Facilities Standards for the Public Buildings Service

March 2005

U.S. GENERAL SERVICES ADMINISTRATION

OFFICE OF THE CHIEF ARCHITECT

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ON THE COVER

United States Courthouse
Seattle, Washington
Architect: NBBJ
GSA Project Manager:
Rick D. Thomas

U.S. General Services Administration
Public Buildings Service
Office of the Chief Architect
1800 F Street, NW
Washington, DC 20405

P B S - P 1 0 0

More Information: http://www.gsa.gov/P100

General Requirements

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United States Courthouse

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The *Facilities Standards* and other design standards are also located on the Internet at http://hydra.gsa.gov/pbs/pc/facilitiesstandards/

1.1 Purpose of the Facilities Standards for the Public Buildings Service

The *Facilities Standards for the Public Buildings Service* establishes design standards and criteria for new buildings, major and minor alterations, and work in historic structures for the Public Buildings Service (PBS) of the General Services Administration (GSA). This document applies to all new facilities or alterations of GSA owned, or lease construction with Government Option to Purchase (See Section 1.3) buildings. It is recommended that the *Facilities Standards* apply to significant build-to-suit lease buildings. This document contains policy and technical criteria to be used in the programming, design, and documentation of GSA buildings.

The *Facilities Standards* is a building standard: it is not a guideline, textbook, handbook, training manual or substitute for the technical competence expected of a design or construction professional.

The *Facilities Standards* shall be used in conjunction with the specific building program for each project, which delineates all project information, such as number and sizes of building spaces, and requirements for mechanical, electrical and other operating systems. It is imperative that each building be designed so that all components comprise an integrated solution, so that operation of the facility, energy usage and other criteria may be maximized.

Since the *Facilities Standards* contain general criteria, there may sometimes be conflicts between the *Facilities Standards* and specific project requirements. The Office of the Chief Architect, Public Buildings Service, General Services Administration, Washington, DC 20405, (202) 501-1888, may be contacted for clarification of any particular requirement.

The provisions of this document are not intended to prohibit the use of alternative systems, methods, or devices not specifically prescribed by this document, provided GSA has approved such alternatives. All technical documentation shall be submitted to the GSA Project Manager. The technical documentation submitted shall demonstrate that the proposed alternative design is at least equivalent or superior to the prescribed requirements in this document with regard to quality, strength, effectiveness, fire resistance, durability, and safety. It is not to be considered a waiver or deletion of a requirement, but shall be recognized as being equivalent protection and in compliance with the technical requirements of this document. The alternative system, method, or device shall be approved when the GSA technical design professional determines that the proposed alternative design is deemed equivalent or superior to the intent of the prescribed requirements of this document for the intended purpose.

U.S. Census Bureau, Bowie, MD.

1.2 General Design Philosophy

As addressed in Appendix A2, all program goals shall be developed with integrated design practices. The following objectives are to be reflected in project programming and design:

Design Quality

GSA is committed to excellence in the design and development of its sites and buildings. For GSA, this means an integrated approach that achieves the highest quality of aesthetics in meeting the requirements of the building's users and accomplishing the mission of the Federal client agency, while at the same time delivering a building that is cost effective to maintain throughout its useful life and is a lasting architectural legacy that will serve the American people for many decades.

Most of the interaction between the Government and its citizens occurs in GSA buildings. Federal buildings express the image of the Government to the public. The Guiding Principles for Federal Architecture, written in 1962 by Senator Daniel Patrick Moynihan, then Special Assistant to the Secretary of Labor, and issued by the Kennedy Administration, embody GSA's commitment to produce quality design and construction. See Figure 1-1.

Design Excellence and Construction Excellence

The GSA Design Excellence Program was formally initiated in 1994 and the Construction Excellence Program in 1998. These programs ensure GSA's long-term commitment to excellence in public architecture, engineering, and construction. The selection of private

sector architects and engineers who design GSA facilities is based foremost on their talent, creativity, and ingenuity. The entire architect/engineer (A/E) design team must demonstrate its ability to satisfy the comprehensive project development and management requirements of the Federal Acquisition Regulations (FAR). The Design Excellence Program incorporates peer professional in the selection of A/E design teams and the review of proposed designs. The peer professionals are distinguished architects, engineers, landscape architects, urban designers, public arts administrators, design educators and critics from across the Nation. The main goal of the Design Excellence Program is to realize the objectives of the Guiding Principles of Federal Architecture.

The main goal of the Construction Excellence Program is to ensure that GSA's construction program delivers exceptionally well-built facilities economically, efficiently, and professionally. Like the Design Excellence Program, the Construction Excellence Program depends on a strong working relationship with the private sector design and construction community.

Flexibility and Adaptability

Federal buildings undergo many changes during their lifetime. As government missions change and priorities change, Federal agencies are created, expanded, and abolished. As a consequence, requirements for space and services change frequently, and space must be reconfigured often. The flexibility to accommodate continual change needs to be "built in" to the building design from the outset and respected in subsequent alterations. Systems flexibility is necessary in GSA buildings.

Sustainability and Energy Performance

GSA is committed to incorporating principles of sustainable design and energy efficiency into all of its building projects. Sustainable design seeks to design, construct and operate buildings to reduce negative impact on the environment and the consumption of natural resources. Sustainable design improves building performance while keeping in mind the health and comfort of building occupants. It is an integrated, synergistic approach, in which all phases of the facility lifecycle are considered. The result is an optimal balance of cost, environmental, societal and human benefits while meeting the mission and function of the intended facility or infrastructure.

Costs

It is imperative that Federal Facilities be designed with the objective of achieving lowest life cycle cost for the taxpayer. To do so, a project's design program must comprehensively define reasonable scope and performance requirements, and must match those needs to an appropriate overall budget. Consistent with programming and budgetary constraints, designed building systems/ features that influence operating costs must then be analyzed and selected to achieve lowest overall life cycle cost.

Life cycle costing will always require the application of professional judgement. While life cycle cost assessments can often be based upon the merits of single system/ feature comparisons, the A/E is expected to expand the analysis to include other systems/features when necessary to establish synergistic effects and first cost trade-offs. There will also be instances where involved life cycle cost elements are not well defined within the industry, defying

credible inclusion with known cost impacts. In such cases, life cycle cost comparisons must be weighed with qualitative issues when making design decisions.

Operations and Building Maintenance

Systems and materials should be selected on the basis of long-term operations and maintenance costs as those costs will be significantly higher over time than first costs. The design of the facility operating systems should ensure ease and efficiency of operation and allow for easy and cost effective maintenance and repair during the facility's useful life.

The designer should obtain constant feedback from the building manager and other maintenance personnel during design. This collaboration will allow the facility to be designed with adequate understanding by both the designer and the building manager as to what is required for optimal life-cycle performance.

GSA requires detailed instructions from the designer stating the operational/maintenance procedures and design intent for all building systems. These instructions will be developed during the design phase and incorporated into the comprehensive training for operation and maintenance personnel.

Historic Buildings

The Historic Buildings program was formally initiated in 1998 as part of the Historic Buildings and the Arts Center of Expertise, established in 1997. The Historic Buildings program provides strategic and technical support to GSA business lines and regional project teams to promote the reuse, viability, and architectural design integrity of historic buildings GSA owns and leases. This mission requires GSA to be on the cutting edge in developing innovative design solutions that are affordable, extend the useful life of historic structures, and minimize the negative effects of changes needed to keep buildings safe, functional, and efficient.

The National Historic Preservation Act of 1966 mandates that Federal agencies use historic properties to the greatest extent possible and strive to rehabilitate them in a manner that preserves their architectural character, in accordance with the Secretary of the Interior's Standards for Rehabilitation. Nearly one-fourth of the space in GSA's owned inventory is in historic buildings. Regional Historic Preservation Officers coordinate external design reviews required under the Act and serve as first points of contact within each region to ensure that projects follow the Secretary's Standards while satisfying GSA's functional requirements.

Principal goals of the Historic Buildings program are to realize the objectives of the National Historic Preservation Act by: a) developing strategies that enable reuse of GSA's historic buildings and b) developing creative design solutions to resolve conflicts between preservation, codes, and functional requirements of modern office use. The program depends on the integral involvement of preservation design professionals in the A/E team throughout design development and project execution and on effective coordination between the design team, GSA preservation staff, and outside review groups.

Art-in-Architecture

GSA has a policy of incorporating fine art into the design of new Federal buildings and in major repair and alterations of existing Federal buildings. One half of one percent of the estimated construction cost is reserved for commissioning works by living artists. These works are acquired through a commissioning process that involves public participation by art professionals, community representatives (including the primary client), and the architect of the building. The A/E team has a responsibility to work with GSA to ensure that the art is an integral component of the building.

Urban Design and Community Development

GSA is committed to maximizing the returns on its Federal real estate investment and to leveraging its investments in ways that support communities, wherever possible. Collaboration with local officials, neighboring property owners, residents, and appropriate interest groups is essential to shape the project in ways that provide positive benefits to the surrounding neighborhood and community.

Project teams should seek out potential issues and collaborate with local partners to solve them. Aggressive identification of issues and opportunities is necessary to minimize project risk and delay, strategize the long term use and maintenance of the facility, maximize the project's positive impact on the community, and bring local resources to bear on delivering the best final product to GSA clients.

Issues of common interest, such as facility location, architectural and urban design, parking, transportation, and security provide significant opportunities to work to address issues. Partners should include not only city officials but other entities with relevant knowledge, concerns, or resources. Formal planning and consultation processes, such as NEPA, zoning, or Section 106, are important. But less formal planning, information sharing, and problem solving activities can be equally valuable to the project team.

First Impressions

The GSA First Impressions Program is a comprehensive, nationwide effort to improve the appearance of the public areas inside and surrounding our existing buildings. The program is comprised of five basic principles: streamlining security, consolidating functions, unifying signage, reducing clutter, and where necessary, implementing architectural modifications to transform the building's overall image. These principles should be applied to any building modernization, repair and alterations project, security upgrade, or landscape improvement that affects the public areas of a property. For mor information visit, **www.gsa.gov/firstimpressions**.

The Integrated Workplace and WorkPlace 2020

The GSA supports an interior design program that provides tenants with superior workplace environments that meet their business goals and enhances employee health, satisfaction, and performance. The workplace is successful when it is a strategic tool that is integral to business and real estate goals. It should provide an effective workplace for federal employees reflecting the clients' culture, motivation, business strategy and nature of their work.

PBS has developed the WorkPlace 2020 Program to help particular organizations identify the unique nature of its work, its culture and its organizational goals, and to directly link design recommendations based on those understandings to the workplace. For more information, visit the WorkPlace 2020 website at: **www.gsa.gov/workplace2020**, or **www.gsa.gov/integratedworkplace**.

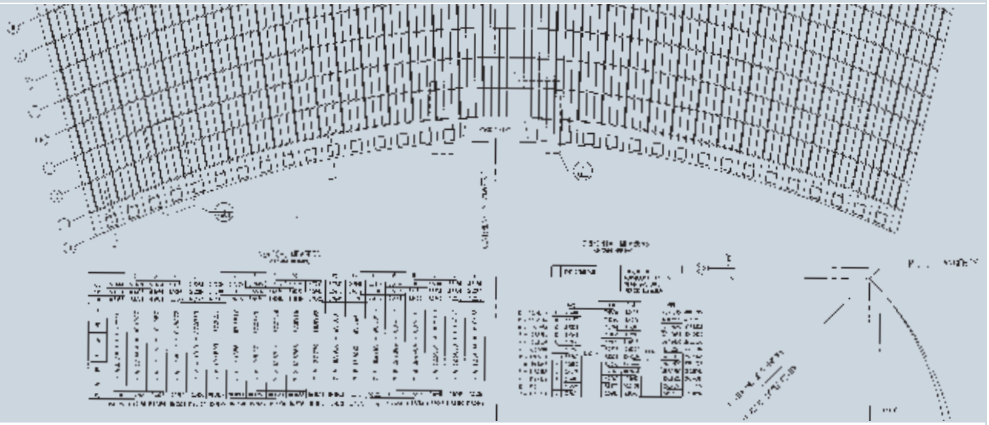
Figure 1-1 Guiding Principles for Federal Architecture

In the course of its consideration of the general subject of Federal office space, the committee has given some thought to the need for a set of principles which will guide the Government in the choice of design for Federal buildings. The committee takes it to be a matter of general understanding that the economy and suitability of Federal office design space derive directly from the architectural design. The belief that good design is optional, or in some way separate from the question of the provision of office space itself, does not bear scrutiny, and in fact invites the least efficient use of public money.

