2.4	B	0.160	0.082
O'Neil HOB	0.150	0.051	II	D	1.00	1.6	2.4	B	0.160	0.082
House Page Dormitory	0.150	0.051	II	D	1.00	1.6	2.4	B	0.160	0.082
House Underground Garage	0.150	0.051	II	D	1.00	1.6	2.4	B	0.160	0.082
Russell Senate Office Building	0.150	0.051	III	D	1.25	1.6	2.4	B	0.160	0.082
Dirksen SOB	0.150	0.051	III	D	1.25	1.6	2.4	B	0.160	0.082
Hart SOB	0.150	0.051	III	D	1.25	1.6	2.4	B	0.160	0.082
Webster Hall	0.150	0.051	II	D	1.00	1.6	2.4	B	0.160	0.082
Senate Child Care	0.150	0.051	II	D	1.00	1.6	2.4	B	0.160	0.082
Senate Underground Garage	0.150	0.051	II	D	1.00	1.6	2.4	B	0.160	0.082
Senate Storage Facility, DC Village	0.150	0.051	II	D	1.00	1.6	2.4	B	0.160	0.082
Landover Mail Facility	0.150	0.051	II	D	1.00	1.6	2.4	B	0.160	0.082
Library of Congress Jefferson Building	0.150	0.051	III	D	1.25	1.6	2.4	B	0.160	0.082
LC John Adams Building	0.150	0.051	II	D	1.00	1.6	2.4	B	0.160	0.082
LC James Madison	0.150	0.051	III	D	1.25	1.6	2.4	B	0.160	0.082

Building	Mapped Acceleration Parameter		Risk Category	Site Class	Seismic Importance Factor I	Site Coefficient		Seismic Design Category	Spectral Response Acceleration Parameters	
	Ss	S1				Fa	Fv		SDS	SD1
Memorial Building										
LC Book Storage Facility, Ft. Meade, MD	0.150	0.051	II	D	1.00	1.6	2.4	B	0.160	0.082
LC Packard Campus, Culpeper, VA	0.195	0.059	II	D	1.00	1.6	2.4	B	0.208	0.094
LC Residential Scholars Center/Child Care Center	0.150	0.051	III	D	1.25	1.6	2.4	B	0.160	0.082
Botanic Garden (BG) Administration Building	0.150	0.051	II	D	1.00	1.6	2.4	B	0.160	0.082
BG Conservatory	0.150	0.051	III	D	1.25	1.6	2.4	B	0.160	0.082
BG Production Facility	0.150	0.051	II	D	1.00	1.6	2.4	B	0.160	0.082
Capitol Power Plant Administration Building	0.150	0.051	III	D	1.25	1.6	2.4	B	0.160	0.082
CPP Boiler House	0.150	0.051	IV	D	1.50	1.6	2.4	C	0.160	0.082
CPP Cogeneration Building	0.150	0.051	IV	D	1.5	1.6	2.4	C	0.160	0.082
CPP West Refrigeration Plant	0.150	0.051	IV	D	1.50	1.6	2.4	C	0.160	0.082
Capitol Police Headquarters	0.150	0.051	IV	D	1.50	1.6	2.4	C	0.160	0.082
Alternate Computing Facility, Manassas, VA	0.126	0.053	IV	C	1.50	1.2	1.7	A	0.100	0.060
U. S. Supreme Court	0.150	0.051	III	D	1.50	1.6	2.4	B	0.160	0.082

Building	Mapped Acceleration Parameter		Risk Category	Site Class	Seismic Importance Factor I	Site Coefficient		Seismic Design Category	Spectral Response Acceleration Parameters	
	Ss	S1				Fa	Fv		SDS	SD1
Thurgood Marshall Building	0.150	0.051	II	D	1.00	1.6	2.4	B	0.160	0.082

5.8. **Foundations:**

a). **Protection of Adjoining Property:** As AOC construction sites become increasingly restricted by their adjacency to existing adjoining and historic facilities, increased consideration must be devoted to the protection of adjoining property and/or buildings. All designs shall minimize, if not completely limit, any disturbance(s) to adjacent properties and/or buildings.

b). Prior to beginning work, the designer shall confer with AOC's Project Manager for the availability of a property description (i.e., campus survey) and need to monitor any adjoining buildings:

i. **Footings Outside of Property Lines:** In most cases, the streets directly adjacent to AOC Facilities fall under the jurisdiction of the AOC. It is a general rule that new footings should not project beyond property lines. As such, any deviations will require prior review and approval by AOC's Project Manager.

ii. **Frost Protection:** For projects in the District of Columbia and except where otherwise protected from frost, footings, foundation walls, piers, and other permanent supports of all buildings and structures shall extend a minimum depth below adjacent grade of 2 feet 6 inches.

iii. **Sheeting, Shoring and Underpinning:** The designer shall prepare Construction Documents clearly to place responsibility for protection of banks of excavation or adjoining buildings with the construction contractor and not the Government. Excavation support systems may not be abandoned in-place without prior review and approval by the AOC.

c). **Ground Water Control:** Designers shall make every reasonable effort to design foundation systems so that positive removal of hydrostatic loads may be achieved without the use of sumps and/or pumping. Deviations require prior review and approval by the AOC's Project Manager. The designer shall coordinate draining of ground water and shall seek approval from AOC's Civil Engineer.

d). **Buried Structures:** The designer shall waterproof all buried structures. Proposed waterproofing measures shall be reviewed and approved by the AOC's Project Manager.

e). **Resource Management:**

i. **Steel Reinforcing & Chairs/Bolsters:** Design shall provide reinforcing steel meeting the minimum requirements for post-consumer as well as pre-consumer recycled content.

ii. **Mix Design:** To the extent consistent with required design strengths, design shall optimize the use of fly-ash (i.e., no more than 25 percent), blended hydraulic cement, and/or slag cement in specified mix designs. The total cement substitutes shall not exceed 25 percent of cementitious content of this mix. Although permitted, the designer shall confirm availability, as well as cost, if fly-ash is to be used. Also, note that any proposed use of silica fume will require prior review and approval by AOC's Project Manager.

iii. **Curing Compounds:** Design shall utilize non-staining, water-based (i.e., low VOC) curing compounds.

iv. **Waste Concrete:** The designer shall confer with the AOC's Project Manager to determine if it is acceptable and/or feasible for waste concrete to be crushed and re-used as fill or as a base course. If not, waste concrete shall be recycled or disposed of in accordance with applicable

federal, state and local laws and regulations.

5.8.1. **Standard Foundations:**

a). Historically, the standard or typical foundation system utilized by the majority of AOC facilities has been spread footings.

5.8.2. **Special Foundations:**

a). The need for special foundation systems other than spread footings may be required, if due diligence identifies the presence of buried structures and/or tunnels and the Project Geotechnical Report identifies subsurface conditions that would make spread footings infeasible. In such cases, the designer shall confer with the AOC Project Manager to discuss possible restrictions, limitations, parameters, expectations, etc., associated with the special foundation system being proposed and its potential impact to the existing in-situ buried structures and/or tunnels.

5.8.3. **Slabs-on-Ground:**

a). **Concrete Slabs-on-Ground:** Minimum concrete compressive strength (f'c=4,000 psi @ 28 days).

i. **Welded Wire Reinforcement (WWR):** Only properly supported flat mats are permitted.

ii. **Reinforcing bars and/or WWR:** Do not place closer than one inch from top finished surface of concrete slab.

iii. **Fiber Reinforcing:** Although not precluded from use, fiber reinforcing will require prior review and approval by the AOC's Project Manager. Its use in ultra-flat floors is strictly prohibited.

iv. **Finish:** Concrete finishes shall be reviewed and approved by the AOC's Project Manager. It should be noted that the preferred finish is float finish; however, historical and/or other design criteria may dictate another finish (i.e., an exposed aggregate finish).

v. **Broom Finish:** If broomed finishes are indicated (i.e., light, medium or heavy), then construction documents shall indicate direction.

b). **Concrete Crack Control:** Design shall make provisions for crack control and tool control joints whenever possible. Employ the following methods, alone or in combination, according to the severity of the condition:

i. Epoxy-coated reinforcing bars/WWR
ii. Concrete surface sealers
iii. Corrosion-inhibiting concrete additives
iv. Water/cement ratio limits
v. Wet curing methods
vi. Tooling of control joints is preferred over saw cutting

c). **Concrete Elements in Parking Structures:** Design shall protect the concrete in parking structures or below building levels by using corrosion-inhibiting additives. Design shall use epoxy-coated reinforcing bars for the top bars of the concrete beam and slab construction and the stirrups of beams and spandrel beams. Parking garage decks shall be adequately sloped and connected to the structures' drainage system.

d). **Resource Management:**

i. **Steel Reinforcing & Chairs/Bolsters:** Design shall provide reinforcing steel meeting the minimum requirements for post-consumer as well as pre-consumer recycled content, in compliance with the requirements of Section 3 – Sustainable Design.

ii. **Mix Design:** To the extent consistent with required design strengths, design shall optimize the use of fly-ash (i.e., no more than 25 percent), blended hydraulic cement, and/or slag cement in specified mix designs. The total cement substitutes shall not exceed 25 percent of cementitious content of this mix. Although permitted, the designer shall confirm availability, as well as cost if fly-ash is to be used. Also, note that any proposed use of silica fume would require prior review and approval by AOC's Project Manager.

iii. **Air Entrainment:** Generally, all concrete permanently exposed to weather should be adequately air-entrained. The AOC acknowledges that adequate air-entrainment may be difficult to achieve when a trowel finish is specified and/or required. If this situation should arise, then it is the designer's responsibility to confer with AOC in order to discuss possible remedial measures, if deemed necessary.

iv. **Curing Compounds:** Design shall utilize non-staining water-based (i.e., low VOC) curing compounds.

v. **Waste Concrete:** The designer shall confer with the AOC Project Manager to determine if is acceptable and/or feasible for waste concrete to be crushed and re-used as fill or as a base course. If not, waste concrete shall be recycled or disposed of in accordance with applicable federal, state and local laws and regulations.

e). **Ultra-Flat Floors:** Due to their very nature along with strict construction and operational tolerances, ultra-flat floors will require consultation with the AOC's Project Manager prior to design. The AOC will discuss structural requirements and expectations, as well as any potential concerns relating to the design, placement and subsequent use of the ultra-flat floor(s) in question. The designer shall provide sufficient evidence indicating experience with similar size projects.

5.9. **Basement Construction:**

a). Basement walls shall be designed so that they can adequately resist and transfer full hydrostatic loads to the superstructure. This approach may seem conservative in light of all the measures being required to insure against hydrostatic loading. However, as indicated above, AOC facilities shall be designed for flexibility, reliability, durability and longevity.

5.10. **Floor Construction**

a). **Concrete Framing Systems:** Cast-In-Place systems are preferred over other concrete framing systems for AOC office facilities.

b). **Concrete:** Design shall make provisions for crack control and employ the following methods, alone or in combination, according to the severity of the condition

i. Reinforcing bars/WWF (epoxy-coated in parking areas and unprotected areas)

ii. Concrete surface sealers

iii. Corrosion-inhibiting concrete additives

iv. Water/cement ratio limits

v. Wet curing methods

c). **Resource Management:**

i. **Steel Reinforcing & Chairs/Bolsters**: Design shall provide reinforcing steel meeting the minimum requirements for post-consumer as well as pre-consumer recycled content, in compliance with the requirements of Section 3 – Sustainable Design.

ii. **Mix Design:** To the extent consistent with required design strengths, design shall optimize the use of fly-ash (i.e., no more than 25 percent), blended hydraulic cement, and/or slag cement in specified mix designs. The total cement substitutes shall not exceed 25 percent of cementitious content of this mix. Although permitted, the designer shall confirm availability, as well as cost, if fly-ash is to be used. Also, note that any proposed use of silica fume will require prior review and approval by AOC's Project Manager.

iii. **Curing Compounds:** Design shall utilize non-staining water-based (i.e., low VOC) curing compounds.

iv. **Concrete Slab Finish Tolerances:** The designer shall measure floor slab finishes in accordance with ASTM El 155 and comply with ACI 117, Standard Specification for Tolerances for Concrete Construction and Materials.

v. **Form-Release Agents:** Design shall utilize colorless, bio-based oil, a minimum of 85 percent soy-based or other bio-based material.

d). **Steel Framing Systems:**

i. **Cambered Composite Beams and Girders:** Cambered composite beams should be considered for beams longer than 30 feet. The camber should equal the deflection calculated for the combined dead load of wet concrete, steel deck, and steel beams. Superimposed dead and live loads should be excluded from the calculation.

ii. **Unshored Composite Beams:** Where unshored construction is used, the additional dead load caused by the increased concrete thickness required to level the slab must be accounted for in the structural design and specification and communicated to the builder.

iii. **Connections:** Show connection details or required reaction loads for all structural steel framing connections.

iv. **Open Web Joist Systems:** Generally, open-web joist floor and roof framing systems have rarely been used and are typically not preferred. This approach may seem conservative. However, as indicated above, AOC facilities shall be designed for flexibility, reliability, durability and longevity. Consult and receive approval from the AOC's Project Manager for use of these systems. If open-web joist framing systems are approved for use, they may not be used for floors or roofs over Mechanical Rooms due to the loads, and need for future flexibility, associated with piping and other suspended MEP items. Structural steel beam framing shall be used at these locations.

5.11. **Special Inspections Schedule:**

a). The design team shall develop special inspection requirements and schedules, consistent with Chapter 17 of the IBC, that pertain to the work contained in the program requirements. The schedule shall not include extraneous inspections that are not pertinent to the work.

5.12. **Restrictions:**

a). Do not drain ground water into sanitary systems.

b). Do not use vapor barriers/vapor retarders under slabs-on-grade in parking structures or under slabs exposed to weather.

c). Saw-cutting of slabs-on-grade shall occur as the final step in the finishing operation. The delay between finishing and saw-cutting shall not exceed one hour.

6. **Shell**

6.1. **Introduction and General Provisions**

a). **Purpose:** This Section establishes the minimum exterior envelope design standards and criteria for AOC's facilities, and shall be applicable for new buildings, additions, renovations, repairs and alterations, modernizations and facility condition assessments. It is the intention for this section to be used in conjunction with the governing standards referenced herein as well as the program requirements for each individual project. If conflicts exist between any of the standards and/or the specific program and project requirements, contact the AOC Project Manager for resolution.

b). **General:** The AOC's facilities are designed for longer service lives than similar private-sector buildings. Additionally, facilities under the jurisdiction of the AOC will typically be subject to multiple renovations/rehabilitations during their lives.

6.2. **Related Sections:**

a). Other Sections that contain important information that may affect elements of this section or their implementation, include, but are not limited:

i. Refer to Section 1, General Requirements.
ii. Refer to Section 5, Superstructure, for structural design criteria.
iii. Consult Section 2, Historic Preservation, and the HPO for further information regarding preservation of Heritage Assets.
iv. Refer to Section 8, Fire Protection and Life Safety, for fireproofing and firestopping requirements and fire suppression systems.

6.3. **Exterior Closure:**

6.3.1. **Envelope Commissioning:**

a). **Envelope Commissioning:** Refer to AOC's commissioning policy, Order 28-11 Commissioning Guidelines (September 2010). Systems to be commissioned include envelope, thermal and moisture protection, and doors and windows. Review envelope design and assemblies for thermal and water integrity, moisture vapor control and assembly life.

6.3.2. **Exterior Walls:**

a). **General:** Exterior walls shall be designed for long life with minimum maintenance in materials consistent with the requirements below. Comply with the following standards:

i. **Brick Masonry:** Technical Notes on Brick Construction, published by Brick Institute of America (BIA).
ii. **Exterior Limestone:** Handbook on Indiana Limestone, published by Indiana Limestone Institute of America.
iii. **Exterior Marble:** Exterior Marble Used in Curtain or Panel Walls, published by Marble Institute of America.
iv. **Granite:** Dimension Stone Design Manual published by Marble Institute of America (MIA) and Building Stone Institute (BSI)
v. **Architectural Precast Concrete:** Architectural Precast Concrete, published by Precast Concrete Institute (PCI).
vi. **Concrete Masonry Units:** As applicable TEK Notes, published by National Concrete Masonry Association (NCMA).
vii. **Minimum U-Factors:** In conformance with specified codes.

b). **Domestic Stone:** Use domestically quarried stone, typically granite, marble, or limestone, reflecting both the permanence and historic character of the United States Congress. Unless otherwise stated, match existing where required.

c). **Support or Temporary Buildings:** For low maintenance materials of life expectancies consistent with the design life of the facility, domestic limestone, precast concrete, or brick masonry is typically used.

d). **Insulation:** Use insulation that is inherently free of wicking and moisture absorption.

i. **Rigid Insulation:** Extruded polystyrene, polyisocyanurate, or XPS, faced as applicable to the installation.
ii. **Fibrous Insulation:** Encapsulate all fiberglass or mineral fiber insulation in foil or plastic covers to limit employee exposure to airborne fibers.
iii. **Semi-Rigid Insulation:** Mineral wool as applicable to the installation.

e). **Parapets:** There shall be no laterally unsupported, unreinforced masonry parapets or cornices above the highest anchorage level.

f). **ATFP Considerations:** Refer to the program requirements and/or consult the AOC's Project Manager to determine if there are any requirements.

g). **Moisture Control:** In masonry or stone cavity walls, ensure that moisture migration to weep holes is assured by use of mortar droppings barriers. Design all horizontal joints between panels, dissimilar materials, or horizontal working joints at shelf lintels and such to ensure positive drainage to the exterior without total dependence on sealants.

h). **Joints:** Design all control, expansion, and joints adjoining doors and windows to shed water without reliance on applied sealants.

i). **Sealants:** Use long-life sealants consistent with required expansion coefficients and materials being joined. Silicone and urethane sealants are preferred at stone and masonry joints maintained by AOC.

j). **Resource Management:**

i. **Mortars:** Design shall optimize use of fly-ash and slag in mortar mix consistent with required design strengths when available.

ii. **Clay and Concrete Masonry Units:** Design shall provide clay and concrete masonry units meeting the minimum requirements for post-consumer as well as pre-consumer recycled content, in compliance with the requirements of Section 3 – Sustainable Design.

6.3.3. **Exterior Stone:**

a). **General:** Principal buildings will normally employ the use of stone finishes. To the extent possible, all stone employed in buildings within the Capitol shall be domestically quarried and finished.

b). Table 6.2.2-1 on the following pages lists the stone used on existing buildings in the Capitol complex, including information on the stone producer/fabricator, stone type, and location.

c). Verify each installation prior to attempting replacement or modification on any surface. Unless directed otherwise, match existing stone for renovations/rehabilitations to existing buildings.

d). Refer to the building preservation guide of each building for additional information not included in this document.

Table 6.2.2-1 Exterior Stone of Existing Buildings

Stone	Source	Type	Location
United States Capitol			
Sandstone	Aquia Quarry, Stafford County, VA	Aquia Creek Sandstone	West Front (painted)
Marble	Lee, MA	Lee White Marble	House and Senate Extensions
Marble	Tate, GA	Cherokee White Marble	Connecting Corridors, East Front, House Extension Pediment
Marble	Cockeysville, MD	White Marble	Balcony and Portico Columns House and Senate Extensions
Marble	Danby, VT	Danby White Marble	Cheek Wall Railings House and Senate Extensions
Granite	Richmond, VA	Grey Granite	West Front
Granite	Woodstock, MD	Grey Granite	West Front
Granite	Stone Mountain, GA	Grey Granite	Building Base and Portico Steps
Granite	Barre, VT	Rocks of Ages Grey	Building Base and Portico Steps
Capitol Visitor Center			
Marble	Blount County, TN	Cedar Tavernelle Marble	Vestibule Base
Sandstone	Boyers and Curwensville, PA	Beige Sandstone	Vestibule Walls
Granite	Rapidan, VA	Jet Mist Grey Granite	Exterior Walls, Base, Stairs, Curbs,
Russell Senate Office Building			
Marble	Danby, Rutland & Proctor, VT	White Marble	All Elevations and Terraces
Marble	Tate, GA	Cherokee White Marble	North elevation
Limeston	Bedford, IN	Buff Limestone	Courtyard Elevations
Granite	Concord, NH	Grey Granite	Building Base and Terraces at the South, East, West and Courtyard

Stone	Source	Type	Location
Granite	Mt Airy, NC	Grey Granite	Building Base North Elevation
Granite	Mt. Waldo, ME	Grey Granite	Building Base, Paving, and Fountain at the Courtyard
Granite	Salisbury, NC	Balfour Pink Granite	Loading Dock, Site Curbing and
Dirksen Senate Office Building			
Marble	Danby, VT	Imperial Danby Marble	Exterior facing on Constitution
Granite	Chelmsford, MA	Chelmsford Grey and White Granite	Entrances Surrounds
Granite	Deer Isle, ME	Deer Island Granite	Building Base
Limeston	Bedford, IN	Buff Limestone	Courtyard Elevations
Hart Senate Office Building			
Marble	Danby, VT	Royal Danby White	Exterior Elevations
Granite	Chelmsford, MA	Chelmsford Grey Granite	Planter Walls
Granite	Mason, TX	Diamond Pearl	Planter Walls, Stairs, Curbs and
Limeston	Bedford, IN	Buff Limestone	Courtyard Elevations
Senate Underground Garage			
Granite	Mt Airy, NC	Grey Granite	Walls, Paving, Curbs
Granite	St. Cloud, MN	Minnesota Pink Granite	Fountain, Walls, Balustrades,
Granite	Isabella, MN	Minnesota Green Granite	Fountain Base
Cannon House Office Building			
Marble	South Dover, NY	Dover White Marble	North and West Elevations
Marble	Ball Grounds, GA	White Marble	South and East Elevations
Granite	North Jay, MA	Grey Granite	Building Base at South Elevation, Curbs and Copings
Limeston	Bloomington, IN	Buff Limestone	Courtyard Elevations
Longworth House Office Building			
Marble	Ball Grounds, GA	White Marble	Building Elevations
Granite	Mt. Desert, MA	Somes Sound Granite	Building Base and Terraces
Limeston	Bloomington, IN	Buff Limestone	Courtyard Elevations
Sandstone	East Branch, NY	Natural Cleft	Terrace Flagging and Paving
Rayburn House Office Building			
Marble	Tate, GA	Cherokee White Marble	East and West Courts
Marble	Proctor, VT	Florence White Marble	East and West Courts
Granite	Marble Falls, TX	Sunset Red Granite	Paving
Granite	Cold Spring, MN	Oxford Gray Granite	Paving
Granite	Redstone, ME	Swenson Pink Granite	Building Base
Granite	Sparta, GA	Davidson Pink	Building Base
Granite	Mt. Desert, ME	Somes Sound Granite	Terrace Walls and Balustrades
Granite	Barre, VT	Regal Gray Granite	Steps, Landings and Borders
Granite	Salisbury, NC	Caroline Pink Granite	Base, Border, Planter Walls, Paving
Limeston	Bedford, IN	Buff Limestone	Courtyard Elevations
Flagstone	Washington, PA East Branch, NY	Flagstone - Natural seam	Steps and Paving at Courtyards
Thomas P. O'Neill House Office Building			
Limeston	Bedford, IN	Buff Limestone	All Elevations
Granite	Unknown	Grey Granite	Building Base
Ford House Office Building			
Limeston	Bedford, IN	Buff Limestone	First Floor All Elevations

Stone	Source	Type	Location
Granite	Concord, NH North Jay, ME	Concord Grey Granite North Jay Granite	Building Base, Curbing, Steps, Paving
East and West Underground Garages			
Granite	Marble Falls, TX Milford, MA	Sunset Red Granite Milford Pink Granite	Split Face Walls
Granite	Redstone, ME Sparta GA	Swenson Pink Granite Sparta (Davison) Pink	Ashlar Walls
Granite	Barre, VT	Regal Grey Granite	Walls, Paving, Steps, Curbs
Granite	Rockville MN Marble Falls, TX	Rockville Granite Cold Spring Red	Fountain and Basin
Granite	Rocklin, CA	Rocklin Gray	Benches
Thomas Jefferson Building, Library of Congress			
Granite	Concord, NH	Swenson Grey Granite	Exterior Elevations, Ramps, Stairs
Granite	Multiple Quarries, MD	Grey Granite	Courtyards Elevations
John Adams Building, Library of Congress			
Marble	Tate, GA	Georgia Cherokee Marble	All Elevations
Granite	Greensboro, NC	North Carolina Pink	Building Base, Moat Walls, Steps
James Madison Memorial Building, Library of Congress			
Marble	Tate, GA	Cherokee white Marble	All Elevations
Marble	Danby, VT	Danby White Marble	Penthouse Walls
Granite	Mason, TX	Diamond Pearl Granite	Building Base, Paving
Granite	Milbank, SD	Dakota Mahogany Granite	Walls, Planters, Pavers
Granite	West Chelmsford, MA	Chelmsford Grey	Curbs
Botanic Garden Conservatory			
Limeston	Bloomington, IN	Buff Limestone	All Elevations
Granite	Greensboro, NC	Pink Granite	Building Base
Flagstone	Crab Orchard, TN	Buff/Orange Flagstone	Terrace Paving
United States Supreme Court			
Marble	Danby, VT	Imperial Danby Marble	All Exterior Elevations
Marble	Tate, GA	Georgia White Marble	Courtyard Elevations
Thurgood Marshall Federal Judiciary Building			
Granite	Chelmsford, MA	Chelmsford Grey Granite	All Exterior Elevations

6.3.4. **Interior and Exterior Balcony Walls and Railings:**

a). **Structural Load Criteria**: Design for loads defined in IBC and ASCE 7 Codes.

b). **Deflection Criteria:** Maximum horizontal and/or vertical deflection shall be limited to 1/4-inch (i.e., the summation of vertical and horizontal deflection).

c). **Metals:** Consistent with project budgets and the historic character of the Capitol complex, the use of decorative bronze and stainless steel metals is encouraged for guardrails and railings. Where possible, use naturally "maintaining" finishes. Restrict the use of lacquered bright brass to internal spaces.

d). **Stone Railings and Balustrades:** Restrict to Principal Buildings.

e). **Applied Finishes:** Avoid color anodized or applied finishes on surfaces subject to "hand contact."

f). **Drains:** Design shall provide "freeze-proof" drains for all enclosed pipe spaces to vent internal spaces.

g). **Service Areas:** Consistent with ADA requirements, design shall use Schedule 40 pipe wherever possible, galvanized with appropriate primers and industrial enamel top coats. In exterior areas, consider Type 304

stainless steel.

h). **Historic Preservation:** Consult Section 2, Historic Preservation, for further information regarding preservation of Heritage Assets.

6.3.5. **Exterior Windows:**

a). **General:** Design shall provide insulated glass units in all new exterior windows unless security requirements mandate other solutions. To the extent practicable, fabricate metal window frames using thermal-break construction.

i. **Historic Windows:** Consistent with security directives for a given project, analyze rehabilitation of existing wood windows prior to replacement with new metal windows that match existing profiles.

ii. **Anchorage:** Window frames should be positively anchored to resist lateral loads. Clearance and flexible mountings should be provided to permit thermal movement and minimize glass breakage in storms and earthquakes.

iii. **Operability:** Consistent with AOC security requirements, provide operable windows wherever practicable in office space, meeting rooms, mechanical rooms, garage and maintenance spaces to allow for secondary ventilation. Do not use in existing buildings where HVAC pressurization needs preclude use.

b). **Standards for Window Design:** The standards to be used as the basis for design reviews and approvals are listed in Section 1, General Requirements, 1.5 Regulatory Requirements. Any standard specifically referenced by the AOC Design Standards shall be considered mandatory.

c). **Principal Buildings:** Design shall provide aluminum or bronze frame construction with low maintenance finishes. Do not use painted frames. Typically, AOC would use Heavy Commercial (HC) or Architectural (AW) class windows for Principal Buildings.

d). **Service and Support Buildings:** Commercial windows, consistent with design life.

e). **Glazing:** Glazing in exterior walls and individual panes over 16 sq. ft. in area, located up to a height of 10 feet above an exterior walking surface, shall be laminated, annealed or heat strengthened safety glass that will remain in the frame when cracked.

f). **Resource Management:**

i. **Wood Windows:** For wood windows provide wood that has been sustainably certified or labeled in accordance with the Forestry Stewardship Council or the Sustainable Forestry Board.

ii. **Metal Windows:** Fabricate from metal with a minimum of 5 percent post-consumer recycled content or 20 percent pre-consumer recycled content.

g). **Minimum R-Factors:** Where inconsistent with finished appearance or affected by adverse contrasts to adjoining glazed surfaces, use low-emissivity coatings or other means to comply with IBC requirements.

h). **Security Glazing:** As programmed for each project. Requirements will be provided separately. Do not remove security window film from existing windows without written AOC approval. Security film to avoid flying glass can be selected to meet sustainability goals of solar heat gain coefficient < 0.4 and visible transmission > 0.6.

i). **Historic Preservation:** Consult Section 2, HISTORIC PRESERVATION, for further information regarding preservation of Heritage Assets.

6.3.6. **Exterior Doors:**

a). **Entrance Doors:** Entrances and exterior door system fabricated of high durability, low maintenance materials, and finishes. Do not use revolving doors at accessible entrances.

i. **Principal Buildings:** Bronze, stainless steel, Muntz metals, etc. are preferred over standard commercial storefront systems utilizing standard aluminum extrusions.

ii. **Support Buildings:** Commercial, medium-style aluminum entrance/storefront systems with anodic finishes are acceptable if the entrances are covered.

iii. **Service Buildings:** Hollow metal systems, glazed appropriately for the security conditions are required.

iv. **Removable Mullions:** Design shall provide a minimum of one set of double doors with a keyed, removable mullion with a lock strike to facilitate equipment

transport at any building without a loading dock.

b). **Finishes:** Natural or rubbed finishes as appropriate to substrates at hand. Use spar varnishes for existing wood doors. Coordinate finishes on historic openings with AOC.

c). **Assisted Openings:** Use hydraulic or pneumatic systems. Limit the use of electrically-assisted door operators to retrofit installation where access to pressurized air is impracticable. Motion detectors and push plates are the preferred methods of actuating assisted doors.

d). **Hollow Metal Doors:** Based on traffic, use ANSI/ Steel Door Institute (SDI)-100 Grade II, Heavy Duty or Grade III, Extra Heavy Duty doors for exterior installations. Use galvanized steel construction (minimum G-90), foamed cores, and 14-gauge galvanized steel frames. Brake face sheets to form and meet in joint on stile edges, weld, and grind smooth. Perimeter locksets shall contain 7-pin tumblers.

e). **Hardware:** See Section 7.7.2.h in **Architecture and Interior Design** for standard hardware types by building. Coordinate all exterior openings with the AOC Project Manager.

i. **Finishes:** Use stainless steel or non-ferrous metals for all exterior hardware. At historically sensitive locations, match existing finishes.

ii. **Exit-Only Doors:** Consult AOC for security provisions for exit only doors in unsupervised locations.

iii. **Secured Hardware:** Hinges, hinge-pins and hasps must be secured against unauthorized removal.

f). **Resource Management:** Wood doors shall contain a minimum of 85 percent bio-based material.

i. **Virgin Lumber:** Design shall provide sustainably harvested, certified or labeled lumber in accordance with Forest Stewardship Council or Sustainability Forestry Board. As practicable, consider the use of recycled wood where appropriate.

ii. **Engineered Wood:** When specifying doors with engineered wood cores, require that they comply with the requirements of ANSI 208.1 or 208.2, as appropriate, for urea-formaldehyde emissions.

iii. **Steel Doors:** Fabricate from steel with either 5 percent post-consumer recycled content or 20 percent pre-consumer recycled content.

6.4. **Roofing:**

a). **General:** Roofs shall be designed for maximum life. Use high durability systems such as sheet copper, tile, glazed terra-cotta, stone and best grades of membrane and/or waterproofing systems.

b). **Thermal Performance:** Design shall specify roof insulation that meets or exceeds the latest International Energy Conservation Code prescriptive requirements for all new and replacement roofs.

c). **Slopes:** Refer to roof slope requirements in the sections that follow.

d). **Cool Roofs:** Except in cases of historic roof replacement, use reflective (light-colored) roofs. A cool roof shall meet the SRI requirements of the IgCC.

e). **Photovoltaic Roofs**: Where required in the Program of Requirements, use photovoltaic roofs.

f). **Green Roofs:** Where required in the Program of Requirements use a green roof. A green roof is defined as a roof that captures and stores rainfall in an engineered growing media that is designed to support plant growth. Roof areas intended for green roof installations are required to complete a structural analysis of the existing roof structural capacity. The roofs are designed so the water drains vertically through the media and then horizontally along waterproofing a layer towards a drain. Green roofs are designed to have minimal maintenance requirements. Plant species are selected so that the roof does not need supplemental irrigation and requires minimal, infrequent fertilization after vegetation is initially established. All plant species shall be approved by the AOC, prior to installation.

g). **Fall Protection:**

i. Conform to most recent ANSI/ASSR Z-359-2007 and later standards to ensure each system's integrity is not compromised.

ii. The AOC Project Manager shall consult AOC Safety, Fire and Environmental Programs Office whenever fall protection systems are being designed, installed, or when existing systems may be impacted by roof work.

iii. The installation shall require 100 percent anchorage load testing and system certification by a qualified Fall Protection Engineer.

iv. Fall Protection systems must be re-certified by the contractor after any impact to the existing systems.

v. Fall Protection systems shall be installed in a manner to be out of the public view.

h). **Other Systems:** Design shall coordinate with fall protection, telecommunications and lightning protection requirements.

i). **Wind Rating:** Design shall provide minimum roofing ratings of 1 to 90 for Principal/Support Buildings and 1 to 60 for Service Buildings.

j). **Water Ponding:** Design shall employ positive roof slopes and "crickets" to prevent ponding of water.

k). **Parapeted Roofs:** Design shall provide overflow scuppers for all roofs that employ parapets.

6.4.1. **Standards for Roof Design:** The standards to be used as the basis for design reviews and approvals are listed in Section 1, General Requirements, 1.5 Regulatory Requirements. Any standard specifically referenced by the AOC Design Standards shall be considered mandatory.

l). **Historic Preservation:** Consult Section 2, Historic Preservation for further information regarding preservation of Heritage Assets.

m). **Maintenance:** Design systems for ready maintenance and observation. Avoid systems requiring "topping-off" (pitch-pockets), or "resealing" (sealant closed cap flashing or termination bars). Place any systems that require inspection in clear view, without requiring bending or stooping. No building element may be supported by the roofing system except walkways.

i. **Expansion Joints:** Use metal-covered expansion joints with elastomeric vapor barrier backup. Set units a minimum of 8" above roof surfaces and design in conformance with SMACNA or CDA standards.

ii. **Roof Walks:** On flat roofs, design shall provide walk surfacing from roof access points to each piece of roof-mounted equipment requiring maintenance. Design shall provide surfacing adjacent to each equipment service point and adjacent to roof perimeters/parapets to facilitate inspection.

n). **Replacement:** Use designs for flashing and terminations that support ready replacement of systems without disturbing underlying substrates. Use snap-flashings and reglets rather than systems that require caps to be bent during roofing replacements. Match appearance and finish of existing materials.

o). **Non-Proprietary Systems:** Wherever possible, use non-proprietary flashing and termination systems, especially coping and gravel-stop systems. For the AOC buildings, custom extrusions and fittings will likely become obsolete and will be impossible to replicate under future maintenance/replacement programs. Use proven SMACNA flashing and termination systems.

p). **Hazardous Materials:** It is mandatory that existing roofs be surveyed for the presence of hazardous materials (principally asbestos and lead), prior to commencing any replacement design. Coordinate access with the Project Manager.

q). **Odors:** Coordinate individual project designs with AOC staff to mitigate the use of odor-causing materials adjacent to occupied areas. Design shall not allow odors to enter any HVAC intakes located on the roof.

r). **Existing Buildings with Lightning Protection System:** If a roof is being replaced and requires removal/reinstallation of an existing lightning protection system, provide new Underwriters Laboratory (UL) certification and grounding tests.

s). **Rain Management:** Where required by the Program of Requirements, use green roofs or a rooftop rainwater collection to retain rainfall on-site.

i. For green roofs, specify systems that: 1) reduce peak run-off rate by 50 percent for a 2-year storm event, or 2) reduce peak

runoff by 25 percent and total quantity of stormwater runoff by 25 percent for a 2-year storm event.

ii. For non-green roofs, implement rooftop rainwater collection of at least 3 inches of rainfall per square foot of roof area annually.

6.4.2. **Membrane Roofing:**

a). **General:** Modified bituminous systems are the current system of choice within the Capitol for low-slope roofing. Wherever practicable, built-up systems shall be replaced with modified bitumen systems, when compatible with existing substrates and roof slopes.

b). **Cool Roofs:** Specify products with solar reflectance index (SRI) of at least 78 for low slope roofs (<2:12), or an SRI of at least 29 for steep sloped roofs (>2:12).

c). **Maintenance:** Locate any sealant surfaces or expansion joints in "easy to observe" places to facilitate ongoing maintenance.

d). **Durability:** Specify membrane roofing with a useful life of at least 30 years.

e). **Emissivity:** Design shall provide system emissivity of at least 0.90.

f). **Principal and Support Buildings:** As appropriate to roof substrates, new roofs and long-term replacement low-slope roofs shall employ 2-ply styrene-butadiene-styrene (SBS) systems. Hotmop apply these systems and provide wearing membranes and base flashings with UV-resisting mineral granules.

g). **Service Buildings:** Short-term replacement roofs may employ atactic-polypropylene (APP) torch-applied systems for facilities scheduled to be replaced within 10 years.

h). **Preferred Insulation Systems:** Consistent with roofing membranes, provide polyisocyanurate board insulation with homasote protection layer, perlite facers, or fiberglass reinforced facers free of asbestos.

i). **Roof Walks:** Design shall provide walk surfacing from roof access points to each piece of roof-mounted equipment requiring maintenance. Design shall provide surfacing adjacent to each equipment service point and adjacent to roof perimeters/parapets to facilitate inspection.

6.4.3. **Sheet Metal Roofing:**

a). **General:** Sheet metal roofing used for Principal and Support buildings within the Capitol is limited chiefly to copper standing seam, copper batten systems and copper flat seamed systems. Systems are designed for maximum life expectancies.

b). **Cool Roofs:** Specify products with solar reflectance index (SRI) of at least 78 for low slope roofs (<2:12), or an SRI of at least 29 for steep sloped roofs (>2:12).

c). **Recycled Content:** Specify roofing with at least 50 percent post-consumer recycled content.

d). **Durability:** Specify products with a useful life of at least 50 years for non-copper metal roofing and at least 100 years for copper roofing.

e). **Copper System Components:** ASTM B 370, cold-rolled copper sheet, H00 temper:

i. Copper Sheet for Panels: 20 oz./sq.ft.

ii. Copper Batten Caps: 20 oz./sq.ft. Note: Many existing batten profiles do not align with contemporary wood sizes. Consult with the AOC prior to modifying profiles.

iii. Snow Guards: Locate snow guards over any entrance bordering a sloped metal roof.

f). **Service Facilities:** Aluminum-coated steel sheets, pre-painted by the coil-coating process may be used for roofing systems of service/support facilities not located within the Capitol. Coat with fluoropolymer 2 coat finish systems unless otherwise directed. Use field-seaming systems that use concealed fasteners.

g). **Lead-Coated Copper:** Limited to matching existing installations only.

6.4.4. **Flashing and Sheet Metal:**

a). **General:** Principal Buildings shall use copper or stainless steel wherever practicable. Design flashing for ready observation by maintenance personnel and for replacement without destruction of retaining components.

b). **Design:** Unless otherwise noted, comply with the current edition of the SMACNA's "Architectural Sheet Metal Manual." Design shall specify cap flashing for ready replacement in areas adjoining roof terminations. Do not design cap or step flashing that requires bending or folding to gain access to roof base courses during re-roofing operations.

6.4.5. **Roof Construction:**

a). **New Construction:** If low slope roofs are necessary, provide a minimum slope of 1/4-inch per foot.

b). **Design:** Roofs shall comply with provisions of the relevant governing Building Code(s) along with local amendments and Minimum Design Loads for Buildings and Other Structures, ASCE-7, as published by the American Society of Civil Engineers. Generally, all roof systems shall be designed with positive slope(s) to drain in order to prevent any unnecessary ponding. The designer should make every effort to locate drains away from column high points. Note: all horizontal storm leader lines shall be adequately and properly insulated to ensure against freezing.

c). **Minimum Live Load:** Design roofs for the minimum uniform roof live load listed in Section 5 Superstructure, unless otherwise increased in the program requirements.

d). **Roof Fall Protection:** Integrate fall protection systems into roof designs and preserve watertight integrity.

e). **Replacement of Existing Roofs:** To the extent possible, replace existing roof systems, especially those on Principal Buildings, with roofing systems that match existing construction.

i. **Roof Details:** Designers, Contractors, etc. are cautioned that existing superstructure, as well as backing materials, such as wood framing members under copper roof purlins, may not match contemporary lumber sizes and/or profiles.

ii. **Structural Loading Considerations:** Consistent with the IEBC Code, consideration of the total weight of new roofing materials shall be compared to the existing roofing to ensure that sufficient structural capacity exists to support the weight of the new roof.

iii. **Hazardous Materials:** Investigate existing materials' composition for presence of asbestos-containing materials and PCB's prior to commencing design. Refer to Section 1.5.5.b for additional regulations and requirements. Budget models for replacement installations shall include total costs of hazmat mitigation and existing system removals.

iv. **Maintenance Loads:** Consideration shall be allowed for loads from staging and materials handling.

v. **Roof Fall Protection:** Where fall protection does not exist, integrate fall protection systems into roof maintenance and/or replacement designs and preserve watertight integrity of roofing system. Any impact to existing installed fall protection systems requires re-installation per current design documents, 100 percent anchorage load testing and system re-certification by a qualified Fall Protection Engineer.

f). **Roof Insulation:** Specify R-values that meet or exceed the latest International Energy Conservation Code prescriptive requirements for all new and replacement roofs.

g). **Roof Access:** Design shall provide stair access to roof areas wherever practicable, with access via "curbed," sheltered and weather-stripped doorways. Where roof hatches must be employed, use insulated, lockable factory-fabricated units that employ integral flashing:

i. Exterior and/or grade access to roof areas is not permitted.

ii. Egress to roofs is not permitted.

iii. Coordinate with Security and Fire Protection for additional requirements.

h). **Roof-Mounted Equipment:** Design shall make every attempt to house roof-mounted equipment in a penthouse(s). If minor pieces of roof-mounted equipment are required, allow adequate space under them to facilitate roof maintenance/replacement and for ready observation of roofing surfaces. Do not support equipment on the roofing system. Any roof mounted equipment must receive a permit from AOC before installation (See ME 28-6, "Roof Device Installation Application and Permit" for details).

6.5. **Special Inspections Schedule:**

a). The design team shall develop special inspection requirements and schedules, consistent with Chapter 17 of the IBC, that pertain to the work contained in the program requirements. The schedule shall not include extraneous inspections that are not pertinent to the work.

6.6. **Restrictions:**

a). Do not use "traffic coatings" on parking decks

without AOC approval.

b). Do not use wood framing in any permanent structural system.

c). Do not expose fireproofing to exterior elements.

d). Armor/protect fireproofed columns subject to vehicular traffic or equipment bumping.

e). Do not use cellulose insulation in exterior masonry walls.

f). Do not use oleo-resinous sealants on exterior surfaces.

g). Do not build rain conductors into exterior masonry walls. Locate any required rain leaders in areas accessible without the need of removal of any stone or masonry walls.

h). Verify specific restrictions with the HPO.

i). Do not use exterior insulation and finish systems (EIFS) or brick veneer on metal studs without prior review and approval by AOC.

j). Do not use ferrous metal anchors without AOC written approval.

k). Do not use colored anodized aluminum for railings.

l). Do not use fluoropolymer coatings (high-performance organic coatings) for guardrails or handrails without AOC approval.

m). Do not use wood windows except for temporary construction or when required to replace historic windows.

n). Do not use mirror glass without AOC approval.

o). Do not use electrically powered accessibility devices at exterior openings (except in retrofit applications).

p). Do not use knock-down frames for exterior openings.

q). Do not use revolving entrance doors without AOC permission.

r). Do not use applied finishes or powder coatings without AOC authorization.

s). Do not use anodized or lacquered finishes on hardware subject to constant hand traffic without AOC permission.

t). Where possible, limit the use of membrane systems to service/support buildings or replacement work.

u). Do not build storm leaders into permanent walls.

v). Do not use pitch pockets - provide clamped metal or thermo-plastic hoods over all penetrations.

w). Do not use flush-mounted membrane or covered membrane expansion joints.

x). Do not locate roof drains adjacent to columns.

y). or other high points that would preclude ready water flow to drain after creep or if short-term snow loading occurs within roof structure framing.

z). Do not suspend ductwork, conduit, lighting fixtures, or ceiling systems from metal roof deck.

aa). Avoid use of “bar anchored” membrane roofing systems. If ethylene propylene diene monomer (EPDM) systems are required because of fume or fire considerations, employ fully-adhered systems.

bb). Do not use ballasted systems without AOC permission.

cc). Do not use galvanized steel for any roofing or flashing installation without AOC written approval.

dd). Do not use aluminum flashing without AOC written approval.

ee). Do not use membrane expansion joint systems for roof applications.

ff). Avoid surface-applied reglets and termination bars except in rehabilitation work.

gg). Do not use aluminum flashing in Principal or Support Buildings.

hh). Do not use applied finishes on flashing without AOC approval.

ii). Do not use galvanized steel flashing of gutters. Unless specified and authorized in writing, new products shall not contain asbestos, lead, PCB’s or other hazardous components.