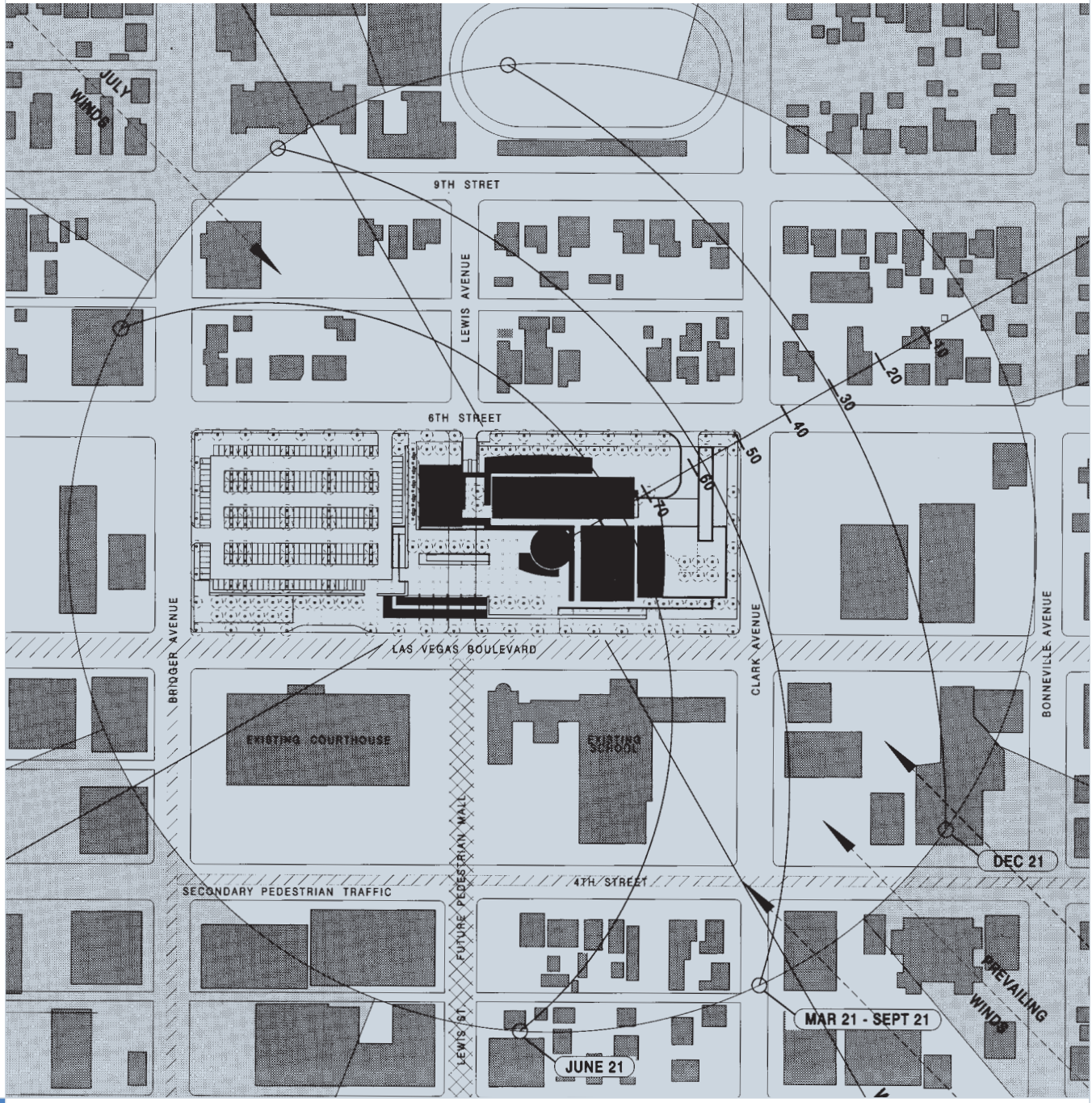
The design of Federal office buildings, particularly those to be located in the nation's capital, must meet a two-fold requirement. First, it must provide efficient and economical facilities for the use of Government agencies. Second, it must provide visual testimony to the dignity, enterprise, vigor and stability of the American Government.

It should be our object to meet the test of Pericles' evocation to the Athenians, which the President commended to the Massachusetts legislature in his address of January 9, 1961: "We do not imitate – for we are a model to others."

The committee is also of the opinion that the Federal Government, no less than other public and private organizations concerned with the construction of new buildings, should take advantage of the increasingly fruitful collaboration between architecture and the fine arts. With these objects in view, the committee recommends a three point architectural policy for the Federal Government.



The policy shall be to provide requisite and adequate facilities in an architectural style and form which is distinguished and which will reflect the dignity, enterprise, vigor and stability of the American National Government. Major emphasis should be placed on the choice of designs that embody the finest contemporary American architectural thought. Specific attention should be paid to the possibilities of incorporating into such designs qualities which reflect the regional architectural traditions of that part of the Nation in which buildings are located. Where appropriate, fine art should be incorporated in the designs, with emphasis on the work of living American artists. Designs shall adhere to sound construction practice and utilize materials, methods and equipment of proven dependability. Buildings shall be economical to build, operate and maintain, and should be accessible to the handicapped.	1
The development of an official style must be avoided. Design must flow from the architectural profession to the Government, and not vice versa. The Government should be willing to pay some additional cost to avoid excessive uniformity in design of Federal buildings. Competitions for the design of Federal buildings may be held where appropriate. The advice of distinguished architects, as a rule, ought to be sought prior to the award of important design contracts.	2
The choice and development of the building site should be considered the first step of the design process. This choice should be made in cooperation with local agencies. Special attention should be paid to the general ensemble of streets and public places of which Federal buildings will form a part. Where possible, buildings should be located so as to permit a generous development of landscape. *— Daniel Patrick Moynihan*	3


JULY WINDS
9TH STRET
LEWIS AVENUE
6TH STREET
10
20
30
40
50
60
70
BRIDGER AVENUE
LAS VEGAS BOULEVARD
CLARK AVENUE
BONNEVILLE AVENUE
EXISTING COURTHOUSE
EXISTING SCHOOL
DEC 21
SECONDARY PEDESTRIAN TRAFFIC
4TH STREET
FUTURE PEDESTRIAN MALL
LEWIS ST.
PREVAILING WINDS
MAR 21 - SEPT 21
JUNE 21

1.3 National Codes and Standards

Federal Law. The Public Buildings Amendments of 1988, 40 U.S.C. 3312 (formerly section 21 of the Public Buildings Act of 1959, 40 U.S.C. 619), require that each building constructed or altered by GSA or any other federal agency shall, to the maximum extent feasible, be in compliance with one of the nationally recognized model building codes and with other applicable nationally recognized codes.

Nationally Recognized Codes. For all design and construction work performed on Federal Buildings by GSA or those functions under GSA's construction authority, GSA has adopted the technical requirements of the following nationally recognized codes referred to in this subsection. The technical requirements of these nationally recognized codes will supplement other GSA requirements mandated by Federal Laws and Executive Orders, as well as other GSA criteria noted within this document that has been established to meet our customers needs and their unique requirements. In addition, the latest edition of the nationally recognized codes, including the current accumulative supplements, in effect at the time of design contract award shall be used throughout design and construction of that project.

Building Code. The International Code Council (ICC) is a consolidated organization that is comprised of what was formerly the Building Officials and Code Administrators International, Inc. (BOCA), the International Conference of Building Officials (ICBO), and the Southern Building Code Congress International, Inc. (SBCCI). Based upon this consolidation and consistent with GSA's established national policy, the GSA will utilize the technical requirements of the family of codes issued by ICC in lieu of the National Building Code (published by BOCA), the Uniform Building Code (published by ICBO), and the Standard Building Code (published by SBCCI).

The ICC family of codes includes, but is not limited to: International Building Code (IBC), International Fire Code (IFC), International Plumbing Code (IPC), International Mechanical Code (IMC), and the International Energy Conservation Code (IECC). The ICC family of codes is available through **www.iccsafe.org/.**

Furthermore, the National Fire Protection Association (NFPA) has established its own family of national model codes and standards. Consistent with GSA's long-standing policy to comply with local codes and standards to the maximum extent practicable, NFPA codes may be used (to the maximum extent practicable) in jurisdictions where NFPA codes have been duly adopted by that locality.

Life Safety Code. GSA has adopted the technical egress requirements of the NFPA, Life Safety Code (NFPA 101), in lieu of the technical egress requirements of the IBC. NFPA 101 is available through **www.nfpa.org/.**

National Electric Code. GSA has adopted the technical electrical requirements of the NFPA, National Electric Code (NFPA 70), in lieu of the technical electrical requirements of the ICC Electrical Code. The National Electrical Code is available through **www.nfpa.org/.**

State and Local Codes. GSA recognizes that the national building codes are typically the foundation of state and local building codes. However, state and local codes also represent important regional interests and conditions. As such, State and Local building codes shall also be followed to the maximum extent practicable.

Legally, however, buildings built on Federal property are exempt from State and local building codes. Notwithstanding, it is GSA's policy to comply with State and local building codes to the maximum extent practicable.

National Standards. The latest edition of the nationally recognized standards herein, in effect at the time of design contract award shall be used during design and construction.

Lease Construction. Lease construction is defined as new construction of a building for Government use in response to GSA's formal solicitation for offers. The construction may be either on a pre-selected site assigned by GSA to the successful offeror or on the offeror's site. Therefore, the building will be developed on private land and the building will be leased to GSA. In these cases, the applicable State and local government codes apply. The developer/owner (i.e., offeror) must also obtain the necessary building permits and approvals from the appropriate State and/or local government officials. The Facilities Standards do not apply to Lease Construction, it does, however, apply to Lease Construction with Government Option to Purchase and is recommended for significant build-to-lease buildings. For requirements for Lease Construction see SFO specific program, i.e. seismic, environmental, fire safety, accessibility, etc.

Lease Construction with Government Option to Purchase. In cases where GSA's formal solicitation for offers has an option for GSA to purchase the building at a future date, the GSA adopted nationally recognized codes and requirements apply as well as the applicable State and local government codes. Should a conflict exist between applicable State and local government codes and the GSA requirements, the GSA requirements take precedence. However, GSA shall carefully consider each conflict based on adequacy, cost, and nationally accepted practice. In addition, the developer/owner must also obtain the necessary building permits and approvals from the appropriate State and/or local government officials as well as from GSA.

Conflicts between Nationally Recognized Codes and GSA Requirements. To ensure flexibility, it is GSA policy to make maximum use of equivalency clauses in all nationally recognized codes. Should a conflict exist between GSA requirements and the GSA adopted nationally recognized codes, the GSA requirement shall prevail. All code conflicts shall be brought to the attention of the GSA Project Manager for resolution.

Code Requirements for Alterations. Generally, involved building systems need only be upgraded to correct deficiencies identified by GSA, unless the entire building is being renovated. All new work is required to meet the applicable nationally recognized codes adopted by GSA and interpreted by the specific GSA Region. If only a portion of the building is being renovated, the IBC shall be evaluated to determine if the entire building must be brought up to code compliance. Any questions or concerns should be discussed with the GSA Project Manager.

Zoning Laws. During the planning process and development of associated environmental documentation for new construction and renovation projects, GSA shall consider all requirements (other than procedural requirements) of zoning laws, design guidelines, and other similar laws of the State and/or local government. This includes, but is not limited to, laws relating to landscaping, open space, building setbacks, maximum height of the building, historic preservation, and aesthetic qualities of a building. The project design team is to fully address such laws and requirements in their planning and design documents. Any proposed deviations from such laws are to be documented, fully justified, and brought to the attention of the GSA Project Manager for resolution.

Local regulations must be followed without exception in the design of systems that have a direct impact on off-site terrain or utility systems (such as storm water run-off,

erosion control, sanitary sewers and storm drains and water, gas, electrical power and communications, emergency vehicle access, and roads and bridges).

With respect to the number of parking spaces, the requirements stated in the building program take precedence over zoning ordinances in all cases. Although GSA may not be able to directly compensate for displaced parking (as a result of site acquisition), the project team should seek creative alternatives and partnerships to address parking concerns brought about by GSA's development. Considerations may include shared parking facilities and strategies to encourage transit use.

In the case of leased facilities built on private land, all local zoning ordinances apply.

State and Local Government Consultation, Review, and Inspections. The GSA project manager shall provide to the appropriate State and/or Local Government officials the opportunity to review the project for compatibility with local plans, zoning compliance, building code compliance, and construction inspections. This must occur early in project design so that the design can easily respond to appropriate recommendations. This includes, but is not limited to the review of drawings and specifications, any on-site inspections, issuing building permits, and making recommendations for compliance with local regulations and compatibility with local fire fighting practices. The GSA Project Manager shall also inform the State and local government officials that GSA and its contractors will not be required to pay any amount for any action taken by the State and/or local government officials to carry out their mission. However, GSA shall review all recommendations made by State and local government officials. Each recommendation shall be carefully considered based on adequacy, cost, and nationally accepted practice. However, GSA has the final authority to accept or reject any recommendation from State and/or local government officials.

Zoning and other considerations relating to urban design issues. The design team should offer local officials an opportunity to informally review and comment on the design concept, for compatibility with local plans, zoning, and design guidelines. Key design milestones, such as at initial concepts and around the project's peer review sessions, offer logical timeframes for these reviews and can be especially helpful to the designers. If local officials choose to review the concept, the GSA project manager should establish a concise window in which comments can be accepted (e.g., no longer than 30 days), and this should be coordinated with the project design schedule. If local officials choose not to review the design concept, this should be noted in the project file.

Design review for code compliance. If the State and local government officials elect to review building designs for code compliance (i.e., final concepts, preliminary designs, and final working drawings), such design submissions will be officially forwarded to the appropriate local officials by the GSA Project Manager. Local officials will be provided 30 days for their review and comment in writing for each proposed design submission, with no time extensions. If comments are not received after the commenting period is over, the GSA Project Manager will proceed with project execution.

Construction Inspections. If the State and local government officials elect to perform code compliance construction inspections, the GSA Project Manager shall include special provisions in the A/E's and each contractor's contract to handle the additional requirement of coordinating their work with State and local government officials. Any findings resulting from such inspections by the State and local government officials shall be immediately communicated to the GSA Project Manager for consideration. It is to be clearly understood by all parties (e.g., State and local government officials, construction contractors, GSA, etc.)

that the State and local government officials do not have the authority to reject, accept, or make changes to the work and is there only to assist GSA in achieving code compliance.

State and local government recommendations. The GSA Project Manager should make an effort to incorporate State and local government recommendations when reasonable and when in the best interest of the Government. Notwithstanding, it is GSA's policy to comply with State and local building codes to the maximum extent practicable. GSA shall review all recommendations made by State and local government officials. Each recommendation shall be carefully considered based on adequacy, cost, and nationally accepted practice. However, GSA has the final authority to accept or reject any recommendation. The GSA Project Manager shall maintain a record of all recommendations and comments from State and local government officials for the duration of the project.

1.4 Guides

The *Facilities Standards* and the noted guides apply to the GSA building program.