7. Architecture and Interior Design

7.1. Introduction and General Provisions:

a). **Purpose:** The design of the building interiors shall be integrated with the exterior shell and reflect the quality levels, service life expectancy and acoustic requirements outlined in 7.2 Related Sections, for related requirements. The quality of lighting fixtures, hardware, trim, etc., shall match the building type and function. In existing buildings, the construction and finishes will match existing conditions and may differ from the following minimum guidelines.

7.2. Related Sections:

a). Other Sections that contain important information that may affect elements of this section or their implementation, include, but are not limited:

i. Refer to Section 1, General Requirements.

ii. Refer to Section 2, Historic Preservation, for preservation of Heritage Assets.

iii. Refer to Section 6, Shell for related requirements.

iv. Refer to Section 11, Electrical for related items.

7.3. Programming and Space Planning:

a). A Program of Requirements (PoR) is necessary for all major facilities. The designer shall approach programming by working with the point of contact assigned by the client or jurisdiction. Space planning shall be done to optimize use of the available space.

7.4. Public Spaces:

a). The design of public spaces shall be appropriate to and will vary depending on the building type and function.

7.4.1. Entrances, Vestibules, and Lobbies:

a). The main lobby shall provide information facilities, waiting areas and easy access to vertical transportation. While the main lobby shall provide for formal reception of visitors and staff, it must also be planned to accommodate security stations, screening equipment, security cameras, the queuing space associated with security processing and emergency egress. The PoR shall detail the number of screening devices required for each project. Secondary entrance requirements are project dependent. The number of entrances staffed by security personnel shall be held to the lowest number possible.

i. **Physical Security:** Design shall provide proper electrical service, empty conduit for government-installed communication/security equipment. In addition, provide floor load capacity to accommodate required equipment and coordinate equipment layout with egress requirements. Contact the Office of Security Programs for coordination of this work with the United States Capitol Police.

ii. **Accessibility Provisions:** See Section 1.5.4 in General Requirements for regulatory requirements.

7.4.2. Stairways:

a). **General:** Design shall provide stair finishes that are durable, easy to clean and maintain, and consistent with the floor that they serve, but applied in a manner that facilitates future removal. Floor finishes in open, monumental stairs adjoining lobbies shall match the finishes of the areas that they adjoin.

b). **Treads and Nosings:** Design shall specify treads that comply with ADA requirements and facilitate future maintenance or replacement of treads.

i. **Egress Stairs:** Design of egress stairs shall use resilient treads with non-slip nosings, free of tight dirt-trapping crevices (such as 1 mm high raised round or square disks) on all stair treads other than those made of stone.

ii. **Service Stairs:** Stairs at loading docks, in mechanical areas, and in general service spaces shall use sealed concrete with replaceable cast metal nosings shaped to an "eased" edge profile.

c). **Railings:** Refer to NFPA101, for additional handrail requirements. Space wall-mounted railings to comply with Code requirements.

i. **Materials:** Design shall specify railings and handrails fabricated from wood, stainless steel, aluminum, galvanized steel, and as justified by installation, brass or bronze.

ii. **Service Areas:** Design shall specify railings in building service areas and exterior service locations exposed to

weather fabricated of aluminum to reduce maintenance costs.

7.4.3. **Elevator and Escalator Lobbies:**

a). **Elevators:** Design shall provide elevators complying with ASME 17.1 and accessibility requirements per section 1.5.4 Provisions for Persons with Disabilities in all multi-story buildings. Group multiple elevators in banks, and separate opposing banks in common groups with lobby areas not less than 10' wide. Locate elevators so that the travel distance from any occupied space is less than 200 feet. See Section 15 in Equipment.

b). **Wheelchair Lifts:** Do not use wheelchair lifts in new construction.

7.4.4. **Corridors:**

a). Irrespective of code requirements, design shall not have corridors of less than 60" minimum width to allow for egress, mail and cleaning carts, and furniture relocations. Design shall provide corridor wall surfaces that match existing conditions in principal buildings. If gypsum drywall is used as a finish in public corridors, it shall be at least 5/8" thick. Further care shall be given to provide finishes that are easy to maintain.

7.5. **Building Support Spaces:**

7.5.1. **Toilet Rooms:**

a). Design shall provide at least one public men's and one public women's toilet room on every floor. On floors with cafeterias or snack bars, provide at least one men's and one women's toilet adjacent to the cafeteria or snack bar entrance. All public and common-use toilet facilities shall be accessible to persons with disabilities and other toilet facilities shall be convertible. All entries to public toilets shall maintain positive obstruction of lines of sight from without. Calculate all occupancies based on a population that is distributed 50 percent women and 50 percent men. Design shall provide fixture counts in conformance with the International Plumbing Code unless a higher count is specified by the client.

i. **Principal Buildings:** Design shall provide continuous vanities of stone at all lavatories. Shield all piping in conformance with ADA requirements.

ii. **Service and Support Buildings:** Design shall provide continuous vanities of artificial stone or plastic laminate as appropriate to the function.

7.5.2. **Family Restrooms:**

a). All office buildings shall provide a minimum of one family restroom. The symbol or sign on the door shall indicate family, wheelchair accessible as well as single user availability.

b). Locate one family restroom on each floor of an office building preferably collocated with centrally located building restrooms and in a manner sensitive to historic features.

c). The physical characteristics of the family restroom should:

i. Provide minimum size for accessibility following, at a minimum, all ADA Accessibility Guidelines.

ii. Provide one accessible sink, one accessible toilet with appropriate accessibility hardware as required, one accessible urinal and one baby changing station.

iii. Provide a lockable door with dead-bolt type occupancy designation.

iv. Provide finishes appropriate for ease of maintenance.

7.5.3. **Lactation Rooms:**

a). The AOC is voluntarily complying with Section 4207 of the Patient Protection and Affordable Care Act (ACA). As part of the ACA, Federal agencies are required to provide a reasonable break time for female employees to express breast milk as needed for her nursing child for 1 year after the child's birth. A place shall be provided for lactation, other than a bathroom, that is shielded from view and free from intrusion from coworkers and the public.

b). As such, all buildings must provide facilities to meet these requirements. Lactation rooms shall be provided according to Table 7.4.3-1 and 7.4.3-2 below and should be located in close proximity to public family restrooms and/or health unit. The information indicated in the tables shall be reviewed and confirmed with the AOC at the beginning of the project.

c). **Room size:**

i. For a single station accessible lactation room, minimum footprint of 5 feet by 7 feet is recommended as it allows for a 5-

foot radius circle with 20-inch deep by 30 inch wide counter.

ii. For a multi-station lactation room, at least one station must meet accessibility requirements. Non-accessible stations must be a minimum of 4 feet by 4 feet.

iii. In multi-station lactation rooms, provide visual partitioning for each station.

iv. Determine the number of lactation stations according to Table 7.4.3.g below. If the number of female employees is unknown, assume half of the number of employees to be female.

d). **Minimum requirements:**

i. A lockable door. In single station lactation rooms, the lock should have an occupancy indicator.

ii. A comfortable chair and a work surface sufficient for lactation equipment.

iii. A small utility-type sink with adjacent counter. In a multi-station lactation room, provide a minimum of one sink per three stations.

iv. Storage for cleaning supplies and paper towels.

v. Provision for towel dispenser and trash receptacle.

vi. A mirror.

vii. A bulletin board.

viii. Well-placed GFCI electrical outlets for each lactation station and near the sink if a multi-station room.

ix. Hard or resilient flooring suitable for regular mopping and sanitizing.

x. Signage to identify that it is a Mothers' Room, with international signage to indicate women only.

xi. Accessibility guidelines should be met for all common features of the room.

e). **Location:**

i. Lactation rooms should be located in a safe area accessible to all and in close proximity to, or adjacent to, family restroom or health unit.

ii. Consideration should be given to acoustics with respect to adjacent occupancies.

f). **HVAC and Lighting:**

i. Provide HVAC and Lighting in accordance with Chapter 9 Mechanical and HVAC and Chapter 11 Electrical, respectively.

g). **Milk Storage:**

i. Install a lockable refrigerator for milk storage, sized sufficiently for the number of users.

h). Number of lactation stations required based on female employee population:

Table 7.4.3-1 Lactation Station Quantities

Lactation Stations	
Number of Female Employees	Number of Stations Needed
Under 100	1
Approximately 250	2
Approximately 500	3
Approximately 750	4
Approximately 1,000	6
For every additional 1,000 female employees	6 additional stations

Table 7.4. 3-2 Lactation Stations by Building

	Total Employees	Female Employees	Lactation Stations Required
U.S. House of Representatives			
CHOB	1,790	895	6
LHOB	2,204	1,102	8
RHOB	2,864	1,432	9
FHOB	1,788	894	6
OFOB	383	192	2
House Total	9,029	4,515	31
U.S. Senate			
RSOB	1,939	970	6
DSOB	1,816	908	6
HSOB	3,113	1,557	10
Postal Square	300	150	2
Senate Total	7,168	3,585	24
U.S. Capitol			
CVC	671	336	3
Capitol	1,638	819	6
Capitol Total	2,309	1,155	9
Library of Congress			
TJB	500	250	2
JAB	700	350	3
JMMB	2,000	1,000	6
LOC Total	3,200	1,600	11
U.S. Botanic Garden			
BGC	26	13	1
BGAD	12	6	1
BGPF	30	15	1
BG Total	68	34	3
U.S. Supreme Court			
SCB	504	252	3
TMFJB	2,000	1,000	6
USSC Total	2,504	1,252	9
Capitol Power Plant			
CPP Total	66	33	1
Office of Security Programs & U.S. Capitol Police			
FB	505	253	3
OSP ACF	62	31	1
USCP HQ	683	342	3
USCP Total	1,250	626	7

7.5.4. **Mechanical/Electrical Rooms:**

a). **Electrical Closets:** Design shall provide not less than the required electrical closets indicated in chapter 11 Electrical.

b). **Mechanical Areas:** When mechanical rooms are located over occupied spaces, special attention shall be given to noise and vibration attenuation, provision of enhanced waterproofing, and access. Electrical and telecommunications closets shall be stacked vertically to provide future allowance for growth.

c). **Finishes:** Design shall provide painted walls, suspended acoustical panel ceilings, and sealed concrete floors.

d). Refer to other chapters of this standard for specific requirements of mechanical and electrical areas.

7.5.5. **IT Rooms:**

a). Design shall provide not less than the required communication and IT closets indicated in chapter 12 Communications Systems. Design shall provide painted walls, suspended acoustical panel ceilings, and sealed concrete floors. In larger IT rooms requiring raised access flooring, provide a heavy-duty system including concrete filled pans with integral carpet rubber or VCT finish.

7.5.6. **Storage Rooms:**

a). Design shall provide access doors and corridors to storage rooms wide enough to accommodate the stored materials and width in adjacent corridors to allow access into storage rooms without contacting adjacent walls and corners.

7.5.7. **Service Spaces:**

a). **Janitor's Closets:** Design shall provide custodial closets at a rate of not less than one per floor. Design shall provide lighting for safe access and egress during power outages. Design shall provide security locksets for service spaces in conformance with AOC standards. Wherever possible, design shall locate janitor's closets proximate to toilet rooms.

b). **Loading Docks:** Design shall provide loading docks in conformance with the Program of Requirements. Design dock heights at 45" and provide at least one dock bay with a powered dock leveler. Design shall provide coiling overhead doors at each dock. Loading berths shall be provided only if specified in the approved building program. Staging areas shall be located adjacent to all loading docks and berths.

7.6. **Special Design Considerations:**

a). Where required by the Program of Requirements (PoR), the design shall provide the following space types.

7.6.1. **Cafeteria:**

a). **Principal Buildings:** Carpet/stone floors, custom wood casework at serving counters, and upholstered banquette seating.

b). **Service Buildings:** Carpet/tile floors and plastic laminate finish casework at serving counters.

c). **Support Buildings:** VCT floors.

7.6.2. **Atrium/Rotunda, Auditorium, Exhibit Hall:**

a). Design of these spaces shall provide the flexibility to address specific functions. Design shall provide finishes appropriate to building type.

7.6.3. **Conference Rooms:**

a). Design shall provide architectural trims and moldings where appropriate in principal and service buildings.

7.6.4. **Members Offices:**

a). Design shall provide gypsum wallboard partitions with plaster skim coat, stone base, and millwork crown molding and trim.

7.7. **Interior Construction:**

7.7.1. **Interior Partitions:**

a). **Structural Isolation:** Nonstructural, rigid partitions must be supported by the structure in such a way that they cannot inadvertently become load-carrying elements. Design shall isolate masonry partitions from the structure of the floor above by a gap and restrain partitions tops from lateral movement by continuous or intermittent steel angles or by steel straps grouted into the wall. Isolate masonry walls from concrete columns by flexible joints. Metal stud partitions do not require in-plane lateral isolation.

b). **Gypsum Drywall Systems:** Design shall comply with Gypsum Association standards

for construction of drywall partition systems and with finish levels (1 lowest - 5 highest) specified in ASTM C-840, Specification for Application and Finishing of Gypsum Board. Design shall use galvanized steel studs and runners for all gypsum drywall partition framing. As a minimum, design shall provide the following construction and finish levels:

i. **Outside Corners in Gypsum Drywall Construction:** Galvanized steel for all standard partitions, stainless steel at wet areas. Design shall limit the use of vinyl trim to curved applications.

c). **Veneer Plaster Systems:** Use USG Imperial Plaster, or an approved equal, on high traffic areas receiving veneer plaster systems.

i. **Backer Board:** Apply cementitious backer board to steel stud framing systems behind all tile systems and for all exterior soffit systems that are to receive stucco or plaster finishes. Design shall provide 1/2" backer to gypsum wallboard in corridors receiving heavy traffic.

ii. **Acoustic Rating:** Design shall provide gypsum wallboard assemblies with acoustic ratings as outlined in Section 1.3.2 in **General Requirements**.

d). Resource Management:

i. **Gypsum Board:** Design shall provide minimum of 10 percent post-consumer recycled content or minimum of 40 percent pre-consumer recycled content.

ii. **Waste Management:** In renovation/ rehabilitation work, design shall coordinate recycling with Division One requirements.

7.7.2. **Interior Doors:**

a). **Standards for Door Design:** The standards to be used as the basis for design reviews and approvals are listed in Section 1, General Requirements, 1.5 Regulatory Requirements.

b). **Fire Shutters:** Design shall have a requirement on the operation of the door to stop if an obstruction is present within the shutter.

c). **Hollow Metal Doors and Frames:** Design shall provide 1-3/4" doors for all applications in conformance with NFPA 80.

d). **Interior Storefronts:** Retail/service areas may employ narrow-stile doors in aluminum storefront systems. For glazed areas that adjoin doors and extend to the floor, design shall provide horizontal mullions at 36" AFF.

e). **Wood Doors and Frames:** Design shall comply with AWI Standards and match existing door profiles and construction in renovation/rehabilitation work. Stile and rail doors are required in new construction for monumental projects.

i. **Principal Buildings:** AWI Premium Quality.

ii. **Support Buildings, Public Areas:** AWI Premium Quality.

iii. **Support Buildings, Staff Areas:** AWI Custom Quality.

iv. **Service Buildings:** Use metal doors.

f). **Bronze and Glass Doors:** Can be utilized in monumental projects as approved by AOC.

g). **Labeled Doors:** Design shall provide rated fire doors constructed in accordance with NFPA 80.

h). **Hardware:** In new construction, design shall utilize lever handle latchsets and locksets to the maximum extent practicable and provide the following:

i. **Suite, Monumental, and Corridor: Doors:** Mortise 7-pin locksets and ball-bearing hinges.

ii. **Office and Single-User Doors**: Cylindrical 7-pin locksets and plain bearing hinges.

iii. **Fire and Security Doors:** Design shall provide hardware constructed according to NFPA 80.

iv. **Closers**: Install interior door closers on the room side of the doors.

v. **Historic Doors**: To the extent possible, match existing or recondition to original specifications.

vi. **Specifying:** Specify using standard BHMA, ANSI, or Federal Specification nomenclature.

vii. **Security**: Coordinate the hardware with the security requirements of the Capitol Police.

viii. **Marking and Keyways:** Mark all keys with "U.S. Government - Do Not Duplicate." All keyways are restricted. Wherever possible, design shall specify removable cores for new work.

ix. **Historic Hardware:** Design shall provide historic hardware unit locksets/latchsets by

special order. To the extent possible, match existing or recondition to original specifications.

x. **Building Specific Requirements:** Design shall provide the building-specific locksets, cylinders and finishes listed in Table 7.2.2 – 1 and 7.2.2-2 below.

xi. **Utility Closet Back of House Locksets:** Use cylindrical commercial grade (e.g., Schlage, Baldwin, Yale, Marks USA) with interchangeable cores small format.

Table 7.7.2 – 1 Building Hardware Grades

DOOR USAGE	GRADE	DOOR CONSTRUCTION	FRAME
Entrances	Ext. H.D.	Seamless, hollow or comp. cores	Full welded
Permanent Partitions	Heavy-duty	Seamless, hollow or comp. cores	Full welded
Fire Doors	Per NFPA 80	Per NFPA 80	Full welded
Short-term Partitions	Standard	Full flush, hollow or comp. cores	Knock-down

Table 7.7.2 – 2 Existing Building Hardware Manufactures

BUILDING	LOCKSETS	CYLINDERS	PANIC BARS	FINISH
U.S. Capitol	Variable but standard is Corbin	Variable but standard is ASSA	Von Duprin for security locations	Variable, US10
Cannon House Office Building	Corbin/Russwin	6-pin	Von Duprin for security locations	US 10B
Longworth House Office Building	Corbin/Russwin	6-pin	Von Duprin for security locations	US 10B
Rayburn House Office Building	Schlage**	6-pin	Von Duprin for security locations	Varies, US10
O'Neill House Office Building	Best	IC Core	Von Duprin	
Ford House Office Building	Corbin/Russwin	6-pin	Von Duprin for security locations, Corbin traditional in others	US26D
East and West House Garages	Sargent	Schlage 6-pin		US26D
Russell Senate Office Building	Baldwin mortise lock	Medeco 7-pin	Von Duprin for security locations	US 10B 613
Dirksen Senate Office Building	Marks USA level handle cylindrical lock	Medeco 7-pin	Von Duprin for security locations	US 10 612
Hart Senate Office Building	Schlage mortise lock/Mark USA lever cylindrical lock	Medeco 7-pin	Von Duprin for security locations	US 10 612
Webster Hall Page School and Dorm	Schlage	Schalge 7-pin	Von Duprin	US4
Jefferson Building	Mixed manuf.; Historic hardware by Yale	Yale 7-pin	Von Duprin traditional and modern styles	Varies, but mostly US9 and US10

BUILDING	LOCKSETS	CYLINDERS	PANIC BARS	FINISH
Adams Building	Chantrell (note that they are out of business)	Yale 7-pin	Yale and Von Duprin for security locations	US 28
Madison Building	Yale	Yale 7-pin	Yale and Von Duprin for security locations	US10B
U.S. Supreme Court	Corbin*	By Government		US 10B
Thurgood Marshall Building	N.A.	N.A.		N.A.
U.S. Capitol Police	Schlage	Medeco by Physical Security		US 32D
Capitol Visitor's Center				
• * Historic unit locksets by special order **Designers should confirm the locksets/keyways in use for the specific area of the project.				

i). **Resource Management:** Wood doors shall contain a minimum of 85 percent bio-based material except where matching doors in historic preservation:

i. **Virgin Lumber:** Design shall provide sustainability vested, certified, or labeled lumber in accordance with Forest Stewardship Council or Sustainability Forestry Board.

ii. **Engineered Wood:** When specifying doors with engineered wood cores, design shall specify compliance with ANSI 208.1 or 208.2, as appropriate, for urea-formaldehyde emissions.

j). **Steel Doors:** Design shall specify fabrication from steel with either 5 percent post-consumer recycled content or 20 percent pre-consumer recycled content.

7.7.3. **Ceiling Suspension Systems and Finishes:**

a). Formal rooms shall receive plaster ceilings consistent with the room's function. Other spaces scheduled to receive monolithic ceilings shall employ traditional gypsum drywall systems.

b). **Gypsum Drywall Systems:** Design shall provide gypsum drywall ceilings in conformance with finish levels specified in ASTM C-840, Specification for Application and Finishing of Gypsum Board:

i. Finish materials for fire-rated ceiling assemblies shall be Type X gypsum drywall or fire-rated acoustical tiles/panels with rated suspension systems.

ii. Fastening: Fasten all gypsum drywall to studs or runners with screws.

c). **Ceiling Suspension Systems:** Ceiling suspension systems shall be anchored to structural slabs or members above. Do not anchor to ductwork or piping. Suspension hangers and wires shall anchor with toggle bolts, molly bolts, self-drilling anchors, cast-in inserts or bolts in expansion shields. Suspended ceilings must be isolated from walls that extend above the ceiling to the building structure.

d). **Wet Areas:** Design shall use stainless steel hangers, wires or straps for suspension systems of ceilings in areas subject to moisture penetration or condensation.

e). **Acoustical Ceilings:** The AOC generally uses suspended acoustical ceilings in staff offices, retail, or service/support areas. Maintenance and tile replacement governs the selection of acoustical ceilings systems within the Capitol complex. Because the AOC maintains so much area and storage facilities are restricted, stocking and keeping track of multiple ceiling tile types is difficult. Additionally, a requirement to respond rapidly to requests for space modifications mandates that standard materials be available and "ready-to-go" without awaiting custom orders or matching within specific manufacturers. Accordingly, design shall limit acoustical ceiling system options to those listed below:

i. **Metal Suspension Systems:** Wide face 15/16" capped "TeeBar" or 9/16" slotted

"TeeBar," steel suspensions systems with electrolytically zinc coated finishes achieving a minimum Z90 coating. 15/16" capped "TeeBar" is typically used behind house or Service Buildings.

ii. **Penetrations:** Center all ceiling tile penetrations within tile fields.

iii. **Hold-downs:** Use hold-downs adjacent to operable doors and windows.

Table 7.7.3 – 1 Ceiling Systems

LOCATION	SYSTEM	FINISH	TRIM
Member's Offices	Gypsum Plaster	Level 5	Embedded galv. trim
Monumental/Formal	Gypsum Plaster	Level 5	Embedded galv. trim
Staff Offices and Conf. Rooms (Principal and Support Buildings)	Single layer 1/2" or Acoustical Ceilings	Level 3	Reveal or embedded galv. trim
Staff Offices and Conf. Rooms (Support and Service Buildings)	Acoustical Ceilings	NA.	NA.
Open Plan Offices	Acoustical Ceilings	NA.	NA.
Corridors and Lobbies (Principal Buildings)	Single layer 5/8"	Level 4	Embedded galv. trim
Corridors and Lobbies (Support and Service Buildings)	Acoustical Ceilings	NA.	NA.
Service or support areas	Single layer 5/8" or Acoustical Ceilings	Level 3	Reveal or embedded galv. trim
Closets, concealed areas	Single layer 1/2"	Level 2	Reveal or embedded galv. trim

f). **Acoustical Panels:** Design shall provide either 24" by 24" by 5/8" or 24" by 48" by 5/8" module standard ceiling tiles. Unless otherwise approved, provide standard square edge complying with ASTM E-1264. All tiles shall be rated Class A (Flame spreads of 25 or less) under ASTM E-84. All acoustical panels shall be asbestos free.

i. **Standard Office Ceilings (support buildings):** Acoustical qualities as follows: open plan NRC min of 0.95; open plan CAC = n/a., closed plan NRC a min of 0.70, closed plan min CAC of 35. Sag, impact and scratch resistant with washable and scrubbable surface. 20-year systems warranty. Recycled content greater than or equal to 30 percent. Recyclable in a closed loop process. Light reflectance no less than 85 percent. CDPH 01350 compliant. USDA Certified BioPreferred.

ii. **Kitchen and Servery Areas:** If suspended acoustical ceilings are used, design shall provide Type IV, Form 2, wet-formed mineral fiber panels with polyester film surfaces and washable finishes, NRC rating of 0.55, CAC of 35, and light reflectance of 0.80.

High-Traffic or Abuse areas: If suspended acoustical ceilings are used, design shall provide Type XX, Form 2, pattern C D surfaces Plain face, ceramic and mineral fiber composition with high-density ceramic-like finish and scrubbable finish, NRC rating of

g). 0.55, CAC of 40, and light reflectance of 0.80.

h). **Linear Metal Systems:** Use only as approved by the AOC on a case-by-case basis based on traffic and exposure conditions.

i). **Resource Management:** Design shall provide ceiling systems that comply with the following:

i. **Tiles and Panels:** Shall be manufactured using a minimum of 10 percent post-consumer recycled content or 40 percent pre-consumer recycled content.

ii. **Steel Suspension Systems:** Shall be fabricated from steel with a minimum of 10 percent post-consumer recycled content or 40 percent pre-consumer recycled content.

iii. **Recycling:** For renovation/rehabilitation projects, design shall include specification provisions for utilization of manufacturer "take-back" programs.

7.7.4. **Compartments and Cubicles**

a). **General:** This section includes ceiling-hung steel, color-coated finish toilet compartments and screens; and marble floor-mounted partitions and screens. Design shall provide wall-hung screens at urinals and floor-mounted pilasters in stalls for persons with physical disabilities.

i. **Stall Size:** Design shall provide 3 ft. on center partition spacing with a minimum stall depth of 60."

ii. **ADA Compliant Stalls:** Design shall provide minimum stall size of 60" by 60" for stalls designated for use by persons with physical disabilities. The designer shall consult AOC Project Manager for instances in renovation/rehabilitation work where existing conditions may indicate a problem.

b). **Metal Toilet Compartments and Screens:** Design shall provide nominal one-inch thick sandwich construction partitions fabricated of baked-enamel coated steel sheet bonded to kraft honeycomb cores. In high traffic public areas, the use of stainless steel face sheets is permitted.

i. **Facing Sheets**: Design shall provide mill-phosphatized steel sheet that is leveled to stretcher-leveled flatness electrolytically zinc-coated steel sheet, ASTM A 591, Class C of the following minimum thicknesses:

ii. **Pilasters (Unbraced):** 0.0478 inch.

iii. **Panels and Screens:** 0.0359 inch. Doors: 0.0299 inch.

iv. **Tapping Reinforcement:** 0.0747 inch.

c). **Core Material for Metal-Faced Units:**

i. **Sound-deadening:** a honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of one-inch minimum for doors, panels, and screens and 1-1/4 inches minimum for pilasters.

ii. **Pilaster Shoes and Sleeves (Caps):** ASTM A 666, Type 302 or 304 stainless steel, not less than 0.0312 inch thick and 3 inches high, finished to match hardware.

iii. **Color-Coated Finish:** Manufacturer's standard baked finish complying with coating manufacturer's written instructions for pretreatment, application, baking, and minimum dry film thickness. Design shall have one color in each room as selected by AOC from manufacturer's full range of colors.

iv. **Ceiling-Hung Compartments:** Design shall provide corrosion-resistant anchoring assemblies complete with threaded rods, lock washers, and leveling adjustment nuts at pilasters for connection to structural support above the finished ceiling without transmitting load to the finished ceiling. Design shall provide sleeves (caps) at tops of pilasters to conceal anchorage and structural details on drawings to ensure coordination.

d). **Marble Partitions:** Ceiling-mounted construction in new facilities utilizing polished marble of minimum HA-16 hardness. Design shall comply with details of Georgia Marble Company unless otherwise noted:

i. **Partitions:** 7/8 inch nominal thickness.

ii. **Pilasters:** 1-1/4 inch nominal thickness.

iii. **Doors:** 1 inch thick veneered solid core wood doors.

e). **Phenolic Partitions:** Can be considered in support and service buildings upon approval by the AOC to meet sustainability requirements.

f). **Hardware and Accessories:** Stainless steel design, heavy-duty operating hardware and accessories.

g). **Stirrup Brackets:** Stainless steel ear or U-brackets for attaching panels and screens to walls and pilasters.

h). **Resource Management:** Metal Partitions shall be steel with a minimum of 50 percent recycled content.

7.7.5. **Lockers:**

a). **General:** Design shall provide enameled steel lockers on 4" concrete bases. Where impractical to use concrete bases (such as in renovation/rehabilitation projects or where the installation is temporary), use metal closed "zee" bases. Where possible, design shall recess lockers into construction. Where not possible to recess lockers, provide continuous sloped tops. Design shall incorporate lockers meeting the requirements for use by persons with physical disabilities in compliance with the regulations set forth in Section 1.5.4 -

Provisions for Persons with Disabilities.

i. **Latches:** recessed latches and lock hasps.
ii. **Shelves:** hat shelves in all lockers.
iii. **Number plates:** Metal with 1/2" high numbers.

b). **Lockers:** In required locker spaces, design shall provide vented lockers at the rate of one locker per employee with sufficient seating provided to permit all locker users to be seated at any time. Associated showers shall be in separate areas from the locker rooms and provide finishes similar to those provided for toilet rooms.

c). **Benches:** Standard 9-1/2" by 1-1/4" maple.

d). **Resource Management:** Metal lockers shall be steel with a minimum of 50 percent recycled content.

7.7.6. **Toilet Accessories**

a). **General:** Stainless steel, flush trim, min. 16-gauge, without brand names or logos. Installation of toilet accessories shall meet the requirements for use by persons with physical disabilities in compliance with the regulations set forth in Section 1.5.4 - Provisions for Persons with Disabilities.

b). **Paper Towel Dispensers:** Recessed (where possible) or semi-recessed:

i. **Public Restrooms**: 8" by 800 ft. roll dispensers.
ii. **Staff Restrooms:** 575 C-fold.
iii. **Private Restrooms:** 300 C-fold.

c). **Combination Towel Dispenser/Waste Receptacle:** Recessed (where possible) or semi-recessed:

i. **Public Restrooms:** 8" x 800 ft. roll dispensers/ 16-gallon waste receptacle.
ii. **Staff Restrooms:** 575 C-fold/ 13-gallon waste receptacle.
iii. **Private Restrooms:** 300 C-fold/ 2 gallon waste receptacle.

d). **Electric Hand Dryers:** Can be considered upon approval by the AOC to meet sustainability requirements.

e). **Trash Receptacles:** Recessed or semi-recessed, 9 or 12/13 gallons.

f). **Sanitary Napkins:** Recessed or semi-recessed dispensers, napkins and tampons, 250 operating costs. Compartment partition-mounted disposal units.

g). **Toilet Paper Dispensers:** Roll-in-reserve with automatic refill, surface-mounted to walls and partitions.

h). **Soap Dispensers:** Deck or wall mounted 'touchless' operation liquid dispenser, 16-oz. capacity, concealed below lavatories, or 45-oz. stainless-steel dispenser mounted under countertops. Alternate: wall mounted, single hand manual operation push/pull lever type liquid soap dispenser with 27 oz. capacity.

i). **Mirrors:** Single 18" by 24" over wall-hung lavatories, continuous over counter mounted lavatories. Design shall provide continuous shelves under all mirrors.

j). **Baby Changing Tables:** To be installed in all public bathrooms, in which they can be accommodated. Surface mounted or recessed horizontal units, stainless steel clad with polyethylene interior. In public bathrooms that cannot accommodate a baby changing table, signage shall be installed indicating the location of the nearest public bathroom that contains a baby changing table.

k). **Grab Bars:** 1-1/4" stainless steel tubing.

7.7.7. **Artwork and Signage:**

a). **Wayfinding Program:** Wayfinding is the process in which people orient and navigate themselves through an environment. Using a medley of visual, spatial, tactile, and auditoria elements, as applicable, a successful wayfinding system or program provides clear, concise, and user-friendly information that reassures people that they are in the right place or going in the right direction within the Capitol complex.

b). **Signage and Pathfinding:** Typically, signage is the most common aid in helping people to find their way through an environment. However, it is relevant to note that effective wayfinding solutions often require more than signage alone. It is important to also consider cognitive processes of pathfinding and trailblazing instincts and explore and embrace intuitive circulation factors within a facility's architecture, lighting, landscape design and landmark elements, whenever possible. Along with a wayfinding system's principal goal of functionality, it is also equally important that the program has a strong visual aesthetic that will create a "sense of place" for people within the environment.

c). **Specific requirements within the Capitol complex:** The graphic guidelines established in the "Capitol Wayfinding Program" shall be used as a basis for signage design for new construction.
   i. The installer shall mount all hangers, channels, rods and other miscellaneous support steel as necessary for the support of suspended equipment (signage) and shall be fastened to the existing structure in such a manner as to not compromise its existing structural integrity or fire rating.
   ii. Signage is required to be installed in compliance with the regulations set forth in Section 1.5.4 – Provisions for Persons with Disabilities.

7.8. **Furnishings:**

7.8.1. **Movable Furnishings:**

a). The Jurisdictions typically purchase movable furniture and furnishings. Case goods and systems furniture manufacturers are predetermined for House and Senate offices.

7.8.2. **Fixed Casework:**

a). **Rostrums and Committee/Hearing Room Furnishings:** Design shall provide Architectural Woodwork Institute (AWI) "Premium" grade for finish and construction.
   i. **Paneling, Transparent Finish:** Design shall provide AWI "Premium" grade lumber, veneers, and finishes.
   ii. **Paneling, Opaque Finish:** Design shall provide AWI "Custom" grade substrates and "Premium" finishes.

b). **Staff Casework:** For casework subject to extensive public use, such as corridor security or information desks in:
   i. **Principal Buildings:** Design shall provide AWI "Premium" grade lumber, veneers, and finishes.
   ii. **Support and Service Buildings:** Design shall provide AWI "Custom" grade including plastic laminate countertops with solid wood edge banding.

c). **Support Casework:** Design shall provide AWI "Custom" grade cabinets, counters and work surfaces in staff workrooms. Countertops shall have plastic laminate finish with self-edge banding. Design shall not specify "post-formed" laminate countertops except in service areas or temporary construction.

d). **Solid Surface Countertops:** Design shall provide solid surface or granite countertops in public restrooms.

e). **Veneer and Plastic Laminate Substrates:** For fully supported panels, AOC prefers Medium Density Fiberboard with "Exterior Glue."

f). **Transparent Finishes - Vertical Woodwork:** Water-reducible lacquers and urethanes are preferred for vertical transparent finishes because of ease of repair, low fume production and lack of yellowing. Design shall specify to back-prime all woodwork.

g). **Temporary Installations:** For "swing spaces" and temporary buildings, design shall utilize commercially available casework fabricated to ANSI/ Kitchen Cabinet Manufacturers Association (KCMA) A161.1 standards and provide "post-formed" laminate countertops.

h). **Resource Management:**
   i. **Virgin Lumber:** Design shall provide sustainably harvested, certified, or labeled in accordance with Forest Stewardship Council or Sustainability Forestry Board. As practicable, consider the use of recycled wood where appropriate.
   ii. **Engineered Wood:** When specifying casework with engineered wood cores or substrates, design shall specify that they comply with the requirements of ANSI 208.1 or 208.2, as appropriate, for urea-formaldehyde emissions.
   iii. **Upholstery Fabric:** Flame resistance: shall be tested to pass UFAC class I or NFPA 260A. Natural fiber or light use fabrics shall be backed; abrasion ratings shall meet High traffic standards (as set forth by the Association for Contract Textiles) for reception and public areas; stain treatment, such as Crypton is recommended for light colored woven fabrics in high traffic applications. Where possible, fabrics made in the United States are preferred.

7.9. **Interior Finishes:**

a). The designer shall contact AOC's Historic Preservation Officer (HPO) to review the historic attributes of the space and to see if any restrictions apply. AOC facilities have unique

requirements and the designer shall contact AOC's Project Manager and AOC's HPO to identify building-specific unique requirements. See Section 3, Sustainable Design, for guidance on sustainable material and finish selections.

7.9.1. **Interior Wall Finishes:**

a). **General:** Design shall provide finishes that are durable, easy to clean and maintain, but applied in a manner that facilitates future removal. Where possible, design shall select colors or sources that will allow matching over the long term.

b). **Flexibility:** The design life of facilities under the jurisdiction of AOC is measured in centuries. During the life of these buildings, even such "hard" spaces as kitchens and restrooms will be rehabilitated many times.

c). **Durability:** In formal buildings at high traffic entrances, corridors and restrooms, the use of natural stone products is encouraged.

d). **Restroom Walls:** Ceramic tile is the preferred wall finish for new public restrooms in Support or Service Buildings. Design shall provide cementitious backer board behind all tile surfaces. The use of moisture-resistant (MR) gypsum board is not acceptable.

e). **Historic Finishes:** Match existing marble finishes in designated restrooms in principal buildings.

f). **Health and Safety:** Food preparation and serving area walls must meet all applicable health standards.

g). **Corridor Finishes:** Design shall use velvet or eggshell paint for finishing plaster and drywall surfaces in corridors and public areas.

h). **CMU Coatings:** In service areas with concrete or concrete masonry unit substrates, design shall specify preparation with masonry block filler and the use of semi-gloss paints to minimize dust collection.

i). **Wood Paneling:** As appropriate to formal rooms and Member/Justice offices, design shall specify finish using water-borne, satin varnishes.

j). **Glazed Wall Tile:** Conforms to ANSI A137.1. Heavy commercial (Abrasion Class V). Virtuous (P1/E1/O1). Breaking strength greater than or equal to 450 lbs. Stain and chemical Class A. 3-year warranty. Green Squared Certified, Level 3 recycled/reclaimed content, 3 Innovation Credits and publically available Environmental Product Data.

k). **Wall Covering:** Type II wall covering compliant with W-101 (2011). Scrubbability no less than 300 cycles per minute. Washability no less than 100 cycles per minute. NSF 342 Platinum Level. VOC emissions – CA 1350 compliant with 5 percent post-consumer content or 10 percent pre-consumer content.

7.9.2. **Interior Wall Painting:**

a). This section includes interior painting systems. Historic paint analysis may be required for designated areas or projects. For historic decorative finishes, the designer shall consult with AOC's HPO and/or AOC's Curator to obtain approval for processes to be used. Fine art and historic decorative murals should not be repainted or touched-up by in-house painters without the express approval of the Curator.

b). **Requirements:**

i. **Regulatory Requirements:** Some of the finishes listed below may be subject to VOC requirements within the District of Columbia, obtainable only in quart packaging. The designer shall consult with AOC's Project Manager prior to specifying alkyd, long-oil urethanes, and varnishes. Preference shall be given to low VOC coatings complying with 20 DCMR 744 and EPA Regulations (40 CFR part 59).

ii. **Specifications:** The listing below predates the Master Painters Institute standards.

c). **Concrete Masonry Units**: (MPI INT 4.2A):

i. **Block Filler:** Block filler, latex, interior/exterior, MPI #4

ii. **Low-Luster, Acrylic-Enamel Finish:** Two finish coats over a block filler.

- **First and Second Coats:** Low-luster (eggshell), acrylic-latex, interior enamel, Gloss Level 2 (MPI #144).

iii. **Semigloss, Acrylic-Enamel Finish:** Two finish coats over a block filler.

- **First and Second Coats:** Semigloss, acrylic-latex, interior enamel, Gloss Level 5 (MPI #147).

d). **Clay Masonry Substrates:**

i. **Institutional Low-Odor/VOC Latex System**:
   - **Prime Coat:** Primer sealer, interior, institutional low odor/VOC, MPI #149.
   - **Intermediate Coat:** Latex, interior, institutional low odor/VOC, matching topcoat.
   - **Topcoat:** Latex, interior, institutional low odor/VOC, (Gloss Level 2), MPI #144.
   - **Topcoat:** Latex, interior, institutional low odor/VOC, semi-gloss (Gloss Level 5), MPI #147.

e). **Gypsum Drywall Substrates:**

i. **Low-Sheen, Low-Odor/VOC Latex:** Two finish coats over a primer.
   - **Prime Coat:** Interior Latex primer/sealer. (MPI #149).
   - **Intermediate Coat:** Institutional low-odor/ VOC interior latex, matching topcoat.
   - **Topcoat:** Institutional low-odor/VOC, low sheen interior latex, (MPI #144).

ii. **Semigloss, Low-Odor/VOC Latex:** Two finish coats over a primer.
   - **Prime Coat:** Interior Latex primer/ sealer. (MPI #149).
   - **Intermediate Coat:** Institutional low-odor/ VOC interior latex matching topcoat.
   - **Topcoat:** Institutional low-odor/VOC, semi-gloss interior latex, (MPI #147).

f). **Plaster Substrates:**

i. **Low-Luster, Acrylic-Enamel System:** Two finish coats over alkali-resistant, latex-based, interior primer.
   - **First and Second Coats:** Low-luster (eggshell or satin), acrylic-latex, interior enamel, (MPI #144).

g). **Woodwork / Hardboard:** (MPI INT 6.3U):

i. **Low-Luster, Acrylic-Enamel Finish:** Two finish coats over alkyd-based, interior wood primer.
   - **First and Second Coats:** Low-luster (eggshell or satin), acrylic-latex, interior enamel.

ii. **Semigloss, Acrylic-Enamel Finish:** Two finish coats over an alkyd-based, interior wood undercoater.
   - **Prime Coat:** Primer, latex, for interior wood**,** (MPI #39).
   - **First and Second Coats:** Semigloss, acrylic-latex, interior enamel, (MPI #147).

iii. **Full-Gloss, Acrylic-Enamel Finish:** Two finish coats over an alkyd-based, interior wood undercoater.
   - **First and Second Coats:** Full-gloss, acrylic-latex, interior enamel.

h). **Stained Woodwork:** Design shall provide the following stained finishes over new, interior woodwork:

i. **Polyurethane Varnish System (MPI INT 6.1 J):** Two finish coats of polyurethane, clear-satin varnish over an alkyd-based, interior wood stain.
   - **Filler Coat:** Paste-wood filler (as required).
   - **Stain Coat:** Alkyd-based, interior wood stain.
   - **First and Second Finish Coats:** Alkyd-based or polyurethane varnish.

ii. **Waterborne Clear Acrylic Over Satin System (MPI INT 6.1R):** Two (2) finish coats of a waterborne, clear-satin varnish over a waterborne, interior wood stain (not for floor or desk surfaces):
   - **Filler Coat:** Paste-wood filler (as required).
   - **Stain Coat:** Waterborne, interior wood stain.
   - **First, Second and Third Finish Coats:** Waterborne acrylic finish.

iii. **Waterborne Clear Acrylic Over Full-Gloss System (MPI INT 6.1R):** Three (3) finish coats of a waterborne, clear, full-gloss varnish over a waterborne, interior wood stain (not for floor or desk surfaces):
   - **Filler Coat:** Paste-wood filler (as required).
   - **Stain Coat:** Interior wood stain.
   - **First and Second Finish Coats:** Waterborne acrylic finish.

i). **Natural-Finish Woodwork:** Design shall provide the following natural finishes over new, interior woodwork:

i. **Alkyd-Based, Satin-Varnish System (MPI INT 6.1C):** Two finish coats of an alkyd-based, clear-satin varnish over a sanding sealer. Design shall provide wood filler on open-grain wood before applying first varnish coat:
   - **Sealer Coat:** Clear sanding sealer.
   - **First and Second Finish Coats:** Alkyd-based or polyurethane varnish.

ii. **Waterborne Clear Acrylic System (MPI INT 6.IF):** Three finish coats of a waterborne, clear-satin acrylic.

j). **Ferrous Metal:**

i. Semigloss, Latex over Alkyd Primer System (MPI INT 5.1Q):
   - **Primer:** Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer.
   - **Intermediate Coat:** Semigloss, acrylic-latex, interior enamel.
   - **Finish Coat:** Semigloss, acrylic-latex, interior enamel.

ii. Semigloss, Alkyd-Enamel System (MPI INT 5.1 R):
   - **Primer:** Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer.
   - **Intermediate Coat:** Alkyd, interior enamel undercoat or semigloss, interior, alkyd-enamel finish coat.
   - **Finish Coat:** Odorless, semigloss, alkyd, interior enamel.

iii. Full-Gloss, Alkyd-Enamel System (MPI INT 5.1R):
   - **Primer:** Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer.
   - **Intermediate Coat:** Alkyd, interior enamel undercoat or full-gloss, interior, alkyd-enamel finish coat.
   - **Two Finish Coats:** Full-gloss, alkyd, interior enamel.

k). **Steel Substrates:**

i. Prime Coat: Primer, rust-inhibitive, water-based (MPI #107).

ii. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 2), (MPI #144).

iii. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (Gloss Level 5)**,** (MPI #147).

l). **Galvanized-Metal Substrates:**

i. Prime Coat: Primer, galvanized, water based**,** (MPI #134).

ii. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 2), (MPI #144).

iii. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (Gloss Level 5), (MPI #147).

m). **Aluminum (Not Anodized or Otherwise Coated) Substrates:**

i. Prime Coat: Primer, quick dry, for aluminum, (MPI #95).

ii. **Intermediate Coat:** Latex, interior, institutional low odor/VOC, matching topcoat.

iii. **Topcoat:** Latex, interior, institutional low odor/VOC, semi-gloss (Gloss Level 5)**,** (MPI #147).