(In case of conflict between the Facilities Standards *and a specific building guide, the guide takes precedence.)*

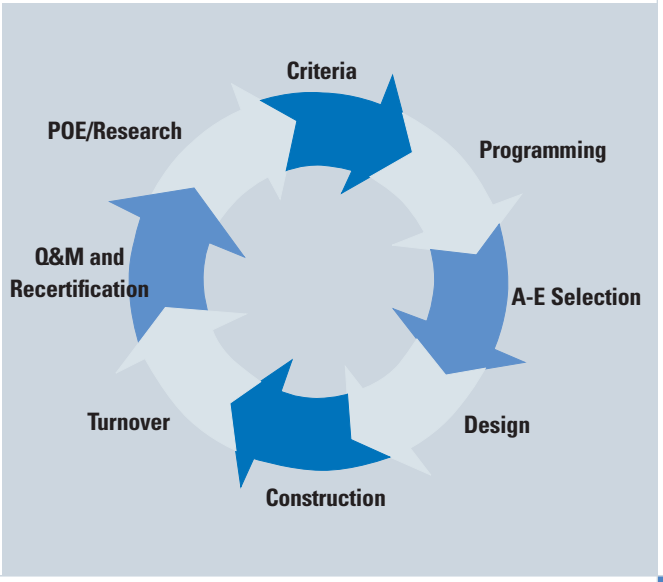
Federal Courthouses	See also: *U.S. Courts Design Guide; U.S. Marshals Service Requirements and Specifications for Special Purpose and Support Space Manual - sections 1,2 &,3; Courthouse Project Handbook, August 2004.*
Border Stations	See also: *United States Border Station Design Guide (PBS – PQ130).*
Child Care Centers	See also: *Child Care Center Design Guide (PBS – P140).*
Design Excellence	GSA PBS *Design Excellence, Policies and Procedures.* GSA PBS *Design Excellence in Leasing.* *The Whole Building Design Guide,* **www.wbdg.org**.
Fine Arts	GSA PBS *Fine Arts Program Desk Guide 2002.*

Project Development	GSA PBS *Project Management Guide.* GSA PBS *The Project Planning Guide.* GSA PBS *Cost Estimating Guide.* GSA PBS *The Building Commissioning Guide.*
Historic Buildings	See also: Secretary of the Interior's *Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings (36 CFR67).* GSA PBS *Growth Efficiency and Modernism.*
Landscape	See also: local standards. Also use *American Association of Nurserymen: ANSI Z60.1* in addition as a design guide.
Security	Interagency Security Committee's *Security Design Criteria.* GSA PBS *Design Notebook for Federal Lobby Security.*
Site Selection	GSA PBS *Site Selection Guide.* GSA PBS *Floodplain Management Deskguide.*

1.5 Commissioning

Definition. All GSA capital construction projects shall employ Total Building Commissioning (TBC) practices to assure delivery of program goals and related performance requirements. TBC practices shall be applied as described herein and compliant with the *GSA Building Commissioning Guide.* See **www.gsa.gov/commissioning** for more information.

As represented in the diagram below, GSA's commissioning process begins with design criteria (as contained within P-100) and client driven design programming requirements, reflected in design A/E selection factors, carried into design through technical submissions/reviews, followed by construction quality control/inspections and tests, leading to turnover practices for facility operations and subsequent recertification testing. This is followed by extended operating practices and the necessary lessons learned to both define research needs and subsequent criteria enhancement.



Commissioning Team. For GSA, commissioning is the responsibility of the entire delivery team. Each member must do their part to ensure that all decisions reflect programmed goals, that submissions/constructed features are reviewed/tested for effectiveness, and that proper docu-mentation is made to certify and support the maintenance of expectations.

Architect-Engineer Role. The design Architect-Engineer shall identify all functional and performance testing/certification requirements for designed features, systems, components, equipment, and materials, necessary to assure programmed performance goals. Commissioned parameters are to address functional/performance issues, not incidental quality control testing. Performance goals, and adequate testing procedures and certifications to assure achievement of these goals, shall be reflected within construction specifications. Construction specification references shall also define any required permanent testing, monitoring and research equipment/provisions.

Procedurally, the A/E is responsible for initiating Program Review Workshops at the beginning of each design submission stage, to review expectations and to identify delivery team concerns. The A/E shall coordinate with the Construction Manager and, if contracted separately, the Commissioning Authority, to fully define commissioning based issues and testing procedures.

Identifying Commissioning Requirements. Selected performance goals must balance the critical nature of expectations with inspection/testing and certification costs. The A/E shall coordinate with GSA's Project Manager and the project's Commissioning Authority to identify appropriate commissioning program goals and develop supporting inspection and testing practices. Commissioning practices and certifications are addressed within individual chapters of this document.

United States and Canada Shared Border Station, Sweet Grass, Montana/Coutts, Alberta

1.6 Environmental Policies & Practices

GSA is committed to being a responsible environmental steward through the consideration of the environment in all our business practices, compliance with environmental laws and regulation, using environmentally beneficial products and services, and using resources in a sustainable manner.

Sustainable Design

GSA is committed to incorporating principles of sustainable design and energy efficiency into all of its building projects. Sustainable design seeks to locate, design, construct and operate buildings to reduce negative impact on the environment and the consumption of natural resources. Sustainable design improves building performance while keeping in mind the health and comfort of building occupants. It is an integrated, synergistic approach, in which all phases of the facility lifecycle are considered. The result is an optimal balance of cost, environmental, societal and human benefits while meeting the mission and function of the intended facility or infrastructure. Further information can be obtained on the Internet through the Whole Building Design Guide **www.gsa.gov/sustainable**.

The essential principles of sustainable design and development for Federal agencies address:

- Site – Optimize site potential
- Energy – Minimize non-renewable energy consumption
- Materials – Use environmentally preferable products
- Water – Protect and conserve water
- Indoor Environmental Quality – Enhance indoor environmental quality
- Operations and Maintenance – Optimize operational and maintenance practices

These principles shall serve as the basis for planning, programming, budgeting, construction, commissioning, operation, maintenance, decommissioning of all new GSA facilities, and for major renovation and alteration of existing buildings and facilities.

LEED® Certification. As a means of evaluating and measuring our green building achievements, all GSA new construction projects and substantial renovations must be certified through the Leadership in Energy and Environmental Design (LEED®) Green Building Rating System of the U.S. Green Building Council. Projects are encouraged to exceed basic LEED® green building certification and achieve the LEED® "Silver" Level.

Energy Performance

By Executive Order mandate, GSA's overall building inventory has an energy performance goal of 55,000 BTU/GSF/year. For new construction, GSA must achieve better energy performance. Therefore, each new facility shall have specific energy targets (BTU/GSF/ year) as established by the Office of the Chief Architect. When no target is provided, energy performance shall exceed 20% below ASHRAE 90.1. The A/E shall design to these targets. For additional information see section 1.7, *Energy Conservation Standards.*

Ronald Reagan Building, Washington, D.C.

Building Materials

Prohibited Materials. The use of the following materials is prohibited on all GSA projects:

- Products containing asbestos.
- Products containing added urea formaldehyde.
- Products containing polychlorinated biphenyls.
- Products containing chlorinated fluorocarbons. (See Chapter 5 for replacements.)
- Solder or flux containing more than 0.2 percent lead and domestic water pipe or pipe fittings containing more that 8 percent lead.
- Paint containing lead.

Recycled-Content Products. GSA is required to buy recycled-content products as designated by EPA through the Comprehensive Procurement Guidelines (CPG).

Architects and engineers should always make environmentally responsible choices regarding new building materials and the disposal of discarded products. Buying recycled-content products ensures that the materials collected in recycling programs will be used again in the manufacture of new products.

Section 6002 of the Resource Conservation and Recovery Act (RCRA) requires EPA to designate products that are or can be made with recovered materials, and to recommend practices for buying these products. Once a product is designated, procuring agencies are required to purchase it with the highest recovered material content level practicable.

EPA also issues guidance on buying recycled-content products in Recovered Materials Advisory Notices (RMANs). The RMANs recommend recycled-content ranges for CPG products based on current information on commercially available recycled-content products. RMAN levels are updated as marketplace conditions change.

Architects and engineers must maximize the opportunity for contractors to bid recycled-content materials by including CPG items in the design specifications. Exceptions will only be permitted if written justification is provided when a product is not available competitively, not available within a reasonable time frame, does not meet appropriate performance standards, or is only available at an unreasonable price.

Examples of CPG construction products are included in Chapter 3, *Architectural and Interior Design,* and Chapter 4, *Structural Engineering.* Information can be obtained about EPA's list of designated products and the accompanying recycled-content recommendations on the Internet at **www.epa.gov/cpg**.

Lead-Based Paint. Paint will be tested for lead content when alteration or demolition requires sanding, burning, welding or scraping painted surfaces. When lead is found,

implement the controls required by OSHA in 29 CFR 1926.62. Do not abate lead-based paint when a painted surface is intact and in good condition, unless required for alteration or demolition. In child care centers, test all painted surfaces for lead and abate surfaces containing lead-based paint.

Asbestos-Containing Materials. Prior to design in a facility to be renovated, a building evaluation by a qualified inspector will be performed. This evaluation will include review of inspection reports and a site inspection. If asbestos damage or the possibility of asbestos disturbance during construction activity is discovered, one of the following four corrective actions must be taken: removal, encapsulation, enclosure or repair.

All design drawings and specifications for asbestos abatement must be produced by a qualified specialist. The guiding standards for this work are the GSA PBS IL-92-8 and OSHA and EPA regulations, in particular 29 CFR 1926.58, 40 CFR 61.140-157 and 49 CFR 171-180. In general, projects should be designed to avoid or minimize asbestos disturbance. The environmental standards will be supplied by the regional office of GSA.

All GSA construction work that disturbs asbestos must be performed using appropriate controls for the safety of workers and the public.

Regular inspection of the abatement work area and surrounding areas should be performed on behalf of GSA to protect the interests of GSA, the building occupants and the public. Such inspections should include visual and physical inspection and air monitoring by phase contrast microscopy and/or transmission electron microscopy, as appropriate. Inspections should be performed under the supervision of a Certified Industrial Hygienist, or individuals accredited under the Asbestos Hazard Emergency Response Act (AHERA) for asbestos abatement supervision.

Laboratories analyzing samples for asbestos must be accredited by the American Industrial Hygiene Association (AIHA) or the National Institute for Standards and Technology's Voluntary Laboratory Accreditation Program. Laboratories analyzing air samples by phase contrast microscopy must have demonstrated successful partici-pation in the National Institute for Occupational Safety and Health (NIOSH) Proficiency in Analytical Testing program for asbestos.

On-site analysis by phase contrast microscopy may be performed as required, provided that the analyst is board-approved in the AIHA Asbestos Analysis Registry and provided that a quality assurance program is implemented, including recounting of a fraction of samples by a qualified laboratory. All final clearance transmission electron microscopy air samples must be analyzed in accordance with the EPA AHERA protocol in 40 CFR 763, Appendix A of subpart E.

Indoor Air Quality

All products to be incorporated into the building, including finishes and furniture, should be researched regarding characteristics of off-gassing and noxious odors that will affect indoor air quality.

Soil Contamination

The Comprehensive Environmental, Response, Compensation, and Liability Act (CERCLA or Superfund) provides authority and distributes responsibility for cleanup of contaminated soil, surface water and groundwater from inactive hazardous substance disposal sites and from hazardous substances released into the environment that facility permits do not cover. If soil or water contamination is a concern during construction of new buildings, major and minor alterations, and work in historic structures, then the EPA regulations under 40 CFR should be followed.

Underground Storage Tanks (USTs)

The EPA finalized regulations USTs in 40 CFR Parts 280 and 281. These regulations apply to all tanks containing petroleum products and hazardous substances as defined by the EPA. The regulations direct facilities to implement technical standards and corrective actions for the management of and releases from USTs. If USTs are a concern during construction of new buildings, major and minor alterations, and work in historic structures, then the EPA regulations should be followed. If a leaking UST is detected/discovered, contact EPA.

Compliance with the National Environmental Policy Act (NEPA)

GSA conducts an environmental review of each project prior to the start of design as required by the National Environmental Policy Act (NEPA). The review identifies environmental impacts and alternative courses of action that may have less impacts. The review can result in:

- A Categorical Exclusion (CATEX) from the requirement to prepare an Environmental Impact Statement (EIS),
- The preparation of an Environmental Assessment that results in a finding of No Significant Impact (FONSI),
- The preparation of an Environmental Assessment that identifies significant impacts, followed by preparation of an Environmental Impact Statement (EIS), or
- The preparation of an EIS.

If an Environmental Assessment or EIS has been prepared, it will constitute the primary guideline for environmental design issues. In those instances where GSA has committed to implementing specific mitigation measures, programmers and designers must ensure that those measures are carried out in the design. For more information on GSA's compliance with NEPA and to download the GSA PBS NEPA Desk Guide and other environmental technical guides visit, **www.gsa.gov/nepa**.

Guidance

The following documents contain specific design requirements or may influence design decisions:

- Council of Environmental Quality (CEQ), Code of Federal Regulations (CFR) Title 40, Parts 1500 - 1508: *Regulations for Implementing the National Environmental Policy Act*.
- GSA ADM 1095.1F: *Environmental Considerations in Decision Making*.
- GSA ADM 1095.6: *Consideration of Floodplains in Decision Making*.
- GSA ADM 1095.5: *Consideration of Wetlands in Decisionmaking*.
- GSA PBS *Floodplain Management Desk Guide*.
- GSA PBS *NEPA Desk Guide*.
- Environmental Protection Agency (EPA), 10 CFR 40, 1.23, 1-4, 1-16: *Procedures for Implementing the Clean Air Act and the Federal Water Pollution Control Act*.
- EPA, 40 CFR 50: *National Primary and Secondary Ambient Air Quality Standards*.
- EPA, 40 CFR 60: *New Source Performance Standards*.
- EPA, 40 CFR 61: *National Emission Standards for Hazardous Air Pollutants*.
- EPA, 40 CFR 82: *Protection of Stratospheric Ozone*.
- EPA, 40 CFR 260-299: *Solid Wastes*.
- EPA, 40 CFR 300-399: *Superfund, Emergency Planning and Community Right-to-Know Programs*.
- EPA, 40 CFR 401-403: *Effluent Guidelines and Standards*.
- *LEED® (Leadership in Energy & Environmental Design) Green Building Reference Guide,* developed by the U.S. Green Building Council.

1.7 Energy Conservation Standards

Performance Goals

Legislation directs the Federal Government to adhere to voluntary Commercial Energy Standards, reflected within the Code of Federal Regulations, 10-CFR 434. ASHRAE Standard 90.1 meets or exceeds 10-CFR 434, and may be substituted as a reference (with exceptions in lighting system performance as addressed in Chapter 6).

Executive Order 13123 establishes a national program goal to reduce building annual energy consumption by 35 percent, using a 1985 baseline. To achieve this goal, GSA's inventory must reach a metered (boundary) annual energy consumption of approximately 55,000 BTU/GSF.

GSA's sustainability objective for LEED certification will likely be associated with trying to beat ASHRAE 90.1 energy performance by defined percentage levels, (e.g. 2 points toward certification for new construction projects with every 20% increment, and for alterations projects with every 10% increment).