7.9.3. **Interior Floor Finishes:**

a). **General:** Design shall provide finishes that are durable, easy to clean and maintain, but applied in a manner that facilitates future removal. Where possible, design shall select colors or sources that would allow matching over the long term.

b). **Flexibility:** The design life of facilities under the jurisdiction of AOC is measured in centuries. During the life of these buildings, even such "hard" spaces as kitchens will be rehabilitated many times. Wherever possible, install flooring using "thin-set" methods that would permit easy removal and replacement as needs change without damage to underlying strata.

c). **Durability:** In buildings at high traffic entrances and corridors, the use of natural stone products is encouraged. Avoid use of limestone, slate or bluestones for interior installations.

d). **Entrances:** Design shall develop entrance areas with grilles or grating systems to mitigate dirt and moisture migration. For Service Buildings, design shall plan for the use of floor mats integrated into flooring system.

e). **Stone Floor Finishes:** Design shall use stone surfaces in high traffic, public areas and stone tile wherever high levels of cleaning or maintenance is required. Design shall use domestically quarried stone tile unless written permission is obtained from the AOC Project Manager.

i. **Marble:** Design shall consider marble for use where the building program dictates, such as for entry lobbies and vestibules, etc. For renovation/rehabilitation projects, match existing unless directed otherwise.

ii. **Granite:** Design shall consider granite for use where the building program dictates, such as for entry lobbies and vestibules, and for surfaces that may be subject to freeze/thaw action or foot traffic transfer of snow removal salts. Use of thermal

finishes preferred at exterior openings exposed to "wet" foot traffic.

iii. **Setting Mortars:** Design shall use either dry-set factory formulated portland cement mortar or latex portland cement mortars in thin set beds wherever possible. Design shall limit colors to natural gray, or for limited installations, white or black.

f). **Concrete Floor Finishes:**

i. **Garage and Parking Areas:** High-density concrete surfaces on pre-stressed structural systems. Float finish, with fluid-applied silane concrete sealer required. Slope all garage floors a minimum of 1/4" per foot to drains.

ii. **Mechanical and Support Areas:** Toweled concrete finish with applied urethane finish coatings formulated to resist chemicals germane to the area of installation.

iii. **Janitor Closets:** 6" by 6" by 1/2" quarry tile or troweled concrete finish with applied urethane coating.

iv. **Concrete Finishes:** Concrete finishes shall be as defined in ACI 301 Specifications for Structural Concrete.

v. **Broomed Finishes:** When broom finished concrete is specified, the direction of the brooming shall be indicated on the drawings.

Table 7.9.3 – 1 Interior Finishes

Interior Finishes	Building Class		
	Principal	Support	Service
Material Quality – General	Marble	Stone	Masonry
Lobbies	Terrazzo/marble	Ceramics	Plaster/wood
Corridors	Terrazzo/marble	*	*
Toilets and Restrooms	Terrazzo/marble	Ceramics	Plaster/tile/wood
Partitioning	Masonry/plaster	GWB/ Acous.	GWB/ Acous.
Ceilings	Plaster	Acoustic	Acoustic

g). **Tile Floor Finishes:** Design shall use tile or stone surfaces in high traffic, public areas and use tile wherever high levels of cleaning or maintenance is required. Design shall use domestically produced tile unless written permission is obtained from AOC's Project Manager.

i. **Porcelain Tile:** Preferred floor finish in public restrooms and staff/private toilets. Conforms to ANSI A137.1. Heavy commercial (Abrasion Class V). Virtuous (P1/E1/O1). Breaking strength greater than or equal to 450 lbs. Stain and chemical Class A. 3-year warranty. Green Squared Certified, Level 3 recycled/reclaimed content, 3 Innovation Credits and publicly available Environmental Product Data.

ii. **Mosaic Tile**: Conforms to ANSI A137.1. Heavy commercial (Abrasion Class V). Virtuous (P1/E1/O1). Breaking strength greater than or equal to 450 lbs. Stain and chemical Class A. 3-year warranty. Green Squared Certified, Level 3 recycled/reclaimed content, 3 Innovation Credits and publicly available Environmental Product Data.

iii. **Quarry Tile:** Minimum standard smooth-cut 6" x 6" natural clay colored preferred. Do not use "flamed edge" styles. Addition of abrasive grit coatings is encouraged in traffic areas where slip resistance is required. Preferred floor surface for kitchen floors. Conforms to ANSI A137.1. Heavy commercial (Abrasion Class V). Virtuous (Class E1). Breaking strength greater than or equal to 450 lbs. Stain and chemical Class A. 3-year warranty. Green Squared Certified, Level 3 recycled/reclaimed content, 3 Innovation Credits and publicly available Environmental Product Data.

iv. **Dimension Stone:** Granite or marble shall be a minimum of 7/8" thick and as large as practicable for the pattern created. Vary dimensions as required to match original installations. Design shall use thermal finishes at entries and other areas exposed to water.

v. **Setting Mortars:** Design shall use either dry-set factory formulated portland cement

mortar or latex Portland cement mortars in 3” mud set beds wherever possible.

h). **Resilient Flooring:** Due to the high traffic and long-term life of most AOC buildings, the use of resilient flooring systems is limited to short-term installations, such as vending areas, workrooms, service support areas or intra-suite use. Design shall provide slip-resistant flooring where required by ADA regulations.

i. **Floor Tile:**

- **Vinyl composition tile (VCT), Vinyl Tile:** Class III 20 mil wear Layer or Class I Monolithic. Thickness of 0.100” or greater (Class III) or 0.125” or greater (Class I). Static load limit greater than or equal to 175 psi. Specialty finish applied. 5-year warranty. Five percent recycled content. Meets Sustainability NSF 332, is CA 1350 compliant and Floor Score Certified.
  Rubber Tile: Class I Homogenous A&B (A=Solid Color Wear Layer; B=Mottled Wear Layer). Thickness of 0.125” or greater. 5-year warranty. Fifty percent recycled content, Floor Score Certified, meets Sustainability NSF332 and is VOC emission – CA 1350 compliant.

ii. **Sheet Goods:**

- **Sheet Vinyl:** Homogeneous, thickness of 0.075 or greater. Static load limit greater than or equal to 250 psi. Specialty top coat applied. 5-year warranty. Five percent recycled/renewable content meets Sustainability NSF332 and is CA 1350 and Floor Score compliant.
- **Linoleum**: Thickness no less than 3.2 mm. Static load limit greater than or equal to 400 psi. Low maintenance coating applied. 3-year warranty. Twenty percent recycled/renewable content. Thirty percent minimum binder content. Is VOC emission – CA1350 compliant.
- **Stair Treads:** Rubber or vinyl treads with integral nosing, non-slip pattern, free of dirt catching grooves or crevices.
- **Base:** Vulcanized thermoplastic rubber (Type TS) w/ solid (homogeneous) construction (Group I). 1-year warranty. Low VOC/Conforms to NSF 332. 4" rubber or vinyl bull nose cove base is the agency standard, with pre-formed corners. Design shall use straight base at carpeted areas.

i). **Terrazzo Systems:** Conforms to ANSI A137.1. Heavy commercial (Abrasion Class V). Virtuous (P1/E1/O1). Breaking strength greater than or equal to 450 lbs. Stain and chemical Class A. 3-year warranty. Green Squared Certified, Level 3 recycled/reclaimed content, 3 Innovation Credits and publicly available Environmental Product Data. Terrazzo floor systems separated from the structural slab by a sand cushion are preferred. The designer shall consult AOC’s Project Manager when a sand cushion system cannot be used.

j). **Laminate Flooring:** Classified as Heavy Commercial Flooring. Wear resistance no less than 6,000 cycles using NEMA test 3.7- taber model 5130 test or equivalent. Static load limit greater than or equal to 8 MPa. High wear resistant thermoset surface. 10-year warranty. California Air Resources Board (CARB) verified Phase 2 and VOC emissions – CA 1350 compliant with 90 percent recycled content.

k). **Special Flooring:** The designer shall consult AOC’s Project Manager prior to specifying marble chip or ceramic granule "seamless" flooring systems.

l). **Raised Floors (Access Flooring):** Design shall use concrete-filled metal floor panels or concrete floor panels. Design shall use stringer type systems for floors subject to cart travel. Unless directed otherwise, design shall provide high-pressure plastic laminate surfaces in computing areas and metal surfaces under office areas scheduled to receive carpet tiles and limit use of heavy-duty bolted stringer systems.

m). **Resource Management:** Ceramic Porcelain and Quarry Tile shall have a minimum of 5 percent post-consumer content or a minimum of 20 percent pre-consumer recycled content whenever possible.

7.9.4. **Exterior Finishes:**

a). **General:** Design shall provide finishes that are durable, easy to clean and maintain. Where possible, design shall select colors or sources that would allow matching over the long term.

i. **Concrete Substrates, Vertical Surfaces:**

- Epoxy System:
- Prime Coat: Epoxy, gloss [, MPI #77].
- Intermediate Coat: Epoxy, gloss [, MPI #77].
- Topcoat: Epoxy, gloss [, MPI #77].

ii. **Concrete Substrates, Horizontal Surfaces:**

- Epoxy Slip-Resistant Deck Coating System:
- Topcoat: Epoxy deck coating (slip-resistant) [, MPI #82].

iii. **Clay-Masonry Substrates: Pigmented Polyurethane over Epoxy System:**

- Prime Coat: Epoxy, gloss [, MPI #77].
- Intermediate Coat: Epoxy, gloss [, MPI #77].
- Topcoat: Polyurethane, two-component, pigmented, gloss (Gloss Level 6) [, MPI #72].

iv. **CMU Substrates: Pigmented Polyurethane over High-Build Epoxy System:**

- Block Filler: Block filler, epoxy [, MPI #116].
- Intermediate Coat: Epoxy, high-build, low gloss [, MPI #108].
- Topcoat: Polyurethane, two-component, pigmented, gloss (Gloss Level 6) [, MPI #72].

v. **Steel Substrates: Pigmented Polyurethane over Epoxy Zinc-Rich Primer and High-Build Epoxy System:**

- Prime Coat: Primer, zinc-rich, epoxy [, MPI #20].
- Intermediate Coat: Epoxy, high-build, low gloss [, MPI #108].
- First Topcoat: Polyurethane, two-component, pigmented, gloss (Gloss Level 6) [, MPI #72].
- Second Topcoat: Polyurethane, two-component, pigmented, gloss (Gloss Level 6) [, MPI #72].

vi. **Galvanized-Metal Substrates: Pigmented Polyurethane over Vinyl Wash and Epoxy Primer System:**

- Prime Coat: Primer, vinyl wash [, MPI #80].
- Intermediate Coat: Primer, epoxy, anti-corrosive, for metal [, MPI #101].
- First Topcoat: Polyurethane, two-component, pigmented, gloss (Gloss Level 6) [, MPI #72].
- Second Topcoat: Polyurethane, two-component, pigmented, gloss (Gloss Level 6) [, MPI #72].

vii. **Wood Substrates: Pigmented Polyurethane System:**

- Prime Coat: Polyurethane, two-component, pigmented, gloss (Gloss Level 6) [, MPI #72].
- Intermediate Coat: Polyurethane, two-component, pigmented, gloss (Gloss Level 6) [, MPI #72].
- Topcoat: Polyurethane, two-component, pigmented, gloss (Gloss Level 6) [, MPI #72].

7.9.5. **Carpet Flooring:**

a). **General:** Building specific requirements will frequently preempt the requirements listed in the table below. The designer shall contact AOC Interior Design staff prior to finalizing any determination affecting carpet.

b). **Construction:** The use of broadloom carpets is restricted to fixed partition senior-level offices and spaces noted below. Design shall use carpet tiles for all areas with demountable or movable partitions. Woven carpets and patterns are preferred over tufted carpets and printed patterns. Woven carpets provide better appearance retention. In woven carpets, less pile weight is required to achieve the same performance as tufted carpet. In special instances, woven carpets such as Axminster or Wilton custom patterned carpets are employed.

i. **Broadloom Carpet Tile:** Texture appearance retention rating of 3.5 or higher (Severe traffic). Type 6 or Type 6, 6, BCF Nylon or bio based tile. 15-year warranty. Fifteen percent Post-Consumer Recycled Content. NSF 140 Gold Level Certified.

c). **Color/Patterns:** Except in private offices and formal reception areas, design shall use patterns to mask spills and soiling. Upon approval, formal areas may use solid colors with or without borders. Solution-dyed carpet is preferable for its bleach and stain resistant properties.

d). **Installation:** Except in senior-level private offices and spaces noted below, install carpet by direct glue methods, using "strippable" adhesives unless adhesives are prohibited due to the historic nature of the existing flooring.

i. Hart Senate Office Building - Carpet tiles throughout except Senator's Office have choice of broadloom or tile.
ii. Russell and Dirksen Senate Office Buildings. Standard broadloom or tiles (for staff areas, tiles must be used where there is modular furniture); Senator's Office have choice of broadloom or tile.
iii. Staff option in most Congressional Offices.
iv. Cannon and Rayburn House Office Buildings - Choice of carpet tiles or broadloom.
v. Longworth House Office Building -Only Committee Rooms may use broadloom as most other areas employ under-carpet wiring systems.

e). **Fiber:** Latest generation nylon, multinobal is preferred. Listed fiber face weights in the table are minimums. All yarn in high traffic, public or food service areas shall be solution-dyed (except for identified patterns). For Axminster or Wilton custom patterned carpets use wool or wool/nylon blend.

f). **Adhesives:** Secure all carpeting with low emitting, low VOC adhesives that meet the requirements of DOEE regulations (20 DCMR 744). Ensure proper ventilation before beginning installation.

g). **Resource Management:**
i. **Carpet Fiber:** To the extent practicable, design shall provide 25-100 percent post-consumer content.
ii. **Carpet and Carpet Tile Backing:** Design shall provide minimum 40 percent post-consumer recycled content for carpet backing and 60 to 90 percent post-consumer content for rubber carpet cushion.
iii. **Reclamation:** Design shall specify manufacturer requirements to participate in carpet reclamation programs to divert carpet waste product from landfills. Many programs are available today for collecting and reclaiming old carpet, even if the carpet is not from a direct manufacturer. These old carpets can be collected and turned into many useful products such as auto parts, padding, or soundproofing and kept out of landfills.
iv. To the extent practicable, carpet should be manufactured in the United States.

h). **Texture Appearance Retention Rating (TARR):** When available - ASTM D5252 Hexapod drum at 12000 cycles evaluated per CRI TM 101. Moderate traffic: min 2.5 TARR (private office, staff office, committee/hearing rooms); Heavy traffic: min 3.0 TARR (clerical areas, work rooms, formal dining rooms, meeting and instructional areas); Severe traffic: min 3.5 TARR (public areas, cafeterias).

7.9.6. **Window Coverings:**

a). Window coverings shall have a neutral appearance when viewed from the exterior of the building.

b). Materials specified for drapery treatments shall pass the requirements of NFPA 101 unless written documentation directs otherwise.

Table 7.9.5 – 1 Carpet Type

LOCATION	BROADLOOM OR TILE	INSTALL METHOD	PILE TYPE	DESIGN	MIN. FACE WEIGHT OR TARR
Member's Private Office	Broadloom	Padded	Cut	Option	42 oz. or Medium
Senior Staff Office	Broadloom	Padded	Cut or Loop	Option	42 oz. or Medium
Staff Office	Broadloom or Carpet Tile	Direct Glue	Cut or Loop	Texture	22 oz. or Medium
Clerical Areas	Broadloom / Carpet Tile	Direct Glue	Loop	Pattern	22 oz. or Heavy
Work Rooms/Support	Carpet Tile	Direct Glue	Loop	Texture	22 oz. or Heavy
Public Reception Areas	Broadloom or Carpet Tile	Direct Glue	Patterned Loop	Texture	28 oz. or Severe
Committee/Hearing Rooms	Broadloom	Padded	Cut	Pattern	42 oz. or Medium
Formal Dining Rooms	Broadloom	Padded	Cut	Pattern	28 oz. or Heavy
Cafeteria Dining	Carpet Tile	Direct Glue	Patterned Loop	Pattern	28 oz. or Severe
Meeting and Instructional Areas	Carpet Tile	Direct Glue	Loop	Pattern	22 oz. or Heavy

7.10. **Restrictions:**

a). Do not use ship's ladders in mechanical rooms without written AOC approval.
b). Do not use painted handrails.
c). Do not use gypsum-based or treated gypsum panels behind tile surfaces.
d). Do not use wood framing in AOC partition systems.
e). Do not use textured finishes for walls. Limit textured finishes to sand floated finishes for Portland cement plaster exterior soffits.
f). Wherever possible, avoid applied finishes on surfaces subject to hand contact. Do not "steam strip" historic wood doors during refinishing operations.
g). Do not use brand names except as provided above.
h). Do not use plastic laminate-faced doors without written AOC direction.
i). Do not use floor-mounted metal partitions in restrooms.
j). Do not use plastic laminate-faced partitions.
k). Do not use HDPE partitions.
l). Do not use wood, lead, or plastic plug type anchors to secure panels or pilasters.
m). Do not use open leg lockers or flat top lockers except in temporary installations. Do not use lockers fabricated from HDPE.
n). Do not use "splatter" type paint finishes.
o). Do not use vinyl wall coverings without written approval of the AOC.
p). Do not use acrylic latex topcoats on metal without AOC permission.
q). Do not use clear urethane coatings on exterior surfaces.
r). Do not use vinyl wall coverings in corridors or public areas without AOC's permission.
s). Avoid use of setting methods that require "dapped" slabs or thick bedding methods in areas that may be subject to future renovations/rehabilitations.
t). Do not use field-proportioned setting mortar except in thick bed installations where long slopes to drain are required.
u). Do not use organic adhesives to set stone tile.
v). Do not use water-based adhesives over "new" or on below-grade concrete slabs.
w). Do not employ "sanding" techniques to remove existing resilient flooring systems.
x). Do not install new resilient flooring systems

over existing resilient flooring systems.

y). Do not use resilient or laminate products with printed "wood grains," without AOC's authorization.

z). Do not use resilient systems with extensive seaming or grout lines.

aa). Do not use curing compounds or sealers on concrete slabs scheduled to receive applied finishes or tile.

bb). Do not use traffic coatings on new or existing garage floors without written AOC authorization.

cc). Do not use resilient tile in public restrooms.

dd). Do not use broadloom carpets or padded carpet in open-plan spaces or areas with demountable partitions.

ee). Do not use dark, solid colors except with AOC approval.

ff). Do not use carpet in corridors subject to heavy traffic.

gg). Do not use carpet within 5 feet of vending machines.

hh). Do not use carpet in serving line areas of cafeterias.

ii). Do not use concealed spline systems without prior authorization.

jj). Do not use patterned or scored face tiles (nodular or cast panels).

kk). Do not use suspended ceiling systems to achieve fire protection of structural components.

ll). Do not use suspended ceiling systems in shower rooms or other high humidity areas without AOC authorization.

mm). Do not use powder-actuated fasteners to anchor ceilings, without AOC and USCP authorization.

nn). Verify specific restrictions with the HPO.

8. Fire Protection and Life Safety

8.1. Introduction and General Provisions:

a). Unless specifically directed otherwise, the technical fire protection requirements of the AOC Design Standards apply to all new construction and to all renovation/rehabilitation projects to the extent that the existing building infrastructure supports. Deviations from these requirements will be considered after the A/E registered fire protection engineer performs a risk assessment of an alternative design and submits the assessment and proposed deviation in accordance with AOC Fire Protection Policy 11-2: Interpretations, Variances and Appeals for Fire and Life Safety. Alternative designs shall provide equivalent fire protection to that required herein.

8.1.1. Design Requirements:

a). **General:** Comply with requirements of the adopted Codes as referenced in Section 1, General Requirements. Design shall reduce the likelihood of fires and mitigate their effects if encountered. Design shall protect human life, reduce the potential loss to property and historic treasures, and maintain continuity of Government function.

i. **Sprinklered Buildings:** Unless specifically directed otherwise in writing or in Section 8.10.1, design all new Capitol buildings for full sprinkler coverage. For purposes of construction type and means of egress, existing buildings shall be considered "protected throughout with an automatic, fully supervised sprinkler system" if the sprinkler system is waiting on construction funding, or under construction. The A/E shall contact the AOC Project Manager to determine the building's status. The Project Manager shall include documentation in the design record.

ii. **Note:** Unprotected atriums that are 55 feet or higher do not negate "protected throughout" status.

b). **Occupancy Classifications and Occupant Load:** Provide before and after egress calculations for all projects to determine effect on existing egress. Comply with the occupancy classifications as defined in the International Building Code. Occupant load factors shall comply with NFPA 101, with the following modifications:

i. **Occupant Load Factor Modifications:** For mechanical rooms and storage rooms, use 500 sq. ft. per person.

c). **Interior Finishes:** Interior finishes for walls, ceilings, floors, draperies, curtains and movable partitions shall meet the requirements of the NFPA 101.

d). **Life Safety Analysis:** As part of the design package for each project, life safety drawings shall be provided. The drawings shall include all pertinent information, such as occupancy classification, construction type, required fire-resistance ratings and types, occupant loads, egress capacity, means of egress requirements and a visual representation of how they are met. In case of a renovation/rehabilitation, the Life Safety Analysis shall be limited to the conditions the renovation/rehabilitation affects.

e). **Historic Preservation:** Consult Section 2, Historic Preservation for further information regarding preservation of Heritage Assets.

8.2. Related Sections:

a). Other Sections that contain important information that may affect elements of this section or their implementation include, but are not limited:

ii. Refer to Section 1, General Requirements.

iii. Refer to Section 2, Historic Preservation, for requirements for the preservation of Heritage Assets.

iv. Refer to Section 9, Mechanical and HVAC, for related information.

v. Refer to Section 10, Plumbing for related information.

vi. Refer to Section 11, Electrical, for related information.

8.3. Fire Safety During Construction and Renovation/Rehabilitation Projects:

a). **Fire Safety During Construction:** A large portion of construction work performed within the Capitol involves work within occupied buildings. Accordingly, it requires compliance with the International Fire Code requirements, NFPA 241 and AOC Fire Protection Policy 11-4, the AOC Fire Code. Refer to Section 1, General Requirements, for all required codes

and standards.

b). **Construction Zoning / Phasing:** Design shall provide phasing drawings for projects affecting existing fire protection systems to provide for code-compliant coverage of spaces during construction. Delineate temporary fire partitions and paths of egress to be used during construction operations. If the project is being constructed using AOC staff, submit to the Jurisdiction Fire Protection Engineer for approval; if the construction is contracted, submit to the Project Manager for approval. Specifications shall provide provisions to ensure proper monitoring of space during times when permanent systems are out of operation.

8.4. Historic Structures:

8.4.1. General:

a). For an overall fire protection plan and to emphasize the Design Team's responsibility to address fire protection and to preserve the historic integrity of historic structures, the Design Team shall explore alternative approaches, outlined in national and state rehabilitation codes and performance-based codes, to resolve conflicts between prescriptive code requirements and preservation goals.

i. The requirements and recommendations of NFPA 914 shall be used as a guide for rehabilitation projects in historic structures.

ii. The Design Team shall also evaluate the Housing and Urban Development (HUD) Guideline "Fire Ratings of Archaic Materials and Assemblies" that provides test data on the fire resistance of a variety of historic materials and GSA publication entitled "Fire Safety Retrofitting in Historic Buildings."

iii. The AOC is the ultimate Authority Having Jurisdiction (AHJ) for all facilities. The AOC Fire Marshal has been delegated authority in regards to fire protection and life safety and must exercise professional judgment to assess the acceptability of alternative compliance solutions in accordance with AOC Fire Protection Policy 11-1: Authority Having Jurisdiction (AHJ) for Fire and Safety.

iv. Early and frequent coordination between the architects, the AOC Historic Preservation Officer (HPO), Curator, Preservation Specialists, external review groups, and the Design Team's fire protection engineer is imperative to timely resolution of conflicts between fire safety and preservation goals.

8.4.2. Fire Protection Alternatives for Consideration:

Listed below are fire protection alternatives that the Design Team's Fire Protection Engineer shall consider when designing a project:

a). Enclosure of stairs in historic buildings should be avoided by designing alternative methods of providing safe egress. If required, new stair enclosures in historic buildings shall be designed to minimize visual impact on significant spaces, including historic lobbies and corridors. Cross-corridor doors should be designed to provide maximum height and width clearance and avoid visually truncating the corridor. Oversized hold-open doors will achieve this goal in most circumstances. Transparent treatments, such as rated glass assemblies or historic doors modified to incorporate rated glass should be considered when barriers must be kept closed to maintain a rated enclosure. Nonprescriptive compliance solutions, such as modification of historic door assemblies, must be approved by the AOC Fire Marshal in accordance with the AOC Fire Protection Policy 11-2: Interpretations, Variances and Appeals for Fire and Life Safety.

b). New fire-rated doors in restoration or rehabilitation zones should be designed to closely resemble historic doors in panel detailing and finish. True-paneled fire doors that replicate the historic door details are preferred for replacement of original paneled stair or corridor doors.

c). In restoration or rehabilitation zones, sprinklers should be carefully placed to minimize damage to ornamental materials and decorated surfaces and should not be installed in fine art murals (consult the Curator). Develop detailed drawings for architecturally sensitive areas, showing precise sprinkler locations, piping locations, channeling of piping, and finishing notes, as necessary, to

ensure proper installation. Sprinklers should be centered and placed symmetrically in relation to ornamental patterns and architectural features defining the space, such as arched openings.

d). Sprinklers and escutcheons should match original architectural surfaces or hardware. Oxidized brass or bronze heads are recommended for use in dark stained, clear finished woodwork. In elaborately decorated ceilings, heads should be camouflaged by custom coating and omitting escutcheon plates. In such cases, low profile, quick response sprinklers are preferred.

e). In restoration and rehabilitation zones, smoke detectors should be carefully placed to minimize destruction of ornamental surfaces and should not be placed in fine art murals (consult the Curator). Where ceilings are elaborately embellished, explore alternative detection products and approaches such as air sampling detection, projected beam, low profile spot detectors, recessed installation or custom-coating detector housings to blend with ornamental finishes.

f). Application of special, non-factory standard finish treatments to smoke detector housings must be coordinated with, and approved in writing, by the manufacturer to ensure that UL labels and detector performance are not compromised. Smoke detector housings must be removed prior to application of special finishes.

g). In restoration and rehabilitation zones, fire alarm devices should be carefully placed to minimize damage to ornamental materials and decorated surfaces. Develop detailed drawings for architecturally sensitive areas, showing the precise device and conduit locations, as necessary, to ensure proper installation.

8.5. **Building Construction:**

a). For each construction type, design fire-resistive ratings of structural members in accordance with the requirements of the International Building Code. Construction type for the associated building shall be agreed to prior to design.

8.6. **Emergency Power, Lighting and Exist Signage:**

a). Design shall provide in accordance with the requirements of NFPA 101, NFPA 110 and NFPA 111. Also, refer to Section 11.9.3 in Electrical.

8.7. **Means of Egress:**

a). All means of egress shall meet NFPA 101 requirements. The International Building Code shall not be used for means of egress.

b). **Special Requirements:** For common paths of travel and dead-end corridors, NFPA 101 exceptions for sprinkler protection shall apply to fully sprinklered fire areas that are separated from un-sprinklered areas by fire-resistive construction equal to that required for protection of shafts, even if the other floors of the building are not sprinklered.

c). **Fire Escapes:** Fire escapes, as defined in NFPA 101, shall not be considered approved exits.

d). **Stairway Pressurization:** Only provide stairway pressurization in accordance with NFPA 101 when required by NFPA 101.

e). **Delayed Egress Systems:** In a building provided with full automatic fire sprinkler protection, the egress path from any point in the building shall pass through not more than two delayed egress locking systems before reaching an exit, provided the combined delay does not exceed 30 seconds. The egress path from any point in the building shall pass through not more than three delayed egress locking systems before exiting the exit discharge, provided the combined delay does not exceed 60 seconds. In a building not provided with full automatic sprinkler protection, the egress path from any point in the building shall pass through not more than one delayed egress locking system before exiting the exit discharge.

8.8. **Fire Alarm Systems:**

a). Design shall provide a fire alarm system throughout all new construction projects and in all major renovation/rehabilitation projects, except in buildings with a total area of less than 5,000 sq. ft. and an occupant load of less than 50 persons. All devices and their installation shall meet ADA requirements. Specific requirements are as follows (also see section 8.15, Restrictions):

b). **Visible and Audible Notification:** All new fire alarm systems shall be provided with an

audible notification system and visual appliances when required per section 8.8.5.

c). **Manual Initiation:** Manual fire alarm stations shall be provided for all fire alarm systems. Exceptions for automatic sprinklers do not apply.

d). **Sequence of Operations**: The sequence of operations for principal buildings shall maintain current arrangements. The sequence of operations in non-principal buildings shall be coordinated with the AOC Fire Marshal.

e). **Stand-alone Systems:** Fire alarm systems shall not be integrated with other building systems such as building automation, energy management, etc. Fire alarm systems shall be self-contained, stand-alone systems, able to function independently of other building systems, except that they shall be capable of accepting mass notification input in project-specific cases.

f). **Zones:** Fire alarm system shall be designed to support partial evacuation, but a total building evacuation shall be employed.

g). **New systems:** New fire alarm systems shall be addressable.

h). **Voice communication:** New fire alarm systems shall include In-Building Fire Emergency Voice/Alarm communication systems. Voice communication may be provided by the USCP Public Address System, so long as the fire alarm system is capable of producing automatic notification signals in accordance with the 2016 edition of NFPA 72, section 23.8.6, including public-mode audible appliances. In addition, the interface between the systems must comply with NFPA 72, section 24.5.25, "*Public Address (PA) System Interface with Facility Fire Alarm System."* Voice communication may be omitted in smaller facilities with AOC Fire Marshal approval.

i). **Control Functions:** Provide control functions through programmable relays whenever feasible. For example, HVAC shutdown and elevator shunt trip shall be controlled through programmable relays and not by direct connection to associated detectors.

j). **Spare Circuit Capacity:** Each new fire alarm circuit shall include 20 percent spare capacity.

k). **Raceway:** All new fire alarm circuits shall be installed per NFPA 70. Exceptions: Rigid conduit must be utilized in Capitol Power Plant facilities.

l). **Capitol Visitor Center Fire Alarm Modifications:** Modifications to the Capitol Visitor Center fire alarm system shall maintain the current fire alarm infrastructure arrangement as subsequently described. New or modified fire alarm system SLC devices shall be connected to SLC segments of the same type of device (pull stations, smoke detectors, heat detectors, etc.). Each segment of the same type of devices shall be connected to an isolation module. A maximum of 25 devices shall be permitted to connect existing isolation modules. New isolation modules shall not be loaded with more than 20 devices.

m). **Secondary Power:** If building generator is used for emergency lighting power, generator may be used and credited as secondary power source for the fire alarm system. Buildings shall be provided with sufficient secondary power (either batteries or generator) to effect building evacuation and USCP accountability after a 24-hour standby period. In principal buildings, this requires 30 minutes of alarm.

n). **Degrade Mode:** Fire alarm system control panels shall not be programmed to operate in "degrade mode," where a single alarm initiating device causes notification appliances to automatically activate in the event of a system fault or communication failure.

8.8.1. **Manual Fire Alarm Stations:**

a). Manual fire alarm stations shall be double-action and installed in every facility in accordance with the requirements of NFPA 72 and the International Building Code. Listed manual fire alarm station covers may be provided for without the need for integral warning horns.

8.8.2. **Suppression System Interfaces:**

a). Fire alarm system shall monitor each flow switch, valve supervisory switch, supplemental suppression system and required fire pump trouble condition as an individual point. Combining multiple valves or other devices into a common zone shall not be permitted on addressable systems.

8.8.3. **Smoke Detectors:**

a). Should smoke detectors be added to an

existing Initiating Device Circuit (IDC), no more than 25 conventional smoke detectors shall comprise any one IDC detection zone.

b). Full smoke detection shall be provided in all buildings. Full detection does not include above-ceiling spaces or parking garages unless specifically required by code.

c). Duct smoke detectors shall be installed in accordance with the International Mechanical Code.

d). In historically significant spaces, detection devices shall be placed carefully to minimize damage to ornamental materials and decorated surfaces. Design shall indicate precise device placement to ensure proper installation and to not intrude into fine art and historic decorative murals.

e). Other detection technologies may be used in areas not appropriate for smoke detection.

f). Remote LED Indicators: All remote LED indicators serving above-ceiling and other obstructed devices shall be labeled.

8.8.4. **Audible Notification Appliances:**

a). In buildings provided with a USCP Public Address System, fire alarm notification appliances may be speakers or horns. In buildings not protected by a USCP Public Address System, fire alarm audible notification appliances shall be speakers.

b). Where voice communication systems are provided, fire alarm speakers shall be installed in elevator cabs and exit stairways. However, these speakers shall only be activated to broadcast live voice messages (e.g., manual announcements only). The automatic voice messages shall be broadcast through the fire alarm speakers on the appropriate floors, but not in stairs or elevator cabs. System shall have the capability of paging each stairway individually.

c). The design shall provide a general philosophy for occupant notification and include delineation of Acoustically Distinguishable Spaces in accordance with NFPA 72.

d). All new In-Building Fire Emergency Voice/Alarm communication Systems that do not utilize the USCP Public Address System for voice communication shall meet intelligibility requirements of NFPA 72.

e). Install audible notification appliances with a 20 percent spare capacity. Such appliances shall not be calculated at maximum capacity.

8.8.5. **Visible Notification:**

a). Visual notification appliances shall meet all requirements of NFPA 72 and ADA Standards.

b). The following areas are considered "public" or "common use" areas, and require visible notification:

i. Assembly spaces
ii. Break rooms
iii. Cafeterias
iv. Classrooms
v. Convenience stairs
vi. Examination and treatment rooms
vii. Food service areas
viii. Hallways
ix. Library book stacks (with public access)
x. Loading docks
xi. Lobbies (including Member reception areas)
xii. Locker and dressing rooms
xiii. Meeting and conference rooms
xiv. Open-offices with cubicles and/or arranged with clearly defined circulation areas
xv. Restrooms other than for private use

c). The following areas are considered "employee work areas," and do not require visible notification throughout, except as necessary to provide reasonable accommodation:

i. Commercial kitchens
ii. Enclosed offices (regardless of the number of desks)
iii. Mechanical and electrical rooms
iv. Photocopy and filing rooms
v. Roofs not open to the public
vi. Storerooms
vii. Warehouses and greenhouses with no access to outside deliveries and vendors
viii. Workshops

8.8.6. **Graphic Annunciator:**

a). Design shall provide at least one graphic annunciator located at the entrance designated by the AOC Fire Marshal Division and the United States Capitol Police. Graphic annunciators shall be provided in accordance with Washington, D.C., Virginia or Maryland fire codes based on the location of the facility.

8.8.7. **Circuits and Pathways:**

a). Fire alarm circuits shall have the following

minimum Pathway Class Designations, but may be modified by other sections:

i. Data Connections between multiple Fire Alarm Control Units – Class X.
ii. All other Signaling Line Circuits – Class B not less than two separate circuits serving any floor.
iii. Initiating Device Circuits – Class B.
iv. Notification Appliance Circuits – Class B, not less than two separate circuits serving any floor.

b). Fire alarm circuits shall have the following minimum Pathway Survivability Levels:

i. In-Building Fire Emergency Voice/Alarm Communication System circuits – Level 2.
ii. All other circuits – Level 0; however, higher levels may be required to meet project specific goals as determined by the Program of Requirements.

8.8.8. **Testing:**

a). Fire alarm system acceptance testing shall comply with all NFPA 72 requirements. Test to be witnessed by the AOC Fire Marshal or their representative.

8.9. **Fire Protection Water Supply:**

8.9.1. **Water Supply:**

a). Verify adequacy of water supply by obtaining water supply flow testing from the local jurisdiction. If the test data is older than one year, perform water supply testing of fire hydrants and, as applicable, fire pumps. Coordinate testing with the Superintendent's office and the Fire Marshal; the Office of Security Programs that will notify the Capitol Police. Flow rates and pressures shall comply with NFPA 13 and the International Building Code.

b). Fire pumps shall only be provided if the sprinkler system demand, including safety factors, cannot be met by the municipal supply.

c). Water supply redundancy shall be provided for each principal building and high-rise building in accordance with International Building Code, Section 403.3.2. See Section 8.9.2 for redundancy of fire pumps.

8.9.2. **Fire Pumps:**

a). Fire pumps shall be designed and installed in accordance with NFPA 20 and the following:

i. **Redundancy:** In buildings classified as High-Rise under the Building Code or Principal building by these standards, redundant fire pumps shall be provided unless it can be demonstrated through hydraulic calculations that the sprinkler system is capable of supporting the two most hydraulically remote sprinklers from either water supply as indicated in Section 8.9.1 without the support of a fire pump.
ii. **Sizing:** Size the fire pump to meet sprinkler system requirements only. Please note, NFPA 13 hose allowances shall be incorporated into all hydraulic calculations at a location as required by the applicable standard or at the designer's discretion when an applicable standard does not provide a specific location for the allowance. Provisions for manual firefighting (NFPA 14 fire hose valves) will be provided by the responding fire department.
iii. **Design:** Design shall provide electric motor-driven, horizontal split case centrifugal type fire pumps where a reliable power supply is provided. Some fire pumps may require an air permit which must be applied for as early in the design process as possible.
iv. **Transfer Switches/Fire Pump Controller:** Design shall provide fire pumps with factory assembled, integrated automatic transfer switches suited for emergency generator services, even if emergency generator is not immediately available; and fire pump controller unit monitored by the fire alarm system.
v. **Jockey Pump:** Design shall provide jockey pump sized to make up the allowable leakage rate within 10 minutes or one gpm, whichever is larger, unless directed otherwise in writing by AOC.

8.10. **Water-Based Fire Suppression Systems:**

8.10.1. **Automatic Sprinkler Systems:**

a). Design shall provide automatic sprinkler systems throughout all new construction projects and in all major renovation/rehabilitation projects in all principal buildings and support buildings in excess of 5,000 sq.ft. in area.

i. **All Areas:** Design shall provide automatic sprinklers in all areas including elevator machine rooms, boiler rooms, mechanical equipment rooms, walk-in freezers and cold rooms, essential electronic facilities, electrical closets, telephone closets, emergency generator rooms, uninterruptable power service and battery rooms, transformer vaults, telephone exchange (PABX) rooms, etc.

ii. **Wet-Pipe Systems:** All sprinkler systems shall be wet-type unless installed in areas subject to freezing. Pre-action systems are not permitted.

iii. **Areas Subject to Freezing:** Design shall provide dry pipe systems, dry pendant / upright systems, provide space heating, or re-route the sprinkler piping. Heat-tape and anti-freeze systems are not permitted.

8.10.2. **Sprinkler System Design:**

a). Hydraulically calculate all sprinkler systems in accordance with the requirements of NFPA 13.

i. **Modifications of Existing Systems:** Pipe sizes for any modifications to an existing system shall be based on the established schedule for the associated building. That schedule may be based on hydraulic calculations or pipe schedule, but must be previously established for that building. In the case of no previously established schedule, calculations back to the fire pump discharge shall be performed to verify design in the case of any net addition in the number of sprinklers for the area in question.

ii. **Hose Allowance:** NFPA 13 hose allowances shall be incorporated into all hydraulic calculations at a location as required by the applicable standard or at the designer's discretion when an applicable standard does not provide a specific location for the allowance

iii. **Safety Factor:** Hydraulic calculations shall provide a safety factor of 10 psi. Existing systems to meet requirements if feasible.

8.10.3. **Sprinklers:**

a). All sprinklers and sprinkler escutcheons installed in AOC new construction or renovation/rehabilitation projects shall be listed by a nationally recognized testing lab. Design shall specify quick response sprinklers unless prohibited by NFPA 13.

8.10.4. **Sprinkler System Piping:**

a). Sprinkler piping, fittings, control valves, check valves, and drain assemblies shall meet the requirements of NFPA 13. The requirements below supersede the requirements of NFPA 13:

i. Black steel piping and/or copper tubing (Type K or L) shall be used for all wet-pipe sprinkler piping.

ii. Steel pipe sizes 2 inches and smaller shall be Schedule 40 and shall be threaded or grooved.

iii. Steel pipe sizes larger than 2 inches shall be minimum Schedule 10. Piping less than Schedule 40 shall be roll-grooved.

iv. Threadable light wall pipe shall not be used.

v. Piping having a corrosion resistant ratio less than 1.0 shall not be used.

vi. Plain-end fittings shall not be used.

8.10.5. **Special Sprinkler System Requirements:**

a). All elevator machine rooms, all electrical switchgear rooms, all transformer vaults, and all essential electronic facilities shall be provided with separate manual isolation valves and a separate water flow switch located outside the room in an accessible and labeled location. Tamper switches shall be provided on all such valves.

b). Sprinklers meeting any of the following criteria shall be equipped with sprinkler guards to provide protection against accidental damage:

i. Mounted less than 7 feet above the floor

ii. In elevator machine rooms and pits

iii. In electrical closets

iv. In electrical equipment rooms

8.10.6. **Floor Control Valves:**

a). All floor control valves shall include a check valve, a control valve, flow switch, test connection, and method for draining test flow discharge water. The height of the control valves is to be accessible from the floor or no higher than seven feet with the valve's direction in an accessible position.

8.10.7. **Testing:**

a). Fire suppression system acceptance testing shall comply with all NFPA 13 requirements. Test to be witnessed by AOC Fire Marshal or their representative.

8.11. **Non-water Based Fire Suppression Systems:**

a). **Wet Chemical Extinguishing Systems:** Wet chemical extinguishing systems shall be installed in all commercial cooking equipment installations, and installed in accordance with NFPA 17A.

b). **Dry Chemical Extinguishing Systems:** Dry chemical extinguishing systems shall not be installed in any commercial cooking equipment installations. Dry chemical extinguishing systems shall be installed in accordance with NFPA 17.

c). **Clean Agent Extinguishing Systems:** Halon or ozone-depleting extinguishing systems shall not be used.

8.12. **Standpipes and Hose Systems**

a). **Standpipes:** Design shall provide standpipes as required by the International Building Code, NFPA 14 and by the following:

i. **All standpipes:** shall be connected to the fire protection water supply, be permanently pressurized, and be installed in accordance with NFPA 14. Manual-wet standpipe systems are permitted in lieu of automatic standpipe systems for buildings located in the District of Columbia.

ii. **Dry standpipes:** shall only be permitted in spaces subject to freezing.

iii. **Where standpipe and sprinkler systems are required**: a combination sprinkler/standpipe system design shall be provided.

iv. **Safety Factor**: Hydraulic calculations shall provide a 10 PSI safety factor.

v. **Water Supply:** When performing hydraulic calculations for standpipe systems, assume that the DC fire department pumper supplies 1,500 gpm at a pressure of up to 200 PSI.

vi. **Exceptions:** If connecting a standpipe to the water supply is not feasible, coordinate with the AOC Fire Marshal.

b). **Fire Department Hose Outlets:** Design shall provide Class 1 system with the caps having both 1.5" and 2.5" outlets. Threads and valves shall be compatible with the local Fire Department requirements.

8.13. **Portable Fire Extinguishers and Cabinets:**

a). Design shall provide portable fire extinguishers and cabinets throughout in accordance with provisions of the NFPA 10.

i. Do not compromise fire partition construction to install recessed or semi-recessed fire extinguisher cabinets.

ii. All wall mounted fire extinguishers and cabinets shall be in compliance with the accessibility requirements of the ADA and IBC.