GSA also fully supports the Government's Energy Star Buildings Program for its existing inventory, achieving metered consumption within the top 25% of involved building categories.

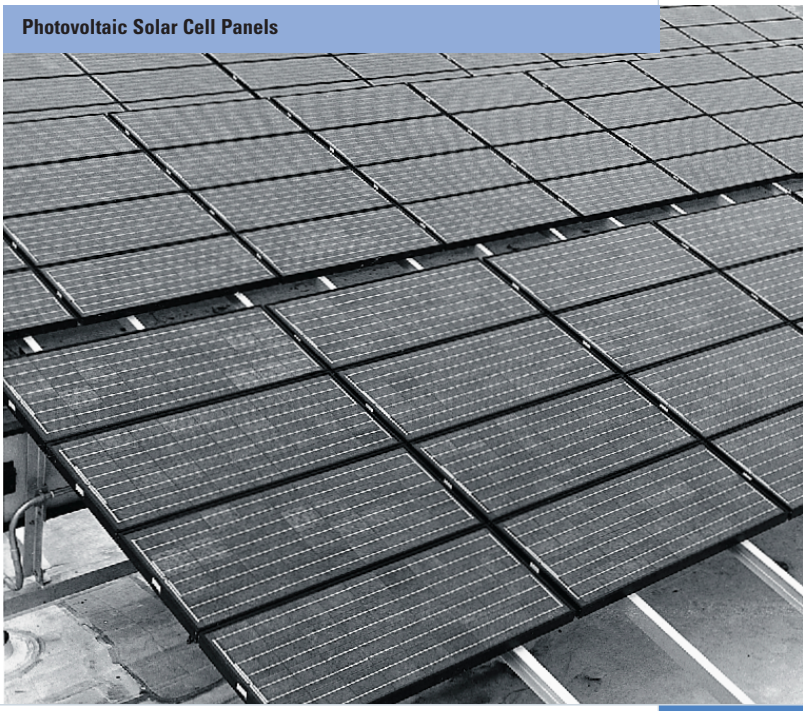
Energy Goal Applications

For New Construction and building modernizations, designs shall achieve the project's individually assigned annual energy goal, established by the Office of the Chief Architect. Generally , this goal will be below the 55,000 BTU/GSF-YR target of the above referenced Executive Order.

For new construction and building modernizations, certification shall be based upon computer simulations of the overall building's annual energy consumption. Computer programs must be approved by the Project Manager, represented by the designer as being capable of simulating weather variations, envelope heat transmission, internal load fluctuations, ventilation and air infiltration impacts, HVAC equipment part-load efficiencies, and considered control strategies.

For Major Renovation/Alterations projects, that do not involve total building modernization, involved system performance shall be certified to achieve at least a 10 percent better peak load energy efficiency, compared to ASHRAE 90.1. Involved equipment efficiencies shall also be within the top 25% of manufactured product lines. Certification shall include side-by-side performance comparisons of each involved system/feature.

Photovoltaic Solar Cell Panels



1.8 Life Cycle Costing

Purpose

Life Cycle Costing (LCC) is an important economic analysis used in the selection of alternatives that impact both pending and future costs. It compares initial investment options and identifies the least cost alternatives for a twenty year period.

The A/E shall contact local utility companies to determine available demand-side management programs and no-cost assistance provided by these companies to designers and owners.

Applications

Basic applications of LCC are addressed within the individual chapters herein and may be further defined within an A-E's design programming scope requirements. As applied to building design energy conservation measures, the process is mandated by law and is defined in the Code of Federal Regulations (CFR), Title 10, Part 436, Subpart A: *Program Rules of the Federal Energy Management Program.* In general, LCC is expected to support selection of all building systems that impact energy use: thermal envelope, passive solar features, fenestration, HVAC, domestic hot water, building automation and lighting. However, LCC can also be applied to building features or involve costs related to occupant productivity, system maintenance, environmental impact and any other issue that impacts costs over time. It is very important to recognize the significance of integrated building systems design in the overall efficiency of the design.

Methodology

There are many established guidelines and computer-based tools that effectively support Present Value LCC analyses. The National Institute of Standards and Technology (NIST) has prepared the Life Cycle Costing Manual for the Federal Energy Management Program (NIST Handbook 135), and annually issues real growth Energy Price Indices and Discount Factors for Life Cycle Cost Analysis. As a companion product, NIST has also established the Building Life Cycle Cost (BLCC) computer program to perform LCC analyses. The latest versions of the BLCC program not only structure the analysis, but also includes current energy price indices and discount factor references. These NIST materials define all required LCC methodologies used in GSA design applications.

It is recommended that the A/E obtain the BLCC software and update from NIST. The latest information on the BLCC software is available on the Internet at: **www.eere.energy.gov/femp.**

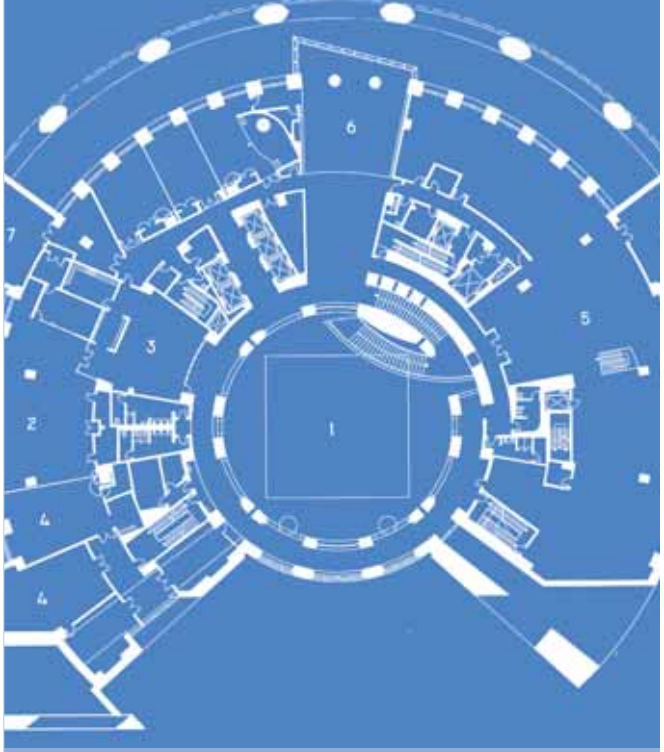
Procedures and Approach

The most effective approach to LCC is to appropriately integrate it into the design process.

The building design evolves from general concepts to detailed analysis. LCC needs to follow the same approach paralleling the focus to the current level of detail study.

It is extremely important for the effective development of the project that commitments are made and retained on the building systems, in a general sense, during the Conceptual Phase.

The building systems should be analyzed for appropriateness during the first stages of the Design Development Phase. A commitment on direction for the systems needs to be made at this time, and any further LCC studies focused on detail within each system.



Charles Evans Whittaker U.S. Courthouse, Kansas City, MO

All LCC effort should be completed in the Design Development Phase of the project.

The following practices are typically required when conducting LCC analyses for building design. They are listed here to address common concerns and frequently asked questions.

- When defining alternatives for life cycle costing, an acceptable level of overall building services must be assured throughout the analysis period.
- Design alternatives must be compared against a baseline reference alternate that is the lowest first cost of the alternatives being considered. The baseline alternate must offer a viable system, employing state-of-the-art design features, and be in compliance with all project requirements. Where existing conditions form part of the baseline alternate, the analysis must not only include intended project work, but also the additional costs necessary to achieve code compliance and reliable operation over the analysis period.
- The analysis period should be chosen to fully represent all costs. When optimizing the design of a single system, all compared alternatives must be considered over the same analysis period. Where possible, the analysis period should be the smallest whole multiple of the service lives for the major systems involved in the analysis. Service lives of HVAC equipment can be found in the ASHRAE Applications manual. In any case, the analysis period should not be over 25 years unless otherwise directed by GSA.
- Costs that have already been incurred or must be incurred, regardless of the chosen alternative, can be deemed "sunk" and excluded from the analysis. Costs that must be incurred during the period from design decisions to construction award should be deemed sunk.
- Baseline and alternative first costs are typically those estimated for the construction award date. The life cycle cost analysis can assume that the award date can be considered the zero point in time for the analysis period, with all other event times referenced to the construction award date. For greater simplicity, the year of design decision can also be considered as the zero point in time, and it can be assumed that the construction award will occur in that year.
- Salvage values for alternatives are typically zero. However, in those cases where scrap values could impact decisions, the present value is calculated as its future value (scrap value) discounted back to the present from the year of occurrence. The formula for this is shown in the LCC Formulas Table 1-1.

Table 1-1
LCC Formulas

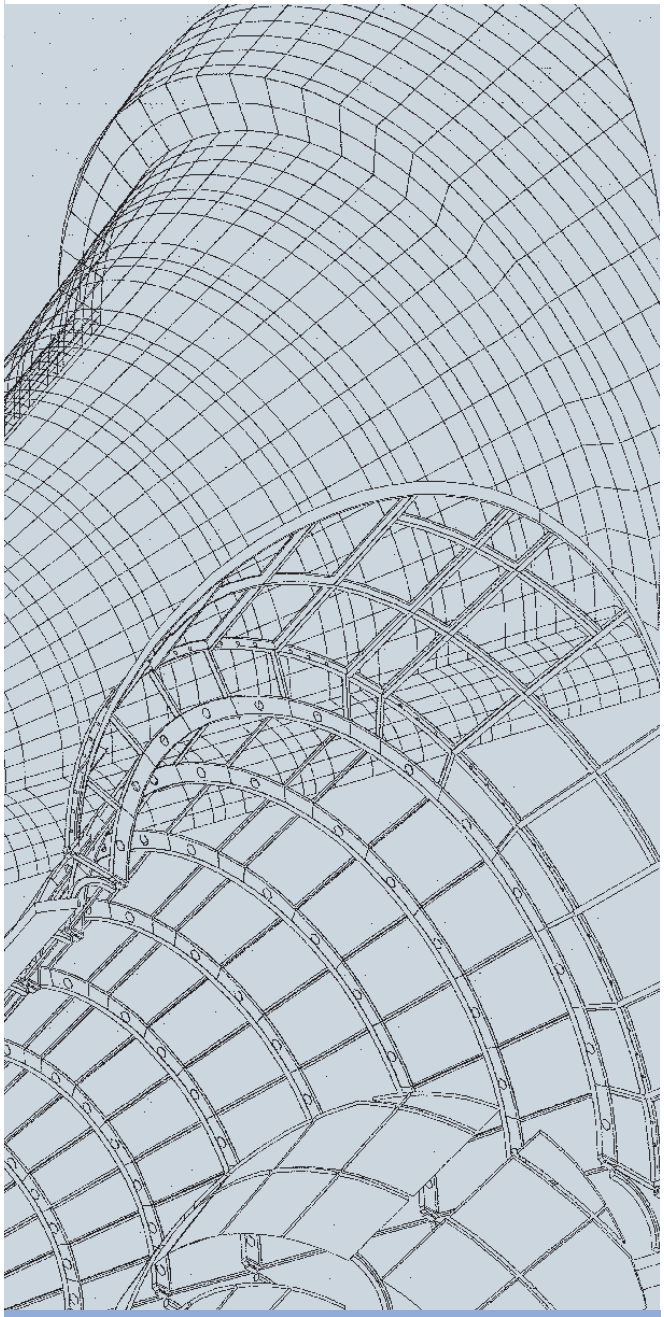
Type of Cost	Cost Examples	Present Value Relationships	Comments
Sunk	Design Fees Funds irrevocably committed	Not Applicable	Costs are not included in the Analysis
First	Investment Costs Construction Costs Purchase Price	PV = TV	For those investment costs that begin at the start of the analysis period
Salvage Value	Scrap value of equipment at the end of its service life	$PV = \frac{FV}{(1+d)^n}$ where $FV=TV(1+e)^n$	Present value equals the future value at the end of the service life, discounted by n service years
Future Investment	One time investments occurring after the start of the analysis period Non-Annual maintenance or repair Major alterations to initial investment work	$PV = TV\frac{(1+e)^n}{(1+d)^n}$ Where FV is the time pro-rated amount that separates investment value to the end of service life salvage value.	Discount the future value (Today's Value escalated at rate e to year n) back to the present.
Residual Value	Equipment with a service life extending beyond the analysis period	$PV = \frac{FV}{(1+d)^n}$	Residual value equals the future value at the end of the analysis period, discounted to the present.
Annually Recurring Fixed	Fixed payment service contracts with inflation adjustments Preventative maintenance	PV = TV(UPW) where $UPW = \frac{(1+d)^n - 1}{d(1+d)^n}$	Annually Recurring Cost, relating to today's value, which increase in price at the same rate as general inflation. The UPWn factors are within the NIST BLCC program.

Type of Cost	Cost Examples	Present Value Relationships	Comments
Annually Recurring Escalating	Service or maintenance which involve increasing amounts of work Frequent replacements that escalate at a rate different than inflation	PV = TV(UPW*) where $UPW^* = \frac{\left[\frac{(1+e)}{(1+d)}\right]^n - 1}{1 - \frac{(1+d)}{(1+e)}}$ or $UPW^* = \left(\frac{1+e}{d-e}\right) \cdot \left[1 - \left(\frac{1+e}{1+d}\right)^n\right]$	The present value of such costs are calculated by using a modified version of the UPW formula (UPW*) which allows for cost escalation.
Energy	Fuel related costs, such as fuel oil, natural gas or electricity	PV = TV(UPW*)	Energy related UPW* factors are found in the NIST BLCC program.
Escalation Rates	Relating Budgetary Escalation to Real Growth Escalation	$E = e + I + eI$ or $e = \frac{E - I}{1 + I}$	Needed to convert budgetary escalation to real growth escalation.

Definitions

FV = future value
PV = present value
TV = today's value
d = real discount rate
e = real growth escalation rate (the differential escalation rate that exists after removing the influence of general inflation)
n = number of years to occurrence or the analysis period, as appropriate
E = Budgetary Escalation
I = Inflation Rate
UPW = Uniform Present Worth factor for fixed recurring costs
UPW* = Modified Uniform Present Worth factor for escalating recurring costs

- Future one-time costs, such as replacement costs, are established by escalating a known today's value (using real growth rate) to its future value in the year it occurs, then discounting that value back to its present value (using a real discount rate). The formula for this is shown in the LCC Formulas Table 1-1.
- For instances where an alternative has service life beyond the analysis period, allowance shall be made for the associated residual service worth. This calculation involves identifying the future residual value at the end of the analysis period, then discounting the amount back to the present. The future residual value can be approximated by multiplying the future investment value (less future salvage value at the end of its service life) by the proportion of time remaining in the analysis period, compared to its service life.
- Annually recurring fixed costs include those costs where increases have no real growth, such as costs that increase at the general inflation rate. They can be represented by the formula shown in the LCC Formulas Table 1-1. Also in this table is the formula for recurring costs where recurring costs escalate. Both formulas involve multiplying a known cost (in today's value) by a uniform present worth value.
- Fuel costs represent a special case of recurring escalating costs. Uniform present worth values are available from NIST data, correlating specific fuel types by sector/location for a defined analysis period. For simplicity, demand charges may be assumed to escalate at the same rate as consumption charges.
- Investment and replacement actions over time may impact recurring costs. For simplicity, unless otherwise directed, fluctuating recurring cost savings may be assumed to be proportionate to the savings realized at the start of the analysis period.
- Calculate the savings to investment ratio (SIR) for comparisons of dissimilar alternatives, such as comparing an HVAC alternative to a lighting alternative. Calculate net savings for comparisons of similar alternatives, such as optimizing insulation thickness in a wall.
- A sensitivity analysis is required whenever assumptions may be considered questionable. This simply requires conducting multiple LCC analyses using extremes of cost parameters in question.
- Due to possible margins of error in estimating costs, alternatives with a life cycle cost differential of less than 10 percent can be judged inconclusive by GSA.
- To define energy related cost impacts for alternatives that are influenced by weather and/or varying loads/schedules, the energy use modeling program DOE2 or other approved software shall be used.



Ronald Reagan Federal Building atrium skylight isometry, Washington, D.C.

1.9 Metric Standards

All projects will be produced using the International System (SI) unless otherwise directed by the Chief Architect. A project is "metric" when:

- Specifications show SI units only.
- Drawings show SI units only.
- Construction takes place in SI units only.
- Inspection occurs in SI units only.
- Cost estimating is based on SI units only.

Reference *Metric Design Guide* (PBS-PQ260).

English and Metric Measurement Reference

A majority of dimensions set by standards and codes currently remain in the English measure system. It is the intent of GSA to support the conversion to metric. Therefore, when a dimensional requirement is stated in this document, the designated dimension by code or regulation will be placed in parenthesis and the corresponding representation in the other measurement system will be placed adjacent to it.

Example: (5') 1.52M diameter clearance for navigation of a wheeled chair in an accessible toilet room.

1.10 Accessibility Design Standards

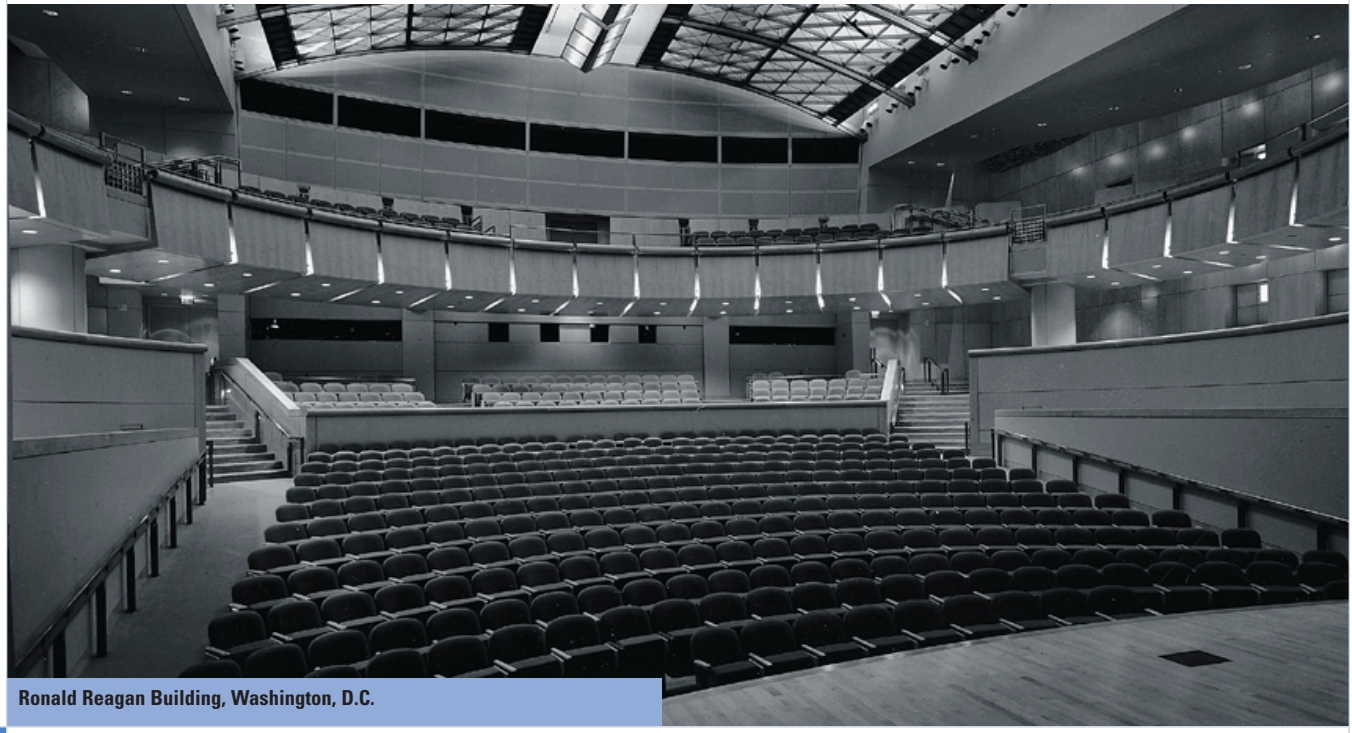
It is GSA policy to make all Federal buildings accessible without the use of special facilities for the disabled. The intent of this policy is to use standard building products set at prescribed heights and with prescribed maneuvering clearances to allow easy use by disabled employees and visitors. Building elements designated specifically for use by disabled persons should be kept to a minimum.

The Architectural Barriers Act Accessibility Standard (ABAAS) is mandatory for all GSA projects. The A/E is responsible for checking to see whether there are local accessibility requirements. If they exist, the most stringent requirements will prevail between local and ABAAS.

The criteria of these standards should be considered a minimum in providing access for the physically disabled. Dimensions that are not stated as "maximum" or "minimum" are absolute. All dimensions are subject to conventional industry construction tolerances except where the requirement is stated as a range with specific minimum and maximum end points.

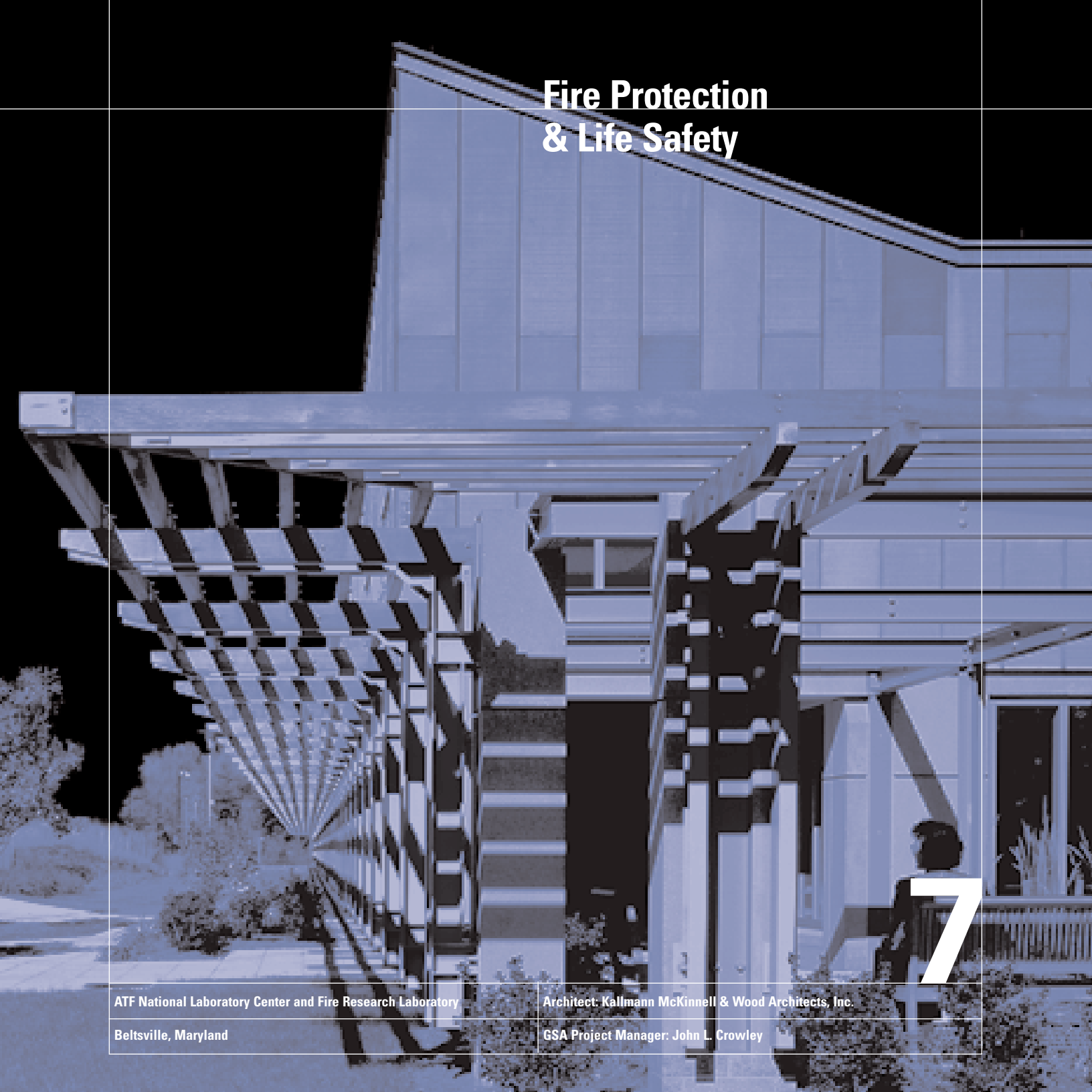
Federal Courthouses

Please refer to Chapter 9 *(Design Standards for U.S. Court Facilities)*, Section 9.2 *(General Requirements), Planning for Accessibility,* and Table 9-1, *Accessibility Requirements.*



Ronald Reagan Building, Washington, D.C.

Fire Protection & Life Safety



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ATF National Laboratory Center and Fire Research Laboratory

Beltsville, Maryland

Architect: Kallmann McKinnell & Wood Architects, Inc.

GSA Project Manager: John L. Crowley

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7.1 General Approach

GSA's approach in the construction of new facilities and projects in existing facilities is to incorporate efficient, cost-effective fire protection and life safety systems that are effective in detecting, extinguishing or controlling a fire event that results in improving overall building safety. The primary goal is to protect human life from fire and products of combustion. The secondary goals are to reduce the potential loss from fire (i.e., Federal real and personal property, maintain client agency mission continuity, and control environmental impact) to the Federal Government and taxpayer.

Scope

This chapter provides the technical fire protection and life safety requirements and design criteria for GSA facilities to meet the goals identified above. The majority of the fire protection and life safety requirements are contained in numerous national codes and standards. Compliance with national codes and standards is explained, and areas where GSA's requirements differ from the referenced national codes and standards are delineated. The Authority Having Jurisdiction (AHJ), for all technical requirements in this chapter, for all fire protection and life safety code interpretations and code enforcement requirements is the GSA regional fire protection engineer.

Applicability

The technical fire protection and life safety requirements are primarily directed to the construction of new facilities and renovation projects. However, for renovation projects where the work area consists of a portion or portions of a building, the requirements herein shall be limited to the work area(s) in which work is being performed, unless when specified by the GSA regional fire protection engineer that the requirements shall also apply throughout the floor on which the work area(s) are located or otherwise beyond the work area. Performance based designs are also encouraged.

A registered fire protection engineer is required to be a full participant of the architect/engineer (A/E) design team for each phase of the project from concepts through design, construction, final acceptance, and occupancy. The design team fire protection engineer must have at least 6 years experience from which at least 3 consecutive years are directly involved in the fire protection engineering field. This same or an equally competent professional must remain on the A/E's project staff for each phase of the project and shall perform the following:

- Analyses and provides criteria for the following:
  - Building Construction
  - Occupancy Classification
  - Means of Egress
  - Fire Alarm System
  - Water Based Fire Extinguishing System(s)
  - Non-Water Based Fire Extinguishing System(s)
  - Smoke Control System(s)
- Calculations for the following:
  - Egress
  - Water Supply
  - Smoke Control (Fire Dynamics)/Timed Egress
  - Audibility for Fire Alarm System

- Design of all fire protection and life safety systems including but not limited to:
  - Fire Alarm System
  - Water Based Fire Extinguishing System(s)
  - Smoke Control Systems/Stair Pressurization Systems

See Appendix A for specific submission requirements.

For all projects involving fire protection and life safety issues, a dialog must be established between the design team fire protection engineer and the GSA regional fire protection engineer. The GSA regional fire protection engineer shall have the right to revise the specific requirements within this chapter based on a technical evaluation/analysis and the project's specific needs.

In addition, the Design Team's registered fire protection engineer may propose alternative designs, systems, methods, or devices not specifically prescribed within this Chapter or in lieu of the specific prescribed requirements within this Chapter. The GSA regional fire protection engineer shall review the technical documentation submitted by the Design Team's registered fire protection engineer to determine if the proposed alternative is deemed equivalent or superior to the intent of the prescribed requirements in this chapter. If the GSA regional fire protection engineer determines that the proposed alternative is deemed equivalent or superior to the intent of the prescribed requirements in this chapter, then the proposed alternative is considered approved by GSA for the purposes of this Chapter and for the application for which the proposed alternative will be used. Refer to Chapter 1 for additional information.