8.14. **Special Fire Protection Requirements**

a). **Storage Facilities:** General and rack storage facilities shall comply with the requirements of NFPA 13.

i. **Record Storage:** The storage arrangements and protection of the facility shall comply with the above and NFPA 232.

ii. **Archive and Record Storage:** In addition to the above, comply also with information provided in NFPA 232 and the National Archives and Records Administration (NARA) guidelines as published in the Federal Register.

iii. **Smoke Detectors:** Install smoke detectors throughout archival storage areas in accordance with the requirements of NFPA 72.

b). **Essential Electronic Facilities:** In computer rooms and other mission-critical electronic facilities, comply with the requirements of NFPA 75 and the following criteria when deemed appropriate by project stakeholders.

i. **Wet Pipe Systems:** Serve all areas, including data storage areas, with wet pipe sprinkler systems employing quick response sprinklers.

ii. **Isolation Valves:** Design shall provide separate manual isolation valves and a separate water flow switch, located outside the room in an accessible and labeled location. Tamper switches shall be provided on all such valves and connected to the fire alarm system.

iii. **Equipment Shutdown:** Activation of the sprinkler water flow switch shall

disconnect power to electronic equipment and the HVAC system with no time delay. Activation of two cross-zoned smoke detectors within a single protected area shall disconnect power to the computer equipment and to the HVAC system.

iv. **Drainage System:** Install and size a drainage system to handle the water from an activated sprinkler system serving the electronic equipment rooms, especially computer rooms.

v. **Clean Agent System:** Clean agent systems shall only be installed when deemed appropriate by the associated jurisdiction Superintendent. Installation of such a system does not negate the requirement for wet-pipe sprinkler protection.

c). **Cooling Towers:** Design shall provide fire protection in accordance with NFPA 214.

d). **Child Care Centers:** In addition to the code requirements of this document, follow all applicable local code requirements. At a minimum, provide automatic sprinkler coverage and full smoke detection coverage throughout.

e). **Laboratories:** Follow International Building Code requirements.

f). **Flammable and Combustible Liquid Storage:** The storage arrangements and protection of a flammable and combustible liquid storage area shall meet the requirements of the AOC Safety Manual and International Building Code.

g). **Elevator Systems**. Elevator systems shall be designed and installed in accordance with ANSI/ASME A17.1.

h). **Atrium Smoke Removal System:** When installed, an atrium smoke removal system shall be designed and installed in accordance with the requirements of the International Building Code and NFPA 92.

i). **Smoke Control Systems:** When installed, a smoke control system shall be designed and installed in accordance with the International Building Code and NFPA 92.

j). **Automated External Defibrillators (AEDs):** Provide Automated External Defibrillator cabinets within 250 feet of travel distance from normally occupied spaces. Cabinets are to be co-located with fire extinguisher cabinets when placed in public corridors where possible. The minimum size for AED cabinets shall be 17-1/2 inches by 17-1/2 inches. The signage and arrangement of cabinets shall be approved by the Jurisdiction Superintendent.

8.15. **Special Inspections Schedule:**

a). The design team shall develop special inspection requirements and schedules, consistent with Chapter 17 of the IBC, that pertain to the work contained in the program requirements. The schedule shall not include extraneous inspections that are not pertinent to the work.

8.16. **Restrictions:**

a). Do not contact local District of Columbia agencies for approvals/permits without prior written approval of AOC. (Note: Some leased facilities and properties not located within the Capitol are subject to District of Columbia regulations).

b). Facilities in the District of Columbia, the State of Maryland, and the Commonwealth of Virginia are subject to varying state and local codes and military regulations. Verify coverage of codes and regulations before commencing work.

c). Verify specific restrictions with HPO.

d). **Code Editions**: The use of different editions of the same code is prohibited unless specifically approved by the AOC Fire Marshal.

9. **Mechanical and HVAC**

9.1. **Introduction and General Provisions:**

a). **Purpose:** Mechanical systems shall not only meet the functional needs of the users, but shall also reflect national priorities such as energy conservation and sustainability. The mechanical system plays a particularly significant role in these areas, and the engineer shall be familiar with the design requirements of AOC in those areas; covered in Section 3, Sustainable Design, specifically subsections 3.3.2 "Energy Performance", 3.3.4 "Environmental Impact of Materials," and 3.3.6 "Protect and Conserve Water," respectively. See Section 1, General Requirements for a complete listing of applicable codes for work with the AOC.

9.1.1. **System Requirements:**

a). Mechanical systems shall support the significance and the dignity of those places that are within the portfolio of the AOC. Most AOC facilities differ from standard commercial facilities in that the expected building lifespan far exceeds a typical commercial facility. HVAC systems should be designed for a 50-year life in most cases. Any deviations from standards shall be flagged and specified in the Program of Requirements. Systems shall be connected to central utilities at the Capitol complex.

b). Design of mechanical systems shall acknowledge this expected building lifespan. However, installed systems and components will change during the lifespan of the building. The components and systems shall be designed so that they will last as long as is reasonably possible, which may be 40 years for a large utility fan or 20 years for a terminal air distribution system. The opportunity for maintenance and system upgrades must be planned without major disruption to the function either of the buildings or their structure.

9.2. **Related Sections:**

a). Other Sections that contain important information that may affect elements of this section or their implementation, include, but are not limited:

i. Refer to Section 1, General Requirements.

ii. Refer to Section 3, Sustainable Design, for energy requirements.

iii. Refer to Section 4, Security, for related information.

iv. Refer to Section 10, Plumbing, for related information, including but not limited to compressed air systems.

v. Refer to Section 11, Electrical, for related information.

vi. Refer to Section 12, Building Automation System, for information related to BASNet.

9.3. **Design Criteria:**

a). Design equipment to meet or exceed the service life for "Components" indicated in table 1.3.1.a) based on the building class of the project.

b). Design criteria include outdoor design conditions, indoor design conditions, and an appropriate estimate of internal loads (lights, equipment, and people) for standardized spaces. The design engineer is responsible to review all design conditions, especially internal loads, and validate them for each design. Information concerning acoustical design criteria is presented in Section 1, General Requirements. Where a project involves exterior mechanical equipment, the installation shall comply with the currently applicable District of Columbia Noise Ordinance (20 DCMR chapters 27-29). Designs involving mechanical systems for the United States Capitol Police shall be thoroughly coordinated with Section 4, Security. Values listed in the tables below shall be verified prior to incorporation into the design.

c). Design and energy analysis requirements refer to the A/E Design Manual, latest edition.

d). The AOC has a central system for heating and cooling for the majority of its buildings. Steam and chilled water are available for HVAC equipment and generally shall be used in these buildings. For new buildings not connected to the central system, standalone chilled water and boiler plants may need to be designed. Refer to additional information within this Section.

e). Project Manager shall contact the HPO prior to design beginning on the routes and places

where new ductwork and related air devices shall be installed. All interior surfaces, decorated surfaces, architecture features like pilasters, cornices and running trim are important elements in Heritage Assets and must be protected and not be disturbed, removed or altered. HPO and the Curator shall review detailed Construction Documents that indicate the location of new devices, routes, access points and avoidance of historic elements. Consult Section 2, Historic Preservation, for further information.

Table 9.3 – 1 Building Outdoor Design Temperatures and Relative Humidity (RH)

	SUMMER			WINTER		
	Deg. F	Deg. C	% RH	Deg. F	Deg. C	% RH
Conditions	95	35	50	0	-28	30

Table 9.3 – 2 Indoor Design Temperatures and RH: The following ranges are provided for general reference -specific Programs of Requirements for individual projects may override these provisions.

	SUMMER			WINTER		
	Deg. F	Deg. C	% RH (Max)	Deg. F	Deg. C	% RH (Min)
Offices	73	24	50	70	21	40
Conference Rooms	73	24	55	70	21	40
Toilets/Lockers	78	26	60	70	21	30
Corridors[B]	75		55	70		
Stairwells[B]	-		-	60		-
ADP Rooms [A]	80	27	55	65	18	20
Storage (General)	80	27	60	60	21	20
Electrical Spaces	85			-		-
Mechanical Spaces	85	29	60	60	21	20
Vaults	95 Max		-	45		-
Elevator Machine Rooms	75		-	45		-
Tunnels	104 Max		-	-		-

[A]Verify special equipment requirements. Refer to ASHRAE "Thermal Guidelines for Data Processing Environments."
ASHRAE 62, 2016recommends %RH to be between 30 - 60% for habitable spaces
[B]For spaces containing elements as defined by AOC Preservation Policy and Building Preservations Guides, contact AOC Historical Preservation Officer for specific requirements.

9.3.1. **Internal Loads:**

a). Ventilation design shall be based on the International Mechanical Code (IMC) as referenced in the ASHRAE requirements. Provide ventilation schedule which includes (for all spaces in the project) room number, room name and use, floor area, number of occupants, outside air per ASHRAE 62.1 Ventilation Rate Procedure, actual supply air, return air, outside and exhaust air.

b). Review the furniture plan/seat count to determine occupancy. If no furniture plan has been prepared, the occupancy level for purposes of heat gain in open office areas will be based on, IMC and ASHRAE Handbook of Fundamentals for heat output. Design should be done using load calculation methods that take into account the time that internal loads are in the space, such as the Heat Balance or Radiant Time Series methods.

c). Base equipment power heat outputs on the latest edition of the ASHRAE Handbook of Fundamentals or manufacturer's data. For personal computer equipment, 80 percent

diversity shall be considered. That is, 80 percent of the computers should be assumed to operate at the same time. For printers, use 50 percent diversity. Loads from convenience receptacles shall match electrical design assumptions.

d). Include equipment heat loads in elevator machine room calculations to assure long-term serviceability of computer controllers. Room design temperature shall be in accordance with equipment manufacturer's recommendations and shall include considerations to provide a suitable working environment for maintenance personnel. Machine room-less elevators have the motor above the cab. This motor shall be kept within manufacturer's temperature requirements. The control computer for the elevator is housed separately and shall be kept to manufacturer's temperature requirements.

e). Base lighting power densities on the actual design or the allowed densities based on ASHRAE 90.1, whichever is greater.

f). As design progresses, provide updated HVAC load calculation report.

9.3.2. **Pressurization:**

a). Design shall provide negative pressure to toilet rooms, showers, lockers, custodial areas, kitchens, garages and battery charging areas and provide for exhaust at kitchens (with no air to be re-circulated). Egress corridors shall be positive with respect to adjacent spaces.

b). For security and life safety related pressurization, contact the Fire Marshal and Design Services, Fire Protection and Mechanical Engineering Branch. Areas with smoke control requirements must be coordinated with the AOC Fire Protection Engineering Branch. Fire protection and smoke control requirements also discussed in Section 8, Fire Protection and Life Safety.

9.3.3. **Zoning Criteria:**

a). Do not exceed 2,000 square feet per terminal unit zone (except for single spaces like large meeting rooms over 2,000 sq.ft.).

9.3.4. **Entrance Vestibules:**

a). Design shall provide for supplemental heating and cooling in security stations at entrance vestibules.

9.4. **Systems:**

9.4.1. **Existing Systems:**

a). The designer shall become familiar with the technical performance standards of existing systems and shall incorporate those into performance of system components. This includes water temperatures, steam pressures, duct static pressure ratings, and electrical power distribution voltages. When performing renovations/rehabilitations that affect part of an existing HVAC system, the entire HVAC system should be reviewed to determine the impact on the system and other spaces due to the renovation/rehabilitation. Any changes to these parameters require an engineering analysis and described in a concept design narrative.

9.4.2. **Major System Renovations/Rehabilitations:**

a). Major system renovations/rehabilitations are defined by AOC as those where the expected construction cost exceeds $5,000,000. The overall goal of a major system renovation/rehabilitation is to provide infrastructure with the ability to function and adapt to changes in system requirements over a 50-year span. When one major system is renovated, the designer shall review whether all systems shall be renovated concurrently.

b). During the conceptual design stage of a major renovation/rehabilitation, the AOC will define in the scope of work any requirements to study options. The study of options is most often done prior to the design stage of a project.

9.4.3. **Mechanical and Service Space Requirements:**

a). Design shall provide for adequate space around equipment to allow for maintenance, as long system life requires ongoing maintenance. This space shall allow for both regular periodic maintenance and replacement of major components. All floor mounted equipment shall be installed on a minimum 4" thick concrete housekeeping pad. (Thickness may vary based on specific needs, such as air handling unit condensate drain pan trap depth.) Where appropriate, consider adding platforms for elevated equipment, not readily accessible for service and maintenance by a standard 8 ft. ladder. Design shall provide access doors sized appropriately and coordinated with the

architectural design. Both the Mechanical Engineer and the Architect shall ensure that there is a reasonable method of replacing the largest single system component without structural cutting of the building.

b). Ensure hydronic components allow for drainage of water. All mechanical rooms shall have floor drains. Where a drain may serve more than 30 gallons, the piping shall be arranged so that drain lines extend to an area that does not have carpet or other sensitive finishes. Design the drains to reduce the potential for releases of hazardous materials to sanitary sewer systems.

9.5. **Special Area HVAC Systems:**

a). When spaces to be designed fall outside the descriptions provided in this manual, the designer shall develop a basis of design with appropriate criteria. For systems that require 24 hour/7 day a week operation, provide individual/separate systems. Include client interviews and other AOC established standards. The Whole Building Design Guide (http://www.wbdg.org/index.php) and the Uniform Facility Criteria may be used, though they shall be considered informative and not part of AOC standards. Standards from other organizations, such as the National Archives (NARA) shall be used where applicable.

b). Special areas include, but are not limited to: atriums, auditoriums, entrance lobbies and vestibules, cafeterias, mail rooms, loading docks, computer and server rooms, fire pump rooms, BAS control rooms and fire command centers.

9.5.1. **Computer Rooms and Data Centers:**

a). During the programming phase, determine both the Class and the Tier of the facility and the anticipated heat load at full capacity through discussions with the data center administrators. The "Class" determines the environmental control of the space. The "Tier" describes the availability of the data system. The refrigeration plants of the Capitol complex are highly reliable and backup sources of air conditioning generally are not provided. Electrical power within the Capitol complex is discussed separately in Section 11, Electrical.

b). For critical spaces, provide for equipment redundancy. The amount and type of redundancy depends on the criticality of the system, as defined by the Tier.

c). Design shall be capable of maintaining operating conditions within required tolerances at both day one operation and full build out. With the rapid advancement of cooling technologies, the designer shall feel free to consider the use of all industry proven cooling methods to adequately serve the space, pending AOC approval. See building automation system communications requirements described further in Section 12 Building Automation Systems. All HVAC systems serving these spaces shall have a communications interface that directly connects to the AOC BASnet (see section 9.9 Building Automation System), for remote monitoring and alarms. Refer to ASHRAE Standards Technical Committee 9.9 "Thermal Guidelines for Data Processing Environments" for additional guidance.

9.5.2. **Museum, Exhibition and Curatorial Spaces:**

a). Develop the environmental needs with the conservator of the exhibition materials in question. These areas include, but are not limited to, curatorial storage and exhibition areas in the Capitol Building and Capitol Visitor Center under the control of the AOC, House and Senate Curators and Capitol Visitor Center Education and Exhibition Head. Generally, those systems shall emphasize stability of the environmental conditions for the materials being exhibited. Contact the Mechanical Engineering department directly for specifics related to the Library of Congress preservation labs and AV Center. Contact the Fire Marshal and Design Services Fire Protection Branch for issues related to fire protection.

9.5.3. **Committee Rooms, Court Rooms, Auditoriums and Other Places of Assembly:**

a). Assembly spaces shall generally constitute a single dedicated zone. Control dewpoint of supply air in consideration of the high latent loads imposed by people in the space. Demand-controlled ventilation should be considered for areas of high variable occupancy.

9.5.4. **Parking Garages:**

a). Evaluate Parking Garages in accordance with the applicable Code and classify the garage as open or closed. If the garage is closed, it shall be provided with mechanical ventilation and an approved carbon monoxide detection system. The carbon monoxide detection system shall control the ventilation system, though it shall not reduce ventilation below 0.05 cfm per square foot. The carbon monoxide level shall be transmitted to the Building Automation System.

9.6. **HVAC Components:**

9.6.1. **Heat Generation:**

a). **General:** The United States Capitol Power Plant (CPP) provides central heat generation (steam) within the Capitol complex with conversion to hot water at many major buildings. Some buildings utilize steam directly as a heat source. Consult AOC staff for steam availability. Some buildings will have access to the GSA steam supply. Both steam supply consumption and condensate return shall be metered. Maintain piping to separate CPP A and CPP B steam service.

b). The goal of the AOC is to utilize heating hot water in occupied spaces for controllability and for safety. Steam should be used for air handler preheat coils due for freeze protection. Review existing conditions and coordinate with the AOC engineering staff. Where possible consider utilizing central steam heat utility for energy efficiency, but if this is not available, the use of electric heat may be acceptable.

c). **Pressures:** Steam is generally available at pressures ranging from 15 to 150 psi. For HVAC applications, use pressure-reducing valves to reduce operating pressure to 15 psig. Some areas, such as kitchens, may require steam pressures in excess of 15 psi. Ensure that all equipment is provided with steam at appropriate pressures.

d). **Central Building Steam to Hot Water Conversion:** Steam control valves at building entrance steam-to-water converters shall incorporate 1/3 - 2/3, staged control valves with isolation valves on each leg. Steam-to-water heat exchangers shall be selected for operation at the minimum pressure to provide the most efficient operation. Design shall provide shell and tube steam to hot water converters with condensate return via piping within the Utility Tunnels. Allocate space to allow removal of the tube bundle from the heat exchanger.

e). **Coils:** Preheat coils in air handlers are preferred to be steam, and all other HVAC is preferred to be hydronic. Steam preheat coils shall be non-freeze drain down type.

f). **Projects Without Central Steam:** When projects are not within the Capitol complex and do not have access to steam from the Capitol Power Plant or a GSA system, design must provide for boilers. Consult the AOC Project Manager at the concept design stage to determine redundancy requirements and if dual fuel units are desired. As noted earlier in this section (under 9.4.1 “Computer Rooms and Data Centers”), provision of redundancy must be evaluated early in the design and discussed with the AOC Design Branch.

9.6.2. **Cooling Systems:** The Capitol complex has a central chiller plant which provides cooling to most of the buildings. Few projects require the addition of chillers and condensing equipment, but those that do require independent cooling should consider the following guidelines.

a). **Cooling Towers:** Since most buildings in Select cooling towers at a wet bulb of 78°F. Condenser flow shall be a 10-degree range, normally 85°F to 95°F. Design shall provide multiple cells for Principal Buildings and provide independent basins with full size equalizing lines. Design shall provide basin heaters sized for 0°F. Tower construction shall be 304 stainless steel; basin and housing shall be constructed of 304 stainless steel. Fans shall be controlled with VFDs.

b). **Unitary Air Cooled Equipment:** Size dry coolers, condensing units and condensers mounted on roofs for 105°F ambient operation. Otherwise, they shall be selected for 95°F ambient operation.

c). **Chillers:** For those few cases where chillers would be required, use sizing which allows maintenance of one chiller while meeting load: for example, three units at 50 percent. The type of chiller (i.e., scroll, rotary screw,

reciprocating or centrifugal) should be made after evaluating life cycle cost. In general, up to 50 tons, scroll or reciprocating chillers should be used, at 50-200 tons rotary screw chillers are preferred, and over 200 tons centrifugal chillers are preferred. Evaluate the need for redundancy in the same manner for cooling as for heating.

9.6.3. **Other Components**:

a). **Humidifiers:**

i. **General:** No direct power plant (treated building) steam shall be used for humidification. The type of clean steam generator shall vary by the demand. For the smallest requirements where no nearby steam source is located, such as a single computer room unit, a bottle/electrode system is acceptable. For individual air handlers of various sizes, where a steam source is available, use a unitary clean steam-to-steam type. For locations with multiple air handlers consider a clean steam type steam-to-steam generator to produce clean pressurized distributed steam. Design shall provide humidification via steam manifold injector humidifiers installed in the supply duct system or in the air handler. Design shall provide high limit humidistats in the ductwork downstream of the humidifiers. Test water quality prior to design so that the need for, and type of, water treatment can be included in the design to minimize scale and reduce maintenance.

ii. **Steam-To-Steam Type:** Design shall provide with stainless steel heat exchanger.

iii. **Electric Steam Generator Type:** Design shall provide cleanable tank type or stainless steel evaporator pan type heat exchanger.

iv. **Control:** The humidifier control panel shall communicate directly with the AOC BASnet system. Coordinate communication protocol with the AOC EMCS group prior to specifying equipment.

b). **Terminal Heat Transfer:** On Finned Tube Radiators, design shall strive for copper-tubes and fins.

c). Vibration isolation equipment, require selections by a professional engineer, and recommendations should be consistent with the ASHRAE Handbooks.

d). Add meters and gauges section, sub-meters and tie back to sustainability. For energy conservation measures, refer to Sustainability section for requirements. Each piece of mechanical equipment must be provided with instrumentation, in addition, to test ports to verify critical parameters, such as capacity, pressures, temperatures and flow rates. Each meter, gauge and flow measuring device must be calibrated before startup and must have provisions for periodic calibration at its location. All the metering devices must be capable of transmitting information to the central BAS for monitoring and control.

9.7. **Hydronic and Steam Distribution:**

9.7.1. **Hydronic Distribution System:**

a). **General:** Where possible, design systems with a 50-year useful life. See Section 1.1.1 in General Requirements, item (c) for Service Life Expectancies Table for guidance of system life, based on the type of facility. AOC Master Specifications contain full technical details for components.

i. For Library of Congress, projects use only ‘Type K’ copper for hydronic distribution piping 4” and smaller. Steel can be used for hydronic distribution piping above 5”. For all other projects “Type L” copper is generally acceptable for hydronic distribution piping 4” and smaller.

ii. **Water Treatment:** A licensed water treatment specialist must design the water treatment for closed and open hydronic system, not associated with the AOC Capitol Power Plant.

iii. **Freeze Protection:** If glycol is used for freeze protection, it shall be Propylene Glycol; use of Ethylene Glycol is prohibited

b). **Chilled Water**: For facilities connected to AOC central system, design temperature, of water is 44°F entering with preferred ΔT of 18°F (62°F leaving) or higher. There are times when loads are not at their peak that the chilled water supply temperature will rise. For critical spaces, such as data centers, archival storage facilities, or other areas requiring year-round

cooling and dehumidification, equipment shall be sized to operate with 48°F chilled water supply in non-peak seasons. Designers shall be required to perform load calculations for both peak cooling loads with 44°F chilled water and for off-peak loads with 48°F chilled water. For systems not connected to the AOC central system, use ΔT compatible with refrigeration equipment.

c). **Heating Hot Water**: Total system temperature drop for new systems shall be 20°F. When connected to an existing system, match the temperature drop of that system. Typically our heating hot water upper temperature limit is 180 deg. F. The use of higher temperature systems shall require from the AOC Project Manager.

d). **Piping Systems**: Typically Design will provide 4-pipe systems for seasonal temperature control flexibility, but building conditions may dictate what the options are.

e). **Ratings**: All chilled water fittings, valves, strainers, etc. associated with the CPP Central Chilled water system shall be rated at Class 150 or greater because our central chilled water system is subject to pressures as high as 140 psi. All other low-pressure hydronic piping specialties shall be rated at Class 125 or greater.

i. **Sizing Criteria:** Piping up to 2 inches in diameter shall have velocities that do not exceed 4 feet per second. Piping 2-1/2 inches in diameter and greater shall have velocities that do not exceed 7 feet per second. Water piping friction loss shall never exceed 4 feet of water pressure drop per 100 feet of piping length for piping up to 2 inches diameter; 6 feet of water pressure drop per 100 feet of piping length for piping over 2 inches diameter.

ii. Grooved piping shall not be allowed on the central chilled water system. Grooved piping may be allowed for service with pressures under 100 psi on a case by case basis, with the approval of AOC Mechanical Engineering. It can be used for run-outs to individual air handlers. It shall not be used in concealed spaces where leaks could create significant damage to historic areas or sensitive equipment.

iii. **Press Seal Piping:** May be used on a case by case basis with the approval of AOC Mechanical Engineering.

iv. **Unions:** Design shall provide unions on screwed, soldered, brazed and welded piping at each side of pumps, circulators, hot water heaters, control valves, balancing valves, strainers and other equipment subject to servicing or replacement.

f). **Valves:**

i. **General:** Valves shall be located as required for shutoff and maintenance of equipment. Incorporate valves as necessary to minimize major downtime and provide flexibility for future modifications/repairs/replacements.

ii. **Applications:** The AOC Master specifications include technical details for the materials, construction, and application of valve types. Refer to that for detailed design and construction requirements that are not listed below.

iii. **Gate Valves:** Hydronic Systems Shut-Off, 3 Inches and Larger.

iv. **Ball Valves:** Hydronic Systems Shut-Off, 2-1/2 Inches and Smaller. Characterized type for flow control applications, 2 inches and smaller.

~~v.~~ Butterfly Valves: Not recommended unless specifically noted. Obtain permission from Architect for use of butterfly valves for any application.

vi. **Globe Valves:** For flow control applications.

vii. **Balancing Valves:** Calibrated globe valves, with indexed positions. (Do not use calibrated 1/4 turn ball valves.) Balancing valves shall be equipped with integral flow and pressure measurement taps.

viii. **Pressure Independent Control Valves:** Shall be considered where there is anticipated variations in fluid performance, or for specific energy savings.

g). **Insulation:** All piping with service below 70°F shall employ a vapor barrier. Strive for a 0 permeability rating. All insulated piping in exposed areas shall be finished with a canvas or fiberglass cloth protective covering, or other field applied jackets approved by the AOC. Design shall provide piping insulation in accordance with AOC Master Specification

requirements.

h). **Pipe Identification:** Match the building's pipe color scheme. Design shall provide piping identification in accordance with AOC Master Specification requirements.

i). **Pumps:** Pump selections should be made on a slope to the right of the peak of the curve to ensure the stable conditions.

9.7.2. **Steam Distribution System**

a). **General:** The following standards of design apply to steam and condensate systems. Where possible, design systems with a 50-year useful life. Low-pressure steam is defined as up to 15 psi. High-pressure steam is in excess of 15 psi. AOC Master Specifications contain full technical details for components.

i. **Ratings:** All low-pressure steam piping shall be rated at Class 125 unless otherwise noted. All high-pressure steam (above 15 psig) shall be rated at 150 or greater, based on the pressure.

ii. **Sizing Criteria:** Piping shall have velocities that do not exceed 8,000 feet per minute. Piping friction loss shall never exceed 1/2 of PSI pressure drop per 100 feet of piping length for low-pressure steam.

iii. **Materials and Application:** See AOC Guide Specifications for more information on piping materials as they relate to high-pressure steam, low-pressure steam and steam condensate.

iv. **Unions:** Design shall provide unions on each side of condensate pumps, traps, other equipment, and piping subject to servicing or replacement.

v. **Traps:** Thermostatic, float and thermostatic, inverted bucket and thermodynamic. Traps shall be located in accessible conditions for testing and replacement. Traps operating under high pressure should be considered for connection to a BAS trap alarm that alerts maintenance personnel upon failure. To avoid water/steam hammer, ensure that there is sufficient elevation drop to the trap. See trap manufacturers installation details for specifics.

vi. **Application:**

Location	Preferred Trap	Acceptable Alternative
PRV Stations	Float and Thermostatic	Thermodynamic
Horizontal Runs	Float and Thermostatic	Inverted Bucket
Steam Separators	Float and Thermostatic	Thermodynamic or Inverted Bucket
Steam Header Drainage	Float and Thermostatic	Thermodynamic or Inverted Bucket
Terminal Ends	Thermodynamic	Float and Thermostatic or Inverted Bucket
Heat Exchanger / Coils	Float and Thermostatic	-

vii. Evaluate the use of float and thermostat and inverted bucket traps in ambient applications subject to freezing. **Air Vent:** Thermostatic stainless steel vent.

b). **Valve Applications:**

i. **Gate Valves:** Low-Pressure Steam Isolation, 3 Inches and Larger.

ii. **Ball Valve:** Low-Pressure Steam Isolation, 3 Inches and Smaller.

iii. **Butterfly Valves:** Not recommended unless specifically approved.

iv. **Globe Valves:** For flow control applications.

v. **Calibrated Globe Valves:** With indexed positions for balancing. (Do not use calibrated 1/4 turn ball valves for balancing).

vi. **High-Pressure Steam Valves:** Design shall use the same as noted for Low-Pressure Steam except use Class 300 or greater.

vii. **Safety Valves:** As required for equipment according to the ASME Boiler and Pressure Vessel Code.

viii. **Pressure Reducing Valves:** Size, capacity, and pressure rating factory set for inlet and outlet pressures indicated. Replace in kind where system is existing. Generally, these valves are pilot operated. Design shall use BAS (Building Automation System) to monitor pressures on new applications.

c). **Insulation:** Design shall provide the piping insulation in accordance with AOC Master Specifications.

9.8. **Ductwork and Distribution**

a). **Air Handling Units (AHU):** This includes air coils, fans and filters. Construct double wall casings of minimum 22-gauge galvanized steel or aluminum outer wall with a minimum R-13 insulation that meets International Building Code fire/smoke requirements between walls. Specify galvanized steel or aluminum interior wall on all not-wet (before cooling coil) sections and stainless steel interior wall on all sections subject to wet conditions.

i. **Pressures:** AHU casing shall be designed to withstand a water gauge pressure differential at least 2" greater than the design differential pressure.

ii. **Structural Requirements:** Casing deflection is not to exceed the values that are listed in AHRI 1350, Table 1.Drain Pans: Externally insulated stainless steel drain pan, piped to drains with min. line size indicated.

iii. **Maximum leakage:** For units serving archival or artifact storage which need precision environmental control specify 1 1/2 percent of scheduled air flow at casing pressure rating.

iv. **Access Doors:** There shall be access doors between each major component (coils, dampers, etc.), minimum 18" wide x 48" high on units that are large enough to accommodate these dimensions. Access doors shall have hinges, latches, a minimum 4" x 4" view window, and insulation requirements as the adjacent casing. Design shall provide interior lighting with external switching.

v. **Control Dampers:** Control dampers shall be ultra-low leakage commercial aerodynamic extruded aluminum with edge seals and extruded aluminum frames. Maximum leakage shall not exceed 4.0 cfm/sq. ft. @ 4" static pressure. For specialized applications see AOC Project Manager. Consider minimum and maximum air dampers for larger air handling units.

b). **Chilled Water Cooling Coils:** Variable flow, constant temperature system. Maximum air velocity through coil 450 ft./min to prevent moisture carryover.

i. **Tubes:** 0.035" thick copper tubes.

ii. **Fins:** 0.010-inch thick lead-free solder coated or mechanically bonded copper fins, 10 fins/inch maximum.

iii. **Casings:** 16 gauge stainless steel casing.

iv. **Headers:** Non-ferrous headers.

v. **Pressure:** 200 psi working pressure.

c). **Steam Heating Coils:** For preheat non-freeze type steam distribution tube: 1-inch O.D. For reheat 5/8 inch O.D. Galvanized steel casing except stainless steel casing downstream of cooling coil or areas subject to moisture. Maximum air velocity 600 feet/minute.

i. **Tubes:** 035-inch thick copper tubes.

ii. **Fins:** 0.010-inch thick lead-free solder coated or mechanically bonded copper fins, 10 fins per inch maximum.

iii. **Casings:** 16-gauge minimum stainless steel when subjected to wet conditions.

iv. **Pressure:** 200 psi working pressure.

v. **Header:** Non-ferrous headers.

d). **Hot Water Heating Coil:** Variable flow, constant temperature system, maximum air velocity through coil not to exceed 600 feet per minute.

i. **Tubes:** 035-inch thick copper tubes.

ii. **Fins:** 0.010-inch thick lead-free solder coated or mechanically bonded copper fins, 10 fins/inch maximum.

iii. **Casings:** 16-gauge minimum stainless steel when subjected to wet conditions.

iv. **Pressure:** 200 psi working pressure.

v. **Header:** Non-ferrous headers.

e). **Air Flow Monitoring Stations:** Consult the AOC Project Manager for thermal dispersion type vs. pitot-static type.

f). **Fancoil Units (FCU):** There are no fan coil units built today which have a 50-year useful life. FCUs shall be chosen with quality in mind to increase the time between replacements.

i. The casing shall be a heavy gauge galvanized steel to reduce vibration. The coil tube thickness shall be as close to 0.035 inches as reasonable and shall be copper. The fin series shall not exceed 10 fins per inch and copper fins are preferred.

ii. Velocities through the cooling coil shall not exceed 500 feet per minute to avoid moisture carryover.
iii. All control valves, coils, fans and filters shall be accessible for maintenance and cleaning through either access doors, removable plates, or removable panels.
iv. fan casings shall be adequately braced and isolated to avoid vibration. Position a non-corroding drain pan (stainless steel, plastic, etc.) under cooling coil and an auxiliary drain pan under the control valve.
v. Consider the use of occupancy sensors to control fan coil units in areas such as dormitory rooms, conference rooms, office spaces and others with intermittent occupancy.

g). **Unit Heaters:** Copper fins and tubes are preferred.

h). **Cabinet Heaters:** See fancoil units above. All items apply except those associated with cooling.

i). **Filters:**
i. **AHUs:** High-efficiency cartridge type - 95 percent efficient (Minimum Efficiency Reporting Value (MERV) 15), with 2-inch, 30 to 40 percent efficient (MERV 8) pre-filter. The designer shall contact the AOC Fire Protection and Mechanical Engineering Branch for specific model numbers.
ii. **Fancoils:** 1-inch thick pleated media – minimum efficiency 30 percent (MERV 8).
iii. Additional filtration may be required for certain locations or facilities and shall be confirmed with AOC for each specific project.

j). **Fans:** AMCA rated. Heavy-gauge seam welded construction adequately braced with structural steel shapes for rigidity. Continuously welded blades. Drain at low point. Rust inhibiting primed surfaces. Include Vibration isolation. Premium efficiency motor. With access door. Design shall use non-corrosive materials (aluminum or stainless steel) for fans serving moist air streams (toilet rooms, dishwashers, showers, etc.).
i. **Acceptable types:** Centrifugal - airfoil, backward curved, backward inclined; Vaneaxial, plug and Propeller. In addition, the designer shall evaluate new emerging technologies where redundancy, quiet, vibration-free operation, optimized energy efficiency and low-cost maintenance is required.
ii. **Battery Rooms or Charging Areas:** Design shall use spark-proof fan.
iii. Fan selections should be made on a slope to the right of the peak of the curve to ensure the stable conditions.

k). **VAV Boxes:** BAS controlled, low leakage, internally insulated with an anti-microbial coating, bottom access door, pressure independent averaging air velocity sensor, and control enclosure. Where a reheat coil is specified, provide manual air vent.

l). **Ventilation and Air Distribution:**
i. **Low-Pressure Duct Design:** Recommend no greater than 0.1 inches/100 feet s.p.
ii. Comply with OSHA required noise levels for spaces not listed in General Requirements in Section 1 of this Guide. For example utility and storage space ventilation.

m). **Ductwork:** Limit leakage on supply and return air ducts to one pressure class higher than that specified in SMACNA standards. Ductwork shall be tested in accordance with SMACNA Ductwork Testing Manual. Maximum allowable duct leakage shall not exceed 50 percent of that allowed by SMACNA's HVAC Air Leakage Manual. Fabricate all ductwork of sheet metal (with the exception of terminal connections to ceiling diffusers). Flexible duct length shall not exceed five feet in length.
i. **Duct Lining – For Sound Attenuation:** Design shall provide lining which resists erosion and microbial growth. Where erosion is of concern, provide a perforated metal inner wall. In the presence of excessive moisture (i.e., downstream of humidifiers), design shall provide double wall duct. Length of double wall duct shall be based on manufacturer's published non-wetting distance.
ii. **Plenum Returns:** For spaces where indoor air quality may be a concern, the AOC prefers ducting returns as opposed to ceiling return air plenums. Plenum type returns shall be discussed with the AOC before consideration.

n). **Ductwork Insulation:** Design shall provide

the following minimum insulation systems for air distribution ductwork: (Since insulation technology is changing rapidly, for consideration of other insulation materials and vapor barriers, consult the AOC Project Manager.)

i. **Concealed Areas:** 1-1/2 inch fiberglass duct-wrap. (Ensure specification has guidance to avoid areas of compressed insulation.)

ii. **Exposed Areas:** 1-1/2 inch rigid fiberglass board covered with canvas or fiberglass cloth protective finish.

iii. **Vapor Barriers:** Design shall provide a vapor barrier for all insulated ductwork subject to condensation. Strive for a 0 permeability rating.

o). **Outside Air Intake:** Locate air intakes at or near roof areas. Do not use "at-grade" air intakes without written approval from the AOC Project Manager which must include a review and approval from AOC-OSP / USCP.

p). **Grease Exhaust Duct Systems:** Duct construction standards shall comply with NFPA 96 and IMC. In the case of a conflict, NFPA 96 shall govern. Duct shall be reinforced and supported in accordance with the latest applicable SMACNA duct construction standards, and insulating fire barrier standards (tested in conformance with UL tests and certified for a grease fire for two hours, with zero clearance to combustibles).

q). **Resource Management:** Fabricate from steel with either 5 percent post-consumer recycled content or 20 percent pre-consumer recycled content.

9.9. **Acoustics and Noise Control:**

a). Criteria for noise levels are generally described in Section 1, General Requirements (under 1.1.1 “Design Requirements,” item (d)). For noise critical spaces (NC<=30) and places of assembly, a qualified acoustical consultant shall evaluate the system design and work with the Design Team to incorporate appropriate noise control measures including sound attenuators. Pressure drop for sound attenuators shall be balanced between fan horsepower effect and attenuator size.

i. **Maximum Duct Velocities:** As a guideline for low-pressure ductwork, do not exceed 1000 feet per minute in noise-sensitive areas.

ii. **Noise Criteria:** Limit duct velocities or provide sound lining or attenuators to comply with the following velocity limits:

- Auditoriums, Legislative Spaces - 800 fpm.
- Private Offices, Conference Rooms, and Libraries – 1,200 fpm.
- General Offices – 1,500 fpm.

9.10. **Building Automation System (Refer to Section 12):**

9.11. **Fuel Oil System:**

a). **General:** The installation of fuel oil piping and equipment must comply with Local, State and Federal requirements, as well as NFPA 30 and 85.

b). **Fuel Oil Systems Piping:** Fuel oil systems piping shall be double-wall containment pipe (pipe-in-pipe) when outdoors, buried or if carrier pipe failure would result in environmental or facility damage. For direct bury applications, consider using fiberglass reinforced plastic piping. Indoors, piping shall be Schedule 40 black steel. Fittings shall be of the same metal grade as the pipe material. Valves shall be bronze, steel or iron and shall be screwed, welded or flanged.

c). **Fuel Oil Transfer Pumps:** Duplex fuel-oil pump sets shall be equipped with a duplex basket-type strainer and spill containment shall be used for pumping fuel oil to fuel burning equipment. Provide secondary containment curb around fuel oil pump set.

d). **Underground Storage Tanks (UST):** UST for fuel oil shall be of double-wall non-metallic construction, or contained in lined vaults to prevent environmental contamination. Tanks shall be sized for actual storage volume for sufficient capacity to provide a minimum of 48 hours of system operation under emergency conditions (72 hours for remote locations). The interstitial space of underground tanks, above-ground, day-tanks and underground piping shall be monitored and alarmed with a leak detection system capable of interfacing with the AOC BASnet. The installation must comply with Local, State and Federal requirements, as well as NFPA 30 and EPA 40 CFR 280.

9.12. **Testing and Balancing:**

a). The Contractor shall test and balance all systems prior to completion of a project and acceptance by the AOC. This includes new systems and renovations/rehabilitations to existing systems. Testing, adjusting and balancing is a prerequisite to commissioning, and all common work shall be closely coordinated. Consult with the AOC prior to the start of a partial renovation/rehabilitation design of a system, to verify the performance of that existing system and whether or not an initial testing and balance report needs to be performed.

b). Testing and balancing shall be performed by an organization certified by the National Environmental Balancing Bureau (NEBB) or the Associated Air Balance Council (AABC). The work shall include all air, water and steam systems at full-load and part-load. Where the schedule of the work does not permit full-load testing, the contractor shall adjust setpoints to mimic full-load conditions.

c). Work shall include supply duct leakage testing on a minimum sample of 10 percent of entire ductwork system. It shall be performed prior to closing in walls, ceilings and anything else that would hinder access to ductwork prior to testing and acceptance.

9.13. **Alterations in Historic Buildings:**

a). A large portion of the buildings within the Capitol complex are historic structures. Since they are both historic structures and modern workplaces, it is necessary to upgrade the mechanical systems within them. These improvements must be undertaken with careful planning and detailed consideration of historic features. Consult Section 2, Historic Preservation, and this Section under 9.2 "Design Criteria" for further information regarding protection of Heritage Assets.

b). The building superintendent and staff should be interviewed to understand how building functions are accommodated in each particular historic structure. Each facility may have its own unique facets, such as the extent of duct leakage where it may be very old.

9.14. **Commissioning:** Commissioning is a process that involves the entire Design Team throughout the planning, design, construction and occupancy of the project. Commissioning Guidelines for AOC Projects are contained in the policy statement of June 7, 2010. Refer to section 1.2.2 Commissioning, for additional requirements.

a). During the initial planning process, the AOC Project Team shall determine the purpose and role of commissioning. The purpose may be to ensure proper integration of a small renovation/rehabilitation into the Capitol complex, or it may be related to a certification. It may range from simple, direct Owner commissioning by the AOC to an independent Commissioning Agent with a substantial budget. As a rule, if a project is designed by an Associate A/E, then commissioning will be performed by a third party hired by the AOC.

b). Within the context of design for mechanical systems, commissioning plays a significant role. The designer of the mechanical system has these responsibilities:

iii. Develop and document the PoR.

iv. Develop a basis of design.

c). Commissioning shall help ensure that mechanical systems operate properly as a holistic system. The parts and pieces must interact as required by the sequences of operation and do so within an appropriate time frame. The pre-functional and functional performance tests will verify this performance, starting with the individual components and progressing to entire systems.

d). Adjustment of system operating parameters affects energy consumption. These will include duct pressure for VAV air handlers, leaving air setpoints, piping pressures and water temperature setpoints. For most projects, these must be adjusted to reflect actual built conditions that may not be easy to calculate in design.

e). Commissioning and testing of systems shall integrate those parts that relate to other building components.

f). Finally, commissioning of mechanical systems includes operations and maintenance (O&M). Both the Commissioning Agent and the mechanical designer must review the O&M Manuals. These shall be organized according to the project specifications and provided to the AOC in both paper and electronic format

(verify final formats with the AOC).

9.15. **Site HVAC: Reserved for Future Use.**

9.15.1. **Site Steam Distribution Systems: Reserved for future use.**

9.15.2. **Site Hydronic Distribution Systems: Reserved for future use.**

9.16. **Restrictions:**

a). Avoid fan-powered boxes where noise level is a concern, or there is limited access for maintenance.
b). Do not use large forward curved fans on air handling units because of lower efficiency and longevity.
c). Do not route condensate lines on the floor to drains if they will cross traffic paths.
d). There shall be no connection of dissimilar metals that could lead to corrosion and a reduction of product life.
e). Do not locate coils in locations that will make access for maintenance or repair difficult.
f). Do not use ferrous headers.
g). Do not use galvanized drain pans.
h). Do not install duct lining in ductwork subject to moisture.
i). Mixing of different manufacturers' equipment on a MS/TP or Arcnet trunk is not permitted.
j). Verify specific restrictions with the HPO.
k). Do not locate steam coils in ceiling plenums or areas that are occupied. If this is not possible due to the constraints of the building, the designer or contractor shall consult with the AOC Project Manager.
l). Do not route utilities, network cabling or fire protection services through mechanical systems (air handlers, and supply and exhaust systems). If this is required due to the constraints of the building, the designer or contractor shall consult with the AOC Project Manager.

10. Plumbing:

10.1. Introduction and General Provisions

a). **Purpose:** The design of the plumbing systems and other building components shall combine to produce a building that meets the project's programmed sustainability target and assigned energy target, as referenced in Section 3.1.3 in Sustainable Design. Plumbing systems must be coordinated and integrated with all other building systems and features. Plumbing systems shall be adapted to support all performance objectives, typically involving sustainability, workplace performance (productivity and efficiency), fire protection, security, historic preservation and improved operations and maintenance.