7.2 Certificate of Occupancy

No new construction or renovation project or portion thereof shall be occupied until the regional fire protection engineer has issued a certificate of occupancy to the GSA Project Manager. Issuance of a certificate of occupancy shall not be construed as an approval of any violation of a Code or GSA design standard or criteria.

Once the GSA regional fire protection engineer has ensured that to the best of their knowledge all fire protection and life safety systems have been completed, inspected, successfully tested and approved and all outstanding fire and life safety deficiencies have been corrected to afford a reasonable degree of safety to the building occupants from fire and similar emergencies, a certificate of occupancy will be issued to the GSA Project Manager.

The GSA regional fire protection engineer is authorized to issue a temporary certificate of occupancy. This certificate shall allow partial occupancy of specific areas, prior to completion of the project. All life safety and fire protection systems serving the areas proposed for occupancy and all floors below shall be completed, inspected, successfully tested and approved by the GSA regional fire protection engineer. The temporary certificate of occupancy shall identify the specific area(s) of the project where occupancy is permitted. Following the issuance of a temporary certificate of occupancy, the GSA regional fire protection engineer shall set a time frame for the completion, inspection, testing and approval of all life safety and fire protection systems, and the correction of any outstanding life safety and fire protection deficiencies. Upon completion, inspection, successful testing and approval of all fire protection and life safety systems and correction of all outstanding fire and life safety deficiencies, the GSA regional fire protection engineer will issue a certificate of occupancy to the GSA Project Manager.

7.3 Fire Safety During Construction and Renovation Projects

General. Fire safety during construction and renovation projects shall comply with the requirements in the International Building Code (IBC), International Fire Code (IFC), and National Fire Protection Association (NFPA) 241.

Fire Protection Systems. Disruptions to fire alarm and sprinkler systems shall be kept to a minimum or avoided. Delineate phasing of construction to ensure that installations of new systems are expedited, and existing systems are kept in service until the replacement system is operational. If fire protection systems are to be disrupted, procedures shall be incorporated into the design to maintain equivalent levels of fire protection and provide formal notification to the facility while systems are down. The GSA regional fire protection engineer shall make the final determination of the adequacy of proposed equivalent levels of fire protection prior to the disruption of any fire protection system. For example, the provision of a 24 hour fire watch by qualified individuals may provide an equivalent level of fire protection during system disruption in some circumstances.

7.4 Commissioning

The commissioning process will ensure that the fire protection and life safety systems and equipment installed in a building are in compliance with the building design requirements.

The Design Team's fire protection engineer shall prepare written commissioning plan documentation that outline the procedures, methods and documentation for each phase of the commissioning process for all types of active and passive fire protection and life safety systems from concept through construction, final acceptance, occupancy, and post occupancy. At a minimum, the commissioning plan documentation shall include a discussion on the building structure; applicable standards, federal laws and regulations; system and equipment performance assumptions, codes and standards strategies; testing and start-up requirements; inspection, testing and maintenance requirements; and safeguards to verify and confirm that systems, equipment and devices have undergone start-up testing prior to final acceptance testing, including the identification and notification of all parties needed to perform and witness all testing. The commissioning plan documentation shall also describe in detail the performance objectives of each fire protection and life safety system planned for the project. In addition, it shall also include all of the additions, deletions or modifications made to each of the fire protection and life safety systems during each phase of the project. All of this documentation will assist the Construction Manager, Project Manager, Commissioning Authority and the GSA regional fire protection engineer in the advocacy, review, inspection and final acceptance process.

In addition, the Design Team's fire protection engineer shall prepare construction contract specifications to align the actions of the construction contractor with the commissioning plan, addressing all involved tests, special inspections, and certifications.

Examples of fire protection and life safety commissioning activities include, but are not limited to the following items:

Preliminary planning: Assure proposed space is accommodated by each involved system as it applies to that space, in accordance with the requirements within PBS-P100 and all referenced codes & standards. Review associated project budgets to assure that an adequate amount of space is shown to not only address each system itself, but validate that architectural, structural, and mechanical system costs associated with pathway, firestopping, concealment, and placement are included in the project's budget. Integrate appropriate GSA guide specification requirements into systems planning in the review of the systems budgets to assure budget assumptions are in concert with the requirements for design.

Preliminary Concept Design: Review concept drawings to assure adequate egress from the conceptual facility, adequate utility connection/service for fire protection systems, adequate site access for fire department and other emergency responders, and assuring compliance with the requirements within PBS-P100 and all referenced codes and standards based on the limited information in this stage of design. Identify proposed hazard ratings and occupancy classifications of various building space types and confirm their impact to involved systems.

Final Concept Design: Confirm that proposed systems comply with the requirements within PBS-P100 and all referenced codes and standards. Assure that systems proposed for the facility will comply with the latest GSA guide specifications for each proposed system. Identify the designer's intent to use acceptable materials/ equipment and that proposed capabilities (if any) are appropriate for the space occupancy classification and hazard ratings.

Design Development: Validate that concept approved fire protection and life safety systems are based on the requirements within PBS-P100, referenced codes and standards, and the latest edition of GSA guide specifications for the systems involved. Check fire protection & life safety engineering calculations to determine accuracy and proper application of design to the facility. Evaluate the project specifications and project drawings for correctness, coordination and agreement. Validate operational assumptions and level of details for each system to assure clarity and detail for project bids and construction direction. Coordinate work with the GSA review process so that the GSA regional fire protection engineer receives the project design package for review after completion of the aforementioned work.

Construction Documents: Review layouts for each fire protection and life safety system, validating that the construction documents are in compliance with the requirements within PBS-P100 and referenced codes and standards, that the construction documents conform to the design drawings, specifications, and supporting contract documents, and that equipment submittals are correctly annotated and the application of each piece of equipment is appropriate for the facility and this project. Review system/equipment locations to assure clearance when in proximity to ductwork and other building features. Validate appropriateness of control sequences, and their representation on drawings and/or specifications. Verify that specifications include appropriate spare parts.

Construction Inspection: During construction, inspect system installations to assure compliance with design intent, approved specifications & drawings, and approved submittals. Coordinate on site inspections with the GSA regional fire protection engineer for the project so that there is unified communication about each system and required changes or improvements. When all system components are in-place, coordinate preliminary and acceptance testing, checking functionality of all modes

of operation. Prepare test reports. Verify that training for building operating staff includes information on what to do for each mode of operation. Verify that an appropriate number of spare system parts are provided per terms of the construction contract. Assure that the GSA regional fire protection engineer is involved in the scheduling of all acceptance testing and has an opportunity to attend testing as required. Participate in the review of test results and needed corrections with the GSA regional fire protection engineer as a means to facilitate issuing a Certificate of Occupancy.

Post Construction Inspection/Operations: Coordinate with GSA project management staff to assure that appropriate service/maintenance agreements exist for the care/servicing of the commissioned systems.

These activities shall be done for the following systems:

- Fire Alarm Systems
  - Initiating Devices and Related Circuits
  - Notification Appliances and Related Circuits
  - Power Supplies and Protection of Same
  - Communication of Signals Exterior to the Building (Central Station & MegaCenter)
  - System Controls and Peripherals
  - Interface with Other Systems (e.g., HVAC, Security Systems, etc.)
- Water Based Fire Extinguishing Systems
  - Sprinkler Systems
  - Water Supply Information
- Fire Pumps
  - Fire Pump
  - Jockey Pump
  - Fire Pump Controller and Transfer Switch
  - Pressure Regulation at Fire Pump
  - Fire Pump Room
- Standpipe and Fire Department Hose Connection Systems
- Non-Water Based Fire Extinguishing Systems
  - Wet Chemical Systems
- Smoke Management Systems
  - Exit Stairway Pressurization
  - Atrium Smoke Removal
- Emergency Power Systems
- Fire Doors and Windows
- Emergency Lighting and Exit Lighting
- Exit signage
- Photoluminescent Material Stairway Marking.
- Egress Systems
  - Aisles
  - Exit Access
  - Exit Stairs
  - Exit Doors & Hardware
  - Exits
  - Exit Discharge
- Other Equipment and Systems
  - Spray Applied Fire Resistive Materials
  - Firestopping Materials
  - Interior Finish Materials
  - High Density Storage Systems
  - Essential Electronic Facility Protection
  - Lightning Protection
  - Portable Fire Extinguishers and Cabinets
  - Fire Command Center
  - Equivalent Technologies

7.5 Building Construction

Types of Construction. For each construction type, design fire resistive ratings of structural members in accordance with the requirements in the IBC.

Special Inspections. The GSA Project Manager shall ensure that special inspections for sprayed fire-resistant materials applied to structural elements and decks are in accordance with the requirements in the IBC. Special inspections shall be based on the fire-resistive design as designated in the approved construction documents.

7.6 Interior Finishes

General. The interior finish requirements for walls, ceilings, floors, draperies, curtains, and movable partitions shall meet the requirements in the IBC.

Special Requirements. The following requirements take precedence over the requirements in the IBC:

Adhesives and other materials used for the installation of carpets shall be limited to those having a flash point of 60 degrees C (140 degrees F) or higher.

All other materials composed of combustible substances, such as wood (e.g., plywood, 610 mm by 1219 mm (2 feet by 4 feet) wood boards, etc.) shall be treated with fire-retardant chemicals by a pressure impregnation process or other methods that treats the materials throughout (as opposed to surface treatment).

7.7 Occupancy Classifications

General. Occupancy classifications shall meet the requirements in the IBC.

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7.8 Means of Egress

General. The means of egress design requirements for the building shall meet the requirements in NFPA 101. The technical egress design requirements in NFPA 101 shall be used in lieu of the technical egress design requirements in the IBC.

Special Requirements. The following requirements take precedence over the requirements in NFPA 101:

- In buildings that are protected throughout by an automatic sprinkler system, 1-hour fire rated corridors shall not be required.
- Interlocking (scissor) stairs shall count as only one exit stair. A minimum of two exit stairs are required for any multi-story building.
- For common paths of travel and dead end corridors, GSA permits the NFPA 101 exceptions for sprinkler protection to apply to fully sprinklered individual floors, even if the other floors of the building are not sprinklered.
- Fire escapes, as defined in the NFPA 101, shall not be considered approved exits.

Stairway Pressurization. In new construction projects having occupied floors located more than 22860 mm (75 feet) above the level of exit discharge or more than 9144 mm (30 feet) below the level of exit discharge, exit stairways shall be pressurized in accordance with the requirements in the IBC.

Photoluminescent Materials

Exit Stair Identification Signs. The following requirements take precedence over the requirements in NFPA 101:

- Stair identification signs shall have a photoluminescent background complying with Standard Specification for Photoluminescent (Phosphorescent) Safety Markings ASTM E2072-04 as a minimum standard.
- The signs shall be a minimum size of 457 mm (18 inches) by 305 (12 inches).
- The letters designating the identification of the stair enclosure shall be a minimum of 38 mm (1 1/2 inches) in height.
- The number designating the floor level shall be a minimum of 127 mm (5 inches) in height and located in the center of the sign.
- All other lettering and numbers shall be a minimum of 25 mm (1 inch) in height.
- The directional arrow shall be a minimum of 76 mm (3 inches) in length.

For projects in historic structures, the Design Team fire protection engineer shall consult with the GSA Regional Historic Preservation Officer and the GSA regional fire protection engineer regarding these requirements.

Exit Stair Treads. The following requirements take precedence over the requirements in the NFPA 101:

- Stair treads shall incorporate a photoluminescent stripe that is either an applied coating, or a material integral with, the full width of the horizontal leading edge of each stair tread, including the horizontal leading edge of each landing nosing.
- The width of the photoluminescent stripe shall be between 25 mm (1 inch) and 51 mm (2 inches).
- The width of the photoluminescent stripe, measured horizontally from the leading edge of the nosing shall be consistent at all nosings.
- The photoluminescent materials used shall comply with ASTM E2072-04 as a minimum standard.

For projects in historic structures, the Design Team fire protection engineer shall consult with the GSA Regional Historic Preservation Officer and the GSA regional fire protection engineer regarding these requirements.

Exit Stair Handrails. The following requirements take precedence over the requirements in the NFPA 101:

- Stair handrails shall incorporate a photoluminescent marking that is either an applied coating, or a material integral with, the entire length of each handrail.
- The photoluminescent handrail marking, at a minimum, shall be located at the top surface of each handrail, having a minimum width of 13 mm (1/2 inch).
- The photoluminescent handrail marking shall stop at the end of each handrail. If the handrail turns a corner, the marking shall continue around the corner.
- The photoluminescent materials used shall comply with ASTM E2072-04 as a minimum standard.

For projects in historic structures, the Design Team fire protection engineer shall consult with the GSA Regional Historic Preservation Officer and the GSA regional fire protection engineer regarding these requirements.

7.9 Fire Alarm Systems

General. Fire alarm systems shall be installed in accordance with the requirements in NFPA 72, the IFC, and the applicable GSA fire alarm system specification.

Special Requirements. The following requirements take precedence over the requirements in NFPA 72 and the IFC:

- All fire alarm systems shall be addressable systems.
- All fire alarm systems installed in buildings shall be an emergency voice/alarm communication system when any one of the following conditions exist:
  - The building is 2 or more stories in height above the level of exit discharge.
  - The total calculated occupant load of the building is 300 or more occupants.
  - The building is subject to 100 or more occupants above or below the level of exit discharge.

  The emergency voice/alarm communication system shall provide an automatic response to the receipt of a signal indicative of a fire emergency. Manual control with the capability of making live voice announcements shall also be furnished to provide occupants notification either on a selective or all-call basis
- With the exception of mass notification, fire alarm systems shall not be integrated with other building systems such as building automation, energy management, security, etc. Fire alarm systems shall be self-contained, stand alone systems able to function independently of other building systems.
- All emergency voice/alarm communication systems shall be installed within a room separated from the remainder of the building by not less than a 1-hour fire resistance rated fire barrier.
- Each fire alarm system shall be provided with a power conditioner to protect the fire alarm system from electrical surges, spikes, sags, over-voltages, brownouts, and electrical noise. The power conditioner shall be U.L. listed and shall have built in overload protection.
- Wiring supervision for fire alarm systems shall be provided as defined in NFPA 72 as follows:
  - Interconnected riser loop or network (Style 7 – Class A)
  - Initiating device circuits (Style B – Class B)
  - Signaling line circuit for each floor (Style 4 – Class B)
  - Signaling line circuit for network (Style 7 – Class A)
  - Notification appliance circuits (Style Y – Class B)
- All fire alarm signals (i.e., alarm, supervisory, and trouble signals) shall be automatically transmitted via a digital alarm communicator over leased phone lines to a U.L. listed Central Station Service and the GSA Regional Emergency Management Control Center.
- All fire alarm system wiring shall be solid copper and installed in conduit. Stranded wiring shall not be used.
- Conduit shall be rigid metal or electrical metallic tubing, with a minimum inside diameter of 19 mm (3/4 inch) that utilizes compression type fittings and couplings.