10.1.1. Design Requirements:

a). Plumbing systems shall generally be designed to exceed the minimum performance requirements of the ASHRAE Standard 90.1 and 10 CFR 434 standards, and shall incorporate cost-effective energy conservation measures that do not compromise building performance or occupant comfort. The design and installation of all plumbing systems and equipment shall be approved by AOC prior to installation. The design shall allow for maintenance, removal, and replacement, including major components such as water heaters, booster pumps and recirculation pump equipment. For facilities that are not located in the boundary of the District of Columbia but house AOC federal workers, AOC Design Standards along with the International Plumbing Code (IPC) and local codes/standards should be used as the basis of design. When discrepancies between standards requirements are encountered, the Project Manager shall determine the requirement. Refer to section 1.5 'Regulatory Requirements.'

b). Project Managers shall contact the Historic Preservation Officer (HPO) prior to designing the routes and places where new piping and related controls and accessories shall be installed. All interior surfaces, decorated surfaces, architecture features like pilasters, cornices, running trim are important elements in Heritage Assets and must be protected and not be disturbed, removed, or altered. HPO and Curator shall review detailed Construction Documents that indicate location of new devices, routes, access points and avoidance of historic elements. Consult Section 2, Historic Preservation for further information regarding protection of Heritage Assets.

10.2. Related Sections:

a). Other Sections that contain important information that may affect elements of this section or their implementation, include, but are not limited:

i. Refer to Section 1, General Requirements.
ii. Refer to Section 2, Historic Preservation, for information related to protection of Heritage Assets.
iii. Refer to Section 3**,** Sustainable Design, for information related to energy requirements.
iv. Refer to Section 9, Mechanical and HVAC, for related information.
v. Refer to Section 11, Electrical, for related information.
vi. Refer to Section 12, Building Automation System, for information related to BASNet.
vii. Refer to Section 16, Sitework, for related information.

10.3. Domestic Water Supply System:

10.3.1. Water Piping:

a). **General:** Water conservation shall be a requirement of all plumbing systems.

b). **Building Service:** Building domestic potable cold-water service shall consist of a pressurized piping distribution system incorporating an independent (separate) service pipe from the tap at the exterior utility service water main to the water meter and backflow preventer equipment inside the building.

c). **Water Meters:** Water meters are required on all water services, regardless of size. Design engineers can download the DC Water design criteria for all sizes of water meters. AOC prefers to house water meters inside our buildings for easy access and repair. When there is no space to construct a meter room in the building an exterior water meter vault shall be constructed, and it must meet the requirements for DC Water, formerly DC WASA. Note that the water meter vaults and

rooms must have adequate access space for DC Water staff to test, repair and replace the meter. The size of water meter vaults shall be in accordance with DC Water standard details. Water meters shall be remote-reading type with transponder signal transmitted by telephone line. Fire protection water service shall not be impacted by the water meter requirements. Irrigation systems and similar water supply/make-up systems that do not discharge to the sanitary sewer shall be sub-metered (remote read) for utility billing rate deduction of sanitary service not utilized. See building automation system communications requirements described further in Section 12 Building Automation Systems.

d). **Backflow Preventer:** The water service shall have a code and water purveyor compliant reduced pressure zone (RPZ) backflow prevention device immediately downstream of the service water meter(s) prior to all other connections and branches. Maintain manufacturer and water purveyor required access and service clearances for backflow preventers. A man lift should not be required to test/calibrate a backflow preventer. Designers shall coordinate with the AOC for requirements to install redundant devices on water mains. All RPZ backflow preventers shall have drainage in accordance with DC Water's Cross Connection Manual, or other local jurisdictions outside of Washington, D.C. as applicable, and shall be installed in accordance with manufacturer's requirements.

e). **Building Internal Distribution:** Internal distribution shall consist of a piping system that supplies domestic potable cold water and hot water to all plumbing fixtures, plumbing equipment, water heaters and mechanical make-up equipment/system demands. All domestic water lines shall be ASTM B-88, Type "L" hard-drawn copper tube with soldered joints (for certain facilities Type "K" is required. The Designer shall verify the requirements with the Project Manager). Design shall provide valves at each branch water line. If required by the Project Manager, provide full open valves (line size valves that will not obstruct water flow when in the full open position) at each branch/riser water line and drain down tees with valves and hose connections on the downstream side of all branch water valves. Also, where required, provide vent valve to ensure proper drainage of isolated piping. Limit water pressures to 80 psig (415 kPa). Design systems to sustain at least 1.5 times the working pressure. For pipe sizes 5 inches in diameter and larger, consult the Mechanical Engineering Branch. All new piping shall be lead-free.

i. **Solder:** Lead-free for all potable water piping. Use brazing filler metals (silver or copper-phosphorous alloys) for continuous operation over 180 deg. F (82 deg. C).
ii. **Flux:** Lead-free, water-flushable complying with ASTM B 813.
iii. **Grooved Piping/Fittings and Press Connect Fittings:** Contractor should get AOC written approval before commencement of work in order to use this installation method. Comply with ASTM B-88.
iv. **Fire Protection:** Domestic water piping that will support fire protection services shall be designed to support working pressures consistent with that usage. Refer to Section 8, Fire Protection and Life Safety, for more information.

10.3.2. **Valves:**

i. **Shut-Off Valves:** Use ball valves on piping up through 2" diameter. Ball valves shall have stainless steel balls and stems. Use flanged gate valves on piping 2.5" diameter and above (butterfly valves shall not be used unless approved by AOC).
ii. **Balancing Valves:** Use globe-type valves.
iii. **Back-flow Devices:** To match the level of hazard. All mains and areas subject to contamination shall have back-flow devices.
iv. **Check Valves:** Swing-type, non-slamming, bronze disk.
v. **T & P Relief Valves:** ASME rated.
vi. **Drain Valves:** Shall have hose end connections.
vii. **Pressure Reducing Valves:** See section below.
viii. **Thermostatic Mixing Valves:**
ix. **Showers Valves:** Design shall provide thermostatic mixing valves for all showers.

10.3.3. **Plumbing Accessories:**

i. **Pipe Escutcheons:** Use push on or split ring escutcheons at all wall penetrations. Consult with AOC Project Manager for specific finishes.
ii. **Hanger and Support:** Comply with types, sizes and spacing provided in AOC Master Specifications.
iii. **Wall Hydrants/Hose Bibs:** One per 100 ft. of exterior wall, a minimum of one per building elevation. Design shall provide vacuum breakers.
iv. **Labeling:** Label all piping in conformance with ASME A 13.1, "Scheme for the Identification of Piping Systems."
v. **Dielectric Unions:** Prevent accelerated corrosion and deterioration in the piping system due to galvanic and stray current. Install between pipes/valves/equipment made from dissimilar metals.

10.4. **Domestic Water Service Pressure Maintenance:**

10.4.1. **Water Service Supply:**

a). The water service supply source (utility) low hydraulic grade line (Low HGL), low head elevation of water source tank or pump, adjusted for friction and head losses/gains, shall be used for determining available water source pressure, pump suction calculations and selection. The water service supply source (utility) high hydraulic grade line (High HGL), high head elevation of utility service water supply source tank or pump, plus booster pump shut-off head for boosted systems (system maximum working pressure), adjusted for static pressure head losses/gains shall be utilized for determining maximum system working pressures.

10.4.2. **Distribution Water Pressure:**

a). Distribution water pressure shall provide fixture, equipment and outlet-required pressures at the hydraulically most demanding (generally the topmost/highest and most remote) outlet. Required outlet pressure shall be minimum requirements of the International Plumbing Code (IPC), or higher requirements of the fixture, equipment, or outlet demand as identified by the manufacturer or warranty.
b). Distribution water pressures shall not exceed system material, piping, and device-rated maximum working pressures, or maximum pressures at the fixture, equipment, or outlet as required by the IPC. The A/E shall schedule and specify pressure-regulating valves or valve stations where maximum working pressure (High HGL, plus booster pump shut-off pressure for boosted systems) may exceed IPC maximum, or manufacturer/warranty maximum operating pressures, generally lower than IPC maximums.

10.4.3. **Building Pressure- Maintenance:**

a). Pilot operated pressure-reducing valves (or valve stations) with expansion by-pass (for domestic hot water) shall be used to regulate supply water pressures within distribution zones. Individual outlets may utilize pressure-reducing valves compliant with code requirements and as recommended by the outlet use manufacturer. Fire protection water service shall not be impacted by the pressure-reducing valves requirements.
b). Pressure-reducing valves shall be specified to operate at peak flow within the entire range of Low HGL and maximum working pressure of the system (High HGL, plus pump shut-off head for pressure-boosted systems).
c). Where a pressure booster pump system is provided, a low-pressure cutoff switch should be set for operation to prevent the creation of a vacuum or negative pressure on the suction side of the pump, thus cutting off water supply to other outlets.
d). A packaged and third-party tested triplex (three pump) booster pumping system or duplex (two pump) with an appropriately sized hydropneumatic storage pressure tank, shall be utilized where water flow test and water purveyor low hydraulic grade line (Low HGL) water pressures do not provide required pressure demands at peak draw. Water pressure boosting shall generally be provided only to those areas or floor elevations where insufficient water pressures may be experienced/ expected utilizing the Low HGL. Outlets on floor elevations or areas that can be served with the required pressures provided at Low HGL shall generally not be pumped. The entire water service shall not be pressure-boosted if only portions of the building systems require pressure maintenance

boosting. Any deviations from these requirements must be coordinated through the AOC Project Manager.

10.5. **Domestic Hot Water System:**

a). **General:** Domestic potable hot water shall be generated by water heaters utilizing natural gas, electricity or steam as the energy source. Selection shall be supported by an economic evaluation incorporating first cost, operating costs and life-cycle costs in conjunction with the HVAC energy provisions.

b). **Supplied Water (cold or pre-heated):** Water supply to water heaters shall include service valve, check valve, expansion tank (sized for expansion of storage capacity only), 27-inch heat trap, mixing valve by-pass primer and hot water return connection as a minimum. 27-inch trap height minimum shall be provided at water heater cold-water inlets for energy savings.

c). **Water Utility:** Cold water supplied from the utility source varies in temperature by season and regional location. The A/E shall obtain, from the water utility purveyor, seasonal cold-water service temperatures supplied by the water utility purveyor (past three-year minimum preferred). Low temperature (lowest of past three years) seasonal cold water service temperatures shall be used in calculation and application of water heating, water heating energy source (steam, heating hot water, gas), and for make-up to the water heating energy source. Preheating of domestic cold water supply to the domestic water heater and cold water make-up to water heating energy source shall be considered utilizing steam condensate or heating hot water return.

d). **Heat Exchanger:** When the HVAC system can supply pre-heat water for domestic use, a Heat Exchanger water heater should be used.

e). **Semi-instantaneous water heaters:** Preferences of our jurisdictions vary, based on their requirements. It is important to meet with the AOC Project Manager before specifying. General recommendations include, where steam is available, semi-instantaneous type water heater may be provided. It is preferred that unit shall have double wall heating coil, ASME rated stainless steel vessel with a working pressure of 150 psi, factory assembled and piped including strainer, steam traps, control valve, integral circulator, vacuum breaker, air vent, ASME temperature and pressure relief valve, gauges, electric control package for integration with building automatic software (BAS) and energy management software (EMS).

f). **Instantaneous water heaters:** Instantaneous water heaters are not permitted as a primary source. For incidental use, sporadic equipment demands, or remote individual fixtures (i.e., lavatory, sink, shower service sink), the use of instantaneous water heaters is permitted. Point-of-use instantaneous water heaters are permitted for use at emergency fixtures to supply “tepid water” immediately at the emergency fixture or group of emergency fixtures.

g). **Storage Tank water heaters:** Domestic hot water supply temperatures shall be generated and stored at a minimum of 60°C (140°F) to eliminate the chance for Legionella.

h). **Fixture outlet temperatures:**

i. 110°F temperature water for general usage (hand washing, lavatory, etc.).

ii. 120°F maximum for group/individual shower and for bathing.

iii. 60 to 90°F for emergency eyewash and showers.

iv. 140°F for commercial type kitchens, boosted to 180°F at dishwashers for final sanitizing rinse.

v. 120-140°F for service sink and mop sink in janitor closets.

i). **Allowance for expansion and contraction:** Allowance for expansion and contraction should be made in all hot water supply mains, risers and branches. It is recommended that suitable expansion loops and swing joints be provided at appropriate locations in the piping runs. Allow 1/8 inch per 10 feet for expansion in copper tubing, and 1/16 inch per 10 feet in iron pipe. The amount of the expansion is readily calculated using the Expansion Equation below.

j). Expansion (mm) = $L \Delta T \alpha$

Where:

L = Length of pipe between anchors (m)

ΔT = Temperature difference between ambient temperature and operating temperatures (°C)

α = Expansion coefficient (mm/m °C) x 10^{-3}

The coefficient of expansion or contraction is defined as the unit increase or decrease in length of a material per 1°F increase or decrease in temperature.

The coefficient of thermal expansion or contraction for commonly used pipe material can be obtained from the pipe manufacturer or ASPE Data Handbook (Volume 4 chapter 11). The coefficients should be in accordance with ASTM D-696.

k). Rubber fittings and device components shall not be permitted within the potable domestic hot water or return systems, as they have been associated with persistent colonization of Legionella. For additional information on water temperature, control of Legionella, and water safety, refer to:

i. ASHRAE 188: Legionellosis: Risk Management for Building Systems – 2015
ii. AIHA publication (2015): Recognition, Evaluation and Control of Legionella in Building Water Systems

l). Distribution systems shall consist of a piping system that connects to water heater(s) that serve all fixtures, equipment and outlet demands requiring potable domestic hot water. The circulation return systems with circulating pump and time clock/balancing valves should be used for temperature maintenance. Where the length of hot water piping from the source of hot water supply to the farthest fixture exceeds code required distance, the hot water supply system shall be provided with a method of maintaining the temperature in accordance with the International Energy Conservation Code (IECC). Domestic hot water shall be available at each hot water outlet within five to seven seconds from the time of operation.

m). Domestic hot water return circuits of substantially varying pressures as a result of pressure zoning or static head cannot successfully be joined to a single pressure zone water heater. Locate individual pressure zone water heater(s) within the pressure zone(s), where return pressures would vary substantially causing dead head on the lower pressure return circuits. Hot water return systems shall have circuit setters (balancing valves) and test plugs at each return circuit, and systems shall be balanced.

n). **Redundant Heaters:** All building main hot water systems shall have redundant heaters. (This does not apply to point-of-use water heaters.) Water systems shall be looped to the extent possible to prevent stagnation and to control sediment buildup.

o). **Central Plant Steam:** When central plant steam is available for water heating, a duplex steam to water converter complete with circulation pumps, mixing valves, thermometers, etc. shall be utilized for heating domestic water.

p). **Central Plant Steam used for Food Service:** When central plant steam is available for water heating, a duplex steam to water converter complete with circulation pumps, mixing valves, thermometers, etc. shall be utilized for heating domestic water. Comply with health code sanitary temperature requirements.

10.6. **Domestic Water Supply Equipment**

a). **General:** Domestic water supply equipment and components shall include, but not be limited to, the following equipment:

i. Water Meters, Heaters, Filtration, Softening
ii. Pressure Booster Systems
iii. Pressure-regulating Valves
iv. Circulating Pumps
v. Backflow Preventers
vi. Circuit setters and Balancing Valves
vii. Thermostatic Mixing Valves
viii. Tempering Valve
ix. Expansion Tanks
x. Isolation Valves
xi. Hangers and Supports
xii. Thermal Insulation

b). Water heaters and expansion tanks shall be compliant with ASME, stamped and rated.

c). Water hammer arrestors shall be provided at each elevation change of every horizontal branch to fixture batteries, at all quick-closing automatic valves (drinking fountains, flush valves, single lever control faucets, temperature regulating valves, dishwashers, return pumps, and similar), and at each floor

on each horizontal main for branches with/without individual fixture or battery water hammer arrestors, for both hot and cold water.

d). Water hammer arrestors shall be compliant with the Plumbing and Drainage Institute (PDI) Standard PDI-WH201, ANSI/ASME A112.26.1M, or as required by code, and as recommended/required by fixture and equipment manufacturer or warranty.

e). Thermostatic mixing valves will be utilized at the water heater main supply hot water line and at emergency fixtures.

f). Tempering Valves will be utilized at general use fixtures. Can be set to any temperature between 90°F and 160°F with flow rates as low as 0.5 gallons per minute and as high as 23 gallons per minute.

10.7. **Plumbing Piping Insulation:**

10.7.1. **General:**

a). All insulation materials shall comply with the fire and smoke hazard ratings (25 for flame spread; 50 for smoke developed) as indicated by ASTM-E84, UL 723 and NFPA 255. Accessories such as adhesives, mastics, cements and tapes shall have the same or better component ratings. Insulation shall be provided in accordance with ASHRAE Standard 90.1. Insulation that is subject to damage or reduction in thermal resistivity if wetted shall be enclosed with a vapor seal (such as a vapor barrier jacket).

10.7.2. **Piping Insulation Requirements:**

a). All piping systems must be insulated in accordance with ASHRAE Standard 90.1. Piping systems conveying fluids having design temperatures less than 18.3°C (65°F) or greater than 40.6°C (105°F) shall be insulated.

b). All piping systems, with surface temperatures below the average dew point temperature of the indoor ambient air and where condensate drip will cause damage or create a hazard, shall be insulated with a vapor barrier to prevent condensation formation regardless as to whether piping is concealed or exposed. Insulation labeling shall comply with the piping label requirements of this document.

c). Water cooler chilled water piping systems shall be insulated with non-permeable insulation (of perm rating 0.00) such as cellular glass. See Section 9, MECHANICAL AND HVAC, for HVAC chilled water system requirements.

d). All exposed and concealed piping shall have PVC jacketing. All sanitary sewer vents terminating through the roof shall be insulated for a minimum of 1.83 meters (6 feet) below the roof line to prevent condensation from forming and include a vapor barrier jacket on this insulation.

e). Domestic cold and hot water distribution systems shall be insulated per ASHRAE Standard 90.1 with vapor barrier for concealed and above-ceiling piping, canvas jacketing and vapor barrier where exposed in mechanical areas, and vapor barrier with PVC jacketing where exposed in other than mechanical areas. All piping exposed in plenums or above the ceiling shall be insulated to prevent condensation.

10.8. **Plumbing Equipment Insulation:**

a). All insulation material shall comply with the fire and smoke hazard ratings indicated by ASTM-E84, NFPA 255 and UL 723. Accessories such as adhesives, mastics, cements, tapes, etc. shall have the same or better component ratings. All equipment including water heaters, heat exchangers and valves must be insulated in accordance with ASHRAE Standard 90.1.

b). Insulation: Design shall provide minimum 1" fiberglass pipe insulation on all domestic cold, hot and re-circulating water lines. Design shall provide a canvas covering to insulation jacket on piping which is installed in exposed areas (corridors, etc.).

10.9. **Sanitary Waste:**

10.9.1. **General:**

a). All plumbing fixtures, drains and equipment requiring drainage shall be arranged for gravity flow with connections to public sewers.

10.9.2. **Sanitary Waste and Vent System**

a). **Sanitary Pipe and Fittings:** A complete sanitary building drainage system shall be provided for all plumbing fixtures, sanitary floor drains, kitchen equipment, and equipment with sanitary, soil or waste drainage/discharge. The sanitary waste and vent system shall be designed in compliance

with International Plumbing Code (IPC) applicable local codes and standards.

i. **Below-Grade Piping:** Service piping shall be service weight cast iron soil pipe with hub and spigot fittings and joints with elastomeric gasket (by pipe manufacturer).

ii. **Above-Grade Piping:** Shall have hubless (no-hub) fittings and joints (by pipe manufacturer) with pipe support compliant with hubless (no-hub) pipe standard and code requirement.

b). **Vent Piping and Fittings**:

i. **Below-Grade Piping:** Service piping shall be service weight cast iron soil pipe with hub and spigot fittings and joints with elastomeric gasket (by pipe manufacturer).

ii. **Above-Grade piping:** Shall have hubless (no-hub) fittings and joints (by pipe manufacturer), or DWV copper with 95-5 tin antimony solder joints.

c). **Sanitary Floor Drains:** Sanitary floor drains shall be provided in multi-toilet fixture restrooms, kitchen areas, mechanical equipment rooms and locations where interior floor drainage accumulates wastes. Single fixture toilet rooms do not require floor drains.

i. In general, floor drains shall be cast iron body type with 6-inch diameter nickel-bronze strainers for public toilets, kitchen areas and other public areas. Receptors, open-site drains, hub drains, trench drains and similar drains shall have a dome bottom strainer (in addition to pedestrian/vehicle grate strainers where required) to reduce splashing, increase free area and prevent debris blockage. Drain body, frame and grate strainers shall be rated for expected wheel loading and shall include drain adapters, extensions, receivers, deck clamps and other features as required by building construction.

ii. Drain strainer free area shall be equal to or greater than the free area of the calculated outlet pipe. Drain strainers in pedestrian areas shall be heel-proof type. Every drain and system opening shall have 1/4-inch maximum strainer openings for rodent-proofing. Discharges shall be elastomeric pinch valves or similar for rodent-proofing. Receptor drain outlets shall be twice the area of combined inlet pipe areas.

iii. Equipment room areas shall require large diameter cast iron strainers, and parking garages shall require large diameter tractor grates rated for expected wheel loading. Drainage for ramps shall require either trench drains or roadway inlets when exposed to rainfall.

iv. Trap primers shall be provided for all sanitary drains (floor drains, receptors, open site drains, hub drains, etc.) where drainage is not routinely expected or is seasonal.
In areas exposed to freezing temperatures, P-traps should be heat traced and insulated.

v. The space under the raised floor of a computer room should be provided with drainage to protect against flooding or trapped water. Refer to Section 8, Fire Protection and Life Safety, for fire protection requirements.

d). **Piping**:

i. **Above-Grade Piping:** Service weight cast iron, no-hub with CISPI couplings.

ii. **Below-Grade Piping:** Use hub and spigot couplings.

iii. **Direct Burial Piping:** Protect piping from external corrosion.

iv. Brace all piping 5 inch and larger according to CISPI standards.

10.9.3. **Sanitary Waste Equipment:**

a). **Grease Interceptors:** Drains and fixtures discharging fat, oil, or grease-laden waste, within 10 feet of the cooking battery, mop, and service sinks in kitchen areas; and as required by the International Plumbing Code (IPC), the state health department and local authorities, shall discharge to a grease interceptor prior to connecting into the sanitary sewer. Grease interceptors shall be sized compliant with requirements of the local authority. Where permitted by the local authority, grease interceptors shall be compliant with the Plumbing and Drainage Institute (PDI) PDI-G101. Drains, fixtures and equipment required to discharge to the grease interceptor shall be as required by the state health department and local authorities. Generally, food grinders, vegetable sinks, fish scaling sinks (provide separator), meat cutting sinks, and clear water wastes are prohibited by the local authority

from extending to the grease interceptor, and shall not be employed except where otherwise required.

b). **Sand/Oil Separator:** Floor drains and/or trench drains in vehicle repair garages shall discharge to a sand/oil separator prior to discharge to the sanitary sewer. The oil separators should be sized in accordance with the maximum anticipated gpm flow rate. Provide a flow-control fitting before the interceptor, and a properly sized oil storage tank.

c). **Automatic Sewage Ejectors:** Sewage ejectors shall only be used where gravity drainage is not possible. Only sanitary drainage from the lowest floors of the building shall be connected to the sewage ejector. Fixtures on upper floors shall use gravity flow to the public sewer. Sewage ejectors shall be non-clog, screenless, alternating duplex pumps, capable of passing a 2-inch solid, with each discharge not less than 102 mm (4 in) in diameter. Sewage ejectors shall be connected to the emergency power system.

d). **Clearwater Drainage:** Clearwater drainage, such as storm rainwater, cooling coil condensate drainage, and similar clearwater drainage, shall not discharge to the sanitary drainage system. Chemically treated mechanical discharge from cooling towers, boilers, chillers and other mechanical equipment shall discharge to the sanitary drainage system for treatment and protection of the environment and waterways. Consideration should be made to divert these water sources to reuse and repurpose the water where possible. Purified steam (i.e., humidification) shall not discharge to the sanitary drainage system.

10.10. **Rainwater Drainage:**

10.10.1. **General:**

a). Do not build storm leaders into inaccessible construction, especially do not encase leaders in masonry or concrete where freeze/thaw cycling of conducted water could crack either piping or structure.

b). **Service Design Standard:** Design rainwater drainage systems to accommodate a "100-year" storm unless other standards are required by the applicable environmental regulations.

10.10.2. **Rainwater Drainage System**

a). **Rainwater Drainage (Storm) Pipe and Fittings:** A complete rainwater (storm) building drainage system shall be provided for all rainwater (storm) drainage for roofs, plazas, balconies, decks, area wells, parking structures, parking garages and similar areas and incorporated into the stormwater discharge design. Clearwater drainage (cooling coil condensate drainage, evaporation pan drainage, icemakers) and similar clear, non-chemically treated drainage shall discharge to the rainwater (storm) drainage system and not the sanitary drainage system. Clearwater drainage without chemical, vegetable, human, animal, protein, fecal, oil, grease or similar pollutants may be discharged to the rainwater (storm) drainage system where approved by code, state, local authority and the EPA.

i. The rainwater (storm) system shall be designed in compliance with all applicable local, state and federal codes and standards. P-traps and house-traps shall only be provided on storm systems where required by code, state or local authority.

ii. Below-grade piping shall be service weight, cast iron soil pipe with hub and spigot fittings and joints with elastomeric gasket (by pipe manufacturer). PVC piping is restricted without AOC written approval. If approved, a proper class B bedding must be provided for adequate laying and support of the pipe. See guide specification for below-grade recommendations.

iii. Above-grade piping shall have hubless (no-hub) fittings and joints (by pipe manufacturer) with pipe support compliant with hubless (no-hub) pipe standard compliant with code (generally within 12 inches of each side of each joint).Use no-hub piping above-grade in buildings to facilitate easier maintenance and replacement. PVC piping is restricted without AOC written approval.

iv. **Automatic Sump Pumps:** Sump pumps shall only be used where gravity drainage is not possible. Only rainwater, storm and clearwater drainage from the lowest floors of the building shall be connected to the sump pump. Drainage from upper floors shall use gravity flow to the public sewer.

Sump pumps shall be alternating duplex pumps and shall be connected to the emergency power system. Foundation and sub-soil drainage systems shall be provided with emergency power source and backwater prevention. Perforated drain tile piping in washed gravel bed with filter fabric shall extend to the duplex sump pumping system as required by the applicable codes. The requirements of the foundation and sub-soil drainage system shall be identified, capacity calculated, and materials identified by the Geotechnical soils engineer and identified in the Geotechnical Report. The layout and installation details and materials (identified by the Geotechnical Report) shall be specified and identified in the structural foundation drawings and indicated on the architectural drawing sections and details. The extension from the system end to the sump pump or daylight termination shall be identified on the plumbing drawings.

b). **Storm Drains:** Rainwater (storm) drains include domed roof drains, secondary roof drains, hub and receptor drains (that do not receive floor drainage), deck drains, parking garage drains, trench drains, area well drains and similar drainage devices. Roof drains and planter drains in non-pedestrian/vehicle areas shall have high dome strainers. Receptors, hub drains, trench drains, and similar drains shall have dome bottom strainers (in addition to pedestrian/vehicle grate strainers where required) to reduce splashing, increase free area and prevent debris blockage. Drain body, frame and grate strainers shall be rated for expected wheel loading and shall include drain adapters, extensions, receivers, deck clamps, gravel stops and other features as required by building construction. Drain strainer free area shall be equal to or greater than the free area of the calculated outlet pipe. Drain strainers in pedestrian areas shall be heel-proof type. Every drain and system opening shall have ¼ inch maximum strainer openings for rodent-proofing. Discharges shall be elastomeric pinch valves or similar for rodent-proofing. In general, drains shall be cast iron body type with nickel-bronze strainers for finished pedestrian areas, aluminum domes for roof drains, ductile iron, or bronze finish for unfinished pedestrian areas. Rainwater drains and equipment room areas shall require large diameter strainers. Drainage for ramps shall require either trench drains or roadway inlets when exposed to rainfall.

c). **Secondary (Overflow) Roof Drainage:** Secondary (overflow) roof drainage shall be accomplished by sidewall scuppers, scupper drains, or a secondary (overflow) roof drainage system. Locate roof drains where structural creep will not affect water in-flows. Roof drains shall be cast iron body type with high dome grates and membrane clamping rings. Design shall provide a separate overflow drain adjacent to each roof drain.

i. Secondary (overflow) roof drains shall be the same as roof drains except with integral standpipe or damming weir extension three inches above the waterproofing membrane and located within five feet of (adjacent to) the primary roof drain, and extended to discharge above grade.

ii. Termination above-grade shall include a concealed bird screen for rodent-proofing, near the discharge. Discharge shall be in a non-occupied, non-pedestrian area that permits drainage away from the building.

d). **Insulation:** Design shall provide 1/2-inch fiberglass pipe insulation and vapor barrier jacket on horizontal storm water pipe above ceiling at roofs over finished office space.

e). **Gutters:** Horizontal semicircular and rectangular gutters should be size per International Plumbing Code (IPC). The method of selecting sizes is similar to that used for round and rectangular leaders. Gutters should be a minimum of four inches wide. The more the roof slope, the wider the gutter should be to prevent the rainwater from flowing over the gutter without entering. The minimum slope the gutter should maintain is 1/16 inch/ft. Use of these systems shall be coordinated with architectural documents.

f). **Downspouts:** The gutter should be sheet metal (which is less susceptible to freezing than nonmetal materials) five feet above grade and cast iron or ductile iron to the tie-in with the underground piping. Downspouts should be a minimum size of 1-¾ x 2-¼ inches and should be a maximum of 75 ft. apart. Design shall use

outlets that dump onto grade on splash blocks or indirectly tied to the underground piping with screens or strainers for filtering debris and sediment. Use of these systems shall be coordinated with architectural documents.

10.10.3. **Rainwater Drainage Equipment**

a). **Sand/Oil Separator:** Floor drains and/or trench drains in vehicle parking structures and parking garages shall connect to a sand/oil separator prior to discharging to a storm sewer, in accordance with all applicable local, state and federal requirements.

10.11. **General Service Compressed Air System**

a). **Air Compressor:** Packaged air compressor and receiver shall be a factory assembled, wired, piped and tested unit that delivers air of quality equal to intake air. The packaged air compressor shall be air-cooled, continuous duty, and capable of operating against a pressure of 690 kPa (125 psig). A medium pressure compressed air system with operating pressure between 125 psig and 200 psig shall be provided.

i. Compressed air pipe and fittings shall be steel pipe, ASTM A53, schedule 40 black steel. Compressed air is used for many processes such as pneumatic tools, pneumatic controls, compressed air operated cylinder for machine actuation, product cleaning, and blow-offs. The system used shall be cost efficient with redundancy.

ii. Locate the air compressor system adjacent or near the actual applications in which it serves with necessary clearances for ventilation and access for maintenance.

iii. It is important to plan for ventilation and access when deciding compressor placement. Allow for three feet around the entire compressor package for maintenance and approximately 42-inches at the motor starter access panel. In addition, avoid areas that are extremely humid or whose ambient temperature exceeds 115°F.

iv. The compressor should be protected from weather. Design shall provide compressor with phase and voltage monitors to eliminate any phase variation and voltage drops.

b). **Other Compressed Air System Equipment:** Design shall provide compatible air dryer and after cooler with condensate separator/trap. Compressed air dryers (refrigerated or desiccant) help to reduce the water vapor concentration and prevent liquid water formation in compressed air lines.

i. Compressed air receiver tank and safety valves shall be constructed in accordance with ASME. Boiler and Pressure Vessel Code Section VIII. A drainpipe and valve shall be installed at the lowest point of every air receiver to provide for the removal of accumulated oil and water.

ii. The receiver shall be equipped with an indicating pressure gauge with one or more spring-loaded safety valves. Set the safety valve to operate when pressure exceeds 10 percent of maximum allowable working pressure of the receiver tank.

10.12. **Natural Gas System**

a). **Service Entrance:** Natural gas service utility piping entering the building shall be protected from accidental damage by vehicles, foundation settlement or vibration.

i. Wall penetrations shall be above-grade and provided with a self-tightening swing joint located upstream of the building and wall penetration.

ii. Where wall penetrations above grade is not possible, the gas pipe shall be within a schedule 80 black steel, corrosion protected, sealed and vented, gas pipe sleeve that extends from 10-feet upstream of the building wall penetration exterior (or excavation shoring limits if greater) to 12-inches (minimum) downstream of the building wall penetration.

iii. Gas piping shall not be placed in unventilated spaces, such as trenches or unventilated shafts, where leaking gas could accumulate (which could result in an explosion).

b). **Gas Piping within Building Spaces:** Gas shall not be piped through confined spaces, such as trenches or unventilated shafts.

i. All spaces containing gas-fired equipment, such as boilers, chillers, water heaters, and generators, shall be mechanically

ventilated and include CO2 monitoring and alarms.

ii. Vertical shafts carrying gas piping shall be ventilated.

iii. Gas meters shall be located outside or in a ventilated gas meter room providing direct access to the local gas utility company.

iv. All gas piping inside ceiling spaces shall have plenum rated fittings.

v. Diaphragms and regulators in gas piping must be vented.

vi. There shall be no gas valves (concealed or inaccessible) permitted above ceilings.

10.13. **Plumbing Fixtures:**

10.13.1. **General:**

a). Design shall provide all required (code, user, occupancy, safety and emergency) plumbing fixtures. Plumbing fixtures shall be compliant with code and state or local requirements. All plumbing fixtures shall have motion/user sensing devices (with manual by-pass) for fixture operation and shall be water conserving/saving-type fixtures, faucets, and valves.

b). Plumbing fixture accessibility clearances, installation, and accessories shall be compliant with ADA Standards.

c). Plumbing fixture and accessory support shall be compliant with code, state requirements, ADA Standards, and manufacturer's requirements.

d). All new fixtures must comply with EPA Lead-Free Requirements and meet the performance standard per section 9 of ANSI/NSF Standard 61: Drinking Water System Components – Health Effects.

e). Use water-conserving designs complying with the most recent versions of the Energy Policy Act or complying with the US EPA's WaterSense standards for all equipment.

i. Ensure that fixtures are current designs.

ii. Ensure that fixtures facilitate cleaning and ease of maintenance.

f). **Water Closets, Wall-Hung:** Vitreous china, siphon jet, elongated bowls with 1-1/2 inch top spud, less than or equal to 1.28 gallons per flush and electronic flush sensor. Equip private toilets with flushometers, public toilets with sensor activation. Floor mounted water closets may be considered as approved by the AOC.

i. **Accessible units**: Use wall-hung units to facilitate wheelchair footrest clearance.

ii. **ADA Mounting Height:** The height of water closets shall be 17 to 19 inches, measured to the top of the toilet seat.

g). **Urinals:** Use wall-hung units with a maximum water consumption of 1 gallon per flush and electronic flush sensor.

i. **Waterless:** Obtain AOC written acceptance prior to designing and specifying water-less urinals.

ii. **ADA Mounting Height**: The rim of the urinal must be no more than 17 inches above the floor.

h). **Lavatories:** Public restrooms. Use minimum 17-gauge (1. 1mm) plated-brass waste fittings on all units. Limit water flow to 1.5 gallons per minute maximum at 60 PSI.

i. **Lavatories, Private:** Cabinet or pedestal models as applicable to the design.

ii. **Service Sinks:** Wall-mounted sink designs preferred. Do not use floor basins without written approval.

iii. **ADA Requirements:** Wall/counter mounted fixtures should have insulation and trap guards.

iv. **Faucets:** All metal construction with either conventional, commercial-grade washer designs, or ceramic washer-less designs. Design shall provide chrome-plated brass, "hands-free" sensor-type faucets driven from building power wherever practicable, with controlled temperatures. All units with individual shut-off valves and tubular plated-brass supply. Battery-powered sensors may be used on renovation/rehabilitation projects upon AOC approval.

i). **Shower Heads:** Water consumption shall be limited to less than or equal to 2.0 gallons per minute maximum at 60 PSI.

j). **Shower Head (ADA):** A shower spray unit with a hose at least 60 inches long that can be used both as a fixed shower head and as a hand-held shower shall be provided.

k). Electric Water Cooler and Drinking Fountain: Wall-mounted stainless steel, 8 gallons per hour.

i. **Water Cooler Temp:** 50°F drinking water, based upon 80°F inlet water and 90°F ambient.

ii. **Accessible units**: Use wall-hung units to facilitate wheelchair clearance.
iii. **Electric Water Coolers**: Electric Water Coolers with built-in bottle filling stations are preferred.

l). **Pantry Sink:** Stainless steel, enameled cast iron, or porcelain, with blade handle and swivel faucet.

m). **Floor Drains:** Cast-iron bodies with polished nickel bronze strainers, with deep seal traps. Where traps are likely to dry out, provide deep seal traps and primers.

n). **Grease Traps:** Design shall provide recessed, semi-automatic types for kitchen areas.

o). **Health Care Fixtures and Equipment:** Health care plumbing fixtures shall conform to the requirement of the International Plumbing Code (IPC).

10.14. **Emergency Plumbing Fixtures:**

a). General: Emergency equipment shall be installed in accessible locations that an injured person can reach in 10 seconds or less and will be within an unrestricted travel distance of 100 feet or less from the hazard. Equipment shall be located so that one person can use both the eyewash and shower at the same time. (Design shall provide floor drain if approved by AOC.) Design shall be reviewed and approved by AOC Safety, Fire, and Environmental Programs Division.

b). Eyewashes shall supply potable water at a flow rate of not less than 0.4 gallons per minute at 30 psi for 15 minutes with a minimum 1/2-inch supply pipe.

c). Shower shall supply potable water at a minimum flow rate of 20 gallons per minute and shall be supplied by an iron pipe having a diameter of at least 1 inch.

d). Combination unit shall have minimum 1-1/4 inch supply pipe.

e). Tempered water immediately at the fixture or group of fixtures

i. Heating source within 25 feet to deliver "tepid water" 16°C (60°F) to < 32°C (90°F), at 0.207 megapascal (30 psi), within 10 seconds, for a minimum period of 15 minutes.
ii. Consider in the design the temperature drop across the valve (generally 7°C or 20°F) at flow.
iii. Design and all accessories shall meet ANSI Standard Z358.1 (2014) "Emergency Eyewash and Shower Equipment."

10.15. **Testing and Balancing and Commissioning:**

a). **Startup:** The A/E shall specify that factory representatives be present for startup of all major equipment, air compressor units and packaged pumping systems.

b). **Testing and Balancing:** It shall be the responsibility of the A/E to adequately specify testing, adjusting and balancing resulting in not only proper operation of individual pieces of equipment but also the proper operation of the overall plumbing systems, in accordance with the design intent. The Testing and Balancing contractor shall have up-to-date certification by the National Environmental Balance Bureau (NEBB), or the Testing, Adjusting and Balancing Bureau (TABB).

c). **Performance Testing:** A/E to specify performance testing of all systems and equipment including water heaters, and other systems for part-load and full-load during summer, winter, spring and fall season as per the schedules specified by the designer. The A/E shall specify the services of an organization certified by NEBB. Performance testing of domestic water heating systems shall include:

i. Heater and remote outlet temperature maintenance.
ii. System and circuit pressure equalization (without over pressurization, excess pressure loss or return pump deadhead).
iii. Control of water hammer at peak draw.
iv. Test for compliance with specifications and design intent for operation of water heater(s), mixing valve(s), circuit setters/balancing valves, return pump(s) and pressure-reducing/regulating valves.

d). **Piping and Equipment Pressure and Leak Testing:** Leak testing shall be conducted at static pressures as required by code (or at 120 percent of maximum design working pressure of system where no code requirement exists), with maximum permissible leakage, using hydro-testing procedures, unless otherwise approved by the AOC.

10.16. **Code and Standards:**

10.16.1. **General:**

a). As stated in Section 1, General Requirements, under 1.3.2 “Codes and Standards”), facilities shall comply with the International Building Code (IBC) and International Plumbing Code (IPC).

10.16.2. **Plumbing Design Standards:** The standards to be used as the basis for design reviews and approvals are listed in Section 1, General Requirements, 1.5 Regulatory Requirements. Any standard specifically referenced by the AOC Design Standards shall be considered mandatory.

10.16.3. **Reflecting Pools and Fountains:**

a). All pools and fountains are considered unique artistic features. As such, design should mitigate biological growth for protection of human health and the environment, while simultaneously protecting the integrity of the feature. For existing AOC pools and fountains, see guidance in AOC Best Practices for Pools and Fountains (AOC Project # AC16002).

b). **Equipment:** Use manufacturer’s equipment skids with all the required equipment mounted and pre-plumbed on the skid. Sizing should account for maintenance and access into the equipment space.

c). The oxidation-reduction potential (ORP) equipment such as a bromine or chlorine feeder should not be in the same area as the fountain equipment. Design shall provide a separate mini-vault or container to house the bromine or chlorine feeder.

d). **Equipment Location:** Inside Mechanical Room, underground vault, or a separate equipment mechanical housing. Equipment location must be reviewed AOC Architectural Review Board.

e). Utilize the building mechanical room area for fountain equipment:

i. Provide clearances around equipment for maintenance.

ii. Locate equipment on housekeeping pads.

iii. When mechanical room space is not available, an underground vault shall house the equipment.

iv. Locate equipment close as possible to the utilities that are interconnected, thereby shortening pipe runs.

f). Locate fountain equipment minimum of 2 feet below the level of the water feature to allow the use of flooded end-suction pumps, whenever possible.

g). The space should be ventilated by an exhaust fan with a minimum of 5 cubic feet per minute (cfm) per horsepower of the display pump, with 300 cfm as a minimum in the case of a small display pump. As a reference, the Plumbing Design Engineer may consult Volume 3, Chapter 5, of the ASPE Plumbing Engineering Design Handbook. Since actual project conditions may vary greatly, the design team’s plumbing and mechanical engineers shall coordinate to ensure that proper ventilation is provided for heat dissipation and operations and maintenance in these spaces.

h). A small pit (about 1 cubic foot) with a 4-inch open drain to waste should be included to receive the filtration discharge or excess water if an equipment failure with piping or pumps occurs.

i). **Subterranean Vault:** The vault must include a hatch or workable and lockable door for access, an interior light, a sump pump and an access ladder. The underground vault should be built with a concrete floor, with reinforced concrete block, precast concrete, or poured-in-place concrete walls. The vault should be large enough to allow code/manufacturers-mandated clearances around the equipment.

j). **Pipe Materials:** Stainless Steel, Polyvinyl chloride (PVC), Copper or Brass shall be used.

k). A backflow prevention device shall be installed in accordance with municipal regulations and other governing codes, in the line with the fill pipe.

l). Water 24 inches or deeper must follow the International Swimming Pool and Spa code.

m). **A Class:** A ground fault circuit interrupter (GFCI) is required for all circuits supplying power to the fountain equipment located within pools and operating above 15 volts. Equipment operating at less than 15 volts should be powered by a transformer that is listed and rated.

10.17. **Restrictions:**

a). Verify specific restrictions with the HPO.

10.17.1. **Domestic Water Supply System:**

a). Do not use butterfly valves in domestic plumbing unless approved by AOC.

b). Avoid placing plumbing in exterior walls.
c). Do not use "plastic" piping within buildings, unless written approval is granted by the AOC.
d). Do not specify galvanized pipes without consulting with AOC (the AOC has a history of galvanized pipe corrosion).
e). Do not locate water lines over mechanical equipment or computer rooms, or through electrical rooms or closets.

10.17.2. **Sanitary Waste Equipment:**

a). Do not use sewage ejectors without written permission of the AOC.
b). Do not use PVC sanitary pipe without written permission of the AOC.

10.17.3. **General Service Compressed Air System:**

a). Do not use plastic piping.
   i. Do not use solder copper pipe fittings.
   ii. Do not use rubber hoses as discharge piping.
   iii. No air receiver tank shall be buried underground or located in an inaccessible place.

10.17.4. **Rainwater Drainage Equipment:**

a). Do not route roof drains or piping over mechanical equipment, computer rooms, or through electrical rooms or closets.

10.17.5. **Natural Gas System:**

a). Do not use plastic pipe within building.
   i. No solder joints permitted.
   ii. Uncoated threaded or socket welded joints in soil or places corrosion can occur.
   iii. Do not use copper piping.

10.17.6. **Plumbing Fixtures:**

a). Do not use floor-mounted water closets except for renovation/rehabilitation installations.
   i. Do not use washer-less faucet employing thermoplastic “nipples.”
   ii. Drinking fountains shall not be installed in public restrooms.

10.17.7. **Emergency Plumbing Systems:**

a). Do not locate emergency eyewash/shower fixtures over electric outlets.
b). Emergency equipment and piping shall be protected from freezing at all times.

10.17.8. **Site Plumbing:**

a). Do not use DC Water provision referring to Part 4, Measurement and Payment.

10.17.9. **Reflecting Pools and fountains:**

a). Do not use ferrous materials for either fittings or pipe.
b). Do not use Black steel piping.

11. **Electrical**

11.1. **Introduction and General Provisions:**

a). For renovation and rehabilitation projects, evaluate existing conditions and electrical systems and notify AOC Electrical Engineering Branch of any deficient systems.

b). For new facilities, coordinate incoming power with the local electric utility company and AOC Electrical Engineering Branch.

c). Where encountered within the area of work, the designer shall replace existing tapped feeders with new individual feeders and the designer shall replace existing feeders that are 30-40 years old with new individual feeders from the original source.

d). Design contractor shall provide temporary electrical services to areas outside of the construction, but affected by the work to ensure that operations are unaffected.

e). Design shall provide recessed clock outlet in each Congressional Suite for legislative clock.

f). Design shall locate transformer vaults and switchgear/switchboards in a centralized location to minimize the length of secondary distribution feeders.

g). Design shall provide shielding for rooms above switchgear and transformer rooms to minimize electromagnetic interference.

h). Design shall coordinate other trades and provide empty conduit systems, accessories, and power supplies for Fire Alarms, Telecommunications, Security, Intercom, cable television (CATV), etc.

11.2. **Related Sections:**

a). Other Sections that contain important information that may affect elements of this section or their implementation, include, but are not limited:

i. Refer to Section 1, General Requirements.

ii. Refer to Section 2, Historic preservation, for information related to protection of Heritage Assets.

iii. Refer to Section 3, Sustainable Design, for information related to energy conservation.

iv. Refer to Section 9, Mechanical and HVAC, for related information.

v. Refer to Section 10, Plumbing, for related information.

vi. Refer to Section 12, Building Automation System, for information related to BASNet.

11.3. **Design Criteria:**

11.3.1. **Historic Preservation:**

a). Project Managers shall contact the HPO prior to designing the routes and places where new wiring and related controls and accessories shall be installed. All interior surfaces, decorated surfaces, architecture features like pilasters, cornices, running trim are important elements in Heritage Assets and must be protected and not be disturbed, removed or altered. HPO and Curator shall review detailed Construction Documents that indicate location of new devices, routes, access points and avoidance of historic elements. Consult Section 2, Historic Preservation, for further information regarding protection of Heritage Assets.

11.3.2. **Building Energy Performance:**

a). Design shall include measures to minimize building electrical energy usage by using energy-efficient equipment, “right-sizing” distribution equipment, minimizing voltage drop in conductors, using automatic lighting controls where appropriate, etc. See building automation system communications requirements described further in Section 12 Building Automation Systems.

11.3.3. **Sustainability Considerations:**

a). Coordinate the project sustainability goals with the requirements of Section 3 – Sustainable Design. Review sustainable goals with AOC Sustainability and Energy Branch.

11.3.4. **Minimum Loads for Equipment Sizing:**

a). For design calculation purposes, design shall use the National Electrical Code (NEC) required loads and use the following in addition to the NEC loads where applicable:

i. Mechanical Equipment: 6-volt amperes (VA)/ft^2

ii. Computer and Peripheral Receptacles: 10 VA/ft^2

iii. Data Centers: 200 VA/f

11.3.5. **Short Circuit, Arc Flash, Coordination Studies, Load Flow/Voltage Drop, Fault Analysis, Demand Load Analysis:**

a). Perform computer generated Short Circuit, Arc Flash and Device Coordination Studies with each project utilizing SKM Power Tools software. All computer generated reports and modeling will be provided electronically in SKM Tools format and Adobe Acrobat format as part of the deliverables. Studies shall include, at a minimum, the following:
   i. A brief summary description of the distribution system configuration.
   ii. A single line diagram illustrating the distribution system and device ratings.
   iii. A summary table showing the device rating and calculated fault current values at each component (or bus node).
   iv. A summary table showing the calculated arc flash hazard at each component (or bus node).
   v. Device coordination plots.
   vi. Where coordination is not possible, provide a summary description of why coordination cannot be achieved.

b). Identify components using naming convention matching that used on construction documents. For components not named on construction documents, provide a unique tag easily identifiable and related to the component and its connected component(s).

c). Perform computer generated Load Flow/Voltage Drop, Demand Load Analysis, Feeder and Transformer Sizing, and Load Schedules with each project utilizing SKM Power Tools Software DAPPER Studies Modules. All computer generated reports and modeling will be provided electronically in SKM Tools format and PDF format as part of the deliverables.

d). Tagging shall comply with Electrical Safety Code.

11.3.6. **Space Considerations:**

a). Design shall provide separate rooms and closets for electrical and telecommunications equipment. Telecommunication rooms and closets shall serve only telecommunication systems. Coordinate room sizes, door sizes, access requirements, door swings, fire ratings, etc. with appropriate disciplines.

b). For the purposes of this Standard, the terms "room" and "closet" are defined as the following:
   i. **Room:** A space that houses the main service equipment for a building or section of a building. Examples include switchgear rooms, transformer vaults, phone switch rooms, main server rooms.
   ii. **Closet:** A space that houses branch distribution equipment that serves only a small area or specific tenant.

c). **Electrical Rooms and Closets:** Design shall lay out equipment to minimize wasted space and to allow the removal of equipment without affecting the access to or operation of other equipment in the space. In new construction and renovations/rehabilitations that enlarge existing electrical spaces, design shall provide a minimum of 25 percent free wall space (in linear feet) to accommodate future equipment. Design shall provide a minimum 6-foot wide x 7-foot high double-leaf door access to each electrical room and minimum 3-foot wide x 7-foot high single-leaf door access to each electrical closet.
   i. Provide not less than one electrical closet for each 20,000 square feet of area served with a minimum of one electrical closed per each floor.

d). **Telecommunications Rooms and Closets:** Design shall size and locate telecommunications spaces in accordance with Building Industry Consulting Services International (BICSI) standards. The minimum Telecommunications Room size is 10 x 12 feet and the minimum Telecommunications Closet size is 8 x 10 feet unless specifically directed otherwise. In new construction and renovations/rehabilitations that enlarge existing telecommunications spaces, design shall provide a minimum of 25 percent free wall space (in linear feet) to accommodate future equipment and sufficient free floor space to accommodate one additional 36-inch-wide communications cabinet. Design shall provide each telecommunications room or closet with a dedicated branch circuit panelboard and Emergency Power Off system in accordance with NEC Article 645. Design shall provide a minimum 6-foot wide x 7-foot high double-leaf door access to each

telecommunications room and minimum 3-foot wide x 7-foot high single-leaf door access to each telecommunications closet.

e). **Building Automation System (BAS) Network Equipment:** Design shall provide a dedicated circuit originating from a generator-backed source for Building Automation Network equipment. Refer to section 12 – Building Automation System, for additional information.

11.4. **Grounding Systems:**

a). Building Grounding system shall comply with Local utility requirements for that location and be in loop configuration. All Grounding conductors shall be Copper.

11.4.1. **Grounding Electrode System:**

a). **Ground Rods:** Design shall provide ground rods 3/4-inch diameter by 10-foot-long made of copper-clad steel. Drive all ground rods to a minimum depth of 12 feet below finished grade or finished floor. Chemical electrodes are not permitted.

b). **Ground Test Wells:** Design shall provide a permanently marked ground test well at the electric service entrance to each building. Design shall provide test wells 12 inches in diameter by 24 inches deep, constructed of polyvinyl chloride (PVC) materials with cast iron covers. Ground test wells in locations subject to vehicular traffic (including riding lawn mowers), and shall be installed in accordance with section 16 of this document.

c). **Ground Bus:** Design shall provide wall-mounted ground bus bar in each electrical room housing switchgear or substations. Interconnect bus with grounding electrode and ground bus in switchgear. Ground resistance shall not exceed 5 ohms.

d). **Fasteners, Clamps, and Connectors:** Fabricate of same materials as the conductors or of materials not subject to catalytic action in the presence of moisture.

11.4.2. **Equipment Grounding Systems**

a). **Wiring:** Design shall provide equipment grounding conductor with branch circuit and feeder wiring.

b). **Computer Rooms:** For computer rooms with a raised floor, design shall provide a Signal Reference Grid (SRG) grounding system under the raised floor in compliance with the following:

i. **Construction:** The underfloor SRG shall be formed by 2-inch wide x .02 inch thick bare copper strips prefabricated to form a 24 x 24-inch on-center mesh. The strips shall be electrically connected at intersection points and secured to the pedestal under the raised floor. As an alternate, a bare #6 American Wire Gauge (AWG) size copper conductor can be used in place of the strips to form the same grid configuration. The conductors shall be electrically connected at the intersection points and secured to the pedestal under the raised floor.

ii. **Perimeter:** A bare #2/0 copper wire is to be installed along the inside perimeter walls of the computer room under the raised floor. Another bare #2/0 copper wire is to be installed along the inside perimeter walls of the computer room along the ceiling. The SRG grounding system is to be exothermically or cad-welded to the perimeter bare #2/0 bare copper ground wire. The #2/0 wire is to be exothermically welded to the building's grounding system to connect electronically the SRG grounding system to the building's grounding system.

iii. **Miscellaneous:** Metal equipment enclosures, metallic pipes, conduits and ducts within the computer room and which cross the SRG grounding system in both the horizontal and vertical planes shall be connected to the SRG grounding system by exothermically welding a #6 AWG ground conductor.

11.5. **Lightning Protection Systems:**

11.5.1. **Lightning Protection System:**

a). Design lightning protection systems in compliance with the Master Label provisions of Underwriters Laboratories standards list in the Standards section of this document. Final resistance-to-ground shall be 5 ohms or less. Design system to be as inconspicuous as possible and shall conceal conductors within the building or behind roof parapets, except for those conductors that must be run on the roof surface. Primary and secondary conductors to

devices and equipment on the roof may be exposed. Tilt air terminals toward the inside of the building and mount in a hidden manner. Design shall comply with of National Fire Protection Association pertaining to lightning arrestors, grounding, grounding electrodes and down conductor clearances. Bond lightning protection system to electrical grounding electrode system in accordance with NEC.

b). Under any modifications and renovation of lightning protection system, contractor shall recertify Master Label from U.L.

11.5.2. **Lightning Protection System Components:**

a). **Ground Rods:** Design shall provide ground rods 3/4-inch diameter by 10 feet long made of copper-clad steel. Drive all ground rods to a minimum depth of 12 feet below finished grade or finished floor. Chemical electrodes are not permitted.

b). **Fasteners, Clamps and Connectors:** Fabricate of same materials as the conductors or of materials not subject to catalytic action in the presence of moisture.

c). **Conductors:** For copper roofs, design shall provide bare standard copper cable, 28 strands of 14 gauge, 375 pounds per thousand feet. For aluminum roofs, all conductors shall be bare standard aluminum cable, 37 strands of 13 gauge, 190 pounds per thousand feet.

d). **Air Terminals:** Design shall extend air terminals at least 10 inch above the object that they are to protect. Fabricate air terminals of solid nickel-plated copper, ½ inch minimum diameter. For copper roofs or 5/8 inch diameter solid aluminum with for aluminum roofs. All air terminals shall have blunt-tip points.

11.6. **Primary Electrical Services:**

11.6.1. **General:**

a). All AOC Buildings are served through a local Utility Power Company's (PEPCO, BG&E, NOVEC, or Dominion Power) 13.8 kV or 480 Volt service to AOC-owned switchgear and then distributed throughout the building. Coordinate utility services with the local electric utility company, local public works departments and AOC Electrical Engineering Branch offices.

b). Design shall install exterior distribution systems in concrete encased conduit systems and make cable selections based on all aspects of cable operation and the installation environment, including corrosion, ambient temperature, rodent attack, pulling tensions and potential mechanical abuse.

11.6.2. **Utility Availability:**

a). The designer shall establish data prior to initial system design. Electrical load estimates must be prepared in conjunction with utility company discussions to establish the capacity of the new electrical services. The designer shall coordinate locations for transformers, vaults, meters, and other utility items with the project team.

11.6.3. **Manholes:**

a). Design shall provide manholes with a composite (non-metallic) ladder.

11.6.4. **Conduit and Duct Banks:**

a). Design shall install medium voltage feeders, secondary voltage service entrance conductors, and secondary voltage feeders in concrete encased duct bank unless directed otherwise by AOC Electrical Engineering Branch.

i. Design shall use Ridge Steel Conduit for encasement.

ii. Design shall maintain separation between Primary, Secondary and Data conductors.

iii. Design shall provide a quantity of spare ducts equal to at least 25 percent of the used ducts in a duct bank. Each duct bank shall have at least one spare duct.

11.7. **Distribution Equipment:**

11.7.1. **Network Transformers:**

a). Type:

i. **Outdoor Applications:** Design shall use liquid-cooled network transformers when installed in exposed outdoor installations or within transformer vaults located outside the building footprint.

ii. **Indoor Applications:** Design shall use either dry-type or liquid cooled network transformers for units installed within the building.

b). **Configuration:** Three or more transformers to achieve an N+1 design requirements.

c). **Ratings:**

i. **kVA Rating:** Per load calculation with 25 percent spare capacity and spot network system design. Design shall include a comparison of systems providing for a single contingency condition of one transformer out of service and greater contingency conditions with multiple transformers out of service.

ii. **Primary Taps:** Full capacity, (2) 2½ percent above and (2) 2½percent below nominal voltage.

iii. **Secondary Voltage:** 480Y277 V or 208Y/120 V.

iv. **Impedance:** 5 percent or greater. Match on network transformers feeding the same Load Collector Bus.

d). **Materials:** Primary and secondary windings - copper.

e). **Terminals:** Transformer secondary terminal built according to Institute of Electrical and Electronics Engineers standard to accept directly mounted network protector.

f). **Monitoring:** The monitoring of electrical power circuits shall be through electronic communication links between devices in distribution system components and control units. The system power monitoring system shall include, but not limited to, remote devices for metering, monitoring, control, and protection; device communication interface hardware; Ethernet switch cabinet, intercommunication wiring; and system software. The advanced power monitoring and control systems shall be capable of enhancing power management and energy monitoring and it shall not be limited to metering, monitoring, and protection but also to acquire and store data.

i. The meters shall be at a minimum of Eaton power Xpert 6000 or approved equivalent while the branch meters shall be at minimum power xpert 2000 and it shall include device communications, interface hardware, ethernet switches, cabinets/enclosures, optical fibers, gateways, intercommunication wiring, system software and licensing (Foreseer) and training, and capable interfacing with the existing infrastructures for expansion to all facilities.

ii. The distribution system components to be monitored shall include the following:

- Network protectors.
- Transformers.
- Low-voltage switchgear.
- Switchboards and motor control centers.
- Meter circuit breakers.
- Automatic transfer switches.
- Fire pump controller.
- Uninterruptable power supply (UPS).
- Medium-voltage switchgear.
- Lighting control system.
- Distribution panels.
- Generator and associated controls.

iii. The power monitoring and control units include the following:

- Advanced power metering base (PMB) and central display unit (CDU).
- Communications module (CM).
- Basic metering device (M).
- Digital input module (DIM).
- Web-enabled gateway device (GW).
- Digital trip unit (DTU) with meter.
- Product operated network interface device or network communications interface devices (designated on drawings as (CM)).
- End-of-line resistor (EOLR).
- Terminal blocks.
- Gateway-uninterruptable power supply (GW-UPS).
- Ethernet switch (ES).
- Product operated network interface (PONI) device.
- Fiber patch device (FP).

iv. The architecture infrastructure shall be capable of expansion, integration with existing monitoring systems via building automation system network (BASnet). The power monitoring system shall be open nonproprietary, provide graphic representation of equipment and devices monitored, and display energy consumption graphically. The power monitoring system shall be able to record, achieve, schedule, trend and perform analysis.

g). **Specific Requirements for Liquid-Cooled Network Transformers:** Transformer shall be equipped with three-position, electrically

interlocked liquid-filled primary switch (the third position for grounding the incoming feeder). Design shall:

i. Include an analysis of thermal, electrical, and environmental characteristics.
ii. Provide gauges for transformer temperature and coolant level.
iii. Provide contacts (wired to a common terminal strip) for the following alarms: Temperature high and high/high, low coolant level and high pressure.
iv. Specify installation on a 4" high concrete pad.

Liquid containment shall comply with the requirements of the codes and regulations listed in section 1.5.

h). **Specific Requirements for Dry Network Transformers:** The transformer shall be designed to carry short time emergency overloads in accordance with American National Standards Institute's (ANSI) as applicable. Duration and magnitude of designed withstand capability shall be as outlined in ANSI Standards and the latest draft of the IEEE Short Circuit Test Code.

i. **Primary Switch:** Equip transformer with two-position primary dry switch.
ii. **Winding Temperature Rise:** 80°C above 40°C ambient at full rated linear load with 220°C insulation system.
iii. **Double-Rated Transformers:** The transformer shall include all devices, wiring, fans and auxiliary equipment necessary for automatic temperature controlled forced air-cooling to obtain additional capacity. Control power for fans shall be 208 V single phase and design shall provide fuse protection for this circuit.
iv. **Sensors:** Design shall embed transformer winding temperature sensor(s) in the winding; local temperature readout; and "high" and "high/high" alarm contacts for remote monitoring.

11.7.2. **Network Protectors:**

a). Network protector status (open/closed) shall be monitored by addressable relay or by an AOC approved gateway. Design shall integrate the output into the AOC BASnet monitoring system with display on a remote computer. Mount relays or AOC approved gateway in an enclosure wired to a terminal block.

i. **Mounting:** Direct, on transformer secondary throat.
ii. **Operating Mechanism:** Spring close.
iii. **Withdrawal Mechanism:** Four position draw-out.
iv. **Fuse Location:** External.
v. **Voltage:** 480 V or 208 V.
vi. **Ampacity:** Based on network configuration and power transformer kVA.
vii. **Forward Current Protection:** Design shall provide forward current protection to address the unprotected fault zone of the network protector.
viii. **Quality Assurance:** Design shall comply with IEEE Standards.

11.7.3. **Medium Voltage Switchgear:**

a). Design of medium voltage switchgear shall be fully compatible with utility requirements. Flexible design shall accommodate future growth. Responsibility of approval by utility company lies with the designer.

i. **Design:** The design shall be supported by short circuit calculation for a fault at the primary breaker and at the low voltage bus. Designer shall provide coordination study with all relay settings in a tabulated format. Remote operators (MOV or HMI) are required to open or close breakers from a safe distance from the switchgear. Remote operators are to be grouped together for ease of maintenance. Door mounted switches and handles require guards to prevent damage or accidental trips.
ii. **Rating:** 13.8kV class (15 kV nominal), 1200 Amp (Minimum), 3 phase.
iii. **Interrupting Capability:** Minimum of 750 MVA, 28 kA @ maximum rated voltage, 95 BIL. Final IC rating to be coordinated with utility company.
iv. **Sensors:** Design shall provide three sets of sensors (PT's and CT's) on each feeder: over-current and under-voltage protection; utility metering; and AOC metering and monitoring. CT connections shall be through shorting circuiting type terminal blocks.
v. **Breakers:** Design shall use enclosed, draw-out type vacuum circuit breakers and

control breakers using 125 VDC (direct current volt) from battery system. Two electronic relays (one primary, the second is redundant) per breaker. Use high voltage feeder breakers to feed downstream power transformers. A maximum of two transformers per branch breaker are permitted.

vi. **Battery System:** The designer shall coordinate battery system with AOC's High Voltage Shop. The batteries and battery charger shall be sized to allow all breakers to be tripped two times and closed two times. The batteries shall be a maintenance-free type.

vii. **Mounting:** Design shall specify installation on four-inch-high concrete pad that is flush with the footprint of the equipment.

viii. **Utility Metering:** Design shall provide metering cabinets and devices in accordance with utility company requirements.

ix. **Metering:** Provide separate metering device for each breaker including the incoming line (network transformers or step-down transformers). Integrate all measured parameters and alarms into a supervisory and monitoring system.

b). **AOC Monitoring:** The monitoring of electrical power circuits shall be through electronic communication links between devices in distribution system components and control units. The system power monitoring system shall include, but not limited to: remote devices for metering, monitoring, control, and protection; device communication interface hardware; Ethernet switch cabinet, intercommunication wiring; and system software. The advanced power monitoring and control systems shall be capable of enhancing power management and energy monitoring and it shall not be limited to metering, monitoring, and protection but also to acquire and store data.

i. The meters shall be at a minimum of Eaton power Xpert 6000 or approved equivalent while the branch meters shall be at minimum power Xpert 2000 and it shall include device communications, interface hardware, ethernet switches, cabinets/enclosures, optical fibers, gateways, intercommunication wiring, system software and licensing (Foreseer) and training, and capable interfacing with the existing infrastructures for expansion to all facilities.

ii. The distribution system components to be monitored shall include the following:
- Network protectors.
- Transformers.
- Low-voltage switchgear.
- Switchboards and motor control centers.
- Meter circuit breakers.
- Automatic transfer switches.
- Fire pump controller.
- Uninterruptable power supply (UPS).
- Medium-voltage switchgear.
- Lighting control system.
- Distribution panels.
- Generator and associated controls.

iii. The power monitoring and control units include the following:
- Advanced power metering base (PMB) and central display unit (CDU).
- Communications module (CM).
- Basic metering device (M).
- Digital input module (DIM).
- Web-enabled gateway device (GW).
- Digital trip unit (DTU) with meter.
- Product operated network interface device or network communications interface devices (designated on drawings as (CM)).
- End-of-line resistor (EOLR).
- Terminal blocks.
- Gateway-uninterruptable power supply (GW-UPS).
- Ethernet switch (ES).
- Product operated network interface (PONI) device.
- Fiber patch device (FP).

iv. The architecture infrastructure shall be capable of expansion, integration with existing monitoring systems via building automation system network (BASnet). The power monitoring system shall be open nonproprietary, provide graphic representation of equipment and devices monitored and display energy consumption graphically. The power monitoring system

shall be able to record, achieve, schedule, trend, and perform analysis.

v. **Communications:** Design shall provide data outlet (Ethernet) at each switchgear location.

vi. **Identification:** Design shall clearly mark utility's feeder numbers on drawings and through labels on each cell.

11.7.4. **Low Voltage Switchgear:**

a). **General:** 480Y/277 V, 3 phase, 4 wire plus ground or 208Y/120 V, 3 phase, 4 wire plus ground. Design shall:

i. Size the bus ampacity to be a minimum of 125 percent of the calculated NEC demand load capacity.

ii. Provide a full capacity (100 percent of phase bus rating) neutral bus.

iii. Provide minimum bus bracing 100 kA.

iv. Specify bus bars tin plated solid copper.

v. Provide ground fault protection per NEC.

vi. Provide a minimum number of spare circuit breakers equal to 30 percent of the quantity of used breakers.

vii. Remote operators (MOV or HMI) are required to open or close breakers from a safe distance from the switchgear. Remote operators are to be grouped together for ease of maintenance. Door mounted switches and handles require guards to prevent damage or accidental trips.

b). **Configuration:** Specify incoming line and all load raceways mounted on the top, unless directed otherwise.

i. Provide rear covered with hinged doors unless directed otherwise.

ii. Provide an approved mimic bus on the front of each switchgear.

iii. Provide laminated nameplates on the front of the switchgear. Lettering min. ¾ inch high for each device, meter, etc.

c). **Mounting:** Install on a 4-inch high concrete pad that is flush with the footprint of the equipment.

d). **Emergency Shutdown:** For each switchgear lineup, provide emergency shutdown control equipment:

i. **Switch**: Specify spring return control switch with pistol grip [Westinghouse W2, Style No.3677A34G03], with lockout capability and with (2) NO momentary contacts in each, the TRIP and the CLOSED positions; located on the center line, 30 inches above floor level.

ii. **Indicating lights**: Specify three red, 125 VDC; located symmetrically on a horizontal line 34 inches above floor level.

iii. **Terminal Block:** Specify (16) point terminal block to accommodate wiring of the above items; location in the far rear of the incoming line section.

iv. **Labels**: Place a plastic laminate nameplate 480 V SWITCHGEAR EMERGENCY SHUTDOWN located below the switch.

e). **Metering:** Provide separate metering device for each breaker including the incoming line (network transformers or step-down transformers). Integrate all measured parameters and alarms into a supervisory and monitoring system.

f). **AOC Monitoring:** The monitoring of electrical power circuits shall be through electronic communication links between devices in distribution system components and control units. The system power monitoring system shall include, but not limited to, remote devices for metering, monitoring, control, and protection; device communication interface hardware; Ethernet switch cabinet, intercommunication wiring; and system software. The advanced power monitoring and control systems shall be capable of enhancing power management and energy monitoring and it shall not be limited to metering, monitoring, and protection but also to acquire and store data.

i. The meters shall be at a minimum of Eaton power Xpert 6000 or approved equivalent while the branch meters shall be at minimum power Xpert 2000 and it shall include device communications, interface hardware, ethernet switches, cabinets/enclosures, optical fibers, gateways, intercommunication wiring, system software and licensing (Foreseer) and training, and capable interfacing with the existing infrastructures for expansion to all facilities.

ii. The distribution system components to be monitored shall include the following:

- Network protectors.
- Transformers.

- Low-voltage switchgear.
- Switchboards and motor control centers.
- Meter circuit breakers.
- Automatic transfer switches.
- Fire pump controller.
- Uninterruptable power supply (UPS).
- Medium-voltage switchgear.
- Lighting control system.
- Distribution panels.
- Generator and associated controls.

iii. The power monitoring and control units include the following:

- Advanced power metering base (PMB) and central display unit (CDU).
- Communications module (CM).
- Basic metering device (M).
- Digital input module (DIM).
- Web-enabled gateway device (GW).
- Digital trip unit (DTU) with meter.
- Product operated network interface device or network communications interface devices (designated on drawings as (CM)).
- End-of-line resistor (EOLR).
- Terminal blocks.
- Gateway-uninterruptable power supply (GW-UPS).
- Ethernet switch (ES).
- Product operated network interface (PONI) device.
- Fiber patch device (FP).

iv. The architecture infrastructure shall be capable of expansion, integration with existing monitoring systems via building automation system network (BASnet). The power monitoring system shall be open nonproprietary, provide graphic representation of equipment and devices monitored, and display energy consumption graphically. The power monitoring system shall be able to record, achieve, schedule, trend and perform analysis.

g). **System:** Provide a system of addressable relays, or an AOC approved gateway of sufficient capacity to monitor the status of equipment associated with the switchgear (network transformers, network protectors, etc.). The system shall be capable of monitoring the status (open/closed) of the (24) discrete contacts. The output shall be integrated into the supervisory and monitoring system with display on a remote computer.

h). **Communications:** Provide data outlet at each switchgear location.

i. Provide cable with 1-inch EMT from monitoring point to the existing BASnet Cisco switch box. Consult with AOC EMCS group for cable specification.

i). **Draw-out breaker:** Provide draw-out type breakers on switchgear for main and feeders.

j). **Fire Pump Feeder Section:** It shall be a separate independent vertical section.

11.7.5. **Busway:**

a). **General:** Buses shall be copper and rated for continuous current amperes, 3-phase, 3 or 4 wire as required by the system, and include integral or internal 50 percent rated ground bus. Calculate short circuit rating based on root mean square (RMS) symmetrical amperes minimum.

b). **Busway systems:** shall be suitable for use indoors. Enclosures shall be metallic. Design shall:

i. Run busway parallel with or at right angles to ceilings, walls, and structural members.

ii. Support busway at 5-foot maximum intervals and brace to prevent lateral movement.

iii. Provide fixed type hinges on risers.

iv. Provide flanges where bus duct penetrate walls and floors, and seal to maintain smoke and fire ratings.

v. Busways in sprinklered space shall be NEMA 3R rated at minimum.

c). **Hot Spot Temperature:** Maximum hot spot temperature rise at continuous-rated load shall not exceed 55°C above the maximum ambient temperature of 40°C in any position. Voltage phasing of entire bus duct system shall be coordinated.

11.7.6. **Motor Control Centers:**

a). **Type:** 3 phase, 4 wire type.

b). **Equipment Ground Bus:** Non-insulated, copper, 50 percent rated ground bus.

c). **Neutral Bus:** Full-size, copper.

d). **Expansion:** Design shall provide for future expansion. Provide one additional set of auxiliary contacts in each starter unit. Provide one spare vertical section for future.

e). **Control Wiring:** Class II, Type B wiring.
f). **Mounting:** Install on a 4-inch high concrete pad that extends 6 inches beyond the footprint of the equipment.

11.7.7. **Variable Frequency Drives (VFDs):**
a). Whenever possible, match new VFDs to existing building equipment.
b). Output cable shall be VFD specific type. Output cable shall run in its own raceway compatible with cable.

11.7.8. **Panelboards:**
a). **General:** Design shall comply with requirements of UL. Design shall use door-in-door construction, with concealed hinges. Design shall provide continuous hinge for the entire front of the box with standard door and hinged trim cover and provide for all panelboards of all sizes.
b). **Minimum Short Circuit Rating:** 10,000 amperes symmetrical.
c). **Panelboard Bus:** Hard-drawn copper, 98 percent conductivity.
d). **Isolated Copper Neutral Bus:** Design shall provide in each panel for connection of circuit neutral breakers. Design shall provide double-size neutral for panelboards when loads served are non-linear (typically office suite loads), served from K-rated transformers or harmonic canceling transformers.
e). **Copper Ground Bus:** Design shall separate bus identified as equipment grounding bus for connecting grounding conductors and bond to steel cabinet.
f). **Minimum Ampacity:** Design shall size the bus ampacity to be a minimum of 125 percent of the calculated NEC demand load capacity.
g). **Breaker Space:** Design shall provide 25 percent spare circuit breakers and 25 percent empty spaces as a minimum.
h). **Panelboards for Electronic Equipment:** For panelboards that supply microprocessor or electronic equipment, design shall provide a 200 percent rated neutral bus, an equipment ground bar and an isolated ground bar.
i). **Main circuit breaker:** Provide main circuit breaker on all new panel boards.

11.7.9. **Circuit Breakers:**
a). **Type:** Thermal magnetic bolt-on type replaceable without disturbing adjacent units in compliance with UL.
b). **Rating:** Fully rated to interrupt the maximum symmetrical fault current available at the terminals. Use of "series" rated circuit breakers is not permitted.
c). **Terminations:** Mechanical lugs. Design shall provide breaker terminals listed as suitable for the type of conductor used.
d). **Multipole Breakers:** Design shall provide trip-type with single operating handle. Breaker design shall be such that overload in one pole automatically causes all poles to open. Maintain phase sequence throughout each panel so that any three adjacent breaker poles are connected to Phases A, B, and C, respectively.
e). **GFCI Circuit Breakers:** UL and NFPA complaint GFCI breakers shall be able to detect and trip on current imbalance of 5 milliamperes or greater per requirements of UL for personal protection and 20 milliamperes or greater per requirements of UL for equipment protection.
f). **Branch Circuit Breakers in Distribution Panelboards:** Where overcurrent protection devices (OCPD's) are indicated to be circuit breakers, design shall use bolt-on breakers. Circuit breakers of 250-ampere frame size and greater may be plug-in type where individual positive locking device requires mechanical release for removal.

11.7.10. **Power Monitoring and Control Integrated Monitoring System:** The monitoring of electrical power circuits shall be through electronic communication links between devices in distribution system components and control units. The system power monitoring system shall include, but not limited to: remote devices for metering, monitoring, control, and protection; device communication interface hardware; Ethernet switch cabinet, intercommunication wiring; and system software. The advanced power monitoring and control systems shall be capable of enhancing power management and energy monitoring and it shall not be limited to metering, monitoring, and protection but also to acquire and store data.
The meters shall be at a minimum of Eaton power Xpert 6000 or approved equivalent while the branch meters shall be at minimum power Xpert

2000 and it shall include device communications, interface hardware, ethernet switches, cabinets/enclosures, optical fibers, gateways, intercommunication wiring, system software and licensing (Foreseer) and training and capable interfacing with the existing infrastructures for expansion to all facilities.

i. The distribution system components to be monitored shall include the following:
- Network protectors.
- Transformers.
- Low-voltage switchgear.
- Switchboards and motor control centers.
- Meter circuit breakers.
- Automatic transfer switches.
- Fire pump controller.
- Uninterruptable power supply (UPS).
- Medium-voltage switchgear.
- Lighting control system.
- Distribution panels.
- Generator and associated controls.

ii. The power monitoring and control units include the following:
- Advanced power metering base (PMB) and central display unit (CDU).
- Communications module (CM).
- Basic metering device (M).
- Digital input module (DIM).
- Web-enabled gateway device (GW).
- Digital trip unit (DTU) with meter.
- Product operated network interface device or network communications interface devices (designated on drawings as (CM)).
- End-of-line resistor (EOLR).
- Terminal blocks.
- Gateway-uninterruptable power supply (GW-UPS).
- Ethernet switch (ES).
- Product operated network interface (PONI) device.
- Fiber patch device (FP).

iii. The architecture infrastructure shall be capable of expansion, integration with existing monitoring systems via building automation system network (BASnet). The power monitoring system shall be open nonproprietary, provide graphic representation of equipment and devices monitored, and display energy consumption graphically. The power monitoring system shall be able to record, achieve, schedule, trend, and perform analysis.

11.7.11. **General Purpose Dry-Type Transformers:**

a). Design shall provide transformers complying with National Electrical Manufacturers Association (NEMA) TP1 and that are Energy Star labeled. Transformer windings shall be copper.

11.7.12. **Raceways and Boxes:**

a). **General:** Design shall provide separate raceways for the following services:
i. Voice/Data Systems
ii. Power
iii. Fire Alarm and Mass Notification Systems
iv. Security Systems
v. Spare for future signal

b). **Raceways:** Design shall use only electrical metallic tubing (EMT), Intermediate Metal Conduit (IMC), Flexible Metal Conduit (FMC), Liquidtight Flexible Metal Conduit (LFMC), or RGS conduits in interior applications. Design shall provide compression fittings and metallic junction boxes for EMT. Set screw type fittings may be permitted for steel conduits at the written discretion of the AOC.

c). **Outlet Boxes and Cover:** UL compliant, cadmium- or zinc-coated, for ferrous metal boxes. UL compliant Outlet Boxes in Hazardous (Classified) Locations.

d). **Cabinets, Junction Boxes, and Pull Boxes:** UL 50, hot-dip, zinc-coated, if steel sheet.

e). **Floor Outlet Boxes:** Boxes shall be adjustable and concrete tight. Each outlet shall consist of nonmetallic or cast body with threaded openings, or sheet-steel body with knockouts for conduits, adjustable ring, brass flange ring, and cover plate with threaded plug.

f). **Receptacles for Damp Locations:** UL listed Aluminum, stainless steel or ferrous metal housing with duplex-type receptacle. Design shall provide gaskets where necessary to ensure watertight installation.

g). **Underfloor Duct Systems:**

i. **General:** Only use when approved by AOC Electrical Engineering Branch. When

used, design shall provide separate ducts for the following services:

- Voice/Data Systems.
- Power.
- Fire Alarm.
- Security System.
- Spare for future signal.

ii. **Junction Boxes:** Design shall size junction boxes to accommodate the various sizes and number of ducts. Junction boxes shall have partitions to isolate the various services, and shall afford access to each compartment through a single handhole.

iii. **Ground Continuity:** Wherever concrete floor cells or plastic insulating sections are used in the system, the terminating metallic sections shall be externally bonded by a braided ground tie equivalent to a number 8 AWG copper wire.

11.7.13. **Wiring:**

a). **General:** Install all conductors (power, communication, or signal) in conduit.

b). **Medium Voltage Wiring:**

i. **Wire and Cable:** Sizes and ampacities based on copper

ii. **Type:** MV105

iii. **Stranding:** Copper, compact round, concentric lay, Class B

iv. **Insulation:** EPR, 133 percent thickness

v. **Shielding:** Wire

vi. **Minimum Conduit Size:** 4-inch

c). **Low Voltage Wiring:**

i. **Wire and Cable:** Sizes and ampacities based on copper. Minimum size wiring for all branch circuits shall be #12 AWG served from a 20-amp circuit breaker.

ii. **Type:** THWN/THHN conforming to UL.

iii. **Minimum Conduit Size:** 3/4-inch.

iv. **Conductors:** Soft-annealed copper. Conductors No. 10 AWG and smaller shall be solid, and No. 8 AWG and larger shall be stranded.

v. **Insulation:** PVC insulated, flame retardant, and moisture resistant.

d). **Computers and Solid State Devices:** The increased use of solid state devices, including the use of computers and printers in office areas, requires careful planning and connection to the existing electrical system. To avoid poor performance of the equipment and to minimize downtime, the design shall observe the following guidelines.

e). **PC Circuits:** Design shall provide a separate branch circuit with dedicated neutral and common ground for circuits serving computers and printers. Signify receptacles on these circuits with gray bodies. Design shall:

i. Provide a dedicated circuit for each printer.

ii. Connect no more than three computers on each circuit.

iii. Connect no more than six duplex convenience receptacles on each circuit.

iv. Not connect any other equipment such as fans, heaters, coffee pots or microwaves to circuits serving PCs and printers.

v. Provide isolated ground receptacle (orange with green triangle) for electronic processing equipment. Isolated ground conductor shall have a direct connection (no daisy chains to additional receptacles) back to the isolated ground bus bar. Provide circuits for electronic processing equipment with a dedicated neutral.

11.7.14. **Surge Suppression:**

a). Design shall provide Underwriters Laboratories (UL) labeled and listed devices suitable for protection of the structure on electric and telephone service entrances and on radio and television lead-ins.

11.7.15. **Receptacles:**

a). **General:** General wiring devices shall be specification grade. The building standard receptacle is duplex, specification grade NEMA 5-20R. Cover plates shall be metal. Color receptacles as follows:

i. Emergency Receptacles: Red

ii. Isolated Grounding Receptacles: Orange

iii. Convenience Receptacles: Coordinate with architectural scheme - white (not ivory) for white or light grey walls

iv. Computer Equipment Receptacles: Gray

11.7.16. **Placement of Receptacles:**

a). **Electrical Rooms:** Design shall provide one duplex GFCI convenience receptacle for every 20 linear feet (lf) of wall with a minimum of one receptacle per wall. Design shall provide one duplex emergency power receptacle in each electrical room on a dedicated circuit.

b). **Electrical Closets:** Design shall provide one

duplex GFCI convenience receptacle for every 20 lf of wall with a minimum of one receptacle per wall. Design shall provide one duplex emergency power receptacle in each electrical closet on a dedicated circuit.

c). **Telecommunications Rooms:** Design shall provide one double duplex GFCI convenience receptacle for every six lf of wall with a minimum of one receptacle per wall in accordance with BICSI standards. Design shall provide dedicated and/or special receptacles as necessary to support the installed equipment; at a minimum, provide two dedicated 20A, 120 Volt duplex electrical GFCI receptacle on emergency power to support the communications equipment.

d). **Telecommunications Closets:** Design shall provide one double duplex GFCI convenience receptacle for every six lf of wall with a minimum of one receptacle per wall in accordance with BICSI standards. Design shall provide dedicated and/or special receptacles as necessary to support the installed equipment; at a minimum provide two dedicated 20A, 120 Volt duplex GFCI electrical receptacle on emergency power to support the communications equipment.

e). **Mechanical Spaces:** Design shall provide one GFCI convenience receptacle on each wall as a minimum. All receptacles in mechanical spaces shall be GFCI.

f). **Office Space:** Design shall place receptacles in exterior walls, in walls around permanent cores and corridors, and in permanent bearing walls. Except for these instances, design shall avoid placement of receptacles in standard office gypsum drywall partitions to the greatest extent possible. For initial planning purposes, assume that office space uses furniture with a density of two workstations for every 100 square feet (9 m^2). Electrical systems should be designed to allow two duplex outlets for computer equipment power and two duplex outlets for normal convenience power per workstation.

i. **Raised Access Floor:** Design shall route all wiring beneath a raised access floor in metal conduit or cable to underfloor distribution boxes. Attach flush-mounted access floor service boxes to the underfloor distribution boxes by means of a plug-in modular wiring system to facilitate easy relocation.

ii. **Cellular Floor Duct and Floor Duct Encased in Concrete:** When cellular floor duct systems are used, the distance between horizontal duct runs is 6 feet. Locate presets every 2 feet along each run.

g). **Corridors:** Design shall locate receptacles 50 feet on center and no more than 25 feet from corridor ends.

h). **Conference Rooms:** Serve in manner similar to general office space. Design shall ensure that an adequate number of receptacles are provided to support audio/visual devices and computer connections.

i). **Maintenance Shops:** Design shall provide plug-mold strips above workbenches with outlets 18" on center. Two circuits minimum on each bench.

j). **Toilet Rooms:** Design shall provide each toilet room with one GFCI receptacle at vanity or sinks and an additional GFCI receptacle located for housekeeping purposes.

k). **Stairs:** Design shall provide one duplex receptacle per landing in each stair tower or stair enclosure.

l). **Cashier Stands:** Design shall provide one duplex receptacle.

m). **Legislative Clock Locations:** Design shall provide one duplex receptacle at each clock location.

n). **Garages/Outdoor Areas:** If installed, they shall be GFCI receptacles.

11.8. **Lighting System:**

11.8.1. **Interior Lighting:**

a). Interior lighting should primarily utilize fluorescent or Light Emitting Diode (LED) sources. Downlights should be compact fluorescent or LED. High bay lighting should be induction or high-output T5 fluorescent or LED. Alternative technologies will be considered if supporting information such as Life Cycle Costs and Efficiencies are provided. All new lighting systems and controls shall be compatible with existing building systems.

b). **Dimming:** Accomplish with compact fluorescent, linear fluorescent fixtures or LED. Although fluorescent dimmers should not be used where harmonics pose a problem. For special applications, such as where ultraviolet

radiation may damage or age historical construction or artwork, incandescent lighting may be used with written approval of the Electrical Engineering Branch.

c). **Fixture Schedule:** Design shall provide a fixture schedule for each project. Indicate three equivalent fixture models with manufacturer's name and model number for each fixture type to be utilized on the project.

d). **Light Pollution:** Design shall arrange lighting in both interior and exterior spaces to minimize light pollution and light trespass.

e). **Historic Preservation:** Consult Section 2, Historic preservation, for further information regarding preservation of Heritage Assets.

11.8.2. **Lighting Criteria for Interior Spaces:**

a). **Open and Private Office Spaces:** Design shall provide fluorescent or LED lighting with even level of illumination. To facilitate changes, use modular (plug-in) wiring for fluorescent or LED fixtures. In open plan areas with systems partitions, reduce the coefficient of utilization to account for light obstruction and partition absorption. Design shall provide task lighting at all workstations.

b). **Automated Data Processing (ADP) Areas:** Design shall employ lighting similar to that used for office areas. If the area contains special workstations for computer graphics, dimmable lighting may be required. If large ADP area is segregated into areas of high and low personnel activity, switching should be used when areas are not being utilized.

c). **Conference and Training Rooms:** Design shall provide a dimmable system with a combination of fluorescent, compact fluorescent or LED lighting. In rooms of 200 sq. ft. or more, always place circuit fixtures across two or more circuits that roughly divide the lighting areas in half to facilitate dimmed areas for visual projections.

d). **Public Corridors, Lobbies, Atria, and Tunnels:** Special lighting concepts are encouraged in these spaces. The lighting design should be integral to the architectural concept. Consideration may be given to wall fixtures or combination wall and ceiling fixtures in corridors and tunnels to relieve the monotony of a long, plain space.

e). **Mechanical and Electrical Spaces:** Design shall equip these spaces with industrial type fluorescent or LED fixtures and locate fixtures to prevent obstruction by tall or suspended equipment.

f). **Dining Areas, Cafeterias, and Serveries:** Ample daylight is the illumination choice in dining areas, assisted by fluorescent fixtures, compact fluorescent or LED lighting for accents.

g). **Supplemental Emergency Lighting:** Design shall provide emergency lighting in mechanical, electrical, and communication rooms; in uninterruptible power supply (UPS), battery, and ADP rooms; in security, fire pump rooms, fire control centers, and other locations containing fire alarm control panels requiring user interface; and in the room where the Building Automation System is located. Design shall provide emergency lighting at the task area for security system closed-circuit television (CCTV) cameras.

h). **Switching:** Design shall provide multiple levels of switching or dimming in rooms with more than four light fixtures.

i). **Structured Parking:** Parking area fixtures shall be fluorescent strip fixtures with wire guards or diffusers. Locate fixtures to preserve vehicle clearances. Consider High-Intensity Discharge, Metal Halide, enclosed fluorescent or LED fixtures for above-grade parking structures.

j). **High Bay Lighting:** Shop, supply or warehouse areas with ceilings above 16 ft. should use High-Intensity Discharge, Metal Halide, high-output T5 fluorescent lighting or LED.

k). **Illumination Levels:** Design shall comply with the Illuminating Engineering Society of North America (IESNA) recommendations.

l). **General Lighting Fixture Criteria:** Design shall provide fixtures of standard, commercial design and avoid custom fixtures without written approval of the AOC's Project Manager. To the extent practicable, design shall specify Energy Star® labeled fixtures. Fixtures must be selected with both energy efficiency and aesthetic appeal in mind.

i. **Baseline Building Fixture:** Design shall use a baseline for office space cost comparisons of a 2 x 2 fixture utilizing T-8

or compact fluorescent (CFL) lamps or LED and electronic ballasts.

ii. Design shall limit the number of fixture types in a given building.

iii. In alterations of existing facilities, design shall attempt to match existing standard fixtures as practicable.

iv. Use indirect/direct or semi-specular parabolic type for offices.

v. Use lamps with low mercury content.

vi. Consult with each Jurisdiction electrical shop supervisor for building standard type fixtures in order to minimize their spare part stock.

m). **Energy Efficient Design:** Lighting power density calculations shall show the effect of both general and task lighting.

i. **Lamps:** Lamps shall conform to the following requirements:

- LED lamp with lamp life rated for 50,000 or greater hours at 70 percent lumen maintenance (L70)
- Fluorescent lamps:

Lamp	Lamp Life (hours)	Mercury Content (micrograms)
T8	> 24,000	<10
T5	> 20,000	<10
CFL	> 10,000	<2

n). **Ballasts:** Design shall provide a sound rating of "A" for offices, conference rooms, and committee rooms. A "B" sound rating is acceptable for corridors or parking garages. Electronic or hybrid ballasts should have harmonics of 10 percent or less.

o). **Lighting Controls:** For new buildings and major renovations/rehabilitations, design shall consider providing centralized digital addressable lighting control systems. Such systems must be configured around an open protocol communications language.

i. **Occupancy Sensors:** Design shall specify occupancy sensors to control fixtures in private offices and other areas. Indicate in initial design submissions the location and type of sensors proposed. Sensors shall have a field adjustable hold-in time of up to 20 minutes.

ii. **Daylight Sensors:** Design shall specify photocells and dimmable ballasts for daylight-response dimming controls of fixtures in perimeter zones. Indicate in initial design submissions, the location and type of sensors proposed.

iii. When used for control of emergency egress lighting, lighting controls systems and components must comply with UL924.

iv. Wireless control devices are not permitted.