Manual Fire Alarm Boxes

General. Manual fire alarm boxes shall be installed in accordance with the requirements in NFPA 72, the IFC, and manufacturer's instructions.

Special Requirements. The following requirements take precedence over the requirements in NFPA 72 and the IFC:

- Manual fire alarm boxes shall be installed in every new construction project in accordance with the spacing and location requirements in NFPA 72.
- Manual fire alarm boxes shall be double-action stations.
- Manual fire alarm boxes shall be of contrasting color to the background on which they are mounted.

Waterflow Switches

General. Waterflow switch(es) shall be installed in accordance with the requirements in NFPA 13, NFPA 72 and the IFC.

Special Requirements. The following requirements take precedence over the requirements in NFPA 13, NFPA 72 and the IFC:

- A waterflow switch(es) shall be provided for each floor or fire area protected by sprinkler systems.
- Each waterflow switch shall be separately annunciated at the main fire alarm control unit and all required annunciators.

Smoke Detectors

General. Smoke detectors shall be installed in accordance with the requirements in NFPA 72, the IFC, and the International Mechanical Code (IMC).

Special Requirements. The following requirements take precedence over the requirements in NFPA 72, the IFC and the IMC:

- Area smoke detectors shall not be installed in each of the following rooms: mechanical equipment, electrical closet, telephone closet, emergency generator room, uninterruptible power service and battery rooms, and other similar rooms.
- Smoke detection appropriate for the application shall be installed in each of the following rooms: electrical switch gear, transformer vaults and telephone exchanges (PABX).
- Duct smoke detectors shall meet the requirements in the IFC and IMC.

Audible Notification Appliances

General. Performance, location, and mounting of audible notification appliances shall be in accordance with the requirements in NFPA 72.

Special Requirements. The following requirements take precedence over the requirements in NFPA 72:

- To ensure audible signals are clearly heard, the sound level shall be at least 70 dBA throughout the office space, general building areas and corridors measured 1524 mm (5 feet) above the floor. The sound level in other areas shall be at least 15 dBA above the average sound level or 5 dBA above any noise source lasting 60 seconds or longer.
- The design for achieving the required minimum dBA levels shall take into consideration all building construction materials such as carpeting, hard surfaces, walls, doors, etc., and any other materials that can cause sound level attenuation and/or clarity problems in the placement and location of all audible notification appliances. The *SFPE Handbook of Fire Protection Engineering*, Chapter on *Design of Detection Systems* or other audio design guides should be used to provide guidance and methodology to achieve the required dBA levels.
- Where emergency voice/alarm communication systems are provided, fire alarm speakers shall be installed in elevator cars and exit stairways; however they 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 cars.

Visible Notification Appliances

General. Placement and spacing of visible notification appliances shall be in accordance with the requirements in NFPA 72.

Special Requirements. The following requirements take precedence over the requirements in NFPA 72:

- Visible notification appliances shall only be installed in projects that involve the installation of new fire alarm systems.
- Visible notification appliances shall only be required to be installed in public and common areas. For the purposes of this requirement, visible notification appliances shall not be required to be installed in individual offices. Public and common areas include public rest rooms, reception areas, building core areas, conference rooms, open office areas, etc.
- Visual notification appliance circuits shall have a minimum of 25 percent spare capacity.
- Visible notification appliances shall not be installed in exit enclosures (i.e., exit stairs, etc.).

Fire Alarm Messages for High Rise Occupancies

Upon receipt of any fire alarm signal, the fire alarm system shall automatically activate a distinctive three-pulse temporal whoop pattern for three (3) cycles followed by the specified automatic voice messages which shall be repeated until the control panel is reset (i.e., three-pulse temporal whoop pattern - three-pulse temporal whoop pattern - three-pulse temporal whoop pattern - voice message; three-pulse temporal whoop pattern - three-pulse temporal whoop pattern - three-pulse temporal whoop pattern - voice message; etc.), or until overridden by manually activated live voice messages.

The automatic voice messages shall be broadcast through the fire alarm speakers on the specified floors, but not in exit stairs or elevator cars. However, the capability to transmit voice messages to elevator cars and exit stairs shall be included, but be manual only.

The "Fire Zone" message shall be broadcast through speakers on the floor of alarm origin, the floor immediately above the floor of origin, and the floor immediately below the floor of origin. In addition, the visible alarm notification appliance circuit(s) shall be activated on the floor of alarm origin, the floor immediately above the floor of origin, and one floor immediately below the floor of origin. A first floor alarm shall transmit a "Fire Zone" message to all below grade levels.

The "Safe Area Zone" message shall simultaneously be broadcast to all other building floors. However, the visible alarm notification appliance circuit(s) shall not be activated on these floors. The "Safe Area Zone" message shall activate for two complete rounds and silence automatically. After five minutes, if the system is still in an alarm condition, the "Safe Area Zone" message shall automatically start and activate for two complete rounds and silence again. This sequence shall be repeated until the fire alarm system is reset. In the event a subsequent fire alarm is received at the fire alarm control panel by a floor that was previously receiving a "Safe Area Zone" message, this floor shall automatically revert to perform the actions for a "Fire Zone" message.

A live voice message shall override the automatic output through use of a microphone input at the main fire command center. When using the microphone, live messages shall be broadcast through speakers in stairwells, in elevator cars, and throughout the selected floor or floors. Each stairwell shall have its own dedicated speaker zone and speaker zone activation switch. Each elevator bank shall have its own dedicated speaker zone and speaker zone activation switch. An "All Call" switch shall be provided which activates all speakers in the building simultaneously.

Messages shall be digitized voice and utilize a professional quality male voice and shall be as follows:

- **"Fire Zone" Message:** "May I have your attention, please. May I have your attention, please. A fire has been reported which may affect your floor. Please walk to the nearest exit and leave the building. Please do not use the elevators," or
- **"Fire Zone" Message:** "May I have your attention, please. May I have your attention, please. A fire has been reported which may affect your floor. Please walk to the nearest exit, walk down ___ floors, re-enter the building, walk onto the floor, and await further instructions. Please do not use the elevators."
- **"Safe Area Zone" Message:** "May I have your attention, please. May I have your attention, please. A fire has been reported in another area of the building. You are in a safe area. Please stay in your work area and await further instructions. Please do not use the elevators."

Annunciator. All fire alarm systems shall have at least one annunciator located within 7620 mm (25 feet) from the primary fire department entrance to the building. For projects in historic structures, the Design Team fire protection engineer shall consult with the GSA Regional Historic Preservation Officer and GSA regional fire protection engineer regarding this requirement.

Survivability

General. The fire alarm system shall meet the survivability requirements in NFPA 72.

Special Requirements. The following requirements take precedence over the requirements in NFPA 72:

- Two vertical risers (i.e., supply and return interconnected network circuits Style 7 - Class A) shall be installed as remote as practicable from each other so that a single fire will not involve both risers.
- The two vertical risers shall be protected by a minimum 2-hour rated enclosure or an approved 2-hour rated cable or system, not common to both vertical risers.
- The horizontal interconnection between the two vertical risers at the top and bottom shall be protected by a minimum 2-hour rated enclosure, or an approved 2-hour cable or system, or an approved construction material having a 2-hour fire resistance rating.
- A minimum of two (2) distinct fire alarm audible notification appliance circuits and a minimum of two (2) distinct visible notification appliance circuits shall be provided on each floor.
- Adjacent fire alarm audible and visible notification appliances shall be on separate circuits.

Fire Command Center

General. The fire command center shall meet the requirements in the IFC.

Special Requirements. The following requirements take precedence over the requirements in the IFC:

- A fire command center shall be constructed in all new construction projects and meet the construction requirements in the IFC.
- Each fire command center shall be provided in a location approved by the GSA regional fire protection engineer after consultation with the local fire department.
- Each fire command center shall be provided with appropriate lighting, ventilation, and emergency lighting.

7.10 Water Supply for Fire Protection

Adequacy of Water Supply. The designer shall assess adequacy of the existing water supply. The designer shall perform water supply flow testing of fire hydrants and/or fire pumps. If data less than one year old is available from the local jurisdiction, the designer shall verify the locations involved as well as the quality and accuracy of the data.

Capacity and Duration. The required fire flows and pressures for buildings shall comply with the requirements in NFPA 13 and the IBC.

Fire Pump Design. When a fire pump is necessary to supplement fire flow and pressure, size it to comply with the requirements in NFPA 13, 14, and 20. For emergency power requirements see PBS-P100, Chapter 6.

Special Requirements. The following requirements take precedence over the requirements in NFPA 13, 14, and 20:

- The fire pump shall be sized only for the sprinkler system requirements only if the local responding fire department can provide the necessary flow and pressure for manual fire fighting operations (i.e., hose stations), through fire department siamese connections.
- The fire pump shall be electric motor driven, horizontal split case centrifugal type, unless this is not feasible.

Fire Pump Installation. The fire pump shall be installed in accordance with the requirements in NFPA 20.

Fire Pump Operations. A fire pump shall start automatically at 69 kPa (10 psi) below pressure maintenance pump (jockey pump) start pressure.

Fire Pump Controller. The power transfer switch and the fire pump controller shall be factory assembled and packaged as a single unit. Separate transfer switches are not permitted. The fire pump controller shall be monitored by the fire alarm system.

Pressure Maintenance Pump (Jockey Pump). A pressure maintenance pump shall be utilized where it is desirable to maintain a uniform or relatively high pressure on the fire protection system. A jockey pump shall be sized to make up the allowable leakage rate within 10 minutes or 3.8 lpm (1 gpm), whichever is larger.

7.11 Water Based Fire Extinguishing Systems

General. Automatic sprinklers systems shall be installed in accordance with the requirements in NFPA 13, the IBC, and the appropriate GSA sprinkler system specification.

Special Requirements. The following requirements take precedence over the requirements in NFPA 13 and the IBC:

- Automatic sprinklers shall be installed throughout all new construction projects where the building has a sufficient municipal water supply system for the design and installation of a sprinkler system at the site.
- Automatic sprinklers shall be installed throughout the designated work area for all major renovation projects where the building has a sufficient municipal water supply system for the design and installation of a sprinkler system at the site.
- Where project sites are located in remote/isolated areas having insufficient or nonexistent water supplies in close proximity, designing the fire sprinkler system in accordance with NFPA 13 can be both impractical and economically very onerous. See Section "Automatic Sprinkler Systems for Remote/Isolated Facilities" for additional information regarding automatic sprinkler system requirements.
- All sprinkler systems shall be wet-pipe sprinkler systems, unless installed in areas subject to freezing.
- In areas subject to freezing, install dry-pipe sprinkler systems, dry pendent sprinklers, or provide heat in the space, and/or reroute the sprinkler piping. Heat tape shall not be used on sprinkler piping.
- Antifreeze sprinkler systems shall not be installed in any new construction or renovation projects.
- Pre-action type sprinkler systems shall not be installed in any new construction or renovation projects.

Sprinkler System Design

General. Sprinkler systems shall be hydraulically calculated in accordance with the requirements in NFPA 13.

Special Requirements. The following requirements take precedence over the requirements in NFPA 13:

- Sprinkler systems shall be designed using a minimum system design area of 1,500 sq. ft. and shall not be decreased below this value.
- Where floor openings are not classified as atriums, the sprinklers at the ceiling shall be zoned with the lower level if it is enclosed on the upper level (the enclosure is effectively creating a high ceiling). Otherwise, sprinklers shall be zoned with the upper level.
- Sprinkler system control valves shall be located in accessible spaces. Sprinkler system control valves shall not be located in above ceiling spaces.

Seismic Protection. Seismic protection shall be installed where required in the IBC.

Types of Sprinklers

General. Quick response sprinklers (QRS) shall be installed in all new construction and renovation projects in accordance with the requirements in NFPA 13.

Special Requirements. The following requirements take precedence over the requirements in NFPA 13:

- Sprinklers equipped with "O-ring" water seals shall not be utilized in any new construction or renovation projects.

- QRS sprinklers shall not be installed in high temperature areas (e.g., high temperature areas defined in NFPA 13 or elevator machine rooms, etc.) in a building. Standard response sprinklers shall be installed of the appropriate temperature rating.
- All automatic sprinklers installed less than 2134 mm (7 feet) above the floor shall be equipped with sprinkler guards to provide protection against accidental damage.

Sprinkler Piping System

General. Sprinkler piping, fittings, control valves, check valves, and drain assemblies shall meet the requirements in NFPA 13.

Special Requirements. The following requirements take precedence over the requirements in NFPA 13:

- Black steel piping and/or copper tubing shall be used for all wet-pipe sprinkler piping. Chlorinated polyvinyl chloride (CPVC) sprinkler piping shall not be installed in any new construction or renovation project, unless specifically approved for installation by the GSA regional fire protection engineer.
- Galvanized (internal and external) sprinkler piping shall be used for all dry-pipe sprinkler systems.
- Steel pipe sizes 51 mm (2 inches) and smaller shall be Schedule 40 and shall be threaded.
- Steel pipe sizes larger than 51 mm (2 inches) shall be minimum Schedule 10. Piping less than Schedule 40 shall be roll grooved.
- Threadable lightwall pipe shall not be used.
- Steel piping having a corrosion resistant ratio less than 1 shall not be used.
- Plain-end fittings shall not be used.

Fire Department Connections. Underwriters Laboratories Inc (UL) listed locking fire department connection caps shall be installed on all fire department connections where the local fire department has a program and the hardware to accommodate locking fire department caps.

Automatic Sprinkler Systems for Remote/Isolated Facilities

General. The requirements below apply to facilities located in remote/isolated areas having insufficient or nonexistent water supply sources for the design and installation of a fire sprinkler system in accordance with the requirements in the NFPA 13. These facilities must also meet the criteria set forth below to determine when it is not economically feasible to install automatic fire sprinkler protection in accordance with NFPA 13.