11.8.3. **Exterior Lighting:**

a). **Exterior Lighting Quality:** Specify fixtures in keeping with the historic architectural goals of the Capitol complex and surrounding areas, using quality materials and details to reduce long-term maintenance costs, energy consumption and waste.

b). **Light Levels:** Lighting levels for exterior spaces should be in accordance with IESNA recommendations and be coordinated with US Capitol Police requirements for that space. Design shall provide calculations with minimum/maximum light level ratios.

c). **Fixtures:** Fixture efficacy should be at least 60 lumens per watt, with ballast power factors >90 percent. Fixtures shall provide direct glare cutoff for street, parking lot and site lighting, unless historically inappropriate. Luminaires shall also provide upward cutoff to eliminate night sky pollution.

d). **Lighting Poles:** Lighting poles for exterior lighting shall conform to AOC Standard Details (Furnished by Electrical Engineering Branch for each project) used within the Capitol complex. Lighting poles shall be cast iron or fluted metal shaft with cast iron base and have a 2”x4” handhole in the pole.

e). **Controls:** Design shall provide a combination of photocell and time clock controls to ensure that fixtures are always off during daytime or unoccupied periods consistent with AOC security requirements.

f). **Concrete Pole Foundations:** Design shall provide an in-grade site lighting power handhole within 24” of the light pole foundation. Design shall provide a minimum of two 1½” PVC conduits (within the base), one for power and one for security, from each concrete foundation to the site lighting handhole. Connect site lighting handholes with

two 1½" PVC conduits. Conduits shall be encased in a minimum of 2" of concrete. Extend concrete foundations in vehicle areas 32" above finished grade. Foundations installed in landscape areas or sidewalks shall be flush with finished grade. The designer shall coordinate special applications with AOC's Electrical Engineering Branch.

g). **Conduit Routing:** Conduits from a Capitol complex building to the first concrete foundation shall contain a hand hole adjacent to the concrete lighting foundation.

h). **Historic Preservation:** Consult Section 2, Historic Preservation, for further information regarding preservation of Heritage Assets.

11.8.4. **Lighting Calculations:**

a). Design shall provide point-by-point computer-generated lighting calculations for both normal and emergency lighting scenarios. For interior spaces, design shall include furniture in the calculations. Calculations output should include a fixture schedule indicating the fixture tag, lamp quantity, lamp lumens and light loss factor for each fixture.

11.8.5. **Lighting Commissioning and Testing**

a). **Commissioning:** Lighting system should be commissioned after all furnishings and finishes have been installed. Energy management systems and other comprehensive control networks should be commissioned as indicated by the system manufacturer, before accepting building spaces for occupancy.

b). **Emergency Lighting Testing:** Design shall provide for acceptance testing to demonstrate compliance with minimum emergency lighting levels and emergency operation.

11.9. **Alternate Power Systems:**

11.9.1. **Emergency Power Systems**

a). **General:** Design shall provide emergency power for life safety features at all facilities as required by code.

b). **Batteries:** Self-contained battery units may be used for individual light fixtures in buildings where an emergency generator is not required (or available). When batteries are the sole source of emergency power to supply lighting, they should be capable of supplying emergency power for a minimum of 1.5 hours. Do not use battery units for new buildings without written approval of the AOC.

c). **Paralleling:** For large loads with multiple generators, generator paralleling should be considered.

11.9.2. **Generator Systems Design:**

a). Design emergency generators in accordance with NFPA, Emergency and Standby Power Systems and emission standards in 40 CFR parts 60 and 89. Provide a system consisting of a central engine generator and a separate distribution system with automatic transfer switch(es), distribution panels, and 480Y/277 lighting panel (if applicable) with dry-type transformers feeding 208Y/120 panels as required.

b). **Radio Interference:** Design shall locate generators at least 100 feet (30 m) from communication equipment to avoid radio interference.

c). **Radiators:** Unit-mounted radiators are preferred. If ventilation is restricted in indoor applications, design shall consider remote installations.

d). **Capacity:** Design shall size generator to approximately 125 percent of design load and considering the inrush load of all motors that are automatically started simultaneously. Initial voltage drop on generator output due to starting currents of loads shall not exceed 15 percent. Consider non-linear loads in sizing the generator.

e). **Fuel Capacity:** Shall support operations for 48 hours.

f). **Mufflers:** Hospital Grade (Low noise type).

g). **Alarms:** Design shall provide remote alarm annunciator and load-bank connection testing cabinet. Alarms shall report back to the Electrical Engineering Branches Monitoring system referenced in section 10.

h). **Exterior Generators:** Design shall provide weatherproof enclosure with provision for cold-weather starting (such as coolant jacket heaters).

i). **Tanks:** Design shall provide one day tank per generator (free standing or Belly. Day tank shall include necessary motor, fuel oil coolers, valves, alarms, and pumps.

j). **Battery Trays:** In accordance with NFPA 480-7(b).

k). **Automatic Transfer Switches:** Design shall

provide separate Automatic Transfer Switches (ATS) for life safety, elevators, and other systems. ATS systems serving motor loads should be dual motor-operated (adjustable time delay neutral position) or have in-phase monitor (transfer when normal and emergency voltages are in-phase) to reduce possible motor damage caused by out-of-phase transfer.

i. **Ground Fault Systems:** To reduce nuisance-tripping of ground fault relays, automatic transfer switches serving 3-phase, 4-wire loads should have 4-pole contacts with an overlapping neutral.

ii. **Bypass Isolation:** Design shall provide bypass isolation switch that allows manual bypass of the normal or emergency source to ensure continued power to emergency circuits in the event of switch failure or required maintenance.

l). **Historic Preservation:** Designer shall coordinate with the HPO the location, air intake, exhaust and visual enclosures of alternate power systems. Consult Section 2, Historic Preservation, for further information regarding preservation of Heritage Assets.

11.9.3. **Emergency Power Loads:**

a). As defined in the Program of Requirements or Task Order, design shall provide emergency power for the following functions:

b). **Category 1: Code-Required Emergency Power:**

i. Emergency Lighting
ii. Exit Signs
iii. Elevators (Call Back Capability/Emergency Operations) and associated HVAC
iv. Fire Pumps
v. Fire Alarm Systems
vi. Mass Notification Systems
vii. Stair Pressurization and Smoke Control

c). **Category 2: Essential Power:**

i. Security:
- Surveillance Cameras
- Door Locks/Access Control
- Barriers
- Wireless Communication System

ii. Safe Havens
- Ventilation/filtration
- Lighting

iii. Critical Building Equipment:
- Sump Pumps
- Heating Equipment to prevent building freezing
- Control Air Compressors
- Condensate Pumps
- Building Automation System (BAS)
- Medicine Storage Refrigerators

iv. **Category 3: Continuity of Operations:**
- Briefing Rooms
- SCIF Rooms
- Emergency Operations Centers

11.9.4. **Uninterruptible Power Supply (UPS) Systems:**

a). **Where Required:** Design shall provide the nature, size and locations of critical loads to be supplied by the UPS in the program. The UPS system shall serve critical loads only.

b). **Solid State Design:** UPS shall be solid state with an input filter or transformer to protect both the UPS and downstream equipment when in bypass. Design shall provide bypass switch to facilitate maintenance and provide UPS with an isolation transformer. Design shall provide three separate services: one to the UPS rectifier circuit, one to the inverter bypass circuit, and one to a maintenance bypass circuit.

c). **Output Characteristics:**

i. Voltage Characteristics: 1 percent.
ii. No-Load Voltage Modulation: Plus or minus 1 percent.
iii. Voltage Adjustment: Plus or minus 5 percent manually.
iv. Frequency Regulation: Plus or minus 0.1 percent.
v. Harmonic Content (RMS Voltage): 3 percent single harmonic maximum.
vi. Load Power Factor Operating Range: 0.9 leading to 0.8 lagging without derating.
vii. Overload Capability: 125 percent for 10 minutes, 150 percent for 30 minutes.

d). **Hot Swap Batteries:** Design shall provide for replacement of batteries without having to power off the UPS unit. Design shall provide lead calcium batteries that do not require additional ventilation. Design shall specify 5-year life batteries.

e). **Capacity:** Design shall size UPS system to meet anticipated design load with an additional 40 percent spare capacity.

f). **Emergency Electrical Power Source Requirements:** When UPS is running on emergency power, the current to recharge the UPS batteries should be limited. This limited battery-charging load should be added when sizing the emergency generator.

g). **System Status and Control Panel:** Design shall provide all instruments and controls for proper system operation. System status panel should have appropriate audio/visual alarms, with associated alarm silencer button. Include the following functions: system on, system bypassed, system fault, out of phase utility fault, over-temperature, UPS overload, and closed generator circuit breaker. Design shall provide an additional remote system status panel and alarm annunciation in space serviced by the UPS.

h). **UPS and Battery Room Requirements:** Design battery room in accordance with NEC Article 480. Design shall provide emergency lighting in both UPS and Battery Rooms and provide a telephone in or adjacent to the UPS Room. Design shall provide acoustical treatment of UPS Room to reduce noise levels.

i). **Battery Racks:** Design shall provide a minimum 5-year life batteries with bracing and connections to match seismic conditions of the site.

j). **Failure of AC power to Return:** Should AC power fail to return before battery voltage reaches the discharge limit, the UPS system shall disconnect from the critical load to safeguard the battery.

11.9.5. **Alternate Power Systems Testing:**

k). Design shall provide for acceptance testing of alternate power systems to demonstrate system operation including transfer of power from preferred source to alternate source and from alternate source back to preferred source. In addition, designs shall require infrared scanning of all newly installed transformers, power panels, and disconnects once under load.

12. **Building Automation System:**

12.1. **Introduction and General Provisions:**

a). **General:** The AOC utilizes a Building Automation System (BAS) network within the Capitol complex and all controls shall integrate with this system. In this document, "AOC BASnet" refers to the overall AOC Building Automation System network within the Capitol complex. The AOC "Building Automation and Control System Communication Integration Plan for the U.S. Capitol Complex" (AIP) shall be used as the basis of all building automation system AOC BASnet additions and alterations.

b). The requirements of this section apply to all AOC facilities at the Capitol complex and non-Capitol complex locations.

c). Any building automation system control changes and additions shall be designed and constructed as part of the AOC BASnet system, not the AOC network. In addition, all changes to equipment in existing systems and new systems require review and approval of the Chief Information Officer and the Configuration Control Board per AOC Order 7-4, Information Technology Security.

d). Fire alarm and security shall be separate systems. They may communicate status alarm and code required functions to the BAS.

e). **Other requirements:**

i. Ethernet IP addresses and other non-IP addressing shall be assigned by the AOC-EMCS.

ii. Non-Capitol complex sites shall comply with the requirements of this section.

12.2. **Related Sections:**

a). Other Sections that contain important information that may affect elements of this section or their implementation, include, but are not limited:

i. Refer to Section 1, General Requirements.

ii. Refer to Section 3, Sustainable Design, for information related to energy conservation.

iii. Refer to Section 9, Mechanical and HVAC, for related information.

iv. Refer to Section 10, Plumbing, for related information.

v. Refer to Section 11, Electrical, for related information.

vi. Refer to Section 15, Equipment, for information related to elevators.

12.3. **Building Automation System Network:**

a). The Building Automation System Network (BASnet) ties together numerous monitoring and control systems including:

i. Mechanical

ii. Plumbing

iii. Electrical

iv. Lighting

v. Daylighting / Shade Systems

vi. Utility Metering

vii. Elevator

12.4. **Operation and Configuration – Networking:**

a). Microprocessor-based PID controllers shall monitor and adjust building systems to optimize their performance and the performance with other systems. The system shall consist of a series of direct digital controllers connected to the building's AOC BASnet local area network. All Ethernet-MS/TP (or Arcnet) BASnet routers shall be Automated Logic LGR type.

b). **System Configuration:** The existing AOC BASnet system is composed of the following components:

i. Microsoft Windows-based server. See AOC for the current version.

ii. CISCO 100/1000 Ethernet routers and switches on a redundant gigabit fiber network to assure high-speed network communications. Ethernet communication is based on ASHRAE 135-Annex-J (BASnet I/P) protocols. CISCO switches are strategically located throughout each of the buildings to provide ethernet communications ports to the BAS control systems.

iii. Each BAS control system communicates through a CISCO switch (and BACnet^{tm} router if required) to the complex-wide AOC BASnet.

c). **Contract Document Requirements:** At a minimum, provide the following in the stand-alone construction documents, in accordance with the Architect-Engineer Design Manual AOC Policy 28-10:

i. Schematic Network Diagrams, including system architecture.

ii. All building utilities shall be metered and monitored by the AOC BASnet. This includes electricity, steam, condensate, chilled water, domestic water, natural gas and fuel oil, as appropriate. Further direction on metering shall be coordinated with AOC-ESB.

iii. Coordinate any security requirements from the Office of Security Programs.

12.4.1. **Network Equipment**

a). **Switches:** Design shall provide Cisco switches. However, due to the dynamic nature of ever-changing technology, coordinate the model number with AOC-EMCS.

b). **Patch Panels:** Design shall provide fiber patch panels as necessary to terminate the strands. Coordinate connector types with the AOC-EMCS.

12.5. **Installation:**

12.5.1. **Wiring:**

a). **Backbone Cabling:**

i. For wiring within buildings, provide 12-strand OS-1 single mode fiber optic cable installed in conduit. Where cable must be installed exposed, design shall provide armored jacketed cables.

ii. For wiring outside buildings, provide OS-2 single-mode fiber optic cable. Coordinate strand count with the AOC. Design shall provide a dedicated fiber link back to the existing infrastructure as directed by the AOC.

b). **Horizontal Cabling:** Design shall provide CAT6A cabling from the network switches to the networked equipment (VFDs, Motor Controllers, Direct Digital Control (DDC) panels, etc.).

c). **Historic Preservation:** Project Managers shall contact the HPO prior to designing the routes and places where new wiring and cabling shall be installed. All interior surfaces, decorated surfaces, architecture features like pilasters, cornices, running trim are important elements in Heritage Assets and must be protected and not be disturbed, removed or altered. HPO and Curator shall review detailed Construction Documents that indicate location of new devices, routes, access points and avoidance of historic elements.

12.5.2. **Raceways and Boxes:**

a). Refer to Section 11.6.12 in Electrical for Raceway and Boxes general requirements.

12.5.3. **Identification:**

a). All BASnet networking and mechanical equipment shall be identified in the following manner:

i. Box covers shall be painted green.

ii. Wires and cables shall be labeled, at a minimum, at each end.

iii. All conduit shall be identified with green markings and labeled every ten feet.

13. **Communications Systems**

13.1. **Introduction and General Provisions:**

a). The Capitol complex utilizes many different types of communications systems. Each system has different requirements. Coordinate system requirements with AOC to meet the scope required. Systems in use include:
   i. Voice and Data Systems
   ii. Building Automation Network (BASnet)
   iii. TV Systems (CATV)
   iv. Security Systems
   v. Legislative Call System

13.2. **Related Sections:**

a). Other Sections that contain important information that may affect elements of this section or their implementation, include, but are not limited:
   i. Refer to Section 1, General Requirements.
   ii. Refer to Section 2, Historic Preservation, for information related to protection of Heritage Assets.
   iii. Refer to Section 11, Electrical, for information related to electrical components.

13.3. **Voice and Data Systems:**

a). The service providers, customers, and their respective voice and data requirements vary greatly across the AOC's facilities. The AOC Project Manager will ascertain the specific requirements on a project-by-project basis.

13.4. **CATV Systems:**

a). Design shall provide Cable Television System receptacles where directed by AOC Electronics Engineering Branch (AOC-EEB).

13.4.1. **Raceway and Boxes:**

a). Refer to Section 11.6.12 in Electrical for general requirements.
b). Design shall provide a raceway system with associated junction boxes for AOC CATV. Design shall provide oversized/deep junction box and minimum 1" metallic conduits. Design shall provide double gang junction box.

13.4.2. **Wiring:**

a). **Expansion of CATV Backbone**: Provide Corning Glass, Freedom Cable, loose tube, gel-free, 144-strand, single mode fiber optic cable.
b). **Building Fiber Installation:** Provide Corning Glass 6-strand MIC/UNIFLEX single-mode armored fiber optic cable to Corning WCH-02-P with Scientific Atlantic 6-channel optical service cable C106327 to fiber node. Provide Scientific Atlantic GainMaker Triple Balance Fiber node, 1000MHz.
c). **Riser Trunk Cable:** Provide Coleman, 625 Series trunk cable #CSC625, non-jacket.
d). **Distribution Cable to First Line Fast Fourier Transform (FFT):**
   i. **Under 300 feet:** Provide Comescope Plenum #2285K RG-11 cable.
   ii. **Over 300 feet:** Provide Coleman trunk cable #CSC625, non-jacket.
e). **Distribution Cable to Second Line FFT:** Provide Comescope Plenum #2285K RG-11 cable.
f). **Feeds to SCIF Enclosures:** Provide Corning Glass, 6-strand MIC/Uniflex, single-mode armored fiber optic cable to Corning WCH-02-P. Provide 2-strand Corning Glass, single-mode fiber optic cable, with APC/SC connectors to an ARRIS CP8016U-02-10 fiber node at the SCIF enclosure with SC/APC Singe Mode Patch Cord from Corning WCH-02-P located within SCIF space.
g). **Historic Preservation:** Project Managers shall contact the HPO prior to designing the routes and places where new sprinklers and related controls and accessories shall be installed. All interior surfaces, decorated surfaces, architecture features like pilasters, cornices, running trim are important elements in Heritage Assets and must be protected and not be disturbed, removed or altered. HPO and Curator shall review detailed Construction Documents that indicate location of new devices, routes, access points, and avoidance of historic elements.
h). **Room Distribution FFT's to Room Receptacle:**
   i. **Under 130 feet:** Coleman Plenum #921019 RG-6 cable.
   ii. **Over 130 feet:** Comescope Plenum #2285K RG-11 cable.
i). **Connectors:** Male compression F-type for both RG-6 and RG-11 cables.
j). **Testing:** System activation procedure to consist of optical testing by OTDR, light testing to be confirmed and within specification by AOC Electronic Engineering

Staff prior to system tie-in. When approval is given and system is verified, a final system test is to be performed to verify RF standards.

i. Distribution output levels = 44.8dB @ channel 2, 48.7dB @ channel 36 and 50.44dB @ channel 57.
ii. Trunk output levels = digital signal est at 31dB @ Channel 62, 31.9dB @ Channel 85, 32.7dB @ Channel 95 and 32.9dB @ Channel 125.
iii. Room Distribution FFT's levels = 23.4dB @ channel 2, 23.9dB @ channel 36 and 25.2dB @ channel 57 (Typical @140' RG-11 cable to Riser FFT's).
iv. Receptacle service output levels = 0dBmV @ channel 3, 0dBmV @ channel 36 and 0dBmV @ channel 125 (Typical @110' RG-6 cable).

13.4.3. **Receptacles:**

a). Design shall provide single female F-type connectors on a single gang face plate at each CATV location. Design shall provide Thomas and Betts self-terminating barrel #TF-81 indoor-rated connectors for receptacles located at the basement level and above and F barrel #E14541 outdoor-rated connectors for receptacles located below ground level.

13.5. **Security/CCTV Systems:**

a). Due to the dynamic nature of these systems, coordinate the respective system requirements with the AOC.

13.6. **Legislative Call System:**

a). The Legislative Call system is a radio frequency (RF) based system. No special wiring other than an AC receptacle is required, except in RF shielded area. For RF shielded area;

i. Provide an AC receptacle for each Legislative Clock placement location.
ii. Provide a single mode fiber optic cable from a Legislative Clock location inside the shielded area to a Legislative Clock location outside the shielded area. Provide CAT5 cable between the Legislative Clocks in the shielded area in a daisy chain link format if more than one Legislative Clock is required in the shielded area.

14. Exterior Horticultural and Irrigation Practices

14.1. Introduction and General Provisions:

a). **Purpose:** Since 1867, the Architect of the Capitol (AOC) has had responsibility for the care and maintenance of the Capitol complex and the Capitol grounds. Refer to Section 2, Historic Preservation, for additional details.

i. The U.S. Botanic Garden was established in 1820 by Congress and today includes over seven acres of outdoor gardens and a 30,000 ft^2 Conservatory southwest of the Capitol at the eastern end of the National Mall, and over 12 acres of lawn and woodland and 85,000 ft^2 of indoor growing space in the D.C Village area of Southwest D.C.

b). **General:** The Capitol grounds host millions of visitors each year who enjoy the beauty and benefits of their urban forest and landscape features. The AOC manages and maintains all landscape features on the Capitol grounds, the U.S. Botanic Garden, Library of Congress Buildings and Grounds and the U.S. Supreme Court Buildings and Grounds including specified parks, facilities, and along the street rights-of-way (ROW).

14.2. Related Sections:

a). Other Sections that contain important information that may affect elements of this section or their implementation, include, but are not limited:

i. Refer to Section 1, General Requirements.

ii. Refer to Section 3, Sustainable Design, for information related to energy conservation.

14.3. Design Requirements:

a). All proposals for new and preservation work in the grounds of the Capitol complex and the Capitol Hill must be submitted and discussed with the Superintendent's Office of the applicable jurisdiction before initiating any work. Contact the Historic Preservation Officer (HPO) for proper procedures and recordkeeping.

b). The following are landscape design considerations to be incorporated into all new landscape designs. The contractor shall work closely with the AOC Project Manager and the jurisdiction's representative, for specific landscape, horticultural and irrigation requirements.

i. Landscape designs must be approved by an AOC Landscape Architect and the jurisdiction superintendent. If the project involves facilities or land under the jurisdiction of the U.S. Botanic Garden, then also obtain approval from the USBG Plant Curator.

ii. Develop integrated pest management practices along with planting schemes, as appropriate to the project scope. Follow procedures documented within the jurisdictions' pest management practices.

iii. Use construction practices that use low impact systems and installation practices to minimize the adverse effects on the soil quality and wildlife habitat.

iv. Confirm the location of underground utility systems and maintain appropriate distances from appurtenances.

v. Soil Practices

- Identify if soil testing is necessary or recently completed for the site. If testing is required, have soil tested by a certified soil testing laboratory and follow the procedures documented within the jurisdiction for soil requirements.
- Ensure state and local laws and regulations regarding erosion and sediment control requirements and storm water management plan requirements are followed as required. Refer to section 1.5 'Regulatory Requirements.'

c). **Where feasible and practicable:**

i. Adhere to the Sustainable Sites Initiative (SITES) framework for those projects implementing new landscape design and practices. A jurisdiction review and approval is required from the superintendent of jurisdiction(s) involved in the project prior to project initiation. The project's architect / engineer is responsible for assessing the appropriate SITES certification level and shall manage/complete/coordinate appropriate certification forms. Projects shall be designed and documented to comply with the requirement of the most recent version of SITES at the Certified or above level.

14.4. **Preservation of Cultural Landscapes:**

a). The Capitol complex has not only a history of building design, construction, and use, but also a rich history of the design and use of its surrounding grounds and landscapes. It is the responsibility of the AOC, the HPO and the superintendent of each jurisdiction to maintain and preserve the Heritage Assets including historic structures, and cultural landscapes and landscaping. The preservation of the cultural landscapes includes the preservation of the designs and the historic plantings, as well as the historic hardscapes like retaining walls, balustrades, fences, paths, walks, lighting devices, garden furniture, sculptures, permanent plaques and monuments. The AOC HPO will advise on the conservation of reliefs, pilasters, cornices, running trim and other historic elements.

b). Existing landscapes share the same conditions as historic buildings: they may be considered for restoration, preservation, rehabilitation or demolition or may be replaced with new designs. As part of project scoping, Designers should consult Cultural Landscape Reports (CLRs) which exist for much of the Capitol complex in order to identify historic elements and their required treatments for a particular project.

14.5. **Jurisdictional Management Plans:**

a). The AOC's Arboretum Management Plan manages and maintains trees on the Capitol grounds, including stumps, and planting sites in specified parks, facilities, and along ROWs. For over 140 years, the Architect of the Capitol has maintained staff committed to developing a strong urban forest.

b). The U.S. Botanic Garden Collections Management Plan and Curatorial Policy is the guiding reference for USBG employees who are maintaining, growing, using, or protecting the accessioned plant collection. This document, along with the USBG Business Plan and new Standard Operating Procedures (SOPs) for plant care created from industry best practices, determine how plants of the USBG collection and landscapes are cared for, as well as the criteria for evaluating and adding new plants into the permanent collection.

14.6. **Tree and Landscape Protection:**

a). **General:** The section includes guidance for the protection and restoration of the trees and landscape plantings in and around the Capitol complex that will be affected by temporary or permanent construction projects.

b). **Standards:**

i. Comply with Tree Maintenance, Planting and Preservation Standards, ANSI A300 Parts 1 through 10.

ii. Comply with Tree Care Industry Association and International Society of Arboriculture standards except where more stringent requirements are indicated by the AOC.

14.6.1. **Requirements:**

a). Temporary Fencing: Install temporary fencing around tree protection zones to protect remaining trees and vegetation from construction damage. Maintain temporary fence and remove when construction is complete. The tree protection zone is at minimum an area equal to a radius of 1.5 feet for each inch of trunk diameter measured 4.5 feet above the ground (i.e., Diameter at Breast Height, dbh)

b). The limits of disturbance shall be outside the tree protection area. Limited activity may take place within the tree protection area only with the expressed permission of the AOC as follows:

i. Work shall be confined to the smallest possible area and accomplished as quickly as possible with minimal fence relocation. The AOC shall approve the work areas and timeframes for commencing and completing work before any construction activities begin.

c). Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

d). Wrap mature tree trunks with dimensional lumber to appropriate height and secure with wire. Employ this technique where insufficient space is available to install protective fencing.

e). Install sign on tree protection area.

f). Monitoring During Construction: Specify that all trees surrounding the site will be monitored

during construction for health and stress. If determined by the architect, the implementation and execution of additional mitigation in accordance with accepted arboricultural industry standards shall be performed. Mitigation may include but is not limited to watering, pruning, cabling/bracing, fertilization, treatment with endo-mycorrhizal and ecto-mycorrhizal fungi and root bio-stimulants, aeration and mulching of the root zones, radial trenching, plant growth regulator applications, and insect and disease prevention or control treatments to assist trees in overcoming stress due to construction impacts.

i. Arborist: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs and other vegetation indicated to remain and to prepare inspection reports.

14.7. **Turf:**

a). Design shall conform to the jurisdiction's specifications and provide varieties appropriate for the environmental conditions and as approved by jurisdiction's superintendent. If feasible, the designer shall specify varieties that can sustain reduced irrigation. Polycultural lawns, including beneficial nitrogen-fixing species such as clover should be considered, where feasible.

14.8. **Plantings:**

a). Design shall conform to jurisdiction's specifications:

i. Specify that no known invasive species be used in outdoor plantings except where jurisdictional guiding documents, such as the Olmstead plans and CLR, otherwise dictate.

ii. Decorative and historic components exist within the gardens and grounds of the Capitol complex; special considerations and techniques are required when working around these features. At a minimum, consultation and coordination with the superintendent of the applicable jurisdiction and the Historic Preservation Officer is required.

14.9. **Irrigation Systems:**

a). Design shall comply with requirements of Section 3 – Sustainable Design, to reduce potable water use for irrigation using strategies such as:

i. Implement rooftop rainwater and grey water collection for irrigation where practicable.

ii. Specify irrigation vendors that are WaterSense certified, where possible.

b). **General:** Irrigation systems should be developed with the following considerations/components:

i. All designs shall include back-flow preventers and clean-outs.

ii. Consult end users and design the system based on their proposed level of monitoring and maintenance.

iii. Include quick coupling valves in locations coordinated with end users.

14.10. **Restrictions:**

a). Facilities at Fort Meade, Maryland; Culpepper, Virginia; and Manassas, Virginia, are subject to varying state and local codes and military regulations. Verify coverage of codes and regulations before commencing work. Verify specific restrictions with the project jurisdiction's superintendent and with the HPO.

15. **Equipment**

15.1. **Equipment:**

a). The Jurisdiction having authority will provide a list of equipment to be located in the facility.

15.2. **Related Sections:**

a). Other Sections that contain important information that may affect elements of this section or their implementation, include, but are not limited:
   i. Refer to Section 1, General Requirements.
   ii. Refer to Section 12, Building Automation System, for information related to energy conservation.

15.3. **Conveying Systems:**

15.3.1. **General:**

a). At least two passenger elevators shall serve all occupied areas of the Capitol. Design all elevators and escalators to comply with ASME A17.1 and with ADA Accessibility Guidelines. All new and altered lifts must comply with ASME A18.1, Safety Standard for Platform Lifts and Stairway Chair Lifts.

b). **Waiting Areas:** Design shall provide sufficient lobby or corridor waiting space to allow passengers to wait for an elevator clear of the building traffic flow.

c). **Mechanical Room Access:** Design shall provide service or freight elevator access to serve the mechanical equipment floor or penthouse.

d). **Freight Elevators:** Design shall locate freight elevators remote from passenger elevator lobbies, of sufficient capacity to transport replacement parts for building systems, such as compressors, motors, fans, elevator hoist motors and similar loads specified in the building program.

15.3.2. **Elevator Traffic Analysis:**

a). For principal and large support buildings, the designer shall employ an independent consultant to determine the number and type of elevators to be employed. The traffic analysis shall determine the quantity, capacity, and speed requirements of the elevators. Absent formal program populations, calculate population at the rate of one person per every 150 sq. ft. of gross building area. Elevator waiting times shall not exceed 30 seconds during peak time periods in a typical bank. Passenger elevators shall have capacities between 2,500 and 3,500 pounds, with cars sized to ASME A17.1 standards.

b). **Peak Loads:** Design shall assume that 10 percent of the population will not require service during the peak period. The designer shall calculate average interval as the time between departures of elevators from the main lobby during the a.m. peak period. Average intervals shall not exceed 30 seconds. Design shall calculate handling capacity as the number of persons the elevator system must move in any given 5-minute period of up-peak traffic used to measure average interval. Design buildings for 16 percent handling capacity.

c). **Other Service:** Design shall provide separate calculations for passenger and for freight or service (combination of passenger and freight) traffic. If the building provides parking levels, the designer shall prepare a separate analysis for shuttle elevators connecting parking levels to the lobby.

15.3.3. **Elevators:**

a). **General:** Design shall specify all elevators to comply with ASME A17.1 and with accessibility requirements indicated in section 1.5.4 Provisions for Persons with Disabilities.

b). **Elevator Types:** The following types of elevator installation are permitted:
   i. **Traction Elevators:** Both geared and gearless, overhead and basement mounted machines for service to more than four stops. Geared machines may be used at speeds of 350 FPM or less. Use gearless machines for speeds of 500 FPM.
   ii. **Hydraulic Elevators:** For service to four stops or fewer, hydraulic elevators may be used. New systems shall be hole-less. Specify biodegradable hydraulic elevator oils. Minimum speed shall be 100 FPM.

c). **Elevator Sizes:** Design shall adjust elevator car sizes to comply with traffic analysis, but at a minimum, provide the following capacities:
   i. Traction passenger elevators shall have minimum capacities of 3,500 lbs.
   ii. Hydraulic passenger elevators shall have minimum capacities of 2,500 lbs.
   iii. Freight elevators shall have minimum capacities of 5,000 lbs.

iv. Service elevators shall have minimum capacities of 4,000 lbs.

d). **Elevator Doors:** Design shall provide the following door configurations:
   i. Passenger Elevators: Center opening
   ii. Freight Elevators: Bi-parting
   iii. Service Elevators: Side-slide

e). **Car Designs:** Design shall provide removable wall panels in passenger and service elevators and stainless steel wall panels in freight elevators. Design shall use industry-standard platform sizes to facilitate future replacement for maintenance. If no separate freight/service elevator is provided, design shall provide passenger elevators with minimum 8' ceilings and recess lighting in freight elevators to preclude damage from cargo.
   i. **Lighting:** Design shall provide energy-efficient lighting and automatic control system and specify controls to turn off cab lights when not in use.
   ii. **Passenger Elevators:**
   - **Principal Buildings:** Design shall match existing premium and custom finishes. For new construction, design shall provide a stone floor finish, wood wall panels and bronze or ornamental metal handrails and bumpers.
   - **Support and Service Buildings:** Design shall provide stainless steel wall panels with a decorative finish and solid stainless steel handrails and bumpers.
   iii. **Freight Elevators:** Design shall provide minimum ceiling height of 10 feet.
   iv. **Service Elevators:** Design shall provide minimum ceiling height of nine feet.

f). **Controllers:** Design shall provide microprocessor controllers with monitoring capabilities. Refer to section 12, Building Automation System for additional information and requirements.

g). **Equipment Rooms:** Design machine room to maintain a temperature range of between 60°F to 85°F and 45 percent to 75 percent RH. Design shall not locate HVAC equipment or condensate lines over control equipment and provide at least one light fixture (minimum 2 lamps, equal wattage) on the emergency lighting circuit. Design shall provide at least one GFCI duplex receptacle for service use on the emergency circuit and on a circuit separate from that used for the control equipment.

h). **Equipment Room Access:** Design shall locate machine rooms to be accessible from public corridors without requiring travel through offices or restrooms.

i). **Maintenance and Service Access:** Design shall provide trap doors, trolley beams and hoist beams at elevator machine rooms for traction elevators where the machine room is not serviced by a freight or service elevator. Design shall provide a fixed pit ladder, fabricated from aluminum, with a light switch, and dedicated GFCI duplex receptacle in each hoistway pit. Design shall provide sump pumps as directed by the AOC. Where equipment penthouses are provided, service elevators or freight elevators must provide access to that level. An elevator must service all maintenance floors.

j). **Security:** Security or specific purpose elevators are designed to transport designated groups of people. These will be custom designed to meet specific requirements.

15.3.4. **Machine-Roomless (MRL):**

a). **General:** A machine-roomless elevator is an elevator with the drive machine, governor, and other related components located in the elevator hoistway. These elevators require specific approval by the AOC. The elevator must have a metal belt and the control system must be located outside of public areas to facilitate safe maintenance procedures. The MRL must meet the following minimum requirements:
   i. Controls must be installed in a fire rated control room.
   ii. The remote-control room must be no more than 10 feet from the hoistway.
   iii. No other equipment is allowed in control room (only equipment directly related to the elevator).
   iv. Main line disconnect switches must be installed within 18 inches of the strike jamb of control room door.
   v. The car position, movement, and direction must be able to be determined from the control room.
   vi. Provide HVAC in the control room so that the temperature does not go below 50 degrees or above 90 degrees.

vii. Access to the governor must be provided from outside the hoistway.
viii. The suspension means must be manufactured for elevator use only and be constructed from steel only.

15.3.5. **Escalators:**

a). **General:** Escalators shall be installed as supplements to elevators when vertical transportation is required for a large unpredictable volume of public traffic. They should be used where the first floor is not large enough to contain the high public traffic so that the interval for elevators can be calculated with accuracy. Because of maintenance costs, design shall use escalators only when necessary. Escalators shall be centrally located, visible from the building entry/security station, and convenient to the areas that they serve.

b). **Capacity:** The designer shall calculate escalator capacity based on the following chart derived from the General Services Administration:

Escalator Width	Capacity in Persons per Hour	Capacity in Persons per 5 Minutes
32 inch	3,000	250
48 inch	4,000	400

c). **Controllers:** Design shall specify microprocessor controllers with monitoring capabilities.

d). **Finishes:** Design shall provide finishes that match existing or are appropriate to the building type.

15.3.6. **Wheelchair Lifts:**

a). Wheelchair lifts must comply with the current edition of ASME 18.1 Safety Standard for Platform Lifts and Stairway Chairlifts. Proper design of accessible routes in new construction should not require the use of wheelchair lifts. In repair and alteration projects, ramps are preferred to wheelchair lifts.

15.3.7. **Hoists, Cranes and Scaffolding**

a). These items shall not have permanent attachment to the building exterior. The AOC Project Manager shall coordinate installation with the U.S. Capitol Police.

15.4. **Restrictions:**

a). Do not use integral return panel car control stations.
b). Do not connect pit sumps directly to sewers.
c). Do not use escalators in design solutions without AOC approval.
d). Do not over-specify casework for office use.
e). Do not use particleboard containing formaldehyde resins.
f). Verify special restrictions with HPO.

16. **Sitework**

16.1. **Introduction and General Provisions:**

a). **Purpose:** This Section establishes the minimum standards and criteria for AOC's facilities, and shall be applicable for civil site work. It is the intention for this section to be used in conjunction with the governing standards referenced herein as well as the program requirements for each individual project located in Washington D.C., Virginia and Maryland. If conflicts exist between any of the standards and/or the specific program and project requirements, contact the AOC Project Manager for resolution.

16.2. **Related Sections:**

a). Other Sections that contain important information that may affect elements of this section or their implementation, include, but are not limited:

i. Refer to Section 1, General Requirements.
ii. Consult Section 2, Historic Preservation, and the HPO for further information regarding preservation of Heritage Assets.
iii. Refer to Section 9, Mechanical and HVAC, for related information.
iv. Refer to Section 10, Plumbing, for related information.
v. Refer to Section 11, Electrical, for related information.
vi. Refer to Section 14, Exterior Horticultural and Irrigation Practices, for related information.

16.3. **Site Preparation:**

16.3.1. **Subsurface Investigation:**

a). **General:** The following design standard is to assist the geotechnical engineer in the preparation of a Subsurface Investigation Report, also known as a Geotechnical Report. The Geotechnical Engineer shall be registered in the project location and is responsible for including in the report all project specific items in accordance with the latest industry standards. Any soil borings performed in Washington, D.C., must be completed in accordance with DC Code 8-103 and associated regulations at 21 DCMR Chapter 18. This may require additional analyses in addition to those listed in this standard. The applicable jurisdiction shall also be contacted by the Geotechnical Engineer to determine project requirements that may also require analysis in addition to those listed in this standard. The recommendations in the Geotechnical Report shall be incorporated into the construction drawings and specifications as appropriate. The report shall be signed and sealed by a professional engineer licensed in the project location.

b). **Site and soil exploration shall include, but not be limited to:**

i. Description of Existing Site Conditions
ii. Surface Drainage
iii. Geologic Information
iv. Filled-in Areas
v. Possible Slide Areas
vi. Specific Site Features
vii. Description of Flooding History and expected frequency and level of floods
viii. Items discussed below, as applicable

c). **Subsurface Features:** The Geotechnical Engineer shall include a plotted record of the stratification of soil deposits, both horizontal and vertical, in the report. This record should indicate, in the soil profile to scale, the surface elevation of all borings and test pits, blow counts (N values), stratum elevation, soil classification, and the thickness and character of the soils encountered. The profiles should reach to such a depth as may be required, and are to include 24-hour water level readings, including percolation rates. Information on the degree of compactness of granular soils and consistency of cohesive soils should be provided.

d). **Exploration Methods:** Field explorations should follow the applicable standards and recognized procedures of geotechnical engineering as set forth by ASTM, ASCE, AASHTO, AEG (Association of Environmental and Engineering Geologists), etc. The Geotechnical Engineer shall determine the interval of soil sampling based on soils encountered, type of structure, and other conditions. The Geotechnical Engineer shall identify test procedures utilized. Spacing and depth of borings must be based on site conditions and proposed construction. Borings shall extend sufficiently into an underlying material of adequate bearing capacity and below the depth of possible slope failure. The

Geotechnical Engineer shall plug bore holes after completion of the borings and obtaining 24-hour water level readings. All information and data obtained must be recorded in the report.

e). **Groundwater Measurements:** The Geotechnical Engineer shall provide information on groundwater elevations and seepage zones, including depth of permanent and perched water tables. Water tables should be determined after completing the boring and a minimum of 24 hours later. Fluctuations with seasons should be investigated.

f). **Classification and Description:** Classification and description of soils shall be done in accordance with ASTM D2487 and D2488. Complete soil descriptions must also include in-place conditions, geologic names, local names and any other information that is pertinent to the interpretation of the subsoil characteristics.

g). **Laboratory Testing:** Testing shall be in accordance with ASTM D 2216, D 4318, D 1557, D 1883 and D 422. The nature and extent of laboratory testing deemed necessary is dependent upon the characteristics of the soil and the anticipated geotechnical problems requiring analysis. For granular soils, gradation tests on representative samples and water content determinations often are adequate. Testing of cohesive soil samples may include but are not limited to, determination of water content, dry density and unconfined compressive strength. The Geotechnical Engineer shall perform consolidation tests on samples from relatively soft soils that may underlie foundations. Expansive pressure of clays should also be determined for foundation design.

i. For deltaic clays that have undergone relatively large strains in the past, the important properties for predicting long-term behavior are the residual effective friction angle and the residual cohesion intercept (the absolute minimum strength of clay material). These parameters should be determined by appropriate laboratory tests. Many reversals are required to reach residual strengths. Some references suggest using a pre-split sample (Ref. Engineering Properties of Clay Shales Report No. 1, by W. Haley and B. N. MacIver).

ii. For less complex situations and subject to approval, the Geotechnical Engineer shall estimate the required parameters by comparison of other index properties (particularly the Atterberg limits) with those of similar soils for which test results are reported in the published literature and based on past experience. Documentation shall be furnished when shear strength parameters are based on results other than laboratory tests. Such documentation must set forth the reasoning by which parameters were determined.

h). **Engineering Analysis and Recommendations:** The report shall include sufficient analytical foundation and slope stability studies and recommendations concerning:

i. Pavement design
ii. Foundation design (include recommendations for construction and settlement joints, if necessary, either in the foundation system or within structure)
iii. Estimated total and differential foundation settlement under anticipated structural loads
iv. Site class for Seismic Design, per ASCE 7-10, Chapter 20.
v. Earthwork
vi. Method and degree of compaction, if structural fill is required (include specifications for compacted fill)
vii. Analysis of weather and/or construction equipment effects on soils during construction
viii. Rock removal
ix. Site grading
x. Stormwater Best Management Practices to achieve local, state and federal drainage requirements
xi. Slope stabilization
xii. Earth restraint systems and applicable monitoring systems
xiii. Removal of earth retention systems
xiv. Dewatering systems
xv. Construction procedures
xvi. Compliance with the requirements of Section 1.3.7, Environmental and Health Regulations, herein

xvii. Subsurface contamination that would prevent implementation of new stormwater management practices of infiltration

xviii. Seismic Site Class

i). **Additional engineering analysis requirements are as follows:**

i. The report shall include a complete record of the field and laboratory findings, including a drawing to scale depicting boring locations and respective elevations, information concerning structures to be built (types and elevations of basements), conclusions reached from the study, and recommendations for use by the designer and the applicable Jurisdiction. Probable total and differential settlement of foundations, special basement problems, and retaining wall design must also be discussed and recommendations set forth.

ii. Where "marine clays" are found, an engineering analysis of the short- and long-term stability of existing and planned slopes must be made including a careful evaluation of potential adverse effects on nearby properties. The stability analysis shall be made by acceptable methods. The long-term stability shall be based on the "residual" shear strength parameters for the "marine clays."

iii. In areas that are susceptible to a high water table (permanent, perched and/or seasonal), the Geotechnical Engineer shall provide a pavement design that considers the water table, and identifies measures to assure dry basements, prevent wet areas, etc. Recommendations and design parameters for permanent groundwater and flood control shall be provided as applicable. Design criteria for flood-resistant construction shall be provided in accordance with the requirements of the 2015 International Building Code (IBC) - Appendix G.

iv. The Geotechnical Engineer shall provide design criteria for retaining walls or structures. The design shall provide allowable bearing pressure, horizontal friction coefficient between structure foundation and soil, as well as anticipated differential settlements for the recommended foundation system. Design shall provide requirements for backfill, compaction and drainage behind sub-grade walls. The report shall also provide recommendations for lateral earth pressures likely to develop on sub-grade walls, including active, at rest and passive pressure diagrams. Also, provide soil structure, soil-to-soil horizontal friction coefficient and seismic soils coefficient.

v. The report shall include a discussion on the problems of expansive soils. It is suggested that the design recommendations be based on the expansive properties of the clay unless it is shown otherwise by X-ray defraction studies or other appropriate laboratory tests.

vi. The report shall include recommendations and design parameters for stormwater management and infiltration facilities.

j). **Construction Plans:** The Geotechnical Engineer must review the final construction plans and state his/her opinion as to whether or not the plans have been prepared in accordance with his recommendations. Deviations from the recommendations must be noted.

k). **Footing and Drainage Design:** Design shall specify foundation structures placed at depths that will minimize differential settlement due to desiccation of underlying clays. The emplacement depth shall be based on the soil characteristics of the site. Consideration must be given to stratification of underlying materials, natural moisture content, and gradation of backfill soils, site grading and adjacent vegetation. Consideration should also be given to special cases of potential volume change of clays underlying footings embedded in thin layers of natural or artificially compacted granular soils. Surface and subsurface drainage mitigation shall be recommended to minimize water entering the "marine clay" soils. Design shall also be in accordance with the requirements of the 2015 IBC - Chapter 18.

l). **Construction Techniques and Inspection:** Sheeting and shoring or other approved methods for bracing may be required. During construction, the Geotechnical Engineer shall:

i. Monitor and inspect these earth support systems during periodic site visits to ensure they have not moved, been

damaged, and are being maintained such that they remain in proper working condition.

ii. Inspect excavations and soil/groundwater conditions throughout construction and be responsible for performing pre-construction and periodic site visits throughout construction to assess site conditions.

iii. Be responsible for updating the excavation, sheeting and dewatering plans as construction progresses to reflect changing conditions and submit an updated plan if necessary.

iv. Submit a written report biweekly, informing the Contractor and the AOC of the status of the plan and an accounting of the Contractor's adherence to the plan, addressing any present or potential problems.

v. All construction involving problem soils must be performed under the full-time inspection of a Geotechnical Engineer. The Geotechnical Engineer shall furnish a written opinion to the applicable Jurisdiction and to the AOC as to whether or not work has been performed in accordance with the approved plans prior to the issuance of use permits.