1. The cost associated with the installation of the interior NFPA 13 fire sprinkler system (includes all costs such as labor, materials, the adequate water supply source, pumps, etc.) has a cost exceeding $10.00 per square foot; and
2. The costs associated with connecting the interior NFPA 13 fire sprinkler system to the adequate water supply source (includes all costs such as labor, materials, the adequate water supply source, pumps, etc.) is greater than 50 percent of the cost for the installation of the interior NFPA 13 fire sprinkler system.

If the preceding conditions exist, the sprinkler system shall be designed in accordance with the requirements in NFPA 13D.

Special Requirements. The following requirements take precedence over the requirements in NFPA 13D:

- The water supply source for the sprinkler system shall be a minimum of 1,000 gallons and shall be capable of meeting system demands for at least 30 minutes.
- Antifreeze sprinkler systems shall not be permitted.

7.12 Non-Water Based Fire Extinguishing Systems

Wet Chemical Extinguishing Systems. Wet chemical extinguishing systems shall be installed to protect commercial food heat-processing appliances required to have a Type 1 hood in accordance with the requirements in NFPA 17A and the manufacturers recommendations.

Dry Chemical Extinguishing Systems. Dry chemical extinguishing systems shall not be installed to protect any commercial cooking equipment installations.

Clean Agent Extinguishing Systems. Clean agent extinguishing systems shall not be installed in any new construction or renovation project, unless specifically approved for installation by the GSA regional fire protection engineer. However, an approved clean agent extinguishing system shall not be installed in lieu of a wet-pipe sprinkler system.

7.13 Standpipes and Fire Department Hose Outlets

Standpipes

General. Standpipes shall be installed in buildings where required in the IFC.

Special Requirements. The following requirements take precedence over the requirements in the IFC:

- All standpipes shall be connected to the fire protection water supply, be permanently pressurized, and be installed in accordance with the requirements in NFPA 14.
- Dry standpipes shall only be permitted in spaces subject to freezing.
- Where standpipe and sprinkler systems are required, a combination sprinkler/standpipe system design shall be provided.

Fire Department Hose Outlets. Each fire main riser shall be provided with 63 mm (2 1/2 inch) fire department hose outlets. Each outlet shall be located in the stair shaft and have a removable 38 mm (1 1/2 inch) adapter and cap. Threads and valves shall be compatible with the local fire department requirements.

7.14 Portable Fire Extinguishers and Cabinets

General. Portable fire extinguishers and cabinets shall be installed in accordance with the requirements in the IFC.

Special Requirements. The following requirements take precedence over the requirements in the IFC:

- Portable fire extinguishers and cabinets shall not be installed in common areas, general office or court space when the building is protected throughout with quick response sprinklers.
- In office buildings protected throughout with quick response sprinklers, fire extinguishers shall only be installed in areas such as mechanical and elevator equipment areas, computer rooms, UPS rooms, generators rooms, kitchen areas, special hazard areas, etc.

7.15 Fire Protection for Storage Facilities

General Storage. The storage arrangements and protection of a general storage facility shall meet the requirements in NFPA 13 and NFPA 231.

Rack Storage. The storage arrangements and protection of a rack storage facility shall meet the requirements in NFPA 13 and, NFPA 230.

Record Storage. The storage arrangements and protection of a record storage facility shall meet the requirements in NFPA 13 and NFPA 232.

Archive and Record Center

General. The storage arrangements and protection of an archive and record center shall meet the requirements in NFPA 13, NFPA 232 and the information provided in NFPA 232A and the National Archives and Records Administration guidelines as published in the Federal Register, GSA sponsored large scale fire testing.

Special Requirements. The following requirements take precedence over the requirements in NFPA 232:

- Smoke detectors shall be installed throughout archival storage areas in accordance with the requirements in NFPA 72.

Flammable and Combustible Liquid Storage. The storage arrangements and protection of a flammable and combustible liquid storage area shall meet the requirements in NFPA 30 and the applicable Factory Mutual Data Sheets.

7.16 Special Fire Protection Requirements

Elevator Systems

General. Elevator systems shall be designed and installed in accordance with the requirements in ANSI/ASME Standard A17.1 and the IBC.

Special Requirements. The following requirements take precedence over the requirements in ANSI/ASME Standard A17.1 and the IBC:

- Venting of hoistways shall meet the requirements in the IBC.
- Each elevator machine room shall be provided with a wet-pipe sprinkler system using standard response sprinklers. The sprinkler system for the elevator machine room shall be provided with separate manual isolation valves and a separate water flow switch located outside the room in an accessible location. Tamper switches shall be provided on all such valves.
- Sprinkler protected elevator machine rooms containing elevator control equipment shall be provided with a means to disconnect automatically the main line power supply to the affected elevator prior to the application of water in accordance with the requirements in NFPA 72.
- Enclosed elevator lobbies are not required to be installed in buildings protected throughout by an automatic sprinkler system.

Electrical Equipment Rooms and Electrical Closets

General. All electrical equipment rooms (e.g., switch gear rooms, transformer vaults, etc.) and electrical closets shall be protected by an automatic sprinkler system in accordance with the requirements in NFPA 13.

Special Requirements. The following requirements take precedence over the requirements in NFPA 13:

- All electrical switchgear rooms and transformer vaults shall be provided with separate manual isolation valves and a separate water flow switch located outside the room in an accessible location. Tamper switches shall be provided on all such valves.
- Sprinklers installed in electrical equipment rooms and electrical closets shall be equipped with sprinkler guards to provide protection against accidental damage.

Essential Electronic Facilities

General. Essential electronic facilities consist of spaces that have high value or mission essential electrical equipment such as mainframe computers or telephone switches with the potential for high dollar loss and/or business interruption. Essential electronic facilities shall be designed in accordance with the requirements in NFPA 75 and the appropriate GSA computer room fire alarm system specification.

Special Requirements. The following requirements take precedence over the requirements in NFPA 75:

- A wet pipe sprinkler system shall be provided throughout the facility including data storage areas.
- Quick response sprinklers shall be used throughout the facility including data storage areas.
- The sprinkler system shall have a separate isolation valve and a separate water flow switch located outside of each protected area in an accessible location. Each valve shall be provided with a tamper switch that is connected to the building's fire alarm system.
- Activation of the sprinkler water flow switch shall disconnect power to the computers and to the HVAC systems with no time delay.
- The activation of two cross-zoned conventional photoelectric smoke detectors or the activation of one

intelligent analog/addressable photoelectric smoke detector utilizing early warning smoke detection technology (e.g., smoke detectors having enhanced algorithms, fire alarm control panel having capability to program individual smoke detector response parameters, or smoke detectors using air sampling technology for use in essential electronic facilities, etc.) within a single protected area shall disconnect power to the computer equipment and to the HVAC system after a pre-set time delay.

- Water based and/or non-water based fire extinguishing systems shall not be installed below raised floors that are less than or equal to 457 mm (18 inches) in height.

Places of Confinement

General. Places of confinement are considered places where persons are held under lock during daytime hours, but not overnight.

Special Requirements. Places of confinement shall meet the following requirements:

- Places of confinement shall be separated from other parts of the building by fire partitions having a minimum 1-hour fire resistance rating. The fire-resistive enclosure shall also include all areas within the secure prisoner movement system.
- Sprinklers shall be installed within all places of confinement, including, but not limited to, prisoner holding cells, the main prisoner detention cell block, prisoner attorney interview rooms, etc.
- The sprinklers installed shall be institutional quick response flush pendent sprinklers designed for standard and extended coverage applications.
- The institutional sprinklers shall have a solder-link type fusible element, a tamper-resistant escutcheon, and a retaining flange that prevents sprinkler movement away from walls and ceilings.

Atriums

General. Atriums shall be designed in accordance with the requirements in the IBC.

Special Requirements. The following requirements take precedence over the requirements in the IBC:

- The atrium sprinkler system shall be designed as a separate sprinkler zone. In addition, a separate manual isolation valve and a separate water flow switch shall be located in an accessible location. A tamper switch shall be provided on all such valves.
- Atrium smoke removal systems shall be designed and installed in accordance with the requirements in the IBC.

Track Files

General. A track file uses a single aisle to give access to an otherwise solid group of open-shelf files. Access is gained by moving shelf units on rollers along a track until the proper unit is exposed.

Special Requirements. Track files shall meet the following requirements:

- The track file system shall be constructed entirely of steel. At least 1.4 mm (18-gauge) sheet metal shall be used for all parts of the shelving unit.
- The system shall be no more than 2438 mm (8 feet) high, and a minimum clearance of 457 mm (18 inches) shall be maintained between the top of the shelving and the ceiling.
- The sprinkler density shall be 12.2 (L/min)/m^2 (0.3 gpm/sq. ft.) over 139 m^2 (1500 sq. ft.). Sprinkler spacing shall be 9.3 m^2 (100 sq. ft.) maximum.
- The back cover of stationary end files shall be solid sheet metal.
- For floor loading requirements see PBS-P100, Chapter 4.

Cooling Towers

General. Cooling towers shall meet the requirements in NFPA 214.

Special Requirements. The following requirements take precedence over the requirements in NFPA 214:

- Cooling towers over 57 cubic meters (2000 cubic feet) in size, having combustible fill shall be provided with an automatic deluge sprinkler system.
- Automatic sprinkler protection shall not be required in cooling towers over 57 cubic meters (2000 cubic feet) in size, constructed of non-combustible materials, having non-combustible components (including piping) and non-combustible decks.
- Automatic sprinkler protection is required for cooling towers which are constructed of combustible materials, have combustible components (such as PVC fill, louvers, drift eliminators, etc.), or a combustible deck.

Residential Housing Units

General. Residential housing units shall meet the requirements in the International Residential Code (IRC).

Special Requirements. The following requirements take precedence over the requirements in the IRC:

- Stairways in residential housing units shall have a maximum riser height of 178 mm (7 inches) and a minimum tread depth of 279 mm (11 inches).
- Residential housing units are required to be protected by an automatic fire sprinkler system. The design of the automatic fire sprinkler system for the residential housing shall be based on the design and installation requirements in NFPA 13D. Each residential housing unit shall be provided with a local waterflow switch that will initiate a local alarm. The sprinkler waterflow alarm shall be arranged so that the operation of the waterflow switch shall produce an alarm signal that is audible throughout all inhabited areas of the individual housing unit. The sprinkler system waterflow switch and control valve shall be monitored for alarm, supervisory, and trouble conditions.
- Residential housing units shall be provided with approved multiple-station smoke alarms in the following locations: (a) in all sleeping rooms, (b) outside of each separate sleeping area, in the immediate vicinity of the sleeping rooms, and (c) on each level of the dwelling unit, including basements. All smoke alarms shall be designed and installed in accordance with the requirements in the NFPA 72. All smoke alarms within the residential housing unit shall be interconnected in such a manner that the activation of any single smoke alarm will activate all the smoke alarms within the individual residential housing unit, and produce an alarm signal that is audible throughout all inhabited areas of the individual residential housing unit. Manual fire alarm stations shall not be installed in the residential housing unit.

Chemical Laboratories

General. Laboratories shall meet the design requirements in NFPA 45 and the IBC.

Special Requirements. The following requirements take precedence over the requirements in NFPA 45:

- Laboratories handling or storing hazardous chemicals, flammable gases, flammable liquids, explosives, and biological laboratories shall not be expanded in existing office buildings.
- All chemical laboratories shall be sprinklered, regardless of size. Sprinkler protection shall be calculated to provide a density of 0.15 gpm per sq.ft. over a 3,000 sq.ft. area.

U.S. Court Facilities

For special fire protection and life safety requirements for U.S. Courts facilities, refer to PBS-P100 Chapter 9 and the *U.S. Courts Design Guide*.

U.S. Marshal Service

For special fire protection and life safety requirements for U.S Marshal Service space, refer to the *USMS Requirements and Specifications for Special Purpose and Support Space; Volumes I, II, and III*.

Land Port of Entry Facilities

For special fire protection and life safety requirements for Land Port of Entry Facilities, refer to the *Land Port of Entry Design Guide*.

Child Care Centers

For special fire protection and life safety requirements for Child Care Centers, refer to the GSA *Child Care Center Design Guide* (PBS-P140).

Child Care Center

7.17 Emergency Power, Lighting and Exit Signage

Emergency and Standby Power Systems. Emergency and standby power shall meet the performance requirements in NFPA 70, NFPA 110, and NFPA 111.

Emergency Lighting. Emergency lighting shall meet the performance requirements in NFPA 101.

Exit Signage. Exit signage shall be installed and meet the performance requirements in NFPA 101.

7.18 Historic Structures

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 state rehabilitation codes, International Existing Building Code (IEBC), and performance based codes to resolve conflicts between prescriptive code requirements and preservation goals. In addition, the requirements and recommendations of NFPA 914 shall be considered for rehabilitation projects in historic structures. The Design Team shall also evaluate the 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 titled *Fire Safety Retrofitting in Historic Buildings*.

GSA's regional fire protection engineer serves as the AHJ, who must exercise professional judgment to assess the acceptability of alternative compliance solutions. Early and frequent coordination between the architects, State Historic Preservation Officer, Regional Historic Preservation Officer, 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.

Fire Protection Alternatives for Consideration. Listed below are fire protection alternatives for the Design Team's fire protection engineer to consider when designing a project:

- New stair enclosures in historic buildings should 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 end in most circumstances. For more ornamental spaces, accordion rated doors may be used. 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. Non-prescriptive compliance solutions, such as modification of historic door assemblies, must be approved by GSA's regional fire protection engineer.
- New fire-rated doors in preservation zones should be designed to resemble historic doors in panel detailing and finish. True-paneled fire doors are preferred for replacement of original paneled stair or corridor doors.
- In historically significant spaces, sprinklers should be carefully placed to minimize damage to ornamental materials. Develop detailed drawings for architecturally sensitive areas, showing precise sprinkler locations 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.
- Sprinklers and escutcheons should match original architectural surfaces or hardware. Oxidized brass or bronze heads are recommended for use in deeply colored (unpainted) 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.
- In historically significant spaces, smoke detectors should be placed to minimize destruction of ornamental surfaces. 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. Application of special finish treatments outside of the standard factory process 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.