16.3.2. **Site Clearing:**

a). **General:** The designer shall refer to the Jurisdiction's standards. The designer shall utilize their standards in the event that they are more stringent than those listed below. The designer shall also contact the applicable Jurisdiction to determine additional project requirements. Any land disturbance (e.g., site clearing, grading, grubbing) shall comply with applicable federal, state and local regulations for stormwater, erosion and sediment control. For example: if the project is in Washington D.C. and disturbs more than 50 square feet of land, the designer shall secure an erosion and sediment control permit in accordance with regulations at 21 DCMR 540 through 547. For projects in Washington D.C. that disturb more than 5,000 square feet of land, the designer must obtain a stormwater permit as required under regulations at 21 DCMR 516 through 530. Coordinate with requirements of Section 14, Exterior Horticultural and Irrigation Practices.

b). **Project drawings must show:**

i. Limits of clearing

ii. Limits of grubbing

iii. Trees and shrubs to remain in area to be cleared

iv. Trees to be removed in areas that are not to be cleared

v. Describe size, density, and type of trees to be cleared and grubbed

vi. Indicate areas with unstable or highly erodible soils, which are to be disturbed

c). **Protection:** Roads and walks shall be free of dirt and debris at all times. Dust control shall be in accordance with requirements of the AOC and the District Department of Energy and the Environment (20 DCMR 605). The most stringent requirements shall govern.

i. Indicate trees, shrubs and existing facilities to be protected. Protection shall be in accordance with section 14, Exterior Horticultural and Irrigation Practices and additional jurisdiction standards and specifications as required.

ii. Design shall provide protection in accordance with the appropriate agency's requirements for existing utilities indicated to remain.

d). **Clearing:** Clearing shall consist of the felling, trimming and cutting of trees into sections and the satisfactory recycling, composting or disposal of the trees and other vegetation designated for removal, including downed timber, snags, brush and rubbish occurring within the areas to be cleared. Clearing shall also include the removal and disposal of structures that obtrude, encroach upon or otherwise obstruct the work.

i. Trees, stumps, roots, brush and other vegetation in areas to be cleared shall be grinded, cut flush with or below the original ground surface, except such trees and vegetation as may be indicated or directed to be left standing. Upon approval by the jurisdiction head, trees designated to be left standing within the cleared areas shall be trimmed in accordance with Tree Maintenance, Planting, and Preservation Standards, ANSI A300 (Parts 1 through 10) under the jurisdictions supervision.

ii. Limbs and branches to be trimmed shall be accordance with Tree Maintenance, Planting, and Preservation Standards, ANSI A300 (Parts 1 through 10) under the jurisdictions supervision.

iii. Comply with Federal Insecticide, Fungicide, and Rodenticide Act (Title 7 U.S.C. Section 136) for requirements on Contractor's licensing, certification and record keeping.

e). **Tree Removal:** Design shall indicate trees and stumps that are designated to be removed from areas outside those areas designated for clearing and grubbing.

f). **Grubbing:** Remove and dispose of stumps, roots larger than three inches in diameter, and matted roots from the designated grubbing areas. Material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purposes, shall be removed to a depth of not less than 18 inches below the original surface level of the ground in areas indicated to be grubbed and in areas indicated as construction areas. Depressions made by grubbing shall be filled with suitable material and compacted to make the surface conform to the original adjacent surface of the ground.

16.3.3. **Site Demolition and Relocation**

a). **General:** This design standard is for horizontal demolition and shall be referred to for plan preparation beginning five feet outside the face of any existing building. The designer shall contact the applicable Jurisdiction to determine project requirements. Prepare a Demolition Plan to include, but not be limited to:

i. Limits of disturbance, erosion and sediment control measures in accordance with all applicable local, state and federal requirements.

ii. Salvage, demolition, and removal procedures for approval/issuance of permit prior to commencement of any work.

iii. Procedures for careful removal and disposition of materials specified to be salvaged, and coordination with other work in progress.

iv. Disconnection schedule of utility services, and a detailed description of methods and equipment to be used for each operation and sequence of operations. This plan shall be approved by the applicable Municipality.

v. Components and materials to be salvaged for reuse or recycling.

vi. Perform work in accordance with the Occupational Safety and Health Administration's (OSHA) standards.

vii. Plans shall conform to the safety requirements contained in American Society of Safety Engineers (ASSE/SAFE) A10.6.

viii. Plans shall conform to the safety requirements contained in the 2015 IBC-Chapter 33.

b). **Existing Conditions:** Plan shall accurately represent the existing conditions of the site and shall be surveyed by a Land Surveyor or Professional Engineer licensed in the project location. All utilities shall be documented horizontally and vertically.

i. Indicate necessary precautions to avoid damage to existing items to remain or to be reused. Items in need of repair or to be replaced shall be approved by AOC and the applicable Jurisdiction.

ii. Indicate existing utilities serving any facilities that are to remain in service. Indicate any temporary utility services required. Ensure demolition will not begin until all utility disconnections have been made. Indicate utilities to be shut off and capped for future use.

iii. Indicate trees and forested areas to be protected and to remain within and outside the project site. Coordinate the plans with the project jurisdictional head and reflect specific requirements in the construction specification for temporary tree and plant protection. Tree protection measures for trees and vegetation to remain shall be shown on the Demolition Plan.

iv. Indicate existing utilities to remain in service and to be protected against damage and utilities to be shut off, disconnected, and sealed.

c). **Dust and Debris Control:** Prevent spread of dust and debris. Do not use water if it results in hazardous conditions such as, but not limited to, ice, flooding, or pollution. Vacuum and

dust work area as required by the applicable Jurisdiction, AOC or the air permit for the project whichever is most stringent.

d). **Protection:** Design shall provide pedestrian, worker and driver protection during demolition. Maintain temporary services during construction, and remove only after permanent services have been installed, tested, and in operation. Prepare and submit a Maintenance of Traffic (MOT) Plan to DDOT for approval.

e). **Earthwork from Demolition Activities:** Refer to the next Section 16.1.4 "Site Earthwork."

f). **Existing Facilities to be Removed:** Indicate existing structures to be removed and elevation. Indicate removal of sidewalks, curbs, gutters and street light bases.

i. Remove existing utilities as indicated and terminate in a manner conforming to the nationally recognized code covering the specific utility and as approved by AOC and applicable Jurisdiction. Plans shall include a provision to notify AOC and the applicable Jurisdiction to stop work in areas where utility lines are encountered which are not indicated on the plans.

ii. Indicate limits of removal for concrete and asphaltic concrete paving and slabs.

g). **Concurrent Earth-Moving Operations:** Plan shall require not beginning excavation, filling and other earth-moving operations that are sequential to demolition work in areas occupied by structures to be demolished until all demolition in the area has been completed and debris removed. Fill holes, open basements and other hazardous openings.

h). **Salvaged Materials and Equipment:** Plan shall indicate materials and equipment to be removed and delivered to a storage site as approved by the AOC and applicable Jurisdiction. Indicate removal of salvaged items, including historical items, in a manner to prevent damage, while in storage or during shipment.

i). **Disposal of Removed Material:** Disposal of debris, rubbish, scrap, and other unsalvageable materials resulting from removal operations shall be in accordance with applicable federal, state, and local laws and regulations.

16.3.4. **Site Earthwork:**

a). **General:** The Geotechnical Engineer shall consult the designer for specific project requirements and incorporate recommendations in the Geotechnical Report as appropriate. The designer shall also contact the applicable jurisdiction to determine additional project requirements. All earthwork shall be completed in accordance with applicable federal, state and local laws and regulations. Project drawings shall include, but not be limited to:

i. Surface elevations, existing and new; with spot shots, contours and flow arrows. Contour interval shall be as specified by the AOC Project Manager.

ii. Trees to be saved.

iii. Tree Protection Zone.

iv. Location of underground obstructions, including existing and proposed utilities.

v. Location and record of soil borings and test pits. Include ground water observations and topsoil thickness encountered in boring, soil classifications, and properties such as moisture content and Atterberg limit determinations. Include a soil map at scale not less than 1"=500'. Identify soil type in tabular form.

vi. Location of borrow, fill, and disposal area.

vii. Limits of clearing and grading. Consider depth of installation, work room needed, pipe size, type of soil, and slopes encountered.

viii. Areas to be seeded.

ix. Hydrological data where available.

x. Sheeting and shoring required.

xi. Pipe trench excavation details.

xii. Location and limits of hard material (rocks).

xiii. Details of special construction such as right-of-way requirements for jacking and boring.

xiv. Details of absorption pits and subsurface drains.

xv. Station and elevation, to an accuracy as required by DDOT, of the horizontal and vertical locations of all existing transmission lines and pipelines that will be crossed by proposed facilities or which lie within 3.5 feet of proposed excavation or grading. Transmission line and pipeline

point locations shall be determined by physical examination and certified by a PE or LS registered in the project location.

b). **Classification of Excavation:** No consideration will be given to the nature of materials, and all excavation will be designated as unclassified excavation. Blasting is not permitted.

i. Exception: All rocks, abandoned walls, piers and similar structures encountered within the area of the excavation shall be removed to a depth of at least 1 foot below Subgrade and backfilled with approved material.

c). **Dewatering Work Plan:** The designer shall include procedures for accomplishing dewatering work. Do not propose French drains, sumps, ditches or trenches within 3 feet of the foundation of any structure, except with specific written approval. The plan shall be prepared by a Professional Engineer licensed in the project location.

d). **Drainage:** The designer shall provide for collection and disposal of surface and subsurface water encountered during construction to keep soil materials sufficiently dry and shall obtain all necessary temporary discharge permits and provide for collecting samples to demonstrate compliance with local discharge limits.

e). **Jacking, Boring, and Tunneling:** The designer shall consider jacking, boring or tunneling in situations where utility lines must be installed more than 15 to 20 feet below the ground surface, through embankments, under minor roads or parking areas, or where surface conditions make it impractical to excavate open trenches. Pipe and conduit less than 36 inches in diameter will normally be installed in smooth steel pipe casing. The designer shall coordinate with installation facility engineers to identify and validate utility crossings where jacking, boring or tunneling will be specified.

f). **Excavation and Borrow Pits:** The designer shall submit drawings and calculations, certified by a registered Professional Engineer, describing methods and monitoring programs for sheeting and shoring of excavations.

g). **Grading Areas:** In addition to the requirements herein, the requirements of the 2015 IBC-Appendix J shall also be adhered to. The designer shall indicate locations of borrow or spoil areas. Spoil materials will be so placed and the worked portions of spoil areas and borrow areas will be so graded and shaped as to minimize soil erosion, siltation of drainage channels, and damage to existing vegetation. Specify degree of compaction.

i. Indicate stockpile locations where they may be kept in a neat and well-drained condition. Clear, grub, and seal, by rubber-tired equipment, the ground surface at stockpile locations. Separately stockpile excavated satisfactory and unsatisfactory materials. Protect stockpiles of satisfactory materials from contamination that may destroy the quality and fitness of the stockpiled material. Steps shall be taken to minimize erosion of materials to include silt fencing when required.

ii. Do not place material on surfaces that are muddy, frozen or contain frost.

iii. Grading shall not be allowed in a floodplain unless done in accordance with applicable federal, state and local laws and regulations. In general, slopes should not exceed 3:1. Minimum slope for overland grading shall be 2.0 percent or as approved by the AOC and applicable jurisdiction. The designer shall locate facilities and grade such that overland relief and adequate drainage is provided. In instances where a sump condition exists or cannot be avoided, the designer must consider the use of storm drain structures. Consider reduced soil exposure by minimizing grading and by adapting proposed work to existing terrain. Proposed grading scheme shall consider providing a balanced site.

iv. Temporary basins or traps should be designed to use the contour of the existing land to minimize grading and vegetation removal. If construction of basins or traps requires the removal of trees, replacement trees as specified by AOC Landscape Architect shall be proposed such that the area is restored to a natural condition when the basin or trap is removed. Plans shall require the contractor to acquire approval from the Site Inspector to ensure grading is in accordance with plan.

v. Grading and earthwork associated with stormwater management facilities shall be in accordance with the applicable federal, state, and local laws and regulations and approved stormwater management plans.

h). **Fill Material:** Compacted fill material shall be of type classification symbol specified by the designer, or of a better quality material as defined by the Unified Soil Classification System. Fill material shall be uncontaminated (does not contain heavy metals or VOCs, for example). Restrictions on the liquid limits and plasticity index of the material may be included where applicable.

i. Fill material shall conform to the definition of satisfactory soil material as defined in AASHTO M 145, Soil Classification Groups A-1, A-2-4, A-2-5 and A-3. Subject to AOC approval, the Geotechnical Report shall govern if it provides a different fill material definition. Fill material shall be free from roots and other organic matter, trash, debris, frozen materials, snow, ice, stones and particles larger than 2” in any dimension, and other deleterious material.

ii. Proposed fill material must be sampled and tested by an approved soil testing laboratory, as follows:

- Soil classification - AASHTO M 145
- Moisture-density relations - AASHTO T 180, Method B or D

i). **Construction Techniques:** Engineered fill and backfill around structures shall be placed with approved select materials. Uniform compaction throughout must be provided in 6" to 8" layers. Each layer of engineered fill shall be compacted at optimum moisture, plus or minus 2 percent, to a density of not less than 98 percent in accordance with AASHTO T-99 or ASTM D-698. Subject to AOC approval, the Geotechnical Report shall govern if a density other than 95 percent is indicated. Compaction must be achieved without yielding of the surface. Layers of fine grained fill that becomes smooth under compaction or construction traffic should be scarified to a depth of 2” to allow adequate bonding between layers. Marine clays shall not be permitted as backfill around structures or behind retaining walls.

j). **Placing Topsoil:** Indicate topsoil that is superior for grass and other plant growth. Minimum thickness shall be 4 inches.

k). **Minimum Standards for Site Density Testing:** Testing frequencies listed on the following pages are the minimums considered necessary to provide effective quality control of soil and aggregate material compactive effort under normal conditions.

i. Additional testing other than that specified shall be performed, if deemed necessary by the Inspection and Testing Agency, the Geotechnical Engineer of Record, or the Site Inspector.

ii. Density tests other than those specified herein may be required for certain types of soil. All testing shall be in conformance with approved test methods.

iii. In the event testing frequencies are specified to be greater in other applicable standards or specifications, those frequencies shall supersede frequencies listed on the following pages.

TEST LOCATIONS	TESTING FREQUENCY
Embankments : Fill sections for streets, and travelways	One density test shall be performed per 5000 sq.ft. per 6" compacted lift. The embankment test shall not be performed at the same spot where the utility trench backfill test was performed. Trench testing shall be performed in addition to the embankment test. Under curb and gutter, one density test shall be performed per 300 feet on alternating sides.
Sub-grade : Cut in existing fill for streets, and travelways	Proofrolling, evaluation and approval by the Geotechnical Engineer of Record. Undercut and stabilization may be necessary as determined by the Geotechnical Engineer of Record. The exception to this requirement is at proposed

TEST LOCATIONS	TESTING FREQUENCY
	underground utilities, Where the existing fill shall be completely removed and replaced with new-engineered fill.
Sub-grade Cut in natural soils	Proofrolling, evaluation, and approval by the Geotechnical Engineer of Record.
Sub-base Material For streets, and travelways	One density test shall be performed per 5,000 square feet per 6-inch compacted lift. When the sub-base aggregate is placed in layers or lifts, each lift shall be tested. Under curb and gutter when placed before the sub-base material in the street, perform one density test per 300 feet on alternating sides.
Base Material **Base Material (cont'd)**	One density test shall be performed per 5,000 square feet at the finished base grade. When the base aggregate is placed in layers or lifts, each 6 inch compacted lift shall be tested at the required frequency.
Storm Drainage System -Backfill *	One density test shall be performed per 300 feet and at vertical intervals not to exceed 12 inches.**
Sanitary Sewer, Water and Gas Mains - Backfill * (Note: Field density test reports must be provided to the Inspector before field approval is given for issuance of tap permits.)	One test shall be performed per 300 feet or between manholes if less than 300 feet apart and at vertical intervals not to exceed 12 inches.**
Sanitary Sewer, Water and Gas Laterals - Backfill for Stub Constructed in Conjunction with Utility Main*	One test shall be performed per 5 laterals and at vertical intervals not to exceed 12 inches.**
Sidewalks	Sidewalk sub-grade: One test shall be performed per 500 feet on alternating sides at the sub-grade elevation. A minimum of two tests per street is required.
Asphalt Concrete Pavement (Note: The thin lift nuclear density test can be used for any surface course placed directly over an aggregate pavement or on a lift of 135 pounds per square yard (or greater) that is placed on an asphalt pavement course).	Saw Cuts or Cores: Two cuts or cores represent one test. A minimum of two tests per street are required regardless of the street length. One test shall be performed per 500 feet of roadway or 1,000 feet of any pass made by a paving train.** OR Conventional Nuclear Density Gauge: One test shall be performed per 500 feet of roadway.** Five (5) tests shall be performed in each test section. A minimum of two test sections per street is required regardless of the length of the street.** Thin Lift Nuclear Density Gauge: Test areas are defined as lots and sublots. A lot consists of 5,000 feet of a pass made by a paving train. Each lot is divided into five sublots of equal size. Two tests will be performed on each

TEST LOCATIONS	TESTING FREQUENCY
	sublot. Each separate street shall consist of at least one lot. Streets less than 500 feet in length shall be tested a minimum of twice.**

* Testing required beneath structures only, including but not limited to sidewalks and streets.

** Testing frequencies shall be as listed above or as designated by the applicable Municipality. The most stringent requirement shall govern.

*** For projects less than 5000 sq.ft., one test for each of the test locations listed in the table above shall be completed.

16.4. **Site Improvements :**

16.4.1. **Roadways:**

a). The designer shall provide paving conforming to the following and in accordance with the requirements of DDOT, Maryland Department of Transportation and Virginia Department of Transportation.

b). **Principal and Secondary Streets:** Conform to procedures, design, construction requirements and specifications of the project locations department of transportation.

c). **Brick Gutters**: Many Capitol complex streets have existing brick gutters. Ensure that existing gutters are protected/ restored as applicable. The design shall provide concrete curbs complying with DDOT standards or match existing conditions.

d). **Parking Lots and Drives:** In addition to the standards referenced above, the design shall comply with applicable regulatory requirements listed in Section 1 General Requirements. The more stringent requirements shall govern.

e). **Curbs:** Design shall use granite curbs. For streets adjoining Support Buildings on the Capitol complex, the design shall provide concrete curbs complying with DDOT standards or match existing conditions. Standard granite used is Mt. Airy white, with a vertical face. The use of concrete curb shall also be in accordance with the regulatory requirements listed in Section 1 General Requirements, as approved by the AOC.

f). **Existing Pavement:** Any portion of existing pavement to be replaced shall, at a minimum, match the existing pavement section, unless the Geotechnical Report indicates otherwise. In either case, the more stringent section shall be used.

g). **Traffic Control:** Design shall conform to authority having jurisdiction and the Manual of Uniform Traffic Control Devices. The designer shall be responsible for obtaining traffic control permit.

h). **Erosion Control:** Conform to the standards of the District Department of Energy and the Environment or the States of Maryland or Virginia depending on the project location. The designer of record shall be responsible for obtaining all required approvals permits for all plans from the Authority Having Jurisdiction, as required. The approved plans for the erosion and sediment control permits and approved stormwater management plans shall be submitted to the AOC for record.

16.4.2. **Parking Areas:**

a). **General:** Design shall provide parking as specified in the building program and provide gradients across surface parking lots in accordance with industry best practices and regulatory requirements of the project location. Designs for new surface parking lots shall investigate options for the installation of pervious pavement materials. Also investigate alternatives to diagonal parking stalls.

b). **Parking Spaces:** Design shall provide parking spaces conforming to the following unless specified different by the AOC Authority Having Jurisdiction:

i. Size of parking spaces and access aisles: Refer to Table 16.4.1 for the minimum dimensions of full-sized parking spaces and Table 16.4.2 for the minimum dimensions of compact parking spaces. The quantity of compact parking spaces shall not diminish the existing spaces provided in any parking area without the approval of the AOC. Requirements for new parking areas shall be established on a project basis.

ii. Accessibility requirements: Comply with applicable provisions of the regulatory requirements listed in Section 1 General Requirements. The more stringent reference shall govern.

Table 16.4.1 - Minimum Dimensions for Full-Sized Parking Spaces and Aisles

Parking Angle	Stall Width	Depth of Stalls Perpendicular to Aisle	One Way Drive Aisle Width	Two Way Drive Aisle Width
45º	9 ft.	17.5 ft.	17 ft.	N/A
60º	9 ft.	19 ft.	17 ft.	N/A
90º	9 ft.	18 ft.	20 ft.	20 ft.
Parallel	22 ft.	8 ft.	12 ft.	20 ft.

Table 16.4.2 - Minimum Dimensions for Compact Parking Spaces and Aisles

Parking Angle	Stall Width	Depth of Stalls Perpendicular to Aisle	One-Way Drive Aisle Width	Two-Way Drive Aisle Width
45º	8 ft.	16.5 ft.	16 ft.	N/A
60º	8 ft.	17 ft.	16 ft.	N/A
90º	8 ft.	16 ft.	20 ft.	20 ft.
Parallel	20 ft.	8 ft.	12 ft.	20 ft.

c). **Paving:** Lots shall be asphalt pavement section. Section depth shall be designed by the Engineer corresponding to the requirements set forth by municipality having jurisdiction.

d). **Walkways:** Five foot minimum width to allow two persons to pass. Hold walkways adjoining parking stalls a minimum of 30" away from the curb. Design shall provide positive walkway cross-slope of 1:50 to ensure water runoff and to limit ice accumulation. For concrete walkways, design shall provide for 6" nominal thickness, 4,000 PSI, 5 percent air-entrained concrete, exposed aggregate finish over 4" of porous fill and shall be in accordance with the regulatory requirements listed in Section 1 General Requirements.

e). **Gratings:** Do not locate grates, inlets, etc. in walkways.

f). **Lighting:** Design shall provide lighting meeting the luminance levels specified below. Additionally, refer to Lighting Requirements, G502.

i. Standard parking: Two (2) footcandle minimum, uniform across all parking areas.

ii. Secure parking: Two (2) footcandle minimum, uniform across all parking areas.

g). **Pavement Markings:** Markings shall meet the requirements of the Manual of Uniform Traffic Control, ADA, and the project locations Department of Transportation requirements. Design shall use hot-thermal-plastic paint for roadways and permanent line paint for parking lots.

16.4.3. **Pedestrian Paving:**

a). **General:** Design shall provide pedestrian paving in accordance with the Capitol Ground's requirements and/or the requirements set forth in this section. The most stringent requirements shall govern.

b). **Standard Concrete Walks:** Design shall provide minimum 5-foot-wide sidewalks, 6" nominal thickness, 4,000 PSI, 5 percent air-entrained concrete, exposed aggregate finish over 4" of porous fill and shall be in accordance with the regulatory requirements listed in Section 1 **General Requirements**. Design shall provide positive cross-slopes of 1:50 to prevent ponding of water and accumulation of ice. Reinforce all walks with suitable welded wire fabric.

i. **Walks Subject to Vehicular Traffic:** 6" nominal thickness, 4,000 PSI, 5 percent air- entrained concrete, rough floated finish over 4" of porous fill and shall be in accordance with the regulatory requirements listed in Section 1 General Requirements.

ii. **Control Joints:** Tooled control joints matching existing patterns.

c). **Exposed Aggregate Concrete Walks:** Design shall use only where directed by AOC Project Manager. Exposed aggregate concrete sidewalks require higher maintenance/replacement than standard finished concrete. Comply with AOC Guide Specifications and regulatory requirements listed in Section 1 **General Requirements**.

d). **Expansion Joints:** Design shall provide cork expansion joints at maximum spacing of 60 feet (18,000 mm), with load-transfer assemblies penetrating the joints to prevent vertical displacement. Seal tops of all expansion joints with urethane sealants.

e). **Concrete Pavers:** Design shall use only when approved by the AOC.

f). **Joint Sealants:** Urethane compounds for all horizontal joints in exterior pedestrian paving.

g). **Granite Curbs:** Design shall provide granite curbs where required to match existing DC installations. Specifications for granite curbs are included in AOC Guide Specifications.

h). **Accessible Ramps:** Design shall comply with latest requirements established by ADA, DDOT, VDOT, MSHA and the accessibility requirements listed in Section 1 **General Requirements**.

16.4.4. **Site Development:**

a). **General:** This section deals with fountains, fences standards, site furnishings, exterior signs, flagpoles, etc.

b). **Ornamental Metal Fences:** Designs for all ornamental fences shall be approved by Congressional Leadership, based upon the recommendation of the AOC Landscape Architect and AOC Historic Preservation Officer.

c). **Chain Link Fences:** Chain link fences shall be coated with black vinyl with matching rails,

fasteners, and hardware.

d). **Construction Fences:** In prominent locations, provide wood fences with wood moldings (AOC Standard Construction Fence) and paint in off-white or "putty" color as approved by the AOC Landscape Architect. In less prominent locations provide wood fences without wood moldings (AOC Utility Construction Fence) and painted as above. For construction fences located off the Capitol complex, provide standard galvanized steel chain link fences.

e). Exterior signs shall be in accordance with the regulatory requirements listed in Section 1 General Requirements, as applicable.

16.5. **Site Plumbing:**

16.5.1. **Site Water Supply and Distribution Systems:**

a). **General:** Design shall provide a water distribution system conforming to the following:

i. **Basic Design:** Design and construction of water distribution systems within the Capitol complex shall meet the requirements set forth by DC Water. The Architect / Engineer is responsible for all municipal design approvals. Any deviation to specified requirements shall be approved by the AOC.

ii. **Piping:** Water pipe shall be minimum Ductile Iron Pipe Class 52. Pipe shall be capable of supporting all system test requirements. Note: Other piping materials may be required if soils and/or groundwater is of corrosive nature. Approval of pipe material shall receive DC Water concurrence. Pipe shall meet the requirements set forth by AWWA.

b). **Gate Valves:** Gate valves shall be resilient seated with rising stem and minimum working pressure of 200 psig. Direction of wrench nut rotation to open shall be as specified by DC Water. Minimum working pressure of gate valves 12 inch and smaller shall be 175 psi and 150 psi for gate valves larger than 12 inches.

c). **Backflow Preventers:** Backflow preventers shall be installed upstream of all fire protection and landscape and irrigation services and other potential sources of contamination of the public water system.

i. If possible, backflow preventers shall be installed within the building for security purposes and ease of maintenance.

ii. If backflow preventers are constructed within a vault, the vault shall be designed and constructed to prevent flooding and freezing of backflow preventer and to allow for ease of entry and for safe maintenance by AOC staff. Comply with OSHA requirements.

iii. Proper drainage is required of all vaults housing backflow preventers.

iv. Backflow prevention devices shall be installed in accordance with federal, state, local and AOC Policy requirements.

d). **Fire Valves:** Valves installed for fire protection system shall include post indicators.

e). **Fire Hydrants:** Hydrants shall be of an approved type and have not less than a 6 inch diameter connection to mains. Refer to NFPA 54 and local codes for additional requirements. Fire hydrants shall have local isolation valves.

16.5.2. **Site Sanitary Sewer Systems:**

a). **General:** Design shall provide gravity sewer system conforming to the following:

i. **Basic Design:** Design and construction of gravity sanitary sewer systems within the Capitol complex shall meet the requirements set forth by the AOC and DC Water. The most stringent requirement shall govern.

ii. **Piping:** Minimum pipe size shall be 8" in diameter. Slope as required to maintain minimum self-cleaning velocity of 2.0 fps.

iii. **Pipe Material:** Pipe material shall be PVC SDR 35 (15" or less) or 15” to 27” PVC meeting ASTM F679 or RCP applicable class. Pipe type and strength depends on soil and water conditions and depth of excavation. Pipe material shall be compatible with local conditions, such as character of waste to be discharged, loadings and discharge temperature. PVC shall not be used if temperature is 120 degrees or above.

b). **Manholes:** Manholes shall be constructed of precast concrete (where applicable) and shall meet AASHTO HS20-44 loading requirements. Size of manhole shall be dependent on pipe size, depth of structure,

buoyancy and need of maintenance.

c). **Existing Service:** Maintain existing AOC service at all times. Design and construction shall allow for operation of site sanitary sewer system at all times throughout the project area. Design or specify by-pass pumping system if approved by the AOC and DC Water. Sewage shall not be allowed to flow into or over surfaces to downstream sewer systems.

d). **As-Built Conditions:** The designer shall add the following sentences to specification sections: "Upon completion of installation and all applicable testing, the installed system shall be camera surveyed by an independent contractor to document "as-built" conditions. As-built drawings of invert elevations, pipe material, and size shall also be prepared by a PE or LS registered in the District of Columbia. Submit videotape, report of findings and as-built drawings to the AOC."

16.5.3. **Site Storm Water Systems:**

a). **General:** Design shall provide gravity storm system conforming to the following:

i. **Basic Design:** Design and construction of gravity storm water systems within the Capitol complex shall meet the requirements set forth by the applicable municipalities within the District of Columbia (DC Water, DCDDOT, DOEE). For those AOC facilities located in Maryland and Virginia comply with applicable regulations of the project location.

ii. **Stormwater Management:** Each project shall comply with the requirements set forth by the District municipality. The AOC shall approve the location of all BMP's.

iii. **Piping:** Minimum pipe size shall be 15 inches in diameter. Slope as required to maintain minimum self-cleaning velocity of 2.0 feet per second.

iv. **Pipe Material:** Pipe material shall be RCPR (Reinforced Concrete Pipe with Rubber Gasket) minimum Class III.

b). **Manholes:** Manholes shall be constructed of precast concrete (where applicable) and shall meet American Association of State Highway Transportation Officials (AASHTO) HS20-44 loading requirements. Size of manhole shall be dependent on pipe size, depth of structure, buoyancy and need for maintenance.

c). **Existing Service:** Maintain existing AOC service at all times. Design and construction shall allow for operation of site storm water systems at all times throughout the project area following the provisions of the approved storm water management plan. Design or specify by-pass pumping system if approved by the AOC and DC Water.

d). **As-Built Conditions:** The designer shall add the following sentences to specification sections: "Upon completion of installation and all applicable testing, the installed system shall be camera surveyed by an independent contractor to document "as-built" conditions. As-built drawings of invert elevations, pipe material, and size shall also be prepared by a PE or LS registered in the District of Columbia. Submit videotape, report of findings, and as-built drawings to the AOC."

16.5.4. **Site Gas System:**

a). Utility gas meter, primary regulator and piping systems located on the site up to the facility for natural gas service shall be supplied and comply with all requirements of Washington Gas Company. Maximum design operating pressure for piping systems located inside buildings shall be five (5) psig. Consult Washington Gas Company for exceptions. For projects at Fort Meade, Maryland, the gas service provider is Baltimore Gas and Electric whose requirements shall be followed.

16.6. **Restrictions:**

a). Drawings shall be prepared at a large enough scale to ensure that an accurate representation is shown on the plans. Standard scale for construction and as-built plans shall be no less than 1" = 20'. Standard profile scale shall be no less than 1" = 20' horizontally and no less than 1" = 5' vertically. The scale used on the as-built plan shall be the same as the scale of the approved construction plan.

b). Plans shall be in accordance with the codes and standards of Section 1 General Requirements.

c). Plans shall be updated as necessary prior to commencement of any site work and after site visit with AOC representative, Contractor, and applicable Jurisdiction's representative.

d). Blasting is not permitted.
e). Do not start design prior to verifying utility information.
f). Direct Buried Conduit: Do not use direct buried cables of any type.
g). Do not use aluminum bus.
h). Do not use chain-link construction fences within the Capitol complex without written AOC approval.
i). Do not use fiberglass or lightweight metal poles or pole accessories.

Section C – Appendix

1. **Acronyms**

A/E – Architect/Engineer
AABC – Associated Air Balance Council
AAMA – American Architectural Manufacturers Association
AASHTO – American Association of State Highway and Transportation Officials
ACI – American Concrete Institute
ADA – Americans with Disabilities Act
ADAAG – Americans with Disabilities Act Accessibility Guidelines
ADM – Aluminum Design Manual
ADP – Automated Data Processing
AEG – Association of Environmental and Engineering Geologists
AF & PA – American Forest & Paper Association
AHRI - Air Conditioning, Heating and Refrigeration Institute
AHU – Air Handling Unit
AIC – American Institute for Conservation of Historic and Artistic Works
AIP – AOC Building Automation and Control System Communication Integration Plan
ALC – Automated Logic Control
AMCA – Air Movement and Control Association
ANLA – American Nursery and Landscape Association
ANSI – American National Standards Institute
ANSI/ASME Standard A17.1- Safety Code for Elevators and Escalators
AOC – Architect of the Capitol
ASCE – American Society of Civil Engineers
ASD – Allowable Stress Design
ASHRAE – American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME – American Society of Mechanical Engineers
ASPE – American Society of Plumbing Engineers
ASSE – American Society of Safety Engineers
ASTM – American Society for Testing and Materials
ATFP – Anti-Terrorism / Force Protection
ATS – Automatic Transfer Switches
AWG – American Wire Gauge
AWI – Architectural Woodwork Institute
BAS – Building Automation System
BEF – Ballast Efficiency Factor
BHMA – Builders Hardware Manufacturers Association
BIA – Brick Institute of America
BICSI – Building Industry Consulting Service International
BLCC – Building Life Cycle Cost software
BTL – BACnet Testing Labs
CATV – Cable Television
CCTV - Closed Circuit Television
CDA – Copper Development Association
CDC – Center for Disease Control
CFL – Compact fluorescent
CFR – Code of Federal Regulations
CISPI – Cast Iron Soil Pipe Institute
CLR – Cultural Landscape Report

CRAC – Computer Room Air Conditioning units
CPP – Capitol Power Plant
DBT – Design Basis Threats
DC – District of Columbia
DC Water – District of Columbia Water and Sewer Authority (formerly DC WASA)
DCFD – District of Columbia Fire Department
DDC – Direct Digital Controls
DOEE-District Department of Energy and Environment
DHI – Door and Hardware Institute
EIFS – Exterior Insulation and Finish Systems
EISA – The Energy Independence and Security Act of 2007
EM – Engineering Manual
EMT – Electrical metallic tubing
EPA – Environmental Protection Agency
EPAct – Energy Policy Act of 2005
EPDM – Ethylene Propylene Diene Monomer roof systems
EPO – Emergency Power Off
EPP – Environmentally Preferable Purchasing (EPP) Program
Et – Evapotransportation
FAR – Federal Acquisition Regulation
FCU – Fancoil Unit
FEMA – Federal Emergency Management Agency
FEMP – Federal Energy Management Program
FFT – Fast Fourier Transform
FHWA – Federal Highway Administration
FMC – Flexible Metal Conduit
FOUO – For Official Use Only
FPM – Feet Per Minute
FSC – Forest Stewardship Council
GFCI – Ground Fault Circuit Interrupter
GPM – Gallons Per Minute
GSA – General Services Administration
HGL – Hydraulic Grade Line
HMMA – Hollow Metal Manufacturers Association
HPO – Historic Preservation Officer
HSS – Hollow Structural Sections
HUD – Housing and Urban Development
HVAC – Heating, Ventilating, and Air Conditioning
IAQ – Indoor Air Quality
ICC – International Code Council
IEBC – International Existing Building Code
IEC – International Electric Code
IEEE – Institute of Electrical and Electronics Engineers
IEQ – Indoor Environmental Quality
IES or IESNA – Illuminating Engineering Society of North America
IGC – International Gas Code
IMC – Intermediate Metal Conduit
IMC – International Mechanical Code
IPC – International Plumbing Codes
KCMA – Kitchen Cabinet Manufacturers Association
LCC – Life Cycle Costing

LEED – Leadership in Energy and Environmental Design
LF – linear feet
LFMC – Liquidtight Flexible Metal Conduit
LGR – Logic Gateway Router
LOC – Library of Congress
LRFD – Load Resistance Factor Design
MAC – Multi-Award Contract
MOT – Maintenance of Traffic
MPI – Master Painters Institute
MUTCD – Manual of Uniform Traffic Control Devices for Street and Highways
NAAMM – National Association of Architectural Metal Manufacturers
NARA – National Archives and Records Administration
NASPEC – North American Specification for Design of Cold-Formed Steel Structural Members
NCMA – National Concrete Masonry Association
NDS – National Design Specification
NEBB – National Environmental Balancing Bureau
NEC – National Electric Code
NECA – National Electrical Contractors Association
NEHRP – National Earthquake Hazards Reduction Program
NEMA – National Electrical Manufacturers Association
NFPA – National Fire Protection Association
NFPA 10 **–** Standard for Portable Fire Extinguishers
NFPA 101 **–** Life Safety Code
NFPA 110 **–** Standard for Emergency and Standby Power Systems
NFPA 111 **–** Standard on Stored Electrical Energy Emergency and Standby Power Systems
NFPA 13 **–** Standard for the Installation of Sprinkler Systems
NFPA 14 **–** Standard for the Installation of Standpipe Private Hydrant, and Hose Systems
NFPA 17 – Standard for Dry Chemical Extinguishing Systems
NFPA 17A **–** Standard for Wet Chemical Extinguishing Systems
NFPA 20 **–** Standard for the Installation of Stationary Pumps for Fire Protection
NFPA 214 **–** Standard on Water-Cooling Towers
NFPA 230 – Standard for the Fire Protection of Storage
NFPA 231 – Standard for General Storage
NFPA 232 **–** Standard for the Protection of Records
NFPA 232A **–** Guide for Fire Protection for Archives and Records Centers
NFPA 24 – Standard for the Installation of Private Fire Service Mains and Their Appurtenances
NFPA 241 **–** Standard for Safeguarding Construction, Alteration, and Demolition Operations
NFPA 25 – Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
NFPA 255 – Standard Method of Test of Surface Burning Characteristics of Building Materials
NFPA 30 **–** Flammable and Combustible Liquids Code
NFPA 30A – Code for Motor Fuel Dispensing Facilities and Repair Garages
NFPA 480 **–** Storage, Handling, and Processing of Magnesium Solids and Powders
NFPA 54 – National Fuel Gas Code
NFPA 70 **–** National Electrical Code
NFPA 70E – Standard for electrical safety in the workplace
NFPA 72 **–** National Fire Alarm Code
NFPA 75 **–** Standard for the Protection of Information Technology Equipment
NFPA 780 **–** Standard for the Protection of Lighting Protection Systems
NFPA 80 – Standard for Fire Doors and Other Opening Protectives
NFPA 85 – Boiler and Combustion Systems Hazards Code
NFPA 88A **–** Standard for Parking Structures

NFPA 914 **–** Code for Fire Protection of Historic Structures
NFPA 92A **–** Standard for Smoke-Control Systems Utilizing Barriers and Pressure Differences
NFPA 92B **–** Standard for Smoke Management Systems in Malls, Atria, and Large Spaces
NFPA 96 **–** Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations
NIST – National Institute of Standards and Technology
NJG – National Joint Guideline
NPDES – National Pollutant Discharge Elimination System
NRC – Noise Reduction Coefficients
NRCA – National Roofing Contractors Association
NSF – National Sanitation Foundation
O&M – Operations and Maintenance
OCPD – Overcurrent protection device
ODS – Ozone Depleting Substances
OSHA – Occupational Safety and Health Administration
PBS-P100 – Facilities Standards for the Public Buildings Service by GSA
PCI – Precast Concrete Institute
PDI – Plumbing and Drainage Institute
PEPCO - Potomac Electric and Power Company
PLC – Programmable Logic Controller
PLM – Polarized Light Microscopy
POR – Program of Requirements
POTW – Publicly Owned Treatment Works
PVC - Polyvinyl chloride
RH – Relative Humidity
RMS – Root Mean Square
SCIF – Sensitive Compartmented Information Facility
SCR – Silicon Controlled Rectifier
SDI – Steel Door Institute
SEI – Structural Engineering Institute
SJI – Steel Joist Institute
SMACNA - Sheet Metal and Air Conditioning Contractors National Association
SOC – Solution Order Contracting
SRG – Signal Reference Grid
SRI – Solar Reflectance Index
TABB – Testing, Adjusting, and Balancing Bureau
TCLP – Toxicity Characteristic Leaching Procedure
TEM – Transmission Electron Microscopy
TMS – The Masonry Society
TSS – Total Suspended Solids
UFAS – Uniform Federal Accessibility Standards
UL – Underwriters Laboratories
UPS – Uninterruptible Power Supply
USDA – United States Department of Agriculture
USGBC – US Green Building Council
UST – Underground Fuel Oil Storage Tanks
VA – Volt amperes
VAV – Variable Air Volume
VCT – Vinyl Composition Tile
VDC – Direct Current Volt
VFD – Variable Frequency Drive
VOC – Volatile Organic Compounds

VVVF – Variable Voltage Variable Frequency
WALCA – Washington Area Landscape Contractors Association
WDMA – Window and Door Manufacturers Association
WRI – Wire Reinforcement Institute
WWR – Welded Wire Reinforcement

2. **Agency Contacts**

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U.S. Botanic Garden Executive Director	202.225.6670
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Capitol Power Plant Superintendent	202.225.4380
Electrical and Electronic	202.226.3471
Engineering Branch	202.224.9827
Environmental Division	202.225.4043
Fire Marshal	202.226.3460
Fire Protection Engineer	202.226.4887
Historic Preservation Officer	202.226.4714
Library Buildings and Grounds, including Ft. Meade, Culpepper sites	202.707.5157
Mechanical Engineering Branch	202.225.5900
Office of Security Programs	202.593.0218
Procurement	202.226.1935
Technical Support Branch	202.225.5900
Utilities Director	202.225.4380